DRAFT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Improvement and Widening of Rongrenggre-Simsanggre-Nengkhra(RSN) Road including Conversion of weak Bridges to Permanent RCC bridges

Meghalaya Logistics and Connectivity Improvement Project (MLCIP)

Submitted to

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Disclaimer: The is a draft version and is being reviewed by the World Bank.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ASI	:	Archaeological Survey of India
BIS	:	Bureau of Indian Standards
BMC	:	Biodiversity Management Committee
CESMP	:	Contractor's Environmental and Social Management Plan
CGWB	:	Central Ground Water Board
CoI	:	Sub Project Road of Impact
CPR	:	Common Property Resources
CPCB	:	Central pollution control Board
CTE/CTO	:	Consent To Establish/Consent to Operate
CW	:	Carriageway
DG	:	Diesel Generator
DPR	:	Detailed Project Report
E&S	:	Environment and Social
EHS	:	Environment Health and Safety
EIA	:	Environmental Impact Assessment
ESF	:	Environmental and Social Framework
ESIA	:	Environmental and Social Impact Assessment
ESMP	:	Environmental and Social Management Plan
E&S Cell	:	Environment& Social Cell, MPWD
ESMF	:	Environmental and Social Management Framework
ESRS	:	Environmental and Social Review Summary
ESS	:	Environmental and Social Standards
ESZ	:	Eco-Sensitive Zone
FPIC	:	Free, Prior, and Informed Consent
GBV	:	Gender-Based Violence
GIS	:	Geographic Information System
GoM	:	Government of Meghalaya
GRM	:	Grievance Redress Mechanism
GHADC		Garo Hills Autonomous District Council
HIV	:	Human Immunodeficiency Virus
IBA	:	Important Bird Area
IBAT	:	Integrated Biodiversity Assessment Tool
IDP	:	Internally Displaced Persons
IEC	:	Information, Education, and Communication
IFC	:	International Finance Corporation
IRC	:	Indian Road Congress
ISFR	:	India State of Forest Report
IUCN	:	The International Union for Conservation of Nature
KBA	:	Key Biodiversity Area
LHS	:	Left Hand Side

LULC	:	Land Use Land Cover
MDF	:	Moderately Dense Forest
MDR/ SH	:	Major District Roads/State Highways
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MLCIP	:	Meghalaya Logistics and Connectivity Improvement Project
MSPCB	:	Meghalaya State Pollution Control Board
MSDMA	:	Meghalaya State Disaster Management Authority
NATMO	:	National Atlas and Thematic Mapping Organization
NBSAP	:	National Biodiversity Strategy and Action Plan
NGO	:	Non-Governmental Organization
NH	:	National Highway
NOC	:	No Objection Certificate
NO_x	:	Oxides of Nitrogen
NTFP	:	Non-timber forest product
OF	:	Open Forest
OHS	:	Occupational Health and Safety
OIP	:	Other Interested Parties
PAP	:	Project Affected Person
PBR	:	People's Biodiversity Register
PESO	:	Petroleum and Explosives Safety Organization
PIA	:	Project Influence Area
PID	:	Project Information Document
PM	:	Particulate Matter
POSH	:	Prevention of Sexual Harassment
PPE	:	Personal Protective Equipment
PROW	:	Proposed Right of Way
PUC	:	Pollution Under Control
PWD	:	Public Works Department
R&R	:	Resettlement and Rehabilitation
RAP	:	Resettlement Action Plans
RF	:	Reserve Forest
RFCTLARR	:	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
RHS	:	Right Hand Side
RoW	:	Right of Way
SBB	:	State Biodiversity Board
SEA	:	Sexual Exploitation and Abuse
SEIAA	:	State Environment Impact Assessment Authority
SEP	:	Stakeholder Engagement Plan
SH	:	Sexual Harassment
SIA	:	Social Impact Assessment
SOP	:	Standard Operating Procedures
ST	:	Scheduled Tribes

SC	:	Scheduled Caste
OBC	:	Other Backward Caste
GC	:	General Caste
TSG	:	Technical Support Group
VDF	:	Very Dense Forest
WB	:	World Bank
WHO	:	World Health Organization
WPA, 1972	:	Wildlife Protection Act, 1972
WPA, 2022	:	Wild Life (Protection) Amendment Act, 2022

EXECUTIVE SUMMARY

E.1 INTRODUCTION

The Meghalaya Logistics and Connectivity Improvement Project (MLCIP), with a total investment of USD 300 million comprising USD 240 million from the World Bank and USD 60 million from the Government of Meghalaya (hereinafter refer to as the state government) aims to: a) enhance connectivity to key growth centers along identified road Sub Project Roads; b) improved rural and district-level logistics infrastructure and services; c) provide greater market access and reduced average cost/time for select agriculture and horticulture products; and, d) strengthen institutional capacity for efficient, climate-resilient transport and logistics, West and East Meghalaya. The rehabilitation of the state roads will be carried out in phases.

MLCIP includes 10 Roads and 5 Bridges totaling to approximately 300 km respectively. The proposed RSN sub Project Road has a total length of 20.564 km, commencing from Rongrengre at chainage 00+000 and terminating at Nengkhra Bazar at chainage 20+564.

The additional land required for the proposed road improvement is approximately 1.2459 Ha (Table 3.16). Area required for spoil management is 0.55 ha (Table 3.15).

The sub-project would include reconstruction and upgradation of the existing pavement from a single lane carriageway to intermediate lane. It also includes climate-resilient design measures based on vulnerability assessment considering Meghalaya's high rainfall conditions. Drainage capacity along the project road has been improved through the provision of culverts, roadside drains, retaining/protection walls, and stream protection measures at vulnerable and bridge locations, as incorporated in the DPR based on site-specific requirements and ESIA observations to ensure proper drainage and prevention of soil erosion and slope instability. Slope protection measures, including retaining walls, turfing, stream protection works, and bio-engineering using locally available grasses and vegetation, have been proposed at vulnerable locations to control soil erosion and stabilize unstable slopes. In addition, durable pavement layers such as CTB/CTSB, paved shoulders, and adequate road safety features have been incorporated in the design to ensure a resilient, safe, and all-weather road infrastructure.

E.2 PROJECT DESCRIPTION AND NEED

The additional land required for the proposed road improvement is approximately 1.2459 Ha (Table 3.16). Area required for spoil management is 0.55 ha. The intervention includes pavement strengthening, drainage improvement, slope stabilization, and safety enhancements. The road serves as a vital link connecting villages and economic centers, thereby improving mobility and reducing travel time and costs.

E.3 BASELINE ENVIRONMENTAL CONDITIONS

The project area experiences high rainfall and humid climatic conditions, making it prone to erosion, drainage congestion, and slope instability. The terrain is characterized by undulating topography with soil types vulnerable to erosion. Surface water bodies, streams, and riverbanks are present along the alignment, playing an important role in local hydrology and community use.

Air and noise quality in the region are generally within acceptable limits due to low industrial activity. The biological environment includes local vegetation and fauna typical of the Garo Hills, with no critical habitats significantly impacted by the project. The area also falls under a high seismic zone (Zone V), indicating vulnerability to natural hazards.

E.4 SOCIO-ECONOMIC PROFILE

The project area is predominantly inhabited by tribal communities governed under the Sixth Schedule, with strong traditional institutions like Nokmas managing land and resources. Livelihoods are mainly dependent on agriculture,

small businesses, and daily wage activities. The project affects a number of households (40 PAHs), with 100 PAPS with minor impacts on livelihoods and structures.

Consultations revealed key community concerns such as poor road conditions, flooding during monsoon, lack of drainage, and safety issues. Communities generally supported the project, expecting improved connectivity. The proposed 20.564 km RSN road sub-project has been designed to minimize land acquisition and associated social impacts while improving connectivity. About 7 km of the road will be upgraded within the existing 12 m Right of Way (RoW), and only 1.2459 ha of additional land will be required over 13.564 km for minor widening, drainage, and safety features. Required Land is community land. Importantly, no residential or commercial structures are affected, and no physical displacement is anticipated. Community infrastructure proposed under FPIC will also be accommodated within the available RoW.

The project will temporarily require 0.55 ha of land for spoil disposal, identified across 1 location in consultation with PWD officials and local communities, including the Nokma. These sites will be restored and returned to landowners after construction. In total, 40 PAHs comprising 100 PAPs will be affected, with impacts being largely minor, partial, and localized. A significant portion includes 28 households (70 PAPs) operating informal roadside kiosks (non-title holders), who will need to relocate outside the RoW. While this will temporarily disrupt their business locations and income, they are expected to resume similar livelihood activities nearby, with no permanent livelihood loss anticipated.

A 30-day advance notice will be provided to affected persons for relocation, and impacts will be managed through compensation, livelihood assistance, and provisions outlined in the Resettlement Action Plan (RAP). Overall, the project does not involve physical displacement and is expected to have manageable social impacts, primarily limited to relocation of informal activities and minor land loss, which will be mitigated through appropriate planning and community engagement.mic benefits.

E.5 KEY ENVIRONMENTAL AND SOCIAL IMPACTS

During the **construction phase**, potential impacts include:

- Soil erosion and slope instability due to earthwork
- Air and noise pollution from construction activities
- Water contamination from runoff and waste
- Temporary disruption to local traffic and community access
- Occupational health and safety risks for workers

During the **operation phase**, impacts are relatively limited but may include:

- Increased vehicular emissions and noise
- Road safety concerns due to higher traffic speed
- Risk of erosion if drainage and slope protection are not maintained

TableE.1: ESIA Observation and Compliance

Sr. No.	Village name	Location Chainage	ESIA Observation	Compliance/ Proposal included in the DPR	Reference in the DPR
1	Rongrengre	0+000	Junction improvement required At the start and end junctions of the project road, additional traffic safety measures such	Junction improvement proposed at Ch 0+000 in Junction drawing. The same shall be incorporated in the	Table No-1 Page No-7 (Sr No-1.8) [Vol-1 Main Report]

			as Blinker/Warning Curve Signage were suggested	EPC scope and relevant road safety drawings in the DPR.	
2	Rongrengre	5+200	Access to the existing graveyard along the Sub Project Road must be maintained.	The design shall ensure proper connectivity and safe access, reflected in the DPR drawings.	
2	Upper Rongreng Baiza (Abagre),Lower Baiza,Chidekgre,Rangmal Badim & Kusimkolgre	0+000 to 6+200	Forest Area (Both Side) of the existing Road.	Black top will be done on the existing at forest location from km 0+000 to 6+200.	TCS-05, Page No-142 [Vol-1 Main Report]
3	Kusimkolgre	6+300	Speed restriction on junction location needed.	Speed restriction sign has been proposed at Junction location Ch-.6+270 (LHS) & 6+330 (RHS) in signage Plan.	TRAFFIC SIGNS PLAN (Km.6+200 to Km.7+800), [Volume X a_TRAFFIC SIGNAGE PLAN - Sheet No. RC/1661/HO/HWB/RD/DWG/RSN/TSP/05/0]
4	Kusimkolgre	6+350	Building Structure at this section on RHS will be protected by slightly shifting the alignment LHS	Building structure will be protected by shifting the alighnment slightly towards RHS side at Ch-6+350.	PLAN & PROFILE (Km.6+000 to Km.7+000), Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/RSN/P&P/07/R0)
5	Kusimkolgre	6+900	Soil Erosion found at Minor Bridge Location, Protection work required at this Section.	To protect from soil erosion, proposed protection work has been incorporated at MNB Ch-6+886.	Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/07/R0
6	Kusimkolgre	7+100	Building Structure at this section on RHS will be protected by slightly shifting the alignment LHS	Building structure will be protected by shifting the alighnment slightly towards LHS side at Ch-7+130.	PLAN & PROFILE (Km.7+000 to Km.8+000), Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/RSN/P&P/08/R0)
7	Kusimkolgre	7+280	Traffic island with Proper road safety sign required for this Section (Bus Stand Section).	Safety sign has been proposed in signage Plan at Ch-7+100 (LHS) & 7+410 (RHS).	TRAFFIC SIGNS PLAN (Km.6+200 to Km.7+800), [Volume X a_TRAFFIC SIGNAGE PLAN - Sheet No. RC/1661/HO/HWB/

					RD/DWG/RSN/TSP/05/0]
8	Kusimkolgre	8+000	Traffic island with Proper road safety sign required for this Section. (Junction Location). Proposal for the improvement of the junction due to Poor Geometry of the Road.	Speed restriction has been taken in signage Plan & realignment has ben proposed to improve the poor geometry at Ch-7+980 (Junction Location).	TRAFFIC SIGNS PLAN (Km.7+800 to Km.9+000), [Volume X a_TRAFFIC SIGNAGE PLAN - Sheet No. RC/1661/HO/HWB/RD/DWG/RSN/TSP/06/0]
9	Dobetkolgre	11+700	Building Structure at this section on RHS will be protected by slightly shifting the alignment LHS	Building structure will be protected by providing Protection wall taken in design. Shifting the alignment slightly towards LHS side at Ch-11+350 done.	PLAN & PROFILE (Km.11+000 to Km.12+000), Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/RSN/P&P/12/R0)
10	Dobetkolgre	11+900	Unstable slope section at RHS	Protection wall of height 1m is proposed from Km 12+020 to 12+060 to Protect from unstable slopesection. (RHS)	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
11	Dawa Nengjata	12+020	Retaining wall required LHS from km 12+020 to 12+040	Already taken in design	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
12	Dawa Nengjata	12+850 to 12+900	Unstable slope Section RHS	Protection wall of height 1m has been proposed from Km 12+820 to 12+880 to protect slope. (RHS) is proposed	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
13	Dawa Nengjata	12+900 to 12+980	Unstable slope Section LHS	Protection wall of height 1m has been proposed from Ch-13+180 to 13+260 to protect slope. (LHS) is proposed	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
14	Dawa Chipitgre	16+500 to 16+600	Unstable slope Section LHS	Not required as per design.	No Unstable slope found at the location
15	Nengkra	17+300 to 17+340	Protection work required RHS	Protection wall of height 1m has been proposed from Ch-17+580 to 17+660 to protect unstable	Table No-15, Page No-165 (Sr No-6.17.7.1) [Vol-1 Main Report]

				slopes. (RHS) has been proposed	
16	Chimagre, Nengkra Bazar	20+300 to 20+600	Protection work required at bridge location	Protection wall of height 1m has been proposed from Ch-19+880 to 19+950 (RHS) to protect from unstable slopes. Additionally to prevent erosion of approaches stream protection works are also proposed at MNB locations.	Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/07/R0
	Nengkra Bazar	20+637 (End of Project)	Spring water collection tank required to store the water coming from natural spring	Proposed spring water collection tank at ch-20+510 (RHS).	Table No-22, Page No-173 (Sr No-6.17.14) [Vol-1 Main Report]
17	Nengkra Bazar	20+564 (End of Project)	2 toilet required on both side of the road with retaining wall due to Unstable slope zone.	2 toilets (RHS) has been proposed at ch-20+565	Table No-23, Page No-173 (Sr No-6.17.14) [Vol-1 Main Report]
18	Nengkra Bazar	20+564 (End of Project)	Settlement of temporary house near connecting Road.	It will be done as per RAP at ch-20+565 (End Ch).	-

E.6 MITIGATION MEASURES AND DESIGN INTERVENTIONS

To address these impacts, several mitigation measures have been integrated into the project design:

- **Erosion control measures** such as toe walls, gabion walls, stone pitching, and river training works at vulnerable chainages
- **Improved drainage systems** to prevent waterlogging and flooding
- **Slope stabilization techniques** including bio-engineering methods like turfing and vegetation
- **Climate-resilient pavement design** with durable materials and stress-absorbing layers
- **Safety measures** including curve improvements, junction design, and traffic calming features

Environmental management during construction will include dust suppression, proper waste management, noise control, and water protection measures.

E.7 SOCIAL SAFEGUARDS AND COMMUNITY ENGAGEMENT

The project follows the World Bank Environmental and Social Framework (ESF), ensuring compliance with national regulations and international standards. Free, Prior, and Informed Consent (FPIC) has been undertaken to engage tribal communities and incorporate their feedback into project design.

A Resettlement Action Plan (RAP) and Indigenous Peoples Development Plan (IPDP) have been prepared to address impacts on affected households and ensure fair compensation and livelihood restoration. A Grievance Redress Mechanism (GRM) is also established to address community concerns effectively.

E.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The ESMP outlines mitigation measures, monitoring requirements, institutional responsibilities, and budget allocation. It includes:

- Environmental monitoring (air, water, noise, soil)
- Social monitoring (livelihood restoration, community safety)
- Occupational health and safety measures
- Capacity building for implementing agencies

ESMP Budget is Rs. 94,24,270.

E.9 STACKHOLDER CONSULTATIONS

The stakeholder consultations were conducted across multiple locations in East Garo Hills with active participation from government officials, local communities, and affected households.

On 21 August 2025, consultations were held with the Divisional Forest Officer (DFO), East & North Garo Hills (4 participants) and local residents (8 participants; Male–6, Female–2). Key issues raised included the road alignment passing through community forests and elephant movement routes, concerns over habitat disturbance, poor road conditions affecting accessibility, and inadequate street lighting impacting safety.

On 28 August 2025, a consultation with PCCF at Shillong (4 participants) highlighted that the project intersects Reserve Forest areas, raising concerns related to forest governance and dependency.

Consultations with youth groups were conducted on 18 and 25 September 2025 (15 participants; Male–10, Female–5), where concerns regarding limited employment opportunities, lack of skill development, and migration risks were discussed, along with demands for entrepreneurship support and improved connectivity.

Women-focused group discussions (FGDs) were held on 23 September and 10 October 2025 (10 participants), highlighting issues such as restricted mobility due to social norms, lack of childcare facilities, limited skill access, and poor awareness of government schemes, along with interest in cooperatives and local enterprises.

Under the FPIC process for priority projects, consultations were conducted on 11 & 23 September, 10 October, and 10 December 2025, involving 139 participants (Male–104, Female–35) across 4 consultation events in project-affected villages. Major agreements included upgradation of the existing road to an intermediate lane with safety measures, drainage, and protection works, along with provisions for passenger waiting sheds, drains with footpaths in settlement areas, separate toilets for males and females, and construction of spring water collection tanks.

Overall, consultations across different dates and locations indicate strong community engagement and support, with emphasis on balancing infrastructure development with environmental safeguards and local socio-economic needs.

E.10 CONCLUSION

The proposed upgradation of the RSN road is a strategically important infrastructure intervention that will significantly enhance regional connectivity, accessibility, and socio-economic development in East Garo Hills. The ESIA indicates that while the project traverses environmentally sensitive areas, including submergence-prone stretches, erosion-prone hilly terrain, and an identified elephant movement Sub Project Road, the anticipated environmental impacts are site-specific, largely temporary, and manageable through appropriate design and mitigation measures.

Key environmental concerns such as drainage congestion, slope instability, vegetation loss, and potential wildlife disturbance have been addressed through climate-resilient engineering solutions, including improved drainage systems, slope protection works, bio-engineering measures, and wildlife safety interventions. With the implementation of the Environmental and Social Management Plan (ESMP), impacts related to air, noise, soil, and water during construction will be effectively controlled, while long-term benefits such as reduced erosion, improved road durability, and safer movement are expected.

From a social perspective, the project involves no physical displacement and only minor, localized impacts, primarily related to temporary relocation of informal roadside livelihoods and limited acquisition of non-productive land. A total of 40 Project Affected Households (PAHs) will be impacted, with mitigation measures outlined in the Resettlement Action Plan (RAP), including compensation, livelihood restoration, and advance notice for relocation. The project has received broad community support through FPIC consultations, with incorporation of community-prioritized features such as drainage, safety measures, and basic amenities.

Overall, the project is assessed to be environmentally sustainable and socially acceptable, consistent with the World Bank Environmental and Social Framework (ESF). The identified risks particularly related to hydrology, geotechnical stability, and biodiversity are adequately addressed through chainage-specific mitigation and robust management measures.

With effective implementation, monitoring, and stakeholder engagement, the project is expected to deliver long-term, climate-resilient, and inclusive development benefits, while maintaining environmental integrity and social equity.

1. INTRODUCTION

1.1 BACKGROUND

The Meghalaya Logistics and Connectivity Improvement Project (MLCIP), with a total investment of USD 300 million comprising USD 240 million from the World Bank and USD 60 million from the Government of Meghalaya (hereinafter refer to as the state government) aims to: a) enhance connectivity to key growth centers along identified road Sub Project Roads; b) improved rural and district-level logistics infrastructure and services; c) provide greater market access and reduced average cost/time for select agriculture and horticulture products; and, d) strengthen institutional capacity for efficient, climate-resilient transport and logistics, West and East Meghalaya. The rehabilitation of the state roads will be carried out in phases.

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The sub-project would include reconstruction and upgradation of the existing pavement from a single lane carriageway to intermediate lane. It also includes climate-resilient design measures based on vulnerability assessment considering Meghalaya's high rainfall conditions. Drainage capacity along the project road has been improved through the provision of culverts, roadside drains, retaining/protection walls, and stream protection measures at vulnerable and bridge locations, as incorporated in the DPR based on site-specific requirements and ESIA observations to ensure proper drainage and prevention of soil erosion and slope instability. Slope protection measures, including retaining walls, turfing, stream protection works, and bio-engineering using locally available grasses and vegetation, have been proposed at vulnerable locations to control soil erosion and stabilize unstable slopes. In addition, durable pavement layers such as CTB/CTSB, paved shoulders, and adequate road safety features have been incorporated in the design to ensure a resilient, safe, and all-weather road infrastructure.

1.2 SCOPE FOR CONDUCTING THE ESIA STUDY

Sub-project road is rated as a "High" risk on the screening for environmental and moderate for social aspects. Rongrenggre Reserve Forest Sub Project Road between Km 00+000 and Km 6+200, indicating ecological sensitivity along with other issues such as erosion, drainage issues, unstable slopes etc. In addition, the project affects approximately 40 Project Affected Households (PAH), leading to notable livelihood concerns. Considering these factors, along with the need for climate-resilient measures such as improved drainage, slope protection, and durable pavement design to address high rainfall conditions, the sub-project has been classified as High Risk. [1]Based on this assessment, the scope of the ESIA study was defined, and the following activities were undertaken for the detailed assessment.

- Collection of project information
- Literature review and data compilation
- Baseline environmental and social assessment
- Identification of potential impacts
- Stakeholder identification and consultation:

[1] The project has obtained **78% as per environmental screening criteria and therefore categorize as High risk**. The social risk is categorized as **Moderate** since the impact on affected households involves **less than 10% loss of assets, including both land and structures**, indicating temporary shifting and manageable livelihood

- Preliminary climate and cumulative impact assessment:
- Environmental and Social Management Plan (ESMP) preparation:
- Monitoring framework:

1.3 APPROACH AND METHODOLOGY

The methodology adopted for the ESIA complied with the requirements of the World Bank ESF (ESSs), the EIA Notifications of the Ministry of Environment, Forest and Climate Change (MoEF&CC), the Indian Roads Congress (IRC) guidelines, the MoRTH Guidelines, and other national guidelines. The following table summarizes the approach adopted for conducting the ESIA study.

Table 1.1: Approach adopted for conducting the ESIA

Sl. No.	Stages	Activities Done
1.	Screening and Scoping	Identified key issues through primary and secondary surveys, assessed stakeholders, and analyzed potential impacts considered in the Environmental and Social Impact Assessment, following the Free, Prior, and Informed Consent (FPIC) process to ensure meaningful participation and consent of Indigenous Peoples and affected communities.
2.	Public Consultation for Scoping Report	Identified key issues to understand stakeholder concerns and inform sub-project design and build awareness on the project including the Free, Prior, and Informed Consent (FPIC) process. This involved engaging with Indigenous Peoples and affected communities through meaningful consultations in a transparent and participatory manner. Consultations were held with the community which includes village heads and community members to raise awareness about the project and the need for FPIC. These consultations allowed the community to be briefed on the role of the ESIA consultants and seek permission to meet and discuss the different components of the project activities.
3.	Baseline Data Collection	Gathered and reviewed primary and secondary data on environmental and social conditions in and around the sub-project area, including air quality, water resources, biodiversity, cultural heritage, and socio-economic factors. Primary physical monitoring was carried out as per the EIA guidelines. For ecological monitoring, transect walks, quadret analysis, community consultation were carried out. The Forest Department, GoM, provided the maps demarcating the legally protected forest including "community reserve". Information was also provide about the Wildlife crossing/ wildlife Sub Project Roads. Information was also collected for the Forest Department, GoM about the animal kills / collisions on these Sub Project Roads. In addition to these data collection form secondary sources, primary data on natural environment was also collected. Potential areas of community health safety conflicts were also identified and the design team was informed about these.
4.	Impact Assessment	Using baseline data, the RSN Project road potential impacts on the environment and local communities were assessed, including direct and indirect effects, as well as short-term and long-term impacts. A targeted assessment was carried as a part of ESIA since the sub-project area falls under a Schedule VI region with the presence of tribal communities. The Second round of FPIC consultations were undertaken as part of the impact assessment to ensure meaningful engagement with Indigenous Peoples (IP's) to further discuss the project design, benefits and impacts, and to provide the communities' priorities and inputs to drafting of the mitigation plans and measures. During this consultation, IPs' written consent to proceed with the Project has been recorded through a resolution and countersigned by the participants, with attendance sheets, photos, etc. and attached as Annexure 7.3.

Sl. No.	Stages	Activities Done
5.	Mitigation and Management Measures	Based on the impact assessment, measures have been proposed to mitigate or minimize adverse environmental and social impacts while enhancing positive outcomes. These included exploring Project road design alternatives to reduce Involuntary resettlement and environmental degradation. These measures have been integrated in the draft Environmental and Social Management Plan, Resettlement Action Plan, Indigenous People's Development Plan, Labor Management Procedures, Stakeholder Engagement Plan and SEA/SH Action Plan, among others.
6.	Draft ESIA Report	A draft report summarizing the findings of the Environmental and Social Impact Assessment (ESIA) has been prepared.
7.	Public Disclosure of ESIA	Public Consultations informed each stage of the ESIA development. In accordance with both GoM and WB requirements, the draft ESIA report and mitigation plans (ESMPs, RAP, IPDP) has been prepared for disclosure and public consultation. Stakeholders, including local communities, NGOs, government agencies, and experts, will be invited to provide feedback and the final report will be revised based on the feedback received. In addition, No Objection Certificates (NOCs) will be obtained from the village-level traditional institutions to ensure community consent and administrative approval before proceeding with the project in the proposed area.
8.	Final ESIA Report	The draft ESIA report and mitigation plans (ESMPs, RAP) will be finalized by incorporating feedback from the public consultation. Comments received will be addressed, and the assessment or proposed measures/plans will be revised as necessary.
9.	Approval and Implementation	The final ESIA report along with mitigation plans will be submitted to the MPWD and the World Bank.
10.	Monitoring	Monitoring of ESIA implementation and management of risks throughout the project implementation

Table 1.2: Source and methodology for primary and secondary data collection

Parameters	Secondary Source
	Environment
Air	**Primary Survey** **Primary Monitoring** **Secondary Source** Central pollution control Board (CPCB, https://cpcb.nic.in/) / Meghalaya State Pollution Control Board (MSPCBhttps://megspcb.gov.in/)
Water	**Primary Survey** **Primary Monitoring** **Secondary Source** 1. District Survey Report, East Garo Hills District, (https://eastgarohills.gov.in/document-category/statistical-report/) 2.CGWBData 2024 (https://cgwb.gov.in/old_website/AQM/NAQUIM_REPORT/Meghalaya/East%20Garo%20Hills%20_report.pdf?utm_source=chatgpt.com)
Noise	**Primary Survey** **Primary Monitoring** **Secondary Source** CPCB (https://cpcb.nic.in/regulation-control/)
Soil	**Primary Survey** **Primary Monitoring** **Secondary Source** 1.District Irrigation Plan 2016-2020(https://pmksy.gov.in/mis/Uploads/2017/20170331050354800-1.pdf) 2.Mapping India's Climate Vulnerability A District Level Assessment (2021) (https://www.ceew.in/sites/default/files/ceew-study-on-climate-change-vulnerability-index-and-district-level-risk-assessment.pdf)
Biodiversity	**Primary survey** 1.Field observation 2.Vegetation assessment was conducted using Nested Quadrate method 4.Faunal assessment was conducted using Visual encounters, sign survey, line transect, and netting survey method 6.LULC analysis through ground truthing **Secondary Source** 1.Desktop study/secondary data collection - Govt. notified acts, peer review published scientific articles, Govt. reports, 2.Online open-source biodiversity databases such as Meghalaya Biodiversity Portal (https://megbiodiversity.nic.in/), PARIVESH Portal (MoEF&CC) (https://parivesh.nic.in/), Global Forest Watch (https://www.globalforestwatch.org/), IUCN Red List of Threatened Species(https://www.iucnredlist.org/) 3.Stakeholder consultation

Parameters	Secondary Source
Hazards and Vulnerability	**Primary survey** Field observation and Consultation with concerned departments and local community **Secondary Source** 1. District Disaster Management Plan for East Garo Hills, 2024 (https://msdma.gov.in/ddmp/DDMP-Williamnagar.pdf) 2. Meghalaya State Disaster Management Authority (MSDMA) (https://msdma.gov.in/)
Natural Environment	**Secondary Source** 1.Customized Rainfall Information System, Hydromet Division, IMD (https://hydro.imd.gov.in/) 2.District Census Handbook, East Garo Hills (https://censusindia.gov.in/nada/index.php/catalog/861/download/36312/DH_2011_1702_PART_B_DCHB_EAST_GARO_HILLS.pdf) 3.Geological Survey of India(https://www.gsi.gov.in/webcenter/portal/OCBIS) 4. District Irrigation Plan 2016-2020 (https://pmksy.gov.in/mis/Uploads/2017/20170331050354800-1.pdf) 5. Consultant's Analysis, Source IMD Gridded Data(https://www.imdpune.gov.in/cmpg/Griddata/Rainfall_25_NetCDF.html) 6. State Action Plan on Climate Change (SAPCC), Meghalaya(https://moef.gov.in/uploads/2017/08/Meghalaya.pdf) 7. Statistical Handbook, Meghalaya 2023 (https://des.megplanning.gov.in/documents/SHB2023-as-on-02-05-24.pdf)
Climate	**Secondary Source** India Meteorological Department – Shillong Climatological Normals, (1991–2020) (https://dsp.imdpune.gov.in/home_normals.php#)
	Land and Livelihood Impact
Land, Livelihood and Common Property Resources	**Primary survey** 1.Census/Household Survey (PAH:40) 2.Focus Group Discussions (3) 3.Key Informants Interviews (25) 4.Field Observations **Secondary Source** Census 2011 (https://www.census2011.co.in/)
	Other Socio-Economic Parameters
Ethnicity	**Primary survey**

Parameters	Secondary Source
	Consultation **Secondary Source** Census 2011(https://www.census2011.co.in/)
Gender	**Primary Survey** Focus Group Discussion Interviews **Secondary Source** Workforce Participation Rate as per Census 2011 (https://www.census2011.co.in/) National Family Heath Survey- 5 (https://mohfw.gov.in › files › NFHS-5_Phase-II_0)
Prevalence of GBV	**Primary survey** Focus Group Discussions with women group **Secondary Source** Police records National Crime Records Bureau (NCRB) (https://ncrb.gov.in)

1.4 STRUCTURE OF THE ESIA REPORT

This Environmental and Social Impact Assessment (ESIA) report has been structured into ten chapters including this introduction chapter as follows.

CHAPTER	DESCRIPTION
Chapter 1	INTRODUCTION
Chapter 2	LEGAL AND INSTITUTIONAL FRAMEWORK
Chapter 3	PROJECT ROAD DESCRIPTION
Chapter 4	THE BASELINE ENVIRONMENT
Chapter 5	ENVIRONMENTAL AND SOCIAL RISKS AND
Chapter 6	ANALYSIS OF ALTERNATIVES,
Chapter 7	STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE
Chapter 8	ENVIRONMENTAL AND SOCIAL MONITORING & REPORTING PROGRAMME
Chapter 9	GRIEVANCE REDRESSAL MECHANISM
Chapter 10	CONCLUSION AND RECOMMENDATIONS

2. LEGAL AND INSTITUTIONAL FRAMEWORK

This chapter reviews all acts, rules, and policies applicable to the proposed road development.

2.1 APPLICABLE ENVIRONMENTAL AND SOCIAL REGULATIONS/ ACTS/ POLICIES AT NATIONAL AND STATE LEVEL

To understand the scope of the environmental and social assessment for the proposed improvements or road works, the relevant laws, legislation, and policies at the national and state levels were reviewed and summarized in Table 2.1 below, including an examination of the legal and institutional frameworks applicable to indigenous and tribal communities as part of the targeted assessment.

Table 2.1: Applicable Environmental and Social Regulations/ACTs/Policies

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
ENVIRONMENTAL REGULATIONS					
1	Environment Protection Act/ Rules 1986	The Environment Protection Act, 1986 (the "Environment Act") provides for the protection and improvement of the environment. Under the Environment Act, the Central Government issues notifications for the protection of ecologically sensitive areas or issues guidelines for matters under the Environment Act	The various environmental quality standards notified under this act apply to MPWD works.		Meghalaya State Pollution Control Board (MSPCB)
2	EIA Notification 14th Sep 2006 and 17 March 2025	Borrowing of minerals (earth, sand, aggregates, etc.) will require prior environment clearance under mining category	Borrowing of minerals (earth, sand, aggregates, etc.) for embankment, bridge, approach road construction	Environmental Clearance through Contractor	SEIAA Meghalaya
3	Air (Prevention and Control of Pollution) Act, 1981, 1987	To provide for the prevention, control and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	Air pollution from proposed Batching Plant or Hot mix plants, stone crusher, DG set etc. during construction stage	Consent to Establish and operate through Contractor	Meghalaya State Pollution Control Board (MSPCB)
4.	Water Prevention and Control of Pollution) Act, 1974, 1988	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	Water pollution during the construction stage from construction/labour camp	Consent to Establish and Operate through Contractor	Meghalaya State Pollution Control Board (MSPCB)
5.	Noise Pollution (Regulation and Control Act) 2000 and amendment till date	The ambient noise standards for day and night across various land use categories were notified by the MoEF&CC under the Noise Pollution (Regulation and Control) Rules, 2000, based on recommendations of the CPCB	Noise emission from proposed activities during construction stage like operation of DG sets, equipment and concrete mixers should be within applicable standards	Regulatory clearance not required but noise monitoring results should be below applicable standard as per CPCB .	MSPCB
6	Hazardous & Other Wastes	Protection against improper handling, storage and disposal of	Hazardous waste generation from proposed activities like generation of	Contractor to obtain authorization for storage,	MSPCB

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
	(Management and Trans-boundary Movement) Rules, 2016 and March, 2024	hazardous waste. The rules prescribe the management requirement of hazardous wastes from its generation to final disposal.	paints waste, used oil/waste oil, bitumen waste, etc.	transport, and disposal of hazardous and other wastes	
7	Construction and Demolition Waste Management Rules, 2016	To manage the demolition and construction waste and prevent environmental degradation	Construction and demolition waste will be generated from proposed activities	Required permission will be obtained by Contractor for proper disposal as per the site specific waste management plan.	Village Council, Municipal Boards
8	Solid Waste management Rules, 2016 and amended thereof	To manage solid waste or semi-solid domestic waste, sanitary waste	Solid Waste will be generated from proposed activities due to influx of labour	Required permission will be obtained by Contractor for proper disposal as per the site-specific waste management plan.	Village Council, Municipal Boards
9	Vehicle Act 1988 Central Motor Vehicle Rules 1989	To minimize the road accidents, penalizing the guilty, provision of compensation to victim and family and check vehicular air and noise pollution.	Transportation of manpower and material will involve vehicular movement. Vehicles must have valid Pollution Under Control (PUC) certificates, Insurance, Fitness Certificate. Driver should have valid Driving License.	PUC and fitness certificates, Insurance. Driving License, Fitness Certificate should be submitted to the PMU before the vehicle is mobilized in the project	State Transport Authorities approved PUC certificate providers
10	The Gas Cylinder Rules 2016	To regulate the storage of gas / possession of gas cylinder more than the exempted quantity.	Gas cylinders may be used during welding and other electromechanical work. Storage within threshold quantity and as per capability analysis. Handling with defined safe practices	Yes, Permission will be required by the Contractor if the storage of gas / possession of gas cylinder is more than the exempted quantity(i.e more than 25 cylinders of total weight exceeding 200 kg for flammable non-toxic gases).	Petroleum and Explosives Safety Organization (PESO)
11	The Mines and Minerals (Development and Regulation) Act, 1957	For development and regulation of mines and minerals in a sustainable manner. The rules regulate the mining of mineral and dealerships for mining and trading.	The construction of works will require stones, aggregates, sand, earth, etc.	The mining permit, EC and CTO has to be submitted to the PMU for clearance. No material shall be procured without the approval. For material procured	Mines and Mineral Department

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
				during the construction the e-transit pass would be submitted along with IUFR.	
12	Meghalaya Forest Regulation (Application and Amendment) Act, 1973	The Act provides a comprehensive legal framework for conservation and sustainable use of bio-resources, reflects a strict regime for access, control and benefit sharing. It restricts access and use of biological resources by outsiders and creates decentralized institutional structures (State Biodiversity Boards -SBB and GP level Biodiversity Management Committees) for conservation of biological diversity.	Provisions of this act will not be applicable since road will not adversely affect any biological diversity	No	Meghalaya State Biodiversity Board
13	Meghalaya Biodiversity Rules, 2010	Conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources	Provisions of this act will not be applicable since road will not adversely affect any biological diversity	No	Meghalaya State Biodiversity Board
14	Wildlife protection Act 1972, 2022	Protection of wildlife in the state of Meghalaya	Wildlife impact is not anticipated in this project.	No	State Forest Department
15	Meghalaya Tree (Preservation) Act, 1976, and the Meghalaya Tree Felling (Non-Forest Areas) Rules, 2006	Conservation of forest and controlled felling of trees	Approx. 23 nos of tree are falling within the ROW.	Permission for felling of trees	State Forest Department
16	Disaster Management Act, 2005	The purpose is to have an effective management of disasters and for matters connected therewith or incidental thereto	The project area falls under the seismic (earthquake prone) zone V and hence construction activities/ interventions will be under purview of this act	No. Contractor should be aware of Guidelines/SOPs/Advisory of MSDMA	Meghalaya State Disaster Management Authority (MSDMA)/MPWD

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
17	Meghalaya Disaster Management Rules, 2008	The rule is to provide measures' to be adopted for prevention and mitigation of disaster; mitigation measure to be integrated with development plans and projects; build capacity and preparedness measure; and specify roles and responsibilities to each dept. in relation to adopted measure	During implementation, setting of labour camps and capacity building of contractor staff	No Contractor should be aware of Guidelines/SOPs/Advisory of MSDMA No tree felling shall be felled without permission from the Forest Department.	Meghalaya State Disaster Management Authority (MSDMA)/MPWD
18	Plastic waste management Rules, 2016	The Plastic Waste Management Rules, 2016 provide a framework for the effective management of plastic waste. They aim to minimize the adverse environmental impact of plastic waste and promote sustainable practices for its handling and disposal.	Plastic waste generation from proposed activities. Safe disposal as per Rules	No. Properly segregate plastic waste at source and hand it over to authorized waste collectors, local bodies, or MSPCB authorized agencies/Recyclers	Village Council/ Municipal Authority/MSPCB
19	E-Waste Management Rules, 2016 and amended thereof	Protection of environment against improper handling storage and disposal of hazardous waste.	E-waste generation from replacement of instrumentation. Safe disposal as per Rules	No. Proper segregation and handing over of e-waste to the MSPCB authorized agencies/Recyclers	MSPCB
20	Petroleum Act, 1934, Petroleum Rules, 2002 (under the Petroleum Act, 1934)	Regulates the storage, transport, handling, and use of petroleum and diesel. Requires licenses for storage of petroleum products beyond prescribed limits.	Storage of High-Speed Diesel (HSD) at construction sites (above threshold limits of 2,500 liters in multiple barrels or 1,000 liters in a singletank requires license/approval.	License for storage from PESO (Petroleum and Explosives Safety Organization) for >25000L; NOC from District Authority/Fire Department. (for >2500 L to 25000L)	PESO, Nagpur (through Regional Office) & District Magistrate/Chief Controller of Explosives.
21	Ground Water Regulation (Central Ground Water Authority – CGWA Guidelines, 2017, adopted by States)	Governs the extraction of groundwater for industrial, infrastructure, or commercial use. Requires NOC/permission prior to abstraction.	Applicable (if groundwater extraction proposed) Groundwater extraction for construction, camp use, or dust suppression requires prior permission.	NOC for groundwater abstraction.	CGWA or State Ground Water Authority (if notified).

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
22	The Meghalaya Water Act, 2011	State-level mandate for use of surface water from rivers, streams, ponds, lakes, etc. for non-domestic/commercial purposes.	Construction water requirements may involve use of surface water from nearby streams/rivers with state approval. Surface water from the Simsang river can be used for road construction with prior permission from the Water Resources Department, North Garo Hills District, Meghalaya.	Permission/Allocation order for surface water abstraction.	Water Resources Department, Government of Meghalaya.
SOCIAL REGULATIONS					
1.	The Meghalaya Transfer of Land (Regulation) Act, 1971	The Act stipulates that no land (including immovable property of every description and any rights over such property) in Meghalaya can be transferred by a tribal to a non-tribal or by a non-tribal to another non-tribal except with the prior sanction of the competent authority.	Relevant to all project interventions involving land acquisition, leasing, or transfer. The project will ensure that all land-related activities including documentation, due diligence, and land management planning comply with this Act. No land transfer or use will be undertaken without approval from the competent authority, ensuring protection of tribal land rights and consistency with ESS5 (Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement)..	Prior permission / No Objection from the concerned Autonomous District Council and compliance with the provisions of the Act before land transfer or acquisition.	Revenue Department; Village Councils-Autonomous District Councils (ADCs)
2.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	The Act ensures transparent land acquisition with fair compensation, rehabilitation, and resettlement. It sets minimum compensation norms, R&R entitlements, and facilities for the displaced, allowing states to enhance benefits. The Act also includes special provisions to protect the interests of Scheduled Castes and Scheduled Tribes.	Yes, as the area falls under 6th schedule A review of the legal and institutional framework applicable to indigenous/tribal communities.	No	Revenue Department, Government of Meghalaya, Garo Hills Autonomous District Council The Sixth Schedule establishes the ADC or VC as institutional mechanisms for governing these areas.
3.	Meghalaya Right to Fair Compensation and Transparency in	Aim to provide a fair, transparent, and participatory process for land acquisition while ensuring adequate	Impact on private Assets and properties	Ensure fair compensation and Guarantee transparency in the acquisition process.	Revenue Department/ District Administration, Village Council

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
	Land Acquisition, Rehabilitation and Resettlement Rules, 2017	compensation and rehabilitation for affected families. These rules align with the broader objectives of the RFCTLARR Act to minimize the adverse impact of land acquisition and promote the welfare of those affected by it.			
4.	Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 & Meghalaya Street Vendors (Protection of Livelihood and Regulation of Street Vending) Rules, 2016	It regulates street vending and protects the rights of street vendors by legalizing their right; protects them from sudden eviction or relocation; spells their rights and obligations.	Applicable to all Project road Sub Project Roads in case of economic displacement and relocation of street vendors.	No	District Administration/ District Municipal Authority, Village Councils under the Autonomous District Councils
5.	Rights of Persons with Disabilities Act, 2016	Ensures that the Persons with Disability (PWD) enjoy the right to equality, life with dignity, and respect for his or her own integrity equally with others.	For the entire Project Road Sub Project Road where PwD are present and affected, and for designing the project in an inclusive manner.	No	Department of Social Welfare, Government of Meghalaya
6.	Right to Information Act, 2005	The Act provides for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, the constitution of a Central Information Commission and State Information Commissions and for matters	All documents pertaining to the project would be disclosed to public.	No	Public Information Officer (PIO)

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
		connected therewith or incidental thereto.			
7.	Article 244(2) &275(1) of the Constitution of India - The Sixth Schedule	Article 244(2) establishes Autonomous District Councils (ADCs) in tribal areas, granting them legislative and administrative powers, empowering them to legislate on land, resources, and local governance. Article 275(1) provides financial grants for the welfare and development of Scheduled Tribes and Scheduled Areas	Applicable in designated tribal areas under the Sixth Schedule	No	Government of India, Autonomous District Councils
8.	The Cadastral Survey and Preparation of Records of Rights Act, 1980 (as amended in 1991)	The Act provides for cadastral survey of lands and preparation of land records in the state. The 1991 amendment enables the ADCs to undertake cadastral surveys with financial and technical assistance from the State Government.	Applicable for project activities involving detailed mapping and verification of land ownership or tenure. Under Project, cadastral mapping and systematic land documentation will support preparation of RAP and verification of community and private ownership. Prior clearance from the concerned village councils will be obtained for all project interventions located on or adjacent to community forest land, in line with ESS1 and ESS5.	yes	Revenue and Disaster Management Department; Autonomous District Councils (ADCs)
9.	GHAD (Land transfer regulation) 1958	Regulates the transfer of land within the Garo Hills to protect tribal land ownership. It restricts transfer of land from tribal communities to non-tribals without prior approval of the Autonomous District Council.	Applicable where land within the jurisdiction of the Garo Hills Autonomous District Council is involved in acquisition, transfer, or use for development projects. If the project utilizes existing government ROW without land transfer, it may not require permission.	Prior permission/No Objection Certificate (NOC) may be required for transfer, lease, or use of land falling under the jurisdiction of the District Council.	Garo Hills Autonomous District Council
LABOUR LAWS APPLICABLE					

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
1	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	It regulates the employment and conditions of service of building and other construction workers and provides for their safety, health and welfare.	Applicable for all building or other constructions works under the project that employs 10 or more workers.	Establishment Registration is required	Labour Commissioner, Meghalaya
2	Workmen Compensation Act, 1923	It provides for payment of compensation by employers to their employees for injury by accident i.e., personal injury or occupational disease.	Construction workers will be involved in the Project Road Sub Project Roads	Workmen compensation Insurance Policy	Commissioner for Workmen's Compensation
3	ESI Act, 1948 (Employees State Insurance Act, 1948)	Employees State Insurance Act provides for health care and hospitalization benefits for construction work force	Construction workers will be involved in the Project Road Sub Project Roads	Insurance Policy.	Commissioner for Workmen's Compensation
4	Inter-state Migrant Workers Act, 1979	It protects workers whose services are requisitioned outside their native states in India. A contractor who employs or who employed five or more Inter-State migrant workmen need to obtain registration under this act	Construction workers will be involved in the Project Road Sub Project Roads	Registration/Labour license	Labour Commissioner, Meghalaya
5	The Child Labour (Prohibition & Regulation) Amendment Act, 2016	It prohibits employment of children in specified hazardous occupations and processes and regulates the working conditions in others.	There should not be any child labour (less than 14 years) in any project activity and adolescents (above 14 and less than 18 years) in any hazardous activity.	No	Labour Commissioner, Meghalaya/ Department of Social Welfare, Government of Meghalaya
6	Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act)	It mandates every organization having more than ten employees to constitute an Internal Complaints Committee (ICC) in the prescribed manner to receive and address the complaints of any sort of sexual harassment from women in a time-	Applicable to all implementing agencies	No	District Officer (District Magistrate or Additional District Magistrate)

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
		bound and extremely confidential manner			
7	Contract Labour (Regulation & Abolition) Act 1970	To provide proper and habitable working conditions. To regulate the functioning of the advisory boards. To lay down the rules and regulations regarding the registration procedure of the establishments employing contract labour	Applicable to all implementing agencies	Labour License Required	Labour Commissioner, Meghalaya
8	Payment of Wages Act, 1936 and the Minimum Wages Act, 1948	Lays down as to by what date, wages are to be paid, when it will be paid and what deductions be made from the wages of the workers, if any.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
9	Payment of Gratuity Act, 1972 The payment of gratuity rules Meghalaya 1972	Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation, if an employee has completed 5 years of service with employer	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
10	Employees Provident Fund and Miscellaneous Provision Act, 1952	Provides for monthly contributions by the employer and as well as by workers with a provision as return of pension of a lump sum (principal and interest accrued) at the end of his/her service term).	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
11	Maternity Benefit Act, 1951 Meghalaya Maternity benefit Rules 1965	Provides for maternity leave for women, during pregnancy and after giving birth and some other benefits to women employees, in case of medical recommendation of bed rest or miscarriage etc.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
12	Payment of Bonus Act, 1965 The Payment of Bonus Rules Meghalaya 1975	Provides payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
13	The Bonded Labour (Abolition) Act 1976 Bonded Labour System (Abolition) Rules 1976	An Act to provide for the abolition of bonded labour system, with a view to prevent economic and physical exploitation of the weaker sections of the people and for all matters connected there with or incidental thereto	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
14	The Trade Union Act, 1926	Lays down the procedure for registration of trade union of workers and employers. The trade unions registered under the Act have been given certain immunities for civil and criminal liabilities.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
15	Schedule Caste and Schedule Tribe (Prevention of Atrocities Act 1989)	Atrocity with SC and ST community is defined as an offense punishable under Section 3 of the Act	Project Area is protected under Sixth Schedule of the Constitution	No	Social Welfare Department, Meghalaya
16	Meghalaya Right to Public Services Act, 2020	Ensures timely delivery of notified public services to citizens by government departments, enhancing transparency, accountability, and efficiency in governance.	Applicable to all government departments and public service providers in Meghalaya	No	Meghalaya State Public Services Delivery Commission (MSPSDC)
17	Occupational Safety, Health & Working Conditions (OSH) Code, 2020 + Meghalaya Factories Rules, 2015	Site safety standards, PPE, welfare amenities, working hours, accident reporting, medical checks, registration of establishments.	Applicable to all construction, labour camps, work fronts, and site facilities	Yes*	Labour Commisioner, Government of Meghalaya
18	Code on Wages, 2019 + Meghalaya Minimum Wages Notifications (latest revision)	Minimum wages (Skilled/Semiskilled/Unskilled), equal pay, wage slips, timely payment, prohibition of illegal deductions.	Applicable to all wage payments through contractors and subcontractors at MLCIP sites.	Yes*	Labour Commisioner, Government of Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ non-applicability	Regulatory Clearance Requirement	Authority
19	Industrial Relations (IR) Code, 2020 + Meghalaya Industrial Disputes Rules, 1973	Conciliation, dispute settlement, prohibition of unfair labour practices, notice of changes in service conditions.	Applicable for grievance redress, worker disputes, conciliation and retrenchment-related issues.	Yes*	Labour Commisioner, Government of Meghalaya
20	Code on Social Security, 2020 + Meghalaya BOCW Welfare Board Rules, 2006	Social security benefits, maternity benefits, PF/ESI, construction worker registration, insurance and disability benefits.	Applicable to EPF/ESI coverage (where notified), worker registration, welfare board benefits.	Yes*	Central: EPFO, ESIC State: Meghalaya BOCW Welfare Board; Labour Department State Rules: Meghalaya BOCW (RE&CS) Rules, 2006

**The labour codes shall be applicable in the state of Meghalaya upon receiving notification from the Government of Meghalaya.*

2.2 IRC AND MORTH CODES APPLICABLE TO THE PROJECT

All road works in India must comply with the IRC, MoRTH guidelines and BIS Codes. Key relevant IRC codes that may directly or indirectly influence the environmental and social management during the design, construction and operational phases are given in **Annexure 2.1**.

2.3 LAND REVENUE GOVERNANCE AND ADMINISTRATION IN GHADC

When Meghalaya was formed in 1972, the Garo Hills Autonomous District Council (GHADC) was retained with its mandate and governance framework largely unchanged. Over time, the Autonomous District Councils (ADCs) have undertaken efforts to codify tribal customary laws through legislations enacted under their authority. Traditional customary institutions have maintained a strong presence in the region, and despite the historical shifts introduced by the British administration and subsequently the Indian State, these institutions have continued to function adapting their practices to align with evolving legal and administrative frameworks.

The Sixth Schedule of the Constitution of India provides the framework for the establishment of Autonomous District Councils (ADCs) in tribal areas. Members of the ADCs are elected by the tribal population for a term of five years. The Garo Hills ADC functions with its own rural and urban local bodies, serving as an important institutional layer of governance.

ADCs act as a bridge between formal state structures and traditional tribal institutions, ensuring that governance reflects both constitutional provisions and customary practices. The Sixth Schedule establishes a system of autonomous, decentralized governance, endowing ADCs with legislative, executive, and judicial powers, including authority to adjudicate certain categories of civil and criminal cases.

In rural areas, traditional institutions such as the Nokmas a two-tier political system among the Garos continue to play a central role. In practice, it is not the State Government, but rather the Autonomous District Councils (ADCs) in conjunction with tribal institutions, that function as the primary authorities for the administration and management of natural resources, including land.

In the Garo Hills, the traditional village chief (Nokma) is regarded as the owner and custodian of community lands. In practice, the Nokma's husband exercises rights to manage the land through his wife, and may dispose of land only with her consent. Village inhabitants are entitled to cultivate as much land as they require, and may select plots within the village boundary, subject to the Nokma's approval. Outsiders are also permitted to settle in the village, provided they offer either an annual rent or a one-time gift/present to the headman.

