DRAFT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

For

Upgradation of Umsning - Jagi Road (37.485 Km) under Meghalaya Logistics and Connectivity Improvement Project (MLCIP), funded by the World Bank

Meghalaya Logistics and Connectivity Improvement Project (MLCIP)

Submitted To

Meghalaya Infrastructure Development Finance Corporation (MIDFC) Ltd.
House No. L/A-56, Lower Nongrim Hills, Top Floor,
Meghalaya Basin Development Authority (MBDA) Building,
Shillong East Khasi Hills, Meghalaya-793003

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

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
E.1 Introduction 1
E.2 Project Description and Need 1
E.3 Baseline Environmental Conditions 1
E.4 Socio-Economic Profile 1
E.5 Key Environmental and Social Impacts 2
E.6 Mitigation Measures and Design Interventions 2
E.7 Social Safeguards and Community Engagement 2
E.8 Environmental and Social Management Plan (ESMP) 3
E.9 Stackholder Consultations 3
E.10 Conclusion 3
1. INTRODUCTION 5
1.1 Background 5
1.2 Scope for Conducting the ESIA Study 5
1.3 Approach and Methodology 6
1.4 Structure of the ESIA Report 11
2. LEGAL AND INSTITUTIONAL FRAMEWORK 12
2.1 Applicable Environmental and Social Regulations/ Acts/ Policies at National and State Level 12
2.2 IRC and MORTH Codes Applicable to the Project 23
2.3 Land Revenue Governance and Administration In KHADC 23
3. PROJECT DESCRIPTION 24
3.1 Umsning Jagi Sub Project Road 24
3.2 Location Details of the UJ Sub Project Road 24
3.3 Project Influence Area 25
3.4 Key Existing Conditions and Proposed Improvements of the UJ Road 28
3.4.1 Right of Way, Carriage Width, Pavement Conditions and Junctions 28
3.4.2 Proposed Road Cross Sections 32
3.4.3 Settlements and Corridor Characteristics 35
3.4.4 Trees 41
3.4.5 SLOPE PROTECTION WORKS 41
3.5 COMPONENTS & ACTIVITIES OF THE PROPOSED PROJECT 42
3.5.1 DETAILED DESIGN AND PRE-CONSTRUCTION STAGE 42
3.5.2 CONSTRUCTION STAGE 42
3.5.3 POST-CONSTRUCTION, OPERATIONS & MAINTENANCE STAGE 43
3.6 Resource Requirements 43
3.6.1 VOLUME OF CIVIL WORKS 44
3.7 Land Requirements 45
3.8 Water Requirements 47
3.9 Manpower Requirement and implementation Schedule for the sub project road 47
4. ANALYSIS OF ALTERNATIVES 48
4.1 Introduction 48
4.2 With and Without Sub Project Alternatives 48
4.2.1 Without Sub Project Scenario 48
4.2.2 With Sub Project Scenario 48
4.3 Environmental and Social Alternatives (To Specific Once) Considered for the Proposed Stretch 50
5. BASELINE ENVIRONMENT 53
5.1 General 53
5.2 Climate 53
5.2.1 Climatic Conditions 53
5.2.2 Temperature 53

5.2.3 Rainfall and Humidity....54
5.2.4 Wind Speed and Direction....62
5.3 Land Environment....62
5.3.1 PHYSIOGRAPHY AND ELEVATION....62
5.3.2 Geology....63
5.3.4 Land Use Pattern....65
5.3.5 Agriculture....66
5.3.6 SOIL QUALITY....66
5.4 Water Environment....69
5.4.1 Water Quality....69
5.5 Air Environment....74
5.5.1 Air Quality....74
5.6 Noise Environment....75
5.7 Biological Environment....77
5.7.1 Biodiversity and Critical Habitat in Project Road....77
5.7.2 Biodiversity and Critical Habitat in sub project stretch PIA....79
5.7.3 Summary of Biodiversity Assessment and Risks....83
5.8 Socio Economic Profile....84
5.8.1 Wages and Benefits....88
5.8.2 Seasonal Employment....88
5.8.3 Poverty....89
5.9 Social Vulnerabilities....89
5.9.1 MIGRATION....89
5.9.2 CRIME....89
5.9.3 GENDER BASED VIOLENCE....89
5.10 Socio-Economic Profile of Project Affected Households....89
5.10.1 DEMOGRAPHY....89
5.10.2 IMPACT TO VULNERABLE HOUSEHOLDS....91
5.10.3 ECONOMIC PROFILE....91
5.10.4 EDUCATION....92
5.10.5 HEALTH STATUS....92
5.10.6 Impact to Structures....92
5.10.7 Trees within RoW....93
5.10.8 Common Property Resources....93
5.11 Archaeological and Historical Monuments....96
5.12 Hazard and Vulnerability Profile....96
5.12.1 Landslide Prone Areas....96
5.12.2 Flood Zones....97
5.12.3 Earthquake Zones....97
5.12.4 Climate Resilient Features....97
6. ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS....100
6.1 Introduction....100
6.2 Impacts Identification and Evaluation....100
6.3 Impact Analysis Using Leopold Matrix (Magnitude/Importance Classification)....100
6.3.1 Impact Evaluation Matrix....100
6.4 Environmental Impacts....105
6.4.1 IMPACTS DURING PRE-CONSTRUCTION PHASE....105
6.4.2 Impacts during Construction Phase....109
6.4.3 IMPACTS DURING OPERATIONAL PHASE....125
6.5 SOCIAL RISKS & IMPACTS....126
6.5.1 Pre-Construction Phase....127

6.5.2 Construction Phase 127
6.5.3 Operation and Post-Construction Phase 128
7. STAKEHOLDER CONSULTAION AND INFORMATION DISCLOSURE 129
7.1 Public Consultation 130
7.1.1 Stakeholder Consultations 130
7.1.2 FPIC Process 133
8. ENVIRONMENTAL AND SOCIAL MANAGEMENT, MONITORING & REPORTING PROGRAMME 134
9. GRIEVANCE REDRESS MECHANISM 184
9.1 Introduction 184
10. CONCLUSION AND RECOMMENDATIONS 185
10.1 Conclusion 185
10.2 Recommendations 186

LIST OF TABLES

Table 1.1: Source and methodology for primary and secondary data collection....8
Table 2.1: Applicable Environmental and Social Regulations/ACTs/Policies....13
Table 2:2: Traditional Systems of land management in Ri Bhoi District....23
Table 3.1: Chainage wise UJ Road stretches details....24
Table 3.2: Details of Existing Carriage way....28
Table 3.3: List of Junctions Umsning - Jagi Road....29
Table 3.4: Summary of Breast Walls....30
Table 3.5: Summary of Toe Walls....30
Table 3.6: Summary of Retaining Wall....31
Table 3.7: TCS Types and their relevant Chainages....32
Table 3.8: Chainage wise List of villages & towns along project road....35
Table 3.9: Details of Drain and Rest area....36
Table 3.10: Details of Bioengineering measures....37
Table 3.11: Details of Cutting....37
Table 3.12: Proposed protective measures for road works, gabion-type retaining walls....38
Table 3.13: Salient features of the Existing UJ Road....40
Table 3.14: Chainage wise list of Trees....41
Table 3.15: Slope protection works....42
Table 3.16: Details of construction material, sources along with the lead....43
Table 3.17: Details of Construction material....44
Table 3.18: Details for the Spoil disposal sites....45
Table 3.19: Details of Land Requirements for proposed activities....45
Table 3.20: Details of the water requirement....47
Table 4.1: "With and Without" Project Scenarios – A Comparative Assessment....49
Table 4.2: Alternative considerations for Minimization of Environmental Impacts....50
Table 5.1: Monthly Mean Maximum and Minimum Temperature....53
Table 5-2: Monthly Rainfall Data....54
Table 5-3: Block wise major soil area and Land Slope for Umsning C & RD....64
Table 5.4: Soil Monitoring Locations....66
Table 5.5: Soil Monitoring Results in the sub-project road....67
Table 5.6: Ground Water Sample Locations in the sub-project area....69
Table 5.7: Ground Water monitoring results in the project area....71
Table 5.8: Ambient Air Quality monitoring locations in the sub-project area....74
Table 5.9: Ambient Air Quality Monitoring Results....75
Table 5.10: Location of Noise Level Monitoring....75
Table 5.11: Analysis of Noise Level Monitoring....76
Table 5.12: Critical Habitat Screening for the Umsning - Jagi Road....80
Table 5.13: Biodiversity and critical habitat assessment-based on field survey and GIS analysis for the (10 km buffer)....83
Table 5-14: Demographic profile of Ri Bhoi district as Per 2011 Census....84
Table 5-15: Population Distribution in Villages along the UJ Road....85
Table 5-16: Sex Ratio in the villages along the UJ road....85
Table 5.17: ST Population in the Villages along the sub project road....86
Table 5.18: Literate Population in Villages along the sub project road....87
Table 5.19: Workforce Population of Village along the sub Project Road....87
Table 5.20: Gender Distribution of PAHs....89
Table 5.21: Gender Distribution of Project-Affected Persons (PAPs)....90

Table 5.22: Community Wise Distribution of PAHs 91
Table 5.23: Distribution of Vulnerable Group 91
Table 5.24: Occupation pattern of PAHs in project area 91
Table 5.25: Monthly Income Range of PAHs 92
Table 5.26: Education Level of PAPs 92
Table 5.27: Type of Impact on Structures 93
Table 5.28: Common Property Resources 94
Table 5.29: Hazard analysis 96
Table 5.30: List of landslide prone areas in Ri-Bhoi District 96
Table 5.31: List of flash flood prone areas in Ri Bhoi Hills District 97
Table 5.32: Seismic Zone details of Ri-Bhoi District 97
Table 5.33:Climate Resilient design 97
Table 6.1: Impact Evaluation Matrix 102
Table 6.2: Details of Borrow Areas 111
Table 6.3: Earthwork details in the project area 112
Table 6.4: Details for the muck disposal site 112
Table 6.5: Mitigation Measures for Ambient Air Quality 115
Table 6.6: Amount of expected Bituminous Material 121
Table 7.1: List of relevant stakeholders 129
Table 7.2: Summary of consultations 131
Table 8.1: Environmental and Social Management Plan 135
Table 8.2: Environmental Monitoring Plan for Environmental condition indicators (Air, Water, Noise and Soil) 167
Table 8.3: Social Monitoring Plan 170
Table 8.4: Environmental and Social Management Plan Budget 175

LIST OF FIGURES

Figure 3.1: Road alignment map for UJ Road 24
Figure 3.2: The LULC map of the direct impact area of UJ road 26
Figure 3.3: 10km Buffer area for UJ subproject road 27
Figure 3.4: Map showing distance from Eco sensitive Zones w.r.t UJ Road 28
Figure 3.5: Typical Cross Sections 35
Figure 5.1: Wind rose Diagram for Shillong (IMD) 62
Figure 5.2: Elevation map of the project road (Elevation Source: SRTM (30m) 63
Figure 5.3 Local geology of the project road 64
Figure 5.4: Geomorphological map of Ri-Bhoi 65
Figure 5.5: Land Use/Land Cover map of project road corridor 66
Figure 5.6: Soil monitoring locations 67
Figure 5.7: Ground Water monitoring locations 70
Figure 5.8: Air Quality monitoring locations 75
Figure 5.9: Noise Quality monitoring locations 76
Figure 5.10: Project Influence Area with 10km buffer area for UJ road 78
Figure 5.11: Map showing distance from Eco sensitive Zones w.r.t Project Road 79

List of Abbreviations

ASI	:	Archaeological Survey of India
BIS	:	Bureau of Indian Standards
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
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
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
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
NABET	:	National Accreditation Board for Education and Training
NATMO	:	National Atlas and Thematic Mapping Organization
NGO	:	Non-Governmental Organization
NH	:	National Highway
NOC	:	No Objection Certificate
NOx	:	Oxides of Nitrogen
NTFP	:	Non-timber forest product
OHS	:	Occupational Health and Safety
OIP	:	Other Interested Parties
PAP	:	Project Affected Person
PESO	:	Petroleum and Explosives Safety Organization
PIA	:	Project Influence Area
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
UJ Road	:	Umsning – Jagi Road
WB	:	World Bank
WHO	:	World Health Organization
WPA, 1972	:	Wildlife Protection Act, 1972
WPA, 2022	:	Wild Life (Protection) Amendment Act, 2022

EXECUTIVE SUMMARY

E.1 INTRODUCTION

The Meghalaya Logistics and Connectivity Improvement Project (MLCIP), with a total investment of USD 300 million comprising USD 240 million from the World Bank and USD 60 million from the Government of Meghalaya (hereinafter refer to as the state government) aims to: a) enhance connectivity to key growth centers along identified road 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.

MLCIP includes 10 Roads and 5 Bridges totaling to approximately 300 km respectively. The proposed UJ project road has a total length of 37.485 km, starting from Sonidan at chainage 40+130 and extending up to Umsiang at chainage 77+615, where the project road concludes.

The additional land required for the proposed road improvement is approximately 0.6868 Ha and for spoil disposal 0.53 ha (temporary use).

The sub-project involves reconstruction and upgradation of the existing pavement from a single-lane carriageway to an intermediate lane, incorporating climate-resilient design measures suited to the high rainfall conditions of Meghalaya. Based on FPIC consultations, several location-specific interventions have been integrated into the DPR to address community concerns and site vulnerabilities. These include erosion protection through toe walls at identified chainages (e.g., Ch 41.400 - Ch41.600, Ch 42.330 - Ch 42.400, Ch 43.220 - Ch 43.300 etc.). Retaining and protection walls have been proposed at multiple locations to safeguard houses and infrastructure, while slope stabilization measures are included to mitigate risks. Community infrastructure demands have been addressed through provision of Bus waiting Sheds, toilets and Street Lights. To improve safety and riding comfort, geometric improvements such as curve improvement, slope flattening and shoulder strengthening have been proposed.

E.2 PROJECT DESCRIPTION AND NEED

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 Ri Bhoi, with no critical habitats significantly impacted by the project. The area also falls under a high seismic zone (Zone VI), 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 Rangbah Shnong managing land and resources. Livelihoods are mainly dependent on agriculture, small businesses, and daily wage activities.

Consultations revealed key community concerns such as poor road conditions, flooding during monsoon, lack of drainage, and safety issues. Communities generally supported the project, expecting improved connectivity. The proposed 37.485 km sub-project has been designed with 0.6868 Ha additional land acquisition and associated social impacts while improving connectivity. Community infrastructure proposed under FPIC will also be accommodated within the existing RoW.

The project will temporarily require 0.53 ha of land for spoil disposal, identified across 4 locations in consultation with PWD officials and local communities, including the Rangbah Shnong. These sites will be restored and returned to landowners after construction. In total, 22 PAHs comprising 124 PAPs will be affected, with impacts being largely minor, partial, and localized. 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 is expected to have manageable social impacts, primarily limited to relocation of informal activities, which will be mitigated through appropriate planning and community engagement.

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

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
- Improved drainage systems to prevent waterlogging and flooding
- Slope stabilization techniques including bio-engineering methods like grass plantation
- Climate-resilient pavement design with durable materials and stress-absorbing layers
- Safety measures including curve improvements, junction improvements, and traffic calming measures.

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

An amount of Rs. 3,39,33,896 have been marked for ESMP budget.

E.9 STACKHOLDER CONSULTATIONS

During the ESIA, consultations were carried out with representatives from the relevant stakeholder categories, including government agencies, communities, and other organizations, with particular attention to vulnerable groups. Special focus was given to communities located in sub-project areas likely to experience significant impacts, such as effects on residential and commercial structures or on common property resources. Key common property resources identified include religious structures, public utilities, and other community assets critical to local livelihoods and cultural heritage.

Representatives from relevant stakeholders were consulted to incorporate their concerns and expertise, ensuring that the project aligns with broader developmental, economic, and environmental objectives. Key discussions focused on potential displacement, loss of livelihoods, environmental degradation, law and order issues, irrigation impacts, structural matters such as cross-drainage structures, and corresponding mitigation measures. These consultations helped document and integrate the priorities and concerns of affected communities, providing valuable input to shape strategies for minimizing adverse impacts. All suggestions were incorporated into the project design to the extent feasible and warranted.

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

Disclosed Stakeholder Engagement Plan link on MPWD website is https://megpwd.gov.in/pdf/2026/ESMF/Stakeholder%20Engagement%20Plan%20MLCIP.pdf.

E.10 CONCLUSION

The proposed upgradation of the UJ road is a strategically important infrastructure intervention that will significantly enhance regional connectivity, accessibility, and socio-economic development in Ri Bhoi. The ESIA indicates that while the project traverses environmentally sensitive areas, 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, have been addressed through climate-resilient engineering solutions, including improved drainage systems, slope protection works and bio-engineering measures. 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 minor, localized impacts, primarily related to temporary relocation of informal roadside livelihoods. A total of 22 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 5 Bridges totaling to approximately 300 km respectively. The proposed UJ project road has a total length of 37.485 km, starting from Sonidan at chainage 40+130 and extending up to Umsiang at chainage 77+615, where the project road concludes.

The additional land required for the proposed road improvement is approximately 0.6868 Ha and for spoil disposal 0.53 ha (temporary use). Details of land requirement are given in Table 3.18 and Table 3.19.

The sub-project involves reconstruction and upgradation of the existing single-lane carriageway to intermediate lane standard with climate-resilient features suitable for the high rainfall conditions of Meghalaya. Based on ESIA findings and FPIC consultations, several location-specific mitigation and community infrastructure measures have been incorporated into the DPR to address drainage congestion, slope instability, erosion risks, pedestrian safety, and public utility requirements.

Retaining walls, breast walls, slope protection works, PCC roadside drains, and footpath-cum-drains have been proposed at vulnerable locations including Surok–Umtyrkhang (Ch. 48+090 to Ch. 48+850), Korhadem (Ch. 53+890 to Ch. 56+490), Umlamphlang (Ch. 61+200), Umlaper (Ch. 62+700 to Ch. 63+410), Umtrai (Ch. 64+600 to Ch. 64+900), Mawshang (Ch. 66+860 to Ch. 69+750), and the critical cutting zone at Ch. 46+080 to Ch. 46+145. Pedestrian safety measures, traffic calming provisions, bus shelters, public toilets, and street lights have also been incorporated at settlement stretches such as Umsiang, Umsiang Maiong, and Umsiang Mawpdeng.

Overall, the DPR includes 19 bus shelters with urinals, 45 nos. street lights, drainage improvements, shoulder strengthening, geometric corrections, and slope stabilization measures to enhance road safety, climate resilience, and community accessibility along the project corridor.

1.2 Scope for Conducting the ESIA Study

Based on the screening assessment, in terms of Environmental impacts the sub-project has been categorized as Substancial Risk due to land slide, Drainage congestion and side slope instability, and High cutting and erosion risk. In terms of social aspects, it has been categorized as High Risk because the project will affect 22 Project Affected Households (PAHs) and requires additional land of Tribal commmunities. Considering these factors, 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.

[1] The project has obtained 71.8% as per environmental screening criteria and therefore categorize as Substantial risk. The social risk is categorized as High risk since there will be impact on 22 nos. of PAH and involved additional land requirement of 0.6868 ha.

- 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
- Monitoring framework

1.3 Approach and Methodology

The approach and methodology included impact identification through surveys, baseline data collection, impact assessment, and mitigation planning. The following table summarizes the approach adopted for undertaking the ESIA study.

Sl. No.	Stages	Activities Done
1.	Screening and Scoping	Identified key issues through primary and secondary surveys, assessed stakeholders, and analyzed potential impacts considered in the Environmental and Social Impact Assessment, following the Free, Prior, and Informed Consent (FPIC) process to ensure meaningful participation and consent of Indigenous Peoples and affected communities.
2.	Public Consultation for Scoping Report	Identified key issues to understand stakeholder concerns and inform about sub-project design and build awareness on the project including the Free, Prior, and Informed Consent (FPIC) process. This involved engaging with affected Indigenous 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 rounds 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. The Forest Department, GoM, provided the maps demarcating the legally protected forest including "community forest". Information was also provided about the Wildlife crossing/ wildlife corridors by the forest department. Information was also collected from the Forest Department, GoM about the animal kills / collisions on these corridors. In addition to these data collection form secondary sources, primary data on natural environment was also collected. Potential areas of community health safety conflicts were also identified and the design team was informed about these.
4.	Impact Assessment	Using baseline data, the Umsning Jagi 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) to further discuss the project design, benefits and impacts, and to provide the communities' priorities and inputs to the 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

Sl. No.	Stages	Activities Done
		attached in IPDP.
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 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	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, IPDP) 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 1.1: Source and methodology for primary and secondary data collection

Parameters	Source
	Environment
Air	Primary survey Primary monitoring Secondary Source Central pollution control Board (CPCB, https://cpcb.nic.in/) / Meghalaya State Pollution Control Board (MSPCB, https://megspcb.gov.in/
Water	Primary survey Primary monitoring Secondary Source 1. District Survey Report, Ri Bhoi District, 2024 (https://ribhoi.gov.in/document-category/statistical_or_plan-report/) 2. CGWB Data 2024 (https://www.cgwb.gov.in/old_website/District_Profile/Meghalaya/Ri%20Bhoi.pdf)
Noise	Primary survey Primary monitoring Secondary Source CPCB (https://cpcb.nic.in/regulation-control/)
Soil	Primary survey Primary monitoring Secondary Source 1. District Irrigation Plan 2016-2020 (https://pmksy.gov.in/mis/Uploads/2017/20170331081041953-1.pdf) 2. Mapping India's Climate Vulnerability A District Level Assessment (2021) (https://www.ceew.in/sites/default/files/ceew-study-on-climate-change-vulnerability-index-and-district-level-risk-assessment.pdf)
Biodiversity	Primary survey 1.Field observation 2.Vegetation assessment was conducted using Nested Quadrate method 3.Faunal assessment was conducted using Visual encounters, sign survey, line transect, and netting survey method

Parameters	Source
	4.LULC analysis through ground truthing Secondary Source 1.Desktop study/secondary data collection - Govt. notified acts, peer review published scientific articles, Govt. reports, 2.Online open-source biodiversity databases such as Meghalaya Biodiversity Portal (https://megbiodiversity.nic.in/), PARIVESH Portal (MoEF&CC) (https://parivesh.nic.in/), Global Forest Watch (https://www.globalforestwatch.org/), IUCN Red List of Threatened Species (https://www.iucnredlist.org/) 3.Stakeholder consultation
Hazards and Vulnerability	Primary survey Field observation and Consultation with concerned departments and local community Secondary Source 1. District Disaster Management Plan for Ri-bhoi, 2024 (https://ribhoi.gov.in/document/district-disaster-management-plan-2024-25-volume-i/) 2. Meghalaya State Disaster Management Authority (MSDMA) (https://msdma.gov.in/)
Natural Environment	Secondary Source 1. Customized Rainfall Information System, Hydromet Division, IMD (https://hydro.imd.gov.in/) 2. District Census Handbook (Part A) – Ri Bhoi: https://censusindia.gov.in/nada/index.php/catalog/866/download/36332/DH_2011_1705_PART_A_DCHB_RIBHOI.pdf 3. Geological Survey of India (https://www.gsi.gov.in/webcenter/portal/OCBIS) 4. District Irrigation Plan 2016-2020 (https://pmksy.gov.in/mis/Uploads/2017/20170331081041953-1.pdf) 5. Consultant's Analysis, Source IMD Gridded Data (https://www.imdpune.gov.in/cmpg/Griddata/Rainfall_25_NetCDF.html) 6. State Action Plan on Climate Change (SAPCC), Meghalaya (https://moef.gov.in/uploads/2017/08/Meghalaya.pdf) 7. Statistical Handbook, Meghalaya 2023 (https://des.megplanning.gov.in/documents/SHB2023-as-on-02-05-24.pdf)
Climate	Secondary Source India Meteorological Department – Shillong Climatological Normals, (1991–2020) (https://dsp.imdpune.gov.in/home_normals.php#)
	Land and Livelihood Impact
Land, Livelihood and Common Property Resources	Primary survey 1.Census/Household Survey (PAH: 22) 2.Focus Group Discussions (3) 3.Key Informants Interviews (8)

Parameters	Source
	4.Field Observations Secondary Source Census 2011 (https://www.census2011.co.in/)
	Other Socio-Economic Parameters
Ethnicity	Primary survey Consultation Secondary Source Census 2011 (https://www.census2011.co.in/)
Gender	Primary survey Focus Group Discussions (2) Interviews (2) Secondary Source Workforce Participation Rate as per Census 2011 (https://www.census2011.co.in/) National Family Heath Survey- 5 (https://mohfw.gov.in › files › NFHS-5_Phase-II_0)
Prevalence of GBV	Primary survey Focus Group Discussions with women group (Seng Kynthei, Seng Longkmie) 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	SUB PROJECT ROAD DESCRIPTION
Chapter 4	ANALYSIS OF ALTERNATIVES
Chapter 5	BASELINE ENVIRONMENT
Chapter 6	ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS
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 define the scope of the environmental and social assessment for the proposed road improvement works, relevant laws, legislation, and policies at both national and state levels were reviewed. The findings are summarized in Table 2.1, which also includes a review of the legal and institutional framework applicable to indigenous and tribal communities as part of a targeted assessment.

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

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

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
	Wastes (Management and Trans-boundary Movement) Rules, 2016 and March, 2024	handling, storage and disposal of hazardous waste. The rules prescribe the management requirement of hazardous wastes from its generation to final disposal.	proposed activities like generation of paints waste, used oil/waste oil, bitumen waste, etc.	authorization for storage, transport, and disposal of hazardous and other wastes	
7	Construction and Demolition Waste Management Rules, 2016	To manage the demolition and construction waste and prevent environmental degradation	Construction and demolition waste will be generated from proposed activities	Required permission will be obtained by Contractor for proper disposal as per the site specific waste management plan.	Village Council, Municipal Boards
8	Solid Waste management Rules, 2016 and amended thereof	To manage solid waste or semi-solid domestic waste, sanitary waste	Solid Waste will be generated from proposed activities due to influx of labour	Required permission will be obtained by Contractor for proper disposal as per the site specific waste management plan.	Village Council, Municipal Boards
9	Vehicle Act 1988 Central Motor Vehicle Rules 1989	To minimize the road accidents, penalizing the guilty, provision of compensation to victim and family and check vehicular air and noise pollution.	Transportation of manpower and material will involve vehicular movement. Vehicles must have valid Pollution Under Control (PUC) certificates, Insurance, Fitness Certificate. Driver should have valid Driving License.	PUC and fitness certificates, Insurance. Driving License, Fitness Certificate should be submitted to the PMU before the vehicle is mobilized in the project	State Transport Authorities approved PUC certificate providers
10	The Gas Cylinder Rules 2016	To regulate the storage of gas / possession of gas cylinder more than the exempted quantity.	Gas cylinders may be used during welding and other electromechanical work. Storage within threshold quantity and as per capability analysis. Handling with defined safe practices	Yes, Permission will be required by the Contractor if the storage of gas / possession of gas cylinder is more than the exempted quantity (i.e more than 25 cylinders of total weight exceeding 200 kg for flammable non-toxic gases).	Petroleum and Explosives Safety Organization (PESO)
11	The Mines and Minerals (Development and	For development and regulation of mines and minerals in a sustainable manner. The rules regulate the	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	Mines and Mineral Department

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
	Regulation) Act, 1957	mining of mineral and dealerships for mining and trading.		be procured without the approval. For material procured during the construction the e-transit pass would be submitted along with IUFR.	
12	Wildlife protection Act 1972, 2022	Protection of wildlife in the state of Meghalaya	Wildlife impact is not anticipated in this project.	No	State Forest Department
13	Meghalaya Tree (Preservation) Act, 1976, and the Meghalaya Tree Felling (Non-Forest Areas) Rules, 2006	Conservation of forest and controlled felling of trees	Approx. 17 nos. of tree are falling within the ROW.	Permission for felling of trees	State Forest Department
14	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
15	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
16	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	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

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
		and disposal.			
17	E-Waste Management Rules, 2016 and amended thereof	Protection of environment against improper handling storage and disposal of hazardous waste.	E-waste generation from replacement of instrumentation. Safe disposal as per Rules	No. Proper segregation and handing over of e-waste to the MSPCB authorized agencies/Recyclers	MSPCB
18	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 single tank 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.
19	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).
20	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 will be used for road construction with prior permission from the Water Resources Department, Ri Bhoi District, Meghalaya.	Permission/Allocation order for surface water abstraction.	Water Resources Department, Government of 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	Applicable in designated tribal areas under the Sixth Schedule	No	Government of India, Autonomous District Councils

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
		Scheduled Tribes and Scheduled Areas			
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 Tribes.	Yes, as the area falls under 6th schedule A review of the legal and institutional framework applicable to indigenous/tribal communities.	No	Revenue Department, Government of Meghalaya, Khasi Hills Autonomous District Council The Sixth Schedule establishes the ADC or VC as institutional mechanisms for governing these areas.
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	Impact on private Assets and properties	Ensure fair compensation and Guarantee transparency in the acquisition process.	Revenue Department/ District Administration, Village Council

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
		affected by it.			
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 constitution of a Central Information Commission and State Information Commissions and for matters connected therewith or incidental thereto.	All documents pertaining to the project would be disclosed to public.	No	Public Information Officer (PIO)
8.	The Cadastral Survey and Preparation of Records of Rights	The Act provides for cadastral survey of lands and preparation of land records in the state. The 1991 amendment enables the ADCs to	Applicable for project activities involving detailed mapping and verification of land ownership or tenure. Under Project, cadastral mapping and systematic land	yes	Revenue and Disaster Management Department; Autonomous District

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
	Act, 1980 (as amended in 1991)	undertake cadastral surveys with financial and technical assistance from the State Government.	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.		Councils (ADCs)
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
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,	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

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
	2016				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
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	Provides for maternity leave for women, during pregnancy and after	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
	Meghalaya Maternity benefit Rules 1965	giving birth and some other benefits to women employees, in case of medical recommendation of bed rest or miscarriage etc.			
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
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)	Site safety standards, PPE, welfare amenities, working hours, accident reporting, medical checks,	Applicable to all construction, labour camps, work fronts, and site facilities	Yes*	Labour Commissioner, Government of Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-applicability	Regulatory Clearance Requirement	Authority
	Code, 2020 + Meghalaya Factories Rules, 2015	registration of establishments.			
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 KHADC

The Khasi Hills Autonomous District Council (KHADC), constituted under the Sixth Schedule of the Constitution of India, is empowered under Paragraph 8 of the Sixth Schedule to assess and collect land revenue and levy taxes within its jurisdiction. Under Paragraph 3 of the Sixth Schedule, the Council also holds legislative authority over specified matters, including land allotment and land use. The jurisdiction of KHADC encompasses the entire Ri Bhoi District. Traditional Systems of land management in Ri Bhoi is presented in Table 2.2.

