

DRAFT

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

**Strengthening and Improvement of Songsak- Mendipathar Road (SMR)
including re-construction of weak CD Works and Bridges**

Meghalaya Logistics and Connectivity Improvement Project (MLCIP)

**Submitted
to**



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

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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	:	Corridor of Impact
CPR	:	Common Property Resources
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
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
MNB	:	Minor Bridge
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

MLCIP includes 10 Roads and 6 Bridges totaling to approximately 300 km respectively. The proposed SMR Sub Project Road has a total length of 35.28 km, commencing from Songsak at chainage 00+000 and terminating at Mendipathar at chainage 35+280.

The land required for the proposed road improvement is approximately 0.2712 Ha and for spoil disposal 0.97 ha. Details of land requirement is given in is given in Table 3.16.

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 has been improved through enlarged culverts, additional cross-drainage structures, and properly graded roadside drains to prevent flooding and waterlogging. Slope protection measures such as retaining walls, turfing, and bio-engineering using local grasses have been proposed to control erosion and landslides. Durable pavement layers (CTB/CTSB) and paved shoulders, along with safety features, ensure an all-weather, resilient and safe road infrastructure.

E.2 Project Description and Need

The project is designed to improve road infrastructure with limited land acquisition, as adequate Right of Way (RoW) is available. 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 (48 PAHs), with 144 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 and economic development. The proposed 35.28 km SM road sub-project has been designed to minimize land acquisition and associated social impacts while improving connectivity. About 31.47 km of the road will be upgraded within the existing 12 m Right of Way (RoW), and only 0.2712 ha of additional land will be required over 3.802 km for minor widening, drainage, and safety features. This additional land affects 1 Project Affected Households (PAHs) and involves partial loss of agricultural land impacting 7 PAPS, though the land is currently not in use. 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 existing RoW.

The project will temporarily require 0.97 ha of land for spoil disposal, identified across 4 locations in consultation with PWD officials and local communities, including the Nokma. These sites will be restored and returned to landowners after construction. In total, 48 PAHs comprising 144 PAPs will be affected, with impacts being largely minor, partial, and localized. A significant portion includes 24 households (63PAPs) 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 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

Chainage	Village	Proposed/Mitigation measure adopted	Mitigation included in DPR	Reference in the DPR
0+000 to 3+525	Songsak Forest Reserve	Forest Area (Both Side) (The Existing Road Blacktop is covered only with no further improvement).	The Existing Blacktop will be maintained only with no further improvement. speed restrictions (rumble strips/table-top crossing), signages and timed movement restrictions at night if necessary, to ensure safe passage at forest location from km 0+000 to 3+695	TCS-05, Page No-153 [Vol-1 Main Report]
4+020	Songkama	Eroding riverbank protection work needed (LHS)	Stream protection has been proposed at location KM 3+950 TO KM 4+120 to	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No.

			prevent further erosion of road embankment.	RC/1661/HO/HWB/RD/DWG/MISC/08/RO
4+300	Songkama	Protection work needed at riverbank (LHS)	Stream protection works has been proposed at location KM 4+220 to KM 4+550 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/08/RO
5+350	Samin Songkama	Waterlogging in school premises during rainfall. Preventing runoff of water towards school (RHS)	Lined drain has been proposed from km 5+130 to 5+225 on Right Side	Table 14, Page No-172 [Vol-1 Main Report]
5+600	Samin Songkama	Waterlogging or overtopping during monsoon.	Box culvert of dimension 1x3.0m span has been proposed at location Km: 5+591	Table 10, Page No-160 [Vol-1 Main Report]
8+000	Samin Wakso	Protect community water resources, prevent contamination, and maintain natural pond ecology. Community reserve pond hence water should not enter the community pond (LHS)(For rubber tree processing purpose only)	As the left-hand side (LHS) curve is located on a raised platform, it prevents water from entering the pond. As the condition is naturally mitigated, no intervention is required at this location, resulting in cost savings, minimal environmental disturbance, and efficient project implementation.	-
10+300	Chidimit Nengsat	Erosion due to river, protection work needed (LHS)	Stream protection works has been proposed at location Km 10+260 to Km 10+305 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/08/RO
10+800	Chidimit Nengsat	Erosion due to river, protection work needed (LHS)	Stream protection works has been at location Km 10+800 to Km 11+010 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/08/RO
11+400	Chidimit Nengsat	Protection work required due to soil erosion in the river on left side (LHS)	Stream protection works has been at Km 11+680 to prevent further erosion of road embankment.	Table 19 & 21, Page No-187 & 191 [Vol-1 Main Report]
12+800–13+800	Chidimit Nengsat	Market section identified.	2-lane improvement with drain-cum-footpath, and	Table 19 & 21, Page No-187 & 191 [Vol-1 Main Report]

			paved shoulders to strengthen road have been proposed.	
15+350	Dagal Apal	Protection work required at Pond (RHS) Section	Proposed Protection wall form km 15+560 to 15+680 to protect the formation from soil erosion	Bill No-11 (Community Amenities)
20+400	Dalbinggre	Protection work required on riverbank left side (LHS)	Stream protection works has been proposed at location Km 20+380 to Km 20+560 to prevent further erosion of road embankment.	Page No-183 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/08/RO
20+700	Dalbinggre	Protection work required on riverbank left side (LHS)	Stream protection works has been proposed at location Km 20+700 to Km 20+780 to prevent further erosion of road embankment.	Page No-183 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/08/RO
20+900	Dalbinggre	Protection work required on riverbank left side (LHS)	Stream protection works has been proposed at location Km 20+855 to Km 20+890 to prevent further erosion of road embankment.	Page No-183 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MISC/08/RO
28+700	New Thapa Kantolguri	Improvement require at T-Junction	Proposed and Incorporated in P&P drawings	Table No. 20, Page No. 188 [Vol-1 Main Report]
31+900 to 32+000	On LHS- Soenang Apal	Graveyard protection on RHS	Protection work of height 2m for the length of 50m required at graveyard section has been proposed.	Bill No-11 (Community Amenities)
33+370 to 33+400	New Phutimari	Require boundary wall due to church.	Church at Ch-34+910 is away from the carriageway edge which do not affect the existing boundary so boundary wall not required	
34+470 to 34+500	Jamgao Sorokpara	Require slope protection	Protection wall of height 1m required from Ch-34+540 to 34+550 on right side (Filling Section) has been proposed	Table No. 15, page No. 176, Sr. No. 6.17.7.1 [Vol-1 Main Report]
34+800 to 35+100	Jamgao Sorokpara	Require boundary wall for playground on RHS	Boundary wall already on existing section which are not disturbed in design	

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 INR 4, 29, 72,600.

E.9 Stakeholder Consultations

A series of stakeholder consultations and FPIC engagements were conducted between August and December 2025 for the Songsak–Mendipathar Sub Project Road to gather inputs from government agencies, local communities, vulnerable groups, and project-affected households. Consultations with the Divisional Forest Officer (DFO), East & North Garo Hills on 21 August 2025 (4 participants) highlighted concerns regarding the road alignment passing through community vegetation areas and elephant movement routes, emphasizing habitat protection and forest clearance requirements. Further consultation with the Forest Ranger Office, East & North Garo Hills on 23 August 2025 (3 participants) focused on the predominant floral and faunal species in the region and wildlife movement patterns. The PCCF, Shillong consultation held on 28 August 2025 (4 participants) raised issues related to human–wildlife conflict (HWC), safety, governance aspects, community dependence on forest resources, and reserve forest considerations.

Six meaningful consultations were conducted with local residents between 25–30 August 2025 across Jamgao Sorokpara, Thapa Darenchi, Songkama, Samin Songkama, Thapa Rangdopa, and Koksi Nengsat villages, involving participants from different habitations including Jamgao Sorokpara (8 male, 2 female), Thapa Darenchi (5 male, 6

female), Koksi Nengsat (6 male, 4 female), Thapa Rangdopa (7 male, 3 female), Samin Songkama (6 male, 4 female), and Songkama (3 male). Community members reported that the poor condition of the existing road was causing severe commuting difficulties, negatively affecting children's access to education and resulting in frequent road accidents and safety risks. Consultations with street vendors on 24 September 2025 involving 4 participants (3 male and 1 female) emphasized the need for smoother roads to improve accessibility and transportation. The Village Nokma consultation held on the same date with 1 participant highlighted the prevalence of waterborne diseases such as diarrhoea, typhoid, and cholera due to unsafe drinking water and poor sanitation, stressing the need for improved water supply and health awareness initiatives.

Focused discussions were also conducted with youth groups and women. Youth group consultations held on 5 & 26 September, 7 October, and 9 December 2025 involving 65 participants identified lack of local employment opportunities, inadequate skill development access, and limited career guidance as major concerns contributing to migration and associated vulnerabilities. Participants emphasized the need for skill development, entrepreneurship promotion, and improved road connectivity to enhance livelihoods and access to services. Women-focused FGDs conducted on the same dates with 45 participants revealed that women were willing to engage in economic activities but faced challenges due to limited opportunities, social barriers, and inadequate institutional support. The consultations highlighted the need for women-centric skill development initiatives and stronger involvement of SHGs in project-related activities such as awareness generation, monitoring, and plantation maintenance.

As part of the FPIC process for priority projects, 12 consultations were conducted at 3 locations between September and December 2025 with Community Members, Project Affected Households, and Families involving 355 participants (310 male and 45 female). Key agreements reached during the consultations included improvement of the existing road to Intermediate Lane standards with safety measures, drainage, and protection works in habitation and market areas subject to technical feasibility; construction of passenger waiting sheds at designated village locations; provision of drains-cum-footpaths near settlement areas; construction of separate toilets for males and females; and implementation of protection works at pond sections and graveyard sections to safeguard community assets and sensitive locations.

E.10 Conclusion

The proposed upgradation of the SMR road is a strategically important infrastructure intervention that will significantly enhance regional connectivity, accessibility, and socio-economic development in North 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 corridor, 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 48 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 corridors; 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 6 Bridges totaling to approximately 300 km respectively. The proposed SMR Sub Project Road has a total length of 35.28 km, commencing from Songsak at chainage 00+000 and terminating at Mendipathar at chainage 35+280, is one of the corridors in MLCIP.

The additional land required for the proposed road improvement is approximately 0.2712 Ha and for spoil disposal 0.97 ha for temporary use. Details of land requirement is given in is given in Table 3.16.

The present 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 has been improved through enlarged culverts, additional cross-drainage structures, and properly graded roadside drains to prevent flooding and waterlogging. Slope protection measures such as retaining walls, turfing, and bio-engineering using local grasses have been proposed to control erosion. Durable pavement layers (CTB/CTSB) and paved shoulders, along with safety features, ensure an all-weather, resilient and safe road infrastructure.

1.2 SCOPE FOR CONDUCTING THE ESIA STUDY

The sub-project is rated as High Risk based on the screening due to significant environmental and social sensitivities along the project corridor such as passes through Songsak Reserved Forest between Km 00+000 and Km 3+525 and 48 Project Affected Households (PAH), leading to notable livelihood concerns. During the consultations, it was also found that during monsoon, few sections of the road get inundated. 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:
- Preliminary climate and cumulative impact assessment:
- Environmental and Social Management Plan (ESMP) preparation

¹ The project has obtained **78.125%** 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 impacts. Hence, the sub-project falls under the **High Risk Category**

- 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 and methodology 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. The Divisional officers, PWD, GoM also interacted with the concerned DFO to understand the location of forest areas in these stretches.
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. In order to make them aware of the project activities, an attendance sheet was maintained to record the presence of villagers who participated in the consultation meeting including geo tagged photographs as evidence of the same. These were the first round of consultations for FPIC.
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, quadrat analysis, community consultation were carried out. The Forest Department, GoM, provided the maps demarcating the legally protected forest including “community reserve”. Information was also providing about the Wildlife crossing/ wildlife corridors. Information was also collected for the Forest Department, GoM about the animal kills / collisions on these corridors. In addition to these data collection from 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 SMR 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.
5.	Mitigation and Management Measures	Based on the impact assessment, measures were proposed to mitigate or minimize adverse environmental and social impacts while enhancing positive outcomes. These included exploring Project road design alternatives to reduce Involuntary

Sl. No.	Stages	Activities Done
		resettlement and environmental degradation, community health safety conflicts etc were carried out. 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	<p>Primary Survey Primary Monitoring (PM10, PM2.5, SOx, NOx) at 5 Locations</p> <p>Secondary Source Central pollution control Board (CPCB, https://cpcb.nic.in/) / Meghalaya State Pollution Control Board (MSPCB, https://megspcb.gov.in/)</p>
Water	<p>Primary Survey Primary Monitoring at 4 Locations</p> <p>Secondary Source 1. District Survey Report, North Garo Hills District, 2024(https://northgarohills.gov.in/document/district-survey-report-of-north-garo-hills-district-for-sand-mining-2019/), District Survey Report, East Garo Hills District, (https://eastgarohills.gov.in/document-category/statistical-report/) 2.CGWBDData 2024(https://www.cgwb.gov.in/old_website/AQM/NAQUIM_REPORT/Meghalaya/North%20Garo%20Hills_Report.pdf)</p>
Noise	<p>Primary Survey Primary Monitoring</p> <p>Secondary Source CPCB (https://cpcb.nic.in/regulation-control/)</p>
Soil	<p>Primary Survey Primary Monitoring</p> <p>Secondary Source 1.District Irrigation Plan 2016-2020(https://pmksy.gov.in/mis/Uploads/2017/20170331050822078-1.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)</p>
Biodiversity	<p>Primary survey 1.Field observation 2.Vegetation assessment was conducted using Nested Quadrante method 4.Faunal assessment was conducted using Visual encounters, sign survey, line transect, and netting survey method 6.LULC analysis through ground truthing</p>

Parameters	Secondary Source
	<p>Secondary Source</p> <p>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</p>
Hazards and Vulnerability	<p>Primary survey</p> <p>Field observation and Consultation with concerned departments and local community</p> <p>Secondary Source</p> <p>1. District Disaster Management Plan for North Garo Hills, 2024 (https://northgarohills.gov.in/disaster-management/)</p> <p>2. Meghalaya State Disaster Management Authority (MSDMA) (https://msdma.gov.in/)</p>
Natural Environment	<p>Secondary Source</p> <p>1.Customized Rainfall Information System, Hydromet Division, IMD (https://hydro.imd.gov.in/) 2.District Census Handbook, North Garo Hills(https://northgarohills.gov.in/demography/) 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/2017/20170331050822078-1.pdf) 5. Consultant’s Analysis, Source IMD Gridded Data(https://www.imdpune.gov.in/cmpg/Griddata/Rainfall_25_NetCDF.html)</p> <p>6. State Action Plan on Climate Change (SAPCC), Meghalaya(https://moef.gov.in/uploads/2017/08/Meghalaya.pdf)</p> <p>7. Statistical Handbook, Meghalaya 2023 (https://des.megplanning.gov.in/documents/SHB2023-as-on-02-05-24.pdf)</p>
Climate	<p>Secondary Source</p> <p>India Meteorological Department – Shillong Climatological Normals, (1991–2020) (https://dsp.imdpune.gov.in/home_normals.php#)</p>
Land and Livelihood Impact	
Land, Livelihood and Common Property Resources	<p>Primary survey</p> <p>1.Census/Household Survey (PAH:48) 2.Focus Group Discussions (3) 3.Key Informants Interviews (25)</p>

Parameters	Secondary Source
	4.Field Observations Secondary Source Census 2011 (https://www.census2011.co.in/)
	Other Socio-Economic Parameters
Ethnicity	Primary survey Consultation, Focus Group Discussion Secondary Source Census 2011(https://www.census2011.co.in/)
Gender	Primary Survey Focus Group Discussion Public Consultations Interviews Secondary Source Workforce Participation Rate as per Census 2011 (https://www.census2011.co.in/) National Family Health 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

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
6	Hazardous & Other Wastes (Management and Trans-boundary Movement) Rules, 2016 and March, 2024	Protection against improper handling, storage and disposal of hazardous waste. The rules prescribe the management requirement of hazardous wastes from its generation to final disposal.	Hazardous waste generation from proposed activities like generation of paints waste, used oil/waste oil, bitumen waste, etc.	Contractor to obtain authorization for storage, transport, and disposal of hazardous and other wastes	MSPCB
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 during the construction the e-transit pass would be submitted along with	Mines and Mineral Department

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
				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. Proper mitigation measures like speed calming measures, safety signages will be undertaken.	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	33 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
19	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
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).
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 Songkama river can be used for road construction with prior permission from the Water Resources Department, North Garo Hills District,	Permission/Allocation order for surface water abstraction.	Water Resources Department, Government of Meghalaya.

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
			Meghalaya.		
SOCIAL REGULATIONS					
1.	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
2.	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)
3.	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	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.

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
		Tribes.			
4.	Meghalaya Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2017	Aim to provide a fair, transparent, and participatory process for land acquisition while ensuring adequate 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.	Impact on private Assets and properties	Ensure fair compensation and Guarantee transparency in the acquisition process.	Revenue Department/ District Administration, Village Council
5.	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 corridors in case of economic displacement and relocation of street vendors.	No	District Administration/ District Municipal Authority, Village Councils under the Autonomous District Councils
6.	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 corridor where PwD are present and affected, and for designing the project in an inclusive manner.	No	Department of Social Welfare, Government of Meghalaya
7.	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	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
		constitution of a Central Information Commission and State Information Commissions and for matters connected therewith or incidental thereto.			
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					
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 corridors	Workmen compensation Insurance Policy	Commissioner for Workmen's Compensation

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
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 corridors	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 corridors	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-bound and extremely confidential manner	Applicable to all implementing agencies	No	District Officer (District Magistrate or Additional District Magistrate)
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

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
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
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

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
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 Commissioner, 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 Commissioner, Government of Meghalaya
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 Commissioner, 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: land procurement mechanisms

Category	Garos
Basis of classification	Ownership of land
Type of land	2 types of ownership a)Community Land b) Private Property 5 Types of land: 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	<i>Pattas</i> are the primary records available in the region, dating from the colonial period. In Garo Hills, land is primarily owned and managed by the communities and land records are generally maintained through customary institutions, where the Nokma (village head) manages and

Category	Garos
	<p>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.</p> <p>J.D. Walker demarcated the A'King land boundaries and gave the <i>Nokmas</i> settled maps in the late 1920s. The availability of patta documents in the village's 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.</p>
Systems for sale/purchase/ mortgage	<p>Pattas are instrumental in mortgaging land in the bank for loans.</p> <p>Selling of the land in the village requires the <i>Nokmas</i> 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.</p>
Managing private property	<p>The <i>Nokna</i> (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.</p>
Managing community property	<p>For the community lands, the power to make decisions is vested in the <i>nokma</i> of the village. For the clan land, the <i>nokna</i> (in heiress) along with her husband and the <i>chras</i> (brothers and maternal uncles) decides together. Any such transaction undertaken without prior consent of the wife (<i>nokna</i>) and her <i>Chra</i> is considered null and void (Marak, 1986).</p>

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 SONGSAK- MENDIPATHAR (SMR) SUB PROJECT ROAD

The proposed SMR Sub Project Road has a total length of 35.28 km, commencing from Songsak at chainage 00+000 and terminating at Mendipathar at chainage 35+280. The Proposed Road existed before the formation of Meghalaya state as per discussions with the MPWD officials.

3.2 LOCATION DETAILS OF THE SUB PROJECT ROAD

This stretch traverses a diverse landscape, including hilly terrains, agricultural lands, scrublands, built-up areas, and passes through 20 villages including 25 habitations. The SMR Road serves as a critical regional connector, enhancing access to economic hubs, industrial centers, and tourism destinations.

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

Table 3.1: Chainage wise SMR Sub Project Road details

Sl. No.	Starting Chainage	End Chainage	Corridor No.	Project length as per DPR	Districts
1	00+000	35+280	6	35.28	East and North Garo Hills

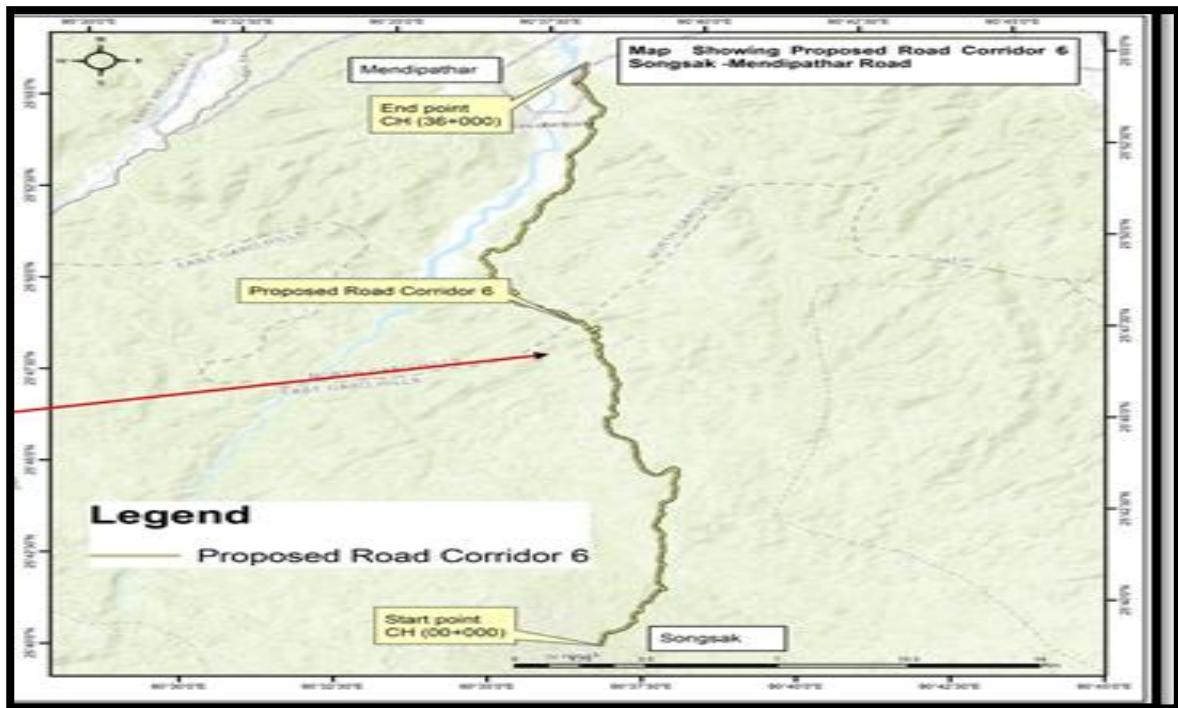


Figure 3.1: Road alignment map for SMR Road

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 assessment 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
3. 10 km of study area

The existing and proposed Right of Way (RoW) of the corridor 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, landslide- and landslip-prone 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 SMR ROAD

The key existing conditions and proposed improvements for the SMR project road 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 35.28 km sub-project road are summarized in **Table 3.2**. The Songsak- Mendipathar (SMR) Road is presently a roadway with a bituminous pavement surface. The existing road conditions are generally good, except potholes prevalent across some stretches. Inadequate drainage exacerbates deterioration during rainfall, making traffic movement difficult, particularly on earthen sections. Existing carriage width is 5.5 m and rehabilitation work will be done in existing carriage width.

Table 3.2: Details of Available ROW

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
1.	Songsak Forest Reserve	0.0000	3.0060	3006	Songsak, East Garo Hills	11 ³
2.	Songsak Forest Reserve	3.0060	3.525	494	Songsak, East Garo Hills	8.7 ³
3.	Songkama	3.525	3.7300	230	Songsak, East Garo Hills	8
4.	Songkama	3.730	4.420	690	Songsak, East Garo Hills	11
5.	Songkama	4.910	5.000	90	Songsak, East Garo Hills	11
6.	SaminSongkama	5.000	5.100	100	Songsak, East Garo Hills	11
7.	SaminSongkama	5.225	5.420	195	Songsak, East Garo Hills	10

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.

³ Pavement width is 5.5m in forest area

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
8.	SaminSongkama	5.420	5.736	316	Songsak, East Garo Hills	11
9.	SaminSongkama	5.736	5.800	64	Songsak, East Garo Hills	11
10.	SaminSongkama	5.800	6.246	446	Songsak, East Garo Hills	10
11.	SaminSongkama	6.246	6.446	200	Songsak, East Garo Hills	11
12.	SaminSongkama	6.446	6.706	260	Songsak, East Garo Hills	11
13.	SaminSongkama	6.706	6.786	80	Songsak, East Garo Hills	11
14.	SaminSongkama	6.786	6.876	90	Songsak, East Garo Hills	11
15.	SaminSongkama	6.876	7.000	124	Songsak, East Garo Hills	11
16.	SaminWakso	7.000	8.000	1000	Songsak, East Garo Hills	11
17.	KoksiNengsat	8.000	8.116	116	Songsak, East Garo Hills	11
18.	KoksiNengsat	8.116	8.300	184	Songsak, East Garo Hills	11
19.	KoksiNengsat	8.300	8.416	116	Songsak, East Garo Hills	11
20.	KoksiNengsat	8.416	8.546	130	Songsak, East Garo Hills	11
21.	KoksiNengsat	8.546	9.086	540	Songsak, East Garo Hills	11
22.	KoksiNengsat	9.086	9.300	214	Songsak, East Garo Hills	11
23.	KoksiNengsat	9.300	9.326	26	Songsak, East Garo Hills	11
24.	KoksiNengsat	9.326	9.556	230	Songsak, East Garo Hills	10
25.	KoksiNengsat	9.556	9.916	360	Songsak, East Garo Hills	10
26.	KoksiNengsat	9.916	10.000	84	Songsak, East Garo Hills	10
27.	ChidimitNengsat	10.000	10.260	260	Songsak, East Garo Hills	11
28.	ChidimitNengsat	10.310	10.816	506	Songsak, East Garo Hills	11
29.	ChidimitNengsat	10.816	11.500	684	Songsak, East Garo Hills	11
30.	ChidimitNengsat	11.526	12.000	474	Songsak, East Garo Hills	11
31.	ChidimitNengsat	12.276	12.536	260	Songsak, East Garo Hills	11
32.	ChidimitNengsat	12.536	12.750	214	Songsak, East Garo Hills	11
33.	ChidimitNengsat	12.750	12.786	36	Songsak, East	10

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
					Garo Hills	
34.	ChidimitNengsat	12.786	13.000	214	Songsak, East Garo Hills	10
35.	ChidimitNamesa	13.000	13.036	36	Songsak, East Garo Hills	11
36.	ChidimitNamesa	13.036	13.446	410	Songsak, East Garo Hills	11
37.	ChidimitNamesa	13.446	14.000	554	Songsak, East Garo Hills	11
38.	ChidimitBoldakgittim	14.000	14.236	236	Songsak, East Garo Hills	11
39.	ChidimitBoldakgittim	14.236	14.536	300	Songsak, East Garo Hills	11
40.	ChidimitBoldakgittim	14.536	15.406	870	Songsak, East Garo Hills	11
41.	ChidimitBoldakgittim	15.406	15.500	94	Songsak, East Garo Hills	11
42.	DagalApal	15.500	15.586	86	Songsak, East Garo Hills	11
43.	DagalApal	15.586	15.876	290	Songsak, East Garo Hills	11
44.	DagalApal	15.876	16.000	124	Songsak, East Garo Hills	11
45.	DagalApal	16.000	16.036	36	Songsak, East Garo Hills	10
46.	DagalApal	16.036	16.200	164	Songsak, East Garo Hills	10
47.	DagalApal	16.200	16.236	36	Songsak, East Garo Hills	11
48.	DagalApal	16.236	17.000	764	Songsak, East Garo Hills	11
49.	Dandakol	17.000	17.086	86	Songsak, East Garo Hills	11
50.	Dandakol	17.086	17.470	384	Songsak, East Garo Hills	11
51.	Dandakol	17.550	17.616	66	Songsak, East Garo Hills	11
52.	Dandakol	17.616	17.700	84	Songsak, East Garo Hills	11
53.	Dandakol	17.770	17.796	26	Songsak, East Garo Hills	11
54.	Dandakol	17.796	18.016	220	Songsak, East Garo Hills	11
55.	Dandakol	18.016	18.076	60	Songsak, East Garo Hills	11
56.	Dandakol	18.076	18.196	120	Songsak, East Garo Hills	11
57.	Dandakol	18.196	18.250	54	Songsak, East Garo Hills	11
58.	Dandakol	18.276	18.356	80	Songsak, East Garo Hills	15

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
59.	Dandakol	18.356	18.406	50	Songsak, East Garo Hills	15
60.	Dandakol	19.440	19.724	284	Songsak, East Garo Hills	11
61.	Dandakol	19.996	20.000	4	Songsak, East Garo Hills	11
62.	Dalbinggre	20.000	20.016	16	Resubelpara, North Garo Hills	11
63.	Dalbinggre	20.016	20.166	150	Resubelpara, North Garo Hills	11
64.	Dalbinggre	20.166	20.420	254	Resubelpara, North Garo Hills	11
65.	Dalbinggre	20.480	21.200	720	Resubelpara, North Garo Hills	11
66.	Dalbinggre	21.200	21.362	162	Resubelpara, North Garo Hills	10
67.	Dalbinggre	21.362	21.600	238	Resubelpara, North Garo Hills	11
68.	Sepikol	21.600	21.646	46	Resubelpara, North Garo Hills	11
69.	Sepikol	21.646	21.696	50	Resubelpara, North Garo Hills	11
70.	Sepikol	21.696	22.500	804	Resubelpara, North Garo Hills	11
71.	DajonggreSonggital	22.500	22.506	6	Resubelpara, North Garo Hills	11
72.	DajonggreSonggital	22.506	22.676	170	Resubelpara, North Garo Hills	11
73.	DajonggreSonggital	22.676	23.250	574	Resubelpara, North Garo Hills	11
74.	DajonggreSonggital	23.310	23.514	204	Resubelpara, North Garo Hills	11
75.	DajonggreSonggital	23.615	23.636	21	Resubelpara, North Garo Hills	11
76.	DajonggreSonggital	23.838	24.000	162	Resubelpara, North Garo Hills	11