Details of land procurement mechanisms are provided below in **Table 2.2**

Table 2:2: Details of land procurement mechanisms

Category	***Garos***
Basis of classification	Ownership of land
Type of land	2 types of ownership 5 Types, 1. A-king Land, 2. A-mate land, 3. A-jinma or A-joma land, 4. A-jikse land, 5. A-milam land
Control and Management	The ancestral head Nokma (head of the clan) manages and allots land to the community. While the Maharis (clan members) look after A-jinma land.
Inheritance	Women inherit and own property: It is usually the youngest daughter who inherits the property.
Records	*Pattas* are the primary records available in the region, dating from the

Category	***Garos***
	colonial period. In Garo Hills, land is primarily owned and managed by the communityies and land records are generally maintained through customary institutions, where the Nokma (village head) manages and allocates A'king land (clan/community land) to clan members for cultivation and settlement. The Hill areas of Garo Hills are the A'King lands, which belongs to the A'King Nokma (headman) of a particular clan. The entire A'King lands are managed by the A'King Nokma who is the guardian and custodian of a particular clan or motherhood. J.D. Walker demarcated the A'King land boundaries and gave the *Nokma*s settled maps in the late 1920s. The availability of patta documents in the villages part of the study show the colonial legacy which is often the only record of the land. (Marak, 1986). Garo Hill Autonomous District Council (GHADC) is known to have the maps for large parts of the district in the Garo Hills.
Systems for sale/purchase/ mortgage	Pattas are instrumental in mortgaging land in the bank for loans. Selling of the land in the village requires the Nokmas presence as witness. Any transactions or inheritance pertaining to the land is recorded in the patta at the District Council, Office. The District Council do not have direct control over the A'King lands and cannot take any arbitrary decisions in matters of sale, mortgage, gift, transfer, etc. Land Classification.
Managing private property	The *Nokna* (heiress) is the owner of family property and has a say in management of both movable and immovable property, whether ancestral or self-acquired. Customarily, no property can be disposed of without the consent of the heiress. However, there might be variations in practice.
Managing community property	For the community lands, the power to make decisions is vested in the *nokma* of the village. For the clan land, the *nokna* (in heiress) along with her husband and the *chras* (brothers and maternal uncles) decides together. Any such transaction undertaken without prior consent of the wife *(nokna)* andher C*hra* is considered null and void (Marak, 1986).

[1] Source:Momin, M. (Ed.). (2003). Readings in History and Culture of the Garos (Essays in honour of Milton S. Sangma). Regency Publications

Awensing R. Sangma: Atchu Ambini Poedorang, p 39; Also see Wangalani Bimik by the same author, pp 31-32.

Marak, G. S. (1986). *Janggi Tangani*. Tura, West Garo Hills: Published by Surendra S. Marak.

3. SUB PROJECT ROAD DESCRIPTION

3.1 RONGRENGGRE-SIMSANGGRE-NENGKHRA (RSN) Road

The proposed sub project Road existed before the formation of Meghalaya state and ROW is limited only up to the existing Drain.The proposed Sub-project road has a total length of 20.564 km, commencing from Rongrengre at chainage 00+000 and terminating at Nengkhra Bazar at chainage 20+564. The Proposed road existed before the formation of Meghalaya state as per discussions with the MPWD officials.

3.2 Location details of the RSN Sub Project Road

This sub project road traverses a diverse landscape, including hilly terrains, agricultural lands, built-up areas, and passes through 7 Villages including 14 habitations. The Sub project road serves as a critical regional connector, enhancing access to economic hub and industrial centers.

Table 3.1 presents the chainage-wise details of Sub-Project road while **Figure 3.1** illustrates the road alignment map.

Table 3.1: Chainage wise RSN Sub-project Road details

Sl. No.	Starting Chainage	End Chainage	Sub-project No.	Project length as per DPR	Districts
1	00+000	20+564	1	20.564	East Garo Hills

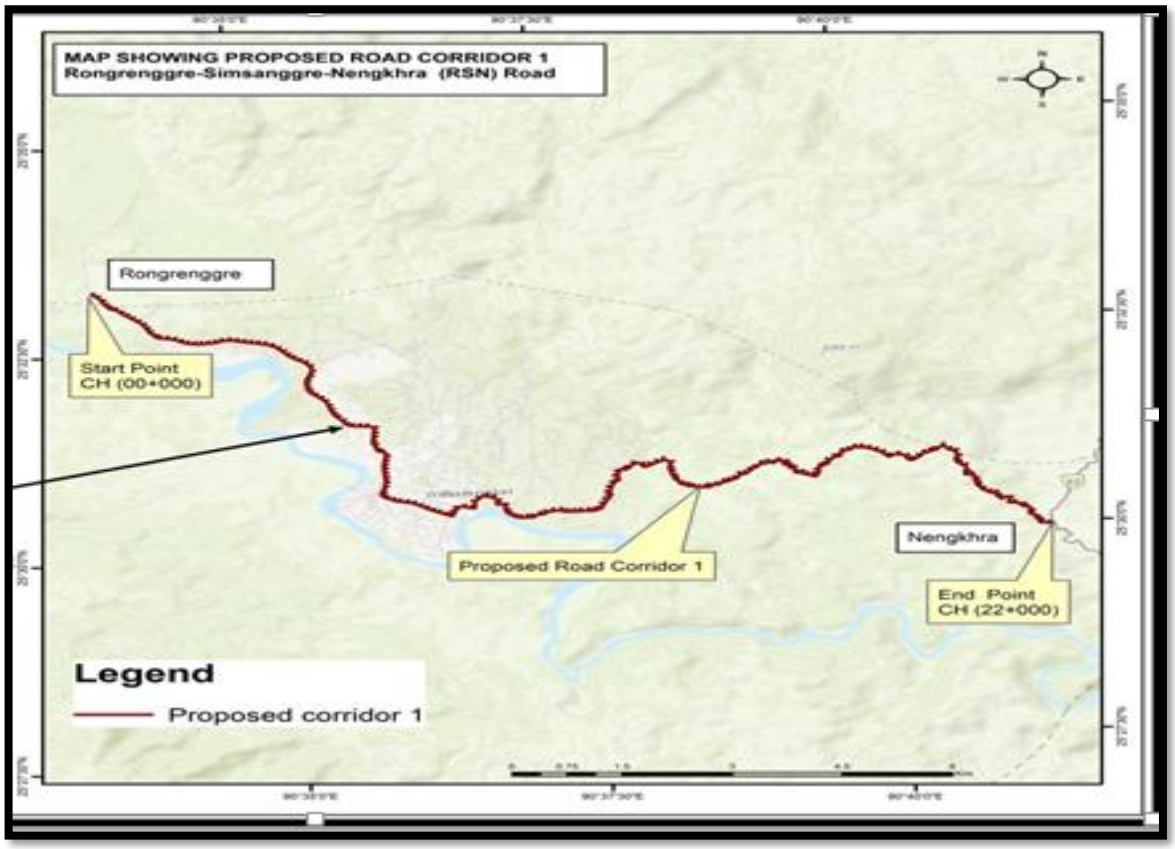


Figure 3.1: Road alignment map for RSN Road

3.3 Project Influence Area

For the purpose of this study, the Project Influence Area has been categorized in three tiers to facilitate a holistic environmental and social impact of the road stretch and to minimize potential environmental and social risks. Three tiers are given below

1. 12 m of ROW for Direct Impact (6m from Centre line)
2. 500 m buffer for indirect impact area [2]ie Corridor of Indirect Impact
3. 10 km of study area

The existing and proposed Right of Way (RoW) of the Sub-Project has been considered adequate for characterizing baseline conditions and for assessing direct socio-economic impacts, including the profile of affected persons, religious structures, and common property resources.

The study impact area has been delineated as 0.5 km on either side of the proposed RoW from the Centre line. This buffer has been considered adequate to cover drainage channels, biodiversity-rich zones, natural habitats, protected areas, agricultural land, unstable slopes stretches, marshy areas, surface water bodies, physical features, and settlements, among others. The LULC map of the direct impact area is presented in **Figure 3.2**.

The following sections of this chapter provide details of the existing road characteristics, key project components, resource requirements and proposed improvements.

3.4 Key Existing Conditions And Proposed Improvements Of The RSN Roads

The key existing conditions and proposed improvements for the RSN project roads are presented in the following sub-sections. These have been compiled based on primary field surveys and the Detailed Project Report (DPR).

3.4.1 Right of Way, Carriage Width AND Pavement Conditions

The Right of Way (RoW) and Carriage Way (CW) for the 20.564 km sub-project road are summarized in **Table 3.2**. The Rongrenggre-Simsanggre-Nengkhra (RSN*)* Road is presently a single-lane roadway with a bituminous pavement surface. The existing road conditions are generally good, except with potholes prevalent across some stretches. Inadequate drainage exacerbates deterioration during rainfall, making traffic movement difficult.

Existing Carriage width of Sub Project Road varies from 4.2 m and proposed width is 5.5 m for intermediate lane. As per DPR design, the Sub project requires 11m – 12m.

Table 3.2: Details of Available ROW

S. No.	Village	Chainage from	Chainage to	Length (in m)	Available RoW (in m)
1	Rongrengre	0.000	0.132	0.132	13.00
2	Rongrengre	0.132	0.330	0.198	15.00
3	Rongrengre	0.330	0.430	0.100	14.50
4	Rongrengre	0.430	0.535	0.105	11.50
5	Rongrengre	0.535	0.635	0.100	12.00
6	Rongrengre	0.635	0.835	0.200	13.00
7	Rongrengre	0.835	1.000	0.165	12.50
8	Upper Rongreng Baiza	1.000	2.000	1.000	12.50
9	Lower Baiza	2.000	2.130	0.130	12.00

[2] Based on Earlier experiences it was observed that dust, noise and other environmental parameters would get attenuated/diluted to meet existing baseline conditions within 500 m from the source.

10	Lower Baiza	2.130	3.000	0.870	13.00
11	Chidekgre	3.000	4.000	1.000	13.00
12	RangmalBadim	4.000	6.000	2.000	13.00
13	Kusimkolgre	6.000	6.200	0.200	13.00
14	Kusimkolgre	6.200	6.500	0.300	14.000
15	Kusimkolgre	6.500	6.892	0.392	13.000
16	Kusimkolgre	7.900	7.970	0.070	10.700
17	Kusimkolgre	8.005	8.018	0.013	12.000
18	Kusimkolgre	8.018	8.120	0.102	12.000
19	Kusimkolgre	8.120	8.225	0.105	14.000
20	Kusimkolgre	8.225	8.520	0.295	12.000
21	Kusimkolgre	8.520	8.590	0.070	12.000
22	Kusimkolgre	8.590	9.000	0.410	12.000
23	TambuA'ding	9.000	9.445	0.445	12.000
24	TambuA'ding	9.445	9.473	0.028	11.500
25	TambuA'ding	9.495	9.570	0.075	14.000
26	TambuA'ding	9.570	10.000	0.430	11.500
27	Ampangdamgre	10.000	10.100	0.100	12.500
28	Ampangdamgre	10.100	10.175	0.075	12.000
29	Ampangdamgre	10.175	10.339	0.164	13.000
30	Ampangdamgre	10.339	11.000	0.661	12.500
31	Dobetkolgre	11.000	11.170	0.170	12.000
32	Dobetkolgre	11.230	11.720	0.490	12.000
33	Dobetkolgre	11.720	11.824	0.104	13.000
34	Dobetkolgre	11.824	12.500	0.676	11.000
35	DawaNengjata	12.500	14.500	2.000	12.000
36	DawaChipitgre	14.940	15.020	0.080	10.000
37	DawaChipitgre	15.120	15.200	0.080	10.000
38	DawaChipitgre	16.480	16.529	0.049	10.000
39	DawaChipitgre	16.541	16.610	0.069	10.000
40	Kusimkolgre	6.892	7.547	0.655	10.700
41	Kusimkolgre	7.547	7.554	0.007	10.700
42	Kusimkolgre	7.554	7.700	0.146	10.700
43	Kusimkolgre	7.700	7.900	0.200	10.700
44	Kusimkolgre	7.970	8.005	0.035	10.700
45	TambuA'ding	9.473	9.495	0.022	11.500
46	Dobetkolgre	11.170	11.230	0.060	11.500
47	DawaChipitgre	14.500	14.730	0.230	10.000
48	DawaChipitgre	14.730	14.940	0.210	10.000
49	DawaChipitgre	15.020	15.120	0.100	10.000
50	DawaChipitgre	15.200	15.835	0.635	10.000
51	DawaChipitgre	15.835	15.885	0.050	10.000
52	DawaChipitgre	15.885	16.060	0.175	10.000
53	DawaChipitgre	16.060	16.190	0.130	10.000
54	DawaChipitgre	16.190	16.417	0.227	10.000

55	DawaChipitgre	16.417	16.480	0.063	10.000
56	DawaChipitgre	16.529	16.541	0.012	10.000
57	DawaChipitgre	16.610	16.770	0.160	10.000
58	DawaChipitgre	16.770	17.000	0.230	10.000
59	Nengkhra	17.000	17.313	0.313	8.750
60	Nengkhra	17.313	17.335	0.022	8.750
61	Nengkhra	17.335	17.541	0.206	8.750
62	Nengkhra	17.541	17.821	0.280	8.750
63	Nengkhra	17.821	17.829	0.008	8.750
64	Nengkhra	17.829	17.840	0.011	8.750
65	Nengkhra	17.840	17.940	0.100	8.750
66	Nengkhra	17.940	18.450	0.510	8.750
67	Nengkhra	18.450	18.510	0.060	8.750
68	Nengkhra	18.510	18.570	0.060	8.750
69	Nengkhra	18.570	18.695	0.125	8.750
70	Nengkhra	18.695	19.000	0.305	8.750
71	Chimagre	19.000	19.360	0.360	8.750
72	Chimagre	19.360	19.430	0.070	8.750
73	Chimagre	19.430	19.560	0.130	8.750
74	Chimagre	19.560	19.740	0.180	8.750
75	Chimagre	19.740	19.990	0.250	8.750
76	Chimagre	19.990	20.500	0.510	8.750
77	Nengkhra Bazar	20.500	20.564	0.064	8.750

(Source: DPR)

Pavement Details:

The Pavement design for main carriageway has been carried out in accordance with IRC: SP: 72-2015 and IRC: 37-2018 guidelines.
The Pavement has been designed with the following inputs: -

- Design Life: 15 years, Design Traffic: 5 MSA, and Subgrade effective CBR (%) – 5 %
- Assumed Pavement composition: BC- 40mm, CTB-170 mm, CTSB-200 mm, Subgrade – 500 mm.

A SAMI layer is to be provided between the bituminous layer and the cementitious base that delays the reflection of crack from the CTB layer to the bituminous layer. The Stress Absorbing Membrane Interlayer (SAMI) of elastomeric modified binder applied at the rate of 10 – 12 kg/10 m^2 covered with 0.1 m^3 of 11.2 mm aggregates

Structural analysis using IITPAVE indicates that the calculated tensile and compressive strains are well within the allowable limits, confirming the adequacy of the proposed pavement crust. Additionally, tensile strain at the bottom of the CTB layer and cumulative fatigue damage due to axle load spectrum were evaluated and found to be within permissible limits. Hence, the proposed pavement crust thickness is considered satisfactory for the design conditions.

Recycling of Pavement

Pavement recycling involves reclaiming and reusing existing pavement materials after reprocessing for resurfacing, repaving, or reconstruction, depending on pavement condition and material characteristics. This approach is environmentally beneficial as it conserves natural aggregates and reduces waste disposal, while also being economically advantageous by reusing the existing bitumen and reducing the need for costly virgin materials. For the project, recycling of the existing bituminous pavement will be carried out using a milling machine and recycling plant,

and the reclaimed material will be incorporated into the new CTB/CTSB layers in accordance with IRC: 120-2015. The recycling proposal covers approximately 50% of the total project length, with a salvage value of 20% considered in the analysis.

Junctions Details:

The details of major and minor junctions are provided in **Table 3.3**.

Table 3.3: List of Major and Minor Junctions of RSN Road Section

Sr. No.	Existing Chainage (Km)	Junction Type	Side	Village / Destination / Remarks	Junction Category
1	00+000	T	-	-	Major Junction
2	01+300	T	Left	To Meghalaya Forest Training School	Minor Junction
3	01+672	T	Right	Vill. Wannanggre	Minor Junction
4	02+237	T	Left	St Marys Secondary School	Minor Junction
5	02+602	Y	Right	Vill. Wannanggre	Minor Junction
6	02+630	T	Left	Rongreng Girl Silviculture Range	Minor Junction
7	02+968	Y	Right	-	Minor Junction
8	06+238	Y	Right	Vill. Nokgilawe	Minor Junction
9	06+530	T	Left	Horti Hub Samgong Williamnagar	Minor Junction
10	06+683	T	Left	Williamnagar	Minor Junction
11	06+905	T	Left	Williamnagar	Minor Junction
12	06+958	T	Right	Vill. Nokgilawe	Minor Junction
13	07+253	T	Left	Vill. Asiragre	Minor Junction
14	07+253	T	Right	Vill. Asiragre	Minor Junction
15	07+588	T	Left	Vill. Asiragre	Minor Junction
16	07+668	T	Left	-	Minor Junction
17	07+970	T	-	-	Minor Junction
18	08+432	+	Left+Right	Vill. Williamnagar	Minor Junction
19	08+765	T	Left	-	Minor Junction
20	09+545	T	Left	-	Minor Junction
21	10+890	T	Left	-	Minor Junction
22	11+205	Y	Left	Vill. Dobetcolgre	Minor Junction
23	11+435	T	Left	Vill. Dobetcolgre	Minor Junction
24	11+725	T	Left	Vill. Dobetcolgre	Minor Junction
25	12+805	Y	Right	-	Minor Junction
26	13+990	Y	Left	Vill. Rongongre	Minor Junction
27	15+290	Y	Right	-	Minor Junction
28	17+975	Y	Left	Vill. Dawa Gittinggre	Minor Junction
29	20+564	T	-	-	Major Junction

(Source: DPR)

Details of Breast Walls: In sections where the cutting height exceeds 3.0 m, a stone masonry breast wall has been proposed with a variable height of up to 2.0 m. The corresponding structural and dimensional details are illustrated

below in table 3.4

Table 3.4: Details of Breast Walls

From (Chainage)	To (Chainage)	Length (m)	Height (m)	Protection Type
Left Hand Side				
18580	18670	90	1	Protection wall upto 3m and Bioengineering
Total (LHS)		**90**		
Right Hand Side				
18460	18510	50	2	Protection wall upto 3m and Bioengineering
19390	19450	60	1	Protection wall upto 3m and Bioengineering
19560	19690	130	1	Protection wall upto 3m and Bioengineering
Total (RHS)		**240**		

3.4.2 PROPOSED ROAD CROSS SECTIONS

The Rongrenggre-Simsanggre-Nengkhra (RSN) Road traverses gently undulating to moderately rolling terrain with elevations ranging from 212 m to 561 m amsl. The alignment largely follows the natural ground profile, requiring only localized earthwork. Minor cutting is needed between at 6+900 where the road runs close to riverbanks and eroding slopes, necessitating bench cutting and slope protection such as gabion and retaining walls. Embankment raising is proposed at low-lying stretches CH 17+300 to CH 17+340 to prevent flooding and improve drainage. Overall, the Sub-Project requires moderate earthwork, with no major cutting, and incorporates suitable drainage and slope stabilization measures to ensure long-term stability and all-weather connectivity.

A total of 10 Typical Cross-Sections (TCS) has been proposed in the DPR (**Annexure 3.1**) for the 20.564 km road stretch. These TCSs vary, with some sections incorporating intermediate lanes, and are specifically designed to address the terrain and infrastructure requirements of the Sub Project Road, including provisions for road widening, slope stabilization, drainage, and utility Sub Project Roads.

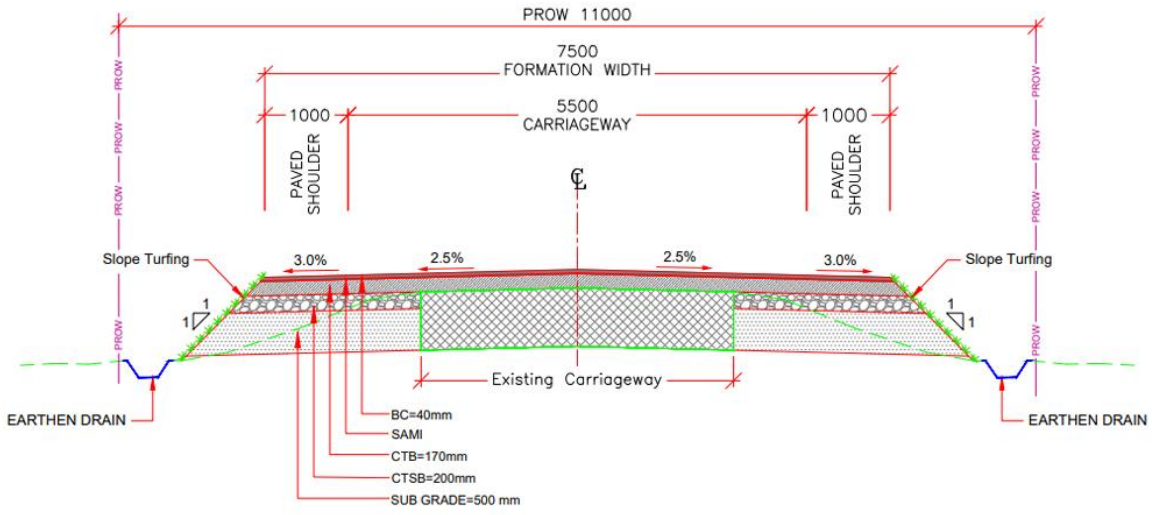
Based on these cross-sections, certain environmental and social impacts may arise, including additional land requirements, tree cutting, and disruption to local ecosystems, biodiversity loss, and alterations to the natural landscape

Details of the 114 different cross-sections, along with the chainage-wise designs adopted, are provided in **Annexure 3.1**. Design details are given in **Figure 3.5.**

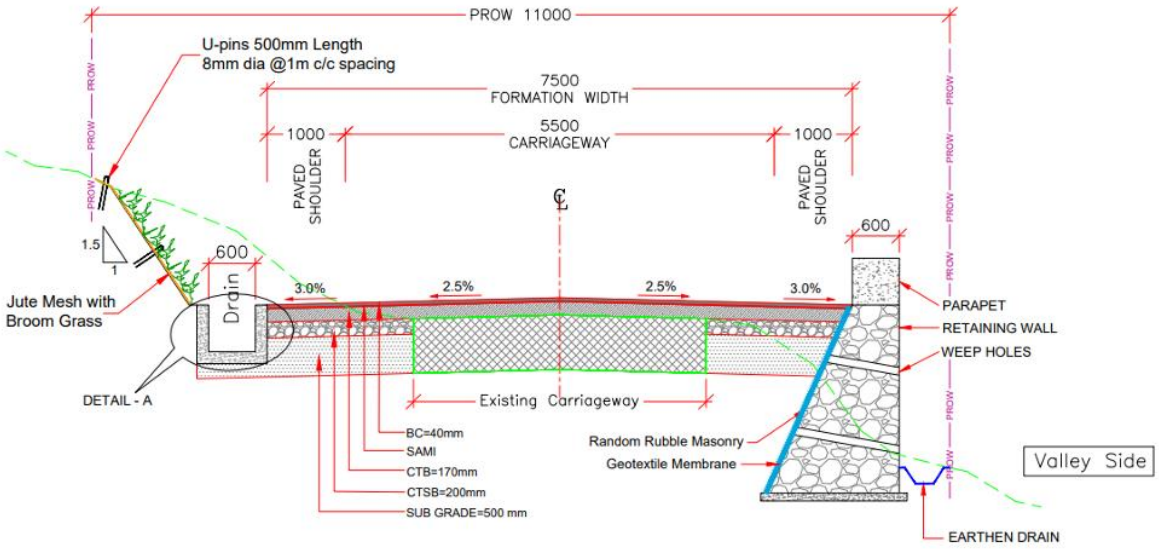
Table 3.5: TCS Types and their relevant Chainages

Sl. No.	TCS Type	Applicable Chainages
1	**TCS-1**	06+500–06+880, 07+700–07+900, 07+970–08+005, 08+225–08+590, 08+590–09+445, 10+175–10+339, 10+500–10+800, 10+860–11+090, 11+824–12+015, 12+240–12+600, 12+740–12+820, 12+930–13+140, 13+190–13+340, 13+480–13+561, 13+573–13+680, 13+880–14+030, 14+240–14+730, 15+320–15+800, 16+190–16+409, 16+770–16+940, 17+020–17+301, 17+335–17+541, 19+430–19+560, 20+043–20+264, 20+284–20+355, 20+493–20+564
2	**TCS-2**	09+570–10+100, 10+800–10+860, 11+090–11+170, 11+230–11+538, 11+547–11+720, 12+600–12+740, 13+140–13+190, 13+340–13+480, 15+200–15+320, 15+885–15+980
3	**TCS-2A**	15+980–16+035
4	**TCS-3**	06+200–06+500, 06+892–07+547, 07+554–07+700
5	**TCS-4**	10+351–10+500, 12+015–12+240, 12+820–12+930, 13+680–13+880, 14+030–14+240, 15+020–15+120, 15+800–15+835, 16+035–16+060, 16+940–17+020, 17+940–18+268, 18+276–18+380, 18+510–18+570, 18+695–19+360, 19+990–20+030, 20+370–20+417, 20+427–20+483

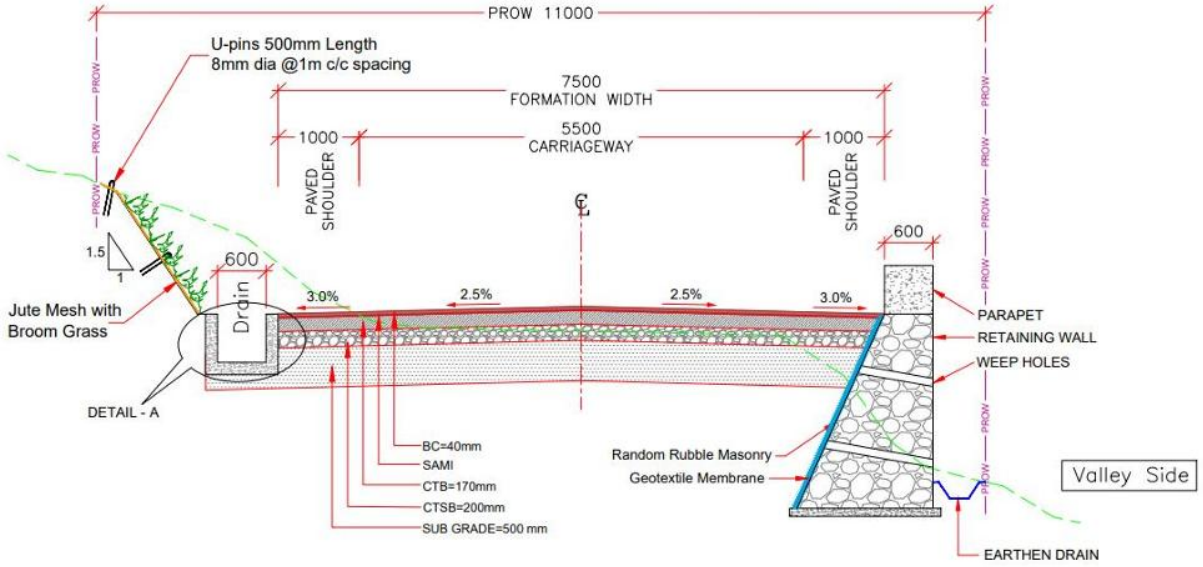
6	**TCS-4A**	18+380–18+450
7	**TCS-5**	00+000–03+468, 03+518–03+724, 03+737–04+378, 04+386–05+505, 05+513–06+200
8	**TCS-6**	08+018–08+120, 09+445–09+473, 09+495–09+570, 11+720–11+749, 11+757–11+784, 14+940–15+020, 15+120–15+200, 16+480–16+529, 16+541–16+610, 17+313–17+335, 17+829–17+840
9	**TCS-6A**	07+900–07+970
10	**TCS-7**	08+120–08+225, 08+520–08+590, 10+100–10+175, 11+170–11+230, 14+765–14+940, 15+835–15+885, 16+060–16+190, 16+417–16+480, 16+610–16+770, 17+541–17+821, 17+840–17+940, 19+740–19+990
11	**TCS-8**	14+730–14+765
12	**TCS-9**	18+570–18+695
13	**TCS-10**	18+450–18+510, 19+360–19+430, 19+560–19+740
14	**Bridge**	03+468–03+518, 03+724–03+737, 04+378–04+386, 05+505–05+513, 06+880–06+892, 07+547–07+554, 08+005–08+018, 09+473–09+495, 10+339–10+351, 11+538–11+547, 11+749–11+757, 11+784–11+824, 13+561–13+573, 16+409–16+417, 16+529–16+541, 17+301–17+313, 17+821–17+829, 18+268–18+276, 20+030–20+043, 20+264–20+284, 20+355–20+370, 20+417–20+427, 20+483–20+493



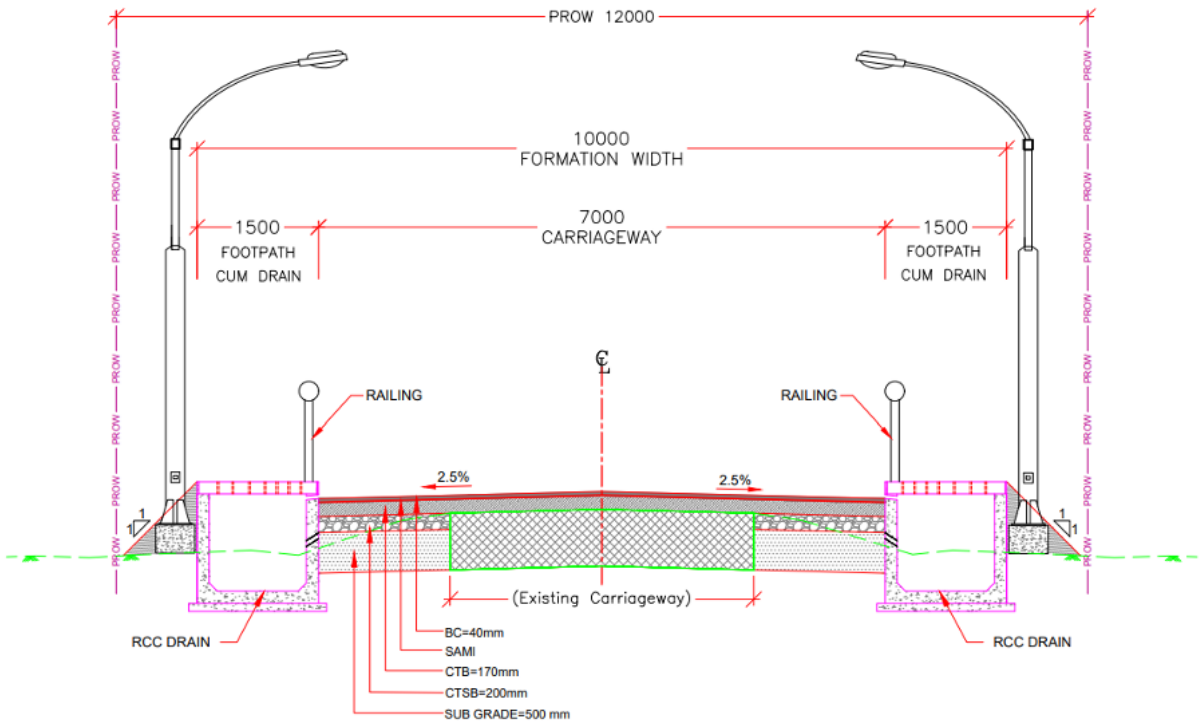
Typical Cross Section-01
Reconstruction of Intermediate Lane in Normal Fill/Cut (<1m)



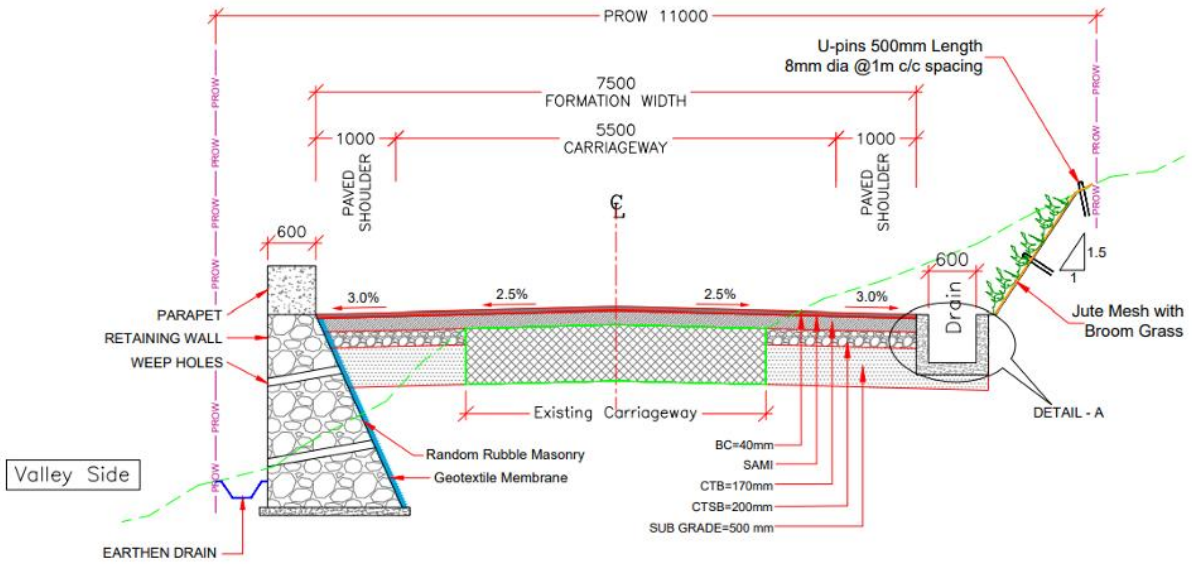
Typical Cross Section - 02
Reconstruction of Intermediate Lane with Cutting on Left side and Filling with Protection on Right side



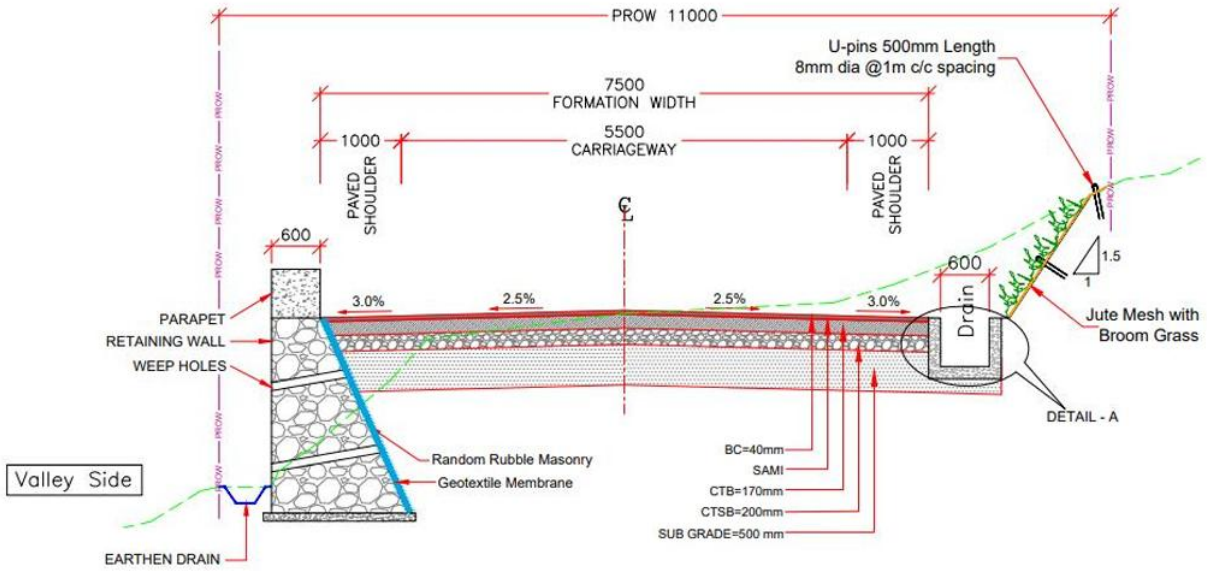
Typical Cross Section - 02 A
Re-alignment of Existing road with Cutting on Left side and Filling with Protection on Right side



Typical Cross-Section - 03
Reconstruction of Intermediate Lane for Built up Section with Both Side Drain Cum Footpath

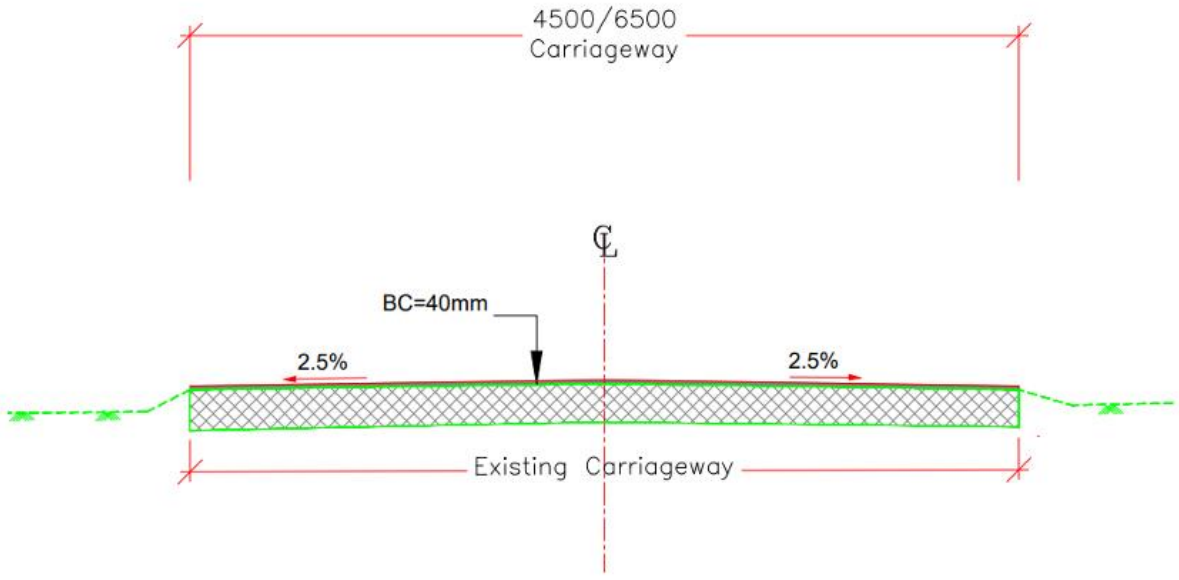


Typical Cross Section - 04
Reconstruction of Intermediate Lane with Cutting on Right side and Filling with Protection on Left side



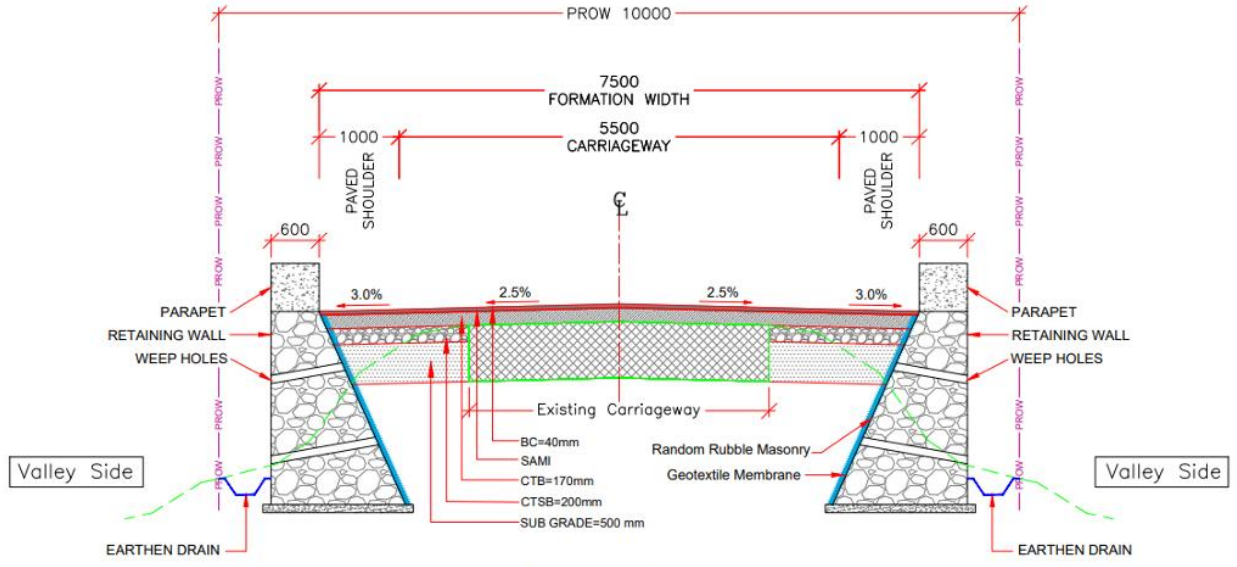
Typical Cross Section - 04A

Re-alignment of Existing Road with Cutting on Right side and Filling with Protection on Left side

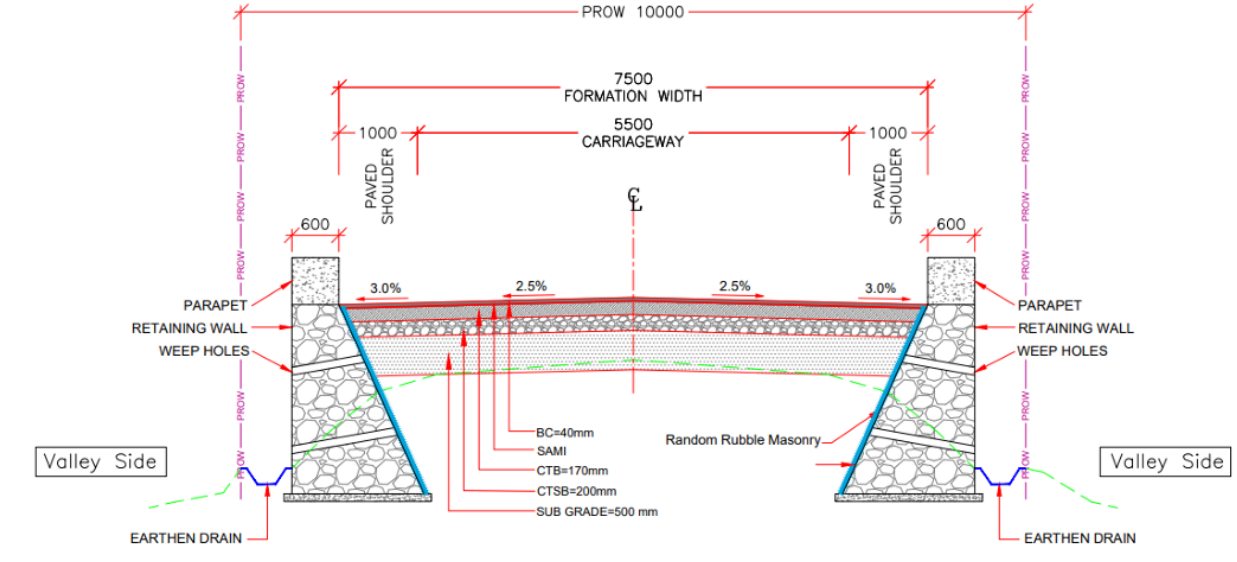


Typical Cross Section-05

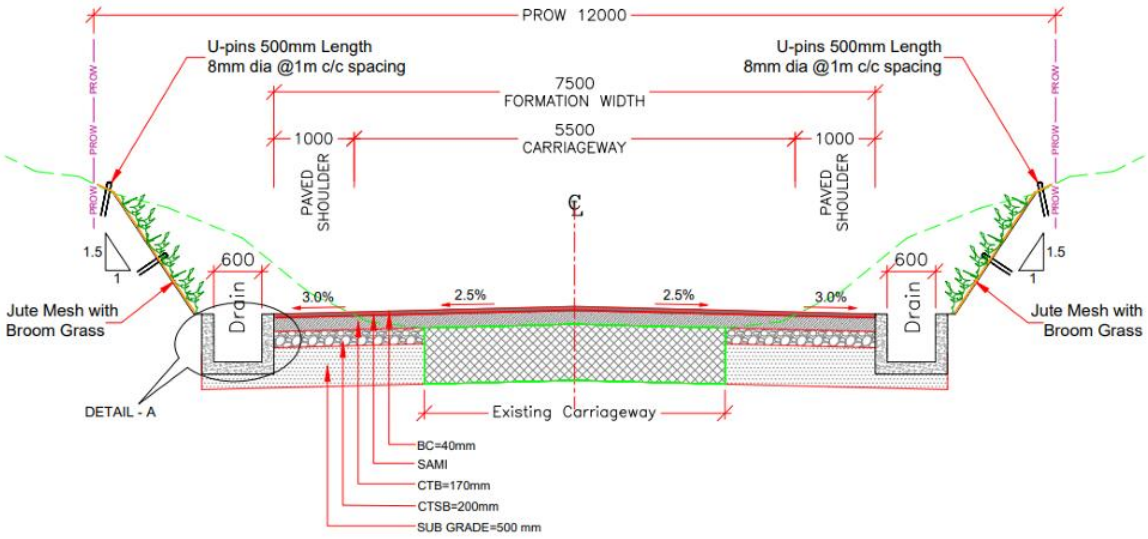
Forest Area (Follow existing alignment with overlay Km.0+000 to Km.6+200)



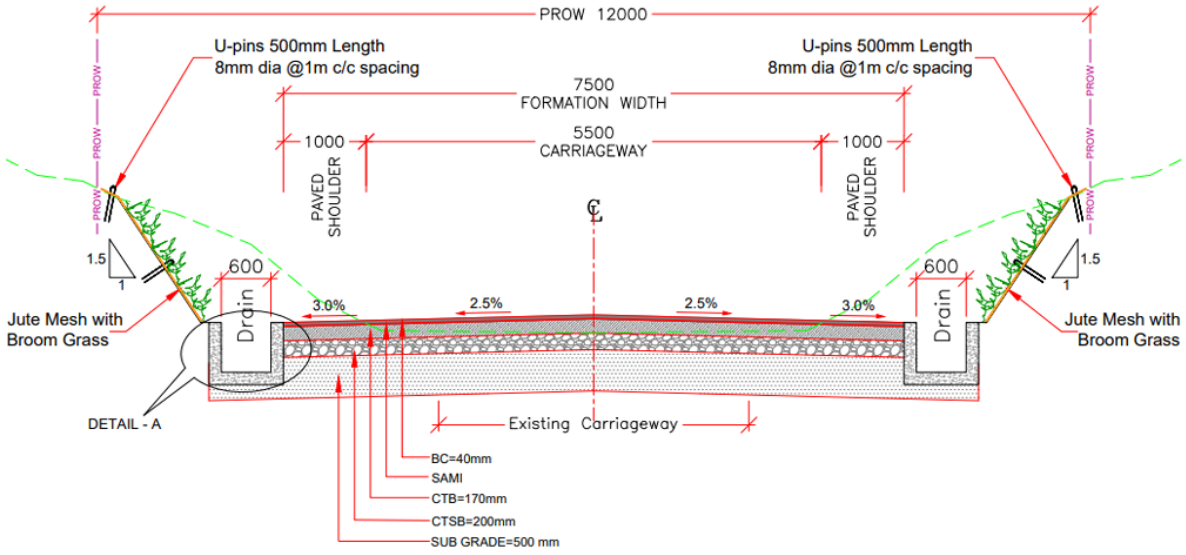
Typical Cross Section - 06
Widening/ Reconstruction of Existing Road With Filling Both Side



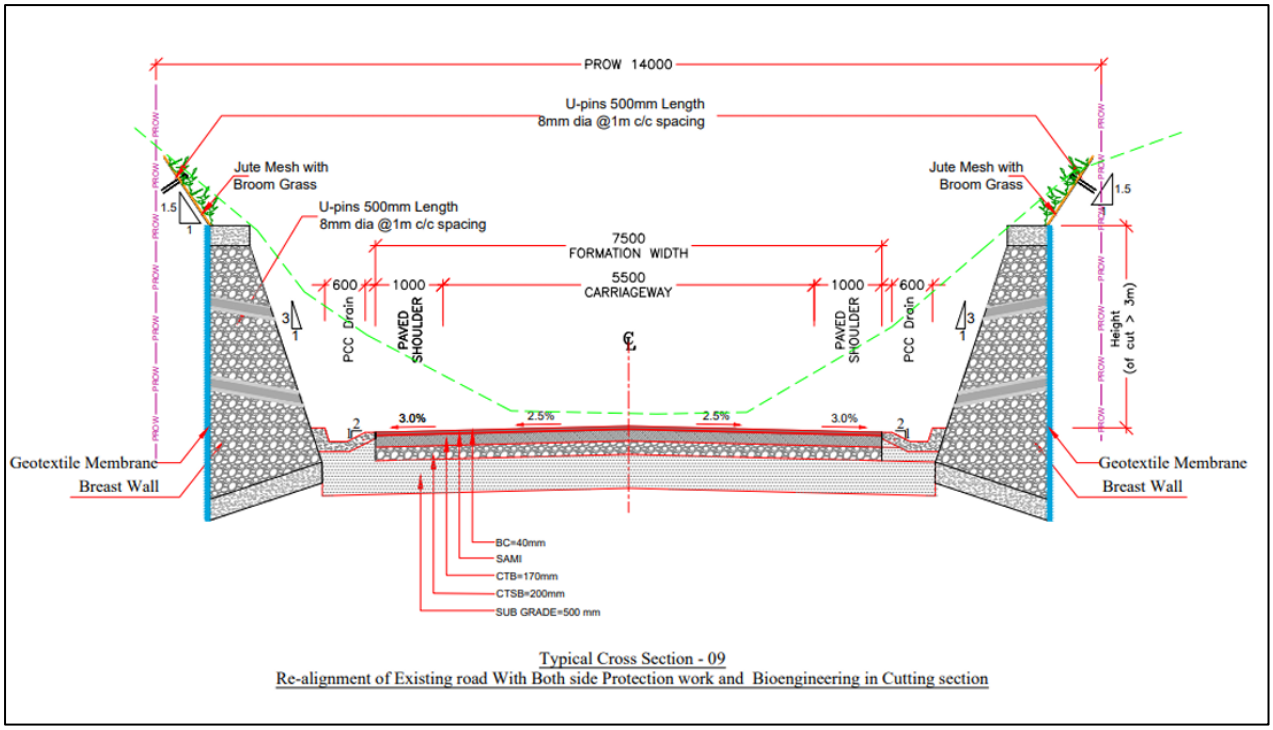
Typical Cross Section - 06A
Re-alignment of Existing road with Both side with Filling Both Side



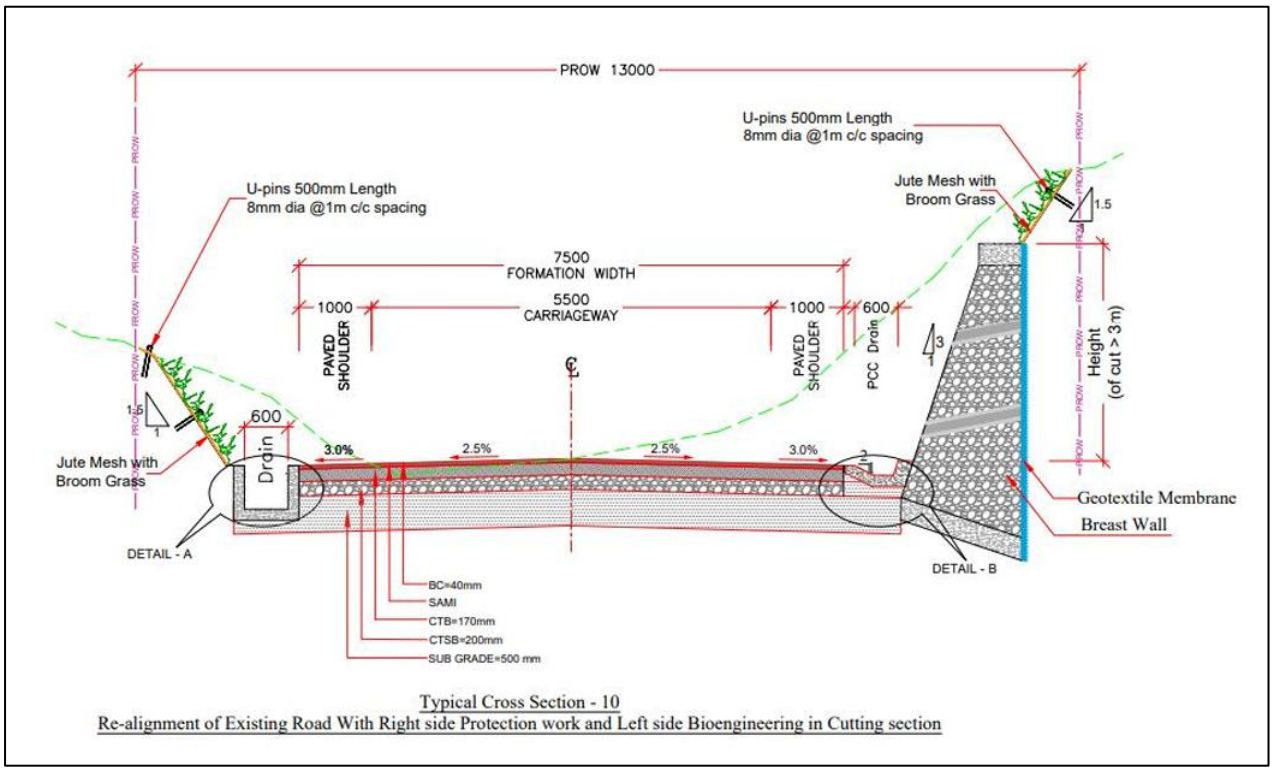
Typical Cross Section - 07
Widening/Reconstruction of Existing Road With Both side Bioengineering with Cutting



Typical Cross Section - 08
Re-alignment of Existing Road with Both side Bioengineering with Cutting



Typical Cross Section - 09
Re-alignment of Existing road With Both side Protection work and Bioengineering in Cutting section



Typical Cross Section - 10
Re-alignment of Existing Road With Right side Protection work and Left side Bioengineering in Cutting section

Figure 3.2: Typical Cross Sections

3.4.3 SETTLEMENTS AND SUB-PROJECT CHARACTERISTICS

3.4.3.1 Settlements:

The RSN Road passes through hilly terrain, rural settlements and towns. The project incorporates a comprehensive

drainage system to ensure proper surface runoff management along the Sub Project Road. The details of the settlements along the stretch are presented in **Table 3.6** below.