Table 2:2: Traditional Systems of land management in Ri Bhoi District

Khasi Classification of Land	
Ri Kynti, or private lands Property of the individual or the *kur* that owns it	Ri Raid or communal lands Community entrusts Durbar Raid to manage on its behalf
1. Ri Nongtymmen: Inherited from generations to generations. 2. Ri Dakhol: Obtained by the right of occupation. 3. Ri Bitor: Acquired on receipt of a ceremonial bottle of liquor. 4. Ri Khurid: Purchased or bought. 5. Ri Seng and Ri Khain: Undivided family-owned land. 6. Ri Maw: Acquired through purchase or through the right of apportionment.	1. Ri Samla: Land acquired by an unmarried person. 2. Ri Shnong: Land villagers can use for cultivation. 3. Ri Lyngdoh: Land set aside for religious leaders. 4. Ri Bam Syiem: Land set aside for ruling chiefs. 5. Ri Bamlang: Land set aside for community use. 6. Ri Leh Mokutduma: Land acquired through litigation. 7. Ri Aiti Mon or Ri Nongmei Nongpa: Land donated or gifted for public use. 8. Ri Raphlang-Ri Bamduh: Barren land which anyone can use. 9. Ri Diengsai-Diengin: Forests area between the uplands and low-lying areas.

3. PROJECT DESCRIPTION

3.1 Umsning Jagi Sub Project Road

The proposed road existed before the formation of Meghalaya State and ROW is limited only up to the existing Drain. The proposed UJ project road has a total length of 37.485 km, starting from Sonidan at chainage 40+130 and extending up to Umsiang at chainage 77+615, where the project road concludes.

3.2 Location Details of the UJ Sub Project Road

The project road traverses a diverse landscape, encompassing hilly terrains, agricultural fields, scrublands, and built-up areas, while passing through 13 villages along its alignment. This UJ road plays a vital role in enhancing regional connectivity by linking economic hubs and facilitating access to industrial centers as well as tourism destinations. Table 3.1 presents the chainage-wise details of the corridor and the alignment of the road is shown in Figure 3.1.

Table 3.1: Chainage wise UJ Road stretches details

Sl. No.	Sub project	Starting Chainage	End Chainage	Project length	District
1	UJ road	40+130	77+615	37.485	Ri Bhoi

Source: DPR

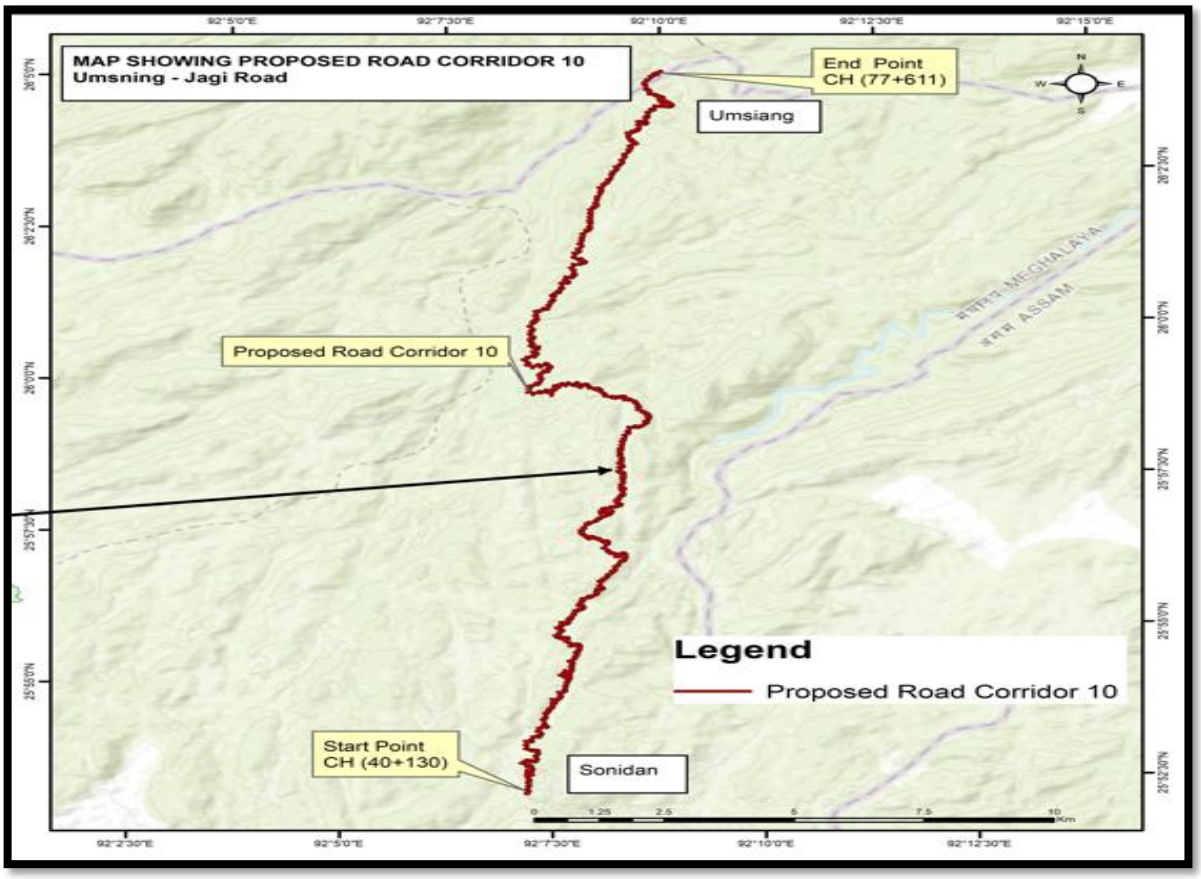


Figure 3.1: Road alignment map for UJ Road

3.3 Project Influence Area

1. For the purpose of this study, the Project impact Area has been categorized in three tiers to facilitate a holistic environmental and social impact 0 m of ROW for Direct Impact (6m from Centre line) i.e. Corridor of Direct Impact (CoI)
2. 500 m buffer for indirect impact area [2] i.e. Corridor of Indirect Impact
3. 10 km of study area (Project Influence Area)

The existing Right of Way (10 m) 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. In stretches where the proposed RoW extends beyond the existing RoW to accommodate hill cutting or slope stabilization measures, the socio-economic assessment has been undertaken based on the actual proposed RoW.

The indirect impact area has been delineated as 0.5 km on either side of the proposed RoW from the Centre Line of the sub-project road. 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 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. 10 km Buffer area for project road is presented in Figure 3.3. Map showing distance from Eco sensitive Zones w.r.t Project Road is presented in Figure 3.4.

[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.

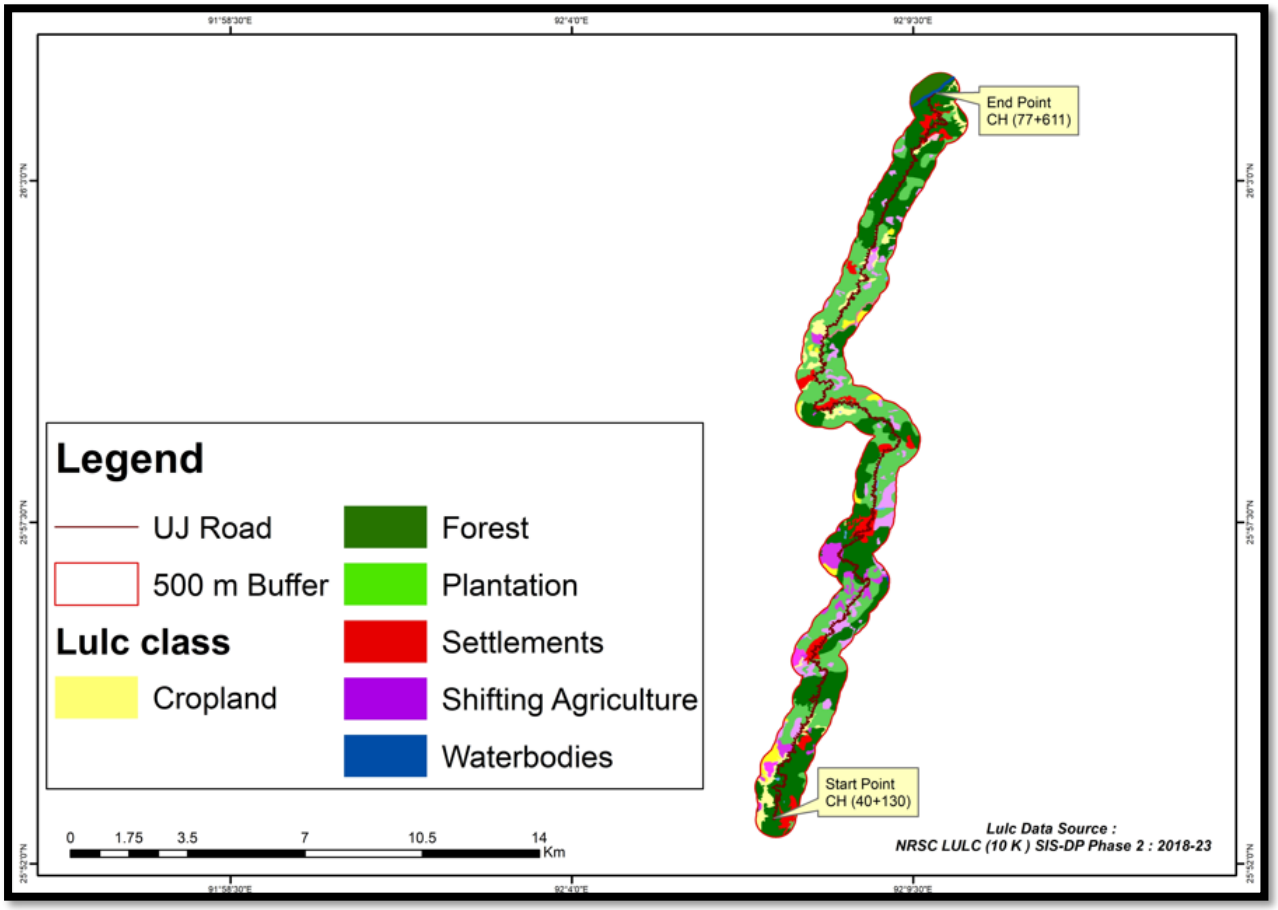


Figure 3.2: The LULC map of the direct impact area of UJ road

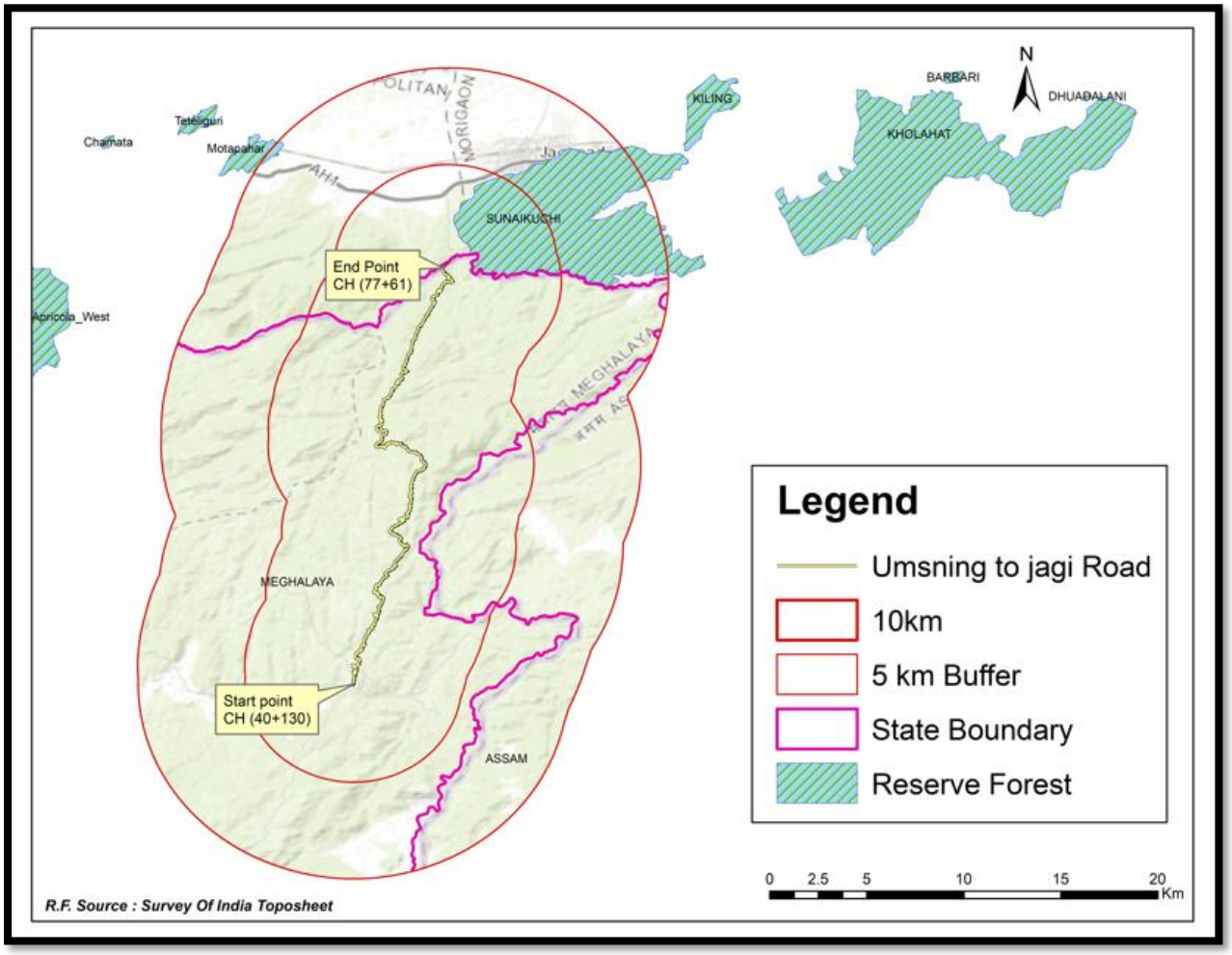


Figure 3.3: 10km Buffer area for UJ subproject road

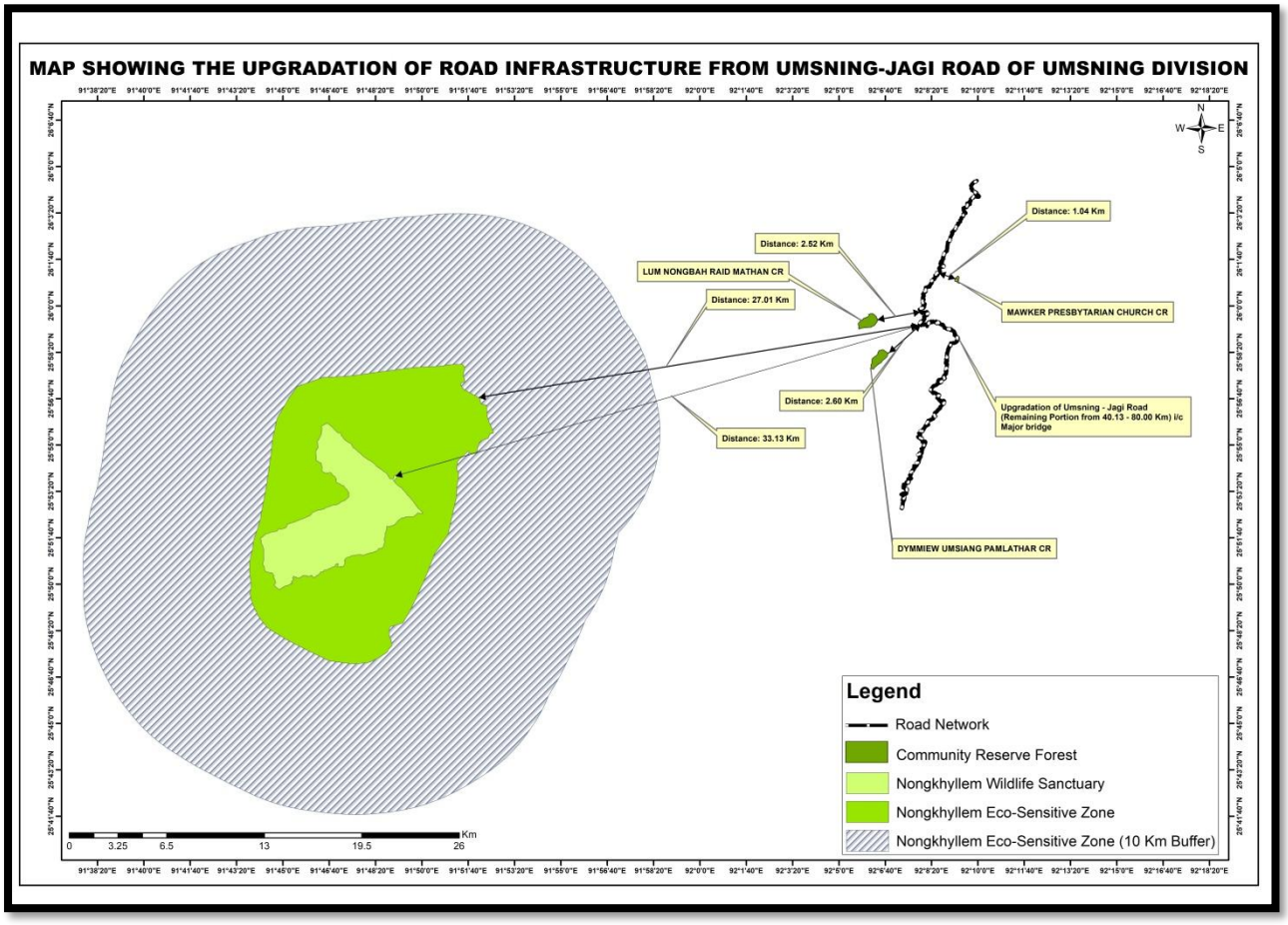


Figure 3.4: Map showing distance from Eco sensitive Zones w.r.t UJ Road

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 UJ Road

The key existing conditions along the UJ subproject road, together with the proposed improvements, are outlined in the following sub-sections. These have been described based on findings from the primary field surveys as well as details provided in the Detailed Project Report (DPR).

3.4.1 Right of Way, Carriage Width, Pavement Conditions and Junctions

The existing Right of Way (RoW) for the project road is 10 m, while the existing carriage is 3.75 m. It is presently a single-lane roadway with a bituminous pavement surface. Details of the existing and proposed carriageway (CW) are summarized in Table 3.2. The pavement along the project stretch is bituminous, with its overall condition ranging from fair to poor, and most sections being in poor condition. Earthen shoulders of about 1.0 m width are provided on both sides; however, their condition has also been observed to be poor.

Table 3.2: Details of Existing Carriage way

S. No.	Chainage in Km		Length in km	Existing Carriageway width in (m)	Proposed Carriageway width in (m)
	From	To			
1	40.130	77.615	37.485	3.75	5.5

Total Length	37.485		

Source: DPR

Pavement Details:

The existing pavement along the project stretch is bituminous, with overall condition ranging from fair to predominantly poor as observed in the DPR and field assessments, and the 1.0 m wide earthen shoulders on both sides are also in poor condition. Under the MLCIP project, a multi-layered pavement design is proposed to enhance durability and performance, comprising 40 mm Bituminous Concrete (BC), 100 mm Aggregate Interlayer Pavement (AIP), 100 mm Cement-Treated Base (CTB), and 200 mm Cement-Treated Sub-Base (CTBS), resulting in a total pavement thickness of 440 mm suitable for varied traffic and environmental conditions.

Junctions Details:

Along the project stretch, there are 8 minor intersections. The details of these junctions are provided in Table 3.3.

Table 3.3: List of Junctions Umsning - Jagi Road

Sr. No	Chainage	Type	Side	Direction
1	48.350	+	Both	Surok–Umtyrkhang
2	53.890	Y	LHS	Korhadem
3	56.490	T	LHS	Korhadem
4	61.200	T	RHS	Umlamphlang
5	62.700	Y	RHS	Umlaper
6	62.950	T	RHS	Umlaper
7	63.410	T	RHS	Umlaper
8	64.600	T	LHS	Umtrai
9	64.900	T	LHS	Umtrai
10	66.860	T	RHS	Mawshang
11	69.750	Y	LHS	Mawshang
12	75.420	+	Both	Umsiang
13	76.545	Y	Both	Umsiang Maiong
14	77.600	T	Both	Umsiang Mawpdeng

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

Table 3.4: Summary of Breast Walls

Summary of Breast Walls						
R. No.	Start Chainage	End Chainage	Length (m)	Side	Structure Height (m)	Cutting Height (m)
1	44355	44460	105	LHS	1.8	2.0 to 3.00
2	44550	44700	150	RHS	1.8	2.0 to 4.00
3	45920	45960	40	RHS	2.55	4.0 to 9.00
4	46080	46145	65	BHS	2.55	4.0 to 12.00
5	46740	46785	45	RHS	2.55	2.0 to 8.00
6	48090	48300	210	RHS	1.8	2.0 to 3.00
7	54400	54605	205	RHS	2.0	2.0 to 5.00
8	75550	75650	100	RHS	1.5	2.0 to 3.00
9	76510	76550	40	RHS	1.5	2.0 to 3.00
10	77440	77515	75	RHS	1.5	2.0 to 2.5
	Total Length in Mtr.		1035			

Details of toe walls is presented in Table 3.5.

Table 3.5: Summary of Toe Walls

S. No.	From (km)	To (km)	Length (km)	Height (m)
1	41.400	41.600	0.200	1.5
2	42.330	42.400	0.070	1.5
3	43.220	43.300	0.080	1.5
4	69.300	69.450	0.150	1.5
5	69.550	69.600	0.050	1.5

Summary of Retaining Wall is presented in Table 3.6.

Table 3.6: Summary of Retaining Wall

Sr. No.	From Chainage	To Chainage	Length (m)	Type	Side	Height (m)
1	41960	42020	60	R WALL	RHS	3
2	43385	43435	50	R WALL	LHS	2
3	44150	44185	35	R WALL	RHS	3
4	44805	45200	395	R WALL	RHS	2
5	45960	46080	120	R WALL	LHS	3
6	46145	46170	25	R WALL	LHS	4
7	48710	48900	190	R WALL	LHS	3
8	51440	51525	85	R WALL	LHS	1.8
9	53490	53570	80	R WALL	LHS	2
10	53660	53750	90	R WALL	LHS	2.5
11	54605	55080	475	R WALL	RHS	2
12	56810	56950	140	R WALL	RHS	2.5
13	57220	57245	25	R WALL	RHS	3
14	57455	57490	35	R WALL	RHS	3
15	58230	58280	50	R WALL	RHS	2
16	62385	62425	40	R WALL	LHS	2.5
17	65780	65820	40	R WALL	LHS	3
18	65895	65950	55	R WALL	LHS	3
19	67285	67315	30	R WALL	RHS	1.8
20	67570	67610	40	R WALL	LHS	1.8
21	67920	67990	70	R WALL	LHS	3
22	69900	69950	50	R WALL	RHS	2
23	73035	73120	85	R WALL	LHS	3

24	73780	73825	45	R WALL	LHS	2.5
25	76050	76080	30	R WALL	RHS	3
26	76145	76165	20	R WALL	RHS	2

3.4.2 Proposed Road Cross Sections

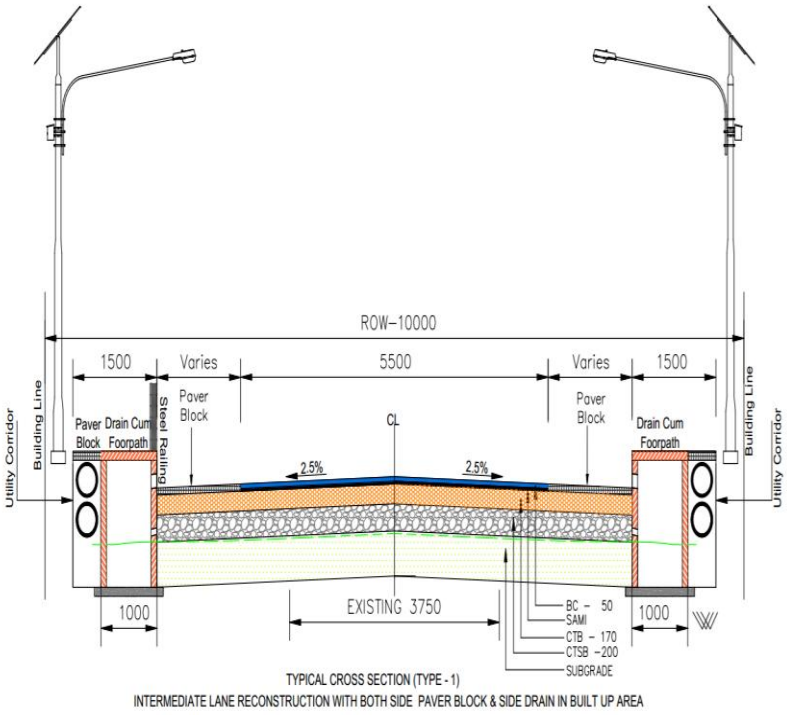
The Umsning-Jagi Road traverses terrain ranging from 95 m to 932 m above mean sea level. Based on the earthwork analysis as presented in Table 5.2 in Chapter 5, the total quantity of material to be excavated (cut) along the project corridor is 212702 m^3, while the total fill requirement is 175002 m^3. After balancing the cut and fill volumes, there remains a surplus of approximately 37700 m^3 of excavated material that will need to be safely disposed of at designated muck disposal sites. This approach ensures effective earthwork management while minimizing environmental impacts and maintaining slope stability along the project corridor.

A total of four Typical Cross-Sections (TCS) has been proposed in the DPR for the 37.485 km project road. These TCSs vary across the alignment, with certain sections incorporating intermediate lanes. Each cross-section has been designed to address the specific terrain and infrastructure requirements, including provisions for road widening, slope stabilization, drainage, and utility corridors. Implementation of these cross-sections may also lead to environmental and social impacts, such as tree cutting, alteration of natural landscapes, potential biodiversity loss, and disruption of local ecosystems.