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
77.	Dajong gate	24.000	24.826	826	Resubelpara, North Garo Hills	11
78.	Dajong gate	24.826	24.926	100	Resubelpara, North Garo Hills	11
79.	Dajong gate	24.926	24.930	4	Resubelpara, North Garo Hills	11
80.	Dajong gate	25.180	25.270	90	Resubelpara, North Garo Hills	11
81.	Dajong gate	25.450	25.500	50	Resubelpara, North Garo Hills	11
82.	Darenchi	25.500	25.713	213	Resubelpara, North Garo Hills	11
83.	Darenchi	25.772	25.783	11	Resubelpara, North Garo Hills	11
84.	Darenchi	25.823	25.900	77	Resubelpara, North Garo Hills	11
85.	Darenchi	26.096	26.166	70	Resubelpara, North Garo Hills	11
86.	Darenchi	26.166	26.766	600	Resubelpara, North Garo Hills	11
87.	Darenchi	26.766	27.106	340	Resubelpara, North Garo Hills	11
88.	Darenchi	27.106	27.596	490	Resubelpara, North Garo Hills	11
89.	Darenchi	27.596	27.600	4	Resubelpara, North Garo Hills	11
90.	ThapaRangdopa	27.600	27.786	186	Resubelpara, North Garo Hills	11
91.	ThapaRangdopa	27.786	28.000	214	Resubelpara, North Garo Hills	11
92.	New ThapaKantolguri	28.000	28.016	16	Resubelpara, North Garo Hills	11
93.	New ThapaKantolguri	28.016	28.136	120	Resubelpara, North Garo Hills	11
94.	New ThapaKantolguri	28.136	28.356	220	Resubelpara,	11

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
					North Garo Hills	
95.	New ThapaKantolguri	28.356	28.446	90	Resubelpara, North Garo Hills	11
96.	New ThapaKantolguri	28.446	28.926	480	Resubelpara, North Garo Hills	11
97.	New ThapaKantolguri	28.926	29.000	74	Resubelpara, North Garo Hills	11
98.	Kantolguri	29.000	29.396	396	Resubelpara, North Garo Hills	11
99.	Kantolguri	29.396	29.550	154	Resubelpara, North Garo Hills	11
100.	Kantolguri	29.550	29.800	250	Resubelpara, North Garo Hills	11
101.	Kantolguri	29.800	29.856	56	Resubelpara, North Garo Hills	10
102.	Kantolguri	29.856	30.000	144	Resubelpara, North Garo Hills	11
103.	Rongkaminchi	30.000	30.450	450	Resubelpara, North Garo Hills	10
104.	Rongkaminchi	30.450	30.695	245	Resubelpara, North Garo Hills	11
105.	Rongkaminchi	30.695	30.700	5	Resubelpara, North Garo Hills	11
106.	On RHS- SoenangAdinggre & On LHS- SoenangApal	30.700	31.300	600	Resubelpara, North Garo Hills	11
107.	On RHS- SoenangAdinggre & On LHS- SoenangApal	31.300	31.386	86	Resubelpara, North Garo Hills	11
108.	On RHS- SoenangAdinggre & On LHS- SoenangApal	31.386	31.500	114	Resubelpara, North Garo Hills	11
109.	On RHS- SoenangAdinggre & On LHS- SoenangApal	31.500	31.576	76	Resubelpara, North Garo Hills	10
110.	On RHS- SoenangAdinggre & On LHS- SoenangApal	31.576	31.650	74	Resubelpara, North Garo Hills	10
111.	On RHS- SoenangAdinggre &	31.650	31.666	16	Resubelpara, North Garo	11

Sl. No.	Name of Habitation/Village	Chainage From (km)	Chainage To (km)	Length (m)	Block/District	Available RoW (m)
	On LHS- SoenangApal				Hills	
112.	On RHS- SoenangAdinggre & On LHS- SoenangApal	31.666	31.776	110	Resubelpara, North Garo Hills	11
113.	On RHS- SoenangAdinggre & On LHS- SoenangApal	31.776	32.000	224	Resubelpara, North Garo Hills	11
114.	SoenangLabourpara	32.400	32.700	300	Resubelpara, North Garo Hills	11
115.	SoenangBahartuli	32.700	33.000	300	Resubelpara, North Garo Hills	11
116.	SoenangBahartuli	33.000	33.200	200	Resubelpara, North Garo Hills	11
117.	SoenangBahartuli	33.200	33.800	600	Resubelpara, North Garo Hills	10
118.	New Phutimari	33.800	34.400	600	Resubelpara, North Garo Hills	11
119.	New Phutimari	34.400	34.800	400	Resubelpara, North Garo Hills	10
120.	New Phutimari	34.800	35.100	300	Resubelpara, North Garo Hills	10
121.	JamgaoSorokpara	35.100	35.280	180	Resubelpara, North Garo Hills	10

Pavement Details:

The pavement design for the main carriageway has been carried out in accordance with IRC: SP:72-2015 and IRC: 37-2018 guidelines. The design considers a 15-year design life, design traffic of 5 MSA, and an effective subgrade CBR of 5%. The proposed pavement composition consists of 40 mm Bituminous Concrete (BC), 170 mm Cement Treated Base (CTB), 200 mm Cement Treated Sub-Base (CTSBS), and 500 mm Subgrade.

A Stress Absorbing Membrane Interlayer (SAMI) is proposed between the bituminous layer and cementitious base to delay reflection cracking from the CTB layer. The SAMI layer will consist of elastomeric modified binder applied at 10–12 kg per 10 m² with 0.1 m³ 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 SMR Road Section

S. No	Chainage	Type	Side	Direction	Type of Junction
1.	0+000	T	Right	Songsak	Major Junction
2.	3+775	T	Right	Village (CC Road)	Minor Junction
3.	4+536	T	Left	Village (BT Road)	Minor Junction
4.	5+052	T	Right	Village (CC Road)	Minor Junction
5.	5+165	T	Right	Village (CC Road)	Minor Junction
6.	6+165	T	Right	Village (CC Road)	Minor Junction
7.	6+455	T	Left	Village (CC Road)	Minor Junction
8.	6+690	T	Right	Village (CC Road)	Minor Junction
9.	8+026	T	Left	Village (BT Road)	Minor Junction
10.	9+922	T	Left	Village (CC Road)	Minor Junction
11.	10+355	T	Right	Village (CC Road)	Minor Junction
12.	10+795	T	Left	Village (BT Road)	Minor Junction
13.	11+314	T	Left	Village (BT Road)	Minor Junction
14.	11+705	T	Left	Village (BT Road)	Minor Junction
15.	11+995	T	Left	Village (BT Road)	Minor Junction
16.	12+695	T	Left	Village (CC Road)	Minor Junction
17.	12+918	T	Right	TO CHLINDING	Minor Junction
18.	13+641	T	Right	Village (CC Road)	Minor Junction
19.	13+745	T	Left	Village (BT Road)	Minor Junction
20.	14+530	T	Left	Village (CC Road)	Minor Junction
21.	14+970	T	Right	Village (CC Road)	Minor Junction
22.	15+415	+	Both	Village (CC Road)	Minor Junction
23.	15+839	T	Left	Village (CC Road)	Minor Junction
24.	15+858	T	Right	Village (CC Road)	Minor Junction
25.	15+945	T	Left	Village (BT Road)	Minor Junction
26.	16+150	T	Right	Village (WBM Road)	Minor Junction
27.	16+695	T	Right	Village (BT Road)	Minor Junction
28.	17+645	+	Both	Village (CC Road)	Minor Junction
29.	17+960	T	Left	Village (WBM Road)	Minor Junction
30.	18+158	T	Right	Village (CC Road)	Minor Junction
31.	20+003	T	Right	Village (CC Road)	Minor Junction
32.	21+308	T	Left	Village (WBM Road)	Minor Junction
33.	21+610	T	Right	Village (BT Road)	Minor Junction
34.	26+660	T	Left	VILL. BALSRIGHTIM	Major Junction
35.	26+965	T	Left	TO MANREGA	Minor Junction
36.	26+992	T	Right	Village (CC Road)	Minor Junction
37.	27+500	T	Right	TO MANREGA	Minor Junction

S. No	Chainage	Type	Side	Direction	Type of Junction
38.	27+955	T	Left	Village (CC Road)	Minor Junction
39.	27+995	T	Right	Village (CC Road)	Minor Junction
40.	28+675	T	Left	VILL. SANIMA	Minor Junction
41.	28+780	T	Left	TO KHANTOLD	Minor Junction
42.	28+880	T	Right	TO KANTHOLAR	Minor Junction
43.	29+195	T	Left	KHANTOL GURI	Minor Junction
44.	29+595	T	Right	Village (CC Road)	Minor Junction
45.	29+650	T	Left	Village (CC Road)	Minor Junction
46.	30+120	T	Left	Village (CC Road)	Minor Junction
47.	30+180	T	Right	Village (CC Road)	Minor Junction
48.	30+310	T	Left	Village (CC Road)	Minor Junction
49.	31+590	T	Both	Village (CC Road)	Minor Junction
50.	32+136	T	Right	Village (CC Road)	Minor Junction
51.	32+680	T	Left	Village (CC Road)	Minor Junction
52.	33+225	T	Left	Village (WBM Road)	Minor Junction
53.	33+436	T	Right	Village (CC Road)	Minor Junction
54.	33+730	T	Right	Village (CC Road)	Minor Junction
55.	34+484	T	Right	Village (WBM Road)	Minor Junction
56.	34+670	T	Right	Village (WBM Road)	Minor Junction
57.	35+309	+	Both	Mendipathar	Major Junction

Details of Breast wall: Details of breast wall is given in 3.4.

Table 3.4: Summary of breast wall

S. No.	Design Chainage		Design Length (m)	Side	Net length (m)	Revised TCS
	From	To				
1	04+420	04+910	490.00	RHS	490.00	TCS-7
2	05+130	05+225	95.00	RHS	95.00	TCS-7
3	10+260	10+310	50.00	RHS	50.00	TCS-7
4	17+470	17+550	80.00	RHS	80.00	TCS-7
5	17+700	17+770	70.00	RHS	70.00	TCS-7
6	18+250	19+440	1190.00	RHS	1190.00	TCS-7
7	19+732	19+840	108.00	RHS	108.00	TCS-7
8	19+840	19+981	140.50	LHS+RHS	281.00	TCS-8
9	20+420	20+480	60.00	RHS	60.00	TCS-7
10	23+250	23+310	60.00	RHS	60.00	TCS-9
11	23+520	23+636	116.00	RHS	116.00	TCS-7
12	23+644	23+838	194.00	RHS	194.00	TCS-9
13	24+930	25+000	70.00	RHS	70.00	TCS-9
14	25+270	25+450	180.00	RHS	180.00	TCS-9
15	25+770	25+840	70.00	RHS	70.00	TCS-9
16	25+900	26+000	100.00	RHS	100.00	TCS-7
Total length (m)					3214.00	

3.4.2 PROPOSED ROAD CROSS SECTIONS

The Songsak- Mendipathar (SM) Road traverses gently undulating to moderately rolling terrain. The alignment largely follows the natural ground profile, requiring only localized earthwork. Minor cutting and filling is needed, where the road runs close to riverbanks and eroding slopes, necessitating bench cutting and slope protection such as gabion and retaining walls. Overall, the corridor requires moderate earthwork, with no major cutting, and incorporates suitable drainage and slope stabilization measures to ensure long-term stability and all-weather connectivity.

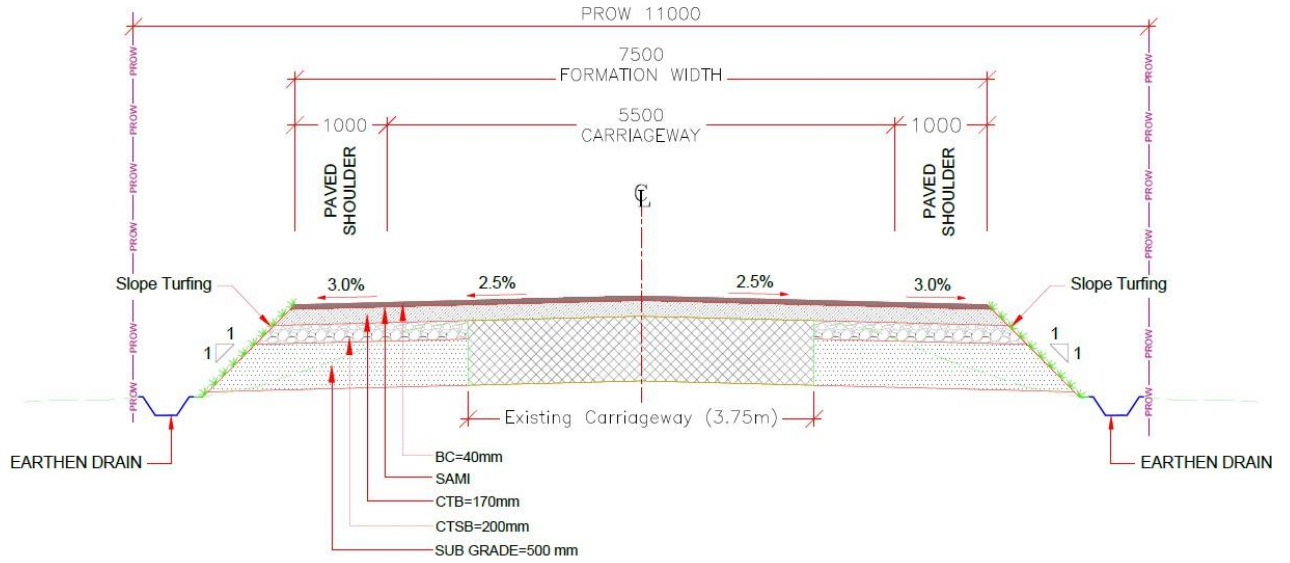
A total of 9 Typical Cross-Sections (TCS) have been proposed in the DPR (**Annexure 3.1**) for the 35.28 km road stretch. These TCSs vary, with some sections incorporating intermediate lanes, and are specifically designed to address the terrain and infrastructure requirements of the corridor, including provisions for road widening, slope stabilization, drainage, and utility corridors.

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

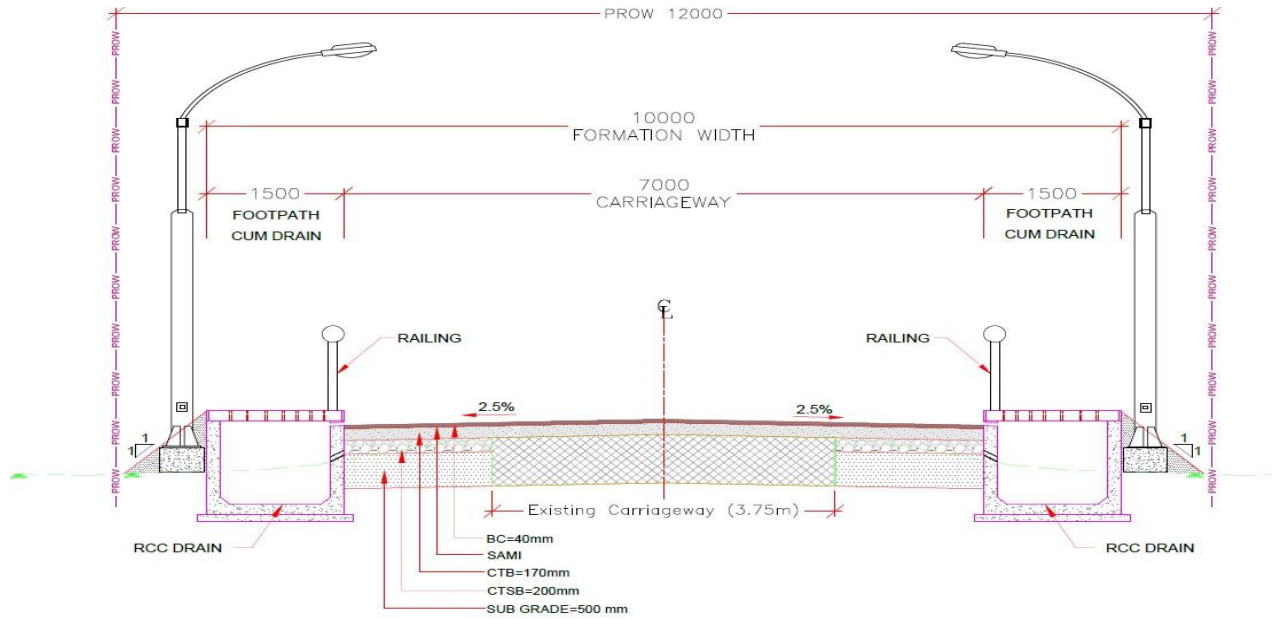
Details of the five different cross-sections, along with the chainage-wise designs adopted, are provided in **Annexure 3.1**. Design details are given in **Figure 3.5**.

Table 3.5: TCS Types and their relevant Chainages

Sl. No.	TCS Type	Chainages
1	TCS-1	03+730-04+240, 04+910-05+100, 05+420-09+179, 09+194-09+300, 10+000-10+154, 10+162-10+260, 10+310-12+750, 13+000-16+000, 16+200-17+470, 17+550-17+700, 17+770-18+250, 19+440-19+724, 19+996-20+200, 20+290-20+420, 20+480-20+688, 20+780-21+200, 21+377-21+529, 21+541-22+710, 22+790-23+250, 23+310-23+520, 23+846-23+878, 23+888-23+925, 23+935-24+930, 25+180-25+270, 25+450-25+770, 26+000-26+836, 26+848-29+550, 29+800-29+996, 30+450-30+695, 30+705-31+299, 31+307-31+500, 31+650-33+200, 33+800-34+400
2	TCS-2	09+300-10+000, 12+750-13+000, 16+000-16+200, 21+200-21+362, 29+550-29+800, 30+004-30+450, 31+500-31+650, 33+200-33+800, 34+400-35+280
3	TCS-3	04+240-04+420, 20+200-20+290, 20+696-20+780, 22+710-22+790, 25+840-25+900
4	TCS-4	05+225-05+420
5	TCS-5	00+000-00+558, 00+568-02+619, 02+631-03+695
6	TCS-6	25+000-25+180
7	TCS-7	04+420-04+910, 05+130-05+225, 10+260-10+310, 17+470-17+550, 17+700-17+770, 18+250-19+440, 19+732-19+840, 20+420-20+480, 23+520-23+636, 25+900-26+000
8	TCS-8	19+840-19+981
9	TCS-9	23+250-23+310, 23+644-23+838, 24+930-25+000, 25+270-25+450, 25+770-25+840
10	Structures	00+558-00+568, 02+619-02+631, 03+695-03+730, 05+100-05+130, 09+179-09+194, 10+154-10+162, 19+724-19+732, 19+981-19+996, 20+688-20+696, 21+362-21+377, 21+529-21+541, 23+636-23+644, 23+838-23+846, 23+878-23+888, 23+925-23+935, 26+836-26+848, 29+996-30+004, 30+695-30+705, 31+299-31+307

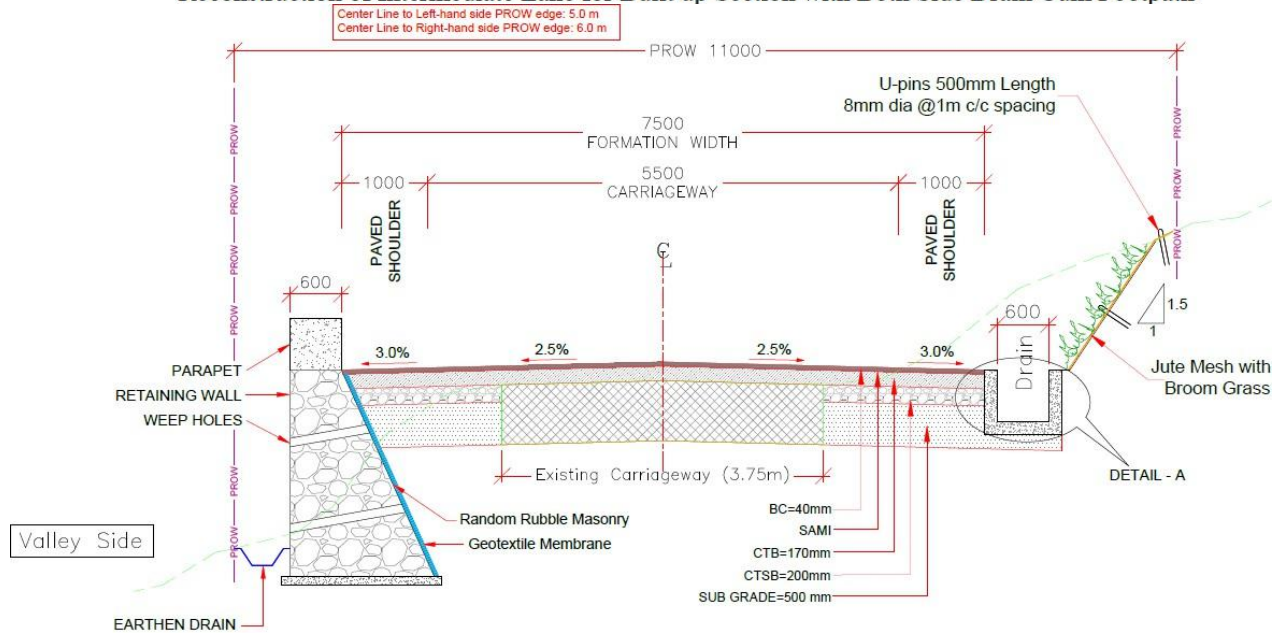


Typical Cross Section-01
Reconstruction of Intermediate Lane in Normal Fill/Cut (<1m)



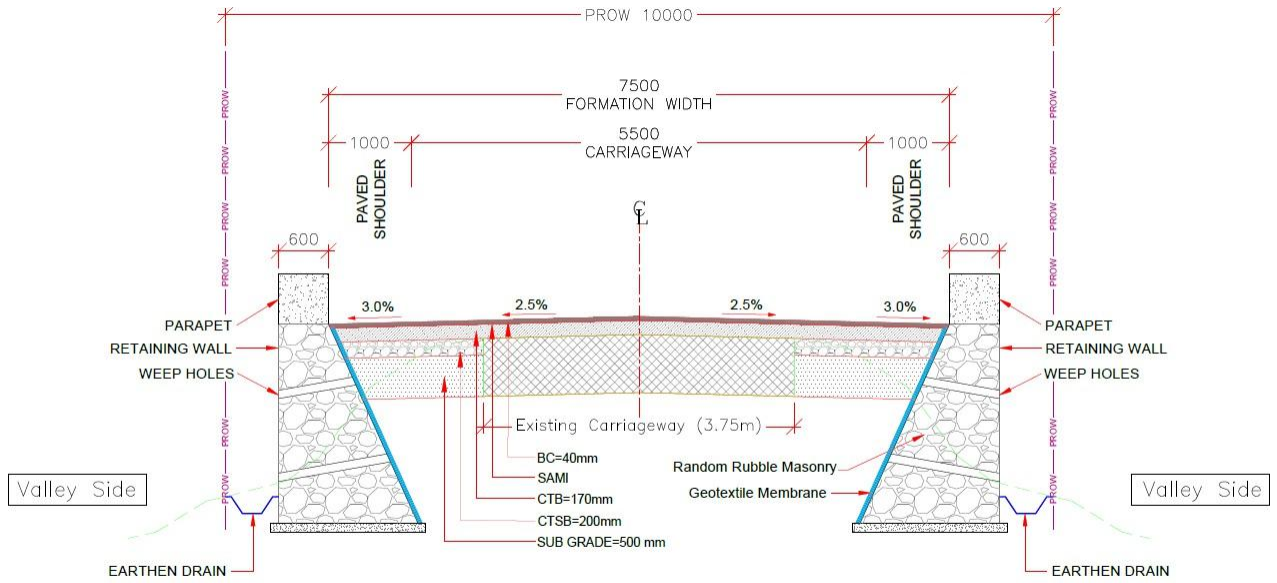
Typical Cross-Section - 02

Reconstruction of Intermediate Lane for Built up Section with Both Side Drain Cum Footpath

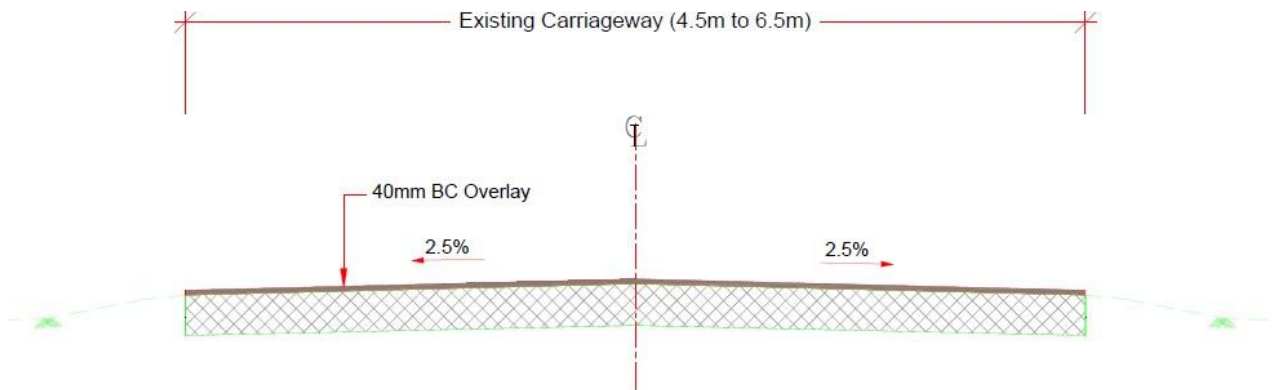


Typical Cross Section - 03

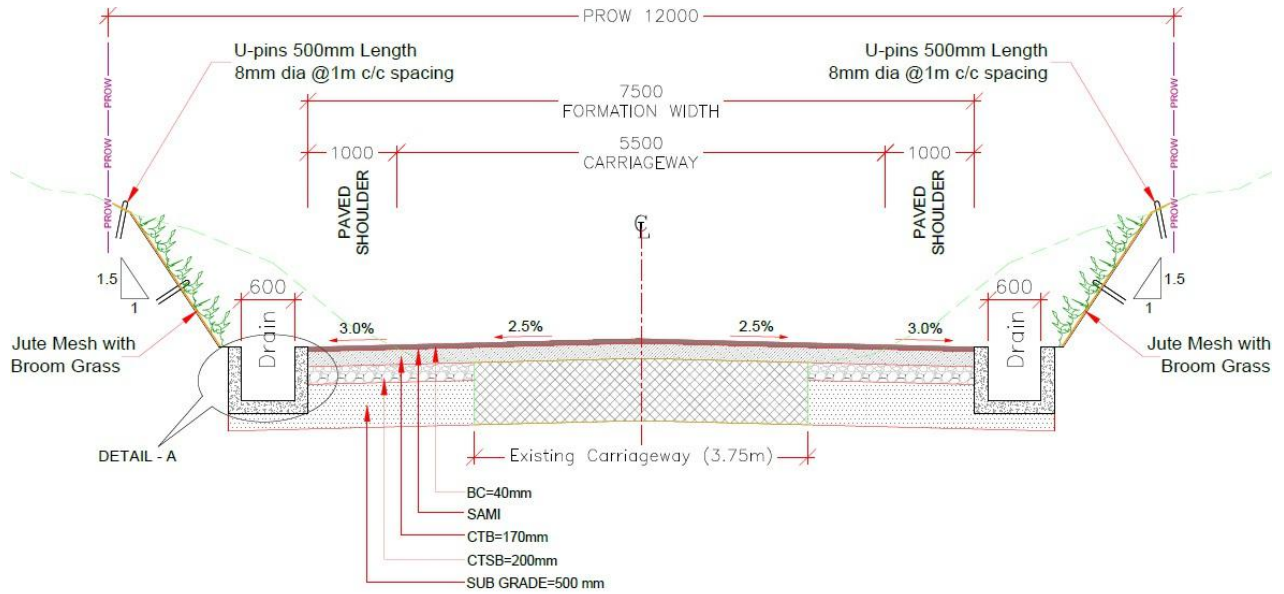
Reconstruction of Intermediate Lane with Cutting on Right side and Filling with Protection on Left side



Typical Cross Section - 04
Widening/ Reconstruction of Existing Road With Filling Both Side



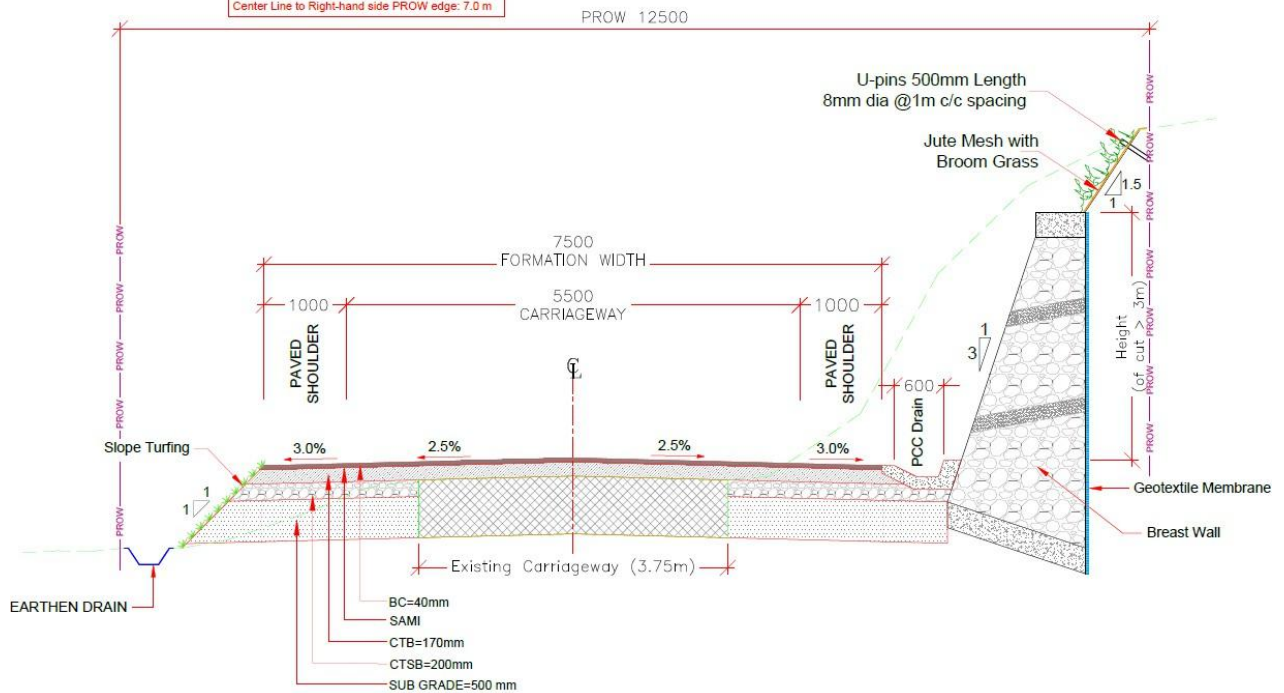
Typical Cross Section-05
For Forest Area (Km.0+000 to Km.3+695)