Table 3.6: Chainage wise List of 14 Habitations/ 7 villages along the project road

Sl. No.	Chainage		Settlements
1.	0+000	1+000	Rongrengre
2.	1+000	2+000	Upper Rongreng Baiza (Abagre)
3.	2+000	3+000	Lower Baiza
4.	3+000	4+000	Chidekgre
5.	4+000	6+000	Rangmal Badim
6.	6+000	9+000	Kusimkolgre
7.	9+000	10+000	TambuA'ding
8.	10+000	11+000	Ampangdamgre
9.	11+000	12+500	Dobetkolgre
10.	12+500	14+500	Dawa Nengjata
11.	14+500	17+000	Dawa Chipitgre
12.	17+000	19+000	Nengkhra
13.	19+000	20+500	Chimagre
14.	20+500	20+564	Nengkhra Bazar

Details of Protection work

The proposed works include 17794 m earthen drains, 2202 m of footpath-cum-drains in built-up sections, and 7671 m PCC roadside drains to facilitate efficient storm water disposal. The proposed PCC drain and breast wall side protection work comprises a total net length of 560.00 m. Out of this, 60.00 m is proposed from Ch. 18+450 to 18+510 on RHS under TCS-10, 250.00 m from Ch. 18+570 to 18+695 on both LHS & RHS under TCS-9, 70.00 m from Ch. 19+360 to 19+430 on RHS under TCS-10, and 180.00 m from Ch. 19+560 to 19+740 on RHS under TCS-10. The cumulative length under TCS-10 is 310.00 m, while TCS-9 accounts for 250.00 m. In addition, adequate drainage arrangements are proposed at bridge locations. In case of bridges across a river, runoff from the bridge deck will be discharged directly into the riverbed through properly designed drainage spouts in accordance with IRC standards. In case of bridges across a River, the main bridge water is to be discharged into riverbed through drainage spouts as per IRC standards. Cross slopes of 2.5 % is adopted for the bridge.

To enhance commuter convenience and improve accessibility, 12 new bus stops are proposed at suitable locations based on traffic demand and settlement patterns. The provision of new bus stops/sheds has been incorporated based on agreements reached with the community during the FPIC process. These facilities are additional to and go beyond the initial design provisions, reflecting community preferences and ensuring improved accessibility and convenience along the Sub Project Road.The proposed bus stops will be designed with appropriate lay-bys, shelters, and pedestrian access to ensure passenger safety and smooth traffic flow. This improvement will strengthen public transport infrastructure along the Sub Project Road and provide better facilities to road users.

A public toilet block of size 3.0 m × 4.0 m is proposed as part of the project to improve sanitation facilities along the corridor. The facility shall be constructed in accordance with approved drawings, relevant technical specifications, and the directions of the Engineer. The proposed work comprises masonry and reinforced cement concrete components to ensure durability and structural adequacy. The toilet block shall be provided with essential sanitary fixtures, anti-skid flooring, adequate water supply arrangements, and a proper drainage system connected to a septic tank and soak pit. Adequate ventilation, lighting, and access provisions shall also be incorporated to maintain hygienic conditions and facilitate ease of maintenance. A total of 2 nos. public toilet blocks are proposed at Km 20+565 on RHS along the project corridor to provide safe, functional, and sustainable sanitation infrastructure for public use.

Details of Drain and rest areas are given in Table 3.7.

Table 3.7: Details of Drain and Rest area

Sl. No.	TCS Type	Chainages (From – To)
1.	TCS-1	06+500–06+880, 07+700–07+900, 07+970–08+005, 08+225–08+520, 08+590–09+445, 10+175–10+339, 10+500–10+800, 10+860–11+090, 11+824–12+015, 12+240–12+600, 12+740–12+820, 12+930–13+140, 13+190–13+340, 13+480–13+561, 13+573–13+680, 13+880–14+030, 14+240–14+730, 15+320–15+800, 16+190–16+409, 16+770–16+940, 17+020–17+301, 17+335–17+541, 19+430–19+560, 20+043–20+264, 20+284–20+355, 20+493–20+564 (B.S)
2.	TCS-2	09+570–10+100, 10+800–10+860, 11+090–11+170, 11+230–11+538, 11+547–11+720, 12+600–12+740, 13+140–13+190, 13+340–13+480, 15+200–15+320, 15+885–15+980 (All RHS)
3.	TCS-2A	15+980–16+035 (RHS)
4.	TCS-4	10+351–10+500, 12+015–12+240, 12+820–12+930, 13+680–13+880, 14+030–14+240, 15+020–15+120, 15+800–15+835, 16+035–16+060, 16+940–17+020, 17+940–18+268, 18+276–18+380, 18+510–18+570, 18+695–19+360, 19+990–20+030, 20+370–20+417, 20+427–20+483 (All LHS)
5.	TCS-4A	18+380–18+450 (LHS)
6.	TCS-6	08+018–08+120, 09+445–09+473, 09+495–09+570, 11+720–11+749, 11+757–11+784, 14+940–15+020, 15+120–15+200, 16+480–16+529, 16+541–16+610, 17+313–17+335, 17+829–17+840 (B.S)
7.	TCS-6A	07+900–07+970 (B.S)
Footpath cum Drains		
	TCS-3	06+200-06+500, 06+892-07+547, 07+554-07+700 (B.S)
PCC Roadside Drains		
1	TCS-2	09+570–10+100, 10+800–10+860, 11+090–11+170, 11+230–11+538, 11+547–11+720, 12+600–12+740, 13+140–13+190, 13+340–13+480, 15+200–15+320, 15+885–15+980 (All LHS)
2	TCS-2A	15+980–16+035 (All LHS)
3	TCS-4	10+351–10+500, 12+015–12+240, 12+820–12+930, 13+680–13+880, 14+030–14+240, 15+020–15+120, 15+800–15+835, 16+035–16+060, 16+940–17+020, 17+940–18+268, 18+276–18+380, 18+510–18+570, 18+695–19+360, 19+990–20+030, 20+370–20+417, 20+427–20+483 (All RHS)
4	TCS-4A	18+380–18+450 (RHS)
5	TCS-7	08+120–08+225, 08+520–08+590, 10+100–10+175, 11+170–11+230, 14+765–14+940, 15+835–15+885, 16+060–16+190, 16+417–16+480, 16+610–16+770, 17+541–17+821, 17+840–17+940, 19+740–19+990 (B.S)
6	TCS-8	14+730–14+765 (B.S)
7	TCS-9	18+570–18+695 (B.S) **on Breast wall side**
8	TCS-10	18+450–18+510, 19+360–19+430, 19+560–19+740 (All RHS) **on Breast wall side**
Rest areas		
1	**Bus Stop (Proposed)**	01+715, 19+018, 02+882, 02+925, 04+910, 07+308, 10+050, 11+485 (RHS) 06+270, 08+445, 12+832, 20+564(LHS)
2	**Toilets**	2 nos. of toilet at Km 20+565 RHS

Bioengineering

For cutting sections, bio-engineering measures are proposed on both left and right sides where heights range from about 1.0 m to 3.0 m slope. These measures are primarily intended for stabilization of cut slopes, prevention of surface erosion, and protection against rain-induced soil washout. Grass turfing and vegetative cover are provided over the shaped cut slopes to ensure long-term slope stability and minimize erosion.

Bio-engineering measures are proposed for cut-slope stabilization, erosion control, and environmental integration. The treatment includes the installation of biodegradable erosion control mats/jute mesh combined with broom grass planting to prevent surface erosion and promote vegetation growth. The slope will be formed at a stable inclination, and the mat will be securely anchored using U-pins. The erosion control mat/jute mesh provides additional reinforcement, particularly for higher cut slopes. Toe drainage will be integrated with the pavement to ensure safe disposal of surface runoff. Overall, these measures will enhance slope stability, reduce maintenance requirements, and improve the environmental and visual quality of the project area. The identified chainages on the right-hand side, namely Ch 14530–14550, 14750–14930, 18370–18410, 18730–18780, 19390–19450, and 19560–19690, exhibit cutting heights ranging from 3.0 m to 4.0 m, indicating relatively steep slope conditions. These sections are more prone to slope instability and erosion, and therefore require appropriate slope stabilization and protection measures. Details of Cutting is given in Table 3.8

Table 3.8: Details of Cutting

Left Hand Side (Cutting Section)			
Chainages from	**Chainages to**	**Length in m**	**Height in m**
8150	8160	10	-1.0
8330	8350	20	-2.0
8540	8570	30	-1.0
9730	9740	10	-1.5
9910	9940	30	-1.0
14760	14870	110	-2.0
15200	15300	100	-2.0
15440	15460	20	-1.0
15490	15510	20	-2.0
15590	15600	10	-1.0
15720	15750	30	-2.5
15850	15890	40	-2.0
16430	16480	50	-1.0
16640	16750	110	-2.0
18240	18250	10	-1.0
Total		**1100**	
Right Hand Side (Cutting Section)			
8160	8180	20	-1.00
8540	8570	30	-1.50
10410	10420	10	-1.50
11200	11220	20	-1.00
11990	12000	10	-1.00
12040	12050	10	-1.50
12270	12280	10	-1.00
12820	12880	60	-2.00
13690	13710	20	-2.00
14180	14200	20	-1.50
14530	14550	20	-3.00
14750	14930	180	-3.00
15100	15110	10	-2.00
15830	15880	50	-2.50

16040	16100	60	-2.00
16440	16480	40	-2.00
16670	16700	30	-1.00
16950	17010	60	-2.00
17580	17700	120	-2.00
17720	17730	10	-1.00
17860	17890	30	-1.00
18050	18090	40	-2.00
18200	18240	40	-2.00
18290	18330	40	-2.00
18370	18410	40	-3.00
18460	18510	50	-5.00
18540	18560	20	-1.00
18620	18690	70	-2.00
18730	18780	50	-3.00
18810	18890	80	-2.00
18910	18980	70	-2.00
19000	19180	180	-2.00
19250	19260	10	-2.50
19290	19300	10	-2.00
19390	19450	60	-4.00
19560	19690	130	-4.00
19740	19810	70	-2.00
19860	19950	90	-2.00
20000	20010	10	-1.00
20060	20080	20	-2.00
20140	20150	10	-2.00
Total		**1910**	

Protection work:

In addition to the protective measures for road works, gabion-type retaining walls have been proposed, covering a cumulative length of 1380 m across all structures within the project. Details are given in table 3.9.

Table 3.9 Proposed protective measures for road works, gabion-type retaining walls

SR NO.	LOCATION OF WALL	CHAINAGE FROM	TOTAL LENGTH (m)	ROAD SIDE	Height (m)
1	MNB	3+498	60	BHS	4.00
2	MNB	3+716	60	BHS	4.00
3	MNB	4+358	60	BHS	4.00
4	MNB	5+492	60	BHS	4.00
5	MNB	6+874	60	BHS	4.00
6	MNB	7+536	60	BHS	4.00
7	MNB	8+014	60	BHS	4.00
8	MNB	9+478	60	BHS	4.00
9	MNB	10+346	60	BHS	4.00
10	MNB	11+558	60	BHS	4.00
11	MNB	11+764	60	BHS	4.00
12	MNB	11+800	60	BHS	4.00
13	MNB	13+584	60	BHS	4.00
14	MNB	16+494	60	BHS	4.00

15	MNB	16+610	60	BHS	4.00
16	MNB	17+384	60	BHS	4.00
17	MNB	17+914	60	BHS	4.00
18	MNB	18+354	60	BHS	4.00
19	MNB	20+126	60	BHS	4.00
20	MNB	20+352	60	BHS	4.00
21	MNB	20+444	60	BHS	4.00
22	MNB	20+510	60	BHS	4.00
23	MNB	20+564	60	BHS	4.00
Total length(m)			**1380**		

UTILITY DETAILS

The Sub- Project Road classified as an Other District Road (ODR) with a total length of approximately 20.564 km, is equipped with several essential utility infrastructures. Electric poles, overhead electric lines, and Optical Fiber (OFR) cables run parallel to the road alignment. These utilities are critical for ensuring uninterrupted power supply and communication services in the project area and will be duly considered during road improvement and construction activities to avoid any disruption or damage. A total of 349 electric poles, 4 transformers, and 93 electric line crossings are identified along the RSN road sub-project for shifting of these, 227 poles are on the LHS and 122 on the RHS. A total of 09 OFC pillars are identified for shifting along the RSN road Sub Project Road, comprising 03 on the LHS and 06 on the RHS. Details of utilities are given in **Annexure1.1.**

3.4.3.2 Sub-Project Characteristics

The salient features of the RSN road are summarized in **Table 3.10** below.

Table 3.10: Current Salient features of the RSN Road

Sl. No.	Characteristics	Features
1	Name of Road	Improvement and Widening of Rongrenggre-Simsanggre-Nengkhra (RSN)
2	Project Road Length	20.564 km
3	District	East Garo Hills
4	Villages/settlements enroute	7 Villages
5	Terrain	Plain/Hilly/Rural
	Existing	▪ The road is affected by various surface damages, including potholes, cracks, and other deterioration.
6	Proposed treatment	Intermediate/ configurations, with or without paved shoulders, where required.
7	Bridges	No. of Minor Bridges – 23
8	Culverts	105
9	Forests / environmentally sensitive areas	• Passes through reserve forest at chainage 0+000 to 6+200. • The proposed road improvement works will be carried out within the available available Right of Way (ROW). As the design strictly utilizes the existing Sub Project Road, no impact on community vegetation or local land use is anticipated in this stretch.
10	Religious Structures Affected	Nil
	Impacted Structures (including Partially Physically displaced Structures)	40
11	Major CPR Impacted	No direct impact on CPR
12	Fifth/Sixth Scheduled Areas	Sixth Schedule Area
13	River crossings	Simsang river
14	Water bodies / ponds	Simsang river
15	Sensitive receptors	1 Church 4 School, 1 community hall, and 1 District Jail. (Chainage details are given in Table 4.22). There is no direct impact on sensitive receptors
16	Transshipment areas/truck parking locations	Nil
17	Land Requirement	The total Land requirement that will be acquired permanently for this sub project is 1.2459 ha. For the purpose of Spoil disposal, 0.55 Ha of land will be required temporarily which has been jointly verified by the Community Members, PWD and independent consultants.

		Refer to Table 3.16 and 3.17 for details. No additional land is required for the development of community amenities. As confirmed through the Free, Prior and Informed Consent (FPIC) process, all such amenities will be implemented within the available Right of Way (ROW.

3.4.4 TREES

The vegetation along the project road comprises a diverse mix of trees, shrubs, herbs, climbers, ferns, and grasses. 19 trees are likely to be impacted or require removal due to the proposed widening. Major trees impacted are Jackfruit, Arecanut, Bamboo, Banana, etc.

Table 3.11: Chainage wise list of Trees

S. No.	Chainage (km)	Common Name	Botanical Name	Girth at Breast Height (cm)
1	0+950	Banana	*Musa paradisiaca*	30
2	1+400	Betel Nut Palm	*Areca catechu*	35
3	2+100	Betel Nut Palm	*Areca catechu*	40
4	2+850	Jackfruit	*Artocarpus heterophyllus*	85
5	4+200	Coconut Palm	*Cocos nucifera*	70
6	5+000	Guava	*Psidium guajava*	45
7	5+650	Neem	*Azadirachta indica*	80
8	6+200	Banana	*Musa paradisiaca*	35
9	7+100	Betel Nut Palm	*Areca catechu*	55
10	8+900	Banana	*Musa paradisiaca*	55
11	9+400	Betel Nut Palm	*Areca catechu*	30
12	10+200	Banana	*Musa paradisiaca*	25
13	12+300	Jackfruit	*Artocarpus heterophyllus*	95
14	13+050	Coconut	*Cocos nucifera*	75
15	14+300	Betel Nut Palm	*Areca catechu*	33
16	15+400	Lemon	*Citrus limon*	25
17	15+900	Betel Nut Palm	*Areca catechu*	38
18	17+250	Banana	*Musa paradisiaca*	30
19	21+750	Guava	*Psidium guajava*	40

Source: EIS Field Survey

To mitigate the ecological impact of tree loss, plantation at the ratio of 1:10 will be carried out. These mitigation measures, along with their implementation strategies, are comprehensively detailed in the Environmental and Social Management Plan (ESMP). The ESMP is attached as **Annexure 3.2.**

3.4.5 SLOPE PROTECTION WORKS

The Sub-Project in East Garo Hills, Meghalaya, faces significant challenges due to its rugged terrain characterized by high hills and deep valleys. The topographic profile of the Rongrenggre–Simsanggre–Nengkhra (RSN) Road reveals a gently undulating to moderately rolling landscape, with elevations ranging from 212 m to 561 m above mean sea level (amsl). The alignment passes through a series of low hillocks and intervening valleys typical of the Meghalaya Plateau. Along the 20.564 km stretch, three prominent elevation peaks and two depressions are observed, indicating alternating cut-and-fill sections. The highest elevations occur near the mid and terminal portions of the Sub Project Road, while the lowest points coincide with valley sections characterized by seasonal drainages and stream crossings.

These topographic variations suggest moderate earthwork requirements, especially in areas with steeper gradients. The general slope direction follows the natural drainage pattern toward adjacent valleys, underscoring the need for effective drainage and slope protection systems. Given the district's susceptibility to the complex terrain, slope stabilization measures are essential to ensure the safety and resilience of the Sub Project Road. The sub-project, therefore, proposes appropriate geotechnical interventions to stabilize both hillside cut slopes and valley-side embankments.

Location wise slope protection works proposed along with project is given in **Table 3.12** below.

Table 3.12: Slope protection works

Chainage	Side	Existing angle (°)	Height of cut / fill (m) (assumed)	Modified angle of repose (°)	Proposed slope protection / notes
6+900	LHS / RHS / Minor bridge	35.0	3.00	26.57	**Localised slope/erosion protection**: stone pitching at toe & wingwalls; riprap apron around abutments; short gabion mattress; lined approach drains; vegetative turfing (vetiver) on exposed faces; provide toe trench and subsoil drain to prevent undermining.
12+850–12+900	LHS / RHS (Unstable slopestretch)	35.0	4.00	26.57	**Unstable slopetreatment plan (critical stretch)**: retaining / breast walls and large gabion structures at toe; stone pitching on slope faces; bamboo crib walls in shallow soils; vegetative turfing + deep-rooted shrubs/grasses; subsurface (French) drains and surface cut-off drains; slope benching and geogrid reinforcement where fills/repairs required; monitoring points/inclinometer.
12+900–12+980	Transitional slope	35.0	4.00	26.57	Gabions/stone pitching at toe; intermediate benching; erosion control blanket until vegetation establishes; subsoil drain at bench; check bunds for runoff.
16+500–16+600	LHS / RHS	35.0	3.00	26.57	Default protection: stone pitching / gabion toe protection; coir logs temporarily; slope regrading to 1V:2H; geotextile filter under rockfill; outlet energy dissipation for drains.
17+300–17+340	RHS	35.0	2.50	26.57	**Raised profile / fill**: use tested surplus excavated material in layers (150–300 mm) compaction ≥95% SP; provide filter + geogrid layers where slope exceeds 1V:2H; reinforced toe (gabion / small retaining wall); slope vegetative cover; subsoil drains to relieve seepage.

(Source: DPR)

3.5 COMPONENTS & ACTIVITIES OF THE PROPOSED PROJECT

The development of the road would necessarily entail the following three stages. Each of the stages would have several activities and sub-activities. The three stages are

3.5.1 DETAILED DESIGN AND PRE-CONSTRUCTION STAGE

- Carrying out ESIA studies & preparation of ESMP and other Environmental and Social management instruments such as RAP, IPDP, LMP, SEA/SH plan and OHS plan
- Finalization of alignment with incorporation of environmental, social and community concerns in addition to the design and safety aspects
- Community consultation for land identification for borrow areas, disposal sites, water availability, siting of camps, tree felling permission
- Identification of sources of construction material

- Contractor mobilization
- Setting of Construction Camp

3.5.2 CONSTRUCTION STAGE

- Site clearing & construction camp establishment
- Construction Material procurement & transportation
- Earthwork, hillside cutting, if required, embankment construction, GSB, WBM, operation of equipment, plant and machinery
- Structure demolition & construction work, if required
- Disposal site management
- Surfacing and shoulder protection & road furniture

3.5.3 POST-CONSTRUCTION, OPERATIONS & MAINTENANCE STAGE

- Decommissioning and restoration of camp area, removal of Construction & demolition waste, Restoration of disposal sites.
- Operation of vehicles and safety of road users

3.6 RESOURCE REQUIREMENTS

The district of East Garo Hills has come into existence in the year 2012 only. Details of construction material required for this project, their Source and Lead are given in **Table 3.13.**

Table 3.13: Source and Lead of Construction Materials

S.no	Item	Unit	Querry Name	Lead Km	RSN Length (m)		Total lead upto Plant
				Road			
1	Earth work	cum	Local Area	0	0.000	20.565	0
2	Fine Sand	cum	Kusimkolgre/Ampangdamgre	0	0.000	20.565	0
3	Coarse sand	cum	Kusimkolgre/Ampangdamgre	0	0.000	20.565	0
4	Agreegate	cum	Rongkem/Samanda	6	0.000	20.565	6
5	Bitumin	MT	Guwahati IOCL refinary	190	0.000	20.565	200
6	Emulsion	MT	Haldia to Site	1110	0.000	20.565	1120
7	TMT Bars	MT	Shilong SAIL	194	0.000	20.565	204
8	Cement	MT	Guwahati	201	0.000	20.565	211
9	Water	KLD					

(Source: DPR)

Assessing the availability of suitable construction materials near the project road is crucial for a road project. Surface water from the Simsang river can be used for road construction with prior permission from the Water Resources Department, Government of Meghalaya.

3.6.1 VOLUME OF CIVIL WORKS

The volume of civil works for MLCIP will be influenced by the type of construction methods, typical cross sections and specific materials used in the sub-project area. These civil works are essential for ensuring the highway's stability, safety and environmental sustainability thereby contributing to the long-term success of the road project. List of materials used such as Bituminous Concrete (BC), Dense Bituminous Macadam (DBM), Prime Coat (PC), Tack Coat (TC), Granular Sub Base (GSB), Wet Mix Macadam (WMM), and Shoulder treatments are included in the DPR. This comprehensive range of materials ensures the road's strength, durability and overall performance.

Based on the information provided in the DPR, the embankment protection measures are designed according to the height of the embankment to ensure slope stability and minimize erosion. For embankments having a height of less than 2.0 m, turfing with suitable grass species will be carried out on the side slopes to prevent soil erosion and maintain surface stability. For embankments with heights ranging between 2.0 m and 3.0 m, a toe wall is proposed at the base of the slope to provide additional structural support and prevent scouring at the toe. In cases where the embankment height exceeds 3.0 m, a retaining wall will be provided on the fill side to retain the earth mass, while a breast wall will be constructed on the cut side to support the excavated slope and prevent slope failure. These protective measures have been proposed as per standard engineering practices and IRC guidelines to ensure the durability and safety of the road embankment structure.

The additional land required for the proposed road improvement works is approximately 1.2459 hectares. The Consultants along with the officials of the PWD and members of the village community including the Nokma jointly identified 1 locations for dumping of spoils.

The required land for spoil disposal site will be taken on lease and will be returned to the land owner after project completion and after having redeveloped in accordance to the community requirements.

As per the earthwork estimation for the Sub Project Road, the total fill quantity is 12990 m^3, and the cut quantity is 65618 m^3. After balancing cut and fill requirements, there remains a surplus of approximately 57891 m^3 of excavated material. This excess earthwork shall be disposed of or utilized by the contractor only at designated and pre-approved disposal sites identified by the Meghalaya Public Works Department (MPWD), in accordance with environmental management and safety norms. Filling at the designated disposal site shall be carried out by adopting the benching method with bench heights of about 1.0 m to 1.5 m to ensure proper stability, compaction, and safe deposition of excavated materials. The disposal area shall be prepared in stepped benches prior to dumping so as to minimize slope instability and erosion, and the filling operation shall be executed in accordance with relevant specifications and the directions of the Engineer.

Table 3.14: Locations for the Spoil disposal sites

Location Chainage	SIDE	Latitude	Longitude	Area in Square m	Approx Quantity
16+100	RHS	25°30'52"N	90°39'47"E	5500	57891 m^3

Further, recycling and reuse of existing pavement materials shall be carried out as per MoRTH Specifications for Road and Bridge Works (latest revision) and IRC:120 guidelines. This approach promotes cut-and-fill optimization, reduces the requirement for fresh borrow materials, minimizes construction waste, and ensures compliance with the Solid Waste Management Rules, 2016 and Environmental (Protection) Act, 1986.

3.7 LAND REQUIREMENTS

1.2459 ha land is required for temporary use for this road project, as most of the construction will be carried out entirely within the available Right of Way (RoW). Land requirement details are given in **Table 3.16.**

Table 3.15: Details of Land requirement for proposed activities

Sl. No.	Village	Chainage from	Chainage to	Length in m	Available ROW	Required ROW	Land required	Ownership of land
1	Ampangdamgre	10.500	10.700	200	10	11	0.0200	Community
2	Dobetkolgre	11.100	11.170	70	10.5	11	0.0035	Community
3	Dobetkolgre	11.170	11.200	30	10.5	12	0.0045	Community
4	Dobetkolgre	11.600	11.700	100	10	11	0.0100	Community
5	Dobetkolgre	11.700	11.720	20	8.5	11	0.0050	Community
6	Dobetkolgre	11.720	11.800	80	8.5	10	0.0120	Community
7	Dobetkolgre	12.100	12.200	100	10.5	11	0.0050	Community
8	Dobetkolgre	12.400	12.500	100	10	11	0.0100	Community
9	Dobetkolgre	12.800	12.900	100	10	11	0.0100	Community
10	Dobetkolgre	13.400	13.500	100	10	11	0.0100	Community
11	Dobetkolgre	13.700	13.800	100	8.5	11	0.0250	Community
12	Dobetkolgre	14.200	14.300	100	9.75	11	0.0125	Community
13	Dobetkolgre	14.300	14.500	200	9	11	0.0400	Community
14	DawaChipitgre	14.600	14.730	130	9	11	0.0260	Community
15	DawaChipitgre	14.730	14.800	70	9	12	0.0210	Community
16	DawaChipitgre	14.800	14.900	100	10.5	12	0.0150	Community
17	DawaChipitgre	14.900	14.940	40	9.5	12	0.0100	Community
18	DawaChipitgre	14.940	15.020	80	9.5	10	0.0040	Community
19	DawaChipitgre	15.020	15.120	100	9.5	11	0.0150	Community
20	DawaChipitgre	15.120	15.200	80	9.5	10	0.0040	Community
21	DawaChipitgre	15.200	15.300	100	9.5	11	0.0150	Community
22	DawaChipitgre	15.500	15.600	100	10.3	11	0.0070	Community
23	DawaChipitgre	15.700	15.835	135	10	11	0.0135	Community
24	DawaChipitgre	15.835	15.885	50	9.75	12	0.0112	Community
25	DawaChipitgre	15.885	15.900	15	9.75	11	0.0019	Community
26	DawaChipitgre	15.900	16.000	100	10.75	11	0.0025	Community
27	DawaChipitgre	16.000	16.060	60	10.1	11	0.0054	Community
28	DawaChipitgre	16.060	16.100	40	10.1	12	0.0076	Community
29	DawaChipitgre	16.100	16.190	90	9.25	12	0.0248	Community
30	DawaChipitgre	16.190	16.200	10	9.25	11	0.0017	Community

31	DawaChipitgre	16.200	16.400	200	8	11	0.0600	Community
32	DawaChipitgre	16.400	16.417	17	8.5	11	0.0043	Community
33	DawaChipitgre	16.417	16.480	63	8.5	12	0.0220	Community
34	DawaChipitgre	16.480	16.500	20	8.5	10	0.0030	Community
35	DawaChipitgre	16.500	16.530	30	7.5	10	0.0075	Community
36	DawaChipitgre	16.530	16.541	11	7.5	11	0.0038	Community
37	DawaChipitgre	16.541	16.600	59	7.5	10	0.0148	Community
38	DawaChipitgre	16.600	16.610	10	8	10	0.0020	Community
39	DawaChipitgre	16.610	16.700	90	8	12	0.0360	Community
40	DawaChipitgre	16.700	16.768	68	9.75	12	0.0153	Community
41	DawaChipitgre	16.768	16.800	32	9.75	11	0.0040	Community
42	DawaChipitgre	16.800	16.900	100	8.5	11	0.0250	Community
43	DawaChipitgre	16.900	17.000	100	10	11	0.0100	Community
44	Nengkra	17.000	17.313	313	8.75	11	0.0704	Community
45	Nengkra	17.313	17.336	23	8.75	10	0.0029	Community
46	Nengkra	17.336	17.500	164	8.75	11	0.0369	Community
47	Nengkra	17.500	17.541	41	10	11	0.0041	Community
48	Nengkra	17.541	17.600	59	10	12	0.0118	Community
49	Nengkra	17.600	17.821	221	8.75	12	0.0718	Community
50	Nengkra	17.821	17.829	8	8.75	11	0.0018	Community
51	Nengkra	17.829	17.841	12	8.75	10	0.0015	Community
52	Nengkra	17.841	17.941	100	8.75	12	0.0325	Community
53	Nengkra	17.941	18.200	259	8.75	11	0.0583	Community
54	Nengkra	18.200	18.300	100	10	11	0.0100	Community
55	Nengkra	18.300	18.400	100	8.75	11	0.0225	Community
56	Nengkra	18.400	18.450	50	10	11	0.0050	Community
57	Nengkra	18.450	18.510	60	10	13	0.0180	Community
58	Nengkra	18.510	18.567	57	10	11	0.0057	Community
59	Nengkra	18.567	18.600	33	10	14	0.0132	Community
60	Nengkra	18.600	18.695	95	8	14	0.0570	Community
61	Nengkra	18.695	18.700	5	8	11	0.0015	Community
62	Nengkra	18.700	18.800	100	10	11	0.0100	Community
63	Nengkra	18.800	18.900	100	9	11	0.0200	Community
64	Nengkra	18.900	19.000	100	10	11	0.0100	Community
65	Chimagre	19.000	19.361	361	10	11	0.0361	Community
66	Chimagre	19.361	19.430	69	10	13	0.0207	Community
67	Chimagre	19.430	19.550	120	10	11	0.0120	Community
68	Chimagre	19.550	19.560	10	9	11	0.0020	Community
69	Chimagre	19.560	19.650	90	9	13	0.0360	Community

70	Chimagre	19.650	19.740	90	11	13	0.0180	Community
71	Chimagre	19.740	19.850	110	11	12	0.0110	Community
72	Chimagre	19.850	19.980	130	10	12	0.0260	Community
73	Chimagre	19.980	20.564	584	10	11	0.0584	Community
	Total Length			**6964**			**1.2459**	
				20564.000				

Source: DPR Consultant

Table Details of proposed activities agreed in the FPIC

Sl. No.	FPIC Agreed Infrastructure / Activity	Description	Land Requirement
1	Improvement of Existing Road	Improvement of the existing road to Intermediate Lane with provision of safety measures, drainage, and protection works in habitation and market areas, subject to technical feasibility	1.2459
2	Passenger Waiting Sheds	Construction of passenger waiting sheds at specific village locations along the project road	No additional land required (with in ROW)
3	Drain cum Footpath	Construction of drain cum footpath near settlement areas for pedestrian safety and proper drainage	No additional land required (with in ROW)
4	Boundary Walls	Construction of 20m Retaining wall from km 12+020 to 12+040	No additional land required (with in ROW)
5	Public Toilets	Construction of separate toilet facilities for males and females at selected locations	No additional land required (with in ROW)
6.	Disposal Site	Identification and use of designated Spoil disposal sites for safe disposal of excavated materials, with proper stabilization and environmental management measures	0.55 ha

3.8 WATER REQUIREMENTS

The overall water requirement of the project is 19.0 KLD; of which 14.5 KLD will be used for construction activities and 4.5 KLD is required for domestic purposes.. Details of Water requirement is given in Table 3.17.

Table 3.16: Water Requirement for Construction Works

Activity	Daily Demand (Liters/km)	Total for 20.564 km (Liters/day)	Remarks
Concreting and curing	626.91	12868	Concrete mixing, compaction, culverts, drains.
Dust Suppression at Work Zone	82.19	1689.69	Reduced due to frequent rain; use only on dry days.
Domestic Purpose	-------	4500	For 50 workers (drinking, cooking, sanitation).

Total	—	**19057.69 Liters/day**	—

(Source: DPR)

3.9 MANPOWER COST REQUIREMENT AND IMPLEMENTATION SCHEDULE FOR THE SUB PROJECT

The workforce requirement, as per consultations with the DPR, will vary during different stages of construction, with peak manpower estimated at about 172 persons. Around 65–70% of the labour force is expected to be sourced locally, while skilled personnel such as machine operators, concrete casting crews, supervisors, and engineers may be engaged from outside the project area and accommodated in construction camps. The project construction period for 20.564 km subproject stretch is considered as 36 months. The total estimated cost of the project is approximately 156.7 Crore (as per DPR).

4. ANALYSIS OF ALTERNATIVES

4.1 INTRODUCTION

In line with best practices for managing environmental and social impacts, several alternative approaches have been considered for the proposed road widening and upgrade project. The design is being refined to enhance safety, improve the road structure, and accommodate both current and future traffic demands. This chapter presents an analysis of the potential impacts under the "With Project" and "Without Project" scenarios.

4.2 WITH AND WITHOUT PROJECT ALTERNATIVES

Alternative analysis was carried out for the project stretch vis-à-vis design scenarios and one scenario of without project. These are described in the following sections.

4.2.1 WITHOUT PROJECT SCENARIO

The road traverses areas with high population densities, particularly in Samanda, as well as hilly and rural stretches where traffic is frequently disrupted due to poor road conditions and the demand for efficient through-traffic movement.

The continued growth in population, rising traffic volumes, and expanding economic activity along the Sub Project Road are likely to exacerbate the existing challenges. Without the proposed upgrades, current road safety hazards and adverse environmental impacts along the route are expected to persist and worsen. Additionally, the limited socioeconomic development of these remote and underdeveloped areas would remain constrained. Therefore, halting the project would not be practical or justified, as it would impede essential improvements and limit the potential for economic growth in the region.

4.2.2 WITH PROJECT SCENARIO

The "With Project" scenario is expected to generate positive long-term impacts across social, environmental, economic, and financial dimensions. Key interventions include widening the existing roadway to intermediate lanes, in line with the project's objectives.

From an economic perspective, the project is viable and is anticipated to substantially improve current conditions, supporting the development goals set by the Government of Meghalaya and enhancing the region's growth potential.

While the project promises multiple developmental benefits, it is important to recognize that, like all infrastructure initiatives, it may also result in certain impacts on the environment and local communities.

Potential environmental and social impacts can be mitigated through the adoption of best environmental management and social development practices. Where impacts cannot be fully avoided, suitable mitigation measures will be implemented to minimize and offset adverse effects. A detailed comparison of the "With Project" and "Without Project" scenarios, along with the anticipated benefits of the proposed project, is presented in **Table 4-1** below.

Table 4.1: "With and Without" Project Scenarios – A Comparative Assessment

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometry	Intermediate lane with shoulder and paved surface is being developed with geometric improvements	Existing Single/Intermediate Lane carriageway with poor geometry
Design Speed	(30-50 kmph for Intermediate Lane)	30-40 kmph entire project section.

Congestion in Settlements	Improved carriageway with good surface and separated footpath with railing in built-up area reduces interaction of pedestrians with through traffic resulting in reduction of vehicular emissions, reducing travel time and vehicle operating cost. This in turn contributes to lowering of GHG emission; and may improve people/public health due to no or low exposure period.	Lack of road or lack of good road surface with shoulder and foot path, congestion and frequent vehicle stoppage due to mixing of local, pedestrian and through traffic will increase localized accumulation of vehicular emission with potential impacts on human health and contribute to generation of GHG emission.
Felling of roadside trees	Felling of both old and young trees. Old and weak trees near the road edge shall be a road hazard and shall be felled. Ten times of felled trees, the number of new young and healthy saplings to be planted as compensation.	No Felling of trees hence maintaining the healthy local ecology.
Pedestrian safety	Pedestrian facilities in the form of footpath, lightning, etc. are to be provided in built-up area locations.	Lack of dedicated pedestrian facilities such as footpaths and adequate lighting making it unsafe for pedestrians.
Road Safety Measures	Provision of proper road markings, zebra crossings, crash barriers and improvement of geometry to reduce accidents.	Accident incidents will rise with an increased traffic volume.
Environmental Quality	Development of roads in hilly and urban settlements improves environmental quality within the urban areas due to lowered pollution levels and relieving of congestion. Besides, an aggressive tree plantation and provision of enhancement features shall not only provide aesthetics but also improve the quality of air.	Poor in settlement areas due to non-motorable road conditions, congestion and high emission levels because of slow movement of traffic. A further deterioration is expected due to Increase in traffic volumes and further congestion.
Drainage	Will be improved due to reconstruction of culverts / bridges/ side drains with adequate hydraulics.	These issues remain un-addressed without the project
Roadside Amenities	Appropriate roadside amenities to be provided at various locations along the Sub Project Road.	Not adequate in the present scenario.
Wayside Facilities	Wayside facilities are proposed at several locations, where necessary like rest areas, with appropriate facilities for recreation, road public toilets, telephones etc.	Not of adequate standards, quality and number in present scenario.

Environmental Enhancement	Enhancement of unstable slopes /water bodies, community and cultural properties	No enhancement measures involved.
Social Development	Higher potential for social development due to improvement in access and consequent increase in connectivity.	Social development activities are likely to be significantly constrained due to the severe inadequacy of infrastructure.
Financial and Economic Analysis	Project financially viable for upgrading from existing lane configuration to intermediate lane configuration.	The cost of maintenance while catering to the projected higher traffic, accident cost, Vehicle operating cost & travel time cost shall be higher.

4.3 ENVIRONMENTAL AND SOCIAL ALTERNATIVES (TO SPECIFIC ONCE) CONSIDERED FOR THE PROPOSED STRETCH

Various avoidance measures have been developed to minimize environmental and social impacts and to protect sensitive features along the proposed sub-project road. **Table 4.2** summarizes the measures adopted to offset these impacts, and a detailed description of each measure is presented in the following sections. Although the RSN Road passes through a landslide-prone zone according to NRSA, no active or existing landslide stretches were observed during the field survey.

Table 4.2: Alternative considerations for Minimization of Environmental & Social Impacts

Sr. No.	Village name	Location Chainage	ESIA Observation	Compliance/ Proposal included in the DPR	Reference in the DPR
1	Rongrengre	0+000	Junction improvement required At the start and end junctions of the project road, additional traffic safety measures such as Blinker/Warning Curve Signage were suggested	Junction improvement proposed at Ch 0+000 in Junction drawing. The same shall be incorporated in the EPC scope and relevant road safety drawings in the DPR.	Table No-1 Page No-7 (Sr No-1.8) [Vol-1 Main Report]
2	Rongrengre	5+200	Access to the existing graveyard along the Sub Project Road must be maintained.	The design shall ensure proper connectivity and safe access, reflected in the DPR drawings.	
2	Upper Rongreng Baiza (Abagre),Lower Baiza,Chidekgre,Rangmal Badim & Kusimkolgre	0+000 to 6+200	Forest Area (Both Side) of the existing Road.	Black top will be done on the existing at forest location from km 0+000 to 6+200.	TCS-05, Page No-142 [Vol-1 Main Report]
3	Kusimkolgre	6+300	Speed restriction on junction location needed.	Speed restriction sign has been proposed at Junction location Ch-.6+270 (LHS) & 6+330 (RHS) in signage Plan.	TRAFFIC SIGNS PLAN (Km.6+200 to Km.7+800), [Volume X a_TRAFFIC SIGNAGE PLAN - Sheet No.

					RC/1661/HO/HWB/ RD/DWG/RSN/TSP/ 05/0]
4	Kusimkolgre	6+350	Building Structure at this section on RHS will be protected by slightly shifting the alignment LHS	Building structure will be protected by shifting the alighnment slightly towards RHS side at Ch-6+350.	PLAN & PROFILE (Km.6+000 to Km.7+000), Volume-X Drawings - Sheet No. RC/1661/HO/HWB/ RD/DWG/RSN/P&P/ 07/R0)
5	Kusimkolgre	6+900	Soil Erosion found at Minor Bridge Location, Protection work required at this Section.	To protect from soil erosion, proposed protection work has been incorporated at MNB Ch-6+886.	Volume-X Drawings - Sheet No. RC/1661/HO/HWB/ RD/DWG/MISC/07/ R0
6	Kusimkolgre	7+100	Building Structure at this section on RHS will be protected by slightly shifting the alignment LHS	Building structure will be protected by shifting the alighnment slightly towards LHS side at Ch-7+130.	PLAN & PROFILE (Km.7+000 to Km.8+000), Volume-X Drawings - Sheet No. RC/1661/HO/HWB/ RD/DWG/RSN/P&P/ 08/R0)
7	Kusimkolgre	7+280	Traffic island with Proper road safety sign required for this Section (Bus Stand Section).	Safety sign has been proposed in signage Plan at Ch-7+100 (LHS) & 7+410 (RHS).	TRAFFIC SIGNS PLAN (Km.6+200 to Km.7+800), [Volume X a_TRAFFIC SIGNAGE PLAN - Sheet No. RC/1661/HO/HWB/ RD/DWG/RSN/TSP/ 05/0]
8	Kusimkolgre	8+000	Traffic island with Proper road safety sign required for this Section. (Junction Location). Proposal for the improvement of the junction due to Poor Geometry of the Road.	Speed restriction has been taken in signage Plan & realignment has ben proposed to improve the poor geometry at Ch-7+980 (Junction Location).	TRAFFIC SIGNS PLAN (Km.7+800 to Km.9+000), [Volume X a_TRAFFIC SIGNAGE PLAN - Sheet No. RC/1661/HO/HWB/ RD/DWG/RSN/TSP/ 06/0]
9	Dobetkolgre	11+700	Building Structure at this section on RHS will be protected by slightly shifting the alignment LHS	Building structure will be protected by providing Protection wall taken in design. Shifting the alignment slightly towards LHS side at Ch-11+350 done.	PLAN & PROFILE (Km.11+000 to Km.12+000), Volume-X Drawings - Sheet No. RC/1661/HO/HWB/ RD/DWG/RSN/P&P/ 12/R0)
10	Dobetkolgre	11+900	Unstable slope section at RHS	Protection wall of height 1m is proposed from Km 12+020 to 12+060 to Protect	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]

				from unstable slopesection. (RHS)	
11	Dawa Nengjata	12+020	Retaining wall required LHS from km 12+020 to 12+040	Already taken in design	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
12	Dawa Nengjata	12+850 to 12+900	Unstable slope Section RHS	Protection wall of height 1m has been proposed from Km 12+820 to 12+880 to protect slope. (RHS) is proposed	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
13	Dawa Nengjata	12+900 to 12+980	Unstable slope Section LHS	Protection wall of height 1m has been proposed from Ch-13+180 to 13+260 to protect slope. (LHS) is proposed	Table No-15, Page No-164 (Sr No-6.17.7.1) [Vol-1 Main Report]
14	Dawa Chipitgre	16+500 to 16+600	Unstable slope Section LHS	Not required as per design.	No Unstable slope found at the location
15	Nengkra	17+300 to 17+340	Protection work required RHS	Protection wall of height 1m has been proposed from Ch-17+580 to 17+660 to protect unstable slopes. (RHS) has been proposed	Table No-15, Page No-165 (Sr No-6.17.7.1) [Vol-1 Main Report]
16	Chimagre, Nengkra Bazar	20+300 to 20+600	Protection work required at bridge location	Protection wall of height 1m has been proposed from Ch-19+880 to 19+950 (RHS) to protect from unstable slopes. Additionally to prevent erosion of approaches stream protection works are also proposed at MNB locations.	Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/07/R0
	Nengkra Bazar	20+637 (End of Project)	Spring water collection tank required to store the water coming from natural spring	Proposed spring water collection tank at ch-20+510 (RHS).	Table No-22, Page No-173 (Sr No-6.17.14) [Vol-1 Main Report]
17	Nengkra Bazar	20+564 (End of Project)	2 toilet required on both side of the road with retaining wall due to Unstable slope zone.	2 toilets (RHS) has been proposed at ch-20+565	Table No-23, Page No-173 (Sr No-6.17.14) [Vol-1 Main Report]

18	Nengkra Bazar	20+564 (End of Project)	Settlement of temporary house near connecting Road.	It will be done as per RAP at ch-20+565 (End Ch).	-

The Environmental and Social Impact Assessment conducted during the pre-design stage helped identify and mitigate potential negative impacts of the project. While the project is expected to provide numerous benefits, the assessment highlighted potential adverse effects associated with widening the road within the proposed 12 m right-of-way. Along these stretches, roadside communities are likely to be directly and immediately affected by construction activities, potentially experiencing losses of land, assets, and livelihoods. In line with the mitigation hierarchy for managing environmental and social risks, alternative analyses were conducted to minimize direct negative impacts. Based on these analyses, the design team was advised to limit road widening to within the available right-of-way.

Mitigation measures primarily focus on settlements along the project road, particularly villages and towns or areas with the highest potential impacts. Stakeholder recommendations have been incorporated into the designs wherever feasible.

The following is a summary of the considerations incorporated into the road design to mitigate environmental and social impacts:

- No widening of the road stretch to avoid the significant loss of land, structures and livelihood.
- Curves and Bends will be smoothed out to improve geometric design. Where adjustments may affect local settlements, realignment of the road has been proposed.
- Paved shoulders will be provided wherever possible to accommodate non-motorized traffic.
- Unnecessary displacement will be avoided by adjusting the alignment, narrowing the impact zone, or tailoring designs to meet both rural and urban cross-section requirements.
- Design speed will be reduced in densely populated areas to enhance safety.
- Impacts on existing shrines and places of worship will be minimized.
- Safety features, including speed control measures near schools and healthcare facilities, will be incorporated.
- Road elevation in settlement areas will be minimized to prevent water seepage into adjacent properties.
- Ensure continuous access to businesses and residential properties throughout the construction period.
- Minimize land clearance to reduce the loss of public and private assets, including wells, tree plantations, and other community resources within the project area.

Project Specific

- Junction improvement, traffic calming, and road safety measures including warning/blinker signage, speed restriction signs, and geometric improvements have been incorporated at key locations such as Ch. 0+000, 6+270–6+330, 7+100–7+410, and 7+980 to improve traffic safety and junction operation along the project corridor.
- Protection and slope stabilization works including retaining/protection walls, stream protection works, and erosion control measures have been proposed at vulnerable locations between Ch. 6+886 and Ch. 19+950, particularly at unstable slope and bridge approach sections at Ch. 11+700, 12+020–13+260, 17+580–17+660, and 19+880–19+950.
- To minimize social and environmental impacts, the existing road formation within the forest stretch from Ch. 0+000 to 6+200 shall be retained with blacktopping on the existing alignment, while local access connectivity including access to the graveyard at Ch. 5+200 and protection of nearby

structures through minor alignment adjustments at Ch. 6+350, 7+130, and 11+350 have been incorporated in the design.

- Public utility and community infrastructure provisions including a spring water collection tank at Ch. 20+510 (RHS) and 2 nos. public toilet blocks at Ch. 20+565 (RHS) have been proposed at the project end location, while temporary structure impacts near Ch. 20+565 shall be addressed as per the RAP provisions.

5. BASELINE ENVIRONMENT

5.1 GENERAL

This chapter presents the existing environmental and social conditions of the RSN project area, compassing natural, physical, biological, cultural, and socio-economic components. Based on this baseline scenario, potential impacts of the proposed sub-project will be identified. The approach and methodology for baseline data collection are detailed in Section 1.3 of Chapter 1

5.2 NATURAL ENVIRONMENT (METEOROLOGY)

This section describes the current meteorological conditions of the area, including climate, temperature, rainfall, and relative humidity.

5.2.1 CLIMATIC CONDITIONS

The climate in the project area is moderate and highly humid, with three distinct seasons: summer, rainy, and winter. The summer season occurs from March to May, followed by the southwest monsoon, which lasts until September. The winter season begins in November and continues through February

5.2.2 TEMPERATURE

In East Garo Hills, winter generally begins in mid-November, with January being the coldest month. During this period, maximum temperatures range from 24–26°C, while minimum temperatures can drop to 10–12°C. Summer starts in March, with July and August typically being the hottest months. During summer, maximum temperatures range between 30–33°C, and minimum temperatures are around 22–24°C. The monthly mean maximum and minimum temperatures for the nearest location, Shillong, as recorded by the India Meteorological Department (IMD), are presented in **Table 5.1**.

Table 5.1: Monthly Mean Maximum and Minimum Temperature

Month	Maximum Temperature in °C	Minimum Temperature in °C
January	24.5	12.5
February	25.0	13.0
March	30.0	18.0
April	31.0	20.5
May	32.5	22.0
June	31.5	23.5
July	33.0	25.0
August	32.8	25.2
September	32.0	24.0
October	30.5	21.5
November	28.5	17.0
December	25.5	13.5

Source: Climatological Table, 2020

Temperature Projection and Implications for RSN Road

According to the Meghalaya State Action Plan on Climate Change (SAPCC, 2022), the Garo Hills region including the East Garo Hills District is projected to experience an increase in mean annual temperature of approximately 1.8–1.9°C by the mid-century period (2021–2050) relative to the 1975 baseline, based on the HadRM3 (PRECIS) regional climate model under the A1B scenario. This gradual warming trend is expected to intensify surface heat exposure and increase the frequency of hot days. For the Rongrenggre-Simsanggre-Nengkhra (RSN*)* Road Sub Project Road, such temperature rise may accelerate bituminous pavement softening, rutting, and surface deformation, particularly in low-lying or exposed segments. To enhance climate resilience, it is recommended to adopt temperature-resistant bitumen grades (higher Performance Grade or polymer-modified binders), ensure adequate pavement compaction, and improve roadside drainage and vegetative cover to mitigate thermal stress. The integration of these measures

will align the road design and maintenance strategies with future climate projections for the region.

5.2.3 RAINFALL AND HUMIDITY

East Garo Hills experiences a subtropical monsoon climate with high humidity throughout the year. Pre-monsoon showers occur during April and May, often accompanied by thunderstorms and occasional hailstorms, followed by a brief dry spell. The southwest monsoon typically begins in late May or early June, with peak rainfall occurring between June and August. The hilly terrain, particularly in the southern and central parts of the district, receives the heaviest rainfall, which contributes to slope instability and increases the risk of unstable slopes along the road Sub Project Road. The average annual rainfall during 2018-2020 is presented in **Table 5.2**, while **Table 5.3** provides the month-wise relative humidity for the year 2020 (nearest location: Shillong, IMD data).

Table 5.2: Last 5 years rainfall data for East Garo Hills District

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall
2018	15.2	18.0	50.0	80.0	200.0	400.0	350.0	320.0	250.0	80.0	20.0	10.0	1,693.2
2019	10.0	12.0	40.0	90.0	310.0	380.0	370.0	300.0	240.0	100.0	15.0	5.0	1,872.0
2020	12.0	15.0	55.0	100.0	320.0	420.0	360.0	330.0	260.0	90.0	10.0	8.0	2,020.0

Source: Customized Rainfall Information System, Hydromet Division, IMD

Table 5.3: Month-wise Relative Humidity

Month	08.30 Hrs	17.30 Hrs
January	88	75
February	85	70
March	80	65
April	82	73
May	87	78
June	93	90
July	92	88
August	90	85
September	88	82
October	85	78
November	83	73
December	87	75

Rainfall Projection and Implications for RSN Road

The Meghalaya State Action Plan on Climate Change (SAPCC, 2022) indicates that the Garo Hills region, including East Garo Hills District, is projected to experience an overall increase in annual rainfall by about 10–15% by mid-century (2021–2050) compared to the 1975 baseline, under the HadRM3 (PRECIS) regional model using the A1B scenario. While total monsoon rainfall is expected to rise, the distribution pattern will likely become more erratic, with intensified short-duration rainfall events and longer dry spells. Such changes could exacerbate surface runoff, soil erosion, and waterlogging along the Rongrenggre-Simsanggre-Nengkhra (RSN) Road Sub Project Road, particularly in low-lying and hilly sections. To address these risks, the project should incorporate enhanced cross-drainage capacity, lined roadside drains, bioengineering for slope protection, and rainwater outlet management to reduce erosion and flooding. The design must also ensure maintenance-friendly drainage infrastructure capable of handling increased peak flow intensities projected for the mid-century climate scenario.

For bridge/cross drainage hydrology analysis, observed hourly rainfall records and local IDF (Intensity–Duration–Frequency) curves are presently unavailable for the project area. Therefore, in the absence of observed short-duration rainfall records, shorter-duration rainfall estimates required for hydrological assessment have been derived using standard hydrological conversion procedures and provisions of IRC SP:13-2022, together with conservative engineering assumptions.