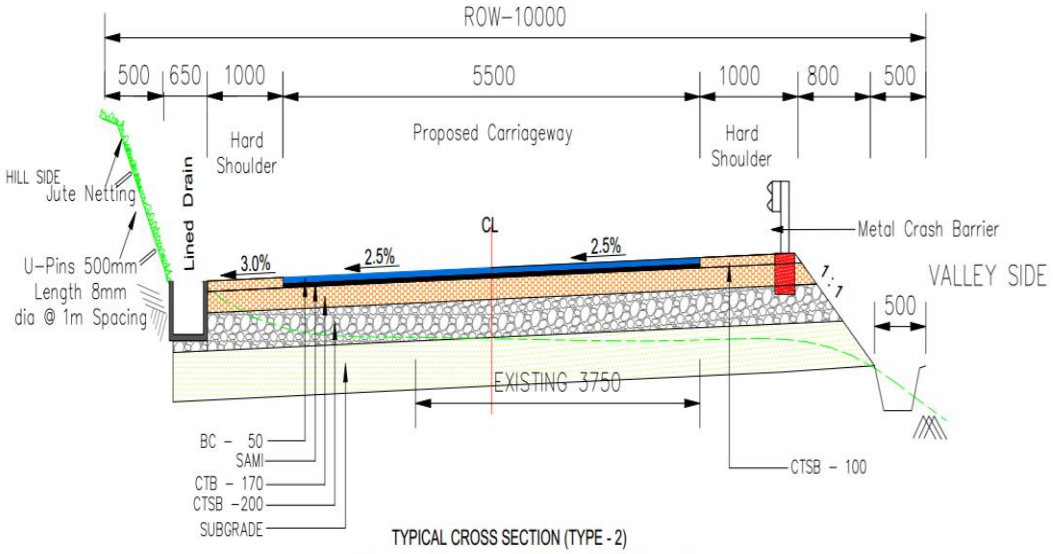
The details of chainage-wise cross-section designs adopted, are provided in Annexure 3.1. A total of four Typical Cross-Sections (TCS) have been presented in Figure 3.5. TCS Types and their relevant Chainages is presented in Table 3.7.

Table 3.7: TCS Types and their relevant Chainages

Sl. No.	TCS Type	Chainages
1	TCS-1	48300–48430; 60850–61000; 64600–64700; 77515–77615
2	TCS-2	40130–41960; 42020–43385; 43435–44150; 44185–44355; 44460–44550; 44700–44805; 45200–45920; 46170–46740; 46785–48090; 48430–48710; 48900–51440; 51525–53490; 53570–53660; 53750–54400; 55080–56810; 56950–57220; 57245–57455; 57490–58230; 58280–60850; 61000–62385; 62425–64600; 64700–65780; 65820–65895; 65950–67285; 67315–67570; 67610–67920; 67990–69900; 69950–73035; 73120–73780; 73825–75550; 75650–76050; 76080–76145; 76165–76510; 76550–77440
3	TCS-3	44355–44460; 44550–44700; 45920–45960; 46080–46145; 46740–46785; 48090–48300; 54400–54605; 75550–75650; 76510–76550; 77440–77515
4	TCS-4	41960–42020; 43385–43435; 44150–44185; 44805–45200; 45960–46080; 46145–46170; 48710–48900; 51440–51525; 53490–53570; 53660–53750; 54605–55080; 56810–56950; 57220–57245; 57455–57490; 58230–58280; 62385–62425; 65780–65820; 65895–65950; 67285–67315; 67570–67610; 67920–67990; 69900–69950; 73035–73120; 73780–73825; 76050–76080; 76145–76165



TYPICAL CROSS SECTION (TYPE - 1)
INTERMEDIATE LANE RECONSTRUCTION WITH BOTH SIDE PAVER BLOCK & SIDE DRAIN IN BUILT UP AREA



TYPICAL CROSS SECTION (TYPE - 2)
INTERMEDIATE LANE RECONSTRUCTION WITH ONE SIDE
LINED DRAIN & OTHER SIDE METAL BEAM CRASH BARRIER

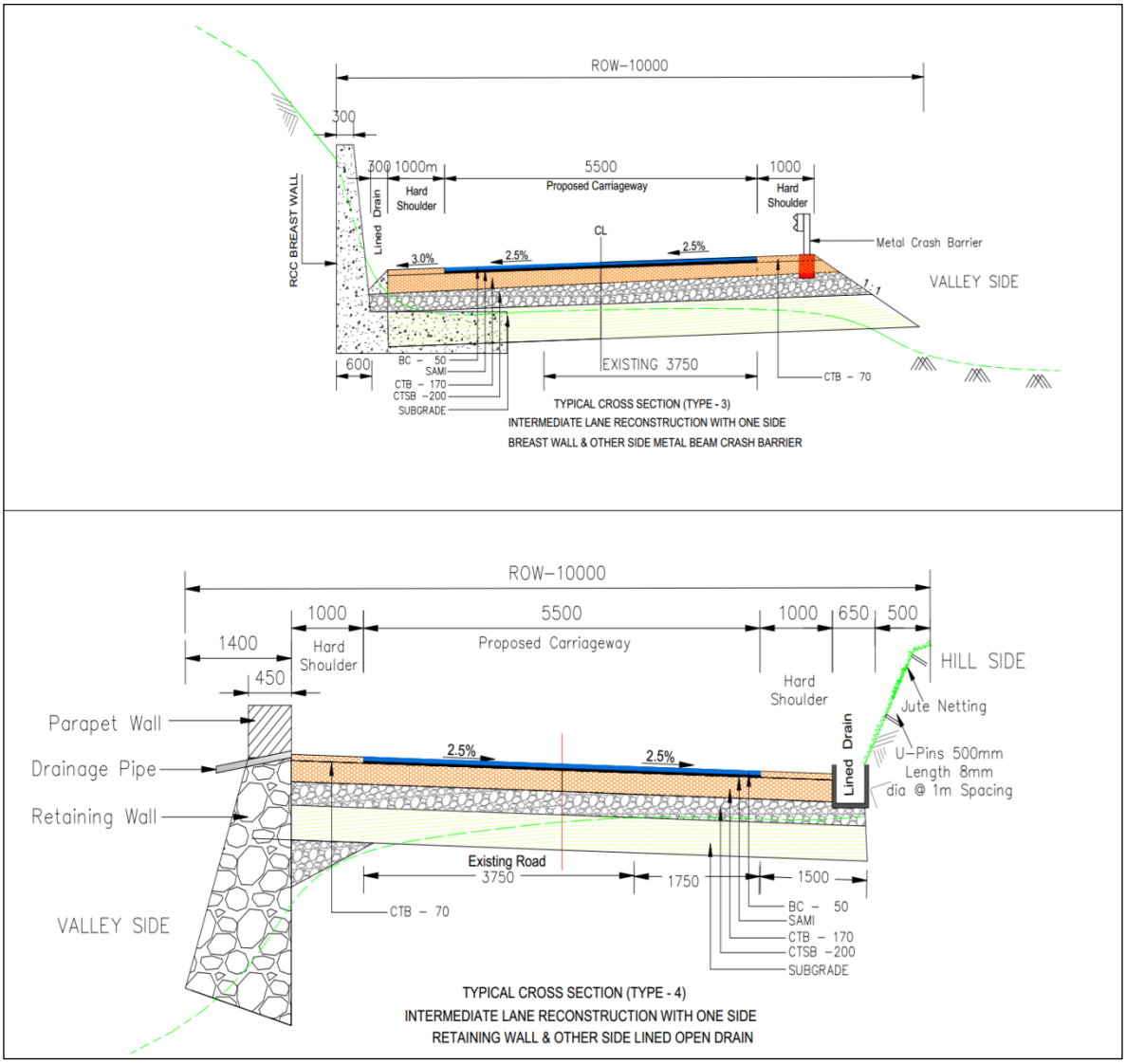


Figure 3.5: Typical Cross Sections

3.4.3 Settlements and Corridor Characteristics

3.4.3.1 Settlements:

The UJ Road passes through hilly terrain, rural settlements and towns. The project incorporates a comprehensive drainage system to ensure proper surface runoff management along the corridor. The UJ Road passes through hilly terrain, rural settlements and towns. The details of the settlements along the stretch are presented in Table 3.8.

Table 3.8: Chainage wise List of villages & towns along project road

S. No.	Village Name	Chainages in KM
1	Sonidan	40.130
2	Mawpat (LHS)	45.000
3	Mawshunam (RHS)	45.000

4	Mawalaho	49.000
5	Kohradem	55.000
6	Sngahtyrkhang	59.000
7	Umlamphlang	61.000
8	Umlaper	62.000
9	Umtrai	65.000
10	Mawshang Mawksiew (RHS)	67.900
11	Umsiang Maiong	76.000
12	Kraikajam	76.500
13	Umsiang Mawpdeng	77.700

Details of Protection work

Provision of Footpath-cum-Drains (TCS-1) is proposed at chainages 48300–48430; 60850–61000; 64600–64700; 77515–77615 . PCC Roadside Drains are planned extensively under TCS-2 along major stretches from 40+130 to 77+440 with intermittent gaps, while localized sections requiring enhanced treatment are covered under TCS-4 at critical chainages such as 41+960–42+020, 43+385–43+435, 44+150–44+185, 44+805–45+200, 45+960–46+080, 46+145–46+170 and other similar short stretches up to 76+165. In addition, other facilities are proposed including existing bus stops at chainages 48.815, 59.246, 60.920, 64.654, 65.543, 66.320, 75.124, 75.620 and 75.810, while new bus stops and public toilets are proposed at key locations between 40.610 and 77.545 km, covering major settlement and activity nodes along the project corridor. Detrails of Drain and rest areas are given in Table 3.9.

Table 3.9: Details of Drain and Rest area

Sl. No.	TCS Type	Chainages (From – To)
1.	Footpath cum Drains	
1	TCS-1	48300–48430; 60850–61000; 64600–64700; 77515–77615
2.	PCC Roadside Drains	
i	TCS-2	40130–41960; 42020–43385; 43435–44150; 44185–44355; 44460–44550; 44700–44805; 45200–45920; 46170–46740; 46785–48090; 48430–48710; 48900–51440; 51525–53490; 53570–53660; 53750–54400; 55080–56810; 56950–57220; 57245–57455; 57490–58230; 58280–60850; 61000–62385; 62425–64600; 64700–65780; 65820–65895; 65950–67285; 67315–67570; 67610–67920; 67990–69900; 69950–73035; 73120–73780; 73825–75550; 75650–76050; 76080–76145; 76165–76510; 76550–77440
ii	TCS-4	41960–42020; 43385–43435; 44150–44185; 44805–45200; 45960–46080; 46145–46170; 48710–48900; 51440–51525; 53490–53570; 53660–53750; 54605–55080; 56810–56950; 57220–57245; 57455–57490; 58230–58280; 62385–62425; 65780–65820; 65895–65950; 67285–67315; 67570–67610; 67920–67990; 69900–69950;

		73035–73120; 73780–73825; 76050–76080; 76145–76165
3.	Others	
I	Bus Stop (existing)	48.815, 59.246, 60.920, 64.654, 65.543, 66.320, 75.124, 75.620, 75.810
Ii	Bus Stop (Proposed)	40.610, 44.500, 47.470, 48.300, 48.800, 53.675, 54.440, 58.480, 59.250, 60.980, 62.140, 62.720, 64.635, 65.550, 66.545, 69.700, 75.655, 76.522, 77.545
iii	Public Toilet (proposed)	40.610, 44.500, 47.470, 48.300, 48.800, 53.675, 54.440, 58.480, 59.250, 60.980, 62.140, 62.720, 64.635, 65.550, 66.545, 69.700, 75.655, 76.522, 77.545

Bioengineering

Bioengineering using local Broom Grass, Vetiver/ local grasses has been proposed. Turfing is provided on embankment slopes for erosion control and Jute net is proposed. Details of bio engineering measures are provided in Table 3.10.

Table 3.10: Details of Bioengineering measures

SR. NO.	Proposed Chainage		Length in (m)	Side
	Start	End		
1	44355	44460	105	LHS
2	44550	44700	150	RHS
3	45920	45960	40	RHS
4	46080	46145	65	BHS
5	46740	46785	45	RHS
6	48090	48300	210	RHS
7	54400	54605	205	RHS
8	75550	75650	100	RHS
9	76510	76550	40	RHS
10	77440	77515	75	RHS
Total Length in Mtr.			1035	

Details of Cutting is provided in Table 3.11.

Table 3.11: Details of Cutting

Proposed Chainage (Start–End)	Length (m)	Side	Structure Height (m)	Cutting Height (m)
44+355 – 44+460	105	LHS	1.8	2.0 to 3.00
44+550 – 44+700	150	RHS	1.8	2.0 to 4.00
45+920 – 45+960	40	RHS	2.55	4.0 to 9.00
46+080 – 46+145	65	BHS	2.55	4.0 to 12.00

46+740 – 46+785	45	RHS	2.55	2.0 to 8.00
48+090 – 48+300	210	RHS	1.8	2.0 to 3.00
54+400 – 54+605	205	RHS	2.0	2.0 to 5.00
75+550 – 75+650	100	RHS	1.5	2.0 to 3.00
76+510 – 76+550	40	RHS	1.5	2.0 to 3.00
77+440 – 77+515	75	RHS	1.5	2.0 to 2.5

Protection work:

In addition to the protective measures for road works, retaining walls have been proposed, covering a cumulative length of 2360 m across all structures within the project. Details are given in Table 3.12.

Table 3.12: Proposed protective measures for road works, gabion-type retaining walls

SR. NO.	Chainages		Total Length	Type	Side	Hights (m)
	From	To				
1	41960	42020	60	R WALL	RHS	3m
2	43385	43435	50	R WALL	LHS	2m
3	44150	44185	35	R WALL	RHS	3m
4	44805	45200	395	R WALL	RHS	2m
5	45960	46080	120	R WALL	LHS	3m
6	46145	46170	25	R WALL	LHS	4m
7	48710	48900	190	R WALL	LHS	3m
8	51440	51525	85	R WALL	LHS	1.8m
9	53490	53570	80	R WALL	LHS	2m
10	53660	53750	90	R WALL	LHS	2.5m
11	54605	55080	475	R WALL	RHS	2m
12	56810	56950	140	R WALL	RHS	2.5m
13	57220	57245	25	R WALL	RHS	3m
14	57455	57490	35	R WALL	RHS	3m
15	58230	58280	50	R WALL	RHS	2m
16	62385	62425	40	R WALL	LHS	2.5m
17	65780	65820	40	R WALL	LHS	3m
18	65895	65950	55	R WALL	LHS	3m
19	67285	67315	30	R WALL	RHS	1.8m
20	67570	67610	40	R WALL	LHS	1.8m
21	67920	67990	70	R WALL	LHS	3m
22	69900	69950	50	R WALL	RHS	2m
23	73035	73120	85	R WALL	LHS	3m
24	73780	73825	45	R WALL	LHS	2.5m
25	76050	76080	30	R WALL	RHS	3m

26	76145	76165	20	R WALL	RHS	2m
	Total Length in Mtr.		2360			

UTILITY DETAILS

Significant utility shifting is required prior to the commencement of construction works. A total of 31 nos. of electric poles and 06 nos. of Transformer are identified along this road corridor for shifting. Of these, 20 poles are on the LHS and 11 on the RHS. Five transformers on the LHS and 1 on the RHS. Details of utilities are given in Annexure1.1.

3.4.3.2 Corridor Characteristics

The salient features of the UJ road are presented in Table 3.13.

Table 3.13: Salient features of the Existing UJ Road

Sl. No.	Characteristics	Details
1	Name of Road	Umsning -jagi Road
2	Project road corridor road Length	37.485 Km
3	District	Ri-Bhoi District
4	Villages/settlements enroute	13 villages
5	Terrain	Hilly
	Existing	3.75 m
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 – 1
8	Culverts	256
9	Forests / environmentally sensitive areas	Within 0.5 km of the project road, habitats include a mix of natural and modified ecosystems influenced by hilly terrain and human activities. Natural habitats feature with bamboo and degraded grasslands.
10	Religious Structures Affected	No religious structure is affected
11	Fifth/Sixth Scheduled Areas	Sixth Schedule Area
12	River crossings	Umsiang river at end point
13	Water bodies / ponds	1 River and 1 Community fish pond at Ch 43+450 RHS
14	Sensitive receptors	Church, school, hostel building, 2 nos of health centres, a community stockyard, a community fish pond. Refer Table 5.28 for chainage wise details of CPR.
15	Common Property Resources	Four waiting stand (Ch 60+945, Ch 61+825, Ch 66+588 and Ch 75+610) will be affected. Refer Table 5.28 for chainage wise details of CPR.
16	Transshipment areas/truck parking locations	Nil
17	Other features / issues if any	Nil
18	Land requirement	The total Land requirement that will be acquired permanently for this sub project is 0.6868 Ha. For the purpose of Spoil disposal, 0.53 Ha of land will be required temporarily which has been jointly verified by the Community Members, PWD and independent consultants. Refer to Table 3.18 & Table 3.19 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

17 trees are situated within the available Right of Way (RoW) on both sides of the road. To mitigate the ecological impact of tree felling, compensatory plantation (@1:10) should be carried out, in accordance with applicable environmental regulations and guidelines. These measures, along with their implementation strategies, are comprehensively detailed in the Environmental and Social Management Plan (ESMP). The chainage wise details of trees are presented in Table 3.14.

Table 3.14: Chainage wise list of Trees

Sl. No.	Chainage (km)	LHS/RHS	Common Name	Scientific Name	Girth at Breast Height (cm)
1.	40.406	RHS	Sal	*Shorea robusta*	210
2.	43.501	LHS	Betel nut	*Areca catechu*	90
3.	43.481	LHS	Diengngan	*Schima wallichii*	180
4.	45.994	LHS	Sal	*Shorea robusta*	140
5.	47.059	RHS	Betel nut	*Areca catechu*	90
6.	47.084	RHS	Betel nut	*Areca catechu*	90
7.	49.416	LHS	Sal	*Shorea robusta*	230
8.	51.816	RHS	Betel nut	*Areca catechu*	120
9.	51.843	RHS	Diengngan	*Schima wallichii*	170
10.	56.533	RHS	Sal	*Shorea robusta*	220
11.	56.574	RHS	Betel nut	*Areca catechu*	120
12.	56.707	RHS	Betel nut	*Areca catechu*	85
13.	57.263	RHS	Betel nut	*Areca catechu*	160
14.	57.417	LHS	Diengngan	*Schima wallichii*	150
15.	57.445	LHS	Diengngan	*Schima wallichii*	120
16.	57.766	RHS	Betel nut	*Areca catechu*	100
17.	57.959	RHS	Betel nut	*Areca catechu*	130

3.4.5 SLOPE PROTECTION WORKS

The project corridor in Ri Bhoi, Meghalaya, encounters significant challenges due to its rugged terrain, characterized by high hills and deep valleys. The topographic profile of the UJ Road indicates a gently undulating to moderately rolling terrain, with elevation ranging between 95 m and 932 m above mean sea level (amsl). The highest elevation zones occur near the mid and terminal sections of the corridor, whereas the lowest points are located in valley sections characterized by seasonal drainage or 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.

Location wise slope protection works proposed along with project is given in Table 3.15.

Table 3.15: Slope protection works

Chainage (From–To)	Side	Approx. Height of Cut (m)	Structure Height (m)	Slope Protection Work Proposed
44+355 – 44+460	LHS	2.0 – 3.0	1.8	Breast wall (toe protection for slope failure)
44+550 – 44+700	RHS	2.0 – 4.0	1.8	Breast wall
45+920 – 45+960	RHS	4.0 – 9.0	2.55	Breast wall (high cut slope stabilization)
46+080 – 46+145	Both	4.0 – 12.0	2.55	Breast wall
46+740 – 46+785	RHS	2.0 – 8.0	2.55	Breast wall
48+090 – 48+300	RHS	2.0 – 3.0	1.8	Breast wall
54+400 – 54+605	RHS	2.0 – 5.0	2.0	Breast wall
75+550 – 75+650	RHS	2.0 – 3.0	1.5	Breast wall
76+510 – 76+550	RHS	2.0 – 3.0	1.5	Breast wall
77+440 – 77+515	RHS	2.0 – 2.5	1.5	Breast wall

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 as follows:

3.5.1 DETAILED DESIGN AND PRE-CONSTRUCTION STAGE

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

3.5.2 CONSTRUCTION STAGE

- Site clearing & construction camp establishment
- Construction Material procurement & transportation
- Earthwork, hillside cutting, if required, embankment construction, GSB, WBM, operation of equipment, plant and machinery
- Structure demolition & construction work, if required

- Disposal site management
- Surfacing and shoulder protection & road furniture

3.5.3 POST-CONSTRUCTION, OPERATIONS & MAINTENANCE STAGE

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

3.6 Resource Requirements

For the proposed road project, assessing the availability of suitable construction materials in the vicinity of the project road is essential. The major materials required include soil, sand, aggregates, bitumen, steel, and cement. Surface water will be utilized for construction purposes, subject to prior permission from the Irrigation/Water Resources Department. Details of the construction materials, their sources, and corresponding lead distances are provided in Table 3.16. Details of Construction material is presented in Table 3.17.

Table 3.16: Details of construction material, sources along with the lead

Material	Quarry / Source Location	Lead (in km)	Surfaced Road	Unsurfaced Gravelled Road	Kutcha Road
Building Stone/ Boulders	7th Km of BB road	59.00	58.000	1.00	0.00
Stone Metal/ Aggregates/ GSB/ Stone Chip/ Filter Material/	11th Km of Shillong Jowai Road (N.H. 44)	81.00	80.000	1.00	0.00
Sand/ Blindage/ Binding Materials	Korbalu	50.00	49.000	1.00	0.00
Cement	Umsning	40.00	39.000	1.00	0.00
HYSD bar	Umsning	40.00	39.000	1.00	0.00

Table 3.17: Details of construction material

Sr. No.	Item	Unit	Estimated Quantity
1	Total Muck Generated	m^3	212702
2	Earthwork (to be fill)	m^3	175002
3	Surplus cut (to be disposed	m^3	37700
4	Fine Sand	m^3	18614
5	Coarse Sand	m^3	55842
6	Aggregate (Coarse aggregate)	m^3	130476
7	Bitumen	MT	1367
8	Emulsion	MT	463
9	TMT Bars	MT	455
10	Cement	MT	15276

Assessing the availability of suitable construction materials near the project road is crucial for a road project. Surface water from the nearest river can be used for road construction with prior permission from the concerned authority.

3.6.1 VOLUME OF CIVIL WORKS

The volume of civil works for MLCIP will depend on the construction methods employed, the typical cross-sections, and the specific materials used within the sub-project area. These civil works are critical to ensuring the highway's stability, safety, and environmental sustainability, thereby contributing to the long-term success of the road project. Details of the materials used including Bituminous Concrete (BC), Dense Bituminous Macadam (DBM), Prime Coat (PC), Tack Coat (TC). The use of this comprehensive range of materials ensures the road's strength, durability, and overall performance.

The total quantity of material to be excavated (cut) along the project corridor is 212702 m^3, while the total fill requirement is 175002 m^3. After balancing the cut and fill volumes, there remains a surplus of approximately 37700 m^3 of excavated material. This excess earthwork shall be disposed of or utilized by the contractor only at designated and pre-approved disposal sites identified by the Meghalaya Public Works Department (MPWD), in accordance with environmental management and safety norms.

The additional land required for the proposed road improvement works is approximately 0.6868 hectares, while an estimated 0.530 hectares (temporary use) of land will be required separately for Spoil disposal purposes. The Consultants along with the officials of the PWD and members of the Village Community including the Rangbah Shnong jointly identified four (4) disposal sites along the project stretch.

As per the approved BOQ (Volume XI) of the DPR, the scope includes excavation in soil and rock, dismantling works, and disposal of excavated/dismantled materials within specified lead distances, along with provisions

for handling, stacking, and reuse of suitable materials in embankment, subgrade, and other construction activities. Recyclable materials such as suitable earth and granular materials will be reused to the extent feasible, while the remaining surplus and Surplus spoil of 37700 cum will be disposed of at designated locations. 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 3.18.

Table 3.18: Details for the Spoil disposal sites

Sr. No.	Land	Lat.	Long.	Area in Ha.	Location in Ch.	Ownership of land. Whether - 1. Govt 2. Private (Individual) 3. Community	If private or individual land owner - NAME OF THE OWNER	Usage of land - 1. Agriculture/ Horticulture/ Fallow Land 2. Barren 3. Commercial
1	Dumping Yard	25.890279°	92.124069°	0.07	42.4	Private	Drum Shadap	Barren Land
2	Dumping Yard	25.921979°	92.131352°	0.09	48.25	Communit y land	--	Fallow Land
3	Dumping Yard	25.984594°	92.152658°	0.13	59.65	Umbah Clan	--	Fallow Land
4	Dumping Yard	26.010930°	92.136614°	0.24	67	Private land	Spritual Umbah	Fallow Land
	Total			0.53				

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

3.7 Land Requirements

Out of the total road length of 37.485 km proposed for sub project road, approximately 35.62 km will be improved within the available ROW (10 m) and therefore will not require additional land. For the remaining road length which is 1.865 km, 0.6868 ha of land is required where the available ROW is insufficient to accommodate proposed road improvements. No additional Land is required for community infrastructure part of the FPIC agreement. As these facilities will be constructed within the available ROW. Details of land requirement is given in Table 3.19.

Table 3.19: Details of Land Requirements for proposed activities

Village	Chainge from	Chainage to	Length	Land requir ed Area in Ha	Ownership of land. Whether - 1. Govt. 2. Private (Individual) 3. Community	If private or individual land owner - NAME OF THE OWNER	Usage of land - 1. Agriculture/ Horticulture 2. Barren 3. Commercial	Whether addl land requirement will be impacted during construction or free movement

								of traffic YES or NO
Sonidan	41.1	41.3	0.2	0.1242	Private	B Makri	Agricultural land but no cultivation	
Sonidan	44.355	44.46	0.105	0.0420	Private	B Dorphang	Agricultural land but no cultivation	
Sonidan	44.55	44.7	0.15	0.0600	Private	S Marten	Agricultural land but no cultivation	
Mawpat (LHS)	45.92	45.96	0.04	0.0160	Private	J Shadap	Agricultural land but no cultivation	
Mawshu nam	45.9	46.2	0.3	0.0938	Community Land	Community Land	Agricultural land but no cultivation	
Mawpat (LHS)	46.08	46.145	0.065	0.0260	Private	R Muktieh	Agricultural land but no cultivation	
Mawpat (LHS)	46.74	46.785	0.045	0.0180	Community land	Community land	Agricultural land but no cultivation	
Mawshu nam	47.17	47.3	0.13	0.0398	Community land	Community land	Agricultural land but no cultivation	
Mawalah o	48.09	48.3	0.21	0.0840	Community Land	Community Land	Agricultural land but no cultivation	

Kohradem	54.4	54.605	0.205	0.0820	Private	K Khymdeit	Agricultural land but no cultivation	
Sngahtyrkhang	57.1	57.3	0.2	0.0151	Community land	Community land	Agricultural land but no cultivation	
Umsiang Maiong	75.55	75.65	0.1	0.0400	Private	P Terang	Agricultural land but no cultivation	
Kraikajam	76.51	76.55	0.04	0.0160	Community land	Religious community	Agricultural land but no cultivation	
Umsiang Mawpdeng	77.44	77.515	0.075	0.0300	Private	P Muktieh	Agricultural land but no cultivation	
Grand Total				0.6868				

3.8 Water Requirements

The overall water requirement of the project is 66.85 KLD, of which 50.293 KLD will be used for construction activities and 16.56 KLD is required for domestic purposes. Details of the water requirement assessed for the project road are presented in Table 3.20.

Table 3.20: Details of the water requirement

Activity	Daily Demand (Liters/km)	Total for 37.485 Km (Liters/day)	Remarks
Concreting and curing	1259.5	47212.3	Concrete mixing, compaction, culverts, drains.
Dust Suppression at Work Zone	82.19	3080.8	Reduced due to frequent rain; use only on dry days.
Domestic Purpose	-------	16,560	For 184 workers (drinking, cooking, sanitation).
Total	—	66853.10 Liters/day	—

3.9 Manpower Requirement and implementation Schedule for the sub project road

The workforce requirement, as per consultations with the DPR, will vary during different stages of construction, with peak manpower estimated at about 184 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 37.485 km subproject stretch is considered as 36 months. The total estimated cost of the project is approximately Rs. 144.36 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 Sub Project Alternatives

An alternative analysis was conducted for the project stretch, considering various design scenarios as well as a "Without Project" scenario. These are described in the following sections.

4.2.1 Without Sub Project Scenario

The road traverses' areas with high population densities, particularly in sonidan, Kohradem, Umlaper as well as hilly and rural stretches where traffic is frequently disrupted due to poor road conditions and the demand for efficient through-traffic movement. This situation is further exacerbated by land-use conflicts, including uncontrolled development along the route and encroachments within the designated right-of-way.

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 Sub Project Scenario

The "With Sub 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 Sub Project" and "Without Sub Project" scenarios, along with the anticipated benefits of the proposed project, is presented in Table 4-1 below.

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

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometry	Intermediate lane with shoulder and paved surface is being developed with geometric improvements	Existing Single/Intermediate Lane carriageway with poor geometry
Design Speed	(30-50 kmph for Intermediate Lane)	30-40 kmph entire project section.
Congestion in Settlements	Improved carriageway with good surface and separated footpath with railing in built-up area reduces interaction of pedestrians with through traffic resulting in reduction of vehicular emissions, reducing travel time and vehicle operating cost. This in turn contributes to lowering of GHG emission; and may improve people/public health due to no or low exposure period.	Lack of road or lack of good road surface with shoulder and foot path, congestion and frequent vehicle stoppage due to mixing of local, pedestrian and through traffic will increase localized accumulation of vehicular emission with potential impacts on human health and contribute to generation of GHG emission.
Felling of roadside trees	Felling of both old and young trees. Old and weak trees near the road edge shall be a road hazard and shall be felled. Ten times of felled trees, the number of new young and healthy saplings to be planted as compensatory afforestation.	No Felling of trees hence maintaining the healthy local ecology.
Pedestrian safety	Pedestrian facilities in the form of footpath, street lights, 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	Not of adequate standards, quality and number in present scenario.