Typical Cross Section - 06

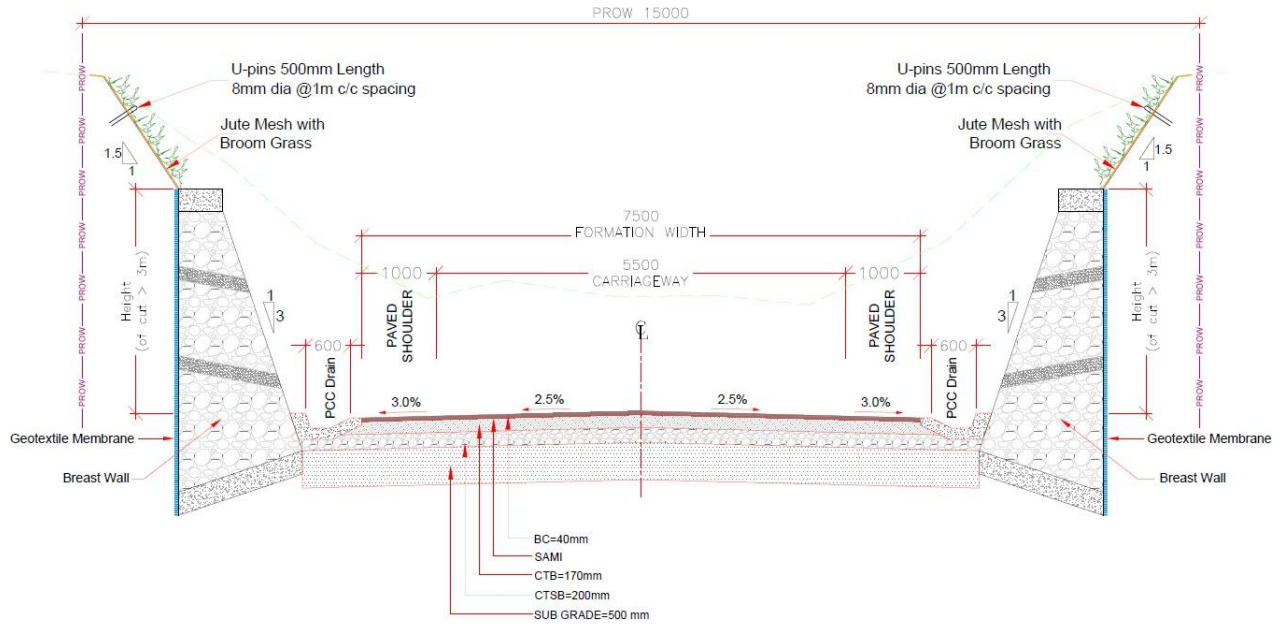
Widening/Reconstruction of Existing Road With Both side Bioengineering with Cutting

Center Line to Left-hand side PROW edge: 5.5 m
Center Line to Right-hand side PROW edge: 7.0 m



Typical Cross Section-07

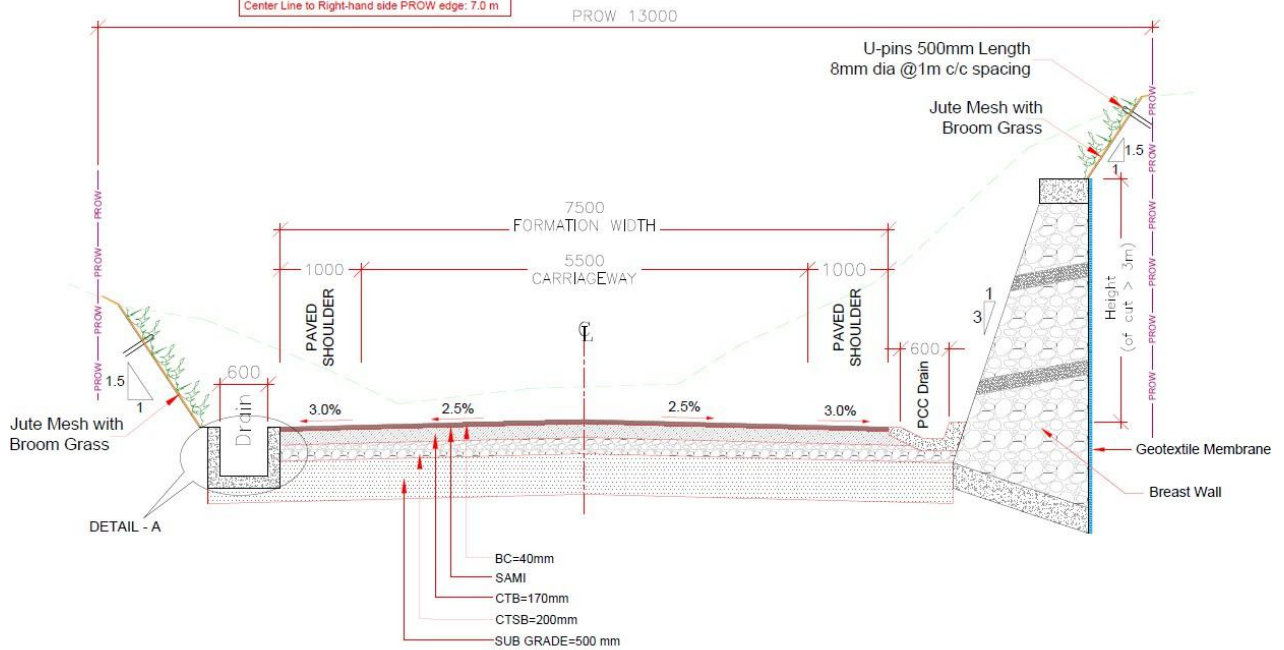
Widening/Reconstruction of Existing Road With Right side Cutting section Protection work and Left side Filling section



Typical Cross Section-08

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

Center Line to Left-hand side PROW edge: 6.0 m
Center Line to Right-hand side PROW edge: 7.0 m



Typical Cross Section-09

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

Figure 3.2: Typical Cross Sections

3.4.3 SETTLEMENTS AND CORRIDOR CHARACTERISTICS

3.4.3.1 Settlements:

The SMR sub project road passes through hilly terrain, rural settlements and towns. The details of the settlements along the sub project road are presented in **Table 3.6** below.

Table 3.6: Chainage wise List of 25 Habitations/ 20 villages along the project road

Sl. No.	Chainage		Settlements
Sub Project Road			
1	0+000	3+500	Songsak Forest Reserve
2	3+500	5+000	Songkama
3	5+000	7+000	Samin Songkama
4	7+000	8+000	Samin Wakso
5	8+000	10+000	Koksi Nengsat
6	10+000	13+000	Chidimit Nengsat
7	13+000	14+000	Chidimit Namesa
8	14+000	15+500	Chidimit Boldakgittim
9	15+500	17+000	Dagal Apal
10	17+000	20+000	Dandakol
11	20+000	21+600	Dalbinggre
12	21+600	22+500	Sepikol
13	22+500	24+000	Dajonggre Songgital
14	24+000	25+500	Dajong gate
15	25+500	27+600	Darenchi
16	27+600	28+000	ThapaRangdopa
17	28+000	29+000	New ThapaKantolguri
18	29+000	30+000	Kantolguri
19	30+000	30+700	Rongkaminchi
20	30+700	32+000	On RHS- SoenangAdinggre
21	30+000	32+000	On LHS- SoenangApal
22	32+000	32+400	SoenangLabourpara
23	32+400	33+000	Soenang Bahartuli
24	33+000	34+000	New Phutimari
25	34+000	35+000	JamgaoSorokpara

Details of Protection work

The proposed works include 50815 m of earthen drains, 7276 m where footpath-cum-drains in built-up sections is proposed, and 1428 m PCC roadside drains and 3214 m PCC roadside drain with Breast wall to facilitate efficient storm water disposal. In addition, adequate drainage arrangements are proposed at bridge locations. A cross slope of 2.5% has been adopted on the bridge deck to ensure effective drainage of rainwater. Further, retaining walls are proposed to provide slope stability and protection, with a total length of 40 m on the left-hand side (LHS) and 28 m on the right-hand side (RHS).

Along the sub project road, a total of 25 existing bus stops are presently available to cater to public transportation needs. To enhance commuter convenience and improve accessibility, 14 new bus stops are proposed at suitable locations based on traffic demand and settlement patterns. 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 corridor and provide better facilities to road users. 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 project corridor.

A total of 26 public toilet blocks, each of size 3.0 m × 4.0 m, are proposed along the project corridor to enhance sanitation infrastructure. These facilities shall be constructed in accordance with approved drawings, relevant codes, and technical specifications, under the supervision and directions of the Engineer. Each toilet block will

consist of masonry and reinforced cement concrete (RCC) structures to ensure structural stability, durability, and long service life. The facilities shall be provided with essential sanitary fixtures, including water closets, urinals (where applicable), wash basins, and proper plumbing systems. The flooring shall be finished with anti-skid tiles to ensure user safety, particularly under wet conditions. A reliable water supply system shall be ensured through appropriate storage and distribution arrangements. The wastewater generated shall be managed through a proper drainage network connected to a septic tank followed by a soak pit, designed as per standard engineering practices.

Each unit shall incorporate adequate ventilation and natural/artificial lighting to maintain hygienic conditions. Proper accessibility features, including user-friendly entry/exit and provisions for maintenance, shall also be integrated into the design. The proposed sanitation facilities are intended to provide safe, hygienic, and sustainable public utility infrastructure, thereby improving overall environmental sanitation and user convenience along the corridor. Tin sheds are proposed at chainages 27+500 to 27+520, 28+600, 29+700, and 30+200 along the project corridor for community use. These shall be constructed as per approved designs and relevant technical specifications under the supervision of the Engineer-in-Charge, comprising a steel structural framework with galvanized corrugated tin roofing sheets, finished flooring, and necessary provisions for drainage, ventilation, and accessibility to ensure durability, user safety, and ease of maintenance.

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	3+730–4+240, 4+910–5+100, 5+225–5+420, 5+420–9+179, 9+194–9+300, 10+000–10+154, 10+162–10+260, 10+310–12+750, 13+000–16+000, 16+200–17+470, 17+550–17+700, 17+770–18+250, 19+440–19+724, 19+996–20+200, 20+290–20+420, 20+480–20+688, 20+780–21+200, 21+377–21+529, 21+541–22+710, 22+790–23+250, 23+310–23+520, 23+846–23+878, 23+888–23+925, 23+935–24+930, 25+180–25+270, 25+450–25+770, 26+000–26+836, 26+848–29+550, 29+800–29+996, 30+450–30+695, 30+705–31+299, 31+307–31+500, 31+650–33+200, 33+800–34+400
2	TCS-3	4+240–4+420, 20+200–20+290, 20+696–20+780, 22+710–22+790, 25+840–25+900
3	TCS-4	5+225–5+420
4	TCS-7	4+420–4+910, 5+130–5+225, 10+260–10+310, 17+470–17+550, 17+700–17+770, 18+250–19+440, 19+732–19+840, 20+420–20+480, 23+520–23+636, 25+900–26+000
2.	Footpath cum Drains	
1	TCS-2	9+300–10+000, 12+750–13+000, 16+000–16+200, 21+200–21+362, 29+550–29+800, 30+004–30+450, 31+500–31+650, 33+200–33+800, 34+400–35+280
3.	PCC Roadside Drains (Rectangular + Breast Wall Combined)	
1	TCS-3	4+240–4+420, 20+200–20+290, 20+696–20+780, 22+710–22+790, 25+840–25+900
2	TCS-6	25+000–25+180
3	TCS-7	4+420–4+910, 5+130–5+225, 10+260–10+310, 17+470–17+550, 17+700–17+770, 18+250–19+440, 19+732–19+840, 20+420–20+480, 23+520–23+636, 25+900–26+000
4.	TCS-8	19+840–19+981
	TCS-9	23+250–23+310, 23+644–23+838, 24+930–25+000, 25+270–25+450, 25+770–25+840
4.	Rest areas	
1.	Bus Stop (existing)	5+435, 7+310, 13+650, 15+360, 15+930, 16+095, 21+500, 24+650, 26+645, 27+250, 31+230, 31+550, 32+155 (All LHS) 6+940, 11+680, 11+940, 12+880, 13+945, 14+430, 18+670, 27+975, 28+860, 29+655, 30+140, 32+460 (All RHS)
	Bus Stop (Proposed)	4+700, 10+200, 12+220, 12+885, 17+635, 19+880, 34+635 (All LHS) 3+800, 9+360, 9+940, 21+290, 27+490, 32+680, 35+255 (All RHS)
2.	Public	26

	Toilet (proposed)	
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Bioengineering

For cutting sections, bio-engineering measures are proposed on both left and right sides where slope heights range from about 1.0 m to 3.0 m. These measures are primarily intended for stabilization of cut slopes, prevention of surface erosion, and protection against rain-induced soil washout. Grass planting 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. **Details of Cutting is given in Table 3.8:**

Table 3.8: Details of Cutting

Left Hand Side (Cutting Section)			
From	To	Length in m	Height in m
5620	5640	20	-1
5660	5670	10	-1
5690	5770	80	-1.5
5830	5910	80	-1.5
7810	7830	20	-1
8470	8490	20	-1
12590	12630	40	-1
14380	14410	30	-1
15200	15230	30	-2
15500	15570	70	-1
16500	16520	20	-1.5
19890	19940	50	-3
23690	23700	10	-1
25020	25160	140	-2
25240	25300	60	-1
25930	25950	20	-2
26340	26370	30	-2
30440	30460	20	-1
30590	30630	40	-1
31860	31870	10	-2
Total Length in m		800	
Right Hand Side (Cutting Section)			
3910	3930	20	-2.00
4040	4110	70	-2.50
4280	4370	90	-1.50
4440	4490	50	-1.50
4530	4590	60	-2.00
4670	4690	20	-2.00
4740	4790	50	-2.50
4840	4890	50	-3.00

4990	5020	30	-1.50
5190	5210	20	-2.00
5960	6050	90	-2.00
6160	6180	20	-1.00
7090	7140	50	-1.00
7260	7290	30	-1.00
7310	7400	90	-1.50
7440	7450	10	-1.00
7700	7740	40	-1.00
8130	8140	10	-1.00
8250	8270	20	-1.00
9040	9050	10	-1.00
10270	10300	30	-2.00
10410	10420	10	-1.00
10560	10580	20	-1.00
10640	10740	100	-1.00
11370	11410	40	-1.00
17330	17350	20	-2.50
17470	17540	70	-1.50
17710	17770	60	-2.00
17900	17910	10	-1.00
17950	17960	10	-1.00
18140	18160	20	-1.00
18260	18300	40	-2.00
18360	18420	60	-1.00
18480	18500	20	-2.00
18590	18630	40	-3.00
18680	18700	20	-2.00
18760	18780	20	-1.00
18800	18820	20	-1.00
18840	18860	20	-2.50
18910	18980	70	-2.00
19050	19090	40	-2.00
19210	19240	30	-2
19320	19330	10	-3
19380	19440	60	-2.5
19540	19560	20	-2
19760	19830	70	-3
19870	19940	70	-4
20060	20110	50	-1.5
20190	20200	10	-1
20420	20480	60	-3
20540	20560	20	-1
20760	20800	40	-1.5
20900	20930	30	-1
21810	21820	10	-2
22010	22020	10	-1.5
22480	22490	10	-2
22570	22590	20	-2
23110	23120	10	-2

23260	23290	30	-2
23520	23610	90	-3
23660	23820	160	-4
24300	24320	20	-2.5
24500	24530	30	-1.5
24950	24970	20	-3
25020	25160	140	-1.5
25260	25290	30	-1.5
25920	25990	70	-2
28540	28550	10	-2
31580	31590	10	-1
31860	31870	10	-1
Total length in m		2720	

Protection work:

In addition to the protective measures for road works, gabion-type retaining walls have been proposed, covering a cumulative length of 480 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	Design chainage	Total length in m	Roadside	Remarks
1	At MNB	2+650	60	BHS	Bridge Approach Protection
2	At MNB	3+740	60	BHS	Bridge Approach Protection
3	At MNB	5+160	60	BHS	Bridge Approach Protection
4	At MNB	9+238	60	BHS	Bridge Approach Protection
5	At MNB	20+038	60	BHS	Bridge Approach Protection
6	At MNB	21+410	60	BHS	Bridge Approach Protection
7	At MNB	21+578	60	BHS	Bridge Approach Protection
8	At MNB	27+018	60	BHS	Bridge Approach Protection
Total Length (m)			480		

Where natural streams or drains run parallel and in close proximity of the roadway, appropriate protection measures such as retaining walls, gabion structures with rivet mattress shall be provided to prevent erosion, scouring, and undermining of the road formation, thereby ensuring long-term stability and safety of the highway infrastructure. Details are given in table 3.10.

Table 3.10 Protection Works for Streams Parallel to Road

Protection Works for Streams Parallel to Road				
Sl. No	Chainage		Length in m	Side
	From	To		
1	3950	4120	170	LHS
2	4220	4450	230	LHS
3	4710	4740	30	LHS
4	4940	4970	30	LHS
5	10140	10160	20	LHS
6	10260	10305	45	LHS
7	10360	10440	80	LHS
8	10800	11010	210	LHS
9	11090	11190	100	LHS
10	11330	11410	80	LHS
11	11440	11460	20	LHS
12	11500	11540	40	LHS
13	20380	20560	180	LHS
14	20700	20780	80	LHS
15	20855	20890	35	LHS
16	21055	21080	25	LHS
17	24420	24460	40	LHS
18	24510	24540	30	LHS
Total length in m			1145	

UTILITY DETAILS

The project road corridor, classified as a Major District Road (MDR) with a total length of approximately 35.28 km, is equipped with several essential utility infrastructures. Electric poles, overhead electric lines, and Optical Fiber (OFR) cables run parallel to the road alignment, serving as key associated facilities that support both local communities and regional connectivity. 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 256 electric poles, 1 transformer, and 107 electric line crossings are identified along the SMR road corridor for shifting. Of these, 172 poles are on the LHS and 84 on the RHS. Details of utilities are given in **Annexure 1.1**.

3.4.3.2 Corridor Characteristics

The salient features of the SMR road are summarized in **Table 3.11** below.

Table 3.11: Current Salient features of the SMR Road

Sl. No.	Characteristics	35.28 km
1	Name of Road	Strengthening and Improvement of Songsak- Mendipathar Road (MDR)
2	Project road corridor road Length	35.28 km (including approaches of Bridge)
3	District	East Garo Hills and North Garo Hills
4	Villages/settlements enroute	20 villages including 25 habitations
5	Terrain	Plain/Hilly/Rural
	Existing	The road is affected by various surface damages, including potholes, cracks, and other deterioration
6	Proposed treatment	Brownfield Improvement of sharp curves within the RoW, reconstruction of weak and damaged/ new culverts and bridges, rehabilitation and strengthening of existing pavement to intermediate lane and protection works.
7	Bridges	No. of Major Bridge – 0 No. of Minor Bridges - 17
8	Culverts	147
9	Forests / environmentally sensitive areas	Passes through Reserved Forest (CH 0+000–3+525),
10	Religious Structures Affected	Nil
	Impacted Structures (including Temporary Structures of NTHs)	48
11	Fifth/Sixth Scheduled Areas	Sixth Schedule Area
12	River crossings	Proposed road is crossing the Chidrang river
13	Water bodies / ponds	1. 2 Rivers: Chidrang River @chainage 35+700 and Songkama River Ch 5+100. 2. 3 Ponds: community pond @Chainage 8+000, community pond @Chainage 8+000 12+800 and Pond @Chainage 15+350
14	Sensitive receptors	4 School, 2 community halls, 1 Anganwadi Centre, 1 Church, in COI 50 m
15	Transshipment areas/truck parking locations	-
17	Other features / issues if any	-
18	Land Requirement	The total Land requirement that will be acquired permanently for this sub project is 0.27 Ha. For the purpose of Spoil disposal, 0.97 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. Approximately 33 trees are likely to be impacted or require removal due to the proposed widening. Major trees impacted are Jackfruit, Mango, Arecanut, Teak, Sal, Neem, Peepal, Bargad, Siris, Guava, Ber, Moringa, etc.

Table 3.12: Chainage wise list of Trees

S. No.	Chainage (km)	Common Name	Botanical Name	GBH (cm)	Height (m)
1.	0+800	Jackfruit	<i>Artocarpus heterophyllus</i>	85	13
2.	1+300	Areca Palm	<i>Areca catechu</i>	35	9
3.	1+900	Banana	<i>Musa paradisiaca</i>	30	6
4.	2+400	Mango	<i>Mangifera indica</i>	90	15
5.	2+900	Jamun	<i>Syzygium cumini</i>	80	13
6.	3+400	Peepal	<i>Ficus religiosa</i>	110	17
7.	3+900	Banyan	<i>Ficus benghalensis</i>	125	18
8.	4+500	Hog Plum (Amra)	<i>Spondias pinnata</i>	55	9
9.	5+000	Bael	<i>Aegle marmelos</i>	65	11
10.	5+500	Amla	<i>Phyllanthus emblica</i>	55	8
11.	6+000	Harad	<i>Terminalia chebula</i>	70	12
12.	6+500	Baheda	<i>Terminalia bellirica</i>	85	14
13.	7+000	Mahua	<i>Madhuca longifolia</i>	90	15
14.	7+600	Indian Elm	<i>Holoptelea integrifolia</i>	80	14
15.	8+800	Jackfruit	<i>Artocarpus heterophyllus</i>	85	13
16.	9+300	Areca Palm	<i>Areca catechu</i>	40	9
17.	9+900	Banana	<i>Musa paradisiaca</i>	35	7
18.	10+400	Mango	<i>Mangifera indica</i>	100	16
19.	11+000	Jamun	<i>Syzygium cumini</i>	75	12
20.	11+600	Peepal	<i>Ficus religiosa</i>	115	16
21.	12+100	Banyan	<i>Ficus benghalensis</i>	130	18
22.	12+800	Hog Plum (Amra)	<i>Spondias pinnata</i>	60	10
23.	13+300	Bael	<i>Aegle marmelos</i>	70	11
24.	13+900	Amla	<i>Phyllanthus emblica</i>	50	8
25.	15+200	Jackfruit	<i>Artocarpus heterophyllus</i>	90	14
26.	15+900	Areca Palm	<i>Areca catechu</i>	45	9
27.	16+500	Areca Palm	<i>Areca catechu</i>	58	8
28.	17+200	Mango	<i>Mangifera indica</i>	95	15
29.	18+000	Jamun	<i>Syzygium cumini</i>	70	12
30.	19+000	Peepal	<i>Ficus religiosa</i>	105	17
31.	21+000	Banyan	<i>Ficus benghalensis</i>	125	18
32.	27+000	Mango	<i>Mangifera indica</i>	90	14
33.	34+000	Neem	<i>Azadirachta indica</i>	85	13

Source: Field Survey

List of Private Trees

S. No.	Chainage (km)	Common Name	Botanical Name	GBH (cm)
1	19+860	Areca Palm	<i>Areca catechu</i>	40
2	19+870	Areca Palm	<i>Areca catechu</i>	42
3	19+880	Areca Palm	<i>Areca catechu</i>	35
4	19+900	Areca Palm	<i>Areca catechu</i>	30
5	19+920	Areca Palm	<i>Areca catechu</i>	40
6	19+950	Areca Palm	<i>Areca catechu</i>	45
7	19+980	Areca Palm	<i>Areca catechu</i>	49

8	19+990	Areca Palm	<i>Areca catechu</i>	48
9	20+000	Areca Palm	<i>Areca catechu</i>	55
10	20+030	Areca Palm	<i>Areca catechu</i>	45

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 project corridor in East and North Garo Hills, Meghalaya, encounters significant challenges due to its rugged terrain, characterized by high hills and deep valleys. The topographic profile of the SMR Sub Project Road reveals a gently undulating to moderately rolling landscape, with elevations ranging from 95 m to 562 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 35.28 km stretch, three prominent elevation peaks and three depressions are observed, indicating alternating cut-and-fill sections. The highest elevations occur near the mid and terminal portions of the corridor, while the lowest points coincide with valley sections characterized by seasonal drainages and stream crossings. This topographical variation implies moderate earthwork requirements during construction, particularly in sections with steeper gradients. The general slope direction varies locally but follows the natural drainage pattern towards adjacent valleys, indicating the need for adequate drainage and slope protection measures. To address these issues, slope stabilization measures are essential to enhance the safety and resilience of the corridor, particularly given the district's susceptibility to landslides and the complexity of the topography. The sub-project proposes geotechnical solutions designed to stabilize both hillside cuts and valley-side slopes.

Field investigations indicate active erosion at multiple chainages, with existing natural slopes ($\approx 35^\circ$) requiring flattening to a safer modified angle of 26.57° . Protection measures such as gabion revetments, riprap pitching, toe walls, and bio-engineering are proposed to stabilize slopes and prevent further riverbank erosion. These treatments will enhance long-term stability, minimize sediment loss, and improve resilience of the corridor.

Location wise slope protection works proposed along with project is given in **Table 3.13** below.

Table 3.13: Slope protection works

Chainage	Side	Existing Angle ($^\circ$)	Height of Cut (m)	Modified Angle of Repose ($^\circ$)	Proposed Slope Protection
4+000	Both / LHS	35.00	3.00	26.57	Protection wall + toe riprap + bioengineering (broom/grass)
4+020	LHS	35.00	3.50	26.57	Gabion mattress + slope regrading to 1V:2H + broom grass planting
4+300	LHS	35.00	4.00	26.57	Gabions/stone pitching at toe + benching + vegetation
10+300	LHS	35.00	5.00	26.57	Riprap revetment + geotextile filter + benching
10+800	LHS	35.00	5.00	26.57	Riprap + toe protection + slope flattening
11+400	LHS	35.00	4.50	26.57	Gabion revetment + check bunds + revegetation
20+400	LHS	35.00	6.00	26.57	Heavy riprap/stone pitching + toe wall + large gabions
20+700	LHS	35.00	5.50	26.57	Gabion mattress + slope regrading + vegetation
20+900	LHS	35.00	6.00	26.57	Riprap + river-training (if required) + vegetation

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 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

Details of construction material required for this project, their Source and Lead are given in **Table 3.14**.

Table 3.14: Source and Lead of Construction Materials

S. No.	Item	Unit	Estimated Quantity (from DPR / calc)	Quarry / Source Location	Total Lead (Km)
1	Earthwork	m ³	50181.51	Local Area	9
	Surplus cut (to be disposed / reused)	m ³	478732.89 (surplus from cut)	MPWD-designated disposal sites	Four (4) disposal sites have been identified along the project stretch with joint verification with PWD, ESIA and DPR consultants.
2	Sand	m ³	44089	Gokolgre, North Garo Hills & Dekachang, North Garo Hills.	45 & 18 respectively
4	Aggregate	m ³	80384	Wagesi. North Garo	51 & 43 respectively

	(coarse aggregate)			Hills & Rongkem, East Garo Hills.	
5	Bitumen	MT	2,083	Guwahati IOCL Refinery	163
6	Emulsion	MT	170	Haldia to Site	1,050
7	TMT Bars	MT	845	Shillong (SAIL)	275
8	Cement	MT	5,060	Guwahati Cement Plant	160
9	Water	KL	49,072.723	Songkama	-

Assessing the availability of suitable construction materials near the project road is crucial for a road project. Surface water from the Songkama river can be used for road construction with prior permission from the concerned Irrigation Department, East Garo Hills District, 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.

As per the earthwork estimation for the project corridor, the total fill quantity is 17541 m³, and the cut quantity is 83272 m³. After balancing cut and fill requirements, there remains a surplus of approximately 72304 m³ 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.

The additional land required for the proposed road improvement works is approximately 0.2712 hectares, while an estimated 0.97 hectares of land will be required separately for Spoil disposal purposes. As per the available data from PWD, a total of Four (4) disposal sites have been identified along the project stretch with joint verification with PWD, ESIA and DPR consultants.

As per the approved BoQ (Page no 227) of Chapter 8 of Vol 1 main DPR and Bill no. 13 in BOQ, the scope includes excavation of unsuitable soil, Spoil/debris removal, loading, transportation, and disposal at identified dumping locations, along with spreading, leveling, and compaction at disposal sites. The total quantity covered under the BoQ for disposal is 72304 cum, out of which recyclable material such as suitable excavated earth and granular material will be reused for embankment formation, shoulder filling, and low-lying area backfilling as per site suitability. Only the balance non-recyclable and excess Spoil is proposed for disposal at the identified chainages. Details of spoil disposal site is given in Table 3.15.

Table 3.15: Details for the Spoil disposal sites

Dumping Location			Coordinate		Area m2	Approx. Quantity (m ³)
SL. NO	LOCATION CHAINAGE	SIDE	X	Y		
1	13+300	LHS	25'74"91"	90'63"00"	2500	3,178 m ³
2	16+300	RHS	25'77"28"	90'62"96"	3700	4,448 m ³
3	21+600	LHS	25'80"79"	90'61"67"	2000	2,665 m ³
4	29+700	LHS	25'84"48"	90'60"97"	1500	1,906 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 quarry materials, minimizes construction waste, and ensures compliance with the Solid Waste Management Rules, 2016 and Environmental (Protection) Act, 1986.

3.7 LAND REQUIREMENTS

The additional land required for the proposed road improvement is approximately 0.2712 Ha and the land for dumping of excess excavated material is 0.97 ha for temporary use. The required land for spoil disposal site will be used temporarily taken on lease 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 4 locations for dumping of spoils.

MPWD, in close coordination with the concerned Village Council and community, will secure the necessary land parcels through mutually agreed arrangements that are fully consistent with the principles of Free, Prior and Informed Consent (FPIC). This approach was discussed in detail during the FPIC consultation meetings with the Village Council head and community members, who expressed their general support for the project and willingness to facilitate the required land access in accordance with customary practices and applicable safeguards.

Land requirement details are given in **Table 3.16**.

