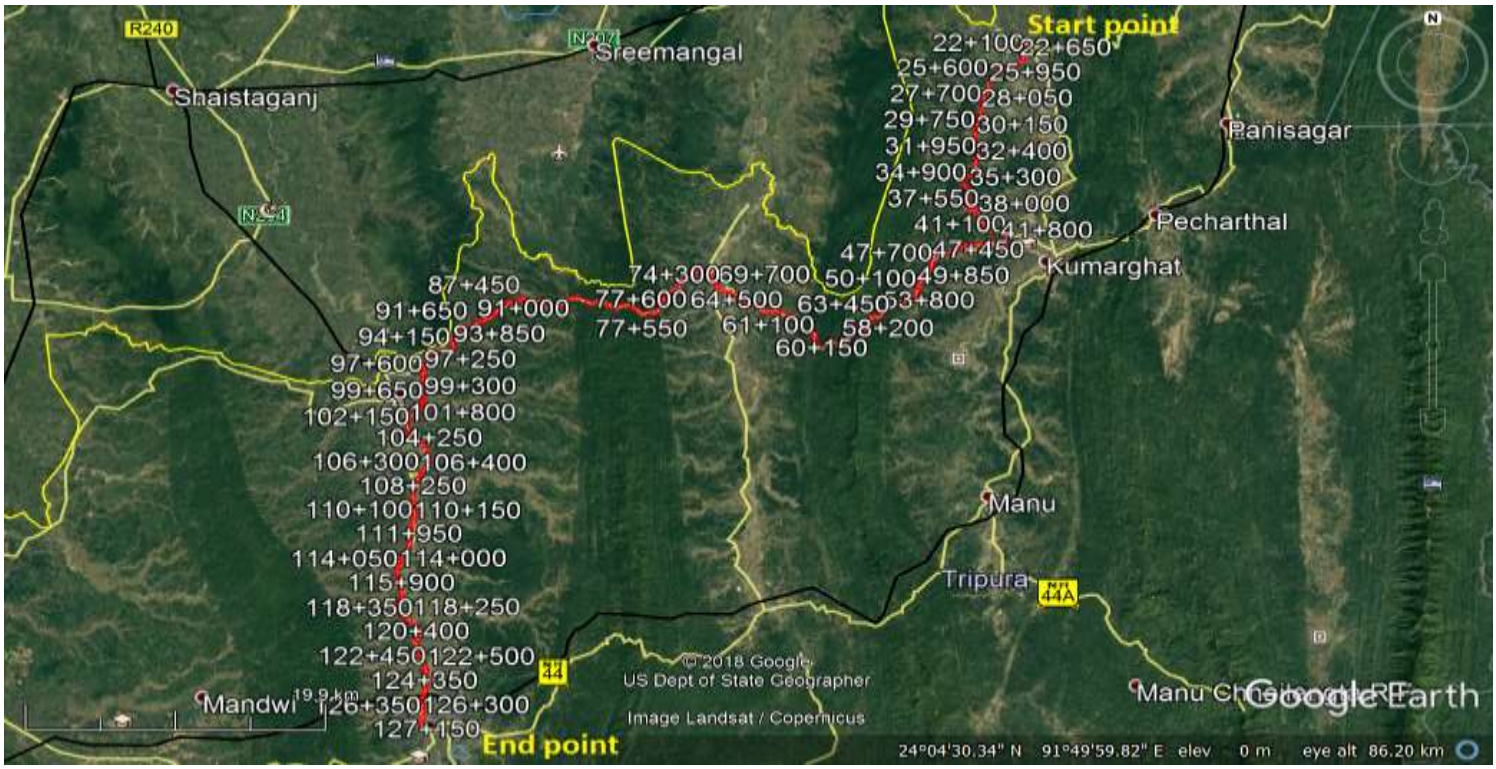
Supplemental Environmental Impact Assessment (SEIA)

FOR

Improvement/Widening to two lane with paved shoulder of Kailashahar to Teliamura via Khowai section of newly declared NH – 208 from CH 21.100 km to 127.319 km.



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ACRONYMS

CPR	: Common Property Resource
CPI	: Consumer Price Index
CGWA	: Central Ground Water Authority
CPCB	: Central Pollution Control Board
DGM	: Deputy General Manager
DC	: District Collector
DP	: Displaced Persons
DHs	: Displaced Households
DFs	: Displaced Families
EA	: Executing Agency
EIA	: Environment Impact Assessment
EMP	: Environment Management Plan
FGD	: Focus group discussions
GoI	: Government of India
GP	: Gram Panchayat
GRC	: Grievance Redressal Committee
GSB	: Paved sub base
HIV/AIDS	: Human Immunodeficiency virus / Acquired immunodeficiency syndrome
IA	: Implementing Agency
ICDS	: Integrated Child Development Services
IS	: Indian Standard
IRC	: Indian Road Congress
JBIC	: Japan Bank for International Cooperation
JICA	: Japan International Cooperation Agency
KII	: Key Informant Interview
LA	: Land Acquisition
MT	: Motorized traffic
NGO	: Non-Government Organization
NH	: National Highway
NHIDCL	: National Highways & Infrastructure Development Corporation Limited
NRRP	: National Rehabilitation and Resettlement Policy
NMT	: Non-motorized traffic
NPK	: Nitrogen, Phosphorous and Potassium
MoRTH	: Ministry of Road Transport and Highways
MI	: Monitoring indicators
OBC	: Other Backward Castes
PHC	: Primary health Centre
PMU	: Project Monitoring Unit
PT	: Pedestrian traffic

PAP	: Project Affected Persons
PIU	: Project Implementation Unit
PT	: Performance Target
RP	: Resettle Plan
RCD	: Road Construction Department
Rs	: Rupee, Indian currency
R&R	: Resettlement and Rehabilitation
SDM	: Sub divisional District Magistrate
SH	: State Highway
SC	: Scheduled Castes
ST	: Scheduled Tribes
SPCB	: State Pollution Control Board
TTAADC	: Tripura Tribal Areas Autonomous District Council

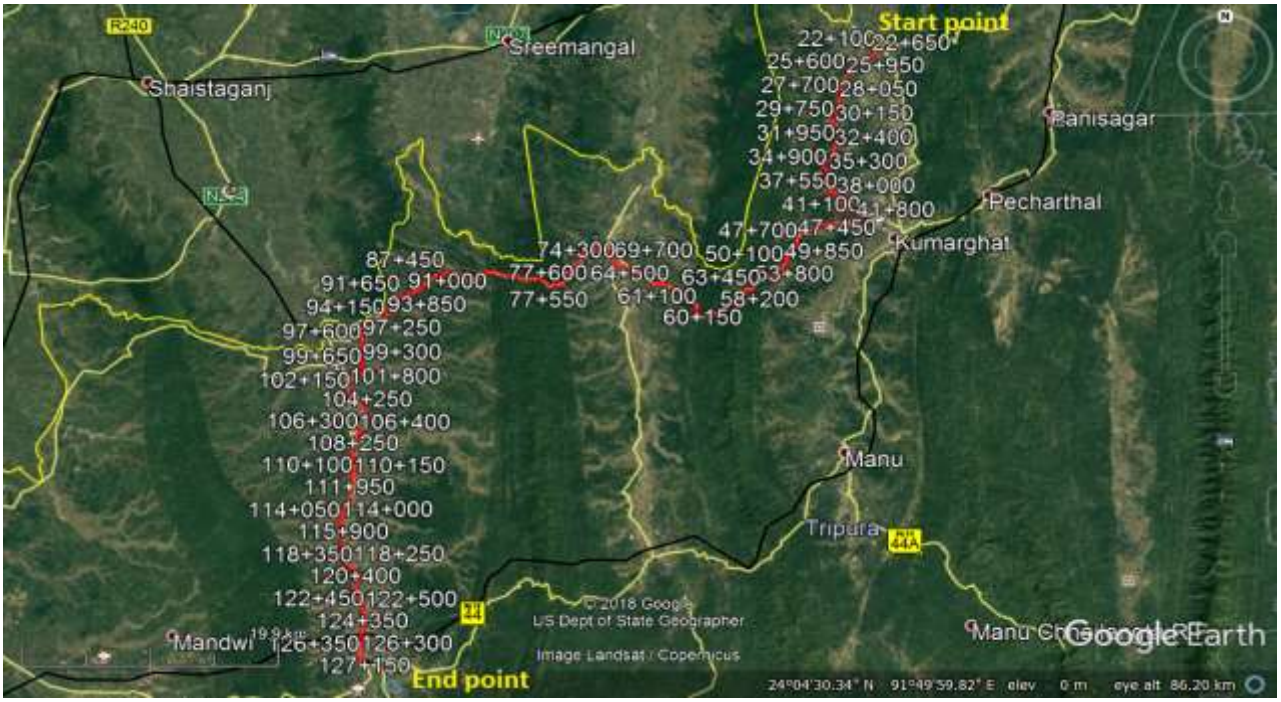
Executive Summary

Project Background

National Highways infrastructure Development Corporation Limited (NHIDCL) has decided to take up the development of various NH stretches/Corridors in the country where intensity if traffic increased significantly and there is a requirement of augmentation of capacity for safe and efficient movement of traffic. In pursue of the above, the present section of NH-208 has been considered for upgradation. The project aims to improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by (i) improving the state highway network, (ii) facilitating safe and appropriate road usage, (iii) increasing efficiency of transport services and (iv) enhancing Tripura State's NHIDCL capacity for road asset development and management. Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions, better employment opportunities outside agriculture and improved access to economic Centers and increased industrial activities in the project area. Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the alignment.

The proposed project transverses from 24°18'30.39"N 92°1'0.87"E at Kirtantoli (near kailasahar town) to 23°50'21.83"N 91°37'36.26"E at NH-44 at Teliamura with elevation varies from 30 m to 243 m. The project road has designed length of 106.219km having started CH 21+100 and end CH 127+319. This section is a part of the NH-208. The project road runs through Unakoti, Dhalai and Khowai districts of Tripura. The project road passes through village / localities namely Kirtontoli, Rajnagar, Durgachoumohini, Manikbhander, Khowai, Kalyanpur & ends at Teliamura. A project location Map of the present section is enclosed in below**.**

Project Location Map



Source: Alignment provided in DPR

The Extent and Objective of the EIA Study

This EIA report has been prepared on the basis of detailed engineering design, field investigations including baseline environmental data collection and stakeholder consultations to meet the requirements for environmental assessment process, and JICA guidelines. EIA extent has been decided considering all likely impacts and risks analyzed in the context of the project's area of influence encompassing (i) the primary project site(s) and related facilities like site clearance, utility shifting etc. (ii) associated facilities project viz. Borrowing, quarrying, disposal of debris, construction camp etc. (iii) areas and communities potentially affected by cumulative impacts and (iv) potential impact from unplanned but predictable developments caused by the project that may occur at later stage or at a different location.

National Legal Frame Works & its Applicability to the Project and Gap Analysis against JICA Environmental Guidelines

Within the framework of environmental laws of India, the Environmental (Protection) Act of 1986 and its enforcement rights has been given to Ministry of Environment, Forest & Climate Change (MOEFCC). It has overall authority for the administration and implementation of the EIA related policies, laws and regulations, sustainable development and pollution control in India. MOEFCC identifies the need to enact new laws and to issue amendment to the existing environmental legislations when required, in order to continue to conserve and protect the environment in India. Central Pollution Control Board (CPCB) and respective State Pollution Control Board (SPCB) implement the acts. At the state level, the Department of Environment and Forest of Tripura perform a role similar to MOEFCC.

JICA Guidelines

Applicability of JICA's Guidelines for Environment and Social Considerations (here in after, ESC) is required if a project is funded by JICA. If a significantly adverse impact on the environment or society has been identified in JICA-assisted project, the following has to be thoroughly considered and studied.

1) ESC are pre-requisite

a. JICA will take necessary measures to ensure that the appropriate ESC is given;

b. When JICA reviews a project proposal and finds that the project could cause negative impacts on the environment or society, JICA advises the project proponents to provide appropriate ESC;

c. If the negative impact of the project cannot be avoided or mitigated to an acceptable level, JICA will not support its implementation.

2) Respect human rights

a. Development project should aim for fair distribution of its benefits and must not burden or exclude certain stakeholders for the sake of others;

b. The project proponents must respect the rights of all people concerned, and pay special

attention to vulnerable social groups such as women, elderly, the poor, people with disabilities, indigenous peoples, ethnic minorities, and other minority groups to ensure that they are involved in decision-making processes and that they benefit from the project;

c. JICA's ESC Guidelines defines 'stakeholders' as local residents including non- titleholders who are affected by the project as well as local NGOs. By involving local stakeholders from the early stage of the project, the project proponents can receive their inputs and plan appropriate measures to address their concerns, avoid conflict, and achieve higher results with their support. For this reason, the project proponents should conduct a series of consultations with local stakeholders in an interactive and meaningful manner. During this process, appropriate consideration must be given to socially vulnerable or different people such as women, children, the elderly and ethnic minorities.

3) Avoid adverse impacts

a. Priority should be given to the avoidance of adverse impacts on the environment or society when a project is planned;

b. Minimization or mitigation of impacts should be considered only if avoidance is not feasible and if the benefit of the project outweighs the cost of mitigation measures;

c. The project proponents must assess the environmental and social impacts at the earliest possible stage of planning, and implement ESC measures in accordance with the ESC Guidelines.

4) Information on ESC must be disclosed to the public

a. Information disclosure is key in ESC. Project proponents must proactively release relevant information to the public;

b. Sharing information with a wide range of stakeholders from the early stage, the project proponents can utilize their feedback to improve the plan/project. In addition, the project proponents can ensure that unnecessary concerns and misunderstandings among the stakeholders are ameliorated.

5) Host country's laws, standards, policies and plans

a. JICA-funded project must comply with the laws, standards, policies, and plans of the host country;

b. If the standard set by the host country differs from the international standard, the project proponents are advised to adopt international standard that better serves the purpose of attaining a higher level of ESC.

6) The World Bank's Safeguard Policies

ESC in a JICA project must be in line with the World Bank's Safeguard Policies including:

a. Operational Policy on Environmental Assessment (OP 4.01);

b. Natural Habitats (OP 4.04);

c. Involuntary Resettlement (OP 4.12);

d. Indigenous Peoples (OP 4.10), and other relevant policies.

The National and State Regulations relevant to the project and its applicability to the project are described below:

National and State Regulations and its applicability for the Project

Law	Description	Applicability in the project
EIA Notification	The EIA Notification of 2006 set out the requirement for environmental assessment in India. Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence.	Not Applicable as project activity does not attract provisions of EIA notification 2006 and its amendment till date.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments(1987)	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water, by Central and State Pollution Control Boards and for conferring on and assigning to CPCB/SPCBs powers and functions relating to water pollution control. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from State Pollution Control Board (SPCB) before starting implementation and Consent to Operate (CTO) before commissioning.	Consent to Establish (CTE) before start of construction works and Consent to Operate (CTO) before start of operation will be required for (if any)- • Batching Plant • Hot mix plants; and • Sand mining
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	This Act was enacted to achieve prevention, control and abatement of air pollution activities by assigning regulatory powers to Central and State boards for all such functions. The Act also establishes ambient air quality standards.	Following will require CTE and CTO from SPCB: Establishment of DG sets more than 10 KVA. • Batching Plant • Hot mix plants; and • Sand mining, if any
Environment (Protection) Act, 1986 and CPCB Environmental Standards. (National	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards.	Ensure applicable standards for ambient air quality. Ensure Emission Limits standards for New DG Sets Ensure Stake Height

Ambient Air Quality Standards 2009)		standards Requirement for DG Sets.
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Ensure applicable noise standards and noise limits for DG sets.
Central Motor Vehicle Act Central Motor Vehicle Rules and (Amendment) Rules (1988 and amendment thereafter)	Objective of this Act is to check vehicular air and noise pollution. Vehicles to be used for construction and other purposes need to meet the standards and certificates prescribed as per the Rules, 1989 to control noise, pollution, etc.	Ensure vehicle exhaust emission standards.
Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	The Act designates areas within 100 meters (m) of the "protected monument/area" as "prohibited area" and beyond that up to 200 m as "regulated area" respectively. No "construction" is permitted in the "prohibited area" and any construction activity in the "regulated area" requires prior permission of the Archaeological Survey of India (ASI).	Not applicable as no such monuments within the project corridors.
The Right to fair compensation and transparency in land acquisition, rehabilitation and resettlement Act, 2013	Private land acquisition is guided by the provisions and procedures of this Act.	Applicable to this project as there is private land acquisition and resettlement.
Seventy Third Constitution Amendment Act 1992	This act guides Governments to establish rules for Panchayat involvement in project preparation and implementation. The Act stipulates involvement of the institutions especially, the Gram Sabha/ Panchayat during project preparation and implementation. The Panchayats at the village level will be involved for preparation and implementation of the project.	Ensure involvements of Gram Sabha/Gram Panhayat in the project design.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to	Applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.

	men and women for work of equal value or type.	
The Sexual Harassment of Women at workplace (Prevention, Prohibition and Redressal) Act, 2013	Whereas sexual harassment results in violation of the fundamental rights of a women to equality under article 14 and 15 of the Constitution of India and her right to life and to live with dignity under article 21 of the Constitution and right to practice any profession or to carry on any occupation, trade or business which includes a right to safe environment free from sexual harassment.	Applicable
The schedule caste and schedule tribe amendment act 2015 and rules 2016	The acts and rules are to provide the protection to tribal people.	Applicable
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable
Wildlife Protection Act, 1972 amendment 1991	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	The Gumti Wildlife Sanctuary is located within 10 km from the end point of the road. The draft ESZ notification no. 1985 dated 31.05.2018 of the sanctuary has been published. The project does not require Environmental Clearance and wildlife clearance is also not applicable as per MoEF&CC circular F.No.22-43/2018-1A.III dated 08.08.2019 and as per IRC:SP:93-2017 guidelines on requirement of environmental clearance of road projects.
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prohibits the use of forest land for non-forest purposes without the approval of Ministry of Environment and Forests and Climate Change (MoEFCC), Government of India	Applicable as 79.756196 ha of forest land is required for project. The stage-1 clearance has already been obtained.
Solid Waste Management Rules 2016	Responsibility of Solid Waste Generator (i) segregate and store the waste generated in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorized waste pickers or waste collectors	Contractor to follow all the rules during construction works.

	as per the direction or notification by the local authorities from time to time.	
Construction and Demolition Waste Management Rules 2016	(i) Every waste generator shall segregate construction and demolition waste and deposit at collection centre or handover it to the authorized processing facilities (ii) Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains. (iii) Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or re-modeling work, (iv) Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste. (v) Large generators shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar, Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;	Contractor to follow all the rules during construction works.
Hazardous Waste Rules 2016	Responsibilities of the occupier for management of hazardous and other wastes.- (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely:- (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery.	Contractor to comply all the requirements of this Act during construction works.
International conventions and treaties		
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to this project as not site within the vicinity of the project.
Wetlands (Conservation and Management) Rules, 2017	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and	Not applicable as subprojects components are not located in designated wetland area.

	reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	
Montreal Protocol 1992	India is a signatory of this convention which aims to reduction in the consumption and production of ozone-depleting substances (ODS), while recognizing differences in a nation's responsibilities. Ozone depleting substances are divided in two groups Chlorofluorocarbons (CFCs) and Hydro chlorofluorocarbons (HCFCs).	Not applicable in this project as no ODS are involved in construction works.
Basel Convention on Trans-boundary Movement of Hazardous Wastes, 1989	India is a signatory of this convention which aims to reduce trans-boundary movement and creation of hazardous wastes.	Contractor to follow the provisions of Hazardous Waste Rules 2016 for storage, handling, transport and disposal of hazardous waste emerged during construction works.
Convention on Migratory Species of Wild Animals (CMS), 1979 (Bonn convention)	CMS, also known as Bonn convention was adopted in 1979 and entered into force on 1 November 1983, which recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine and avian migratory species throughout their ranges. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.	Not applicable to this project as no migratory species of wild animals are reported in the project areas.

Study of Alternative Options

A comparative analysis of various alternatives considered to avoid, prevent or minimize impacts that would be inevitable if technically (based on design speed and geometrics) best-fit alignment is followed. The consideration of alternatives to a proposal is a requirement of the EIA report. During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparative analysis of the alternatives will help to determine the best method of achieving project objectives while minimizing environmental and social impacts. Three options have been selected to decide the final alignment, these three options are:-

1. Zero option: No project intervention is implemented i.e. transportation by present roads is continued to be used.
2. The selected option: The option is used for this EIA impact study
3. Others options (widening options): The option is to widen the existing road to the level of the planned road.

Zero option has been ruled out as present road is not able to withstand increased traffic. The widening

option of existing road was also not feasible due to its geometric design, R&R issues, socioeconomic viability, environmental & road safety aspects. The initial site visit and detailed ground reconnaissance by the consultants revealed that by and large this selected alignment having less/minor effect on environmental and social components is acceptable. The proposed alignment was selected after finalization of various options such as realignments, bypasses, keeping in view objectives of the project, traffic condition, obligatory points, geometric designs, congestions and socioeconomic viability, environmental & road safety aspects.

Description of the Project Components

Project road improvement will broadly follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines. It will be of 7m width carriageway with paved shoulder of 1.5m in rural/hilly and 2.5m in built-up section on both the side. In some places, there are provisions of earthen shoulders of 2m width on both side of the road. 39.3% of the total road length proposed to be realigned. The length of realignment stretch is 41.750km. Besides, a stretch of 4.990km length is proposed at Khowai bypassing the main town form design chainage 96120m to 101110m. Footpath with cover drain has been proposed in built up area & Brick Masonry drain has been proposed on hill side for proper drainage purpose. The salient features of the project have been presented below.

Salient Features of the Project

1.	Project	Improvement/Widening to two lane with paved shoulder of Kailashahar to Teliamura via Khowai section of newly declared NH – 208 from CH 21.100 km to 127.319 km.
2.	Location of the proposed project	The proposed project transverses from 24°18'30.39"N 92° 1'0.87"E at Kirtantoli (near Kailasahar town) to 23°50'21.83"N 91°37'36.26"E at NH-44 at Teliamura.
3.	Total Length of the proposed project	106.219 km
4.	Terrain	Plain, rolling and hilly
5.	Seismic Zone	Zone V
6.	Geographical Location	Start Location 24°18'30.39"N 92° 1'0.87"E End Location 23°50'21.83"N 91°37'36.26"E
7.	Proposed Bridges and ROB	53 nos. minor bridges & 08 nos. major bridges 01 no. of ROB
8.	Bus Bay/ Truck Lay Bye	13 nos. of bus bay and 01 no. of truck lay bye
9.	Design Speed	
	a) Plain Terrain (in general)	Ruling: 100 kmph Minimum: 80 kmph
	b) Rolling Terrain	Ruling: 80 kmph Minimum: 65 kmph
	C) Hilly Terrain	Ruling: 60 kmph Minimum: 40 kmph For Hair Pin Bend: min 20kmph
10.	Carriageway Width	7.0 m

11.	Width of Shoulder	In Rural/Built-up section:
	a) Paved	2 x 1.5m (in Rural); 2x 2.5m (in Built-up); In hill section: 1.5m (on hill side) and 1.5m (on valley side)
	b) Earthen	2 x 2.0m
12.	Footpath width at built-up areas	2 x 2.0m
13.	Number of affected persons and household	Affected persons 4286 and Affected household 2464
14.	Nos. of private structures affected	2464
15.	Total number of CPRs affected Community and Religious)	38
16.	Total Area of Land Acquisition	254.69 Ha out of which 119.10 Ha Private land 54.23 Ha Government Land , 1.598 Ha other land and 79.756 ha forest land .
17.	Forest Land Diversion	79.756196 ha
18.	Total R&R budget for the proposed project RP	Rs. 256.46 Ha.

Source: DPR Vol- IV (Part A)

The typical cross sections (TCS) as per the following details area enclosed as **Annexure -1.**

(a) TCS of 2 lane carriageway with paved shoulder in rural area applicable for plain/rolling terrain (reconstruction),

(b) TCS of 2 lane carriageway with paved shoulder in bypass and realignment stretch applicable for plain/rolling terrain (new construction),

(c) TCS of 2 lane carriageway with paved shoulder in bypass and realignment stretch applicable for plain/rolling terrain in cutting section (new construction) and

(d) TCS of 2 lane carriageway with paved shoulder and both side RCC cover drain in built up area applicable for plain/rolling terrain (reconstruction).

(e) Typical cross section of 2-lane carriageway with paved shoulder and both side rectangular brick masonry drain applicable for mountainous terrain (reconstruction).

Baseline Environment

The project state, Tripura falls under the sub-tropical to temperate climatic region. The climate of the project districts Unakoti, Dhalai & Khowai is characterized by moderate temperature and high humid nature. There are three prominent seasons summer, rainy and winter. The State of Tripura comes under the very high risk seismic zone in the country, namely, Zone V of seismic Zoning Map of India. The major geomorphic element observed in Tripura is north-south running parallel hill regions and intervening valleys.

Ambient air and noise quality conformed the prescribed limit. Air & Noise level is comparatively high in Teliamura (End point), Durgachoumohini, Kalyanpur & Khowai being populated area with

comparatively higher vehicular movement. Ground water samples collected from the hand-pumps of various locations as well as surface water quality along with soil quality also confirm the prescribed limit. Dominant land use in the 10km radius of the project road is vegetation /forest land with an area covering 75.57% which is higher than the Tripura's over all forest cover. It is followed by agriculture land which covers an area of 9.34% in 10km radius of the project road.

The recorded forest area of the state is 6,294 km^2, which constitutes 60.02% of its geographical area. The Reserved Forest (RF) constitute 66.33%, Protected Forest (PF) 0.03% and Unclassified Forest constitute 33.64%. The forest cover in the state, based on interpretation of satellite imagery of January 2009 is 7,977 km^2 which is 76.04% of the total geographical area. Important flora in the project road are *Schima wallichi*, *Syziguim cuminii*, *Albizia procerra*, *Artocarpas chaplasa*, *Lagerstromia parviflora*, *Alstonia scholaris*, *Dillenia pentagyna*, *careya arborea*, *Lannea grandis*, *Amoora wallichii*, *Cedrella toona*, *Sapium baccatum*, *Trewia nudiflora*, *Grewia microcos*, *Odina wodier*, *Garuga pinnata*, etc. Bamboo plays a very vital role in the economy of the State along with rubber plantation as it serves the artisan & non-artisan users of the state.

Anticipated Environmental Impacts and Proposed Mitigation Measures

The road will benefit the residents and other stakeholders in the settlement areas of important nearby towns of Fatikroy, Kumarghat, Komolpur and Ambasa and villages/ localities i.e. Kirtantoli, Jarultali, Rajnagar (near Fatikroy), Gokulnagar, Ganganagar, Rajkandi, Saidacherra, Dangdung, Durgachoumohini, Bamuncherra, Eararpar, Manikbhander, lambucherra, Sreerampur, Sukhiabari, Langtibari, Laxmicherra, Behalabari, Khowai, Mahadevtila, Saratala, Chebri, Gourangatila, Baganbazar, Dwarikapur, Kalyanpur, Totabari, Komolnagar, Mohorchora and Trishabari by providing improved connectivity to state capital and other important destination of nearby states of Assam, Meghalaya & Mizoram. About 38.6% of the project road is proposed for either realignment or bypass. This process involves diversion of both agriculture and forest land along with eviction of some existing structures including shops, school boundary wall and temples. More than 75% of the land use in 10km radius of the project road is forest cover. A total of 7743 numbers of trees likely to be fell down during the widening process. The widening of the project road along with realignment and bypass development shall cause loss of vegetation/tree felling, other ecological imbalance and habitat destruction. Another significant impact identified during site visit is water quality deterioration of ponds abutting the project road. However, with effective environmental management plan, all these aspects can be mitigated.

Public Consultation and Information Disclosure

Consultation held with various government officials and local people from the fringe area of the project road. Divisional Forest Officers of all the three project districts were consulted during the field study along with higher officials from the Tripura State Pollution Control Board. Informal public consultations were held at seven important locations of the project road including both starting point (Kirtantali) and end point (Teliamura, near NH-44). All of them welcomed the road development and improvement project. Suggestion received mainly on improved drainage system, adequate compensation, protection measures for water bodies (mainly ponds) and petty contracts for the local contractors during the construction phase of the project road. The second stage Public/stake holder consultation have been done in six locations from 23.09.2019 to 25.09.2019 after informing

stakeholders vide NHIDCL letters F.NHIDCL/BO Agt./DPR/12(3)/2016-17/Vol-II/2177-89 dated 07.09.2019 in district Unakoti, F.NHIDCL/BO Agt./DPR/12(3)/2016-17/Vol-II/2167-76 dated 07.09.2019 in district Dhalai, F.NHIDCL/BO Agt./DPR/12(3)/2016-17/Vol-II/2156-66 dated 07.09.2019 in district Khowai covering all the three benefits districts as per JICA guidelines. During second stage stakeholders / public consultation meetings, stakeholders appreaciated the project and would like it's early implementation for the development of the area.

Environmental Management Plan

The Environmental Management Plan is prepared for avoidance, mitigation and management of the negative impacts of the project. It also covers remedial measures require to be taken EMP includes the list of all the project related activities, their impacts at different stages of project during pre-construction phase / design phase, construction phase and operational phase on environment and remedial measures to be undertaken to mitigate these impacts. Environmental Management Plan (EMP) is intended to set out clearly and unambiguously the likely negative impacts of construction and/or operation of the project, the action that is required to avoid or mitigate each impact and the responsibility for taking each action. Responsibility is made legally binding when actions are subsequently specified in contracts. A comprehensive environmental management plan has been designed for the project road; 1) to ensure compliance and regulatory requirements of Tripura and the Government of India, 2) To formulate avoidance, mitigation and compensation measures for anticipated adverse environmental impacts during construction and maintenance and ensure that environmentally sound, sustainable and good practices are adopted and to stipulate monitoring and institutional requirements for ensuring safeguard compliance. A strict environmental monitoring program also formulated for implementation during both construction and operation stage of the project road. A total budget amount of Rs. 5,06,87,588.00 has been allocated for implementation of environment safeguards under the compensatory afforestation in the project.

Findings and Conclusion

The significant environmental impacts attributable to the upgrading of the road sections pertains to tree cutting, construction of bridges, temporary deterioration of environmental attributes/ambient during construction phase from land clearing, silt run off, borrowing of earth, camp operations and community and occupational health and safety. These impacts can be mitigated adopting good construction practices and effective implementation of Environmental Management Plan (EMP). During operation stage, the main impacts are increase in mobile emissions, noise level, accident risk to motorist, pedestrian and animals. Road safety measures are proposed as per IRC: SP: 44-1996 like road delineators, signage, metal beam crash barriers and guideposts etc. Retaining walls have been proposed on embankment slopes where ponds are abutting to avoid seepage into sub grade and erosion of road embankment.

The EIA/EMP report was prepared after thorough interaction with the engineering section of the consultants so that the negative impacts on the environment and human population could be avoided as far as possible. Some of the important findings of the study are as follows: -

1. There will be insignificant loss of bio-diversity as no rare plant or animal species are going to be affected by the present project.

2. The alignment is not passing through any Sanctuary or National Park however, Gumti Wildlife Sanctuary is located approx. 8 km away from the end point of the project.
3. Precautionary measures such as underpass, pipe culverts and chain link fences etc. have been suggested to mitigate the likely impacts if any wild life present in Project area.
4. No monuments protected by the Archaeological Survey of India (ASI) are located within the ROW of project road.
5. The most important factors, which need continuous attention and assessment during the construction phase, are the ambient air quality, the water quality and the noise level. The ambient air quality of the study area is good and noise levels are within the standards.
6. The total land requirement for the project is 252254.86 ha. Out of which 79.756196 ha is forest land for which stage-1 forest clearance has already been obtained.
7. There are 2464 nos. of private structures and 38 nos. of CPRs recorded within the corridor of impact and need to be replaced. However, the proposed project will definitely have positive impacts on the socio-economic environment of the people of surrounding villages experiencing development in the area in specific and state and nation as a whole.

1. INTRODUCTION

1.1 General

Tripura is located in north-eastern part of India and covers an area of 10,491.69 km^2. Agartala is its capital. The total population is 329.66 million which accounts for 2.72% of the country. One-third of its total population composed by scheduled tribes' population. It is third smallest state of India. The Gross State Domestic Product (GSDP) at current prices increased from Rs.8, 903.53 crores in 2004-05 to Rs.26, 809.60 crore in 2013-14 (P). The per capita income of the State also rose steadily from Rs.24, 394 in 2004-05 to Rs.31,111 in 2007-08 and to Rs.50,859 in 2011-12 and to Rs.69,705 in 201314 (P).

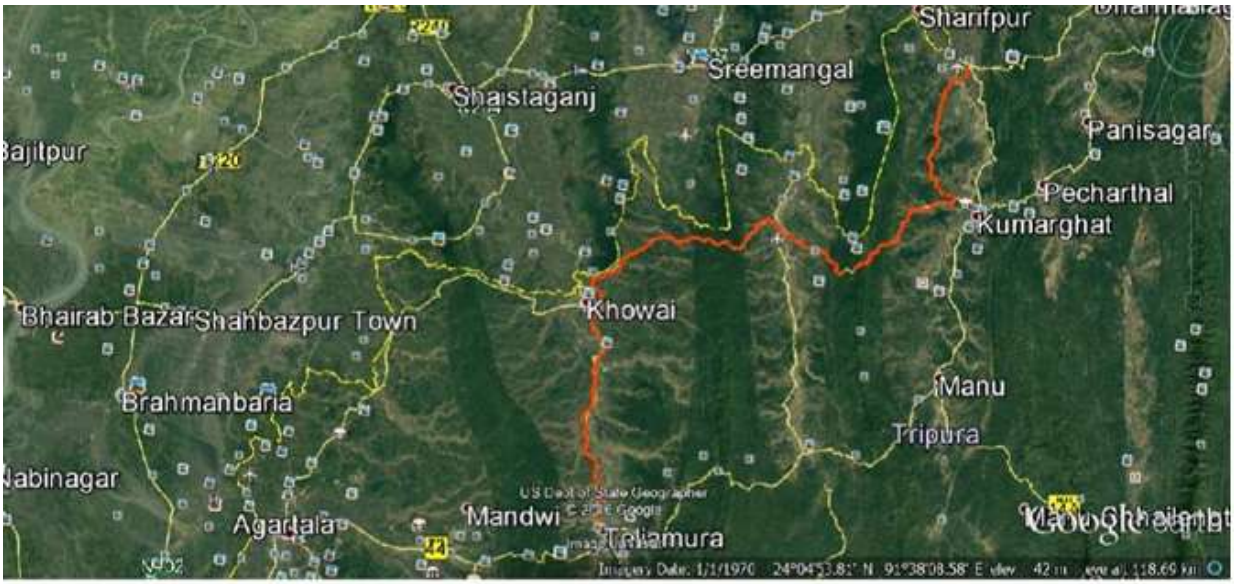
The deficient network and quality of the road infrastructure is an important deterrent factor constraining the development of major part of the state. The overall length of roads in Tripura is 42,200 km. As of 2015, the National Highways make up of 645 km and the State Highways including major district road and other district road consist of 1817 km. Tripura lies in a geographically disadvantageous location in India, as only one major highway, the National Highway 44, connects it with the rest of the country.

1.2 The Project

Project aims to improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by (i) improving the state highway network, (ii) facilitating safe and appropriate road usage, (iii) increasing efficiency of transport services and (iv) enhancing Tripura State's NHIDCL capacity for road asset development and management. Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions, better employment opportunities outside agriculture and improved access to economic Centers and increased industrial activities in the project area.

The project road starts from Kirtantoli (near kailasahar town) at junction of SH (Kailasahar-Kumarghat) and ends at NH-44 at Teliamura. The project road runs through Unakoti, Dhalai and Khowai districts of Tripura. Unakoti District has been recently renamed from the original North Tripura District as the outcome of bifurcation of newly created North Tripura District comprising of the Northern most part of Tripura state which has come into effect from 21.01.2012. Kailashahar is the District headquarters of Unakoti District. The project road passes through village / localities namely Kirtontoli, Rajnagar, Durgachoumohini, Manikbhander, Khowai, Kalyanpur & ends at Teliamura. A key Map of the project corridor is enclosed in **figure 1.1**

Public Works Department (NHIDCL) has been constituted by the Government of Tripura (GoT) with the purpose of development of highways and any structures thereon/other infrastructure projects entrusted to it and as part of this endeavour, the NHIDCL has been mandated to undertake improvement and up-gradation of various National Highways at different location in Tripura. Hence, NHIDCL has invited proposal for carrying out Feasibility Study and Detailed project preparation for Detailed Project Report for improvement and Widening to two lanes of newly declared NH-208 (tentative length 106.219km) for execution on EPC Mode.



Source: Alignment provided in DPR

Starting Point (Kirtontoli)

End Point (Teliamura)

Figure 1.1: Project Location Map

1.3 EIA Objectives

The EIA report covers the general environmental profile of the study area and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the project's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) is also proposed as part of this report which includes mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program, and the responsible entities for mitigation and monitoring. EIA has four basic objectives; (i) identify the environmental issues that should be taken into account due to project interventions (ii) determine the magnitude of potential environmental concerns and to ensure that environmental considerations are given adequate weight at planning/design stage (iii) identify need for further environmental studies or Environmental Impact Assessment (EIA) and (iv) suggest enhancement measures, if any.

1.4 Extent of the EIA

This EIA report has been prepared on the basis of detailed engineering design, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation as per prevailing Policy Statement. EIA extent has been decided considering all likely impacts and risks analyzed in the context of the project's area of influence encompassing (i) the primary project site(s) and related facilities like site clearance, utility shifting etc. (ii) associated facilities project viz. Borrowing, quarrying, disposal of debris, construction camp etc. (iii) areas and communities potentially affected by cumulative impacts and (iv) potential impact from unplanned but predictable developments caused by the project that may occur at later stage or at a different location. The core zone of impact is taken as 15 m on the either side of the alignment. However, the study area is considered up to 10 km on either side of road alignment for larger analysis of landuse and other environmental features.

1.5 EIA Methodology

EIA commenced with the review of technical details provided by the DPR team and preceding environmental assessment reports conducted for the project road. This was followed by a reconnaissance site visit and discussion with the implementing agency to reconfirm the technical details of the project road improvement work. This helped to identify those environmental attributes which may get altered with the passage of time and incorporate additional information to the baseline environmental scenario/environmental setting of the project. Further steps followed for EIA has been concisely described in following paragraphs.

Review of Country's Legal Framework: India has a well-defined policy/legal framework for safeguard of environment. Prior to initiation of any civil work, it is essential to analyze the various permissions/clearances required for any developmental project. Same has been presented in later section of this chapter.

Primary Data Collection: Environmental resource inventory will be prepared for all environmental features viz. terrain, landuse, waterways/water bodies, road side vegetation, sensitive receptors, common property resources, utilities, drainage, flooding/water logging, industries, accident prone areas etc. within the area of interest/core zone. Information about this will be done by trained persons under the supervision of an expert team. Similarly, biodiversity survey was also carried out. Baseline monitoring was conducted at the locations for which data was not available in environmental assessment report conducted by detailed design team.

Secondary Data Collection: Secondary sources include published government reports, environmental impact assessments conducted in the similar region, government websites, recognized institutions and relevant government departments (forest, irrigation, pollution control board, fisheries, statistics, Indian Meteorological Department (IMD) and Tripura Space Application Centre (TSAC) etc. Recent Google images have been captured to view environmental features at regional scale.

Public Consultation: Meaningful consultations were organized with the NHIDCL, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, water logging/flooding, flora and fauna, socio-economic standing of local people, impact due to loss of land other assets and common property resources, accident risk during construction and operation stage, perceived benefits

and losses, etc. Information thus gathered was used to integrate it in project design and formulate mitigation measures and environmental management plan.

Other Tools, Surveys and Studies: Assessment of landuse of larger area beyond the project site has been prepared for better planning and decision-making. Remote sensing and Geographic Information System (GIS) based landuse map of the study area (10 km buffer) was prepared through recent satellite imagery. A rapid bio-diversity assessment was also carried out to generate baseline on floral and faunal elements in the project area. The survey also helped in assessing impact on any rare threatened or endangered species of floral species in the project area. Extensive air, noise, water & soil quality monitoring & analysis has been carried out in the project road. Primary and Secondary Information Sources has been provided below in table 1.1.

Table1.1: Primary and Secondary Information Sources

Information	Sources
Technical Details	NHIDCL and Design Team
Inventory of road features	Ground Physical surveys
Climatic condition	Indian Meteorological Department Websites
Geology, Seismicity, Soil and Topography	State of Environment Report, Pollution Control Board, journal and research publications and Primary Survey
Land Use/ Land Cover	State of the Environment Report, Satellite Imagery based land use analysis, primary survey (Ground Truthing)
Drainage Pattern	GIS Map and Tooling, Detail Project Report and onsite observations, primary survey
Roadside Forest/Vegetation	Forest Range Offices/State Forest Department, Tripura & Primary Survey
Archaeological / Heritage sites	Archaeological Survey of India, Primary Survey
Air quality Noise, Soil and Water	Primary survey
Borrow areas, quarries and other construction material source	NHIDCL, Detailed Project Report and Consultation
River geo-morphology, hydrology, drainage, flood patterns,	Detailed Project Report, Consultation and site verification
Soil profile	Primary Survey
Groundwater Conditions	Central Groundwater Board
Socio-economic environment	Different Govt. agencies/civic bodies, official websites maintained by state govt., census of India 2011, and public Consultation during the Field survey

Assessment of Potential Impacts: The assessment of the type, nature, direct, indirect, cumulative or induced impacts and their significance to the physical, biological, and socio-economic components of the environment will be done to ascertain whether the project is environmentally sustainable or not. Nature of impacts will be classified as significant, insignificant, short-term, long-term, reversible, irreversible etc. After identification of nature and extent of impacts, mitigation measures will be suggested.

Preparation of the Environment Management Plan: The project specific Environment Management Plan (EMP) was formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. This includes

- Mitigation of potentially adverse impacts

- Monitoring of impacts and mitigation measures during project implementation and operation
- Institutional capacity building and training
- Compliance to statutory requirements
- Integration of EMP with Project planning, design, construction and operation.

Environment Monitoring Plan: The monitoring and evaluation are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to plan or not. It provides the necessary feedback for project management to ensure project objectives are met and on schedule. The reporting system is based on accountability to ensure that the environmental mitigation measures are implemented. Environmental monitoring program has the underlying objective to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. Such program targets proper implementation of the EMOP. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the EMP.
- To evaluate the adequacy of environmental assessment.
- To suggest ongoing improvements in management plan based on the monitoring
- To enhance environmental quality through proper implementation of mitigation measures.
- To meet existing environmental regulatory framework and community obligations.

Performance Indicators: The significant physical, biological and social components affecting the environment at critical locations serve as wider/overall performance Indicators. However, the following specific environmental parameters can be quantitatively measured and compared over a period of time and are, therefore, selected as specific Performance Indicators (PIs) for monitoring because of their regulatory importance and the availability of standardized procedures and relevant expertise. Performance indicators requiring quantitative measurements are:

- Air quality with respect to PM2.5, PM10, NOx and SO2 at selected location.
- Water quality as per CPCB prescribed Standards
- Noise levels at sensitive receptors (schools, hospitals, community/religious places).
- Survival rates of trees planted as compensatory plantation.

Assessment of EA Capacity to address the environmental concern of the project: EIA assess the capacity of the executing agency for effective implementation of EMP. Accordingly, if needed, a training and awareness program will be formulated to enhance the capacity of officials for implementing proposed mitigation measures and monitoring the resultant effects, as well as create awareness amongst workers and public. The institutions/agencies like regional office of MoEF, SPCB/CPCB, and Indian Institute of Technologies can be consulted for such trainings. Independent subject's experts/consultants (e.g., for the environmental awareness program, impact assessment specialist will be the resource person) can also be the resource persons to impart trainings. These experts /agencies shall be appointed based on specific need for the training. A separate budget for training will be allocated under the Construction Supervision Consultant budget.

1.6 Structure of the Report

The EIA has been structured as recommended in Terms of Reference. An introduction section has been included to have a general overview of the project. The report has been compiled and presented as follows-

Chapter 1-Introduction

Chapter 2- Policy, Legal and Administrative Framework

Chapter 3- Description of Project

Chapter 4- Baseline Environmental Studies

Chapter 5-Anticipated Impacts and Mitigation Measures

Chapter 6- Public Consultation & Information Disclosure

Chapter 7-Environmental Management Plan, Monitoring Plan and Grievance Redress Mechanism

Chapter 8 -Conclusion and Recommendation

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The chapter presents a review of the existing institutions and legislations relevant to the project at the National and State level. The Environmental Assessment process needs to adopt environmental regulations and guidelines of Government of India (GoI).

2.1 Country's Legal Framework and Regulatory Requirements

The Government of India has laid out various policy guidelines, acts and regulations for the safeguard and conservation environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests (MoEF) and the Central Pollution Control Board (CPCB)/Tripura State Pollution Control Board (TSPCB) in the present context. Environmental Regulations/ Legislations and its Applicability to the Project has been provided in Table 2.1.

Table 2.1: Environmental Regulations/ Legislations and its Applicability to the Project

Law	Description	Applicability in the project
EIA Notification	The EIA Notification of 2006 set out the requirement for environmental assessment in India. Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence.	Not Applicable as project activity does not attract provisions of EIA notification 2006 and its amendment till date.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments(1987)	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water, by Central and State Pollution Control Boards and for conferring on and assigning to CPCB/SPCBs powers and functions relating to water pollution control. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from State Pollution Control Board (SPCB) before starting implementation and Consent to Operate (CTO) before commissioning.	Consent to Establish (CTE) before start of construction works and Consent to Operate (CTO) before start of operation will be required for (if any)- • Batching Plant • Hot mix plants; and • Sand mining
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	This Act was enacted to achieve prevention, control and abatement of air pollution activities by assigning regulatory powers to Central and State boards for all such functions. The Act also establishes ambient air quality standards.	Following will require CTE and CTO from SPCB: Establishment of DG sets more than 10 KVA. • Batching Plant • Hot mix plants; and • Sand mining, if any
Environment (Protection) Act, 1986 and CPCB Environmental Standards. (National Ambient Air Quality Standards 2009)	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards.	Ensure applicable standards for ambient air quality. Ensure Emission Limits standards for New DG Sets Ensure Stake Height standards Requirement for DG Sets.

Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Ensure applicable noise standards and noise limits for DG sets.
Central Motor Vehicle Act Central Motor Vehicle Rules and (Amendment) Rules (1988 and amendment thereafter)	Objective of this Act is to check vehicular air and noise pollution. Vehicles to be used for construction and other purposes need to meet the standards and certificates prescribed as per the Rules, 1989 to control noise, pollution, etc.	Ensure vehicle exhaust emission standards.
Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	The Act designates areas within 100 meters (m) of the "protected monument/area" as "prohibited area" and beyond that up to 200 m as "regulated area" respectively. No "construction" is permitted in the "prohibited area" and any construction activity in the "regulated area" requires prior permission of the Archaeological Survey of India (ASI).	Not applicable as no such monuments within the project corridors.
The Right to fair compensation and transparency in land acquisition, rehabilitation and resettlement Act, 2013	Private land acquisition is guided by the provisions and procedures of this Act.	Applicable to this project as there is private land acquisition and resettlement.
Seventy Third Constitution Amendment Act 1992	This act guides Governments to establish rules for Panchayat involvement in project preparation and implementation. The Act stipulates involvement of the institutions especially, the Gram Sabha/ Panchayat during project preparation and implementation. The Panchayats at the village level will be involved for preparation and implementation of the project.	Ensure involvements of Gram Sabha/Gram Panhayat in the project design.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
The Sexual Harassment of	Whereas sexual harassment results in violation of the fundamental rights of a	Applicable

Women at workplace (Prevention, Prohibition and Redressal) Act, 2013	women to equality under article 14 and 15 of the Constitution of India and her right to life and to live with dignity under article 21 of the Constitution and right to practice any profession or to carry on any occupation, trade or business which includes a right to safe environment free from sexual harassment.	
The schedule caste and schedule tribe amendment act 2015 and rules 2016	The acts and rules are to provide the protection to tribal people.	Applicable
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable
Wildlife Protection Act, 1972 amendment 1991	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	The Gumti Wildlife Sanctuary is located within 10 km from the end point of the road. The draft ESZ notification no. 1985 dated 31.05.2018 of the sanctuary has been published. The project does not require Environmental Clearance and wildlife clearance is also not applicable as per MoEF&CC circular F.No.22-43/2018-1A.III dated 08.08.2019 and as per IRC:SP:93-2017 guidelines on requirement of environmental clearance of road projects.
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prohibits the use of forest land for non-forest purposes without the approval of Ministry of Environment and Forests and Climate Change (MoEF&CC), Government of India	Applicable as 79.756196 ha of forest land is required for project. The stage-1 clearance has already been obtained.
Solid Waste Management Rules 2016	Responsibility of Solid Waste Generator (i) segregate and store the waste generated in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorized waste pickers or waste collectors as per the direction or notification by the local authorities from time to time.	Contractor to follow all the rules during construction works.
Construction and Demolition Waste Management Rules 2016	(i) Every waste generator shall segregate construction and demolition waste and deposit at collection centre or handover it to the authorized processing facilities	Contractor to follow all the rules during construction works.

	(ii) Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains. (iii) Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or re-modeling work, (iv) Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste. (v) Large generators shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar, Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;	
Hazardous Waste Rules 2016	Responsibilities of the occupier for management of hazardous and other wastes.- (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely:- (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery.	Contractor to comply all the requirements of this Act during construction works.
International conventions and treaties		
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to this project as not site within the vicinity of the project.
Wetlands (Conservation and Management) Rules, 2017	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	Not applicable as subprojects components are not located in designated wetland area.
Montreal Protocol 1992	India is a signatory of this convention which aims to reduction in the consumption and production of ozone-depleting substances	Not applicable in this project as no ODS are involved in construction works.

	(ODS), while recognizing differences in a nation's responsibilities. Ozone depleting substances are divided in two groups Chlorofluorocarbons (CFCs) and Hydro chlorofluorocarbons (HCFCs).	
Basel Convention on Trans-boundary Movement of Hazardous Wastes, 1989	India is a signatory of this convention which aims to reduce trans-boundary movement and creation of hazardous wastes.	Contractor to follow the provisions of Hazardous Waste Rules 2016 for storage, handling, transport and disposal of hazardous waste emerged during construction works.
Convention on Migratory Species of Wild Animals (CMS), 1979 (Bonn convention)	CMS, also known as Bonn convention was adopted in 1979 and entered into force on 1 November 1983, which recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine and avian migratory species throughout their ranges. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.	Not applicable to this project as no migratory species of wild animals are reported in the project areas.

2.2 Procedure for Forest Clearance

MOEFCC has initiated online submission and disposal of forest clearance cases. The detail procedure is available on ministry website http://forestsclearance.nic.in/. However, the work-flow is unchanged which has been illustrated in figure below (**Figure-2.1**). Steps and Procedure for Obtaining Borrow Area Permit and Applicable Indian Road Congress (IRC) Codes have been provided in Table 2.2 and 2.3 respectively.

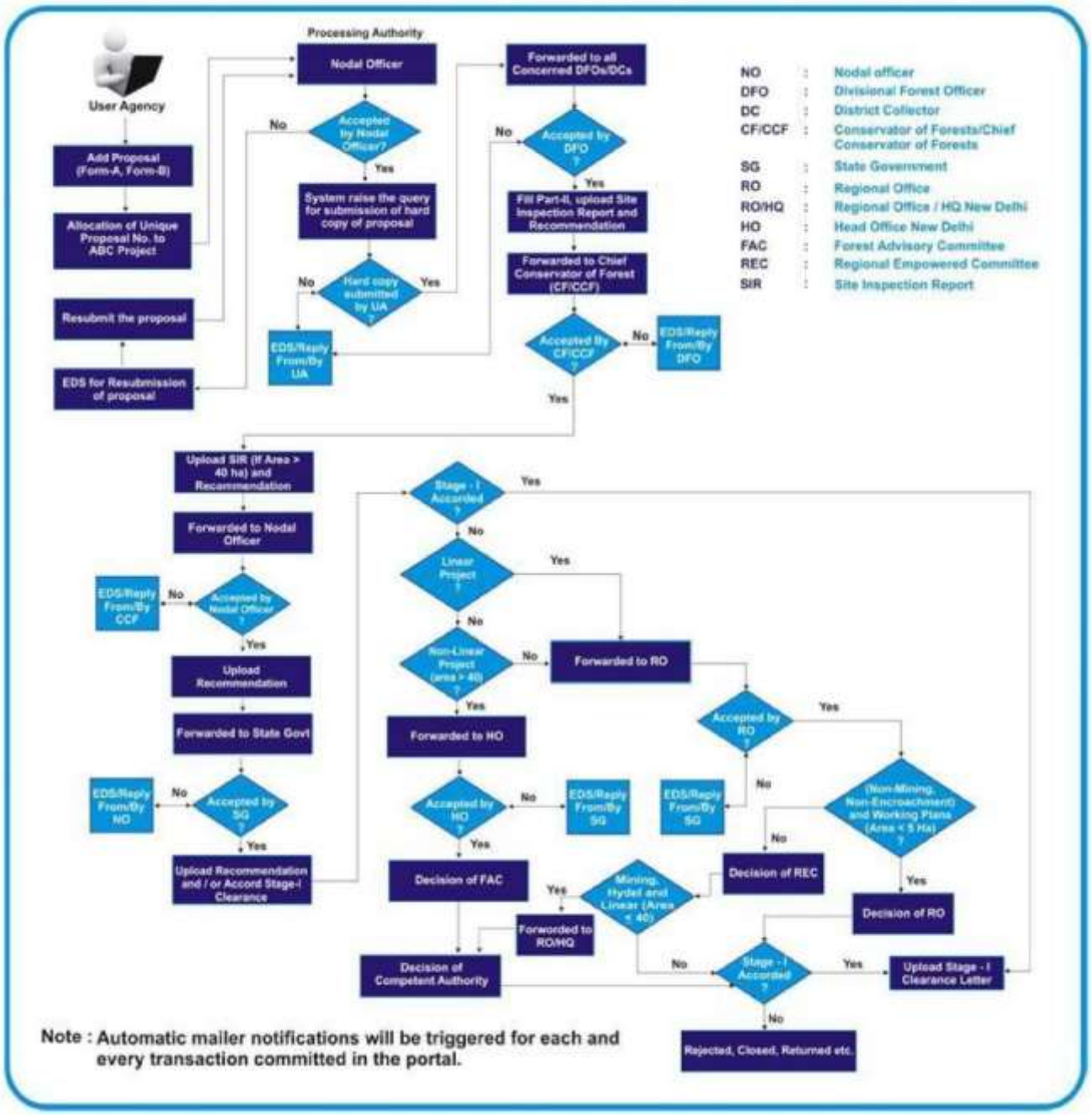


Figure 2.1: Procedure and Work Flow for Forest Clearance

Table 2.2: Steps and Procedure for Obtaining Borrow Area Permit

Steps	Activities
1	Contractor identifies the Borrow Area (BA) quantity based on prospective BA identified in F/S/DPR
2	Contractor identifies the Borrow pits with quantity and raise Request for Inspection (RFI) to IE/CSC.
3	IE/CSC inspects borrow pit in the presence of Environmental Engineer of contractor and land owner with his lease document.
4	Contractor takes the sampling of soil in identified pit and test in lab. IE/CSC approves the pit based on the test report (Moisture contents, particle size etc.)
5	Contractor makes the agreement with land owner and get NOC from Gram Panchayat if necessary
6	If BA is more than 5Ha (B1 category), contractor submit application for clearance to State Environment Impact Assessment Authority (SEIAA) the project is treated as B1 EIA and Public Hearing needs to be carried out.
7	If BA is < 5Ha (B2 category), contractor submit application in Form 1M, Prefeasibility report and approved mine plan to District Environment Impact Assessment Authority (DEISAA). DEIAA gives clearance base on the recommendation of District Environment Appraisal Committee (DEAC).
8	Contractor pays Royalty amount to state government at the prescribed rate.
9	Contractor submit Borrow Area Redevelopment plan to IE/CSC.
10	Contractor raise RFI to IE/CSC for Borrow pit excavation
11	Contractor fulfills the compliance of EC agency observations if any.
12	Contractor will maintain haul road and ensure for fugitive dust suppression
13	Contractor does sampling of each pit at the time of excavation test and gets approval of IE/CSC.
14	Contractor raises RFI to IE/CSC before closing the pit.
15	Contract reclaims borrow pit as per owner agreement and gets clearance from him.

Key Considerations prior to selection of Borrow Areas:

- Cluster shall be formed if the distance between peripheries of one lease to the other and is less than 500m in homogenous mineral area.
- Minimum distance between two clusters is 500 meters.
- Maximum depth of excavation 2000mm from existing ground level.
- In case of fertile land; 15 cm top soil is stock piled. Further up to max.30 cm depth.
- Maintain 5m distance from the toe of the final section of the road/Embankment.
- BA not to be dug within 1500 m of village. If unavoidable should not exceed 30 cm in depth.
- Ridges not less than 8m width shall be left an interval of not exceeding 300m.

Applicable Indian Road Congress (IRC) Codes to the Project Road: Key IRC guidelines have been summarized that have a direct/indirect bearing on the environmental management during design and construction stages.

Table 2.3: Applicable Indian Road Congress (IRC) Codes

S. No	Code Title/Theme	Code
1	Guidelines on requirement of environmental clearance for road projects	IRC:SP:93-2011 & IRC:SP:93-2017
2	Guidelines on Landscaping and tree plantation	IRC:SP: 21-2009
3.	Guidelines for EIA of Highway projects	IRC:104-1988
4.	Guidelines for Borrow area identification, use and its rehabilitation	IRC:10-1961
5	Guidelines for Pedestrian Facilities	IRC: 103 -1988
6.	Ribbon developments on highways and its prevention	IRC: SP: 1996
7.	Manual on Landscaping of road	IRC: SP: 21-1979
8.	Report on recommendations of IRC Regional workshops on highway safety	IRC: SP: 27-1984
9.	Road safety for Children (5-12 years old)	IRC: SP: 32-1988
10	Guidelines on road drainage	IRC: SP: 42-1994
11	Highway safety code	IRC: SP: 44-1994
12	Guidelines for safety in construction zones	IRC: SP: 55-2001
13	Recommended practice For treatment of embankment slopes and erosion control	IRC: 56-1974

2.3 JICA Guidelines

Applicability of JICA's Guidelines for Environment and Social Considerations **(here in after, ESC)** is required if a project is funded by JICA. If a significantly adverse impact on the environment or society has been identified in JICA-assisted project, the following has to be thoroughly considered and studied.

1) ESC are pre-requisite

a. JICA will take necessary measures to ensure that the appropriate ESC is given;

b. When JICA reviews a project proposal and finds that the project could cause negative impacts on the environment or society, JICA advises the project proponents to provide appropriate ESC;

c. If the negative impact of the project cannot be avoided or mitigated to an acceptable level, JICA will not support its implementation.