Component	"With" Project Scenario	'Without" Project Scenario
	rest areas, with appropriate facilities for road public toilets, street lights etc.	
Environmental Enhancement	Enhancement of water bodies, community and cultural properties	No enhancement measures involved.
Social Development	Higher potential for social development due to improvement in access and consequent increase in connectivity.	Social development activities are likely to be significantly constrained due to the severe inadequacy of infrastructure.
Financial and Economic Analysis	Project financially viable for upgrading from existing lane configuration to intermediate lane configuration.	The cost of maintenance while catering to the projected higher traffic, accident cost, Vehicle operating cost & travel time cost shall be higher.

4.3 Environmental and Social Alternatives (To Specific Once) Considered for the Proposed Stretch

Various avoidance measures have been developed to minimize environmental and social impacts and to protect sensitive features along the proposed sub-project road. Table 4.2 summarizes the measures adopted to offset these impacts, and a detailed description of each measure is presented in the following sections.

Table 4.2: Alternative considerations for Minimization of Environmental Impacts

Sr. No.	Village Name	Location Chainage	ESIA Observation	Compliance / Proposal included in DPR	Reference in DPR
1	Surok–Umtyrkhang	48+850, 48+300 & 48+800, 48+300 to 48+430, 48+090 to 48+300	Provision of Breast / R. Wall at the RHS of this chainage is not incorporated in the estimate. This location is susceptible to land slide especially during monsoon.	Main Report, Table 6.20-B: Summary of Retaining Wall. Main Report, Table 6.24: Details of Proposed Bus Shelters, Main Report, Table 6.26-B: Details of Street Light. Main Report, Table 6.25: Details of Drain cum Footpath. Main Report, Table 6.19: Summary of Breast Walls	(BOQ, Sr. No. 20) (BOQ, Sr. No. 28), (BOQ, Sr. No. 29) (BOQ, Sr. No. 24) (BOQ, Sr. No. 21).
2	Korhadem	53+890–56+490	Inadequate roadside drainage	PCC Roadside Drain (TCS-2) proposed	Drainage Layout Drawings
3	Umlamphlang	61+200	Localized runoff	Roadside drain with slope protection	Cross Section &

			and slope cutting		Drainage Design
4	Umlaper	62+700–63+410	High cutting and erosion risk	Retaining structures + PCC drain (TCS-3 & TCS-2)	Protection Works & Drainage Plan
5	Umtrai	64+600–64+900	Drainage congestion and side slope instability	PCC drain and slope stabilization	DPR Drawings & ESMP Measures
6	Mawshang	66+860–69+750	Surface runoff accumulation	Roadside drains (TCS-2) and localized protection	Drainage Plan
7	Umsiang	75+420–75+650	Settlement area with pedestrian movement	Footpath-cum-drain and bus stop provision	Utility & Road Furniture Plan
8	Umsiang Maiong	76+545	Lack of sanitation facilities	Bus stop & public toilet proposed	Rest Area Layout
9	Umsiang Mawpdeng	77+440–77+615	High traffic and pedestrian interface	Footpath, drain and traffic calming measures	Road Safety & Utility Plan
10	Critical Cutting Zone	46+080–46+145	Deep cutting (up to 10 m) and slope instability	Retaining wall / slope protection (TCS-4)	Protection Works Drawings
11	Common for Whole Project Alignment	--	Bus waiting Sheds and Street Lights are to be provided for all habitations	Complied, 19 No's of Bus Shelters with urinals, 30 No's of Street Lights	Main Report, Table 6.24: Details of Proposed Bus Shelters, Main Report, Table 6.26-B: Details of Street Light. (Rs. 83,50,000)

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. Out of the total road length of 37.485 km proposed for sub project road, approximately 35.62 km will be improved within the available ROW (10 m) and therefore will not require additional land. For the remaining road length which is 1.865 km, 0.6868 ha of land is required where the available ROW is insufficient to accommodate proposed road improvements. . 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:

- The design will incorporate utility ducts for underground pipelines and Cables crossovers to ensure safe and organized routing of essential services, minimize future excavation, and enable maintenance without disrupting the road infrastructure.
- Curves and bends will be smoothed to improve geometric design; where adjustments may affect local settlements, road realignment 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.

In addition, the following specific measures are suggested as ESIA inputs for incorporation into the DPR:

- Mawlaho Market (48+320): Junction improvement, speed breakers at built-up entry, pedestrian facilities, and bus stop provision have been included to manage high pedestrian activity.
- Synod Secondary School (~54+500 Design Chainage): Minor junction development, pedestrian crossing, and speed breakers have been provided for safety of school children.
- Umlaper Sub Centre (62+136, RHS): Channelized entry with ramp access has been incorporated for safe and inclusive movement.
- Umtrai PHC (~64+640 Design): Junction has been properly designed and improved to ensure safe access.
- Church (~69+700 Design, LHS): Junction improvement along with pedestrian facilities has been provided to manage congregation movement.
- Hostel Building (~75+700 Design, LHS): Speed reduction measures and pedestrian facilities have been provided for resident safety.

5. BASELINE ENVIRONMENT

5.1 General

This chapter provides an overview of the existing environmental and social conditions of the project area, covering natural, physical, biological, cultural, and socio-economic components. Based on this baseline scenario, the potential impacts of the proposed sub-project have been identified. The approach and methodology adopted for baseline data collection are outlined in Section 1.3 of Chapter 1.

5.2 Climate

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

5.2.1 Climatic Conditions

The climate of Ri-Bhoi district is characterized by moderate temperatures and high humidity throughout the year. The district experiences three distinct seasons: summer, monsoon, and winter. Summer typically lasts from March to May, followed by the Southwest (SW) monsoon season, which extends until September. Winter begins in November and continues through the end of February.

5.2.2 Temperature

In Ri-Bhoi District, winter generally begins in November, with January being the coldest month. During this period, minimum temperatures can drop to around 5-7 °C in the higher elevations, while daytime conditions remain mild and sunny though exact average maximums are not consistently recorded. Summer sets in from March onwards, with July and August being the warmest months, especially during the monsoon season. Although specific temperature ranges are limited in official records, the warmest periods are typically marked by moderate daytime temperatures averaging between 25–30 °C, while nights remain relatively cool.

Table 5.1 below presents the monthly mean maximum and minimum temperatures recorded at Shillong (IMD data), which has been considered as the nearest representative location for the project area.

Table 5.1: Monthly Mean Maximum and Minimum Temperature

Month	Maximum Temperature (°C)	Minimum Temperature (°C)
January	18.6	2.2
February	21.2	3.7
March	25.6	6.8
April	27.1	10.1
May	27.0	11.8
June	27.1	14.7
July	27.4	16.3
August	27.3	16.2
September	26.9	14.8
October	25.2	10.9

November	22.8	7.1
December	20.1	4.0

Source: India Meteorological Department – Shillong Climatological Normals, (1991–2020)

Temperature projection and implications for project road

According to the Meghalaya State Climate Action Plan, Ri Bhoi District is projected to experience an increase in average annual temperature of about 1.6°C to 1.7°C by 2050 (relative to the 1970s baseline), along with greater variability in monsoon rainfall, more intense downpours, and a higher frequency of extreme weather events. Such climate trends heighten the risk of slope slips, localized flooding, drainage congestion, and premature pavement deterioration, particularly along road sections passing through the district's rolling terrain and high-rainfall zones.

To improve climate resilience, the project design includes enhanced cross- and longitudinal-drainage capacity, strengthened retaining and breast walls, the use of climate-resilient pavement materials, and targeted slope stabilization and bioengineering measures suitable for Ri Bhoi's geomorphological setting. These measures collectively aim to minimize vulnerability to heat- and rain-induced stresses, protect the structural stability of the roadway, and ensure reliable long-term serviceability under evolving climatic conditions.
Source: Meghalaya State Climate Action Plan.

5.2.3 Rainfall and Humidity

Ri-Bhoi district experiences a humid subtropical to temperate monsoon climate, influenced by its elevation and geographical features. Pre-monsoon showers typically occur in April and May, often accompanied by thunderstorms and occasional hailstorms, followed by a short dry period. The southwest monsoon usually arrives by late May or early June, bringing heavy rainfall, with the peak occurring between June and August. While Ri-Bhoi does not receive as much rainfall as the southern parts of Meghalaya, such as Mawsynram and Cherrapunji, it still faces challenges like localized flooding, waterlogging, and increased risk of landslides, particularly along major transportation routes during the peak monsoon months.
The average annual rainfall as recorded at the Shillong IMD station (Nearest IMD station), is presented in Table 5.2, which provides the year-wise rainfall distribution.

Table 5-2: Monthly Rainfall Data

Month	Average rainfall (mm)
January	12.6
February	15.4
March	42.7
April	131.4
May	244.5
June	423.7
July	402.0

August	328.4
September	270.1
October	197.2
November	24.7
December	7.2
Annual total	2,099.9

Source: India Meteorological Department – Shillong Climatological Normals, (1991–2020)

Rainfall projection and implications for the sub-project road

According to the Meghalaya State Climate Action Plan (2022), Ri Bhoi District is expected to experience increasingly erratic rainfall patterns by 2050, characterized by a rise in extreme precipitation events and short-duration, high-intensity rainfall. In the project area, which already receives high monsoon rainfall due to its undulating terrain and proximity to the central plateau, these projected changes may further intensify surface runoff, soil erosion, slope instability, and localized flooding along the project corridor. Such conditions can place additional pressure on existing drainage systems, accelerate pavement deterioration, and pose risks of traffic disruption, especially during the peak monsoon period.

To mitigate these climate-related risks, the project design incorporates expanded cross-drainage structures, improved longitudinal side drains with adequate outfall arrangements, properly engineered muck disposal sites, and bio-engineering techniques for slope protection. These interventions aim to strengthen stormwater management, minimize erosion and slope failures, and ensure road stability, safety, and year-round connectivity under the projected rainfall variability and increasing extreme weather events in the Umsning–Jagi region.

The Ri-Bhoi district in Meghalaya experiences consistently high humidity levels, typical of its subtropical highland climate. The average relative humidity remains around 83% throughout the year, reflecting persistently high moisture content in the atmosphere.

Justification for Selection of Design Rainfall for Bridge/cross drainage Hydrology

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 are installed in Meghalaya under the hydrometeorological modernization programme of IMD. Daily rainfall data from stations in the project area (East Meghalaya) were analysed and the maximum observed one-day rainfall values are summarized below:

District / Region	1-Day (24 hr) Max Rainfall (mm)
East Meghalaya	440 (CWC Subzone 2b, 50-year)

The IMD Gridded Rainfall Data (0.25° × 0.25° resolution), available for approximately 110 years, was also studied for regional assessment. However, a major limitation of the IMD gridded rainfall data in Meghalaya is

the highly complex topography and localized microclimatic conditions. 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.

IMD Data

Station / Location	Station Index	Years of Data	Overall Highest MAXRF (mm)	Date & Hour of Peak
SHILLONG	42516	39	108.3 mm	17-07-2007 | 08–09 hrs IST
MAWSYNRAM	42514	2	80.0 mm	21-06-1969 | 19–20 hrs IST
SOHRA (CHERRAPUNJI)	42515	26	207.0 mm	10-10-1994 | 08–09 hrs IST

Considering the above, the design rainfall corresponding to 24-hour duration and the relevant 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,	=	440	mm
(CWC Flood Estimation Report for Sub Zone 2b)			
As per MITP Report Climate change factor for rainfall	=	1.252	
Considering Climate Change 100 year 24 hr Rainfall	=	550.88	mm
Adopted 100 year 24 hr Rainfall	=	560	mm
Intensity of Rainfall Ic for tc=24hr (Considering 100 year 24 hr rainfall)			
Ic = (F/T) x((T+1)/(tc+1))	=	291.667	mm/hr
Conversion ratio for 1 hrs as per CWC Flood Estimation Report	=	0.48	
100 years maximum 1 Hr Rainfall	=	268.80	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 268.80 mm/hr is more than the maximum observed 24-hour district rainfall of approximately 207mm (Sohra) ,108.3mm (Shillong) & 80mm (Mawsynram) 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 maximum up to 4 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) = 1.542 SQKM =154 ha
Length of Longest stream (L) = 2.639
Rational Formula
Design Discharge Q 100Design Discharge Q 100 =0.028 x Px f xA xIc

H- Elevation Difference between critical point to the structure= 151.864 m
Time of Concentration tc is given by Eq 4.9 = (0.87 x L3/H)0.385
= (0.87 x 2.639^3x151.864) ^0.385
= 0.420 hrs
Design Rainfall = 56 cm
From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic = 56/ 24 x ((24+1)/0.42+1)
= 41.07981 cm/hr
From IRC SP 13, Spread Factor "f" from f curve fig 4.2From IRC SP 13, Spread Factor "f" from f curve fig 4.2 = 0.97
From IRC SP 13, table 4.1, coefficient of runoff for the catchment characteristics
P = 0.8
Design Discharge Q 100 = 0.028 x Px f xA xIc = 0.028 x0.8 x 0.97 x 154.2 x 41.07981
= 137.6362 Cumecs

Adequacy check for Box type bridge
size of box - 10.0m x 2.740m
IRC SP 13 clause 19.2.8
Area 27.4 Sqm
Wetted Perimeter, P = 15.48 m

R= A/P 1.77

As RC SP:13 Clause 19.2.8
Entry loss Ke= 0.572 R0.3 0.678
Friction loss = 0.0035 L/R1.25 0.342
λ =A/(1+ke+kf) 1/2 19.278
Height of box 2.74 m
Q capacity =λ*(2gH)0.5 =141.347 Cumecs
or
By Mannings formula =Ax 1/n x R2/3 x S0.5 =
= 1/0.013 x 1.540.66 x x (.0025)0.5 x 27.4
=154.203 Cumecs
n for concrete 0.013, s slope for box type of bridge can be adopted between 400-1000 in std practice

Q design=137 < Q capacity= 141.347cumecs

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

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

Hydrology of Culvert at CA CH-41+110				
	Input Data			
	HYDROLOGY OF Culvert AT KM 0+600			
1	Name of River / Stream / Nala	=	Local	
2	Catchment Area (A)	=	0.016	SQKM
3	Length of Longest stream (L)	=	0.081	KM
4	Point Rainfall in mm	=	44	cm
5	CWC Subzone	=	2b	
6	Modified rainfall after application of Climate resilience factor 1.252	=	56	cm
A	Estimation of Design Discharge by Empirical 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	=	19	
			=19x0.016^(3/4)	
	Q	=	0.872	Cumecs
B	Rational Formula			
	Design Discharge Q 100	=	0.028 x Px f xA xIc	
	Rational can be used for small culverts with basin upto 15 Sqkm			
		=	16	Ha
	H- Elevation Difference between critical point to the structure=		4.765	m
	Time of Concentration tc is given by Eq 4.9	=	(0.87 x L3/H)0.385	

			= (0.87 x 0.081^3 x4.765) ^0.385	
		=	0.029	hrs
	100 years return period rainfall for 24hrs as per CWC flood estimation report Subzone 2b and application of climate resilience factor			
		=	56	cm
	From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic	=	56/ 24 x (24+1)/0.029+1)	
		=	56.689	cm/hr
	From IRC SP 13, Spread Factor "f" from f curve fig 4.2	=	0.85	
	From IRC SP 13, table 4.1, coefficient of runoff for the catchment characteristics			
	P	=	0.5	
	Design Discharge Q 100	=	0.028 x Px f xA xIc	
		=	1.107	Cumecs
D	Design Discharge: (Refer IRC - SP: 13 - 2004, Clause: 6.2)			
	Discharge by Dicken's Formula =	0.872	m3/s	
	Discharge by Rational Formula =	1.107	m3/s	
	Maximum Discharge =	1.107	m3/s	
	Hence, Design Discharge =	1.107	m3/s	
	Design discharge from observed flood	1.107	Cumecs	
	Dimension of Culvert	0.9	m dia.	
	Area of flow (A)	2.545	m2	
	Perimeter of flow	2.828	m	
	Slope of flow	0.0025		
	Hydraulic mean depth (R) = A/P	0.9	m	
	Rugosity coefficient (n)	0.013		
	Conveyance factor (λ) = (A. R^2/3)/n	195.8242		
	Capacity of culvert	0.979	m3/s	
		Revise		
	Revised section of Culvert due to lower capacity of Culvert. Revision in design discharge calculation are mentioned below			
	Dimension of Culvert	1	m Box	
	Area of flow (A)	3.14	m2	
	Perimeter of flow	3.14	m	
	Slope of flow	0.005		
	Hydraulic mean depth (R) = A/P	1	m	
	Rugosity coefficient (n)	0.013		

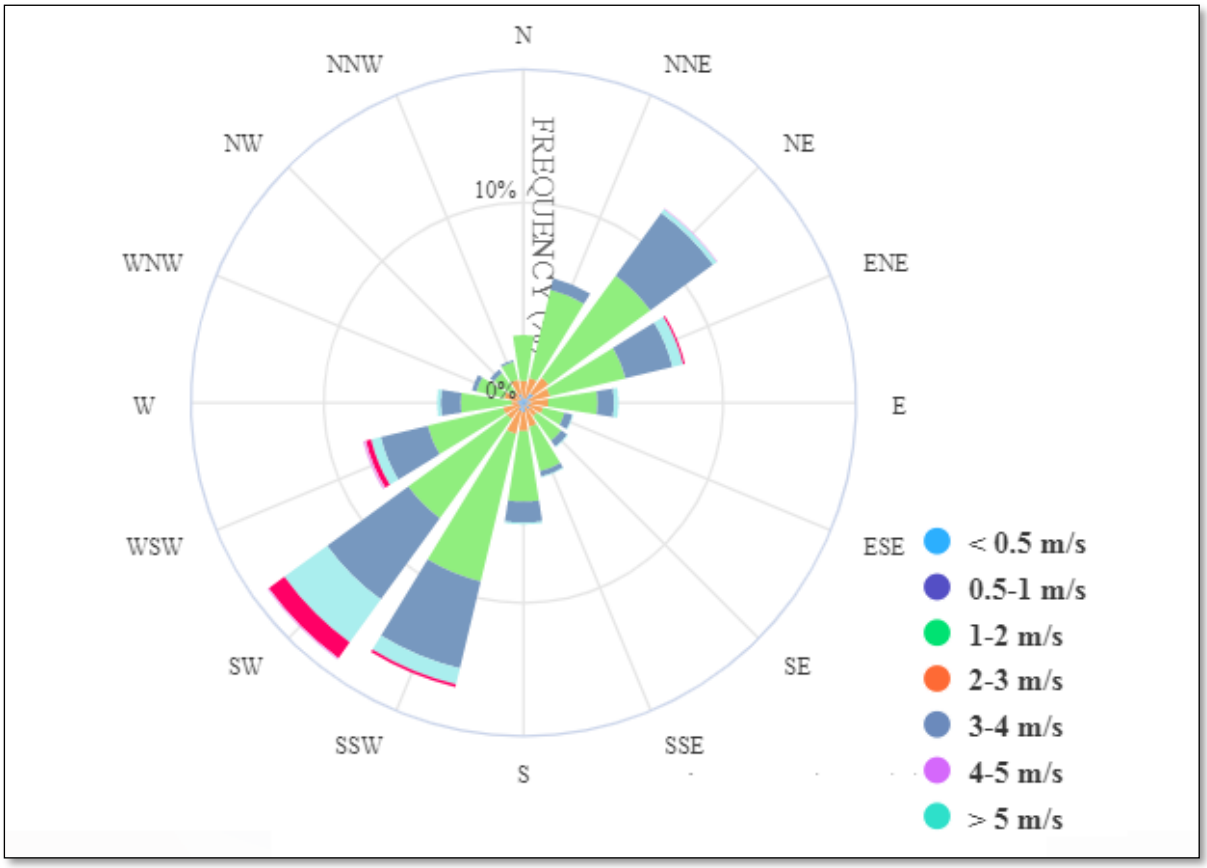
	Conveyance factor (λ) = (A. R^2/3)/n	241.758		
	Capacity of culvert	1.2087	m3/s	
		Safe		

Hydrology of Culvert at CA CH-44+075				
	Input Data			
	HYDROLOGY OF Culvert AT KM 0+600			
1	Name of River / Stream / Nala	=	Local	
2	Catchment Area (A)	=	0.095	SQKM
3	Length of Longest stream (L)	=	2.311	KM
4	Point Rainfall in mm	=	44	cm
5	CWC Subzone	=	2b	
6	Modified rainfall after application of Climate resilience factor 1.252	=	56	cm
A	Estimation of Design Discharge by Empirical 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	=	19	
			=19x0.095^ (3/4)	
	Q	=	3.24	Cumecs
B	Rational Formula			
	Design Discharge Q 100	=	0.028 x Px f xA xIc	
	Rational can be used for small culverts with basin upto 15 Sqkm			
		=	9.46	Ha
	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 2.311^3x75.5) ^0.385	
		=	0.472	hrs
	100 years return period rainfall for 24hrs as per CWC flood estimation report Subzone 2b and application of climate resilience factor	=	56	cm
	From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic	=	56/ 24 x (24+1)/0.472+1)	
		=	39.548	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	=	0.7	

	Design Discharge Q 100	=	0.028 x Px f xA xIc	
		=	7.2595	Cumecs
D	Design Discharge: (Refer IRC - SP: 13 - 2004, Clause: 6.2)			
	Discharge by Dicken's Formula =	3.240	m3/s	
	Discharge by Rational Formula =	7.259	m3/s	
	Maximum Discharge =	7.259	m3/s	
	Hence, Design Discharge =	7.259	m3/s	
	Design discharge from observed flood	7.259	Cumecs	
	Culvert Span	3x1	m	
	Area of flow (A)	3	m2	
	Perimeter of flow	5	m	
	Slope of flow	0.001		
	Hydraulic mean depth (R) = A/P	0.6	m	
	Rugosity coefficient (n)	0.013		
	Conveyance factor (λ) = (A. R^2/3)/n	164.164		
	Capacity of culvert	5.191	m3/s	
		Revise		
	Revised section of Culvert due to lower capacity of Culvert. Revision in design discharge calculation are mentioned below			
	Culvert Sapn	5x1	m Box	
	Area of flow (A)	5	m2	
	Perimeter of flow	7	m	
	Slope of flow	0.002		
	Hydraulic mean depth (R) = A/P	0.714	m	
	Rugosity coefficient (n)	0.013		
	Conveyance factor (λ) = (A. R^2/3)/n	307.2502		
	Capacity of culvert	13.740	m3/s	
		Safe		

5.2.4 Wind Speed and Direction

The annual windrose diagram for Shillong (nearest IMD station) is presented in Figure 5.1. The average wind speed is about 4.9 km/hr, predominantly blowing from the southwest direction.



Source: IMD Climatological Tables for 1991–2020

Figure 5.1: Wind rose Diagram for Shillong (IMD)

5.3 Land Environment

This section describes the key characteristics of the project area including its Physiography, Elevation, Geology, Geomorphology and soils, land use pattern, agriculture and soil.

5.3.1 PHYSIOGRAPHY AND ELEVATION

Ri-Bhoi district in Meghalaya is characterized by rugged, forested hills with deep valleys and numerous perennial rivers, including the Umkhrah, Umshyrpi, and Umiam, which support agriculture and local water supply. The general elevation ranges from about 100 metres above mean sea level (amsl) in the northern plains to nearly 1,000 metres amsl in the southern hilly areas. The terrain gradually rises towards the south, with hill ranges and ridges interspersed with river valleys and flat patches of cultivable land.

Source: CGWB District Ri Bhoi District

Baseline Scenario for Road

As per the elevation map, the Umsning - Jagi road passes through terrain ranging from 95 to 932 meters above mean sea level, which will require careful alignment and slope stabilization measures during road construction. The elevation profile of the project stretch is shown in Figure 5.2.

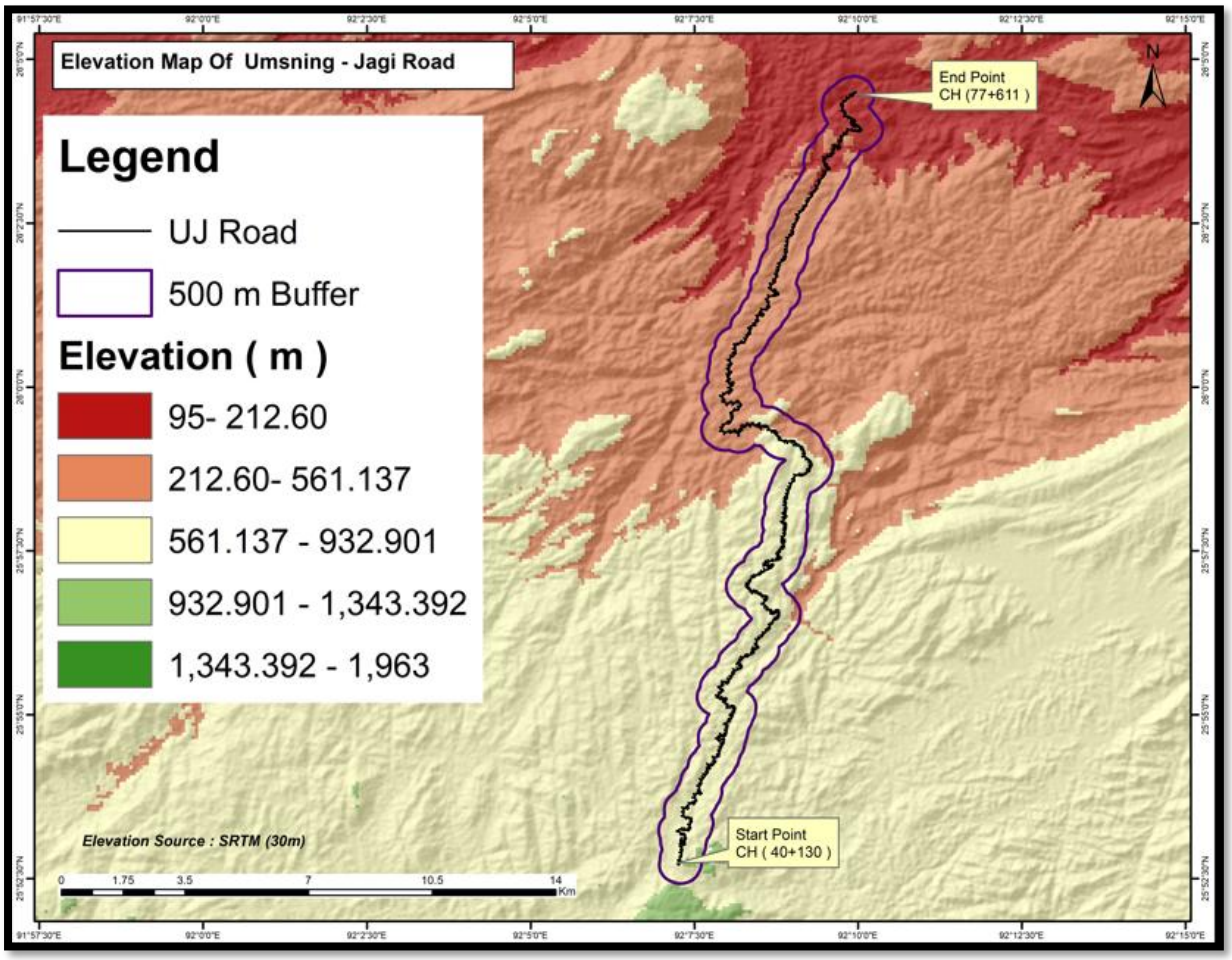


Figure 5.2: Elevation map of the project road (Elevation Source: SRTM (30m)

5.3.2 Geology

Baseline Scenario for Project Road

The Umsning–Jagi corridor in East Meghalaya predominantly traverses terrain underlain by Proterozoic crystalline rocks belonging to the Assam–Meghalaya Gneissic Complex. The initial section of the alignment exposes grey to pink porphyritic granite and coarse-grained pink and grey granite, representing intrusive phases of the Precambrian basement. These rocks are hard, massive, and form a rugged and stable foundation, which largely controls the surface morphology and provides a firm substratum for construction activities.

Further along the corridor, the lithological sequence includes mica (biotite) gneiss, pegmatite and quartz veins, and localized occurrences of quartzite with thin phyllite interbands. These rocks signify multiple episodes of metamorphism and late-stage hydrothermal activity, typical of the eastern Shillong Plateau region.
The geology of the project road is depicted in Figure 5.3.