Table 3.16: Details of Land requirement

Sr. No	Village	Chainge from	Chainage to	Length (m)	Available RoW	Required ROW	Required Land	Owner ship of Land	Use of Land
1	SaminSongkama	5.000	5.080	80	8.0000	11.0000	0.0240	Community	Horticulture
2	SaminSongkama	5.080	5.110	30	0.0000	12.0000	0.0360	Community	Horticulture
3	SaminSongkama	5.110	5.160	50	8.0000	11.0000	0.0150	Community	Horticulture
4	Dandakol	19.870	19.940	70	3.0000	15.0000	0.0840	Community	Horticulture
5	Dandakol	19.940	19.981	41	11.0000	15.0000	0.0164	Community	Horticulture
6	Dandakol	19.981	20.030	49	9.0000	11.0000	0.0098	Community	Horticulture
7	DajonggreSonggital	23.500	23.562	62	2.0000	12.5000	0.0651	Community	Horticulture
8	DajonggreSonggital	23.562	23.600	38	7.0000	12.5000	0.0209	Community	Horticulture
Total Length				420.000			0.2712		

Table 3.17: 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	0.2712 ha
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
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	0.97 Ha (land will be leased)

3.8 WATER REQUIREMENTS

The overall water requirement of the project is 36.952 KLD, of which 30.62 KLD will be used for construction activities and 6.3 KLD is required for domestic purposes. Source of water is Songkama and Chidrang River. Details of Water requirement is given in Table 3.18.

Table 3.18: Water Requirement for Construction Works

Activity	Daily Demand (Liters/km)	Total for 35.28 Km (Liters/day)	Remarks
Concreting and curing	786.64	27753	Concrete mixing, compaction, culverts, drains.
Dust Suppression at Work Zone	82.19	2899.66	Reduced due to frequent rain; use only on dry days.
Domestic Purpose	-----	6300	For 70 workers (drinking, cooking, sanitation).
Total	—	36,952.66 Liters/day	—

3.9 MANPOWER 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 145 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 35.28 km subproject stretch is considered as 36 months. The total estimated cost of the project is approximately 260.4 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 Resubelpara Development Block (North Garo Hills) and Songsak Development Block (East Garo Hills) as well as hilly upland, gentle plain 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 corridor 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.

Component	"With" Project Scenario	"Without" Project Scenario
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 compensatory afforestation	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 corridor.	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 landslides/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.

Component	"With" Project Scenario	"Without" Project Scenario
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 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. The land requirement has been minimized as the road improvement will be undertaken within the available Right of Way (ROW) to the maximum possible extent. Land is required at the following chainages: 5.000 km, 5.080 km, 5.110 km, 19.870 km, 19.940 km, 19.981 km, 23.500 km, and 23.562 km for 420 m. RoW is available at rest of the Chainages for 35 Km. Approximately 0.2712 ha of additional land will be required to maintain the ROW. **Table 4.2** summarizes the measures adopted to offset these impacts, and a detailed description of each measure is presented in the following sections.

Table 4.2: Alternative considerations for Minimization of Environmental Impacts

Chainage	Village	Proposed/Mitigation measure adopted	Mitigation included in DPR	Reference in the DPR
0+000 to 3+525	Songsak Forest Reserve	Forest Area (Both Side) (The Existing Road Blacktop is covered only with no further improvement).	The Existing Blacktop will be maintained only with no further improvement. speed restrictions (rumble strips/table-top crossing), signages and timed movement restrictions at night if necessary, to ensure safe passage at forest location from km 0+000 to 3+695	TCS-05, Page No-153 [Vol-1 Main Report]
4+020	Songkama	Eroding riverbank protection work needed (LHS)	Stream protection has been proposed at location KM 3+950 TO KM 4+120 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0
4+300	Songkama	Protection work needed at riverbank (LHS)	Stream protection works has been proposed at location KM 4+220 to KM 4+550 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0
5+350	Samin Songkama	Waterlogging in school premises during rainfall. Preventing runoff of water towards school (RHS)	Lined drain has been proposed from km 5+130 to 5+225 on Right Side	Table 14, Page No-172 [Vol-1 Main Report]

5+600	Samin Songkama	Waterlogging or overtopping during monsoon.	Box culvert of dimension 1x3.0m span has been proposed at location Km: 5+591	Table 10, Page No-160 [Vol-1 Main Report]
8+000	Samin Wakso	Protect community water resources, prevent contamination, and maintain natural pond ecology. Community reserve pond hence water should not enter the community pond (LHS)(For rubber tree processing purpose only)	As the left-hand side (LHS) curve is located on a raised platform, it prevents water from entering the pond. As the condition is naturally mitigated, no intervention is required at this location, resulting in cost savings, minimal environmental disturbance, and efficient project implementation.	-
10+300	Chidimit Nengsat	Erosion due to river, protection work needed (LHS)	Stream protection works has been proposed at location Km 10+260 to Km 10+305 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0
10+800	Chidimit Nengsat	Erosion due to river, protection work needed (LHS)	Stream protection works has been at location Km 10+800 to Km 11+010 to prevent further erosion of road embankment.	Page No-182 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0
11+400	Chidimit Nengsat	Protection work required due to soil erosion in the river on left side (LHS)	Stream protection works has been at Km 11+680 to prevent further erosion of road embankment.	Table 19 & 21, Page No-187 & 191 [Vol-1 Main Report]
12+800–13+800	Chidimit Nengsat	Market section identified.	2-lane improvement with drain-cum-footpath, and paved shoulders to strengthen road have been proposed.	Table 19 & 21, Page No-187 & 191 [Vol-1 Main Report]
15+350	Dagal Apal	Protection work required at Pond (RHS) Section	Proposed Protection wall form km 15+560 to 15+680 to protect the formation from soil erosion	Bill No-11 (Community Amenities)
20+400	Dalbinggre	Protection work required on riverbank left side (LHS)	Stream protection works has been proposed at location Km 20+380 to Km 20+560 to prevent further erosion of road embankment.	Page No-183 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0

20+700	Dalbinggr e	Protection work required on riverbank left side (LHS)	Stream protection works has been proposed at location Km 20+700 to Km 20+780 to prevent further erosion of road embankment.	Page No-183 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0
20+900	Dalbinggr e	Protection work required on riverbank left side (LHS)	Stream protection works has been proposed at location Km 20+855 to Km 20+890 to prevent further erosion of road embankment.	Page No-183 [Vol-1 Main Report] & Volume-X Drawings - Sheet No. RC/1661/HO/HWB/RD/DWG/MIS C/08/R0
28+700	New Thapa Kantolguri	Improvement require at T-Junction	Proposed and Incorporated in P&P drawings	Table No. 20, Page No. 188 [Vol-1 Main Report]
31+900 to 32+000	On LHS- Soenang Apal	Graveyard protection on RHS	Protection work of height 2m for the length of 50m required at graveyard section has been proposed.	Bill No-11 (Community Amenities)
33+370 to 33+400	New Phutimari	Require boundary wall due to church.	Church at Ch-34+910 is away from the carriageway edge which do not affect the existing boundary so boundary wall not required	
34+470 to 34+500	Jamgao Sorokpara	Require slope protection	Protection wall of height 1m required from Ch-34+540 to 34+550 on right side (Filling Section) has been proposed	Table No. 15, page No. 176, Sr. No. 6.17.7.1 [Vol-1 Main Report]
34+800 to 35+100	Jamgao Sorokpara	Require boundary wall for playground on RHS	Boundary wall already on existing section which are not disturbed in design	

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 existing 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.
- Reserve forest (Ch.00+000 to 3+525) falls under this location. The Existing pavement will only be relaid with no further improvement.
- 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
- A school zone is observed between chainages 5+300–5+350 (LHS), where safety measures like speed limit signage, rumble strips, and pedestrian crossings are proposed. At chainage 5+600, a box culvert is planned to improve drainage and prevent waterlogging or shoulder erosion. A church structure along the alignment will be protected by maintaining a safe buffer, controlling dust and noise, and coordinating with the community during construction.
- Multiple locations along the alignment, including chainages 4+020, 4+300, 10+300, 10+800, 11+400, 20+400, 20+700, and 20+900, show riverbank erosion, for which protective works like stone pitching and retaining walls are proposed. At chainage 5+350, a flooding risk near the school zone has been identified, and drainage improvements are planned to divert runoff and prevent water entry into the school premises.

5. BASELINE ENVIRONMENT

5.1 GENERAL

This chapter presents the existing environmental and social conditions of the SMR 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 Project Road is passing through East Garo Hills and North Garo Hills districts. 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 between 24–26°C, while minimum temperatures can drop to 10–12°C. Summer begins in March, with July and August typically being the hottest months. During summer, maximum temperatures range from 30–33°C, and minimum temperatures are around 22–24°C.

In North 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 SMR Road

According to the Meghalaya State Action Plan on Climate Change (SAPCC, 2022), the Garo Hills region including the North Garo Hills District and 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 Songsak- Mendipathar Road (SMR) corridor, 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 experience 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 landslides along the road corridor.

North 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 landslides along the road corridor. The average annual rainfall during 2018-2020 is presented in **Table 4.2**, while **Table 4.3** provides the month-wise relative humidity for the year 2020 (nearest location: Shillong, IMD data).

Table 5.2: Last 5 years rainfall data

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 SMR Road

The Meghalaya State Action Plan on Climate Change (SAPCC, 2022) indicates that the Garo Hills region, including East and North 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 Sub Project Road corridor, 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, (CWC Flood Estimation Report for Sub Zone 2b)	=	360	mm
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 I_c for $t_c=24$ hr (Considering 100 year 24 hr rainfall)			
$I_c = (F/T) \times ((T+1)/(t_c+1))$	=	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 100 = 0.028 x P x f x A x Ic

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 1.1³x75)^{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 4.2 = 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 P x f x A x Ic = 0.028 x 0.4 x 0.99 x 161 x 39.10

$$= 69.80 \text{ Cumecs}$$

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

$$\text{Entry loss } K_e = 0.572 R^{0.3} = 0.65$$

$$\text{Friction loss } -0.035 L/R^{1.25} = 0.461$$

$$\lambda - A/(1+K_e+K_f)^{1/2} = 15.88$$

Height of box 2.178 m

$$Q \text{ capacity} = \lambda * (2gH)^{0.5} = 103.82 \text{ Cumecs}$$

or

By Mannings formula $= A \times 1/n \times R^{2/3} \times S^{0.5} =$

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

$$= 86.1 \text{ Cumecs}$$

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

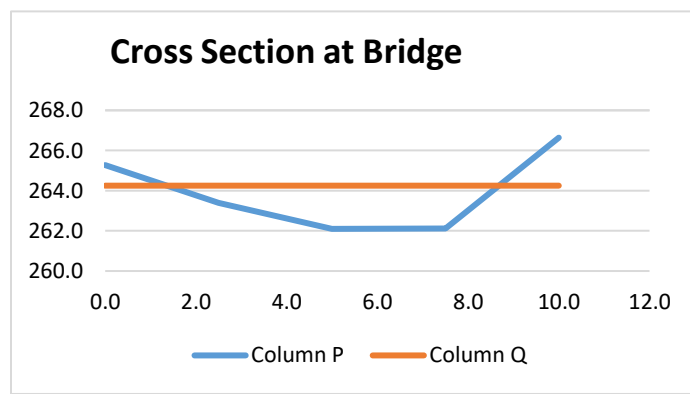
Adequacy check for deck type proposed bridge

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

$V=1/n \times R^{2/3} \times S^{1/2}= 6.462\text{m/s}$

$Q= V \times A = 6.642 \times 12.833$

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}	=	$0.028 \times P \times f \times A \times I_c$
Catchment area	=	121 Ha
H- Elevation Difference between critical point to the structure=	=	40 m
Time of Concentration t_c 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, I_c	=	$45.072/ 24 \times (24+1)/0.18+1$
	=	39.89 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 runoff for the catchment characteristics		
P	=	0.4
Design Discharge Q_{100}	=	$0.028 \times P \times f \times A \times I_c$

= **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 $K_e = 0.572 R^{0.3}$	0.69	
Friction loss $-0.035 L/R^{1.25}$	0.355028	
$\lambda - A/(1+k_e+k_f)^{1/2}$	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					
			$=18 \times 0.091^{(3/4)}$					
	Q	=	5.78	Cumecs				
B Rational Formula								
	Design Discharge Q ₁₀₀	=	$0.028 \times P \times f \times A \times l_c$					
	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	=	$(0.87 \times L^3/H)^{0.385}$					
			$= (0.87 \times 0.091^3 \times 4.14)^{0.385}$					
		=	0.03	hrs				
	100 years return period rainfall for 24hrs as per CWC flood estimation report Subzone 2b and application	=	45.072	cm				

of climate resilience factor							
From IRC SP 13 eq. 4.10a Intensity of rainfall , I _c	=	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 runoff for the catchment characteristics							
P	=	0.6					
Design Discharge Q ₁₀₀	=	0.028 x P x f x A x I _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



Final Detailed Project Report

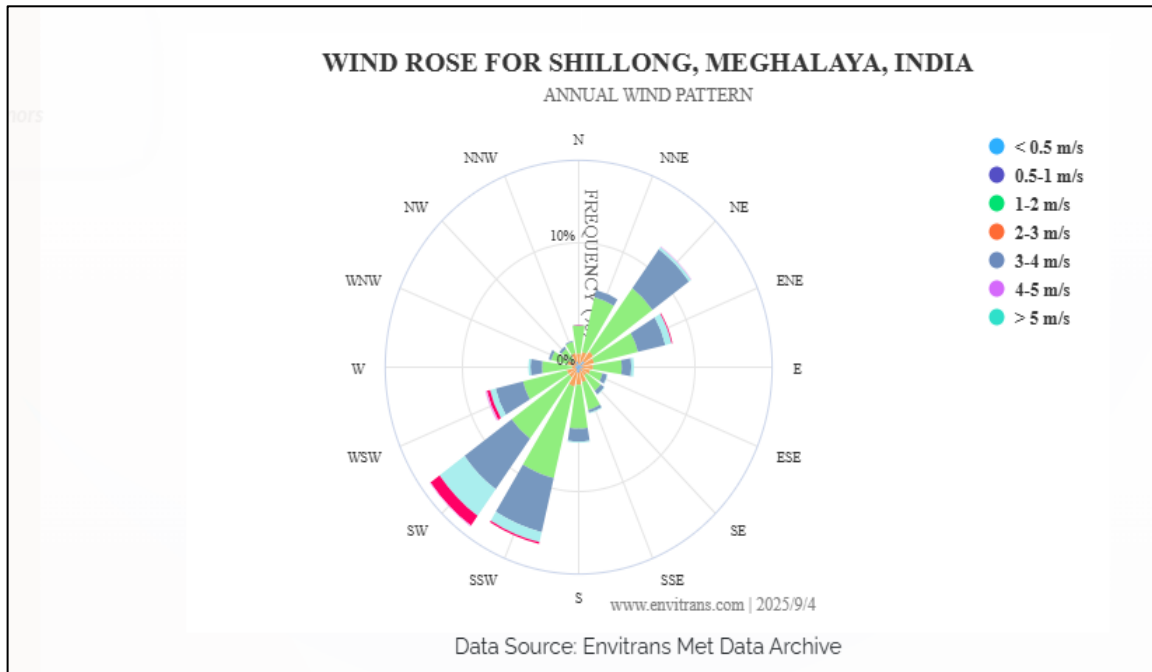
Consultancy services for preparation of feasibility study and Detailed Project Report for construction and improvement of roads in the state of Meghalaya (West Meghalaya). Rongsai - Borjhora - Bajengdoba Road (RBB)

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 metres 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 (26.1 km from the project road and 12.44 km from the ESZ), 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 landscape⁴.

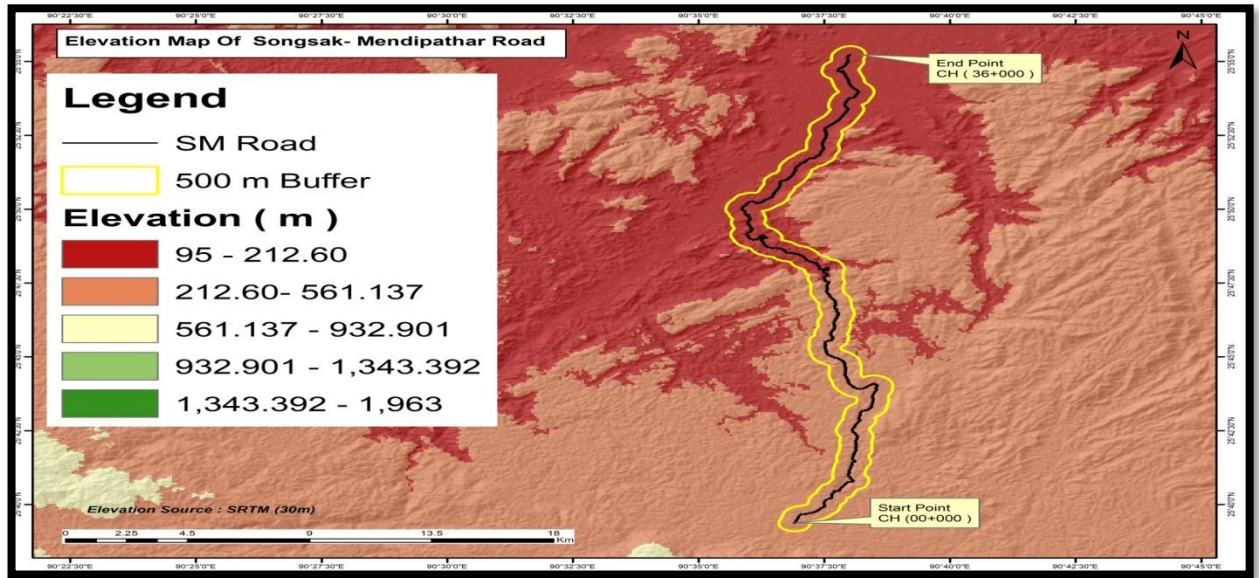
North Garo Hills District, the northern extension of the Garo Hills in Meghalaya, is characterized by hilly and undulating terrain interspersed with valleys and riverine tracts. The district is drained by several important rivers, including the Damring, Dudhnoi, Krishnai, Didram, Rongkhu, and Rongreng, all of which flow northward and eventually join the Brahmaputra. Elevation in the district ranges from approximately 100m above mean sea level in the northern plains adjoining Assam to over 1,000m in the southern highlands and ridges, with the central hilly belt

⁴ District Census Handbook, East and North Garo Hills

generally lying between 300 and 600m. The district’s physiography is defined by forested hills and sloping terrain that gradually descends northwards, giving North Garo Hills its distinct landscape⁵.

Baseline Scenario for SMR Road

As per elevation map of East and North Garo Hills District, the SMR project road stretch lies in the range of 95-562



m. The corridor wise elevation map of the project stretch is given in **Figure 5.2**.

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

5.3.2 GEOLOGY

Baseline Scenario for Sub- Project Road

Geology of the Sub Project Road (East Garo Hills)

- The corridor is underlain by weathered and lateritic residual soils developed on Precambrian/Paleozoic crystalline basement.
- The surface profile comprises lateritic crust and ferruginous gravel underlain by clayey–silty lateritic soil, grading into saprolite and deeply weathered bedrock.
- The competent substratum consists of fractured/jointed Shillong Group/Garo Hills metamorphics (schist, phyllite, metasiltstone) with minor intrusive rocks.
- Fresh rock is encountered at moderate depths depending on slope and local erosion.
- Structural features include closely spaced joints, shear zones and minor faults influencing groundwater seepage and weathering.
- Slope sections and cut slopes exhibit steep angles and are often underlain by colluvium and slope-wash deposits.
- Groundwater is generally shallow in weathered zones with perched water in clay lenses; surface drainage follows seasonal streams and roadside channels and shows rapid monsoon runoff.
- Geohazards: monsoon-triggered shallow slides, raveling of lateritic caps, erosion of cuttings and differential settlement over thick saprolite/clay layers.
-

North Garo Hills

- Dominated by Precambrian crystalline basement rocks (gneiss, granite, and quartzite).

⁵ District Census Handbook, North Garo Hills

- Discrete Gondwana coal-bearing sediments occur along valleys and river sections.
- Alluvial deposits are present in northern plains.
- Terrain is rugged and hilly in the south, becoming gently sloping toward the north.
- Economic geology: small coal occurrences (Siju–Dudnai belt), building stone, laterite and minor limestone.

Seismicity

- The corridor lies in Seismic Zone V as per IS 1893; design must adopt the relevant importance factor as per IRC:6.
- Retaining walls, culverts and bridge components should be detailed for seismic earth pressures and bearing design corresponding to PGA ≈ 0.36 g.

Environmental & construction notes

- Avoid deep excavation and major cut slopes during the monsoon (June–September); adopt staged construction with temporary drainage and silt-traps.
- Spoil disposal should be carried out only at designated stable benches (>10 m from drainage lines), compacted in layers and protected with toe bunds.
- At stream crossings, maintain riparian buffers; avoid natural forested slopes with dense canopy.

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

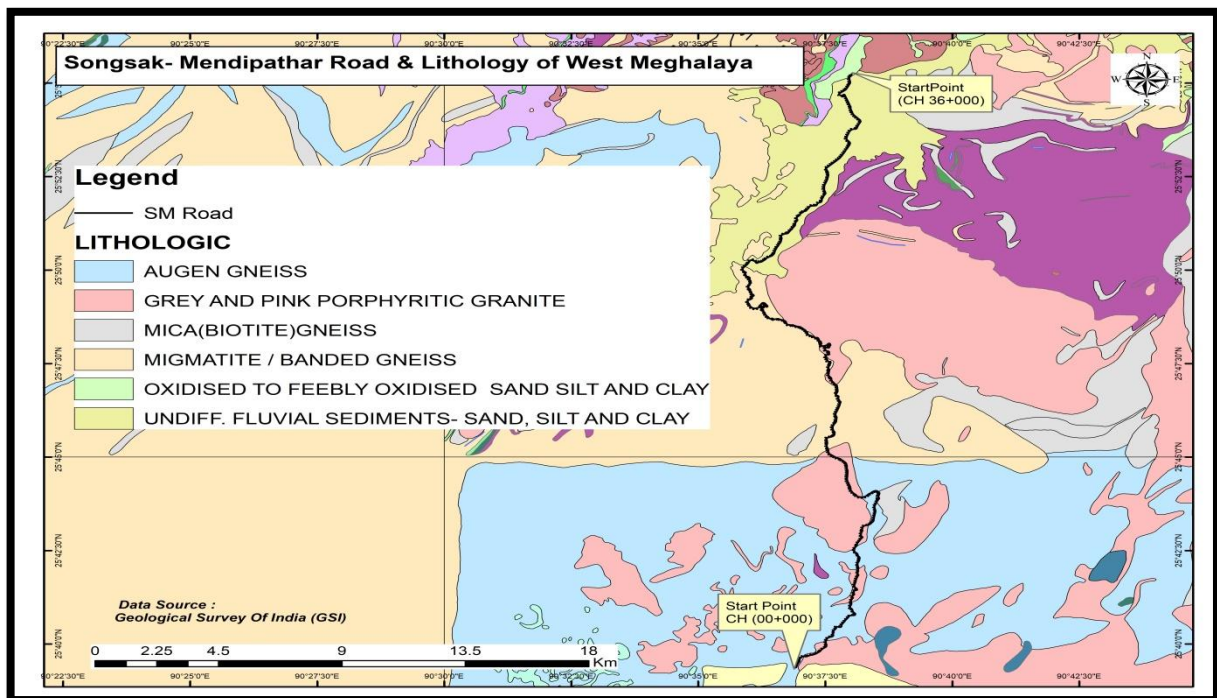


Figure 5.3: Local geology of the road stretch of sub–Project Road SMR

5.3.3 GEO-MORPHOLOGY AND SOILS

Geomorphologically, the East Garo Hills and North Garo Hills District, through which the SMR Road traverses, can be classified into six physiographic domains: structural hills and valleys, structural plateau, active floodplain, older floodplain, younger alluvial plain, and pediment–pediplain complex. The road corridor predominantly passes through hilly and undulating terrain dominated by structural hills and valleys, gradually transitioning into plateau regions and floodplains in certain stretches.

Soils along the project road are predominantly laterite and lateritic soils, with acidity as a major characteristic. In the hilly sections, where the parent rocks weather slowly and are regularly washed by high rainfall, the soils are highly

acidic compared to the relatively low-lying plains. The texture varies from sandy loam to clay loam, with patches of lateritic red soil. These soils are rich in organic matter and nitrogen due to their relatively undisturbed and virgin nature. However, lateritic soils are prone to erosion and leaching during heavy monsoonal rainfall, leading to degradation and slope instability in certain road stretches.

Given the terrain and soil characteristics, the SMR 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 stability⁶.

Table 5.4: Block wise major soil class area in Ha. and Land Slope

Name of the Block	Soil Type			Land Slope (%)			
	Major Soil Classes	Major Soil Type	Area (Ha)	0-3% (Ha)	3-8% (Ha)	8-25% (Ha)	>25% (Ha)
Resubelpara Development Block (North Garo Hills)	Sandy loam to clay loam	Laterite & Lateritic soils	85,620	6,500	14,200	23,100	41,820
Songsak Development Block (East Garo Hills)	Red lateritic loam	Laterite & Lateritic soils	72,950	4,600	12,300	19,800	36,250

²Source: - Divisional Soil and Water Conservation Dept., William Nagar, East Garo Hills

Geomorphological map of North Garo Hills district is depicted in the **Figure 4.4** below.

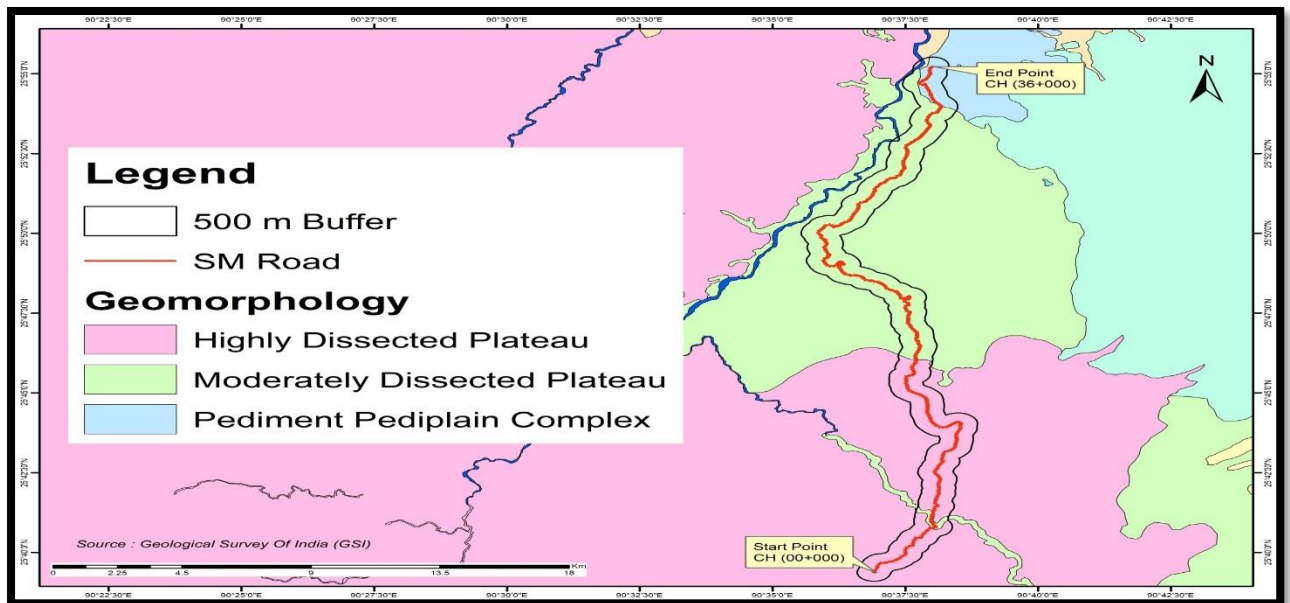


Figure 5.4: Geomorphological map of Sub-Project Road

5.3.4 LAND USE PATTERN

The LULC map⁷ of 500m reveals that along the SMR Road, the land use distribution shows that settlements occupy the largest share at forest land constitutes the major portion, covering 56.41% of the total area. Settlements account for 27.61%, while crop land represents 9.73%. Scrub land covers 3.64%, and water bodies occupy 2.60% of the total area, etc. The LULC map of 500m on either side of the road is presented in **Figure 5.5** below

⁶District Irrigation Plan 2016–2020, East and North Garo Hills, Government of Meghalaya.