2) Respect human rights

a. Development project should aim for fair distribution of its benefits and must not burden or exclude certain stakeholders for the sake of others;

b. The project proponents must respect the rights of all people concerned, and pay special attention to vulnerable social groups such as women, elderly, the poor, people with disabilities, indigenous peoples, ethnic minorities, and other minority groups to ensure that they are involved in decision-making processes and that they benefit from the project;

c. JICA's ESC Guidelines defines 'stakeholders' as local residents including non- titleholders who are affected by the project as well as local NGOs. By involving local stakeholders from the early stage of the project, the project proponents can receive their inputs and plan appropriate measures to address their concerns, avoid conflict, and achieve higher results with their support. For this reason, the project proponents should conduct a series of consultations with local stakeholders in an interactive and meaningful manner. During this process, appropriate consideration must be given to socially vulnerable or different people such as women, children, the elderly and ethnic minorities.

3) Avoid adverse impacts

a. Priority should be given to the avoidance of adverse impacts on the environment or society when a project is planned;

b. Minimization or mitigation of impacts should be considered only if avoidance is not feasible and if the benefit of the project outweighs the cost of mitigation measures;

c. The project proponents must assess the environmental and social impacts at the earliest possible stage of planning, and implement ESC measures in accordance with the ESC Guidelines.

4) Information on ESC must be disclosed to the public

a. Information disclosure is key in ESC. Project proponents must proactively release relevant information to the public;

b. Sharing information with a wide range of stakeholders from the early stage, the project proponents can utilize their feedback to improve the plan/project. In addition, the project proponents can ensure that unnecessary concerns and misunderstandings among the stakeholders are ameliorated.

5) Host country's laws, standards, policies and plans

a. JICA-funded project must comply with the laws, standards, policies, and plans of the host country;

b. If the standard set by the host country differs from the international standard, the project proponents are advised to adopt international standard that better serves the

purpose of attaining a higher level of ESC.

6) The World Bank's Safeguard Policies

ESC in a JICA project must be in line with the World Bank's Safeguard Policies including:

a. Operational Policy on Environmental Assessment (OP 4.01);

b. Natural Habitats (OP 4.04);

c. Involuntary Resettlement (OP 4.12);

d. Indigenous Peoples (OP 4.10), and other relevant policies.

3. PROJECT DESCRIPTION

3.1 Location of the Project

The start point of the project road is Kirtantoli at Km 21+100 near Kailasahar town and ends at Km 127+319 at NH-44 at Teliamura. The project road starts from Kirtantoli (near kailasahar town) at junction of SH (Kailasahar-Kumarghat) and ends at NH-44 at Teliamura. The project road runs through Unakoti, Dhalai and Khowai District of Tripura. Unakoti District has been recently renamed from the original North Tripura District as the outcome of bifurcation of newly created North Tripura District. Kailashahar is the District headquarters of Unakoti District. The district has a total geographical area of 686.97 km2. Dhalai District was created in the year of 1995 by bifurcating North Tripura District and including part of Amarpur Sub-Division of the South Tripura District & the District covers an area of about 2426 sq km. Khowai is situated in a plain along the Khowai River.

3.2 Need of the Project Road

Poor road infrastructure of Tripura, both in terms of its network connectivity and riding quality, is an important factor constraining the development of the state despite its vast potential. Proposed road will be a vital link to connect existing national highway (NH-44) with nearby areas of the three project districts besides connecting significant rural population. This will resuscitate the local economy and help local people to be part of main stream society. Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the alignment.

3.3 Characteristics of Exiting Road

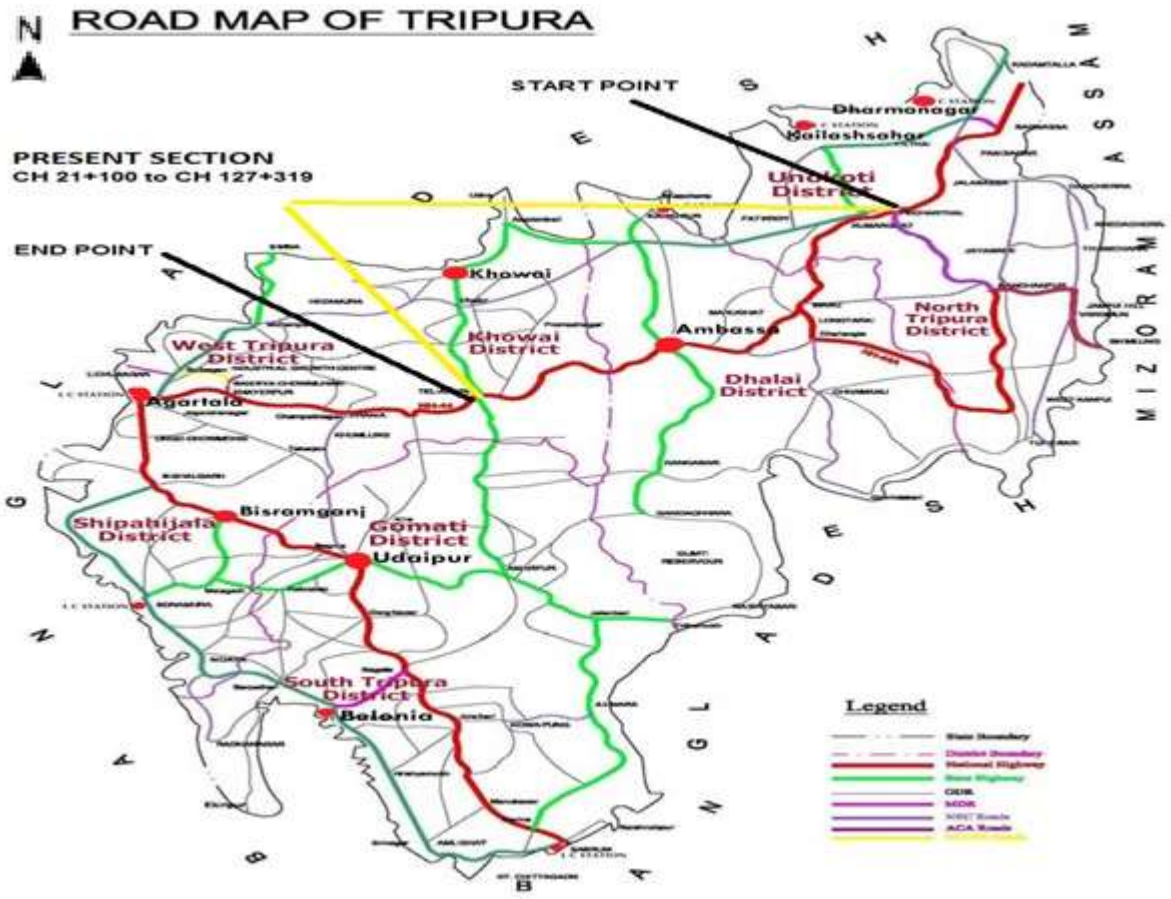
The project road passes through plain, rolling and Hilly terrain with a considerable part of the road passing through settlement areas. The existing road also passes through agriculture land, barren land, residential/commercial establishments, public utilities such as schools, health care centres & other government offices etc. The existing road also passes through forest area for considerable portion. The existing road has general carriage way varied from 3.5m to 7.5m. Lined and unlined both types of drains are present at considerable length, on both sides of the project road. 5 major junctions and 84 minor junctions exist in the project road. Pavement condition is below average with presence of pot holes, raveling, rutting and patching is observed on the pavement surface. Existing project road is passing through numbers of schools, health centers, veterinary centre, panchayat offices and religious structures.

3.4 Study of Alternate Options

A comparative analysis of various alternatives considered to avoid, prevent or minimize impacts that would be inevitable if technically (based on design speed and geometrics) best-fit alignment is followed. The consideration of alternatives to a proposal is a requirement of the EIA report. During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparative analysis of the alternatives will help to determine the best method of achieving project objectives while minimizing environmental and social impacts. Three options have been selected to decide the final alignment, these three options are:-

1. Zero option: No project intervention is implemented i.e. transportation by present roads is continued to be used.
2. The selected option: The option is used for this EIA impact study
3. Others options (widening options): The option is to widen the existing road to the level of the planned road.

Figure 3.1 shows the existing road network covering National Highway (NH), State Highway (SH), Major District Roads (MDR) and Other District Roads (ODR) in Tripura. The present section is a part of newly declared NH- 208 (earlier known as NH- 44).



Source: Tripura.gov.in

Figure 3.1 Road Network in Tripura

3.4.1 **Overview of alternatives**

The overview of all the three alternatives along with features of the alternative plan is described in table 3.1.

Table 3.1 Overview of Alternatives

Alternatives	Location map	Features of the alternative plan
Zero option: No project intervention is implemented i.e. transportation by present roads is continued to be used.		• Concept: To utilize the existing roads. The road start from Kirtantoli (near Kailasahar town) and end at Teliamura. • Project features: No widening/alternative of road nor land acquisition is required.
Option 1: **The selected option:** The option is used for this EIA impact study		• Concept: Proposed road will be a vital link to connect national highway (NH-208, earlier known as NH-44) with nearby areas of the three project districts besides connecting significant rural population. This will resuscitate the local economy and help local people to be part of main stream society. • Project features: Improvement/Widening to two lane with paved shoulder of Kailashahar to Teliamura via Khowai section of newly declared NH – 208 from CH 21.100 km to 127.319 km as per the revised alignment with Byepass. • Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the existing road and revised alignment /bypass at such places will improve the horizontal geometry and eliminate the reverse curves .

Option 2: Others options (widening options): The option is to widen the existing road to the level of the planned road.		• Concept: To accommodate the widening of the present section within exiting ROW/acquisition along the ROW. • Project features: Improvement/Widening to two lane with paved shoulder. The proposed project transverses from 24°18'30.39"N 92° 1'0.87"E at Kirtantoli (near Kailasahar town) to 23°50'21.83"N 91°37'36.26"E at NH-208 at Teliamura. • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.

Source: EIS Pvt. Ltd. and DPR Vol IV

3.4.2 Comparison of alternatives

Comparison of all the three alternatives and their evaluation were made and described in Table 3.2 as follows.

Table 3.2 Comparisons of Alternatives and the Evaluation

Option	Without Project	Option 1	Option 2
Overview of alternative plans	Without Project: To utilize the existing Roads (The road start from Kirtantoli (near kailasahar town) and end at Teliamura.)	Plan with the improved curve correction, bypasses, and shortest route.	To accommodate the widening of the present section within exiting ROW/acquisition along the ROW.
Impact on natural environment	**A:** Additional impact is minimal	**B:** Passes through the hills and the reserved/protected forests for which forest land diversion of 79.756196 ha is required. A total of 34,650 numbers of	**C:** Passes through the hills and the reserved/protected forests for which forest land diversion is

		trees likely to be fell down during the project. Having some reversible impacts on local ecology and biodiversity, however ,compensatory afforestation and other mitigation measures will reduce the impacts.	required. The numbers of tree likely to be fell down 51, 450 due to road side plantation along the existing alignment specifically rubber wood plantation. Additional forest land diversion & more tree cutting impacts on local biodiversity.
Area under protected/ important or sensitive species of flora or fauna/Wildlife Sanctuary	**A:** Additional impact is minimal	**B:** The proposed alignment does not pass through Wildlife Sanctuary .However; Gumti Wildlife Sanctuary is located approx. 8 km away from the end point of the project. No direct impact on sanctuary flora & fauna is envisaged.	**C:** The proposed alignment does not pass through Wildlife Sanctuary .However; Gumti Wildlife Sanctuary is located approx. 8 km away from the end point of the project The more tree cutting as compare to option 1 will have more impact on avifauna and floral biodiversity.
Pollution	**D:** There is concern about traffic congestion specifically at junction points, narrow road & poor geometry of the road leads to air pollution.	**B:** air pollution and noise during the construction will be concerned .However , they can be minimized by appropriate mitigation measures and once the road is operational, the air and noise pollution get reduced by smooth traffic movement.	**C:** Although there is concern about certain amount of air pollution and noise during the construction, they can be minimized by appropriate Mitigation measures. However due to poor geometry and curves, traffic congestion will still be concern even during road operational and lead to air pollution and noise pollution.

Impact on social environment	**A:** Resettlement and land acquisition will not be required with this plan.	**B:** The number of residents to be resettled is minimum among the plans with project implementation (Structure affected Residential and commercial : approx. 622). **B:** It is likely that tribal reside on the hills where the road passes through. However bypass reduces the impact.	**C:** The number of residents to be resettled is large as road site settlements are approx. 1250 as people prefer to settle along the road and without bypass at congested locations impacts are more. **C:** Tribal live along the hill side road & road widening without bypass having more resettlement impacts .
Technical issues	**D:** Existing Road has technical issues as existing horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations	**A:** No major technical issues	**D:** major technical issues as alignment will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH)
Project Cost	**A:** No additional costs are incurred.	**B:** Total length is shortest , therefore cost is less	**C:** Total length is more, therefore expenses are more.
Traffic Safety	**D:** It is not suitable and not as per IRC guidelines for safety.	**A:** Safe and smooth traffic condition will improves the traffic safety.	**D:** The widening cannot be done as per IRC guidelines for safety and widened road may cause more accidents due to poor geometry and sharp curves.
Project Effect	**D:** The road is a part of NH-208 and not meeting the safety standards. Also traffic congestion is point of concern. No action will lead to local people agony.	**A:** The project will improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities in all the three benefitted districts and helps in poverty reduction in the region.	**C:** The Project will have positive impacts in terms of better economic opportunities ,however without safety norms widening may increase the accidents rate along the alignment.

Total evaluation (Ranking)	**D**	**B**	**C**
	Present road is not able to withstand the increasing traffic also Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves causing discomfort to road users causes accidents. Therefore , no action is not desirable.	It is the shortest route and having fewer impacts. The alignment will overall improve the efficiency of road by improvised road geometry & curve correction, reduce travel time and ultimately contribute to expansion of economic opportunities. The most desirable option.	Although impacts may be less in terms of land acquisition, however more impacts due to tree cutting, more residential and commercial structures acquisition along the road (By not bypassing the congested locations). Further, major technical issues as alignment will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) and not meeting the safety norms, therefore not a recommended option..

(Note) A: The highest evaluation, B: Good, C: Other options can be desirable, D: Shall be avoided

3.4.3 Conclusion:

Zero option has been ruled out as present road is not able to withstand increased traffic & safety norms. The widening option (Option 2) of existing road was also not feasible due to its geometric design, R&R issues, socioeconomic viability, environmental & road safety aspects. The initial site visit and detailed ground reconnaissance revealed that by and large the selected alignment having less/minor effect on environmental and social components is acceptable. The proposed alignment (Option 1) was selected after finalization of various options such as realignments, bypasses, keeping in view objectives of the project, traffic condition, obligatory points, geometric designs, congestions and socioeconomic viability, environmental & road safety aspects.

3.5 Development/Improvement Proposals

Project road improvement will broadly follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines. In case of any compromise with these guidelines, has been specifically mentioned with reasons. All efforts have been made to maintain the consistency of design criteria barring few exceptional cases due to limiting factors for the reason that of ground conditions. Design criteria adopted for the project along with silent features is summarized in Table 3.3.

Table 3.3: Design Standards and silent features of the project

1.	Project	Improvement/Widening to two lane with paved shoulder of Kailashahar to Teliamura via Khowai section of newly declared NH – 208 from CH 21.100 km to 127.319 km.
2.	Location of the proposed project	The proposed project transverses from 24°18'30.39"N 92° 1'0.87"E at Kirtantoli (near Kailasahar town) to 23°50'21.83"N 91°37'36.26"E at NH-44 at Teliamura.
3.	Total Length of the proposed project	106.219 km
4.	Terrain	Plain, rolling and hilly
5.	Seismic Zone	Zone V
6.	Geographical Location	Start Location 24°18'30.39"N 92° 1'0.87"E End Location 23°50'21.83"N 91°37'36.26"E
7.	Proposed Bridges and ROB	53 nos. minor bridges & 08 nos. major bridges 01 no. of ROB
8.	Bus Bay/ Truck Lay Bye	13 nos. of bus bay and 01 no. of truck lay bye
9.	Design Speed	
	a) Plain Terrain (in general)	Ruling: 100 kmph Minimum: 80 kmph
	b) Rolling Terrain	Ruling: 80 kmph Minimum: 65 kmph
	C) Hilly Terrain	Ruling: 60 kmph Minimum: 40 kmph For Hair Pin Bend: min 20kmph
10.	Carriageway Width	7.0 m
11.	Width of Shoulder	In Rural/Built-up section:
	a) Paved	2 x 1.5m (in Rural); 2x 2.5m (in Built-up); In hill section: 1.5m (on hill side) and 1.5m (on valley side)
	b) Earthen	2 x 2.0m
12.	Footpath width at built-up areas	2 x 2.0m
13.	Number of affected persons and household	Affected persons 4286 and Affected household 2464
14.	Nos. of private structures affected	2464
15.	Total number of CPRs affected Community and Religious)	38
16.	Total Area of Land Acquisition	254.69 Ha out of which 119.10 Ha Private land 54.23 Ha Government Land , 1.598 Ha other land and 79.756 ha forest land .
17.	Forest Land Diversion	79.756196 ha
18.	Total R&R budget for the proposed project RP	Rs. 256.46 Ha.

Source: DPR Vol-IV Part A

3.5.1 Cross Section

Cross-section for the improved facility should be adequate to cater to the traffic expected over the design period and offer safe and convenient traffic operation at speeds consistent with the terrain conditions and functional classification of this road.

The cross-sectional elements (lane/shoulder width etc.) shall be as per standards specified in geometric design standard mentioned above. Following typical cross-sections have been envisaged for the subject project as mentioned below:

Table 3.4: Details of Typical Cross-sections Adopted in different Stretches

TCS Type	TCS Description	Length(m)
TCS-1	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA (RECONSTRUCTION) APPLICABLE FOR	29524
TCS-2	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH (NEWCONSTRUCTION) APPLICABLE FOR PLAIN/ROLLING TERRAIN	27865
TCS-3	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH APPLICABLE FOR PLAIN/ROLLING TERRAIN IN CUTTING SECTION (NEWCONSTRUCTION)	7705
TCS-4	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RCC COVER DRAIN IN BUILTUP AREA APPLICABLE FOR PLAIN/ROLLING TERRAIN (RECONSTRUCTION)	6400
TCS-5	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	7288
TCS-6	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND LEFT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	1835
TCS-7	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND RIGHT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	2090
TCS-8	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER LEFT SIDE BREAST WALL AND RIGHT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN	1550
TCS-9	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER RIGHT SIDE BREAST WALL AND LEFT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	1550
TCS-10	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER RIGHT SIDE RETAINING WALL AND LEFT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN	1440

TCS-11	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER LEFT SIDE RETAINING WALL AND RIGHT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	972
TCS-12	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER LEFT SIDE BREAST WALL AND RIGHT SIDE RETAINING WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	300
TCS-13	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER RIGHT SIDE BREAST WALL AND LEFT SIDE RETAINING WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	150
TCS-14	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RETAINING WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)	2015
TCS-15	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE BREAST WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (NEWCONSTRUCTION)	5725
TCS-16	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN	8560
TCS-17	NEW CONSTRUCTION OF 2 LANE CARRIAGEWAY IN ROB APPROACHES WITH BOTH SIDE SERVICE ROAD	1250
Total length of proposed project road		106219

Source: DPR Vol-I Main report

3.5.2 Pavement Design

Pavement Design for New and Widening pavement has been done as Per IRC-37: 2012. Considering 90th percentile CBR as Design CBR which is found out 6% from the graph and Design Traffic 20msa, the proposed pavement thickness of the project road has been mentioned below in Table 3.5.

Table 3.5: Recommended Flexible Pavement Thickness

BC (mm)	DBM (mm)	WMM (mm)	GSB (mm)
40	85	250	200

3.5.3 Realignment & Bypass

39.3% of the total road length proposed to be realigned. The length of realignment stretch is 41.750km. Realignment has been proposed after geometric improvisation at the following location. Besides, a stretch of 4.510km length is proposed at Khowai bypassing the main town form design chainage 96120m to 101110m.

3.5.4 Bridges and Culverts

There are 53 nos minor bridges are found in the project road. Among them 4 nos are proposed to be retained and 6 nos bridges are bypassed. 39 nos existing minor bridges are proposed to be reconstructed. Additional 3 nos new minor bridges have been included in the project road. 3 nos major beside minor

bridges are exist in the project road. Among them 2 nos are proposed to be reconstructed. 1 no major bridge at existing chainage km 116.712(span 2x27+1x33m) & 1 no minor bridge at existing chainage km 116.765(Span 1x18.288m) will be reconstructed with 1 no major bridge of span 4x40m. 207 existing culverts are proposed to be reconstructed by box culvert. 25 existing culverts are omitted due to through cutting. Additional 34 box culverts are proposed in the proposed alignment. Hence, 241 numbers of box culverts proposed in the project road.

3.5.5 ROB

A ROB is proposed over railway crossing at the design chainage 124+311km in the proposed alignment.

3.5.6 Junctions/Intersections Improvement

There are 8 major intersections in the project road which are proposed to be improved at grade. 84 existing minor junctions are proposed to be improved for the project road. The details of major Junctions have been given in Table 3.6.

Table 3.6 List of Major Junctions

Sl No	Existing Chainage (Km)	Design Chainage (Km)	Side	Type	Remarks
1	21+100	21+100	Right	3-Legged	Junction with Kailasharar to Kumarghat
2	42+340	40+788	Left	3-Legged	Road leads to Fatikroy
3	75+055	69+640	Left	3-Legged	Road leads to Ambassa
4	76+500	71+068	Right	3-Legged	Road leads to Kamalpur
5	103+220	96+120	Right	3-Legged	Junction is provided at the start point of Bypass at khowai
6	111+150	101+110	Right	3-Legged	Junction is provided at the end point of Bypass at khowai
7	117+800	106+970	Right	3-Legged	Road leads to Ramchandra Ghat Market
8	139+425	127+319	Right	3-Legged	Road leads to Agartala

Source: DPR Vol-I Main report

3.5.7 Bus Bay/ Truck Lay Bye

Bus bays are proposed at 13 locations and Truck Lay Bye at 1 location along the project road. The list of proposed bus bay Truck Lay Bye location is mentioned below in Table 3.7.

Table 3.7: Location of proposed Bus Bay/Truck Lay Bye

Sl No	Design Chainage(km)	Side	Remarks
1	21+850	Both	Bus Bay
2	27+400	Both	Bus Bay
3	43+535	Both	Bus Bay

4	45+750	Left	Bus Bay
5	46+565	Right	Bus Bay
6	64+150	Both	Bus Bay
7	71+400	Both	Bus Bay
8	87+485	Both	Bus Bay
9	95+710	Both	Bus Bay
10	102+025	Both	Bus Bay
11	107+380	Both	Bus Bay
12	113+875	Both	Bus Bay
13	126+565	Both	Bus Bay
14	100+695	Both	Truck Lay Bye

Source: DPR Vol-I Main report

3.5.8 Drainage Work

Footpath cum cover drain of 2.0m Width has been proposed in built up area, cover drain of 1.0m width has been proposed in ROB approaches for service road, Brick Masonry drain has been proposed on hill side & Catch water drain has been proposed on hill side for proper drainage purpose. 12.8km length of 2.0m width RCC Cover Drain in built up area, 2.5km length of 1.0m width RCC Cover Drain for service road, 41.133km Brick Masonry Drain proposed in the project road and 21.525km Catch Water Drain proposed in the project road.

3.5.9 Protective Work

6392 m Retaining walls & 15500m Breast wall are proposed in the project road.

3.4.10 Miscellaneous Provision for Traffic Guidance and Safety

A high-speed facility is basically aimed at providing safe efficient and economic movement to motorised through traffic with comfort and pleasing environment during the journey. To achieve these objectives in practice, it is essential to make certain miscellaneous provisions for traffic guidance and safety. Accident record shows that there are no critical stretches with respect to accident severity, where ASI exceeds the accident threshold. Repetition of accident at certain locations could be attributed to factors like ribbon development and uncontrolled access along with poor illumination on the stretch. The safety measures and devices as proposed by the Consultants along the highway are described below:

+ Road side Furniture
+ Street Lighting
+ Landscaping and Tree plantation

3.5.11 Roadside Furniture

For notification of road features and also for safety and guidance of the road users, the project road will be provided with all the necessary traffic control and safety devices. These include:

+ Traffic Signs and Pavement Markings

Traffic signs and pavement markings shall include roadside signs, overhead signs, curve mounted signs and road marking along the project highway. The locations for these provisions shall be based as per IRC:35-1997 and IRC:67-2012 respectively.

+ Road Delineators
+ Pedestrian Guard Railing +
Metal Beam Crash Barrier

Metal beam crash barrier shall be provided on both edges of the road where road height is equal to or exceeds 3m and on outer edges of sharp curves. Suitable reflectors have been proposed to be fixed on the beam @ 3 m centre-to-centre for proper delineation of the barrier line.

+ Traffic safety Devices wherever required

+ Boundary Stones
+ Hectometer/Kilometer/ 5th KilometerStones
+ Traffic Blinker Signal (L.E.D) at intersections

3.5.12 Street Lighting

+ Adequate lighting will be provided for bus bays and Truck Lay byes.
+ Street lighting will also be provided for highway alignment passing through potentially hazardous locations such as built-up area, junctions.

3.5.13 Landscaping and Plantation

(i) Landscaping of the highway shall be done at suitable locations. The aim of landscaping will be conservation of existing natural or manmade features e.g. ponds, historical buildings and scenic vistas along the highway.
(ii) Landscaping will address the issue of drainage to ensure minimum disturbance to the natural drainage and at the same time ensure protection of natural surfaces from erosion.
(iii) Proper landscaping will be provided for highway alignment to fit-in with surroundings for pleasing appearance, reducing headlight glare and adverse environmental effects such as air pollution, noise pollution and visual intrusion.
(iv) Landscaping will include stabilization of embankment by pitching and/or turfing / plantation. The treatment of embankment slopes along the highway will be as per recommendations of IRC: 56 - 1974, depending upon soil type involved. Planting of shrubs, hedges and trees on medians and sides for highways of reducing glare effect, reducing visual intrusion, noise pollution and air pollution.
(v) Trees, their spacing and arrangement in different situations will be as per IRC: 21 - 1979 and IRC: SP: 66 — 1976.

4. BASELINE ENVIRONMENTAL STUDIES

Baseline environmental conditions about all facet of environment viz. physical, biological and socio-economic have been established using both primary and secondary sources. Efforts have been made to collect the latest information's both at regional as well as local level especially along the project corridor. This will help to predict likely changes in the environment due to the project and will serve as performance indicators for various components.

4.1 Physical Environment

4.1.1 Meteorology & Climate

The project state, Tripura falls under the sub-tropical to temperate climatic region. The climate of the project districts Unakoti, Dhalai & Khowai is characterized by moderate temperature and high humid nature. There are three prominent seasons summer, rainy and winter. The summer season spans from March to May and is followed by SW monsoon lasting till September. Winter season starts from November and lasts till the end of February. The temperature in the area varies from 5.1˚C to 35.6˚C. The humidity is generally high throughout the year. In summer season the relative humidity varies between 50 to 90 percent and in rainy season, the relative humidity is over 85 percent in morning and in evening it varies between 70 to 80 percent.

Rainfall: The rainfall pattern in Tripura varies not only from place to place but also between seasons. Tripura experiences very heavy rain from June to September/October from the South West Monsoon. The rainfall is at higher side at southern and northern side of the state of Tripura. Winter seasons in Tripura are mostly dry. The annual average rainfall of the State is 2122 mm. The average monsoon rainfall for last 10 years is 1710 mm. The average numbers of rainy days for last 5 years is 95. The co-efficient of variation of rainfall in the area ranges from 6 - 32% suggested a low variability of annual rainfall.

Humidity: The relative humidity of the state stays at higher side throughout the year. In summer, the relative humidity lies between 50 to 74 percent whereas during rainy season it goes beyond 85 percent. The maximum and minimum relative humidity is 85 percent and 57 percent in the month of July and January respectively.

Wind: The wind speed and wind direction of an area influences the dispersal of pollutants from a point and non-point sources. The wind direction in the project district is from South East to North West and the maximum wind speed recorded is between 3.0 — 4.0m/sec.

Temperature: The temperature of the State shows a declining trend from west to east. This phenomenon can be attributed to the increase of height in eastern part of Tripura and increase in distance from Bay of Bengal. The summer in the state of Tripura is intense. Cold weather starts from about the end of November when the temperature of both day and night decreases steadily. January is the coldest month of the year. The highest temperature recorded from the monitoring conducted by IMD at A.D. Nagar weather monitoring station, Agartala during pre-monsoon was 39.5°C and the minimum temperature recorded during was 12.7˚C.

4.1.2 Hazards/ Disasters

Natural hazards such as earth quake, flood, drought, cyclone etc. cause destruction of human life and properties. A natural calamity and disaster during the life cycle of the project may exert significant effects on the project activity, project function and also inhibits the availability of resources for the project. The access to the project site may also get disturbed through disruption of transportation links. Major natural calamities pertaining to the state of Tripura are furnished below:

Seismicity & Earthquakes

The State of Tripura comes under the very high risk seismic zone in the country, namely, Zone V of seismic Zoning Map of India. A large number of moderate to large magnitude earthquakes have occurred within the State boundary as well as within 100 km distance around it. Major and significant earth quakes have been furnished in table 4.1 below.

Table 4.1: Significant Earthquake of Tripura

Date/ Year of Earthquake	Location of Epicentre	Remarks
1869	Within 18 km of the district town of Dharmanagar.	An earth quake of M 7.5 occurred, caused massive destruction in permanent infrastructures and lives. The old royal palace at Udaypur got destroyed form this earth quake.
12th June 1897	In Shillong Plateau, near Rangjuli, Assam	An earthquake took place in the state and adjacent areas of which magnitude M 8.7. This was one of the most powerful earthquakes in the Indian sub-continent. The quake wreaked havoc across the present states of Tripura, Assam and Meghalaya.
1918	N.A.	Srimangal area experienced an earth quake with a magnitude of M 7.6 1930 Dubri An earth quake took place with a magnitude of M 7.1
15th Aug,1950	Indo-China Border Region	An earth quake hit mainly the northern part of Tripura and it was originated from Indo-China boarder region. The magnitude of this earthquake was 8.5 Richter. It was the 6th largest earth quake of 20th century.
1950	N.A.	An Earthquake of magnitude 6.3 Richter occurred within North Tripura district caused damage to the buildings and other infrastructures
1970 to 2000	N.A.	According to the records of the Indian Meteorological Department, 41 earthquakes of 5.6 or lower magnitude have occurred within the coordinates 23.00°-25.00°N and 91.00°-93.00°E

Source: Tripura Disaster Management Authority

Flood

750 km^2 of land area of Tripura is considered to be flood prone. Nearly all the rivers are rainfed and are prone to flood. The State is bestowed with a relatively high average annual rainfall of with average number of rainy days at 92. Normally rain arrives in the State in late April and continues up to October. However, the intensity of rainfall increases during the months of June to September. Higher rainfall, that occurs during this period causing floods in low lying areas and erosion of land. Tripura, in the past witnessed worst form of disasters by disruption of means of communications caused due to damage of roads and bridges and also blockage of roads due to landslides. Flash flood is also a common phenomenon during rainy season. In last twenty years two major flood events occurred in the state of Tripura - One in 1999 and another in 2004 causing huge economic loss. Drought is an infrequent calamity in the state. However, it normally occurs in the State of Tripura due to delayed rainfall in the months of April-May. Deficient rainfall in those months results scarcity of drinking water as ground water level go down. The impact of dry spell hampers most on agricultural activities. It also adversely affects the Pisciculture, Sericulture and Tea plantations resulting to production loss in these sectors. Induced 27 by extremely low rainfall, drought occurred in the year 1988 and in the year 1999. Summer vegetables, paddy, sesamum, maize, etc were the crops that had been damaged. Most affected districts were West Tripura, South Tripura and Gomati District. Figure 4.1 shows Seismic Zone Map of India.

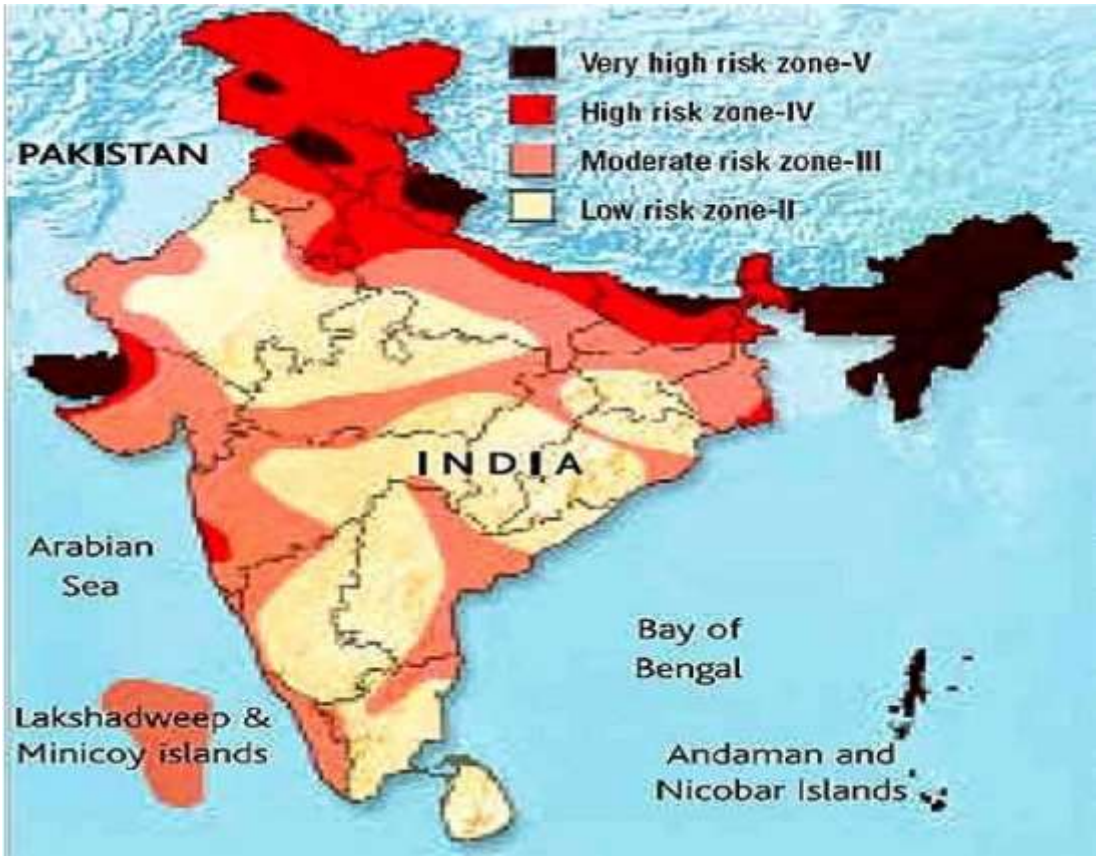


Figure 4.1: Seismic Zone Map of India

Source: moes.gov.in

4.1.3 Ambient Air & Noise Environment

The air environment is most sensitive to any developmental work leading to various type of air pollution. As per present norms, guidelines and practices the air quality monitoring within 10 km radius of the core zone is essential. Air environment is one of the most important components of the ecosystem. The prime objective of ambient air quality monitoring of project area is to assess existing air environment. Air pollution forms an important and critical factor to study the environmental issues in the linear project. Air quality has to be frequently monitored to know the extent of pollution due to road traffic and allied activities. This will be useful for assessing the conformity to standards of the ambient air quality during implementation of the proposed project road construction activities.

The following criteria were taken into account during selection of the sampling locations for collection of representative samples:

- Topography of the area
- Human settlements within the study area
- Meteorological condition in the region
- Representation of the area
- Safety, accessibility and non-interference with general routine of the people residing near the sampling location

In absence of any existing data on ambient air quality and noise levels of the project area, onsite monitoring was conducted at select locations. Major part of the project road passes through built-up areas and agriculture land. The project road is a major connectivity from Kailashar to Agartala via Teliamura passing through some major settlements including parts of Khowai Municipal Council. It is very important to measures air quality in the project road stretch since there are numbers of schools, health centres and public utility services along the project road.

Air Quality: SPM, PM10 and PM2.5 have been estimated by gravimetric method. Modified West and Gaeke Method have been adopted for estimation of SO2. Jacobs - Hochheiser Method has been adopted for the estimation of NOx.

The ambient air quality levels with respect to particulate matter (PM10), particulate matters below 2.5micron $_{(PM2.5)}$ ranges from 32-23 to 19µg/m^3 & 14-10 µg/m^3 respectively in the project area. While SO2 & NOx are also within the prescribed limit in the project area in all the four location monitored for ambient air quality. Hence ambient air quality levels conform to the prescribed National Ambient Air Quality Standards (NAAQS) appended as ***Appendix-4*** at all the four sampling sites. Particulate matter found after analysis mostly due to dust flying in the air. Ambient Air Quality in the Project Road has been given in table 4.2 below.

Table 4.2: Ambient Air Quality in the Project Road

S. No.	Locations	Parameters (ug/NCM)				Category
		PM10	PM2.5	SO2	NOx	
1	Teliamura (NH44)	32	14	7.1	11.3	Commercial
2	Rajkandi	29	11	6.9	11.9	Residential
3	Dwarikapur	25	10	7.2	12.1	Commercial
4	Mahadevtila	23	10	7.4	12.2	Sensitive
5	Lakshmichera	25	11	7.1	12.3	Residential

6	Khowai	30	12	6.9	11.9	Commercial
7	Bamunchera	23	10	7.2	12.3	Residential
8	Durgachoumohini	31	13	7.4	12.4	Commercial
9	Kalyanpur	30	14	7.1	11.7	Commercial
10	Kirtontoli	27	12	6.7	11.6	Residential
CBCP Standard for industrial, residential and other rural Areas		**100**	**60**	**80**	**80**	**Standards**

Source: DPR Vol-IV (Part A)

Air Sampling at Jolaibari

Air Sampling at Ratanpur Primary Health Centre

Air Sampling at Teliamura

Air Sampling at

Air Sampling at Kalyanpur

Noise: The physical description of sound concerns its loudness as a function of frequency. Noise in general is unwanted/un-desired sound, which is composed of frequencies of different loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the A weighted scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear.

Noise Monitoring at Starting Point (Kirtantali)

Noise monitoring near Ganaki HS School

Noise Monitoring at End Point (Near NH44)

These ambient noise levels conform to the prescribed limit for all landuse categories monitored ***(Appendix-7)***. Noise level is comparatively high at Jolaibari due to higher traffic load of NH-44. Comparatively high noise level recorded in Teliamura, Khowai & Kalyanpur due to heavy vehicular load in the existing road junction.

Table 4.3: Noise Level in dB(A) along the Project Road

S. No.	Locations	Day Time Noise Level	Day Time Noise Level
		(6.00 am-9.00 pm)	(9 pm-6.00 am)
1	Teliamura (NH44)	56	44
2	Rajkandi	54	43
3	Dwarikapur	50	40
4	Kalyanpur	54	45
5	Lakshmichera	55	42
6	Khowai	51	45
7	Bamunchera	50	40
8	Durgachoumohini	54	45
9	Mahadevtila	53	42
10	Kirtontoli	55	44

Source: DPR Vol-IV (Part A)

4.1.4 Landforms/Physiography and Topography

The state of Tripura resides in the North-East corner of India and lying between the latitude of 22˚56'N to 24˚32'N and longitude 91˚09'E to 92˚20'E.The state shares state boundary with Assam and Mizoram in the east (53 and 109 km respectively) and international boundary - with Bangladesh (839 km.) General altitude of the state differs between 15m to 750m from MSL. The physiography of Tripura tends to flatten towards west. The longitudinal valleys are juxtaposed in between the numerous hillocks and undulating surfaces. Agricultural activities occur in the fertile soil of these valleys. Series of parallel hill-ranges running north to south divide the state into broad parallel valleys, consisting of undulating hillocks covered with jungle & meandering streams. The range of hills rises from the plains of Sylhet in Bangladesh at the north and proceeds southwards until they join the Chittagong hill tracts in the east. Principal ranges of western part of the state are Baramura - Deotamura and Atharamura ranges. Structurally, the State of Tripura represents the western fringe of the typical 'ridge and valley' structural province of the late tertiary fold mountain belt, commonly known as the Indo-Burma Ranges (Purbachal Range).

4.1.5 Drainage Pattern

The state of Tripura is gifted with surface water resources. Entire drainage system in the state of Tripura is rain-fed and ephemeral in nature. Surface run off during rainy season introduces water into dry or almost dry narrow streams from elevated land. Governed by the topographic gradient and soil types, these streams meet with other streams to form a canal or larger stream. Subsequently all such streams fall in a large river. All major rivers originate from hill ranges and show a typical drainage pattern called trellis drainage, except a few instances of dendrite pattern. Khowai is main River in the project road area.

4.1.6 Geology & Hydrogeology

The major geomorphic element observed in Tripura is north-south running parallel hill regions and intervening valleys. The hills are tightly folded anticlines with broad synclinal valleys. Geologically, the area is occupied by the folded sedimentary formations ranging in age from lower Tertiary to Recent. In Tripura, the loamy soil type facilitates the percolation and infiltration of water from the surface into the ground water regime. Moreover, presence of sand stone facilitates the movement of water under the ground as well and acts as storage of water. It indicates that soil profile and nature of the bedrock helps runoff water to move into the ground water regime from recharge zone.

In the state of Tripura, the ground water occurs in shallow aquifers under unconfined and semi - confined to confined conditions. Fine to medium grained sand stones form the principal aquifer. In major part of the state, ground water occurs under unconfined condition in shallow depth. Ground water occurs under confined condition within shallow depths in small isolated zones. Aquifer system of the area is divided into two types, viz, shallow aquifer within 50 m bgl and deep aquifer between 50 to 300 m bgl. As per CGWB Report, 2008, the wells are constructed within a depth range of 6 to 171 m bgl. Discharge of the wells varies from 0.01 to 2.00 lit/sec during pre-monsoon period and from 0.02 to 2.5 lit/sec during post-monsoon period.

Three types of hydro-geological formations identified in the state of Tripura and they are as follows: Alluvial formation with thickness varies between 10-15 m and occurs along the bank of rivers and water can be extracted through dug well and ordinary hand pumps; Dupitila formation with thickness from 10-15m and nearly horizontal in disposition and it has low permeability and low storage capacity due to high clay content. It indicates that the water yielding capacity from this type of formation is very low; Sand stone of Tipam formation constituted the principle aquifer of this area and it consists of sub rounded fine to medium grained, friable sandstone with intercalated clay. Tipam formation is found in valleys of Tripura. The permeability of this formation is much higher than Dupitila and Surma sandstone.

4.1.7 Soil (Types and Chemical Characteristics)

The soil type of the state of Tripura can be classified in five major groups. They are reddish yellow brown sandy soils, red loam and sandy loam soils, older alluvial soils, younger alluvial soils and lateritic soils. Among these soil categories, reddish yellow brown sandy soil covers approximately 33 percent of the total geographic area and distributed along north-south axis of Tripura. Red loam and sandy loam soil covers 43.07 percent of total soil cover in state of Tripura. This soil type is associated with forest ecosystem and rich in nutrients. Older alluvial soil type covers 10 percent of total soil cover in Tripura and found mainly in river terraces and in high plains. Approximately 9 percent of the state's soil cover is constituted by younger alluvial soil. This type of soil is confined to the flood plains of river such as Khowai, Gumti etc. This nutrient rich soil type is composed of clay loam and loam.

Approximately 5 percent of the state's total soil cover comes under "lateritic soil" which is very poor in nutrient content. This can be recognized along the western boundary of the state of Tripura. Soils of Tripura have been grouped into five soil reaction classes viz. extremely acidic (<4.5 pH)-10%, very strongly acidic (4.6-5.0)-26%, strongly acidic (5.1-5.5) - 54% and medium (5.6-6.0)-8% and slightly acidic (6.1-6.5)-2%.The results is given in table below. It is observed from the soil analysis result that the soil quality of project road meet the requirement of ICAR for agriculture purposes. Physical-Chemical Characteristics of Soil at various locations have been provided in table 4.4 (a) to 4.4 (f).

Table 4.4 (a): Physical-Chemical Characteristics of Soil at Kirtantali

Sl. No.	**Parameters**	(0-30cm)	(30-60cm)	60-90cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
	Grain Size (%)			
	a) Sand	42	40	45
	b) Silt Content	37	38	35
2	c) Clay Content	21	22	20
3	Porosity (%)	21	22	23
4	Bulk Density (g/cm3)	1.51	1.49	1.45
5	pH	5.7	5.8	5.8
6	Elect. Conductivity (m-mhos/cm)	0.35	0.35	0.36
7	Water Holding Capacity (%)	42	44	45
8	Liquid Limit (%)	21.6	21.7	21.8

9	Plastic Limit (%)	13.2	13.5	13.7
10	Infiltration Rate (%)	2.7	2.9	2.9
11	Field Capacity (%)	8.4	8.4	8.5
12	Wilting Co-efficient (%)	0.5	0.5	0.5
13	Available Magnesium (Kg/Ha)	18	19	19
14	Organic Carbon (%)	0.49	0.35	0.24
15	Sodium Absorption Ratio	0.35	0.38	0.39
16	Carbon Exchange Capacity (meq/100g)	7.5	7.4	7.4
17	Nitrogen as N (kg/Ha)	239	232	230
18	Phosphorous as P_2O_5 (kg/ha)	7.7	7.9	7.9
19	Potash as K2O (kg/ha)	102.5	105.5	106.5

Source: DPR Vol-IV (Part A)

Table 4.4 (b): Physical-Chemical Characteristics of Soil at Durgachoumohini

Sl. No.	Parameters	(0-30cm)	(30-60cm)	60-90cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
	Grain Size (%)			
	a) Sand	41	43	44
	b) Silt Content	36	36	37
2	c) Clay Content	23	21	19
3	Porosity (%)	20	22	23
4	Bulk Density (g/cm3)	1.51	1.46	1.45
5	pH	4.7	4.8	4.8
6	Elect. Conductivity (m-mhos/cm)	0.36	0.35	0.34
7	Water Holding Capacity (%)	42	43	40
8	Liquid Limit (%)	23.6	23.7	23.8
9	Plastic Limit (%)	13.5	13.6	13.7
10	Infiltration Rate (%)	2.7	2.8	2.9
11	Field Capacity (%)	8.4	8.4	8.6
12	Wilting Co-efficient (%)	0.5	0.5	0.5
13	Available Magnesium (Kg/Ha)	16	18	19
14	Organic Carbon (%)	0.42	0.32	0.29
15	Sodium Absorption Ratio	0.34	0.36	0.38
16	Carbon Exchange Capacity (meq/100g)	7.5	7.4	7.3
17	Nitrogen as N (kg/Ha)	335	327	321
18	Phosphorous as P_2O_5 (kg/ha)	4.9	5.1	5.2
19	Potash as K2O (kg/ha)	142.5	145.5	151.5

Source: DPR Vol-IV (Part A)

Table 4.4 (c): Physical-Chemical Characteristics of Soil at Kalyanpur

Sl. No.	Parameters	(0-30cm)	(30-60cm)	60-90cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
	Grain Size (%)	100	100	100

	a) Sand	44	42	43
	b) Silt Content	35	38	38
	c) Clay Content	21	20	19
3	Porosity (%)	21	20	20
4	Bulk Density (g/cm3)	1.5	1.46	1.44
5	pH	4.7	5.2	5.4
6	Elect. Conductivity (m-mhos/cm)	0.35	0.35	0.36
7	Water Holding Capacity (%)	42	44	45
8	Liquid Limit (%)	24.6	25.7	26.8
9	Plastic Limit (%)	13.1	13.3	13.4
10	Infiltration Rate (%)	2.7	2.8	2.8
11	Field Capacity (%)	8.2	8.3	8.5
12	Wilting Co-efficient (%)	0.5	0.5	0.5
13	Available Magnesium (Kg/Ha)	15	15	16
14	Organic Carbon (%)	0.49	0.45	0.42
15	Sodium Absorption Ratio	0.34	0.35	0.35
16	Carbon Exchange Capacity (meq/100g)	6.5	7.2	7.2
17	Nitrogen as N (kg/Ha)	221	212	210
18	Phosphorous as $_{P2O5}$ (kg/ha)	6.7	6.9	6.9
19	Potash as K2O (kg/ha)	122.5	135.5	136.5

Source: DPR Vol-IV (Part A)

Table 4.4 (d): Physical-Chemical Characteristics of Soil at Dwarikapur

Sl. No.	Parameters	(0-30cm)	(30-60cm)	60-90cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
	Grain Size (%)	100	100	100
	a) Sand	41	43	44
	b) Silt Content	40	39	38
2	c) Clay Content	19	18	18
3	Porosity (%)	20	22	23
4	Bulk Density (g/cm3)	1.49	1.46	1.45
5	pH	5.5	5.6	5.6
6	Elect. Conductivity (m-mhos/cm)	0.34	0.35	0.35
7	Water Holding Capacity (%)	39	40	41
8	Liquid Limit (%)	25.6	26.7	26.8
9	Plastic Limit (%)	13.2	13.3	13.5
10	Infiltration Rate (%)	2.7	2.8	2.9
11	Field Capacity (%)	8.2	8.3	8.4
12	Wilting Co-efficient (%)	0.5	0.5	0.5
13	Available Magnesium (Kg/Ha)	16	17	17
14	Organic Carbon (%)	0.39	0.35	0.34
15	Sodium Absorption Ratio	0.33	0.34	0.35
16	Carbon Exchange Capacity (meq/100g)	6.7	7.1	7.1
17	Nitrogen as N (kg/Ha)	219	201	190

18	Phosphorous as P_2O_5 (kg/ha)	7.1	7.4	7.5
19	Potash as K2O (kg/ha)	109.5	115.5	116.5

Source: DPR Vol-IV (Part A)

Table 4.4 (e): Physical-Chemical Characteristics of Soil at Khowai

Sl. No.	Parameters	(0-30cm)	(30-60cm)	60-90cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
2	Grain Size (%)	100	100	100
	a) Sand	44	48	50
	b) Silt Content	33	31	31
	c) Clay Content	23	21	19
3	Porosity (%)	25	26	26
4	Bulk Density (g/cm3)	1.49	1.48	1.48
5	pH	5.7	5.7	5.8
6	Elect. Conductivity (m-mhos/cm)	0.36	0.36	0.35
7	Water Holding Capacity (%)	42	40	40
8	Liquid Limit (%)	21.8	21.8	21.9
9	Plastic Limit (%)	13.2	13.3	13.5
10	Infiltration Rate (%)	2.8	2.8	2.8
11	Field Capacity (%)	8.4	8.4	8.5
12	Wilting Co-efficient (%)	0.5	0.5	0.5
13	Available Magnesium (Kg/Ha)	14	16	17
14	Organic Carbon (%)	0.42	0.37	0.28
15	Sodium Absorption Ratio	0.37	0.38	0.38
16	Carbon Exchange Capacity (meq/100g)	7.1	7.1	7.1
17	Nitrogen as N (kg/Ha)	242	234	230
18	Phosphorous as P2O5 (kg/ha)	7.1	7.3	7.4
19	Potash as K2O (kg/ha)	134.5	135.5	138.5

Source: DPR Vol-IV (Part A)

Table 4.4 (f): Physical-Chemical Characteristics of Soil at Teliamura

Sl. No.	Parameters	(0-30cm)	(30-60cm)	60-90cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
2	Grain Size (%)	100	100	100
	a) Sand	47	46	45
	b) Silt Content	36	36	37
	c) Clay Content	17	18	18
3	Porosity (%)	26	26	25
4	Bulk Density (g/cm3)	1.48	1.48	1.47
5	pH	5.7	5.8	5.9
6	Elect. Conductivity (m-mhos/cm)	0.34	0.35	0.35

7	Water Holding Capacity (%)	39	39	40
8	Liquid Limit (%)	21.6	21.6	21.8
9	Plastic Limit (%)	13.2	13.5	13.6
10	Infiltration Rate (%)	2.7	2.8	2.9
11	Field Capacity (%)	8.2	8.3	8.5
12	Wilting Co-efficient (%)	0.5	0.5	0.5
13	Available Magnesium (Kg/Ha)	15	17	18
14	Organic Carbon (%)	0.45	0.38	0.34
15	Sodium Absorption Ratio	0.36	0.38	0.38
16	Carbon Exchange Capacity (meq/100g)	7.2	7.2	7.3
17	Nitrogen as N (kg/Ha)	258	245	237
18	Phosphorous as P_2O_5 (kg/ha)	6.7	7.1	7.1
19	Potash as K2O (kg/ha)	127.5	125.5	126.5

Source: DPR Vol-IV (Part A)

4.1.8 Land Use of Project Influence Area

A detailed land use map in 10km radius from the proposed project road corridor has been prepared with the help of latest satellite imageries and based on the primary field observation. Dominant land use in the 10km radius of the project road is vegetation /forest land with an area covering 75.57% which is higher than the Tripura's over all forest cover. It is followed by agriculture land which covers an area of 9.34% in 10km radius of the project road. Plantation, standing crops, shrubs, and agriculture land combine to cover an area of 2.15%. Although a major part of the project road is passing through built-up area, its percentage in 10km radius of the project road is only 5.57%. Land Use Map is given below as **Figure 4.2**. Table 4.5 shows Land Use of the Project Road Corridor (10km radius)

Table 4.5: Land Use of the Project Road Corridor (10km radius)

Sl. No.	Land Use Pattern	Area (in %)
1	Vegetation/ Forest Land	75.57
2	Plantation/ Standing Crops/ Shrubs	2.15
3	Agriculture Land	9.34
4	Built-up Land/ Human Settlement	5.57
5	Road Network	2.50
6	Railway Track (Under Construction)	0.12
7	Water body/Rivers	1.45
8	Waste Land/Fellow Land/ Barren Land	3.29

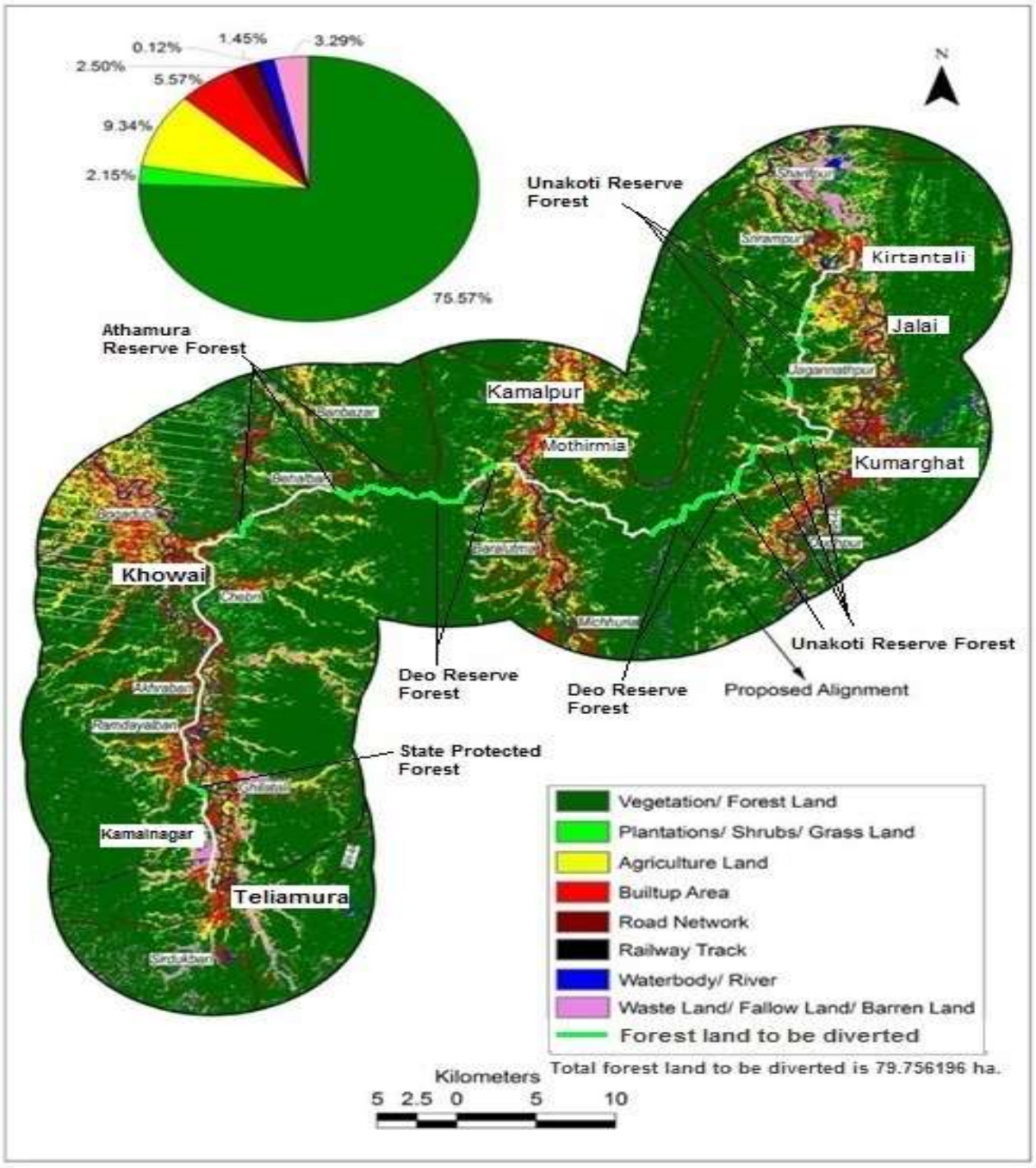


Figure 4.2: Land Use Map of the Project Road Corridor (10km radius)

Source: DPR Vol-IV (Part A) and EIS Pvt. Ltd.

4.1.9 Ground Water (Occurrence and Quality)

In shallow aquifer ground water occurs under unconfined and semi-confined to confined conditions. In major part of the area ground water occurs under unconfined condition in shallow depth. Ground water occurs under confined condition within shallow depths in small isolated zones, e.g., in central and eastern part of Matabari block, in central part of Kakraban block, in northern part (Rajapur - Kanchannagar area) of Bagafa block, in Srirampur area of Rajnagar block, in the southern part (Jalefa - Harina area) of Satchand block. In deeper aquifers ground water occurs under semi-confined to confined conditions. Ground water occurs under artesian condition in Teliamura, Dhuptali, Rajnagar, Muhuripur, Charakbai, East Pipariakhola, Fulkumari and Satchand area.

In the study area hand pump, bore well and deep bore well have been made to trap underground water. Grab sampling method was adopted in case of ground water system like open and tube wells. The samples from tube wells were collected from running condition. Ground water samples have been collected from ten locations to assess drinking water quality of the project area. All the three samples confirm (Table 4.6) suitability of the ground water for drinking purpose.