District wise Daily Rainfall Data in the project corridor

A number of rain gauge stations were installed in Meghalaya under the hydrometeorological modernization programme of the Indian Meteorological Department (IMD) during 2009, supported through World Bank and Central Government funding initiatives. Daily rainfall data from IMD rain gauge stations located in West Garo Hills, South Garo Hills, East Garo Hills, and North Garo Hills were analyzed for the period 2009–2025 and attached as Annexure I. The maximum observed one-day rainfall values from the available 16-year record are summarized below:

District	Date	1 day (24 hr) Max Rainfall in mm
West Garo Hills	31-05-2021	245.83
South Garo Hills	15-06-2021	248.71
East Garo Hills	15-06-2021	231.56
North Garo Hills	31-05-2021	237.68

The observed rainfall data is available only for a limited period of 16 years. Therefore, IMD Gridded Rainfall Data (0.25° × 0.25° resolution), available for approximately 110 years, was also studied for regional assessment. The IMD Gridded data series also have 1 day (24hr) rainfall data. The maximum one-day rainfall of year 1980 to 2025 has been attached as Annexure II.

However, a major limitation of the IMD gridded rainfall data (0.25° × 0.25° resolution),in Meghalaya is the highly complex topography and localized microclimatic conditions of the state. Due to steep terrain and orographic effects, adjacent regions often experience significantly different rainfall intensities. Consequently, regional-scale gridded rainfall data may not accurately represent localized extreme rainfall events required for hydrological design. Similar inconsistencies were observed during comparison between observed rain gauge data and IMD gridded rainfall data.

Considering the above, the design rainfall corresponding to 24-hour duration and 100-year return period has been adopted from the CWC Flood Estimation Report, which represents standard engineering practice for hydrological design of bridges and cross-drainage structures in ungauged catchments in India.

Further, historical IMD daily rainfall observations from nearby districts indicate that observed extreme one-day rainfall events are generally lower than the adopted regional design rainfall values, supporting the conservative nature of the selected design rainfall for hydrological assessment.

As per the CLIMATE CHANGE VULNERABILITY AND PROJECTIONS FOR PROJECT MITP (MEGHALAYA) annex1, it is recommended that the climate change factors shall be applied to "increase *in **1-day maximum rainfall (Rx1day)** is a critical hydrological variable for calculating **design discharge, flood levels, and flow velocity**, and must therefore be used as the **climate change adjustment factor** in the design of road and bridge infrastructure."*

The MITP report recommends climate adjustment factors of approximately:

- +15% for drainage systems,
- +25% for culverts and minor bridges, and
- up to +35% for major bridge hydrological design parameters,

Accordingly, climate resilience considerations have been incorporated in the adopted design rainfall through application of the recommended climate adjustment factor, enhanced hydraulic capacity, additional freeboard above expected flood levels, and sensitivity assessment for future extreme rainfall scenarios.

Estimation of One Hour Rainfall for hydraulic assessment

100 Year Return Period rainfall for 24 hr,	=	360	mm
(CWC Flood Estimation Report for Sub Zone 2b)			
As per MITP Report Climate change factor for rainfall	=	1.252	
Considering Climate Change 100 year 24 hr Rainfall	=	450.7	mm
Adopted 100 year 24 hr Rainfall	=	450.7	mm
Intensity of Rainfall Ic for tc=24hr (Considering 100 year 24 hr rainfall)			
Ic = (F/T) x((T+1)/(tc+1))	=	234.75	mm/hr
Conversion ratio for 1 hrs as per CWC Flood Estimation Report	=	0.48	
100 year maximum 1 Hr Rainfall	=	216.336	mm/hr

The project catchments are steep and hilly with short flow paths, resulting in low time of concentration, generally less than one hour. Such catchments respond rapidly to intense rainfall and generate high peak runoff within a short duration. Therefore, the Critical Intensity Method as per IRC SP:13–2022, Clause 4.7.6 has been adopted for estimation of design discharge.

The critical intensity is given by:

$$I_c = \frac{F}{T}\left(\frac{T+1}{t_c+1}\right)$$

$$I_c = I_o\left(\frac{2}{t_c+1}\right)$$

The time of concentration is calculated using:

$$t_c = 0.87\left(\frac{L^3}{H}\right)^{0.385}$$

The calculated 1-hour rainfall intensity of 234.75 mm/hr is nearly equivalent to the maximum observed 24-hour district rainfall of approximately 245 mm, reflecting a highly conservative design approach. Accordingly, the adopted short-duration rainfall values and supplementary hydraulic safety provisions adequately account for extreme rainfall conditions, future climate variability, and uncertainties associated with projected extreme storm events. The incorporation of these conservative hydraulic and climate resilience measures is expected to enhance the long-term safety, reliability, and performance of the infrastructure under future hydrological extremes.

Adequacy Check as per IRC SP 13:2022

After incorporating the resilience factor into the design rainfall, the adequacy of both existing and proposed bridges was evaluated using the methodology explained below. Bridges found to be inadequate have been proposed for reconstruction, while those meeting the required capacity criteria have been recommended for retention.

Considering that the average catchment area is ranging between 1.5 to 3 sq.km and the existing bridge widths range between 7 m and 15 m, a detailed adequacy check was performed. The analysis indicated that at many locations, the existing bridge sizes were adequate; accordingly, the proposed bridge dimensions have been kept the same and revised accordingly. The details are provided in the inventory.

The detailed adequacy check is given below:

Example for Discharge calculation and adequacy check proposed box type MNB

Catchment Area (A) = 1.61SQKM =161 ha

Length of Longest stream (L) = 2

Rational Formula

Design Discharge Q 100Design Discharge Q 100 =0.028 x Px f xA xIc

H- Elevation Difference between critical point to the structure= 75 m

Time of Concentration tc is given by Eq 4.9 = (0.87 x L3/H)0.385

= (0.87 x 1.1^3x75) ^0.385

= 0.20 hrs

Design Rainfall = 45.072 cm

From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic = 45.072/ 24 x ((24+1)/0.2+1)

= 39.10 cm/hr

From IRC SP 13, Spread Factor "f" from f curve fig 4.2From IRC SP 13, Spread Factor "f" from f curve fig 4.2 = 0.99

From IRC SP 13, table 4.1, coefficient of runoff for the catchment characteristics

P = 0.4

Design Discharge Q 100 = 0.028 x Px f xA xIc =0.028 x0.4 x 0.99 x 161 x 39.10

= **69.80 Cumecs**

Adequacy check for Box type bridge

size of box - 10.60m x 2.178m

IRC SP 13 clause 19.2.8

Area 23.0868 Sqm

Wetted Perimeter, P = 14.956 m

R= A/P 1.54

As RC SP:13 Clause 19.2.8

Entry loss Ke= 0.572 $R^{0.3}$ 0.65

Friction loss -0.035 $L/R1^{.25}$ 0.461

λ -A/(1+ke+kf) $^{1/2}$ 15.88

Height of box 2.178 m

Q capacity =λ*$(2gH)^{0.5}$ =**103.82 Cumecs**

or

By Mannings formula =Ax 1/n x $R^{2/3}$ x $S^{0.5}$ =

= 1/0.013 x $1.54^{0.66\,x}$ x $(1/750)^{0.5\,x}$ 23.0868

=86.1 Cumecs

n for concrete 0.013, s slope for box type of bridge can be adopted between 500-1000 in std practice

Q design=69 < Q capacity= 103cumecs

Based on both methods, the box culvert is hydraulically adequate to safely convey the design discharge

Adequacy check for deck type proposed bridge

The longitudinal slope of the stream has been obtained from the surveyed longitudinal section (L-section), while the cross-section has been established based on detailed topographical survey data. The High Flood Level (HFL) has been assumed considering the design discharge and site conditions, and the corresponding cross-sectional flow area has been determined. Using the computed longitudinal slope and hydraulic parameters, the discharge has been evaluated using Manning's equation. The discharge thus obtained has been compared with the discharge estimated using the Rational Method, and the higher of the two values has been adopted for design to ensure a conservative approach. Based on the assessed HFL, the soffit level of the proposed bridge has been fixed by providing the requisite freeboard in accordance with relevant codal provisions.

The longitudinal slope calculated based on survey =0.069

The cross-section at the bridge location has been developed based on the actual bed levels of the nala/stream obtained from topographical survey (indicated in blue). The High Flood Level (HFL) has been marked in red at the bridge location on the cross-section, as depicted below.

HFL= 264.250m

Cross - Sectional Area of Flow, A = 12.830 Sqm

Wetted Perimeter , P = 20.264 m

Hydraulic Mean Radius, R = A / P = 0.633 m

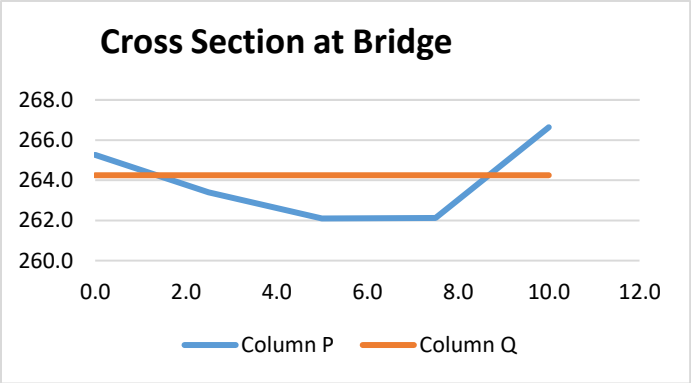
Longitudinal Slope (as calculated), S = 0.069

n 0.030

V=1/n x $R^{2/3}$ x $s^{1/2}$= 6.462m/s

Q= V x A = 6.642 x 12.833

Discharge = 82.905 cumecs



at the bridge location, the discharge corresponding to the assumed High Flood Level (HFL) of 264.25 m has been found to be greater than the estimated design discharge of 69 cumecs. Hence, the adopted HFL is considered adequate for safely passing the design flood. The same HFL has been used for fixing the soffit level of the proposed bridge

In a similar manner, the hydraulic capacity of the existing bridge has also been assessed using the same methodology to evaluate its adequacy in safely conveying the design discharge.

Adequacy check for deck type existing bridge

Rational Formula

Design Discharge Q $_{100}$Design Discharge Q 100	=	0.028 x Px f xA xI_c	
Catchment area	=	121	Ha
H- Elevation Difference between critical point to the structure=		40	m
Time of Concentration tc is given by Eq 4.9	=	$(0.87 \times L^3/H)^{0.385}$	
	=	0.18	hrs
100 years return period rainfall for 24hrs as per CWC flood estimation report Subzone 2b			
	=	45.072	cm
From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic	=	45.072/ 24 x (24+1)/0.18+1)	
	=	39.89	cm/hr
From IRC SP 13, Spread Factor **"f" from** f curve fig 4.2From IRC SP 13, Spread Factor **"f" from** f curve fig 4.2	=	0.995	
From IRC SP 13, table 4.1, coefficient of runoff for the catchment characteristics			
P	=	0.4	
Design Discharge Q $_{100}$	=	0.028 x P x f x A x I_c	
	=	**53.79 cumecs**	

Existing size of box	10.60	x 2.971
IRC SP 13 clause 19.2.8		
Area	31.4926	Sqm
Wetted Perimeter , P =	16.542	m
R=	1.90	
Entry loss Ke= 0.572 $R^{0.3}$	0.69	
Friction loss -0.035 $L/R^{1.25}$	0.355028	
λ -A/(1+ke+kf) $^{1/2}$	22.00126	
Height of box	2.971	m
$Q=\lambda*(2gH)^{0.5}$	**167.976**	Cumecs

Discharge carrying capacity of box is more than calculated discharge therefore it is safe

Design calculations justifying consideration of Climate resilience factor in design of hydrology for culverts is attached below:

Hydrology at CA CH-0+600 RBB Road								
	HYDROLOGY OF Culvert AT KM 0+600							
1	Name of River / Stream / Nala	=	Local					
2	Catchment Area (**A)**	=	0.22	SQKM				
3	Length of Longest stream (L)	=	0.091	KM				
4	Point Rainfall in mm	=	36	cm				
5	CWC Subzone	=	2b					
6	**Modified rainfall after application of Climate resilience factor 1.252**	=	45.072	cm				
A	**Estimation of Design Discharge by Emperical Formula as per**							
	IRC SP-13-2004, Article 4							
1	**Dickens Formula**							
	Q	**=**	**CA^(3/4)**					
	C =14-19 where annual rainfall is more than 120cm							
	For 1500mm rainfall	=	18					
			=18x0.091^ (3/4)					
	Q	=	5.78	Cumecs				
B	**Rational Formula**							
	Design Discharge Q_{100}	=	0.028 x Px f xA xI_c					
	Rational can be used for small culverts with basin upto 15 Sqkm							
		=	22	Ha				
	H- Elevation Difference between critical point to the structure=		4.14	m				
	Time of Concentration tc is given by Eq 4.9	=	$(0.87 \times L^3/H)^{0.385}$					
			= (0.87 x 0.091^3x4.14)^0.385					
		=	0.03	hrs				
	100 years return period rainfall for 24hrs as per CWC flood estimation report Subzone 2b and application of climate resilience factor	=	45.072	cm				

	From IRC SP 13 eq. 4.10a Intensity of rainfall , Ic	=	45.072/ 24 x (24+1)/0.03+1)					
		=	45.39	cm/hr				
	From IRC SP 13, Spread Factor **"f"** from f curve fig 4.2	=	0.995					
	From IRC SP 13, table 4.1, coefficient of runofff for the catchment characterstics							
	P	=	0.6					
	Design Discharge Q_{100}	=	0.028 x Px f xA xI_c					
		=	**16.69**	Cumecs				
D	**Design Discharge : (Refer IRC - SP : 13 - 2004, Clause : 6.2)**							
	Discharge by Dicken's Formula =	5.78	m^3/s					
	Discharge by Rational Formula =	16.69	m^3/s					
	Maximum Discharge =	16.69	m^3/s					
	Hence, Design Discharge =	**8.67**	m^3/s					
	Design discharge from observed flood	8.67	Cumecs					
	Dimension of Culvert	1	m dia.					
	Area of flow (A)	0.7854	m^2					
	Perimeter of flow	3.1416	m					
	Slope of flow	0.454945						
	Hydraulic mean depth (R) = A/P	0.250001	m					
	Rugosity coefficient (n)	0.033						
	Conveyance factor (λ) = (A.R^2/3)/n	9.440687						
	Capacity of culvert	6.367707	m^3/s					
		Revise						
	Revised section of Culvert due to lower capacity of Culvert. Revision in design discharge calculation are mentioned below							

	Dimension of Culvert	1 x 5 x 2.8	m Box					
	Area of flow (A)	11.9000	m^2					
	Perimeter of flow	9.7600	m					
	Slope of flow	0.028867						
	Hydraulic mean depth (R) = A/P	1.219262	m					
	Rugosity coefficient (n)	0.033						
	Conveyance factor (λ) = (A.R^2/3)/n	411.5853						
	Capacity of culvert	69.9296	m^3/s					
		Safe						

Note: The additional structures proposed on the project roads to address climate-resilient design considerations have been incorporated in the submitted Final Detailed Project Report under Chapter 6, Clause 6.19, Page No. 132. Kindly refer to the attached image below.

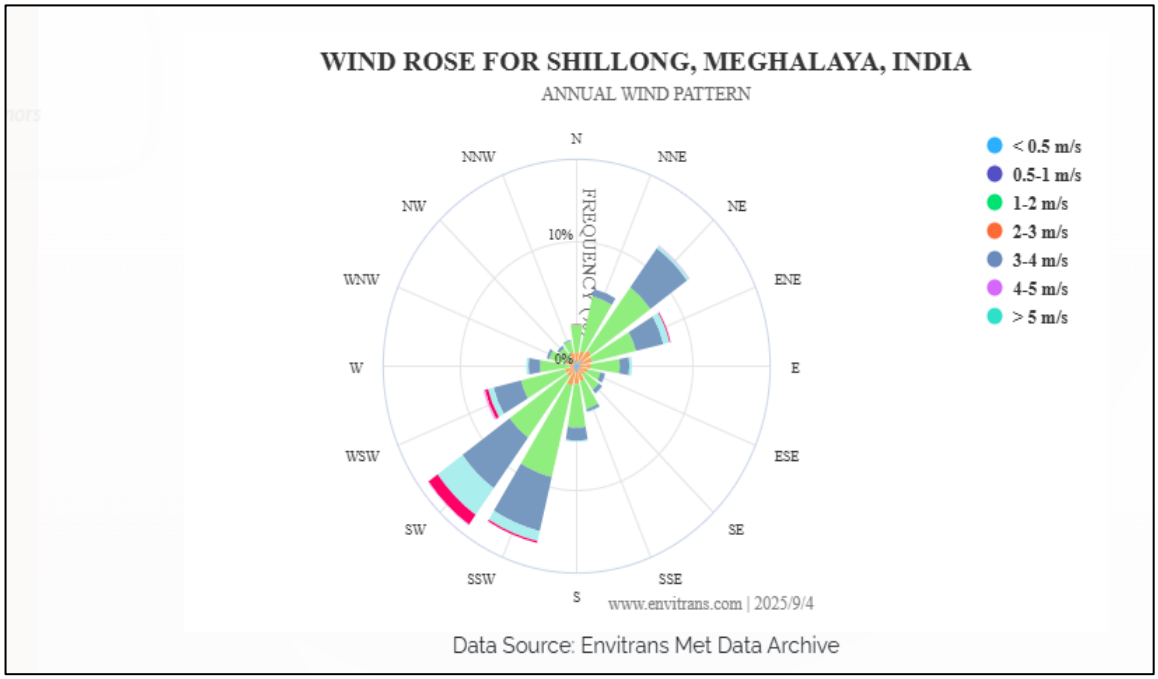
6.19 Climate Resilient Feature

Climate-Resilient Design		Upgradation of Rongsai Borjhora Bajengdoba Road from single to intermediate lane. (RBB)
1.Climate Vulnerability Assessment During Design	Roads and bridges undergo systematic climate vulnerability assessments early in design to identify hotspots prone to extreme rainfall, flooding, erosion, waterlogging, landslides and submergence.	Based on the findings of these assessments, climate-resilient design measures have been incorporated into the project. The design discharge for bridges and culverts has been increased by 25.2%, and the design discharge for cross-drainage structures has been enhanced by 14.5% as per (Shared Socioeconomic Pathways) SSP 5-8.5 data from IITM (Indian Institute of

Climate-Resilient Design		Upgradation of Rongsai Borjhora Bajengdoba Road from single to intermediate lane. (RBB)
		Tropical management) Pune in consultation with MITP to account for projected increases in rainfall intensity under future climate scenarios.
		Considering future climate vulnerability and
2. Enhanced Drainage & Flood Management	Larger culverts,	At critical locations where the existing culvert dimensions were found to be insufficient, the size of the culverts has been increased by converting 2 Pipe culverts to Box Culverts and additional 15 no. of Pipe culverts have been proposed for improving drainage. These measures have been adopted to improve hydraulic capacity, prevent flooding and damage to the road, and ensure uninterrupted connectivity, thereby achieving an all-weather road.
	cross-drainage structures,	Specific provisions for cross-drainage structures are made to enhance hydraulic efficiency, prevent clogging, and ensure the stability of both the structures and their approaches. These provisions include floor aprons, cut-off walls, quadrant pitching, stream-protection works, return walls, and retaining walls.
	properly graded roadside drains prevent waterlogging and lower flood damage.	Proper gradient to road side drain are provided parallel to road and their connectivity with existing and newly proposed culverts are done to avoid any kind of flooding on the road section.
	Road designs incorporate improved cross-drainage systems, culverts, and surface water management to remain serviceable during intense monsoon rainfall common in Meghalaya's wet	Improved Cross Drainage system

5.2.4 WIND SPEED AND DIRECTION

Wind Rose diagram was prepared for 1 year, for the wind data recorded at Shillong (nearest station taken) is given in **Figure 5.1**. Average Wind speed of 1.6 m/s in the direction of NE to South west is observed.



Source: Envitrans

Figure 5.1: Wind rose Diagram

5.3 LAND ENVIRONMENT

5.3.1 PHYSIOGRAPHY AND ELEVATION

East Garo Hills District, located in the central part of Meghalaya, is characterized by rugged hilly terrain, interspersed with deep valleys, forested slopes, and seasonal streams. The district is drained by several important rivers, including the Simsang, Daring, Didram, and Rongreng, which generally flow eastward or southeastward, with some eventually entering Bangladesh as part of transboundary river systems. Elevation in the district ranges from around 150 meters above mean sea level in the low-lying eastern areas to over 1,400 metres in the southwestern highlands, particularly around the Nokrek Biosphere Reserve, one of the highest points in the Garo Hills. The physiography of East Garo Hills is marked by steep ridges, forested hills, and undulating plateaus, descending gradually toward the plains in the east, which gives the district its varied and dramatic landscape3.

Baseline Scenario for RSN Road

As per elevation map of East Garo Hills District, the RSN project road stretch lies in the range of 200-561 m. The proposed road of 20.565 km length, where the terrain is comparatively stable. Cutting will be carried out along 1,100 m on the LHS and 1910 m on the RHS of the proposed road alignment. In addition to the protective measures proposed for the road works, gabion-type retaining walls have been recommended to stabilize vulnerable sections. These structures will cover a cumulative length of 1380 m across all locations within the sub project road to prevent slope instability and erosion. The identified chainages on the right-hand side, namely Ch 14530–14550, 14750–14930, 18370–18410, 18730–18780, 19390–19450, and 19560–19690, exhibit cutting heights ranging from 3.0 m to 4.0 m, indicating relatively steep slope conditions.

[3] District Census Handbook, East Garo Hills

Cut slope stabilization and protection measures have been proposed at identified vulnerable cutting sections along both sides of the project corridor. On the left-hand side (LHS), cutting sections are distributed between Ch. 8+150 and Ch. 18+250 with cutting heights varying from 1.0 m to 2.5 m, covering a total cumulative length of about 1,100 m. Major LHS cutting stretches include Ch. 14+760 to 14+870, Ch. 15+200 to 15+300, and Ch. 16+640 to 16+750 where cutting heights up to 2.0 m have been observed.

Similarly, on the right-hand side (RHS), cutting sections are identified from Ch. 8+160 to Ch. 20+150 with cutting heights ranging from 1.0 m to 5.0 m over a total cumulative length of about 1,910 m. Significant cutting stretches are located between Ch. 14+750 to 14+930, Ch. 17+580 to 17+700, Ch. 19+000 to 19+180, and Ch. 19+560 to 19+690, including isolated locations with higher cut slopes up to 5.0 m near Ch. 18+460 to 18+510. Appropriate slope stabilization and protection measures shall be implemented at these locations in accordance with the approved design and relevant technical specifications to ensure long-term slope stability and roadway safety

These sections are more prone to slope instability and erosion, and therefore require appropriate slope stabilization and protection measures.

The Sub-Project wise elevation map of the project stretch is given in **Figure 5.2**.

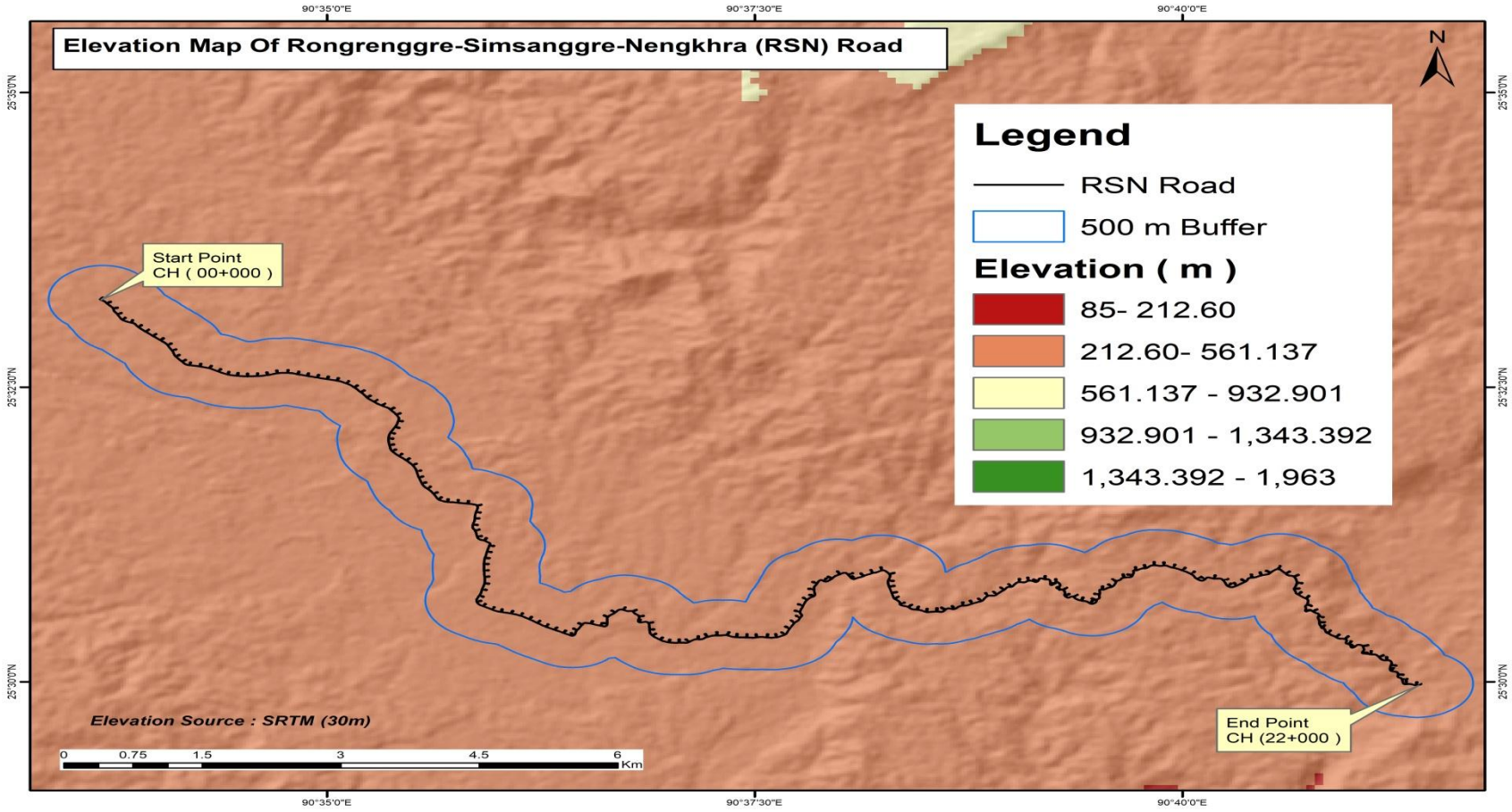


Figure 5.2: Elevation map of the RSN project area (Elevation Source: SRTM (30m)

5.3.2 GEOLOGY

Baseline Scenario for Sub- Project Road

- **Precambrian Basement:** Granite gneiss, schist, quartzite forming the core hilly terrain.
- **Gondwana Rocks:** Found in Rongrenggre–Williamnagar–Songsak areas; mainly sandstone, shale, and coal seams.
- **Tertiary Sediments:** Garo Group (sandstone, siltstone, shale, carbonaceous shale, coal), important for coal deposits.
- **Alluvium:** Present in lower valleys and floodplains of Simsang River.
- **Economic Geology:** Coal mining is significant (Rongrenggre–Nangalbibra–Darugiri belt). Small occurrences of limestone and clay also reported.

Structural Features

- The region is part of the **Shillong Plateau uplift**, bounded by the **Dauki Fault** in the south.
- The terrain is dissected by faults and joints, giving rise to rugged topography.

Major rivers (Dudnai, Krishnai, Simsang, etc.) follow structurally controlled valleys

Hydrogeology

Crystalline rocks: Yield limited groundwater through fractures and weathered zones.

- **Coal-bearing sandstones:** Moderate aquifers.
- **Alluvium:** Good potential for shallow tube wells in foothill plains.

Site Specific Geology

- The RSN Road site in East Garo Hills is underlain predominantly by weathered and lateritic residual soils developed on a basement of Precambrian/early Paleozoic crystalline rocks. The near-surface profile typically consists of an upper zone of lateritic crust and ferruginous gravel (variable thickness), underlain by a clayey to silty lateritic horizon grading into saprolite and intensely weathered bedrock. The competent substratum is formed by fractured and jointed Shillong Group / Garo Hills metamorphic units (schists, phyllites and meta-sediments) and subordinate intrusive lithologies; fresh rock is generally encountered at moderate depths dependent on local slope and erosion exposure. Structural features important for the site include closely spaced joints, shear zones and occasional small-scale faults that control groundwater seepage and preferential weathering; slope angles along the roadside and cut slopes are locally steep and are underlain by colluvial deposits and slope wash. Groundwater is usually shallow in weathered horizons and perched within discontinuous clay lenses; surface drainage follows small seasonal streams and roadside channels and is prone to rapid runoff during monsoon. Geohazards to note are slope instability during heavy rainfall (shallow translational slides and raveling of lateritic caps), erosion of roadside cuttings, and differential settlement where thick saprolite or compressible clay layers occur beneath fills.
- For design and construction: confirm the thickness of laterite/saprolite and the depth to fresh rock by boreholes and standard penetration (SPT) / CPT testing at representative locations; map joint orientations and shear zones during site logging; evaluate seasonal groundwater levels and infiltration; and apply slope stabilization (benching, retaining walls, drainage channels and

revegetation) and suitable foundation options (strip footings on treated laterite, raft foundations, or pile support where deep weathering is present) based on the geotechnical findings.

The geology of the RSN Road is depicted in **Figure 5.3**, below.

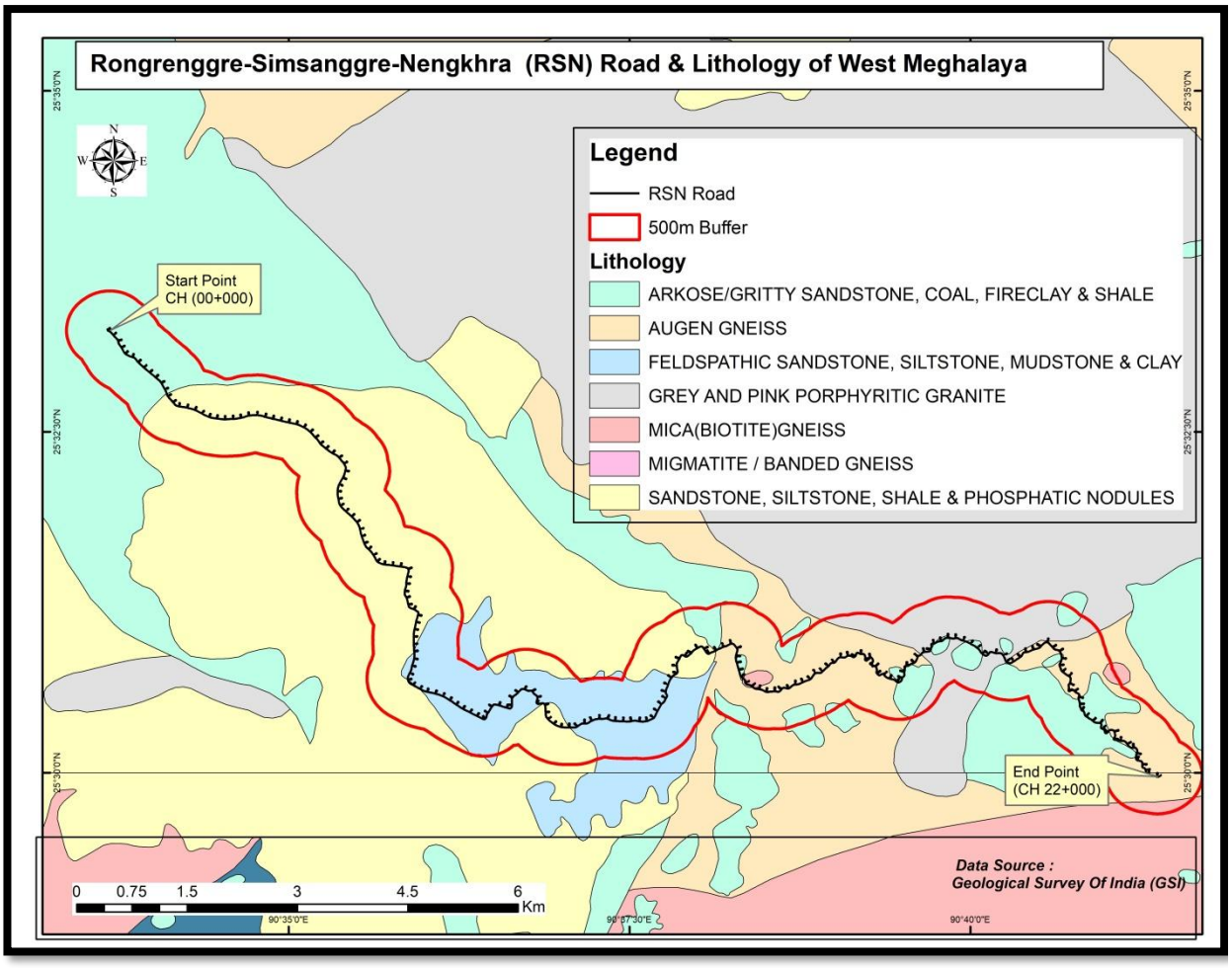


Figure 5.3: Local geology of the road stretch of Sub-Project Road RSN

5.3.3 GEO-MORPHOLOGY AND SOILS

Soils along the project road vary according to the terrain. Lateritic soils, predominant in the northern parts of the district, are characterized by their reddish-brown color, high iron content, and moderate fertility. Red-loamy soils, found mainly in Rongjeng and Songsak areas, are moderately fertile and suitable for cultivating maize, millets, and various horticultural crops. Red and yellow soils, commonly occurring in Samanda and Williamnagar, are acidic in nature with pH values ranging from 4.9 to 5.6. These soils possess moderate organic matter content but are generally deficient in phosphorus and potash.

Given the terrain and soil characteristics, the RSN Road requires adequate slope stabilization, drainage, and erosion-control measures such as check walls, bio-engineering techniques, and roadside plantation to minimize soil loss and maintain road stability[4].

[4]District Irrigation Plan 2016–2020, East Garo Hills, Government of Meghalaya.

Table 5.4: East Garo Hills District - major soil class area in Ha. and Land Slope

Major Soil Class	Total Area (ha)	0–3% Slope (ha)	3–8% Slope (ha)	8–25% Slope (ha)	>25% Slope (ha)
Fine Loam	1,38,916	20,070	94,033	53,717	—

Source: District Irrigation Plan 2016–2020, East Garo Hills, Government of Meghalaya

Geomorphological map of East Garo Hills district is depicted in the **Figure 5.4** below.

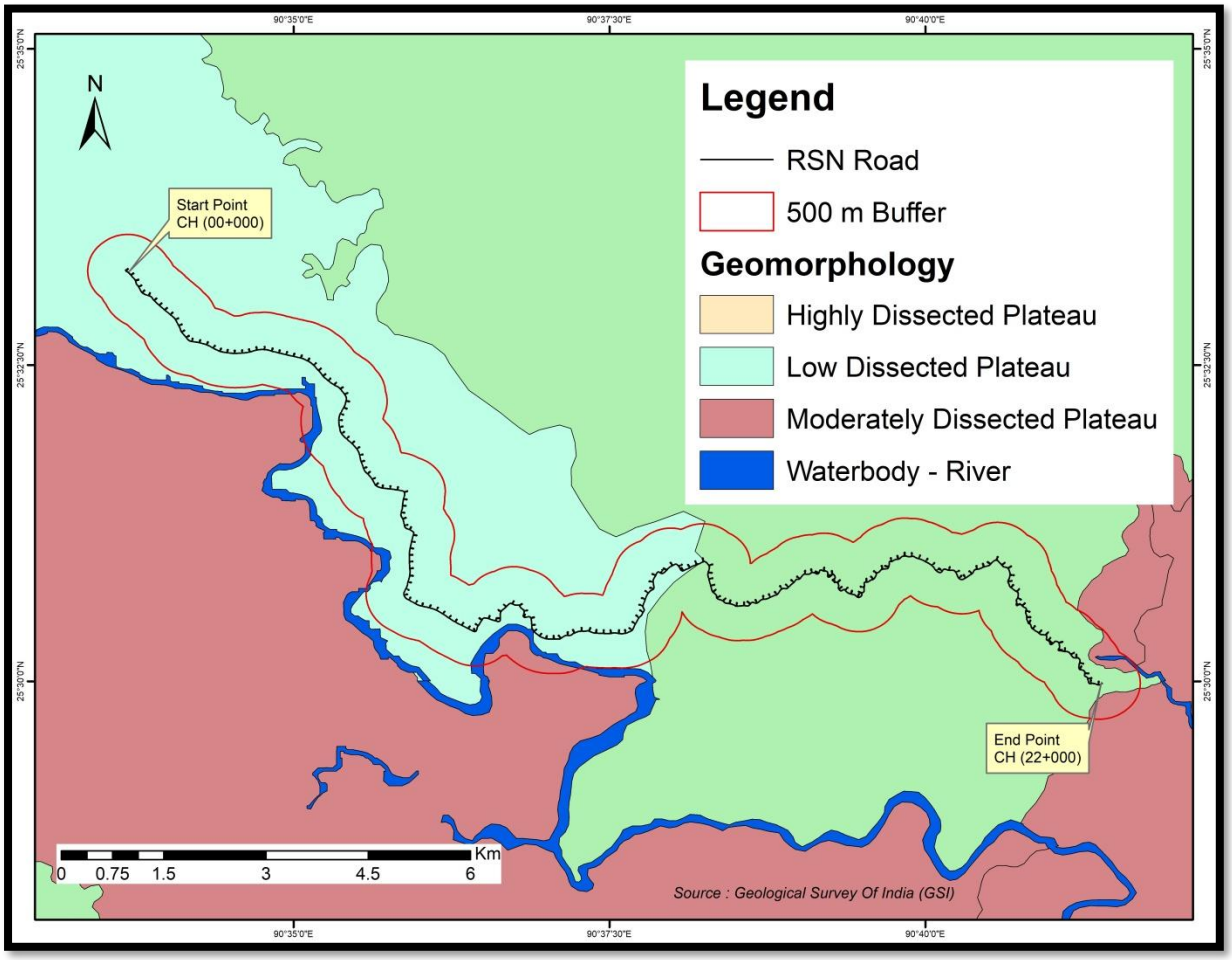


Figure 5.4: Geomorphological map of East Garo Hills district

5.3.4 LAND USE PATTERN

The LULC map[5] of 500m reveals that the RSN stretches area comprises of crop land, forest, plantation, settlements, scrub land, and water bodies, etc. The LULC map of 500m on either side of the road is presented in Figure 5.5 below

[5] LULC Data source: NRSC: LULC (10 k) SIS-DP Phase-2: 2018-23

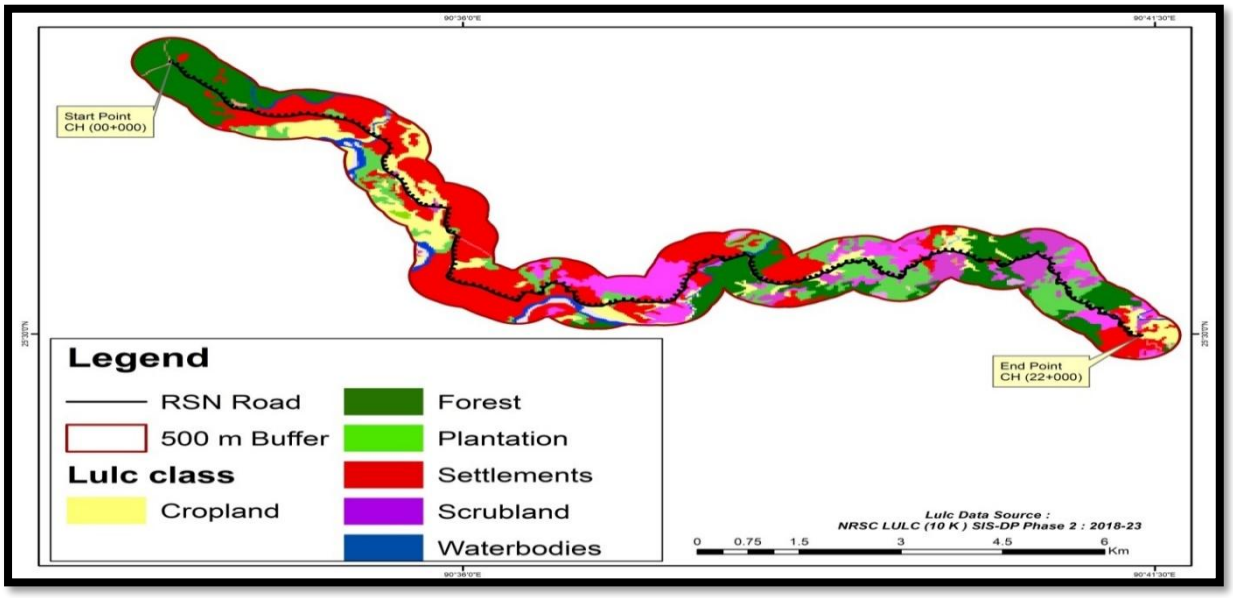


Figure 5.5: Land Use / Land Cover map of RSN road Sub Project Road

5.3.5 AGRICULTURE

Baseline Scenario in Sub Project Road Area

According to the consultations that was organized with Indigenous communities, the majority of the population in the sub-project area relies on agriculture as their primary source of livelihood, with Jhum cultivation being the predominant farming practice among local communities. Key crops grown in the RSN road area include paddy, maize, sesame, cauliflower, cabbage, chilli, bitter gourd, tomatoes, lettuce, pumpkin, betel nut, betel leaf, pineapple, and banana. Farmers primarily sell their products in local markets, while surplus yields are supplied to other districts or states through vendors.

5.3.6 SOIL QUALITY

Soil monitoring was conducted at 04 Locations in the month of October. Details of the soil sampling locations are presented in Table 5.6 and shown in Figure 5.6. The collected soil samples were analyzed for various parameters in an NABL-accredited laboratory. The soil monitoring results are presented in the Table 5.6.

Table 5.5: Soil sampling Locations

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	RSN Sub-project Road	SaminSongkama bettle nut garden	SQ1	25°31'56.74"N	90°35'24.10"E
2		SaminWakso Garden	SQ2	25°30'19.66"N	90°36'58.44"E
3		Dajong gate Agriculture Field	SQ3	25°30'42.16"N	90°38'50.09"E
4		SoenangApal Agriculture Field	SQ4	25°30'53.49"N	90°40'10.75"E

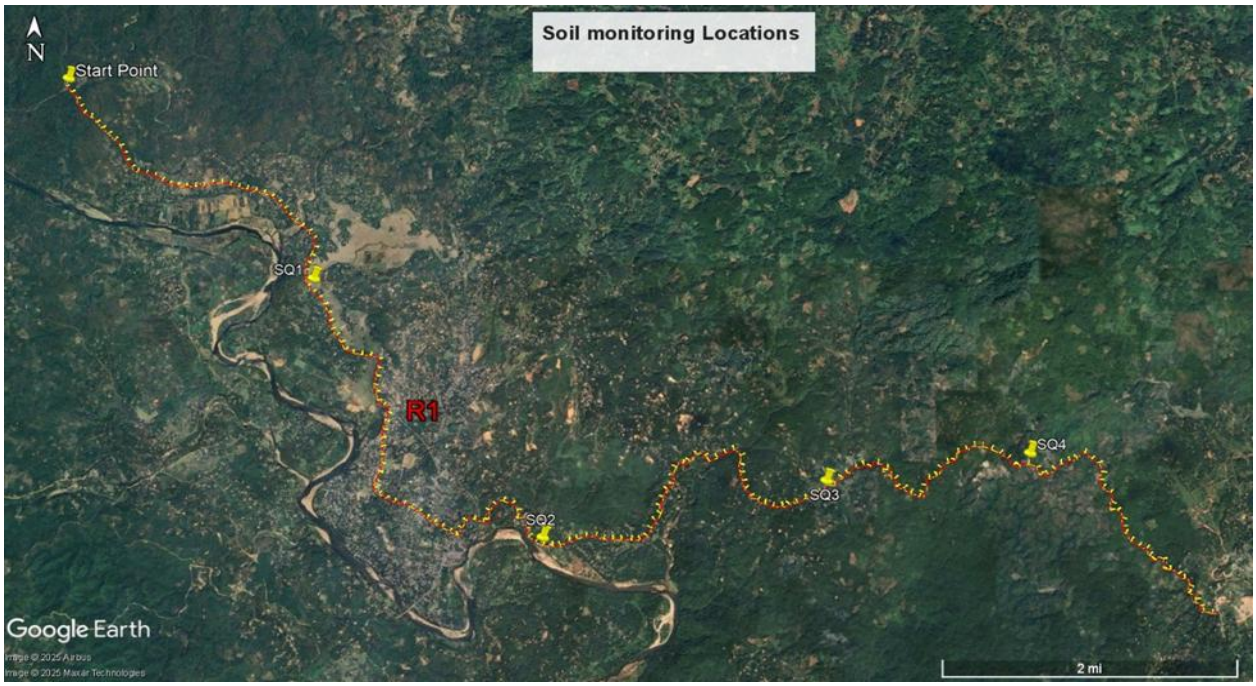


Figure 5.6: Soil monitoring locations

Table 5.6: Soil Monitoring Results in the sub-project area

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	SQ4	Test Method
1.	Colour		Brown	Brown	Brown	Brown	STRL/STP/SOIL/01
2.	Textural Class		Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	IS2720 (P-4), 1985 (Reaff: 2015)
3.	Bulk Density	gm/cm^3	1.23	1.56	1.29	1.31	IS 14765: 2000, RA 2010
4.	Water Holding Capacity	%	27.4	35	29.4	29.6	STRL/STP/SOIL/01
5.	Sand	%	50.4	51.0	53.1	50.8	IS2720 (P-4), 1985 (Reaff: 2015)
6.	Silt	%	27.1	28.9	26.2	29.6	IS2720 (P-4), 1985 (Reaff: 2015)
7.	Clay	%	22.5	20.1	20.7	19.6	IS2720 (P-4), 1985 (Reaff: 2015)
8.	pH (1:2 Suspension)	-	5.65	6.55	5.79	5.67	IS:2720 (part-26),1987 (Reaff:2011)
9.	Electrical Conductivity (1:2)	µmhos/cm	218.0	237.0	226.0	227.0	IS: 14767(2000), RA 2016
10.	Organic Matter	%W/W	3.28	3.18	4.69	3.31	STRL/STP/SOIL/01
11.	Exchangeable Calcium	mg/kg	1260.0	1210.0	1269.0	1254.0	IS 2720 (Part 24): 1976, RA 2010
12.	Exchangeable Magnesium	mg/kg	512.2	490.3	485.7	511.4	IS 2720 (Part 24): 1976, RA 2010
13.	Copper	mg/kg	9.5	12.1	11.7	10.6	IS 2720(Part-27):1977

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	SQ4	Test Method
14.	Nickel	mg/kg	7.9	8.2	9.1	8.4	IS 2720(Part-27):1977
15.	Chromium	mg/kg	10.6	9.8	10.7	11.6	IS 2720(Part-27):1977
16	Iron	mg/kg	77.6	86.3	77.5	78.9	IS 2720(Part-27):1977
17	Lead	mg/kg	0.3	0.2	0.2	0.4	IS 2720(Part-27):1977
18	Sulphate	mg/kg	12.9	11.8	12.9	13.3	IS 2720(Part-27):1977
19	Nitrogen (as N)	Kg/Ha	234.0	238.0	226.4	204.7	IS:10158:1982, RA 2009
20.	Phosphorous	Kg/Ha	103.6	104.7	97.6	93.4	IS:10158:1982, RA 2009
21.	Exchangeable Potassium	Kg/Ha	51.2	53.5	55.4	60.4	STRL/STP/SOIL/01

5.4 WATER ENVIRONMENT

Water bodies in the RSN project area of 20.564 km stretch are mainly Simsang river was observed during the field study. Several small perennial and seasonal streams intersect or run adjacent to the Rongrenggre-Simsanggre-Nengkhra (RSN) Road Sub-Project in East Garo Hills District. These streams serve as vital sources of domestic water, livelihood support for nearby communities, and ecosystem linkages within the local drainage network. Local villages use the stream water primarily for washing, bathing, small-scale irrigation, and livestock watering, particularly during the dry months when groundwater availability is low. In some sections, community fish rearing and bamboo growth are also supported by these watercourses. The streams contribute to local groundwater recharge and wetland formation, enhancing biodiversity along riparian stretches. However, unregulated runoff from roads and nearby settlements occasionally leads to siltation and turbidity, affecting water quality and downstream use. The project design therefore emphasizes protection of natural flow channels, provision of cross-drainage structures, and controlled discharge of construction runoff to prevent any disruption or contamination of these locally significant water bodies. The below section describes the Surface and Ground water conditions in the sub-project area as well as the relevant water quality standards.

5.4.2 SURFACE WATER

04 Surface water samples have been selected from sources present along the project roads to ascertain the baseline conditions of the surface water quality. The surface water samples collected included samples from river in the month of October. Location details of the surface water samples are presented in Table 5.7 and shown in Figure 5.6. Results of the Surface water quality are shown in Table 5.8.

Table 5.7: Surface Water Monitoring Locations

S. No	Source of Sample	Sample Code	Geographical Coordinate	
			Latitude	Longitude
1	Darem River	SW1	25°31'55.96"N	90°35'25.04"E
2	Simsang River	SW2	25°30'20.37"N	90°36'56.17"E
3	Giting River	SW3	25°30'41.52"N	90°38'47.62"E
4	Chipitgittim River	SW4	25°30'57.04"N	90°40'1.09"E

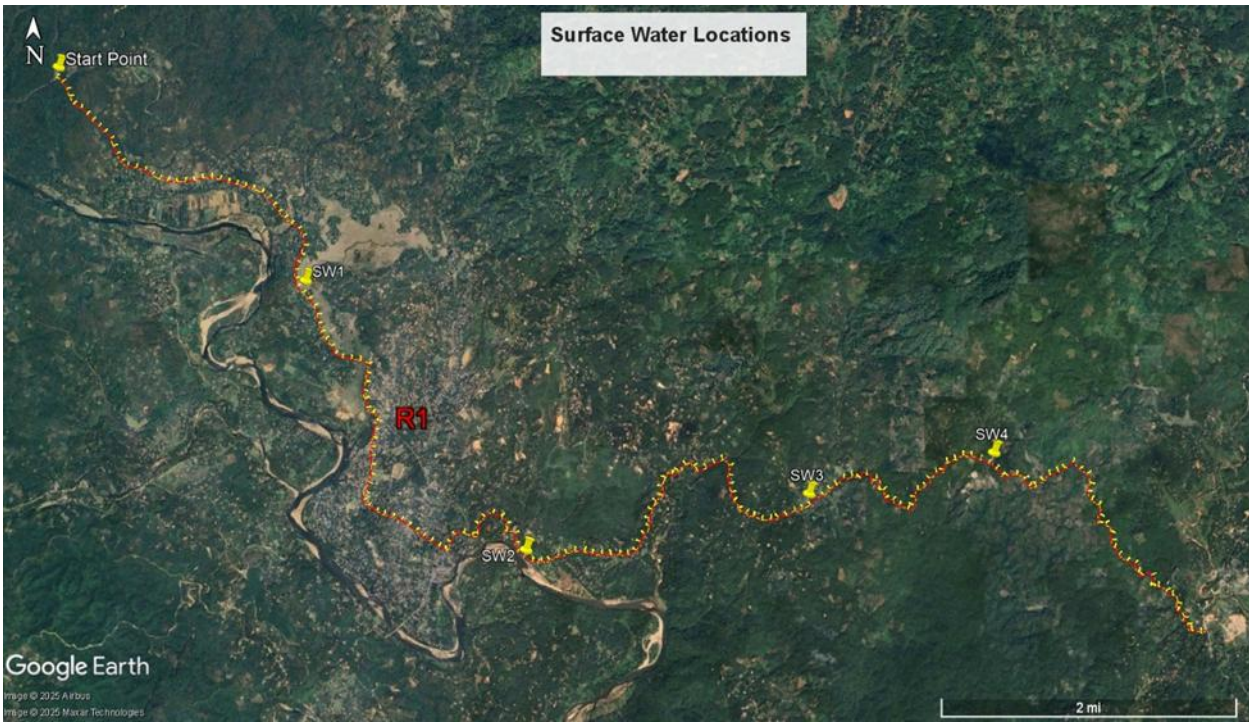


Figure 5.7: Surface Water monitoring locations

Table 5.8: Surface Water Quality Monitoring results in the project area

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C) Tolerance Limit	SW-1	SW-2	SW-3	SW-4	Test method
1	pH	-	6.5 -8.5	6.7	7.40	7.60	6.90	IS: 3025(Pt-11)1983, RA. 2002
2	Temperature	°C	-	17.8	15.9	17.8	16.6	APHA 23nd Edn.2017-2550 B
3	D.O	mg/l	Minimum -4	7.20	7.30	7.40	7.70	IS 3025(Part-38): 2006
4	BOD	mg/l	30	5.60	5.10	5.50	5.40	IS 3025(Part-44):1993, RA 2009
5	Colour	Hazen	300	4	5	6	4	IS: 3025 (Pt-4) 1983, RA 2017
6	Odour	-	-	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
7	TDS	mg/l	1500	235.6	229.2	238.9	239.8	IS 3025(Part-16): 1984, RA 2006
8	TSS	mg/l	-	25.0	23.0	27.0	26.4	IS 3025(Part-17)
9	TKN	mg/l		2.6	2.4	2.5	2.2	IS: 3025(Pt-34)1988, RA. 2003
10	Ammonical Nitrogen	mg/l		0.45	0.49	0.50	0.44	IS: 3025(Pt-34)1988, RA. 2003
11	Nitrate (as NO_3)	mg/l	50	2.4	3.1	2.5	2.3	IS: 3025(Pt-34)1988, RA. 2003

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C) Tolerance Limit	SW-1	SW-2	SW-3	SW-4	Test method
12	Free Ammonia	mg/l		<0.1	<0.1	<0.1	<0.1	IS: 3025(Pt-34)1988, RA. 2003
13	Chlorides (as Cl)	mg/l	600	29.6	27.4	28.1	28.5	IS 3025(Part-32): 1988
14	Sulphates (as SO_4)	mg/l	400	30.6	29.7	24.4	30.2	IS 3025(Part-24):1986, RA 2003
15	Fluoride (as F)	mg/l	1.5	0.58	0.47	0.51	0.52	APHA 21st Ed., 4500F(D)
16	Oil & Grease	mg/l	0.1	<0.1	<0.1	<0.1	<0.1	IS 3025(Part-39):1991, RA 2009
17	Phenolic Compound (as C_6H_5OH)	mg/l	0.005	<0.001	<0.001	<0.001	<0.001	5530-B, C&E, APHA 23nd 2017
18.	Arsenic	mg/l	0.2	<0.1	<0.1	<0.1	<0.1	3110- B, APHA 23nd Ed. 2017 (AAS)
19	Mercury (as Hg)	mg/l	-	<0.001	<0.001	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
20	Lead (as Pb)	mg/l	0.1	0.02	0.02	0.02	0.02	3110- B, APHA 23nd Ed. 2017 (AAS)
21	Cadmium (as Cd)	mg/l	0.01	0.003	0.001	0.001	0.002	3110- B, APHA 23nd Ed. 2017 (AAS)
22.	Chromium (as Cr^{+6})	mg/l	0.05	0.02	0.04	0.03	0.01	IS 3025(Part-52): 200
23.	Copper (as Cu)	mg/l	1.5	0.19	0.15	0.19	0.18	3110- B, APHA 23nd Ed. 2017 (AAS)
24.	Zinc (as Zn)	mg/l	15	0.20	0.16	0.23	0.17	3110- B, APHA 23nd Ed. 2017 (AAS)
25	Selenium (as Se)	mg/l	-	<0.1	<0.1	<0.1	<0.1	IS: 3025 (P- 56)
26.	Anionic detergents (as MBAS)	mg/l	1.0	<0.1	<0.1	<0.1	<0.1	Annexure K Of IS 13428
27.	Iron (as Fe)	mg/l	50	0.52	0.42	0.34	0.19	3500-Fe- B, APHA 23nd Ed. 2017
28.	Sulphide (as H_2S)	mg/l	-	0.18	0.19	0.27	0.23	IS-3025 (P-29)
29.	Phosphate (as PO_4)	mg/l	-	5.51	5.35	7.10	5.65	APHA 22nd Edn.2012-4500-P C
30.	Cyanide (as CN)	mg/l	0.05	<0.1	<0.1	<0.1	<0.1	4500-CN-B, C & E, APHA 23nd Ed.2017
31.	Manganese (as Mn)	mg/l	-	0.04	0.02	0.04	0.03	3110- B, APHA 23nd Ed.2017
32.	COD	mg/l	-	19.3	21.1	17.3	20.60	IS 3025(Part-58): 2006
33.	Total Coli form	MPN/100ml	5000	790	1050	940	700	IS: 1622-1981

5.4.3 GROUND WATER

02 Ground water samples have been selected from sources present along the project roads to ascertain the baseline conditions of the ground water quality. The Ground water samples collected included samples in the month of October. Location details of the surface water samples are presented in Table 5.9 and shown in Figure 5.7. Results of the Surface water quality are shown in Table 5.10.