⁷ LULC Data source: NRSC: LULC (10 k) SIS-DP Phase-2: 2018-23

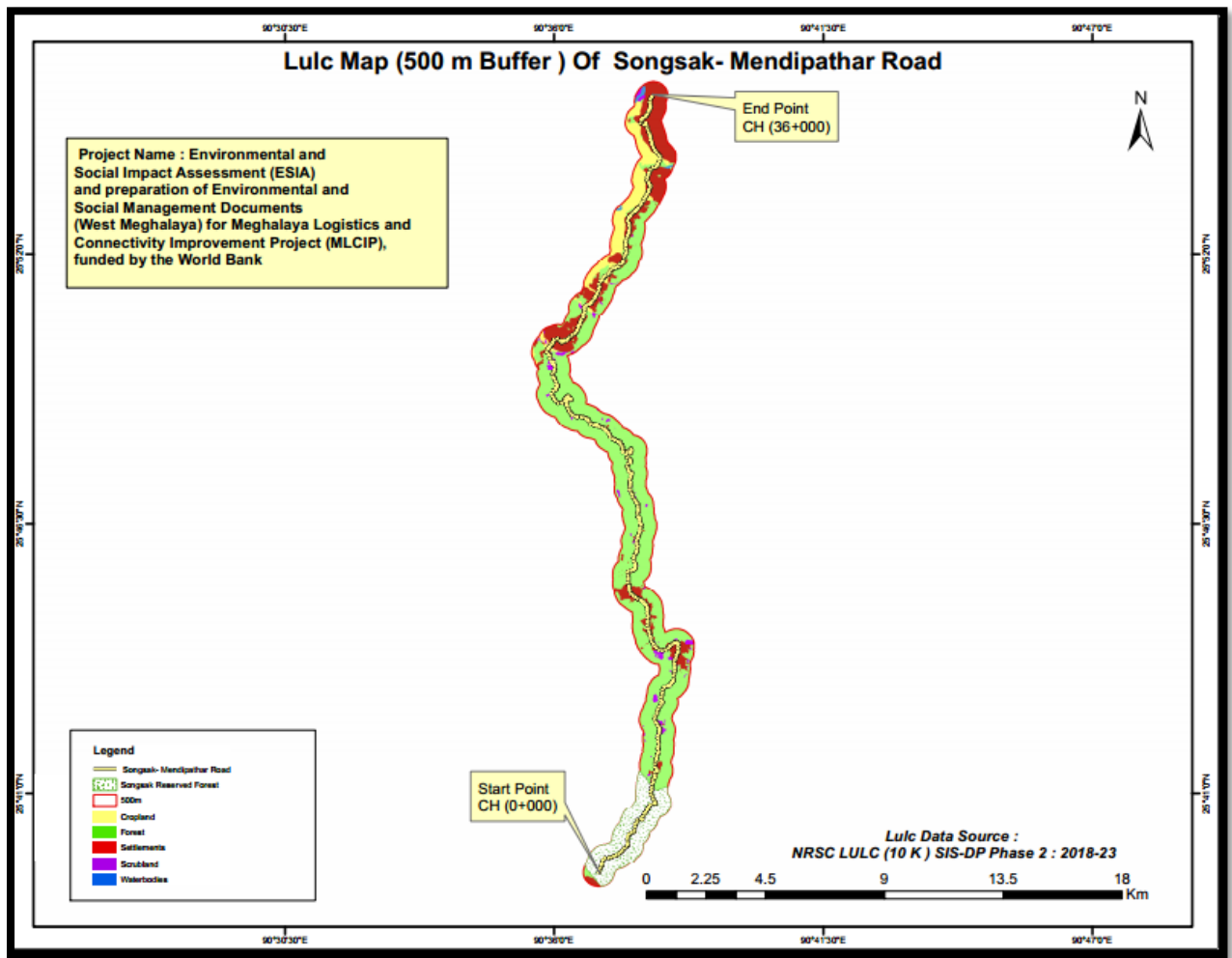


Figure 5.5: Land Use / Land Cover map of SMR road corridor

5.3.5 AGRICULTURE

Baseline Scenario in Project Corridor 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 SMR 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

Details of the soil sampling locations are presented in **Table 5.5** 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 Monitoring Locations

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Sub Project Road SMR 35.28 km stretch	SaminSongkama bettle nut garden	SQ1	25°41'28.65"N	90°38'6.34"E
2		SaminWakso Garden	SQ2	25°42'44.22"N	90°38'8.06"E
3		Dajong gate Agriculture Field	SQ3	25°48'57.58"N	90°36'6.83"E
4		SoenangApal Agriculture Field	SQ4	25°51'45.74"N	90°37'12.76"E

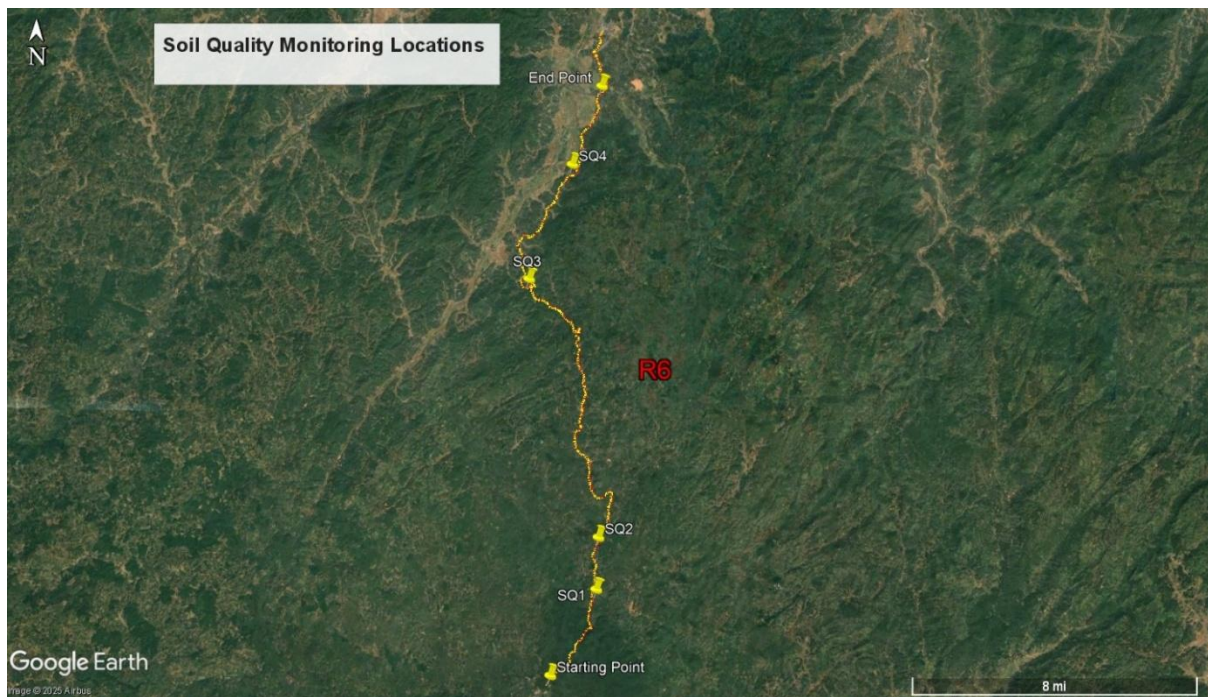


Figure 5.6: Soil monitoring locations

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	1.29	1.27	1.33	1.23	IS 14765: 2000, RA 2010
4	Water Holding Capacity	%	29.4	28.9	27.8	27.4	STRL/STP/SOIL/01
5	Sand	%	52.1	53.1	59.0	49.0	IS2720 (P-4),1985 (Reaff: 2015)
6	Silt	%	26.9	25.9	22.1	25.8	IS2720 (P-4),1985 (Reaff: 2015)
7	Clay	%	17.6	21.7	18.9	18.2	IS2720 (P-4),1985 (Reaff: 2015)
8	pH (1:2	-	5.79	5.85	6.12	5.65	IS:2720 (P-26),

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	SQ4	Test Method
	Suspension)						1987 (Reaff:2011)
9	Electrical Conductivity (1:2)	µmhos/cm	226.0	238.5	223.8	218.0	IS: 14767(2000), RA 2016
10	Organic Matter	%W/W	4.69	3.48	3.16	3.28	STRL/STP/SOIL/01
11	Exchangeable Calcium	mg/kg	1269.0	1218.5	1195.2	1260.0	IS 2720 (Part 24): 1976, RA 2010
12	Exchangeable Magnesium	mg/kg	519.4	512.2	465.6	490.4	IS 2720 (Part 24): 1976, RA 2010
13	Copper	mg/kg	11.7	9.8	11.2	10.5	IS 2720(Part-27): 1977
14	Nickel	mg/kg	9.1	8.1	9.4	7.4	IS 2720(Part-27): 1977
15	Chromium	mg/kg	10.8	9.4	9.9	10.6	IS 2720(Part-27): 1977
16	Iron	mg/kg	78.5	84.6	91.2	77.6	IS 2720(Part-27): 1977
17	Lead	mg/kg	0.2	0.3	0.4	0.2	IS 2720(Part-27): 1977
18	Sulphate	mg/kg	13.2	15.1	17.5	12.9	IS 2720(Part-27): 1977
19	Nitrogen (as N)	Kg/Ha	238.0	229.4	205.8	234.0	IS: 10158:1982, RA 2009
20	Phosphorous	Kg/Ha	105.6	99.8	94.2	103.6	IS: 10158:1982, RA 2009
21	Exchangeable Potassium	Kg/Ha	52.4	56.8	61.5	51.2	STRL/STP/SOIL/01

The soil quality assessment across four sampling locations (SQ1–SQ4) along SM Road, Meghalaya indicates generally uniform characteristics typical of the region. The soil texture at all locations is classified as sandy loam, with sand content ranging from 48.2% to 57.6%, silt between 21.8% and 27.2%, and clay varying from 18.4% to 20.5%. Bulk density values (1.22–1.30 g/cm³) and water holding capacity are within normal ranges for hill soils, indicating good structural stability.

Soil pH is moderately acidic (5.10–5.48), which is typical for Northeast Indian soils and suitable for most crops with appropriate nutrient management. Electrical conductivity values (205.3–220.6 µmhos/cm) confirm low salinity levels. Organic matter content is relatively high (4.10–5.25%), indicating good soil fertility and biological activity.

Macronutrients show moderate to good levels, with nitrogen ranging from 210.2 to 245.8 kg/ha, phosphorus from 95.8 to 110.6 kg/ha, and potassium between 55.8 and 64.3 kg/ha. Exchangeable calcium and magnesium values also remain within healthy fertility ranges. Heavy metal concentrations, including copper, nickel, chromium, iron, and lead, are found at low levels, well within permissible limits, indicating absence of industrial contamination.

Overall, the soil in the project area is fertile, structurally stable, and suitable for vegetation growth, with no significant contamination concerns..

5.4 WATER ENVIRONMENT

Water bodies in the SMR project area of 35.28 kms stretch are mainly Songkama and Chidrang rivers, 03 ponds (within 50m), and 02 streams were observed during the field study. Several small perennial and seasonal streams intersect or run adjacent to the (SMR) Road corridor in North Garo Hills District and 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 in the Month of October from the pond and river. Location details of the surface water samples are presented in **Table 5.7** and shown in **Figure 5.7**.

Table 5.7: Surface Water Monitoring Locations

S. No	Source of Sample	Sample Code	Geographical Coordinate	
			Latitude	Longitude
1	Rongre River	SW1	25°31'55.96"N	90°35'25.04"E
2	Rongal River	SW2	25°30'20.37"N	90°36'56.17"E
3	Dagal Apal Pond	SW3	25°30'41.52"N	90°38'47.62"E
4	Dajong Stream	SW4	25°30'57.04"N	90°40'1.09"E

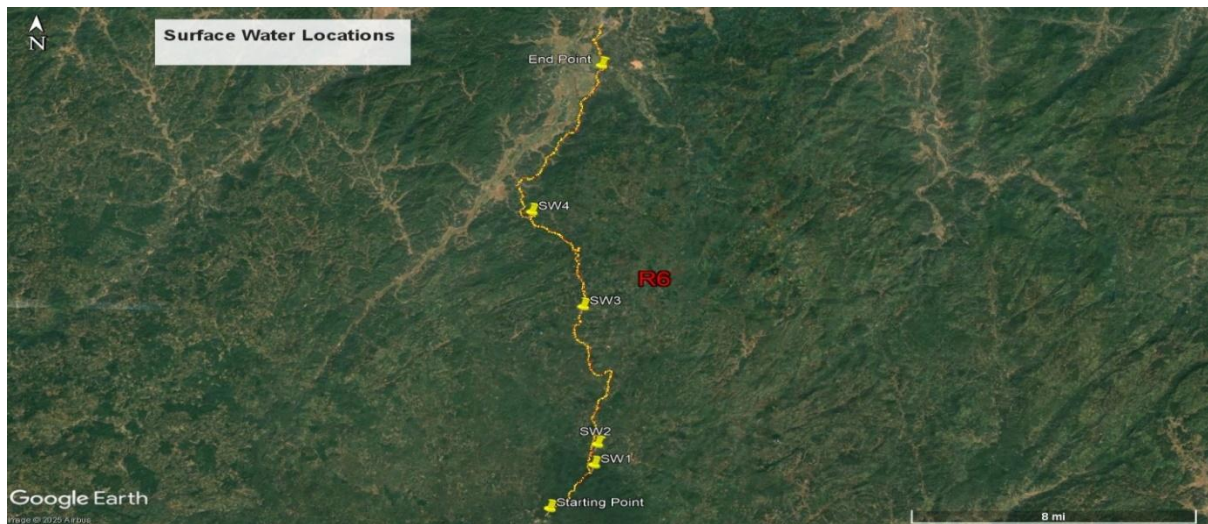


Figure 5.7: Ground Water monitoring locations

The surface water quality assessment for sampling stations SW-1 to SW-4 indicates that the water generally meets the IS:2296-1992 Class-C standards. The pH across locations ranges from 6.30 to 7.30, remaining within acceptable limits, while temperature values also fall within normal ranges suitable for aquatic life. Dissolved Oxygen levels are high (8.20–8.80 mg/l), surpassing the minimum requirement of 4 mg/l and reflecting good water aeration. BOD and COD values are low, indicating minimal organic pollution. Total dissolved and suspended solids are well within acceptable levels, suggesting low mineral and particulate load. Nutrients such as nitrate, ammonical nitrogen, TKN and phosphate are present in low to moderate concentrations without indicating significant nutrient pollution. Major anions such as chlorides and sulphates remain far below permissible limits. Heavy metals including arsenic, lead, cadmium, chromium and others are either below detection limits or within prescribed standards, showing absence of toxic contamination. Microbial quality is also acceptable, with total coliform values well below the allowable limit. Overall, the results confirm that the surface water is largely clean, free from significant pollution, and suitable for Class-C designated uses such as outdoor bathing.

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

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C)	SW-1	SW-2	SW-3	SW-4	Test method
			Tolerance Limit					
1	pH	-	6.5 -8.5	7.21	7.20	6.90	6.20	IS: 3025(Pt-11)1983, RA. 2002
2	Temperature	°C	-	16.3	17.3	18.6	16.6	APHA 23 nd Edn.2017-2550 B
3	D.O	mg/l	Minimum -4	7.40	7.80	7.50	7.20	IS 3025(Part-38): 2006
4	BOD	mg/l	30	5.30	5.80	5.40	5.20	IS 3025(Part-44):1993, RA 2009
5	Colour	Hazen	300	5	5	4	6	IS: 3025 (Pt-4) 1983, RA 2017
6	Odour	-	-	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
7	TDS	mg/l	1500	241.5	240.8	239.8	229.4	IS 3025(Part-16): 1984, RA 2006
8	TSS	mg/l	-	22.0	28.0	26.4	24.4	IS 3025(Part-17)
9	TKN	mg/l		2.2	2.8	2.0	2.3	IS: 3025(Pt-34)1988, RA. 2003
10	Ammonical Nitrogen	mg/l		0.44	0.48	0.44	0.42	IS: 3025(Pt-34)1988, RA. 2003
11	Nitrate (as NO ₃)	mg/l	50	2.3	2.5	2.3	2.4	IS: 3025(Pt-34)1988, RA. 2003
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	28.5	26.8	28.5	28.5	IS 3025(Part-32): 1988
14	Sulphates (as SO ₄)	mg/l	400	30.2	25.8	30.2	30.2	IS 3025(Part-24):1986, RA 2003
15	Fluoride (as F)	mg/l	1.5	0.42	0.58	0.52	0.52	APHA 21 st 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 ₆ H ₅ OH)	mg/l	0.005	<0.001	<0.001	<0.001	<0.001	5530-B, C&E, APHA 23 nd 2017
18.	Arsenic	mg/l	0.2	<0.1	<0.1	<0.1	<0.1	3110- B, APHA 23 nd Ed. 2017 (AAS)
19	Mercury (as Hg)	mg/l	-	<0.001	<0.001	<0.001	<0.001	3110- B, APHA 23 nd Ed.2017
20	Lead (as Pb)	mg/l	0.1	0.02	0.02	0.02	0.02	3110- B, APHA 23 nd Ed. 2017 (AAS)
21	Cadmium (as Cd)	mg/l	0.01	0.001	0.002	0.001	0.001	3110- B, APHA 23 nd Ed. 2017 (AAS)

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C) Tolerance Limit	SW-1	SW-2	SW-3	SW-4	Test method
22.	Chromium (as Cr ⁺⁶)	mg/l	0.05	0.03	0.03	0.03	0.03	IS 3025(Part-52): 200
23.	Copper (as Cu)	mg/l	1.5	0.18	0.21	0.18	0.19	3110- B, APHA 23nd Ed. 2017 (AAS)
24.	Zinc (as Zn)	mg/l	15	0.17	0.18	0.21	0.20	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	0.21	0.20	0.19	0.17	3500-Fe- B, APHA 23nd Ed. 2017
28.	Sulphide (as H ₂ S)	mg/l	-	0.13	0.15	0.20	0.19	IS-3025 (P-29)
29.	Phosphate (as PO ₄)	mg/l	-	5.45	6.40	5.65	5.65	APHA 22 nd 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	-	0.02	0.04	0.02	0.02	3110- B, APHA 23nd Ed.2017
32.	COD	mg/l	-	18.60	16.4	19.40	17.20	IS 3025(Part-58): 2006
33.	Total Coli form	MPN/100ml	5000	1300	1250	790	730	IS: 1622-1981

5.4.3 GROUND WATER

02 ground water samples from sub–Project Road SMR have been collected in the Month of October along the sub-project roads to ascertain the baseline conditions of the ground water quality. The sampling locations were selected based on the land-use pattern and competitive uses in the sub-project areas. Location details of the groundwater samples are presented in **Table 5.9** and shown in **Figure 5.8** and results are presented in **Table 5.10**. Ground water samples have been analyzed in accordance with the Drinking Water Quality Standards of IS 10500:2012.

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	SM road	Koksi Negsat ADHOC UP School	GW1	25°43'31.25"N	90°38'29.59"E
2		Thapa Darenchi PHC	GW2	25°50'0.46"N	90°35'53.28"E

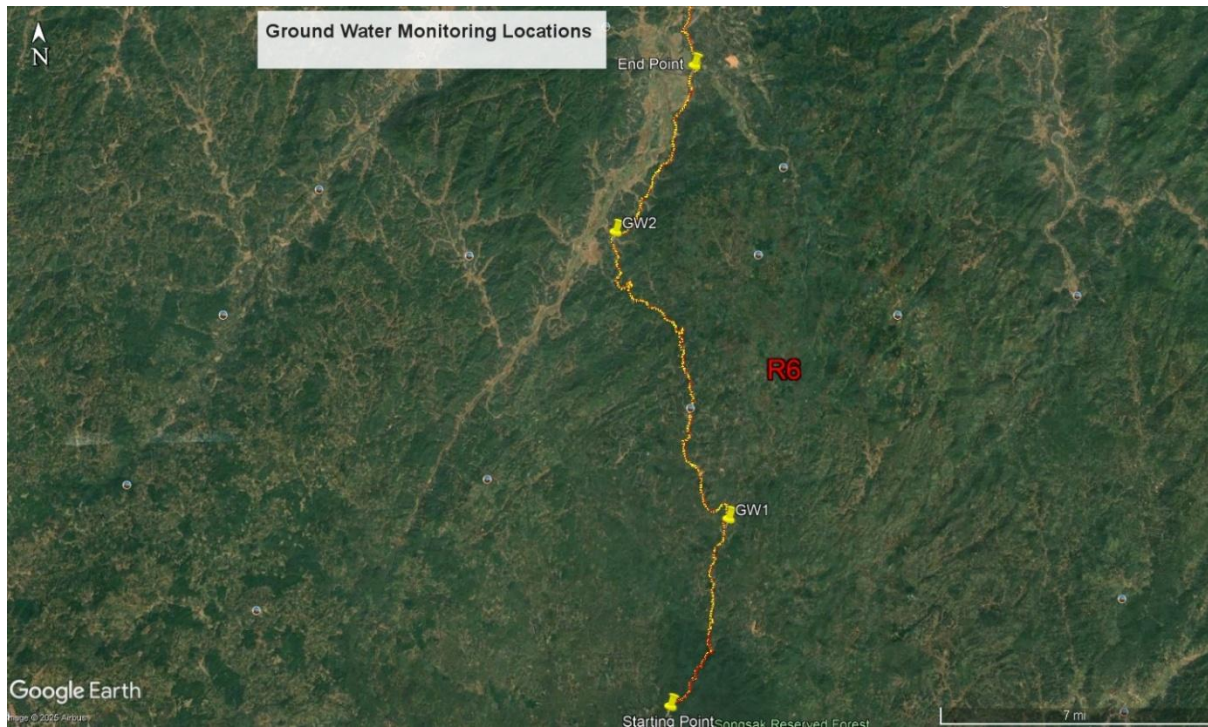


Figure 5.8: Ground Water monitoring locations

The groundwater quality analysis for samples GW-1 and GW-2 indicates that the measured parameters largely comply with the requirements of IS: 10500-2012 for drinking water. Physical parameters such as colour, odour, taste, turbidity and pH are within desirable limits, confirming that the water is aesthetically acceptable. Total dissolved solids, total hardness, calcium, magnesium and alkalinity are well below their permissible levels, reflecting good mineral balance without hardness-related concerns. Major ions such as chlorides, sulphates and nitrates are present in low concentrations, showing absence of significant inorganic contamination. Heavy metals including iron, chromium, arsenic, copper, manganese, lead, cadmium, mercury and nickel were either undetected or below acceptable limits, indicating no toxic metal pollution. Organic pollutants such as phenolic compounds, detergents, mineral oil, ammonia and boron are also below detection or within acceptable levels. Both samples meet microbiological standards, as Total Coliform and E. coli are absent, confirming the water is safe from bacterial contamination. Overall, the groundwater quality at both locations is suitable for potable use without the need for major treatment.

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	7.15	6.90	IS: 3025(Pt-11)
6	Total Hardness (as CaCO ₃)	mg/l	200	600	118	125	IS 3025(Part-21)
7	Iron (as Fe)	mg/l	0.3	No Relaxation	0.24	0.21	3500-Fe- B, APHA 23rd Ed.2017

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	Test method
			Desirable Limit	Permissible Limit			
8	Chlorides (as Cl)	mg/l	250	1000	19.4	22.1	IS 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	0.385	0.41	4500-F-(D), APHA 23 st Ed.2017
10	TDS	mg/l	500	2000	258.5	261.1	IS 3025(Part-16)
11	Calcium (as Ca ²⁺)	mg/l	75	200	27.3	23.7	IS 3025(Part-40)
12	Magnesium (as Mg ²⁺)	mg/l	30	100	10.2	5.3	500- Mg B, APHA 23nd d.2017
13	Sulphate (as SO ₄)	mg/l	200	400	12.3	13.2	IS 3025(Part-24)
14	Nitrate (as NO ₃)	mg/l	45	No Relaxation	14.2	8.4	IS: 3025(Pt-34)
15	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	0.01	110- B, APHA 23nd d.2017
16	Alkalinity as CaCO ₃	mg/l	200	600	141.2	126.6	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	110- B, APHA 23nd d2017
19	Copper (as Cu)	mg/l	0.05	1.5	<0.05	0.05	110- B, APHA 23nd d2017
20	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	0.01	110- B, APHA 23nd d2017
21	Zinc (as Zn)	mg/l	5	15	0.22	.16	110- B, APHA 23nd d2017
22	Ammonia (as NH ₃ -N)	mg/l	0.5	No Relaxation	<0.1	0.1	500-NH ₃ -B & C, APHA 23 rd D2017
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 ₆ H ₅ OH)	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	110- B, APHA 23nd d2017
28	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	0.1	500- CN-B, C & E, APHA 3nd Ed2017
29	Lead	mg/l	0.01	No Relaxation	<0.01	0.01	110- B, APHA 23nd d2017

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	110- B, APHA 23nd d.2017
31	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	0.001	110- B, APHA 23nd d.2017
32	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	<0.02	4500-Cl-B, APHA 23nd Ed2017
33	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	0.2	110- B, APHA 23nd d.2017
34	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	0.0001	No Relaxation	No relaxation	PHA 6440,23nd Ed.2017
35	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	No relaxation	PHA 6430,23nd Ed.2017
36	Total Coli form	MPN/100ml	Shall not be detectable in any 100 ml of sample			Microbiological Parameters	IS: 1622-1981
37.	<u>E.Coli</u>	<u>E.Coli</u> /100ml	Shall not be detectable in any 100 ml of sample			<1	<1
						Absent	Absent

5.5 AIR ENVIRONMENT

5.5.1 AIR QUALITY

The Project has the potential to impact air quality, and while these impacts can be managed through mitigation measures outlined in the ESMP and adherence to good international practices, there remains a possibility of significant residual impacts

Residential and other sensitive locations proximity to roads were the criteria used for selecting the sample locations. Parameters like Particulate Matter (PM₁₀), Particulate Matter (PM_{2.5}), Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂) and Carbon Monoxide (CO) were monitored. Map showing monitoring locations are given in **Table 5.11 & Figure 5.9**.

Table 5.11: Ambient Air Quality Monitoring Locations

Sl. No.	Monitoring Location	Sample Code	Geographical Coordinate	
			Latitude	Longitude
1	SaminSongkama	AQ1	25°41'28.71"N	90°38'7.10"E
2	Nangapa Bazar	AQ2	25°44'46.30"N	90°37'55.00"E
3	Dandakol	AQ3	25°47'60.00"N	90°37'35.36"E
4	Darenchi	AQ4	25°50'8.79"N	90°35'57.31"E
5	New Phutimari	AQ5	25°53'39.31"N	90°37'57.07"E



Figure 5.9: Air Quality monitoring locations

The ambient air quality monitoring results at locations AQ1 to AQ5 along the project corridor show that all monitored parameters are well within the National Ambient Air Quality Standards (NAAQS), 2009. PM10 levels range from 42.1 to 47.2 $\mu\text{g}/\text{m}^3$ and PM2.5 from 17.4 to 22.4 $\mu\text{g}/\text{m}^3$, both below the respective limits of 100 $\mu\text{g}/\text{m}^3$ and 60 $\mu\text{g}/\text{m}^3$, indicating low particulate pollution. Gaseous pollutants including sulphur dioxide (5.1–6.6 $\mu\text{g}/\text{m}^3$) and nitrogen dioxide (6.3–9.2 $\mu\text{g}/\text{m}^3$) are also significantly lower than the permissible limit of 80 $\mu\text{g}/\text{m}^3$, suggesting minimal industrial or vehicular emission impacts. Carbon monoxide levels, ranging between 0.264 and 0.330 $\mu\text{g}/\text{m}^3$, are far below the standard of 2000 $\mu\text{g}/\text{m}^3$, confirming negligible CO pollution. Overall, the assessment indicates that the air quality in the project area is clean, with pollutant concentrations well within regulatory limits and no observable air pollution concern.

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/m ³)	PM _{2.5} (µg/m ³)	Sulphur Dioxide (SO ₂) (µg/m ³)	Nitrogen Dioxide (NO ₂) (µg/m ³)	Carbon Monoxide (CO) (µg/m ³)
1	SM road	SaminSongkama	AQ 1	25°41'28.71"N	90°38'7.10"E	42.2	18.4	5.2	6.8	0.268
2		Nangapa Bazar	AQ 2	25°44'46.30"N	90°37'55.00"E	46.4	21.2	6.3	8.8	0.300
3		Dandakol	AQ 3	25°47'60.00"N	90°37'35.36"E	44.6	19.4	5.4	8.6	0.264
4		Darenchi	AQ 4	25°50'8.79"N	90°35'57.31"E	42.1	17.4	5.1	6.3	0.266
4		New Phutimari	AQ 5	25°53'39.31"N	90°37'57.07"E	47.2	22.4	6.6	9.2	0.330
National Ambient Air Quality Standards, Central Pollution Control Board, 2009						100	60	80	80	2000
Test Methods						IS:5182 (P-23): 2006	SOP1/STR L/ Ambient Air/ Gravimetric method	IS:5182 (P-2): 2006	IS:5182(P-6): 2006	IS:5182(P-10):199, RA-2003

5.6 NOISE ENVIRONMENT

The principal sources of construction noise and vibration anticipated during the Project include:

- Delivery and movement of staff, materials, construction plant, and machinery;
- Site preparation works, including establishment of construction camps;
- Hill cutting and excavation activities;
- Removal of existing road pavement and structures; and
- Restoration and finishing works.

Most of these activities are expected to occur in proximity to the existing road alignment. Night-time construction is not generally proposed, except under special circumstances where continuity of work is essential (e.g., critical traffic management needs or safety considerations). 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 was monitored over a period of 24 hour by the authorized NABL laboratory. The noise monitoring has been conducted in October, 2025 for determination of noise levels at 04 locations for (Figure 5.10) in the direct impact area as per Table 5.13 below.

Table 5.13: Ambient Noise Monitoring Locations

S. No.	Location	Sample Code	Latitude (North)	Longitude (East)
1	SaminSongkama	NQ1	25°41'28.66"N	90°38'7.14"E
2	Nangapa Bazar	NQ2	25°44'46.16"N	90°37'55.00"E
3	Dandakol	NQ3	25°48'0.22"N	90°37'35.49"E
4	Darenchi	NQ4	25°50'8.71"N	90°35'57.23"E
5	New Phutimari	NQ4	25°53'39.22"N	90°37'57.00"E

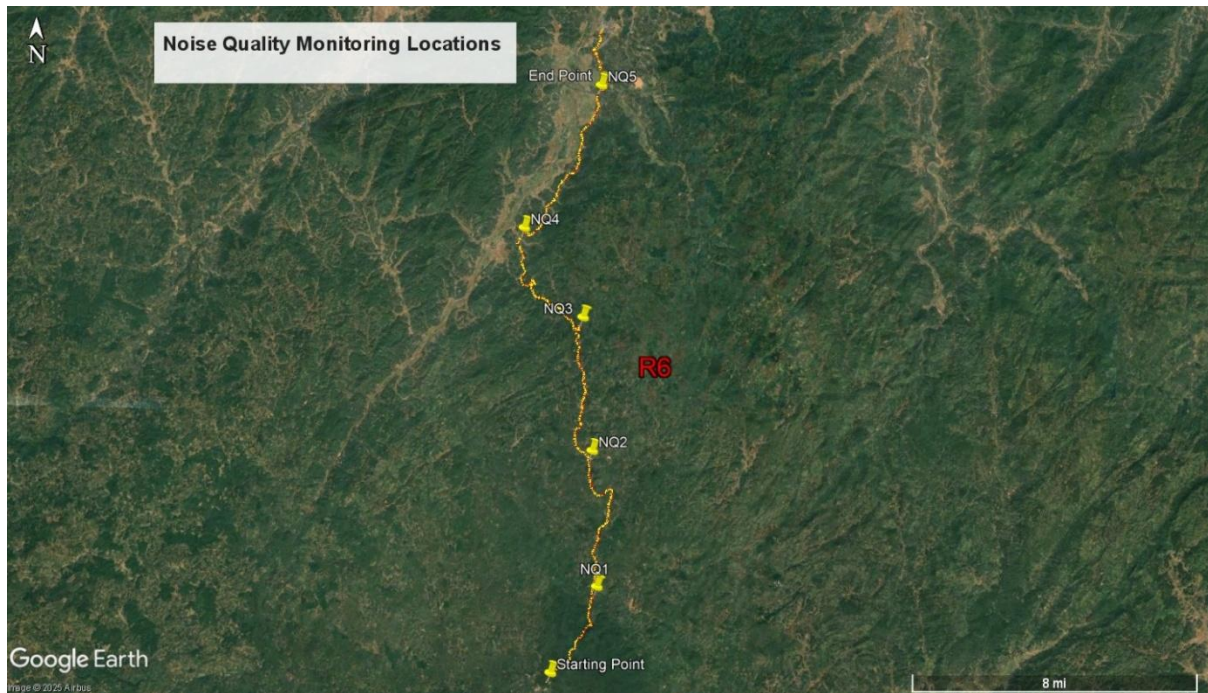


Figure 5.10: Noise quality monitoring locations

Average Ambient Noise Monitoring Results is given in **Table 5.14**.