Table 4.6: Ground Water Quality of the Project Area

Sl. No.	Location	Source	EC ¼S/cm	HCO3	Cl	Ca	Mg	TH as CaCO3	Na	K
	Unit		25ÚC	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	Kirtantali	Hand pump	228	60	19	42	29	71	38	4.2
2	Durgachoumahi	Hand pump	210	58	18	44	26	70	35	4.4
3	Khowai	Hand pump	252	61	14	40	29	69	42	4.8
4	Mahadevtila	Hand pump	222	59	17	43	28	71	37	4.6
5	Kalyanpur	Hand pump	240	58	20	45	29	74	40	4.4
6	Dwarikapur	Hand pump	204	57	19	46	27	73	34	4.2
7	Bamuncherra	Hand pump	216	60	21	42	26	68	36	4.6
8	Fatikray	Hand pump	228	58	23	46	28	74	38	4.2
9		Hand pump	222	61	18	40	29	69	37	4.4
10	Teliamura	Hand pump	234	60	17	42	28	70	39	4.6

Source: DPR Vol-IV (Part A)

4.1.10 Surface Water Quality

Surface water samples taken from the Khowai River, a stream intersecting project road and also from three ponds adjacent to project road located at Teliamura, Kalyanpur & have been compared with the standards prescribed by Central Pollution Control Board (CPCB) for Irrigation- Class D and propagation of wildlife and fisheries -Class-E (***Appendix-5 & 6***). The results of the samples conforms their suitability for both these purposes. Results of the surface water quality in the project area have been summarized in table 4.7 below.

Table 4.7: Surface Water Quality of the Project Area

Water Sampling from road side tube-well

Water Sampling from Pond

Water Sampling from Supply Water

Water Sampling from Khowai River

Parameters	Location						Limit as per IS:2296 Class 'C'
	Pond at Teliamura	Pond at Kalyanpur	Pond at Dwarikapur	Pond at Mahadevtila	Khowai River	Stream near Kirtantali	
Physical							
pH	6.9	6.8	6.9	6.8	6.7	6.8	6.5-8.5
Temperature	24.5	25.5	25	24.5	25.5	24.5	*
Colour, HU	3	3	3	3	4	4	300
Odour							
Turbidity (NTU)	26	24	24	22	32	30	*
Total Suspended Solids	28	33	32	30	42	45	

Total Dissolved Solids	431	396	414	412	467	498	1500
Chemical							
P-Alkanity as CaCO3	Nil	Nil	Nil	Nil	Nil	Nil	*
Total Alkanity as CaCO3	152	142	147	157	182	187	*
Chloride as Cl	18	21	19	24	12	13	600
Sulphate as SO4	197	186	191	182	168	156	400
Nitrate as NO3	0.8	0.9	1.1	0.9	0.2	0.3	50
Fluride as F	<0.4	<0.5	<0.5	<0.4	<0.3	<0.3	1.5
Total Hardness as CaCO3	98	90	94	94	106	113	*
Calcium Hardness as CaCO3	54	50	52	56	66	68	*
Magnesium Hardness as CaCO3	44	40	42	38	40	45	*
Disolve Oxygen	5.4	5.8	5.6	5.6	6.8	6.6	4
COD	18	20	16	18	14	16	*
BOD (3days at 27^{Ú}C)	4.2	4.8	4.6	4.8	5.8	5.7	3
Total Kjeldahl Nitrogen as N	2.3	2.8	1.9	2.1	1.7	1.8	*
Sodium as Na	15	12	13	13	24	26	*
Potassium as K	2	2	2	2	3	3	*
Silica as SiO2	12	12	11	12	16	15	*
Heavy Metals							
Iron as Fe	0.9	0.8	0.8	0.8	1.1	1.2	5
Manganese as Mn	<0.07	<0.07	<0.08	<0.07	<0.05	<0.06	*
Total Chromium as Cr	NT	NT	NT	NT	NT	NT	0.05
Lead as Pb	NT	NT	NT	NT	NT	NT	0.1
Zinc as Zn	0.1	0.1	0.1	0.1	0.2	0.2	15
Cadmium as Cd	NT	NT	NT	NT	NT	NT	
Copper as Cu	NT	NT	NT	NT	NT	NT	
Nickel as Ni	NT	NT	NT	NT	NT	NT	
Arsenic as As	NT	NT	NT	NT	NT	NT	0.2
Selenium as Se	NT	NT	NT	NT	NT	NT	0.05
Cyanide as CN	NT	NT	NT	NT	NT	NT	0.05
Mercury as Hg	NT	NT	NT	NT	NT	NT	
Others							
Oil & Grease	BDL	BDL	BDL	BDL	BDL	BDL	0.1
Phenolic Compound as C6H6OH	NT	NT	NT	NT	NT	NT	0.005
Coliform Organisms (MPL/100ml)	2.2X90	2.2X90	2.2X90	2.2X90	2.2X120	2.2X120	5000

Source: DPR Vol-IV (Part A)

4.2 Biological Environment and Biodiversity

The state of Tripura is characterized by diverse natural resources and agronomically – potential tropical areas. The recorded forest area of the state is merely 6,294 sq. km which contributes forest cover to the

tune of 60.02 per cent of the geographical area at the state level. Legally, the forest area in the State has been classified into three categories, viz., Reserved Forest, Protected Forest and Unclassified Forest, which constitute 66.33 per cent, 0.03 per cent and 33.64 per cent of the total recorded forest area, respectively (**FSI, 2017**). In term of forest canopy density classes, the state has very dense forest 1.04 per cent, 61 oderator dense forest 44.67 per cent, open forest 30.33 per cent, scrub 0.69 per cent, and non-forest 23.27 per cent. Figure 4.3 shows forest cover map of Tripura and Figure 4.4 to 4.6 is geo-reference map showing forest area proposed to be diverted for widening of nh- 208 (slected from kailashahar to teliamura via khowai) under unakoti, Dhalai and Khowai district. The total area of forest land to be diverted is 79.759196 ha.

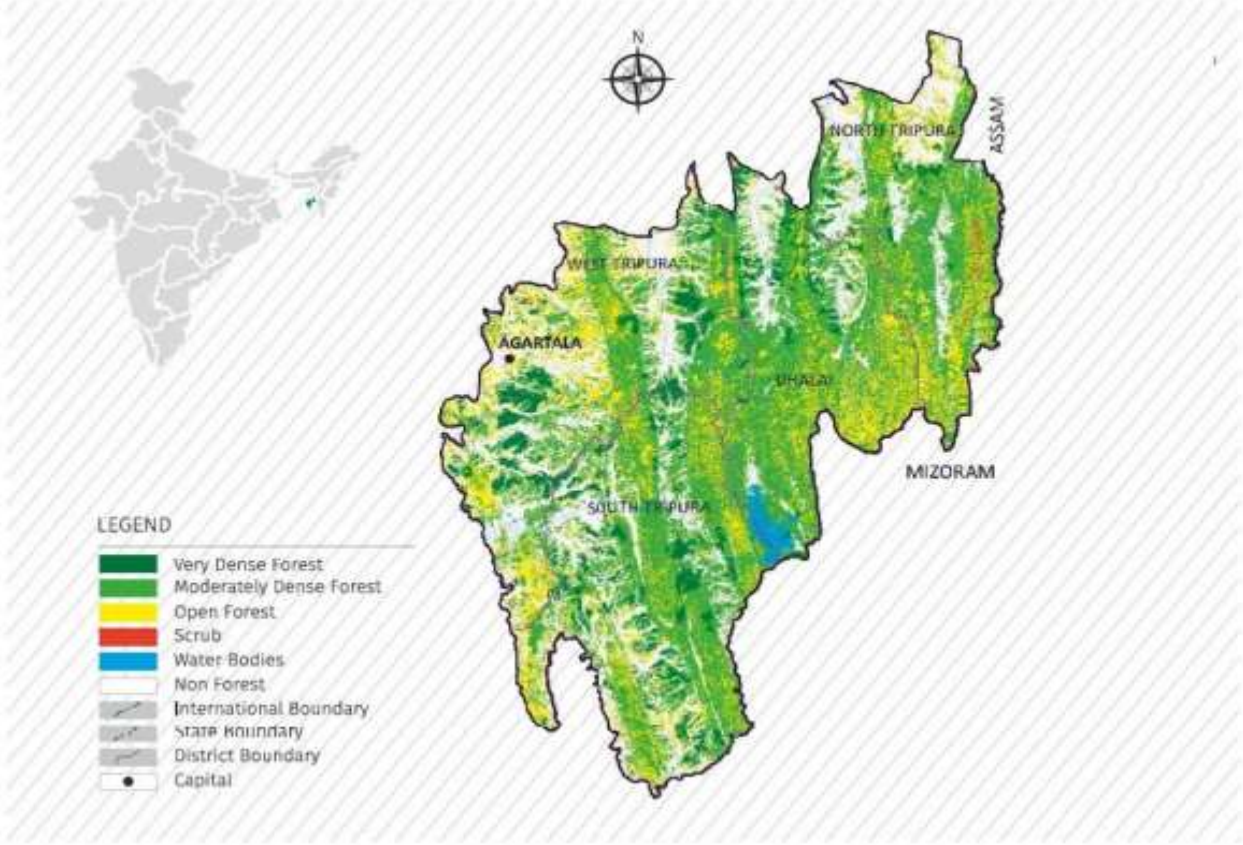


Figure 4.3: Forest cover map of Tripura

Source: fsi.nic.in

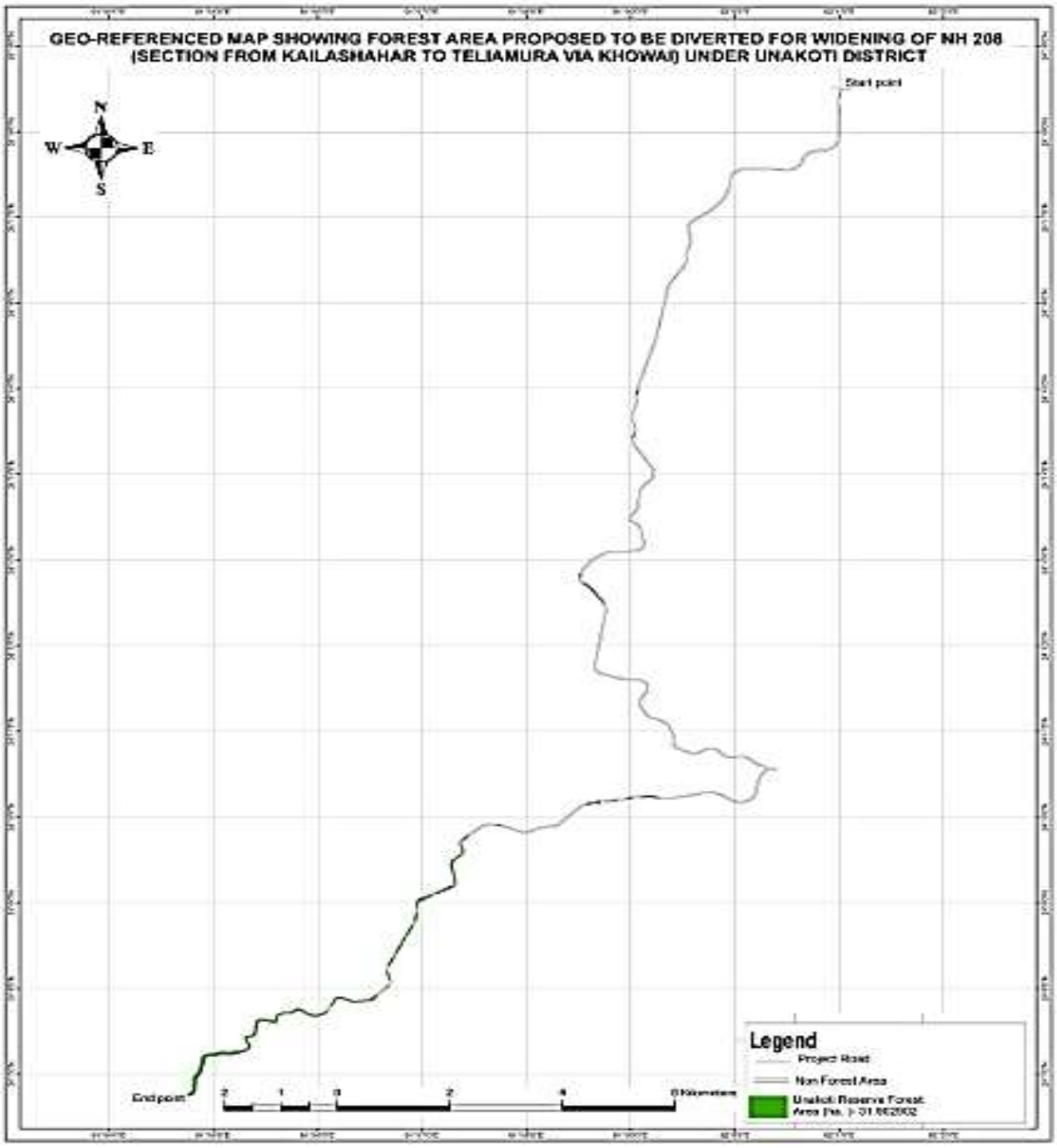
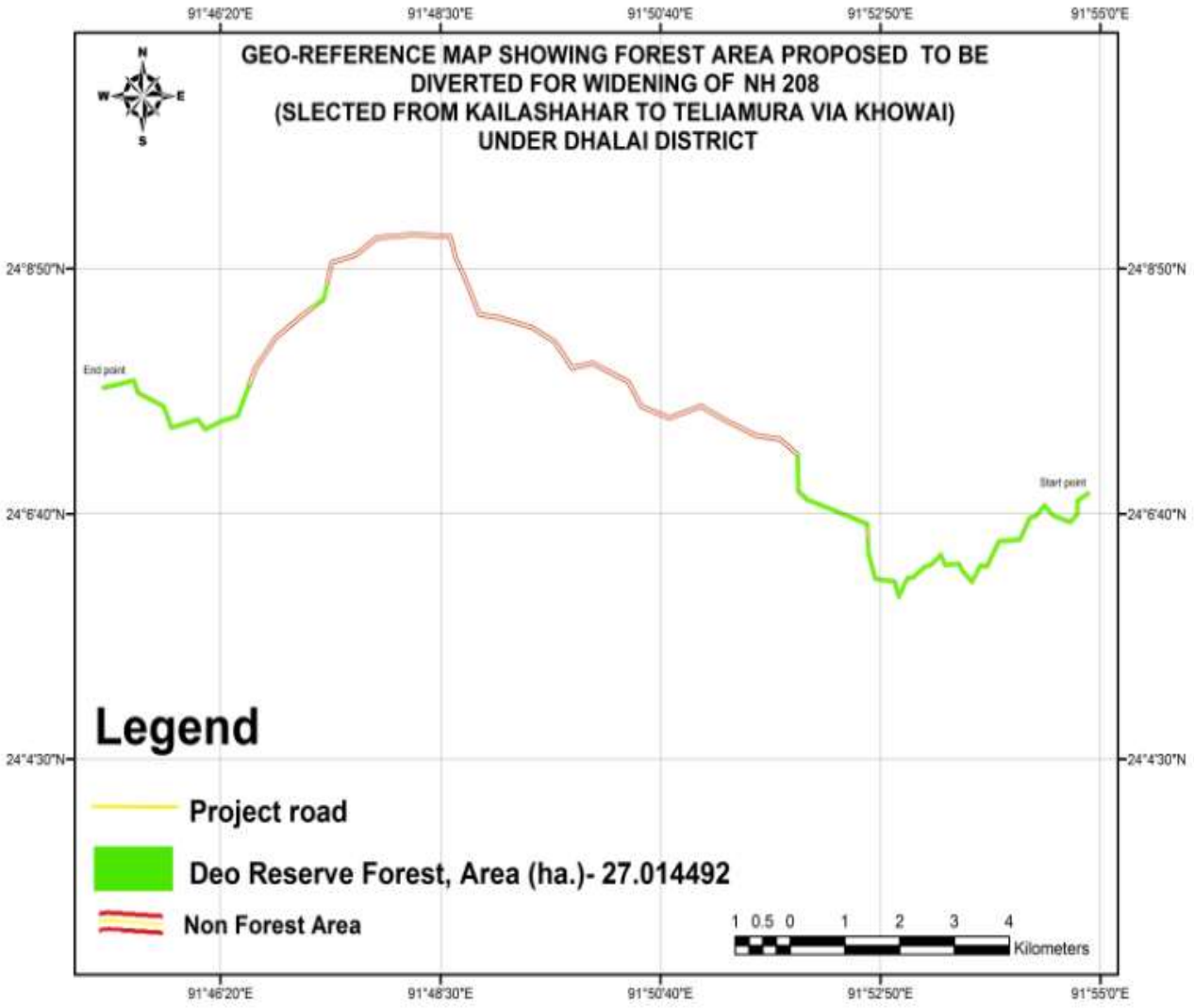


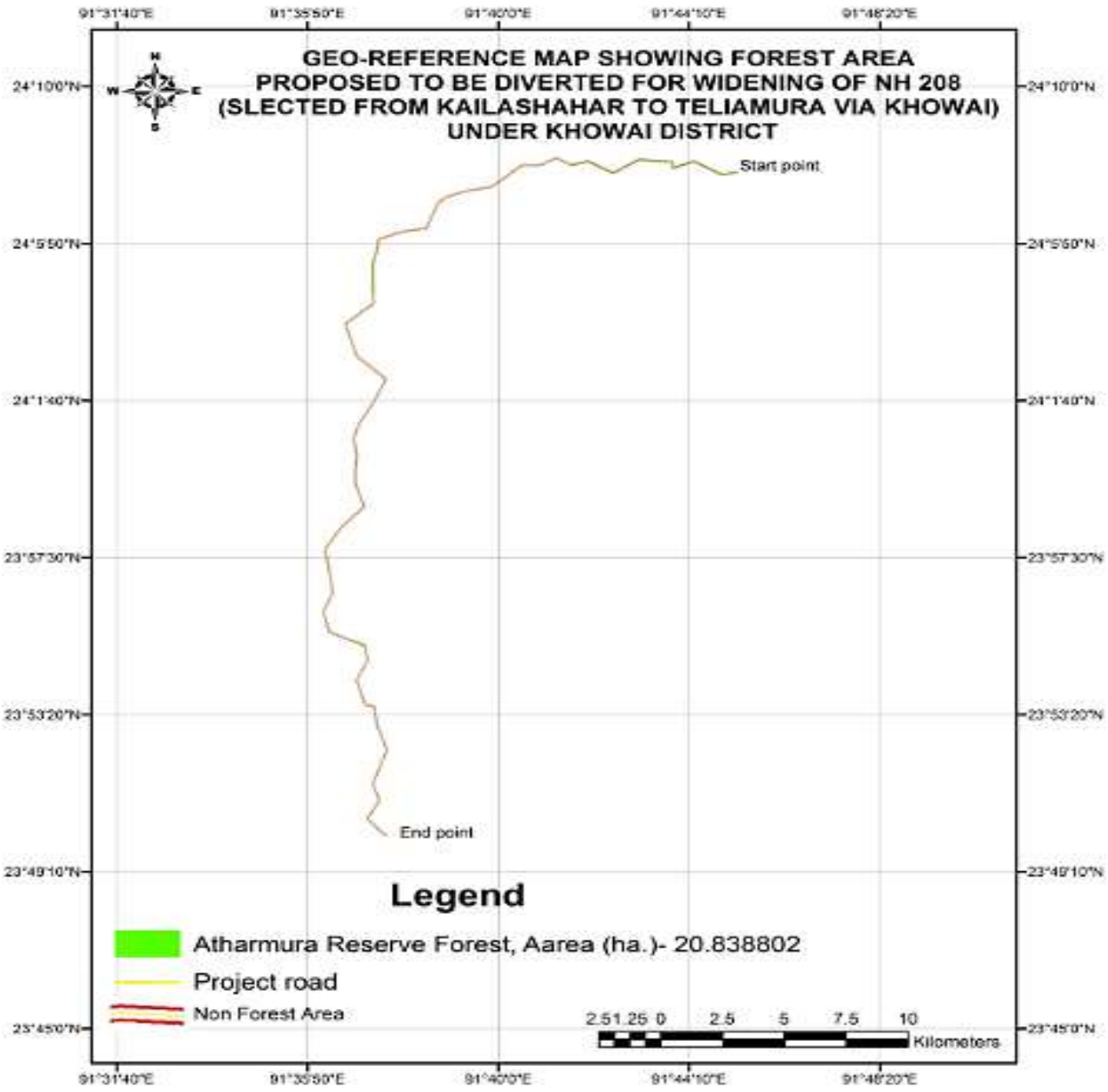
Figure4.4: Geo-Reference Map Showing Forest Area Proposed To Be Diverted For Widening of NH-208 (Slected From Kailashahar To Teliamura Via Khowai) Under Unakoti District

Source: EIS Pvt. Ltd.



Source: EIS Pvt. Ltd.

Figure 4.5: Geo-Reference Map Showing Forest Area Proposed To Be Diverted For Widening of NH-208 (Slected From Kailashahar To Teliamura Via Khowai) Under Dhalai District



Source: EIS Pvt. Ltd.

Figure 4.6: Geo-Reference Map Showing Forest Area Proposed To Be Diverted For Widening of NH-208 (Slected from Kailashahar To Teliamura Via Khowai) Under Khawoi District

4.2.1 Methodology for Ecological and Biodiversity Analysis

A phased and consultative approach was followed to carry out the ecological and biodiversity assessment during monsoon season in August-September, 2019. The successive phases include: (i) reconnaissance survey, (ii) on-site primary data collection for flora and fauna using standardised ecological methods, and (iii) secondary data collection through review of available literature (published and memiographic, and electronic media). Wherever necessary, the desired information was collected/substantiated through

formal and informal interactions/discussions with the field staff of the line department, revenue authorities at village level, local inhabitants and natural resource users.

The vegetation of terrestrial ecosystem was classified following Champion and Seth (1968) for forest types and Dabadghao and Shankarnarayana (1973) for grassland types.
The floristic composition (floral biodiversity) of terrestrial ecosystem was studied through field visits and using quadrat method as per need. Both the angiospermic and non-angiospermic flora were recorded using random sampling and identified following published taxonomic literature and by consulting the professionals of relevant study area. The phytosociological attributes could not be studied on account of very dense growth of vegetation with complete cover of the ground. For aquatic ecosystems, the phytoplanktons, zooplanktons and macrophytes were studied upto species level.

For biodiversity analysis of fauna, transect method was followed. The timing is during August-September, 2019, which is the wet and humid season. The dry season data were based on the additional information for fish species, avifauna and mammals which was collected from local people, local market and working plan of the Forest Department. The status of the plant and animal species, such as, endemic, rare, endangered and threatened, etc., is reported following IUCN Red list of RET species, Red Data Book of BSI, Wildlife (Protection) Act, 1972 and as per local availability.

In order to understand the composition of vegetation, most of the plant species were identified in the field itself whereas in case of the species that could not be identified at the site, a herbarium specimen of the same was collected without uprooting the plant, and additionally their photographs were also taken wherever necessary for identification later with the help of available published literature and flora of the region.

Analysis of existing flora and fauna (as described hereunder) indicates almost negligible presence of threatened and endangered species of plants and animals. Local availability (based on field visits and interactions with the inhabitants) for each species of plant and animal has been indicated in each checklist which is an indicative of abundance and dominance of the existing species.

4.2.1.1 Forest and Grassland Types

Following the classification of forest types given by **Champion and Seth (1968),** the project site includes Moist Deciduous Forest and Semi-Evergreen Forest based on different bio-edaphic conditions.
The grass cover in the project site belongs to *Phragmites-Saccharum-Imperate* type mainly and *Themeda-Arudinella* type particularly in upland conditions, as described by Debadghao and Shankarnarayana (1973).

4.2.1.2 Biological Diversity

Representative examples of usages of biodiversity by the inhabitants in the project area and actual biodiversity in terrestrial and aquatic ecosystems in the project area are illustrated in Figures 7 to 9. The taxonomic details of floral and faunal biodiversity in land-based and water-based ecosystems in the project site are enumerated in Tables 4.8 to 4.18. The economic importance of major species in detailed in Table 4.13.

A total of 268 wild species of flora (165) and fauna (103) were recorded in the project area during the field study. Of the floral diversity in wild, 134 species were recorded in terrestrial and 31 in aquatic ecosystem. The non-flowering plant species include Bryophytes (04) and Pteridophytes (04). No

Gymnosperm species could be recorded in the project site. The terrestrial floral biodiversity include 41 tree species, 15 shrub species, 33 herb species, 13 climber species, 29 grass species and 03 parasitic species. The aquatic ecosystem floral biodiversity includes phytoplankton 13 species and higher plant species 18. The faunal biodiversity includes, 07 butterfly species, 06 insect species, 02 amphibians, 09 reptiles, 31 avifauna and 19 mammal species. The aquatic ecosystem specific faunal diversity includes 11 zooplankton species and 18 fish species.

Fig. 7 Biodiversity usages for human consumption in the project site (from top to bottom- Dry fish, citrus landrace, bhat karela, colocasia, corm, squash, beans and leaf vegetable lal sag, arecanut beetle, Phoenix and Banana and papaya fruits.

Fig. 8 Biodiversity in domesticated landscape and aquatic ecosystem (from top to bottom- NH208 towards Kailashar, wet agriculture, homested garden, tea orchart, a field obserbation by the consultant on plant diversity, aquatic ecosystem occupiedy by *Nelumbo nucifera*)

Fig. 9 Biodiversity in wild landscape (from top to bottom-wild flora along the rural road, interaction about local use of wild biodiversity with the local person, biodiversity along NH208, floating flora in a natural pond,wild banana in wildland, and a ramanant of shifting cultivation in ranfed landscape .

Source: EIS Pvt. Ltd.

(A) TERRESTRIAL FLORAL DIVERSITY

Table 4.8: Major non-flowering plant species in the project area

S. NO.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN CATEGORY
(A) BRYOPHYTES					
1	*Funaria spp.*	?	Funariaceae	Common	-
2	*Marchantia spp.*	?	Marchantiaceae	Rare	-
3	*Plagiochasma spp.*	?	Plagiochasmaceae	Common	-
4	*Riccia spp.*	?	Ricciaceae	Common	-
(B) PTERIDOPHYTES					
1	*Adiantum sp.*	?	Adiantaceae	Common	-
2	*Pleopeltis sp.*	?	Pleopeltae	Common	-
3	*Pteris sp.*	?	Pteridae	Common	-
4	*Pteridium spp.*	?	Pteridiae	Very common	-
(C) GYMNOSPERMS					
Not recorded					

** Source: EIS Pvt. Ltd.*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

Table 4.9: Tree species (angiospermic) recorded in the project area

S.No.	SCIENTIFIC NAME	LOCAL / ENGLISH NAME	FAMILY	LOCAL AVAILABLITY	IUCN CATEAGARY
1.	Acacia auriculiformis	?	Mimosaceae	Common	NA
2.	*Acacia leucophloea*	Reonjha	Mimosaceae	Abundant	NA
3.	*Acacia nilotica*	Babul	Mimosaceae	Abundant	NA
4.	*Aegle marmelos*	Bel	Rutaceae	Very common	NA
5.	*Ailanthus excelsa*	Maharukh	Simarubiaceae	Abundant	NA
6.	*Albizzia lebbek*	Kala siris	Mimosaceae	Common	NA
7.	*Anogeissus pendula*	Kardhai	Combretaceae	Abundant	NA
8.	*Artocarpus heterophyllus*	Kathal	Moraceae	Common	
9.	*Artocarpus lacucha*	Kathal	Moraceae	Common	
10.	*Azadirachta indica*	Neem	Meliaceae	Very common	NA
11.	*Bauhinia purpurea*	Kevlor	Caesalpiniaceae	Common	NA
12.	*Bauhinia racemosa*	Asto	Caesalpiniaceae	Common	NA
13.	*Bombax ceiba*	Semal	Malvaceae	Common	NA
14.	*Butea monosperma*	Dhak; palas	Papilionaceae	Very common	NA
15.	*Caryota urens*	Tad	Arecaceae	Common	NA
16.	*Cassia fistula*	Amaltas	Caesalpiniaceae	Common	NA
17.	*Dalbergia sissoo*	Shisham	Papilionaceae	Very common	NA
18.	*Emblica officinalis*	Amla	Euphorbiaceae	Abundant	NA
19.	*Erythrina suberosa*	Pangra	Papilionaceae	Very common	NA
20.	*Eucalyptus tereticornis*	Neelgiri	Myrtaceae	Common	NA
21.	*Ficus bengalensis*	Bar	Moraceae	Rare	NA
22.	*Ficus glomerata*	Gular	Moraceae	Common	NA
23.	*Ficus hispida*	Kathgular	Moraceae	Rare	NA
24.	*Ficus religiosa*	Pipal	Moraceae	Common	NA
25.	*Ficus tomentosa*	Son pakar	Moraceae	Common	NA
26.	*Flacourtia indica*	Kakai	Salicaceae	Common	NA
27.	*Garuga pinnata*	Kekar	Burseraceae	Rare	NA
28.	*Gmelina arborea*	?	Lamiaceae	Common	NA
29.	*Lagerstroemia parviflora*	Ledi	Lytharaceae	Abundant	NA
30.	*Leucaena leucocephala*	Babul	Fabeaceae	Common	NA
31.	*Mangifera indica*	Aam	Anacardiaceae	Common	NA
32.	*Schleichera trijuga*	Kusum	Sapindaceae	Very common	NA
33.	*Syzygium cumini*	Jamun	Myrtaceae	Very common	NA
34.	*Tectona grandis*	Sagaun	Verbenaceae	Very Common	NA
35.	*Terminalia arjuna*	Koha	Combetaceae	Very common	NA
36.	*Terminalia belerica*	Bahera	Combretaceae	Common	NA
37.	*Terminalia chebula*	Harra	Combretaceae	Very common	NA

38.	*Terminalia myriocarpa*	?	Combretaceae	Common	NA
39.	*Terminalia tomentosa*	Saja	Combretaceae	Common	NA
40.	*Zizyphus jujube*	Ber	Rhamnaceae	Common	NA
41.	*Zizyphus xylopara*	Ghot	Rhamnaceae	Common	NA

** Source: EIS Pvt. Ltd.*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 4.10: Shrub species (Angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Adhatoda vasica*	Adusa	Acanthaceae	Abundant	NA
2.	*Calotropis procera*	Madar	Apocynaceae	Very common	NA
3.	*Cassia fistula*	Amaltas	Caesalpiniaceae	Common	NA
4.	*Cassia tora*	Banar	Caesalpiniaceae	Abundant	NA
5.	*Clerodendron viscosum*	Bhat	Verbenaceae	Common	NA
6.	*Colebrookea oppositifolia*	Ameda	Apocynaceae	Very common	NA
7.	*Jatropha curcas*	Ratan jyoti	Euphorbiaceae	Common	NA
8.	*Lantana camara*	Kuri	Verbenaceae	Abundant	NA
9.	*Murraya paniculata*	Madhukamani	Rutaceae	Common	NA
10.	*Nyctanthes arbor-tristis*	Parijat	Nyctaginaceae	Very common	NA
11.	*Prosopis juliflora*	Kikar	Mimosaceae	Common	NA
12.	*Tamarix dioica*	Bhayo	Tamaricaceae	Very common	NA
13.	*Vitex negundo*	Nirgudi	Verbenaceae	Common	NA
14.	*Woodfordia fruticosa*	Meghapati	Lythaceae	Common	NA
15.	*Zizyphus jujuba*	Ber	Rhamanaceae	Common	NA

** Source: EIS Pvt. Ltd.*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 4.11: Herb species (angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Achyranthus aspera*	Latjeera	Amaranthaceae	Abundant	NA
2.	*Acorus calamus*	Bach	Acoraceae	Very common	NA
3.	*Ageratum conyzoides*	?	Asteraceae	Very common	NA

4.	*Ageratum houstonianum*	?	Asteraceae	Abundant	NA
5.	*Argemon mexicana*	Siparkata	Papaveraceae	Common	NA
6.	*Asparagus filicinis*	Satavar	Liliaceae	Rare	NA
7.	*Astragalus sp.*	?	Caesalpiniaceae	Common	-
8.	*Centlla asiatica*	Brahmi	Apiaceae	Rare	NA
9.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Common	NA
10.	*Cyprus rotundus*	Motha	Cyperaceae	Very common	NA
11.	*Datura metel*	Datura	Solanaceae	Rare	NA
12.	*Datura stramonium*	Datura	Solanaceae	Rare	NA
13.	*Desmodium pulchellum*	Chipati	Papilionaceae	Abundant	NA
14.	*Dicliptera bupleuroides*	?	Acanthaceae	Very common	NA
15.	*Euphorbia emodi*	?	Euphorbiaceae	Common	NA
16.	*Euphorbia hirta*	?	Euphorbiaceae	Common	NA
17. .	*Fimbristylis dichotoma*	?	Cyperaceae	Very common	NA
18.	*Gloriosa superba*	Karihari	Liliaceae	Rare	NA
19.	*Medicago spp.*	?	Papilionaceae	Common	-
20.	*Memosa pudica*	Chhui mui	Mimosacea	Common	LC
21.	*Musa spt.*	Kela	Musaceae	Very common	-
22.	*Nyctanthes arbor-tristis*	Parijati	Oleaceae	Rare	NA
23.	*Ocimum sanctum*	Bantulsi	Lamiaceae	Common	NA
24.	*Oxalis corniculata*	?	Oxalidaceae	Very common	NA
25.	*Parthenium hysterophorus*	Gajar ghas	Asteraceae	Abundant	NA
26.	*Picrius spp.*	?	Cyperaceae	Common	-
27.	*Plumbago zeylanica*	Chitawar	Plumbaginaceae	Very common	NA
28.	*Sida acuta*	Kareta	Malvaceae	Comoon	NA
29.	*Solanum nigrum*	Bhatkatya	Solanaceae	Very common	NA
30.	*Sonchus asper*	?	Asteraceae	Very common	NA
31.	*Thespesia lampas*	Ban kapas	Malvaceae	Common	NA
32.	*Vanda parviflora*	Arkind	Orchidaceae	Rare	NA
33.	*Xanthium strumarium*	Godhru	Asteraceae	Abundant	NA

Source: EIS Pvt. Ltd.
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972

Table 4.12: Climber species (angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Abrus precatorius*	Ratti	Papilionaceae	Common	NA NF
2.	*Asparagus racemosus*	Satwar	Liliaceae	Common	NA
3.	*Clematis triloba*	Morbel	Ranunculaceae	Common	NA
4.	*Cryptolepis buchnania*	Nagbel	Combretaceae	Rare	NA NF

5.	*Dioscorea bulbifera*	Kand	Papilionaceae	Common	NA NF
6.	*Dioscorea danoda*	Bechaadi	Papilionaceae	Common	NA NF
7.	*Jasminum arborescens*	Chameli	Oleaceae	Very common	NA
8.	*Pueraria tuberosa*	?	Leguminosae	Common	NA
9.	*Smilax zeylanica*	Ramdaton	Vitaceae	Common	NA NF
10.	*Smilax aspera*	?	Vitaceae	Common	NA NF
11.	*Tinospora cordifolia*	Giloi	Menispermaceae	Common	NA
12.	*Ventilago aciculata*	Qyuti	Rhamnaceae	Rare	NA NF
13.	*Vitex negundo*	?	Lamiaceae	Common	NA

Source: EIS Pvt. Ltd.
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 4.13: Grass species (angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Agrostis spp.*	?	Poaceae	Very common	-
2.	*Apluda mutica*	Phuli	Poaceae	Common	NA
3.	*Aristida setacea*	Thani	Poaceae	Rare	NA
4.	*Arundinella bengalensis*	?	Poaceae	Common	NA
5.	*Arundinella setosa*	Fulbahari	Poaceae	Common	NA
6.	*Bambusa Balcoa*	Bans	Poceae	Common	NA
7.	*Bambusa nutans*	Bans	Poceae	Common	NA
8.	*Bambusa affinis*	Bans	Poceae	Common	NA
9.	*Bothriochloa intermedia*	?	Poaceae	Abundant	NA
10.	*Bothriochloa pertusa*	?	Poaceae	Common	NA
11.	*Chrysopogon fulvus*	Ghoriya	Poaceae	Common	NA
12.	*Cynodon dactylon*	Dub	Poaceae	Abundant	NA
13.	*Dactyloctenium aegyptium*	?	Poaceae	Very common	NA
14.	*Dendrocalamus strictus*	Baans	Poaceae	Very common	NA
15.	*Dichanthium annulatum*	Kel	Poaceae	Very common	NA
16.	*Digitaria spp.*	?	Poaceae	Very common	-
17.	*Elusine indica*	?	Poaceae	Common	NA
18.	*Eregrostis interrupta*	?	Poaceae	Very common	NA
19.	*Eregrostis tenella*	Bhurbhuli	Poaceae	Very common	NA
20.	*Eulaliopsis binata*	Sabai/Bhabar	Poaceae	Common	NA
21.	*Heteropogon contortus*	Kumariya	Poaceae	Abundant	NA
22.	*Imperata cylindrica*	Chhir	Poaceae	Very common	NA
23.	*Iseilema laxum*	Mushan	Poaceae	Common	NA
24.	*Panicum spp.*	?	Poaceae	Common	-
25.	*Paspalum scrobiculatum*	?	Poaceae	Common	NA

26.	*Saccharum spontaneum*	Kans	Poaceae	Very Common	NA
27.	*Setaria glauca*	?	Poaceae	Common	NA
28.	*Themeda quadrivalvis*	?	Poaceae	Common	NA
29.	*Thysanolaena maxima*	Phulbahari	Poaceae	Rare	NA

Source: EIS Pvt. Ltd.
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 4.14: Parasitic angiosperms recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Cuscuta reflexa*	Amarbel	Convolvulaceae	Common	NA
2.	*Dendrophthoe falcata*	Banda	Loranthaceae	Rare	NF
3.	*Viscum articulatum*	Banda	Viscaceae	Common	NA

Source: EIS Pvt. Ltd.
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

4.2.2 Economically-Important Tree Species (Terristrial)

Forests in Tripura are valuable sources of commercial timber and non-timber or non-Wood forest products (NTFP or NWFP). Forest products play an important role in the livelihood of the local people and socio-economic development of the State. In addition to meeting the bonafide needs of the villagers residing in and around the forest areas, sale of forest products contributes appreciably to the State exchequer. During the field survey, numbers of plant species which are of economic importance in the area were recorded. These plant species are used by local people for various purposes in their day to day life. These species include timber, firewood, fruits-yielding, fodder, oil-yielding, medicinal and multiple usages.
A total of 30 major species of economically-important plants were recorded in the project area. These include 16 tree species, 11 herbaceous species, 04 shrub species and 01 species of climber **(Table 4.16)**

Table 4.15: Major economically-important plant species recorded in the project area during the study period

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	ECONOMIC USE**
(A) TREE SPECIES				
1.	*Acacia catechu*	Khair	Papilionaceae	FW
2.	*A. leucophloea*	Ronjh	Fabaceae	FW
3.	*A. nilotica*	Babul	Fabaceae	T, FW
4.	*Ailanthes excelsa*	Maharukh	Simaroubaceae	FO
5.	*Angle marmelos*	Bel	Rutaceae	R, Me, FrE
6.	*Anogeissus pendula*	Kardhai	Combretaceae	FW

7.	*Azadhirachta indica*	Neem	Meliaceae	MP
8.	*Bauhinia purpurea*	Kevlor	Caesalpiniaceae	FO
9.	*Butea monosperma*	Dhak	Fabaceae	FW, LP
10.	*Emblica officinale*	Amla	Euphorbiaceae	FrE, Me
11.	*Syzygium cumini*	Jamun	Myrtaceae	FrE, T
12.	*Tectona grandis*	Sagwan	Verbenacae	T
13.	*Terminalia belerica*	Imli	Caesalpiniaceae	MP
14.	*Ficus bengalensis*	Bad	Moraceae	Me
15.	*Terminalia arjuna*	Arjun	Combretaceae	Me
16.	*Terminalia chebula*	Harra	Combretaceae	Me
(B) SHURB SPECIES				
1.	*Adhatoda vasica*	Adhusa	Acanthaceae	Me
2.	*Calotropis procera*	Aak	Apocynaceae	R
3.	*Clerodendron serratum*	Mamri	Celastraceae	Me
4.	*Zizyphus jujuba*	Ber	Rhamnaceae	MP
C) CLIMBER SPECIES				
1.	*Tinospora cordifolia*	Gurj	Menispermaceae	Me
(D) HERBACEOUS SPECIES				
1.	*Asparagus filicinis*	Satavari	Liliaceae	Me
2.	*Achyranthus aspera*	Gathiya	Amranthaceae	Me
3.	*Acorus calamus*	Bach	Acoraceae	Me
4.	*Bamboosa spp. (03)*	Bans	Poaceae	MP
5.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Me
6.	*Dendrocalamus spp.(02)*	Bans	Poaceae	MP
7.	*Gloriosa superba*	Karihari	Liliaceae	Me
8.	*Saccharum spontaneum*	Sarkanda	Poaceae	MP

**** Source: EIS Pvt. Ltd.***

*****Economic Use: FW= Firewood, T=Timber, FO=Fodder, R= Religious, Me=Medicinal, FrE= Fruit edible, MP=Multi-purpose, O=Oil-***

(B) FAUNAL DIVERSITY

Table 4.16: Butterflies recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	*Antheraea mylitta*	Common	NA
2.	*Belenois aurota*	Common	NA
3.	*Curetis theitis*	Common	NF
4.	*Goladenia indrani*	Common	LC
5.	*Graohium nomius*	Abundant	NF
6.	*Prosotas dubiosa indica*	Common	NF
7.	*Talicada nyseus*	Common	NA

Source: EIS Pvt. Ltd.

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

NA= not assessed yet for IUCN red list; LC=Least concern; NF= not found in the catalogue of IUCN

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 4.17: Major Insect fauna recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Trumpet tail	*Aisoma panorpoids*	Common	NA
2.	Giant honeybee	*Apis dorseta*	Common	NA
3.	Honey bee	*Apis indica*	Common	NA
4.	Ant	*Camponotus sp.*	Abundant	NA
5.	Blister beetle	*Mylabris pustulata*	Common	NA
6.	Scorpion	*Typhlochactus mitchelli*	Rare	NA

Source: EIS Pvt. Ltd.

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

NA= not assessed yet for IUCN red list

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 4.18: Major amphibians and reptiles recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	LOCAL AVAILABILITY	WLA SCHEDULE	IUCN STATUS
(A) AMPHIBIANS					
1.	Toad	*Duttaphrynus melanostictus*	Abundant	IV	LC
2.	Frog	*Rana caterbeiana*	Common	IV	LC
(B) REPTILES					
1.	Krait	*Bangarus caeruleus*	Common	IV	NA
2.	Girgit	*Kelotes versicolor*	Common	IV	NA
3.	Cobra	*Naja naja*	Common	II	VU
4.	Lizard	*Podaris muralis*	Abundant	IV	NA
5.	Ajgar	*Python molurus*	Rare	I	NA
6.	Dhaman	*Tiyas mucosus*	Abundant	IV	NA
7.	Pit viper	*Trimeresurus gramineus*	Rare	IV	LC
8.	Monitor lizard	*Varanus benghalensis*	Common	I	LC
9.	Russel viper	*Vipera russelli*	Rare	IV	LC

***** Source: EIS Pvt. Ltd.***

NA=Not Assessed; NF=Not Found in the IUCN catalogue; LC= Least Concern; VU=Vulnerbale; EN=Endangered

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

Table 4.19: Avifauna (bird species) recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILIBILITY	WLA SCHEDULE*	IUCN STATUS	Migratory Status
1.	Myna	*Acridotheres tristis*	Common	IV	LC	Resident
2.	Purple Heron	*Ardea purpurea*	Common	IV	LC	Resident
3.	Indian Pond Heron	*Ardeola grayii*	Rare	IV	LC	Resident
4.	Common Kingfisher	*Alcedo atthis*	Rare	-	LC	Resident
5.	Anjan	*Ardea cinerea*	Common	-	LC	Resident
6.	Neelkanth	*Corasias benghalensis*	Common	-	LC	Resident
7.	Crow	*Corvus splendens*	Common	IV	LC	Resident
8.	Bater	*Coturnix coturnix*	Abundant	IV	LC	Resident
9.	Kathphora	*Dinipium bengalense*	Rare	IV	LC	Resident
10.	Bagula	*Egretta garzetta*	Common	IV	LC	Resident
11.	Koyal	*Eudynamys scolopacea*	Rare	IV	LC	Resident
12.	Titar	*Francoleus pondicerianus*	Rare	IV	LC	Resident
13.	Jal murgi	*Gallinula chloropuh*	Common	IV	LC	Resident
14.	Red Jungle fowl	*Gallus gallus*	Common	IV	LC	Resident
15.	Common crane	*Grus virgo*	Rare	IV	LC	Winter migratory
16.	White-backed Vulture	*Gyps bengalensis*	Rare	-	LC	Migration
17.	Common Hawk-Cuckoo	*Hierococcyx varius*	Rare	IV	NA	Resident
18.	Cheel	*Milvus migrans*	Rare	IV	LC	Resident
19.	Black crown night Heron	*Nycticorax nycticorax*	Rare	IV	LC	Resident
20.	Spotted Scops owl	*Otus spilocephalus*	Rare	?	LC	Resident
21.	Sparrow	*Passer domesticus*	Common	IV	LC	Resident
22.	Small Minivet	*Pericrocotus cinnamomeus*	Common	-	LC	Resident
23.	Great Cormorant	*Phalacrocorax carbo*	Common	-	LC	Resident
24.	Little Cormorant	*Phalacrocorax niger*	Common	-	LC	Resident
25.	Baya	*Ploceus philippinus*	Common	IV	LC	Resident
26.	Black headed myna	*Pogodarum sturnus*	Common	-	NA NF	Resident
27.	Parrot	*Psittacula krameri manillensis*	Common	I	LC	Resident
28.	Black heded Bulbul	*Pycnonotus atriceps*	Common	-	NA	Resident
29.	Little Grebe	*Tachybaptus ruficollis*	Rare	-	NA	Resident

30.	Common green shank	*Tringa nebularia*	Common	-	NA	Resident
31.	Common bustard Quale	*Turnix suscitator*	Common	-	NA	Resident

** Source: EIS Pvt. Ltd.*
NA=Not Assessed; NF=Not Found in the IUCN catalogue; LC= Least Concern;
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

Table 4.20: Mammal species recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILIBILITY	WLA Schedule*	IUCN STATUS
1.	?	*Axis axis*	Rare	-	NA
2.	?	*Bos gaurus*	Rare	II	VU
3.	Neelgai	*Boselaphus tragocatnelus*	Common	III	NA
4.	Sambhar	*Cervus unicolor*	Rare	III	VU
5.	?	*Felix chaus*	Rare	-	NA
6.	Gilahri/squirrel	*Funembulus pamerum*	Abundant	IV	NA
7.	Nevla/mongoose	*Herpestus edwardsii*	Common	II	NA
8.	Porcupine	*Hystrix indica*	Common	IV	NA
9.	Rabbit	*Lepus nigricollus*	Common	-	LC
10.	Monkey	*Maccaca mulata*	Common	II	NA
11.	Bherki/barking dear	*Muntiacus muntjac*	Common	III	LC
12.	Leopard	*Panthera pardus*	Rare	I	VU
13.	Indian Fruit bat	*Pteropus giganteus*	Common	V	LC
14.	Rat	*Rattus rattus*	Common	V	NA
15.	Bat	*Skotophilus heathi*	Common	-	NA
16.	Langur	*Somnopithecus entellus*	Rare	II	NA
17.	Chhuchhunder	*Suncus murinus*	Common	-	LC
18.	Wild boar	*Sus scrofa*	common	III	NA
19.	Fox	*Vulpes bengalensis*	Common	II	NA

** Source: EIS Pvt. Ltd.*
NA=Not Assessed; LC= Least Concern; VU=Vulnerbale; EN=Endangered
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

(C) AQUATIC FLORAL AND FAUNAL DIVERSITY

Table 4.21: Aquatic phytoplankton and other plant species diversity in the project area

Sl. No.	PHYTOPLANKTON SPECIES
1.	*Anabaena spp.*
2.	*Anacyustis spp.*
3.	*Arthrspiora spp.*
4.	*Chara spp.*
5.	*Chlorella spp.*
6.	*Chlorococcum spp.*
7.	*Desmidium spp.*
8.	*Euglena spp.*
9.	*Fragilaria spp.*
10.	*Nostoc spp.*
11.	*Oscillatoria spp.*
12.	*Ulothrix spp.*
13.	*Volvox spp.*

Sl. No.	HIGHER PLANT SPECIES	LOCAL AVAILABILITY
1.	*Acorus calamus*	Common
2.	*Arundo donax*	Common
3.	*Azolla sp.*	Common
4.	*Ceratophyllum sp.*	Very Common
5.	*Cyperus spt.*	Very common
6.	*Eregrostielis nordoides*	Abundent
7.	*Hydrilla sp.*	Abundant
8.	*Imperata cylindrica*	Common
9.	*Ipomoea aquatica*	Common
10.	*Justiacia sp.*	Rare
11.	*Limnophila chinensis*	Common
12.	*Melastoma spp.*	Common
13.	*Nelumbo nucifera*	Rare
14.	*Nyphaea sp*	Rare
15.	*Phragmites karka*	Common
16.	*Potamogeton pectinatus*	Abundant
17.	*Typha angustifolia*	Common
18.	*Vernonia anagallis*	Common

Table 4.22: Aquatic fauna recorded in the project area

S. no.	GROUP	SPECIES
1	Zooplankton	*Brachionus spp*
		Bosmina spp.
		Cyclops spp.
		Daphnia spp.
		Euglaena spp.
		Filinia spp.
		Horerlla spp.
		Macrothrix spp.
		Moina spp.
		Nauplius spp.
		Vorticella sp.

Source: EIS Pvt. Ltd.

Table 4.23: Ichthyo fauna (fish species) * recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Kotri	*Anabas testidinius*	Very common	NA
2.	?	*Barillius Barila*	Common	NA
3.	?	*Barillius bola (Raiamas bola)*	Common	LC
4.	Catla	*Catla catla*	Common	NA
5.	Channa	*Channa marulius*	Very Common	LC
6.	Channa	*Channa Punctatus*	Very Common	LC
7.	Mrigal	*Cirrhina mrigala*	Common	NA
8.	Magur	*Clarius batrachus*	Very common	NA
9.	Common Carp	*Cyprinus carpio*	Common	VU
10.	Kalbos	*Labeo calbasu*	Common	LC
11.	Rohu	*Labeo rohita*	Abundant	LC
12.	Tengra	*Mystus cavacius*	Very Common	*NA*
13.	Seenghar	*Mystus seeghalus*	Rare	NA
14.	?	*Nemacheilus multifasciatus*	Common	NA
15.	Chital	*Notopterus chitala*	Very Common	LC
16.	?	*Punticus chola*	Common	LC
17.	?	*Punticus sophore*	Common	LC
18.	Karwadi	*Punticus ticto*	Common	LC

Source: EIS Pvt. Ltd.
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; LC= Least concern;VU= Vulnerable; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.
****Migration for food only (sometimes due to pollution/siltation)***

4.2.3 Seasonal Variation in Biodiversity

The filed study was conducted in the peak growth period (rainy season) which produces maximum bio diversity of the site. The tree and shrub diversity will remain same in other seasons of the year. In the herb and grass species, there will be insignificant changes in the rest of the year. Similarly in case of the faunal diversity there will be minor variations in zooplanktons and bird species. Detailed studies on bio diversity in different seasons of the year could not be available for the project area. The secondary data is limited to a checklist of species which does not differentiate the availability of bio diversity in different seasons. However, being a linear project the impacts on seasonal variation of bio diversity is very limited and no detailed seasonal variation study is required.

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4.3. Economic Development

The economy of Tripura is agrarian. More than 50 per cent of its population depends on agriculture for livelihood. Contribution of agriculture & allied activities to the Gross State Domestic Product (GSDP) is 23%. The economy of Tripura is characterized by high rate of poverty, low per-capita income (Rs.28806 against country's average of Rs. 33,283) low capital formation, in-adequate infrastructure facilities, geographical isolation and communication bottleneck, inadequate exploitation and use of forest and mineral resources, low progress in industrial field and high un-employment problem. Agriculture growth has remained much lower than the growth rates witnessed in the industrial and services sectors in the State. The average annual growth rate in real terms of Net State Domestic Product (NSDP) at 1999-2000 prices for 2007-08 (P) was 7.16 percent, which shows a down fall from earlier projections.

4.3.1 Agriculture, Forestry and Fisheries

Agriculture: Agriculture and allied activities is the mainstay of the people of Tripura and provides employment to about 64% of the population. There is a preponderance of food crop cultivation over cash crop cultivation in Tripura. At present about 62% of the net sown area is under food crop cultivation. Paddy is the principal crop, followed by oilseed, pulses, potato and sugarcane. Tea and rubber are the important cash crops of the State. Tripura has been declared the Second Rubber Capital of India. The state is the highest producer of true potato seeds in the world. The state is self-sufficient in coconut production. It has immense potential for horticulture development. Fruits like pineapple, orange, jackfruit, and banana are traditionally grown in the state. Cashew and litchis are also produced. 7,46,954 MT of rice and 1,59,466MT of potato produced in 2014-15 by the state.

Forestry: Forest is an integral part of the culture and tradition of Tripura. Forestry sector provides important supplementary income and inputs in daily lives of tribal people residing in forested areas. 91.52% of total household depend on fuel wood in Tripura; which stands much higher than national average of 61.50%.Tripura is the second largest producer of rubber in India and rubber produced is of superior quality.

Fisheries: The state has made remarkable progress in fishery sector with limited resources and now, stands on the leading position in North Eastern Region. Considering the increasing demand for fish in the state, government has been giving emphasis to increase the productivity from the existing water areas. Till 2007-08 Fish Farmers Development Agencies (FFDA) have brought 6920.96 hectares water area under scientific fish culture.

4.3.2 Industries and Mineral Resources

Industries: The industrialisation in the State is yet to take off and industry sector is not able to open employment opportunities despite State Government's effort for comprehensive base for industrialization. There are 7 industrial estates, 2 large and medium industrial units and 2066 small scale units in the state. Industrial growth has been low mainly due to lack of infrastructure (roads, road transport and power) and being land locked. The handloom industry is an important sector in providing large-scale employment in Tripura. State government is focusing on development of Tea, Natural Gas and IT industries. There is no major industry along the project road except one small pipe and chemicals industry.

Minerals: The state is endowed with a number of mineral resources. Besides oil and gas, the state has good reserves of clay and silica sand. The total oil and gas wealth of state is 588 thousand tons whereas that of clay and quartz silica sand is 0.3 and 0.2 thousand tons respectively.

4.3.3 Infrastructure Facility

Transport: Road transport is not only dependable means of transport and lifeline of the state through its hostile-hilly terrain. The National Highway (NH-44) is the only link road with rest of the country which is passing-through neighbouring states of Assam and Meghalaya. Details of road network in Tripura as on 2014-15 has been given below in table 4.24-

Table 4.24: Road Network in Tripura

Features	Length (in km)
National Highway (NH)	645
Major District Road (MDR)	90
Other District Road	1,195
Village Road (RD & ADC)	8,159
IBP Road (BRO)	726
Railway Road	158
Village Road (NHIDCL)	9,674
State Highway (SH)	532
Black topped road	10,011
Brick soled road	6,442
Earthen road	4,568

Source: DPR Vol-IV (Part A)

Tripura still remained backward in terms of railway connectivity and total railway link is 153 km. In 2008-09, the rail connectivity has been extended to the capital city of Agartala through the metre gauge

connecting it to Badarpur and Lamding of Assam by same metre-gauge. The work for further extension of railway line from Agartala to Sabroom completed.

So far as civil aviation is concerned, the people of the state are dependent especially on the flights operating between Agartala-Kolkata and Agartala-Guwahati. Air have also been improved from Agartala to Delhi and Chennai. The runway at Agartala Airport has been extended to 7,500 feet. Helicopter service was introduced in October, 2002 to connect some remote areas.

Power: The State has two sources of generation of electricity namely, hydro and thermal. The State is endowed with natural gas, which enhances potentially for thermal power generation. Out of the two major sources of power generation, thermal power accounts for 94% while remaining 6% is generated from hydel power. Present peak demand of the State is around 400 MW. After commissioning of mega gas power project at *Paltana*, the state has been exporting power to its neighboring states.

Irrigation: Tripura has a total cultivable land of 2,55,241 ha and irrigation potential of 1,17,000 ha. 1,13,598 ha of area brought under irrigation as on 31st March'2015. Further, 78,330 ha area have been used for irrigation in 2014-15.

Water Supply and Sanitation: State and centre has given high priority in improving water supply and sanitation in both rural and urban areas. Presently, in 40 Blocks under 8 District of Tripura, daily drinking water is being supplied through 933 Deep Tube Well Schemes, 837 Small Bore Tube Wells, 8 Surface Water Treatment Plants, 312 Iron Removal Plants, 73 Over Head Tanks and Spot Sources. As on 01.04.2010, 547,206 nos individual house hold toilets, 4,550 nos school toilets, 5,232 nos Balwadi toilets, and 162 nos sanitary complex have been constructed under different sanitation program.

4.3.4. Social and Cultural Resources

Demography: As per details from Census 2011, total population of Tripura is 36,73,917 of which male and female are 18,74,376 and 17,99,541 respectively. In 2001, total population was 3,199,203 in which males were 1,642,225 while females were 1,556,978. The total population growth in this decade was 14.75% while in previous% it was 15.74%. The population of Tripura forms 0.30 % of India in 2011. In 2001, the figure was 0.31 percent. Literacy rate in Tripura has seen upward trend and is 87.75% as per 2011 population census. Of that, male literacy stands at 92.18 % while female literacy is at 83.15%. In 2001, literacy rate in Tripura stood at 73.19% of which male and female were 82.42% and 64.33% literate respectively. As per the Census 2011, project districts have following facts (Table 4.25) on demography Vis-a Vis state and the country. However, some of the basic information on demographic structure of Unakoti & Khowai District is not available in public domain.

Table 4.25: Demography of the Project Districts, State and Country

Description	India	Tripura	Unakoti District	Dhalai District	Khowai District
Population	1,21,01,93,422	36,73,917	2,76,506	3,27,564	3,27,564
Male	62,37,24,248	18,74,376	1,40,210	1,94,000	1,67,401
Female	58,64,69,174	17,99,541	1,36,296	1,83,000	1,60,163
Population Growth	17.64	14.84%	--	--	--

Sex Ratio (Female/1000 Male)	940	960	972	945	957
Density/km^2	382	350	403	157	270
Literacy	74.04%	87.2%	86.91%	97%	87.78 %
Male Literacy	82.14	91.5%	90.92%	97%	92.17%
Female Literacy	65.46	82.7%	82.79%	96%	83.17%

Source: Census of India, 2011and District Administration

6, 54,918 of the total population belong to schedule castes (SC). Out of which 3, 34,370 are males and 3.20,548 are females. Proportion of SC population is 17.8% of the total population of the state as per the census'2011. 11, 66,813 of the total population belong to schedule tribes (ST). Out of which 5, 88,327 are males and 5, 78,486 are females. Proportion of ST population is 31.8% of the total population.