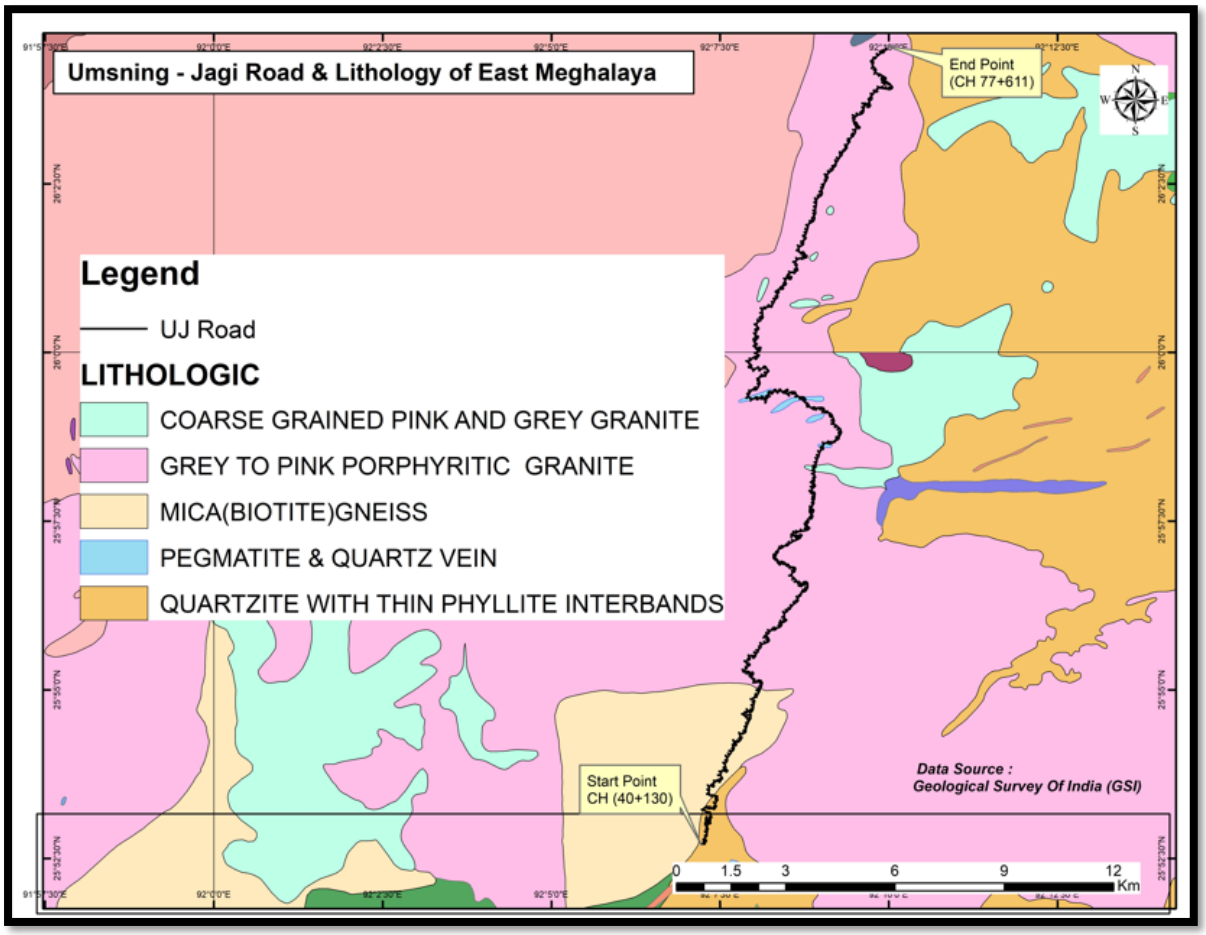


Figure 5.3 Local geology of the project road

5.3.3 GEO-MORPHOLOGY AND SOILS

Geomorphologically, Ri-Bhoi district is characterized by rugged hills, undulating plateaus, valleys, and riverine floodplains. The terrain is predominantly hilly, with steep slopes in upland areas gradually transitioning into plateau regions and low-lying valleys in certain stretches.

Soils in the district are mainly lateritic and acidic, formed from the weathering of Shillong Group rocks under high rainfall. In the hilly sections, soils are highly acidic, with textures ranging from sandy loam to clay loam, and patches of lateritic red soil. These soils are rich in organic matter and nitrogen but are prone to erosion and leaching during heavy monsoon rains, which can lead to slope instability.
The block-wise soil type and land slope is given in below Table 5-3.

Table 5-3: Block wise major soil area and Land Slope for Umsning C & RD

Block	Major Soil Type	Area (Ha)	0–3% Slope	3–8% Slope	8–25% Slope	>25% Slope
Umsning C &	Loamy to clay loam	72,500	5,000	11,800	21,700	34,000

RD	soils					

Source: District Irrigation Plan 2016–2020, Ri Bhoi, Government of Meghalaya

Baseline Scenario for Sub- Project Road

The Umsning - Jagi Road section in Ri-Bhoi District soils are predominantly acidic, consisting mainly of red and yellow loams with sandy-to-sandy loam textures—derived from weathered gneissic, schistose, and quartzitic bedrock typical of the Meghalaya Plateau. The soils are generally well-drained but moderately leached due to high rainfall. The southern portion of the road traverses a moderately dissected plateau, representing a relatively stable terrain with gentle slopes. Moving northward, the alignment passes through areas of highly dissected plateau and moderately dissected hills and valleys, characterized by rugged terrain, steeper slopes, and narrow valleys shaped by fluvial erosion. The northernmost stretch approaches low-lying areas near water bodies and river channels, indicating a gradual transition from plateau to plains. Overall, the corridor covers a mix of plateau and dissected hill terrain, requiring appropriate drainage and slope stabilization measures along the steeper stretches. Geomorphological map of the project road is depicted in the Figure 5.4.

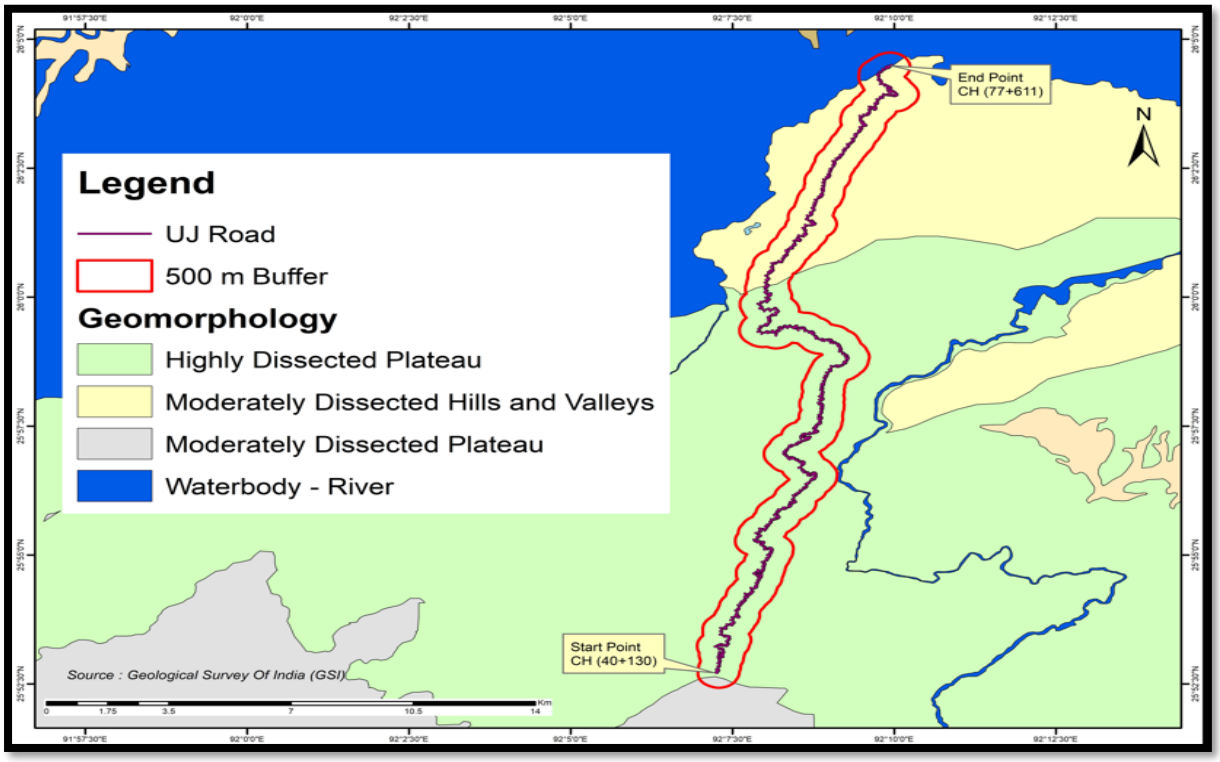


Figure 5.4: Geomorphological map of Ri-Bhoi

5.3.4 Land Use Pattern

Baseline Scenario of the UJ Road

The Land Use and Land Cover (LULC) within 500 m of the Umsning–Jagi Road, the land cover is dominated by plantation (36%), followed by forest (27%), shifting agriculture (17%), built-up area (13%), cropland (6%), and water bodies (2%). The alignment does not pass through any Forest area, Protected Area, National Park, Wildlife Sanctuary or Wetland. Landscapes are divided into hills plain and rural landscapes. Among them, a number of landscape types and subtypes are distinguished. Three landscape types were identified within the project influence area - 1,000 m wide corridor along the alignment (within 500 m of the centerline of the alignments). The Land Use/Land Cover map of the project road corridor is presented in Figure 5.5.

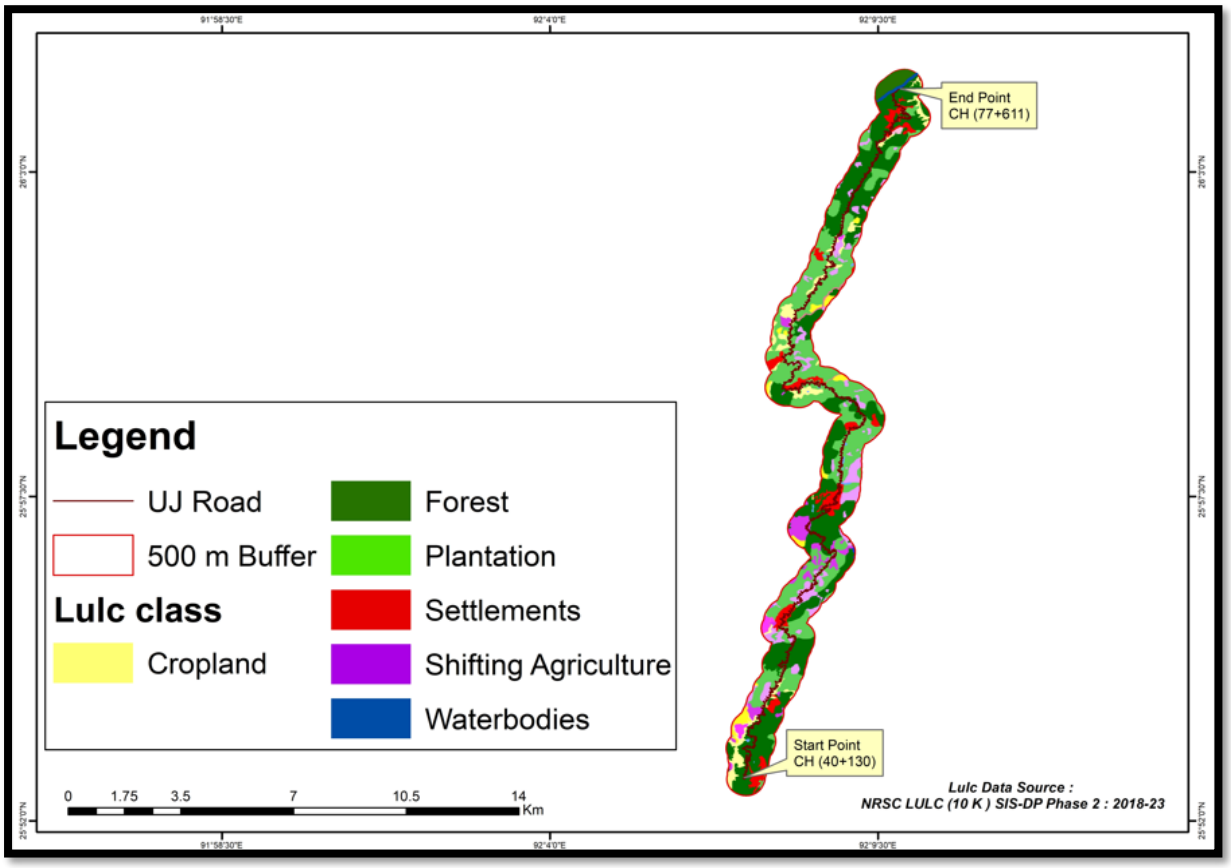


Figure 5.5: Land Use/Land Cover map of project road corridor

5.3.5 Agriculture

Baseline Scenario in Project Corridor Area

According to the consultations that was organized with the Indigenous communities, it was found that agriculture remains the main livelihood practice. The traditional practice of shifting cultivation (jhum) is still present among local households, particularly on steeper slopes and marginal lands, though it is not the dominant or primary form of farming for the majority of households in the area. Key crops grown in the UJ road area include paddy, maize, sesame, millet, jowar, 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 5.4 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 5.5.

Table 5.4: Soil Monitoring Locations

Sl. No.	Project Area	Monitoring Location	Sample	Geographical Coordinate

			Code	Latitude	Longitude
1	Umsning - Jagi	Sonidan (Agriculture field)	SQ1	25°52'57.36"N	92° 7'20.07"E
2		Korhadem (paddy field)	SQ2	25°57'20.29"N	92° 8'37.33"E
3		Umtrai (Agriculture Field)	SQ3	25°59'53.05"N	92° 7'55.48"E
4		Umsiang (Agriculture Field)	SQ4	26° 4'5.45"N	92° 9'56.69"E

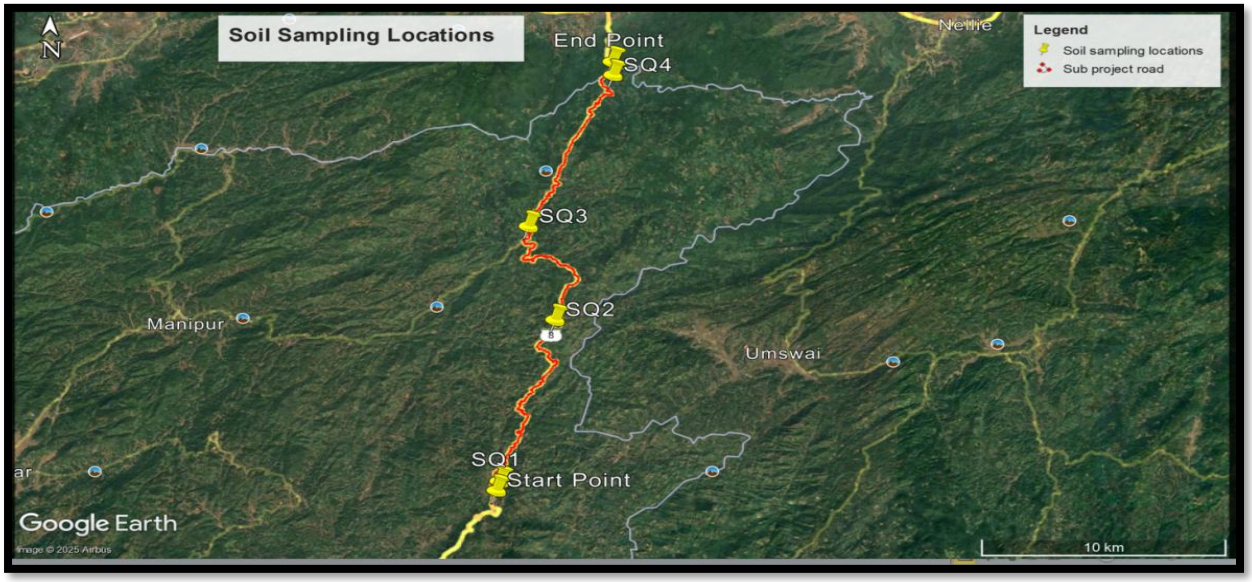


Figure 5.6: Soil monitoring locations

Table 5.5: Soil Monitoring Results in the sub-project road

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	SQ3	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	1.5	1.6	1.3	1.3	IS 14765: 2000, RA 2010

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	SQ3	Test Method
4	Water Holding Capacity	%	22.2	26.2	23.9	23.2	STRL/STP/SOIL/01
5	Sand	%	51.8	52.9	55.7	55.0	IS2720 (P-4),1985 (Reaff: 2015)
6	Silt	%	25.0	24.1	23.5	22.8	IS2720 (P-4),1985 (Reaff: 2015)
7	Clay	%	23.2	23.1	20.8	22.2	IS2720 (P-4),1985 (Reaff: 2015)
8	pH (1:2 Suspension)	-	4.0	4.3	4.2	3.5	IS:2720 (P-26), 1987 (Reaff:2011)
9	Electrical Conductivity(1:2)	µmhos/cm	219.8	233.0	242.6	241.9	IS: 14767(2000), RA 2016
10	Organic Matter	%W/W	1.0	1.1	1.2	0.5	STRL/STP/SOIL/01
11	Exchangeable Calcium	mg/kg	813.8	843.7	737.7	737.0	IS 2720 (Part 24): 1976, RA 2010
12	Exchangeable Magnesium	mg/kg	238.8	208.7	288.7	288.0	IS 2720 (Part 24): 1976, RA 2010
13	Copper	mg/kg	2.6	2.9	1.6	0.9	IS 2720(Part-27): 1977
14	Nickel	mg/kg	0.9	1.4	0.1	-0.6	IS 2720(Part-27): 1977
15	Chromium	mg/kg	2.3	1.6	1.3	0.6	IS 2720(Part-27): 1977
16	Lead	mg/kg	0.3	0.4	0.4	0.3	IS 2720(Part-27): 1977
17	Sulphate	mg/kg	14.4	15.0	17.5	16.8	IS 2720(Part-27): 1977

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	SQ3	Test Method
18	Total Nitrogen (as N)	%	0.2	0.2	0.3	0.4	IS:10158:1982, RA 2009
19	Available Phosphorous	mg/kg	8.8	9.7	7.7	7.0	IS:10158:1982, RA 2009
20	Exchangeable Potassium	mg/kg	93.8	86.7	79.7	79.0	STRL/STP/SOIL/01

Soils along the corridor are sandy loam, well-drained and moderately acidic (pH 5.2–5.6), which is typical for the region's high rainfall conditions. Organic matter levels are moderately high, reflecting good natural leaf-litter enrichment. Major nutrients (N & P) are moderate, whereas Potassium is slightly low due to natural leaching.

5.4 Water Environment

Water bodies along the 37.485 Km project road corridor are primarily represented by Umsiang River, as observed during field studies. Surface water quality testing will be conducted in the river and other key sensitive ponds and streams to ensure water safety and identify any potential contamination. If required, the contractor will be instructed to implement appropriate mitigation measures to maintain water quality during construction. (refer to ESMP and Section 6.4.2.8).

Road construction projects are water-intensive, requiring a substantial volume of water throughout the construction period. As discussed with the DPR team, surface water is proposed as the primary source for construction purposes, subject to prior permission from the competent authority. In exceptional cases where surface water is unavailable, groundwater resources may be utilized. The project area has been classified as 'safe' by the CGWB; therefore, no further detailed groundwater assessment is required within the scope of this ESIA study.

5.4.1 Water Quality

Ground Water:

Three ground water samples have been collected in the month of October along the sub-project road 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 area. Location details of the groundwater samples are presented in Table 5.6 and shown in Figure 5.7 and results are presented in Table 5.7. Ground water samples have been analysed in accordance with the Drinking Water Quality Standards of IS 10500:2012.

Table 5.6: Ground Water Sample Locations in the sub-project area

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Umsning - Jagi	Sonidan	WQ1	25°52'57.22"N	92° 7'20.48"E
2		Korhadem	WQ2	25°57'21.34"N	92° 8'37.12"E
3		Umtrai	WQ3	25°59'54.23"N	92° 7'56.37"E
4		Umsiang	WQ4	26° 4'5.41"N	92° 9'55.34"E

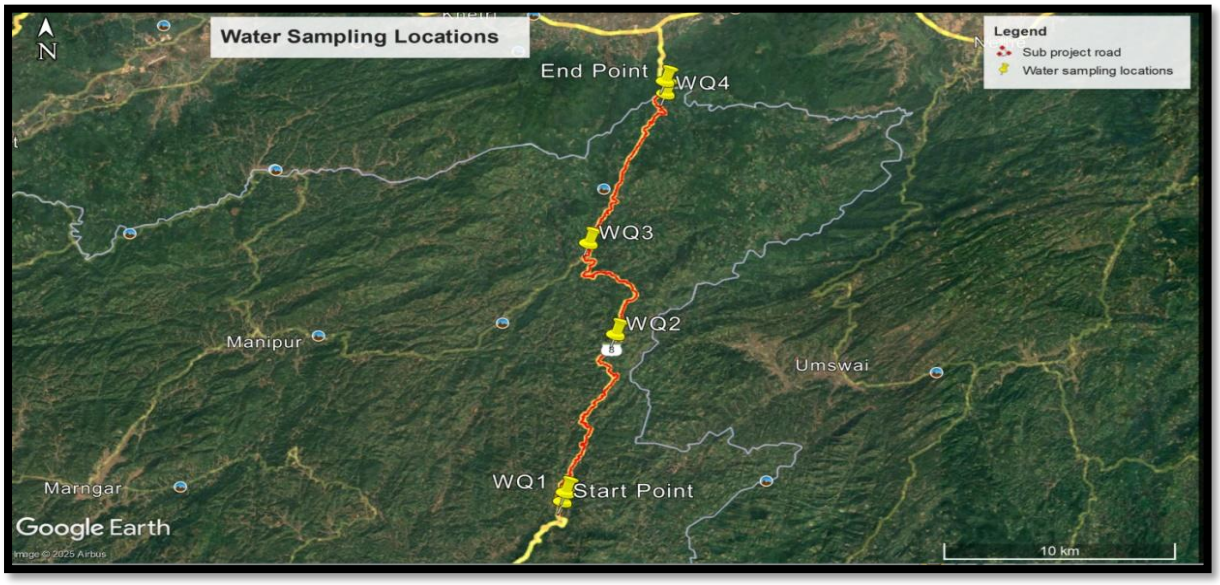


Figure 5.7: Ground Water monitoring locations

Groundwater samples (GW-1, GW-2, and GW-3) were tested against the IS 10500:2012 drinking water standards. All three samples were clear, colourless, and had agreeable odour and taste. The pH ranged from 6.5 to 7.1, falling within the acceptable range. Total hardness (112–138 mg/l), calcium (22.8–25.4 mg/l), magnesium (13.9–19.2 mg/l), chlorides (18.7–22.5 mg/l), sulphates (10.6–15.2 mg/l), and alkalinity (130.5–133.7 mg/l) were all well below the desirable limits. Iron levels (0.11–0.27 mg/l) also remained within permissible limits. TDS values were low (179–192 mg/l), indicating good mineral quality. Toxic metals such as chromium, arsenic, lead, cadmium, mercury, nickel, and aluminium were all below detectable limits, ensuring safety. Fluoride was below detection in all samples. Other parameters including ammonia, detergents, boron, mineral oil, phenolic compounds, and residual chlorine were either below detection or within limits. Nitrate levels (8.7–12.8 mg/l) were also significantly lower than the standard. Sodium and potassium levels were within normal ranges. Microbiological analysis confirmed that total coliforms and E. coli were absent,

indicating no faecal contamination. Overall, the groundwater quality at all three locations is well within drinking water standards and safe for consumption.

Table 5.7: Ground Water monitoring results in the project area

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
1	Color	Hazen	5	15	<5	<5	<5	IS: 3025(Pt-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-8)
4	Turbidity	NTU	1	5	<1	<1	<1	IS 3025(Part-10)
5	pH	-	6.5-8.5	No Relaxation	6.5	6.9	7.1	IS: 3025(Pt-11)
6	Total Hardness (as $CaCO_3$)	mg/l	200	600	138	131	112	IS 3025(Part-21)
7	Iron (as Fe)	mg/l	0.3	No Relaxation	0.11	0.20	0.27	3500-Fe- B, APHA 23nd Ed.2017
8	Chlorides (as Cl)	mg/l	250	1000	18.7	22.5	21.9	IS 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	BDL	BDL	BDL	4500-F-(D), APHA 23st Ed.2017
10	TDS	mg/l	500	2000	179	192	188	IS 3025(Part-16)
11	CALCIUM (as Ca2+)	mg/l	75	200	23.8	25.4	22.8	IS 3025(Part-40)
12	MAGNESIUM (as Mg2+)	mg/l	30	100	19.2	17.7	13.9	3500- Mg B, APHA 23nd Ed.2017
13	Sulphate (as SO_4)	mg/l	200	400	10.6	15.2	13.6	IS 3025(Part-24)
14	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed.2017
15	Alkalinity as $CaCO_3$	mg/l	200	600	133.7	132.8	130.5	IS 3025(Part-23)

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
16	Aluminium (as Al)	mg/l	0.03	0.2	<0.01	<0.01	<0.01	IS 3025(Part-55)
17	Total Arsenic (as As)	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
18	Copper (as Cu)	mg/l	0.05	1.5	<0.05	<0.05	<0.05	3110- B, APHA 23nd Ed2017
19	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
20	Zinc (as Zn)	mg/l	5	15	0.20	0.18	0.26	3110- B, APHA 23nd Ed2017
21	Ammonia (as NH3-N)	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	4500-NH3-B &C, APHA 23rd ED2017
22	Anionic Detergents (as MBAS)	mg/l	0.2	1	<0.1	<0.1	<0.1	Annexure K of IS-13428
23	Boron (as B)	mg/l	0.5	1	<0.5(BDL)	<0.5(BDL)	<0.5(BDL)	IS: 3025 (Pt-57)
24	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	IS 3025(Part-39)
25	Phenolic Compound (as C6H5OH)	mg/l	0.001	0.002	<0.001	<0.001	<0.001	IS 3025(Part-44)
26	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.002	<0.002	<0.002	3110- B, APHA 23nd Ed2017
27	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	<0.1	<0.1	4500- CN-B, C & E, APHA 23nd Ed2017
28	Lead	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
29	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
30	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
31	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	<0.02	<0.02	4500-Cl-B, APHA 23nd Ed2017
32	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	<0.2	<0.2	3110- B, APHA 23nd Ed.2017
33	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	0.0001	No Relaxation	No Relaxation	No Relaxation	APHA 6440,23nd Ed.2017
34	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	No Relaxation	No Relaxation	APHA 6430,23nd Ed.2017
35	Nitrate	mg/l	45	No Relaxation	9.8	8.7	12.8	IS: 3025(Pt-34)
36	Sodium (as Na^+)	mg/l	-	-	24.6	18.8	21.8	APHA 4500-Na B / IS 3025 (Part 45): 1993
37	Potassium (as K^+)	mg/l	-	-	5.8	7.9	7.2	APHA 4500-K B / IS 3025 (Part 45): 1993
Microbiological Parameters								
36	Total Coli form	MPN/ 100ml	Shall not be detectable in any 100 ml of sample		<1	<1	<1	IS: 1622-1981
37	E.Coli	E.Coli/ 100ml	Shall not be detectable in any 100 ml of sample		Absent	Absent	Absent	IS: 1622-1981

5.5 Air Environment

5.5.1 Air Quality

There are no major industries along the project road, and vehicular movement is the primary source of emissions. Based on site observations and public consultations, no noticeable deterioration in ambient air quality was observed.

Ambient air quality monitoring has been conducted at four locations during the month of October. Parameters like Particulate Matter (PM 10), Particulate Matter (PM 2.5), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Carbon Monoxide (CO) were monitored. Monitoring locations are given in Table 5.8 & Figure 5.8.