Table 5.14: Average Ambient Noise Monitoring Results in the sub-project area (SMR Road)

Sl. No.	Project Area	Location	Sample Code	Latitude (North)	Longitude (East)	Equivalent Noise Level, Leq (Day*)	Equivalent Noise Level, Leq (Night**)
						dB (A)	dB (A)
1	SM road	SaminSongkama	NQ1	25°41'28.66"N	90°38'7.14"E	44	32
2		Nangapa Bazar	NQ2	25°44'46.16"N	90°37'55.00"E	62	41
3		Dandakol	NQ3	25°48'0.22"N	90°37'35.49"E	53	39
4		Darenchi	NQ4	25°50'8.71"N	90°35'57.23"E	48	36
5		New Phutimari	NQ4	25°53'39.22"N	90°37'57.00"E	59	42

*Day Time means from 6:00am to 10:00pm

**Night Time means from 10:00pm to 6:00am

The noise monitoring results for locations NQ1 to NQ4 indicate that the ambient noise levels in the project area comply with the prescribed limits of the Central Pollution Control Board (CPCB). In residential locations such as Samin Songkama, Dandakol and Darenchi, daytime noise levels range from 44.4 to 53 dB(A) and nighttime values from 32.8 to 39 dB(A), all remaining below the respective limits of 55 dB(A) for daytime and 45 dB(A) for nighttime. The commercial location, Nangapa Bazar, also shows acceptable noise levels, with 52 dB(A) during the day and 41.7 dB(A) at night, well within the corresponding standards of 65 dB(A) and 55 dB(A). Overall, the findings indicate that ambient noise in the project area is within permissible limits, reflecting low noise pollution and a generally quiet environment.

Based on the monitored noise levels, the ambient noise in all locations remains well within the CPCB prescribed limits for both day and night, across residential as well as commercial areas. Since the existing noise levels already

comply with the permissible standards and do not present any significant adverse impact on the surrounding community, the provision of noise barriers is not required. The data clearly indicate that vehicular movement and project activities are not contributing to excessive noise, and the current environment is already acoustically stable without the need for additional mitigation measures.

5.7 BIOLOGICAL ENVIRONMENT

5.7.1 BIODIVERSITY IN EAST AND NORTH 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 corridors.

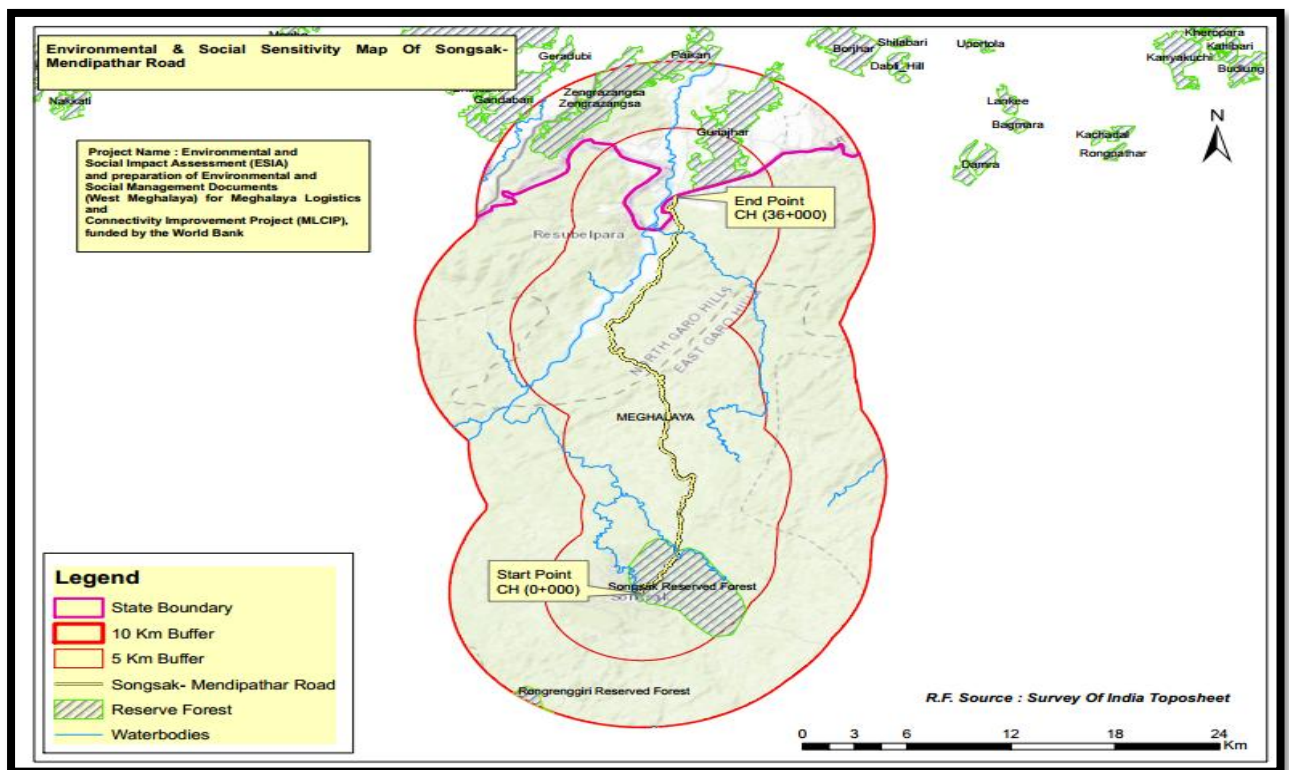


Figure 5.11: 10km Buffer area for project road

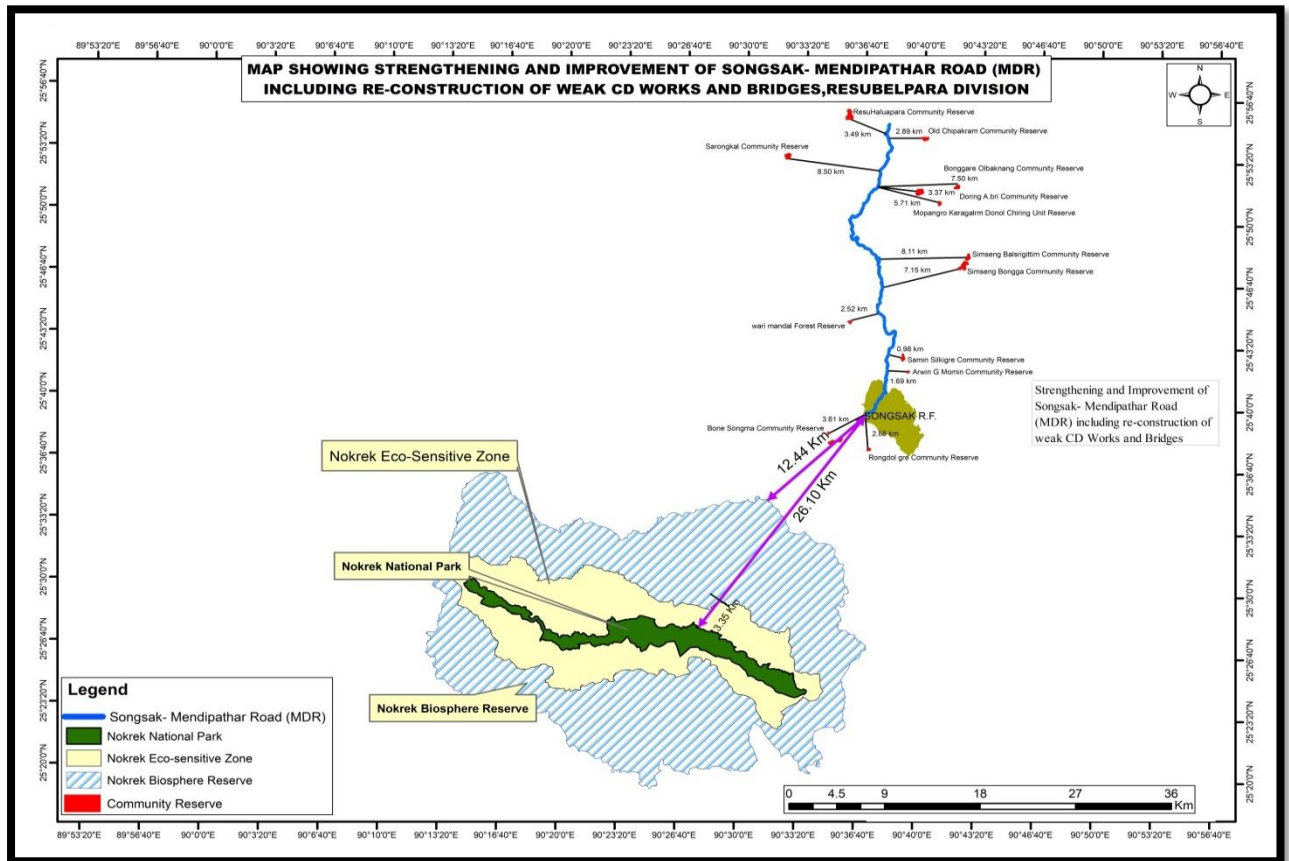


Figure 5.12: Map showing distance from Eco sensitive Zones w.r.t Project Road.

Along the roadside, common plantation trees include Jackfruit, Arecanut, and Mango tree. In some stretches, Banana, Bamboo, and Areca Nut are also planted by villagers. Shrubs commonly observed include Lantana, Eupatorium, Hibiscus, Clerodendrum. 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 200 species of flora and fauna and 18 species of aquatic biodiversity, comprising 68 tree species, 10 shrubs, 23 herbs, 11 ferns, and 7 grass species. In addition, 6 mammal species, 45 bird species, 6 reptile species, 4 amphibian species, 25 butterfly species, and 12 fish species were documented. 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 Project Road corridor roads. However, improved connectivity after construction may increase the risk of hunting and illegal wildlife trade

In the East and North 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 zoo therapeutic remedies. 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 STRETCH 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 and Endangered species, that, 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 In / Out
<i>Gavialis gangeticus</i> (Gharial)	CR	No	Full Migrant	Large perennial rivers (Ganga–Brahmaputra system)	Low	Major rivers absent near SMR road is Chidrang River. Gharials are absent from the Chidrang River due to historical regional extinction, the loss of deep-water habitats, and high mortality from fishing net entanglement.	Out
<i>Pangshura sylhetensis</i> (Assam Roofed Turtle)	CR	Yes (Eastern Himalaya & NE India)	Non-migrant	Slow-flowing rivers and floodplains	Low	The Assam Roofed Turtle is critically endangered and rare in the Chidrang River due to habitat siltation from logging.	Out
<i>Nilssononia nigricans</i> (Black Softshell Turtle)	CR	Yes (Assam & adjoining states)	Non-migrant	Temple ponds, lowland rivers	Low	The Black Softshell Turtle is critically endangered and rare in the Chidrang River because it survives primarily in sacred temple ponds after being decimated in the wild by meat poaching and habitat siltation.	Out
<i>Laticilla cinerascens</i> (Swamp Grass-babbler)	EN	Yes	Non-migrant	Tall wet grasslands in Brahmaputra floodplains	Low	Habitat absent; no wet grassland or marsh areas it is a habitat specialist requiring vast, undisturbed elephant grass islands (chars), which are missing due to agricultural conversion and overgrazing.	Out
<i>Melanochelys tricarinata</i> (Tricarinate Hill Turtle)	EN	Yes	Non-migrant	Hill forests of NE India	Moderate	it is critically endangered and likely absent or extremely rare in the Chidrang River because it is a terrestrial species that prefers dry sal forests over river water.	Out
<i>Hoolock hoolock</i> (Western Hoolock Gibbon)	EN	Yes	Non-migrant	Evergreen forests of NE India	Moderate	These are arboreal species and require contiguous forest cover for movement ⁸ . There is no contiguous forest cover along the road. Thus the habitat does not exist in the project areas	Out
<i>Elephas maximus</i> (Asian Elephant)	EN	No	Non-migrant (seasonal mover)	Forests and corridors in Garo Hills	Moderate	Landscape species; project involves minor road improvement without corridor obstruction. Elephants are absent from the immediate SMR Road vicinity due to habitat fragmentation from road construction and high human activity, which disrupts their traditional migratory paths between	Out

⁸ <https://neprimateconservancy.org/western-hoolock-gibbon/>

Scientific Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
						the Garo Hills and the floodplains.	
<i>Indotestudo elongata</i> (Elongated Tortoise)	CR	No	Non-migrant	Forest floor dweller in moist forests	Low	It is rare due to habitat destruction from Jhum (slash-and-burn) forest fires.	Out
<i>Morenia petersi</i> (Indian Eyed Turtle)	EN	No	Non-migrant	Rivers, ponds, wetlands	Low	The Indian Eyed Turtle is rare in the Chidrang due to its need for undisturbed, vegetation-rich ponds and pesticide runoff.	Out
<i>Nycticebus bengalensis</i> (Bengal Slow Loris)	EN	No	Non-migrant	Evergreen and semi-evergreen forests	Moderate	These are arboreal species and require contiguous forest cover for movement ⁹ . There is no contiguous forest cover along the road. Thus the habitat does not exist in the project areas	Out
<i>Hardella thurjii</i> (Crowned River Turtle)	EN	No	Non-migrant	Large river systems	Low	Absent in upland terrain	Out
<i>Geoclemys hamiltonii</i> (Spotted Pond Turtle)	EN	No	Non-migrant	Wetlands and slow rivers	Low	It is rare in the Chidrang River due to massive illegal trade for the pet market and the conversion of its shallow marshy habitats into agricultural land.	Out
<i>Cuora mouhotii</i> (Keel Box Turtle)	EN	No	Non-migrant	Forest floor species	Moderate	It is likely absent from the Chidrang River because it is a terrestrial forest specialist that is heavily poached for traditional medicine and threatened by habitat loss from shifting cultivation.	Out
<i>Manis crassicaudata</i> (Indian Pangolin)	EN	No	Non-migrant	Dry forests, scrubland	Moderate	The pangolins live primarily in forested areas and in burrows. They are elusive and are thus not found near disturbed habitats. Since all the improvements are limited within the existing right of way their habitat is unlikely within the project direct impact.	Out
<i>Cuon alpinus</i> (Dhole)	EN	No	Non-migrant	Forests, scrubland	Moderate	It is likely absent from the Chidrang River area due to the depletion of wild prey and fatal diseases (like distemper) caught from domestic dogs.	Out
<i>Sarcogyps calvus</i>	CR	No	Congregatory	Open forests,	Moderate	It is absent due to loss of tall nesting trees to	Out

⁹ <https://neprimateconservancy.org/western-hoolock-gibbon/>

Scientific Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
(Red-headed Vulture)				settlements		deforestation	
<i>Nilssonia hurum</i> (Indian Peacock Softshell Turtle)	EN	No	Non-migrant	Rivers and wetlands	Low	It is rare in the Chidrang River because it survives primarily in sacred temple ponds after being decimated in the wild by meat poaching and habitat siltation.	Out
<i>Varanus flavescens</i> (Yellow Monitor)	EN	No	Non-migrant	Semi-aquatic, open wetlands	Low	It is absent because no suitable habitat of wetland present near the sub project Road	Out
<i>Nilssonia gangetica</i> (Indian Softshell Turtle)	EN	No	Non-migrant	Rivers, ponds	Low	It is rare in the Chidrang River because it survives primarily in sacred temple ponds after being decimated in the wild by meat poaching and habitat siltation.	Out
<i>Axis porcinus</i> (Hog Deer)	EN	No	Non-migrant	Grasslands, floodplains	Low	The Hog Deer is absent because it is a grassland specialist requiring open, moist floodplains rather than the dense, hilly forest terrain of Songsak.	Out
<i>Sterna acuticauda</i> (Black-bellied Tern)	EN	No	Migratory	River sandbars, wetlands	Low	The Black-bellied Tern is absent because it is a river-island specialist that requires large sandy banks for nesting, making the rocky, tree-shaded streams of the Songsak hills unsuitable.	Out
<i>Haliaeetus leucoryphus</i> (Pallas's Fish Eagle)	EN	No	Migratory	Large water bodies, lakes	Low	The Pallas's Fish-eagle is absent because it is a large-wetland specialist requiring major rivers or lakes for fishing, which are not present within the dense hill forests of Songsak.	Out
<i>Aquila nipalensis</i> (Steppe Eagle)	EN	No	Full Migrant	Open landscapes, migratory flyways	Low	The Steppe Eagle is absent because it is a migratory specialist of open plains and grasslands, avoiding the dense, hilly forests of Songsak where it cannot easily hunt or scavenge.	Out
<i>Emberiza aureola</i> (Yellow-breasted Bunting)	CR	Yes	Full Migrant	Wet paddy fields, reed beds	Low	The Yellow-breasted Bunting is absent because its global population has collapsed by 95% due to illegal trapping, and it requires open floodplains rather than dense hill forests.	Out
<i>Calidris tenuirostris</i> (Great Knot)	EN	Yes	Full Migrant	Coastal wetlands	None	The Great Knot is absent because it is a coastal shorebird that requires saltwater mudflats,	Out

Scientific Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
Knot)						making the inland freshwater and forest habitats of Songsak entirely unsuitable.	
<i>Gyps bengalensis</i> (White-rumped Vulture)	CR	No	Congregatory	Forest edges, open country	Moderate	Songsak reserve forest is bird hotspots in the study area ¹⁰ . There are no nesting cliffs or other habitats in the project area. It is absent due to a 99.9% population crash caused by diclofenac poisoning in livestock and the lack of undisturbed tall nesting trees.	Out

¹⁰ <https://ebird.org/hotspots>

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		
	PAs - Wildlife Sanctuary, National Park, conservation reserve or community reserve, Tiger reserve and corridor and Eco-sensitive zone (As notified under the Wildlife Protection Act, 1972)	Not present	-
	Reserve Forest (As notified under India Forest Act, 1927)	Present	The proposed road alignment passes through Songsak Reserve Forest
	Protected wetland of Meghalaya	Not Present	Nil
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 Present	No Schedule I species were recorded during the field surveys within the study area. However, based on secondary data sourced from the IBAT Tool, 26 Schedule I species are known to occur in the broader landscape. These species have been duly considered and screened during the Critical Habitat Analysis, and none are anticipated to be present within or significantly impacted by the project area. Details are given in Table 5.15.
	(ii) Species listed under Schedule III of the Wildlife (Protection) Act, 2022	Not present	
	(ii) Species notified as “threatened species” by the Govt. of Meghalaya under the Meghalaya Biodiversity Rules 2010	Not Present	
	(iii) Critically Endangered/Endangered species as listed by the IUCN Red List of	Not Present	

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
	Threatened species		
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	
	(iii) Important fish & Key Biodiversity Area	Yes, present	<ul style="list-style-type: none"> Chidrang River @chainage 35+700 and Songkama River Ch 5+100 The Chidrang River & Songkama and adjoining water bodies in North Garo Hills & 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	
	(v) Notified Elephant Reserve and Corridor	Not 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).

The identification of 26 Schedule-I species through the Integrated Biodiversity Assessment Tool (IBAT) reflects their potential distribution within the broader landscape, based on global datasets such as the IUCN Red List and the World Database on Protected Areas (WDPA). It is important to note that IBAT outputs are indicative in nature, representing modeled habitat suitability and regional occurrence rather than confirmed, site-specific presence along the project corridor.

Field reconnaissance and ecological surveys conducted as part of the ESIA study did not record any direct or indirect evidence—such as sightings, tracks, nests, or signs of habitat use of Schedule-I species within the immediate project influence area. Accordingly, while the surrounding landscape may support these species, the absence of field-verified occurrences within the project stretch suggests that no critical wildlife habitat is directly intersected by the proposed road alignment. Nevertheless, appropriate precautionary mitigation measures will be incorporated to address any potential ecological sensitivities. A transit walk was carried out by the ESIA team along the entire project corridor 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 3+525. 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. Based on the biodiversity assessment, the proposed SMR 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.

5.8 SOCIO ECONOMIC PROFILE

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.

East Garo Hills District, situated in the eastern part of the Garo Hills in Meghalaya, was officially upgraded from a sub-division to a full-fledged district on 23rd October 1976. The district shares its boundaries with Goalpara district of Assam to the north, West Khasi Hills district to the east, West Garo Hills district to the west, and South Garo Hills district to the south. Williamnagar serves as the district headquarters, which also acts as the administrative and commercial hub.

Geographically, the district lies between 25°24'05" and 26°00'57" North latitudes and 90°08'42" and 91°02'00" East longitudes, encompassing a total area of 2,603 square kilometers. The terrain is predominantly hilly, with numerous rivers, streams, and dense forest cover contributing to its rich biodiversity and scenic landscapes. The district is part of the Garo Hills region, which is known for its unique matrilineal tribal society, traditional practices, and cultural heritage.

The proposed project site is located in the North Garo Hills District of Meghalaya. Established in 2012 from the erstwhile East Garo Hills, the district covers an area of approximately 1,113 sq. km, with its administrative headquarters at Resubelpara. It shares boundaries with Assam to the north and east, East Garo Hills district to the south, and West Garo Hills district to the west.

Government and Administration: East Garo Hills District is administered under the Government of Meghalaya and functions in accordance with the Sixth Schedule of the Indian Constitution. Under this framework, the Garo Hills Autonomous District Council (GHADC) exercises authority over matters related to land, forests, and customary

practices of the tribal communities, while law enforcement, revenue administration, and other major state functions remain under the direct 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. Each block is managed by a Block Development Officer (BDO) who oversees the implementation of government schemes, rural infrastructure projects, and welfare programs at the local level.

At the village level, administration is further strengthened by village councils, which function as grassroots institutions to address local governance, customary laws, and community development. This dual system of modern administrative machinery and traditional tribal councils ensures participatory governance while preserving the socio-cultural identity of the Garo people.

North 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 Resubelpara, Bajengdoba, and Kharkutta. The administrative headquarters is located at Resubelpara, which also serves as the main center for governance and coordination of developmental activities.

5.8.1 SOCIO-ECONOMIC PROFILE OF THE PROJECT ROADS

The socio-economic details of the SMR 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 project corridor passes through (20) villages. Based on the population size, it may be mentioned that smaller rural settlements such as Dajonggre Songgital (67) and Soenang Pahartuli (146), which have significantly lower populations. Gender distribution is generally balanced, in Koksi Nengsat, and Chidimit Nengsat has more females than males. Larger settlements like Koksi Nengsat (813) and Chidimit Nengsat (703) play a key role in the region's demographics, reflecting the varied population density across the corridor. 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

Sl. No.	Village Name	Male	Female	Total
1.	Samin Wakso (Songkama -Waksogre)	194	191	385
2.	Koksi Nengsat	397	416	813
3.	Chidimit Nengsat	331	372	703
4.	Chidimit Namesa	272	261	533
5.	Childimit Boldakgittim	99	87	186
6.	Dagal Apal	117	99	216
7.	Dandakol	282	299	581
8.	Dalbinggre	157	174	331
9.	Sepikol	292	281	573
10.	Dajonggre Songgital	30	37	67
11.	Dajong gate	131	110	241
12.	Darenchi	177	159	336
13.	Thapa Roangdopa	90	100	190

Sl. No.	Village Name	Male	Female	Total
14.	New Kantolguri	265	242	507
15.	Rongkaminchi	325	320	645
16.	Soenang Adinggre	135	112	247
17.	Soenang Apal	253	264	517
18.	Soenang Labourpara	141	135	276
19.	Soenang Bahartuli	77	69	146
20.	New Phutimari(New Putimari)	295	295	590

Source: Census 2011

5.8.2.2 SEX RATIO

The sex ratio across the project-affected villages shows notable variation according to Census 2011. The lowest sex ratio is observed in Dajong gate (Thapa Rongdeng) at 840, followed closely by Soenang Adinggre at 830 and Dagal Apal at 846. Childimit Boldakgittim also records a relatively low ratio of 879. On the other hand, Dajonggre Songgital has the highest sex ratio at 1233, with Chidimit Nengsat at 1124, Dalbinggre at 1108, and Thapa Roangdopa at 1111, reflecting a significantly higher number of females relative to males. The other villages, including Samin Wakso, Rongkaminchi, Soenang Apal, and Soenang Labourpara, fall within a moderate range. 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.	Samın Wakso (Songkama -Waksogre)	985
2.	Koksi Nengsat	1048
3.	Chidimit Nengsat	1124
4.	Chidimit Namesa	960
5.	Childimit Boldakgittim	879
6.	Dagal Apal	846
7.	Dandakol	1060
8.	Dalbinggre	1108
9.	Sepikol	962
10.	Dajonggre Songgital	1233
11.	Dajong gate (Thapa Rongdeng)	840
12.	Darenchi (Thapa Darenchi)	898
13.	Thapa Roangdopa	1111
14.	New Kantolguri	913
15.	Rongkaminchi	985
16.	Soenang Adinggre	830
17.	Soenang Apal	1043
18.	Soenang Labourpara	957
19.	Soenang Bahartuli (Soenang Pahartuli)	896
20.	New Phutimari(New Putimari)	1000

Source: Census 2011

5.8.2.3 SCHEDULED TRIBE POPULATION

The district is predominantly inhabited by the Scheduled Tribe (ST) population. Their settlements along the project road corridor are primarily concentrated in smaller rural villages, with Koksi Nengsat (788) and Chidimit Nengsat (667) recording the highest ST populations. Medium-sized settlements such as Rongkaminchi (636) and New Phutimari (579) also have a significant ST presence. In contrast, smaller villages like Soenang Pahartuli (146) and Dajonggre Songgital (66) have comparatively lower ST populations. A detailed distribution of the ST population along the project corridor is provided in **Table 5.19**.

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

Sl. No.	ST Population				
	Village Name	Male	Female	Total	Percentage
1.	Samin Wakso (Songkama -Waksogre)	176	178	354	91.95
2.	Koksi Nengsat	383	405	788	96.92
3.	Chidimit Nengsat	315	352	667	94.88
4.	Chidimit Namesa	254	256	510	95.68
5.	Childimit Boldakgittim	98	84	182	97.85
6.	Dagal Apal	117	98	215	99.54
7.	Dandakol	276	290	566	97.42
8.	Dalbinggre	149	162	311	93.96
9.	Sepikol	288	275	563	98.25
10.	Dajonggre Songgital	30	36	66	98.51
11.	Dajong gate (School) (Thapa Rongdeng)	129	109	238	98.76
12.	Darenchi Thapa Darenchi	168	149	317	94.35
13.	Thapa Roangdopa	87	97	184	96.84
14.	New Kantolguri	263	239	502	99.01
15.	Rongkaminchi	319	317	636	98.60
16.	Soenang Adinggre	133	112	245	99.19
17.	Soenang Apal	251	259	510	98.65
18.	Soenang Labourpara	136	135	271	98.19
19.	Soenang Bahartuli (Soenang Pahartuli)	77	69	146	100.00
20.	New Phutimari	291	288	579	98.14

Source: Census 2011

5.8.2.4 WORKFORCE POPULATION

The workforce distribution in the region highlights rural areas like Koksi Nengsat (361 workers) and Rongkaminchi (346 workers) as economic hubs, with strong female participation in Soenang Apal. The detailed workforce of the project affected villages is given in Table 5.20.

Table 5.20: Workforce Population in the Project Road corridor area

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			Percentage
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Samin Wakso (Songkama -Waksogre)	99	107	206	0	0	0	99	107	206	53.51
Koksi Nengsat	163	167	330	17	14	31	180	181	361	44.40
Chidimit Nengsat	127	50	177	12	40	52	139	90	229	32.57
Chidimit Namesa	99	9	108	6	8	14	105	17	122	22.89
Childimit Boldakgittim	44	38	82	4	4	8	48	42	90	48.39
Dagal Apal	58	24	82	34	50	84	92	74	166	76.85
Dandakol	112	103	215	24	43	67	136	146	282	48.54
Dalbinggre	83	76	159	2	4	6	85	80	165	49.85
Sepikol	137	128	265	30	36	66	167	164	331	57.77
Dajonggre Songgital	13	13	26	1	1	2	14	14	28	41.79

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			Percentage
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Dajong gate (School) (Thapa Rongdeng)	49	41	90	6	5	11	55	46	101	41.91
Darenchi Thapa Darenchi	93	72	165	7	5	12	100	77	177	52.68
Thapa Roangdopa	35	3	38	0	0	0	35	3	38	20.00
New Kantolguri	86	10	96	0	0	0	86	10	96	18.93
Rongkaminchi	176	156	332	8	6	14	184	162	346	53.64
Soenang Adinggre	72	65	137	0	0	0	72	65	137	55.47
Soenang Apal	113	123	236	7	4	11	120	127	247	47.78
Soenang Labourpara	69	79	148	5	2	7	74	81	155	56.16
Soenang Bahartuli	44	47	91	3	1	4	47	48	95	65.07
New Phutimari (New Putimari)	122	122	244	1	1	2	123	123	246	41.69

Source: Census 2011

5.8.3 EDUCATION

The educational scenario in the project corridor reveals notable variations in literacy levels across rural areas. Soenang Apal (98.11) and New Putimari (94.51%) lead in literacy rates, while villages like Dalbinggre (44.02) and Chidimit Namesa (47.26) show minimal literacy levels.

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 corridor area

Sl. No.	Literate Population				
	Village Name	Male	Female	Total	Percentage
1.	Samin Wakso (Songkama -Waksogre)	94	73	167	43.38
2.	Koksi Nengsat	185	154	339	41.70
3.	Chidimit Nengsat	186	184	370	52.63
4.	Chidimit Namesa	113	94	207	38.84
5.	Childimit Boldagittim	51	29	80	43.01
6.	Dagal Apal	58	43	101	46.76
7.	Dandakol	146	130	276	47.50
8.	Dalbinggre	59	55	114	34.44
9.	Sepikol	120	134	254	44.33
10.	Dajonggre Songgital	18	25	43	64.18
11.	Dajong gate (School) (Thapa Rongdeng)	61	61	122	50.62
12.	Darenchi (Thapa Darenchi)	128	105	233	69.35
13.	Thapa Roangdopa	54	51	105	55.26
14.	New Kantolguri	174	164	338	66.67
15.	Rongkaminchi	245	228	473	73.33
16.	Soenang Adinggre	98	81	179	72.47
17.	Soenang Apal	199	216	415	80.27
18.	Soenang Labourpara	88	72	160	57.97
19.	Soenang Bahartuli (Soenang Pahartuli)	51	44	95	65.07
20.	New Phutimari (New Putimari)	229	236	465	78.81

Sl. No.	Literate Population				
	Village Name	Male	Female	Total	Percentage
)				

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 corridors 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 SMR road in East and North 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 this sub project road, 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. Community members noted that while some individuals occasionally seek temporary or seasonal employment outside the village, long-term migration is limited, and livelihoods continue to be largely locally anchored.