Working Class population: As per the census'2011, total working class population of Tripura is 14, 69,521. Hence, 40% of the total population of the state belongs to working class. The non-working population is about 60% which is an indication of the weak economic base and under-development. About 72% of the rural populations are living below poverty line. Details of working class population have been given below in table 4.26.

Table 4.26: Working Class Population of Tripura

Category	Population	Percentage
Total Workers	14,69,521	100%
Cultivators	2,95,947	20.14%
Agriculture labourers	3,53,618	24.06%
Category	Population	Percentage
Household industries	41,496	2.82%
Other workers	7,78,460	52.97%

Source: Census of India, 2011and District Administration

Educational Facilities: Tripura has made a comprehensive progress in the field of education since launching of first five-year-plan. It can be evident from the Census- 2011 data that overall literacy rate in the State is 87.75 % against the similar proportion for all India 74.04%. For school education facility, there are 2378-Junior Basic Schools, 1139-Senior Basic Schools, 459-High Schools and 311-Higher Secondary Schools in the state. For education, the State has one Central University and one private ICFAI-University, 15- General Degree Colleges, 1- Institute of Advanced Studies in Education, 2-Engineering Colleges, 1- Women's Polytechnic, 1- Government Law College, 1- Govt. Music College, and 1- Art & Craft College.

There are numbers of higher secondary schools, high schools, primary schools, numbers Anganbadis (institution to care for poor and deprived children as creche homes) etc. recorded in the project road stretch. Details of 15 major academic institutes within the ROW and touching the ROW of the project road have been given below in table 4.27.

Table 4.27: Educational Institutes near the Project Road

Sl. No.	Chainage (KM)	Key Environmental feature	Side	Remark
1	21.35	Kirtan Tali Girls School	LHS	Touching ROW
2	24.05	Chaintali Mitra Para ICDS Center	RHS	Within ROW
3	66.35	Baman Charra High School	RHS	Within ROW
4	72.7	Lumbachara High School	RHS	Within ROW
5	84.6	Sukhiya Bari J.B. School	LHS	Within ROW
6	85.4	Shadas Bashnas Bari SB School	RHS	Within ROW
7	101.4	Ganaki ClassXII School	RHS	Within ROW
8	108.9	Gourangatila H.S. School	LHS	Within ROW
9	112.35	Darikapur High School	LHS	Within ROW
10	117.35	Utabari SB School	RHS	Within ROW
11	122.4	Moharchara HS School	LHS	Within ROW
12	122.45	Ananda Marga Primary School	RHS	Within ROW
13	126.15	Eacher Bill HS School	RHS	Within ROW
14	126.7	Teliamura English Medium High School	LHS	Within ROW
15	127.15	Teliamura High School	RHS	Within ROW

Source: DPR Vol-IV (Part A)

Health Care Facilities: There were 19-Hospitals, 11- Rural Hospitals and Community Health Centres, 77-Primary Health Centres, 579- Sub-Centres/Dispensaries, 6- Blood Banks and 7-Blood Storage centres in allopathic branch during 2008-09 through which the State Government has been providing basic health facilities to all section of the society. The State Government Medical College has been started from August 2006, which is the first medical college in the State, and named as Agartala Government Medical College (AGMC). Total no of beds in the hospital is 2894. There are number of public health care centres along the project road. Details of health centres in the project road has been given below in table 4.28-

Table 4.28: Health Centres near the Project Road

Sl. No.	Chainage (KM)	Key Environmental feature	Side	Remark
1	73.2	Srirampur Health Centre	RHS	Within ROW
2	102.35	Santala Sub-health Centre	LHS	Within ROW
3	104.9	Chebri Primary Health Centre	RHS	Within ROW

Source: DPR Vol-IV (Part A)

Tourism: Tourism based on wildlife, forest and Hindu / Buddhist religious places have good potential in the state. Presently promotion of tourists has been affected by inadequate infrastructure. The development of tourism related infrastructure facilities are essential and prerequisite for promotion of tourism in the state. Important tourist destinations in the project districts are Bhubaneswari Temple, Tripureswari Temple (Matabari), Trishna Wildlife Sanctuary in Gomati district and 14-Gods Temple, Ujjayanta Palace, Brahmakunda, Kamalasagar and Sepahijala Wildlife Sanctuary in Sepahijala district. Unakoti Tirthosthan, an archeological place is 6km from the starting poing of the project road.

5. ANTICIPATED ENVIRONMENTAL IMPACTS AND ITS MITIGATION MEASURES

Road improvement projects are likely to bring several changes in the local environment both beneficial and adverse. This section of report prepared to identify nature, extent and magnitude of all such likely changes vis-a-vis project activities for all stage of project cycle i.e. pre-construction, construction and operation. Beneficial impacts are mostly long-term and permanent whereas adverse impacts are localized and temporary in nature and are likely to occur mostly during construction stage.

5.1 Beneficial Impacts

The objective of the project road is to improve the condition of the existing road by upgrading it to NH enhance improving connectivity to Agartala and neighboring towns of Assam, Meghalaya & Mizoram. In this process, the road will benefit the residents and other stakeholders in the settlement areas of important nearby towns of Fatikroy, Kumarghat ,Komolpur and Ambasa and villages/ localities i.e. Kirtantoli, Jarultali, Rajnagar (near Fatikroy), Gokulnagar,Ganganagar, Rajkandi, Saidacherra, Dangdung, Durgachoumohini, Bamuncherra, Eararpar, Manikbhander, lambucherra, Sreerampur, Sukhiabari, Langtibari, Laxmicherra, Behalabari, Khowai, Mahadevtila, Saratala, Chebri, Gourangatila, Baganbazar, Dwarikapur, Kalyanpur, Totabari, Komolnagar, Mohorchora and Trishabari by providing imporved connectivity to state capital and other important destination of nearby states of Assam, Meghalaya & Mizoram. Proposed road will be a vital link to connect NH-44 (Starting Point) which is the only linking road connecting to the rest of the country passing via Agaratala, capital of the project state. This will resuscitate the local economy and help local people to be part of main stream society. Further, the proposed road project aims at improving horizontal geometry of the road for riders comfort.

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

During operation stage, road-side economic activities supporting transport like gasoline stations, automotive repair shops, lodging, and restaurants will increase due to increased number of vehicles. Increase in agro-industrial activities are also expected to take advantage of improved access to urban Centres where there are higher demands and better prices for agricultural products. Other generic benefits of road improvement projects are (i) reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

5.2 Adverse Impacts

About 38.6% of the project road is proposed for either realignment or bypass. This process involves diversion of both agriculture and forest land along with eviction of some existing structures including shops, school boundary wall and temples. More 0than 75% of the land use in 10km radius of the project road is forest cover. The widening of the project road along with realignment and bypass development shall cause loss of vegetation/tree felling, other ecological imbalance and habitat destruction. Another significant impact identified during site visit is water quality deterioration of large number of ponds abutting the project road.

Other impacts arising from the project road improvement are: (i) acquisition of private land and other assets impacting livelihood of local population, (ii) borrowing, (iii) impact on water bodies, (v) increased risk of accident due to faster vehicular movement (iv) increase in air pollution and noise pollution due to increased traffic. Except for land acquisition and habitat destruction, all impacts are reversible, temporary, localized in nature, and can be easily mitigated/minimized/avoided by effective implementation of environment management plan (EMP).

Following subsections describes anticipated impacts and its mitigation measures on all aspects of physical, ecological and socio-cultural environment during construction and operation stage of the projects.

5.3 Pre-construction Impacts

5.3.1 Land Assets

Project will cause acquisition of private land resulting in loss of livelihood to the local population. Adequate compensation and rehabilitation assistance shall be proposed for affected households in consistent to Government of India's policies. Income restoration measures/livelihood options for vulnerable group/resource poor sections and other affected persons as recommended shall be implemented. All impacted common public utilities will be relocated and reconstructed in consultation with the respective local communities under the project.

5.3.2 Diversion of Forest Land & Tree cutting

Project road is passing through reserve/protected forest at considerable length. 79.756196 ha of forest land need to be acquired for the project road as per the estimation. Construction of project road will welcome diversion of forest cover while constructing the project road. A total of 7743 nos of trees expected to fell due to project road construction activities. Project proponent has already obtained forest clearance vide letter no. 3814-18 dated February 20, 2019. The plantation will be done as per the norms fixed by the Forest Department.

5.3.3 Natural Hazards

Proposed project road in general is not liable to flooding. During public consultation it was revealed by the local people that flash flood occurs in several villages in the project area during the months of monsoon season. The project state is in seismic zone-V with high risk of seismic activities. Hence All CD structures have been proposed to design for 50yr return period with anticipated risk of rarer flood of next higher frequency i.e. 100 yr return period flood on the designed structure. Waterway and elevation of all the bridges shall be designed accordingly to counter impact due to flood or flash flood. Embankment height along potential flood affected areas shall increase. Lined and unlined side drains have been included in the design to avoid water-logging. Relevant IS codes have been adopted in designing the structures to sustain the highest magnitude of earthquake corresponding to Seismic zone V.

5.3.4 Wildlife Movement

The proposed alignment does not pass through Wildlife Sanctuary. However, Gumti Wildlife Sanctuary is located approx. 8 km away from the end point of the project.

5.4 Construction Stage Impacts

5.4.1 Climate & Air Quality

The potential sources of air emission during the construction phase of the project are: (i) dust from earth works (during site preparation), (ii) emissions from the operation of equipment, machines and vehicles for construction, (iii) fugitive emissions during the transport of construction materials, (v) air emissions other than dust arise from combustion of hydrocarbons particularly from the hot mix plants and process of heating bitumen and (vi) dust generated due to rock cutting and blasting. Most of the emissions will be in the form of coarse particulate matter which will settle down in close vicinity of construction site.

The stone aggregate will be sourced from licensed quarries. The project implementation unit is not going to establish new quarries for the project. The pollution related aspects to these quarries are independently compiled by the quarry owners. The aggregate will be transported in the tarpaulin covered trucks.

Mitigation Measures

- Vehicles delivering loose and fine materials shall be covered.
- Loading and unloading of construction materials in covered area or provisions of water fogging around these locations.
- Storage areas should be located downwind of the habitation area.
- Water shall be sprayed on earthworks periodically
- Regular maintenance of machinery and equipment. Vehicular pollution check shall be made mandatory.
- Hot mix plants should be located at least 1.5 km from the nearest habitation, school, hospital, archaeological site, forest, rivers, streams and lakes, 500 m from ponds, and national highway, 250 m from state highway, unless otherwise required by statutory requirements after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.
- Bitumen emulsion and bitumen heaters should be used to extent feasible.
- Only crushers licensed by SPCB Tripura shall be used.
- LPG should be used as fuel source in construction camps instead of wood.
- Regular water sprinkling of unpaved haulage roads3.
- Mask and other PPE shall be provided to the construction workers
- Diesel Generating (DG) sets shall be fitted with adequate height as per regulations (Height of stack = height of the building + 0.2 KVA. Low sulphur diesel shall be used in DG sets as well as machineries.
- Contractor should submit a dust suppression and control program to the NHIDCL prior to construction.

5.4.1.1 Prediction of Impact on Ambient Air Quality

To assess the impact on air quality of the project area during operation phase, air pollution dispersion modeling was carried out using future traffic projections. The modeling was carried out using CALINE-4, line source model developed by the California Transport Department. Carbon monoxide (CO) is the main component of the vehicular pollution. So, prediction of CO concentration is representative of the impacts of air pollution due to traffic movement.

CALINE - 4 Model

The air dispersion model used is ***CL4 (A Graphical User Interface for CALINE4)*** developed by the California Department of Transportation (Caltrans) for predicting air pollutant concentrations near roadways. CALINE4 is a simple line source Gaussian plume dispersion model.

CALINE4 is a model based on the Gaussian diffusion equation and employs a mixing zone concept to characterize pollutant dispersion over the roadway. The purpose of the model is to assess air quality impacts near transportation facilities. Given source strength, meteorology and site geometry, the model can predict pollutant concentrations for receptors located within 500 meters of the roadway. It also has special options for modeling air quality near intersections, street canyons and parking facilities.

CALINE4 divides individual highway sections into a series of elements from which incremental concentrations are computed and then summed to form a total concentration estimate for a particular receptor location. Downwind concentrations from the element are modelled using the crosswind FLS (Finite Line Source) Gaussian formulation, but óy and óz are modified to consider the mechanical turbulence created by moving vehicles and the thermal turbulence created by hot vehicle exhaust in the region directly over the highway, region considered as a zone of uniform emissions and turbulence.

(a) Input Data Requirement:

- **Emissions**
  The emissions are provided by traffic volume (vehicles/h) and emission factor (gr/mile/vehicle) for each section

- **Meteorology**
  Wind speed Wind direction Wind direction standard deviation Atmospheric stability Class Mixing Height Ambient Temperature.

The details of input parameters considered for the modeling exercises are presented in the following paragraphs.

- **Traffic Data**
  The traffic surveys have been carried out along the corridor to establish base year traffic with reference to traffic movements. Average hourly traffic data has been considered for the present modeling exercises.

- **Meteorological Data**

  "Worst case wind angle" run type was considered to predict the worst-case scenario. The met inputs entered were:

- Wind speed: 1.0m/s
- Stability Class: F
- Mixing Height: 50m
- Standard Deviation: 5°
- Ambient Air Temperature: 25°C

(b) PRESENTATION OF RESULTS

For One-hour simulations, the concentrations were estimated around 3 receptors to obtain an optimum description of variations in concentrations over the distance of 30m, 50m & 100m downwind from the centerline for the worst angles as identified by the model. Based on the observed traffic flows and reconnaissance surveys, the proposed project has been divided into three homogenous traffic sections. The nearest receptor was considered to be at 30m from the centerline of Homogenous Sections. Air modeling results of all the three homogenous sections of NH- 208 have been presented in **Table 5.1(a) to 5.1(b).**

Table 5.1(a):- Air Modeling Result for section 0.000 km to 20.000 km (Predicted Conc. of CO)

Predicted Maximum 1-hour Concentration of CO (ppm)						
Receptor Distance from Center Line	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
at 30 m	0	0	0	0	0.1	0.1
at 50 m	0	0	0	0	0	0
at 100 m	0	0	0	0	0	0

Predicted Maximum 1-hour Concentration of CO (µg/m3)						
Receptor Distance from Center Line	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
at 30 m	0	0	0	0	115	115
at 50 m	0	0	0	0	0	0
at 100 m	0	0	0	0	0	0

Table 5.1(b):- Air Modeling Result for section 20.000 km to 85.500 km (Predicted Conc. of CO)

Predicted Maximum 1-hour Concentration of CO (ppm)

Receptor Distance from Center Line	2015	2018	2020	2025	2030	2033
at 30 m	0	0	0	0	0.1	0.1
at 50 m	0	0	0	0	0	0
at 100 m	0	0	0	0	0	0

Predicted Maximum 1-hour Concentration of CO (µg/m3)						
Receptor Distance from Center Line	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
at 30 m	0	0	0	0	115	115
at 50 m	0	0	0	0	0	0
at 100 m	0	0	0	0	0	0

Table 5.1(c):- Air Modeling Result for section 85.500 km to 118.000 km (Predicted Conc. of CO)

Predicted Maximum 1-hour Concentration of CO (ppm)						
Receptor Distance from Center Line	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
at 30 m	0	0	0	0.1	0.1	0.1
at 50 m	0	0	0	0	0.1	0.1
at 100 m	0	0	0	0	0	0

Predicted Maximum 1-hour Concentration of CO (µg/m3)						
Receptor Distance from Center Line	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
at 30 m	0	0	0	115	115	115
at 50 m	0	0	0	0	115	115
at 100 m	0	0	0	0	0	0

Source: EIS Pvt. Ltd.

The predicted 1hr maximum concentration of CO after improvement and widening of the proposed project is found to be within 4000 µg/m^3 prescribed in National Ambient Air Quality Standards, 2009 for residential, rural and other areas.

5.4.1.2 Change in Ambient air and GLC

The air pollution impact of excavation in ordinary earth and boulders and rock is directly dependent upon construction methodology, annual rate of excavation, mode of transport within the construction site, mode of screening and method of crushing. The air pollution sources at the proposed project site can be broadly classified into three categories, viz. area source, line source and instantaneous point source.

Excavation by various activities in project area is construed as an area source which includes excavation pit(s) and activities happening in the excavation area like digging, dozing, hauling and loading/unloading. The dust emission from these areas will be fugitive in nature. The excavator operations, loading/unloading operations will also cause dust emission though it will be confined to the area of operation of the machinery. The gaseous emission from their operation shall be minimal and limited within the project.

Transportation of excavated material from the project site to dumping sites area categorized as line source. Since the dumper movement on haul road will be within the project area, no adverse impact shall be felt in the settlement area.

(i) Dust Dispersion Modeling for Excavation Operation

In the present study, United States Environmental Protection Agency (USEPA–42 series) approved mathematical equations have been used to predict concentrations for different operations in project including the material transportation. To predict the particulate emissions, Envitrans AERMODCloud. (Air Dispersion Modeling Software) an interface based on ISCST3 – was used to predict changes in air quality i.e., maximum ground level concentration (GLC's) of Particulate Matter. Short term model options were opted for uniform emissions rates. The concentration of other gaseous pollutants i.e. SO2 and NOx was found to be much lower than the threshold limit (80 µg/m3), the air modeling was restricted to determination of PM_{10} and $PM_{2.5}$ in the present case for the monitoring locations where respective maximum value was identified. The emission factors adopted for various project operations are mentioned below:
Emission Factor for Excavation and Material Loading/unloading.

For excavation and material handling the emission factor for PM_{10} has been adopted as per USEPA – 42 series.
For Dozing Operation:
$EFPM_{10}$ (kg/hr) = 0.34 X s1.5(%) / M1.4(%)
Where,
$EFPM_{10}$ (kg/hr) = emission factor in kg/hr
S = silt contents in percentage by weight
M = moisture content in percentage by weight
For Material Loading/unloading:
$EFPM_{10}$ (kg/hr) = 0.34 [0.119 / M0.9]
Where,
$EFPM_{10}$ (kg/hr) = emission factor in kg/ton
M = moisture content in percentage by weight.
Emission Factor for Material Haulage within Project:

The emission rate is dependent on several factors which include soil properties, climatic conditions, vehicular traffic, wind forces and machinery operation. The Empirical equation for calculation of emission rate is as under.

E= k*(1.7) *(s/12) *(S/48) *(W/2.7)0.7*(W/2.7)0.7 (w/4)0.5 * (365-p/365) g/VKT

Where,

E=Emission Rate

K = Particle size multiplier

s=Silt Content of the Road surface material

S= Mean Vehicle Speed (km/hr)

W=Mean Vehicle Weight (tons)

w=Mean number of wheels

p= Number of days with at least 0.254mm of precipitation per year

Note: The emission factor for $PM_{2.5}$ has been considered 60% of PM_{10}.

The Isopleth developed for PM_{10} and $PM_{2.5}$ along the road alignment where monitored values are highest in receptor villages and is shown in **Figure 5.1 and 5.2 for PM_{10} and $PM_{2.5}$** respectively. The maximum GLC due to excavation, loading & unloading activities for PM_{10} and $PM_{2.5}$ were found to be 5.3 µg/m3 and 3.1 µg/m3 respectively and has been shown in Table 5.2.

Table 5.2: Maximum Concentration at receptors

Location	Pollutants	N-Cord.	E-Cord.	GLC (µg/m^3)
Teliamura (NH44)	PM $_{10}$	23.841120°	91.627929°	5.3
Teliamura (NH44)	PM $_{2.5}$	23.841120°	91.627929°	3.1

Source: EIS Pvt. Ltd.

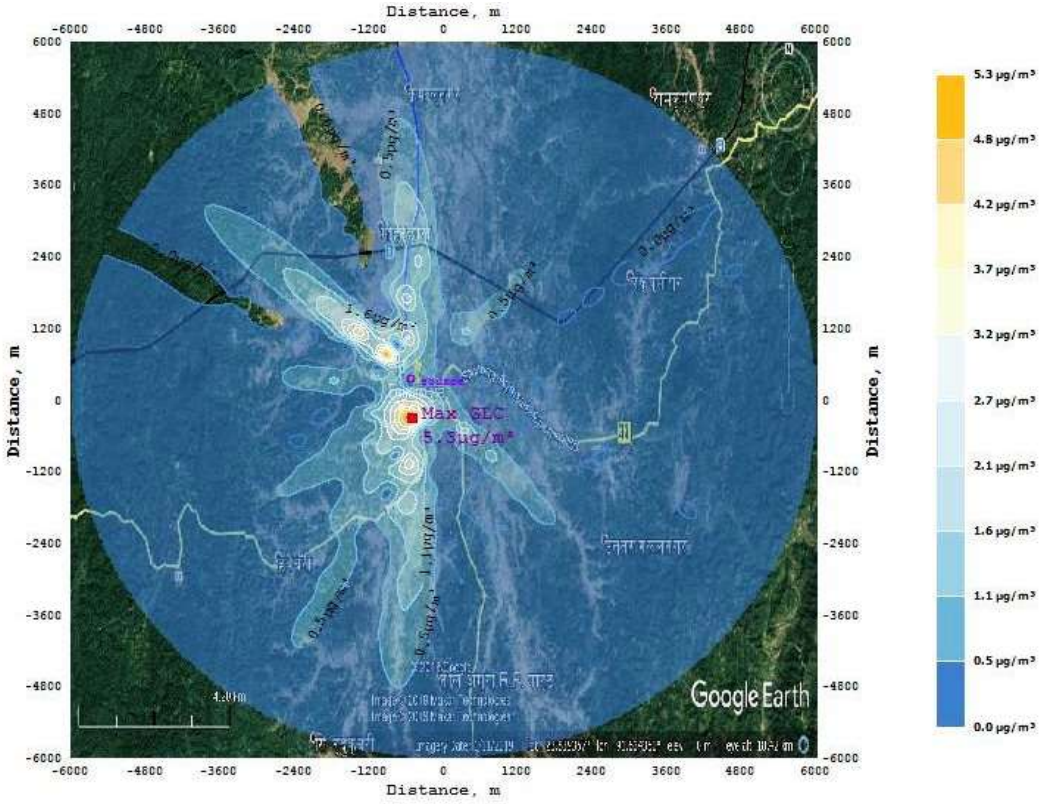

Figure 5.1: Isopleth of Maximum Predicted 24 hourly Ground – Level Concentrations for PM_{10}

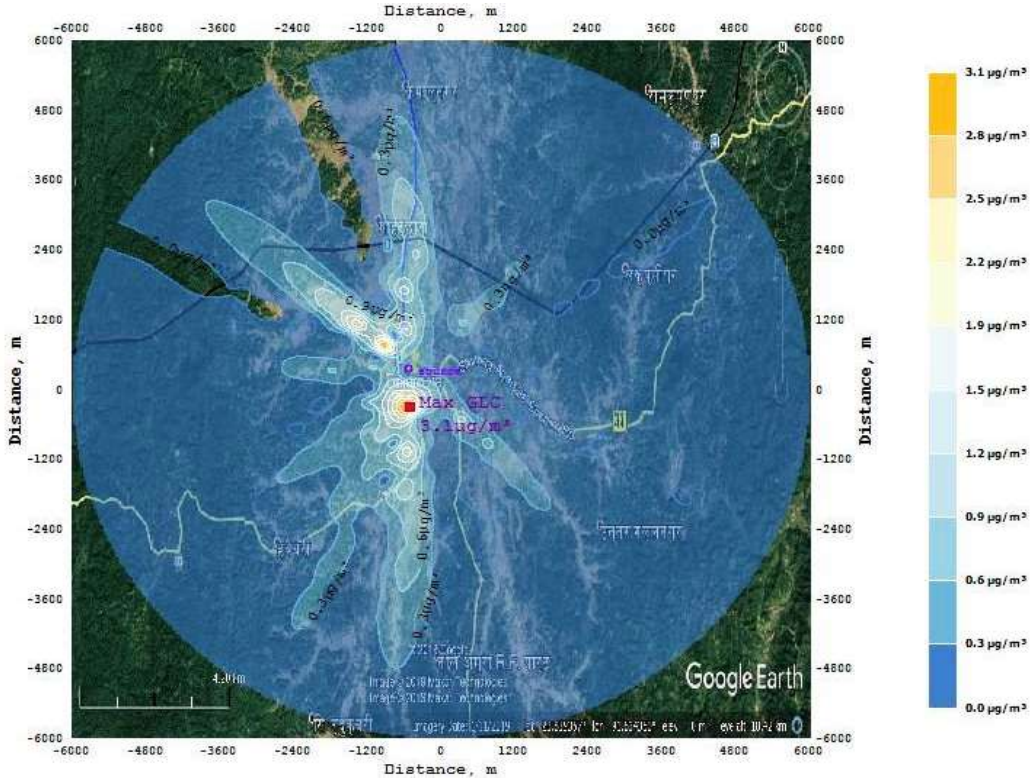

Figure 5.2: Isopleth of Maximum Predicted 24 hourly Ground – Level Concentrations for $PM_{2.5}$

Source: EIS Pvt. Ltd.

Resultant Impact

The resultant impact due to construction activities (excavation and crushing) on the ambient air quality for PM_{10} and $PM_{2.5}$ at monitoring station Teliamura (NH44) is presented in **Table 5.3(a)** which shows that, the resultant concentration level is within the NAAQS whereas **Table 5.3 (b)** shows the resultant levels due to excavation and construction activities after taking Mitigation Measures (MM) as per EMP.

Table 5.3 (a): Resultant levels due to excavation and construction activities

Station Name	Pollutants	Max. Conc. (µg/m3)	Predicted GLC (µg/m3)	Resultant concentration (µg/m3)	NAAQS (µg/m3)
Teliamura (NH44)	PM10	32	5.3	37.3	100
Teliamura (NH44)	PM2.5	14	3.1	17.1	60

Table 5.3 (b): Resultant levels due to excavation and construction activities after taking Mitigation Measures (MM) as per EMP

Station Name	Pollutants	Max. Conc. (µg/m3)	Predicted GLC (µg/m3)	GLC after taking MM as per EMP (µg/m3)	Resultant concentration taking MM as per EMP (µg/m3)	NAAQS (µg/m3)
Teliamura (NH44)	PM10	32	5.3	1.06	33.06	100
Teliamura (NH44)	PM2.5	14	3.1	0.62	14.62	60

Source: EIS Pvt. Ltd.

5.4.2 Noise & Vibration

Noise level may increase temporarily in the close vicinity of construction activities, maintenance workshops and earth work site. These construction activities are expected to produce noise levels in the range of 80 - 95 dB(A) (at a distance of about 5 m from the source) . Although this level of noise is higher the permissible limit for ambient noise level for residential/commercial levels but will occur only intermittently and temporary. This noise level will attenuate fast with increase in distance from noise source. Since the project road is passing through considerable built-up area, impact of noise on sensitive structures such as schools, hospitals is highly anticipated. There are several noise sensitive receptors such as educational institutes, health centres along

with residential areas. Noise barriers shall be provided in those sensitive noise receptors to avoid detrimental impact due to noise pollution. List of noise sensitive receptor in the project road has been given below.

Table 5.4: Sensitive Noise Receptors in the Project Road

Sl. No.	Chainage (KM)	Key Environmental feature	Side	Remark
1	21.35	Kirtan Tali Girls School	LHS	Touching ROW
2	24.05	Chaintali Mitra Para ICDS Center	RHS	Within ROW
3	45.15	Ananda Marga School	LHS	Within ROW
4	66.35	Baman Charra High School	RHS	Within ROW
5	71.3	Manikbhandar S.B School	RHS	Within ROW
6	72.7	Lumbachara High School	RHS	Within ROW
7	73.2	Srirampur Health Centre	RHS	Within ROW
8	84.6	Sukhiya Bari J.B. School	LHS	Within ROW
9	85.4	Shadas Bashnas Bari SB School	RHS	Within ROW
10	101.4	Ganaki ClassXII School	RHS	Within ROW
11	102.35	Santala Sub-health Centre	LHS	Within ROW
12	104.9	Chebri Primary Health Centre	RHS	Within ROW
13	108.9	Gourangatila H.S. School	LHS	Within ROW
14	112.35	Darikapur High School	LHS	Within ROW
15	117.35	Utabari SB School	RHS	Within ROW
16	122.4	Moharchara HS School	LHS	Within ROW
17	122.45	Ananda Marga Primary School	RHS	Within ROW
18	126.15	Eacher Bill HS School	RHS	Within ROW
19	126.7	Teliamura English Medium High School	LHS	Within ROW
20	127.15	Teliamura High School	RHS	Within ROW

Source: DPR Vol-IV (Part A)

5.4.2.1 Impacts on noise levels

The assessment of potential road noise impacts helps in understanding one of the most significant pollution, the noise pollution. Some salient features related to potential noise impact of a road development include: (i) the road noise impact is greatest where busy road passes through densely populated areas, townships and markets (ii) the range of noise level should be understood in relation to the habitation type also; for example, road noise in industrial area is not likely to be problematic but at sensitive location like schools and hospitals; its impact may be significant, (iii) mitigation of noise in urban areas is rather difficult, especially at the road intersections.

Environmental noise particularly highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road.

The impacts of noise due to the project will be of temporary significance locally in the construction phase and slight increase may occur during the operation stages. **Table 5.5** presents the source of noise pollution and the impact categorization.

Table 5.5: Source of the Noise pollution and its impact

Sr. No.	Phase	Source of Noise pollution	Impact categorization
1	**Pre-construction**	• Man, material & machinery movements • establishment of labor camps, onsite offices, stock yards and construction plants	• All activities will last for a short duration and also shall be localized in nature
2	**Construction Phase**	• **Plant Site** Stone crushing, asphalt production plant and batching plants, diesel generators etc. • **Work zones** Community residing near to the work zones	• **Plant Site:** Impact will be significant within 500m. • **Work zones**: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.
3	**Operation Phase**	• Due to increase in traffic (due to improved facility)	• Will be compensated with the uninterrupted movement of heavy and light vehicles.

Source: EIS Pvt. Ltd.

Although the baseline day & night time noise levels monitored at ten locations along the proposed project are within permissible limits specified by the MoEF&CC. The highest Leq noise levels was recorded at Teliamura (NH44) which is 56 dB(A) during daytime and 44 dB(A) during night time. The Mathematical equation used for noise prediction is L2 = L1-20 Log D2/D1.

5.4.2.2 Prediction of Noise Impact on Noise level

A noise propagation modeling study has been conducted to find out the impact from the noise generated because of the estimated total traffic flow as well as the significance of these impacts. The noise modeling has been done taking into account the design speed at various stretches and the stretches with restricted speeds have also been considered. DhwaniPRO is a computer program developed to undertake construction, industrial and traffic noise propagation studies for noise assessment.

The Traffic data has been collected at three locations along the project road during base year 2015 and same is projected up to year 2033 as per table 5.6.Different operative speeds have been used for various horizon years in the design life to get a realistic picture of the noise levels.

Table 5.6: Projected Traffic

Year	Homogeneous Section-I (KM 0.000- KM 20.000)		Homogeneous Section-II (KM 20.000- KM 85.500)		Homogeneous Section-II (KM 85.500-KM 118.000)	
	Length- 20.000 km		Length- 65.500 km		Length- 32.500 km	
	No	PCU	No	PCU	No	PCU
2015	4204	5142	4351	4981	7503	7541
2018	4867	5952	5037	5766	8686	8729
2020	5366	6562	5553	6358	9576	9624
2025	6848	8376	7087	8114	12221	12283
2030	8740	10690	9045	10356	15598	15676
2033	10118	12374	10471	11988	18057	18147

Source: DPR Vol-I (main report)

DhwaniPRO model is used for noise modeling and predicted noise levels are presented in Table **5.6** and **Figure 5.2(a) to (f)**.

Table 5.7: Noise level predictions for the receptors at the homogenous intersections

S.No.	Locations	2015	2018	2020	2025	2030	2033
1	Teliamura (NH44)	46	47	48	49	50	52
2	Rajkandi	26	27	28	29	30	31
3	Dwarikapur	38	39	40	41	42	43
4	Kalyanpur	33	34	35	36	37	38
5	Lakshmichera	43	44	45	46	47	49
6	Khowai	45	46	47	48	49	50
7	Bamunchera	39	40	41	42	43	44
8	Durgachoumohini	41	42	43	44	45	46
9	Mahadevtila	29	30	31	32	33	34
10	Kirtontoli	37	38	39	40	41	42

Source: EIS Pvt. Ltd.

Outcome of the Noise level Modelling:

The outcome of the noise modeling is as follows:

- The predicted noise levels during both day and night time are within limit upto the end of design life of the project for all the land uses i.e., commercial, residential/rural and sensitive.

The Contour map showing noise levels due to total traffic outcome at the homogenous intersections from the period of 2015 – 2033 has been shown in **Figure 5.3 (a)** to **5.3 (f).**

Figure 5.3 (a):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2015 year

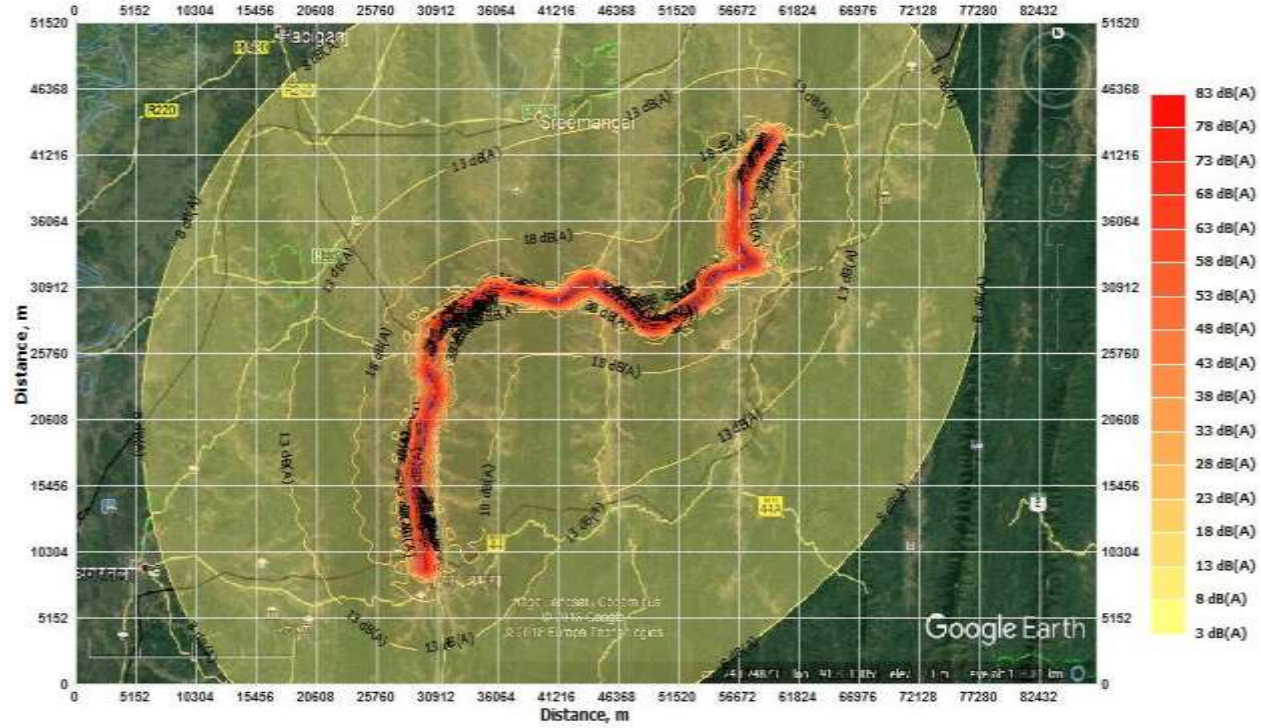

Figure 5.3 (b):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2018 year

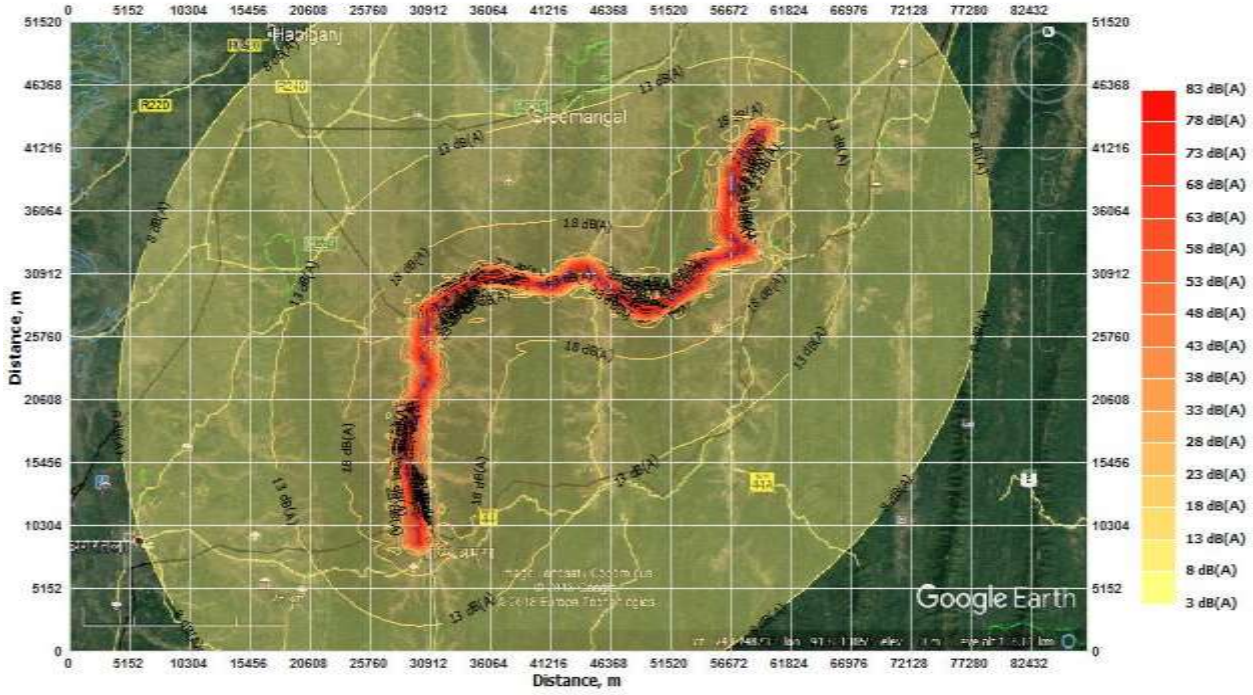

Figure 5.3 (c):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2020 year

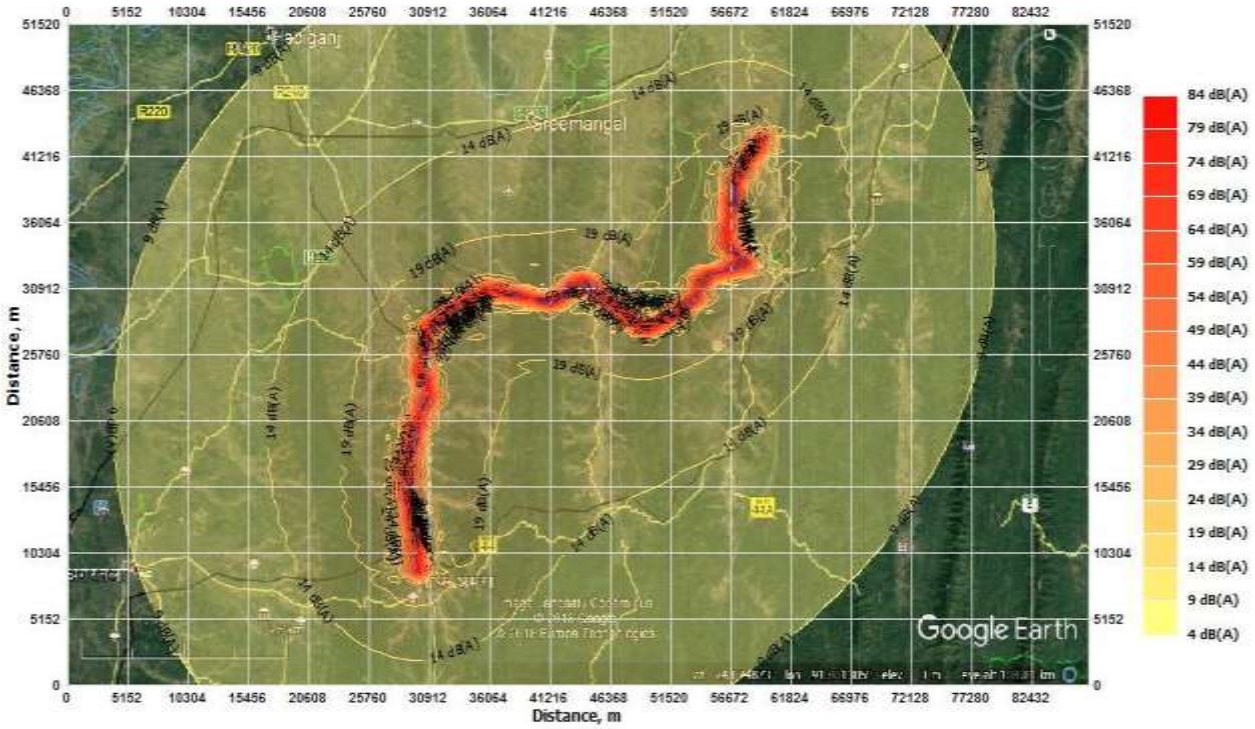

Figure 5.3 (d):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2025 year

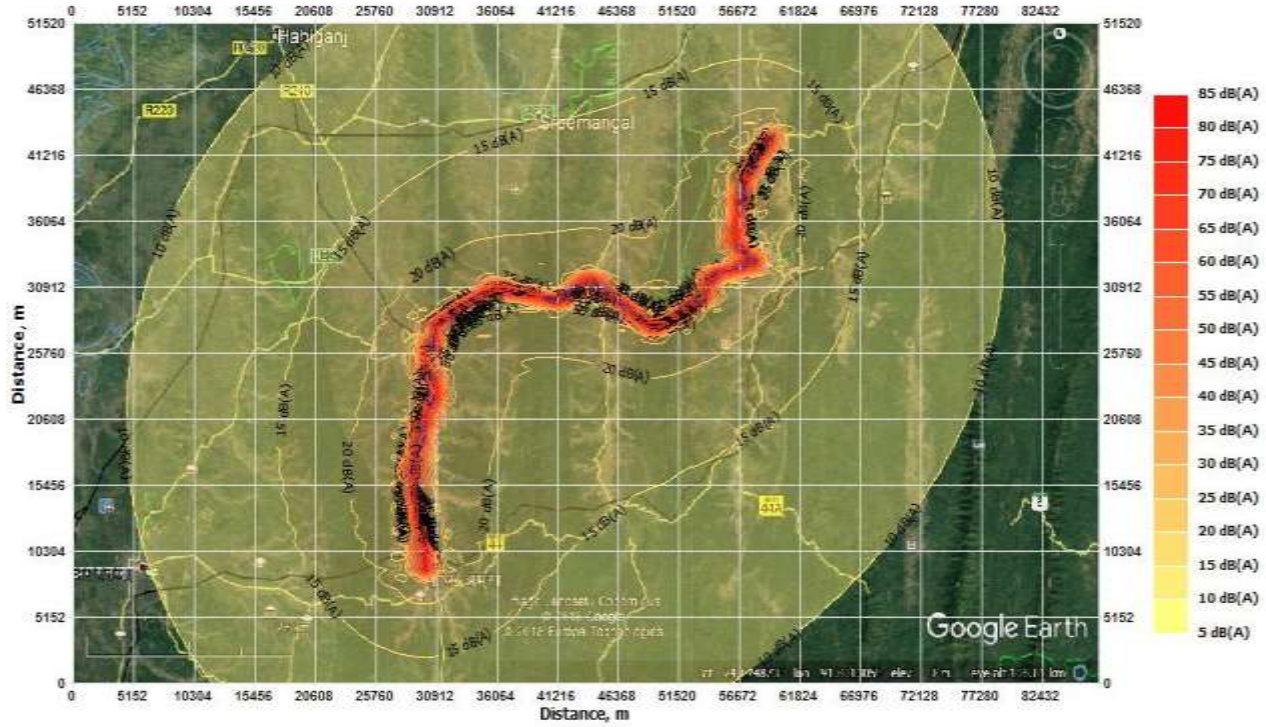

Figure 5.3 (e):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2030 year

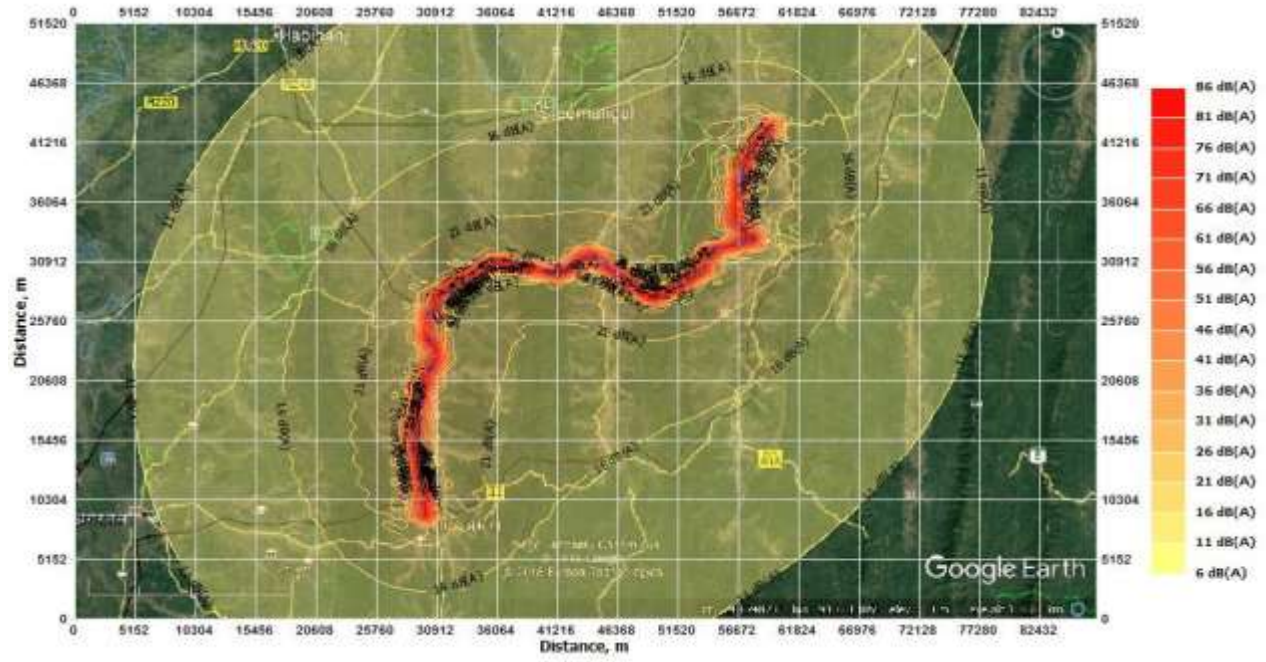

Figure 5.3 (f):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2033 year

Source: EIS Pvt. Ltd.

Mitigation measures to reduce Noise levels

The following are the mitigation measures to reduce noise pollution:

- Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90dB (A). If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with noise shields.
- Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
- Workers in the vicinity of high noise levels will be provided earplugs, helmets and will be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift.
- During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the engineer will ask the site engineer to take suitable steps of restricting the work hours even further or use an alternative roller.
- Proposed tree and shrub plantations planned for avenue plantation especially close to settlements, may form an effective sound buffer during the operation stage.

5.4.3 Land & Soil

Topography and aesthetics: Activities like (i) Clearing of vegetation (ii) Cutting of highland (iii) Waste/Debris disposal and (iv) Establishment of labour camps change the topography and appearance of the landscape. Following mitigation measures to overcome the issue.

Mitigation Measures

- Cut materials should be used in road embankment or disposed-off in environmentally acceptable manner.
- Cut slopes should be re-vegetated immediately after widening activities
- Borrow areas, if required should be rehabilitated and brought back as far as possible to their previous appearance. Some borrows shall be converted into ponds to compensate loss of water bodies. This will also enhance the local aesthetics
- Cut off material should be used to widen the road or disposed of at proper disposal sites
- Provision and allocation of proper waste disposal bins and sites are required. Supply of cooking gas should be provided by the contractor to eliminate the use of fire wood.

Loss of Productive Soil and Change in Land use: Proposed project road shall be passing through agriculture and forest land in realignment and bypass portion. This will lead to acquisition of substantial quantity of land. Hence, agricultural yield of the area is likely to be affected.

Mitigation Measures

- The top soil from the productive land if required shall be preserved and reused for plantation purposes. It shall also be used as top cover of embankment slope for growing vegetation to protect soil erosion.

- It shall be ensured that the land taken on lease for access road, borrow areas, construction camp is restored back to its original land use.

Soil Erosion/Silt Runoff: Soil erosion may take place near cutting areas, at steep and uncompact embankment slope, and wherever vegetation is cleared. Soil erosion may have cumulative effect viz. siltation, embankment damage, drainage problem etc. Loss of soil due to run off from earth stock-piles may also lead to siltation.

Mitigation Measures

- Bank protection measures shall be taken at erosion prone areas.
- Provision of side drain to guide the water to natural outfalls.
- When soil is spread on slopes for permanent disposal, it shall be buttressed at the toe by retaining walls.
- Side slopes of the embankment shall not be steeper than 2H: 1V. Turfing of embankment slopes shall be done along the stretch.
- IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control shall be taken into consideration.

Borrow Areas and Quarries: Need for opening borrows areas is anticipated. It may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born disease. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution. Opening of new quarries is not envisaged due to the proposed project. Quarry material will be sourced from existing licensed quarries. The dredging and use of dredged material, if involved, may have its impact in terms of localized sedimentation level increase and dispersion of pollutants present in the dredged material in the river water.

Mitigation Measures

- Borrow areas if required, shall not be located near forest areas. The edges of borrow sites shall be no closer than 3 meters from any fence line or boundary. Adequate clearance shall be provided for the construction of catch drains. Borrow sites shall have adequate drainage outlets unless the relevant landowner has agreed that the borrow area is to create a permanent tank or dam. Cut batter slopes shall not be steeper than 3 to 1 and shall be left by the Contractor in a tidy and safe condition to the satisfaction of the Engineer. Written clearance from the land owner/village head shall be obtained before leaving a site
- Obtain statutory approval from competent authority as detailed in chapter II (recent policy initiatives on mining of minor mineral)
- Borrow pits shall be selected from barren land/wasteland to the extent possible. Borrow areas should not be located on cultivable lands except in the situations where land owners desires to level the land. The top soil shall be preserved and depth shall be restricted to the desired level.
- Borrow areas should be excavated as per the intended end use by the owner. The Indian Road Congress (IRC):10-1961 guideline should be used for selection of borrow pits and amount that can be borrowed.

- The dredged material from the nearby water body shall be tested for presence of heavy metals and other pollutants before its reuse.
- The depths in borrow pits to be regulated so that the sides shall not be steeper than 25%, to the extent possible, borrow areas shall be sited away from populated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil.

Compaction and Contamination of Soil: Soil of the haulage roads and construction camp area may be compacted due to movement of construction vehicles, machineries and equipment's, and due to sitting of construction camps and workshops. Soil may get contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery.

Soil may also get contaminated due to inappropriate disposal of domestic solid waste and sewage from construction camps. Sub soil contamination may also be attributed to: scarified bitumen wastes, operation of the emulsion sprayer and laying of hot mix, storage and stock yards of bitumen and emulsion, excess production of hot mix and rejected materials.

Mitigation Measures

- Fuel and lubricants shall be stored at the predefined storage location. The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.
- Unavoidable waste shall be stored at the designated place prior to disposal. To avoid soil contamination at the wash-down and re-fueling areas, "oil interceptors" shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF&CC authorized re-refiners.
- Movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.
- Approach roads shall be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land shall be reclaimed after construction activity.
- Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp.
- Domestic solid waste at construction camp shall be segregated into biodegradable and non-biodegradable waste. Non-biodegradable and non-saleable waste shall be disposed-off to authorize land fill site. If land fill site not available then burial of the waste in a secured manner shall be ensured.

5.4.4 Water Resources

Loss of Water Bodies: There are 238 locations where the proposed road passes through the edge of ponds / well. Most of them are within the right of way very close to the alignment. Retaining walls are proposed at such locations. Earth filling may be required in some cases but limited to a narrow strip of 1-1.5 m. This will cause reduction in volumetric capacity of these ponds. However, overall impact will not be significant since the project area is endowed with abundant surface water resources. Moreover, the usage of these ponds is limited to washing/cattle bathing and fishing. No other aquaculture was observed other than fishing of some indigenous variety mostly for domestic consumption and restricting mosquito breeding.

Apart from this, the project road is intersecting 49 rivers & streams including major rivers such as Dhalai River, Khowai River & Telpa Chara River & Sudha Chara River. New bridges are proposed to construct in these water bodies. There will be temporary disturbance to the water bodies limited to bridge construction period. Construction activities on bridges shall be stopped during breeding time of fish and other aquatic species. Details of ponds and rivers/nala (stream in Indian) intersecting the project road have been given in
Annexure-2 as key environmental features.

Mitigation Measure

- Alignment may be suitably modified to avoid encroachment of water bodies wherever possible
- Efforts shall be made to increase its volumetric capacity either by increasing depth or area wherever feasible.
- Borrow areas shall be converted into ponds at least equivalent to filling.

Siltation and Deterioration in Surface Water Quality: Construction activities may increase turbidity level increasing the sediment load. Sometimes contamination of surface water may take place due to accidental spills of construction materials, oil, grease, fuel, and paint. Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas. During construction phase, care would be exercised to control silt so that the water available in the ponds and wells especially those located very near to the ROW may not be contaminated.

Extraction of sand from the river bed will increase turbidity and affect propagation of fishes and other aquatic life mainly benthic organisms. The macro-benthic life which remains attached to the river bed material may get dislodged and carried away downstream by turbulent flow. Mining and dredging activities, poorly planned stockpiling and uncontrolled dumping of overburden, and chemical/fuel spills from equipment's and machinery involved in dredging may cause deterioration of water quality for downstream users, and poisoning of aquatic life. However, the river bed sand quarries identified for the project have no density and diversity of benthic fauna. Fishing is practiced in the water bodies intersecting the project road. There are several ponds adjacent to the proposed project road. Moreover, any extraction of river bed material is regulated by different authorities like State Environmental Impact Assessment Authority, State Pollution Control Board and State Mining Department with an objective to conserve top soil, avoid impact on aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals. The project will utilize river bed materials from existing licensed quarries with all stipulated conditions of above mentioned authorities.

Mitigation Measure

- Construction works near waterways/water bodies will not be undertaken during the monsoon season
- Retaining walls have been proposed to prevent erosion
- Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- No construction camp within 500m of any water body

- Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards.
- Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge
- Collect all waste oil, store in sealed damage-proof containers and dispose it to recyclers.
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual cleanup.
- temporary retention ponds, interception drains, and silt traps are installed to prevent silt laden water from entering adjacent water bodies/waterways;
- The slopes of embankments leading to water bodies should be modified and rechanneled to prevent entry of contaminants.
- Comply with requirements of the clearance issued by the relevant state authority for mining in rivers
- No construction related activities of bridges during breeding season of fish and other aquatic species.

Alteration of Surface Water Hydrology/Drainage: Diversion of major streams due to construction is expected. There are 50 minor bridges are found in the project road. Among them four bridges are proposed to be retained and three bridges are bypassed. 42 numbers of existing minor bridges are proposed to be reconstructed. Three major bridges exist in the project road. Among them two bridges are proposed to be reconstructed. One major bridge at existing chainage km 116.712(span 2x27+1x33m) & one minor bridge at existing chainage km 116.765(Span 1x18.288m) will be reconstructed with one major bridge of span 4x40m. Apart from that reconstruction/new construction of 297 box culverts will be done during lean flow period. Diversion of some nallahs may be required for a very short period. Courses of those nallahs will be brought back to original within no time once construction is finished.

Groundwater: Water for construction purpose will be sourced mainly through major streams along the project road. Suitable arrangement for drinking in the campsite will be managed by contractor without affecting availability to local community. The area is not classified as critical semi-critical or overexploited by CGWB. However, uncontrolled drinking water abstraction can deteriorate the situation. Contamination of groundwater is not envisaged since all construction camps will have septic tanks or mobile toilets depending on the number of workers in each camp.

Mitigation Measures

- Provision for adequate numbers of septic tank to avoid contamination of ground water.
- Requisite permission will be obtained for abstraction of groundwater.
- The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.
- Water harvesting structures shall be proposed for groundwater augmentation in the project area.
- No change in groundwater regime is envisaged hence no mitigation is proposed.

5.4.5 Construction Debris/ Waste/Muck

Muck/Debris is likely to be generated since dismantling of existing pavement is involved. The muck will also be generated during cutting of road section. The table 5.8 shows the muck generated in the project. The disposal locations have been selected and presented in Table 5.9. All the muck generated will be disposed as per C&D Waste Management rule 2016.