Table 5.9: Ground Water Sample Locations in the sub-project area

Sl. No	Project Area	Monitoring Location	Sample Code	Geographical Co-ordinates	
				Latitude	Longitude
1	RSN Sub-project Road	St. Merry School	GW1	25°32'37.05"N	90°34'39.95"E
2		RangmalBadim	GW2	25°31'38.79"N	90°35'36.10"E

Figure 5.8: Ground Water monitoring locations

Table 5.10: Ground Water monitoring results in the project area

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	Test method
			Desirable Limit	Permissible Limit			
1	Color	Hazen	5	15	<5	<5	IS: 3025(Pt-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-8)
4	Turbidity	NTU	1	5	<1	<1	IS 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	6.9	7.4	IS: 3025(Pt-11)
6	Total Hardness (as $CaCO_3$)	mg/l	200	600	119.6	124.5	IS 3025(Part-21)

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	Test method
			Desirable Limit	Permissible Limit			
7	Iron (as Fe)	mg/l	0.3	No Relaxation	0.24	0.26	3500-Fe- B, APHA 23nd Ed.2017
8	Chlorides (as Cl)	mg/l	250	1000	21.2	20.6	IS 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.44	0.28	4500-F-(D), APHA 23st Ed.2017
10	TDS	mg/l	500	2000	271.1	268.4	IS 3025(Part-16)
11	Calcium (as Ca^{2+})	mg/l	75	200	14.2	26.3	IS 3025(Part-40)
12	Magnesium (as Mg^{2+})	mg/l	30	100	16.2	11.4	3500- Mg B, APHA 23nd Ed.2017
13	Sulphate (as SO_4)	mg/l	200	400	11.1	14.4	IS 3025(Part-24)
14	Nitrate (as NO_3)	mg/l	45	No Relaxation	7.8	8.8	IS: 3025(Pt-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	<0.01	3110- B, APHA 23nd Ed.2017
16	Alkalinity as $CaCO_3$	mg/l	200	600	124.2	136.6	IS 3025(Part-23)
17	Aluminium (as Al)	mg/l	0.03	0.2	<0.01	<0.01	IS 3025(Part-55)
18	Total Arsenic (as As)	mg/l	0.01	No Relaxation	<0.01	<0.01	3110- B, APHA 23nd Ed2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	<0.05	3110- B, APHA 23nd Ed2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	<0.01	3110- B, APHA 23nd Ed2017
21	Zinc (as Zn)	mg/l	5	15	0.18	0.20	3110- B, APHA 23nd Ed2017
22	Ammonia (as NH_3-N)	mg/l	0.5	No Relaxation	<0.1	<0.1	4500-NH_3-B &C, APHA 23rd ED2017
23	Anionic Detergents (as MBAS)	mg/l	0.2	1	<0.1	<0.1	Annexure K of IS-13428
24	Boron (as B)	mg/l	0.5	1	<0.5(BDL)	<0.5(BDL)	IS: 3025(Pt-57)
25	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	<0.1	IS 3025(Part-39)
26	Phenolic Compound (as C_6H_5OH)	mg/l	0.001	0.002	<0.001	<0.001	IS 3025(Part-44)
27	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.002	<0.002	3110- B, APHA 23nd Ed2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	<0.1	4500- CN-B, C & E, APHA 23nd Ed2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	<0.01	3110- B, APHA 23nd Ed2017

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	Test method
			Desirable Limit	Permissible Limit			
30	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	<0.02	3110- B, APHA 23nd Ed.2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	<0.2	4500-Cl-B, APHA 23nd Ed2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	No Relaxation	3110- B, APHA 23nd Ed.2017
34	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	0.0001	No Relaxation	No Relaxation	APHA 6440,23nd Ed.2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	No Relaxation	APHA 6430,23nd Ed.2017
Microbiological Parameters							IS: 1622-1981
36	Total Coli form	MPN/ 100ml	Shall not be detectable in any 100 ml of sample		<1	<1	IS: 1622-1981
37.	E.Coli	E.Coli/ 100ml	Shall not be detectable in any 100 ml of sample		Absent	Absent	IS: 1622-1981

5.5 AIR ENVIRONMENT

5.5.1 AIR QUALITY

Residential and other sensitive locations proximity to roads were the criteria used for selecting the sample locations (Table 5.11). 04 locations were selected for air quality monitoring. Monitoring was done in the month of October. Parameters like Particulate Matter (PM10), Particulate Matter (PM2.5), Sulphur dioxide (SO2), Nitrogen dioxide (NO2) and Carbon Monoxide (CO) were monitored. Map showing monitoring locations are given in Figure 5.8. Ambient air quality results are given in Table 5.12.

Table 5.11 Ambient Air Quality Monitoring Locations

Sl. No.	Monitoring Location	Sample Code	Geographical Coordinate	
			Latitude	Longitude
1	Lower Baiza	AQ1	25°32'32.42"N	90°35'4.14"E
2	Kusimkolgre	AQ2	25°30'30.44"N	90°36'50.06"E
3	DawaNengjata	AQ3	25°30'48.65"N	90°38'59.32"E
4	Nengkhra Bazar	AQ4	25°29'59.12"N	90°41'20.38"E

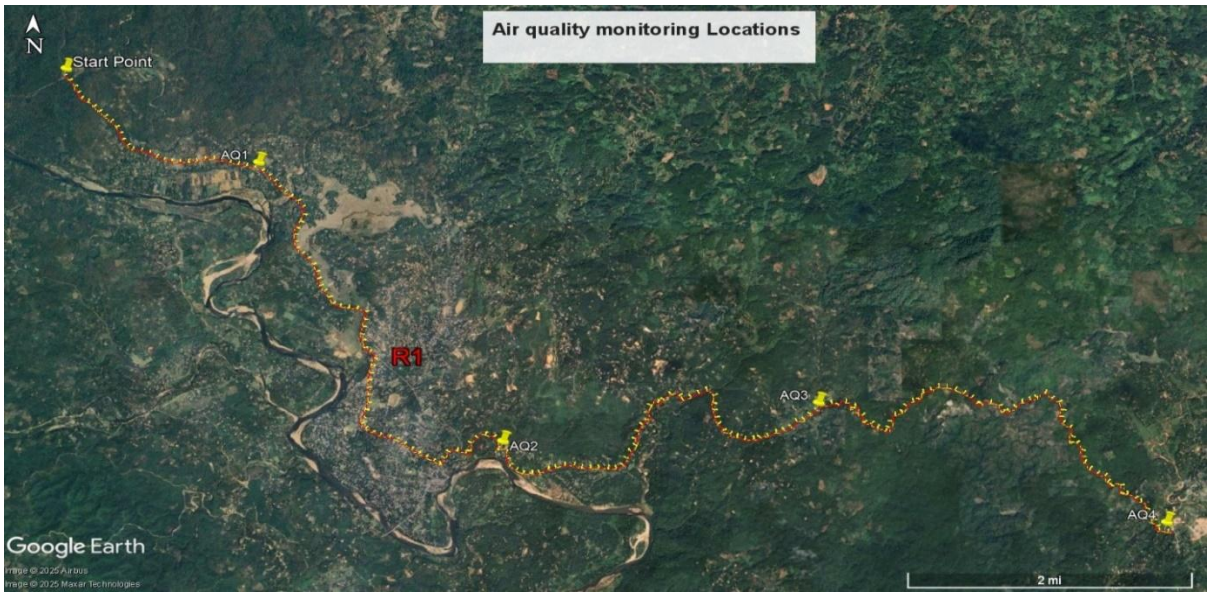


Figure 5.9: Air Quality monitoring locations

Table 5.12: Ambient Air Quality Monitoring Results within project influence area

Sl. No.	Project Area	Location	Sample Code	Latitude (North)	Longitude (East)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	Sulphur Dioxide	Nitrogen Dioxide (NO_2) (µg/m³)	Carbon Monoxide (CO) (µg/m³)
1	Sub Project Road 1	Lower Baiza	AQ 1	25°32'32.42"N	90°35'4.14"E	42.5	17.4	6.6	7.2	0.280
2		Kusimkolgre	AQ 2	25°30'30.44"N	90°36'50.06"E	44.6	18.7	7.4	8.2	0.265
3		DawaNengjata	AQ 3	25°30'48.65"N	90°38'59.32"E	42.6	18.8	8.2	7.9	0.245
4		Nengkhra Bazar	AQ 4	25°29'59.12"N	90°41'20.38"E	48.2	23.4	6.3	9.1	0.290
National Ambient Air Quality Standards, Central Pollution Control Board, 2009						100	60	80	80	2000
Test Methods						IS:5182 (P-23): 2006	SOP1/STRL/ Ambient Air/ Gravimetric method	IS:5182 (P-2): 2006	IS:5182 (P-6): 2006	IS:5182 (P-10):1999, RA-2003

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5.6 NOISE ENVIRONMENT

This section describes the noise quality standards and the existing ambient noise levels, including the locations of the monitoring stations.

To compute the average Noise Level dB (A), noise level is monitored over a period of 24 hour by the authorized NABL laboratory. The noise monitoring has been conducted for determination of noise levels at 04 locations for (Figure 5) in the month of October as per Table 5.13 below. Results are given in Table 5.14.

Table 5.13: Ambient Noise Monitoring Locations

S. No.	Locations	Monitoring code	Latitude	Longitude
1	Lower Baiza	NQ1	25°32'32.37"N	90°35'4.20"E
2	Kusimkolgre	NQ2	25°30'30.35"N	90°36'50.09"E
3	DawaNengjata	NQ3	25°30'48.62"N	90°38'59.40"E
4	Nengkhra Bazar	NQ4	25°29'59.08"N	90°41'20.45"E

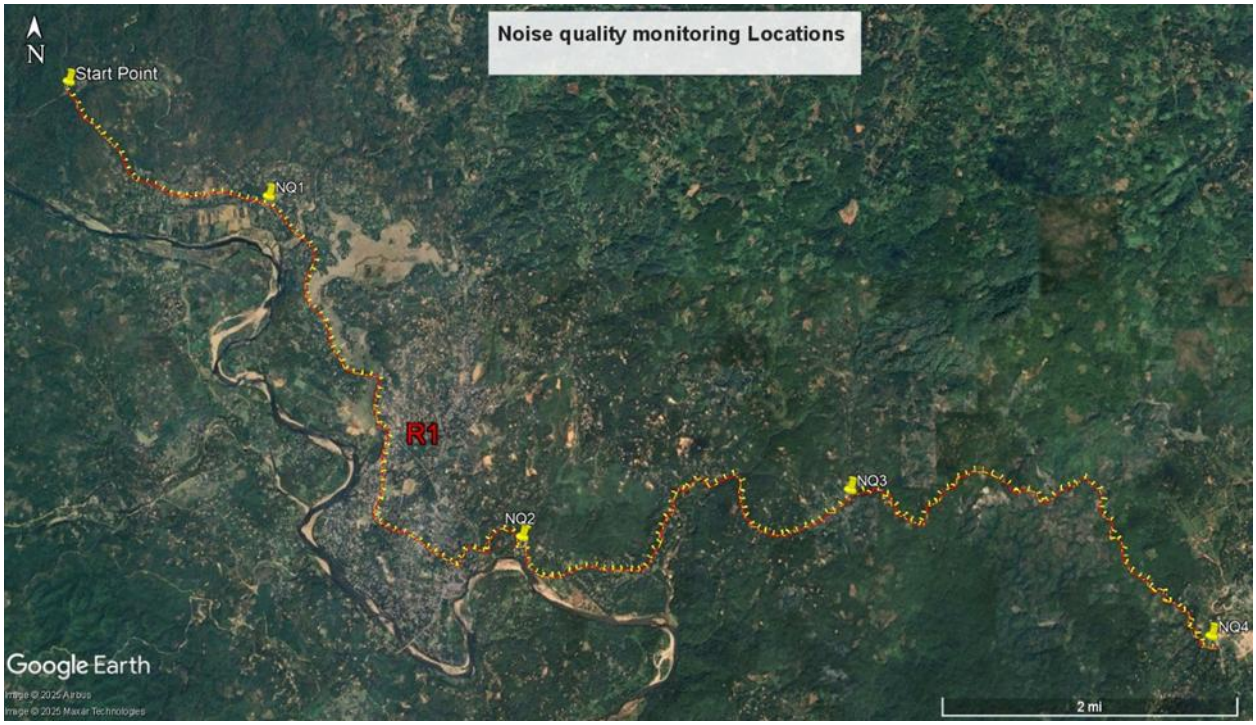


Figure 5.10: Noise quality monitoring locations

Table 5.14**: Average Ambient Noise Monitoring Results in the sub-project area**

Sl. No.	Location	Sample Code	Type of area	Equivalent Noise Level, Leq (Day*) dB (A)	Equivalent Noise Level, Leq(Night**) dB (A)	CPCB Day Limit	CPCB Night Limit
1	Lower Baiza	NQ1	Residential	43.1	30.4	55	45
2	Kusimkolgre	NQ2	Commercial	46.5	36.2	65	55
3	DawaNengjata	NQ3	Residential	41.6	31.7	55	45
4	Nengkhra Bazar	NQ4	Commercial	47.7	37.3	65	55

5.7 BIOLOGICAL ENVIRONMENT

5.7.1 BIODIVERSITY IN EAST GARO HILLS DISTRICT

The project influence area has been delineated with a buffer of up to 10 km from the periphery of the proposed RoW to identify environmentally sensitive features such as protected areas, wildlife sanctuaries, national parks, wetlands, and wildlife Sub Project Roads. 10 km Buffer area for project road is presented in **Figure 3.3**. Map showing distance from Eco sensitive Zones w.r.t Project Road is presented in **Figure 3.4.**

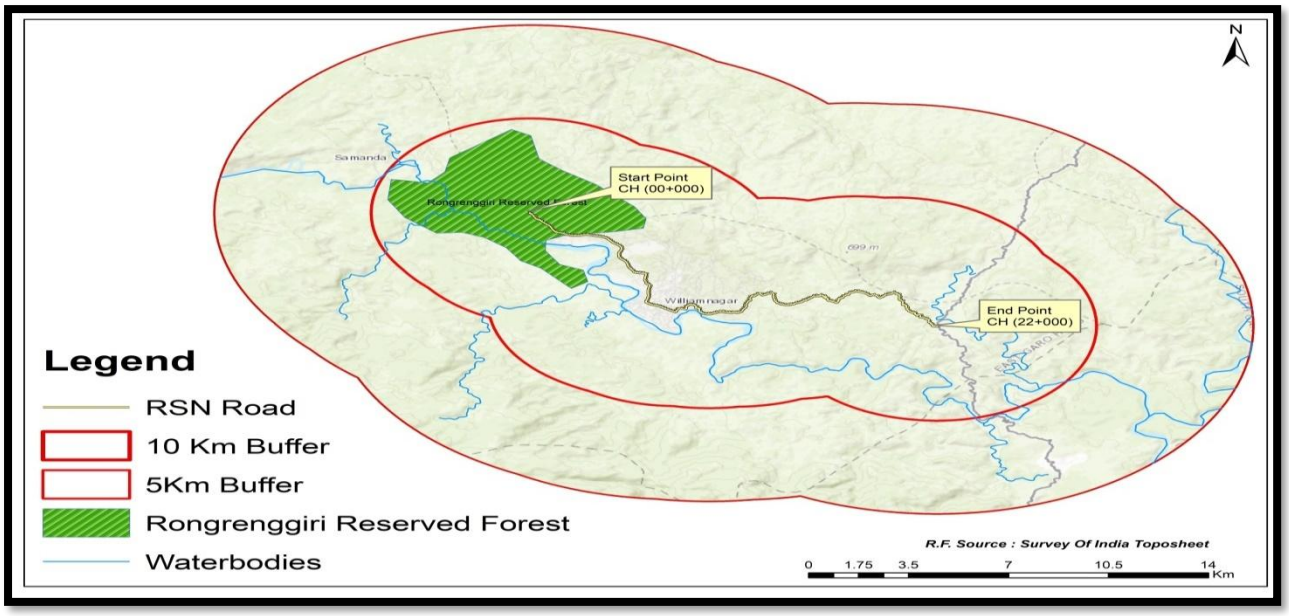


Figure 5.6: 10km Buffer area for project road

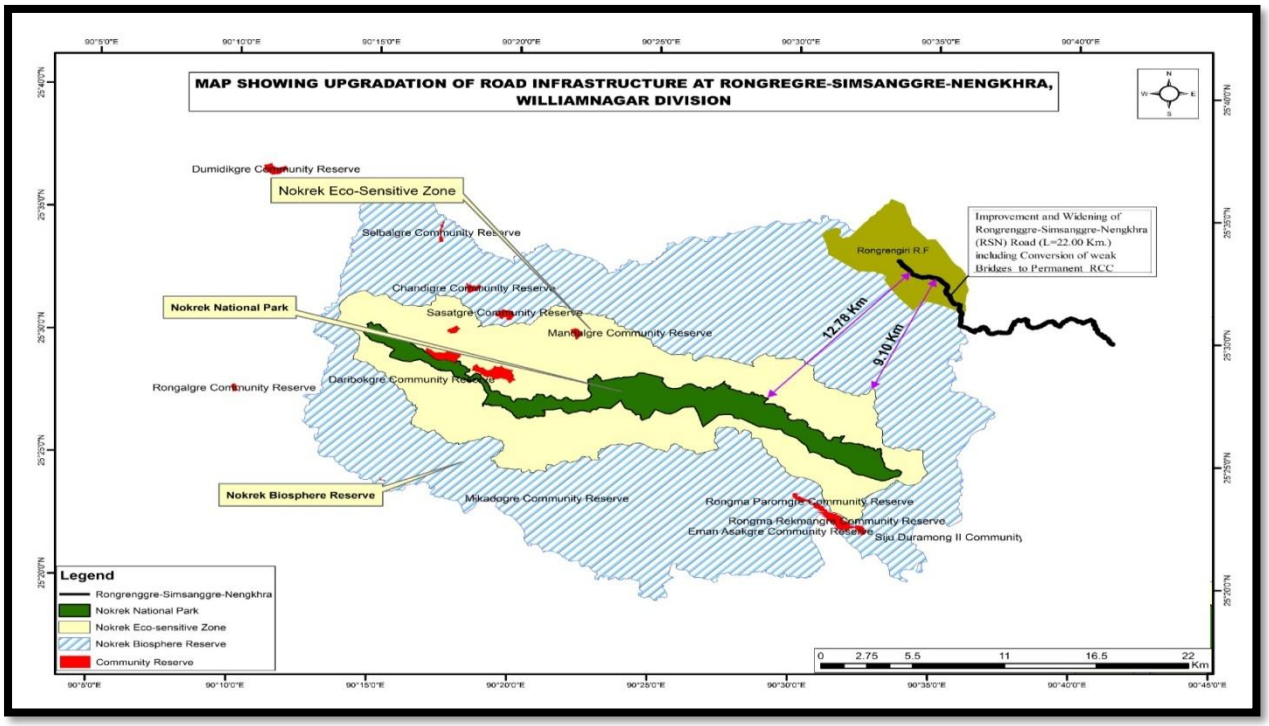


Figure 5.7: Map showing distance from Eco sensitive Zones w.r.t Project Road.

Along the roadside, common plantation trees include Jackfruit, Arecanut etc. In some stretches, Banana, Bamboo, and Betel Nut palms are also planted by villagers. Shrubs commonly observed include Lantana, Eupatorium, Hibiscus, Clerodendrum, and various Bamboo plants. In moist patches, ferns and thickets of Ardisia and Strobilanthes are also common. Common herbs along the roadside include grasses Mint, Wild Ginger, Turmeric, Broom grass etc.

A primary biodiversity survey was conducted during the field visit in August 2025. The primary survey specifically recorded 23 tree species, 7 shrub species, 9 herb species, 3 fern species, and 7 grass species. In terms of fauna, the primary survey documented 10 bird species, 3 mammal species, 2 reptile species, 1 amphibian species, and 5 butterfly species.

The biodiversity survey from both Primary and secondary source documented a total of 119 floral species, comprising 68 tree species, 10 shrubs, 23 herbs, 11 ferns, and 7 grasses. Additionally, 18 species of aquatic biodiversity were recorded. Faunal diversity included 11 mammal species, 52 bird species, 19 reptile species, 2 amphibian species, 25 butterfly species, and 12 fish species.

The methodology adopted for biodiversity assessment is attached as **Annexure 5.1.**
Detailed list of flora, fauna, and aquatic biodiversity, along with their conservation status, is provided in **Annexure 5.2**.

During the field survey and consultations with local communities and forest department officials, no evidence of wild animal hunting was recorded within the Direct Impact area of the Sub-Project road. However, improved connectivity after construction may increase the risk of hunting and illegal wildlife trade

In the East Garo Hills district of Meghalaya, traditional medicine remains central to primary healthcare among Garo communities, and alongside plants, animal by-products are also used for zootherapeutic remedies. While detailed, district-wide inventories are still scarce, evidence from the Garo Hills and neighboring Northeast India indicates that a variety of wild species are targeted for medicinal use and bushmeat, with pangolins and primates among the species of concern. Robust, site-level documentation from East Garo Hills is still limited, underscoring the need for focused surveys to map hunting hotspots and species affected within the district.

Given these findings, our study underscores the importance of conservation-driven infrastructure planning, ensuring that developmental activities in East Garo Hills align with ecological sustainability and biodiversity protection. The following sections provide a detailed breakdown of the biodiversity recorded, emphasizing species conservation status and the ecological significance of different taxonomic groups

5.7.2 BIODIVERSITY AND CRITICAL HABITAT IN SUB-PROJECT PIA

Critical habitat screening was conducted based on the “Critical Habitat” criteria outlined by World Bank’s ESF.

The biodiversity screening indicates that although several threatened species, including the Western Hoolock Gibbon (EN), Chinese Pangolin (CR), Clouded Leopard (VU), and critically endangered vultures, are known to occur in the broader Garo Hills landscape, their likelihood of significant impact from the project is low to moderate Therefore, all listed species have been screened out, as the project is unlikely to cause adverse impacts on their populations or habitats.
Details are provided in Table 5.15.

Table 5.15: Critical Habitat analysis

Scientific Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened Out / Out
Aceros nipalensis (Rufous-necked Hornbill)	Vulnerable	Yes (Eastern Himalaya)	No	Forests of NE India including Meghalaya	High	It is arboreal species and require contiguous forest cover for movement. The Sub Project Road is characterized by fragmented vegetation and lacks continuous canopy connectivity. Thus, the habitat does not exist in the project areas.	Screened Out
Hoolock hoolock (Western Hoolock Gibbon)	Endangered	Yes (NE India to Bangladesh)	No	Tropical evergreen forests including Garo Hills	Medium–High	These are arboreal species and require contiguous forest cover for movement[6]. There is no contiguous forest cover along the road. Thus the habitat does not exist in the project areas	Screened Out
Manis pentadactyla (Chinese Pangolin)	Critically Endangered	No	No	Occurs in forested landscapes of NE India	Medium	The pangolins live primarily in forested areas and in burrows. They are elusive and are thus not found near disturbed habits. Since all the improvements are limited within the exiting right of way their habitat is unlikely within the project direct impact.	Screened Out
Neofelis nebulosa (Clouded Leopard)	Vulnerable	No	No	Tropical forests with dense cover across NE India	Medium	It is a highly elusive, forest-dependent species that prefers dense, contiguous canopy cover for movement and hunting. The Sub Project Road is characterized by fragmented forest patches and lacks continuous habitat connectivity. Thus, suitable habitat is not present within the project area.	Screened Out
Sus salvanius (Pygmy Hog)	Critically Endangered	Yes (Assam–	No	Terai and grasslands of NE India	Low	It is a habitat-specialist species that depends on dense, tall wet grasslands for shelter, foraging,	Screened Out

[6] https://neprimateconservancy.org/western-hoolock-gibbon/

		Foothill range)				and breeding. The Sub Project Road lacks suitable tall grassland habitat and is primarily characterized by disturbed or modified land use. Thus, suitable habitat is not present within the project area.	
Gyps bengalensis (White-rumped Vulture)	Critically Endangered	No	Congregatory	Widely distributed in NE states	Medium	There are no bird hotspots in the study area . The nearest hotspot is Balpakram 33.27km) [7] . There are no nesting cliffs or other habitats in the project area.	Screened Out
Grus antigone (Sarus Crane)	Vulnerable	No	Congregatory	Wetlands, marshes, agricultural fields of India	Low	It is a wetland-dependent species that inhabits shallow marshes, flooded fields, and agricultural landscapes with standing water. The Sub Project Road lacks suitable wetland habitats and permanent waterlogged areas required for its feeding and breeding. Thus, suitable habitat is not present within the project area.	Screened Out

Project Influence Area (Within 10 km):

Critical habitat assessment was conducted based on the "Critical Habitat" criteria outlined by World Bank's ESF. The details of the presence of critical habitat within PIA are summarized in **Table 5.16**.

Table 5.16: Biodiversity and critical habitat assessment-based on field survey and GIS analysis for the Direct Impact Area (10 km)

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
I.	(a) Habitats protected by national and state legal regulations		
	(i) Pas – Wildlife Sanctuary, National Park, conservation reserve or community reserve, Tiger reserve and Sub Project Road and Eco-sensitive zone (As notified under the Wildlife Protection Act, 1972)	Not Sighted	
	(ii) Reserve Forest (As notified under India Forest Act, 1927)	Present	Project road is passing through Rongrenggiri R.F at change from 0+000 to 6+200

[7] https://ebird.org/hotspots

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
	(iii) Protected wetland of Meghalaya	Not Present	-
II.	b) Habitat of significant importance to Critically Endangered or Endangered species		
	(i) Species listed under Schedule I of the Wildlife (Protection) Act, 2022	Not Sighted	While secondary data from the Integrated Biodiversity Assessment Tool (IBAT) indicated the potential regional presence of seven Schedule I species (Wildlife Protection Act, 2022), comprehensive primary field investigations were deployed to verify their status within the 10 km Area of Influence (AoI). Rigorous line transect surveys, quadrate sampling, and micro-habitat mapping confirmed that critical micro-habitats required to sustain these specific species are absent from the direct impact zone, and zero encounters were recorded during the active survey period."
	(ii) Species listed under Schedule III of the Wildlife (Protection) Act, 2022	Not Sighted	Schedule III species are not observed during the field survey.
	(ii) Species notified as "threatened species" by the Govt. of Meghalaya under the Meghalaya Biodiversity Rules 2010	Not Sighted	No threatened species were observed during the field surveys conducted within the project road Sub Project Road
	(iii) Critically Endangered/Endangered species as listed by the IUCN Red List of Threatened species	Sighted	Field observations Confirm presence of Teak Species in 10 km radius study area.
III.	c) Habitats of significant importance to endemic or restricted-range species d) Habitats that support globally or nationally significant concentrations of migratory or congregatory species e) Highly threatened or unique ecosystems		
	(i) Biosphere Reserve (Core Area)	Not present	
	(ii) Ramsar Site	Not present	

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
	(iii) Important fish & Key Biodiversity Area	Yes, present	• Simsang River @12+400 • The Simsang River and adjoining water bodies in East Garo Hills support a diverse freshwater fish community, including economically and ecologically important species such as carps (Labeo rohita, Catla catla), barbs (Puntius sophore, Raiamas bola), and native species like the Garo Stone Loach (Aborichthys garoensis) and Garo Spineless Eel (Garo khajuriai). These species inhabit a range of environments, from fast-flowing hill streams to rivers, ponds, and reservoirs, and are currently classified as Least Concern in terms of conservation status .(Rec.Zool.Surv.India.72 Page 1-22 1977)
	(iv) Habitat of Appendix I – Endangered migratory species as per the Convention on the Conservation of Migratory Species (CMS)	Not present	No such species were observed during the field survey.
	(v) Notified Elephant Reserve and Sub Project Road	Not present	No Govt. notified Elephant reserve and Sub Project Road present.
	(vi) Natural habitats	Not Present	The habitats in the project area are modified for agricultural purposes, and the degraded forest is primarily dominated by bamboo species, Banana and Arecanut.

5.7.3 SUMMARY OF BIODIVERSITY ASSESSMENT AND RISKS

Most of the flora and fauna present within the Direct Impact Area fall under the Least Concern category as per the IUCN Red List of Threatened Species (IUCN, 2024) and are not included in Schedule I or Schedule III of the Wildlife Protection Act, 2022. A total of 07 species are listed under Schedule I of the Wildlife Protection Act, 2022. Although none of these species were recorded during the field surveys conducted in the study area, their presence has been indicated through secondary information sourced from the IBAT Tool.

The presence of 07 Schedule-I species identified through the Integrated Biodiversity Assessment Tool (IBAT) indicates the potential distribution range of these species within the broader landscape based on global biodiversity databases such as the International Union for Conservation of Nature (IUCN) and World Database on Protected Areas (WDPA). However, IBAT outputs represent modelled habitat suitability or regional occurrence data, not necessarily confirmed site-specific presence along the exact Sub Project Road. During the field reconnaissance and ecological assessment conducted for the DPR/EIA study, no direct evidence such as sightings, tracks, nests, or habitat use of Schedule-I wildlife species was recorded within the immediate project influence area. Therefore, while IBAT highlights that the wider landscape may support Schedule-I species (including potential elephant movement Sub Project Roads), the absence of confirmed field observations within the project stretch indicates that critical wildlife habitat is not directly present within the road alignment, though precautionary mitigation measures such as signage and speed regulation at the two potential elephant crossing locations are recommended.

A transit walk was carried out by the EIS consultant along the entire Sub Project Road during the Enumeration Block (EB) survey to verify on-ground conditions, identify environmental and social sensitivities, validate inventory data, and cross-check community-reported issues.

A reserve forest falls within the Direct Impact Area of the project road between chainages 00+000 and 6+200. No improvement and reconstruction has been proposed in this section. Based on the biodiversity assessment, the proposed RSN road works are not expected to cause significant, adverse, or irreversible impacts; Although the Biodiversity Management Plan (BMP) is attached as **Annexure -4.3** to protect reserve forest.

Field surveys, consultations with local communities, and studies by the Forest Department indicate the absence of critical habitats, endangered fauna, or hunting threats within the Direct Impact Area.

5.8 SOCIO ECONOMIC ENVIRONMENT

The baseline study assessed the socio-economic profile of households and families within the Project Influence Area that may be affected by the project. The assessment covered various parameters, including education levels, ethnicity, religion, sources of livelihood, and income levels of the affected families.

The proposed project site is located in the East Garo Hills District of Meghalaya. East Garo Hills District was upgraded from a sub-division to a full-fledged district in 1976, after the erstwhile Garo Hills District was reorganized with a view to bring the administration closer to the people. In 2012 East Garo Hills District was further reorganized to form a new district, the North Garo Hills District, out of the erstwhile Resubelpara Civil Sub-Division. The District is bounded by South Garo Hills on the south, West Garo Hills on the west, West Khasi Hills on the East and North Garo Hills on the north.

Government and Administration: East Garo Hills is administered under the Government of Meghalaya and operates in accordance with the provisions of the Sixth Schedule of the Indian Constitution. This empowers the Garo Hills Autonomous District Council (GHADC) to manage matters related to land, forests, and customary practices, while law enforcement and other major state functions remain under the purview of the Meghalaya

Government. The district is divided into five Community and Rural Development (C&RD) Blocks, including Williamnagar, Rongjeng, Samanda, Chokpot, and Songsak. The district headquarters is located at Williamnagar, which serves as the primary center for administration, governance, and coordination of developmental activities.

5.8.1 SOCIO-ECONOMIC PROFILE OF THE PROJECT ROADS

The socio-economic details of the RSN Road are discussed below. The methodology for data collection is detailed in section 1.3 of chapter 1.

5.8.2 DEMOGRAPHY

5.8.2.1 POPULATION

The Sub-Project encompasses smaller rural settlements such as Dobetkolgre (Dobet Kolgre Apotgittim) (94) and Rongrengre (Rongregre) (129), which have relatively lower populations. Overall, the gender distribution is generally balanced, however, certain settlements—such as Nengkhra (Nengkhra Awe)— has a higher female-to-male ratio. Larger settlements like Nengkhra (Nengkhra Awe) (904) and Chidekgre (Chiokgre) (540) play a key role in shaping the region's demographic profile, highlighting variations in population density along the Sub Project Road. The population distribution of the sub-project affected villages is presented in **Table 5.17**.

Table 5.17: Population distribution of the sub-project affected villages

S.No.	Village Name	Male	Female	Total
1.	Rongrengre (Rongregre)	66	63	129
2.	Chidekgre (Chiokgre)	274	266	540
3.	Dobetkolgre (Dobet Kolgre Apotgittim)	52	42	94
4.	Dawa Nengjata (Dawa Nengjata)	75	58	133
5.	Dawa Chipitgre	102	86	188
6.	Nengkhra (Nengkhra Awe)	449	455	904
7.	Chimagre	198	197	405

Source: Census 2011

5.8.2.2 SEX RATIO

In Sub-Project 1 (RSN Road) the sex ratio shows significant variation across villages. Nengkhra (Nengkhra Awe) has the highest sex ratio at 1,013, reflecting a relatively balanced male-to-female population. This is followed by Chimagre and Chidekgre (Chiokgre), with sex ratios of 995 and 971, respectively. Rongrengre (Rongregre) reports a ratio of 955. At the lower end, Dawa Nengjata records the lowest sex ratio at 773, followed by Dobetkolgre (Dobet Kolgre Apotgittim) at 808 and Dawa Chipitgre at 843. Detailed sex ratio data for the project-affected villages and two towns are presented in **Table 5.18**.

Table 5.18: Sex ratio in the villages along the sub-project road

Sl. No.	Village Name	Sex Ratio
1.	Rongrengre (Rongregre)	955
2.	Chidekgre (Chiokgre)	971
3.	Dobetkolgre (Dobet Kolgre Apotgittim)	808
4.	Dawa Nengjata (Dawa Nengjata)	773
5.	Dawa Chipitgre	843
6.	Nengkhra (Nengkhra Awe)	1013
7.	Chimagre	995

Source: Census 2011

5.8.2.3 SCHEDULED TRIBE POPULATION

The district is predominantly inhabited by the Scheduled Tribe (ST) population, who primarily reside in small rural villages along the project road Sub Project Road. Nengkhra (Nengkhra Awe), with 872 ST residents, and Chidekgre (Chiokgre), with 539, have the highest concentrations of ST population in the area. Medium-sized villages such as Chimagre (396) and Dawa Chipitgre (188) also reflect a significant tribal presence. In contrast, smaller settlements like Dobetkolgre (Dobet Kolgre Apotgittim) and Rongrengre (Rongregre), with ST populations of 94 and 124 respectively, have relatively lower numbers. A detailed distribution of the ST population along the Sub Project Road is provided in **Table 5.19**.

Table 5.19: Population distribution of the sub-project affected villages

	ST Population				
Sl. No.	**Village Name**	**Male**	**Female**	**Total**	**Percentage**
1.	Rongrengre (Rongregre)	64	60	124	64
2.	Chidekgre (Chiokgre)	273	266	539	273
3.	Dobetkolgre (Dobet Kolgre Apotgittim)	52	42	94	52
4.	Dawa Nengjata (Dawa Nengjata)	75	58	133	75
5.	Dawa Chipitgre	102	86	188	102
6.	Nengkhra (Nengkhra Awe)	429	443	872	429
7.	Chimagre	200	196	396	200

Source: Census 2011

5.8.2.4 WORKFORCE POPULATION

The Garo communities residing along the RSN road Sub Project Road are primarily engaged in agriculture and horticulture activities, including cultivation of paddy, maize, banana, and arecanut. In addition, some households are involved in livestock rearing, wage labour, and small-scale local trade for supplementary income. The occupational structure of the Sub Project Road villages reflects a predominantly agrarian economy supplemented by wage labour and small-scale trade activities. To better understand the workforce composition, a detailed analysis of main and marginal workers across the study area villages is presented in Table 5.20. This table highlights not only the overall workforce distribution but also gender-wise participation, providing insights into the socio-economic dynamics of the Sub Project Road settlements. The detailed workforce of the project affected villages is given in **Table 5.20**.

Table 5.20: Workforce Population in the Project Road Sub Project Road area

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Percentage
Rongrengre (Rongregre)	28	25	53	0	4	4	28	29	57	44.19
Chidekgre (Chiokgre)	107	33	140	101	28	129	109	106	215	39.81
Dobetkolgre (Dobet Kolgre Apotgittim)	21	13	34	1	3	4	22	16	38	40.43
Dawa Nengjata (Dawa Nengjata)	29	5	34	4	24	28	33	29	62	46.62
Dawa Chipitgre	39	7	46	5	32	37	44	39	83	44.15
Nengkhra (Nengkhra Awe)	184	28	212	20	46	66	204	74	278	30.75
Chimagre	88	64	152	2	25	27	90	89	179	44.20

Source: Census 2011

5.8.3 EDUCATION

The educational landscape within the Sub Project Road exhibits significant variation in literacy rates across the rural villages. Dobetkolgre (Dobet Kolgre Apotgittim) leads with a literacy rate of 83.31%, followed by Chidekgre (Chiokgre) at 75.29%. In contrast, villages such as Rongrengre (Rongregre) and Dawa Chipitgre have notably lower literacy rates of 57.66% and 60.96%, respectively.

The detailed distribution of literate and illiterate populations in the sub-project affected villages is provided in **Tables 5-21.**

Table 5.21: Literate Population in the Project Road Sub Project Road area

		Literate Population			
Sl. No.	Village Name	Male	Female	Total	Percentage
1.	Rongrengre (Rongregre)	33	31	64	49.61
2.	Chidekgre (Chiokgre)	156	173	329	60.93
3.	Dobetkolgre (Dobet Kolgre Apotgittim)	37	32	69	73.40
4.	Dawa Nengjata	35	26	61	45.86
5.	Dawa Chipitgre	48	41	89	47.34
6.	Nengkhra (Nengkhra Awe)	232	211	443	49.00
7.	Chimagre	106	77	183	45.19

Source: Census 2011

5.8.4 WAGES AND BENEFITS

Public consultations with local communities revealed that wages in the project area are lower than in urban centers, and workers often do not receive benefits such as healthcare, pensions, or paid leave. According to the Department of Rural Development (2023–24), the notified wage rate for unskilled labor in these Sub Project Roads is Rs. 541, as per the latest Meghalaya notification effective from 1 April 2025 (dated 21st July 2025). While the lower cost of living partially offsets these lower wages, achieving financial stability remains a challenge

for many workers

5.8.5 SEASONAL EMPLOYMENT

Initial consultations with communities along the RSN road in East Garo Hills indicated that agriculture and allied activities remain the primary sources of livelihood, including shifting cultivation, horticulture and livestock rearing. Community members reported that employment opportunities are largely seasonal, linked mainly to agricultural cycles and occasional local wage labour. During lean agricultural periods, households often experience underemployment and income fluctuations, prompting some individuals to seek temporary work in nearby towns or other districts. Improved road connectivity under the project is expected to enhance access to markets, services, and alternative livelihood opportunities for these settlements

5.8.6 POVERTY

In Sub-Project-1, poverty rates are higher in rural areas compared to urban centers. Households in remote villages, where road connectivity is still developing, largely depend on subsistence farming. Limited access to markets, credit, and financial services further constrains their economic opportunities, contributing to the higher prevalence of poverty in these areas.

5.8.7 SOCIAL VULNERABILITIES

5.8.7.1 MIGRATION

Consultations with villagers indicate that residents prefer to remain within their local areas, primarily engaging in agriculture and commercial activities within their villages. Migration to other locations is uncommon, as most people choose to sustain their livelihoods locally.

5.8.7.2 CRIME

In Sub-Project-1, most disputes in the villages are resolved locally through traditional mechanisms, with the Nokma (village headman) playing a central role in dispute resolution. Only cases that cannot be settled at the community level or require legal intervention are escalated to and officially recorded by the police. **Table 5.22** presents the major crime cases registered at Samanda Police Station over the years. During consultations with police officials, it was reported that crime levels in Sub Project Road 1 are very low, and no specific crime-related data was shared.

Table 5.22: Crime records over the years (2019-2024) from Samanda Police Station

Year/ Major crime	Crime against property	Robbery	Theft	Murder	Kidnapping	Others	Total cases Register
2019	10	1	8	0	1	17	37
2020	4	0	2	1	1	15	23
2021	6	0	2	1	2	12	23
2022	7	0	0	0	0	3	10
2023	1	0	0	1	1	12	15
2024	1	1	0	1	1	14	18

Source: Field Survey

5.8.7.3 GENDER BASED VIOLENCE

According to records from the Samanda Police Station, no general Gender-Based Violence (GBV) cases have been reported in Sub Project Road RSN, indicating a relatively safe environment for women. Additionally, cases under the Protection of Children from Sexual Offences (POCSO) Act have been registered over the years, including two cases in 2010 and single cases in 2019, 2022, 2023, and 2024. Consultations in Sub Project Road RSN, revealed that no such cases were reported in the current year.

5.9 SOCIO-ECONOMIC PROFILE OF PROJECT AFFECTED HOUSEHOLDS

Socio-economic data of project-affected households were collected through census and socio-economic surveys, systematically tabulated and analyzed to assess the extent of adverse impacts on land, structures, and livelihoods. A structured, pretested questionnaire was used as the primary tool for conducting these surveys. The survey has been conducted in September 2025.

5.9.1 DEMOGRAPHY

The total number of project-affected households is 40. The **Table 5.23** below summarizes the gender distribution of the head of the Household.

Table 5.23: Gender Distribution of PAHs

Gender	Sub Project Road 3	Percentage
Male	22	55
Female	18	45
Total	40	100

Source: EIS primary survey – 2025

5.9.1.1 GENDER DISTRIBUTION OF PROJECT-AFFECTED PERSONS

Out of a total of 90 Project Affected Persons (PAPs), 5 are male (59%) and 41 are female (41%), indicating an almost equal distribution between male and female beneficiaries. Gender Distribution of Project-Affected Persons (PAPs) is given in **Table 5.24**.

Table 5.24: Gender Distribution of Project-Affected Persons (PAPs)

	Project Affected Persons	Percentage
Male	59	59
Female	41	41
Total	100	100

Source: EIS primary survey – 2025

5.9.1.2 ETHNICITY

The detailed distribution of ethnic groups in Sub Project Road wise is given in **Table 5.25** below. In Sub Project road, a total of 40 individuals belong to different communities. The majority are Garo (22 persons, 55%), followed by Rabha (12 persons, 30%), Muslims (4 persons, 10%).

Table 5.25: Community Wise Distribution of PAHs

Communities	Sub Project Road RSN	Percentage
Garo	26	65
Rabha	12	30
Muslim	4	10
Total	**40**	**100**

Source: EIS primary survey – 2025

5.9.2 IMPACT TO VULNERABLE HOUSEHOLDS

Vulnerable group of households included women-headed households, below-poverty-line, physically disabled, and elderly population (60+ years). **Table 5.26** below describes the distribution pattern of vulnerable group in the study area.

Table 5.26: Distribution of Vulnerable Group

Vulnerable Category	PAHs
Aged persons above 60 years	7
Below Poverty Line	0
Woman Headed Household	9
Other Backward Classes	0
Physically Challenged	0

Source: EIS primary survey – 2025

5.9.3 ECONOMIC PROFILE

EMPLOYMENT PATTERNS

5.9.3.1 PRIVATE BUSINESS/ ENTREPRENEURSHIP DOMINANCE

Among the 40 Project Affected Households (PAHs), the majority (22) are engaged in private business, while 6 depend on agriculture. Only 8 households are involved in government or private service. Details are provided in **Table 5.27.**

Table 5.27: Occupation pattern of PAHs in sub-project area

Sl. No.	Occupation	PAHs
1	Agriculture	6
2	Private Business	22
3	Service (Govt./Pvt.)	8
4	Others (Non-Working)	4
Total		**40**

Source: EIS primary survey – 2025

5.9.3.2 INCOME

The income profile of Project Affected Households (PAHs) under Sub-Project-1 indicates a predominantly low-income group. A vast majority, 92.5% (37 households), earn less than ₹25,000 annually, highlighting significant economic vulnerability. Only 7.5% (3 households) fall within the ₹25,000–₹50,000 income range. Notably, no households were reported in higher income brackets (above ₹50,000). Overall, the data reflects that all affected households belong to economically weaker sections, with limited financial capacity. Details are provided in Table 5.28.

Table 5.28: Annual Income Range of PAHs

Sl. No.	Annual Income Range of HH	Sub-Project-1	
		No. of PAHs	Percentage
1	less than 25000	37	92.5
2	25000- 50000	3	7.5
3	50000-100000	--	--

Sl. No.	Annual Income Range of HH	Sub-Project-1	
		No. of PAHs	Percentage
4	More than 100000	--	--
Total		**40**	**100**

Source: EIS primary survey – 2025

5.9.4 EDUCATION

In Sub-Project 1, out of a total population of 100 persons, education levels show a balanced distribution across genders. The majority have studied up to high school (30 persons), followed by 17 with primary education and 23 with higher secondary education. A smaller group of 6 individuals are graduates or above, while 12 are illiterate. Overall, male (51) and female 39 participation across education levels is nearly equal. Details are provided in Table 5.29.

Table 5.29: Education Level of PAPs

Sl. No	Education	Sub-Project-1		
		Male	Female	Total
1	Children below 6 years	6	6	12
2	Primary (Class 1 to 4)	12	5	17
3	High School (Class 5-10)	25	5	30
4	Higher Secondary (Class 11-12)	9	14	23
5	Graduate and above	1	5	6
6	Illiterate	6	6	12
	Total	59	41	100

5.9.5 HEALTH STATUS

The predominant waterborne diseases in the study area include as diarrhea, typhoid, cholera, and malaria are commonly reported, particularly during the monsoon season when water contamination and stagnant water breeding increase. Hepatitis A and jaundice have also been observed in areas with poor sanitation and unsafe drinking water sources. In addition, dengue fever and respiratory infections such as influenza and tuberculosis are prevalent due to changing climatic conditions and limited access to consistent healthcare services. Although sanitation coverage has improved in recent years, the lack of proper sewage systems and public toilet facilities continues to contribute to the spread of these communicable diseases in certain villages of Samanda Block.

In Samanda Block, notable improvements have been achieved in sanitation coverage under various government initiatives. However, a section of households still lacks well-constructed toilets and proper sewage disposal systems. The absence of public toilets and washroom facilities poses additional difficulties, particularly for individuals working in open areas, markets, or other shared spaces, highlighting the need for enhanced sanitation infrastructure and hygiene awareness.

Songsak and Samanda PHC serves as the primary healthcare facility, supported by Rongjeng CHC within the Project Influence Area (PIA),

5.9.6 IMPACT TO STRUCTURES

The Sub project Road details of the impacted structures are given in below **Table 5.30**. Chainage wise details are provided in **Annexure 5.3**. No structures are affected on land additionally required for the sub project. However, a total of 40 structures located within the available Right of Way (ROW) are partially affected along the Sub

Project Road.

These include 4 commercial structures, 1 residential-cum-commercial structures, and 7 residential structures, that are partially affected– primarily affecting boundary walls, gates, bamboo fencing, and GI sheet extensions. These structures extend into the existing ROW from adjoining land parcels and are classified as encroachments. Accordingly, all such affected persons are categorized as encroachers in accordance with the RPF. The impacts are limited to secondary structures and do not result in physical displacement.

In addition, 28 roadside kiosks located within the ROW operated by Non-Title Holders will be relocated and are categorized as encroachers as per the RPF. These structures are associated with livelihood activities, and their impact will result in both temprorary physical and economic displacement.

A 30-day notice period will be provided to all Project Affected Persons (PAPs) whose structures fall within the project ROW, allowing them sufficient time to salvage materials and relocate. Additionally, roadside kiosks/vendors will be provided with shifting/transport allowance, and relocation grant as per the entitlement matrix. The format of the notice issued to affected households is given in Annexure 4 of the RAP and the list of structures is given in Annexure 5.3.

Table 5.30: Type of Impact on Project Affected Household

Type of Structure	Type of Impact	PAH Category	No of PAHs	PAPs	% of impact
Residential Cum Commercial structures (Gate, Concrete Boundary wall)	Loss of structure (partial impact)	Encroachers	1	2	<10
Commercial (GI Shade Fencing)	Loss of structure (partial impact)	Encroachers	4	10	
Residential structures (GI shade and bamboo fencing of houses)	Loss of structure (partial impact)	Encroachers	7	18	<10
Roadside Kiosks/Squaters	Temporary Economic Displacement	Encroachers (NTH)	28	70	<10
Total			40	100	

5.9.7 TREES IN ROW

19 trees are situated within the available Right of Way (RoW) on both sides of the road. To mitigate the ecological impact of tree felling, compensatory plantation (@1:10)/ as suggested by Forest Department should be carried out, in accordance with applicable environmental regulations and guidelines. These measures, along with their implementation strategies, are comprehensively detailed in the Environmental and Social Management Plan (ESMP).

5.9.8 COMMON PROPERTY RESOURCES

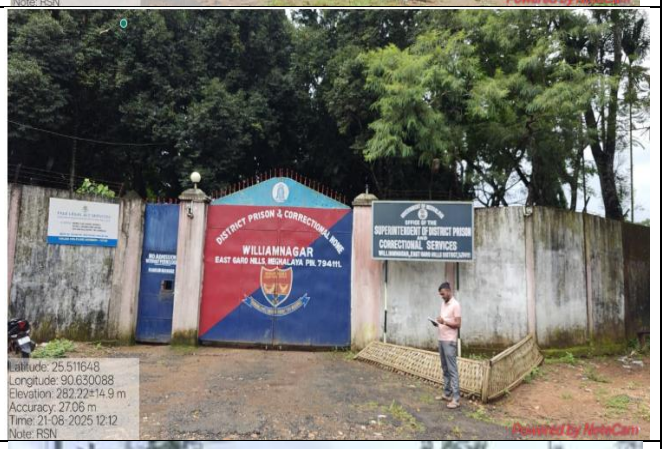
The Common Property Resources (CPR) assessment classifies structures into government and community/public facilities. Government structure including compound walls (CWs) of government buildings, schools, and community halls comprise 09 minor structures that may be affected during construction. A summary of CPRs is provided in **Table 5.31**.