5.8.7.2 CRIME

In sub project road, 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 and 5.23 presents the major crime cases registered in Songsak and Resubelpara Police Station over the years. During consultations with police officials, it was reported that crime levels in Sub Project Road SMR are very low, and no specific crime-related data was shared.

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

Year/ Major crime	Crime against property	Robbery	Theft	Murder	Kidnapping	Others	Total cases Register
2019	8	1	7	2	3	16	37
2020	5	0	3	2	2	12	24
2021	4	0	2	1	2	10	19
2022	2	0	1	0	1	5	9
2023	2	0	1	1	1	9	14
2024	1	1	0	1	1	8.5	12

Table 5.23: Crime records over the years (2019-2024) from Resubelpara Police Station

Year/ Major crime	Crime against property	Robbery	Theft	Murder	Kidnapping	Others	Total cases Register
2019	10	1	9	2	4	18	44
2020	6	0	4	3	3	14	30
2021	5	0	3	2	2	12	24
2022	3	0	1	1	1	6	12
2023	3	0	1	1	2	11	18
2024	2	0.5	1	1	1	9.5	15

Source : Field Survey

5.8.7.3 GENDER BASED VIOLENCE

According to records from the Songsak and Resubelpara Blocks, no general Gender-Based Violence (GBV) cases have been reported in Sub Project Road SMR, 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. Consultations in Corridor 6 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 48. The **table 5.24** below summarizes the gender distribution of the head of the Household.

Table 5.24: Gender Distribution of PAHs

Gender	SMR Road	Percentage
Male	36	75
Female	12	25
Total	48	100

Source: primary survey – 2025

5.9.1.1 GENDER DISTRIBUTION OF PROJECT-AFFECTED PERSONS

Out of a total of 144 Project Affected Persons (PAPs), 71 are male (51.8%) and 66 are female (48.17%), indicating an almost equal distribution between male and female beneficiaries. Gender Distribution of Project-Affected Persons (PAPs) is given in **Table 5.25**.

Table 5.25: Gender Distribution of Project-Affected Persons (PAPs)

Gender	Project Affected Persons	Percentage
Male	77	53.47
Female	67	46.53
Total	144	100

Source: EIS primary survey – 2025

5.9.1.2 ETHNICITY

The detailed distribution of ethnic groups in corridor wise is given in **Table 5.26** below.

Table 5.26: Community Wise Distribution of PAHs

Communities	Corridor6	Percentage
Garo	48	100
Rabha	0	0
Muslim	0	0
Total	48	100

Source: primary survey – 2025

5.9.2 IMPACT TO VULNERABLE HOUSEHOLDS

Census and Socio-economic survey will identify vulnerable group of households which included women-headed households, below-poverty-line, physically disabled, and elderly population (60+ years). **Table 5.27** below describes the distribution pattern of vulnerable group in the study area.

Table 5.27: Distribution of Vulnerable Group

Vulnerable Category	PAHs
Aged persons above 60 years	7
Below Poverty Line	5
Woman Headed Household	12
Physically Challenged	0

Source: primary survey – 2025

5.9.3 ECONOMIC PROFILE

5.9.3.1 PRIVATE BUSINESS/ ENTREPRENEURSHIP DOMINANCE

Among the 48 Project Affected Households (PAHs), the majority (28) are engaged in private business, while 12 depend on agriculture and another 4 falls under other occupations. Only 4 households are involved in government or private service. Details are provided in **Table 5.28**.

Table 5.28: Occupation pattern of PAHs in sub-project area

Sl. No.	Occupation	PAHs
1	Agriculture	12
2	Private Business	28
3	Service (Govt / Pvt.)	4
4	Others (non-working)	4
Total		48

Source: primary survey – 2025

5.9.3.2 INCOME

The income profile of the surveyed households shows a pronounced concentration in the lowest income category. A majority of households, 44 (91.6%), have an annual income of less than ₹25,000, indicating widespread economic vulnerability. Only 4 households (8.3%) fall within the ₹25,000–₹50,000 income bracket. No households were reported in the higher income categories of ₹50,000–₹100,000 or above ₹100,000. Details are provided in Table 5.29.

Table 5.29: Monthly Income Range of PAHs

Sl. No.	Monthly Income Range of HH	Project Road	
		No. of PAHs	Percentage
1	less than 25000	44	91.6
2	25000- 50000	4	8.3
3	50000-100000	0	0
4	More than 100000	0	0
Total		48	100

Source: primary survey – 2025

5.9.4 EDUCATION

In sub project road, out of a total population of 137 persons, education levels show a balanced distribution across genders. The majority have studied up to high school (37 persons), followed by 30 with primary education and 16 with higher secondary education. A smaller group of 12 individuals are graduates or above, while 16 are illiterate. Overall, male (74) and female 63 participation across education levels is nearly equal. Details are provided in Table 5.28.

Table 5.30: Education Level of PAPs

Sl. No	Education	Sub Project Road		
		Male	Female	Total
1	Children below 6 years	10	8	18
2	Primary (Class 1 to 4)	19	16	35
3	High School (Class 5-10)	23	23	46
4	Higher Secondary (Class 11-12)	8	9	17
5	Graduate and above	6	6	12
6	Illiterate	11	5	16
Total		77	67	144

Source: primary survey – 2025

5.9.5 HEALTH STATUS

The predominant waterborne diseases in the study area include diarrhea, typhoid, and cholera, which pose significant health risks, particularly in regions with limited access to clean water and healthcare services as per public consultation with KII (Table 7.1). Poor sanitation and contaminated water sources further contribute to

illnesses such as hepatitis A and typhoid fever. In addition, communicable diseases like dengue fever and respiratory infections continue to be prevalent concerns in the area (Table 7.1).

As per community consultation, SMR settlements have made significant progress in sanitation. However, some households still lack access to well-constructed toilets with proper sewage disposal systems. The absence of public toilets and washrooms remains a critical issue, especially for individuals working in open or shared spaces.

Songsak and Resubelpara PHC serves as the primary healthcare facility, supported by Resubelpara PHC and CHC within the Project Influence Area (PIA), The National Health Mission (NHM) Meghalaya supports these via the 108-ambulance helpline and 14410 health query line.

5.9.6 IMPACT TO STRUCTURES

The project corridor wise 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 the additional land (0.27 Ha) that is required for the sub project. However, a total of 47 structures located within the existing Right of Way (ROW) are partially affected along the project corridor.

These include 19 commercial structures, 3 residential-cum-commercial structures, and 1 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, 24 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 temporary 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 the RAP and the list of structures is given in Annexure 5.3.

Table 5.31: Type of Impact on Project Affected Household

Type of Impact	Description	PAH Category	No of PAHs	No of PAPs	% of impact
Commercial Structures (bamboo and GI Sheet fencing of Shops)	Loss of structure (partial impact)	Encroachers	19	59	<10
Residential Cum Commercial structures (GI Sheet Shades, GI & bamboo fencing of house)	Loss of structure (partial impact)	Encroachers	3	10	<10
Residential structures (GI Sheet Shades and boundary walls of houses)	Loss of structure (partial impact)	Encroachers	1	5	<10
Roadside Kiosks/Squatters	Temporary Economic Displacement	(NTH)	24	63	<10
Land	Fallow Land	Land user	1	7	

Total			48	144	
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5.9.7 TREES IN ROW

33 trees are situated within the existing 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. Taking a cue from the MITP, the survival of the trees should be monitored. These measures, along with their implementation strategies, are comprehensively detailed in the Environmental and Social Management Plan (ESMP).

10 no of Areca nut trees will be cut which belongs to an individual Watjang Ch. Marak) who has planted these trees on the community land. . Compensation for these trees has been duly incorporated in the RAP budget. The affected owners, will be compensated in accordance with applicable norms, ensuring restoration of income and support to their economic well-being. A total compensation amount of ₹49,000 has been provided in the RAP budget for these trees. (Chapter 8, Table 8.1 OF RAP).

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 20 minor structures that may be affected during construction. Since they are outside the direct influence zone, no adverse impacts are anticipated. A summary of CPRs is provided in **Table 5.32**.







Table 5.32: Common Property Resources located within 50 m of the ROW


Sl. No.	Type of CPR Structures	Chainage	Distance from the PROW	
1.	Forest Office	Ch. 3+800	7 m from center line RHS	No direct impact; design speed reduced to 20 km/h with improved signage to enhance road safety.
2.	HWC	Ch 9+450	4 m from center line RHS	
3.	Police Camp	Ch. 15+450	6 m from Centre line LHS	
4.	PHC	Ch. 15+900	6 m from Centre line LHS	
5.	Pollution Testing Station	Ch. 35+560	6 m from Centre line LHS	
6.	Anganwadi Centre	Ch. 32+700	7.5 m from Centre line RHS	No direct impact; design speed reduced to 20 km/h with improved signage to enhance road safety. Speed restriction signs before and after school (Both side of the school)
7.	School	Ch 9+500	7 m from center line RHS	
8.	School	Ch 12+300	5 m from Centre line LHS	
9.	School	Ch 5+400	6 m from center line RHS	
10.	School	Ch 9+400	8 m from center line RHS	
11.	School	Ch. 15+900	8 m from Centre line LHS	
12.	Church	Ch. 29+670	6 m from Centre line LHS	No direct impact; design speed reduced to 20 km/h with improved signage to enhance road safety.
13.	Church	Ch 11+750	8 m from center line RHS	

14.	Church	Ch. 13+900	5 m from Centre line LHS	No direct impact; design speed reduced to 20 km/h with improved signage to enhance road safety.
15.	Church	Ch. 31+400	3 m from Centre line LHS	
16.	Church	Ch. 33+400	5 m from Centre line RHS	
17.	Graveyard	Ch. 32+000	7.3 m from Centre line LHS	
18.	Community hall	Ch. 14+500	7 m from Centre line LHS	
19.	Community Hall	Ch. 32+420	7 m from Centre line RHS	
20.	Nangapa Market	Ch. 13+000	6.2 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.

New Ch No	LHS/RHS with distance from centre line	Structure	Pictures
0+000	-	Starting Point	
36+000	-	End Point	

3+650	-	Reserved Forest	 <p>Latitude: 25.67574 Longitude: 90.63454 Elevation: 251.7815 m Accuracy: 12.15 m Time: 25-08-2025 12:55 Note: SM</p>
3+800	RHS, 7m from Centre line	Forest Office	 <p>Latitude: 25.680369 Longitude: 90.6347 Elevation: 223.18325 m Accuracy: 69.7 m Time: 25-08-2025 12:25 Note: SM Forest Office 3+800.</p>
5+400	RHS, 6m from Centre line	School	 <p>Latitude: 25.692762 Longitude: 90.634442 Elevation: 203.83359 m Accuracy: 5.79 m Time: 25-08-2025 12:20 Note: SM School 5+400.</p>
9+400	RHS, 8m from Centre line	School	 <p>Latitude: 25.725516 Longitude: 90.641365 Elevation: 240.11745 m Accuracy: 8.275 m Time: 25-08-2025 12:01 Note: SM School 9+400.</p>
9+450	RHS, 4m from Centre line	HWC	 <p>Latitude: 25.726308 Longitude: 90.641325 Elevation: 242.018762 m Accuracy: 10.526 m Time: 25-08-2025 12:00 Note: SM HWC 9+450.</p>
9+500	RHS, 7m from Centre line	School	 <p>Latitude: 25.726911 Longitude: 90.641261 Elevation: 244.52479 m Accuracy: 7.686 m Time: 25-08-2025 11:58 Note: SM School 9+500.</p>

11+750	RHS, 8m from Centre line	Church	 <p>Latitude: 25.736316 Longitude: 90.63316 Elevation: 219.815252 m Accuracy: 3.79 m Time: 25-08-2025 11:53 Note: SM Church 11+750</p>
12+300	LHS, 5 m from Centre line	School	 <p>Latitude: 25.741095 Longitude: 90.622095 Elevation: 237.221169 m Accuracy: 12.15 m Time: 25-08-2025 11:51 Note: SM School 12+300</p>
13+000 LHS	LHS, 6.2 from Centre line	Nangapa Market	 <p>Latitude: 25.747169 Longitude: 90.621725 Elevation: 233.37449 m Accuracy: 21.681 m Time: 25-08-2025 11:46 Note: SM Nangapa Market 13+000</p>
13+900	LHS, 5m from Centre line	Church	 <p>Latitude: 25.762692 Longitude: 90.625394 Elevation: 185.752694 m Accuracy: 3.285 m Time: 25-08-2025 11:43 Note: SM Church 13+500</p>
14+500	LHS, 7 m from Centre line	Community hall	 <p>Latitude: 25.758351 Longitude: 90.625394 Elevation: 222.571772 m Accuracy: 3.285 m Time: 25-08-2025 11:40 Note: SM Community Hall 14+500</p>

15+450	LHS, 6m from Centre line	Police Camp	 <p>Latitude: 25.765055 Longitude: 90.629076 Elevation: 215.65+7.97 m Accuracy: 10.51 m Time: 25-08-2025 11:37 Note: SM Police Camp 15+450</p>
15+900	LHS 8 m, from Centre line	PHC	 <p>Latitude: 25.768704 Longitude: 90.628245 Elevation: 211.12+13.46 m Accuracy: 6.463 m Time: 25-08-2025 11:34 Note: SM PHC 15+900</p>
15+900	LHS, 8m from Centre line	School	 <p>Latitude: 25.768694 Longitude: 90.628245 Elevation: 212.59+6.8 m Accuracy: 6.463 m Time: 25-08-2025 11:35 Note: SM School 15+900</p>
29+670	LHS, 6m from Centre line	Church	 <p>Latitude: 25.801142 Longitude: 90.633956 Elevation: 217.59+6.8 m Accuracy: 6.513 m Time: 25-08-2025 10:28 Note: SM Church 29+670</p>
31+400	LHS 3 m from Centre line	Church	 <p>Latitude: 25.863138 Longitude: 90.622462 Elevation: 64.88+5.54 m Accuracy: 25.12 m Time: 25-08-2025 10:19 Note: SM Church 31+400</p>
32+420	RHS, 7m from Centre line	Community Hall	 <p>Latitude: 25.863077 Longitude: 90.624251 Elevation: 62.33+4.41 m Accuracy: 3.802 m Time: 25-08-2025 10:10 Note: SM Community Hall 32+420</p>



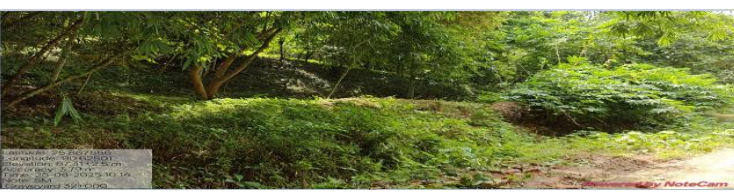

32+700	RHS 7.50m from Centre line	Anganwadi Centre	
33+400	RHS, 5m from Centre line	Church	 <small>Latitude: 25.8785418 Longitude: 90.6202014 Elevation: 70.0543.59 m Accuracy: 168.1 m Time: 25-08-2025 10:01 Note: SM Ch: 33+400</small>
35+360	LHS, 6m from Centre line	Pollution Testing Station	 <small>Latitude: 25.8346334 Longitude: 90.6322750 Elevation: 82.85141 m Accuracy: 7.857 m Time: 25-08-2025 09:42 Note: SM End Ch:</small>
32+000	LHS, 7.3m from Centre line	Graveyard	 <small>Latitude: 25.8346334 Longitude: 90.6322750 Elevation: 82.85141 m Accuracy: 7.857 m Time: 25-08-2025 09:42 Note: SM End Ch:</small>
35+300		Public Consultation	 <small>Latitude: 25.894608 Longitude: 90.632767 Elevation: 82.85141 m Accuracy: 7.857 m Time: 25-08-2025 09:41 Note: SM End Ch: 35+300</small>

Figure 5.13: Illustrative view of the road features in Sub Project Road SMR

5.10 HAZARD AND VULNERABILITY PROFILE

The Hazard and Vulnerability profile of the SMR Road area and East & North Garo Hills district includes landslide hazards, flash flood, earthquake, etc. The drought, group clash, fire incidents, etc. also occur in the district. The seasonal hazard analysis of the East & North Garo Hills District¹¹ is given in **Table 5.33** below.

¹¹ District Disaster Management Plan for Meghalaya, 2024

Table 5.33: 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	←											→

5.10.1 EARTHQUAKE ZONES

The project road stretches fall under Zone – V, which is at Very High risk and intensity is IX. Seismic Zone details of North Garo Hills is presented in **Table 5.34**.

Table 5.34: Seismic Zone details of North Garo Hills

District	Seismic Zone	Notable Faults	Recent Earthquakes
North Garo Hills	Zone V (lower)	Internal faults like Dudhani, Darugiri	—

5.10.2 CLIMATE RESILIENT FEATURES

The upgradation of the Songsak- Mendipathar Road (SMR) Road from a single lane to an intermediate lane 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 landslides. 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 5.35.

Table 5.35: Climate Resilient design

Climate-Resilient Design		Upgradation of Sub Project Road
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 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 prioritisation 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 reconstructing 13 smaller dimension culverts to higher dimension culverts and additional 25 no. of Pipe culverts have been provided 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.
	Roadside drains: 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 Stabilisation & Erosion Control	Bio- engineering (vegetation, geotextiles) and structural retaining walls reduce landslide risk in project Regions.	Bio engineering by using local Broom Grass and also provide vetiver or jetty grass. Turfing has been provided at the embankment slope.

	<p>Earthwork design based on climate data accounts for increased rainfall intensity.</p> <p>In hilly terrains, bio-engineering measures are used to stabilise embankments and slopes (e.g., vegetation, geotextiles).</p> <p>Structural treatments like retaining walls, gabion walls, breast walls protect roads against landslides and Soil erosion.</p>	<p>Retaining wall up to 3.0 m Height and above 3.0 m height use Bio engineering.</p>
4 All-Weather Surface Materials	<p>Using durable pavement materials that resist damage from heavy rains, moisture ingress, and temperature fluctuations</p>	<p>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</p>
5 Design with Safety & Maintenance Objectives	<p>All climate- resilient designs are integrated with road safety measures (road geometry improvements, signage, crash barriers, and delineation).</p>	<p>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.</p>

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 35.28 km priority roads in Sub Project Road SMR. 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 5, 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 5.1**. 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	Air Quality	Noise	Water Resources	Soil Stability	Flora & Fauna	Public Health	Community Safety	Cultural Heritage	Hazardous Material Risk	Drainage	Road Safety
Construction											
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	HN	HN	HN	N	MN	MN	MN	N	HN	MN	MN

Plants											
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 & Community	-	—	—	—	—	MP	MP	N	N	N	LP

Engagement											
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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 6.1** presents the environmental and social significance ratings of various project activities during the pre-construction, construction, and operational phases of the SMR 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 corridor. 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 ESIA, 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 Songsak- Mendipathar Road (SMR). While most construction activities are proposed within the existing Right of Way (RoW), minor land requirement 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 SMR 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 33 trees will be felled along the corridor, leading to localized loss of vegetation and minor habitat disturbance

Mitigation Measures:

- Avoid construction camps and material storage near streams or forest patches.
- 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).

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 equipment 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 existing 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 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 camps have 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.

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 labour management plan and implemented.
- The layout of camps will be reviewed and cleared by the Environment expert, CSC prior to establishment.

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

A total of 256 electric poles, 1 transformer, and 107 electric line crossings are identified along the SMR road corridor for shifting. A total of 256 OFC pillars are identified for shifting along the SMR road corridor, comprising 172 on the LHS and 84 on the RHS.

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 the 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) and 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 from unauthorized quarries 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 PIU/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 PIU; 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. Over extraction of natural resources can lead to unwarranted impacts. To prevent this the following mitigations are proposed.

Mitigation Measures:

- Obtain permission for groundwater abstraction from the CGWA/SGWA and or Surface water from State Water Resources Department.
- Prefer use of surface water from local streams or treated water from nearby sources.
- Extraction from community wells or structures used by community is prohibited unless it is allowed on cases by case basis.
- 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 to the PIU 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, and transportation of material. , These activities 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 landslides require robust safety protocols.

Most of the adverse environmental impacts are related to construction works which are inevitable but are manageable through good engineering and construction practices which have mostly been well defined and standardized. The negative environmental effects can be taken care of at an early stage through proper construction planning, sensitization of workforce and supervision and oversight by the works supervisor.

The associated activities of road construction works would involve operation of plant, movement of machinery 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:

IMPACTS ON PHYSIOGRAPHY

The SMR 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 existing right-of-way (ROW) in settlement areas.

The Songsak- Mendipathar Road (SMR) Road traverses gently undulating terrain with elevations ranging from 95 m to 562 m amsl, where only minor cutting and filling are required to achieve the desired formation level. The total estimated cut quantity is 528914.44 m³ and fill quantity is 50181.51 m³, resulting in a surplus of approximately 478732.89 m³ of excavated material to be disposed of at MPWD-designated sites. No major hill cutting is involved, though embankment raising is proposed in low-lying and flood-prone stretches about 300 mm at chainage 5+350, with riverbank protection works (stone pitching, retaining walls, and vegetative stabilization measures such as planting deep-rooted native grasses and shrubs along the embankment) at chainages 4+020, 4+300, 10+300, 10+800, 11+400, 20+400, 20+700, and 20+900 to prevent instability caused by continuous water flow, scouring, and surface runoff during monsoon periods. These works are aimed at improving drainage efficiency, slope stability, and road durability.

Mitigation Measures

The project has identified the 04 disposal sites. Additional 0.97 ha land is required for Spoil disposal. Details are given in Table 3.15.

To prevent environmental impacts from the disposal sites, the following needs to be kept in mind during disposal:

- Clear the debris from construction sites. Unusable Debris are to be carried by trucks/dumpers to the identified dumping yards. Covers should be placed on 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 amount 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 SMR Roads 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 72304 m³ 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. 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 from quarries approved by the PIU (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 payments.

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., 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 corridor, 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. The alignment passes through areas which have sandy loam with varying amounts of clay, typically exhibiting low to medium plasticity. These soils are light textured and are thus prone to erosion by winds and during rain and consequent slides can occur due to hilly slopes of the area. Additionally, the movement and operation of vehicles, construction equipment, and material transport during project execution may cause soil compaction, particularly in 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 quarry 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 Quarry 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 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 (m³)	Cut (m³)
SMR	17541	83272

From the above table it is calculated that after balancing cut and fill, the remaining quantity of 72304 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 3.15. Average height should be 1.5 m to 2 m.

In addition, waste from off-spec hot-mix as well 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,
- Contractor have to obtain the permission of the PIU after submitting the EC, CTE, CTO any quarry area
- These measures shall be monitored through the supervision consultant to ensure effective implementation during the construction phase

Spoil Disposal

The Spoil disposal should be carried out at the site identified and 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/ masonry wall at the periphery.
- 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 quarry sites
- Stone crushing, handling, and storage of aggregates at on-site asphalt mixing plants are integral to the SMR Road Corridor 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 corridor 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 SO₂, 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.

Table 6.3: Mitigation Measures for Ambient Air Quality

Impact Source	Mitigation Measures
Transportation and tipping of cut material; site levelling and excavation	<p>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.</p> <p>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.</p>
Transportation of raw materials from quarries 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	<p>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.</p> <p>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.</p>
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 (SO₂, NO_x, CO)	<p>Ensure all machinery meets CPCB emission norms/ MoRTH emission standards (GSR 144);</p> <ul style="list-style-type: none"> • Prohibit idling of vehicles; • 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 , NO _x , 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 corridor. 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 SMR Road is moderate and confined mostly within the existing 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 machineries 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).
- 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

Construction activities may increase turbidity level by increasing the sediment load. There are water bodies observed along the SMR Road. Sometimes contamination of surface water may take place due to accidental spills of construction materials, oil, grease, fuel, and paint. Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of worker camps and from spillages from vehicle parking area and/or fuel and lubricant storage areas. During the construction phase, if silt is not adequately controlled, it would lead to contamination of water sources especially those close to the Right of Way (RoW).

Fishing is practiced in the water bodies intersecting the SMR Road. Moreover, any extraction of river bed material is regulated by different authorities like State Environmental Impact Assessment Authority, State Pollution Control Board and State Mining Department with an objective to conserve top soil, avoid impact on aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals. The project may utilize river bed materials from existing licensed quarries, subject to compliance with all stipulated conditions of the aforementioned authorities.

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 (with all facilities mentioned above) with the permission of the CSC/PIU.
- 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.
- 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, bank protection measures are required to prevent accelerated sedimentation, which can disrupt drainage patterns and negatively impact riverine habitats. The road alignment generally follows the existing topography, except at the locations of cross-drainage structures. Within the project stretch of 35.28 km, there are 42 Junction and 19 Minor Bridge exists in the project area of 35.28 km road length. Totally 172 culverts are proposed for new construction, reconstruction/retention. Among these, 1 is slab culvert, 90 are box culvert and 49 are pipe culvert. Proposed pipe culverts are 32. Many of the existing culverts present in the project area if not adequately strengthened during the proposed road widening with rehabilitation/upgradation, can lead to structural failures, causing disruptions in water flow, increased flood risk and potential damage to the road.

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. SMR project road stretch will require 36.9 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 Chidrang River @chainage 35+280 and Songkama River Ch 5+100. The demand for construction is proposed to be met from surface water sources. However, in extreme cases, where surface water is not available, it is proposed to use groundwater resources. 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 unauthorised 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 from third parties the Contractor shall only source it from sources cleared by PIU. 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

6.4.2.7 CONSTRUCTION AND DEMOLITION WASTE

Construction and demolition (C&D) waste from major demolitions is not expected along the proposed SMR alignment because no Pucca 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 maintain clear pedestrian/vehicular passage around work areas.
- **Permits & authorised 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.

6.4.2.8 MUNICIPAL SOLID WASTE

SMR road corridor will generate approximately 83.4 to 91.7 kg of municipal solid waste per day during the construction stage, this is estimated based on approximately 145 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 disposed of hygienically as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of Project Authority.
- The camping area should be periodically sprayed with Bleaching powder and other disinfectants.

6.4.2.8 HAZARDOUS WASTE

Approximately 178 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.

Corridor wise scarifying existing bituminous surface in the project area is listed in **Table 6.4** below.

Table 6.4: Amount of expected Scarified Bituminous material

Sl. No.	Description	Unit	Quantity
1.	Scarifying existing bituminous waste	cum	178

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 to Authorized recyclers or Aggregators and the records maintained in Form V of the Hazardous Waste Rules.

6.4.2.9 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-project corridor does not fall within the high-risk Unstable slope or 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.

At chainage 5+350, a flooding risk has been observed near the school zone on the left-hand side (LHS). During heavy rainfall, surface runoff from the adjoining area tends to flow towards the school premises, posing a risk of localized flooding and potential damage to school property and infrastructure. To mitigate this issue, proper storm water management measures are proposed, including the construction of roadside drains and cross-drainage structures to effectively channel runoff away from the school. In addition, the road embankment near this section will be slightly raised where necessary to prevent water accumulation and entry into the school compound, ensuring both safety and accessibility during monsoon periods. These sections indicate the vulnerability of the terrain to slope instability and potential road hazards.

Temperature fluctuations and high wind velocity contribute to gradual deterioration of road surfaces, especially asphalt roads. Over time, these conditions increase maintenance costs. Riverbank erosion is a significant concern along the stretch. Riverbank erosion has been observed at multiple chainages along the project road, primarily on the left-hand side (LHS) near river-adjacent sections. The affected stretches include chainages 4+020, 4+300,

10+300, 10+800, 11+400, 20+400, 20+700, and 20+900. These sections exhibit varying degrees of bank instability caused by continuous water flow, scouring, and surface runoff during monsoon periods. The erosion not only threatens the stability of the road embankment but also poses risks to nearby community assets and vegetation.

To address this, riverbank protection works are proposed, including stone pitching, retaining walls, and vegetative stabilization measures such as planting deep-rooted native grasses and shrubs along the embankment. These interventions aim to arrest further soil loss, stabilize the slope, and minimize sedimentation in the river channel. Regular monitoring and maintenance of these protection measures will ensure the long-term stability of the road and adjacent riverbanks. This indicates that the section is vulnerable to surface runoff and sediment displacement, which could affect the stability of the bridge foundations and the adjoining road embankment.

6.4.2.10 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.

6.4.2.11 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. Electrocutation, 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-construction 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.

6.4.2.12 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 wherever feasible 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.

6.4.2.13 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 continuous stretch. 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 measures 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 are parked on the roadside the area should be barricaded by water filled New Jersey barrier. Retroreflective 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

- Labour camp will be set up as per WB guidance (Annexure 6.2).
- The Project Board shall be installed at the beginning /start of the package. The Project Board should provide the critical information about the project including the grievance mechanism.

- The construction zone must be access controlled, and the workers must be provided valid identification cards to allow entry.
- The Contractor shall provide, explain, and obtain signed acknowledgement of the Worker Code of Conduct from all workers as part of the employment agreement. Time to time orientation programme on Code of conduct to be organized with the workers by the contractor.

6.4.2.14 ROAD SAFETY MEASURES

Road construction activities may affect road safety for commuters, pedestrians, students, women, and elderly persons using the corridor. Since sections of the sub-project alignment pass through landslide-prone areas, there is a risk of periodic landslides 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.

In addition, sensitive receptors such as schools are located close to the Sub Project Road, specifically at Ch. 05+400, Ch. 09+400, Ch. 09+500, Ch. 15+900, will require enhanced traffic safety management measures during construction, including speed control, signage, safe pedestrian access, and coordination with school authorities

Mitigation Measures

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 also been proposed along critical stretches of the project corridor to enhance road safety by preventing vehicles from leaving the carriageway and minimizing the severity of run-off road accidents.

6.4.2.15 ANTICIPATED IMPACTS ON BIOLOGICAL ENVIRONMENT

The Songsak- Mendipathar (SM) 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.

A total of 26 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. Details are provided in Table 5.15.

As per the design, the construction activities would also involve felling of 33 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 PIU would be intimated to ascertain the presence of Chinese pangolin and Indian Pangolin. 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

Environmental impacts such as riverbank erosion (4+020, 4+300, 20+400, 20+700, and 20+900) will be addressed through improved drainage management and erosion control structures. Details are given below in **Table 6.8**.