Table 5.8 Abstract of Muck Generated in the project

Chainage		Proposed Length (Km)	Cut Volume (cum)	Filling + Sub-grade Volume (cum)	Quantity of Muck Generated (cum)	Estimated Quantity of muck to be utilized in valley side within proposed ROW and existing ROW at realignment stretches (cum)	Balance Quantity of Muck to be disposed in Selected Location (cum)	Quantity of muck due to swell factor (83% for Soil) (cum)
From Km	To Km							
21.100	127.319	106.219	4399774	185948 6	2540288	290000	2250288	2711190

Source: NHIDCL

Table 5.9: Muck disposal locations

Sl No	District	Identification No of Muck Dumping Site	Name of the Dumping Location/Site	Capacity of the Dumping Site considering 20% compaction (cum)	GPS Co-ordinates	
					Latitude	Longitude
1	Unakoti	***MDS/U-01***	Manu River Embankment from Dalugaon to Baraitali	217419	Start-24°17'00.784'' Intermediate-24°16'12.063'' End-24°15'12.214''	Start-92°00'46.040'' Intermediate-92°01'08.440'' End-92°01'24.396''

2		***MDS/U-02***	Manu River and Laxmicherra Embankment from Kamrangabari Steel Bridge to Laxmicherra Bridge	293959	Start-24°19'02.041'' Intermediate-24°17'43.978'' End-24°17'38.605''	Start-92°00'21.300'' Intermediate-92°00'06.052'' End-92°00'34.649''
3		***MDS/U-03***	Laxmicherra and Manu River Embankment from Bhagabannagar to Srirampur Steel Bridge	239153	Start-24°19'00.066'' Intermediate-24°19'24.025'' End-24°18'20.962''	Start-91°59'47.965'' Intermediate-92°00'52.173'' End-92°01'49.244''
4		***MDS/U-04***	Manu River Embankment at Kamrangabari	89225	Start-24°17'38.216'' Intermediate-24°17'28.241'' End-24°17'13.789''	Start-92°00'34.758'' Intermediate-92°00'50.656'' End-92°01'08.148''
5		***MDS/U-05***	Manu River Embankment at Jalai	94080	Start-24°16'12.102'' Intermediate-24°15'51.142'' End-24°15'35.718''	Start-92°01'41.781'' Intermediate-92°01'53.537'' End-92°02'22.237''
6		***MDS/U-06***	Manu River Embankment at Lasharmath	55688	Start-24°19'44.384'' Intermediate-24°19'57.638'' End-24°20'11.805''	Start-91°57'56.615'' Intermediate-91°58'09.388'' End-91°58'13.105''
7		***MDS/U-07***	Manu River Embankment at Samrurmukh	61563	Start-24°21'05.552'' Intermediate-24°21'16.828'' End-24°21'16.341''	Start-91°57'35.895'' Intermediate-91°57'30.284'' End-91°57'20.937''
8		***MDS/U-08***	Levelling of degraded land of the Sarbeswari Brick Industry	179838	Start-24°18'41.165'' Intermediate-24°18'33.215'' End-24°18'26.362''	Start-92°02'37.339'' Intermediate-92°02'35.267'' End-92°02'30.603''

9		***MDS/U-09***	Levelling of degraded land of the Sagar Engineering Limited Brick Field	215650	24°16'25.017''	92°00'54.665''
10		***MDS/U-10***	Levelling of degraded land of the Aakash Engineering Company Brick Field	164448	24°18'19.942''	92°03'00.173''
11		***MDS/U-11***	Levelling of degraded land of the Asha Brick Industry	270055	24°17'23.765''	92°00'26.220''
12		***MDS/U-12***	Filling at different low-lying areas	219270	24°18'50.454'' 24°18'18.891''	92°00'28.420'' 92°02'49.567''
13	Dhalai	***MDS/D-01***	Widening of Kamalpur Morachara to Ambassa Road	13695	Start-24°11'24.397''Intermediate-24°11'19.419''End-24°11'06.511''	Start-91°50'19.111''Intermediate-91°50'36.301''End-91°50'36.134''
14		***MDS/D-02***	Widening of Bimanghati Chowmuhani to Duraicherra Road	76094	Start-24°07'37.460'' Intermediate-24°07'07.169'' End-24°07'39.589''	Start-91°48'46.914'' Intermediate-91°47'29.336'' End-91°46'49.357''
15		***MDS/D-03***	Widening of Lambuchhara to Mayachari Road	81585	Start-24°10'57.763'' Intermediate-24°09'55.922'' End-24°09'12.682''	Start-91°47'05.115'' Intermediate-91°46'27.014'' End-91°47'49.674''
16		***MDS/D-04***	Widening of Kamalpur	19215	Start-24°11'05.276'' Intermediate-24°10'44.062'' End- 24°10'15.648''	Start-91°50'36.145'' Intermediate-91°50'44.647'' End-91°50'38.329''

			to Manipuri Basti Road			
17		***MDS/D-05***	Widening of Kamalpur to Salema Road (4 Location)	185235	Start: 24°9'56.699" End: 24°9'18.583"	Start: 91°48'57.863" End: 91°48'43.545"
					Start: 24°8'17.189" End: 24°6'22.731"	Start: 91°49'4.36" End: 91°49'39.803"
					Start: 24°5'33.179" End: 24°4'6.946"	Start: 91°49'20.556" End: 91°49'48.501"
					Start: 24°3'57.418" End: 24°1'57.273"	Start: 91°49'49.47" End: 91°50'4.47"
18		***MDS/D-06***	Levelling of degraded land of the Maa Brick Industry	368346	24°10'07.337''	91°50'36.397''
			Total=	**2844516**		

Source: NHIDCL

Mitigation measures

- All excavated materials from roadway, shoulders, verges, drains, cross drainage and the like will be the property of the EA and will be used for backfilling embankments, filling pits, and landscaping.
- Unusable debris material should be suitably disposed-off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner.
- Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.

5.4.6 Ecological Resources

Terrestrial: Estimation of felling number of trees has been carried out by the state forest department, government of Tripura. Felling of trees is also involved resulting in habitat destruction and fragmentation. Plantation in adjacent unused land shall be carried out throughout the project road effectively with proper provision as per norms fixed by the forest department. This will bring down the adverse impact of tree felling and help in restoration process of local ecosystem. It must also be ensured that there is no impact on any rare threatened or endangered species. A total of 7743 numbers of trees likely to be fallen down during the widening process.

Forest Fires: Risk of forest fire cannot be ruled out due to uncontrolled burning of grasses/shrubs for clearance of ROW, fuel accumulation due to accidental spillage or improper storage of explosives.

Mitigation Measures

- Requisite clearance and permission from forest department shall be obtained for cutting all the felling trees.
- Plantation shall be done on areas exposed after site clearance as per the norm fixed by the state forest department. All tree plantations will be carried out in close consultation with forest department.
- For safe traffic operation, vertical clearance between the crown of the carriageway and lowest part of overhang of the tree available across the roadway shall conform to the standards laid down in IRC: SP: 21-2009. The pit size, fencing, watering, and manure/fertilizing requirements shall also conform to the above standard. Excess use of pesticides shall be restricted.
- Immediate removal of fuel accumulations near forest areas;
- Clearance of vegetation shall not be done by burning along forested/thickly vegetated areas.
- Planting and management of fire-resistant species adjacent to and within ROW.
- Plantation of local/ endogenous species to attract avian fauna.
- Provision of fire lines to avoid further spread over of fire.

Aquatic Ecology: Temporary sedimentation and water quality deterioration is expected from the project during the construction stage. Improvement of existing embankments particularly along the waterways may increase silt while accidental spill of materials, chemicals, and fuels will deteriorate receiving water quality.

There are numbers of water bodies in the form of private and community ponds along with 49 numbers of rivers, streams and nallah. Majority of those streams and nallahs are seasonal and only active during the monsoon season. It has been observed during the field survey that fishing activities practiced along the existing road in those ponds. 238 nos. of ponds come within the ROW of the road. Alignment of the road should be designed to avoid any kind of construction activities in these existing fisheries to safeguard aquatic life. Provision of retaining walls already mentioned in the civil designing of the project road

Mitigation Measures

> Siltation shall be avoided by measures suggested above in impact on surface water resource section.
> Strict monitoring during construction of bridge over the river as well as during renovation of culvert to avoid contamination of the river and stream water.
> Labour camps shall be minimum 500m away from any type of water bodies.

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5.4.6.1 Conservation and Mitigation Measures

Being the tropical moist environment, the flora of the project area has high potential of regeneration and can withstand the adverse influences of the project activities. However, the following measures could be essentially practiced for upscaling environmental and biodiversity conservation in the project area.

1. **Monitoring**: Regular monitoring of the existing vegetation for aerial extent,
   Species composition, biomass production and successional status are necessary besides

monitoring of faunal population.

2. Management of Conservation Activities: The conservation need be practiced **at landscape level following local people-centric decentralized participatory approach** where bottom up approach for generation of information and practices for conservation need be given priority. **A collaborative management approach** involving all stakeholders such as the Forest department, Wildlife wing, local people and knowledge partners-academia and research, and interface institutions like non-profit organizations and trusts would be appropriate for this purpose. Whenever possible, the Corporates may also be involved as stakeholder to perform social responsibility (corporate social responsibility) in terms of their contribution as monetary support and technology for maintenance of habitat, habitat improvement and awareness generation.

3. Awareness Generation: The knowledge and technical skills are pre- requisite for human capital to perform in a desired manner. It is, therefore, suggested that the information in regard to species of plants and animals existing in the project site, importance of these species for conservation of food chain organisms and ecological processes essential for ecological balance at the site, threats for their survival and suitable package of practices for conservation of biodiversity need be made available to the local people and other stakeholders **through print and electronic media, street plays *(nukkad natak)* and exhibitions. Local festivals and fairs (*mela*) can serve as better opportunities for awareness generation.**

Awareness generation with respect to the importance of keystone species particularly, about religious taboos of local communities and indigenous practices of biodiversity conservation **among youth** need to be promoted. **The youth and socially-accepted persons may be utilized as guards against illegal utilization of wild plant and animal species in the area.**

4. Promotion of Eco-development and Eco-tourism: In order to reduce the dependency of local people on the forest, savanna, grassland and natural biodiversity for different socio-economic needs, such as, fire-wood, small timber, leaf fodder and medicinal species, etc., the eco-development programmes considering the cultural and socio-economic and environmental dimensions specific to the project site need be encouraged utilizing local population, their indigenous knowledge and practices. Wherever necessary, the technology developed through scientific experiments and field experiences in regard to sustainable utilization of natural resources and organic agriculture including agro-forestry need be integrated with the traditional practices. Eco-development is now seen as a site- specific conservation-friendly measure for environmentally-compatible and socially-acceptable economic development.

5. Aquaculture for Fishery: Fish provides meat of white category which in addition to serve as a source of beneficial protein and fat also contributes as animal- based food that does not lead to cardio-vascular diseases and high blood pressure in human-beings. Additionally, fish is among the most potential source of vitamin-A. It is, therefore, suggested that **fish farming** as an aquaculture practice need be popularized in the project area to meet the **twin objectives of fish harvest** and **fish conservation** in natural water bodies and wetlands. The pond-based fishery may be promoted in the project area. Suitable fish species such as *Barilius barila*, *Channa punctatus*, *Cirrhinus mrigala, Catla catla, Labeo rohita ,Nemacheilus multifasciatus and Puncticus ticto etc.,* may get priority for this activity. Fishery Department of the Government of Tripura can contribute as resource organization for fish seed and capacity building programmes.

6. Promotion of Farm Forestry, Agro-Forestry and Silvo-pasture: The multi- species landuses, such as, agro-forestry and farm forestry in the wet farm land, and horti- pastoral and silvo-pastoral practices on the abundant *jhum land,* barren lands and wasteland need be given priority to achieve soil conservation and to obtain plant species-based economic goods, such as, food

grains, fire-wood, small timber, fodder,other minor forest and wasteland produces and fruits simultaneously. For this purpose, locally-preferred species must be considered on priority.

7. Promotion of Traditional Agriculture: As the bird fauna prefer a mosaic of grasslands and croplands with traditional crops, the cultivation of traditionally grown crops, such as, sorghum, pearl millet, sesame,horse gram, black gram, green gram, lentil etc. should be promoted on private farmlands. Thus, cultivation of crop species on farm land and abundant agricultural land together with grassland management will provide suitable habitats to the bird fauna.

8. Control of Illegal Harvest: The poaching and killing of the large herbivores and bird fauna in the project area during the construction phase of the Project may occur due to influx of project-related human forces,. Such activities need to be monitored regularly in the large project area. **The labourers need to be educated about the significance of herbivores and avifauna for ecosystem functions of biodiversity so that they develop a concern of care**. Wherever necessary, the poachers must be punished suitably following the legislative procedures.

9. Habitat Management for Wildlife: Both regulatory (for human actions) and habitat management practices, including engineering devices need be utilized for managing and improving the wild flora and habitat for wildlife. **The landscape approach following decentralized collaborative management need be adapted for this purpose**.

The habitat management practices such as, road-side plantation, rain water harvesting, biofencing along road-side and plantation areas , eradication of *Prosopis juliflora, Parthenium hysterophorus and other weedy and invasive alien species,* regulated grazing of domesticated livestock at selected sites could be adopted.

For good governance in the interest of biodiversity conservation and sustainable economic development, the following regulatory measures need be considered equitably in case of common citizens, authorities and very important persons.

- Wildlife (Protection) Act 1972 and amendments
- The Forest Conservation Act 1980
- The (Prevention and Control of Air Pollution) Act 1981 and cess Act, 1984
- The (Prevention and Control of Water Pollution) Act 1974
- The Environment (Protection) Act 1986
- The Biodiversity Act, 2002 and Rules 2004
- Discharge of effluents as per EPA 1986
- Noise Pollution and Control Rules 2000
- Construction and Demolition of Waste Management Rules 2016
- Solid Waste Management Rules 2016
- Plastic Waste Management Following Plastic Waste Management Rules 2016

The habitat requirement for the animal species included in schedule –I and II and as per IUCN REDLIST, is given in Table no. 5.10. It is evidence that no habitat protection is required for these species in the project site as these habitats are available in plenty.

Table 5.10: Habitat requirement of the proposed project site specific faunal species listed in Schedules – I (S-I) and II (S-II) of the wildlife (protection) Act, 1972

S.NO.	Faunal Species Botanical name / Local or English name	Conservation Status		Habitat Requirement	Habitat Protection Need
		WPA 1972	IUCN		
1	Python molurus / Ajgar	S-I	NA	Forest, grasslands, marshes and streams	Not needed as the habitats are available in plenty in the proposed project site
2	Varanus benghalensis / Monitor Lizard	S-I	LC	Prefers forest, large trees and agricultural areas	Not needed as the habitats are available in plenty in the proposed project site
3	Psittacula krameri manillensis / Parrot	S-I	LC	All habitats can withstand the onslaughts of urbanization and deforestation	Not needed as the habitats are available in plenty in the proposed project site
4	Panthers pardus / leopard	S-I	VU	Forest, savannas, can disturbed sites, adoptable to human disturbances but prefers appropriate vegetation covers	Not needed as the habitats are available in plenty in the proposed project site
5	Herpestes edwardsii / Nevla or Indian mongoose	S-II	NA	Grasslands, open areas, rocky patches, scrub land, cultivated fields and other disturbed areas, dry secondary forest and areas near human settlements	Not needed as the habitats are available in plenty in the proposed project site
6	Bos gaurus / Gaur	S-II	VU	Prefers relatively undisturbed forest in hilly terrain, bamboo areas, shrub lands and grasslands	Not needed as the habitats are available in plenty in the proposed project site
7	Maccaca mulata / Monkey	S-II	NA	Adapted to wide range of habitats including urbanized areas	Not needed as the habitats are available in plenty in the proposed project site

8	Semnopithecus entellus / Langur	S-II	NA	Adapted to wide range of habitats	Not needed as the habitats are available in plenty in the proposed project site
9	Vulpes bengalensis / Indian fox	S-II	LC	Prefers short open grasslands, flat undulating terrain and scrub lands	Not needed as the habitats are available in plenty in the proposed project site

Source: EIS Pvt. Ltd.

10. Conservation of water bodies:

The availability of water, particularly during drier seasons and in upland areas, becomes the most important factor to all types of wild animals including the mammals, birds and reptiles. If water is available sufficiently, then all other factors become secondary for the presence and survival of the wildlife in any wild land area. Places suitable for mini ponds and water holes, watershed development need be identified in the vicinity of the project area to store rainwater. Further, to make water available throughout the year, some of these water holes could be recharged through artificial means if necessary. Proper slope need be given at these points so that these water sources can be conveniently accessed by the wild animals. Proper cover through vegetation need be developed near these water sources so that the prey species are able to hide themselves from the predators at the time of approaching the water sources. To attract the birds, plant species of food value to the birds need be planted near water holes. If water and food are available to the birds and other fauna without any anthropogenic disturbances, the area can also become an ideal place for bird and wild animal watching and ecotourism.

5.4.7 Construction Camp & Immigration of Workers

Poor sitting and improper management of construction camp may lead to several adverse impacts on environment viz. (i) loss of vegetation due to use of wood as fuel source for cooking (ii) deterioration in nearby surface water bodies' quality (iii) compaction and contamination of soil due to uncontrolled disposal of solid waste (iv) Poor sanitation may result to transmission of communicable diseases among the workers and the host communities. This include the possible spread of sexually transmitted disease, diseases from improper handling and supply of foodstuffs, poor water supply, insect-borne diseases, and alcoholic and drug.

Mitigation measures

- No productive land should be utilized for construction camp. All sites must be graded, ditched and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities including recreational facility for workers shall be erected and maintained to standards and scales approved by the resident engineer. All camps should maintain minimum distance of 500 m from habitation and water bodies.
- All construction camps shall be provided sanitary toilet with provision of septic tanks attached with soak pits. Storm water drains shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated with bleaching powder on a regular basis. Garbage bins must be provided in the camp and regularly emptied and disposed-off in a hygienic manner. LPG cylinders shall be provided as fuel source for cooking to avoid any tree cutting.
- At every workplace, the Contactor will ensure that a readily available first-aid unit. Workplaces away from regular hospitals shall have indoor health units. Suitable transport shall be provided to approach the nearest hospital. At every workplace an ambulance containing the prescribed equipment and nursing staff shall be provided.

- The Contractor will ensure the good health and hygiene of all workers to prevent sickness and epidemics. These include the HIV/AIDS prevention program to reduce the risk and transfer of HIV virus. Activities under the program include monthly information, education, and communication campaigns to workers, drivers, delivery crew, and communities on the risk. Health check-up by health professionals should be carried out for the construction labours from time to time at regular interval.

- The Contractor will provide adequate and safe drinking water supply for the use of the workers as per the latest permissible limit of drinking water. The Contractor will ensure that all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No alcoholic liquor or prohibited drugs will be imported to, sell, give, and barter to the workers of host community.
- Migrant workers may be the potential carriers of various diseases. Local community may get exposed to the diseases carried by migrant workers. Regular health check-up and immunization camps shall also be organized for the workers and nearby population.

5.4.8 Safety of Construction Workers and Accident Risk to Local Community

The following safety aspects viz. (i) safety of construction workers, (ii) safety of road users including pedestrians and cyclists (iii) safety to animals; (iv) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during design and construction stage and (v) conduct of safety audit. Impact and mitigations due to blasting operation as already been detailed in Noise and Vibration section.

Mitigation measures

- During the construction phase, contractors shall be required to adopt and maintain safe working practices. Internationally accepted and widely used safety procedures should be followed during (i) road works (ii) handling of large construction equipment and machineries, (iii) handling of chemicals and hazardous materials and inflammable substances (iii) welding (iv) electrical works etc.
- Contractor shall arrange all PPEs for workers, first aid and fire-fighting equipment's at construction sites. An emergency plan shall be prepared duly approved by engineer in charge to respond to any instance of safety hazard.
- To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan shall be drawn up by the concessionaire. Traffic in construction zones shall be managed as per the provisions of IRC SP 55.

- After construction is completed in a particular zone, it shall be opened for normal operation. All diversions/access roads should be closed before start of normal operation.
- Use of retro-reflectorized traffic signs, and cantilever/gantry types overhead signs, thermoplastic road marking paints, delineators, traffic cones, empty bitumen drums, barricades, and flagmen will be used to ensure traffic management and safety. Conduct of regular safety audit on safety measures adopted during construction. The audit will cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures, environment, site safety guidelines, and miscellaneous services.

5.4.9 Obstruction & Disruption of Traffic

Disruption of access to infrastructure or social resource due to construction activity will cause nuisance and to a certain extent additional cost to the public in terms of longer travel period due to diversion or heavier traffic. It will also pose risk of accident to motorist at night if these blockages and disruption are not clearly demarcated.

Mitigation Measures

- The contractor will submit a Traffic Plan to the Project Engineer at least two weeks before the construction starts that will result to obstruction. This Plan will recommend for approval, the safe and convenient temporary diversion of traffic during construction, design of barricades, delineators, signs, markings, lights, and flagmen, among others.
- For widening of existing carriageway and part of it will be used for passage of traffic, paved shoulder will be provided on one side of the existing road by the contractor with the following minimum requirements:
- The surface used by the through traffic will be firm bituminous compacted surface free of defect
- On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. These paved diversions will comply with standards on junctions and temporary cross drainage.
- Transportation of quarry material to the construction sites through heavy vehicles shall be done through existing major roads to the extent possible. This will restrict wear and tear to the village/minor roads. Small vehicles/non-motorized vehicle can also be used for its further transportation to the construction sites from temporary storage areas.

5.4.10 Transports & Storage Materials

The construction material primarily will consist of aggregate, sand, cement, bitumen, lubricating oil and fuel for vehicle and construction equipment's. These will be primarily stored temporarily at construction camps. The oils, fuels and chemicals will be stored on concreted platform with spills collection pits. The cement will be stored under cover. All these temporary storage areas will be located at least 150m away from the habitat. The likely impacts due to transportation and storage including fugitive emission have already been covered under different sections above.

5.4.11 Land & Private Properties

The assessment made in resettlement plan shall be referred for exact loss of private properties and measures to compensate such losses. Besides monetary compensation for any loss of private trees, compensatory afforestation as per the norms fixed by state forest department and extensive plantation has been incorporated in the EMP to have long-term environmental benefits. Income restoration

measures/livelihood options for vulnerable group/resource poor sections and other affected persons as recommended by social development/resettlement expert shall be implemented.

5.4.12 Common Property Resources

Project road is proposed through existing road passing through mainly built-up areas including schools, health centres and other common public properties. However, a total of 39.22km of the project road is proposed for either realignment or bypass. Realignment portion is mostly passing through agriculture and forest land. Hence, there will be loss of community structures/ facilities/utilities along the proposed alignment. Geometric adjustments have been made to minimize the loss to any such facilities. Alternate access has to be provided to access these structures during construction stage. All community structures likely to be dismantled shall be suitably relocated. For exact extent of impact on these structures and mode of compensation, resettlement/land acquisition plan shall be referred.

5.5 Operation Stage Impact

5.5.1 Road Maintenance

Lack of proper maintenance may deteriorate the road condition over the years resulting into numerous problems such as rise in accidents, disruption of transportation services, tree survival. Project implementation unit must allocate adequate resources and logistics to ensure that the road is being maintained and intended benefits are generated thereof.

5.5.2 Soil Erosion and its Cumulative Impacts

The consequences of soil erosions are far wider than repair and maintenance of the road. Along the project road, the inflow of water into ponds during rains causes erosion of the embankment besides seepage of water into embankment and subgrade resulting in softening of the subgrade. This may also increase siltation in water bodies. Project design includes provisions of retaining walls/retaining walls for the protection. Regular checks shall be made to ensure its effectiveness.

5.5.3 Air Pollution

Likely rise in traffic after road improvement may cause air and noise pollution in the vicinity of the project Vehicular emission will be the principle source of pollution during operation stage. The project road is located in thickly vegetated and open agricultural land which will provide adequate dispersion dynamics of gaseous pollutants. Vegetation acts as sink to air pollutants. Further, the improved road condition will facilitate free flow of traffic thereby reducing the emission level significantly.

5.5.4 Noise Pollution

Noise level is likely to increase due to increased traffic. Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch and speed limitation and honking restrictions may be enforced near sensitive locations. Solid noise barrier shall be placed especially in academic institutes (Anganvadis, primary schools, high schools, higher secondary schools) and health centres adjacent to the project road.

5.5.5 Water Pollution

Accidental oil spillage, washing of vehicles, used engine oils can contaminate the nearby water bodies. Expansion joints and drainage spouts are choked due to silt and vegetation growth. In order to prevent water pollution; communities should not allow drivers washing their vehicles near the streams and ponds.

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

5.5.6 Ecology Environment

Survival rate of road side plantation shall be ensured during the operation stage. Regular monitoring of plantation shall be carried out. Implementation of compensatory afforestation fund shall be release on time to the state forest department. Execution of compensatory afforestation shall be supervised time to time in collaboration with state forest department. Effectiveness of measures suggested for any adverse impact on wildlife and loss of floral diversity must be strictly adhered to in consultation with forest department.

5.5.7 Ribbon Development/Encroachment of ROW

Increase in economic activities more often results in ribbon development along highways. This may cause congestion to road users and increase in accident. NHIDCL Tripura shall explore options like avenue plantation and/or fencing and initiating regulatory provisions to stop encroachment of ROW.

5.5.8 Pedestrian and Commuter Safety

Improvements to the road surface will be conducive to safe vehicle travel at higher speeds. Such speeds may increase the incidences of accidents. Incorporating the following measures could offset this negative impact;

- Provision of centre line road marking where possible, edge delineation etc.
- Provision of clearly marked signing at townships, sensitive areas such as schools, temples and health centres
- Enforcement of speed limits and other traffic rules, especially near schools, hospitals, temples and built-up sections
- Safety of road users could be ensured during repairing of carriageway and hydraulic structures by placing standard sign boards, barricading of the repairing site etc.

5.5.9 Cumulative and Induced Impacts

Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induce development in the project area. Increase in agro-industrial activities are also expected to take advantage of improved access to urban centers where there are higher demand and better prices for agricultural products. The project area is in the vicinity of Indo-Bangladesh international border. Hence the project will accelerate industrial activities and induce development significantly to enhance cross border trade. The improved road will provide better connectivity and result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

5.6 GHG Emissions from the Road Project

i. Vehicles Details

Car, Trucks, Motorcycle etc. type Vehicles will be run on the proposed section of NH-208. The running of this vehicle has been divided in three sections along the proposed road. The Vehicles are converted in PCU for estimation purpose.

ii. Prediction of Traffic Volume

DPR team has forecasted the road traffic and flow of the traffic for the years 2035 considering 2015 as a base year for which traffic survey was done. The details of estimated traffic from 2015 to 2033 in various sections are presented in table-5.11.

Table 5.11: Estimated Vehicles (PCU) Number/per day

Year	Homogeneous Section-I (KM 0.000- KM 20.000)		Homogeneous Section-II (KM 20.000- KM 85.500)		Homogeneous Section-III (KM 85.500-KM 118.000)	
	Length- 20.000 km		Length- 65.500 km		Length- 32.500 km	
	No	PCU	No	PCU	No	PCU
2015	4204	5142	4351	4981	7503	7541
2018	4867	5952	5037	5766	8686	8729
2020	5366	6562	5553	6358	9576	9624
2025	6848	8376	7087	8114	12221	12283
2030	8740	10690	9045	10356	15598	15676
2033	10118	12374	10471	11988	18057	18147

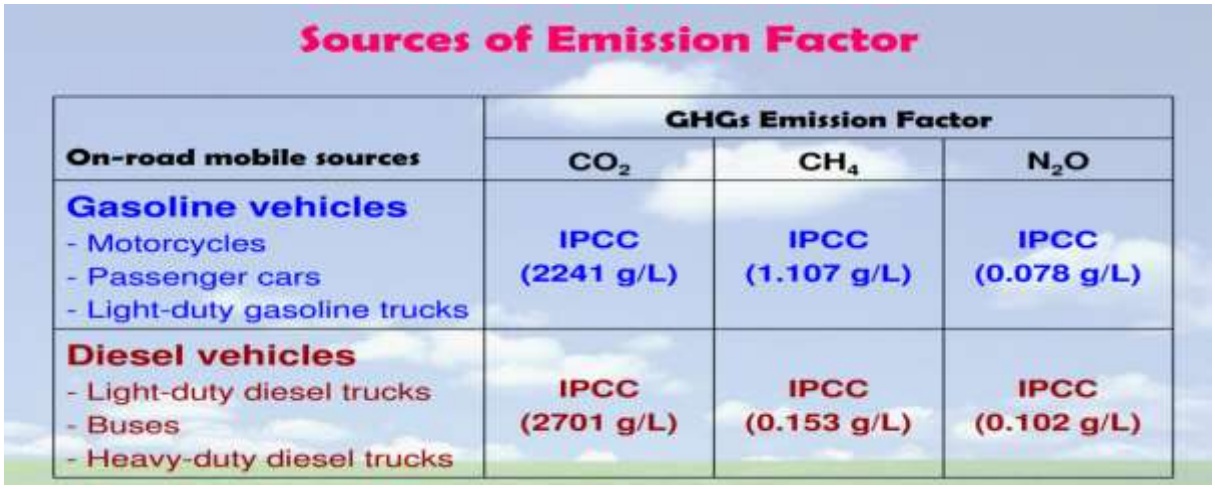
Source: DPR Vol-I (Main report)

iii. Traffic Details

It is assumed that the traffic will run on the road for as per Table 5.11 and the estimated travel for each vehicle would be as per distance in respective section. It has also assumed that all the vehicles will run on diesel fuel. The average run of traffic per liter diesel would be 4 kilometers (Fuel Consumption Standards for Heavy-Duty Vehicles in India).

iv. GHG Emission Factor

This study has followed the method of IPCC GHG emission factor. It is related with the gram emission of GHG per liter burning of diesel fuel. The IPCC GHG Emission factors are listed below.



v. GHG Emission

The GHG emissions are estimated based on the per day traffic volume of the yearly estimated total Passenger car unit (PCU) at each section are presented in Table 5.21 to 5.14 and the detail section wise estimated emissions of the proposed road project is given in table 5.12 to 5.14 and Table 5.15 give total GHG emissions of the road project.

Table 5.12: GHG Emissions in Homogeneous Section-I (KM 0.000- KM 20.000)

GHG Inputs				**Emission Calculations(Tonnes)**					
GHG	**Factor(g/l)**	**Diesel Fuel consumption Liter per Km travelling**	**Travelling Distance(Km)**	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
CO_2	2701	0.25	20	69	80	89	113	144	167
Ch_4	0.153	0.25	20	0.003	0.004	0.005	0.006	0.008	0.009
N_2o	0.102	0.25	20	0.002	0.003	0.004	0.005	0.006	0.007

Table 5.13: GHG Emissions in Homogeneous Section-II (KM 20.000- KM 85.500)

GHG Inputs				**Emission Calculations(Tonnes)**					
GHG	**Factor(g/l)**	**Diesel Fuel consumption**	**Travelling Distance(Km)**	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**

		Liter per Km travelling							
CO_2	2701	0.25	65.5	220	255	281	358	458	530
Ch_4	0.153	0.25	65.5	0.012	0.014	0.015	0.020	0.025	0.030
N_2o	0.102	0.25	65.5	0.008	0.009	0.010	0.013	0.017	0.02

Table 5.14: GHG Emissions in Homogeneous Section-III (KM 85.500-KM 118.000)

GHG Inputs				**Emission Calculations(Tonnes)**					
GHG	**Factor(g/l)**	**Diesel Fuel consumption Liter per Km travelling**	**Travelling Distance(Km)**	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
CO_2	2701	0.25	32.5	165	0.191	0.211	0.270	344	398
Ch_4	0.153	0.25	32.5	0.009	0.010	0.011	0.015	0.019	0.022
N_2o	0.102	0.25	32.5	0.006	0.007	0.007	0.010	0.012	0.015

Table 5.15: Total GHG Emissions Homogeneous in Project Road

GHG Inputs				**Emission Calculations(Tonnes)**					
GHG	**Factor(g/l)**	**Diesel Fuel consumption Liter per Km travelling**	**Travelling Distance(Km)**	**2015**	**2018**	**2020**	**2025**	**2030**	**2033**
CO_2	2701	0.25	128	454	526	581	741	946	1095
Ch_4	0.153	0.25	128	0.024	0.028	0.031	0.041	0.052	0.061
N_2o	0.102	0.25	128	0.016	0.019	0.021	0.028	0.035	0.042

Source: EIS Pvt. Ltd.

The generated CO2 emission per day would be 454 Tones in the base year 2015. The CO2 emission in the projected year 2033 would be 1095 Tones which is 2.4 times more then the base year estimated GHG. The impact due to other green house gases will be insignificient.

5.7 Summary of Assessment

Summary of the Assessment has been provided below in Table 5.16.

Table 5.16: Summary of Impact Assessment

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air Quality	B-	B+	D	D	Construction phase: - Minimum dust dispersion will be expected. - Maintenance of machinery will be conducted regularly, resulting in reducing exhaust gas emissions. Operation phase: - Air pollution caused by exhaust gas generated from the vehicles is predicted.
	2	Water Quality	B-	B-	D	D	Construction/Operation phase: Although turbidity increases due to construction around the river, the effect is temporary. For wastewater accompanying concrete construction and wastewater containing oil, the muddy stream caused by embankment at the time of rainy weather, measures are taken sufficiently by proper concrete use and greening.
	3	Waste	B-	D	D	D	Construction phase: - Waste containing hazardous materials will be generated by construction work, but it will be prevented as appropriately disposed. Operation phase: - Minimum solid waste is expected.
	4	Soil Contamination	B-	B-	B-	D	Construction phase: Since there is a possibility of soil contamination due to leakage of fuel oil and lubricant from construction vehicles and construction machinery, appropriate measures are taken. Operation phase: Because paddy field are affected by the new traffic, impacts on surrounding rural areas and farmland are occurred, but these impacts are limited.
	5	Noise and Vibration	B-	B-	D	D	Construction phase: - Construction machinery and vehicles will be maintained regularly. - Low-noise/ low-vibration machinery will be used. - Noise levels generated from construction machinery will meet noise level standards at the nearest residential area Operation phase:

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							- Noise levels generated from construction machinery will meet noise level standards at the nearest residential area and will be limited to small amount.
	6	Odor	D	D	D	D	Construction/Operation phase: Little materials will cause the odors.
	7	Sediment	B-	D	B-	D	Construction phase: Negative impacts due to disturbing river mud at the time of bridge constructions can be considered. Operation phase: -
Natural Environment	8	Protected Areas	D	D	D	D	Construction/Operation phase: There is no protected area in the planned site.
	9	Ecosystem	B-	B-	B-	D	Construction phase: As there are forests by afforestation or natural forests along the road and it will be logged, there is some negative effect on animals and plants. Operation phase: Although there are some effects on animals and plants in the adjacent area, the impacts are limited.
Natural Environment	10	Hydrology	D	B-	D	D	Construction phase: Individual hydrological conditions are altered by construction work such as embankment. Although it is affected by bridge construction over rivers, appropriate measures are taken. Operation phase: No impact
	11	Topography and Geology	B-	B-	B-	D	Construction phase: Construction works such as filling embankments and measures against soft soils may affect the topography and geology. However, the impacts are not critical because the levees are installed, and the majority of project planned places are flat. Operation phase: Although there is erosion on the embankment surface due to the occurrence of storm surge or flooding, the damages should be minimum before the disasters by constructing a protective surface protector.
Social Environment	12	Resettlement and Land Acquisition	B-	C	B-	D	Pre-Construction: Approximately 119.107 ha of private land including residential and commercial structure need to be acquired. 2464 HHs will be resettled, which needs approximate resettlement assistance and/or compensation. Construction/Operation: Few impacts are expected due to availability of resettlement sites adjacent to present location and adequate compensation and resettlement assistances.
	13	Poor Classes	B-	B-	B+	B+	Pre-Construction: Roughly 5% of project affected households are under BPL. As per the land acquisition law, additional cash compensation will be provided to BPL households Construction: Positive impacts are expected from direct or

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							indirect job opportunities along the construction site. Operation: Positive impact are expected due to improvement of local economy facilitated by improved road network.
	14	Tribal Peoples	B-	B-	B+	B+	Pre-Construction: Mostly non-titled tribal households and/or product sales stands will be resettled but limited agricultural land will be affected. Construction: Direct and indirect job/business opportunities are expected during construction. Operation: Positive impacts are expected from the implementation of the Tribal Development Plan as a part of development assistance by project owner for the affected tribal communities in course of the competent authorities' plans including TTAADC's plans
	15	Local Economy such as Employment and Livelihood, etc.	B-	B+	B+	B+	Pre-Construction: Positive impacts are expected due to additional cash flow in PAHs and constriction of the resettlement households, etc. Construction: Positive impacts are expected from construction work and additional employment. Operation: The construction of road and bridges will benefit the lives of local people such as improvement of access to social services and opportunity of employment.
Social Environment	16	Land Use and the Utilization of Local Resources	B-	D	B-	D	Pre-Construction/ Construction: The implementation of this project will change the traditional land use pattern. Local resources can get stringent. Operation: No impact is expected, as activities requiring change of land use and utilization of local resources will be completed by the end of construction.
	17	Water Usage and Water Rights	B-	B-	B-	D	Pre-construction: No activities are expected to give any impact on water usage. Construction phase: Some impacts are expected due to additional need of water for construction and the turbid water discharged from the construction site. Operation phase: No impacts are expected.
	18	Existing Social Infrastructure and Services	B-	B-	B-	B+	Pre-construction: Some social infrastructure will subject to relocation. Access to social infrastructure and social service may be affected due to resettlement of project affected persons. For mitigating this impact, appropriate resettlement assistance will be required. Construction: Construction work will disturb access to existing social infrastructure and social services for mitigating this impact, passage shall be secured during construction. Operation: Access to social infrastructure and services will be improved. Increased traffic volume may disturb the access to existing social infrastructure and services. For mitigating this,

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							passage needs to be secured.
	19	Local Communities and Decision-making Institutions	B-	B-	B-	B-	Pre-construction: Displacement may affect the existing network of local communities and decision-making institutions. Construction: Community can be further separated due to construction work. Operation: Flow of new residents could change the priorities of the local communities and decision making.
	20	Unequal Distribution of Benefits and Damages	B-	B-	B-	D	Pre-Construction: Particularly cash compensation could be unequally distributed without supervision by the authorities. Construction: Job and business opportunities could be unequally distributed without supervision by the authorities. Operation: Generally, all stakeholders will be benefit from the projects as same as common road projects.
	21	Local Conflicts of Interest	B-	D	B-	D	Pre-Construction: All project affected stakeholders understand the project impacts and are appreciated for the improvement of the NH208. Construction: Conflicts between local residence and external workers may occur because of changes in local customs if the external workers cannot understand local customs. Operation: No impacts are expected.
	22	Cultural Heritage	D	D	D	D	Pre-Construction/Construction/Operation: There is no historical/ cultural/archaeological properties nor heritage sites at the project site.
	23	Landscape	B-	D	D	D	Pre-construction: No impacts are expected. Construction: No significant impact will be expected due to the existence of present NH208. Operation: No impacts are expected.
	24	Gender	B-	B+	B-	B+	Pre-construction: Unequal distribution of compensation can be occurred within households. Construction: Unequal employment opportunity can be provided at construction site. Operation: Improvement of local economy will give positive impact on improvement of job opportunity and livelihood.
	26	Children's Rights	B-	B+	B-	B+	Pre-construction phase: There are children among households to be resettled and/or lose their livelihood means. Children from households losing their land or jobs may suffer from adverse impact on their household economy, such as dropping-out of school. Construction phase: Access way to their schools will be physically hindered by the construction site. For mitigating this impact, passage shall be secured. Child labour can be provoked at the construction site because of the huge demand for unskilled workers.

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							Operation phase: Children will have better access to social services throughout the year. Education opportunity can be improved. Conversion of existing traffic to the access road will improve safety of children as pedestrian.
	27	Infectious Disease such as HIV/AIDS	B-	B-	B-	B-	Pre-construction: No impact is expected as no influx of migrant labor is expected at this phase. Construction: A temporary influx of migrant labor during the construction period may increase the risk of infectious diseases. For mitigating this risk, measure for prevention of infection shall be taken. Operation: Improved mobility of local residents and influx of external residents may increase the risk of infectious diseases. For mitigating this risk, measure for prevention of infection shall be taken.
	28	Work Environment (Including Work Safety)	B-	D	B-	B+	Pre-construction: No activities are expected to give any impact on work environment. Construction phase: Accidents may be caused by construction work. Operation phase: Less road maintenance work is expected and less work accidents are expected.
	29	Sunlight	D	D	D	D	Pre-construction/Construction/Operation: No impact is expected due to the existence of present NH208.
	30	Accidents	B-	B-	B-	B-	Pre-construction: No activities are expected to cause accidents. Construction phase: Accidents may be caused by construction work. Operation phase: Road accidents may be increased without prevention measures and safety education along the communities.
Others	31	Cross-boundary Impact and Climate Change	C	C	D	B-	Construction phase: CO_2 emissions due to construction activities are temporary/minimum impact on climate change. Operation phase: CO_2 emissions due to the vehicles that run by fossil fuels affects climate change in the long term.

Note: A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

6. Public Consultation and Information Disclosure

6.1 Meaningful Consultation

Meaningful consultations were carried out during detailed design and EIA preparation. All the principles of information dissemination, information solicitation, integration, co-ordination, and engagement into dialogue were incorporated in the consultation process. A framework of mitigating different environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially at the micro level by setting up a dialogue with the village people from whom information on site facts and prevailing conditions were collected. This will be continued during the implementation of the project through grievance redress mechanism.

6.2 Objectives of the Public Consultations

Public consultations were held to allow the incorporation of relevant views of the stakeholders in the final project design, mitigation measures, implementation issues, and enhance the distribution of benefits. Stakeholder's consultations were held with intent to understand their concerns, apprehensions, overall opinion and solicit recommendations to improve project design and implementation. Informal meetings, interviews were organized covering the entire project design stage. Consultations provide affected public a platform to ensure incorporation of their concerns in the decision making process and foster co-operation among officers of NHIDCL Department, Govt. of Tripura, the community and the stakeholders to achieve a cordial working relationship for smooth implementation of the project. It inculcates the sense of belongingness in the public about the project.

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

6.3 Methodology

Consultation with the stakeholders, beneficiaries, and community leaders were carried out using standard structured questionnaires as well as unstructured questionnaires. Questionnaire survey/ discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. In addition, environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders and experts. In addition, personal discussions with officials, on site discussion with affected stakeholders, and reconnaissance visits have also been made to the project area.

6.4 Project Stakeholders

All types of stakeholders were identified to ensure as wide coverage as possible like Residents, shopkeepers and businesspeople who live and work along the road specially the project affected persons, road users/commuters, executing agency, government institutions whose remit includes areas or issues affected by the project (state environment and forest department, Pollution Control Board (PCB), Irrigation Department, Public Health Engineering (PHED) Department and most importantly the beneficiary community in general.

6.4.1 Consultations with Government Agencies

The list of officials from various government departments contacted during EIA preparation and issues discussed is summarized in Table 6.1.

Table 6.1: Summary of Consultation Held with State Government Departments

S. No	Person	Designation	Issues Discussed
1	Bhanumathi G. IFS	District Forest Officer, Dhalai, Ambassa	Discussed about the eco-sensitivezone, wildlife habitat and tree fellingdetails related to the project road. Suitable species for road side plantation and movement of wildlife in project corridor
2	Shakti Kanth Singh, IFS	District Forest Officer, Unakoti, Kumarghat	
3	P.R. Vaddarapu,	District Forest Officer, Khowai	
4	Mihir Kanti Das	Scientist-B, State Pollution Control Board	Discussed about the various NOC and permits from the SPCB. Seasonal monitoring of the project district atleast quarterly to have environmental database on pollution level.

Source: DPR Vol-IV (Part A)

6.4.2 Consultation with Local People/Beneficiaries

The informal consultation generally started with explaining the project, followed by an explanation to potential impacts. Participant's views were gathered with regard to all aspects of the environment which may have direct or indirect impact on local people. Table 6.1 summarizes the details of consultation with local people. Key issues discussed are:

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

Consultations were held along all sub-projects. Local community welcomed the decision of road proposal. They perceived several benefits like faster and cheaper connectivity, improved accessibility to better infrastructure facilities, reduction in migration, increased economic activities and appreciation in value of land and many others. But at the same time they apprehended that the risk of accident, air and noise pollution will increase due to high traffic density after widening. Main demand and suggestions made by the participants are;

- Adequate compensation and rehabilitation assistance to affected households
- Employment and petty contracts during construction
- provision of side drains
- Provision of adequate culverts
- Road safety measures.
- Extensive plantation
- Protection of Ponds and creation of new ponds
- Restriction on honking near built-up areas and sensitive receptors
- Lighting in built-up areas and sensitive receptors
- Measures to minimize air and noise pollution
- Water harvesting structures
- Bus Shelters
- Parking areas in markets.

Design considerations have been made to incorporate most of the suggestions and demands of the local people except those which are beyond the scope of project like improvement of already deteriorated water quality, extra advantage to the effected persons, health services etc.

Table 6.2: Summary of key points discussed in Public Consultation conducted during October, 2016

Location	Information/Demands/Suggestions of Participants	File photo
Kirtontali (Near Starting Point)	**Information shared and Suggestions made:** No industries in nearby areas leading the working class to engage mainly as daily-wage labours. Ground water level for potable water is at 160 feet. Local petty contractor shall get upper hand to grab small contracts and supply orders. Speed control provision especially near built-up areas, schools and health centres to avoid accident. No heavy flood occurs in the region since last twenty years. Adequate provision of drinking water supplied by the local Panchayat and municipal bodies at Kailashar. Daily wages labor goes to Agartala for construction and other works. Request for extra wide of road at busy market areas. **Suggestions Recommended for Integration in Design**: Design team shall be recommended to provide extra widening within the ROW especially in the market area in consultation with NHIDCL. Recommendation for speed control in sensitive locations has been suggested in the chapter-5 (Mitigation Measures). Daily wages labor from the localities shall be given preference	 Plate 1
Singri Bill (Ch. 10km)	**Information and Suggestions:** Adequate compensation and other benefits for effected households. Suggested for side drain, traffic light and road side plantation in built-up areas and in near common public facilities such as community hall, Bazar, schools, temples and health centres. No wildlife movement observed in the project road. Irrigation facilities need to improve in the area to help farmers. **Recommended Suggestions for Integration in Design**: Compensation will be provided as per the latest norms and conditions of Govt. of India. Commitments for 'other benefit' & 'irrigation' are beyond scope and limitation. Provision for side drain & traffic light in important locations suggested to the design team along with suggestion for roadside plantation.	 Plate 2

Purba Lambuchara (Ch. 50.5km)	**Information and Suggestions:** No flood activities in recent past. Forest area start near to this point in the project road. However, no visible movement of wildlife except monkeys in the built-up area. Most of the people engaged as daily wage labors and agriculture activities. Fishing is not practiced widely though scope is there. Suggestion for giving chance to petty contractors for small work during construction of project road. **Recommended Suggestions for Integration in Design**: All the suggestion recommended to the design team. Allocation of petty contracts shall be considered for the local contractors.	 Plate 3
Basaibari (Ch. 71.1km)	**Information and Suggestions:** 85% of the total population belongs to scheduled tribe. Paddy, Potato, Watermelon and some vegetables are main crops of this area. Rubber gardens are also there in the area. Agriculture labour, daily-wage labours and rubber farming are major source of income. Improved road condition will motivate the local people to involve in more agricultural activities to grab the market of nearby areas as well as of Agartala. **Recommended Suggestions for Integration in Design**: All the suggestion recommended to the design team. Unskilled labor for construction activities hall be taken from the local communities. Minimal loss of rubber farming shall be taken care during construction stage.	 Plate 4

Mahadevtila (Ch. 80.85km)	**Information and Suggestions:** The major bypass of the project avoiding busy township of Khowai joined here. Local people are demanding reasonable compensation for the proposed land acquisition. Minimal impact to the nearby water bodies and common public utility service such as schools, hospitals etc. demanded by the local public. **Recommended Suggestions for Integration in Design**: Strict vigilance on construction activities on bypass to avoid key environmental features wherever possible. All the sensitive issue shall be discussed with local public bodies before execution. All the measures shall be taken to avoid destruction of public properties during construction phase.	 Plate 5
Gongrai Chora (Ch. 87.85km)	**Information and Suggestions:** Similar to most of the fringe areas, people of this location also mainly dependent on agriculture, daily-wages and rubber cultivation for livelihood. No flood activities in this part of the project road. However, occasional waterlogging during monsoon season. Suggest for road side drainage. **Recommended Suggestions for Integration in Design**: All the suggestion recommended to the design team especially for road side drainage.	 Plate 6

Teliamura (End point)	**Information and Suggestions:** End point of the project road connects to NH-44. Hence, disturbance due to vehicular noise reported during public consultation. Recommended for noise barrier such as massive plantation nearby schools, health centres by the project proponent. Avoid demolition of important public utilities such as schools, health centres, temples, clubs etc. **Recommended Suggestions for Integration in Design**: Road side plantation has been recommended to the civil work team. Minimal noise disturbance during construction phase suggested. All the possible measures shall be taken to avoid demolition of important structures nearby project road.	 Plate 7

Source: DPR Vol-IV (Part A)

Consultation held with various government officials and local people from the fringe area of the project road. Divisional Forest Officers of all the three project districts were consulted during the field study along with higher officials from the Tripura State Pollution Control Board. Informal public consultations were held at seven important locations of the project road including both starting point (Kirtantali) and end point (Teliamura, near NH-44). All of them welcomed the road development and improvement project. Suggestion received mainly on improved drainage system, adequate compensation, protection measures for water bodies (mainly ponds) and petty contracts for the local contractors during the construction phase of the project road.

The second stage Public/stake holder consultation have been done in six locations from 23.09.2019 to 25.09.2019 after informing stakeholders vide NHIDCL letters F.NHIDCL/BO Agt./DPR/12(3)/2016-17/Vol-II/2177-89 dated 07.09.2019 in district Unakoti, F.NHIDCL/BO Agt./DPR/12(3)/2016-17/Vol-II/2167-76 dated 07.09.2019 in district Dhalai, F.NHIDCL/BO Agt./DPR/12(3)/2016-17/Vol-II/2156-66 dated 07.09.2019 in district Khowai covering all the three benefits districts as per JICA guidelines. Below Table 6.3 shows the schedule, locations and nos. of peole attanded public/stakeholders consultation. Photographs of second stage public/stakeholder consultation Annexure 10. The detailed minutes of meeting has been provided in SIA&RAP report.

Table 6.3: Schedule, Locations and nos. of people attended Public/Stakeholders Consultation

Sr.No	Date & Time	Name of District	Venue of Public Hearing Meeting	Nos. of people attanded
1.	23/09/2019 Monday (Morning) 10.00 am to 12.30 pm	Unakoti	Panchamnagar Community Hall, Village : Panchamnagar , Panchayat : Milong, Block : Gournagar, Sub –Division : Kailasahar Distt - Unakoti, State : Tripura (India)	90 PAP's and 10 officials
2.	23/09/2019 Monday (Evening) 2.00 pm to 04.30 pm	Unakoti	Rubber Society Community Hall Vill - Saidacherra, Block : Kumarghat Distt- Unakoti, Tripura (India)	104 PAP's and 11 Officials
3.	24/09/2019 Tuesday (Morning) 10.00 am to 12.30 pm	Dhalai	Dhurga Chowmohani Block office Vill- Dhergachowmohani , Distt- Dhalai, Tripura (India)	134 PAP's and 16 Officials
4.	24/09/2019 Tuesday (Evening) 2.00 pm to 04.30 pm	Dhalai	Manikbhander, " Maitri Bhawan" Vill- Manikbhander, Kalampura, Distt- Dhalai, Tripura (India)	67 PAP's + 14 Officials
5.	25/09/2019 Wednesday (Morning) 10.00 am to 12.30 pm	Khowai	Hachwkni Kharang Community Hall Village : Bachaibari Distt : Khowai, Tripura (India)	180 PAP's + 14 Officials
6.	25/09/2019 Wednesday (Evening) 2.00 pm to 04.30 pm	Khowai	Kalayanpur Community Hall Vill : Kalyanpur, Sub- Division : Teliamura, Distt-Khowai, Tripura (India)	202 PAP's + 14 Officials

Source: EIS Pvt. Ltd.

During second stage stakeholders / public consultation meetings, stakeholders appreaciated the project and would like its early implementation for the development of the area.

7. Environmental Management Plan, Monitoring Plan & Grievance Redress Mechanism

7.1 Environmental Management Plan

Environmental Management Plan (EMP) is intended to set out clearly and unambiguously the likely negative impacts of construction and/or operation of the project, the action that is required to avoid or mitigate each impact and the responsibility for taking each action. Responsibility is made legally binding when actions are subsequently specified in contracts. The EMP (**Appendix 1**) also ensures that the positive impacts are conserved and enhanced. It addition, it provides measures for institutional strengthening and effectiveness assessment through defined monitoring plan, reporting and corrective & preventive action planning. More specifically the objectives of the EMP are:

- To ensure compliance and regulatory requirements of Tripura and the Government of India;
- To formulate avoidance, mitigation and compensation measures for anticipated adverse environmental impacts during construction and maintenance and ensure that environmentally sound, sustainable and good practices are adopted;
- To stipulate monitoring and institutional requirements for ensuring safeguard compliance;

The EMP has been prepared based on all foreseen impacts at the time of preparing this EIA. It is a living document. If any new or unforeseen impacts occur during project implementation, the EMP will be updated by the CSC Environmental Specialist. The new impacts may be due to design changes or changes in project situation or other reasons. If the new or unforeseen impacts are deemed significant, NHIDCL, Govt. of Tripura will revise the EIA report as well.

7.2 Environment Monitoring Program

The monitoring and evaluation are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to plan or not. It provides the necessary feedback for project management to ensure project objectives are met and on schedule. The reporting system is based on accountability to ensure that the environmental mitigation measures are implemented. Environmental monitoring program has the underlying objective to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. Such program targets proper implementation of the EMP. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the EMP.
- To evaluate the adequacy of environmental assessment.
- To suggest ongoing improvements in management plan based on the monitoring and to devise fresh monitoring on the basis of the improved EMP.
- To enhance environmental quality through proper implementation of suggested mitigation measures.
- To meet the requirements of the existing environmental regulatory framework and community obligations.

7.2.1 Performance Indicators

The significant physical, biological and social components affecting the environment at critical locations serve as wider/overall performance Indicators. However, the following specific environmental parameters can be quantitatively measured and compared over a period of time and are, therefore, selected as specific Performance Indicators (PIs) for monitoring because of their regulatory importance and the availability of standardized procedures and relevant expertise. A comprehensive monitoring plan for all performance indicators has been prepared for all stages appended as **Appendix 2.**This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibility for implementation and supervision. Performance indicators requiring quantitative measurements are:

- Air quality with respect to PM2.5, PM10, NOx and SO2 at selected location.
- Water quality with reference to DO, BOD, Oil and grease, COD, Suspended Solids and Turbidity, Alkalinity rivers/streams and water bodies at selected points.
- Noise levels at sensitive receptors (schools, hospitals, community/religious places).
- Survival rates of trees planted as compensatory plantation to compensate for lost forestlands and compensatory plantation rose for removal of roadside trees.

Ambient Air Quality (AAQ) Monitoring: Ambient air quality parameters recommended for monitoring road development projects are PM2.5, PM10, Carbon Monoxide (CO), Oxides of Nitrogen (NOx) and Sulphur Dioxide (SO2). These are to be monitored, right from the commencement of construction activity at selected locations of plants and machinery, crushers on sites, excavation works etc. Data should be generated once in a season excluding monsoon in accordance with the National Ambient Air Quality Standards as per CPCB recent notification of 2009 (Appendix 5).

Water Quality Monitoring: The physical and chemical parameters recommended for analysis of water quality relevant to road development projects are pH, total solids, total dissolved solids, total suspended solids, oil and grease, COD, Chloride, Lead, Zinc and Cadmium. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are given in the Environmental Monitoring Plan. The monitoring of the water quality is to be carried out at locations identified along the project road during construction and operation phase. The Indian Standard Specifications - IS10500: 1991 is given in Appendix 7. Surface water quality will be monitored as per fresh water classification of CPCB (Appendix 8).

Noise Level Monitoring: The measurements for monitoring noise levels would be carried out at sensitive receptors and construction sites along the project roads. The Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989 or the standards by State Pollution Control Board. The CPCB standards are given in Appendix 6. Sound pressure levels would be monitored on twenty-four hour basis. Noise should be recorded at "A" weighted frequency using a "slow time response mode" of the measuring instrument.

Success of Re-vegetation: Additional compensatory plantation will be carried out by the civil works contractor in partnership with the local Joint Forest Management (JFM) Committee. NHIDCL through the CSC will seek necessary support and guidance from the local Forestry Department for getting plantation activities carried out through the JFMs. Suggested plantation locations are multi-layered plantation near sensitive receptors and other community property resources. Further, trees preferred by local birds can be planted on the forest land along the project roads in consultation with forest department. Remaining trees can be planted near rivers and canals intersecting project roads. Survival rate till construction period will be monitored by supervision consultant. Later on it can be handed over to forest department. Survival rate of a minimum of 75% shall be ensured.

Records of Accidents: Contractors to keep records of all types (construction sites/road accident) of accidents during construction period. During the operation stage monitoring, NHIDCL will maintain records of traffic through their field offices with support from forest department and local people.

7.3 Organizational Set-up of Implementing Agency

NHIDCL Tripura is the implementing agency for the project. NHIDCL is a section of state NHIDCL, govt. of Tripura and mandated with construction and maintenance of national highways and bridges with its own resources, private funding or external funding. Presently, it is having a lean organizational set-up in comparison to its mandate. It is headed by Chief Executive Officer (CEO). The CEO has joint charge as, under the Act, the position is held by the Principal Secretary, Road Construction Department. Technical wing is headed by Member

Technical supported by General Managers, Deputy General Managers and Managers for different cells.

7.4 Proposed Institutional Arrangement

NHIDCL, as the Project Executing Agency, shall be responsible for overall implementation of the project, and shall perform, or cause to be performed, its obligations as set forth herein and the Project Agreement through Government of Tripura.

A dedicated safeguards team for implementation of safeguards for all projects under NHIDCL including the current project, shall be appointed. The team will be headed by the Member (Administration) and supported by a Deputy General Manager (DGM) and Manager at the headquarter level and an engineer from each Project Implementation Unit (PIU) at the field level.

NHIDCL shall establish field Project Implementation Unit (PIU) for implementing the project. PIU will oversee works for roads under the project. One of the engineers in PIU will be appointed as the safeguards focal person and be responsible for overseeing implementation of EMP.

A construction supervision consultant (CSC) firm will be recruited to supervise and administer civil works contracts and to ensure the works are executed in accordance with the drawings, technical specifications and contract conditions including implementation of EMP. The CSC team will include one environmental specialist and one wildlife specialist. Proposed institutional arrangement for NHIDCL has been illustrated through a flow diagram (Figure 6.2).