Table 5.8: Ambient Air Quality monitoring locations in the sub-project area

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Umsning - Jagi	Sonidan	AAQ1	25°52'57.35"N	92° 7'20.06"E
2		Korhadem	AAQ2	25°57'20.28"N	92° 8'37.34"E
3		Umtrai	AAQ3	25°59'53.05"N	92° 7'55.48"E
4		Umsiang	AAQ4	26° 4'5.44"N	92° 9'56.67"E

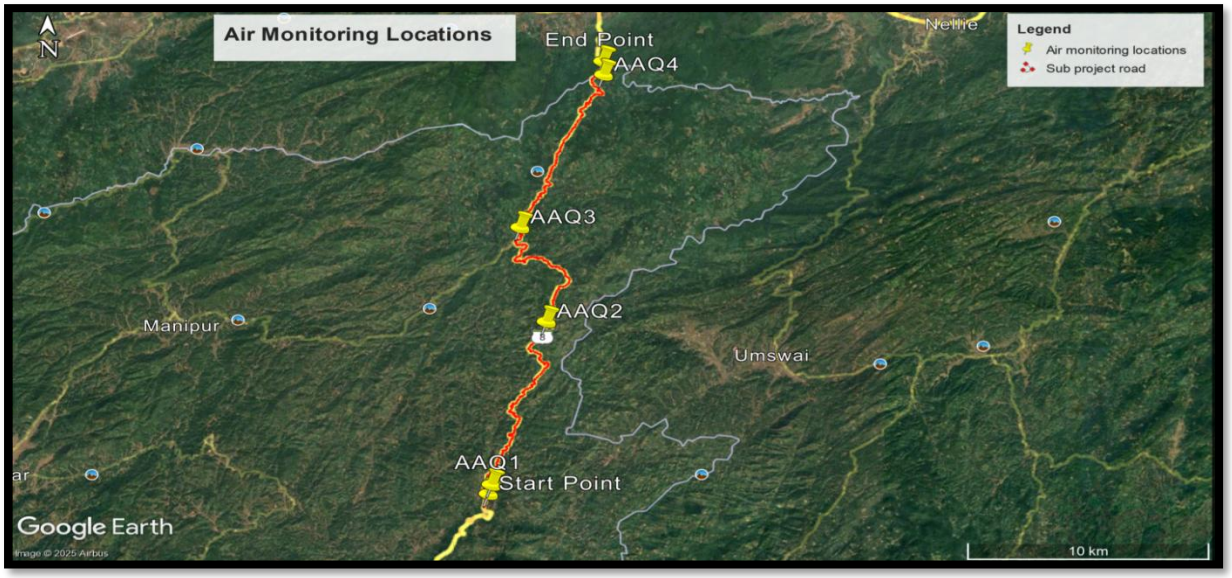


Figure 5.8: Air Quality monitoring locations

The monitored ambient air quality along the 37.485 Km project corridor indicates that concentrations of key air pollutants are well within the permissible limits prescribed under the National Ambient Air Quality Standards (NAAQS, CPCB 2009). The recorded PM10 levels ranged from 51.6 to 60.3 µg/m³, with the highest concentration observed at Umsiang and the lowest at Korhadem. PM2.5 concentrations varied between 24.9 and 32.8 µg/m³, again showing a slightly elevated level at Umsiang. Sulphur Dioxide (SO_2) levels remained low across all sites, ranging from 6.1 to 6.9 µg/m³, while Nitrogen Dioxide (NO_2) varied from 7.0 to 8.2 µg/m³, both well within permissible limits. Carbon Monoxide (CO) concentrations were also low, ranging from 0.230 to 0.320 µg/m³. Overall, the monitored parameters indicate that the ambient air quality in all four locations remains within acceptable standards, with Umsiang showing marginally higher particulate concentrations compared to the other sites. Overall, the air quality in the project corridor is good and within National Ambient Air Quality Standards, suggesting no immediate air pollution concerns in the area. Ambient Air Quality Monitoring Results is presented in Table 5.9.

Table 5.9: Ambient Air Quality Monitoring Results

Sl. No.	Project Area	Location	Sample Code	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	Sulphur Dioxide (SO_2) (µg/m³)	Nitrogen Dioxide (NO_2) (µg/m³)	Carbon Monoxide (CO) (µg/m³)
1	Umsning - Jagi	Sonidan	AAQ1	53.8	28.3	6.4	7.6	0.260
2		Korhadem	AAQ2	51.6	24.9	6.1	7.0	0.230
3		Umtrai	AAQ3	56.4	31.5	6.6	7.8	0.290
4		Umsiang	AAQ4	60.3	32.8	6.9	8.2	0.320
National Ambient Air Quality Standards, Central Pollution Control Board, 2009				100	60	80	80	2000

5.6 Noise Environment

There are no major industries along the project road, and the primary source of noise is vehicular traffic. Based on site observations and public consultations, no significant noise levels were observed.

The noise level monitoring was carried out at four locations. A noise level meter has been used to measure noise levels as instant values which are integrated over a mentioned period to give Leq values as “A” weighted average. The detail of noise quality monitoring stations is mentioned in Table 5.10 and Figure 5.9. Analysis of the noise data collected from the site is mentioned in Table 5.11.

Table 5.10: Location of Noise Level Monitoring

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Umsning - Jagi	Sonidan	NQ1	25°52'57.35"N	92° 7'20.06"E
2		Korhadem	NQ2	25°57'20.28"N	92° 8'37.34"E
3		Umtrai	NQ3	25°59'53.05"N	92° 7'55.48"E
4		Umsiang	NQ4	26° 4'5.44"N	92° 9'56.67"E

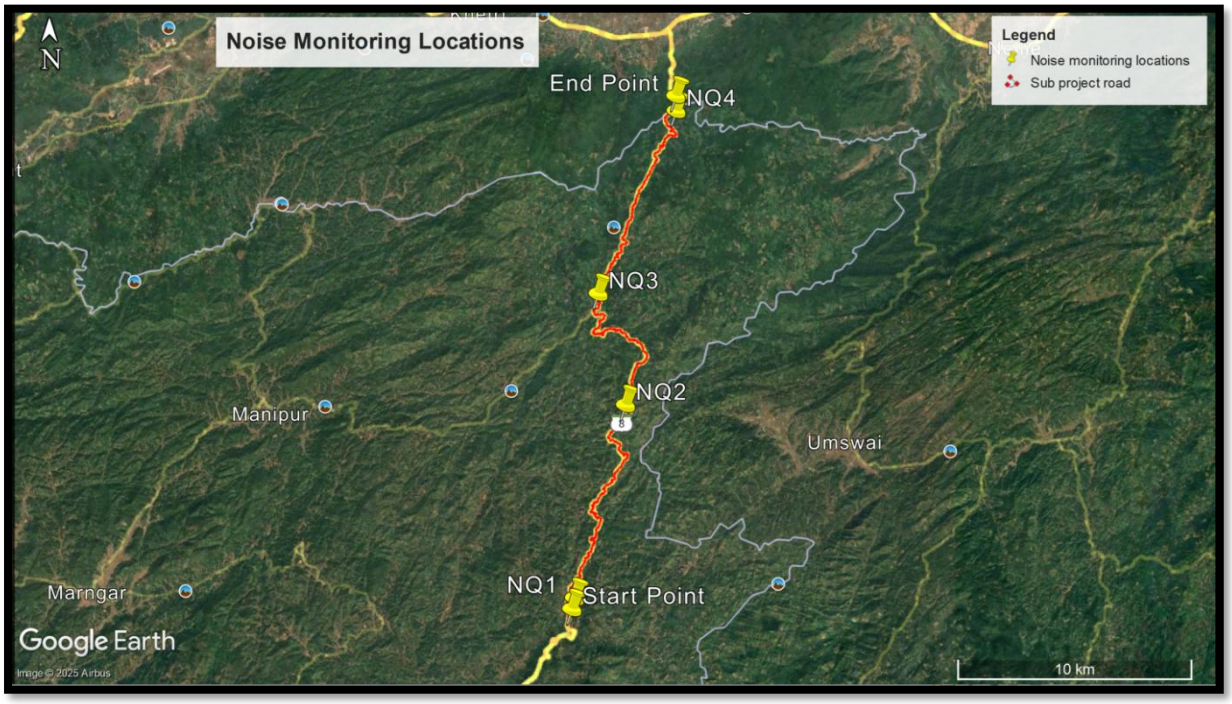


Figure 5.9: Noise Quality monitoring locations

Table 5.11: Analysis of Noise Level Monitoring

Location	Land Use	Standards dB(A)		Day Time Leq (dB(A))	Night Time- Leq (dB(A))
		Day	Night		

Sonidan	Residential	55	45	52.6	37.7
Korhadem	Residential	55	45	51.2	35.6
Umtrai	Residential	55	45	53.7	36.9
Umsiang	Commercial	65	55	58.3	38.6

As per the baseline monitoring, it was found that Noise level (Leq) was meeting the standards at all the three monitoring locations. In the residential locations of Sonidan, Korhadem, and Umtrai, daytime noise levels ranged from 51.2 to 53.7 dB(A), all remaining below the 55 dB(A) limit, while nighttime levels were between 35.6 and 37.7 dB(A), also well within the 45 dB(A) standard. At Umsiang, which falls under the commercial category, the recorded daytime level of 58.3 dB(A) stayed below the 65 dB(A) limit and the nighttime level of 38.6 dB(A) was comfortably within the permissible 55 dB(A) limit. Overall, the monitored noise environment complies with regulatory norms and does not indicate any exceedance across the surveyed locations.

5.7 Biological Environment

5.7.1 Biodiversity and Critical Habitat in Project Road

The biodiversity within 10 km radius of the UJ Roads were studied based on the secondary sources followed by primary data collection in the direct impact area. Project Influence Area with 10 km buffer area is presented in Figure 5.10. The methodology adopted for biodiversity assessment is attached as Annexure 5.1. Map showing distance from Eco sensitive Zones w.r.t Project Road is presented in Figure 5.11.

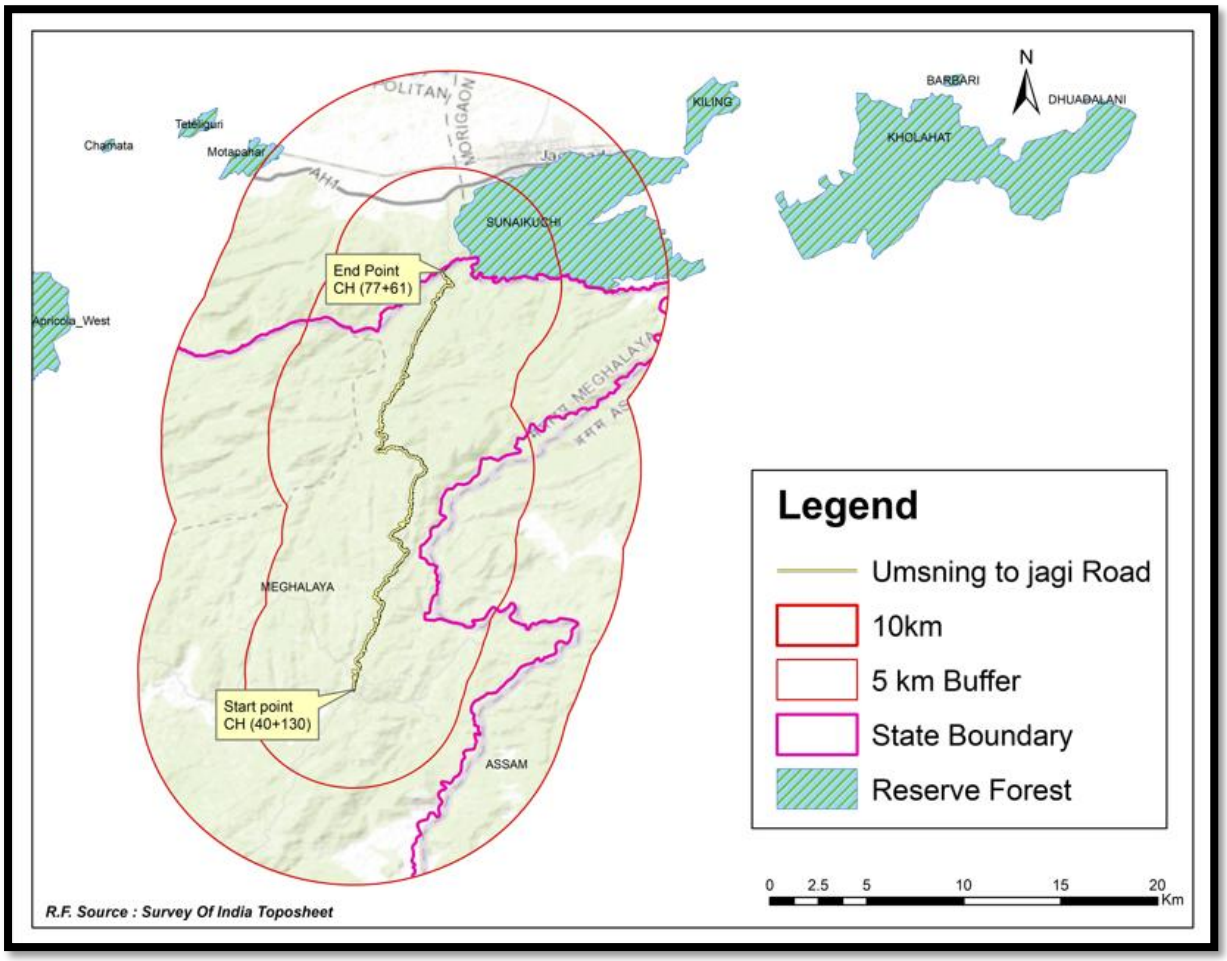


Figure 5.10: Project Influence Area with 10km buffer area for UJ road

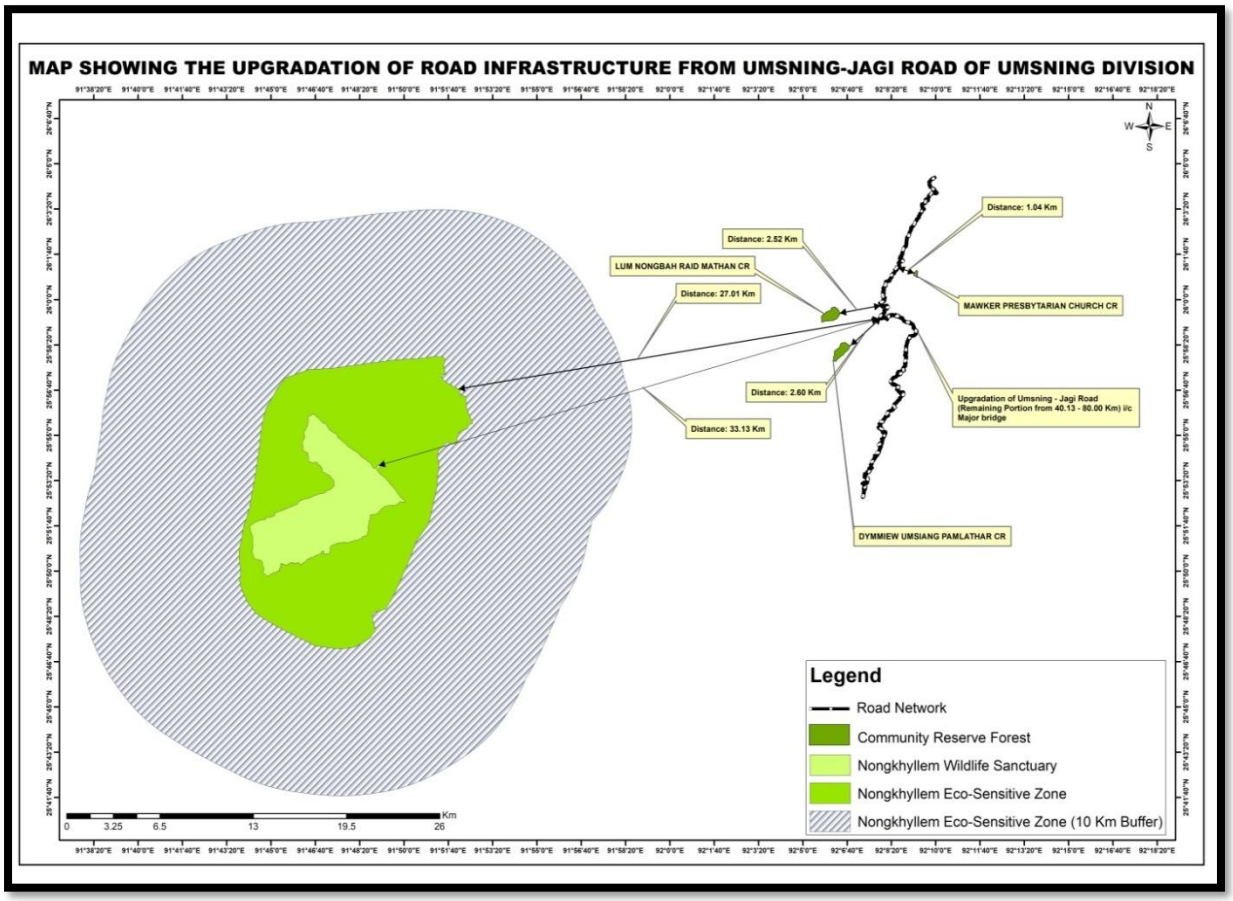


Figure 5.11: Map showing distance from Eco sensitive Zones w.r.t Project Road

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

During the review of secondary data, a total of 40 species of flora (10 Tree species, 3 Shrubs, 5 Herbs, 18 Fern, and 4 Grass species), 11 mammal species, 16 bird species, 6 reptile species, 4 amphibians and 11 butterfly species were recorded. The detailed list of flora and fauna is attached as 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.

5.7.2 Biodiversity and Critical Habitat in sub project stretch PIA

The biodiversity within 10 km radius of the UJ Road corridor-wise (refer to Section 3.3 on PIA) were studied based on the secondary sources followed by primary data collection in the direct impact area and presented in Figure 3.3 in Chapter 3.

Project Influence Area (Within 10 km):

Critical habitat screening was conducted based on the “Critical Habitat” criteria outlined by World Bank’s ESF. The biodiversity screening indicates that although several threatened species, including the Western Hoolock Gibbon (EN), Chinese Pangolin (CR), Indian Pangolin (EN), and critically endangered vultures, are known to occur, 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 5.12.

Table 5.12: Critical Habitat Screening for the Umsning - Jagi Road

Scientific Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution (Ri Bhoi)	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
Hoolock hoolock (Western Hoolock Gibbon)	Endangered (EN)	NE India & Bangladesh	No	Occurs in semi-evergreen forests of Ri Bhoi, especially in intact canopy areas	Low	These are arboreal species and require contiguous forest cover for movement3.There is no contiguous forest cover along the road. Thus the habitat does not exist in the project areas	Screened Out
Nycticebus bengalensis (Bengal Slow Loris)	Endangered (EN)	NE India, SE Asia	No	Found in forest fringes of Ri Bhoi; nocturnal, uses dense vegetation	Low	These are arboreal species and require contiguous forest cover for movement. There is no contiguous forest cover along the road. Thus the habitat does not exist in the project areas	Screened Out
Macaca assamensis (Assam Macaque)	Near Threatened (NT)	No	No	Common in Ri Bhoi forest edges, agricultural fringes	Moderate	This species is largely arboreal and depends on continuous forest canopy for movement and foraging. However, along the UJ road corridor, the habitat is fragmented with	Screened Out

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

						discontinuous vegetation and significant human disturbance. Therefore, the project area does not provide suitable habitat conditions to support the presence of this species, and it can be screened out from further assessment.	
Manis pentadactyla (Chinese Pangolin)	Critically Endangered (CR)	NE India, SE Asia	No	Occasional in Ri Bhoi forest patches; uses burrows in moist soils	Low	The pangolins live primarily in forested areas and in burrows. They are elusive and are thus not found near disturbed habits. Since all the improvements are limited within the exiting right of way their habitat is unlikely within the project direct impact.	Screened Out
Manis crassicaudata (Indian Pangolin)	Endangered (EN)	Indian Subcontinent	No	Occurs in mixed agricultural–forest landscapes	Low	The pangolins live primarily in forested areas and in burrows. They are elusive and are thus not found near disturbed habits. Since all the improvements are limited within the exiting right of way their habitat is unlikely within the project direct	Screened Out

						impact.	
Gallus gallus (Red Junglefowl)	Least Concern (LC)	No	Locally congregatory	Occurs in scrub and agricultural edges	Moderate	There are no bird hotspots in the study area. The nearest hotspot is Nongkhyllem Wildlife Sanctuary[4](27.01 km) . There are no nesting cliffs or other habitats in the project area.	Screened Out
Anthracoceros albirostris (Oriental Pied Hornbill)	Near Threatened (NT)	No	Occasional local congregation	Found in forest edges of Ri Bhoi; nests in tree cavities	Low	There are no bird hotspots in the study area. The nearest hotspot is Nongkhyllem Wildlife Sanctuary[5](27.01 km) . There are no nesting cliffs or other habitats in the project area.	Screened Out
Arborophila chloropus (Green-legged Partridge)	Least Concern (LC)	No	No	Found in lowland forests and scrub of Ri Bhoi	Low	There are no bird hotspots in the study area. This species is not found in Nongkhyllem Wildlife Sanctuary[6](27.01 km)	Screened Out

CR: Critically Endangered, EN : Endangered

The details of the presence of critical habitat within PIA are summarized in Table 5.13.

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

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

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

Table 5.13: Biodiversity and critical habitat assessment-based on field survey and GIS analysis for the (10 km buffer)

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
I.	(a) Habitats protected by national and state legal regulations		
	(i) PAs - Wildlife Sanctuary, National Park, conservation reserve or community reserve, Tiger reserve and corridor and Eco-sensitive zone (As notified under the Wildlife Protection Act, 1972)	Not present	
	(ii) Reserve Forest (As notified under India Forest Act, 1927)	Not Present	
	(iii) Protected wetland of Meghalaya	Not Present	
II.	b) Habitat of significant importance to Critically Endangered or Endangered species		
	(i) Species listed under Schedule I of the Wildlife (Protection) Act, 2022	Not Sighted	
	(ii) Species listed under Schedule III of the Wildlife (Protection) Act, 2022	Not Sighted	
	(ii) Species notified as "threatened species" by the Govt. of Meghalaya under the Meghalaya Biodiversity Rules 2010	Not Sighted	
	(iii) Critically Endangered/Endangered species as listed by the IUCN Red List of Threatened species	Not Sighted	
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	No	
	(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 Sal, Diengngan, Betel nut etc.

5.7.3 Summary of Biodiversity Assessment and Risks

A transect walk was conducted during the month of October 2025 along the sub-project road to document the existing biological environment, including vegetation types, floral composition, and habitat conditions, and to

identify ecologically sensitive areas along the project corridor. A total of 40 species of flora (10 Tree species, 3 Shrubs, 5 Herbs, 18 Fern, and 4 Grass species), 11 mammal species, 16 bird species, 6 reptile species, 4 amphibians and 11 butterfly species were recorded during the field survey. The detailed list of flora and fauna is attached as **Annexure 5.2.**

A total of five species listed under Schedule I of the Wildlife (Protection) Act, 1972 (as amended) have been identified through secondary data sources, including the IBAT tool. However, these species were not recorded during the field surveys conducted within the study area. Furthermore, as per the National Tiger Conservation Authority (NTCA), the sub-project road does not pass through any tiger corridor.

As per the Champion and Seth (1968) classification, the vegetation along the Umsning–Jagi Road in Ri-Bhoi District, Meghalaya, is predominantly characterized by Sub-tropical Moist Deciduous Forest, reflecting comparatively lower rainfall and gentler terrain than the southern Khasi Hills. These forests are composed mainly of moist deciduous broad-leaved species, with patches of semi-evergreen elements in sheltered valleys and along stream courses. Due to long-standing anthropogenic pressures such as shifting cultivation, agriculture, and roadside development, much of the natural vegetation along the corridor has been modified. Consequently, large stretches are occupied by secondary forests, bamboo brakes, grasslands, and scrub vegetation, particularly near settlements and road margins. Overall, the road traverses a heterogeneous mosaic of degraded natural forest and secondary vegetation typical of the foothill ecosystems of the Ri-Bhoi region.

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, source of livelihood and income levels of affected families.
The project corridor is predominantly inhabited by Scheduled Tribe communities, who constitute the majority of the population across all districts. The Khasi tribe along with the Bhoi, Maram and Pnar Sub tribes, each with a distinct dialect reside along the project corridor.
These communities maintain rich cultural traditions, including matrilineal social structures among the Khasis, indigenous festivals, and belief systems that often coexist with Christianity. This ethnic and cultural diversity underpins Ri Bhoi District's societal identity and strongly influences local governance, land use practices, and community-based natural resource management.

As per the 2011 census, the demographic profile, literacy rates, and tribal population of the project district are presented below, with detailed demographic data provided in Table 5.14.

Table 5-14: Demographic profile of Ri Bhoi district as Per 2011 Census

District	Total Pop	Male Pop	Female Pop	Rural Pop	Urban Pop	Literacy Rate Overall	Male	Female
Ri-Bhoi	258,840	132,531	126,309	233,587	25,253	75.67 %	76.79	74.49

Source: Census 2011

Socio-Economic baseline of the project roads

The project road provides a vital link for numerous settlements, supporting communities that depend on the corridor for daily mobility, economic activities, and access to essential services. The region's socio-economic activities are closely intertwined with the natural and cultural landscape, making the road a critical component of local livelihoods and overall development.

Population:

The project corridor passes through thirteen villages, namely Sonidan, Kohradem, Sngahtyrkhang, Mawshunam, Mawpat, Mawshang Mawksiew, Umsiang Maiong, and other nearby settlements. Based on the population size, it may be mentioned that the project corridor encompasses smaller rural settlements such as Sngahtyrkhang (64) and Mawshunam (94), which have relatively low populations. Gender distribution is generally balanced, though some areas such as Mawpat and Mawshang Mawksiew have a higher proportion of females. Larger settlements, including Sonidan (1,206) and Kohradem (839), significantly influence the region's demographics, reflecting the variation in population density along the corridor. The population distribution of the sub-project affected villages is presented in Table 5.15.

Table 5-15: Population Distribution in Villages along the UJ Road

Total Population				
Sl No	Village Name	Male	Female	Total
1.	Sonidan	603	603	1206
2.	Mawpat	60	70	130
3.	Mawshunam	45	49	94
4.	Mawalaho	218	218	436
5.	Kohradem	435	404	839
6.	Sngahtyrkhang	36	28	64
7.	Umlamphlang	113	110	223
8.	Umlaper	485	447	932
9.	Umtrai	693	332	1025
10.	Mawshang Mawksiew	127	155	282
11.	Umsiang Maiong	193	145	338
12.	Kraikajam	124	129	253
13.	Umsiang Mawpdeng	198	205	403

Source: Census 2011

SEX RATIO

The sex ratio along the project road varies from 751 to 1,220. Most villages, including Mawpat (1,167), Mawshunam (1,089), and Mawshang Mawksiew (1,220), Kraikajam (1040), Umsiang Mawpdeng (1035) have more females than males, while Kohradem (929) and Sngahtyrkhang (778), Umlamphlang (973), Umlaper (922), Umtrai (1087), Umsiang Maiong (751) have a male-biased population. Overall, the corridor shows a predominantly female-biased demographic with notable inter-village variation. Detailed sex ratio data for the project-affected villages and two towns are presented in Table 5.16.

Table 5-16: Sex Ratio in the villages along the UJ road

Village Name	Sex Ratio
Sonidan	1000
Mawpat	1167
Mawshunam	1089
Mawalaho	1000
Kohradem	929
Sngahtyrkhang	778
Umlamphlang	973
Umlaper	922
Umtrai	1087
Mawshang Mawksiew	1220
Umsiang Maiong	751
Kraikajam	1040
Umsiang Mawpdeng	1035

Source: Census 2011

Scheduled Tribe population:

The project corridor covers thirteen rural settlements with varied population sizes. Larger villages such as Sonidan (1,206) and Kohradem (839) are the key demographic centres, while smaller settlements like Sngahtyrkhang (64) and Mawshunam (94) reflect the low-density habitation pattern typical of remote areas. A detailed distribution of the ST population along the project corridor is provided in Table 5.16.

Table 5.17: ST Population in the Villages along the sub project road

ST Population				
Village Name	Male	Female	Total	Percentage
Sonidan	593	600	1193	98.92
Mawpat	60	70	130	100
Mawshunam	44	49	93	98.94
Mawalaho	217	218	435	99.77
Kohradem	435	403	838	99.88
Sngahtyrkhang	33	27	60	93.75
Umlamphlang	111	110	221	99.10
Umlaper	928	483	445	47.75
Umtrai	332	361	693	67.60
Mawshang Mawksiew	126	154	280	99.29
Umsiang Maiong	68	55	123	36.39
Kraikajam	12	10	22	8.70
Umsiang Mawpdeng	191	202	393	97.52

Source: Census 2011

Education:

The educational scenario in the project corridor reveals notable variations in literacy levels across rural areas. Sonidan and Kohradem lead in literacy rates, while villages like Sngahtyrkhang and Mawshunam show minimal literacy levels. Gender imbalances persist, with females generally exhibiting higher literacy rates; however, some villages such as Mawpat and Mawshang Mawksiew demonstrate more balanced gender participation.

The detailed distribution of literate in the sub-project affected villages is provided in Table 5.18.