Table 5.31: Common Property Resources located within 50 m of the ROW

Sl. No.	Type of CPR Structures	Chainage	Distance from the PROW
1.	District Jail, Williamnagar	Ch. 11+878	8 m from center line LHS
2.	St. Mary's School		9 m from center line LHS
3.	SSA & LP School	Ch 02+220	10 m from center line LHS
4.	Hill Side English School	Ch 4+800	20 m from center line RHS
5.	Dobetkolgre LP School	Ch 11+076	7 m from center line RHS
6.	St. Mary's Church	Ch 11+700	9 m from center line LHS
7.	Church	Ch 02+294	10 m from Centre line RHS
8.	Co-Operative Society Community hall	Ch 02+220	10 m from Centre line RHS
9.	Sacred Site Kosi Ampang Damgre Sacred Site	Ch. 17+272	20 m from Centre line LHS

An illustrative view of the CPRs / Other important locations, along with their respective distances from the centerline, is presented in **Figure 5.11** below.

Chainage	Side		Structure	Geo tagged photos
	LHS	RHS		
02+220 – 02+294	1+1		St. Mary's School & Church LHS	
4+800	1		SSA & LP School LHS	

11+076		1	Hill Side English School LHS	
11+700		1	Dobetkolgre LP School RHS	
11+878	1		District Jail, Williamnagar LHS	
17+272		1	Co-Operative Society Community hall RHS	

Ch 10+000	1		Kosi Ampang Damgre Sacred Site	
Ch 02+220		1	Church	
Total	5	4		

Figure 5.11: Illustrative view of the road features in Sub-Project Road RSN

5.10 HAZARD AND VULNERABILITY PROFILE

The Hazard and Vulnerability profile of the RSN Road area and East Garo Hills district includes unstable slopehazards, flash flood, earthquake, etc. The drought, group clash, fire incidents, etc. also occur in the district. The seasonal hazard analysis of the East Garo Hills District[8] is given in **Table 5.32** below:

Table 5.32: Hazard analysis

Type of Hazards	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Landslide			◄							►		
Earthquake	◄											►
Flashflood		◄								►		
Storm			◄			►						
Fire Accident	◄											►
River Erosion				◄					►			
Industrial Hazard	◄											►
Road Accident	◄											►

5.10.2 Climate Resilient Features

The Improvement and Widening of Rongrenggre-Simsanggre-Nengkhra (RSN) Road including Conversion of weak Bridges to Permanent RCC bridges has been designed by incorporating climate-resilient measures to address the region's high rainfall, hilly terrain, and associated risks such as flooding, erosion, and unstable slopes. A climate vulnerability assessment was carried out during the design stage, and the findings were integrated into the engineering design to enhance the road's durability and serviceability under present and future climate conditions. Key measures include improved drainage systems, slope stabilization, resilient pavement materials, and integrated safety provisions to ensure long-term functionality and all-weather connectivity. Climate Resilient design features are given in Table 5.33.

Table 5.33: Climate Resilient design

[8] District Disaster Management Plan for Meghalaya, 2024

Climate-Resilient Design		**Improvement and Widening of Rongrenggre – Simsanggre- Nengkhra Road (L=22.00 Km.)**
1. Climate Vulnerability Assessment During Design	Roads and bridges undergo systematic climate vulnerability assessments early in design to identify hotspots prone to extreme rainfall, flooding, erosion, waterlogging, unstable slopes and submergence.	Based on the findings of these assessments, climate-resilient design measures have been incorporated into the project. The design discharge for bridges and culverts has been increased by 25.2%, and the design discharge for cross-drainage structures has been enhanced by 14.5% as per (Shared Socioeconomic Pathways) SSP 5-8.5 data from IITM (Indian Institute of Tropical management) Pune in consultation with MITP to account for projected increases in rainfall intensity under future climate scenarios.
	This assessment informs alignment choices, drainage design, slope protection measures and prioritisation of resilient interventions.	Considering future climate vulnerability and existing stream scouring pathways, appropriate alignment decisions and resilient interventions have been incorporated into the design. Stream training works and slope protection measures have been provided where streams run parallel to the road alignment to control erosion and reduce flood and scour risks. In addition, upstream and downstream protection measures have been incorporated for culverts in accordance with IRC SP: 13, to prevent scouring of approaches and the bed around the structures. These measures demonstrate that the climate vulnerability assessment has directly informed drainage design, slope protection strategies, and the prioritization of resilience-enhancing interventions.
2. Enhanced Drainage & Flood Management	Larger culverts,	At critical locations where the existing culvert dimensions were found to be insufficient, the size of the culverts has been increased by reconstruction of 18 higher dimension culverts and additional 2 no. of Pipe culverts have been proposed for improving drainage. These measures have been adopted to improve hydraulic capacity, prevent flooding and damage to the road, and ensure uninterrupted connectivity, thereby achieving an all-weather road.
	cross-drainage structures,	Specific provisions for cross-drainage structures are made to enhance hydraulic efficiency, prevent clogging, and ensure the stability of both the structures and their approaches. These provisions include floor aprons, cut-off walls, quadrant pitching, stream-protection works, return walls, and retaining walls.
	Properly graded roadside drains prevent waterlogging and lower flood damage.	Proper gradient to road side drain are provided parallel to road and their connectivity with existing and newly proposed culverts are done to avoid any kind of flooding on the road section.

	Road designs incorporate improved cross-drainage systems, culverts, and surface water management to remain serviceable during intense monsoon rainfall common in Meghalaya's wet climate.	Improved Cross Drainage system
3. Slope Stabilization & Erosion Control	Bio-engineering (vegetation, geotextiles) and structural retaining walls reduce Unstable sloperisk in project regions.	Bio engineering by using local Broom Grass and also provide grass. Turfing has been provided at the embankment slope.
	Earthwork design based on climate data accounts for increased rainfall intensity.	
	In hilly terrains, bio-engineering measures are used to stabilise embankments and slopes (e.g., vegetation, geotextiles).	
	Structural treatments like retaining walls, gabion walls, breast walls protect roads against unstable slopes and soil erosion.	Retaining wall up to 3.0 m Height and above 3.0 m height use Bio engineering
4. All-Weather Surface Materials	Using durable pavement materials that resist damage from heavy rains, moisture ingress, and temperature fluctuations	CTB/CTSB (Cement Treated Base/Sub- Base) layers are generally more climate- resilient than DBM/BC layers. Cement- treated layers provide higher structural stiffness, better load distribution, and superior resistance to moisture damage, erosion, and rutting critical where subgrades are often weak and water infiltration is frequent high rainfall and hill terrain of Meghalaya, paved shoulders provide superior climate resilience compared to hard shoulders by effectively preventing water ingress, erosion, and pavement edge failures
5. Design with Safety & Maintenance Objectives	Climate-resilient designs are integrated with road safety measures (road geometry improvements, signage, crash barriers, and delineation).	High rainfall and hill terrain of Meghalaya, paved shoulders provide superior climate resilience compared to hard shoulders by effectively preventing water ingress, erosion, and pavement edge failures.

6. ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

6.1 INTRODUCTION

The project is expected to generate both positive and adverse environmental and social impacts along the 20.564 km priority roads in Sub Project Road RSN. This chapter analyzes the potential impacts arising from the implementation of project activities. The impacts differ in type, nature, magnitude, extent, timing, duration, certainty, and reversibility.

The assessment takes into account the nature of the project, the scope of activities, and the potential magnitude of impacts across different environmental and social components, namely:

- **Physical Environment:** air quality, water resources, noise levels, and soil
- **Biological Environment:** flora and fauna
- **Socio-economic Components:** property removal, land acquisition, ASI-protected sites, and influx of labor

6.2 IMPACTS IDENTIFICATION AND EVALUATION

The potential impacts were identified in three main steps:

1. Identification of project activities/aspects causing impacts;
2. Establishing affected environmental and social components (valued receptors). These were determined to include vegetation, water bodies, soil, land stability, water quality and quantity, ambient air quality, employment and livelihoods, vulnerable groups, infrastructure, public safety and occupational health and safety;
3. Determining potential environmental and social impacts in an impact Identification Matrix

Based on the understanding of the project information as outlined in chapter 3 and baseline environmental conditions detailed in chapter 4, the anticipated impacts of the MLCIP project are identified and discussed in the subsequent sections. The potential environmental and social impacts (both adverse and positive) of the MLCIP project activities during the Design, Construction and Operational Phases were identified and evaluated through the Leopold Matrix, where the interactions between relevant project activities and the natural/physical environmental components and the social components were considered to determine whether or not the interaction may create potential impacts.

6.3 IMPACT ANALYSIS USING LEOPOLD MATRIX (MAGNITUDE/IMPORTANCE CLASSIFICATION)

The Leopold Matrix is a comprehensive checklist designed for the identification, evaluation, assessment and analysis of environmental impacts on the development project following the interaction matrix analysis approach by Leopold. The Leopold Matrix developed for the road upgradation project is provided as **Table 6.1**. The checklist interaction matrix for environmental impact assessment was obtained by placing identified existing environmental components in the columns and the proposed project activities in the rows of the matrix. The process is summarized as follow:

6.3.1 IMPACT EVALUATION MATRIX

In order to assess the impacts of the proposed project, the impacts analysis across the project phases was done

as follows.

1. Pre-Construction Phase
2. Construction Phase
3. Operational Phase

The description of the project activities and magnitude of the impacts for the various environments and social components for this project are presented in the below table. These impacts further have been categorized as per the World Bank's Environmental and Social Standards (ESSs) applicable to the project.

Table 6.1: Impact Evaluation Matrix

Project Activity Relevant WB ESS	Air Quality	Noise	Water Resources	Soil Stability	Flora & Fauna	Public Health	Community Safety	Cultural Heritage	Hazardous Material Risk	Drainage	Road Safety
Pre-Construction Phase											
Site Clearance (Tree Felling, Vegetation removal, utility relocation)	MN	MN	N	MN	MN	LN	LN	LN	N	N	LN
Labour Camp Siting & Mobilization	MN	MN	MN	N	Low	MN	MN	N	MN	LN	N
Site identification for construction plants, quarrying, material storage	HN	HN	HN	MN	HN	HN	HN	MN	HN	HN	HN
Earthworks (Excavation, Filling)	MN	HN	MN	HN	MN	MN	LN	LN	MN	MN	MN
Grading, Levelling and Surface laying	HN	HN	MN	MP (Improved Stability)	MN	MN	LN	LN	MN	MN	MN
Drainage & Culvert Installation	N	LN	MP (Improved Drainage)	MP (Improved Stability)	LP	LP	LP	N	N	MP	LP
Slope Stabilization & Bioengineering	N	N	LN	MP (Improved Slope Stability)	MP	LP	LP	N	N	MP	LP

Construction Water Usage	LN	N	MN	LN	LN	LN	LN	N	N	LN	LN
Operation of Construction Plants	HN	HN	HN	N	MN	MN	MN	N	HN	MN	MN
Waste Generation and Disposal	MN	N	MN	MN	MN	HN	MN	N	HN	HN	MN
Fuel and Hazardous Material Handling	MN	N	MN	N	LN	HN	MN	N	HN	N	N
Construction Traffic & Machinery	HN	HN	LN	LN	LN	MN	MN	N	MN	N	HN
Health & Safety Training and OHS Implementation	HP	HP	HP	N	N	HP	MP	N	MP	N	MP
Decommissioning of Construction Sites, Plants, Labour Camps	MN	MN	MN	MN	LN	MN	LN	N	MN	LN	LN
Operational Phase											
Operational Traffic Flow	LN	LN	LN	LN	LN	MP (Improved Access to Health Services)	MP(Improved Connectivity)	LN	LN	MP (Improved Drainage)	MP (Improved Road Safety)
Transportation of Hazardous Materials	MN	LN	LN	LN	MN	HN	HN	MN	HN	MN	HN
Compensatory Plantation	HP	N	MP	MP	HP	MP	MP	LP	N	MP	HP
Monitoring &	-	—	—	—	—	MP	MP	N	N	N	LP

Community Engagement											

HN – High Negative Impact, MN – Moderate Negative Impact, LN – Low Negative Impact, N – Neutral Impact, LP – Low Positive Impact,MP – Moderate Positive Impact, HP – High Positive Impact

Interpretation of Impact Assessment Matrix

The **Table 5.1** presents the environmental and social significance ratings of various project activities during the pre-construction, construction, and operational phases of the RSN Road sub-project.

Pre-Construction Phase

Activities such as site clearance, tree felling, and utility relocation are assessed as having moderate to minor (MN–LN) environmental and social impacts due to localized vegetation removal and possible disturbance to cultural or community assets. Labour camp siting and mobilization) exhibit moderate risks, primarily associated with worker welfare, land use conflicts, and sanitation. Identification of sites for construction plants, quarrying, and material storage represents a high-risk (HN) activity, as it can significantly affect land stability, noise, dust, and habitat quality if not properly managed.

Construction Phase

The earthworks, grading, and surface laying have moderate to high impacts (MN–HN) due to soil disturbance, erosion, dust generation, and safety concerns, although they also produce positive impacts (MP) through improved slope stability and road quality. Drainage and culvert installation and slope stabilization with bioengineering are considered moderately positive (MP) activities, improving overall stability and flood resilience of the Road. Construction water usage, waste generation, and fuel handling have low to moderate impacts, mainly localized and temporary in nature. Health and safety measures and OHS implementation result in high positive impacts (HP) by improving worker welfare and reducing accident risks. Decommissioning of construction sites and labour camps carries minor to moderate residual impacts, which can be mitigated through site restoration and waste clearance.

Operational Phase

During operation, the road will yield several positive outcomes, including improved connectivity, access to health and education services, better drainage, and enhanced road safety. Compensatory plantation contributes high positive (HP) environmental benefits, supporting biodiversity restoration and slope stabilization. Finally, monitoring and community engagement ensure long-term sustainability and social inclusion, producing moderate to low positive impacts through participatory oversight and grievance redress.

6.4 ENVIRONMENTAL IMPACTS

The assessment of potential environmental impact consists of comparing the expected changes in the environment with or without the project. The analysis predicts the nature and significance of the expected impacts. The following sections provide a detailed analysis of the project's environmental and social impacts across its various phases in detail. Corresponding mitigation measures have been incorporated into the sub-project ESMP and sub-project RAP, IPDP, including project- level plans (LMP, Work Site safety Plan (OHS plan), SEP, and SEA/SH Prevention and Response Plan). Based on this indicative ESMP, contractor will prepare contractor's environment and social management plan (C-ESMP) and get it approved by MPWD before starting the pre-construction work.

6.4.1 IMPACTS DURING PRE-CONSTRUCTION PHASE

The project envisages upgrading the existing single-lane carriageway to an intermediate lane configuration to enhance the capacity and extend the service life of the Rongrenggre-Simsanggre-Nengkhra (RSN) Road. While most construction activities are proposed within the available Right of Way (RoW), minor land will be required at specific locations for curve correction, embankment raising, drainage improvement, and slope protection.

Pre-construction activities will primarily include:

- Site clearance and reconstruction/improvement of approach roads for movement of plant and machinery,
- Establishment of contractor's camp, material storage, and construction yard, and
- Planning for material sourcing and finalization of work methodology. The contractor shall as part of the material procurement identify the quarry from which the sourcing would take place. Along with the process of approval of the material they would submit the copy of the EC, CTO to the CSC/PMU. If these documents are identified to be correct then the CSC/PMU would provide an approval of the quarry as part of the material approval. During construction, material can only be procured from these quarries. The royalty payment challans for the material procured would be submitted to the CSC/PMU along with the bills by the contractors.

The impact on the different environmental components is discussed in detail in the following sections:

Ecological and Environmental Impacts

During the pre-construction phase, potential impacts are anticipated from site clearance, vegetation removal, tree felling, material sourcing, labour camp establishment, and utility relocation. The AP Sub Project Road passes mostly through agricultural areas and community land, River. Some of the associated activities e.g establishment of the construction camp, storage of material, staging of equipment which will require land outside the RoW these activities outside the RoW have potential to disturb the sensitive ecology. During field visit, no bird nest has been observed on road side trees. A total of 19 trees will be felled along the Sub Project Road, leading to localized loss of vegetation and minor habitat disturbancelogical events can cause impacts.

Mitigation Measures:

- Avoid construction camps and material storage near streams or forest patches. Flood plain, encroachment into natural habitats. Location of the dumpsite, construction camp, Material Storage areas, Machinery staging area shall be reviewed and approved by CSC. The Environmental specialist of CSC shall undertake the visit of the probable sites (at the prospecting stage of the site) and shall provide his opinion on the suitability and also protection measures (within 7 days of such request being made by Contractor) which need to be taken to ensure suitability

- Restrict vegetation clearing to the minimum area required for works.
- Maintain a buffer of at least 100 m from natural drainage channels or water bodies.
- Implement soil erosion control measures (silt fencing, sediment traps, and slope turfing).
- Prohibit hunting, fishing, or collection of forest produce by workers.
- Awareness and sensitization of labourers on local wildlife and biodiversity conservation.
- Schedule noisy operations (rock breaking, heavy equipment use) away from bird nesting seasons (March–July).
- Site-specific Environmental Management Plans (EMP) will may be developed by the contractor in consultation with the Environment Officer of PMU if any of the location of the constriction activites have sentiive ecology to minimize biodiversity loss.

Occupational Health and Safety (OHS)

The road construction activity involves operation of equipment, vehicle and machinery which poses OHS challenges. The construction activities also involve the use of hot bitumen, and working with hazardous material i.e. molten bitumen spray. In addition, the construction activity would take place when the traffic is operational on the road. This poses an additional challenge for the workers. To ensure safe working conditions, a the Contractor needs to carry out a detailed Hazard Identification and Risk Assessment (HIRA) will be conducted for each task A preliminary Hazard Identification and Risk Assessment have been carried out (Annexure 6.3) and some mitigation measures suggested and included in the Labour Management Plan for the project. The work methodology will define activity sequencing and associated occupational and community health and safety (OHS/CHS) risks. It will be reviewed by the PIU- PWD under the oversight of ESMU prior to approval of Work Methodology.

Mitigation Measures:

- Develop and implement a site-specific OHS Plan conforming to World Bank Environmental, Health and Safety (EHS) Guidelines.
- The OHS Plan shall be submitted along with the Method statement. The PIU–PWD & CSC shall review the OHS Plan and provide their comments within 15 working days. Once these comments have been addressed and the OHS Plan approved the Method Statement shall be approved. The Method statement shall not be approved by CSC unless the OHS Plan has been approved
- Arrange for PPE (helmets, safety shoes, high-visibility vests, gloves) to all workers.
- Develop tie-up with hospitals for the regular health check-up and Health Emergency and Accidents.
- Ensure proper sanitation, adequate potable water (minimum 5 liters per person per day), and waste disposal facilities in camps.
- All lifting should have the appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144..
- Engage trained personnel for operating machinery and working at height or confined spaces.

Community Health and Safety

The project is not expected to result in significant adverse impacts on ecosystem services.

Construction works along existing habitations and roadside markets can pose safety risks to pedestrians and road users. The improvement works will largely be confined within the available Right of Way (ROW). No diversion of forest land or large-scale removal of vegetation is involved. However, minor and temporary impacts may occur during construction, such as localized disturbance to roadside vegetation, increased sediment runoff affecting nearby surface water, and temporary obstruction of natural drainage during earthworks.

Construction works along existing habitations and roadside markets can pose safety risks to pedestrians and road users.

Mitigation Measures:

- Prepare and implement a work site specific Traffic Management Plan to regulate vehicle movement, material haulage, and diversions. The Traffic Management Plan shall indicate the locations for diversions, work zones, transition zones. It shall define the safety precautions and the signages etc, in conformance to IRC SP 55: 2014. The Traffic Management Plan shall also be submitted along with the Method Statement and shall state the process for implementation and notification for inspection of the traffic safety measures.

- Make arrangement for New Jersey barriers/ Water filled barrier, MS steel barricades (2 m high), signage, and warning lamps at work sites.
- Prepare a **Community Health and Safety Plan** (CHS Plan) ensuring public segregation from work zones. The Generic CHS Plan will be submitted along with the Work Statement and should be considered an integral part of the Work Methodology and Work Plan. The Work Plan should not be approved without an approved CHS Plan. The site-specific management plan should present the additional measures which have to be to be implemented. Every RFI should be accompanied with a site specific OHS, CHS and Traffic Safety Plan, which should define the site-specific measures which were implemented. Without these plans being implemented the works should not be approved.
- The material transport route through existing network of roads should be planned and approved by the local transport authorities. Possible risk areas need to be identified along with sensitive receptors and their time of sensitivity. The Traffic Management Plan shall be developed accordingly
- Schedule high-risk activities during off-peak hours to minimize traffic congestion.
- Develop posters for Community Awareness. Conduct community awareness campaigns before any temporary road closure or service disruption.

The OHS Plan, CHS Plan, and Traffic Safety Plan must be reviewed and approved by CSC/MPWD before initiation of construction. To mitigate these ecosystem service risks, appropriate measures have been incorporated in the design and Environmental and Social Management Plan (ESMP). These include provision of adequate cross-drainage structures and roadside drains to maintain natural water flow, slope stabilization and protection works (gabion walls, retaining walls) in vulnerable stretches, controlled construction practices to prevent sediment runoff, and restoration of disturbed areas through turfing and plantation. These measures will ensure that the quality of freshwater, soil stability etc. roadside vegetation, There will be some impact due to tree felling which is anticipated to be long term but would not irreversible because the plantation will be undertaken by the project

Construction Camp and Site Selection

The location of the construction camp has adverse impacts while its design and layout would influence the impacts during the operations stage. The establishment of labour camps and construction support facilities may exert localized pressure on water availability, sanitation systems, and waste management infrastructure. Appropriate provisions for safe drinking water, adequate sanitation, drainage arrangements, and solid waste disposal must be made to prevent health and hygiene issues. To avoid these unwanted impacts the following mitigations are proposed. There will be No constructional camp, material storage area setup upto100 m on both sides from reserve forest (At 0+000 to 6+200).

Mitigation Measures:

- Contractor's camps, stockpile, and equipment yards will be located at least 500 m from settlements and 100 m from water bodies or forest areas.
- Camps should follow IFC/World Bank Labour Accommodation Guidelines and local environmental norms.
- The measures suggested in the BCOW rules shall also be included in the plan and implemented.
- The layout of camps will be reviewed and cleared by the Environment Officer, PMC prior to establishment.
- Regularly monitor disposal sites to prevent contamination and visual pollution.

- No construction camp, material storage area, will be setup 100 m on both sides from Reserve Forest.

Disposal of Construction Debris and Waste

Limited C&D waste (excavated material, asphalt fragments, scrap metal) will be generated. However, haphazard disposal of such debris can lead to both environmental and social issues.

Mitigation Measures:

- Segregate reusable and non-reusable debris.
- Reuse topsoil for slope stabilization and landscaping.
- Dispose of debris only at approved low-lying barren areas located at least 1 km downwind of settlements and away from drainage lines.
- The waste shall be disposed in predesignated location jointly identified by the PWD/Community. Details of Spoil disposal site is given in Table 3.15.
- Avoid dumping in water bodies, wetlands, or near agricultural fields.
- Regularly monitor disposal sites to prevent contamination and visual pollution.

Shifting of Utilities

Minor relocation of electrical poles, telephone lines, and water pipelines may be required.

Mitigation Measures:

- Coordinate with line departments (MePDCL, PHE, Telecom) for planned relocation prior to construction.
- Provide prior notice to local communities about any temporary service disruption.
- Restrict utility shifting to daytime hours to avoid safety risks at night.
- The scheduling of the construction works will be shared with the line department (MePDCL, PHE and Telecom Departments) for ensuring uninterrupted services during construction.
- Provision of utility ducts for underground pipelines shall be incorporated into the design to ensure safe and organized routing of essential services, minimize future excavation, and facilitate maintenance without disrupting road infrastructure

Plant, Machinery, and Vehicle Selection

Early-stage stakeholder engagement and to prevent pollution from the different activities during the construction phase preparation of a Contractor's Environmental and Social Management Plan (C-ESMP) will be essential. The following are envisaged:

- The C-ESMP shall apply the mitigation hierarchy—prioritizing avoidance, then minimization, and finally offsetting and restoration through design improvements, slope stabilization, compensatory plantation, and safety training. Implementation of these measures during the pre-construction stage will ensure environmentally responsible preparation and minimize potential social disruptions before commencement of construction works. The CESMP will be submitted along with the Method Statement. The PMU and CSC will review it as stated above for other plans and shall provide its observations. Once these observations are addressed the CESMP will approve. The Method Statement will not be approved without the approval of the CESMP. Hence the Contractor cannot undertake any works on site till the time the C-ESMP, OHS Plan, Traffic Management Plan, CHS Plans are approved.
- All construction equipment and vehicles shall comply with MoRTH emission standards (GSR 144[9]) and

[9] https://morth.nic.in/sites/default/files/notifications_document/GSR%20598%20%28E%29%20dated%2030%20September%202020%20Seperate%20emission%20norms%20for%20agriculture%20tractors%20and%20CEV.pdf

have valid Pollution under Control (PUC) certificates. The contractor shall maintain equipment in good working condition to minimize noise and air pollution.
- Conduct air quality monitoring according to the EMP. This will be carried out before the works and will be considered as a reference baseline

Sourcing of Construction Materials

The sourcing of materials such as aggregates, sand, and stone may cause adverse impacts on land, air, and water quality if not properly managed. Sourcing material form unauthorised querries and not operating them as per the specification can lead to unwanted impacts on the environment.

Mitigation Measures:

- The contractor shall as part of the material procurement identify the quarry from which the sourcing would take place. Along with the process of approval of the material they would submit the copy of the EC, CTO to the PMU. If these documents are identified to be correct then the PMU would provide an approval of the quarry as part of the material approval.
- If contractor procures any material (such as ready-mix concrete, asphalt/macadam, aggregates etc.), from third party agencies, contractor shall ensure that such agencies have all necessary clearances/permissions as required under the law; these include CTE/CTO from MSPCB, environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PMU; PIU will approve the source only after all the certificates are submitted; and`shall collect the copy of these certificates and submit to PMU; PIU will approve the source only after all the certificates are submitted; and`

Water Requirement

Construction water will be required for concrete mixing, dust suppression, and domestic use. Overextraction of natural resources can lead ot unwarranted impacts. To prevent this the following mitigations are proposed.

Mitigation Measures:

- Obtain permission for groundwater abstraction from the State Water Resources Department or Surface water from Irrigation Department. appropriate Agency.
- Prefer use of surface water from local streams or treated water from nearby sources.
- Avoid over-extraction from community wells.
- Maintain drainage around storage and batching areas to prevent stagnation.
- In the case that water is sourced by tankers the Contractor shall submit the permission of the borewell before the sourcing of water.
- Maintain record of the water extracted or sources by tankers

6.4.1.1 IMPACTS DURING CONSTRUCTION PHASE

Major Activities during the construction phase involves earthworks, grading, drainage works, cutting of slopes, slope protection, disposal of cut material, and culvert construction, laying of bitumen, transportation of material. , These activities are expected to cause significant short-term adverse impacts on air quality, noise, water resources, and soil stability (ESS2, ESS3, ESS4). Occupational health and safety (OHS) risks including accidents, exposure to dust and noise, handling of heavy machinery, and potential unstable slopes require robust safety protocols.

Most of the adverse environmental impacts are related to construction works which are inevitable but are manageable through certain tested and known environment friendly practices. The negative environmental effects can be taken care of at an early stage through proper engineering designs and through the contract

during construction practices.

Construction Phase

The construction phase involves earthworks, grading, drainage works, slope protection, and culvert installation, which are expected to cause significant short-term adverse impacts on air quality, noise, water resources, and soil stability. Occupational health and safety (OHS) risks including accidents, exposure to dust and noise, handling of heavy machinery, and potential unstable slopes require robust safety protocols.

Mitigation measures under the C-ESMP include:

- Engineering and bioengineering measures such as retaining walls, protection walls, stream/erosion protection works, and alignment adjustments have been incorporated at vulnerable locations including CH 6+886, 11+350–12+060, 12+020–13+260, 17+580–17+660, and bridge approaches near CH 20+300–20+600 to stabilize slopes, prevent soil erosion, and protect nearby structures.
- Proper drainage and flood management provisions have been integrated at waterlogged and erosion-prone sections through protection works at minor bridge locations, stream protection measures, and raised/protected embankment sections, particularly around CH 17+300–17+340 and CH 20+300–20+600, to reduce monsoon-related damages and slope instability.
- Traffic and road safety improvements have been proposed at critical junctions, settlements, schools, and bus stand locations including CH 0+000, 6+270–6+330, 7+100–7+410, and 7+980 through junction improvement, curve correction, speed restriction signage, warning/blinker signs, and traffic safety measures incorporated in the DPR and signage plans.

Accept all additionally, the Contractor must ensure provision of PPE, emergency preparedness plans, spill prevention measures, and OHS training and monitoring to reduce worker and community risks.

The standard road construction works involved are site clearance, excavation, filling of earth materials and subgrade materials, laying of bituminous mixtures, handling of hazardous materials like bitumen, diesel, etc., dumping of unusable debris materials, transportation of materials from production site to construction site, and other constructional activities and associated works like mobilization of construction equipment, setting up of construction plants, setting up of workforce camps, quarrying, material storage etc. These activities have certain impacts of various magnitudes on different components of the environment.

The anticipated impacts due to all these activities have been described below:

6.4.1.2 IMPACTS ON PHYSIOGRAPHY

The sub-project area comprises an existing road that traverses through hill, rolling, and plain terrain. The land use along the road stretches is primarily agricultural, interspersed with dense vegetation and areas of shifting cultivation. The proposed improvement will follow the same alignment, upgrading the existing single/intermediate lane to an intermediate lane with paved shoulders, along with geometric corrections at selected locations.

The existing ground profile will be maintained, with minor profile adjustments at certain locations. Rehabilitation, and upgradation, will generally be restricted to the available right-of-way (ROW) in settlement areas.

The Rongrenggre-Simsanggre-Nengkhra (RSN) Road traverses gently undulating terrain with elevations ranging from 212 m to 561 m amsl, where only minor cutting and filling are required to achieve the desired formation level. The total estimated cut quantity is 65618 m^3 and fill quantity is 12990 m^3, resulting in a surplus of approximately 57891 m^3 of excavated material to be disposed of at MPWD-designated sites. Quarry sites for the RSN road project have been identified to ensure a reliable and sustainable supply of construction materials such as sand and stone. Sand will be sourced from Kusimkolgre and Ampangdamgre quarries, located approximately 1.5 km away from the 6th and 11th km stretches of the RSN road. Similarly, stone and blindage materials will be obtained from the Rongkhem quarry in Samanda, situated about 1 km from the 146th km point of NH-127B. The proximity of these borrow areas and quarries minimizes transportation distance and cost, ensuring efficient material supply while reducing environmental impact associated with long-distance hauling.

Mitigation Measures

The project has identified the 01 disposal sites. Details are given in table 3.15.
To prevent environmental impacts, form the disposal sites, the following needs to be kept in mind during disposal:

- Clear the debris from construction sites. Unusable Debris's are to be carried by trucks/dumpers to the identified dumping yards. Covers should be placed on the the trucks during the transportation of material. Usable construction and demolition waste/ debris should be stored separately outside the RoW at a designated place for usage.
- The locations of dumping sites should be selected with following considerations.
- Unproductive/wastelands shall be selected for dumping sites.
- These should be away from residential areas and located at least 1km downwind side of these locations,
- These sites shall be finalized such that they do not lie within any designed forest or other eco-sensitive areas, do not affect natural drainage courses and no endangered/rare flora is impacted by such disposal.
- The lowlands, natural depressions which are natural sinks will not be used for dumping as these are natural sinks.
- Drainage channels should not be used for dumping
- Local Authorities should be consulted about the location of debris disposal sites before finalizing the locations.
- Dumping sites should not contaminate water sources.
- Dumping sites should have adequate capacity for the number of debris generated. Design of dumping site is given in Annexure 6.1 Dump site Stabilization plan.

6.4.2.1 IMPACTS ON GEOLOGY

The construction of RSN Road will require different materials such as earth, aggregate, boulders, and sand that occur naturally and whose formation process is slow and takes years. Minimizing the construction footprint on natural resources is a fundamental design principle for pavement and structures. The sourcing of material from unlicensed quarries can also have unwarranted impacts.

With an estimated surplus of approximately 57891 m^3 of excavated material after balancing cut and fill, the DPR emphasizes reuse of suitable cut and excavated earth for embankment formation, slope dressing, and construction of protection works such as toe walls, gabion retaining walls, and river training structures at critical erosion-prone locations, particularly near chainage 12+900, 16+500 and 17+300. In addition, stone and granular materials recovered from dismantling of existing pavement and drainage structures will be recycled and reused for sub-base layers, shoulder construction, and filter media where technically feasible, thereby reducing dependence on new quarry material. These practices not only conserve natural resources but also minimize environmental impacts from material extraction, transportation, and waste disposal. Only unsuitable or non-recyclable materials will be disposed of at MPWD-designated disposal sites in accordance with environmental management guidelines. To prevent unwarranted impacts the following measures are proposed:

Mitigation Measures

- The aggregate, sand and other construction material shall be supplied form quarries approved by the PMU (indicated in the Pre-Construction stage)
- The challans for the royalty paid against the material used shall be included in the IUFR / Bills submitted for payment.

6.4.2.2 Impact on soil

Contamination of soil during the construction stage may happen primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping near water bodies.

Topsoil loss may occur in land parcels used for short-term purposes (e.g., borrow areas, construction camps) as well as in areas permanently impacted due to road rehabilitation, unless measures for preservation are adopted. Project activity involves tree cutting and vegetation removal from the COI followed by construction and strengthening of the present carriageway.

Since the project involves upgrading an existing road alignment rather than developing a Greenfield Sub Project Road, substantial removal of topsoil is not anticipated. However, localized topsoil disturbance may occur during shoulder widening, drainage improvement, and embankment raising activities. To mitigate this, the ESIA prescribes specific topsoil management measures to be implemented during construction. These include: (i) stripping and preserving topsoil up to a depth of 150 mm from all areas of cutting, filling, and temporary construction zones; (ii) storing topsoil separately in designated stockpiles with proper slope protection and sediment barriers to prevent erosion; (iii) reuse of stored topsoil for median greening, roadside plantation, and slope turfing after construction; and (iv) prohibition of topsoil disposal at dumping sites. These measures shall form part of the Environmental Management Plan (EMP) and be monitored through the supervision consultant to ensure effective implementation during the construction phase.

The alignment traverses areas with sandy loam soils containing small amounts of clay and exhibiting low to medium plasticity. These light-textured soils are prone to erosion by wind and rainfall, and in hilly stretches, slope instability may occur. Additionally, the movement and operation of vehicles, construction equipment, and material transport during project execution may cause soil compaction, particularly in borrow areas, temporary storage sites, and parking zones if not properly managed. Soil compaction reduces permeability and soil fertility, affecting natural drainage and vegetation growth. Improper operation of borrow areas can also impact the soil environment. Adjacent properties may also be impacted, or it can also lead to erosion. Additionally, the associated activities e.g. haul roads may deteriorate due to movement of overloaded trucks, facilities e.g. culverts or embankment may also get damaged.

6.4.2.3 QUARRIES

Construction materials required for the project road will be transported from Quarries. Details of Quarries site is given in Table 3.14 of Chapter 3.

Opening of a new borrow pit creates the following impact:

- The quarrying of earth in an unregulated manner may lead to unstable slopes, erosion, loss of fertility, inundation of water, breeding areas for mosquitos and an unhygienic environment. Fertile topsoil may be wasted if not preserved for backfilling.
- The transportation of earth from quarry areas in open/uncovered trucks can increase the dust levels and overloaded borrow transportation material may cause spillage of material on road causing dust,

high emission, vehicle wear and tear, road surface damage due to overloading.

- Haul roads may develop surface damage due to plying of trucks and if left unattended may cause problems to other pedestrians and commuters on the road.
- Open quarry pits abandoned without proper restoration may lead to accidents and risks of social nuisance.

. The earthwork details in the project area are listed in **Table 6.2** below.

Table 6.2: Earthwork details in the project area

Sub Project Road	Fill (m^3)	Cut (m^3)
RSN	12990	65618

From the above table it is calculated that after balancing cut and fill, the remaining quantity of 57891 cu.m earthwork will be dumped/disposed by the contractor only at a place designated and authorized by the MPWD. The details of Spoil disposal sites are provided in **Table 6.3**. Average height should be 1.5 m to 2 m.

In addition, waste from off-spec hot-mix as wells as from the regular operations of the machinery e.g. layers and bitumen sprayers during the surfacing of the roads. The concrete wastes from the batching plant and transit mixer wash would also be generated.

The labour camps would be setup for construction which would generate municipal solid waste and hazardous waste (waste oil from the maintenance and operation of machinery). These wastes have potential to contaminate the soil around the site if it is not properly stored, handles and disposed.

If these excess excavated material, construction and demolition wastes are disposed on agricultural land or adjoining properties it may result in loss of productivity of land and can also impact the ecology.

Mitigation Measures

PREVENTING COMPACTION OF SOIL

- To minimize this impact, all construction activities and machinery movement will be strictly confined within the designated Right of Way (RoW) and approved working areas.
- Parking and servicing of vehicles and equipment will be allowed only in designated hard-surfaced zones,

Spoil Disposal

The Spoil disposal should be carried out at the site identified and i in and the following precautions taken

- Spoil disposal sites shall be located on stable, non-erodible terrain away from water bodies and agricultural land. The edges of the Spoil disposal area should be contained with gabion/ masonary wall at the pheriphery.
- Dumping will be done in compacted layers (≤1 m thick) with retaining walls, drainage channels, and slopes maintained within the natural angle of repose (30°–35°).
- Each site will be protected with toe walls, sediment traps, and vegetative cover for stabilization.
- The contractor shall operate only at approved locations under supervision and maintain the site until full rehabilitation is achieved.
- The site should incorporate proper retaining structures, such as toe walls and catch drains, to prevent sliding and erosion.

- Adequate drainage must be provided through surface and subsurface channels to control runoff.
- Spoil should be deposited in layers, compacted, and stabilized using vegetation or geo-textiles to minimize dust and erosion.
- Access roads should be provided to ensure safe transport of Spoil, and the site should be fenced and clearly demarcated.
- Environmental safeguards, including periodic monitoring and rehabilitation plans, must be integrated into the design to ensure long-term stability and ecological compliance.

The typical design of the Spoil disposal site will be incorporated into the DPR. Dumpsite Stabilization Plan is attached as Annexure 6.1.

Waste Disposal

- The storage, handling and disposal of Municipal Solid Waste, Hazardous Waste and construction demolition waste the Contractor should follow all the provision of the respective rules. The guidance for storage of these wastes is presented in Annexure 6.2 The same guidance (storage of Hazardous Waste) may be used for storage of hazardous materials (oil, lubricants)

6.4.2.4 AMBIENT AIR QUALITY

Construction stage impacts will have adverse impacts on the workers as well as the settlements adjacent to the road, especially those in the downwind direction. There are two types of pollution, i.e. dust pollution and pollution from harmful gases.

Impacts from Generation of dust

- Transportation and tipping of cut material - while the former will occur over the entire stretch between the cutting location and disposal site, the latter is more location specific and more intense;
- Transportation of raw materials from quarries and borrow sites
- Stone crushing, handling, and storage of aggregates at on-site asphalt mixing plants are integral to the RSN Road Sub Project Road project. These activities generate significant dust and noise.
- Site levelling and vegetation clearing, including the removal of trees and topsoil, are being carried out along the alignment to prepare for subgrade laying. These operations are critical but environmentally impactful, especially near forested or community areas.
- Concrete batching plants and asphalt mix plants are being set up along the Sub Project Road to support continuous construction. These facilities involve the mixing of aggregates with bitumen, releasing particulate matter, hydrocarbons, and heat, which may affect local air quality and nearby settlements
- Construction of structures and allied activities

Impacts from Generation of polluting gases including SO_2, NO_x and CO

- Large construction equipment, trucks and asphalt producing and paving equipment
- The movement of heavy machinery, oil tankers etc.
- Inadequate vehicle maintenance and the use of adulterated fuel in vehicles.

The impacts are expected to be temporary (limited to construction period) and confined within construction areas.

Mitigation Measures for Ambient Air Quality

Impact Source	Mitigation Measures
Transportation and tipping of cut material; site levelling and excavation	Regular water sprinkling (at least 3 times in a dry season) on haul roads, excavation areas, and disposal sites to suppress dust. Limit vehicle speeds to 25 km/h on unpaved roads. A log book of the sprinkling has to be maintained. The Contractor should take into consideration the requirement of water for sprinkling which undertaking the planning of works. A grievance system should be communicated to the population along the road so that they can also intimate any dust pollution related issues.
Transportation of raw materials from quarries and borrow sites	Cover all vehicles carrying loose materials with tarpaulin; avoid overloading and ensure proper loading/unloading to prevent spillage.
Stone crushing, batching, and asphalt plants	Locate plants at least 500 m from settlements and sensitive receptors; install dust extraction, bag filters, and stack emission controls. Regularly maintain equipment to minimize emissions. The emission have to be monitored as per the monitoring plan specified in the ESIA Report. A log of the maintenance should also be maintained by the Contractor. The measures suggested in the CTE and CTO shall be maintained.
Site clearing, vegetation removal, and handling of topsoil	Restrict vegetation clearance to the required RoW; immediately stabilize exposed soil using mulching, water spraying, or temporary turfing.
Concrete and asphalt mixing operations	Use pre-mixed bitumen and maintain mixing temperature within permissible limits to reduce hydrocarbon release. Avoid fuel adulteration.
Operation of heavy machinery and transport vehicles	Maintain all equipment and vehicles regularly; prohibit use of old or poorly maintained machinery; use low-sulphur fuel.
Generation of gaseous pollutants (SO_2, NOx, CO)	Ensure all machinery meets CPCB emission norms/ MoRTH emission standards (GSR 144); • Prohibit idling of vehicles; • Schedule Schedule material transport to avoid congestion.
Worker and community exposure to dust and fumes	Provide PPE (dust masks, goggles) to workers; display warning and awareness signs; avoid high-emission activities near schools or dense settlements.
Monitoring and compliance	Conduct periodic ambient air quality monitoring (PM_{10}, $PM_{2.5}$, SO_2, NOx, CO) at identified locations and ensure compliance with CPCB National Ambient Air Quality Standards. The Monitoring plan presented in the ESIA Report shall be adhered to.

6.4.2.5 NOISE

During construction, particularly in residential and commercial areas, ambient noise levels may temporarily exceed statutory limits within about 50 m of active work zones due to operation of heavy machinery, material transport, and equipment use. The main noise sources will include excavators, graders, vibratory rollers, and

transport vehicles, which typically generate levels above 70 dB(A). Vibration from rollers may also affect nearby structures depending on soil type, structural age, and construction quality.

These impacts will be intermittent, short-term, and localized, as all construction activities will not occur simultaneously along the Sub Project Road. Sensitive receptors such as schools, hospitals, and religious places located near the project road may experience temporary disturbance during high-noise activities. However, impacts will attenuate with distance and can be effectively mitigated through equipment maintenance, scheduling of high-noise works during daytime, and strict adherence to CPCB noise standards.

The scale of construction required for upgrading the RSN Road is moderate and confined mostly within the available Right of Way (RoW). The primary sources of noise emissions include construction equipment, material transport vehicles, stone crushers, and asphalt plants. These activities are temporary, localized, and limited to the construction period. Noise levels are expected to rise intermittently during operations such as excavation, compaction, and pavement laying, especially near settlements and sensitive receptors like schools and health centers. However, with proper scheduling of high-noise activities during daytime, maintenance of equipment, , and adherence to CPCB noise standards, the impacts will remain within acceptable limits. Consequently, the overall scale of works and the expected marginal increase in post-construction traffic are not anticipated to result in any significant or lasting adverse impacts on ambient air quality or noise levels.

Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops, and vehicles and earthmoving equipment. These construction activities are expected to generate noise levels in the range of 80 – 95 dB(A) at about 1m from the source. While the actual ambient noise level experienced at surrounding receptors will depend on distance, terrain, and intervening structures

MITIGATION MEASURES

- Staging of construction equipment and unnecessary idling of machinery within noise-sensitive areas shall be avoided wherever possible.
- All plants and equipment used in construction (including third-party units) must conform to MoEF&CC/CPCB noise standards.
- All vehicles and equipment used in construction shall be fitted with effective exhaust silencers.
- Servicing of all construction vehicles and machinery shall be done regularly; during routine servicing, the effectiveness of exhaust silencers shall be checked and replaced if defective.
- Construction activities shall be restricted to daytime hours (6 AM–10 PM). Night-time work may be carried out only in emergencies, following all prescribed mitigation measures for night operations.
- Unnecessary honking at construction sites shall be strictly prohibited.
- Temporary barricading shall be installed around active construction zones, especially near settlements, schools, or hospitals, to minimize noise propagation.
- Noise monitoring shall be carried out at construction sites as per the approved monitoring schedule, and results shall be submitted to the Project Management Consultant (PMC) and Project Management Unit (PMU) for review and compliance verification.

DG SET NOISE CONTROL STANDARDS

To minimize noise from generator operations during construction, the following measures shall be implemented:

- The contractor must use silent DG sets as prescribed by the Central Pollution Control Board (CPCB).
- If a silent DG set is not available, noise shall be controlled by providing an acoustic enclosure or acoustically treated housing.
- The acoustic enclosure shall be constructed with suitable materials of adequate thickness, supported by a structural or sheet-metal base, and insulated with fire-retardant acoustic foam.

- The acoustic enclosure/acoustic treatment shall be designed to provide a minimum 25 dB(A) insertion loss or to meet ambient noise standards, whichever is higher.
- Each DG set shall be provided with a proper exhaust muffler to further reduce noise emissions.
- The DG set shall be properly sited to minimize its noise impact beyond the premises, ensuring compliance with ambient noise standards at the nearest receptor.
- A routine and preventive maintenance schedule shall be prepared and followed in consultation with the DG set manufacturer to ensure that noise levels do not deteriorate with use.

At the outset, it should be noted that unavailability of exact information on the construction methodology, hours of work, no. of equipment and their ratings / fuel consumption, construction schedule, etc. are the limiting factors while estimate the construction noise for this subject project;

6.4.2.6 SURFACE WATER QUALITY AND SILTATION

For the Improvement and Widening of Rongrenggre-Simsanggre-Nengkhra (RSN) Road including Conversion of weak Bridges to Permanent RCC bridges, the potential impacts on surface water due to the construction of bridges and cross-drainage structures have been assessed and addressed in the design stage. During construction, temporary impacts such as increased turbidity, siltation, and localized disturbance to natural drainage may occur due to excavation, earthwork, and material handling. However, these impacts will be short-term and mitigated through measures such as silt traps, sedimentation pits, controlled excavation, avoidance of debris disposal in water bodies and proper diversion of runoff during construction. Construction activities such as earthworks, material storage, and operation of construction camps may temporarily affect surface water quality along the RSN Road Sub Project Road. Proposed sub project road run parallel to Simsang river Chainages, 12+400. Earth Runoff from exposed soil surfaces, stockpiles, and construction zones can carry suspended solids, oils, and debris into nearby streams or drainage channels, leading to increased turbidity and siltation. Additionally, improper disposal of construction wastewater or accidental spills of fuels and lubricants may also contribute to localized water pollution. Fishing is practiced in the Simsang River, which intersects the RSN Road Sub Project Road. Construction activities such as bridge works, river training, and slope protection may temporarily increase turbidity and sediment load in the river, potentially affecting local fish habitats and water quality. These effects are expected to be localized and short-term, primarily during active construction near the river crossing.

Labour camps and site facilities will generate domestic wastewater and sewage, which, if discharged untreated, may degrade nearby water bodies.

Mitigation measures

Labour Camp and Construction Yard

- Temporary construction/fabrication yard / labour camp (with no more than 10 labour) can be proposed at the cross drainage construction site (will all facilities mentioned above) with the permission of the CSC/PMU..
- To prevent this, sewage treatment through septic tanks and soak pits or mobile bio-toilets shall be provided at all camps.
- Construction runoff shall be managed through temporary drainage channels, sediment traps, and silt fencing, ensuring that no untreated discharge enters natural watercourses.
- . Runoff from the camp shall be passed through an oil-water separator. All peripheral drains shall be linked to the oil water separator
- The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into river or any other nearby water bodies by passing wastewater to sedimentation tank to be considered as part of the EM plan and Contractor's responsibility.

- Stagnation of water should not be allowed at any place near the campsite as a precaution against vector-borne disease.
- The wash water from the concrete mixer/ batching plant/ miller should only be disposed at a pit developed in construction camp

Water Pollution from Fuel and Lubricants

- Spill Prevention and Control: Store fuel and lubricants in bunded areas (110% capacity of the largest container) with proper spill kits (sand, absorbents). Immediately clean up any spills or leaks.
- Impervious Flooring: Provide impermeable flooring (e.g., compacted clay or concrete base with HDPE lining) in storage areas for materials such as bitumen, fuel, cement, and chemicals to prevent seepage into soil and groundwater.
- Transfer of fuel by decantation is prohibited, Fuel Pump (manual or electric) should be used
- Storm water Management: Construct peripheral drains around storage yards to collect and divert runoff to sedimentation pits before discharge. Prevent mixing of clean storm water with contaminated runoff.
- Regular Inspection: Conduct routine checks for leakages, cracks, or improper containment in fuel and chemical storage zones. construction sites. Oil-water separator with adequate residence time to be provided before the outfall of these.
- Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a way that spillage of fuels and lubricants does not contaminate the ground. Only fuel pumps will be used for the transfer of fuel during refueling.

Pollution from construction activities

- The runoff from the construction material storage yard must be channelized through peripheral drains connected to sedimentation tanks (holding tanks excavated in the ground) of adequate capacity

6.4.2.6 IMPACTS ON NATURAL DRAINAGE AND WATERSHED MANAGEMENT (FLOODING)

Along the rivers and streams crossed by the road, there is a need for bank protection measures to avoid accelerated sedimentation that can affect drainage patterns as well as riverine habitats. The alignment follows the existing topography except for the location of the cross-drainage structure. 29 Junction and 23 Minor Bridge exist in the project area of 20.564 km road length. Totally 105 culverts are proposed for new construction, reconstruction/retention. Among these, 2 is slab culvert, 13 are box culvert, 83 pipe culverts and 2 Proposed Pipe culvert. Proposed box culverts are 11.

If the existing culverts are not adequately strengthened during road widening and rehabilitation, they may fail structurally, leading to disruptions in water flow, increased flood risk, potential damage to the road, and safety hazards for road users and nearby communities.

Mitigation Measures:

- The contractor will ensure that no construction materials/debris shall disposed off or block the flow of water of any water course and cross drainage channels.
- The stockpiled material must be prevented from erosion and deposition in the drainage channel from sites where these are stocked for construction.
- The runoff from the construction material storage yard must be channelized through peripheral drains connected to sedimentation tanks (holding tanks excavated in the ground) of adequate capacity

- All sedimentation tanks and peripheral drains must be cleaned before the monsoon.

6.4.2.7 GROUND WATER QUALITY

The road construction projects are water intensive and demand a large volume of water during the entire project's construction period however in this project the works are rehabilitation in nature, the quantum of water require will be minimal. However surface water RSN project road stretch will require 19 KLD. Although the actual water requirement may vary depending on the contractor's construction methodology and equipment usage. As discussed with the DPR team, the primary source of water for construction will be the Simsang River. The availability of surface water is sufficient. Hence demand for the construction is proposed to be met from the surface water sources. The demand for construction is proposed to be met from surface water sources. The project area is not classified as critical, semi-critical or overexploited by CGWB. It is "safe" area for ground water abstraction.

There is no pressure on ground water resources as most of the water requirement will be fulfilled by surface water.

Mitigation Measure

- Peripheral drains and temporary drainage channels will be provided at the construction site to safely divert stormwater runoff and prevent water accumulation.
- Silt traps/sedimentation pits and soak pits will be constructed to capture sediments and allow runoff water to infiltrate, supporting groundwater recharge and preventing contamination.
- Construction water will not be procured from any unauthorized wells or existing wells. The permission of CGWB would be obtained in case new wells are sunk;
- The Contractor shall install a meter at the point of extractor and keep a log of the water extracted
- All the measures suggested in the permission for Borewell shall be adhered to
- In case the water is sourced form third parties the Contractor shall only source it form sources cleared by PMU. In such cases also eh shall maintain a log of the water procured.
- Water usage for construction work would be reduced by adopting following best practices:
    - Use buckets etc. to wash tools instead of using running water;
    - Use of auto shut off taps (without sensors) in labour accommodation;
    - Install water metres with main supply pipes/water tanks/bore well to assess quantity of consumed water

6.4.2.8 CONSTRUCTION AND DEMOLITION WASTE

Construction and demolition (C&D) waste from major demolitions is not expected along the proposed RSN alignment because no permanent structures will be removed. Only temporary structures with masonry or light walls (e.g., temporary kiosks, sheds, boundary walls) will be dismantled where absolutely necessary to establish the right-of-way. Even these limited removals, if not handled correctly, can obstruct natural drainage, cause siltation of nearby waterbodies, generate dust, and create temporary traffic inconveniences or health nuisances. To avoid such impacts, all temporary-structure debris will be managed through a contractor-led waste handling plan that emphasizes source segregation, timely removal, reuse/recycling where feasible, controlled transport, and disposal at authorized sites.

Key mitigation measures

- **Avoidance & minimization:** limit removals to only those temporary walls/structures that are

unavoidable for construction; explore minor realignments or temporary protection works to retain structures where possible.