Table 7.1: Responsibilities for Environmental Safeguards Implementation

S. No	Agency	Responsibility
1.	NHIDCL Tripura - HQ Level, Member (Administration), Deputy General Manager (DGM), Manager	– Ensure that project complies with GOI laws and regulations – Ensure that contract documents include all relevant parts of the environmental assessment and project agreements. – Ensure that sufficient funds are available to properly implement all agreed environmental safeguards measures – Obtain all statutory clearances and permissions – Review and approve the Contractor's Implementation Plan with Supervision Consultant for the environmental measures, as per the EMP – Review the environmental performance of the project through an assessment of the periodic environmental monitoring reports submitted by the Supervision Consultants – overall project coordination and management through PIU supported by CSC – Formation of Grievance Redress Mechanism – Ensure updating of the EMP if any new or unanticipated environmental impacts occur during project implementation due to design change or other reasons
2.	Project Implementation Unit (PIU) – Field Level	– Ensure that Project complies with GoI laws and regulations – Ensure that the environment checklist is completed on time by contractor, reviewed by CSC and submitted to NHIDCL – Participating in State and District level meetings to facilitate LA and R&R activities – Periodic appraisal of progress and reporting to the HQ on
S. No	Agency	Responsibility

		monthly basis, - Facilitating the contractor to obtain necessary permissions/ approvals and its submission to HQ - Directly interact with project affected persons and record their views and grievances and transmit the same to HQ - Settle grievances if any at field level. - Review and approve the package specific EMP's and EMOP's and make necessary modifications if required. - Facilitate the establishment of a grievance redress mechanism, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances related to environment safeguards - Ensure that all mitigation measures as given in the EMP are implemented properly - Ensure proper conduction of environmental monitoring during pre-construction, construction and operation phases - Verify the monitoring checklists/reports prepared by the CSC - Ensure annual environmental monitoring reports are prepared - Identify environmental corrective actions and prepare a corrective action plan, as necessary
3.	Environment Specialist, Construction Supervision Consultant (CSC)	– Review and approve the contract package specific EMAP's prepared by the contractor – Daily on site supervision for implementation of environmental safeguards – Completion of monitoring checklists – Close coordination and communication with the contractor to facilitate implementation of all mitigation measures identified in EMP – Preparation of monitoring reports and submission to PIU – Provide technical support and advise for addressing complaints and grievances – Provide technical advice and on the job training to the contractors as necessary – Preparation of annual monitoring reports based on the monitoring checklists and submission to NHIDCL – Review and approve updated/revised contract specific EMP's if an new or unanticipated environmental impacts occur during project implementation due to design change or other reasons
4.	Contractor	– Responsible for the physical implementation of the mitigation measures proposed in the Environmental Management Plans (EMP) associated with the construction activities. – Responsible for implementation of the Environmental Monitoring Program (EMOP) on collection of environmental quality data. Prepare contract package specific (EMOP) for approval by the CSC and/or PIU before the start of physical works – Ensure that adequate budget provisions are made for implementing all mitigation measures specified in the EMP and EMOP – Participate in induction training on EMP provisions and requirements delivered by the PIU – Obtain necessary environmental license(s), permits etc. from relevant agencies for associated facilities for project road works, quarries, hot-mix plant etc. prior to commencement of civil

		works contracts – Implement all mitigation measures in the EMP – Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by CSC. – Ensure compliance with contractual obligations – Collect the baseline data on environmental quality before the start of physical works and continue collection of environmental quality data as given in the Environmental Monitoring Plan during construction – Respond promptly to grievances raised by the local community or and implement corrective actions

Source: DPR Vol-IV (Part A)

7.5 Institutional/Capacity Building

To enhance the capacity of officials for effective implementation of proposed mitigation measures and monitoring the resultant effects, as well as create awareness amongst workers and public, the training and awareness program is planned and is given in Table 7.2. The institutions/agencies like regional office of MoEF, SPCB/CPCB, and Indian Institute of Technologies can be consulted for such trainings. Independent subject's experts/consultants (e.g., for the environmental awareness program, impact assessment specialist will be the resource person) can also be the resource persons to impart trainings. These experts /agencies shall be appointed based on specific need for the training. A separate budget for training has been allocated under the CSC budget.

Table 7.2: Training/Workshop for EMP Implementation

S.No	Target group	Subject(s)	Method	Time Frame
1	All staffs of NHIDCL including PIU project staff involved in implementation of the	**Environmental Overview:** Environmental Regulations, project related provisions of various Acts/ Guidelines, Procedures of EC and FC, process and methodology for EIA, EMPs	Lectures cum interaction	Before beginning of the implementation of the subproject.
2	Managers (Env.) at PIU, Supervision Consultant's Environmental Specialists and Select	**Implementation of EMPs:** Basic features of an EMP, Planning, designing and execution of environmental mitigation and enhancement measures, monitoring and evaluation of environmental conditions - during construction and operation	Workshops and Seminars	Before the construction begins
3	Environmental officer, design team, Supervision Consultant Construction Contractors' staff	**Environmentally Sound Construction Practices:** Clean construction technology, alternatives materials and techniques for construction, Waste Management and minimization in construction, pollution control devices and methods for construction sites and equipment, Environmental clauses in contract documents and their implications, protection of flora and fauna Environmental monitoring during construction	Workshops and Site visits	Before the construction

4	PIU and Supervision Consultant, NGOs and community representatives	**Monitoring Environmental Performance during Construction:** Air, Water, Soil and Noise, tree survival Monitoring requirement and techniques, Evaluation and Review of results, Performance indicators and their applicability, possible corrective actions, reporting requirements and mechanisms	Lectures, Worksho p and site visits	During initial phases of construction
5	-do-	Long-term Environmental Issues in Project Management: Designing and implementing environmental surveys for ambient air, noise, biological and water quality surveys, data storage, retrieval and analysis, contract documents and environmental clauses, risk assessment and management, contingency planning and management and value addition	Workshops and seminars	During implementati on of the Subproject
6	Public /contractors workers	Awareness program on environmental protection and measures being implemented by NHIDCL and their role in sustaining the measures taken including for noise pollution, air pollution, safety, soil conservation, and agricultural productivity	Workshops	During construction and initial phase say 3 years of operation
7	NHIDCL Staff, Supervision Consultant, Engineering Staff of	Restoration of sites viz borrow areas, construction Camps, Crushing units, HMP etc. And Reporting Formats/procedure	Lecture/Pre sentations	before Contractor Demobilizati on

Source: DPR Vol-IV (Part A)

7.6 Grievance Redress Mechanism

All the three parties involved in this project implementation i.e. Contractor, CSC and executing agency will maintain complaint registers at their following respective offices:

- Contractor's main site offices i.e. office of the Project Manager;
- CSC's main site office i.e. office of the Engineer's Representative; and
- PIU DGM office i.e. Employer's field office

Level 1 - PIU level: All public complaints regarding environmental issues received by any of the above mentioned offices will be entered into the register with specific details such as name and address of the person or representative of the community registering a complaint, the details of complaint, and time. The Executive Engineer and Engineer's Representative will immediately communicate the details of the complaint to the Contractor. The environment and safety officer of the contractor will promptly investigate and review the environmental complaint and implement appropriate corrective actions to arrest or mitigate the cause of the complaints within 3 days' time of receiving the complaint. The contractor will report to CSC environment expert about the action taken on the complaint, also within 3 days' time of receiving the complaint, for his further intimation to DGM PIU. The person making the complaint will also be intimated by the complaint receiving person or his representative, about the action taken, within 3 days.

Level 2 - State level: Grievances not redressed by the PIU level will be brought to the State level Grievance Redress Committee (GRC). The State level GRC will be headed and chaired by Executive Engineer. The state level GRC will comprise of the following:

- Member (Administration), NHIDCL

- Environmental Specialist, CSC
- A representative from the respective local community or JFM committee member
- Representative of concerned agency such as Forestry Department or State Pollution Control Board depending on the nature of the complaint/issue

The main responsibilities of the GRC will be to: (i) record grievances, categorize, and prioritize grievances and resolve them as soon as possible; (ii) immediately inform the EA of serious cases; and (iii) report to complainants on decisions made regarding their grievances within three weeks of receiving the grievance from the PIU level. The decision must include the agreed timeline for addressing the grievance. Grievances related to resettlement benefits, compensation, relocation, replacement cost and other assistance will be addressed by following the grievance redress system.

7.7 Environment Management Budget

Most of the measures have been addressed as part of good engineering practices, the costs for which have been accounted for in the engineering/cost. All costs towards pre-construction clearances/permission will be borne by executing agency. These costs are indicative. The environmental budget for the various environmental management measures proposed under the project is presented in Table below. A total budget amount of **Rs. 12,70,72,712/-** (approximately) has been allocated for implementation of environment safeguards under the project. Table 7.3 shows Environment Management Budget

Table 7.3: Environment Management Budget

Sl. NO.	ITEM DESCRIPTION	QUANTITY	UNIT	RATE (Rs.)	AMOUNT (Rs.)	Responsibility
A	**Tree Plantation**					
A.1	Net present value over 79.756196 ha of forest land (@ Rs. 9.39 lakh over 31.902 ha, @ Rs. 9.39 lakh over 20.8388 ha and @ Rs. 7.30 lakh over 27.0144 ha) under DFO, Unakoti/Dhalai/Khowai	79.756196	Ha	Rs. 9.39 lakh over 31.902 ha, Rs. 9.39 lakh over 20.8388 ha and @ Rs. 7.30 lakh over 27.0144 ha)	6,92,44,124	PIUNHIDCL/CSC through Forest Department
A.2	Cost of compensateory afforestation over 161.62 ha of degraded forest land @ Rs. 3,13,622/- per ha including anticipated cost increase for works schedule for subsequent years (over55.92 ha under Dhalai, over 41.7 ha under Khowai, over 64.00 under Unakoti)	161.62	Ha	3,13,622	5,06,87,588	PIUNHIDCL/CSC through Forest Department
				Sub Total	**11,99,31,712**	
B	**Environmental Monitoring**					
B.1	Ambient air quality monitoring (Construction Stage) as per Appendix 2 for 2years at thrice in a year	12	No.	10,000	7,20,000	NHIDCL/CSC through Approved Monitoring Agency
B.2	Ambient air quality monitoring (Operation Stage) as per Appendix 2 @three times for one year	9	No.	10,000	2,70,000	
B.3	Ambient noise level monitoring (Construction Stage) as per Appendix 2 once in a year for two years	12	No.	5000	1,20,000	

B.4	Ambient noise level monitoring as per Appendix 2 once in a year for one year	9	No.	5000	45,000	
B.5	Water quality monitoring of surface water as per Appendix 2 for two years at 10 location for three times including samples from construction camp	10	No.	5000	3,00,000	
B.6	Water quality monitoring of drinking water for 6 locations three times a year during operation	6	No.	5000	90,000	
B.7	Soil Quality analysis as per Appendix 2 during construction stage	6	No.	8000	48,000	
B.8	Soil Quality analysis as per Appendix 2 during operation stage	6	No.	8000	48,000	
				Sub Total	**16,41,000**	
C	**Environmental Training/ Awareness Camp**					
C.1	Training at site	2		1,00,000	2,00,000	PIU through Supervision Consultant
C.2	Awareness Camp	6		50,000	3,00,000	
				Sub Total	**5,00,000**	
D	**Budget for conservation and management of biodiversity in and around the project site**				50,00,000	PIU through Supervision Consultant
Grand Total= Rs. 12,70,72,712/-						

Source: DPR Vol-IV (Part A), Forest proposal & EIS Pvt. Ltd.

8. CONCLUSION AND RECOMMENDATION

EIA Study of the project road ascertains that it is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed project, most of which are localized and temporary in nature and easy to mitigate.

Project road is not located in any environmentally sensitive areas. However, considerable portion of the project road passes along/through forest cover. There are numbers of sensitive noise receptors such as higher secondary schools, high schools and primary schools & Anganwadis & health centres adjacent to the ROW of the project road. Hence, environmental management plan shall be strictly implemented to overcome all the adverse impacts from the project activities specially in forest area and sensitive noise receptors.

The significant environmental impacts attributable to the upgrading of the road sections pertains to tree cutting, construction of bridges, temporary deterioration of environmental attributes/ambient during construction phase from land clearing, silt run off, borrowing of earth, camp operations and community and occupational health and safety. These impacts can be mitigated adopting good construction practices and effective implementation of Environmental Management Plan (EMP). During operation stage, the main impacts are increase in mobile emissions, noise level, accident risk to motorist, pedestrian and animals. Road safety measures are proposed as per IRC: SP: 44-1996 like road delineators, signage, metal beam crash barriers and guide posts etc. Retaining walls have been proposed on embankment slopes where ponds are abutting to avoid seepage into sub grade and erosion of road embankment.

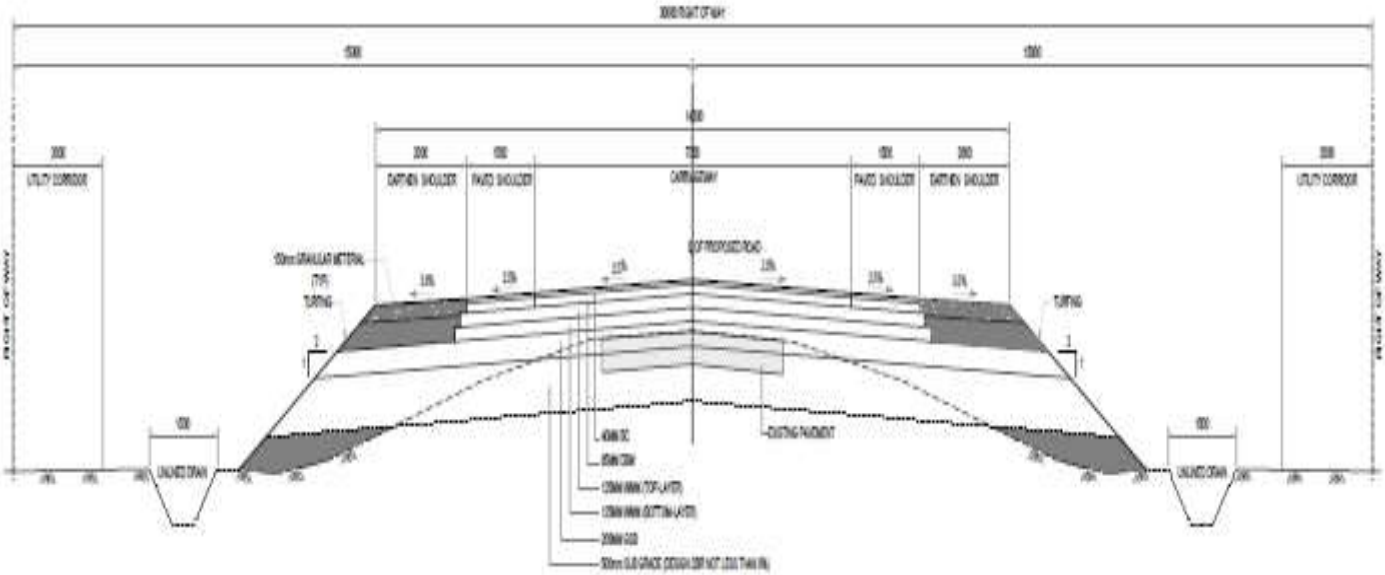
Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the alignment. The local people appreciated that improved connectivity will bear out several socio-economic positive benefits resulting to improved quality of life. Project road is starting from Kirtantali junction of road from Kailashar to Kumarghat at Unakati district and end at NH-44 at Teliamura of Khowai district. It connects some important habitats of Unakati, Dhalai & Khowai districts. It has immense potential to boost economy of the region since the livelihood of most of the peoples form the local people dependent on agriculture. Improved road condition will encourage them to invest more in agriculture and take the opportunity to connect to the mainstream economy of the country.

EIA study ascertains that the project is unlikely to cause any significant environmental impacts. The Executing Agency (NHIDCL, Tripura) 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 with approval of Project In-Charge, NHIDCL.

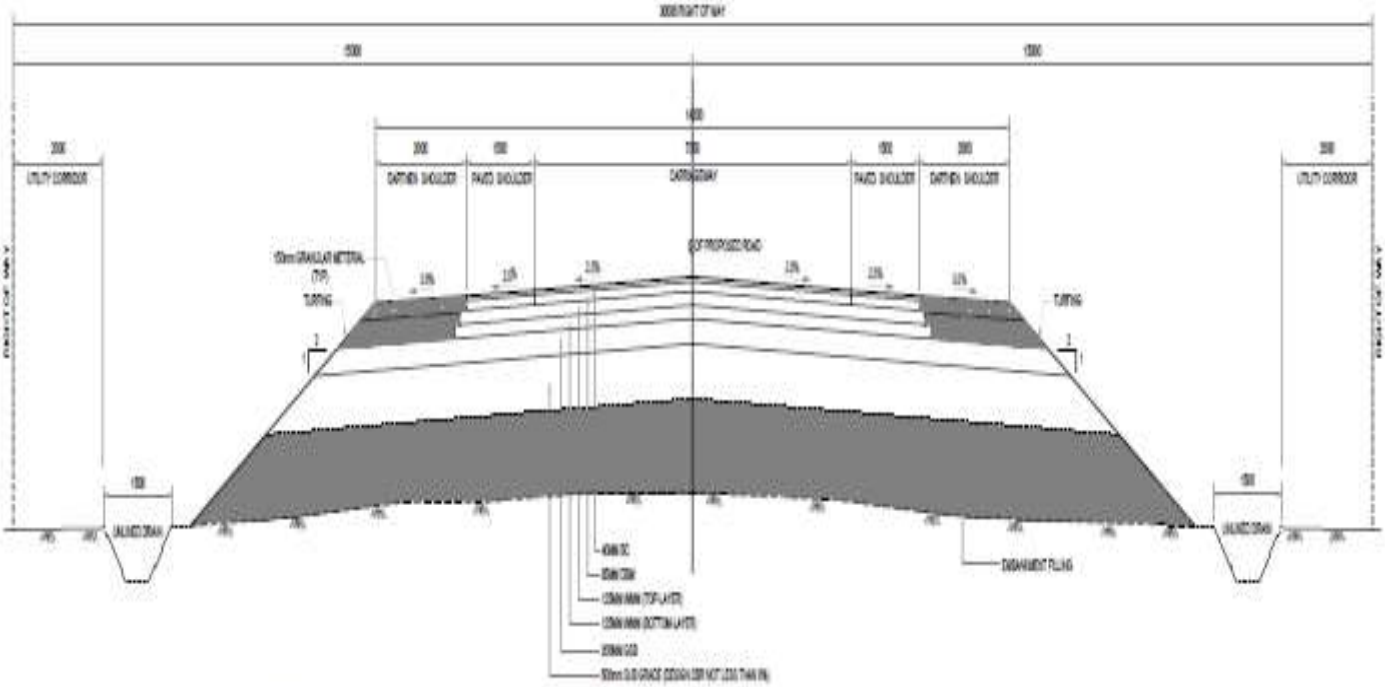
ANNEXURES

Annexure-1

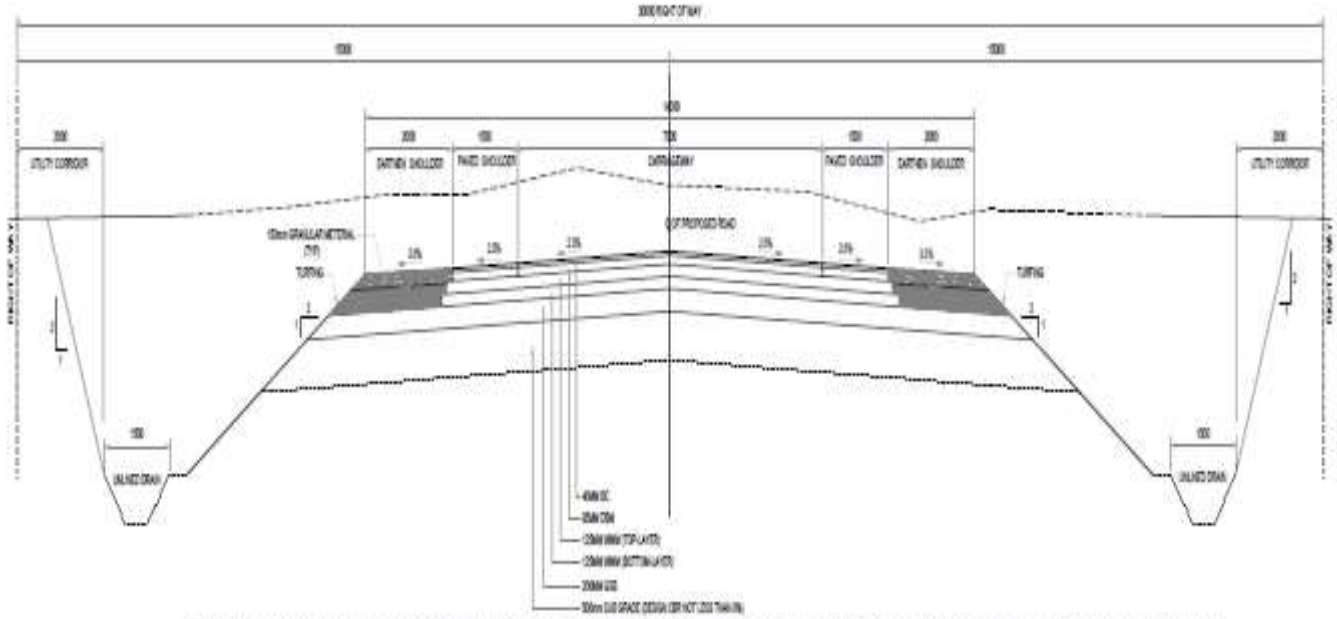
Typical cross sections for Road



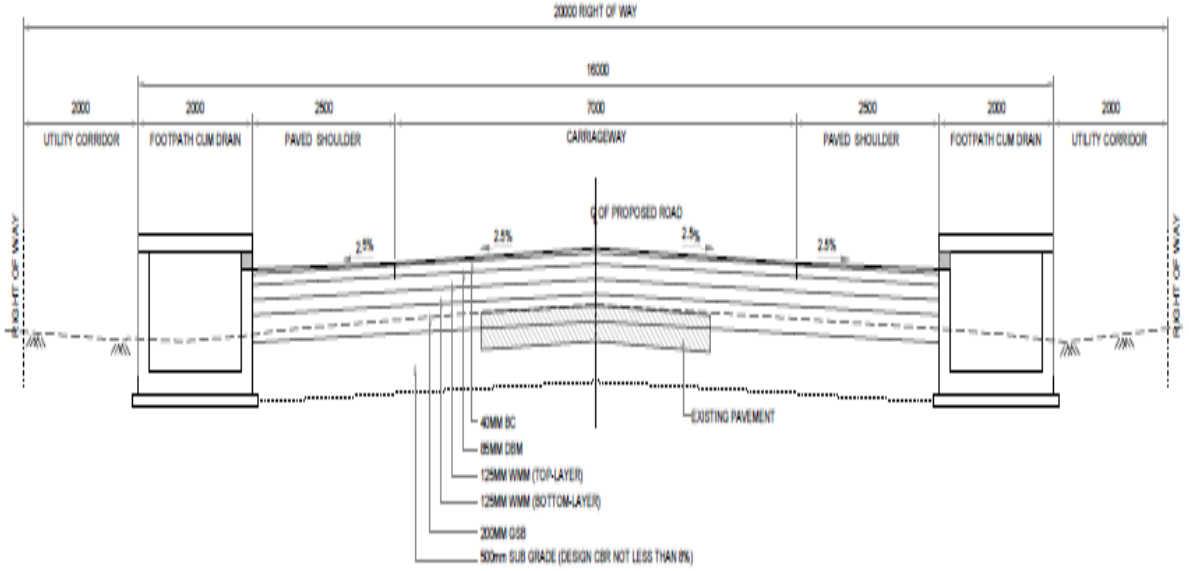
TCS-1 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA APPLICABLE FOR PLAIN/ROLLING TERRAIN (RECONSTRUCTION)



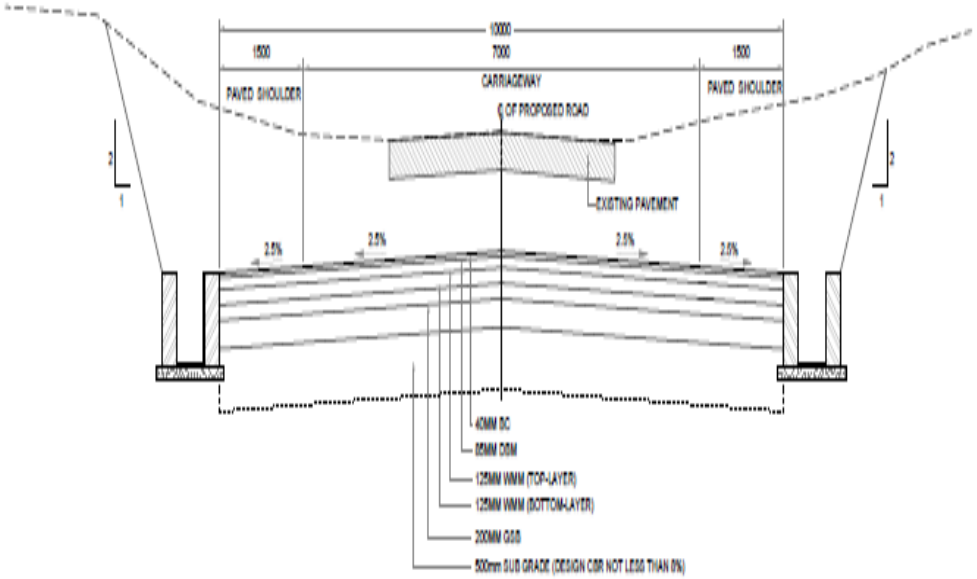
TCS-2 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH APPLICABLE FOR PLAIN/ROLLING TERRAIN (NEWCONSTRUCTION)



TCS-3 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH APPLICABLE FOR PLAIN/ROLLING TERRAIN IN CUTTING SECTION (NEW CONSTRUCTION)



TCS-4 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RCC COVER DRAIN IN BUILTUP AREA APPLICABLE FOR PLAIN/ROLLING TERRAIN (RECONSTRUCTION)



TCS-5 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)

Source: DPR Vol-IX (Part A)

Annexure-2

Strip Mapping of the Project Road (NH-208)