Table 5.18: Literate Population in Villages along the sub project road

Literate Population				
Village Name	Male	Female	Total	Percentage
Sonidan	262	275	537	44.53
Mawpat	37	43	80	61.54
Mawshunam	31	27	58	61.70
Mawalaho	81	88	169	38.76
Kohradem	204	192	396	47.20
Sngahtyrkhang	19	16	35	54.69
Umlamphlang	57	59	116	52.02
Umlaper	283	215	498	53.43
Umtrai	217	247	464	45.27
Mawshang Mawksiew	78	80	158	56.03
Umsiang Maiong	112	68	180	66.27
Kraikajam	63	62	125	49.41
Umsiang Mawpdeng	103	111	214	53.10

Source: Census 2011

Total workforce:

The workforce data shows a total of 2,542 employees, consisting of 1,438 males and 1,104 females. While male employees slightly outnumber females overall, the gender distribution varies across different groups. The detailed workforce of the project affected villages is given in Table 5.19.

Table 5.19: Workforce Population of Village along the sub-Project Road

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Percentage
Sonidan	296	91	387	1	1	2	297	92	389	32.26

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Percentage
Mawpat	33	30	63	0	0	0	33	30	63	48.46
Mawshunam	15	17	32	0	3	3	15	20	35	37.23
Mawalaho	90	70	160	1	17	18	91	87	178	40.83
Kohradem	167	131	298	40	45	85	207	176	383	45.65
Sngahtyrkhang	12	11	23	1	1	2	13	12	25	39.06
Umlamphlang	50	48	98	4	2	6	54	50	104	46.64
Umlaper	200	179	379	1	0	1	201	179	380	40.77
Umtrai	184	190	374	27	50	77	211	240	451	44.00
Mawshang Mawksiew	52	29	81	1	0	1	53	29	82	29.08
Umsiang Maiong	97	52	149	3	4	7	100	56	156	46.15
Kraikajam	74	40	114	0	0	0	74	40	114	45.06
Umsiang Mawpdeng	81	86	167	8	7	15	89	93	182	45.16

Source: Census 2011

5.8.1 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

5.8.2 Seasonal Employment

Initial consultations with communities along the UJ road in Ri Bhoi District 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.

5.8.3 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.

5.9 Social Vulnerabilities

5.9.1 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.

5.9.2 CRIME

In Sub project road, most disputes in the villages are resolved locally through traditional mechanisms, with the 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.

5.9.3 GENDER BASED VIOLENCE

No general Gender-Based Violence (GBV) cases have been reported in Sub Project Road, 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 Sub Project Road revealed that no such cases were reported in the current year.

5.10 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 structures and livelihoods. A structured, pre-tested questionnaire served as the primary tool for these surveys, which were conducted in September 2025.

5.10.1 DEMOGRAPHY

The total number of project-affected households in terms of structures are 22, comprising of a total of 124 PAPs. Among these, 17 households (77%) are male-headed, while 5 households (23%) are female-headed. Table 5.20 below summarizes the gender distribution of the heads of households.

Table 5.20: Gender Distribution of PAHs

Gender	PAH	Percentage
Male	17	77.0
Female	5	23.0
Total	22	100.0

Source: EIS primary survey – 2025

5.10.1.1 GENDER DISTRIBUTION OF PROJECT-AFFECTED PERSONS

The gender distribution of Project-Affected Persons (PAPs) of 22 project-affected households shows a nearly balanced composition, with a slightly higher proportion of males. Out of a total of 124 PAPs, 59 individuals (41.9%) are male, while 65 individuals (58.1%) are female. The gender distribution of PAPs is presented in Table 5.21.

Table 5.21: Gender Distribution of Project-Affected Persons (PAPs)

Gender	Project Road	
	Project Affected Persons	Percentage
Male	59	41.9
Female	65	58.1
Total	124	100.0

Source: EIS primary survey – 2025

5.10.1.2 ETHNICITY

Along the project road, all PAHs belong to the Khasi tribe falling under either of the following sub-groups: Bhoi, Maram and Pnar. The Bhoi community constitutes the majority, representing 72.8% of settlements, followed by the Maram community at 18.2% and the Pnar community at 9.0%. The detailed distribution of ethnic groups along the project road is provided in Table 5.22.

Table 5.22: Community Wise Distribution of PAHs

Communities	PAH	Percentage
Bhoi	16	72.8%
Maram	4	18.2%
Pnar	2	9.0%

5.10.2 IMPACT TO VULNERABLE HOUSEHOLDS

Census and socio-economic surveys identified vulnerable groups among the households, including women-headed households, below-poverty-line families, and the elderly population (60+ years). Table 5.23 presents the distribution of these vulnerable groups within the study area.

Table 5.23: Distribution of Vulnerable Group

Vulnerable Category	PAH	Percentage
Aged persons above 60 years	3	37.5
Below Poverty Line	0	0
Woman Headed Household	5	62.5
Scheduled Caste	0	0
Physically Challenged	0	0

5.10.3 ECONOMIC PROFILE

5.10.3.1 AGRICULTURAL DOMINANCE

Along the project road, the majority of people are engaged in agriculture (11), business (4), service sector (3) and other (4) play a smaller role, reflecting a predominantly agrarian and informal local economy. The occupational pattern of project-affected households (PAHs) in the area is presented in Table 5.24.

Table 5.24: Occupation pattern of PAHs in project area

Sl. No.	Occupation	PAH
1	Agriculture	11
2	Business	4
3	Service Sector	3
4	Others (Labours)	4
Total		22

5.10.3.2 INCOME

Along the project road, 50% of households earn less than ₹25,000 per month, while 32% earn between ₹25,000–50,000, and another 18% earn between ₹50,000–1,00,000. The monthly income range of project-affected households (PAHs) is presented in Table 5.25.

Table 5.25: Monthly Income Range of PAHs

Sl. No.	Monthly Income Range of HH	Project Road	
		No. of PAHs	Percentage
1	less than 25000	9	50
2	25000- 50000	7	32
3	50000-100000	6	18
4	More than 100000	0	0
Total		22	100.0

5.10.4 EDUCATION

Along the project road, out of 124 individuals, most have attained primary (40) or high school education (32). Fewer individuals have completed higher secondary (17) or graduate and above levels (15), while 20 individuals are illiterate. This indicates a moderate overall educational attainment, with particular scope for improvement among women. The education levels of Project-Affected Persons (PAPs) are presented in Table 5.26.

Table 5.26: Education Level of PAPs

Sl. No	Education	Project Road		
		Male	Female	Total
1	Primary (Class 1 to 4)	20	20	40
2	High School (Class 5-10)	14	18	32
3	Higher Secondary (Class 11-12)	8	9	17
4	Graduate and above	7	8	15
5	Illiterate	10	10	20
	Total	59	65	124

5.10.5 HEALTH STATUS

The health status of Ri Bhoi District has improved over the years due to targeted government initiatives; however, significant challenges remain. Rural-urban disparities, limited healthcare infrastructure, and the increasing prevalence of lifestyle-related diseases are major concerns. The district continues to face a dual burden of communicable diseases, such as malaria, dengue, and diarrheal illnesses, alongside a rising incidence of non-communicable diseases (NCDs), including hypertension, diabetes, and cardiovascular conditions. Improving overall health outcomes requires a multi-pronged approach that emphasizes healthcare accessibility, nutritional support, health education, disease prevention, and early diagnosis across both rural and urban areas.

The Umsning Community Health Centre (CHC) functions as a secondary-level central health facility in the project area, and act as a referral centre for Primary Health Centre (PHC) at Umtrai and Sonidan sub-centre at Umlaper along the Umsning–Jagi Road corridor. Outreach efforts are also made via Mobile clinics and weekly outreach sessions deliver routine care, vaccinations, and maternal services. The National Health Mission (NHM) Meghalaya supports these via the 108-ambulance helpline and 14410 health query line.

5.10.6 IMPACT TO STRUCTURES

No structures are affected on the additional land (0.6868 Ha) that is required for the sub project. However, a total of 12 structures located within the existing Right of Way (ROW) are partially affected along the project corridor.

The proposed improvements along the project corridor are expected to partially impact (less than 10% of the structure) twelve structures, involving 6 commercial structures (GI sheet shop fencing) affecting 8 PAHs, and 6 residential structures (Bamboo fencing, concrete stairs) affecting 6 PAHs.

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. The format of the notice issued to affected households is given in RAP. List of structure is given in Annexure 5.3. Type of Impact on Project Affected Household are presented in Table 5.27.

Table 5.27: Type of Impact on Structures

Type of Impacts	Type of Impact	PAH Category	No of PAHs	No of PAPs	% of impact
Residential Structures (Such concrete staircase, bamboo fencing, Parking shed and concrete compound walls)	Loss of structure (partial impact)	Encroachers	6	34	<10
Commercial Structures (Such as tin shade, tin shed)	Loss of structure (partial impact)	Encroachers	8	48	<10
Land	Loss of Fallow Land	Land Owner	8	42	<10
Total			**22**	**124**	

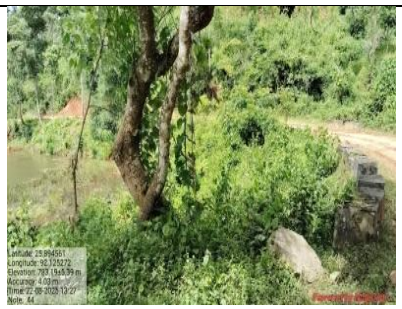
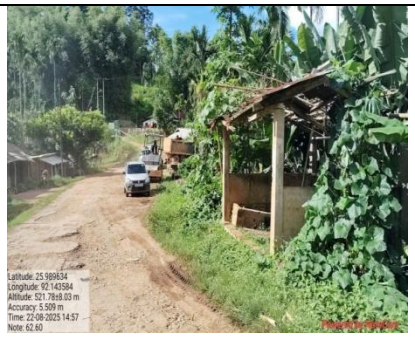
5.10.7 Trees within RoW

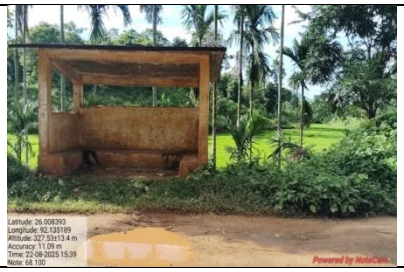
17 trees are situated within the existing Right of Way (RoW) on both sides of the road. To mitigate the ecological impact of tree felling, plantation (@1:10)/ as suggested by Forest Department should be carried out, in accordance with applicable environmental regulations and guidelines. These measures,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

5.10.8 Common Property Resources

The Common Property Resources (CPRs) assessment classifies structures into government and community/public facilities. Along the project stretch, one church at Ch 69+755 (LHS), one school at Ch 55+200 (RHS), one community stock yard at Ch 44+400 (LHS), and one community fish pond at Ch 43+450 (RHS). Additionally, two health centers are located at Ch 62+136 (RHS) and Ch 66+324 (LHS). A total of four waiting stands is also present along the alignment. Details of the CPRs along the project road are presented in Table 5.28.

Table 5.28: Common Property Resources

CH No.	Type of Structures	Distance form centre line	Pictures
44+400 LHS	Community Stock yard	7 m	
43+450 RHS	Community fish pond	15 m	
55+200 RHS	Synod Sec School	20 m Access to school	
60+945 RHS	Waiting stand	3 m	

61+825 LHS	Waiting stand	3 m	
62+136 RHS	Umlaper Sub centre	6 m	
66+324 LHS	Umtrai PHC	50 m	
66+588 LHS	Waiting stand	3 m	
69+755 LHS	Church wall	3.5 m	
75+610 RHS	Waiting stand	2.5 m	

Total Nos.	12

5.11 Archaeological and Historical Monuments

No ASI Protected monuments found within 0.5 km from the project site. Therefore, no baseline archaeological sites of direct significance are associated with the proposed UJ road corridor.

5.12 Hazard and Vulnerability Profile

The hazard and vulnerability profile of the UJ road area and Ri-Bhoi district includes landslides, flash floods, earthquakes, among others. Other hazards such as droughts, group clashes, and fire incidents also occur in the district. A seasonal hazard analysis of Ri-Bhoi district is presented in Table 5.29.

Table 5.29: 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	◄											►

5.12.1 Landslide Prone Areas

The list of landslide-prone areas in Ri-Bhoi district is provided in Table 5.30. The Umsning-Jagi road does not have any weak spots zone as well as most acting sliding zone. Other areas where hill slopes are made of soft and highly weathered rocks, earthen boulders etc. and the cut slopes fail by slumping, sliding and toe failures due to erosion such as at 44.355–44.460 km, 44.550–44.700 km, 45.920–45.960 km, 46.080–46.145 km, 46.740–46.785 km, 48.090–48.300 km, 75.550–75.650 km, 76.510–76.550 km, and 77.440–77.515 km. Such spots are identified and toe protection of slopes is proposed by constructing the breast walls.

Table 5.30: List of landslide prone areas in Ri-Bhoi District

S.No.	Name of Block/Subdivision	Name of the Locations
1	Nongpoh Subdivision	Umling, Pahamsyiem, Nongpoh, Mawdiangum
2	Umsning Block	Umsning, Umroi, Mawlyngkhung, Mawbri
3	Umling Block	15th Mile, Byrnihat, Killing, Umiam
4	Jirang Block	Patharkhmah, Jirang, Nongkyndang, Amphreng

Source: District Disaster Management Plan Ri-Bhoi district

According to the landslide density map of Ri-Bhoi district, the UJ road passes through areas of high to moderate landslide density, except for the initial stretches.

5.12.2 Flood Zones

The list of flash flood-prone areas in Ri-Bhoi district is provided in Table 5.31. Notably, no flood-prone areas have been identified along the project road.

Table 5.31: List of flash flood prone areas in Ri Bhoi Hills District

Name of Block/Sub-Division	Flash Flood Prone Locations
Umsning	Umlaper

Source: District Disaster Management Plan Ri-Bhoi district.

5.12.3 Earthquake Zones

Earthquakes

- High Seismic Risk: The region falls under Seismic Zone V, the most severe category in India.
- Caused by the region's location near the Himalayan tectonic plate boundary and Shillong Plateau faults.

The project road stretches fall under Zone – V, which is at Very High risk and intensity is IX. Seismic Zone details of Ri-Bhoi is presented in Table 5.32.

Table 5.32: Seismic Zone details of Ri-Bhoi District

District	Seismic Zone	Notable Faults	Recent Earthquakes
Ri-Bhoi	Zone V (Very High Damage Risk Zone)	Barapani Fault, Oldham Fault, and Kopili Fault system	Ri Bhoi district lies in a seismically active zone influenced by the Kopili and Barapani faults and has experienced several low to moderate earthquakes (Mw 3.5–5.0) in recent years, including notable tremors near Umsning and Nongpoh in 2018 and 2022, indicating ongoing tectonic activity in the region.

Source: Meghalaya State Disaster Management Authority

5.12.4 Climate Resilient Features

The upgradation of the Sh-04(UJ) 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 5.33.

Table 5.33:Climate Resilient design

Climate-Resilient Design		**Upgradation of UJ Road from single to intermediate lane**
1. Climate Vulnerability	Roads and bridges undergo systematic climate vulnerability	Based on the findings of these assessments, climate-resilient design measures have been

Assessment During Design	assessments early in design to identify hotspots prone to extreme rainfall, flooding, erosion, waterlogging, landslides and submergence.	incorporated into the project. In accordance with recommended climate change factors under SSP 5–8.5, the design discharge for culverts and bridges has been increased by 25%, while the design discharge of drains has been enhanced by 14.5%, to account for projected increases in rainfall intensity under future climate scenarios, as per IITM Pune data in consultation with MITP.
	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 existing culverts were found to be inadequate, necessary improvements have been proposed based on detailed assessment. As per the proposed plan, all 256 existing culverts (235 pipe, 8 slab, and 13 stone masonry) are to be replaced. In addition, 28 new culverts have been proposed, comprising 17 pipe culverts and 11 box culverts, to enhance the drainage network. These measures aim to improve hydraulic capacity, minimize the risk of flooding and road damage, 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 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 roadside drains have been provided parallel to the road and connected to existing and newly proposed culverts to prevent waterlogging and reduce flood

		damage.
	Road designs incorporate improved cross-drainage systems, culverts, and surface water management measures to ensure that the road remains serviceable during intense monsoon rainfall, which is common in Meghalaya's wet climatic conditions. These provisions help in effective drainage of stormwater, prevent waterlogging, and enhance the resilience of the road infrastructure during heavy rainfall events.	Improved Cross Drainage system
3 Slope Stabilisation & Erosion Control	Bioengineering measures such as vegetation, geotextiles, and structural retaining systems are used to reduce landslide risks	Bioengineering using local Broom Grass, Vetiver/Jetty grass has been proposed. Turfing is provided on embankment slopes for erosion control
	Earthwork design also considers increased rainfall intensity in hilly terrain.	
	In hilly terrains, bio-engineering measures are used to stabilise embankments and slopes (e.g., vegetation, geotextiles).	
	Structural measures like retaining walls, gabion walls and breast walls protect roads from landslides and soil erosion.	Retaining walls up to 3.0 m height are proposed, while bioengineering measures are used for slopes above 3.0 m height.
4 All-Weather Surface Materials	Use of durable pavement materials that resist damage from heavy rainfall, moisture ingress and temperature fluctuations.	CTB/CTSB (Cement Treated Base/Sub-Base) layers are proposed as they provide higher structural stiffness, better load distribution and improved resistance to moisture damage, erosion and rutting compared to GSB and WMM layers.
5 Design with Safety & Maintenance Objectives	Climate-resilient road design integrated with safety measures such as improved road geometry, traffic signage, crash barriers and delineators.	Considering the high rainfall, restricted ROW and hilly terrain of Meghalaya, Hard shoulders are proposed to prevent water ingress, reduce erosion and avoid pavement edge failures, thereby improving durability and safety. Chevron, delineators and road studs for curve, are provide to enhance the visibility during night time.

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 road corridor. This chapter presents an analysis of the potential impacts arising from the implementation of project activities. These impacts vary in type, nature, magnitude, extent, timing, duration, certainty, and reversibility. The assessment takes into account the nature of the project, the types of activities involved, and the scale of potential impacts across various environmental and social components, including:

- Physical Environment: Air quality, water resources, noise levels, and soil
- Biological Environment: Flora, Fauna and
- Socio-economic components: Property removal, Land Acquisition, ASI sites, Influx of labour

6.2 Impacts Identification and Evaluation

The potential impacts were identified through a three-step process:

1. Identification of project activities/aspects that could generate impacts;
2. Establishing the affected environmental and social components (valued receptors), which 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. Determination of potential impacts through the preparation of an Impact Identification Matrix.

Based on the project information presented in Chapter 3 and the baseline environmental conditions described in Chapter 4, the anticipated impacts of the MLCIP project were identified and analyzed. The potential environmental and social impacts—both adverse and positive—arising from project activities during the Design, Construction, and Operational Phases were evaluated using the Leopold Matrix. This approach considered the interactions between project activities and both natural/physical environmental components and social components to determine whether such interactions could result in potential impacts.

6.3 Impact Analysis Using Leopold Matrix (Magnitude/Importance Classification)

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

6.3.1 Impact Evaluation Matrix

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

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

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

As per the impact evaluation matrix the environmental and social screening indicates that during the pre-construction phase, potential impacts are expected to be low to moderate, mainly due to site clearance, vegetation removal, and establishment of labour camps or material storage areas. These may temporarily affect air quality, noise levels, and local soil stability, but impacts will remain localized and reversible if proper site selection, vegetation management, and waste disposal measures are followed.

During the construction phase, impacts may intensify, particularly concerning air and noise pollution, waste generation. Activities such as excavation, grading, and drainage could also temporarily affect water resources and slope stability. However, these impacts are temporary and manageable through effective implementation of the Environmental and Social Management Plan (ESMP), including dust suppression, proper waste and fuel handling, and strong occupational health and safety (OHS) protocols.

In the operational phase, environmental and social risks are expected to be low to moderate, mainly linked to traffic movement, community safety, and road drainage maintenance. The project will also yield positive benefits, including improved road safety, slope stability, drainage efficiency, and local accessibility, along with biodiversity gains through Compensatory.

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
Site Clearance (Tree Felling, Vegetation removal, utility relocation)	MN	MN	N	MN	MN	LN	LN	MN	N	N	LN
Labour Camp Siting & Mobilization	MN	MN	MN	N	Low	MN	N	MN	MN	LN	N
Site identification for construction plants, quarrying, material storage	HN	HN	HN	MN	HN	HN	N	HN	HN	HN	HN
Earthworks (Excavation, Filling)	MN	HN	MN	HN	MN	MN	LN	MN	MN	MN	MN
Grading, Levelling and Surface laying	HN	HN	MN	MP (Improved Stability)	MN	MN	LN	MN	MN	MN	MN
Drainage & Culvert Installation	N	LN	MP (Improved Drainage)	MP (Improved Stability)	LP	LP	LP	HN	N	MP	LP
Slope Stabilization & Bioengineering	N	N	LN	N	MP	LP	LP	N	N	MP	LP
Construction Water Usage	LN	N	MN	LN	LN	LN	LN	N	N	LN	LN
Operation of Construction Plants	HN	HN	HN	N	MN	MN	MN	N	HN	MN	MN

Waste Generation and Disposal	MN	N	MN	MN	MN	HN	MN	N	HN	HN	MN
Fuel and Hazardous Material Handling	MN	N	MN	N	LN	HN	MN	N	HN	N	N
Construction Traffic & Machinery	HN	HN	LN	LN	LN	MN	MN	N	MN	N	HN
Health & Safety Training and OHS Implementation	HP	HP	HP	N	N	HP	MP	N	MP	N	MP
Decommissioning of Construction Sites, Plants, Labour Camps	MN	MN	MN	MN	LN	MN	LN	N	MN	LN	LN
Operational Phase											
Operational Traffic Flow	LN	LN	LN	LN	LN	MP	MP	LN	LN	MP	MP
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	MP	MP	HP
Monitoring & Community Engagement	-	—	—	—	—	MP	MP	N	MP	N	LP

Below is an explanation of the rating undertaken for the Leopold compliance matrix.

Short Form	Full Form
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

6.4 Environmental Impacts

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

6.4.1 IMPACTS DURING PRE-CONSTRUCTION PHASE

The project envisages upgrading the existing single-lane carriageway to an intermediate lane configuration to enhance the capacity and extend the service life of the UJ Road. While all the construction activities are proposed within the existing Right of Way (RoW).

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.

During the pre-construction phase, potential impacts are anticipated from site clearance, vegetation removal, tree felling, material sourcing, labour camp establishment, and utility relocation. A total of 17 trees will be felled along the corridor, leading to localized loss of vegetation and minor habitat disturbance (ESS6). These impacts will be mitigated through compensatory plantation at a ratio of 1:10, greenbelt development, and adoption of native species tolerant to local climatic and pollution conditions.

Significant utility shifting is required prior to the commencement of construction works. A total of 31 nos. of electric poles and 06 nos. of Transformer are identified along this road corridor for shifting. Of these, 20 poles are on the LHS and 11 on the RHS. Five transformers on the LHS and 1 on the RHS. Utility relocation activities may temporarily disrupt local services and traffic movement, and therefore must be planned and executed in coordination with respective line departments, ensuring safety and minimal community inconvenience (ESS4).

The sourcing of materials such as aggregates, sand, and stone may cause short-term adverse impacts on land, air, and water quality if not properly managed. Hence, materials shall be procured only from authorized borrow areas, licensed quarries, and SPCB-approved crushers following CPCB guidelines. 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.

Early-stage stakeholder engagement and preparation of a Contractor's Environmental and Social Management Plan (C-ESMP) will be essential. 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 work methodology will define activity sequencing and associated occupational and community health and safety (OHS/CHS) risks. It will be reviewed by the Project Management Unit (PMU) and C-ESMP prior to mobilization.

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 UJ corridor 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 17 trees will be felled along the corridor, leading to localized loss of vegetation and minor habitat disturbance.

Mitigation Measures:

- Avoid locating construction camps and material storage near streams, flood plain, encroachment into natural habitats. Location of the dumpsite, construction camp, Material Storage areas, Machinery staging area shall be reviewed and approved by CSC. The Environmental specialist of CSC shall undertake the visit of the probable sites (at the prospecting stage of the site) and shall provide his opinion on the suitability and also protection measures (within 7 days of such request being made by Contractor) which need to be taken to ensure suitability.
- Restrict vegetation clearing to the minimum area required for works.
- Maintain a buffer of at least 100 m from natural drainage channels or water bodies.
- Implement soil erosion control measures (silt fencing, sediment traps, and slope turfing).
- Prohibit hunting, fishing, or collection of forest produce by workers.
- Awareness and sensitization of labourers on local wildlife and biodiversity conservation.
- Schedule noisy operations (rock breaking, heavy equipment use) away from bird nesting seasons (March–July).
- Site-specific Environmental and social Management Plans (ESMP) shall be developed by the contractor in consultation with the Environment Officer of PMU if any of the location of the constriction activities has sensitive ecology to minimize biodiversity loss.

Occupational Health and Safety (OHS)

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

Mitigation Measures:

- Develop and implement a site-specific OHS Plan conforming to World Bank Environmental, Health and Safety (EHS) Guidelines.
- The OHS Plan shall be submitted along with the Method statement. The PIU–PWD & CSC shall review the OHS Plan and provide their comments within 15 working days. Once these comments have been addressed and the OHS Plan approved the Method Statement shall be approved. The Method statement shall not be approved by CSC unless the OHS Plan has been approved
- Arrangements for PPE (helmets, safety shoes, high-visibility vests, gloves) to all workers.
- Develop tie-up with hospitals for the regular health check-up and Health Emergency and Accidents.

- Ensure proper sanitation, adequate potable water (minimum 5 liters per person per day), and waste disposal facilities in camps.
- All lifting should have the appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144.
- Engage trained personnel for operating machinery and working at height or confined spaces.

Community Health and Safety

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

Construction works along existing habitations and roadside markets can pose safety risks to pedestrians and road users. The improvement works will largely be confined within the 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.

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

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

Construction Camp and Site Selection

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 layout of camps will be reviewed and cleared by the Environment Officer, PMTC prior to establishment.

Disposal of Construction Debris and Waste

Limited C&D waste (excavated material, asphalt fragments, scrap metal) will be generated.

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.
- Avoid dumping in water bodies, wetlands, or near agricultural fields.
- Regularly monitor disposal sites to prevent contamination and visual pollution.

Shifting of Utilities

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

Mitigation Measures:

- Coordinate with line departments (MePDCL, PHE, Telecom) for planned relocation prior to construction.
- Provide prior notice to local communities about any temporary service disruption.
- Restrict utility shifting to daytime hours to avoid safety risks at night.
- The scheduling of the construction works will be shared with the line department (MePDCL, PHE and Telecom Departments) for ensuring uninterrupted services during construction.

Plant, Machinery, and Vehicle Selection

All construction equipment and vehicles shall comply with MoRTH emission standards (GSR 144[7]) and have valid Pollution Under Control (PUC) certificates. The contractor shall maintain equipment in good working condition to minimize noise and air pollution.

Sourcing of Construction Materials

All aggregates, sand, and stone shall be sourced only from approved quarries having valid environmental clearance and consent to operate. Sourcing material from unauthorized queries and not operating them as per the specification can lead to unwanted impacts on the environment.

Mitigation Measures:

- Contractor to submit quarry permits, EC copies, and compliance reports before material use.

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

- No borrowing shall be allowed within forest areas or near habitations.
- Borrow area restoration to be certified by the Environmental Officer, PMU before final payment.
- Borrow areas, if required, shall obtain EC, comply with MoEF&CC Standard Operating Procedures (SOP 2022) for rehabilitation and closure.
- If contractor procures any material (such as ready-mix concrete, asphalt/macadam, aggregates etc.), from third party agencies, contractor shall ensure that such agencies have all necessary clearances/permissions as required under the law; these include CTE/CTO from MSPCB, environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PMU; PIU will approve the source only after all the certificates are submitted; and`
- Conduct air quality monitoring according to the EMP.

Water Requirement

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

Mitigation Measures:

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

6.4.2 Impacts during Construction Phase

The construction phase involves earthworks, grading, drainage works, slope protection, and culvert installation, which are expected to cause significant short-term adverse impacts on air quality, noise, water resources, and soil stability (ESS2, ESS3, ESS4). Occupational health and safety (OHS) risks including accidents, exposure to dust and noise, handling of heavy machinery, and potential landslides require robust safety protocols.

Mitigation measures under the C-ESMP include:

- Safety measures should be taken at Ch 62+136 (Umlaper Sub centre) and Ch 66+324 (Umtrai PHC) during the construction phase such as barricading, signages etc.
- Safety measures shall be implemented to avoid any damage to the school infrastructure and to ensure the safety of students, staff, and the surrounding community during all phases of construction at (55+200).
- At cultural and religious features like Church (69+755),: Access roads should not be damaged or obstructed during construction activities; necessary precautions must be taken to maintain uninterrupted access for local residents and emergency services. Solar blinker and Junction development work is proposed.

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

The standard road construction works involved are site clearance, excavation, filling of earth materials and subgrade materials, laying of bituminous mixtures, handling of hazardous materials like bitumen, diesel, etc., dumping of

unusable debris materials, transportation of materials from production site to construction site, and other constructional activities and associated works like mobilization of construction equipment, setting up of construction plants, setting up of workforce camps, quarrying, material storage etc. These activities have certain impacts of various magnitudes on different components of the environment.