Table 6.5: Drainage management and erosion control structures

Chainage (km)	Issue / Environmental Impact	Type of Work Envisaged	Detailed Design Interventions / Description
4+020	Eroding riverbank observed on LHS	Riverbank protection works	<ul style="list-style-type: none"> • Construction of toe wall / bank protection along LHS • Provision of riprap or gabion revetment with geotextile underlay • Regrading and stabilization of bank slope • Turfing / vegetative measures for long-term stabilization
4+300	Continued erosion observed on riverbank (LHS)	Riverbank erosion control works	<ul style="list-style-type: none"> • Strengthening of eroding left bank using gabion revetment / riprap • Stone apron or toe protection to arrest scour • Drainage improvement to prevent runoff-induced erosion • Vegetative slope stabilization
20+400	Riverbank erosion observed on LHS	Protection work on riverbank (LHS)	<ul style="list-style-type: none"> • Provision of gabion wall or riprap along eroded bank • Reprofilng of slope and placing stone pitching • Turfing / vetiver grass to stabilize upper bank • Installation of toe protection
20+700	Riverbank erosion observed on LHS	Riverbank stabilization works	<ul style="list-style-type: none"> • Construction of riprap / gabion protection along LHS • Slope regrading to stable gradient • Bioengineering measures for slope stabilization • Toe berm or stone apron to prevent undercutting

20+900	Riverbank erosion observed on LHS	Left bank erosion protection works	<ul style="list-style-type: none"> • Bank revetment using stone pitching or gabions • Toe wall / apron to control scour • Turfing or vegetative cover to protect upper slopes • Maintenance and monitoring of treated stretches
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6.4.2.16 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. A guidance note for the protocol on the "chance find procedure" is to be incorporated in the indicative ESMP as part 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 corridor 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 (ESS4). 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 corridor’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 SMR 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 and residential communities. The route traverses along agricultural land 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 design optimization, compensation, and community engagement, have been incorporated 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 construction of the SMR road is not expected to have social impacts on roadside communities, as 0.27 ha land is required for the project and most construction activities will be undertaken within the existing Right of Way (RoW). Approximately 47 structures are expected to be affected by the project and they are present within RoW, the details of which has been given in **Table 5.29**. FPIC was carried out as the project will result in loss of assets and cause relocation of IP's.

The majority of the impacts are associated with encroachers with no major permanent displacement involved. Commercial structures, mainly consisting of bamboo and GI sheet fencing of shops, account for impacts on 19 PAHs (59 PAPs). Similarly, 3 PAHs (10 PAPs) associated with residential-cum-commercial structures and 1 PAHs (5 PAPs) linked to residential structures will face partial boundary walls and GI shades.

A significant portion of the impact is related to roadside kiosks (24 PAHs and 63 PAPs), which fall under the category of squatters (Non-Title Holders) and will experience temporary economic displacement rather than physical relocation. A total of 24 PAHs (comprising 63 PAPs) associated with roadside kiosks will face temporary economic displacement. 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 project corridor 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. The road alignment requires minimal additional land (0.27 Ha), as most mitigation and improvement works are confined within the existing paved road.

Overall, 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.

Key interventions along the alignment include:

- A school zone has been identified between chainages 5+300 and 5+350 (LHS), where the proximity of the school to the roadway poses potential safety concerns for students and pedestrians. To address this, a comprehensive set of road safety measures will be implemented, including the installation of speed limit signage (restricted to 20 km/hr), rumble strips, warning boards, and clearly marked pedestrian crossings. These measures will help in alerting drivers, controlling vehicle speed, and ensuring the safe movement of schoolchildren during entry and exit hours. Additional provisions, such as roadside fencing or guardrails, may also be considered to enhance the safety of the school premises from vehicular movement.
- At chainage 5+600, a drainage deficiency has been observed, where stormwater accumulation poses a risk of surface runoff and possible erosion of the road shoulders. To mitigate this, the construction of a box culvert is proposed to facilitate proper drainage and smooth discharge of stormwater, thereby preventing water stagnation, soil erosion, and potential pavement damage. This intervention will improve the overall road stability and ensure uninterrupted water flow across the alignment during heavy rainfall.
- In addition, a church structure has been identified along the project alignment (exact chainage to be confirmed), representing a socially and culturally sensitive location. During construction, adequate protective measures will be adopted to minimize any disturbance to religious activities and the surrounding community. These include maintaining a safe buffer distance between construction works and the church boundary, implementing noise and dust suppression measures, restricting heavy machinery operations during prayer hours, and ensuring continuous community engagement. These actions will ensure that the project respects local sentiments while maintaining environmental and social safeguards.

A total of 144 PAPs may experience temporary livelihood disruptions during the construction period, as access to their shops, farms, or workplaces may be temporarily diverted or closed for about 4–5 days during construction activities. However, these impacts are expected to be short-term and will be managed through advance notice, access management, and phased construction planning to minimize inconvenience.

The assessment of impacts on structures and land along the project corridor indicates that the effects are largely minor and localized in nature, primarily involving partial damage to existing assets. As summarized in the table, a total of 48 Project Affected Households (PAHs) comprising 144 Project Affected Persons (PAPs) are expected to experience impacts.

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 SMR road alignment requires approximately 0.27 ha of land and is expected to affect about 48 structures, most of which are located within the existing 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 corridor, 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 existing 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 project corridor. These disruptions may affect daily mobility and reduce customer access to roadside businesses for short periods.

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 corridor. 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 Assessment (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	<ul style="list-style-type: none"> • Village community • Street side Shop Owners • Shop owners (NTH) • Road Users • Residential structure owners <p>Nokma</p>
Interested Parties	<p>A. Government agencies</p> <ul style="list-style-type: none"> ▪ 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 & North Garo Hills) ▪ District Legal Services Authority ▪ District Child Protection Unit ▪ Office of the Child Development Project Officer ▪ Nokma <p>B. Civil Society Organizations – Songsak–Mendipathar Road (SMR) Corridor:</p> <ul style="list-style-type: none"> ▪ Local Churches & Faith-Based Institutions (Songsak & Mendipathar areas): Play an important role in education, social welfare, and community development, supporting local populations along the SMR corridor. ▪ Women Self-Help Groups (SHGs): Actively engaged in small-scale livelihood activities such as food processing, agriculture-based enterprises, and handicrafts, with support from government programs like ATMA. ▪ Women’s Cooperative Societies: Facilitate micro-savings and credit access, helping

Category of stakeholder	Type of stakeholder
	<p>reduce dependence on moneylenders and promoting income-generating activities among women.</p> <ul style="list-style-type: none"> ▪ Under the Meghalaya Livelihood and Forest Ecosystem Management Project (MegLIFE), multiple SHGs, IVCS (village cooperatives), and community groups are active in Garo Hills including Songsak, focusing on livelihoods, forest management, and income generation <p>C. Community based Organization</p> <ul style="list-style-type: none"> ▪ Bio-Diversity Management Committee
Vulnerable groups	<ul style="list-style-type: none"> ▪ 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 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. Stakeholder Engagement Plan is attached as **Annexure 7.2**.

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 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 are 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 reserve forest habitat/clearance concerns.
Forest Ranger Office East & North Garo Hills	23 August 2025	3 nos	List of Floral and faunal species predominant in East & North Garo Hills and Details about wildlife movement
PCCF, Shillong	28 August 2025	4 nos	HWC & safety; governance/dependence, Reserve forest
Local residents 6 meaningful consultations	25 August 2025 Jamgao Sorokpara, Thapa Darenchi and Songkama 28 August 2025 Samin Songkama 30 August 2025 Thapa Rangdopa and Koksi Nengsat	Jamgao Sorokpara (8 male and 2 Female), Thapa Darenchi (5male and 6 Female), Koksi Nengsat (6 male and 4 female), Thapa Rangdopa (7 Male, 3 Female), Samin Songkama (6 male, 4 Female) and Songkama (3	Participants highlighted that the poor condition of the existing road is causing serious commuting difficulties, which is negatively affecting children’s access to education. They also reported that the deteriorated road condition has led to frequent road accidents, raising safety concerns among the local community.

Stakeholders	Dates of Consultation	No of Participants	Summary of Key Feedback
		Male).	
Street vendors	24 September 2025	4 Nos (Male – 3 Female – 1)	Construct smoother roads to enhance accessibility and improve transportation.
Village Nokma	24 September 2025	01 Nos	Waterborne diseases such as diarrhoea, typhoid, and cholera are prevalent due to unsafe drinking water and poor sanitation. The community stressed the need for improved water supply and health awareness.
Youth Groups	5 & 26 September, 7 October 2025, 09 December 2025	65 Nos	Along the Songsak–Mendipathar Sub Project Road, limited local employment opportunities, inadequate skill development access, and lack of career guidance contribute to migration as a common coping strategy, often with associated risks. Strengthening skill development, promoting entrepreneurship, and improving road connectivity are key priorities to enhance livelihoods and access to services.
Women FGD	5&26 September, 7 October 2025, 09December 2025	45 Nos	Women along the SMR Sub Project road are willing to engage in economic activities but face constraints due to limited opportunities, social barriers, and lack of structured support. There is a need for women-focused skill development initiatives and greater involvement of SHGs in project-related activities such as awareness, monitoring, and plantation upkeep to enhance their participation and livelihoods.
Consultations held during FPIC for Priority Projects			
Community Members & Project Affected Households & Families	5&26 September, 7 October 2025, 09December 2025	12 Consultations at 3 Locations 355 Nos (Male – 310 Female – 45)	<p>Major key Agreements:</p> <ul style="list-style-type: none"> • 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 • Protection work required at Pond Section • Protection at grave yard section

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 SMR 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 SMR 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 AP 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 AP 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	<ul style="list-style-type: none"> Obtain all necessary statutory clearances (CTE, CTO, Labour License, Fire NOC, Tree Cutting Permission, 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 be provided. 	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	<ul style="list-style-type: none"> RPF and RAP shall be followed MPWD division, Village Council and concerned authorities shall coordinate implementation. 	MPWD division, Village Council and concerned authorities	Compensation records maintained; Grievances resolved	MPWD/CSC/NGO

				<p>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.</p>			
3	Preparation of Works Methodology Contractor's ESMP (CESMP)		Inadequate preparation and implementation of CESMP by Contractor can leave environmental and social issues unattended	<ul style="list-style-type: none"> 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/ construction camp/ labour camp	Land use and ecology	Discharges from Yards/ Camps to pollute the surroundings and lead to social tension.	<ul style="list-style-type: none"> Contractor needs to identify suitable land for storage yard/ construction camp/ labour camp 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 	Contractor	Approved site location; Lease/NOC copies;	MPWD/PMC/CSC

				<p>activities, once the project is completed.</p> <ul style="list-style-type: none"> • 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 turving). • 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 Group¹² 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 3+525). 			
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¹² Workers' accommodation: processes and standards

5	Supply of Construction Material	Physiography	Sourcing materials from unauthorized sources.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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. Measures suggested in the permission will also 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 	Contractor	Permission for Water source; Usage records; Wastewater management measures	MPWD/PMC/CSC

				<p>pits, septic tank or be linked to a mobile treatment unit. Bio-toilets can also be considered as an option</p> <ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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. • 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. • 	Contractor	To be mobilized before construction; approved OHS plan	MPWD/PMC/CSC
8	Identification of OHS Hazard and Risk Categorization	Occupational Health & Safety	May cause physical harm, injury, illness, or death to workers.	<ul style="list-style-type: none"> • 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 	Contractor	OHS hazard register; Inspection reports;	MPWD/PMC/CSC

				<p>submit it as part of the Work Plan and Methodology. The Work Plan shall be approved only when the OHS Plan is satisfactory.</p> <ul style="list-style-type: none"> • 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. 			
9	Other Construction Vehicles, Equipment and Machinery	Pollution Management	Vehicles and equipment not complying with regulations may lead to pollution of environment.	<ul style="list-style-type: none"> • 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 	Contractor	Records of valid PUC / fitness; Inspection log	MPWD/PMC/CSC

				<p>appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144.</p> <ul style="list-style-type: none"> 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 specifications which are likely to be mentioned by MSPCB in the consent. . 			
10	Tree Cutting	Ecology	Loss of green cover and biodiversity	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> The MPWD and the Contractor shall carry out joint field verification to ascertain the local 	Contractor	Verification reports;	MPWD

				<p>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.</p> <ul style="list-style-type: none"> • 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. 			
12	Identification of Borrow Area	Damage to existing eco-system due to borrowing activities	Indiscriminate borrowing activities may damage the eco-system and lead to unproductive environment	<ul style="list-style-type: none"> • Borrow area should be located at a minimum distance of 300m from 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 guidelines¹³ issued by the concerned SEAC and SEIAA. 	Contractor	Borrow area EC copy; Approved management and closure plan	MPWD /CSC
13	Identification	Community	The safety aspects	<ul style="list-style-type: none"> • Plants and equipment will be 	Contractor	Approved route	MPWD/CSC

¹³ https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/1001_19032025024958.pdf

	of construction material transportation route	Health and Safety	<p>like</p> <ul style="list-style-type: none"> (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. 	<p>installed sufficiently away from the settlements.</p> <ul style="list-style-type: none"> • 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 where heavy equipment is in operation. • In the consideration of risk at 		<p>plan; Community consultation record</p>	
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				<p>civil works, each labour should be covered under ECA 1923 insurance until completion of work.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 	Contractor	Approved disposal site and its management plan; NOC, Agreement with landowner; Waste disposal records;	MPWD/CSC

				<p>natural sinks</p> <ul style="list-style-type: none"> • 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 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	<ul style="list-style-type: none"> • 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 	Contractor/ Divisional offices of MPWD	Records of Relocation completion.	MPWD/ PMC/CSC

				<p>daytime hours to avoid safety risks at night.</p> <ul style="list-style-type: none"> 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 			
16	Planning for Worksite and Work Zone Safety	Community Health and Safety	Accidents and inconvenience to communities	<ul style="list-style-type: none"> 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. 	Contractor	Community Health Safety Plan	MPWD/PMU

				<ul style="list-style-type: none"> 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. 			
		<ul style="list-style-type: none"> CONSTRUCTION 					
1	Crushers, Hot mix Plants & Batching Plants	Air Pollution	Impacts due to establishment and operation of plants and equipment	<ul style="list-style-type: none"> The Contractor shall submit a detailed layout plan for all such sites and seek prior approval before entering into a formal agreement 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 as per 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. 	Contractor	Approved layout plan; Valid NOCs/Consents; Dust suppression records; Air quality monitoring reports	MPWD/PMC/CSC
2	Operation of Borrow Areas	Topsoil and land	Impacts due to improper operation and closing of	<ul style="list-style-type: none"> Borrow areas shall be selected as specified in the guidance in The Contractor should submit 	Contractor	EC and lease copies; Approved Borrow area	MPWD/PMC/CSC

			borrow areas	<p>the EC, a copy of agreement with the landowner, borrow area management and closure plan before initiating any kind of borrowing activities.</p> <ul style="list-style-type: none"> • The Borrow are should comply with the conditions set in the EC/ SoP from MoEFCC. • 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. 		restoration and Closure plan	
3	Operation of Quarries	Physiography and Geology	Impacts due to improper management, operation and closing of quarries	<ul style="list-style-type: none"> • 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 fo the project the Contractor has to 	Contractor	Quarry permit, EC; Safety inspection report; Haul Road maintenance record, dust suppression measure, geotagged photos	MPWD/PMC/CSC

				<p>obtain EC and other relevant permits and licenses.</p> <ul style="list-style-type: none"> • In case of Blasting , A Blasting Management Plan shall be prepared in addition to the Blasting Permit, • 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	<ul style="list-style-type: none"> • 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. 	Contractor	Debris disposal/reuse records; Approved Site restoration plan; Photographic documentation.	MPWD/PMC/CSC

				<ul style="list-style-type: none"> • 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 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. 			
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				<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 	Contractor	Records of Waste reused/disposed; Details of approved disposal site; Photographic documentation.	MPWD/PMC/CSC

				<p>design/ sub base, strengthening of shoulders as directed by CSC on other lower order roads</p> <ul style="list-style-type: none"> • The disposal of bituminous wastes shall be carried out by the 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	<ul style="list-style-type: none"> • 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 	Contractor	Spill log; Waste oil disposal records; Fuel storage inspection record. Photographic documentation.	MPWD/PMC/CSC

				<p>contain 110% of the capacity of storage.</p> <ul style="list-style-type: none"> • The area should be provided with ABC type fire extinguishers as per the IS codes (IS 1641, IS 1642 and IS 1643, etc) • 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	<ul style="list-style-type: none"> • 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 	Contractor	Hazardous waste permits, records and returns	PMC/CSC

				<p>and disposal shall be maintained and made available for inspection.</p> <ul style="list-style-type: none"> Returns shall be submitted to comply with the Hazardous Waste Permit. 			
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.	<ul style="list-style-type: none"> 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,	Emissions	The emissions from vehicles and	<ul style="list-style-type: none"> Fitness and PUC of the vehicles and equipment's need to be 	Contractor	Valid PUC certificates;	MPWD/PMC/CSC

	and machinery		<p>construction equipment will pollute the air causing health and safety issues as well.</p>	<p>ensured.</p> <ul style="list-style-type: none"> • Maintain all equipment and vehicles regularly; prohibit use of old or poorly maintained machinery; use low-sulphur fuel • 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. 		<p>Equipment maintenance log; Emission test results</p>	
10	Operation of construction Camp and construction activities	Contamination of Surface / Ground Water	<p>Discharges from construction activities and construction camps/ labour will lead to surface/groundwater pollution.</p>	<ul style="list-style-type: none"> • 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 	Contractor	<p>Water quality monitoring report; Waste disposal records; Camp inspection records. Photographic documentation.</p>	MPWD/PMC/CSC

				<p>water sources or misusing the sources.</p> <ul style="list-style-type: none"> Minimize the use of bentonite slurry during piling works and prefer biodegradable materials wherever feasible. 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	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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 	Contractor	Water consumption log; Permission for water source; Installation of Rainwater harvesting structure	MPWD/PMC/CSC

				<p>camps and plant sites to promote sustainable use of water.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 	Contractor	Noise level test report; PPE usage record; Complaint register; vehicles, plants and equipment maintenance records.	MPWD/PMC/CSC

				<p>done regularly; during routine servicing, the effectiveness of exhaust silencers shall be checked and replaced if defective.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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. 			

				<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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. The CSC shall maintain oversight 	Contractor	Approved Blasting management Plan; Blasting permission; Incident log. Geotagged photos.	MPWD/PMC/CSC

				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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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 harm to fauna.	<ul style="list-style-type: none"> 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 	Contractor	Work timing records; Site inspection checklist	MPWD/PMC/CSC

				<p>environmental standards</p> <ul style="list-style-type: none"> 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. 			
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 construction/ project sites. Improper first aid facilities on the sites could affect health and safety of workers and others.	<ul style="list-style-type: none"> 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 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 	Contractor	Approved OHS plan; OHS training log; PPE checklist; Awareness programme and Health inspection reports	MPWD/PMC/CSC

				<p>and their use shall be ensured.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 	Contractor	Safety signage installed; Community complaint register; Traffic control records	MPWD/PMC/CSC

			(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.	<p>provided at construction zone near habitation area and public roads, and the same will be maintained throughout the construction period.</p> <ul style="list-style-type: none"> • 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 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.	<ul style="list-style-type: none"> • Develop and implement ERS • Train personnel and Establish communication channels • Systematic planning and training 	Contractor	Approved ERP; Emergency drill and training report; Incident response record	MPWD/PMC/CSC

				for emergencies.			
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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. • 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 	Contractor	Force majeure preparedness plan; Emergency contact list	MPWD/PMC/CSC
25	Labour camp establishment and workforce sanitation management	Occupational Health and Hygiene	Impacts related to unhygienic surroundings	<ul style="list-style-type: none"> • 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 	Contractor	Sanitation inspection record; Hygiene logbook	MPWD/PMC/CSC

				<p>toilets shall be provided at workplace.</p> <ul style="list-style-type: none"> • Preventive Medical care shall be provided to workers. • Proper Hygiene shall be maintained 			
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.	<ul style="list-style-type: none"> • 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 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. 	Contractor	Approved TMP; Signage/ barricade checklist; Traffic incident register; geotagged photos	MPWD/PMC/CSC
27	Labour camp management and workforce conduct during construction	GBV-SEAH Risks	GBV-SEAH risks may arise due to labour influx	<ul style="list-style-type: none"> • Ensure labour camps are away from settlement areas • Ensure that every worker working in the project has been given an orientation on the 	Contractor	Signed CoC register; GBV training log; GBV complaint record	MPWD/PMC/CSC

				<p>Worker's Code of Conduct, especially on GBV and SEA/SH, and has signed the Code of Conduct.</p> <ul style="list-style-type: none"> • 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 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.	<ul style="list-style-type: none"> • 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, 	Contractor	Chance find report; Notification records	MPWD/PMC/CSC

				establishment of labour camp, staging of plant equipment or vehicle, parking of vehicle etc. in the vicinity of the Archaeological Properties or Monoliths			
29	Engagement of labour	Compliance to Labour Welfare Laws and reporting	Workplace accidents and injuries, unsafe working condition, loss of productivity etc.	<ul style="list-style-type: none"> 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. 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. 	Contractor	Labour law compliance record; Training attendance record	MPWD/PMC/CSC/ Labour Inspectors, Govt of Meghalaya

				<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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 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. 	Contractor	Labour License and registration records; Local labour hiring records; Orientation logs;	MPWD/PMC/CSC Labour Inspectors, Govt of Meghalaya
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	<ul style="list-style-type: none"> 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 	Contractor/ CSC/ PWD	Meetings conducted per month Attendance records with representation of Indigenous communities, women, and vulnerable groups Number of issues raised and	MPWD/ PMC

				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.		resolved Availability of documented meeting records (MoMs)	
32	Grievance Redressal	GRM	Increased impunity, conflict and violence; Loss of trust and confidence	<ul style="list-style-type: none"> Establish a grievance redressal mechanism Ensure that the mechanism is impartial and independent Provide adequate support to people who use the mechanism Communicate effectively with people about the mechanism 	Contractor	GRM register; Grievance resolution records	MPWD/PMC/CSC
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	<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. 	Contractor	Site clearance restoration records and closure NOC; Geotagged photos	MPWD

				<ul style="list-style-type: none"> • 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. 			
2	Operation and maintenance of road slopes, embankments, and drainage systems	Soil Erosion due to Runoff over Steep Slopes and Embankments	Loss of fertile topsoil; Siltation of nearby water bodies; Slope instability or road damage	<ul style="list-style-type: none"> • Regularly inspect slopes and embankments for erosion signs. • Implement bioengineering measures like turfing, hydroseeding, and vegetation planting. • Provide stone pitching, retaining walls, or gabions where needed. • Maintain effective drainage systems to reduce concentrated runoff. 	Contractor	Reports on Erosion inspection; implementation of mitigation measures; Drain maintenance log	MPWD
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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 movement during road operation	Noise Environment and Community Health	Noise nuisance to residents; Disturbance to schools, hospitals, and wildlife	<ul style="list-style-type: none"> • Conduct periodic noise level monitoring. • 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. 	Contractor	Noise monitoring results; Maintenance records	MPWD
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	<ul style="list-style-type: none"> • 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	Waste Management and Pollution Control	Soil and water contamination from indiscriminate disposal; Visual pollution and clogging of drains	<ul style="list-style-type: none"> • Collect and dispose of maintenance waste at designated locations. • Prohibit dumping into drainage channels or low-lying areas. • Reuse or recycle suitable 	Contractor	Waste logbook; Disposal records	MPWD

	phase			materials (e.g., asphalt, concrete, metal).			
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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
	Operations for 3 Seasons for 2 consecutive years.			At 3 locations during operation stage where monitoring had been done during construction stage				
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. Gground 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 locations for 3 Seasons for 1 years. Water (Ground water) at 2 locations for 3 Seasons for 1 years.		At 4 locations during operation stage where monitoring had been done during construction stage		

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
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 2 consecutive years.		At 03 locations during operation stage where monitoring had been done during construction stage	18	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
	Operation			2 locations for 3 Seasons for 2 consecutive years.		During operation stage where monitoring had been done during construction stage	12	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	RP Implementation consultant/ MPWD	% of affected households receiving compensation & assistance	Household surveys, payment records	Quarterly
Labour & Working Conditions	Contractor/ CSC/ MPWD	Compliance with fair wages, working hours, safety	Labour camp inspections, interviews	Monthly
		% of local workforce employed in project	Contractor reports	Quarterly
Social Inclusion & Gender	RP Implementation consultant/ Contractor/ MPWD	% of women engaged in livelihood activities	Beneficiary tracking	Quarterly
Stakeholder Engagement & Grievance Redressal	RP Implementation consultant/ Contractor/ MPWD	No. of community consultations held	Consultation records	Bi-annually
		% of grievances resolved within set timeline	GRM logs	Quarterly
Indigenous Peoples & Cultural Heritage	RP Implementation consultant/ Contractor/ MPWD	Documentation of FPIC & community agreements	Meeting records, video/audio evidence	Ongoing
		No. of cultural sites protected/enhanced	Site inspections, community feedback	Annually

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 specialized 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

8.7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN BUDGET

An amount of Rs. **4, 29, 72,600**, 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	Costs Covered By
						(INR)	
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 capacity building	PIU Cost
2	Plans and Protocols Orientation (1	At Beginning of	lump sum			Included	PIU Cost

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	day)	Construction					
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	----	---	-----	Civil works contract
	Subtotal (B)					-----	Civil works contract
C.	Construction Contractor ESMP Implementation						
1	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0 mtr height at stipulated	Construction	to be provided at each of the	To be decided by the contractor as per his schedule of works	-	0	Civil works contract

SI.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	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		active sites by the Contractor (i.e. till the completion for the works)				
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

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
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
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	Construction	Numbers			-----	Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	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 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			-----	Civil works contract
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	Construction	Nos	----	---	-----	Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	solid waste generated at the worksite including cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc.						
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.	330	2020	6,66,600	----
10	Three tier plantatation for Elephant Corridor	Construction				-----	Civil works contract
11	Worker Code of Conduct orientation, labour awareness sessions, and OHS refresher training	Construction	Lumpsum	-		Included in the Contract	Civil works contract
	Sub Total (C)					6,66,600	
D	Social Safeguards Implementation (Framework Instruments)						
1	Stakeholder engagement, consultations, disclosure, and GRM	Construction &	-	-		5,00,000	As per SEP

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	implementation (SEP)	Operation					
2	Indigenous people development plan (IPDP)	Construction & Operation	-	-		3,93,00,000	As per IPDP of the Sub Project
3	Resettlement action Plan (RAP)	Construction	-	-		18,64,000	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)					4,16,64,000	
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
	Biodiversity Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	ESMP Supervision Cost	Construction and Operation	per month	0	-	0	PIU Cost
	Equipment	Construction and Operation	(Noise Meter 1 nos, Cameras 1 nos)	lumpsum		0	PIU Cost
	Sub Total (E)					0	
	Grand Total (A+B+C+D+E)					4,29,72,600	

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. A confidential and survivor-centred grievance channel for Sexual Exploitation, Abuse, and Harassment (SEA/SH) complaints will be established as part of the GRM, ensuring safe reporting, referral to appropriate support services, and handling by trained personnel in accordance with the SEA/SH Prevention and Response Action Plan. Details are provided in Chapter 7 of ESMF.

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 & North 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.
- 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.
- Approximately 33 nos. of trees are located within the existing Right of Way (RoW) along both sides of the road. To mitigate the ecological impact of tree felling, compensatory plantation at 1:10 ratio for each tree cut should be undertaken in line with applicable environmental regulations and guidelines.
- The project requires approximately 0.27 ha of additional land and is expected to affect about 48 Project Affected Households (PAHs), primarily through partial impacts on structures located within the existing Right of Way. These impacts will be addressed through compensation and assistance measures outlined in the Resettlement Action Plan (RAP).
- The project road is expected to have some environmental and social impacts due to construction activities along the corridor, 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. These observations and their corresponding recommendations are summarized below

- **Ch. 0+000–3+525:** Forest stretch – no road widening; existing blacktop maintained; speed control, signage, and possible night restrictions.
- **Ch. 3+950–4+120:** Stream protection works proposed (erosion control).
- **Ch. 4+220–4+550:** Additional stream protection works (erosion control).
- **Ch. 5+130–5+225:** Lined drain (RHS) to prevent school waterlogging.
- **Ch. 5+591:** Box culvert (1×3.0 m) for overtopping/waterlogging.
- **Ch. 8+000:** Pond naturally protected due to raised road; no intervention.
- **Ch. 10+260–10+305:** Stream protection works (erosion control).
- **Ch. 10+800–11+010:** Stream protection works (erosion control).
- **Ch. 11+680:** Localized erosion protection works.
- **Ch. 12+800–13+800:** Market area – 2-lane road with drain-cum-footpath and paved shoulders.
- **Ch. 15+560–15+680:** Protection wall for pond area.
- **Ch. 20+380–20+560:** Stream protection works.
- **Ch. 20+700–20+780:** Stream protection works.
- **Ch. 20+855–20+890:** Stream protection works.
- **Ch. 28+700:** T-junction improvement incorporated.
- **Ch. 31+900–32+000:** Graveyard protection wall (2 m height, 50 m length).
- **Ch. 33+370–33+400:** No boundary wall required (church away from road).
- **Ch. 34+540–34+550:** Slope protection wall (1 m height, RHS). **Ch. 34+800–35+100:** Existing playground boundary retained; no intervention.

10.2 RECOMMENDATIONS

- The Contractor shall 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 areas etc. within one month from the date of entering into the contract.
- MPWD shall conduct regular stakeholder consultations including local residents, village councils, and public representatives, and maintain records of each consultation and meeting. These consultations are to be carried out during the pre-construction and construction phases to ensure stakeholder concerns are addressed and documented.

- MPWD shall 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 qualified and experienced ES&HS Staff for ESMP implementation as well as to ensure imparting induction, work-specific and other required trainings to the workers;
- MPWD shall ensure implementation of the Resettlement Action Plan (RAP) and provide compensation and assistance to Project Affected Households (PAHs) in accordance with RAP provisions.
- 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 coordinated 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 ESMP implementation, RAP implementation and redress of grievances on a regular basis
- The contractor to ensure safe access and mobility for vulnerable people such as elderly persons, children, and people with disabilities during the construction stage.
- The project shall implement the Labour Management Procedure (LMP) and Occupational Health and Safety (OHS) Plan to ensure safe working conditions.
- The SEA/SH Prevention and Response Action Plan shall be implemented during construction, including worker training, code of conduct enforcement, and survivor-sensitive grievance handling.
- The Grievance Redress Mechanism (GRM) shall remain functional throughout construction and operation phases.