Chainage	Key Environmental feature	Side	Remark
21.1	Shop	LHS	Within ROW
21.15	Water logged area	LHS	Within ROW
21.2	Agricultural Land	RHS	Within ROW
21.25	Open area	RHS	Within ROW
21.3	Agricultural Land	RHS	Within ROW
21.35	Kirtan Tali Girls School	LHS	Touching ROW
21.4	Pond	LHS	Touching ROW
21.45	Krishna Mandir	RHS	Touching ROW
21.5	Agricultural Land	LHS	Touching ROW
21.55	Water logged area	RHS	Touching ROW
21.6	Agricultural Land	LHS	Touching ROW
21.65	Agricultural Land	LHS	Touching ROW
21.7	Agricultural Land	LHS, RHS	Touching ROW
21.75	Agricultural Land	LHS	Touching ROW
21.8	Agricultural Land	LHS	Touching ROW
21.85	Agricultural Land	LHS	Touching ROW
21.9	Agricultural Land	RHS	Touching ROW
21.95	Agricultural Land	RHS	Touching ROW
22	Agricultural Land	RHS	Touching ROW
22.05	Agricultural Land	RHS	Touching ROW
22.1	Agricultural Land	RHS	Touching ROW
22.15	Water logged area	LHS	Touching ROW
22.2	Agricultural Land	RHS	Touching ROW
22.25	Agricultural Land	RHS	Within ROW
22.3	Agricultural Land	RHS	Within ROW
22.35	House	LHS	Within ROW
22.4	House	LHS	Within ROW
22.45	Water logged area	RHS	Within ROW
22.5	Water logged area	RHS	Within ROW
22.55	Pond	RHS	Within ROW
22.6	Water logged area	LHS	Within ROW
22.65	Kamranga Bari Road	LHS	Within ROW
22.7	House	RHS	Touching ROW
22.75	Agricultural Land	RHS	Within ROW
22.8	Agricultural Land	RHS	Within ROW
22.85	Agricultural Land	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
22.9	Agricultural Land	LHS	Within ROW
22.95	Over lay Kamranga Bari road	RHS	Within ROW
23	Agricultural Land	RHS	Within ROW
23.05	Agricultural Land	RHS	Within ROW
23.1	Agricultural Land	RHS	Within ROW
23.15	Agricultural Land	RHS	Within ROW
23.2	Residential area	RHS	Within ROW
23.25	Residential area	RHS	Within ROW
23.3	Open area	RHS	Within ROW
23.35	Open area	RHS	Within ROW
23.4	Open area	RHS	Within ROW
23.45	Starting of new bridge	Middle	Within ROW
23.5	New Bridge	Middle	Within ROW
23.55	New Bridge	Middle	Within ROW
23.6	New Bridge	Middle	Within ROW
23.65	New Bridge	Middle	Within ROW
23.7	Ending of new bridge	Middle	Within ROW
23.75	Crossing the existing road	Middle	New Alignment
23.8	Water logged area	RHS	Within ROW
23.85	Agricultural Land	Middle	Within ROW
23.9	Agricultural Land	Middle	Within ROW
23.95	Agricultural Land	Middle	Within ROW
24	Agricultural Land	Middle	Within ROW
24.05	Chaintali Mitra Para ICDS Center	RHS	Within ROW
24.1	Crossing the existing road	Middle	Within ROW
24.15	Paddy Land	Middle	Within ROW
24.2	Paddy Land	Middle	Within ROW
24.25	Paddy Land	Middle	Within ROW
24.3	Paddy Land	Middle	Within ROW
24.35	Crossing the existing road	RHS	Within ROW
24.4	Village road connected to new road	LHS	Within ROW
24.45	Paddy Land	LHS	Within ROW
24.5	Paddy Land	LHS	Within ROW
24.55	Vivekananda Club	RHS	Within ROW
24.65	Bank Daptar and house	LHS	Within ROW
24.7	Kalibari and house	RHS	Within ROW
24.75	To Subhagan road	LHS	Within ROW
24.8	Paddy Land	LHS	Within ROW
24.85	Tea garden	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
24.9	Tea garden	Middle	Within ROW
24.95	Tea garden	Middle	Within ROW
25	Tea garden	Middle	Within ROW
25.05	Tea garden	Middle	Within ROW
25.1	Tea garden	Middle	Within ROW
25.15	Tea garden	Middle	Within ROW
25.2	Tea garden	Middle	Within ROW
25.25	Tea garden	Middle	Within ROW
25.3	Tea garden	Middle	Within ROW
25.35	Tea garden	Middle	Within ROW
25.4	Tea garden	Middle	Within ROW
25.45	Tea garden	Middle	Within ROW
25.5	Tea garden	Middle	Within ROW
25.55	Tea garden	Middle	Within ROW
25.6	Tea garden	Middle	Within ROW
25.65	Tea garden	LHS	Within ROW
25.7	Tea garden	LHS	Within ROW
25.75	Tea garden	LHS	Within ROW
25.8	Open area	RHS	Within ROW
25.85	Open area	LHS	Within ROW
25.9	Shop	LHS	Within ROW
25.95	Open area	LHS	Within ROW
26	Vivekananda Vidyapit	LHS	Within ROW
26.05	Paddy Land	LHS	Within ROW
26.1	Paddy Land	LHS	Within ROW
26.15	Road junction and some shops	LHS	Within ROW
26.2	Open area	LHS	Within ROW
26.25	Open area	LHS	Within ROW
26.3	Open area	LHS	Within ROW
26.35	Open area	LHS	Within ROW
26.4	Open area	LHS	Within ROW
26.45	House	RHS	Within ROW
26.5	Road to Malaibasti	RHS	Within ROW
26.55	Agricultural Land	LHS	Within ROW
26.6	Agricultural Land	LHS	Within ROW
26.65	Shop and house	RHS	Within ROW
26.7	Cultivated land	RHS	Within ROW
26.75	Cultivated land	RHS	Within ROW
26.8	Cultivated land	RHS	Within ROW
26.85	Cultivated land	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
26.9	Cultivated land	RHS	Within ROW
26.95	Shop and house	LHS	Within ROW
27	Pond	RHS	Within ROW
27.05	Paddy Land	LHS	Within ROW
27.1	Paddy Land	RHS	Within ROW
27.15	Pond	RHS	Touching ROW
27.2	Paddy Land	RHS	Within ROW
27.25	Paddy Land	LHS	Within ROW
27.3	Paddy Land	RHS	Within ROW
27.35	Paddy Land	RHS	Within ROW
27.4	Paddy Land	RHS	Within ROW
27.45	Paddy Land	LHS	Within ROW
27.5	House	RHS	Within ROW
27.55	Pond	RHS	Within ROW
27.6	Pond	LHS	Touching ROW
27.65	Paddy Land	LHS	Within ROW
27.7	Pond	RHS	Within ROW
27.75	Paddy Land	LHS	Within ROW
27.8	Culvart	Middle	Within ROW
27.85	Paddy Land	RHS	Within ROW
27.9	Pond	RHS	Within ROW
27.95	Pond	RHS	Within ROW
28	Paddy Land	LHS	Within ROW
28.05	Paddy Land	RHS	Within ROW
28.1	Paddy Land	LHS	Within ROW
28.15	Paddy Land	RHS	Within ROW
28.2	Paddy Land	RHS	Within ROW
28.25	Pond	RHS	Within ROW
28.3	Pond	RHS	Within ROW
28.35	Paddy Land	RHS	Within ROW
28.4	Pond	LHS	Within ROW
28.45	Pond	LHS	Within ROW
28.5	Pond	RHS	Within ROW
28.55	Pond	RHS	Within ROW
28.6	Culvert	Middle	Within ROW
28.65	Pond	LHS	Within ROW
28.7	Paddy Land	RHS	Within ROW
28.75	Paddy Land	LHS	Within ROW
28.8	Culvert	Middle	Within ROW
28.85	House	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
28.9	Hill area	Middle	Within ROW
28.95	Hill area	Middle	Within ROW
29	Hill area	Middle	Within ROW
29.05	Hill area	Middle	Within ROW
29.1	Hill area	Middle	Within ROW
29.15	Pond	LHS	Touching ROW
29.2	Crossing the existing road	LHS	Within ROW
29.25	Hill area	LHS	Within ROW
29.3	Hill area	LHS	Within ROW
29.35	Rubber garden	RHS	Within ROW
29.4	Mix jungle	LHS	Within ROW
29.45	Tea garden	RHS	Touching ROW
29.5	Mix jungle	LHS	Within ROW
29.55	Mix jungle	LHS	Within ROW
29.6	Mix jungle	LHS	Within ROW
29.65	Mix jungle	LHS	Within ROW
29.7	Mix jungle	LHS	Within ROW
29.75	Singirbill Nala	Middle	Within ROW
29.8	Pond	RHS	Within ROW
29.85	Pond	RHS	Within ROW
29.9	Shop, pond and house	LHS	Within ROW
29.95	Road junction and some shops	RHS	Within ROW
30	Pond	RHS	Within ROW
30.05	Pond	RHS	Touching ROW
30.1	Open area	Middle	Within ROW
30.15	Open area	Middle	Within ROW
30.2	Pond	RHS	Touching ROW
30.25	Rubber garden	RHS	Within ROW
30.3	Rubber garden	LHS	Within ROW
30.35	Rubber garden	RHS	Within ROW
30.4	Rubber garden	LHS	Within ROW
30.45	Rubber garden	LHS	Within ROW
30.5	Rubber garden	LHS	Within ROW
30.55	Rubber garden	LHS	Within ROW
30.6	Rubber garden	LHS	Within ROW
30.65	Rubber garden	LHS	Within ROW
30.7	Rubber garden	LHS	Within ROW
30.75	Rubber garden	LHS	Within ROW
30.8	Rubber garden	LHS	Within ROW
30.85	Rubber garden	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
30.9	Paddy Land	RHS	Within ROW
30.95	Pond	LHS	Within ROW
31	Kancha Nala	Middle	Within ROW
31.05	Kancha Nala	LHS	Within ROW
31.1	Kancha Nala	LHS	Within ROW
31.15	Pond	RHS	Within ROW
31.2	Open area	RHS	Within ROW
31.25	Open area	RHS	Within ROW
31.3	Open area	RHS	Within ROW
31.35	Open area	RHS	Within ROW
31.4	Open area	RHS	Within ROW
31.45	Open area	RHS	Within ROW
31.5	Pond	RHS	Within ROW
31.55	Hill area	LHS	Within ROW
31.6	Hill area	LHS	Within ROW
31.65	Hill area	LHS	Within ROW
31.7	Hill area	LHS	Within ROW
31.75	Hill area	LHS	Within ROW
31.8	Pond	LHS	Within ROW
31.85	Kancha Nala	Middle	Within ROW
31.9	Paddy Land	Middle	Within ROW
31.95	Paddy Land	Middle	Within ROW
32	Pond	LHS	Touching ROW
32.05	Paddy Land	LHS	Within ROW
32.1	Paddy Land	LHS	Within ROW
32.15	Paddy Land	LHS	Within ROW
32.2	Paddy Land	LHS	Within ROW
32.25	Shop	LHS	Within ROW
32.3	Pond	LHS	Within ROW
32.35	Open area	Middle	Within ROW
32.4	Kancha Nala	Middle	Within ROW
32.45	Hill area	Middle	Within ROW
32.5	Hill area	Middle	Within ROW
32.55	Hill area	Middle	Within ROW
32.6	Hill area	Middle	Within ROW
32.65	Hill area	Middle	Within ROW
32.7	Hill area	Middle	Within ROW
32.75	Hill area	Middle	Within ROW
32.8	Hill area	Middle	Within ROW
32.85	Hill area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
32.9	Hill area	Middle	Within ROW
32.95	Temple	RHS	Touching ROW
33	Miling Sub-health Centre	LHS	Touching ROW
33.05	Paddy Land	Middle	Within ROW
33.1	Paddy Land	Middle	Within ROW
33.15	Paddy Land	Middle	Within ROW
33.2	Paddy Land	Middle	Within ROW
33.25	Paddy Land	Middle	Within ROW
33.3	Paddy Land	Middle	Within ROW
33.35	Paddy Land	Middle	Within ROW
33.4	Culvert	Middle	Within ROW
33.45	Paddy Land	Middle	Within ROW
33.5	Paddy Land	Middle	Within ROW
33.55	Paddy Land	Middle	Within ROW
33.6	Paddy Land	RHS	Within ROW
33.65	Paddy Land	RHS	Within ROW
33.7	Paddy Land	RHS	Within ROW
33.75	Golakpur Chara	Middle	Within ROW
33.8	Paddy Land	LHS	Within ROW
33.85	Paddy Land	LHS	Within ROW
33.9	Paddy Land	LHS	Within ROW
33.95	Paddy Land	LHS	Within ROW
34	Paddy Land	LHS	Within ROW
34.05	Paddy Land	LHS	Within ROW
34.1	Paddy Land	LHS	Within ROW
34.15	Open area	LHS	Within ROW
34.2	Open area	LHS	Within ROW
34.25	Open area	LHS	Within ROW
34.3	Bridge on River	Middle	Within ROW
34.35	Open area	LHS	Within ROW
34.4	Paddy Land	LHS	Within ROW
34.45	Hill area	LHS	Within ROW
34.5	Hill area	LHS	Within ROW
34.55	Hill area	LHS	Within ROW
34.6	Hill area	LHS	Within ROW
34.65	Hill area	LHS	Within ROW
34.7	Hill area	LHS	Within ROW
34.75	Hill area	LHS	Within ROW
34.8	Hill area	LHS	Within ROW
34.85	Hill area	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
34.9	Hill area	LHS	Within ROW
34.95	Hill area	LHS	Within ROW
35	Hill area	LHS	Within ROW
35.05	Hill area	LHS	Within ROW
35.1	Hill area	LHS	Within ROW
35.15	Hill area	LHS	Within ROW
35.2	Rubber garden	LHS	Within ROW
35.25	Rubber garden	LHS	Within ROW
35.3	Rubber garden	LHS	Within ROW
35.35	Rubber garden	RHS	Within ROW
35.4	Rubber garden	RHS	Within ROW
35.45	Bamboo bush	LHS	Within ROW
35.5	Hill with jungle	LHS	Within ROW
35.55	Rubber garden	LHS	Within ROW
35.6	Hill with jungle	LHS	Within ROW
35.65	Hill with jungle	LHS	Within ROW
35.7	Hill with jungle	LHS	Within ROW
35.75	Hill with jungle	LHS	Within ROW
35.8	Rubber garden	LHS	Within ROW
35.85	Rubber garden	LHS	Within ROW
35.9	Rubber garden	LHS	Within ROW
35.95	Residential area	LHS	Within ROW
36	Residential area	LHS	Within ROW
36.05	Residential area	LHS	Within ROW
36.1	Residential area	RHS	Within ROW
36.15	Residential area	RHS	Within ROW
36.2	Residential area	RHS	Within ROW
36.25	Residential area	RHS	Within ROW
36.3	Residential area	RHS	Within ROW
36.35	Residential area	RHS	Within ROW
36.4	Nala	LHS	Within ROW
36.45	Open area	Middle	Within ROW
36.5	Open area	Middle	Within ROW
36.55	Open area	Middle	Within ROW
36.6	Open area	Middle	Within ROW
36.65	Open area	Middle	Within ROW
36.7	Open area	Middle	Within ROW
36.75	Paddy Land	RHS	Within ROW
36.8	Pond	RHS	Within ROW
36.85	Pond	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
36.9	Paddy Land	RHS	Within ROW
36.95	Pond	LHS	Within ROW
37	Pond	LHS	Within ROW
37.05	Pond	LHS	Within ROW
37.1	Pond	LHS	Within ROW
37.15	Pond	RHS	Within ROW
37.2	Fatik Cherra	LHS	Within ROW
37.25	Pond	LHS	Within ROW
37.3	Shops	RHS	Within ROW
37.35	Paddy Land	Middle	Within ROW
37.4	Paddy Land	Middle	Within ROW
37.45	Paddy Land	Middle	Within ROW
37.5	Paddy Land	Middle	Within ROW
37.55	Paddy Land	Middle	Within ROW
37.6	Paddy Land	Middle	Within ROW
37.65	Paddy Land	Middle	Within ROW
37.7	Paddy Land	Middle	Within ROW
37.75	Paddy Land	Middle	Within ROW
37.8	Paddy Land	Middle	Within ROW
37.85	Agricultural Land	Middle	Within ROW
37.9	Agricultural Land	LHS	Within ROW
37.95	Agricultural Land	LHS	Within ROW
38	Pond	LHS	Within ROW
38.05	Pond	RHS	Within ROW
38.1	Water logged area	LHS	Within ROW
38.15	Water logged area	LHS	Within ROW
38.2	Residential area	LHS	Within ROW
38.25	Segun Garden	LHS	Within ROW
38.3	Hill with jungle	LHS	Within ROW
38.35	Residential area	RHS	Within ROW
38.4	Radhanagar Village	RHS	Within ROW
38.45	Hill with jungle	LHS	Within ROW
38.5	Agricultural Land	LHS	Within ROW
38.55	Pond	LHS	Within ROW
38.6	Hill with jungle	RHS	Within ROW
38.65	Hill with jungle	LHS	Within ROW
38.7	Well	LHS	Within ROW
38.75	Hill with jungle	LHS	Within ROW
38.8	Assam Rifles Camp	LHS	Within ROW
38.85	Shop	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
38.9	Shop	RHS	Within ROW
38.95	Assam Rifles Camp	LHS	Within ROW
39	Assam Rifles Camp	RHS	Within ROW
39.05	Assam Rifles Camp	RHS	Within ROW
39.1	Assam Rifles Camp	RHS	Within ROW
39.15	Assam Rifles Camp	RHS	Within ROW
39.2	Assam Rifles Camp	RHS	Within ROW
39.25	Assam Rifles Camp	RHS	Within ROW
39.3	Assam Rifles Camp	RHS	Within ROW
39.35	Segun Garden	LHS	Within ROW
39.4	Segun Garden	RHS	Within ROW
39.45	Segun Garden	RHS	Within ROW
39.5	Pond	RHS	Within ROW
39.55	Water logged area	RHS	Within ROW
39.6	Rubber garden	LHS	Within ROW
39.65	Rubber garden	LHS	Within ROW
39.7	Segun Garden	LHS	Within ROW
39.75	Segun Garden	RHS	Within ROW
39.8	Segun Garden	RHS	Within ROW
39.85	Rubber garden	LHS	Within ROW
39.9	Ground Water Tank	LHS	Within ROW
39.95	Hill with jungle	RHS	Within ROW
40	Hill with jungle	RHS	Within ROW
40.05	Hill with jungle	RHS	Within ROW
40.1	Hill with jungle	RHS	Within ROW
40.15	Hill with jungle	LHS	Within ROW
40.2	Hill with jungle	LHS	Within ROW
40.25	Segun Garden	LHS	Within ROW
40.3	Residential area	RHS	Within ROW
40.35	Segun Garden	LHS	Within ROW
40.4	Segun Garden	RHS	Within ROW
40.45	Rajnagar Village	LHS	Within ROW
40.5	Residential area	RHS	Within ROW
40.55	Residential area	RHS	Within ROW
40.6	Segun Garden	RHS	Within ROW
40.65	Temple	RHS	Within ROW
40.7	Residential area	RHS	Within ROW
40.75	Residential area	RHS	Within ROW
40.8	Residential area	RHS	Within ROW
40.85	Residential area	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
40.9	Rajnagar Village	Middle	Within ROW
40.95	Residential area	Middle	Within ROW
41	Residential area	Middle	Within ROW
41.05	Residential area	Middle	Within ROW
41.1	Residential area	Middle	Within ROW
41.15	Residential area	Middle	Within ROW
41.2	Segun Garden	RHS	Within ROW
41.25	Segun Garden	RHS	Within ROW
41.3	Segun Garden	RHS	Within ROW
41.35	Segun Garden	RHS	Within ROW
41.4	Residential area	LHS	Within ROW
41.45	Gakulnagar Village	RHS	Within ROW
41.5	Gakulnagar Village	RHS	Within ROW
41.55	Open area	LHS	Within ROW
41.6	Open area	RHS	Within ROW
41.65	Open area	RHS	Within ROW
41.7	Segun Garden	LHS	Within ROW
41.75	Residential area	LHS	Within ROW
41.8	Gakulnagar Village	LHS	Within ROW
41.85	Gakulnagar Village	LHS	Within ROW
41.9	Gakulnagar Village	LHS	Within ROW
41.95	Gakulnagar Village	LHS	Within ROW
42	Gakulnagar Village	LHS	Within ROW
42.05	Residential area	Middle	Within ROW
42.1	Residential area	Middle	Within ROW
42.15	Residential area	Middle	Within ROW
42.2	Residential area	Middle	Within ROW
42.25	Gakulnagar Market	Middle	Within ROW
42.3	Gakulnagar Market	Middle	Within ROW
42.35	Gakulnagar Market	Middle	Within ROW
42.4	Gakulnagar Market	Middle	Within ROW
42.45	Residential area	Middle	Within ROW
42.5	Residential area	Middle	Within ROW
42.55	Temple	LHS	Within ROW
42.6	Residential area	LHS	Within ROW
42.65	Bridge on river	Middle	Within ROW
42.7	Bridge on river	Middle	Within ROW
42.75	Pond	Middle	Within ROW
42.8	Paddy Land	RHS	Within ROW
42.85	Residential area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
42.9	Supari Garden	RHS	Within ROW
42.95	Residential area	RHS	Within ROW
43	Residential area	LHS	Within ROW
43.05	Residential area	RHS	Within ROW
43.1	Residential area	RHS	Within ROW
43.15	Residential area	LHS	Within ROW
43.2	Bamboo bush	LHS	Within ROW
43.25	Residential area	LHS	Within ROW
43.3	Residential area	LHS	Within ROW
43.35	Residential area	LHS	Within ROW
43.4	Residential area	LHS	Within ROW
43.45	Shiv Temple	RHS	Within ROW
43.5	Residential area	LHS	Within ROW
43.55	Residential area	LHS	Within ROW
43.6	Residential area	LHS	Within ROW
43.65	Residential area	LHS	Within ROW
43.7	Residential area	LHS	Within ROW
43.75	Pond	LHS	Within ROW
43.8	Residential area	LHS	Within ROW
43.85	Residential area	LHS	Within ROW
43.9		Middle	Within ROW
43.95	Rubber garden	RHS	Within ROW
44	Ganganagar Village	LHS	Within ROW
44.05	Ganganagar Village	RHS	Within ROW
44.1	Ganganagar Village	RHS	Within ROW
44.15	Ganganagar Village	Middle	Within ROW
44.2	Hill with jungle	Middle	Within ROW
44.25	Rubber garden	Middle	Within ROW
44.3	Hill with jungle	Middle	Within ROW
44.35	Hill with jungle	Middle	Within ROW
44.4	Paddy Land	Middle	Within ROW
44.45	Paddy Land	Middle	Within ROW
44.5	Paddy Land	Middle	Within ROW
44.55	Domsora Nala	Middle	Within ROW
44.6	Paddy Land	Middle	Within ROW
44.65	Paddy Land	LHS	Within ROW
44.7	Paddy Land	Middle	Within ROW
44.75	Paddy Land	Middle	Within ROW
44.8	Open area	Middle	Within ROW
44.85	Paddy Land	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
44.9	Play Ground	Middle	Within ROW
44.95	Pond	RHS	Within ROW
45	Paddy Land	Middle	Within ROW
45.05	Prani Sampad Bikash Daftar	RHS	Within ROW
45.1	Paddy Land	LHS	Within ROW
45.15	Ananda Marga School and Pump house	LHS	Within ROW
45.2	Open area	RHS	Within ROW
45.25	Pond	LHS	Within ROW
45.3	Pond	LHS	Within ROW
45.35	Pond	Middle	Within ROW
45.4	Open area	LHS	Within ROW
45.45	Pond	LHS	Within ROW
45.5	Well	LHS	Within ROW
45.55	Open area	Middle	Within ROW
45.6	Open area	LHS	Within ROW
45.65	Segun Garden	RHS	Within ROW
45.7	House	LHS	Within ROW
45.75	Open area	LHS	Within ROW
45.8	Open area	LHS	Within ROW
45.85	Pond	RHS	Within ROW
45.9	Market area	Middle	Within ROW
45.95	Market area	Middle	Within ROW
46	NHIDCL Sub-Division Office	RHS	Within ROW
46.05	Saidachhera Village	RHS	Within ROW
46.1	Saidachhera Village	RHS	Within ROW
46.15	Saidachhera Village	RHS	Within ROW
46.2	Saidachhera Village	RHS	Within ROW
46.25	Paddy Land	LHS	Within ROW
46.3	Open area	LHS	Within ROW
46.35	Open area	LHS	Within ROW
46.4	Bridge on river	LHS	Within ROW
46.45	Paddy Land	Middle	Within ROW
46.5	Paddy Land	Middle	Within ROW
46.55	Saidachhera Village	Middle	Within ROW
46.6	Saidachhera Village	LHS	Within ROW
46.65	Saidachhera Village	LHS	Within ROW
46.7	Hill with jungle	RHS	Within ROW
46.75	Hill with jungle	RHS	Within ROW
46.8	Hill with jungle	RHS	Within ROW
46.85	Pond	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
46.9	Sadacherra Village	LHS	Within ROW
46.95	Sadacherra Village	LHS	Within ROW
47	Sadacherra Village	LHS	Within ROW
47.05	Rubber garden	RHS	Within ROW
47.1	Rubber garden	RHS	Within ROW
47.15	Rubber garden	RHS	Within ROW
47.2	Pond	LHS	Within ROW
47.25	Pond	LHS	Within ROW
47.3	Rubber garden	RHS	Within ROW
47.35	Rubber garden	RHS	Within ROW
47.4	Rubber garden	RHS	Within ROW
47.45	Rubber garden	RHS	Within ROW
47.5	Rubber garden	RHS	Within ROW
47.55	Rubber garden	RHS	Within ROW
47.6	Hill with jungle	LHS	Within ROW
47.65	Hill with jungle	LHS	Within ROW
47.7	Hill with jungle	LHS	Within ROW
47.75	Hill with jungle	LHS	Within ROW
47.8	Hill with jungle	LHS	Within ROW
47.85	Hill with jungle	LHS	Within ROW
47.9	Hill with jungle	LHS	Within ROW
47.95	Hill with jungle	LHS	Within ROW
48	Hill with jungle	LHS	Within ROW
48.05	Hill with jungle	LHS	Within ROW
48.1	Hill with jungle	LHS	Within ROW
48.15	Rubber garden	RHS	Within ROW
48.2	Rubber garden	RHS	Within ROW
48.25	Rubber garden	LHS	Within ROW
48.3	Rubber garden	LHS	Within ROW
48.35	Hill with jungle	LHS	Within ROW
48.4	Rubber garden	LHS	Within ROW
48.45	Hill with jungle	LHS	Within ROW
48.5	Hill with jungle	LHS	Within ROW
48.55	Rubber garden	LHS	Within ROW
48.6	Jurichara Nala	Middle	Within ROW
48.65	Hill with jungle	LHS	Within ROW
48.7	Hill with jungle	LHS	Within ROW
48.75	Hill with jungle	LHS	Within ROW
48.8	Hill with jungle	LHS	Within ROW
48.85	Hill with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
48.9	Hill with jungle	RHS	Within ROW
48.95	Hill with jungle	Middle	Within ROW
49	Hill with jungle	LHS	Within ROW
49.05	Hill with jungle	LHS	Within ROW
49.1	Pond	LHS	Within ROW
49.15	Hill with jungle	LHS	Within ROW
49.2	Hill with jungle	LHS	Within ROW
49.25	Hill with jungle	LHS	Within ROW
49.3	Hill with jungle	LHS	Within ROW
49.35	Hill with jungle	LHS	Within ROW
49.4	Hill with jungle	LHS	Within ROW
49.45	Hill with jungle	LHS	Within ROW
49.5	Hill with jungle	LHS	Within ROW
49.55	Hill with jungle	LHS	Within ROW
49.6	Hill with jungle	LHS	Within ROW
49.65	Hill with jungle	LHS	Within ROW
49.7	Hill with jungle	LHS	Within ROW
49.75	Hill with jungle	LHS	Within ROW
49.8	Hill with jungle	LHS	Within ROW
49.85	Hill with jungle	LHS	Within ROW
49.9	Hill with jungle	LHS	Within ROW
49.95	Hill with jungle	LHS	Within ROW
50	Hill with jungle	LHS	Within ROW
50.05	Hill with jungle	RHS	Within ROW
50.1	Hill with jungle	LHS	Within ROW
50.15	Hill with jungle	RHS	Within ROW
50.2	Hill with jungle	RHS	Within ROW
50.25	Hill with jungle	RHS	Within ROW
50.3	Hill with jungle	RHS	Within ROW
50.35	Hill with jungle	RHS	Within ROW
50.4	Hill with jungle	LHS	Within ROW
50.45	Hill with jungle	LHS	Within ROW
50.5	Nala	LHS	Within ROW
50.55	Hill with jungle	LHS	Within ROW
50.6	Hill with jungle	LHS	Within ROW
50.65	Hill with jungle	LHS	Within ROW
50.7	Hill with jungle	LHS	Within ROW
50.75	Hill with jungle	LHS	Within ROW
50.8	Hill with jungle	LHS	Within ROW
50.85	Temple	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
50.9	Shop	LHS	Within ROW
50.95	Hill with jungle	LHS	Within ROW
51	Hill with jungle	LHS	Within ROW
51.05	Hill with jungle	Middle	Within ROW
51.1	Hill with jungle	Middle	Within ROW
51.15	Hill with jungle	Middle	Within ROW
51.2	Hill with jungle	Middle	Within ROW
51.25	Hill with jungle	Middle	Within ROW
51.3	Hill with jungle	Middle	Within ROW
51.35	Hill with jungle	Middle	Within ROW
51.4	Hill with jungle	RHS	Within ROW
51.45	Hill with jungle	LHS	Within ROW
51.5	Hill with jungle	LHS	Within ROW
51.55	Hill with jungle	LHS	Within ROW
51.6	Hill with jungle	LHS	Within ROW
51.65	Pump house	LHS	Within ROW
51.7	Hill with jungle	LHS	Within ROW
51.75	Hill with jungle	LHS	Within ROW
51.8	Hill with jungle	LHS	Within ROW
51.85	Hill with jungle	LHS	Within ROW
51.9	Hill with jungle	LHS	Within ROW
51.95	Hill with jungle	LHS	Within ROW
52	Hill with jungle	LHS	Within ROW
52.05	Hill with jungle	LHS	Within ROW
52.1	Hill with jungle	LHS	Within ROW
52.15	Hill with jungle	LHS	Within ROW
52.2	Hill with jungle	LHS	Within ROW
52.25	Hill with jungle	LHS	Within ROW
52.3	Hill with jungle	LHS	Within ROW
52.35	Hill with jungle	LHS	Within ROW
52.4	Hill with jungle	LHS	Within ROW
52.45	Hill with jungle	LHS	Within ROW
52.5	Hill with jungle	LHS	Within ROW
52.55	Hill with jungle	LHS	Within ROW
52.6	Hill with jungle	LHS	Within ROW
52.65	Hill with jungle	LHS	Within ROW
52.7	Hill with jungle	LHS	Within ROW
52.75	Hill with jungle	LHS	Within ROW
52.8	Bridge on Nala	LHS	Within ROW
52.85	Valley Side	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
52.9	Valley Side	LHS	Within ROW
52.95	Valley Side	LHS	Within ROW
53	Valley Side	LHS	Within ROW
53.05	Valley Side	LHS	Within ROW
53.1	Valley Side	LHS	Within ROW
53.15	Valley Side	LHS	Within ROW
53.2	Open area	LHS	Within ROW
53.25	Open area	LHS	Within ROW
53.3	Open area	LHS	Within ROW
53.35	Open area	LHS	Within ROW
53.4	Hill with jungle	LHS	Within ROW
53.45	Hill with jungle	LHS	Within ROW
53.5	Hill with jungle	LHS	Within ROW
53.55	Hill with jungle	LHS	Within ROW
53.6	Hill with jungle	LHS	Within ROW
53.65	Hill with jungle	LHS	Within ROW
53.7	Hill with jungle	LHS	Within ROW
53.75	Hill with jungle	LHS	Within ROW
53.8	Hill with jungle	LHS	Within ROW
53.85	Hill with jungle	LHS	Within ROW
53.9	Hill with jungle	LHS	Within ROW
53.95	Hill with jungle	LHS	Within ROW
54	Hill with jungle	LHS	Within ROW
54.05	Hill with jungle	LHS	Within ROW
54.1	Hill with jungle	LHS	Within ROW
54.15	Hill with jungle	LHS	Within ROW
54.2	Hill with jungle	RHS	Within ROW
54.25	Hill with jungle	RHS	Within ROW
54.3	Hill with jungle	RHS	Within ROW
54.35	Hill with jungle	RHS	Within ROW
54.4	Hill with jungle	RHS	Within ROW
54.45	Hill with jungle	RHS	Within ROW
54.5	Hill with jungle	RHS	Within ROW
54.55	Hill with jungle	RHS	Within ROW
54.6	Hill with jungle	RHS	Within ROW
54.65	Hill with jungle	RHS	Within ROW
54.7	Hill with jungle	RHS	Within ROW
54.75	Hill with jungle	RHS	Within ROW
54.8	Hill with jungle	RHS	Within ROW
54.85	Hill with jungle	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
54.9	Hill with jungle	RHS	Within ROW
54.95	Hill with jungle	RHS	Within ROW
55	Hill with jungle	RHS	Within ROW
55.05	Hill with jungle	RHS	Within ROW
55.1	Hill with jungle	RHS	Within ROW
55.15	Hill with jungle	RHS	Within ROW
55.2	Hill with jungle	RHS	Within ROW
55.25	Hill with jungle	RHS	Within ROW
55.3	Hill with jungle	RHS	Within ROW
55.35	Hill with jungle	RHS	Within ROW
55.4	Hill with jungle	RHS	Within ROW
55.45	Hill with jungle	RHS	Within ROW
55.5	Hill with jungle	RHS	Within ROW
55.55	Hill with jungle	RHS	Within ROW
55.6	Hill with jungle	RHS	Within ROW
55.65	Hill with jungle	RHS	Within ROW
55.7	Hill with jungle	RHS	Within ROW
55.75	Hill with jungle	RHS	Within ROW
55.8	Hill with jungle	RHS	Within ROW
55.85	Hill with jungle	RHS	Within ROW
55.9	Hill with jungle	RHS	Within ROW
55.95	Hill with jungle	RHS	Within ROW
56	Hill with jungle	RHS	Within ROW
56.05	Hill with jungle	RHS	Within ROW
56.1	Hill with jungle	LHS	Within ROW
56.15	Hill with jungle	LHS	Within ROW
56.2	Hill with jungle	LHS	Within ROW
56.25	Hill with jungle	LHS	Within ROW
56.3	Hill with jungle	LHS	Within ROW
56.35	Hill with jungle	LHS	Within ROW
56.4	Hill with jungle	LHS	Within ROW
56.45	Hill with jungle	LHS	Within ROW
56.5	Hill with jungle	LHS	Within ROW
56.55	Superi Garden	RHS	Within ROW
56.6	Superi Garden	RHS	Within ROW
56.65	Superi Garden	RHS	Within ROW
56.7	Bridge on Nala	Middle	Within ROW
56.75	Hill with jungle	LHS	Within ROW
56.8	Hill with jungle	LHS	Within ROW
56.85	Hill with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
56.9	Bridge on Nala	Middle	Within ROW
56.95	Hill with jungle	LHS	Within ROW
57	Hill with jungle	LHS	Within ROW
57.05	Hill with jungle	LHS	Within ROW
57.1	Hill with jungle	LHS	Within ROW
57.15	Hill with jungle	LHS	Within ROW
57.2	Hill with jungle	LHS	Within ROW
57.25	Hill with jungle	LHS	Within ROW
57.3	Shop	LHS	Within ROW
57.35	Hill with jungle	LHS	Within ROW
57.4	Well	LHS	Within ROW
57.45	Hill with jungle	LHS	Within ROW
57.5	Hill with jungle	LHS	Within ROW
57.55	Hill with jungle	LHS	Within ROW
57.6	Hill with jungle	LHS	Within ROW
57.65	Hill with jungle	LHS	Within ROW
57.7	Hill with jungle	LHS	Within ROW
57.75	Hill with jungle	LHS	Within ROW
57.8	Hill with jungle	LHS	Within ROW
57.85	Hill with jungle	LHS	Within ROW
57.9	Hill with jungle	LHS	Within ROW
57.95	Hill with jungle	LHS	Within ROW
58	Hill with jungle	LHS	Within ROW
58.05	Hill with jungle	LHS	Within ROW
58.1	Rubber garden	LHS	Within ROW
58.15	Rubber garden	LHS	Within ROW
58.2	Rubber garden	LHS	Within ROW
58.25	Superi Garden	RHS	Within ROW
58.3	Rubber garden	RHS	Within ROW
58.35	Rubber garden	RHS	Within ROW
58.4	Tea Garden	RHS	Within ROW
58.45	Segun Garden	LHS	Within ROW
58.5	Segun Garden	LHS	Within ROW
58.55	Segun Garden	LHS	Within ROW
58.6	Valley Side	LHS	Within ROW
58.65	Valley Side	LHS	Within ROW
58.7	Telpa Cherra River	Middle	Within ROW
58.75	Telpa Cherra River	Middle	Within ROW
58.8	Bridge on river	Middle	Within ROW
58.85	Hill with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
58.9	Hill with jungle	LHS	Within ROW
58.95	Hill with jungle	LHS	Within ROW
59	Hill with jungle	LHS	Within ROW
59.05	Hill with jungle	LHS	Within ROW
59.1	Hill with jungle	LHS	Within ROW
59.15	Hill with jungle	LHS	Within ROW
59.2	Hill with jungle	LHS	Within ROW
59.25	Hill with jungle	LHS	Within ROW
59.3	Hill with jungle	LHS	Within ROW
59.35	Hill with jungle	LHS	Within ROW
59.4	Hill with jungle	LHS	Within ROW
59.45	Hill with jungle	LHS	Within ROW
59.5	Hill with jungle	LHS	Within ROW
59.55	Hill with jungle	LHS	Within ROW
59.6	Hill with jungle	LHS	Within ROW
59.65	Hill with jungle	LHS	Within ROW
59.7	Hill with jungle	LHS	Within ROW
59.75	Hill with jungle	LHS	Touching ROW
59.8	Hill with jungle	LHS	Touching ROW
59.85	Hill with jungle	LHS	Within ROW
59.9	Hill with jungle	LHS	Within ROW
59.95	Hill with jungle	LHS	Within ROW
60	Segun Garden	LHS	Within ROW
60.05	Segun Garden	LHS	Within ROW
60.1	Segun Garden	LHS	Within ROW
60.15	Segun Garden	LHS	Within ROW
60.2	Segun Garden	LHS	Within ROW
60.25	Segun Garden	LHS	Within ROW
60.3	Segun Garden	LHS	Within ROW
60.35	Segun Garden	LHS	Within ROW
60.4	Segun Garden	LHS	Within ROW
60.45	Segun Garden	LHS	Within ROW
60.5	Segun Garden	LHS	Within ROW
60.55	Segun Garden	LHS	Within ROW
60.6	Segun Garden	LHS	Within ROW
60.65	Hill with jungle	LHS	Within ROW
60.7	Hill with jungle	RHS	Within ROW
60.75	Hill with jungle	RHS	Within ROW
60.8	Hill with jungle	RHS	Within ROW
60.85	Hill with jungle	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
60.9	Hill with jungle	RHS	Within ROW
60.95	Hill with jungle	RHS	Within ROW
61	Hill with jungle	RHS	Within ROW
61.05	Hill with jungle	RHS	Within ROW
61.1	Hill with jungle	RHS	Within ROW
61.15	Hill with jungle	RHS	Within ROW
61.2	Hill with jungle	RHS	Within ROW
61.25	Hill with jungle	RHS	Within ROW
61.3	Hill with jungle	RHS	Within ROW
61.35	Hill with jungle	RHS	Within ROW
61.4	Hill with jungle	RHS	Within ROW
61.45	Hill with jungle	RHS	Within ROW
61.5	Hill with jungle	RHS	Within ROW
61.55	Hill with jungle	RHS	Within ROW
61.6	Hill with jungle	RHS	Within ROW
61.65	Tilak Charra River	Middle	Within ROW
61.7	Hill with jungle	RHS	Within ROW
61.75	Hill with jungle	RHS	Within ROW
61.8	Hill with jungle	LHS	Within ROW
61.85	Hill with jungle	LHS	Within ROW
61.9	Hill with jungle	LHS	Within ROW
61.95	Hill with jungle	LHS	Within ROW
62	Hill with jungle	LHS	Within ROW
62.05	Hill with jungle	LHS	Within ROW
62.1	Hill with jungle	LHS	Within ROW
62.15	Bridge on Adarsha Cherra River	Middle	Within ROW
62.2	Hill with jungle	LHS	Within ROW
62.25	Hill with jungle	LHS	Within ROW
62.3	Hill with jungle	LHS	Within ROW
62.35	Hill with jungle	LHS	Within ROW
62.4	Hill with jungle	LHS	Within ROW
62.45	Hill with jungle	RHS	Within ROW
62.5	Hill with jungle	RHS	Within ROW
62.55	Hill with jungle	RHS	Within ROW
62.6	Rubber garden	RHS	Within ROW
62.65	Rubber garden	RHS	Within ROW
62.7	Rubber garden	RHS	Within ROW
62.75	Hill with jungle	RHS	Within ROW
62.8	Hill with jungle	RHS	Within ROW
62.85	Hill with jungle	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
62.9	Hill with jungle	RHS	Within ROW
62.95	Hill with jungle	RHS	Within ROW
63	Hill with jungle	RHS	Within ROW
63.05	Hill with jungle	RHS	Within ROW
63.1	Hill with jungle	RHS	Within ROW
63.15	Hill with jungle	RHS	Within ROW
63.2	Hill with jungle	RHS	Within ROW
63.25	Hill with jungle	RHS	Within ROW
63.3	Paddy Land	RHS	Within ROW
63.35	Paddy Land	RHS	Within ROW
63.4	Paddy Land	RHS	Within ROW
63.45	Paddy Land	RHS	Within ROW
63.5	Rubber garden	LHS	Within ROW
63.55	Rubber garden	LHS	Within ROW
63.6	Rubber garden	LHS	Within ROW
63.65	Open area	LHS	Within ROW
63.7	Open area	LHS	Within ROW
63.75	Shop	LHS	Within ROW
63.8	Paddy Land	LHS	Within ROW
63.85	Paddy Land	LHS	Within ROW
63.9	Paddy Land	LHS	Within ROW
63.95	Pond	LHS	Within ROW
64	Paddy Land	RHS	Within ROW
64.05	Paddy Land	RHS	Within ROW
64.1	Pond	RHS	Within ROW
64.15	Pond	LHS	Within ROW
64.2	Paddy Land	LHS	Within ROW
64.25	Paddy Land	LHS	Within ROW
64.3	Paddy Land	LHS	Within ROW
64.35	Paddy Land	LHS	Within ROW
64.4	Pond	LHS	Within ROW
64.45	Durgachawamani Market	Middle	Within ROW
64.5	Durgachawamani Market	Middle	Within ROW
64.55	Durgachawamani Market	Middle	Within ROW
64.6	Durgachawamani Market	Middle	Within ROW
64.65	Durgachawamani Market	Middle	Within ROW
64.7	Paddy Land	LHS	Within ROW
64.75	Pond	LHS	Within ROW
64.8	Paddy Land	LHS	Within ROW
64.85	Paddy Land	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
64.9	Paddy Land	LHS	Within ROW
64.95	Paddy Land	LHS	Within ROW
65	Paddy Land	LHS	Within ROW
65.05	Open area	LHS	Within ROW
65.1	Open area	LHS	Within ROW
65.15	Open area	LHS	Within ROW
65.2	Pond	RHS	Within ROW
65.25	Segun Garden	RHS	Within ROW
65.3	Segun Garden	RHS	Within ROW
65.35	Segun Garden	RHS	Within ROW
65.4	Segun Garden	RHS	Within ROW
65.45	House	LHS	Within ROW
65.5	Pond	LHS	Within ROW
65.55	Pond	LHS	Within ROW
65.6	Open area	LHS	Within ROW
65.65	Pond	Middle	Within ROW
65.7	Garden	Middle	Within ROW
65.75	Paddy Land	LHS	Within ROW
65.8	Water logged area	LHS	Within ROW
65.85	Water logged area	LHS	Within ROW
65.9	Water logged area	LHS	Within ROW
65.95	Open area	RHS	Within ROW
66	Pond	RHS	Within ROW
66.05	Houses	Middle	Within ROW
66.1	Open area	Middle	Within ROW
66.15	Open area	Middle	Within ROW
66.2	Open area	Middle	Within ROW
66.25	Pond	Middle	Within ROW
66.3	Pond	LHS	Within ROW
66.35	Baman Charra High School	RHS	Within ROW
66.4	Pond	LHS	Within ROW
66.45	Pond	RHS	Within ROW
66.5	Paddy Land	RHS	Within ROW
66.55	Paddy Land	RHS	Within ROW
66.6	Paddy Land	RHS	Within ROW
66.65	Chulubari Village	RHS	Within ROW
66.7	Chulubari Village	RHS	Within ROW
66.75	Chulubari Village	RHS	Within ROW
66.8	Chulubari Village	RHS	Within ROW
66.85	Paddy Land	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
66.9	Paddy Land	LHS	Within ROW
66.95	Tripura State Electricity Corporation	RHS	Within ROW
67	Bamancharra Village	LHS	Within ROW
67.05	Way to Halahali Bazar	LHS	Within ROW
67.1	Water logged area	LHS	Within ROW
67.15	Paddy Land	LHS	Within ROW
67.2	Agricultural Land	LHS	Within ROW
67.25	Agricultural Land	LHS	Within ROW
67.3	Agricultural Land	LHS	Within ROW
67.35	Agricultural Land	LHS	Within ROW
67.4	Agricultural Land	LHS	Within ROW
67.45	Agricultural Land	LHS	Within ROW
67.5	Agricultural Land	LHS	Within ROW
67.55	Agricultural Land	LHS	Within ROW
67.6	Shop	LHS	Within ROW
67.65	Agricultural Land	LHS	Within ROW
67.7	Agricultural Land	LHS	Within ROW
67.75	Agricultural Land	LHS	Within ROW
67.8	Paddy Land	LHS	Within ROW
67.85	Paddy Land	LHS	Within ROW
67.9	Residential area	LHS	Within ROW
67.95	Rubber garden	LHS	Within ROW
68	Residential area	LHS	Within ROW
68.05	Residential area	LHS	Within ROW
68.1	Residential area	LHS	Within ROW
68.15	Residential area	LHS	Within ROW
68.2	Residential area	LHS	Within ROW
68.25	Residential area	LHS	Within ROW
68.3	Residential area	LHS	Within ROW
68.35	Residential area	LHS	Within ROW
68.4	Residential area	LHS	Within ROW
68.45	Open area	RHS	Within ROW
68.5	House	RHS	Within ROW
68.55	Pond	RHS	Within ROW
68.6	Pond	LHS	Within ROW
68.65	Pond	LHS	Within ROW
68.7	Pond	LHS	Within ROW
68.75	Agricultural Land	Middle	Within ROW
68.8	Agricultural Land	Middle	Within ROW
68.85	Agricultural Land	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
68.9	Agricultural Land	Middle	Within ROW
68.95	Agricultural Land	Middle	Within ROW
69	Agricultural Land	Middle	Within ROW
69.05	Bridge on Dhalai River	Middle	Within ROW
69.1	Bridge on Dhalai River	Middle	Within ROW
69.15	Bridge on Dhalai River	Middle	Within ROW
69.2	Bridge on Dhalai River	Middle	Within ROW
69.25	Bridge on Dhalai River	Middle	Within ROW
69.3	Open area	Middle	Within ROW
69.35	Pond	RHS	Within ROW
69.4	House	RHS	Within ROW
69.45	Manikvandar Market area	Middle	Within ROW
69.5	Manikvandar Market area	Middle	Within ROW
69.55	Manikvandar Market area	Middle	Within ROW
69.6	Manikvandar Market area	Middle	Within ROW
69.65	Manikvandar Market area	Middle	Within ROW
69.7	Manikvandar Market area	Middle	Within ROW
69.75	Manikvandar Market area	Middle	Within ROW
69.8	Manikvandar Market area	Middle	Within ROW
69.85	Pond	RHS	Within ROW
69.9	Paddy Land	LHS	Within ROW
69.95	Paddy Land	LHS	Within ROW
70	Paddy Land	LHS	Within ROW
70.05	Paddy Land	RHS	Within ROW
70.1	Paddy Land	LHS	Within ROW
70.15	Paddy Land	RHS	Within ROW
70.2	Paddy Land	RHS	Within ROW
70.25	Paddy Land	RHS	Within ROW
70.3	Paddy Land	RHS	Within ROW
70.35	Paddy Land	RHS	Within ROW
70.4	Paddy Land	RHS	Within ROW
70.45	Paddy Land	RHS	Within ROW
70.5	Bridge on Erra Cherra	Middle	Within ROW
70.55	Paddy Land	RHS	Within ROW
70.6	Paddy Land	RHS	Within ROW
70.65	Paddy Land	RHS	Within ROW
70.7	Paddy Land	LHS	Within ROW
70.75	Paddy Land	LHS	Within ROW
70.8	Paddy Land	RHS	Within ROW
70.85	Open area	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
70.9	Open area	LHS	Within ROW
70.95	Manikbhandar Market area	Middle	Within ROW
71	Manikbhandar Market area	Middle	Within ROW
71.05	Manikbhandar Market area	Middle	Within ROW
71.1	Manikbhandar Market area	Middle	Within ROW
71.15	Manikbhandar Market area	Middle	Within ROW
71.2	Bridge on Pitrai Cherra Nala	Middle	Within ROW
71.25	Manikbhandar Gram Panchayet Plot	RHS	Within ROW
71.3	Manikbhandar S.B School Play Ground	RHS	Within ROW
71.35	Residential area	LHS	Within ROW
71.4	Residential area	LHS	Within ROW
71.45	Residential area	LHS	Within ROW
71.5	Residential area	LHS	Within ROW
71.55	Pond	LHS	Within ROW
71.6	Pond	LHS	Within ROW
71.65	Residential area	RHS	Within ROW
71.7	Paddy Land	RHS	Within ROW
71.75	Open area	LHS	Within ROW
71.8	Residential area	RHS	Within ROW
71.85	Water logged area	RHS	Within ROW
71.9	Water logged area	RHS	Within ROW
71.95	Water logged area	LHS	Within ROW
72	Pond	RHS	Within ROW
72.05	Residential area	LHS	Within ROW
72.1	Residential area	LHS	Within ROW
72.15	Residential area	LHS	Within ROW
72.2	Bridge on Lambu Cherra Nala	Middle	Within ROW
72.25	Market area	LHS	Touching ROW
72.3	Market area	LHS	Touching ROW
72.35	Market area	LHS	Touching ROW
72.4	Market area	RHS	Touching ROW
72.45	Residential area	LHS	Touching ROW
72.5	Water logged area	LHS	Touching ROW
72.55	Water logged area	LHS	Within ROW
72.6	Residential area	LHS	Within ROW
72.65	Open area	RHS	Within ROW
72.7	Lumbachara High School	RHS	Within ROW
72.75	Residential area	RHS	Within ROW
72.8	Residential area	LHS	Within ROW
72.85	Open area	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
72.9	Open area	LHS	Within ROW
72.95	Residential area	LHS	Touching ROW
73	Residential area	LHS	Within ROW
73.05	Paddy Land	LHS	Within ROW
73.1	Paddy Land	RHS	Within ROW
73.15	Paddy Land	LHS	Within ROW
73.2	Srirampur Health Centre	RHS	Within ROW
73.25	Paddy Land	RHS	Within ROW
73.3	Paddy Land	RHS	Touching ROW
73.35	Paddy Land	RHS	Within ROW
73.4	Paddy Land	RHS	Within ROW
73.45	Paddy Land	RHS	Within ROW
73.5	Bridge on Srirampur Cherra Nala	Middle	Within ROW
73.55	Pond	LHS	Within ROW
73.6	Paddy Land	LHS	Within ROW
73.65	Paddy Land	LHS	Within ROW
73.7	Pond	LHS	Within ROW
73.75	Pond	LHS	Within ROW
73.8	Shop	LHS	Within ROW
73.85	Pond	LHS	Within ROW
73.9	Shops	RHS	Within ROW
73.95	Bridge on Ghoshpara Cherra nala	Middle	Within ROW
74	Paddy Land	LHS	Within ROW
74.05	Paddy Land	LHS	Within ROW
74.1	Paddy Land	LHS	Within ROW
74.15	Paddy Land	LHS	Within ROW
74.2	Paddy Land	LHS	Within ROW
74.25	Paddy Land	LHS	Within ROW
74.3	Paddy Land	LHS	Within ROW
74.35	Paddy Land	LHS	Within ROW
74.4	Paddy Land	LHS	Touching ROW
74.45	Radha Krishna Temple	LHS	Within ROW
74.5	2 Pond	RHS	Within ROW
74.55	Paddy Land	LHS	Within ROW
74.6	Paddy Land	LHS	Within ROW
74.65	Paddy Land	LHS	Within ROW
74.7	Paddy Land	LHS	Within ROW
74.75	Paddy Land	LHS	Within ROW
74.8	Paddy Land	LHS	Within ROW
74.85	Pond	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
74.9	Paddy Land	LHS	Touching ROW
74.95	2 Pond	LHS	Within ROW
75	Pond	RHS	Within ROW
75.05	Paddy Land	LHS	Within ROW
75.1	Paddy Land	RHS	Within ROW
75.15	Pond	LHS	Within ROW
75.2	Paddy Land	LHS	Within ROW
75.25	Pond	RHS	Within ROW
75.3	Paddy Land	LHS	Within ROW
75.35	Paddy Land	LHS	Within ROW
75.4	Paddy Land	LHS	Within ROW
75.45	Paddy Land	LHS	Within ROW
75.5	Paddy Land	LHS	Within ROW
75.55	Paddy Land	LHS	Within ROW
75.6	Paddy Land	LHS	Within ROW
75.65	Bridge on Nala	Middle	Within ROW
75.7	Paddy Land	LHS	Within ROW
75.75	Paddy Land	LHS	Within ROW
75.8	Paddy Land	LHS	Within ROW
75.85	Residential area	RHS	Within ROW
75.9	Residential area	RHS	Within ROW
75.95	Hill with jungle	LHS	Within ROW
76	Hill with jungle	LHS	Within ROW
76.05	Hill with jungle	LHS	Within ROW
76.1	Hill with jungle	LHS	Within ROW
76.15	Hill with jungle	LHS	Within ROW
76.2	Hill with jungle	LHS	Within ROW
76.25	Hill with jungle	LHS	Within ROW
76.3	Hill with jungle	LHS	Within ROW
76.35	Hill with jungle	LHS	Within ROW
76.4	Hill with jungle	LHS	Within ROW
76.45	Valley with jungle	LHS	Within ROW
76.5	Valley with jungle	LHS	Within ROW
76.55	Valley with jungle	LHS	Within ROW
76.6	Valley with jungle	LHS	Within ROW
76.65	Valley with jungle	LHS	Within ROW
76.7	Valley with jungle	LHS	Within ROW
76.75	Valley with jungle	LHS	Within ROW
76.8	Valley with jungle	LHS	Within ROW
76.85	Valley with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
76.9	Valley with jungle	LHS	Within ROW
76.95	Valley with jungle	RHS	Within ROW
77	Valley with jungle	RHS	Within ROW
77.05	Valley with jungle	RHS	Within ROW
77.1	Valley with jungle	RHS	Within ROW
77.15	Valley with jungle	RHS	Within ROW
77.2	Valley with jungle	RHS	Within ROW
77.25	Valley with jungle	RHS	Within ROW
77.3	Valley with jungle	RHS	Within ROW
77.35	Valley with jungle	RHS	Within ROW
77.4	Valley with jungle	RHS	Within ROW
77.45	Valley with jungle	RHS	Within ROW
77.5	Valley with jungle	RHS	Within ROW
77.55	Valley with jungle	RHS	Within ROW
77.6	Hill with jungle	LHS	Within ROW
77.65	Hill with jungle	LHS	Within ROW
77.7	Hill with jungle	LHS	Within ROW
77.75	Hill with jungle	LHS	Within ROW
77.8	Hill with jungle	LHS	Within ROW
77.85	Hill with jungle	LHS	Within ROW
77.9	Hill with jungle	LHS	Within ROW
77.95	Hill with jungle	LHS	Within ROW
78	Valley with jungle	RHS	Within ROW
78.05	Valley with jungle	RHS	Within ROW
78.1	Valley with jungle	RHS	Within ROW
78.15	Valley with jungle	RHS	Within ROW
78.2	Hill with jungle	RHS	Within ROW
78.25	Hill with jungle	RHS	Within ROW
78.3	Valley with jungle	LHS	Within ROW
78.35	Valley with jungle	LHS	Within ROW
78.4	Valley with jungle	LHS	Within ROW
78.45	Hill with jungle	LHS	Within ROW
78.5	Hill with jungle	LHS	Within ROW
78.55	Hill with jungle	LHS	Within ROW
78.6	Hill with jungle	LHS	Within ROW
78.65	Valley with jungle	LHS	Within ROW
78.7	Valley with jungle	LHS	Within ROW
78.75	Valley with jungle	LHS	Within ROW
78.8	Hill with jungle	LHS	Within ROW
78.85	Hill with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
78.9	Hill with jungle	LHS	Within ROW
78.95	Hill with jungle	LHS	Within ROW
79	Hill with jungle	LHS	Within ROW
79.05	Hill with jungle	LHS	Within ROW
79.1	Hill with jungle	LHS	Within ROW
79.15	Valley with jungle	LHS	Within ROW
79.2	Valley with jungle	LHS	Within ROW
79.25	Hill with jungle	RHS	Within ROW
79.3	Hill with jungle	RHS	Within ROW
79.35	Hill with jungle	RHS	Within ROW
79.4	Hill with jungle	RHS	Within ROW
79.45	Hill with jungle	RHS	Within ROW
79.5	Hill with jungle	RHS	Within ROW
79.55	Hill with jungle	RHS	Within ROW
79.6	Hill with jungle	RHS	Within ROW
79.65	Hill with jungle	RHS	Within ROW
79.7	Valley with jungle	RHS	Within ROW
79.75	Valley with jungle	RHS	Within ROW
79.8	Valley with jungle	RHS	Within ROW
79.85	Valley with jungle	RHS	Within ROW
79.9	Valley with jungle	RHS	Within ROW
79.95	Valley with jungle	RHS	Within ROW
80	Valley with jungle	RHS	Within ROW
80.05	Valley with jungle	RHS	Within ROW
80.1	Hill with jungle	RHS	Within ROW
80.15	Hill with jungle	RHS	Within ROW
80.2	Hill with jungle	RHS	Within ROW
80.25	Hill with jungle	RHS	Within ROW
80.3	Hill with jungle	RHS	Within ROW
80.35	Hill with jungle	RHS	Within ROW
80.4	Hill with jungle	RHS	Within ROW
80.45	Hill with jungle	RHS	Within ROW
80.5	Rubber garden	LHS	Within ROW
80.55	Rubber garden	LHS	Within ROW
80.6	Rubber garden	LHS	Within ROW
80.65	Rubber garden	LHS	Within ROW
80.7	Valley with jungle	LHS	Within ROW
80.75	Valley with jungle	LHS	Within ROW
80.8	Valley with jungle	LHS	Within ROW
80.85	Valley with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
80.9	Valley with jungle	LHS	Within ROW
80.95	Valley with jungle	LHS	Within ROW
81	Valley with jungle	LHS	Within ROW
81.05	Hill with jungle	LHS	Within ROW
81.1	Hill with jungle	LHS	Within ROW
81.15	Hill with jungle	LHS	Within ROW
81.2	Hill with jungle	RHS	Within ROW
81.25	Hill with jungle	RHS	Within ROW
81.3	Hill with jungle	RHS	Within ROW
81.35	Hill with jungle	RHS	Within ROW
81.4	Hill with jungle	RHS	Within ROW
81.45	Valley with jungle	LHS	Within ROW
81.5	Hill with jungle	RHS	Within ROW
81.55	Hill with jungle	RHS	Within ROW
81.6	Hill with jungle	RHS	Within ROW
81.65	Hill with jungle	LHS	Within ROW
81.7	Hill with jungle	LHS	Within ROW
81.75	Hill with jungle	LHS	Within ROW
81.8	Hill with jungle	LHS	Within ROW
81.85	Hill with jungle	LHS	Within ROW
81.9	Hill with jungle	LHS	Within ROW
81.95	Hill with jungle	LHS	Within ROW
82	Hill with jungle	LHS	Within ROW
82.05	Hill with jungle	LHS	Within ROW
82.1	Hill with jungle	LHS	Within ROW
82.15	Hill with jungle	RHS	Within ROW
82.2	Hill with jungle	RHS	Within ROW
82.25	Hill with jungle	RHS	Within ROW
82.3	Hill with jungle	RHS	Within ROW
82.35	Hill with jungle	RHS	Within ROW
82.4	Hill with jungle	RHS	Within ROW
82.45	Hill with jungle	RHS	Within ROW
82.5	Hill with jungle	RHS	Within ROW
82.55	Hill with jungle	RHS	Within ROW
82.6	Hill with jungle	RHS	Within ROW
82.65	Hill with jungle	RHS	Within ROW
82.7	Hill with jungle	RHS	Within ROW
82.75	Hill with jungle	RHS	Within ROW
82.8	Valley with jungle	LHS	Within ROW
82.85	Valley with jungle	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
82.9	Valley with jungle	LHS	Within ROW
82.95	Valley with jungle	LHS	Within ROW
83	Valley with jungle	LHS	Within ROW
83.05	Hill with jungle	RHS	Within ROW
83.1	Hill with jungle	RHS	Within ROW
83.15	Hill with jungle	RHS	Within ROW
83.2	Hill with jungle	RHS	Within ROW
83.25	Hill with jungle	RHS	Within ROW
83.3	Hill with jungle	RHS	Within ROW
83.35	Paddy Land	RHS	Within ROW
83.4	Paddy Land	RHS	Within ROW
83.45	Hill with jungle	LHS	Within ROW
83.5	Hill with jungle	LHS	Within ROW
83.55	Water logged area	LHS	Within ROW
83.6	Paddy Land	RHS	Within ROW
83.65	Paddy Land	RHS	Within ROW
83.7	Paddy Land	RHS	Within ROW
83.75	Open Land	RHS	Within ROW
83.8	Open Land	RHS	Within ROW
83.85	Open Land	RHS	Within ROW
83.9	Hill with jungle	RHS	Within ROW
83.95	Segun Garden	RHS	Within ROW
84	Segun Garden	RHS	Within ROW
84.05	Segun Garden	RHS	Within ROW
84.1	Segun Garden	RHS	Within ROW
84.15	Segun Garden	RHS	Within ROW
84.2	Segun Garden	RHS	Within ROW
84.25	Jungle	RHS	Within ROW
84.3	Jungle	RHS	Within ROW
84.35	Jungle	RHS	Within ROW
84.4	Jungle	RHS	Within ROW
84.45	Rubber garden	LHS	Within ROW
84.5	Houses	LHS	Within ROW
84.55	Residential area	RHS	Within ROW
84.6	Sukhiya Bari J.B. School	LHS	Within ROW
84.65	Sukhiya Bari Village	LHS	Within ROW
84.7	Rubber garden	LHS	Within ROW
84.75	Rubber garden	LHS	Within ROW
84.8	Rubber garden	LHS	Within ROW
84.85	Rubber garden	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
84.9	Rubber garden	LHS	Within ROW
84.95	Rubber garden	LHS	Within ROW
85	Houses	Middle	Within ROW
85.05	Rubber garden	LHS	Within ROW
85.1	Kandabasti Village	RHS	Within ROW
85.15	Kandabasti Village	RHS	Within ROW
85.2	Kandabasti Village	RHS	Within ROW
85.25	Kandabasti Village	RHS	Within ROW
85.3	Rubber garden	LHS	Within ROW
85.35	Rubber garden	LHS	Within ROW
85.4	Shadas Bashnas Bari SB School	RHS	Within ROW
85.45	Shadas Bashnas Bari SB School	RHS	Within ROW
85.5	Rubber garden	RHS	Within ROW
85.55	Rubber garden	RHS	Within ROW
85.6	Segun Garden	RHS	Within ROW
85.65	Segun Garden	RHS	Within ROW
85.7	Pond	RHS	Within ROW
85.75	Pond	RHS	Within ROW
85.8	Pond	LHS	Within ROW
85.85	Pond	LHS	Within ROW
85.9	Jungle	LHS	Within ROW
85.95	Pond	LHS	Within ROW
86	Pond	RHS	Within ROW
86.05	Pond	LHS	Within ROW
86.1	Pond	LHS	Within ROW
86.15	Pond	RHS	Within ROW
86.2	Jungle	RHS	Within ROW
86.25	Jungle	RHS	Within ROW
86.3	Jungle	RHS	Touching ROW
86.35	Hill with jungle	LHS	Touching ROW
86.4	Hill with jungle	LHS	Within ROW
86.45	Hill with jungle	LHS	Within ROW
86.5	Bridge on Nala	Middle	Within ROW
86.55	Paddy Land	Middle	Within ROW
86.6	Paddy Land	Middle	Within ROW
86.65	Paddy Land	Middle	Within ROW
86.7	Paddy Land	Middle	Within ROW
86.75	Bridge on Manikanta Cherra nala	Middle	Within ROW
86.8	Crossing road to Manikanta Bari	Middle	Within ROW
86.85	Hill with residential area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
86.9	Pond	Middle	Within ROW
86.95	Pond	Middle	Within ROW
87	Pond	Middle	Within ROW
87.05	Hill with residential area	LHS	Within ROW
87.1	Hill with residential area	LHS	Touching ROW
87.15	Hill with residential area	LHS	Touching ROW
87.2	Pond	LHS	Within ROW
87.25	Residential area	Middle	Within ROW
87.3	Residential area	Middle	Within ROW
87.35	Residential area	Middle	Within ROW
87.4	Segun Garden	LHS	Within ROW
87.45	Residential area	RHS	Within ROW
87.5	Baghai Bari Village	RHS	Within ROW
87.55	Pond	LHS	Within ROW
87.6	Residential area	RHS	Within ROW
87.65	Pond	RHS	Within ROW
87.7	Durga Mandir	RHS	Within ROW
87.75	Bhealabari Market	RHS	Within ROW
87.8	Bhealabari Market	RHS	Within ROW
87.85	Bhealabari Market	RHS	Within ROW
87.9	Bhealabari Market	RHS	Within ROW
87.95	Residential area	LHS	Within ROW
88	Pond	Middle	Within ROW
88.05	Pond	Middle	Within ROW
88.1	Segun Garden	RHS	Within ROW
88.15	Segun Garden	RHS	Within ROW
88.2	Bridge on Nala	Middle	Within ROW
88.25	Paddy Land	LHS	Within ROW
88.3	Paddy Land	LHS	Within ROW
88.35	Rubber garden	LHS	Within ROW
88.4	Water logged area	LHS	Within ROW
88.45	Laxmi Chara Village	RHS	Within ROW
88.5	Vodafone Tower	LHS	Within ROW
88.55	Laxmi Chara Village	Middle	Within ROW
88.6	Laxmi Chara Village	Middle	Within ROW
88.65	Laxmi Chara Village	Middle	Within ROW
88.7	Rubber garden	RHS	Within ROW
88.75	Rubber garden	LHS	Within ROW
88.8	Segun Garden	LHS	Within ROW
88.85	Segun Garden	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
88.9	Segun Garden	LHS	Within ROW
88.95	Segun Garden	LHS	Within ROW
89	Paddy Land	RHS	Within ROW
89.05	Bridge on Laxmi Cherra River	Middle	Within ROW
89.1	Paddy Land	Middle	Within ROW
89.15	Paddy Land	Middle	Within ROW
89.2	Hill with jungle	Middle	Within ROW
89.25	Hill with jungle	Middle	Within ROW
89.3	Hill with jungle	Middle	Within ROW
89.35	Hill with jungle	Middle	Within ROW
89.4	Hill with jungle	Middle	Within ROW
89.45	Hill with jungle	Middle	Within ROW
89.5	Hill with jungle	Middle	Within ROW
89.55	Hill with jungle	Middle	Within ROW
89.6	Hill with jungle	Middle	Within ROW
89.65	Hill with jungle	Middle	Within ROW
89.7	Rubber garden	RHS	Within ROW
89.75	Rubber garden	RHS	Within ROW
89.8	Rubber garden	RHS	Within ROW
89.85	Rubber garden	RHS	Within ROW
89.9	Rubber garden	RHS	Within ROW
89.95	Water logged area	LHS	Within ROW
90	Water logged area	LHS	Within ROW
90.05	Pond	RHS	Within ROW
90.1	Rubber garden	RHS	Within ROW
90.15	Rubber garden	RHS	Within ROW
90.2	Rubber garden	RHS	Within ROW
90.25	Rubber garden	RHS	Within ROW
90.3	Pond	RHS	Within ROW
90.35	Paddy Land	LHS	Within ROW
90.4	Paddy Land	LHS	Within ROW
90.45	Nursery Garden	LHS	Within ROW
90.5	Pond	LHS	Within ROW
90.55	Paddy Land	RHS	Within ROW
90.6	Paddy Land	RHS	Within ROW
90.65	Paddy Land	RHS	Within ROW
90.7	Pond	LHS	Within ROW
90.75	Residential area	Middle	Within ROW
90.8	Pond	RHS	Within ROW
90.85	Residential area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
90.9	Well and Pond	LHS	Within ROW
90.95	2 Pond	Middle	Within ROW
91	Pond	LHS	Within ROW
91.05	Pond	LHS	Within ROW
91.1	Paddy Land	LHS	Within ROW
91.15	Paddy Land	LHS	Within ROW
91.2	Hill with jungle	RHS	Within ROW
91.25	Hill with residential area	RHS	Within ROW
91.3	Paddy Land	RHS	Within ROW
91.35	Pond	RHS	Within ROW
91.4	Paddy Land	RHS	Within ROW
91.45	Paddy Land	RHS	Within ROW
91.5	Paddy Land	RHS	Within ROW
91.55	Paddy Land	RHS	Within ROW
91.6	Paddy Land	RHS	Within ROW
91.65	Paddy Land	RHS	Within ROW
91.7	Paddy Land	RHS	Within ROW
91.75	Paddy Land	LHS	Within ROW
91.8	Paddy Land	LHS	Within ROW
91.85	Paddy Land	LHS	Within ROW
91.9	Paddy Land	LHS	Within ROW
91.95	Paddy Land	LHS	Within ROW
92	Paddy Land	LHS	Within ROW
92.05	Segun Garden	RHS	Within ROW
92.1	Segun Garden	RHS	Within ROW
92.15	Paddy Land	RHS	Within ROW
92.2	Paddy Land	RHS	Within ROW
92.25	Paddy Land	RHS	Within ROW
92.3	Paddy Land	RHS	Within ROW
92.35	Paddy Land	RHS	Within ROW
92.4	Paddy Land	RHS	Within ROW
92.45	Paddy Land	RHS	Within ROW
92.5	Paddy Land	RHS	Within ROW
92.55	Paddy Land	RHS	Within ROW
92.6	Paddy Land	RHS	Within ROW
92.65	Segun Garden	RHS	Within ROW
92.7	Segun Garden	RHS	Within ROW
92.75	Paddy Land	LHS	Within ROW
92.8	Paddy Land	RHS	Within ROW
92.85	Road crossing	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
92.9	CPI (M) Party Office	LHS	Within ROW
92.95	Bachai Bari Market	Middle	Within ROW
93	Bachai Bari Market	Middle	Within ROW
93.05	Bachai Bari Market	Middle	Within ROW
93.1	Bridge on Basai Bari Cherra Nala	Middle	Within ROW
93.15	Bridge on Basai Bari Cherra Nala	Middle	Within ROW
93.2	Open Land	Middle	Within ROW
93.25	Pond	Middle	Within ROW
93.3	Pond	Middle	Within ROW
93.35	Residential area	Middle	Within ROW
93.4	Residential area	Middle	Within ROW
93.45	Well and Pond	Middle	Within ROW
93.5	Paddy Land	LHS	Within ROW
93.55	Open Land	RHS	Within ROW
93.6	Barabagai Village	RHS	Within ROW
93.65	Residential area	RHS	Within ROW
93.7	Residential area	RHS	Within ROW
93.75	Residential area	RHS	Within ROW
93.8	Pond	LHS	Within ROW
93.85	Residential area	Middle	Within ROW
93.9	Residential area	Middle	Within ROW
93.95	Pond	Middle	Within ROW
94	Paddy Land	RHS	Within ROW
94.05	Paddy Land	LHS	Within ROW
94.1	Residential area	RHS	Within ROW
94.15	Residential area	RHS	Within ROW
94.2	Barabagai Village	RHS	Within ROW
94.25	Pond	RHS	Within ROW
94.3	Residential area	RHS	Within ROW
94.35	Residential area	RHS	Within ROW
94.4	Pond	RHS	Within ROW
94.45	Residential area	Middle	Within ROW
94.5	Residential area	Middle	Within ROW
94.55	Residential area	Middle	Within ROW
94.6	Pond	RHS	Within ROW
94.65	Residential area	RHS	Within ROW
94.7	Paddy Land	LHS	Within ROW
94.75	Paddy Land	LHS	Within ROW
94.8	Residential area	RHS	Within ROW
94.85	Pond	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
94.9	Residential area	LHS	Within ROW
94.95	Paddy Land	LHS	Within ROW
95	Paddy Land	LHS	Within ROW
95.05	Pond	LHS	Within ROW
95.1	Paddy Land	LHS	Within ROW
95.15	Paddy Land	Middle	Within ROW
95.2	Paddy Land	Middle	Within ROW
95.25	Paddy Land	Middle	Within ROW
95.3	Pond	Middle	Within ROW
95.35	Pond	Middle	Within ROW
95.4	Pond	Middle	Within ROW
95.45	Cherma Bazar Village	Middle	Within ROW
95.5	Cherma Bazar Village	Middle	Within ROW
95.55	Cherma Bazar Village	Middle	Within ROW
95.6	Cherma Bazar Village	Middle	Within ROW
95.65	Paddy Land	RHS	Within ROW
95.7	Paddy Land	RHS	Within ROW
95.75	Paddy Land	RHS	Within ROW
95.8	Paddy Land	RHS	Within ROW
95.85	Pond	LHS	Within ROW
95.9	Paddy Land	LHS	Within ROW
95.95	Paddy Land	LHS	Within ROW
96	Pond	RHS	Within ROW
96.05	Pond	RHS	Within ROW
96.1	Paddy Land	RHS	Within ROW
96.15	Paddy Land	RHS	Within ROW
96.2	Paddy Land	RHS	Within ROW
96.25	Paddy Land	RHS	Within ROW
96.3	Paddy Land	RHS	Within ROW
96.35	Paddy Land	RHS	Within ROW
96.4	Paddy Land	RHS	Within ROW
96.45	Paddy Land	RHS	Within ROW
96.5	Paddy Land	RHS	Within ROW
96.55	Paddy Land	RHS	Touching ROW
96.6	Paddy Land	RHS	Within ROW
96.65	Paddy Land	RHS	Within ROW
96.7	Residential area	Middle	Within ROW
96.75	Residential area	Middle	Within ROW
96.8	Residential area	Middle	Within ROW
96.85	Residential area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
96.9	Pond	LHS	Within ROW
96.95	Paddy Land	Middle	Within ROW
97	Paddy Land	Middle	Within ROW
97.05	Paddy Land	Middle	Within ROW
97.1	Paddy Land	Middle	Within ROW
97.15	Bridge on Deep Jela Sora Cherra	Middle	Within ROW
97.2	Paddy Land	Middle	Within ROW
97.25	Paddy Land	Middle	Within ROW
97.3	Paddy Land	Middle	Within ROW
97.35	Overlap On Existing Road	Middle	Within ROW
97.4	Pond	LHS	Within ROW
97.45	Pond	LHS	Within ROW
97.5	Pond	RHS	Within ROW
97.55	Paddy Land	RHS	Within ROW
97.6	Paddy Land	RHS	Within ROW
97.65	Pond	LHS	Within ROW
97.7	House	LHS	Within ROW
97.75	Paddy Land	LHS	Within ROW
97.8	Paddy Land	LHS	Within ROW
97.85	Paddy Land	LHS	Within ROW
97.9	Paddy Land	LHS	Within ROW
97.95	Bridge on Singcherra Nala	Middle	Within ROW
98	Residential area	RHS	Within ROW
98.05	Residential area	LHS	Within ROW
98.1	Water logged area	RHS	Within ROW
98.15	Singchara Village	Middle	Within ROW
98.2	Park area	Middle	Within ROW
98.25	Sukanta Memorial Hall	LHS	Within ROW
98.3	Play Ground	Middle	Within ROW
98.35	Open Land	Middle	Within ROW
98.4	Open Land	Middle	Within ROW
98.45	Open Land	Middle	Within ROW
98.5	Open Land	Middle	Within ROW
98.55	Open Land	Middle	Within ROW
98.6	Open Land	Middle	Within ROW
98.65	Open Land	Middle	Within ROW
98.7	Open Land	Middle	Within ROW
98.75	Open Land	Middle	Within ROW
98.8	Open Land	Middle	Within ROW
98.85	Open Land	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
98.9	Open Land	Middle	Within ROW
98.95	Open Land	Middle	Within ROW
99	Open Land	Middle	Within ROW
99.05	Open Land	Middle	Within ROW
99.1	Open Land	Middle	Within ROW
99.15	Open Land	Middle	Within ROW
99.2	Open Land	Middle	Within ROW
99.25	Bridge on River	Middle	Within ROW
99.3	Bridge on River	Middle	Within ROW
99.35	Open Land	Middle	Within ROW
99.4	Open Land	Middle	Within ROW
99.45	Crossing road to Champahdor	Middle	Within ROW
99.5	Open Land	Middle	Within ROW
99.55	Open Land	Middle	Within ROW
99.6	Open Land	Middle	Within ROW
99.65	Open Land	Middle	Within ROW
99.7	Open Land	Middle	Within ROW
99.75	Open Land	Middle	Within ROW
99.8	Open Land	Middle	Within ROW
99.85	Open Land	Middle	Within ROW
99.9	Open Land	Middle	Within ROW
99.95	Open Land	Middle	Within ROW
100	Open Land	Middle	Within ROW
100.05	Open Land	Middle	Within ROW
100.1	Open Land	Middle	Within ROW
100.15	Open Land	Middle	Within ROW
100.2	Open Land	Middle	Within ROW
100.25	Open Land	Middle	Within ROW
100.3	Open Land	Middle	Within ROW
100.35	Open Land	Middle	Within ROW
100.4	Open Land	Middle	Within ROW
100.45	Open Land	Middle	Within ROW
100.5	Open Land	Middle	Within ROW
100.55	Open Land	Middle	Within ROW
100.6	Open Land	Middle	Within ROW
100.65	Open Land	Middle	Within ROW
100.7	Open Land	Middle	Within ROW
100.75	Open Land	Middle	Within ROW
100.8	Open Land	Middle	Within ROW
100.85	Open Land	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
100.9	Open Land	Middle	Within ROW
100.95	Open Land	Middle	Within ROW
101	Open Land	Middle	Within ROW
101.05	Open Land	Middle	Within ROW
101.1	Open Land	Middle	Within ROW
101.15	Shop area	RHS	Within ROW
101.2	Overlap On Existing Road	RHS	Within ROW
101.25	Pump house	RHS	Within ROW
101.3	Shop area	RHS	Within ROW
101.35	Play Ground	RHS	Within ROW
101.4	Ganaki ClassXII School	RHS	Within ROW
101.45	Maha Dev Tilla Market area	Middle	Within ROW
101.5	Maha Dev Tilla Market area	Middle	Within ROW
101.55	Maha Dev Tilla Market area	Middle	Within ROW
101.6	Maha Dev Tilla Market area	Middle	Within ROW
101.65	Ram Thakur Temple	LHS	Within ROW
101.7	Bridge on Sonatala Cherra Nala	Middle	Within ROW
101.75	Paddy Land	RHS	Within ROW
101.8	Paddy Land	RHS	Within ROW
101.85	Paddy Land	RHS	Within ROW
101.9	Paddy Land	RHS	Within ROW
101.95	Paddy Land	RHS	Within ROW
102	Paddy Land	RHS	Within ROW
102.05	Paddy Land	RHS	Within ROW
102.1	Paddy Land	RHS	Within ROW
102.15	Shop	LHS	Within ROW
102.2	Paddy Land	LHS	Within ROW
102.25	House	RHS	Within ROW
102.3	Paddy Land	LHS	Within ROW
102.35	Santala Sub-health Centre	LHS	Within ROW
102.4	Paddy Land	LHS	Within ROW
102.45	Paddy Land	LHS	Within ROW
102.5	Pond	LHS	Within ROW
102.55	Pond	LHS	Within ROW
102.6	Bothside Pond	LHS	Within ROW
102.65	Post office	LHS	Within ROW
102.7	Shiv Temple	LHS	Within ROW
102.75	Market area	Middle	Within ROW
102.8	Market area	Middle	Within ROW
102.85	Market area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
102.9	Market area	Middle	Within ROW
102.95	Residential area	Middle	Within ROW
103	Residential area	Middle	Within ROW
103.05	Residential area	Middle	Within ROW
103.1	Pond	RHS	Within ROW
103.15	Residential area	LHS	Within ROW
103.2	Pond	RHS	Within ROW
103.25	Paddy Land	LHS	Within ROW
103.3	Paddy Land	LHS	Within ROW
103.35	Residential area	LHS	Within ROW
103.4	Sonatala Village	LHS	Within ROW
103.45	Sonatala Village	LHS	Within ROW
103.5	Paddy Land	LHS	Within ROW
103.55	Paddy Land	LHS	Within ROW
103.6	Paddy Land	LHS	Within ROW
103.65	Paddy Land	LHS	Within ROW
103.7	Paddy Land	LHS	Within ROW
103.75	Paddy Land	LHS	Within ROW
103.8	Pond	RHS	Within ROW
103.85	Bridge on 2no Mara Cherra	Middle	Within ROW
103.9	Paddy Land	RHS	Within ROW
103.95	Dibyendu Chowmoni Village	Middle	Within ROW
104	Dibyendu Chowmoni Village	Middle	Within ROW
104.05	Pond	LHS	Within ROW
104.1	Residential area	Middle	Within ROW
104.15	Residential area	Middle	Within ROW
104.2	Market area	Middle	Within ROW
104.25	Market area	Middle	Within ROW
104.3	Market area	Middle	Within ROW
104.35	Pond	RHS	Within ROW
104.4	Pond	RHS	Within ROW
104.45	Residential area	LHS	Within ROW
104.5	Pond	RHS	Within ROW
104.55	Residential area	RHS	Within ROW
104.6	Residential area	RHS	Within ROW
104.65	Pond	RHS	Within ROW
104.7	Pond	RHS	Within ROW
104.75	Paddy Land	RHS	Within ROW
104.8	Paddy Land	RHS	Within ROW
104.85	Animal Health Centre	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
104.9	Chebri Primary Health Centre	RHS	Within ROW
104.95	Pond	RHS	Within ROW
105	Bridge on Mara Cherra	Middle	Within ROW
105.05	Paddy Land	RHS	Within ROW
105.1	House	RHS	Within ROW
105.15	Pond	RHS	Within ROW
105.2	Paddy Land	RHS	Within ROW
105.25	Pond	RHS	Within ROW
105.3	Market area	RHS	Within ROW
105.35	Paddy Land	LHS	Within ROW
105.4	Paddy Land	LHS	Within ROW
105.45	Paddy Land	LHS	Within ROW
105.5	Paddy Land	LHS	Within ROW
105.55	Residential area	Middle	Within ROW
105.6	Residential area	Middle	Within ROW
105.65	Residential area	Middle	Within ROW
105.7	Paddy Land	RHS	Within ROW
105.75	Chebri market	Middle	Within ROW
105.8	Chebri market	Middle	Within ROW
105.85	Chebri market	Middle	Within ROW
105.9	Pond	Middle	Within ROW
105.95	Pond	Middle	Within ROW
106	Residential area	Middle	Within ROW
106.05	Residential area	Middle	Within ROW
106.1	Residential area	Middle	Within ROW
106.15	Chebri market	Middle	Within ROW
106.2	Chebri market	Middle	Within ROW
106.25	Chebri market	Middle	Within ROW
106.3	Chebri market	Middle	Touching ROW
106.35	Pond	Middle	Within ROW
106.4	Pond	Middle	Within ROW
106.45	Open Land	Middle	Within ROW
106.5	Open Land	Middle	Within ROW
106.55	Bridge on Khowai River	Middle	Within ROW
106.6	Bridge on Khowai River	Middle	Within ROW
106.65	Bridge on Khowai River	Middle	Within ROW
106.7	Bridge on Khowai River	Middle	Within ROW
106.75	Open Land	Middle	Within ROW
106.8	Open Land	Middle	Within ROW
106.85	Open Land	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
106.9	Pond	LHS	Within ROW
106.95	Open Land	LHS	Within ROW
107	Houses	Middle	Within ROW
107.05	Bridge on Dholai Chara Cherra Nala	Middle	Within ROW
107.1	Residential area	Middle	Within ROW
107.15	Residential area	Middle	Within ROW
107.2	Residential area	Middle	Within ROW
107.25	Paddy Land	RHS	Within ROW
107.3	Pond	RHS	Within ROW
107.35	Pond	LHS	Within ROW
107.4	Pond	RHS	Within ROW
107.45	Pond	RHS	Within ROW
107.5	Paddy Land	RHS	Within ROW
107.55	Paddy Land	RHS	Within ROW
107.6	Paddy Land	RHS	Within ROW
107.65	Paddy Land	RHS	Within ROW
107.7	Paddy Land	RHS	Within ROW
107.75	Pond	RHS	Within ROW
107.8	Paddy Land	RHS	Within ROW
107.85	Residential area	Middle	Within ROW
107.9	Pond	RHS	Within ROW
107.95	Residential area	Middle	Within ROW
108	Residential area	Middle	Touching ROW
108.05	Pond	LHS	Within ROW
108.1	Residential area	LHS	Within ROW
108.15	Paddy Land	RHS	Within ROW
108.2	Paddy Land	RHS	Within ROW
108.25	Pond	Middle	Within ROW
108.3	Residential area	RHS	Within ROW
108.35	Paddy Land	RHS	Within ROW
108.4	Paddy Land	RHS	Within ROW
108.45	Paddy Land	RHS	Within ROW
108.5	Paddy Land	RHS	Within ROW
108.55	Residential area	LHS	Within ROW
108.6	Residential area	LHS	Within ROW
108.65	Pond	RHS	Within ROW
108.7	Residential area	Middle	Within ROW
108.75	Residential area	Middle	Within ROW
108.8	Residential area	Middle	Within ROW
108.85	Residential area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
108.9	Gourangatila H.S. School	LHS	Within ROW
108.95	Market area	Middle	Within ROW
109	Market area	Middle	Within ROW
109.05	Market area	Middle	Within ROW
109.1	Market area	Middle	Within ROW
109.15	Paddy Land	LHS	Within ROW
109.2	Paddy Land	LHS	Within ROW
109.25	Pond	LHS	Within ROW
109.3	Paddy Land	RHS	Within ROW
109.35	Paddy Land	RHS	Within ROW
109.4	Pond	LHS	Within ROW
109.45	Paddy Land	RHS	Within ROW
109.5	Paddy Land	RHS	Within ROW
109.55	Pond	LHS	Within ROW
109.6	Pond	LHS	Within ROW
109.65	Pond	RHS	Within ROW
109.7	Pond	RHS	Within ROW
109.75	Water logged area	LHS	Within ROW
109.8	Paddy Land	RHS	Within ROW
109.85	Pond	LHS	Within ROW
109.9	Paddy Land	LHS	Within ROW
109.95	Residential area	LHS	Within ROW
110	Pond	LHS	Within ROW
110.05	Pond	LHS	Within ROW
110.1	Pond	LHS	Within ROW
110.15	Residential area	Middle	Within ROW
110.2	Residential area	Middle	Within ROW
110.25	Residential area	Middle	Within ROW
110.3	Open Land	Middle	Within ROW
110.35	Open Land	Middle	Within ROW
110.4	Open Land	Middle	Within ROW
110.45	Open Land	Middle	Within ROW
110.5	Bridge on Laxminarayanpur Manta Cherra	Middle	Within ROW
110.55	Open Land	Middle	Within ROW
110.6	Open Land	Middle	Within ROW
110.65	Open Land	Middle	Within ROW
110.7	Open Land	Middle	Within ROW
110.75	Open Land	Middle	Within ROW
110.8	Paddy Land	Middle	Within ROW
110.85	Open Land	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
110.9	Open Land	Middle	Within ROW
110.95	Open Land	Middle	Within ROW
111	Open Land	Middle	Within ROW
111.05	Open Land	Middle	Within ROW
111.1	Open Land	Middle	Within ROW
111.15	Open Land	Middle	Within ROW
111.2	Open Land	Middle	Within ROW
111.25	Open Land	Middle	Within ROW
111.3	Open Land	Middle	Within ROW
111.35	Paddy Land	Middle	Touching ROW
111.4	Paddy Land	Middle	Within ROW
111.45	Open Land	Middle	Within ROW
111.5	Open Land	Middle	Within ROW
111.55	Open Land	Middle	Within ROW
111.6	Open Land	Middle	Within ROW
111.65	Residential area	Middle	Within ROW
111.7	Pond	RHS	Within ROW
111.75	Bridge on Darikapur cherra Nala	Middle	Within ROW
111.8	Market area	Middle	Within ROW
111.85	Market area	Middle	Within ROW
111.9	Market area	Middle	Within ROW
111.95	Residential area	Middle	Within ROW
112	Residential area	Middle	Within ROW
112.05	Residential area	Middle	Within ROW
112.1	Residential area	Middle	Within ROW
112.15	Residential area	Middle	Within ROW
112.2	Residential area	Middle	Within ROW
112.25	Pond	LHS	Within ROW
112.3	Darikapur Market	Middle	Within ROW
112.35	Darikapur High School	LHS	Within ROW
112.4	Open Land	RHS	Within ROW
112.45	Pond	RHS	Within ROW
112.5	Pond	RHS	Within ROW
112.55	Pond	LHS	Within ROW
112.6	Pond	LHS	Within ROW
112.65	Residential area	LHS	Within ROW
112.7	Residential area	LHS	Within ROW
112.75	Residential area	LHS	Within ROW
112.8	Residential area	LHS	Within ROW
112.85	Pond	RHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
112.9	Residential area	RHS	Within ROW
112.95	Pond	RHS	Within ROW
113	Residential area	RHS	Within ROW
113.05	Residential area	LHS	Within ROW
113.1	Residential area	Middle	Within ROW
113.15	Pond	Middle	Within ROW
113.2	Pond	Middle	Within ROW
113.25	Pond	Middle	Within ROW
113.3	Residential area	RHS	Within ROW
113.35	Bridge on Gungrai Cherra	Middle	Within ROW
113.4	Residential area	Middle	Within ROW
113.45	Pond	LHS	Within ROW
113.5	Gangari Village	LHS	Within ROW
113.55	Pond	LHS	Within ROW
113.6	Pond	Middle	Within ROW
113.65	Pond	Middle	Within ROW
113.7	Residential area	RHS	Within ROW
113.75	Residential area	LHS	Within ROW
113.8	Pond	LHS	Within ROW
113.85	Pond	LHS	Within ROW
113.9	Pond	LHS	Within ROW
113.95	Pond	LHS	Within ROW
114	Pond	LHS	Within ROW
114.05	Pond	RHS	Within ROW
114.1	Residential area	RHS	Within ROW
114.15	Residential area	RHS	Within ROW
114.2	Residential area	RHS	Within ROW
114.25	Pond	RHS	Within ROW
114.3	Residential area	RHS	Within ROW
114.35	Residential area	RHS	Within ROW
114.4	Pond	RHS	Within ROW
114.45	Pond	LHS	Within ROW
114.5	Kalyanpur Market area	Middle	Within ROW
114.55	Kalyanpur Market area	Middle	Within ROW
114.6	Kalyanpur Market area	Middle	Within ROW
114.65	Kalyanpur Market area	Middle	Within ROW
114.7	Kalyanpur Market area	Middle	Within ROW
114.75	Kalyanpur Market area	Middle	Within ROW
114.8	Pond	RHS	Within ROW
114.85	Kalyanpur Market area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
114.9	Kalyanpur Market area	Middle	Within ROW
114.95	Kalyanpur Market area	Middle	Within ROW
115	Kalyanpur Market area	Middle	Within ROW
115.05	Kalyanpur Market area	Middle	Within ROW
115.1	Pond	LHS	Within ROW
115.15	Pond	LHS	Within ROW
115.2	Kalyanpur Market area	Middle	Within ROW
115.25	Kalyanpur Market area	Middle	Within ROW
115.3	Bridge on Sarbang Cherra	Middle	Within ROW
115.35	Tripura Gramin Bank	RHS	Within ROW
115.4	Kalyanpur Market area	Middle	Within ROW
115.45	Kalyanpur Market area	Middle	Within ROW
115.5	Pond	Middle	Within ROW
115.55	Pond	LHS	Within ROW
115.6	Pond	RHS	Within ROW
115.65	Shops	LHS	Within ROW
115.7	Kalyanpur Forest Division	LHS	Within ROW
115.75	Kalyanpur Forest Division	LHS	Within ROW
115.8	Kalyanpur Forest Division	LHS	Within ROW
115.85	Kalyanpur Forest Division	LHS	Within ROW
115.9	Residential area	Middle	Within ROW
115.95	Residential area	Middle	Within ROW
116	Residential area	Middle	Within ROW
116.05	Residential area	Middle	Within ROW
116.1	Residential area	Middle	Within ROW
116.15	Residential area	Middle	Within ROW
116.2	Residential area	Middle	Within ROW
116.25	Kali Temple	LHS	Within ROW
116.3	Paddy Land	RHS	Within ROW
116.35	Paddy Land	RHS	Within ROW
116.4	Paddy Land	RHS	Within ROW
116.45	Bridge on Kubra Cherra	Middle	Within ROW
116.5	Pond	RHS	Within ROW
116.55	Residential area	LHS	Within ROW
116.6	Residential area	LHS	Within ROW
116.65	Residential area	LHS	Within ROW
116.7	Residential area	LHS	Within ROW
116.75	Hill with jungle	RHS	Within ROW
116.8	Pond	LHS	Within ROW
116.85	Pond	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
116.9	Jungle	RHS	Within ROW
116.95	Jungle	RHS	Within ROW
117	Jungle	RHS	Within ROW
117.05	Residential area	LHS	Within ROW
117.1	Residential area	LHS	Within ROW
117.15	Residential area	LHS	Within ROW
117.2	Residential area	LHS	Within ROW
117.25	Residential area	LHS	Within ROW
117.3	Durga Temple	LHS	Within ROW
117.35	Utabari SB School	RHS	Within ROW
117.4	Residential area	Middle	Within ROW
117.45	Residential area	Middle	Within ROW
117.5	Residential area	Middle	Within ROW
117.55	Pond	RHS	Within ROW
117.6	Pond	RHS	Within ROW
117.65	Jungle	LHS	Within ROW
117.7	Jungle	LHS	Within ROW
117.75	Pond	LHS	Within ROW
117.8	Segun Garden	LHS	Within ROW
117.85	Segun Garden	LHS	Within ROW
117.9	Segun Garden	LHS	Within ROW
117.95	Segun Garden	LHS	Within ROW
118	Segun Garden	LHS	Within ROW
118.05	Paddy Land	Middle	Within ROW
118.1	Paddy Land	Middle	Within ROW
118.15	Paddy Land	LHS	Within ROW
118.2	Paddy Land	LHS	Within ROW
118.25	Pond	RHS	Within ROW
118.3	Pond	RHS	Within ROW
118.35	Residential area	Middle	Within ROW
118.4	Residential area	Middle	Within ROW
118.45	Residential area	Middle	Within ROW
118.5	Open Land	Middle	Within ROW
118.55	Open Land	Middle	Within ROW
118.6	Open Land	Middle	Within ROW
118.65	Totabari Village	LHS	Within ROW
118.7	Residential area	Middle	Within ROW
118.75	Residential area	Middle	Within ROW
118.8	Residential area	Middle	Within ROW
118.85	Residential area	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
118.9	Residential area	Middle	Within ROW
118.95	Residential area	Middle	Within ROW
119	Market area	Middle	Within ROW
119.05	Market area	Middle	Within ROW
119.1	Market area	Middle	Within ROW
119.15	Market area	Middle	Within ROW
119.2	Market area	Middle	Within ROW
119.25	Market area	Middle	Within ROW
119.3	Pond and bridge on Majvandar cherra	Middle	Within ROW
119.35	Both side pond	Middle	Within ROW
119.4	BSNL tower	RHS	Within ROW
119.45	Residential area	Middle	Within ROW
119.5	Residential area	Middle	Within ROW
119.55	Soni Temple	LHS	Within ROW
119.6	Residential area	Middle	Within ROW
119.65	Residential area	Middle	Within ROW
119.7	Residential area	Middle	Within ROW
119.75	Residential area	Middle	Within ROW
119.8	Residential area	Middle	Within ROW
119.85	Kamalnagar Village	Middle	Within ROW
119.9	Kamalnagar Village	Middle	Within ROW
119.95	Kamalnagar Village	Middle	Within ROW
120	Kamalnagar Village	Middle	Within ROW
120.05	Kamalnagar Village	Middle	Within ROW
120.1	Paddy Land	Middle	Within ROW
120.15	Residential area	Middle	Within ROW
120.2	Residential area	Middle	Within ROW
120.25	Residential area	Middle	Within ROW
120.3	Residential area	Middle	Within ROW
120.35	Residential area	Middle	Within ROW
120.4	Residential area	Middle	Within ROW
120.45	Mara Gong Para	Middle	Within ROW
120.5	Pond	LHS	Within ROW
120.55	Shiv Temple and Pond	RHS	Within ROW
120.6	Pond	LHS	Within ROW
120.65	Mara Gong Para	Middle	Within ROW
120.7	Pond	LHS	Within ROW
120.75	Mara Gong Para	Middle	Within ROW
120.8	Mara Gong Para	Middle	Within ROW
120.85	Mara Gong Para	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
120.9	Mara Gong Para	Middle	Within ROW
120.95	Pond	RHS	Touching ROW
121	Mara Gong Para	Middle	Within ROW
121.05	Pond	LHS	Within ROW
121.1	Amarnagar Village	Middle	Within ROW
121.15	Amarnagar Village	Middle	Within ROW
121.2	Amarnagar Village	Middle	Within ROW
121.25	Amarnagar Village	Middle	Within ROW
121.3	Pond	LHS	Within ROW
121.35	Amarnagar Village	Middle	Within ROW
121.4	Amarnagar Village	Middle	Within ROW
121.45	Amarnagar Village	Middle	Within ROW
121.5	Amarnagar Village	Middle	Within ROW
121.55	Moharcherra Market	Middle	Within ROW
121.6	Moharcherra Market	Middle	Within ROW
121.65	Moharcherra Market	Middle	Within ROW
121.7	Moharcherra Market	Middle	Within ROW
121.75	Moharcherra Market	Middle	Within ROW
121.8	Moharcherra Market	Middle	Within ROW
121.85	Bridge on Moharchara Sara Nala	Middle	Within ROW
121.9	Moharcherra Market	Middle	Within ROW
121.95	Moharcherra Market	Middle	Within ROW
122	Pond	RHS	Within ROW
122.05	Moharcherra Village	RHS	Within ROW
122.1	Moharcherra Village	RHS	Within ROW
122.15	Moharcherra Village	RHS	Within ROW
122.2	Moharcherra Village	RHS	Within ROW
122.25	Moharcherra Village	RHS	Within ROW
122.3	Moharcherra Village	RHS	Within ROW
122.35	Bridge on Moharchara sara 2 Nala	Middle	Within ROW
122.4	Moharchara HS School	LHS	Within ROW
122.45	Ananda Marga Primary School	RHS	Within ROW
122.5	Pond	LHS	Within ROW
122.55	Moharcherra Village	Middle	Within ROW
122.6	Moharcherra Village	Middle	Within ROW
122.65	Moharcherra Village	Middle	Within ROW
122.7	Pond	LHS	Within ROW
122.75	Pond	LHS	Within ROW
122.8	Pond	LHS	Within ROW
122.85	Pond	LHS	Within ROW