- **Segregation on site:** separate inert masonry/brick, concrete, metal, wood and mixed waste at designated temporary collection points to maximize reuse/recycling.
- **Reuse & recycling:** priorities reuse of intact masonry/brick and concrete as backfill or for temporary access tracks; recover metal and timber for reuse.
- **Designated storage & timely removal:** store debris in covered areas away from drains and surface water; remove to authorized disposal/recycling facilities within agreed short timeframes to prevent runoff and scavenging.
- **Dust control:** dampen stockpiles and vehicle loads, cover trucks during transport, and restrict demolition/dismantling operations during high-wind conditions.
- **Drainage protection:** install silt traps/sediment control (e.g., sandbags, temporary settling pits) at nearby drains and around stockpiles to prevent siltation of water bodies.
- **Traffic & public safety:** schedule dismantling works off-peak where possible, use flaggers and signage, and maintains clear pedestrian/vehicular passage around work areas.
- **Permits & authorized disposal:** ensure waste is transported only to licensed C&D disposal or recycling facilities and that manifests/receipts are retained.
- **Contractor responsibilities & training:** the contractor shall prepare the C&D waste handling plan, train workers on segregation and pollution prevention, and maintain daily records of waste quantities and destinations.
- **Monitoring & reporting:** include C&D waste management in construction supervision checklists; undertake fortnightly inspections and submit waste disposal receipts as part of monthly compliance reports.

6.4.2.9 MUNICIPAL SOLID WASTE

RSN road Sub Project Road will generate approximately 15 to 18 kg of municipal solid waste per day during the construction stage, this is estimated based on approximately 45 working people in the project site. This waste if not disposed of properly, may lead to littering in the immediate vicinity of the camp sites and contamination of ground water as well as air pollution due to unauthorized burning.

Mitigation measures

- Disposal of sanitary wastes and excreta shall be into septic tanks. If bio-toilets will be used the excreta could be converted to manure.
- Kitchen wastewater shall be disposed into soak pits/kitchen sump located preferably at least 15 m from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed of in landfill sites.
- Provide segregated garbage bins in the camps and ensure that these are regularly emptied and disposedand of disposed of hygienically as per Comprehensive Solid Waste Management Plan approved by the Environmental Expert of Project Authority.

- The camping area should be periodically sprayed with Bleaching powder and disinfectants.

6.4.2.10 HAZARDOUS WASTE

Approximately 150 cu.m.of scarified bituminous material will be generated from the project road during pavement rehabilitation.Improper disposal may cause localized soil and water contamination due to leaching of hydrocarbons; therefore, its reuse and handling shall follow MoRTH (5th Revision) guidelines.

As per MoRTH Clause 517 and Clause 305.2.2.2, the scarified bituminous material shall be recycled and reused in Granular Sub-Base (GSB), Wet Mix Macadam (WMM) layers, or for pavement shoulders, after appropriate screening and blending to achieve the required gradation. The reclaimed mix can also be incorporated in hot or cold recycling processes depending on site conditions and equipment availability.

Any quantity of scarified bitumen found unsuitable for reuse shall be disposed of at designated locations approved by the Engineer-in-Charge, with proper base lining and containment to prevent leachate migration and protect soil and water quality. This approach promotes resource recovery, cost efficiency, and environmental compliance in line with MoRTH and CPCB sustainability principles.

Sub Project Road wise scarifying existing bituminous surface in the project area is listed in **Table 6.3** below.

Table 6.3: Amount of Scarified Bituminous waste

Sl. No.	Description	Unit	Quantity
1.	Scarifying existing bituminous waste	cum	150

A small quantity of hazardous substances (such as diesel, petroleum products, and other chemicals) will be used or stored during the project. If not stored properly, these substances may cause leakage or spillage, leading to soil and water contamination. During the construction phase, used batteries are also likely to be generated, which must be disposed of in compliance with the Battery Waste Management Rules, 2022. Improper disposal of lead-based batteries can result in leakage of lead, causing soil and water pollution.

Mitigation Measures:

- The Contract shall obtain Authorization for Generation, Storage and Handling of Hazardous Waste from MPSCB.
- The Hazardous Waste shall be stored as per the provisions specified in the rules (Segregated and access Controlled space, Covered, Impervious floor, bounded for 110% capacity)
- The Contractor shall maintain records of the generation, storage and disposal as per the provisions using the forms specified in the Hazardous Waste rules.
- The Waste shall be disposed of to Authorized recyclers or Aggregators and the records maintained in Form V of the Hazardous Waste Rules.

6.4.2.11 NATURAL DISASTER

Based on the satellite image processing study on landslides and hazard assessment conducted under the Meghalaya State Action Plan on Climate Change (SAPCC) (2022), several hazard-prone and vulnerable zones have been identified across the state of Meghalaya. The review of the available hazard mapping indicates that the proposed sub-Sub Project Road does not fall within the high-risk Unstable slopeor hazard-prone zones

identified under the SAPCC assessment.

Detailed field reconnaissance and site verification was undertaken along the project alignment to assess potential geotechnical and hydrological risks. During the inspection, no direct evidence of flooding or prolonged waterlogging was observed along the project road. However, certain stretches of the alignment run in close proximity to river channels and streams, making these locations susceptible to localized bank erosion and soil instability, particularly during periods of high discharge and seasonal runoff.

Roads in hilly areas, particularly Other District Roads and their connecting links, are highly vulnerable to unstable slopes and debris slides during extreme rainfall events. In addition, inadequate drainage further aggravates waterlogging, leading to pavement deterioration and structural damage. Along the project stretch, water accumulation and submergence have been observed at several locations. Notably, at chainage 17+300 to 17+340 (RHS), pavement damage associated with waterlogging has been observed. To address this, protection works have been provided downstream at chainage 17+580 to 17+660 (RHS), along with improved drainage arrangements and road profile adjustments to mitigate future water stagnation and associated deterioration.

Several unstable slope-prone sections have been identified along the Sub Project Road. A critical unstable slope location at chainage 11+900 (RHS) has been addressed through design optimization, with protection measures provided at chainage 12+020 to 12+060 (RHS). Additional unstable slope-prone stretches occur between chainages 12+850 to 12+900 (RHS), where protection works have been implemented from chainage 12+820 to 12+880 (RHS), and between chainages 12+900 to 12+980 (LHS), where slope protection has been incorporated from chainage 13+180 to 13+260 (LHS). Another unstable slope-prone section at chainage 16+500 to 16+600 (LHS) has been reviewed and found not requiring any intervention as per the final design assessment.

Soil erosion remains a concern at specific locations along the Sub Project Road, particularly near the minor bridge at chainage 6+900, where protection measures have been incorporated at chainage 6+886 to ensure embankment stability and structural safety. Additionally, erosion risks near bridge approaches have been addressed through protection works at chainage 19+880 to 19+950 (RHS), along with associated stream protection measures to safeguard the roadway and adjoining structures.

Overall, these revised chainage-specific interventions reflect design optimization and ensure targeted mitigation of risks related to unstable slope, erosion, and waterlogging, thereby enhancing the climate resilience, safety, and long-term performance of the road infrastructure.

6.4.2.12 DISRUPTION OF COMMUNITY SERVICES

During road construction, local infrastructure such as water supply lines, irrigation channels, drainage systems, and access roads may be affected. These facilities are essential for domestic water use, agricultural activities, and community mobility. Improper or incomplete restoration of these services can lead to adverse impacts on local livelihoods and may also affect the integrity and progress of the road works.

6.4.2.13 IMPACTS ON OCCUPATIONAL HEALTH & SAFETY

During the construction phase of the road project, workers are continuously exposed to various occupational and environmental hazards. These include prolonged exposure to dust and gaseous emissions from equipment, vehicles, and material handling. In addition, there are significant safety risks associated with activities such as hill-side cutting, benching, excavation, embankment formation, operation of heavy machinery, and protection works along eroded riverbanks. Specific risks also arise from working near waterlogged or submerged sections, culvert and bridge construction, and sharp curves or junction improvements, where vehicular movement poses added danger. Electrocution, work at heights, slips, trips, and falls, as well as tree cutting and vegetation

clearance, further contribute to potential safety concerns. Proper use of personal protective equipment (PPE), adherence to standard operating procedures (SOPs), traffic and work-zone safety management, and regular safety training will be critical to prevent accidents and ensure worker well-being throughout the construction period.

Mitigation Measure

- A Hazard Risk Identification and Assessment (HIRA) carried out by the Contractor during the Pre-constrction for the activities which will be included in the road component of the Meghalaya Logistics and Connectivity Improvement Project. The Occupational Health and Safety Plan attached as Annexure 6.3 shall be implemented by the Contractor.
- The Contractor will provide adequate resources for its implementation.

6.4.2.14 DIVERSION OF TRAFFIC

Since the road upgradation works will be carried out on the existing alignment, there will be a direct interface with road traffic. Short-term impacts during construction will include traffic diversions and management challenges, potentially causing hindrance to the existing traffic flow. There is also a risk of accident hazards during this phase. Although such diversions do not directly impact the natural environment, poorly planned diversions can lead to adverse effects. Rapid restoration of diverted services can help minimize the severity of impacts resulting from the disruption of existing services.

6.4.2.15 WORK SITE SAFETY

During the construction activities the exiting road would be used by traffic. The risk of accident and collisions are very high because of the constricted width of the road, use of road by both construction vehicle and equipment and the local people for commuting. Thus, pedestrian, vehicles are susceptible to danger.

Labour camps and site operations pose community health and safety risks , including sanitation, water access, and increased traffic hazards. Labour influx may exacerbate these risks if not well managed.

The following mitigation measures are thus proposed:

Mitigation Measures

Safety in Construction

- RFI will be raised for all excavation or cutting. The CSC will not approve any RFI for more than 500 m at one go or contigious stretched. The RFI for excavation on both sides of the carriageway shall not be issued at any time. The subsequent RFI for the adjoining chainages should be issued only when the levelling and back filling is done
- Barricade the construction area using hard barricades (of 2 m height MS Steel Barricades/ New Jersey Barrier/ Water filled barriers) where the drop in level is more than 0.3 m.
- Initiate site clearance and excavation work only after barricading of the site is done.
- Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes, etc.,), to the barricaded area
- Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area
- Undertake the work section wise, a 500m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones

- In case of settlement areas Steel / wooden Planks of sufficient capacity should be provided to cross over the trench.
- The Work zone safety signages shall be placed as per IRC : SP 55. All the safety measreus stated in MoRTH Circular RW/NH-36098/25/2022-S&R (P&B)/pt. dated 16.03.2023 shall be applied.
- Construction material must be stored in the barricaded area. If temporary storage is required (for 1-2 days) outside the demarcated construction area, the same must be discussed with the community.
- Retroreflective tapes shall be fitted on all sides of equipment
- Reverse horns must be placed on all vehicles and equipment. In case of rotating equipment rotation alarm must also be fixed on the equipment.
- Preferably machinery should not be parked beside the carriageway. If machinery is parked on the roadside the area should be barricaded by water filled New Jersey barrier. Retrorefletive tape must be fixed on the barrier for easy visibility. Solar LED blinkers shall be placed on the machinery for easy visibility.

Labour Influx related

- The project will prioritize the engagement of local workforce to the extent possible during the construction phase. Contractors will be encouraged to hire unskilled and semi-skilled labour from nearby villages along the Sub Project Road. This approach will not only support local livelihood opportunities but also promote community participation in project activities. Skilled labour may be sourced externally if not available locally; however, preference will be given to local workers wherever feasible.
- Labour camp will be set up as per WB guidance (Annexure 6.2).
- The Project Board shall be presented at the beginning /start of the package. The Project Board should provide the critical information about the project include the grievance mechanism.
- The construction zone must be access controlled, and the workers must be provided valid identification cards to allow entry.
- Contractor should introduce, explain and get signed by a Worker Code of Conduct as part of the employment contract. Time to time orientation programme on Code of conduct to be organized with the workers by the contractor.

6.4.2.16 ROAD SAFETY MEASURES

Road construction activities may affect road safety for commuters, pedestrians, students, women, and elderly persons using the Sub Project Road. Since sections of the sub-project alignment pass through unstable slope - prone areas, there is a risk of periodic unstable slope and rockfall affecting traffic movement and public safety during construction.

Although animal crossings have not been reported along the current project stretch, the possibility of wildlife or livestock movement during the construction phase cannot be ruled out; therefore, appropriate mitigation measures shall be incorporated into the Contractor's C-ESMP.

The road Safety measures suggested in IRC SP 55 need to be implemented. The following additional road safety measures have to be implemented include:

- Suitable safety measures in the form of safety barriers along valley side have been proposed throughout the mountainous terrain of the project stretch.

- For lane decision making, thermoplastic reflective road markings, traffic signage, has been proposed to ensure night visibility.
- Crash barriers have been proposed along critical stretches of the Sub Project Road to enhance road safety by preventing vehicles from leaving the carriageway and minimizing the severity of run-off road accidents

6.4.2.17 ANTICIPATED IMPACTS ON BIOLOGICAL ENVIRONMENT

The Rongrenggre-Simsanggre-Nengkhra (RSN) Road project is a road improvement activity confined to the existing alignment, with no widening or diversion through undisturbed habitats. Although several Endangered and Critically Endangered species occur regionally within the 10 km Study area, the project does not intersect or significantly influence any critical habitat as defined under World Bank ESS6 Paragraph 27–29. Hence, no species or habitat within the project's area of influence qualifies as Critical Habitat. All species are therefore screened out from Critical Habitat consideration.

No such species were observed during the field survey. A total of 07 species are listed under Schedule I of the Wildlife Protection Act, 2022. Although none of these species were recorded during the field surveys conducted in the 10 km study area, their presence has been indicated through secondary information sourced from the IBAT Tool. Details are provided in Table 5.15

As per the design, the construction activities would also involve felling of 19 nos of trees. In addition there would be clearing of the undergrowth and, bushes and shrubs. The unplanned removal would impact the impact on habitats of birds and animals unless the removal of vegetation in planned and limited. The following mitigation measures are required:

Mitigation Measures:

- No tree felling should be carried out without permission of the Forest Department, GoM.
- Clearing and uprooting should be avoided beyond that which is directly required for construction activities.
- If any termite mound is found adjacent to the highway, precaution will be taken, the mound would not be disturbed, and the Bio-diversity specialist of the PMU would be intimated to ascertain the presence of Chinese pangolin and Indian Pangoloin. Pipe culvert will be constructed at a location identified by the Bio-diversity specialist. Additionally, the mitigation measures suggested by the specialist will be adopted.
- Kerosene / LPG should be preferably used to avoid felling of the trees or provide community kitchen for the labour camps for cooking.
- Camps and storage yards shall be located in the areas already devoid of vegetation or having little vegetation
- Compensatory Afforestation 1: 10 would be carried out by the Contractor. As indicated in the ESMF an app based monitoring of the plantation would be carried out.
- All the workers will need to be oriented and monitored by the contractor so as not to cause any harm to the flora and fauna.
- Hunting and fuel wood collection will be strictly prohibited

Impacts on Aquatic Ecology:

During the construction phase, aquatic ecology may be affected by increased silt inflow into surface water bodies and the discharge of liquid wastes or untreated sewage from construction and labour camps.

Mitigation Measures:

- Disposal of construction material or debris into rivers or streams will be strictly prohibited.
- Regular monitoring of water quality will be conducted to ensure compliance with environmental standards

- The dewatering carried out from the excavated pits will not be discharged directly into the river. It will be transferred into a sedimentation tank of adequate size and residence time before discharge.
- A silt curtain will be provided across the river to prevent sediments from flowing downstream.
- Any works affecting aquatic habitat will be done during low flow (when water depth is less than 5 m) and when banks would be dry
- No Solid waste should be discharged into any waterbody
- Where any GI wire mesh gabions are used; all GI wire ends need to be folded inside.
- Ensure that no construction activities will be carried out during monsoon and the fish breeding season

6.4.2.17 IMPACTS ON ARCHAEOLOGICAL, HISTORICAL AND CULTURAL SITES

There are no historical and cultural sites of importance observed in the project stretch.

The other key potential impacts during the construction of the Project may be related to the risk of partial or total removal or destruction of unknown heritage assets (undiscovered archaeological sites) due to ground removal, which implies the need for setting mitigation approach.

During the construction works, as part of the Contractor's project CESMP, a "chance-find" procedure will be developed and implemented. The mitigation plan for the "chance find procedure" has been incorporated into the ESMP and is presented in Chapter 8 of this ESIA. Workers need to be trained in the use of this procedure. Cultural Heritage Monument Conservation Plan is attached as **Annexure 6.6.**

6.4.3 IMPACTS DURING OPERATIONAL PHASE

During the operation stage, the main environmental impacts are expected from increased traffic volume and speed, which may elevate safety risks, particularly in rural areas. However, no sudden or significant increase in traffic is anticipated, as the road already exists and is open to public use.

The project also offers opportunities to restore vegetation around the road Sub Project Road and worksite through a compensatory plantation program. This initiative will enhance the aesthetic quality of the area and contribute to soil stabilization and reclamation.

During the operation phase, moderate increases in air and noise pollution may occur due to higher vehicular movement. Nevertheless, the overall impacts are largely positive, with enhanced road safety, reduced travel time, and improved connectivity supporting local economic development. Landscaping, replantation, and slope bioengineering measures will improve local biodiversity, stabilize embankments, and enhance the Sub Project Road's visual aesthetics.

6.4.3.1 Impacts on Water Quality and Resources

During the operation phase, the likelihood of water quality degradation is very low. Potential impacts on surface water may arise only from accidental spills. However, the probability of such incidents is minimal, as the road design incorporates safety enhancements, including curve improvements, road widening, and pedestrian facilities, which collectively reduce the risk of accidents.

6.4.3.2 Impact on Air Quality

Vehicular emissions are the principal source of pollution during the operation stage. The RSN project road being mostly located adjacent to open agricultural land and un-classed forest, adequate dispersion of gaseous pollutants is expected.

6.4.3.3 Impact on Noise Quality

Impact due to increased noise level and vibration is anticipated due to increased vehicular movement upon improvement of existing road condition. Road side plantation will act as a noise barrier and is likely to reduce

the noise quality during the operational phase and any further mitigation is beyond the control of the project authority.

6.4.3.4 Accidents Involving Hazardous Materials

Accidents involving hazardous chemicals may generally be catastrophic to the environment, though the probability of occurrence is low. Prevention of an accident involving hazardous material is a better way of minimizing the impacts. The provisions mandated by 'The Hazardous Wastes (Management and Handling) rules, 1989 and "Manufacture Storage and import of Hazardous Chemicals Rules" 1989 under the Environmental (Protection) Act, 1986 will be complied with. Vehicles delivering hazardous substances will be expected to have printed warning signs on the vehicles and measures to contain any hazardous spillage on the road.

In case of spillage, the report to relevant departments will be made and instructions will be followed in taking up the contingency measures immediately as per the Emergency Management Plan of the contractor's OHS plan.

6.5 SOCIAL RISKS & IMPACTS

The construction of the road is expected to intersect various areas of significant social and economic value, which necessitates careful consideration and management. Key areas of concern include impacts on agricultural lands, residential communities, and culturally significant sites. The route traverses along agricultural lands that are important for local food production, livelihoods and eco system services in general. Disruption to these areas could result in economic losses for farmers and reduced agricultural output. Mitigation measures, including re-alignment, compensation, and access to community benefit programs have been considered to minimize adverse effects and ensure that the project contributes positively to the socio-economic landscape. This has been outlined in the Resettlement Action Plan.

The proposed subproject road of 20.564 km has been designed to minimize land acquisition. Approximately 7 km of the alignment will be improved within the Right of Way (ROW) of 12 m. For the remaining 13.564 km, 1.2459 Ha of additional land will be required in locations where the available ROW is insufficient. This additional land is required primarily for minor road widening to achieve intermediate lane configuration, construction of drainage and safety features.

This land belongs to community land. No residential or commercial structures are impacted on this required land, and therefore no physical displacement is anticipated.

No additional Land is required for community infrastructure part of the FPIC agreement as these facilities will be constructed within the available ROW. Details of land requirement is given in Table 3.16

The proposed Sub project will also require 0.55 ha of land (temporary use) for spoil disposal. The required land for spoil disposal side will be used temporarily and will be returned to the land Owner after project completion and after having redeveloped in accordance to the community requirements. The Consultants along with the officials of the PWD and members of the village community including the Nokma jointly identified 1 location for dumping of spoils. Details of Land requirement for proposed activities are given in Table 3.17.

A total of 40 PAHs comprising 100 Project Affected Persons (PAPs) are expected to be affected by the subproject. The impacts are largely partial and localized in nature, with no loss of primary residential structures.

A significant proportion of the affected population comprises 28 households (70 PAPs) operating roadside kiosks, which fall under the category of encroachers (Non-Title Holders). These are small, informal, and subsistence-level commercial activities such as tea stalls, vegetable vendors, repair shops, and food outlets. The project will require removal of these kiosks from within the ROW, resulting in disruption to their existing business locations. Affected persons will shift their kiosks to nearby alternative locations and continue their activities there, and are not expected to return to the current sites within the Sub Project Road after construction. While the nature of

livelihood activities will remain the same, the impact involves loss of the existing business location and associated income during the transition period. Given the small scale of operations, impacts on any hired labour or additional workers are expected to be limited and short-term.

A 30-day notice period will be provided to all Project Affected Persons (PAPs) whose structures fall within the project ROW, allowing them sufficient time to salvage materials and relocate, along with other entitlements as per the Entitlement matrix provided in the RPF and RAP. The format of the notice issued to affected households is provided in Annexure 4 of the RAP. FPIC was carried out as the project will result in loss of assets and cause relocation of IP's.

Overall, the project does not result in any physical displacement. The impacts are primarily associated with relocation of informal commercial activities, partial loss of agricultural land (not in use), and minor impacts on secondary structures within the ROW. No permanent loss of livelihood is anticipated, as affected persons are expected to continue their existing occupations following relocation or adjustment. The impacts are localized and can be managed through appropriate compensation, livelihood support, and construction-phase management measures

The road alignment requires minimal additional land (1.2459 Ha), as most mitigation and improvement works are confined within the existing paved road. Key interventions along the alignment include:

The road alignment requires minimal additional land (1.2459 Ha), as most mitigation and improvement works are confined within the existing paved road. Key interventions along the alignment include:

- At chainage 6+350, a building structure on the RHS was initially identified as potentially impacted. However, the alignment has been slightly shifted towards the LHS as part of geometric design optimisation, ensuring no impact on the structure.
- At chainage 6+450, an existing culvert is located within the project influence area; however, no improvement or intervention is required as it is in good condition and does not affect the proposed works.
- At chainage 7+100, a building structure on the RHS was identified. The alignment has been adjusted towards the LHS under the revised geometric design, ensuring no impact on the structure.
- At chainage 11+400, a culvert (partly new and partly existing) is present; however, no impact is envisaged as the structure is in sound condition and no improvement works are proposed.
- At chainage 11+700, a building structure on the RHS with a boundary wall was initially identified as potentially affected. However, following geometric design modification and alignment shift towards the LHS, the structure is no longer impacted. Speed regulation measures have also been considered as a precautionary safety measure.
- At chainage 12+020, a school is located near the project alignment, where a retaining wall was proposed on the LHS from chainage 12+020 to 12+040. With the incorporation of the retaining wall in the final geometric design, no adverse impact on the school is anticipated**.**

Furthermore, the easement zones around the construction areas will potentially cause hindrance on land use, limiting some of the activities such as building construction, tree planting, and certain agricultural practices. These restrictions can disrupt community development plans, hinder local businesses, and affect the overall quality of life for residents.

To mitigate these social impacts, household surveys, meaningful stakeholder consultations and FPIC consultations were carried out to understand the concerns and needs of affected communities. The Free, Prior, and Informed Consent (FPIC) process was followed in a culturally appropriate manner to ensure meaningful

engagement with Indigenous Peoples, securing their consent through transparent and participatory consultations [See IPDP for details]. Additionally, community engagement programs have been conducted to provide clear information about the project, address misconceptions, and explore opportunities for local benefits, such as job creation and infrastructure improvements. Contractors will be required to ensure that access to residences, shops, agricultural land, and public amenities is maintained throughout the construction period.

The Project recognizes the critical importance of addressing Sexual Exploitation, Abuse, and Harassment (SEA/SH) both within the workplace and in interactions between workers and the local community. To address these concerns, SEA/SH Prevention and Response Action Plan has been prepared for the project which will be implemented during the sub-project implementation

Social impacts associated with the project have been assessed across the pre-construction, construction, and operation phases of the project lifecycle.

6.5.1 PRE-CONSTRUCTION PHASE

Nature of Impacts

During the pre-construction phase, social impacts are primarily associated with land requirements, impacts on structures, and livelihood disturbance arising from project preparation activities. The proposed RSN road alignment requires approximately 1.2459 ha of additional land and is expected to affect about 40 structures, most of which are located within the available Right of Way (RoW). These impacts are largely partial in nature and include roadside kiosks, boundary walls, fencing, gates, and small commercial extensions. Such impacts may result in loss of assets and temporary livelihood disruption, particularly for small roadside vendors.
The project affects Indigenous Peoples (IPs) residing along the Sub Project Road, requiring culturally appropriate consultation and consent processes prior to implementation.

Mitigation Measures

Mitigation during the pre-construction phase focuses on planning and compensation measures. Household surveys, stakeholder consultations, and the Free, Prior, and Informed Consent (FPIC) process have been conducted to ensure meaningful participation of affected communities. Compensation for affected assets, livelihood assistance, and relocation support where required; will be implemented through the Resettlement Action Plan (RAP). Community amenities identified through consultations with Indigenous Peoples have been incorporated into the Indigenous Peoples Development Plan (IPDP). Continued disclosure and consultation will be undertaken through the Stakeholder Engagement Plan (SEP). Project design has minimized land acquisition by confining most works within the available RoW.

6.5.2 CONSTRUCTION PHASE

Nature of Impacts

The construction phase is expected to generate mostly temporary social impacts. Construction activities may restrict access to residences, agricultural land, shops, and public facilities along the Sub Project Road. These disruptions may affect daily mobility and reduce customer access to roadside businesses for short periods. Furthermore, construction related activities may result in property damages along the corridor.

Construction activities may also increase pressure on local ecosystem resources due to the presence of workers in the project area. Vulnerable groups including elderly persons, women-headed households, and economically weaker households may face additional mobility and safety challenges during construction.
The project may require a limited number of workers from outside the project area, creating potential risks related to labour influx, worker–community interaction, communicable diseases, and SEA/SH risks. Occupational health and safety risks for workers are also anticipated during this phase.

Mitigation Measures

Construction-phase impacts will be managed through measures included in the Environmental and Social Management Plan (ESMP) and project level Labour Management Procedure (LMP). Contractors will maintain alternative access routes, schedule works in phases, provide advance notice of construction activities, and install safety signage and temporary crossings to ensure continued access to residences, shops, and public facilities. Contractors will be required to source materials responsibly and avoid dependence on local forest resources. Special attention will be given to vulnerable groups by maintaining access to healthcare facilities, schools, and markets through temporary walkways and crossings where necessary. Further, contingencies will be made to ensure that any construction related damages to property are compensated by the contractors. Moreover, information on grievance mechanisms must be clearly displayed and function effectively to address any grievances from the community members and workers at the site.

Labour-related risks will be managed through implementation of the Labour Management Procedure (LMP), worker codes of conduct, labour camp management provisions, occupational health and safety measures, and worker grievance mechanisms. The SEA/SH Prevention and Response Action Plan will be implemented during construction to address risks related to worker–community interaction. Monitoring of these measures will be carried out as part of ESMP implementation.

6.5.3 OPERATION AND POST-CONSTRUCTION PHASE

Nature of Impacts

No significant adverse social impacts are anticipated during the operation phase. Instead, the improved road infrastructure is expected to generate positive social and economic outcomes for communities along the Sub Project Road. Improved connectivity will enhance access to markets, healthcare facilities, schools, and administrative services. Road safety improvements and better drainage infrastructure will improve mobility and travel reliability, particularly during the monsoon season.

Enhancement and Monitoring Measures

During the operation phase, the focus will be on sustaining project benefits and ensuring road safety. Community awareness programs on road safety and maintenance of road infrastructure will support long-term project sustainability. Improved connectivity is expected to contribute to local economic development, improved service access, and poverty reduction in the project area. Efforts should also be made to ensure non-discriminatory employment practices, particularly in the inclusion of women. Over the long term, the project is expected to contribute positively to poverty reduction and overall community development.

7. STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

This chapter provides an overview of the stakeholder consultations carried out as part of the Environmental and Social Impact Assessments (ESIA) for the proposed Meghalaya Logistics and Connectivity Improvement Project (MLCIP). These consultations were aimed at ensuring a participatory approach to identifying and addressing potential environmental and social impacts associated with the project.

Relevant stakeholders were mapped and can be categorized under three broad categories as shown in below **Table 7.1**.

Table 7.1: List of relevant stakeholders

Category of stakeholder	Type of stakeholder
Project-Affected Parties	• Village community • Street side Shop Owners • Shop owners (NTH) • Road Users • Residential structure owners • Nokma
Interested Parties	**A. Government agencies** ▪ Public Works Department (Roads), Meghalaya (PWD-R) ▪ Garo Hills Autonomous District Council (GHADC) ▪ Meghalaya Forests & Environment Department ▪ Meghalaya State Pollution Control Board (MSPCB) ▪ Meghalaya State Biodiversity Board (MSBB) ▪ Land Records & Revenue Department, Meghalaya ▪ Meghalaya State Disaster Management Authority (MSDMA) ▪ Meghalaya Energy Corporation Limited (MeECL) (for electricity & power supply) ▪ Public Health Engineering (PHE) Department (Water supply & sanitation) ▪ Agriculture Department, Meghalaya ▪ Irrigation Department, Meghalaya ▪ Transport Department, Meghalaya ▪ Urban Affairs Department, Meghalaya (instead of Town Committee) ▪ Health & Family Welfare Department, Meghalaya (including AIDS Control Society functions) ▪ Department of Arts & Culture, Meghalaya (instead of Directorate of Archaeology, Meghalaya) ▪ District Social Welfare Office (East Garo Hills) ▪ District Legal Services Authority ▪ District Child Protection Unit ▪ Office of the Child Development Project Officer ▪ Nokma **B. Civil society organizations: Local NGOs such as** ▪ **Rongjeng Catholic Church**– Engages in education & literacy, rural development, vocational training, child welfare in Rongjeng area ▪ **Ampangdamgre Women's SHG** – Home processing unit: jam, jelly, RTS; skill training by ATMA (Agriculture Training) **Samanda Prapgre Women's Multipurpose Cooperative Society Ltd**– It works primarily

Category of stakeholder	Type of stakeholder
	on micro-savings and credit services, helping members access small loans and reduce dependence on moneylenders. The society also supports women's livelihood activities. **C. Community based Organization** ▪ Bio-Diversity Management Committee
Vulnerable groups	▪ Women Headed Household (WHH), ▪ PAPs falling under Below Poverty Line (BPL), ▪ Scheduled Tribe (ST) categories, ▪ Persons with disabilities

During ESIA, consultations were conducted with representatives from all three categories of stakeholders. The consultations conducted with government agencies, communities, & other organizations with representation from vulnerable groups were undertaken. Special attention was given to engaging with communities from sub-project locations that are likely to experience significant impacts, such as impact on residential and commercial structures, etc.

Representatives from interested parties were consulted to incorporate their concerns and expertise to align the project with broader developmental objectives associated with economic and environmental goals. Key discussions during the consultations were focused on potential displacement, loss of livelihoods, environmental degradation, law & order issues in project area, forest land related issues, irrigation related, structural issues such as Cross Drainage Structures, etc., and related mitigation measures, ensuring that the concerns and suggestions of all stakeholders were documented and considered in project planning. The consultations provided valuable insights into the priorities and concerns of affected local community, helping to shape mitigation measures for minimizing adverse impacts.

Through public participation in consultations, stakeholder's viewpoints and suggestions were captured as an input to the technical design, which were duly considered, and all the suggestions were incorporated in the project design to the extent feasible and /or warranted.

Additionally, **Annexure 7.1** provides a summary of consultations with project-affected parties from local communities and institutional stakeholders from government agencies.

The project has prepared a project level Stakeholder Engagement Plan (SEP) which details out the procedures of stakeholder engagement during the project cycle. The SEP outlines the process, methods and frequency of engagement with various stakeholders and will be accordingly implemented during the project period.

Disclosed Stakeholder Engagement Plan link on MPWD website is

https://megpwd.gov.in/pdf/2026/ESMF/Stakeholder%20Engagement%20Plan%20MLCIP.pdf.

7.1 Public Consultation

Public consultations were a key component of the Environmental and Social Impact Assessment (ESIA) process. These consultations were conducted to ensure that the views, concerns, and suggestions of local communities and other stakeholders were effectively considered in project planning and decision-making. The process was guided by the principles of transparency, inclusiveness, and participation, in line with the requirements of the World Bank's Environmental and Social Standard 10 (ESS10) on Stakeholder Engagement and Information Disclosure. Consultations were organized at different stages of the project to inform stakeholders about the project objectives, potential environmental and social impacts, and proposed mitigation measures, while also providing an opportunity for them to share feedback and local insights. The outcomes of these consultations were incorporated into the project design and environmental and social management plans to enhance the

project's sustainability and community acceptance.

7.1.1 STAKEHOLDER CONSULTATIONS

Stakeholder consultations formed an integral part of the Environmental and Social Impact Assessment (ESIA) process. These consultations were carried out to ensure that the perspectives, concerns, and expectations of all relevant stakeholders particularly the project-affected persons, IPs, and vulnerable groups were effectively captured and integrated into project planning and decision-making.

The details of consultations along the project road is presented in **Table 7.2**.

Table 7.2: Summary of consultations

Stakeholders	Dates of Consultation	No of Participants	Summary of Key Feedback
Divisional Forest Officer (DFO), East & North Garo Hills	21 August 2025	4 nos	Road alignment passes through community forests and elephant routes; habitat/clearance concerns.
PCCF, Shillong	28 August 2025	4 nos	Reserve Forest intersect; governance/dependence.
Local residents 6 meaningful consultations	21 August 2025- Kusimkolgre 21 August 2025- Dawa Chipitgre 2 September Nengkhra Bazar & Dobetkolgre 5 September,2025 at Ampangdamgre and Upper Rongreng Baiza (Abagre)	Kusimkolgre (7 male), Dawa Chipitgre (2 Male and 6 Female), Nengkhra Bazar (13 Male, 2 Female) , Dobetkolgre (9 male , 4 Female) , Ampangdamgre (8 Male and 6 Female) Upper Rongreng Baiza (Abagre) (2 Male and 2 Female)	• Participants raised concerns about the ongoing streetlight problem, emphasizing the need for better illumination for safety. • The current road conditions are poor and not smooth, which impacts accessibility and transportation.
Youth Groups	18 & 25 September 2025	15 Nos (Male –10 Female – 5)	Limited skill/jobs; risky migration; want entrepreneurship & better goods/service connectivity.
Women FGD	23 September & 10 October 2025	10 Nos	Low skill access; norms restrict mobility/work; no childcare; poor scheme awareness; keen on cooperatives & local enterprise.
Consultations held during FPIC for Priority Projects			
Community Members &	11 & 23 September, 10		**Major key Agreements:**

Stakeholders	Dates of Consultation	No of Participants	Summary of Key Feedback
Project Affected Households & Families	October, and 10 December 2025	4 Consultations 139 Nos (Male – 104 Female – 35)	• Improvement of the existing road to Intermediate Lane with provision of safety measures, drainage, and protection works in habitation and market areas, subject to technical feasibility. • Construction of passenger waiting sheds at specific village locations • Construction of drains cum footpath near settlement areas etc. • Construction of separate toilets for males and females • Construction of Spring water Collection Tank

7.1.2 FPIC PROCESS

As per the requirements of the World Bank's Environmental and Social Standard 7 (ESS7), Free, Prior, and Informed Consent (FPIC) is required where project activities affect lands and natural resources traditionally owned or used by Indigenous Peoples, result in their relocation, or have significant impacts on their cultural heritage. For the proposed Rongrenggre-Simsanggre-Nengkhra (RSN) Road sub-project, FPIC was triggered under the first condition, as the intervention involves the use of land and natural resources traditionally used by Indigenous communities, including vegetated community land. Accordingly, a structured FPIC process was undertaken to ensure culturally appropriate engagement with Indigenous communities and their traditional institutions, including Nokmas, village councils, and community representatives. Consultations were conducted in the local Garo language using accessible formats and covered key aspects of the project such as alignment, design, anticipated environmental and social impacts, and proposed mitigation measures, with particular attention to land use, vegetated community land, water sources, livelihoods, and community assets.

The FPIC process was carried out in a phased and participatory manner through multiple rounds of consultations, allowing adequate time for internal deliberations in accordance with customary decision-making systems. The process ensured inclusive participation of women, youth, and vulnerable groups, and was undertaken in good faith, free of coercion or external influence. The outcomes reflect broad community support for the RSN sub-project, subject to agreed mitigation measures and design considerations, which have been incorporated into the project design. These measures, along with the detailed record of the FPIC process and continued engagement framework, are presented in the Indigenous Peoples Development Plan (IPDP) prepared specifically for the RSN sub-project.

Documentation of the FPIC process, including signed minutes of meetings and attendance records endorsed by Community Leaders, is provided in the Indigenous Peoples Development Plan (IPDP) prepared for the RSN sub-project.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT, MONITORING AND REPORTING PROGRAMME

8.1 GENERAL

Monitoring and reporting are critical components in the implementation of the project. Monitoring involves periodic checks to determine whether activities are being carried out in accordance with the proposed mitigation plans. It provides essential feedback to project management, helping ensure that project objectives are achieved on schedule. The reporting system ensures that environmental and social mitigation measures are implemented as planned. Together, monitoring and reporting support the proper implementation of the Environmental and Social Management Plan (ESMP).

The broad objectives of monitoring and reporting on E&S management are:

- To evaluate the performance of mitigation measures proposed in the ESMP and in other mitigation plans.
- To evaluate the adequacy of environmental and social assessment.
- To suggest improvements in ESMP and other mitigation plans based on the monitoring and to devise fresh monitoring based on the improved ESMP.
- To enhance environmental quality and social development through proper implementation of suggested mitigation measures.
- To meet the requirements of the existing environmental and social regulatory framework and community obligations.

8.2 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) has been prepared in accordance with the World Bank's Environmental and Social Framework (ESF) to ensure that the potential environmental and social impacts identified during the assessment are effectively managed during the design, construction, and operation phases of the project. The ESMP outlines specific mitigation, enhancement, and monitoring measures; defines institutional responsibilities; and provides a framework for capacity building and reporting. It serves as a practical tool to guide the implementation of mitigation measures, ensuring compliance with applicable national regulations and the World Bank's Environmental and Social Standards (ESSs), while promoting sustainable and inclusive project outcomes.

Table 8.1: Environment and Social Management Plan

Sl. No.	Activity	Environment and Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
PRE-CONSTRUCTION							
1	Consents/ Permits/ Approvals/ Compliances	Regulatory Compliance	Non-compliance to various Environmental/ social/ regulatory requirements pertaining to the proposed project could lead to legal Implications	➢ Obtain all necessary statutory clearances (CTE, CTO, Labour License, Fire NOC, Tree Cutting Permission, and Hazardous Waste Authorization etc.) ➢ Obtain necessary insurance and indemnities as specified in the Contract Agreement or a necessitated by law. ➢ The CSC will not allow any construction activity without these being completed ➢ Renew permits before expiry. ➢ The conditions mentioned in the permit need to be maintained. ➢ Reports and Returns need to provide.	Contractor/ MPWD	CTE, CTO, Labour License, Fire NOC, Tree Cutting Permission Insurance and indemnities to be submitted and tracked	MPWD/PMC/CSC

2	Land Procurement	Asset and Livelihood	Loss of Land/ Livelihoods	➢ RPF and RAP shall be followed MPWD division, Village Council and concerned authorities shall coordinate implementation. Compensation records shall be maintained; grievances resolved. Civil works shall commence only after written confirmation from PMU/MPWD that RAP compensation, assistance, and site handover have been completed for the relevant stretch.	MPWD division, Village Council and concerned authorities	Compensation records maintained; Grievances resolved	MPWD/CSC/NGO
3	Preparation of Works Methodology Contractor's ESMP (CESMP)		Inadequate preparation and implementation of CESMP by Contractor can leave environmental and social issues unattended	➢ The contractor needs to follow the project ESMP to formulate the CESMP aligned with its work methodology. ➢ The CESMP shall be submitted with the Work Plan and Method Statement. ➢ The CSC shall review it and provide one set of consolidate comments within 15 days and the plan shall be approved once these are compiled to by the Contractor. The Work Plan and Method Statement will be approved by MPWD only when the CESMP, Traffic Management Plan, OHS Plan is prepared and approved by the CSC.	Contractor	Approved CESMP including TMP, LMP and other relevant plans, and implemented;	MPWD/PMC/CSC
4	Identification of land for material storage yard/	Land use and ecology	Discharges from Yards/ Camps to pollute the surroundings and	➢ Contractor needs to identify suitable land for storage yard/ construction camp/ labour camp	Contractor	Approved site location; Lease/NOC copies;	MPWD/PMC/CSC

	construction camp/ labour camp		lead to social tension.	➢ The land shall not be closer to the water bodies, waterlogged areas or wetlands. ➢ The land will be handed back to the owner in the same condition as it was prior to the commencement of project activities, once the project is completed. ➢ Contractor to produce the lease agreements, NOC etc. for these lands. ➢ Avoid construction camps and material storage near streams or unclassed forest on community land, flood plain, encroachment into natural habitats. ➢ Restrict vegetation clearing to the minimum area required for works. ➢ Maintain a buffer of at least 100 m from natural drainage channels or water bodies. ➢ Implement soil erosion control measures (silt fencing, sediment traps, and slope turfing). ➢ Prohibit hunting, fishing, or collection of forest produce by workers. ➢ Awareness and sensitization of labourers on local wildlife and birds. ➢ The guidance for the preparation, construction and operation of the labour camp shall comply with the			

				World Bank Group10 Guidance on Labour Accommodation ➢ No construction camp, material storage area, will be setup 100 m on both sides from the reserve forest (0+000 to 6+200).			
5	Supply of Construction Material	Physiography	Sourcing materials from unauthorized sources.	➢ The Contractor will submit the EC, CTE, CTO of the aggregate and sand quarry to the PMU for the approval at the beginning of the project. ➢ Procurement of construction material only from approved quarries and sites and licensed/ authorized vendors/ manufacturers. ➢ Contractor to produce approvals and receipts of the payment of royalty for all the material procured along with the bill .	Contractor	EC, Permits, challans, Material source approval copies;	MPWD/CSC
6	Water	Groundwater and Surface Water	Abstraction and Pollution of surface and groundwater sources.	➢ The Contractor will be responsible for arranging adequate supply of water for the entire construction period. ➢ In case of own borewell the Contractor shall obtain a permission of abstraction form CGWB/ SWID. ➢ He shall arrange for a meter to be fixed at the borewell and the log of the water extracted will be maintained.	Contractor	Permission for Water source; Usage records; Wastewater management measures	MPWD/PMC/CSC

10 Workers' accommodation: processes and standards

				➢ Measures suggested in the permission will also be maintained ➢ The contractor will minimize the pollution and wastage of water during construction. The labour camp shall be provided with adequate number of toilets as specified in BOCW Act/ WBG Guidance on Labour accommodations. The toilets have to be provided with soak pits, septic tank or be linked to a mobile treatment unit. Bio-toilets can also be considered as an option ➢ The Construction Camp, Construction material storage yard will be providing with peripheral drain which shall be linked to a sedimentation tank. ➢ The vehicle repair area , oil storage area shall be impervious , the runoff form these areas shall be sent to a drain and the same is connected to an oil water separator of adequate capacity			
7	Appointment of Environment, Social and Safety Officers		Inefficient and incompetent supervision by contractors may lead to negative impacts on environment, Social, health and safety.	➢ The contractor will appoint qualified and experienced Environment. Social and Safety personnel to ensure implementation of CESMP and occupational health and safety issues at the camps and construction work sites.	Contractor	To be mobilized before construction; approved OHS plan	MPWD/PMC/CSC

				➢ The Environmental Officer along with the other key members of the team shall be responsible for the preparation of the Plans and also obtaining the statutory permits.			
8	Identification of OHS Hazard and Risk Categorization	Occupational Health & Safety	May cause physical harm, injury, illness, or death to workers.	➢ Develop a site-specific Hazard Identification and Risk Assessment (HIRA) and develop mitigation measures. The Contractor shall prepare an OHS Plan containing the HIRA and submit it as part of the Work Plan and Methodology. The Work Plan shall be approved only when the OHS Plan is satisfactory. ➢ Arrange for PPE (helmets, safety shoes, high-visibility vests, gloves) to all workers. ➢ Develop tie up with local Hospital/ PHCs/ CHCs for Health Checkups of labours and also to handle to any accident cases. ➢ Ensure proper sanitation, adequate potable water (minimum 5 litres per person per day), and waste disposal facilities in camps. ➢ Consulting with workers to identify hazards that may not be obvious to employers or safety professionals. ➢ Reviewing safety data sheets (SDSs) to collect information about the hazards of chemicals and other substances used in the workplace.	Contractor	OHS hazard register; Inspection reports;	MPWD/PMC/CSC

9	Other Construction Vehicles, Equipment and Machinery	Pollution Management	Vehicles and equipment not complying with regulations may lead to pollution of environment.	➢ The contractor will maintain records of fitness and Pollution Under Control (PUC) certificates for all vehicles and generators used during the contract period. This certification shall be renewed and always maintained. The certificate shall be submitted with the bill (if necessary) ➢ All lifting should have the appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144. ➢ Engage trained personnel for operating machinery and working at height or confined spaces. ➢ Crushers, hot-mix and batching plants shall be located at least 1000m (1km) away from residential/ settlements, forests, wildlife movement areas, and commercial establishments, preferably in the downwind direction. ➢ The crushers, batching plant and all other equipment shall meet the specification which are likely to be mentioned by MSPCB in the consent.	Contractor	Records of valid PUC / fitness; Inspection log	MPWD/PMC/CSC

10	Tree Cutting	Ecology	Loss of green cover and biodiversity	➢ Maximum efforts shall be made to minimize the number of trees to be felled. ➢ The requirement or specifics to fell trees shall be notified to the Forest Department in advance. ➢ Tree felling shall only be carried out when permission has been obtained from the Forest Department. ➢ Tree cutting and disposal shall be done as per the Forest Dept.	Contractor	Records of trees cut and saved.	MPWD/CSC
11	Joint field verification	Community Engagement	The impacts may not have been identified in time.	➢ The MPWD and the Contractor shall carry out joint field verification to ascertain the local complaints/suggestions and to confirm the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the ESMP. ➢ Contractor shall provide advance notice to communities and village councils prior to road closures, diversions, or major construction activities. ➢ The MPWD shall maintain proper documentation and justifications/reasons in all such cases.	Contractor	Verification reports;	MPWD
12	Identification of Borrow	Damage to existing eco-	Indiscriminate borrowing activities	➢ Borrow area should be located at a minimum distance of 300m from	Contractor	Borrow area EC copy; Approved	MPWD /CSC

	Area	system due to borrowing activities	may damage the eco-system and lead to unproductive environment	the residential/ settlement area. Preferably, non-agricultural land and barren lands shall be used. Proper barricading should be provided and access to the borrow areas should be restricted to the unauthorized persons. ➢ The Contractor will have to obtain the Environmental Clearance for borrow areas. ➢ The borrow area will be operated as per the MoEFCC guidelines11 issued by the concerned SEAC and SEIAA.		management and closure plan	
13	Identification of construction material transportation route	Community Health and Safety	The safety aspects like (i) safety of road users including pedestrians and cyclists (ii) safety of cattle; (iii) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the construction stage. Children are	➢ Plants and equipment will be installed sufficiently away from the settlements. ➢ Proper caution signage, barricading, delineators, lightings etc. will be installed at construction zone and temporary diversions. ➢ Hard barricading will be provided at construction zone near habitation area and public roads, and the same will be maintained throughout the construction period. ➢ Proper traffic management will be ensured near roads of the Construction zone. ➢ Road safety education will be imparted to drivers running	Contractor	Approved route plan; Community consultation record	MPWD/CSC

11 https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/1001_19032025024958.pdf

			most vulnerable to injury due to vehicular accidents.	construction vehicles. In case of negligent driving, suitable action will be taken. ➢ Speed restrictions shall be imposed on project vehicles to control speeding. ➢ Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations. ➢ The general public/ residents shall not be allowed to any of the risk areas of the project, e.g., excavation sites, construction sites and areas where heavy equipment is in operation. ➢ In the consideration of risk at civil works, each labour should be covered under ECA 1923 insurance until completion of work. ➢ Contractor shall maintain continuous access to residences, shops, agricultural land, and community facilities during construction. ➢ Temporary walkways or alternate access routes shall be provided where needed. ➢ Special attention shall be given to safety of children, elderly persons,			

				and persons with disabilities near work zones.			
14	Identification of sites for debris disposal or wastes generated from construction camps and site offices	Land and Water environment	Pollution due to indiscriminate dumping of wastes. Wastes entering water bodies and groundwater causing pollution	➢ MPWD Division and the Contractor are responsible for identifying a suitable area in consultation with local administration to dispose of the wastes from labour camps, construction sites and site offices. ➢ The locations of dumping sites should be selected with following considerations i) Unproductive/wastelands preferred , ii) away from residential areas (at least 1km downwind side), iii) are not designed forest or other eco-sensitive areas, Iv) do not affect natural drainage courses , v) no endangered/rare flora is impacted vi) are not lowlands, natural depressions which are natural sinks ➢ Drainage channels should not be used for dumping ➢ Local Authorities should be consulted about the location of debris disposal sites before finalizing the locations. ➢ The topsoil of 15cm shall be removed before any works are carried out Reuse topsoil for slope stabilization and landscaping. ➢ Dispose of debris only at approved low-lying barren areas located at least 1 km downwind of	Contractor	Approved disposal site and its management plan; NOC, Agreement with landowner; Waste disposal records;	MPWD/CSC

				settlements and away from drainage channels. ➢ Avoid dumping in water bodies, wetlands, or near agricultural fields. ➢ Regularly monitor disposal sites to prevent contamination and visual pollution.			
15	Relocation of Utility and Common Property Resources (CPR)	Utility Service	Loss of services from utilities and common property resources for the public	➢ When the utilities/ Common Property Resources need to be shifted, they will be shifted in consultation with the communities and with least inconvenience to the public. ➢ If any displacement of Utility/CPRs is required, they will be relocated with prior approval of the concerned agencies. The relocation site identification will be in accordance with the choice of the community. ➢ Restrict utility shifting to daytime hours to avoid safety risks at night. ➢ The scheduling of the construction works will be shared with the line department (MePDCL, PHE and Telecom Departments) for ensuring uninterrupted services during construction. ➢ Provision of utility ducts for underground pipelines shall be incorporated into the design to ensure safe and organized routing of essential services, minimize	Contractor/ Divisional offices of MPWD	Records of Relocation completion.	MPWD/ PMC/CSC

				future excavation, and facilitate maintenance without disrupting road infrastructure			
16	Planning for Worksite and Work Zone Safety	Community Health and Safety	Accidents and inconvenience to communities	➢ Make arrangement for New Jersey barriers/ Water filled barrier, MS steel barricades (2 m high), signage, and warning lamps at work sites. ➢ Prepare a Generic Community Health and Safety Plan (CHS Plan) along with the Work Methodology and Work Plan. The Work Plan should not be approved without an approved CHS Plan. ➢ Schedule high-risk activities during off-peak hours to minimize traffic congestion. ➢ Develop posters for Community Awareness. Conduct community awareness campaigns before any temporary road closure or service disruption. ➢ Every RFI should be accompanied with a site specific OHS, CHS and Traffic Safety Plan, which should define the site-specific measures which were implemented. Without these plans being implemented the works should not be approved.	Contractor	Community Health Safety Plan	MPWD/PMU
		➢ CONSTRUCTION					
1	Crushers, Hot mix Plants & Batching Plants	Air Pollution	Impacts due to establishment and operation of plants and equipment	➢ The Contractor shall submit a detailed layout plan for all such sites and seek prior approval before entering into a formal agreement	Contractor	Approved layout plan; Valid NOCs/Consents; Dust suppression	MPWD/PMC/CSC

				with a landowner for setting-up such sites. ➢ Specifications of crushers, hot mix plants, and batching plants shall comply with the technical requirements of the contract and prior Consent / NOC for all such plants shall be obtained. ➢ No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority ➢ The emission has to be monitored asper the monitoring plan specified in the ESIA Report. ➢ The plant has to be maintained as per the specification of the manufacturer. A log of the maintenance should also be maintained by the Contractor.		records; Air quality monitoring reports	
2	Operation of Borrow Areas	Topsoil and land	Impacts due to improper operation and closing of borrow areas	➢ Borrow areas shall be selected as specified in the guidance in The Contractor should submit the EC, a copy of agreement with the landowner, borrow area management and closure plan before initiating any kind of borrowing activities. ➢ The Borrow are should comply with the conditions set in the EC/ SoP from MoEFCC.	Contractor	EC and lease copies; Approved Borrow area restoration and Closure plan	MPWD/PMC/CSC

				➢ Topsoil up to a depth of 150 mm from all areas of cutting, filling, and temporary construction zones, shall be stripped and preserved as indicated in the MoEFCC SoP / MoRTH Orange Book: Specification for Road and Bridge Works; ➢ Topsoil will be stored separately in designated stockpiles with proper slope protection and sediment barriers to prevent erosion; ➢ Reuse stored topsoil for median greening, roadside plantation, and slope turfing after construction; and ➢ Prohibit disposal of topsoil at dumping sites.			
3	Operation of Quarries	Physiography and Geology	Impacts due to improper management, operation and closing of quarries	➢ The Contractor shall only source material from quarries approved by PMU(indicated in the Pre-Construction stage) ➢ The challans for the royalty paid against the material used shall be included in the Bills submitted for payments. ➢ In case of new quarry for the project the Contractor has to obtain EC and other relevant permits and licenses. ➢ Inca se of Blasting , A Blasting Management Plan shall be prepared in addition to the Blasting Permit,	Contractor	Quarry permit, EC; Safety inspection report; Haul Road maintenance record, dust suppression measure, geotagged photos	MPWD/PMC/CSC