Chainage	Key Environmental feature	Side	Remark
122.9	Pond	LHS	Within ROW
122.95	Moharcherra Village	Middle	Within ROW
123	Moharcherra Village	Middle	Within ROW
123.05	Moharcherra Village	Middle	Within ROW
123.1	Moharcherra Village	Middle	Within ROW
123.15	Moharcherra Village	Middle	Within ROW
123.2	Moharcherra Village	Middle	Within ROW
123.25	Moharcherra Village	Middle	Within ROW
123.3	Culvert	Middle	Within ROW
123.35	Chilitabari Village	Middle	Within ROW
123.4	Chilitabari Village	Middle	Within ROW
123.45	Chilitabari Village	Middle	Within ROW
123.5	Chilitabari Village	Middle	Within ROW
123.55	Chilitabari Village	Middle	Within ROW
123.6	Chilitabari Village	Middle	Within ROW
123.65	Chilitabari Village	Middle	Within ROW
123.7	Over bridge on Railway Track will statt	Middle	Within ROW
123.75	Over bridge on Railway Track	Middle	Within ROW
123.8	Over bridge on Railway Track	Middle	Within ROW
123.85	Over bridge on Railway Track	Middle	Within ROW
123.9	Over bridge on Railway Track	Middle	Within ROW
123.95	Over bridge on Railway Track	Middle	Within ROW
124	Over bridge on Railway Track	Middle	Within ROW
124.05	Over bridge on Railway Track	Middle	Within ROW
124.1	Over bridge on Railway Track	Middle	Within ROW
124.15	Over bridge on Railway Track	Middle	Within ROW
124.2	Over bridge on Railway Track	Middle	Within ROW
124.25	Over bridge on Railway Track	Middle	Within ROW
124.3	Below Railway Track	Middle	Within ROW
124.35	Below Railway Office	RHS	Within ROW
124.4	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.45	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.5	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.55	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.6	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.65	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.7	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.75	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.8	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.85	Over bridge on Railway Track (Residential area)	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
124.9	Over bridge on Railway Track (Residential area)	Middle	Within ROW
124.95	Over bridge on Railway Track (Residential area)	Middle	Within ROW
125	Over bridge on Railway Track (Residential area)	Middle	Within ROW
125.05	Residential area	Middle	Within ROW
125.1	Residential area	Middle	Within ROW
125.15	Residential area	Middle	Within ROW
125.2	Residential area	Middle	Within ROW
125.25	Residential area	Middle	Within ROW
125.3	Residential area	Middle	Within ROW
125.35	Residential area	Middle	Within ROW
125.4	Residential area	Middle	Within ROW
125.45	Culvert	Middle	Within ROW
125.5	Residential area	Middle	Within ROW
125.55	Residential area	Middle	Within ROW
125.6	Pond	Middle	Within ROW
125.65	Pond	RHS	Within ROW
125.7	Residential area	LHS	Within ROW
125.75	Pond	LHS	Within ROW
125.8	Residential area	LHS	Within ROW
125.85	Residential area	LHS	Within ROW
125.9	Pond	RHS	Within ROW
125.95	Residential area	Middle	Within ROW
126	Residential area	Middle	Within ROW
126.05	Residential area	Middle	Within ROW
126.1	Residential area	Middle	Within ROW
126.15	Eacher Bill HS School	RHS	Within ROW
126.2	Residential area	Middle	Within ROW
126.25	Residential area	Middle	Within ROW
126.3	Residential area	Middle	Within ROW
126.35	Residential area	Middle	Within ROW
126.4	Residential area	Middle	Within ROW
126.45	Residential area	Middle	Within ROW
126.5	Residential area	Middle	Within ROW
126.55	Residential area	Middle	Within ROW
126.6	Residential area	Middle	Within ROW
126.65	Residential area	Middle	Within ROW
126.7	Teliamura English Medium High School	LHS	Within ROW
126.75	Karailong Market	Middle	Within ROW
126.8	Karailong Market	Middle	Within ROW
126.85	Karailong Market	Middle	Within ROW

Chainage	Key Environmental feature	Side	Remark
126.9	Karailong Market	Middle	Within ROW
126.95	Karailong Market	Middle	Within ROW
127	Karailong Market	Middle	Within ROW
127.05	Karailong Market	Middle	Within ROW
127.1	Karailong Market	Middle	Within ROW
127.15	Teliamura High School	RHS	Within ROW
127.2	Bridge on Sudhachhara River	Middle	Within ROW
127.25	Karailong Market	Middle	Within ROW
127.3	Karailong Market	Middle	Within ROW
127.319	End at Teliamura Junction	Middle	Within ROW

Source: DPR Vol-IV (Part A)

APPENDICES

APPENDIX 1

ENVIRONMENTAL MANAGEMENT PLAN

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions 1.2 Construction of concrete pavement in habitat areas considering alignment level and drainage.	• Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (drained by habitats occasionally to prevent damage to road and rain water entry to habitats' houses. ▪ Provision of adequate no. of cross drainage structures based on drainage pattern around the alignment	To meet the Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 and avoid water logging	Throughout the habitat areas Provision for Both side drains in all the important locations including built-up areas.	MI: Design and number of cross and side drains, slab/box culverts, and Hume pipes PT: Design and numbers are in accordance with site needs	Review of detail design documents & drawings and comparison with site conditions/ During design stage	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	NHIDCL/CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
1.3 Safety along the proposed alignment	▪ Vertical and horizontal geometrics in consistent to IRC/MORTH guidelines ▪ Provision of crash barriers at high embankments. ▪ Speed breakers in habitat areas, schools, junction and curves to regulate speed. ▪ Provision of retro-reflective warning signboards near school, hospital ,religious places and forests ▪ Safety kerb at all bridge s ▪ Informatory signage on approach to school, ▪ Ambulance and medical aid posts ▪ Checking for overloading at toll plazas ▪ Speed restrictions in built up sections curve locations etc	To meet the Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012 and to make sure safety provision in design stage	Crash barriers Speed Restriction sign posts at road junction at 92 locations of which 8 are major and 84 are minor intersections. Major intersections are at Design Chainage-21.100 (Starting point Kailashar to Kumarghat), 40.788(Roads to Fatikroy), 69.640 (Road to Ambassa), 71.068(Road to Kamalpur), 96.120(Bypass Starting point at Khowai), 101.110 (End point of Khowai Bypass), 106.970 (Road to Ramchandra Ghat Market), 127.319 (Road to Agartala), Object Markers Delineators	MI: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc. PT: numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions/ During design stage	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	NHIDCL (NH)/CSC
2. Cross broder, Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	▪ Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	To meet the IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement and to minimize damage to the bridges/pavments	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions/ during design stage	preliminary design cost of F/S consultant Detailed design cost to be borne by concessionaire	Design consultant	NHIDCL/CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.2 Earthquake	▪ Relevant IS codes shall be adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area	To make the Dislodgement of superstructure as per Clause 222 of IRC: 6 and design new bridge as per relevant IRC code, to minimize damage in case of an earthquake	Entire Stretch	MI: Bridges and Culverts PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions/ during design stage	F/S consultant, Detailed design cost to be borne by concessionaire	concessionaire	NHIDCL/ CSC
3. Protected area, Diversion of Forest Land and Cutting of Trees								
3.1 Need for cutting of trees and diversion of forest land	▪ Geometric adjustments to minimize tree cutting and diversion of forest land ▪ Obtain tree cutting permission from forest department ▪ Provision for mandatory compensatory afforestation as per the norms for deposit of payment to Forestry Department	To follow Forest Conservation Act, 1980 and minimize cutting of trees & forest land acquisition	Throughout the corridor. Especially in the forest cover area. Hence all the trees coming in ROW in those parts will fell down.	MI: Number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation as per the norms fixed by state forest department PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	Review final design. Check budget provision for compensatory afforestation and additional Plantation/ during design stage	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	NHIDCL, Design consultants forest department	NHIDCL/ Forest department

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Ecosystem								
4.1 Road design causing accidents of wild animals and disruption in their movement	▪ Provision of rumble strip, cautionary and informatory sign boards near potential wildlife crossing locations ▪ Speed restriction in the sections where wildlife movement is reported ▪ Clearance of all shrubs grown inside the ROW once in a year after monsoon to provide better lateral visibility to drivers ▪ Maintain 15 m distance between two trees during avenue plantation	To minimize accidents and disruption of wildlife movement	No visible wildlife movement in the project road. However, project road passing through forest land shall be considered.	MI: budget allocation for rumble strips, cautionary and informatory sign boards, PT: Budget adequate to fulfill the installation of recommended facilities and structures	Review of bid documents and project budget plan/ during design stage	Covered under costs for F/S Consultant	NHIDCL, Design Consultant	NHIDCL in coordination with Forest Department
4.2 Forest Fires	▪ Measures to avoid accident followed by fuel accumulation ▪ Removal of maintenance slash or management by controlled burning. ▪ Plant fire-resistant species in RoW ▪ Thinning slashing during non-dry season ▪ No construction camp within 500m	To minimize forest fire	Throughout the	MI: Damage to roadside flora and spillage /fuel accumulation induced accident PT: Zero incidence of forest ire	During design stage	Covered under F/S consultant cost	concessionaire	NHIDCL/ Forest department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	▪ All telephone and electrical poles/wires and underground cables should be shifted before start of construction ▪ Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services ▪ Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any	To meet the legal requirements and maintain the utility services in the area	Near forest covers. corridor	MI: Number of complaints from local people, Shifting plan and status of utility services PT: No. of complaints should be zero. Minimal time for utility shifting	Interaction with concerned utility authorities and local public/ during per construction stage	Included under NHIDCL's costs	Contractor/ NHIDCL/utility company	NHIDCL/ CSC

B. Construction Stage								
1. Air Pollution								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	▪ Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC ▪ Transport, loading and unloading of loose and fine materials through covered vehicles. ▪ Paved approach roads. ▪ Storage areas to be located downwind of the habitation area. ▪ Water spraying on earthworks, unpaved haulage roads and other dust prone areas. ▪ Provision of PPEs to workers.	To minimize air pollution and meet the MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	MI: PM_{10} & $PM_{2.5}$ level measurements Complaints from locals due to dust PT: $PM_{2.5}$ level<60 g/m^3 & PM_{10} level < 100 g/m^3 Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor/ during construction period of two yearsquarterly during dry season	Included in civil works cost	Concessionaire	NHIDCL
1.2 Emission of air pollutants (HC, SO_2, NO_x, CO etc.) from vehicles due to traffic congestion and use of equipment and machinery	▪ Regular maintenance of machinery and equipment. ▪ Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. ▪ Only crushers licensed by the PCB shall be used ▪ DG sets with stacks of adequate height and use of low sulphur diesel as fuel. ▪ LPG should be used as fuel source in construction camps instead of wood ▪ Ambient air quality monitoring ▪ Contractor to prepare traffic management and dust suppression plan duly approved by NHIDCL (NH), Tripura	To follow the Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	MI: Levels of HC, SO_2, NO_2, and CO. Status of PUC certificates PT: SO_2 and NO_2 levels are both less than 80ug/m^3. PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by Contractor/ during construction period of two years quarterly during dry season	Included in civil works cost	Concessionaire	NHIDCL /CSC
2. Noise Pollution								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	▪ All equipment to be timely serviced and properly maintained. ▪ Construction equipment and machinery to be fitted with silencers and maintained properly. ▪ Only IS approved equipment shall be used for construction activities. ▪ Timing of noisy construction activities shall be done during night time and weekend near schools, ▪ Implement noisy operations intermittently to reduce the total noise generated	To follow Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works and mimimize pollution	Throughout project section especially at Kirtan Tali Girls School, Chaintali Mitra Para ICDS Center, Vivekananda Vidyapith, Miling Sub-health Centre, Baman Charra High School, Srirampur Health Centre, Sukhiya Bari J.B.	MI: day and night Noise levels. Number of complaints from local people PT: Zero complaints or no repeated complaints by local people. Average day and	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site/ during construction period once in two year	Included in civil works costs	Concessionaire	NHIDCL/CSC

	▪ Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. ▪ Restrict construction near residential, built up and forest areas construction to the night hours. ▪ Honking restrictions near sensitive areas ▪ PPEs to workers ▪ Noise monitoring as per EMoP.		School,Shadas Bashnas Bari SB School, Ganaki ClassXII School, Santala Sub-health Centre, Gourangatila H.S. School, Darikapur High School, Utabari SB School, Moharchara HS School, Ananda Marga Primary School, Eacher Bill HS School, Teliamura English Medium High School, Teliamura High School and all the Anganbadi Centres throughout the project road etc.	night time noise levels are within permissible limits for work zone areas				
3. Land and Soil Pollution								
3.1 Landuse Change and Loss of productive / topsoil	▪ Non-agricultural areas to be used as borrow areas to the extent possible. ▪ If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. ▪ Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original landuse	To mimimize land acquisition and preservation of top soil	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3.2 Borrow area management	▪ Obtain EC from SEIAA before opening any new borrow area. ▪ Comply to EC conditions of SEIAA ▪ Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. ▪ Depths of borrow pits to be regulated and sides not steeper than 25%. ▪ Topsoil to be stockpiled and protected for use at the rehabilitation stage. ▪ Transportation of earth materials through covered vehicles. ▪ Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation ▪ Borrow areas not to be dug continuously. ▪ To the extent borrow areas shall be sited away from habitat areas. ▪ Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond.	To follow IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause 305.2.2 MORTH Specifications for Road and Bridgeworks Guidelines for Borrow Areas management and propoer closing of borrow areas to avoid accidents & land stability	Borrow sites location	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people. PT: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints No use of black cotton soil	Review of design documents and site observations/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC
3.3 Quarry Operations	▪ Aggregates will be sourced from existing licensed quarries. ▪ Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to NHIDCL. ▪ The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. ▪ Obtain environmental clearance from SEIAA in case of opening new quarry	To meet Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules and to minimize the environmental damage	Existing quarries of project districts viz. Unakoti, Dhalai & Khowai Districts.	MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new Quarries/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3.4 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	▪ Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. ▪ Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. ▪ Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. ▪ Land taken for construction camp and other temporary facility shall be restored to its original conditions	To minimize environmental pollution due to utilization of haul roads	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition PT: Zero occurrence of destroyed/compacted land and undestroyed land	Site observation/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC
3.5 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	▪ Construction vehicles and equipment will be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. ▪ Fuel storage and refuelling sites to be kept away from drainage channels. ▪ Unusable debris shall be dumped in ditches and low lying areas. ▪ To avoid soil contamination Oil-Interceptors shall be provided at wash down and refuelling areas. ▪ Waste oil and oil soaked cotton/ cloth shall be stored in containers labelled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors ▪ Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. ▪ Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board	To minimize soil contamination due to spilage	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area PT: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation/ during construction period of two years	Included in civil work cost.	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Topography and Geology								
4.1 Change in topography due to Construction activities, earthwork, and cut and fill, stockpiles etc. No change in geology is anticipated	▪ Side slopes of all cut and fill areas will be graded and covered, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than2:1. ▪ The earth stockpiles to be provided with gentle slopes to soil erosion.	To meet IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion and minimize slope failure and soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues	Review of design documents and site Observation/ during construction period of two years especially in rainy season	Included in civil works cost	Concessionaire	NHIDCL/ CSC
5. Hydrology								
5.1 Sourcing of water during Construction	▪ Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. ▪ Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. ▪ Water intensive activities not to be undertaken during dry season. ▪ Provision of water harvesting structure	To follow CGWA Guidelines and conservation of water resources	Throughout the project location	MI: Approval from competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local People/ during construction period of two years	Included in civil work cost	Concessionaire	NHIDCL/C SC
5.2 Disposal of strom water during construction	▪ Provisions shall be made to connect road side drains with existing nearby natural drains.	To minimize water logging during rain and follow Clause No.1010 EP Act 1986 MORT&H Specifications for Road and Bridgeworks	Throughout the Project section	MI: Condition of drainage system in construction site. Presence /absence of water logging in project area. PT: Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents/ during construction period of two years	Included in civil work cost	Concessionaire	NHIDCL /CSC
5.3 Alteration in surface water hydrology	▪ Existing drainage system to be maintained and further enhanced. ▪ Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. ▪ Culverts reconstruction shall be done during lean flow period.	To meet design requirement, Clause No. 501.8.6. MORT&H Specifications and maintaining the existing drainage system	All the major streams and Nallahs flowing through the proposed road, all the road side ponds (238nos) and Rivers mainly Khowai, Dhalai intersecting	MI: Proper flow of water in existing streams and rivers PT: No complain of water shortage by downstream communities. No	Review of design documents Site observation/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

			the project road. There are 49 rivers/streams intersecting the project road.	record of overtopping/ water logging				

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6. Ecosystem								
6.1 Vegetation loss due to site preparation and construction activities	▪ Restrict tree cutting upto toe line considering safety to road users. ▪ Roadside trees to be removed with prior approval of competent authority. ▪ Mandatory compensatory plantation at norms fixed by State Forest Department ▪ Additional plantation as per the IRC guidelines to be carried out by concessionaire ▪ Regular maintenance trees planted. ▪ Provision of LPG in construction camp as fuel source to avoid tree cutting. ▪ Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. ▪ Controlled use of pesticides/ fertilizers	To follow Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66 and mimimize vegetation loss	Roadside plantation throughout the project road with survival rate of minimum 75% Additional Plantation norms fixed by state forest dept. for diversion of forest cover as 'Compensatory Afforestation' in the designated location notified by state forest department	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Additional compensatory afforestation done on norms fixed by state forest department.	Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy Field observations/ during construction period of two years	Mandatory Compensatory afforestation cost is included in project costs under NHIDCL-NH. Additional compensatory afforestation costs included in civil works costs	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	NHIDCL-NH/CSC/ State Forest Department
7. Construction Camps/Working conditions								
7.1 Impact associated with location	▪ All camps should be established with prior permission from PCB. Camps to maintain minimum distance from following: # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from traffic route # 500 m from identified wildlife crossing areas	To meet the design Requirement The Water (Prevention and Control of Pollution) Act,1974and its amendments thereof and minimize the environmental impacts due to construction camps activities, discharges and emissions	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community/ during construction period of two years	Included in civil works cost	Concessionaire and EO	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Worker's Health in construction camp	▪ The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by NHIDCL (NH). The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. ▪ Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. ▪ Preventive medical facilities in camp ▪ Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. ▪ No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. ▪ Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.	To make sure that the Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act,1974 and amendments thereof shall be followed and hygiene in camp shall be maintained	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby/ during construction period of two years	Part of the civil works costs	Concessionaire	NHIDCL /CSC
8. Management of Construction Waste/Debris								
8.1 Selection of Dumping Sites	▪ Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. ▪ Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality ▪ Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies ▪ Dumping sites must be having adequate capacity equal to the amount of debris	To meet design Requirement, MORT&H guidelines and General Conditions of Contract Document and to follow construction & Demolition waste rule, 2016	At all Dumping/Disposal Sites	MI: Location of dumping sites Number of public complaints. PT: No public complaints. Consent letters for all dumping sites available	Field survey and interaction with local people. Review of consent Letter/ during construction period of two years	Included in civil works cost.	Concessionaire .	NHIDCL /CSC

	generated. ▪ Public perception and consent from the village Panchayats has to be obtained before finalizing the location.			with contractor				

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
8.2 Reuse and disposal of construction and dismantled waste	▪ The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. ▪ All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. ▪ Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. ▪ The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. ▪ Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.	To meet design Requirement, MORT&H guidelines and General Conditions of Contract Document and to follow construction & Demolition waste rule, 2016	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people/ during construction period of two years	Included in civil works cost.		
9. Accidents, Traffic Management and Safety								
9.1 Management of existing traffic and safety	▪ Traffic Management Plan shall be submitted by the contractor and approved by the CSC. ▪ The traffic control plans shall contain	To meet design requirement and IRC: SP: 27 -1984, Report Containing	Throughout the project road corridor	MI: Traffic management plan. Presence/ absence of safety signs,	Review traffic management plan Field observation of traffic management	Included in civil works cost.	Concessionaire	NHIDCL /CSC

	details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. ▪ The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.	Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014 and avoid traffic congestion and safety of workers/road users during construction		traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site	and safety system Interaction with people in vehicles using the road/ during construction period of two years			

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	▪ On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. ▪ Restriction of construction activity to only one side of the existing road ▪ The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". ▪ Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document						
9.**2** Pedestrians, animal movement	▪ Temporary access and diversion, with proper drainage facilities. ▪ Access to the schools, temples and other public places must be maintained when construction takes place near them. ▪ Fencing wherever animal movement is expected. ▪ Large number of box culverts has been proposed. .All structures having vertical clearance above 2m and not catering to perennial flow of water may serve as underpass for animals	Same as above	Near habitation on both sides of schools, health centres, religious centres, graveyards, construction sites, haulage roads, diversion sites.	MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people PT: Easy access to schools, temples and public places. Zero complaints	Field observation Interaction with local people/ during construction period of two years	Included in civil works cost.	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
9.3 Safety of Workers and accident risk from construction activities	▪ Contractors to adopt and maintain safe working practices. ▪ Usage of fluorescent and retro refectory signage, in local language at the construction sites ▪ Training to workers on safety procedures and precautions. ▪ Mandatory appointment of safety officer. ▪ All regulations regarding safe scaffolding, ladders, working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with. ▪ Provision of PPEs to workers. ▪ Provision of a readily available first aid unit including an adequate supply of dressing materials. ▪ The contractor will not employ any person below the age of 18years ▪ Use of hazardous material should be minimized and/or restricted. ▪ Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. ▪ Accident Prevention Officer must be appointed by the contractor.	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction Workers/ during construction period of two years	Included in civil works cost	Obligation of Concessionaire	NHIDCL /CSC
9.4 Accident risk to local community	▪ Restrict access to construction sites only to authorized personnel. ▪ Physical separation must be provided for movement of vehicular and human traffic. ▪ Adequate signage must be provided for safe traffic movement ▪ Provision of temporary diversions and awareness to locals before opening new construction fronts.	Same as above	Construction sites	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
10. Site restoration and rehabilitation								
10.1 Clean-up Operations, Restoration and Rehabilitation	▪ Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. ▪ The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. ▪ All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. ▪ All the opened borrow areas will be rehabilitated and 'Engineer' will certify	To restore the original condition in surrounding	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found Satisfactory/ immediately after construction is over	Included in civil works cost.	Concessionaire	NHIDCL /CSC
Operation and Maintenance stage								
1. Ecosystem								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	▪ Effectiveness of mitigative measures (rumble strips, informative hoarding /cautionary signage, clearance of shrubs from right of way, maintaining 15m distance between 2 trees during avenue plantation etc.) recommended in design stage shall be monitored. ▪ NHIDCL, Tripura to keep record of all accidents. ▪ Fresh assessment in case of future widening	To minimize vehicle-animal collision and human-animal conflict	No wildlife movement corridor in the project road. However, provision shall be undertaken in the forest area along the project road.	MI: No. of vehicle - animal collision. Time (day or night, season/month and location of collision. Cause of collision. No of incidence of human – animal conflict. PT: minimum vehicle – animal collisions. No of consultation done with forest department	Site Observation Discussion with local People Collection of information from Forestry Department/ during operation period	Included in Operation / Maintenance cost	NHIDCL field offices/Forest Department	
1.2 Vegetation	▪ Planted trees, shrubs, and grasses to be properly maintained. ▪ The tree survival audit to be conducted at least once in a year to assess the effectiveness	To follow Forest Conservation Act 1980 and make sure survival of trees/green cover	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of	Records and field observations. Information from Forestry Department/ during operation period	Included in Operation / Maintenance cost	NHIDCL /Forest Department	

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Pollution								
2.1 Air pollution due to vehicular movement	▪ Roadside tree plantations shall be maintained at least with 70% survival rate. ▪ Regular maintenance of the road will be done to ensure good surface condition ▪ Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. ▪ Signages shall be provided reminding them to properly maintain their vehicles to economize on fuel consumption. ▪ Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipment's	To meet the requirement of Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981 and minimize the air pollution	Throughout the project road corridor	MI: Ambient air quality ($PM_{2.5}$,PM_{10}, CO,SO_2 ,NO_2) PT: Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection/ during operation period quarterly during dry season	Included in Operation / Maintenance cost	NHIDCL	
3. Noise Pollution								
3.1 Noise due to movement of traffic	▪ Effective traffic management and good riding conditions shall be maintained ▪ Speed limitation to 20 km/hour and honking restrictions near sensitive receptors ▪ Construction of noise barriers near sensitive receptors with consent of local community ▪ The effectiveness of the multi layered plantation should be monitored and if need be, solid noise barrier shall be placed. ▪ Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	To meet the requirement of Noise Pollution (Regulation and Control) Rules,2000 and amendments Thereof and minimize the noise pollution	Sensitive receptors- Kirtan Tali Girls School, Chaintali Mitra Para ICDS Center, Vivekananda Vidyapith, Miling Sub-health Centre, Baman Charra High School, Srirampur Health Centre, Sukhiya Bari J.B. School,Shadas Bashnas Bari SB School, Ganaki ClassXII School, Santala Sub-health Centre, Gourangatila H.S. School, Darikapur High School, Utabari SB School, Moharchara HS School, Ananda Marga Primary School, Eacher Bill HS School, Teliamura English Medium High School, Teliamura	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites/ quarterly during operation period	Included in Operation / Maintenance cost	NHIDCL	

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil Pollution								
4.1 Soil erosion at embankment during heavy rainfall.	▪ Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. ▪ Necessary measures to be followed wherever there are failures	To minimize soil erosion during strom	At bridge locations and embankment as well as highland slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site Observation/ during operation period in rainy season	Included in Operation / Maintenance cost	NHIDCL	
5. Water resources/Flooding and Inundation/Sedimentation								
5.1 Siltation	▪ Regular checks shall be made for soil erosion and turfing conditions for its effective maintenance.	To check erosion and minimize siltation	Near all the surface Water bodies	MI: Water quality PT: No turbidity of surface water bodies due to the road	Site observation/ during operation period in rainy season	Included in Operation / Maintenance cost	NHIDCL	
5.2 Water logging due to blockage of drains, culverts or streams	▪ Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. ▪ Monitoring of water borne diseases due to stagnant water bodies	To meet IRC: SP:21-2009 and avoid water logging	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging 70% tree survival	Site observation/ during operation period in rainy seson	Included in Operation / Maintenance cost	NHIDCL	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	▪ Maintain shoulder completely clear of vegetation. ▪ Minimum offset as prescribed in IRC:SP:21-2009 to be maintained ▪ Regular maintenance/trimming of plantation along the road side ▪ No invasive plantation near the road.	To meet IRC: SP:21-2009 and improve visibility	Throughout the Project route	MI: Presence and extent of vegetation growth on either side of road. Number of accidents. PT: No accidents due to vegetation growth	Visual inspection Check accident records/ during operation period	Included in Operation / Maintenance cost	NHIDCL	

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	▪ Traffic control measures, including speed limits, will be enforced strictly. ▪ Further encroachment of squatters within the ROW will be prevented. ▪ Monitor/ensure that all safety provisions included in design and construction phase are properly maintained ▪ Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. ▪ Tow-way facility for the breakdown vehicles if possible.	To meet IRC:SP:55-2014 and provide traffic control measures to minimize accidents	Throughout the Project route	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non-fatal accident rate is reduced after improvement	Review accident Records Site observations/ during operation period	Included in Operation / Maintenance cost	NHIDCL	
6.3.Transport of Dangerous Goods	▪ Existence of spill prevention and control and emergency responsive system ▪ Emergency plan for vehicles carrying hazardous material	To prepare emergency plan for vechile carrying harzdous chemical/metarials	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records/ during operation period	Included in Operation / Maintenance cost	NHIDCL	

Source: DPR Vol-I (main report) and EIS Pvt. Ltd.

APPENDIX 2

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Purpose of the monitoring	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air **Pollution**	Construction stage	SPM, PM_{10} $PM_{2.5}$ SO_2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	To assess the ambient air quality during the construction stage for comparision with baseline values	Sampling per built up area during active construction as per given numbers of samples- Batching Plant (1),Near Hot Mix Plant (1), Teliamura(1), Rajkandi (1), Dwarikapur (1), Lakshmichera (1), Khowai (1), Bamunchera (1), Durgachomahini (1), Mahadevtila (1), Kirtantali (1) Total=12 Samples (Batching and hot mix plants sampling part of SPCB annual renewal of permits)	Thrice in a year during construction for 2 years	Air quality standard by CPCB	12X3X2X10000= 7,20,000	Concessionaire through approved monitoring agency	NHIDCL/ CSC
	Operation stage			To assess the ambient air quality during the operation stage for confirming inmprovement in ambient air quality	Representative sample three each for residential, commercial and sensitive (9Locations)-	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3X10000x9 =2,70,000	NHIDCL through approved monitoring agency	NHIDCL /CSC
Water **Pollution**	Construction stage	Drinking Water (as per IS: 10500-1991)	Surface water criteria for freshwater classification	To assess the water quality during the construction stage for comparision with baseline values	water from 10 locations including each at construction camps (drinking water) Grab sample collected from source and analysis as per Standard Methods for Examination of Water and Wastewater	3 times in year (except monsoon) for 2years	Water quality standard by CPCB	10x 5000x3x2 = 3,00,000	Concessionaire through approved monitoring agency	NHIDCL /CSC
	Operation stage			To assess the water quality during the operation	Drinking water from 6locations (representative)	3 times in a year (except monsoon) for one year	Water quality standard by CPCB	6X3X5000 = 90, 000	NHIDCL through approved monitoring agency	NHIDCL/CSC

				stage for changes if any						
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and	IS:4954-1968 as adopted by CPCB for Identified Study	To assess the ambient noise level during the construction stage for comparision with baseline values	Same as air quality at 12 locations	Once in a year for Two years	National Ambient Noise Standard	12X2X5000 =1,20,000	Concessionaire through approved monitoring agency	NHIDCL /CSC
	Operation stage	night	Area CPCB/IS:4954-1968Using Noise level meter	To assess the noise level during the operation stage for confirming inmprovement if any	Same as air quality	One time per year for 1 year (9locations)	specified in Environment Protection Act, 1986	5000x9 =45,000	NHIDCL through approved monitoring agency	NHIDCL /CSC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer SHAJ/ supervision consultant	To assess soil qualityy during the construction stage for comparision with baseline values	Labour Camp, Dumping/storage areas and HMP sites (6 locations)	Once during whole construction stage	ICAR standard	48000(@₹ 8000/ sample)	Concessionaire through approved monitoring agency	NHIDCL/CSC
	Operation stage	Oil and grease		To assess the soil quality during the operation stage if any spliage occurred	At oil spillage locations and other probable soil contamination location (Max. 6locations)	Once for the first year of operation	CPCB standard	48000(@₹ 8000/ sample)	NHIDCL through approved agency	NHIDCL /CSC
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		To identify the erosion location if any so that corrective action shall be taken appropriately	Cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	NHIDCL /CSC
	Operation Stage			To identify the erosion location if any so that corrective action shall be taken appropriately		Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of NHIDCL	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Purpose of the monitoring	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Drainage Congestion	Construction stage	Visual Checks		To identify the drainage congestion location if any so that corrective action shall be taken appropriately	Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Concessionaire'	NHIDCL /CSC
	Operation Stage			To identify the drainage congestion location if any so that corrective action shall be taken appropriately		Once in a year before rainy season	None Specific	Routine Engineering Work	NHIDCL	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	To follow thr IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines	Part of the Concessionaire' s quote	Concessionaire with approval from NHIDCL	NHIDCL /CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	To follow thr IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			NHIDCL /CSC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	To provide hygienic condition at labour camp	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Concessionaire with approval from NHIDCL	NHIDCL /CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		To check the number of trees to be felled	Throughout the Project Section	Compensatory Afforestation for 79.756196ha forest land	As suggested by Forest Dept.	5,06,87,588	Compensatory: NHIDCL /Local Forest Departments Additional Plantation: Concessionaire	
	Operation stage	Audit for survival rate of trees plantation		To make sure survival rate shall be maintained	Throughout the Project Section				The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period NHIDCL through Concessionaire will be responsible for monitoring	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Purpose of monitoring	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by SHAJ		To maintained the accidents records	Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by CSC	Part of the regular monitoring	Concessionaire	NHIDCL /CSC
	Operation stage			To maintained the accidents records	Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of NHIDCL with support from local police	
Wildlife Vehicle Collisions	Construction Stage	Nature and cause of collision, season, Month and time of collision.		To maintained the records	Project road passing through forest land	occurrence of collision	As suggested by forest department	Civil Cost	Concessionaire	NHIDCL/CSC
	Operation stage	1. Success of road furniture's viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on information available with forest department and local people.		To maintained the records and provide information if any further improvement will be required	Project road passing through forest land	Random all through the year		Operation and Maintenance Cost	NHIDCL in coordination with forest department or through an specialized wildlife expert team	

Source: DPR Vol-I (main report) and EIS Pvt. Ltd.

APPENDIX 3

National Ambient Air Quality Standards

Pollutants	Concentration in ambient Air			
	Average	Industrial, Residential and other rural area	Ecologically Sensitive Area (Notified by Central Government)	Methods of Measurement
SO2 ug/m^3	Annual*	50	20	- Improved West and Geake
	24 hours**	80	80	- Ultraviolet Fluorescence
NO_x ug/m^3	Annual*	40	30	- Modified Jacob and Hochheiser
	24 hours**	80	80	- Chemiluminescence
PM10 ug/m^3	Annual*	60	60	- Gravimetric - TEOM
	24 hours**	100	100	- Beta Attenuation
PM2.5 ug/m^3	Annual*	40	40	- Gravimetric - TEOM
	24 hours**	60	60	- Beta Attenuation
Ozone (O3) ug/m3	8 Hours**	100	100	- UV Photometric - Chemiluminescence
	1 Hour**	180	180	- Chemical Method
Lead ug/m^3	Annual*	0.50	0.50	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
	24 hours**	1.0	1.0	- ED-XRF using Teflon filter
CO ug/m^3	8 Hours**	2000	2000	- Non Dispersive Infra-Red
	1 Hour**	4000	4000	
NH3 ug/m^3	Annual*	100	100	- Chemiluminescence - Indophenol blue method
	24 hours**	400	400	
Benzene (C6H6) ug/m^3	Annual*	05	05	- Gas Chromatography based Continuous Analyzer - Adsorption followed by GC Analysis
Benzo Pyrene-Particulate Phase only ug/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
Arsenic ng/m^3	Annual*	06	06	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel ng/m^3	Annual*	20	20	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

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

APPENDIX 4

Drinking Water Quality Standards (as per IS: 10500-1991)

Sl. No.	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1.	Colour (Hazen units)	5	25
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity (NTU)	5	10
5.	pH	5-8.5	No relaxation
6.	Total Coliforms (MPN/100 mL)	nil	-
7.	Pathogenic Organisms or Virus	nil	-
8.	TDS (mg/L)	500	2000
9.	Mineral Oil (mg/L)	0.01	0.03
10.	Free Residual Chlorine (mg/L)	0.2	-
11.	Cyanide (mg/L as CN)	0.05	No relaxation
12.	Phenol (mg/L C6H5OH)	0.001	0.002
13.	Total Hardness (mg/L as CaCO3)	300	600
14.	Total Alkalinity (mg/L as CaCO3)	200	600
15.	Chloride (mg/L as Cl)	250	1000
16.	Sulphate (mg/L as SO4)	200	400
17.	Nitrate (mg/L as NO3)	45	100
18.	Fluoride (mg/L as F)	1	1.5
19.	Calcium (mg/L as Ca)	75	200
20.	Magnesium (mg/L as Mg)	30	100
21.	Copper (mg/L as Cu)	0.05	1.5
22.	Iron (mg/L as Fe)	0.3	1
23.	Manganese (mg/L as Mn)	0.1	0.3
24.	Zinc (mg/L as Zn)	5	15
25.	Boron (mg/L as B)	1	5
26.	Aluminium (mg/L as AL)	0.03	0.2
27.	Arsenic (mg/L as As)	0.05	No relaxation
28.	Mercury (mg/L as Hg)	0.001	No relaxation
29.	Lead (mg/L as Pb)	0.05	No relaxation
30.	Cadmium (mg/L as Cd)	0.01	No relaxation
31.	Chromium (VI) (mg/L as Cr)	0.05	No relaxation
32.	Selenium (mg/L as Se)	0.01	No relaxation
33.	Anionic Detergents (mg/L MBAS)	0.2	1
34.	PAH (mg/L)	nil	-
35.	Pesticides (□g/L)	Absent	0.001
36.	Alpha Emitters (10^{-6}□c/mL)	nil	0.0001
37.	Beta Emitters (10^{-6}□c/mL)	nil	0.001

APPENDIX 5

Water Quality Criteria and Standards for Freshwater Classification (CPCB, 1979)

Parameters	BOD mg/l	pH	D.O. in mg/l	Oil & Grease mg/l
CPCB standard Class A (drinking water without conventional treatment but after disinfections)	d 2.0	6.5 — 8.5	e 6.0	--
CPCB standard Class B (for outdoor bathing)	d 3.0	6.5 - 8.5	5.0	--
CPCB standard Class C (drinking water after conventional treatment and disinfections)	d 2.0	6 - 9	e 4.0	--
CPCB standard Class D (for propagation of wild life, fisheries)	--	6.5 - 8.5	e 4.0	d 0.1
CPCB standard Class E (for irrigation)	--	6.0-8.5	--	--

'--' Indicates not applicable/relevant

APPENDIX 6

National Ambient Noise Standards

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

Gazette Notification dated 26th December 1989. It is based on the weighted equivalent noise level (Leq).

* Day time is from 6 am to 9 pm whereas night time is from 9 pm to 6 am

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

These noise standards have been given the status of statutory norms vide Noise Pollution (Regulation and Control) Rules, 2000. However, these rules have changed the periods for 'Day Time' and 'Night Time' to 6 a.m. to 10 p.m. and 10 p.m. to 6 am respectively.

APPENDIX 7

MANAGEMENT OF CONSTRUCTION PLANTS, EQUIPMENT AND VEHICLES PLANT MANAGEMENT

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 □g/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** **Date:**

Installed Capacity: **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:

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

APPENDIX 8

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 subcontractors' 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 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

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.

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 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.

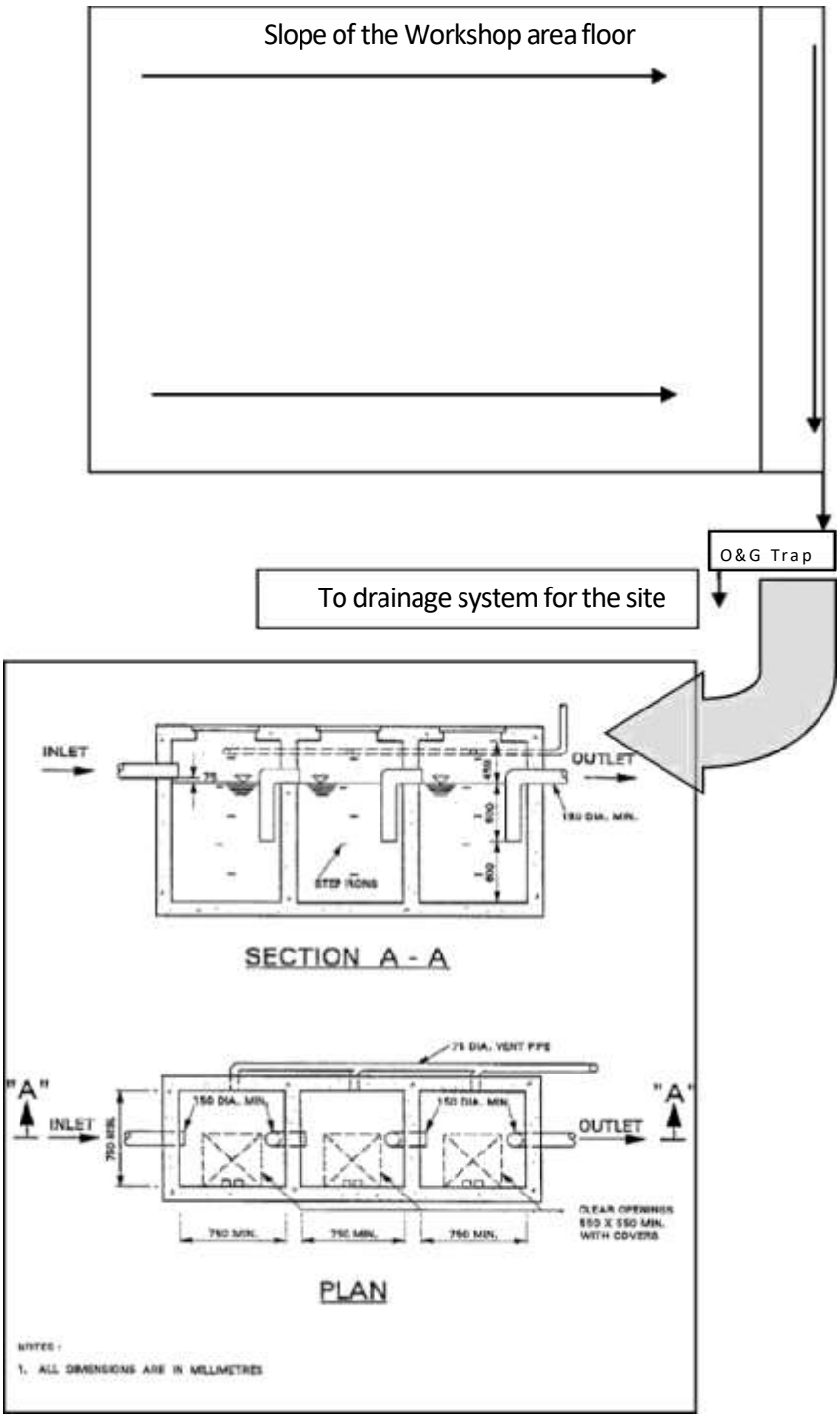
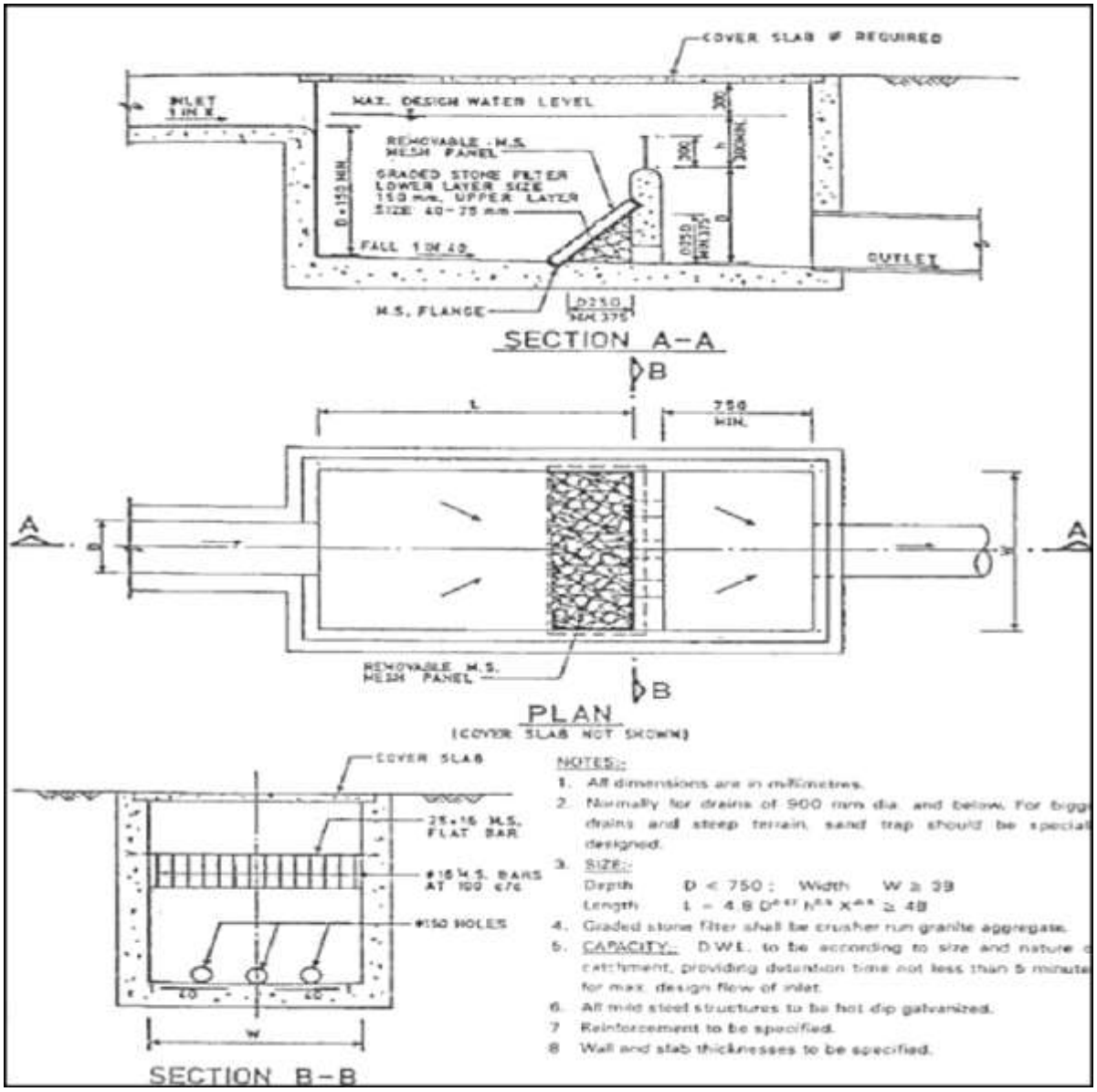


Figure: Workshop Area Pollution Control

- All the waste oil collected, from skimming of the oil trap as well as from the drip pans, or the mechanical degreaser shall be stored in accordance with the Environment Protection (Storage and Disposal of Hazardous Wastes) Rules, 1989. For this purpose, metallic drums should be used. These should be stored separately in sheds, preferably bunded. The advantage of this arrangement is that it allows for accurate accounting in case the waste material is sold to oil waste recyclers or other users like brick-kiln owners who can burn such inferior fuel.

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

Figure: Sedimentation Chamber for vehicle washing ramp discharge



Facilities for Labour

Potential Environmental Impacts

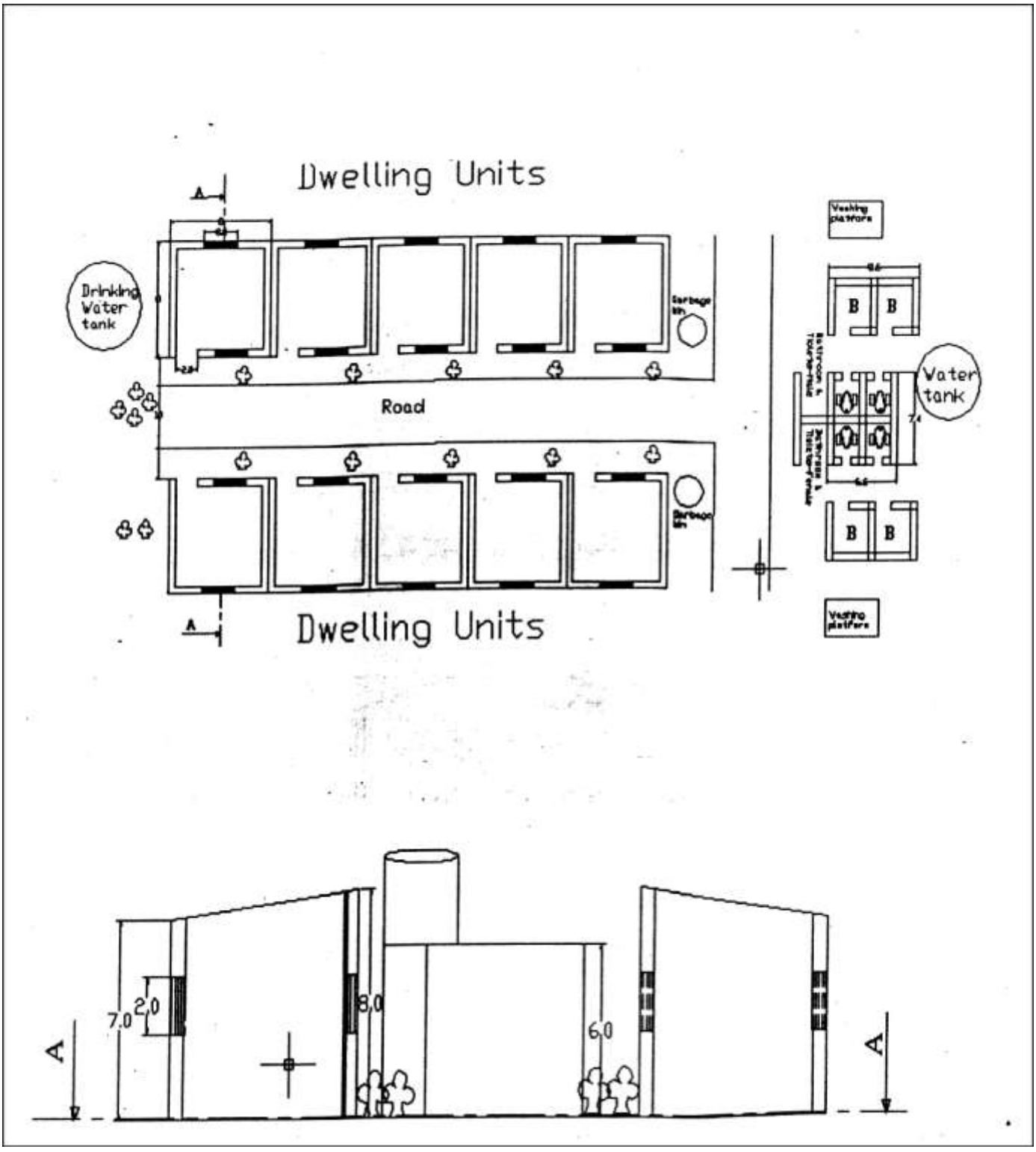
The sudden arrival and relatively longer duration of stay of construction crew can cause substantial strain on the existing infrastructure facilities like water supply, sanitation and medical care, especially in rural areas. Pollution from domestic wastes can affect local sources of water supply and 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.

TYPICAL DRAWING OF WORKERS' CAMP SANITARY FACILITY



APPENDIX 9

MANAGEMENT OF CONSTRUCTION WASTE 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	1 Segregating debris and bitumen during generation; 1 Segregating re-usable portion of debris and bitumen and storing preferably near areas of re-use; and 1 Temporary storage of waste material at sites as directed by the Engineer.
Waste disposal	1 Disposal of waste material at approved disposal site within a week of generation; 1 Disposal site should be properly demarcated; 1 Proper leveling / grading at disposal site/s; 1 Recommended / agreed safeguard measures to avoid ground water contamination by leachate from disposal of scarified material are to be implemented; 1 Recommended / agreed safeguard measures to avoid soil erosion are to be implemented; 1 Recommended / agreed plan for surface treatment of waste disposal site/s are to be implement.

Appendix 10

Photographs of second stage public/stakeholder consultation

Photographs During first Public/Stake Holder Consultation Meeting date 23.09.2019 at Panchamnagar Community Hall, Village Panchamnagar, Panchayat Milong, Block Gournagar, District Unakoti, Tripura

Source: EIS Pvt. Ltd.

Photographs during second Public/Stake Holder Consultation Meeting date 23.09.2019 at Rubber Society Community Hall, Vill - Saidacherra, Block : Kumarghat, Distt- Unakoti, Tripura

Source: EIS Pvt. Ltd.

Photographs during third Public/Stake Holder Consultation Meeting date 24.09.2019 at Dhurga Chowmohani Block office, Vill- Dhergachowmohani , District Dhalai, Tripura

Source: EIS Pvt. Ltd.

Photographs during fourth Public/Stake Holder Consultation Meeting date 24.09.2019 at Manikbhander, " Maitri Bhawan", Village Manikbhander, Kalampura, Distt- Dhalai, Tripura

Source: EIS Pvt. Ltd.

Photographs during Sixth Public/Stake Holder Consultation Meeting date 25.09.2019 at Hachwkni Kharang Community Hall, Village Bachaibari, Distt Khowai, Tripura

Source: EIS Pvt. Ltd.

Photographs during sixth Public/Stake Holder Consultation Meeting date 25.09.2019 at Kalayanpur Community Hall, Village Kalyanpur, Sub- Division Teliamura, Distt- Khowai, Tripura




Source: EIS Pvt. Ltd.