				➢ No quarry or associated plants can be set-up within 1000m from the residential/ settlement locations ➢ Contractor shall prepare a haul road network for quarry transport and ensure the suitability of such haul roads from the safety of residents, biodiversity and other environment points of views.			
4	Dismantling of Bridges/ Culverts/ Structures, Hill Cutting	Land use and Land quality	Impacts due to improper dismantling and disposal	➢ All necessary precautions shall be taken while working near cross-drainage channels, to prevent earthwork, stonework, construction materials from obstructing cross-drainage at rivers, streams, and drainage systems, or from causing flooding. ➢ Any material which has spilled into the river/ drainage channel or road shall be removed by end of day. ➢ In case of hill cutting if any debris cannot be removed by end of day the and shall be demarcated with, crash barrier and traffic safety beacons. However, such sites cannot be left for more than 2 days. ➢ Reusable materials (e.g., steel, stones, and bricks) shall be segregated and stored properly for reuse or recycling. ➢ Non-recyclable debris and waste materials shall be transported to approved disposal sites identified	Contractor	Debris disposal/reuse records; Approved Site restoration plan; Photographic documentation.	MPWD/PMC/CSC

				and approved by the concerned authority. ➢ Dampen stockpiles and vehicle loads, cover trucks during transport, and restrict demolition/dismantling operations during high-wind conditions. ➢ Only sites which have been approved by the PMU/PMC/CSC shall be used for dumping. ➢ Temporary barriers or silt fences shall be provided to prevent debris from entering watercourses. ➢ Dumping will be done in compacted layers (≤1 m thick) with retaining walls, catch and chute drains, and slopes maintained within the natural angle of repose (30°–35°). ➢ Each site will be protected with toe walls of adequate height, sediment traps, and vegetative cover for stabilization. ➢ The contractor shall operate only at approved locations under supervision and maintain the site until full rehabilitation is achieved. ➢ The site should incorporate proper retaining structures, such as toe walls and catch drains, to prevent sliding and erosion. ➢ Adequate drainage must be provided through surface and subsurface channels to control			

				runoff. Temporary barriers or silt fences shall be provided to prevent debris from entering watercourses. ➢ Muck should be deposited in layers, compacted, and stabilized using vegetation or geo-textiles to minimize dust and erosion. ➢ Access roads should be provided to ensure safe transport of muck, and the site should be fenced and clearly demarcated. ➢ Upon completion, the associated disposal sites shall be restored to their original condition or as directed by the Engineer			
5	Road scraping and dismantling	Bituminous waste disposal	Impacts due to hazardous wastes	➢ The contractor shall maintain records of quantities generated, transported, and disposed of, along with details of the disposal site and approvals obtained. ➢ Bituminous waste shall be collected and stored temporarily in impermeable, lined containers or areas to prevent leaching or contamination of soil and groundwater. ➢ Scrapped Bituminous Material shall be reused in asphalt mix design/ sub base, strengthening of shoulders as directed by CSC on other lower order roads ➢ The disposal of bituminous wastes shall be carried out by the	Contractor	Records of Waste reused/disposed; Details of approved disposal site; Photographic documentation.	MPWD/PMC/CSC

				Contractor at secure landfill sites approved by the concerned government authorities. ➢ No bituminous waste shall be disposed of in water bodies, open lands, agricultural fields, or along the roadside ➢ Periodic inspections shall be carried out to ensure compliance with waste management guidelines.			
6	Storage of Fuel and Repair of vehicles	Soil pollution due to Oil and fuel spills from construction equipment and plants or storage of Hazardous waste.	Contamination of Soil	➢ Construction plants, workshops, and fuel storage areas shall be located at least 500 m away from any surface water body and environmentally sensitive locations. ➢ Oil interceptors shall be installed at construction camps, vehicle parking, and washing areas to trap oil and grease before wastewater is discharged. ➢ All fuel and lubricant storage tanks shall be placed on impermeable platforms or within bunded (contained) areas. ➢ The Storage area should be covered and have restricted access ➢ The area should be bunded to contain 110% of the capacity of storage. ➢ The area should be provided with ABC type fire extinguishers as per the IS codes (IS 1641, IS 1642 and IS 1643, etc)	Contractor	Spill log; Waste oil disposal records; Fuel storage inspection record. Photographic documentation.	MPWD/PMC/CSC

				➢ Transfer of fuel by decantation is prohibited, Fuel Pump (manual or electric)should be used ➢ Regular maintenance and inspection of construction equipment and vehicles shall be carried out to prevent leakage of oil, fuel, or hydraulic fluids. ➢ Spill control kits (absorbent pads, sand, and containment booms) shall be available at all fuel storage and handling locations. ➢ Records of fuel usage, storage, and waste oil disposal shall be maintained and made available for inspection. ➢ Storm water runoff from fuel and equipment storage areas shall be directed through oil-water separators before discharge.			
7	Operation of Plant, Machinery and equipment	Generation of Hazardous Waste	Contamination of land and soil	➢ Used oil and lubricants shall be collected, stored in labelled, leak-proof containers, and handed over only to authorized aggregators/recyclers for disposal in compliance with applicable hazardous waste regulations. ➢ Records of waste oil generation and disposal shall be maintained and made available for inspection. ➢ Returns shall be submitted to comply with the Hazardous Waste Permit.	Contractor	Hazardous waste permits, records and returns	PMC/CSC

8	Operation of Vehicles and earthwork during construction	Air Pollution - Dust Generation	Dust generation will cause air pollution and will have impacts on health and safety.	➢ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ➢ Water should be sprinkled regularly (3 time a day) on the work sites. ➢ Plying of vehicle on unpaved surface should be prohibited. ➢ Speed limits shall be enforced for construction vehicles within and near project sites to reduce dust generation. ➢ Personal protective equipment (PPE) such as masks shall be provided to all workers exposed to dusty environments. ➢ Air quality monitoring shall be conducted periodically to ensure compliance with prescribed air quality standards. ➢ Community complaints related to dust shall be recorded, and addressed promptly. ➢ The Contractor should keep a records of community grievances due to dust, runoff separately and mitigations adopted.	Contractor	Air quality monitoring reports; Dust suppression log; PPE compliance records	MPWD/PMC/CSC
9	Operation of Vehicles, plant, and machinery	Emissions	The emissions from vehicles and construction equipment will pollute the air causing health and safety issues as well.	➢ Fitness and PUC of the vehicles and equipment's need to be ensured. ➢ Maintain all equipment and vehicles regularly; prohibit use of old or poorly maintained machinery; use low-sulphur fuel	Contractor	Valid PUC certificates; Equipment maintenance log; Emission test results	MPWD/PMC/CSC

				➢ Dust extraction, collection and control systems shall be installed at batching plants, crushers, and material handling areas to minimize particulate emissions ➢ Ensure all machinery meets CPCB emission norms/ MoRTH emission standards (GSR 144); prohibit idling of vehicles; schedule material transport to avoid congestion.			
10	Operation of construction Camp and construction activities	Contamination of Surface / Ground Water	Discharges from construction activities and construction camps/ labour will lead to surface/groundwater pollution.	➢ All the debris resulting from construction activities and labour camp shall be removed from the site and disposed at approved sites (by CSC/ PMC/ PMU) away from water bodies, on a regular basis to prevent them from getting into surface runoff. ➢ The Contractor shall maintain the sanitation facility in good conditions. Covered and enclosed facility shall be provided for washing and bathing. ➢ The sanitation facility and waste management facility to be shall be maintained in construction camp. ➢ Construction labours should be restricted from polluting the water sources or misusing the sources. ➢ Minimize the use of bentonite slurry during piling works and prefer biodegradable materials wherever feasible.	Contractor	Water quality monitoring report; Waste disposal records; Camp inspection records. Photographic documentation.	MPWD/PMC/CSC

				➢ All piling slurry shall be managed in a closed containment system and shall not be allowed to enter water bodies, drains, or surrounding soil. ➢ Residual slurry shall be disposed of only in designated lined pits/approved sites; disposal near agricultural land and natural drainage channels shall be prohibited.			
11	Operation of construction equipment, DG sets, and labour camps during construction	Deterioration of Air Quality	Emission	➢ LPG shall be used as fuel for cooking of food at construction labour camp instead of fuel wood. ➢ DG sets should meet the specification mentioned by CPCB from time to time			
12	Sourcing Water for project	Surface Water resources	Over extraction or exploitation of ground/surface water will lead to water scarcity.	➢ Contractor to ensure optimum and judicious use of water; ➢ The Contractor shall install and keep the water meter running at the point of extraction, main consumption areas. A log of water abstraction and ➢ Discourage labour from wastage of water and applicable prior approvals shall be obtained from concerned authorities. ➢ Rainwater harvesting structures shall be installed at construction camps and plant sites to promote sustainable use of water.	Contractor	Water consumption log; Permission for water source; Installation of Rainwater harvesting structure	MPWD/PMC/CSC

				➢ Awareness programs shall be conducted for labourers and staff on responsible water use and conservation practices. ➢ Records of daily water consumption shall be maintained as part of regular reporting.			
13	Coffer dam to make dry working space for bridge work	Water Environment and Aquatic Habitat	Change in the flow pattern and quality of water, effect on local habitat	➢ Selecting the right location for the cofferdam to minimize its impact on the environment. ➢ Using environmentally friendly materials to construct the cofferdam eg. Biodegradable/ reusable materials can be used instead of concrete. ➢ Restoring the environment after construction. This may involve replanting vegetation and removing any debris.	Contractor	Worksite inspection record; Restoration completion record	MPWD/PMC/CSC
14	Operation of Vehicle, Plant and Machinery	Noise	Noise from construction vehicles, plant and equipment will lead to noise pollution and cause health and safety issues	➢ Staging of construction equipment and unnecessary idling of machinery within noise-sensitive areas shall be avoided wherever possible. ➢ All plants and equipment used in construction (including third-party units) must conform to MoEFCC/CPCB noise standards. ➢ All vehicles and equipment used in construction shall be fitted with effective exhaust silencers. ➢ Servicing of all construction vehicles and machinery shall be done	Contractor	Noise level test report; PPE usage record; Complaint register; vehicles, plants and equipment maintenance records.	MPWD/PMC/CSC

				regularly; during routine servicing, the effectiveness of exhaust silencers shall be checked and replaced if defective. ➢ Construction activities shall be restricted to daytime hours (6 AM–10 PM). Night-time work may be carried out only in emergencies, following all prescribed mitigation measures for night operations. ➢ Unnecessary honking at construction sites shall be strictly prohibited. ➢ Temporary barricading shall be installed around active construction zones, especially near settlements, schools, or hospitals, to minimize noise propagation. ➢ Noise monitoring shall be carried out at construction sites as per the approved monitoring schedule, and results shall be submitted to the Project Management Consultant (PMC) and Project Management Unit (PMU) for review and compliance verification.			
15	Operation of DG Sets	Noise and Air	Noise	➢ The contractor must use silent DG sets as prescribed by the Central Pollution Control Board (CPCB). ➢ Each DG set shall be provided with a proper exhaust muffler to further reduce noise emissions.			

				➢ The DG set shall be properly sited to minimize its noise impact beyond the premises, ensuring compliance with ambient noise standards at the nearest receptor. ➢ A routine and preventive maintenance schedule shall be prepared and followed in consultation with the DG set manufacturer to ensure that noise levels do not deteriorate with use.			
16	Blasting of rocks (if required)	Blasting	Unmanaged blasting result in health and safety issues and accidents.	➢ The Contractor will inform well in advance the PMU of the requirement for blasting. ➢ He will have to obtain all required Statutory permission as is required from all Government Authorities, public bodies and private parties; ➢ The Blasting Management Plan shall be prepared by the Contractor and reviewed by the CSC and approved by PMC/PMU. ➢ The Blasting permits shall be reviewed by the PMU. Blasting will be carried out only with permission of Engineer-in-charge. ➢ All the statutory laws and regulations, rules etc., pertaining to acquisition, transport, storage, handling, and use of explosives will be strictly followed.	Contractor	Approved Blasting management Plan; Blasting permission; Incident log. Geotagged photos.	MPWD/PMC/CSC

				➢ The CSC shall maintain oversight of the implementation of the Blasting Management Plan.			
17	Tree Felling	Loss of trees and Plantation works	Cutting of trees can lead to loss of biodiversity.	➢ No tree felling should be carried out without permission of the Forest Department, GoM. ➢ Clearing and uprooting should be avoided beyond that which is directly required for construction activities. ➢ Kerosene / LPG should be preferably used to avoid felling of the trees or provide community kitchen for the labour camps for cooking. ➢ Camps and storage yards shall be located in the areas already devoid of vegetation or having little vegetation ➢ Compensatory Afforestation 1: 10 would be carried out by the Contractor. As indicated in the ESMF an app-based monitoring of the plantation would be carried out.	Contractor	Tree felling register; Plantation record;	MPWD/PMC/CSC
18	Removal of Vegetation	Terrestrial Flora and Fauna	Construction activities and workers may cause harm to flora and fauna.	➢ All the workers will need to be oriented and monitored by the contractor so as not to cause any harm to the flora and fauna. ➢ Hunting and fuel wood collection will be strictly prohibited	Contractor	Worker awareness attendance; Wildlife sighting log	MPWD/PMC/CSC
19	Discharges from Construction	Aquatic Fauna	Construction activities and workers may cause	➢ Disposal of construction material or debris into rivers or streams will be strictly prohibited.	Contractor	Work timing records; Site inspection	MPWD/PMC/CSC

			harm to fauna.	➢ Regular monitoring of water quality will be conducted to ensure compliance with environmental standards ➢ Any works affecting aquatic habitat will be done during low flow (when water depth is less than 5 m) and when banks would be dry. ➢ Where any GI wire mesh gabions are used; all GI wire ends need to be folded inside. ➢ Ensure that no construction activities will be carried out during monsoon and the fish breeding season.		checklist	
20	Construction Activities	Occupational Health and Safety	When Occupational Health and Safety are compromised the associated risks from accidents and incidents could affect health and safety of the workers and others on constriction/ project sites. Improper first aid facilities on the sites could affect health and safety of workers and others.	➢ The Contractor would prepare OHS plan and other required plans as per the WBs guidelines. ➢ All the labourers to be engaged for construction works shall be screened for health and adequately treated before issue of work permits. ➢ Periodic health check-up of construction workers. ➢ Prevention of mosquito breeding need to be ensured at the project site and other ancillary areas ➢ The contractor's Environment and Safety personnels, shall ensure implementation of CESMP including Occupational health and safety	Contractor	Approved OHS plan; OHS training log; PPE checklist; Awareness programme and Health inspection reports	MPWD/PMC/CSC

				issues at the camp, construction work sites ➢ All workers and staff should be provided with Personal Protective Equipment (PPE) appropriate to their job on-site and their use shall be ensured. ➢ All construction sites should be barricaded properly. ➢ Smoking should be prohibited near areas of fire or explosion risk. ➢ Sufficient supply of potable water should be ensured for all workers and employees on-site. ➢ Ensure a First Aid room at the camp and first aid kits are available in all work areas. ➢ Safe working techniques will be followed up and all the workers will be trained. ➢ An Emergency Response system in case of any incidence will be developed and implemented. ➢ The Contractor will conduct awareness programmes on EHS, HIV/AIDS and other sexually transmitted diseases for workers at least once in a quarter and the record of such training programme must be recorded. ➢ Conduct regular safety audits on safety measures adopted during construction.			

21	Community Health and Safety	Community Safety	The safety aspects like (i) safety of road users including pedestrians and cyclists (ii) safety of cattle; (iii) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the construction stage. Children are most vulnerable to injury due to vehicular accidents.	➢ Plants and equipment will be installed sufficiently away from the settlements. ➢ Proper caution signage, barricading, delineators, lightings etc. will be installed at construction zone and temporary diversions. ➢ Hard barricading will be provided at construction zone near habitation area and public roads, and the same will be maintained throughout the construction period. ➢ Proper traffic management will be ensured near roads of the Construction zone. ➢ Road safety education will be imparted to drivers running construction vehicles. In case of negligent driving, suitable action will be taken. ➢ Speed restrictions shall be imposed on project vehicles to control speeding. ➢ Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations. ➢ The general public/ residents shall not be allowed to any of the risk areas of the project, e.g., excavation sites, construction sites and areas	Contractor	Safety signage installed; Community complaint register; Traffic control records	MPWD/PMC/CSC

				where heavy equipment is in operation. ➢ In the consideration of risk at civil works, each labour should be covered under ECA 1923 insurance until completion of work.			
22	Emergency Response system	Emergency Response system	Absence may result to increased incidents, injury, economic loss etc.	➢ Develop and implement ERS ➢ Train personnel and Establish communication channels ➢ Systematic planning and training for emergencies.	Contractor	Approved ERP; Emergency drill and training report; Incident response record	MPWD/PMC/CSC
23	Health Management	Health Management – Communicable Diseases	The water fringe areas provide suitable habitats for the growth of vectors of various diseases, which is likely to increase the incidence of water-borne diseases.	➢ There would be possibility of the transmission of communicable diseases due to migration of labour population from other areas at the construction site. ➢ Agreement shall be made with nearby health centre or hospital for emergency treatment. ➢ Special Measures for COVID 19 should be strictly followed at the camp and construction site.	Contractor	Health screening record; Awareness session log; Medical report; Agreement with nearby hospital	MPWD/PMC/CSC
24	Risk of Natural Hazards	Risk of Natural Hazards	The project area is at risk from floods and Earthquakes.	➢ Protection of Agriculture Land near roads/ bridges. ➢ The mitigation measures should be adopted as per norms of State Disaster Management Authority, Government of Meghalaya.	Contractor	Site assessment report; Record of Compliance with SDMA norms	MPWD/PMC/CSC
		Risk of Force Majeure	These unforeseen risks can have both adverse environmental and social impacts	➢ All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc.	Contractor	Force majeure preparedness plan; Emergency contact list	MPWD/PMC/CSC

				➢ All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work. ➢ Contractor has to prepare a response plan before start of construction works			
25	Labour camp establishment and workforce sanitation management	Occupational Health and Hygiene	Impacts related to unhygienic surroundings	➢ At every workplace, good and sufficient water supply shall be maintained to avoid waterborne diseases to ensure the health and hygiene of workers. ➢ Adequate drainage, mobile toilets shall be provided at workplace. ➢ Preventive Medical care shall be provided to workers. ➢ Proper Hygiene shall be maintained	Contractor	Sanitation inspection record; Hygiene logbook	MPWD/PMC/CSC
26	Traffic diversion, detour management, and movement of construction vehicles	Community Health, Safety, and Traffic Management	Unplanned and unmanaged traffic diversion and detours can result in public nuisance.	➢ Before start of the construction, proper traffic management plan will be prepared and submitted to MPWD for approval. Secure assistance from local police for traffic control during the construction. ➢ Necessary signage and barricading will be provided for safety of road users. ➢ Contractor will ensure that no construction materials and debris are lying on the road. It will be collected and disposed of properly. ➢ Unnecessary parking and sound pollution to be strictly avoided near	Contractor	Approved TMP; Signage/ barricade checklist; Traffic incident register; geotagged photos	MPWD/PMC/CSC

				settlements and sensitive receptor such as schools, hospital and cultural centres. ➢ The contractor will ensure that the diversion/ detour is always maintained in running conditions, particularly during the monsoon to avoid disruption to traffic flow.			
27	Labour camp management and workforce conduct during construction	GBV-SEAH Risks	GBV-SEAH risks may arise due to labour influx	➢ Ensure labour camps are away from settlement areas ➢ Ensure that every worker working in the project has been given an orientation on the Worker's Code of Conduct, especially on GBV and SEA/SH, and has signed the Code of Conduct. ➢ Conduct periodic awareness programs targeted at women labourers and women and children of communities residing close to the work sites for reporting incidents of GBV- SEAH ➢ Ensure complaints of GBV- SEAH are recorded and addressed with urgency. Ensure that name(s) of complainant(s) are kept in confidence and enable anonymous reporting of complaints. ➢ Activate GBV Grievance Redressal Committee immediately on receipt of any GBV- SEAH complaint. Take action on recommendation of the GBV Grievance Redressal	Contractor	Signed CoC register; GBV training log; GBV complaint record	MPWD/PMC/CSC

				Committee within 24 hours of submission of the report.			
28	Works carried out near the Archaeological Properties or Monoliths, chance finds	Chance Finds	There is a possibility of Cultural relics, Chance finds at the construction sites. Without proper plan these artefacts may be misused by contractor/ workers.	➢ If any cultural remains of geologic or archaeological interest are found, Stop work immediately. ➢ CSC and MPWD shall be immediately informed of such discovery and carry out the instructions for dealing with the same ➢ No construction related activity not limited to the following storage of material or debris, establishment of labour camp, staging of plant equipment or vehicle, parking of vehicle etc shall be carried out in the vicinity of the Monoliths/ Archaeological Properties.	Contractor	Chance find report; Notification records	MPWD/PMC/CSC
29	Engagement of labour	Compliance to Labour Welfare Laws and reporting	Workplace accidents and injuries, unsafe working condition, loss of productivity etc.	➢ Establish a policy and ensure the compliance within the organization, from the top to the lowest-level employee, understands the importance of complying with labour laws and reporting. ➢ Employees should be trained on their rights and responsibilities under labour laws. ➢ Employees should have a way to report violations of labour laws without fear of retaliation. This could be a hotline, an email address, or a suggestion box.	Contractor	Labour law compliance record; Training attendance record	MPWD/PMC/CSC/ Labour Inspectors, Govt of Meghalaya

				➢ Investigating and taking action on violations. This could include disciplinary action against the violator, or even legal action. ➢ Employees should be kept updated on the organization's compliance with labour laws. This could be done through regular training sessions, newsletters, or other communication channels. ➢ Contractor shall establish and maintain a Worker GRM consistent with the LMP. Worker grievances shall be recorded and resolved within defined timelines. ➢ Anonymous reporting shall be permitted and retaliation prohibited. Employment of child labour and forced labour is prohibited. Age-verification records shall be maintained.			
30	Engagement of Labour	Labour Influx	Strain on infrastructure, such as housing, healthcare, and education; social tension, as new arrivals compete with locals for jobs and resources.	➢ Proper plan for labour influx by investing in infrastructure and social services. ➢ Governments can regulate the flow of labour to ensure that it is orderly and sustainable. ➢ Local communities can engage with new arrivals to help them understand the local culture and customs. ➢ Maximum use of local labours	Contractor	Labour License and registration records; Local labour hiring records; Orientation logs;	MPWD/PMC/CSC Labour Inspectors, Govt of Meghalaya

				➢ Workers shall receive orientation on local customs and behavioural expectations. Workers shall not enter nearby settlements unnecessarily. Contractor shall coordinate with village authorities regarding labour camp establishment.			
31	Site-specific stakeholder engagement and consultation	Community participation, transparency, and inclusion of affected persons, including Indigenous communities (FPIC compliance)	Lack of information sharing, unresolved grievances, and reduced community participation in project activities	➢ Establish and implement a structured system of regular consultation meetings at the site level in line with ESS10 and FPIC requirements under ESS7. ➢ Conduct meetings at least twice a month with PAPs, Nokma /traditional leaders, women and youth groups, and local institutions. ➢ Share project information, discuss construction-related impacts, review implementation of mitigation measures, and address concerns through the GRM. The process will also be used to track adherence to agreed FPIC commitments and ensure culturally appropriate engagement throughout project implementation.	Contractor/ CSC/ PWD	Meetings conducted per month Attendance records with representation of Indigenous communities, women, and vulnerable groups Number of issues raised and resolved Availability of documented meeting records (MoMs)	MPWD/ PMC
32	Grievance Redressal	GRM	Increased impunity, conflict and violence; Loss of trust and confidence	➢ Establish a grievance redressal mechanism ➢ Ensure that the mechanism is impartial and independent	Contractor	GRM register; Grievance resolution records	MPWD/PMC/CSC

				➢ Provide adequate support to people who use the mechanism ➢ Communicate effectively with people about the mechanism			
33	Monitoring and Reporting Mechanism	Monitoring and Reporting (Monthly/ Quarterly)	Monitoring environmental attributes like (Air, Water, Noise & soil microbiology) and proper reporting are important for the successful ESMP implementation	➢ The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per Monitoring Plan prepared. ➢ Regular submission of CESMP implementation monitoring report	Contractor	Monthly/quarterly ESMP compliance report; Monitoring data records	MPWD/PMC/CSC
➢ OPERATION PHASE							
1	Closure and restoration of temporary construction-related sites during project completion stage	Debris and Waste from Clearing/ Closure of Construction Site, Labor Camps, Disposal Sites, and Borrow Areas	Land and soil contamination due to improper waste disposal; Aesthetic degradation; Health risks to nearby communities	➢ Contractor shall prepare and implement a Site Restoration Plan approved by the Engineer. ➢ On completion of works, all kuccha structures, debris, and wastes shall be cleared. ➢ Disposal pits and sanitation trenches shall be filled, compacted, and sealed. ➢ Topsoil removed during construction shall be re-spread to aid vegetation regrowth. ➢ Native grass or trees shall be planted to stabilize restored areas and improve aesthetics.	Contractor	Site clearance restoration records and closure NOC; Geotagged photos	MPWD
2	Operation and maintenance of road slopes, embankments,	Soil Erosion due to Runoff over Steep Slopes and	Loss of fertile topsoil; Siltation of nearby water bodies; Slope instability or	➢ Regularly inspect slopes and embankments for erosion signs. ➢ Implement bioengineering measures like turfing,	Contractor	Reports on Erosion inspection; implementation	MPWD

	and drainage systems	Embankments	road damage	hydroseeding, and vegetation planting. ➢ Provide stone pitching, retaining walls, or gabions where needed. ➢ Maintain effective drainage systems to reduce concentrated runoff.		of mitigation measures; Drain maintenance log	
3	Operation and maintenance of road drainage systems and surface runoff management	Water Pollution from Road Runoff and Drainage into Water Bodies	Deterioration of surface and groundwater quality; Sediment and oil contamination in nearby streams or waterbodies	➢ Conduct regular water quality monitoring during operation phase. ➢ If pollutants exceed prescribed limits, install silt traps, or sedimentation chambers. ➢ Ensure roadside drains are cleaned and desilted regularly. ➢ Conduct public awareness to discourage waste disposal into water bodies.	Contractor	Water quality monitoring results; Drain cleaning records	MPWD
4	Operation of road and vehicular movement along the project corridor	Air Quality Management	Deterioration of ambient air quality; Nuisance to roadside residents and vegetation; Reduced visibility	➢ Establish and maintain roadside plantation to serve as dust barriers. ➢ Maintain smooth road surfaces to minimize dust generation. ➢ Install signage discouraging over-speeding, which increases dust levels.	Contractor	Air quality results; Plantation survival record	MPWD
5	Vehicular movement and emissions during road operation	Air Pollution and Public Health	Increased levels of NOx, SO_2, CO, and PM; Health impacts on local population; Deterioration of roadside vegetation	➢ Conduct ambient air quality monitoring at sensitive locations. ➢ Maintain green buffers along the corridor. ➢ Organize awareness campaigns for drivers on emission reduction and vehicle maintenance.	Contractor	Air quality results; Plantation survival record ; Awareness records	MPWD
6	Increased traffic	Noise Environment	Noise nuisance to residents;	➢ Conduct periodic noise level monitoring.	Contractor	Noise monitoring results;	MPWD

	movement during road operation	and Community Health	Disturbance to schools, hospitals, and wildlife	➢ Provide noise barriers, dense plantation near sensitive receptors. ➢ Enforce "No Horn" zones near schools and hospitals. ➢ Maintain road surface to minimize noise due to uneven pavement.		Maintenance records	
7	Traffic operation and movement of vehicles along the project road	Road Safety and Accident Risks	Traffic congestion; Increased likelihood of road accidents; Risk to pedestrians and local communities	➢ Install and maintain proper signage, reflectors, and road markings. ➢ Ensure adequate lighting at intersections and pedestrian zones. ➢ Provide speed control measures and pedestrian crossings in settlement areas. ➢ Conduct community road safety awareness programs.	Contractor	Accident record; Safety audit report; Awareness records	MPWD
8	Roadside maintenance, drain cleaning, and repair activities during operation phase	Waste Management and Pollution Control	Soil and water contamination from indiscriminate disposal; Visual pollution and clogging of drains	➢ Collect and dispose of maintenance waste at designated locations. ➢ Prohibit dumping into drainage channels or low-lying areas. ➢ Reuse or recycle suitable materials (e.g., asphalt, concrete, metal).	Contractor	Waste logbook; Disposal records	MPWD

8.3 PERFORMANCE INDICATORS

Environmental and social components identified in affecting the environment and social conditions at critical locations have been suggested as performance indicators (PIs).

For example, near the construction site, a thick layer of dust over the nearby vegetation/leaf is an indication that the dust control measures are not effective. The performance indicators shall be evaluated under three heads as;

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution.
- Environmental and social management indicators to determine compliance with the suggested environmental and social management measures. Social monitoring indicators will be indicated as part of the Resettlement Action plan (RAP)/Indigenous People Development Plan (IPDP).
- Operational performance indicators have also been devised to determine efficacy and utility of the proposed mitigation measures.

The performance indicators and monitoring plans prepared for the road stretch are given in **Annexure 8.1**. Details of the performance indicative parameters for each of the component will have to be identified and reported during all stages of the implementation.

8.4 MONITORING PLAN FOR ENVIRONMENTAL CONDITIONS

Environmental monitoring involves regular checking of the environmental management issues detailed in the ESMP and to ascertain whether the mitigation measures are achieving their objectives, according to the ESMP, with the progress of the works. It provides the necessary feedback for Project management to keep the programme on schedule.

For each environmental condition, the Monitoring Plan specifies the parameters to be monitored, the locations of monitoring sites, and the frequency and duration of monitoring. It also outlines the applicable standards, as well as the responsibilities for implementation and supervision. The Monitoring Plan, along with details of monitoring locations for environmental condition indicators during the construction and operation stages of the project, is presented in **Table 8.1**.

The monitoring will be carried out by Contractor through the NABL accredited agency and will be supervised by the Environment Specialists of the CSC/PMC and E&S cell MPWD.

8.5 MONITORING PLAN FOR SOCIAL CONDITIONS

The social monitoring plan is designed to track and evaluate the effectiveness of social safeguard measures implemented under the Environmental and Social Impact Assessment (ESIA). It ensures compliance with national and international social safeguard frameworks, including the Resettlement Action Plan (RAP) and the Indigenous Peoples Development Plan (IPDP). The monitoring plan for social condition indicators of the sub-project during the construction stage is presented in **Table 8.2**.

Table 8.2: Environmental Monitoring Plan for Environmental condition indicators (Air, Water, Noise and Soil)

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
Air	Construction	CO, NOx, PM10, PM2.5 and SO2	CPCB Guidelines (NAAQMS/ Volume- I/2013-14)	3 locations for 3 Seasons* for 2 consecutive years	24 hours sampling	3 locations (Construction Plant Sites, settlements and Work Zones)	18	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			3 locations for 3 Seasons for 1 Year		At 3 locations during operation stage where monitoring had been done during construction stage	9	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
Water	Construction	As per Drinking Water Standards	Indian standards for inland surface waters (IS:2296,1982) and for drinking water (IS:10500-2012)	(surface water at 2 locations for 3 Seasons for 2 consecutive years. Ground water at 2 locations for 3 seasons for 2 consecutive years	As per Grab Sampling guidelines	Drinking water samples from the labour camps and from hand pumps. Surface water from the water courses near the work site and River.	24	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			Surface water 2		At 4 locations	12	Contractor through

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
				locations for 3 Seasons for 1 years. Water (Ground water) at 2 locations for 3 Seasons for 1 years.		during operation stage where monitoring had been done during construction stage		NABL accredited Laboratory and supervised by Construction Supervision Consultant
Noise	Construction	Noise Levels on dB (A) scale	Noise rules 2000 by CPCB	3 locations for 3 Seasons for 2 consecutive years.	Leq in dB(A) of daytime and night-time	Near the working zones, sensitive receptors and construction plant sites.	18	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			3 locations for 3 Seasons for 1year.		At 03 locations during operation stage where monitoring had been done during construction stage	9	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
Soil	Construction	Monitoring of Pb, SAR and Oil and Grease	(IS): 2720 for 'Method of Test for Soils'	2 locations for 3 Seasons for 2 consecutive years.	Grab Sampling	Soil at 2 location 3 times a year for 24 Months At 2 locations	12	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
	Operation			2 locations for 3 Seasons for 1Year		During operation stage where monitoring had been done during construction stage	6	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant

*Except Monsoon

Social Monitoring will be done during Construction stage of the proposed Project as per the details provided in Table 8.3.

Table 8.3: Social Monitoring Plan

Indicator Category	Responsibility	Performance Indicators	Data Collection Method	Frequency
Resettlement & Livelihood Restoration	RAP Implementation consultant/ MPWD	• % of affected households receiving compensation & assistance; livelihood restoration progress • RAP implementation completion certification for civil-works stretches; livelihood restoration status of vulnerable households • Number of PAPs surveyed and compensated (by category). • Compensation disbursed and structures restored. • Households relocated prior to construction. • Livelihood program enrollment. • GRM usage and resolution rate. • Timeliness of compensation relative to displacement.	Household surveys, payment records, RAP monitoring reports	Quarterly
Labour & Working Conditions	Contractor/ CSC/ MPWD	• Compliance with fair and equal wages, working hours, safety, Working conditions & worker rights: • Non-payment, delayed or unequal wages; denial of benefits (overtime, leave, maternity, bonus); discrimination in hiring/promotion/termination; unclear employment terms;	Labour camp inspections, interviews	Monthly

		restrictions on organizing; absence of grievance mechanism.		
		• % of local workforce employed in project • Worker GRM functioning and resolution status; labour camp inspection compliance; OHS training coverage (%)	Contractor reports	Quarterly
Community Health & Safety	Contractor / CSC / MPWD	• Number of accidents/incidents affecting communities; traffic safety compliance; public safety measures at worksites; access-continuity complaints recorded/resolved; safety compliance near settlements/schools	Beneficiary tracking	Quarterly
Social Inclusion & Gender Stakeholder Engagement & Grievance Redressal	RAP Implementation consultant/ Contractor/ MPWD RAP Implementation consultant/ Contractor/ CSC/MPWD	• Participation of women in consultations and % of women engaged in livelihood activities • SEA/SH awareness training coverage (% workers trained) • Percentage of women among total project workforce, disaggregated by skilled, semi-skilled, and unskilled categories. • Data of average daily wages paid to women and men for comparable work (wage parity index) • Number of days women are engaged compared to men in similar roles.	Beneficiary tracking, Consultation records	Bi-annually

		• Growth in women's income due to project participation. • Reduction in women's migration days (if they previously migrated for work). • Number of women gaining new market-oriented and employable skills. • Number of women accessing government schemes, agricultural interventions, or entitlements. • Improvement in women's asset ownership (productive and household assets). • Percentage of women trained under the project, disaggregated by road safety training, livelihood enhancement training, and project-related technical or non-technical skills. • Percentage of women participants in stakeholder consultations, including consultations with Indigenous Peoples and FPIC processes where applicable under ESS7. • Percentage of women beneficiaries reporting improved mobility, perceived safety, and access to essential services,		

		measured through periodic beneficiary feedback surveys. • Number and percentage of GBV/SEA/SH-related grievances received, resolved, and resolved within the stipulated timeframe, disaggregated by complainant gender and grievance type. • Increase in women's participation and leadership in local institutions and decision-making processes (membership, management roles, committees, etc.). • Improvement in women's representation in consultations and project-related decision forums.		
		• No. of community consultations held	GRM logs	Quarterly
		• % of grievances resolved within timeline; average grievance resolution time	Meeting records, video/audio evidence	Ongoing
Indigenous Peoples & Cultural Heritage Indigenous Peoples & Cultural Heritage	RP Implementation consultant/ Contractor/ MPWD RP Implementation consultant/ Contractor/ MPWD	• Summary of affected IPs by impact type, gender, age, village, income, status, and household vulnerability including female-headed households. • Documentation of consultations with Indigenous communities and traditional institutions, FPIC	Site inspections, community feedback	Annually

		meetings & community agreements • Number of meaningful consultations with IP, trainings, and IEC materials (e.g., brochures, flyers) disseminated. • % of IP women participants; vulnerable IPs attending • Documentation of negotiation process, participants, locations, and correspondence. • Evidence of broad support from community records of process, participants, and agreements. • Whether consultations were inclusive, gender-sensitive, free from coercion, and respectful of IP customs and languages.		
Supply Chain/ Contractor Compliance	Contractor/ PMC/ CSC/ MPWD	• Confirmation of no child labour or forced labour in supply chain; contractor ESMP compliance reporting	Contractor audits, compliance reports	Annually
SEA/SH Risk Management	Contractor / PMC/ CSC / MPWD	• SEA/SH Code of Conduct compliance; SEA/SH complaints recorded and referred through survivor-centred GRM; SEA/SH awareness sessions conducted • Risks of SEA/SH to community members, particularly women and children by contractors' workers during construction period;	Training records, GRM records, supervision reports	Quarterly

		• Risks of workplace SH at all establishments by co-workers under the project		

8.6 REPORTING SYSTEM

Effective monitoring and supervision would require regular reporting of the implementation of the E&S Management measures by the contractor. The E&S Non-conformance / non-performance needs to be flagged and followed up on regularly so that performance improves. Repeated non-conformance / non-performance needs to be brought to the notice of decision makers for contractual action and management decision. These aspects will be monitored and reported through the Concurrent Monitoring and Reporting.

The more strategic aspects of E&S Performance Monitoring, Gap Analysis, and documentation of good and bad practices, which would guide the management to have a review and provide direction, will be done through the Periodic Monitoring. The Mid-Term and End-Term audits will be carried out through specialised Third-Party Agencies to be hired under the project. The findings and recommendations of these studies, along with the analysis of the concurrent monitoring, will be used by the Officers of the E&S Cell to brief the Management during the review. Details are given in section 9.1 of Chapter 9 of ESMF

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN BUDGET

An amount of Rs. **92, 67, 510** have been marked for ESMP budget. The detailed budget for the same has been presented in Table 8.4.

Table 8.4: ESMP Budget

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
A.	**Monitoring Measures**						
1	Air quality monitoring	Construction	No.	18	9,000	1,62,000	Civil works contract
		Operation	No.	9	9,000	81,000	Civil works contract
2	Noise levels monitoring	Construction	No.	24	7,000	1,68,000	Civil works contract
		Operation	No.	6	7,000	42,000	Civil works contract
3	Soil quality monitoring	Construction	No.	18	3,000	54,000	Civil works contract
		Operation	No.	9	3,000	27,000	Civil works contract
4	Ground and Surface Water	Construction	No.	12	6,000	72,000	Civil works contract
		Operation	No.	6	6,000	36,000	Civil works contract
	Subtotal (A)					**6,42,000**	
B.	**Capacity Building**						
1	EMSP implementation (1 days)	On Award of Contract	lump sum			Included in project safeguards	PIU Cost

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
						capacity building	
2	Plans and Protocols Orientation (1 day)	At Beginning of Construction	lump sum			Included	PIU Cost
3	Experiences and best practices sharing	Once every Year for 2nd yr, 3rd yr , 4th yr , 5th yr	lump sum			Included	PIU Cost
4	Contractors Orientation to Workers on ESMP implementation and refresher program	Once every year or as directed by the PIU	Lump sum			Included	Civil works contract
5	Water Sprinkling Measures for Dust Suppression	Construction	Trips	No of trips to be decided by the Contractor (work areas and haul roads to be sprinkled as two times every day or as directed by the Engineer)	-	0	Civil works contract
6	Silt Fence along Water Bodies	Construction	Rm	690	331		

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
	Subtotal (B)					------	
C.	**Construction Contractor ESMP Implementation**						
1	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0 mtr height at stipulated active site of the same project site, made with angle iron frame of 50x50x5mm and GI sheet of 0.63mm thick including primer painted initially, painting, lettering & border with reflective paint at the time of every shifting, traffic diversion arrangement, safety guard, suitable lightning arrangement during night, complete in all respect till completion of the project as per technical specification and direction of Engineer-In-charge and same shall be possessed by the contractor after completion of the Project	Construction	to be provided at each of the active sites by the Contractor (i.e. till the completion for the works)	To be decided by the contractor as per his schedule of works	-	0	Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
2	Supplying and fixing of cautionary and or information signs boards including the cost of posts, fixtures, fixing, foundation, fitting and fixing. Sheeting will be made of encapsulated lens type of retro-reflective type and message / borders will be screen printed complete as per screen specification in IRC SP 55: 2001. To be made available at all time at the work sites as required and directed by the engineer	Construction	Numbers	To be decided by the contractor as per his schedule of works (every worksite to have cautionary boards as described by the Engineer)	-	0	Civil works contract
3	Supplying and fixing of flashing beacon warning lights including the cost of posts, fixtures, fixing, foundation, fitting and fixing, cost of material, labour, loading, unloading, lead, lift, shifting, transportation etc. and as per specification in IRC SP 55: 2001	Construction	Numbers	To be decided by the contractor as per his schedule of works (every worksite to have flashing beacons to warn the approaching train as directed by the Engineer)	-	0	Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
4	Provision and maintenance of Bio toilets with 1 male and 1 female units including cost of material, labour, loading, unloading, lead, lift, transportation, shifting etc. And shall be made available at worksite at the direction of the PIU. The facility shall complete with water arrangement, privacy, lighting arrangement. The WC and /urinals should be made of stainless Steel and the partitions should be made of aluminums framework with FRP panels. The bio-digester tank should be approved by Defence Research & Development Organization (DRDO) or any other competent agency. The whole toilet shall be mounted on MS framework with skids; Overhead water tank shall be made of HDPE with proper arrangement of ball cock and mosquito proof cover. These should also be provided with two dustbins for wet and dry waste. The bio-digester toilets shall be mounted on	Construction	Numbers				Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
	skids and shall not require any creation of permanent structure so that they can be shifted from one worksite to another						
5	Provision of Helmets (IS CODE 2925 : 1984) , Safety Shoes (IS CODE 5852 : 1996), Googles (•IS CODE 5983 : 1980), Reflective Jackets, mitten/ gloves (IS 2573) , safety nose masks to all personnel (including temporary labour) involved in the worksites	Construction	Lumpsum				
6	Provision of First Aid Kits for worksites	Construction	Nos				Civil works contract
7	Provision and maintenance of waste collection bins in sets of 2 (blue and green) for collection of municipal solid waste generated at the worksite including cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc.	Construction	Nos				Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
8	Environment, Health & Safety Engineer/Supervisor having Bachelors in Env Science / Management/ B.Tech (Env Engg.) Diploma in Central Labour Institute / Regional Labour Institute (Mandatory)	Construction	Nos				Civil works contract
9	Tree Plantation (Afforestation) (1:10 ratio)	Construction	Nr.	19	2040	38760	Civil works contract
10	Worker Code of Conduct orientation, labour awareness sessions, and OHS refresher training	Construction	Lumpsum	-		Included in the Contract	Civil works contract
	Sub Total (C)					------	
D	**Social Safeguards Implementation (Framework Instruments)**						
1	Stakeholder engagement, consultations, disclosure, and GRM implementation (SEP)	Construction & Operation	-	-		5,00,000	As per SEP
2	Indigenous people development plan	Construction &	-	-		47,89,000	As per IPDP of the Sub

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
	(IPDP)	Operation					Project
3	Resettlement action Plan (RAP)	Construction	-	-		34,54,510	As per RAP of the Sub project
4	Safeguards capacity building and training (ESMF)	Construction	-	-	-	As per ESMF	Project
5	Labour Management Plan Budget	Construction				As Per LMP	Project
	Sub Total (D)					**0**	
E	**PIU ESMP Implementation cost**						
	Environmental Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	Social cum Tribal Development Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	Labour / OHS Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	Gender Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
	Biodivesity Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	ESMP Supervision Cost	Construction and Operation	per month	0	30000	0	PIU Cost
	Equipment	Construction and Operation	(Noise Meter 1 nos, Cameras 1 nos)	lumpsum		0	PIU Cost
	Sub Total (E)					**87,43,510**	
	Total (A+B+C+D+E+F)				**INR**	**94,24,270**	

8.7 INSTITUTIONAL FRAMEWORK OF THE PROJECT

The Meghalaya Infrastructure Development and Finance Corporation (MIDFC) acts as the nodal agency for planning, financing, and coordinating major infrastructure projects, with the PMU providing overall strategic and policy oversight. The Project Implementation Unit (PIU) under PWD executes road and connectivity works, ensuring technical quality, environmental and social safeguards, and coordination with local institutions. An E&S Cell within PIU manages safeguards, including tribal land rights, biodiversity, and community engagement, supported by specialized experts. Project Management Consultants (PMC) provide technical, managerial, and E&S support, while Construction Supervision Consultants (CSC) ensure on-site compliance with quality, safety, and safeguard standards. Divisions of PWD supervise field-level execution, facilitate grievance redressal, and monitor ESMP implementation. This structure aligns with Meghalaya's institutional framework and Sixth Schedule provisions to integrate sustainability and positive social-environmental outcomes. Details are provided in chapter 7 of ESMF.

9. GRIEVANCE REDRESSAL MECHANISM

9.1 INTRODUCTION

An effective grievance redressal mechanism fosters good governance, accountability, and transparency in addressing project-related environmental and social concerns. An integrated system, featuring Grievance Redressal Cells (GRCs), will be established at the MIDFC Project Management Unit (PMU), supported by designated officers and dedicated procedures. Grievances may be lodged in person, in writing, via email, or by telephone, with overall coordination managed by the PMU's Social and Environmental Expert. The mechanism will become operational from the commencement of R&RAP and construction activities, adopting a two-tier structure at the site and state (PMU) levels, and incorporating regular platforms and meetings to facilitate timely and amicable resolution.

The project follows a two-tiered Grievance Redress Mechanism (GRM). Tier I operates at the project/site level, chaired by the Village Head with PWD, CSC, and contractor representatives, aiming to resolve grievances within 15 days. Tier II functions at the State/PMU level, chaired by the Secretary of Planning, addressing unresolved or escalated grievances within 15 days. Complaints can be submitted via toll-free helplines, WhatsApp, email, in-person at DPIU/PMU offices, project sites, grievance boxes, or social media. All complaints are logged, categorized, acknowledged within 2 days, investigated, and actions taken by the respective GRCs. Feedback is collected post-resolution, and reparations, if applicable, are documented. Training on grievance handling, stakeholder engagement, and gender sensitivity is conducted every six months. Complainants can escalate to Tier II or pursue legal remedies at any stage. Details are provided in Chapter 7 of ESMF. The grievance mechanism for workers will be setup by the contractors prior to convening of civil works. The grievance mechanism process has been described in detail in the Labor Management Procedures.

10. CONCLUSION AND RECOMMENDATIONS

10.1 CONCLUSION

An Environmental and Social Impact Assessment Study was conducted to assess the potential environmental and social impacts of the project. Primary information about the project influence area was gathered using an Environmental and Social Screening Checklist to evaluate the extent of environmental and social impacts resulting from project interventions. Environmental and social baseline data were collected from secondary sources to depict the existing conditions of the project area accurately. This information serves as a foundation for assessing potential environmental and social impacts, as well as enhancing the accuracy of impact predictions. Additionally, public consultations and FPIC were held with stakeholders to incorporate their inputs and concerns. The key findings of the ESIA are summarized as follows:

- Proposed project will ease the traffic flow and create safe and smooth mobility to motor vehicles as well as pedestrians. The proposed road improvement can reduce travel time from the farthest section of the road to the nearby market from one hour to just 30 minutes. The project is imperative for encouraging more trade and commercial activity (including public transport) in the district of East Garo Hills.
- The environmental and the social impact assessment have been conducted in accordance with World Bank ESF and National & State regulations. All the potential impacts were identified in relation to pre-construction, construction, and operation phases.
- Rongrenggre Reserve Forest is located along the project road Sub Project Road at chainages 6+000 to 6+200 However, as all construction activities will remain confined within the available Right of Way (RoW), no adverse impact is anticipated.
- The proposed project alignment does not pass through any Wildlife Sanctuary/National Park/Biosphere Reserve/Tiger Reserve.
- No ASI Protected monuments found within 0.5 km from the project site.
- 19 nos. of trees are located within the available Right of Way (RoW) along both sides of the road. To mitigate the ecological impact of tree felling, compensatory afforestation should be undertaken in line with applicable environmental regulations and guidelines.
- The project road is expected to have some environmental and social impacts due to construction activities along the Sub Project Road, its proximity to culturally important sites such as community center, church, school, etc. and potential effects on Project-Affected Persons (PAPs) arising from access-related issues.
- Stakeholder Consultations were conducted to assess the perception of the people about the proposed project. The outcome of the consultations suggested that people are in general with the project because it will improve the present road conditions and connectivity. However, they also raised the requirement for the road safety measures; road furniture's (including streetlights, signage's, speed breaker etc.) and proper compensation for the loss of their assets.
- Occupational health and safety measures for both workers and the local community shall be ensured through the preparation and implementation of a comprehensive Labour Management Plan (LMP), in compliance with the World Bank's Environmental and Social Standard ESS2 on Labor and Working Conditions

- The mitigations will be further assured by a program of environmental and social monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environmental and social conditions has stipulated or protected. This will include observations on- and off- site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported by the contractor to the MPWD.
- The ESMP shall be included in the bidding document along with appropriate contractual clauses for safeguarding the environment and social impacts during the project construction and operation (maintenance period).
- An overall project level and also construction stage level Grievance Redress Mechanism (GRM) will be formed to receive, feedback, suggestions and complaints, if any, from affected parties and addressing them during the construction stage and operation stage.
- The prepared ESMP will assist the Contractor and MPWD in mitigating the Environmental and Social impacts and guide them in the environmentally sound execution of the proposed project.

A copy of the updated ESMP shall be always kept on-site during the construction period. As per the World Bank policy requirements, the prepared safeguard documents shall be disclosed in the World Bank website.

During the field survey, as well as consultations with the Detailed Project Report (DPR) team and the Public Works Department (PWD), several key issues were identified. For each observation, appropriate mitigation measures have been proposed to minimize adverse impacts and ensure smooth project implementation.

- ESIA observations across the Sub Project Road from Ch. 0+000 to 20+637 have been systematically addressed and incorporated into the DPR through design improvements, protection works, and safety measures.
- Junction safety and traffic management measures have been provided at Ch. 0+000 (Rongrengre) and key locations including Ch. 6+270–6+330, 7+100–7+410, and 7+980, with signage, speed control, and junction improvement works.
- The forest stretch from Ch. 0+000 to 6+200 has been retained on the existing alignment with only blacktopping, minimizing environmental disturbance.
- Access to sensitive community facilities, including the graveyard at Ch. 5+200, has been ensured through appropriate design provisions.
- Structural impact avoidance has been achieved through alignment shifts and protection measures at Ch. 6+350, 7+130, and 11+350, ensuring no major displacement of buildings.
- Slope instability and erosion issues have been addressed through protection works at key locations including:
  Ch. 6+886 (minor bridge),
  Ch. 12+020–12+060,
  Ch. 12+820–12+880,
  Ch. 13+180–13+260,
  Ch. 17+580–17+660,
  Ch. 19+880–19+950.
- A critical unstable slope section at Ch. 16+500–16+600 was assessed and found not requiring intervention as per design.
- Drainage and waterlogging issues, particularly at Ch. 17+300–17+340, have been addressed through downstream protection works and improved drainage planning.
- Bridge and culvert-related erosion protection has been provided, including works near minor bridge at Ch. 6+886 and bridge approach protection at Ch. 19+880–19+950.

➢ Community infrastructure provisions have been included at the project end section, including:
  –Spring water collection tank at Ch. 20+510
  – Two toilet facilities at Ch. 20+565

- RAP provisions have been included for temporary settlements near Ch. 20+565–20+637 as per rehabilitation requirements.

Overall, carriageway widening, drainage improvement, and geometric design corrections have been integrated throughout the corridor, ensuring safe, environmentally compliant, and socially responsive road development.

10.2 RECOMMENDATIONS

- The Contractor should prepare a site-specific contractor's Environmental and Social Management Plan called as C-ESMP based on final design and identifications of locations of construction camps, quarries and borrow areas etc. within one month from the date of entering into the contract.
- MPWD to conduct required consultations regularly/periodically at Preliminary assessment, ESIA preparation , Before and after ESIA disclosure, Preparation of RAP and IPDP or when required with all the stakeholders, including local residents, village councils and public representatives and maintain the record of each consultation and meeting;
- MPWD to organize training for the capacity development of concerned staff of ESMU/PMC and district level MPWD engineers on ESHS policies, regulations, implementation, monitoring and reporting about the ESMP implementation before construction activities.
- Contractors will engage the experienced ES&HS Staff for ESMP implementation as well as to ensure imparting induction, work-specific and other required trainings to the workers;
- MPWD will support Project Affected Peoples (PAPs) as per RAP prepared for the RSN Road stretch.
- Contractor/ MPWD to ensure the compliance of applicable laws at state/national level and relevant policies and best practices.
- The shifting of public utilities will be planned in advance to maintain supply of electricity and telephone services to people without or minimum disruptions, with prior intimation through Media, newspaper and other mode of communication.
- MPWD to monitor the implementation and redress of grievances timely and amicably.
- The contractor to ensure safe access to vulnerable people such as elderly and people with disabilities during the construction stage.