Environment screening of the proposed road alignment has identified several community assets and sensitive receptors along the corridor. These include educational institutions such as Synod Secondary School (55+200), health facilities like Umlaper Sub Centre (62+136) and Umtrai PHC (66+324), cultural and religious features including a church wall (69+755), and other community facilities like markets, hostels, and stock yards. Mitigation measures have been proposed to minimize impacts, such as provision of retaining walls for valley-side structures, improvement of junctions, regulated access to community facilities, and installation of speed management devices near schools and religious sites. Safety precautions during construction have also been recommended around hostels, health centres, and other sensitive areas. Overall, the screening emphasizes the importance of incorporating protective measures and community safeguards into the project design and construction stages.

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

6.4.2.1 Impacts on Physiography

The sub-project area comprises an existing road traversing hilly terrain. Land use along the road stretches includes agricultural areas, dense vegetation, and shifting cultivation. The same alignment will generally be followed for upgrading the road from existing single/intermediate lanes to an intermediate configuration with paved shoulders and 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 Umsning-Jagi Road traverses terrain ranging from 95 m to 932 m above mean sea level.

The total quantity of material to be excavated (cut) along the project corridor is 212702 m^3, while the total fill requirement is 175002 m^3. After balancing the cut and fill volumes, there remains a surplus of approximately 37700 m^3 of excavated material that will need to be safely disposed of at designated muck disposal sites. This approach ensures effective earthwork management while minimizing environmental impacts and maintaining slope stability along the project corridor.

Mitigation Measures

The following needs to be kept in mind during disposal:

- Clear the debris from construction sites. Unusable Debris's are to be carried by trucks/dumpers to the identified dumping yards. 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.

6.4.2.2 Impacts on Geology

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

To prevent unwarranted impacts the following measures are proposed:
Mitigation Measures

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

6.4.2.3 Impact on Soil

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

Topsoil loss may occur in land parcels used for short-term purposes (e.g., borrow areas, construction camps) as well as in areas permanently impacted due to road rehabilitation, unless measures for preservation are adopted. Project activity involves tree cutting and vegetation removal from the PRoW 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 borrow areas, temporary storage sites, and parking zones if not properly managed. Soil compaction reduces permeability and soil fertility, affecting natural drainage and vegetation growth.
Improper operation of borrow areas can also impact the soil environment. Adjacent properties may also be impacted, or it can also lead to erosion. Additionally, the associated activities e.g. haul roads may deteriorate due to movement of overloaded trucks, facilities e.g. culverts or embankment may also get damaged.

6.4.2.3.1 Borrow Areas and Quarries

The details of quarries area have been presented in Table 3.13 of Chapter 3. The details of borrow areas is presented in Table 6.2:

Table 6.2: Details of Borrow Areas

S. No.	Location (km)	Side
1	40.60	RHS
2	49.90	LHS

3	52.60	RHS
4	59.30	LHS
5	74.10	RHS

Details for the Earthwork and Muck Disposal Sites As given below in the table, earthwork quantity from cutting comes out more than the required for filling. The earthwork detail in the project area is listed in Table 6.3.

Table 6.3: Earthwork details in the project area

Corridor	Fill (m^3)	Cut (m^3)
UJ road	175002	212702

From the above table it is calculated that after balancing cut and fill, the remaining quantity of 37700 cum earthwork will be dumped/disposed by the contractor. The details for the muck disposal site are presented in Table 6.4. Average height should be 6 m to 7 m.

Table 6.4: Details for the muck disposal site

S.No.	Location	Distance from UJ road (m)	Area of disposal site (ha)	Quantity of Muck to be disposed (cum)	Environment Sensitivity (If any)
1	Mawpat village at Ch 42+400 km	5	0.04	2900	To minimize environmental impacts, all efforts will be made to avoid cutting trees, and the site will be managed to preserve existing vegetation.
2	Mawlaho at Ch 48+200 km	5	0.07	5036	No specific environmental sensitivity noted
3	Sngahtyrkhang at Ch 59+700	5	0.14	10072	To minimize environmental impacts, all efforts will be made to avoid cutting trees, and the site will be managed to preserve existing vegetation.
4	Umtrai at Ch 67+000	10	0.28	20734.25	To minimize environmental impacts, all efforts will be made to avoid cutting trees, and the site will be managed

					to preserve existing vegetation.

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

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

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

Mitigation Measures

Preventing Compaction of Soil

- To minimize this impact, all construction activities and machinery movement will be strictly confined within the designated Right of Way (RoW) and approved working areas.
- Parking and servicing of vehicles and equipment will be allowed only in designated hard-surfaced zones,
- Contractor have to obtain and submit CTE and CTO to PWD before deciding any quarry area

Borrow Area Management

- Contractor have to obtain and submit CTE and CTO to PWD before deciding any borrow area
- Borrow area should be located at a minimum distance of 300m from the residential/ settlement area, public road. Proper barricading should be provided and access to the borrow areas should be restricted to the unauthorized persons.
- The Contractor should submit the EC, a copy of agreement with the landowner, borrow area management and closure plan before initiating any kind of borrowing activities.
- The Borrow are should comply with the conditions set in the EC/ SoP from MoEF&CC.
- 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 MoEF&CC 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.
- These measures shall be monitored through the supervision consultant to ensure effective implementation during the construction phase.
- For sitting location

Muck Disposal

- Muck disposal sites shall be located on stable, non-erodible terrain away from water bodies and agricultural land.
- 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.
- 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.
- Environmental safeguards, including periodic monitoring and rehabilitation plans, must be integrated into the design to ensure long-term stability and ecological compliance.

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 waste are presented in Annexure 6.2 The same guidance (storage of Hazardous Waste) may be used for storage of hazardous materials (oil, lubricants)

The typical design of the muck disposal site will be incorporated into the DPR. Dumpsite Stabilization Plan is attached as Annexure 5.1.

6.4.2.4 AMBIENT AIR QUALITY

Construction-stage activities are likely to have adverse impacts on both workers and settlements adjacent to the road, particularly those located downwind. The main types of pollution anticipated are dust pollution and emissions from harmful gases from the construction plant and equipment.

Impacts from Generation of dust

- Transportation and tipping of cut material - while the former will occur over the entire stretch between the cutting location and disposal site, the latter is more location specific and more intense;
- Transportation of raw materials from quarries and borrow sites
- Site levelling, clearing of trees
- Construction of structures and allied activities

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

- Hot mix plants

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

The impacts are expected to be temporary (limited to construction period) and confined within construction areas. Mitigation Measures for Ambient Air Quality is presented in Table 6.5.

Table 6.5: Mitigation Measures for Ambient Air Quality

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

6.4.2.5 Noise

During construction, particularly in residential and commercial areas, ambient noise levels may temporarily exceed statutory limits within about 50 m of active work zones due to operation of heavy machinery, material transport, and equipment use. The main noise sources will include excavators, graders, vibratory rollers, and transport vehicles, which typically generate levels above 70 dB(A). Vibration from rollers may also affect nearby structures depending on soil type, structural age, and construction quality.

These impacts will be intermittent, short-term, and localized, as all construction activities will not occur simultaneously along the 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, use of temporary noise barriers, scheduling of high-noise works during daytime, and strict adherence to CPCB noise standards.

The scale of construction required for upgrading the UJ Road is moderate and within the existing Right of Way (RoW) with curve improvement at few stretch which required community land. 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, use of noise barriers or temporary screens near sensitive locations, and adherence to CPCB noise standards, the impacts will remain within acceptable limits. Consequently, the overall scale of works and the expected marginal increase in post-construction traffic are not anticipated to result in any significant or lasting adverse impacts on ambient air quality or noise levels.

Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops, and vehicles and earthmoving equipment. These construction activities are expected to generate noise levels in the range of 80 – 95 dB(A) at about 1m from the source.

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 or noise barriers 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).
- 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.

6.4.2.6 Surface Water Quality and Siltation

Construction activities such as earthworks, material storage, and operation of construction camps may temporarily affect surface water quality along the UJ Road corridor. Proposed sub project road cross Umsiang river at Chainage 78+400. Earth Runoff from exposed soil surfaces, stockpiles, and construction zones can carry suspended solids, oils, and debris into nearby streams or drainage channels, leading to increased turbidity and siltation. Additionally, improper disposal of construction wastewater or accidental spills of fuels and lubricants may also contribute to localized water pollution. Construction activities such as bridge works, river training, and slope protection may temporarily increase turbidity and sediment load in the river, potentially affecting local fish habitats and water quality. These effects are expected to be localized and short-term, primarily during active construction near the river crossing.

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

Mitigation measures

Labour Camp and Construction Yard

- To prevent this, sewage treatment through septic tanks and soak pits or mobile bio-toilets shall be provided at all camps.
- Construction runoff shall be managed through temporary drainage channels, sediment traps, and silt fencing, ensuring that no untreated discharge enters natural watercourses.
- Runoff from the camp shall be passed through an oil-water separator. All peripheral drains shall be linked to the oil water separator.
- The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into river or any other nearby water bodies by passing wastewater to sedimentation tank to be considered as part of the EM plan and Contractor's responsibility.
- Stagnation of water should not be allowed at any place near the campsite as a precaution against vector-borne disease.
- The wash water from the concrete mixer/ batching plant/ miller should only be disposed at a pit developed in construction camp

Water Pollution from Fuel and Lubricants

- Spill Prevention and Control: Store fuel and lubricants in bunded areas (110% capacity of the largest container) with proper spill kits (sand, absorbents). Immediately clean up any spills or leaks.

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

6.4.2.7 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 that could alter drainage patterns and affect riverine habitats. The road alignment generally follows the existing topography, except at locations of cross-drainage structures. The project road stretch includes a total of 1 minor bridge and 256 culverts. Many of the existing culverts, if not adequately strengthened during the proposed road widening, rehabilitation, and upgradation, could fail structurally, leading to disruptions in water flow, increased flood risk, and potential damage to the road. Such failures may also pose safety hazards to road users and nearby communities.

Mitigation Measures:

- Site Selection: Locate material and pile storage yards at least 100 m away from water bodies, wells, or natural drainage channels. Avoid low-lying or flood-prone areas.
- Proper implementation of erosion and sediment control measures including silt fencing, and controlled work scheduling will minimize such impacts.

6.4.2.8 GROUND WATER QUALITY

The road construction projects are water intensive and demand a large volume of water during the entire project's construction period. Project road stretch will require approx. 93.5 KLD. 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.

Untreated discharge from the labour camp may lead to contamination of ground water sources in the vicinity of the camp.

Mitigation Measure

- 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 In case the water is sourced form third parties the Contractor shall only source it form sources cleared by PMU. In such cases also eh shall maintain a log of the water procured.
- Water usage for construction work would be reduced by adopting following best practices:
    - Use buckets etc. to wash tools instead of using running water;
    - Use of auto shut off taps (without sensors) in labour accommodation;
    - Install water metres with main supply pipes/water tanks/bore well to assess quantity of consumed water

6.4.2.9 CONSTRUCTION AND DEMOLITION WASTE

Construction and demolition (C&D) waste from major demolitions is not expected along the proposed sub project road because no permanent structures will be removed. Only temporary structures with masonry or light walls (e.g., temporary kiosks, sheds, compound 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 water bodies, 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.

6.4.2.10 MUNICIPAL SOLID WASTE

The project corridor is expected to generate approximately 74 to 92 kg of municipal solid waste per day during the construction stage, based on an estimated 184 workers at the project site, assuming an average waste generation of 0.4 to 0.5 kg per person per day. 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.
- The camp shall implement a two bin system and the workers should made aware about the segregation of water.
- Poster and leaflets will be done to make the camp residents aware of the segregation and process of segregation
- 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.

6.4.2.11 HAZARDOUS WASTE

Approximately 260 m^3 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.

The corridor-wise details of existing bituminous surface to be scarified in the project area are presented in Table 6.6.

Table 6.6: Amount of expected Bituminous Material

Sl. No.	Description	Unit	Quantity
1.	Scarifying existing bituminous waste	cum	260

A small quantity of hazardous substances, such as used oil, diesel, petroleum products, and other chemicals, will be used or stored during construction. If these substances are not stored properly, leakage or spillage may occur, potentially causing contamination of soil and water.

During the construction phase, used batteries are expected to be discarded and must be disposed of in accordance with the Battery Waste Management Rules, 2022. Lead-based batteries, if not properly managed, may contaminate soil and water through the leakage of lead.

Mitigation Measures:

- The Contract shall obtain Authorization for Generation, Storage and Handling of Hazardous Waste from MSPCB.
- 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.

DISRUPTION OF COMMUNITY SERVICES

Local services, including water supply lines, irrigation channels, drainage systems, ditches, and streets, are often disrupted during road earthworks. These services are essential for crop production, drinking water supply, and local access, and their damage can also affect road construction activities. Details of utilities, such as electric poles, are provided in Annexure 1.1.

6.4.2.12 Impacts on Occupational Health & Safety

During the construction phase of the road project, workers are continuously exposed to various occupational and environmental hazards. These include prolonged exposure to dust and gaseous emissions from equipment, vehicles, and material handling. In addition, there are significant safety risks associated with activities such as hill-side cutting, benching, excavation, embankment formation, operation of heavy machinery, and protection works along eroded riverbanks. Specific risks also arise from working near waterlogged or submerged sections, culvert and bridge construction, and sharp curves or junction improvements, where vehicular movement poses added danger. Electrocution, work at heights, slips, trips, and falls, as well as tree cutting and vegetation clearance, further contribute to potential safety concerns. Proper use of personal protective equipment (PPE), adherence to standard operating procedures (SOPs), traffic and work-zone safety management, and regular safety training will be critical to prevent accidents and ensure worker well-being throughout the construction periodMitigation 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.

6.4.2.13 DIVERSION OF TRAFFIC

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

6.4.2.14 Work Zone 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 (ESS2, ESS4), 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 stretched. The RFI for excavation on both sides of the carriageway shall not be issued at any time. The subsequent RFI for the adjoining chainages should be issued only when the leveling 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.
- Retro reflective 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. Retro refletive 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 (Labour Management Plan is attached as Annexure 6.2).
- The Project Board shall be presented at the beginning /start of the package. The Project Board should provide the critical information about the project include the grievance mechanism.
- The construction zone must be access controlled, and the workers must be provided valid identification cards to allow entry.
- Contractor should introduce, explain and get signed by a Worker Code of Conduct as part of the employment contract. Time to time orientation programme on Code of conduct to be organized with the workers by the contractor.

6.4.2.15 Road Safety Measures

Road Construction activity will impact safety on the road for commuters, pedestrians, students, women and elderly people. In addition to this, sub project stretch being in landslide prone areas, there will be chances of landslide/rock fall on the road from time to time. Animal crossings, although not reported in the current stretch, can yet be a possibility during the construction stage and mitigation measures may have to be incorporated in the Contractor's C-ESMP. There are schools at chainage Ch 55+200 RHS.

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

Traffic Management

- Speed reduction measures to be taken near Ch 44+400
- Safety measures shall be implemented to avoid any damage to the school infrastructure and to ensure the safety of students, staff, and the surrounding community during all phases of construction at Ch 55+200.

6.4.2.16 Anticipated Impacts on Biological Environment

Since the proposed Umsning - Jagi Road involves no widening beyond the existing Right of Way (RoW) except at few sections for curve improvement, and no diversion of forest land or habitat alteration. A species wise screening was carried out and it was assessed that none of the identified species meet the threshold for Critical Habitat criteria

under IFC PS6 or World Bank ESS6. Hence, all species have been screened out from further critical habitat assessment was not carried out.

A total of 05 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.

As per the design, the construction activities would also involve felling of 17 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.
- 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 plantation 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

6.4.2.17 IMPACTS ON AQUATIC ECOLOGY

Impacts on aquatic ecology during construction include increased silt inflow into surface water bodies and the potential discharge of liquid wastes and untreated sewage from construction and labour camps, spillage of fuel and other constriction material or waste into drainage channels or water bodies.

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
- Any works affecting aquatic habitat will not 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 water body
- Where any GI wire mesh gabions are used; all GI wire ends need to be folded inside.
- Ensure that no construction activities will be carried out during monsoon and the fish breeding season

6.4.2.18 IMPACTS ON ARCHAEOLOGICAL, HISTORICAL AND CULTURAL SITES

No ASI-protected monuments are located within 0.5 km of the project site.

Another key potential impact during project construction is the risk of partial or total destruction of previously unknown heritage assets, such as undiscovered archaeological sites, due to ground excavation. This highlights the need for a defined mitigation approach.

During the construction works, as part of the Contractor's project CESMP, a "chance-find" procedure will be developed and implemented. The mitigation plan for the "chance find procedure" has been incorporated into the ESMP and is presented in Chapter 8 of this ESIA. Workers need to be trained in the use of this procedure. Cultural Heritage Monument Conservation Plan is attached as Annexure 6.5.

Mitigation Measures

- If any cultural remains of geologic or archaeological interests 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

6.4.3 IMPACTS DURING OPERATIONAL PHASE

During the operation stage, the main sources of environmental impacts are the increased traffic volume and speed. The increase in traffic volume and speed may enhance the safety risk especially in the rural area. No sudden change in the volume of traffic is expected due to this road as the road already exists and opened for public traffic. The project also provides opportunities for the restoration of vegetation around the vicinity of the worksite and roads by implementing the compensatory plantation programme, which will not only enhance the aesthetic view but can also help in reclamation of soil.

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 (ESS6) will improve local biodiversity, stabilize embankments, and enhance the corridor's visual aesthetics.

Various impacts during operation phase are discussed below:

6.4.3.1 Impacts on Water Quality and Resources

During the operation phase, the possibility of degradation of water quality is very remote. The impact on the surface water quality during operation can be expected due to accidental spillage. However, the probability of such accidents is minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are taken care of in the design stage.

6.4.3.2 Impact on Air Quality

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

5.4.3.3 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.

6.4.3.5 Impact on Ecology

During the operational phase, significant impacts on aquatic ecology are not anticipated; although the alignment crosses a river, appropriate mitigation measures such as sediment control, construction of temporary diversion structures, and proper wastewater management will minimize potential adverse effects.

To address the potential impacts on biodiversity, a comprehensive set of mitigation measures have been developed and incorporated into the ESMP.

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.

Out of the total road length of 37.485 km proposed for sub project road, approximately 35.62 km will be improved within the available ROW (10 m) and therefore will not require additional land. For the remaining road length which is 1.865 km, 0.6868 ha of land is required where the available ROW is insufficient to accommodate proposed road improvements. No additional Land is required for community infrastructure part of the FPIC agreement.

This land belongs to 8 Project Affected Households (PAHs) and involves partial loss of agricultural land affecting 42 PAPs although the agricultural land is not in use. No residential or commercial structures are impacted on this additional land, and therefore no physical displacement is anticipated. No additional land is required for community infrastructure under the FPIC agreement, as these facilities will be constructed within the available ROW.

The proposed Sub project will also require 0.53 ha of land for spoil disposal. The required land for spoil disposal side will be used temporarily and will be returned to the land Owner after project completion and after having redeveloped in accordance to the community/landowner requirements. The Consultants along with the officials of the PWD and members of the village community including the Rangbah Shnong jointly identified 4 locations for dumping of spoils. Details of Land requirement for proposed activities is given in Table 3.18.

A total of 22 PAHs comprising 124 Project Affected Persons (PAPs) are expected to be affected by the subproject. The impacts are largely partial and localized in nature, with no loss of primary residential structures.

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

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. 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.

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 UJ road alignment requires approximately, 0.6868 ha of additional land and is expected to affect 12 structures, most of which are located within the existing Right of Way (RoW). These impacts are largely partial in nature and include 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 available RoW.

6.5.2 CONSTRUCTION PHASE

Nature of Impacts

The construction phase is expected to generate mostly temporary social impacts. Construction activities may restrict access to residences, agricultural land, shops, and public facilities along the 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). 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.

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 CONSULTAION AND INFORMATION DISCLOSURE

This chapter presents an overview of the stakeholder consultations conducted as part of the Environmental and Social Impact Assessment (ESIA) for the proposed MLCIP. These consultations were intended to ensure a participatory approach in identifying and addressing potential environmental and social impacts of 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	Project Stakeholder
Project-Affected Parties	• Village community • Street side Shop Owners • Shop owners (NTH) • Residential structure owners • Dorbar Shnong
Interested Parties	Government agencies • Public Works Department Meghalaya • Khasi Hills Autonomous District Council (KHADC) • Meghalaya Forests & Environment Department • Meghalaya State Pollution Control Board (MSPCB) • Meghalaya State Biodiversity Board (MSBB) • Educational Institute Civil society organizations • Church-based Organisations (Presbyterian / Catholic Missions) – significant role in education, health, and social services across villages • Women's groups
Vulnerable groups	• Women Headed Household (WHH), • PAPs falling under Below Poverty Line (BPL), • Scheduled Tribe (ST) categories,

During ESIA, consultations were conducted with representatives from all relevant 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, 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 Institutions and Annexure 7.2 provides summary of consultation from project-affected parties.

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

Disclosed Stakeholder Engagement Plan link on MPWD website is https://megpwd.gov.in/pdf/2026/ESMF/Stakeholder%20Engagement%20Plan%20MLCIP.pdf

7.1 Public Consultation

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

7.1.1 Stakeholder Consultations

Stakeholder consultations 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
Local residents at Sonidan	22-08-2025	Male (6)	Strong community support; concerns on safety (streetlights), need for better road conditions, fair compensation, and issues related to hill cutting
Local residents at Mawpat	22-08-2025	Male (8)	Positive response; emphasis on road safety, maintenance, inclusive infrastructure, and fair compensation
Local residents at Mawshunam	22-08-2025	Male (5) Female (2)	Need for livelihood generation and skill development. Strong community support
Local residents at Sngahtyrkhang	26-08-2025	Male (4) Female (3)	Need for economic empowerment and targeted support for women. Need for livelihood generation and skill development.
Local residents at Umlaper	26-08-2025	Male (6) Female (2)	General support with focus on better connectivity and accessibility
Local residents at Umsiang	26-08-2025	Male (4) Female (2)	General support with focus on better connectivity and accessibility
PAH	30-09-2025	01 Nos	General support with focus on better connectivity and accessibility
PAH	30-09-2025	01 Nos	Environmental concern regarding tree cutting and preference for minimal land disturbance
FGD with Youth	19-09-2025	Youth (8 nos.)	Need for livelihood generation, skill development, and reduction in migration
FGD with Women	19-09-2025	Women (4 nos.)	Need for economic empowerment and targeted support for women

Stakeholders	Dates of Consultation	No of Participants	Summary of Key Feedback
FGD with Women	19-09-2025	Women (2 nos.)	Demand for women-centric development and community participation
Consultations held during FPIC for Priority Projects			
Community Members & Project Affected Households & Families	04, 19 September, 10 October, 9 December 2025	8 Consultations, 190 Nos., (Male – 155 Female – 35)	**Major key Agreements:** • 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

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 UJ 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 Rangbah Shnong, village councils, and community representatives. Consultations were conducted in the local Khasi 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 UJ 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 UJ 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 UJ sub-project.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT, MONITORING & 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. Environment and Social Management Plan is presented in Table 8.1.

Table 8.1: Environmental and Social Management Plan

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
		PRE-CONSTRUCTION					
1	Consents/ Permits/ Approvals/ Compliances	Regulatory Compliance	Non-compliance to various Environmental/ social/ regulatory requirements pertaining to the proposed project could lead to legal Implications	➢ Obtain all necessary statutory clearances (CTE, CTO, Labour License, Fire NOC, Tree Cutting Permission, 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 needs to 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	➢ RPF and RAP shall be followed. MPWD division, Village Council and concerned authorities shall coordinate implementation. Compensation records shall be maintained; grievances resolved. Civil works shall commence only after written confirmation from PMU/MPWD that RAP compensation, assistance, and site handover have been completed for the relevant stretch.	MPWD division, contractor and concerned authorities	Compensation records maintained; Grievances resolved	MPWD/CSC/NGO
3	Preparation of Works Methodology		Inadequate preparation and implementation of	➢ The contractor needs to follow the project ESMP to formulate the CESMP aligned with its work methodology.	Contractor	Approved CESMP including TMP, LMP and other	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
	Contractor's ESMP (CESMP)		CESMP by Contractor can leave environmental and social issues unattended	➢ 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.		relevant plans, and implemented;	
4	Identification of land for material storage yard/ construction camp/ labour camp	Landuse and ecology	Discharges from Yards/ Camps to pollute the surroundings and lead to social tension.	➢ 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 activities, once the project is completed. ➢ Contractor to produce the lease agreements, NOC etc. for these lands. ➢ 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).	Contractor	Approved site location; Lease/NOC copies;	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				➢ Prohibit hunting, fishing, or collection of forest produce by workers. ➢ Awareness and sensitization of laborers on local wildlife and birds. ➢ The guidance for the preparation, construction and operation of the labour camp shall comply with the World Bank Group[8] Guidance on Labour Accommodation			
5	Supply of Construction Material	Physiography	Sourcing materials from unauthorized sources.	➢ The Contractor will submit the EC, CTE, CTO of the aggregate and sand quarry to the PMU for the approval at the beginning of the project. ➢ Procurement of construction material only from approved quarries and sites and licensed/ authorized vendors/ manufacturers. ➢ Contractor to produce approvals and receipts of the payment of royalty for all the material procured along with the bill / IUFR.	Contractor	EC, Permits, challans, Material source approval copies;	MPWD/CSC
6	Water	Groundwater and Surface Water	Abstraction and Pollution of surface and groundwater sources.	➢ The Contractor will be responsible for arranging adequate supply of water for the entire construction period. ➢ In case of own borewell the Contractor shall obtain a permission of abstraction form CGWB/ SWID. ➢ He shall arranged for a meter to be fixed at	Contractor	Permission for Water source; Usage records; Wastewater management measures	MPWD/PMC/CSC

[8] Workers' accommodation: processes and standards

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				the bore well and the log of the water extracted will be maintained. ➢ Measures suggested in the permission will also be maintained ➢ The contractor will minimize the pollution and wastage of water during construction. The labour camp shall be provided with adequate number of toilets as specified in BCOW Act/ WBG Guidance on Labour accommodations. The toilets have to be provide with soak pits, septic tank or be linked to a mobile treatment unit. Bio-toilets can also be considered as an option ➢ The Construction Camp, Construction material storage yard will be provide 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	➢ 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 tram shall be responsible for the preparation of the Plans and	Contractor	To be mobilized before construction; approved OHS plan	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
			safety.	also obtaining the statutory permits.			
8	Identification of OHS Hazard and Risk Categorization	Occupational Health & Safety	May cause physical harm, injury, illness, or death to workers.	➢ Develop a site specific Hazard Identification and Risk Assessment (HIRA) and develop mitigation measures. The Contractor shall prepare an OHS Plan containing the HIRA and submit it as part of the Work Plan and Methodology. The Work Plan shall be approved only when the OHS Plan is satisfactory. ➢ Arrange for PPE (helmets, safety shoes, high-visibility vests, gloves) to all workers. ➢ Develop tie up with local Hospital for Health Checkups of labours and also to handle to any accident cases. ➢ Ensure proper sanitation, adequate potable water (minimum 5 litres per person per day), and waste disposal facilities in camps. ➢ Consulting with workers to identify hazards that may not be obvious to employers or safety professionals. ➢ Reviewing safety data sheets (SDSs) to collect information about the hazards of chemicals and other substances used in the workplace.	Contractor	OHS hazard register; Inspection reports;	MPWD/CSC
9	Other	Pollution	Vehicles and	➢ The contractor will maintain records of fitness and Pollution Under Control (PUC) certificates	Contractor	Records of valid	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
	Construction Vehicles, Equipment and Machinery	Management	equipment not complying with regulations may lead to pollution of environment.	for all vehicles and generators used during the contract period. These certification shall be renewed and always maintained. The certificate shall be submitted with the IUFR's (if necessary) ➢ All lifting should have the appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144. ➢ Engage trained personnel for operating machinery and working at height or confined spaces. ➢ Crushers, hot-mix and batching plants shall be located at least 1000m (1km) away from residential/ settlements, forests, wildlife movement areas, and commercial establishments, preferably in the downwind direction. ➢ The crushers, batching plant and all other equipment shall meet the specifications which are likely to be mentioned by MSPCB in the consent. .		PUC / fitness; Inspection log	
10	Tree Cutting	Ecology	Loss of green cover and biodiversity	➢ Maximum efforts shall be made to minimize the number of trees to be felled. ➢ The requirement or specifics to fell trees shall be notified to the Forest Department in advance. ➢ Tree felling shall only be carried out when	Contractor	Records of trees cut and saved.	MPWD/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				permission has been obtained from the Forest Department. ➢ Tree cutting and disposal shall be done as per the Forest Dept.			
11	Joint field verification		The impacts may not have been identified in time.	➢ The MPWD and the Contractor shall carry out joint field verification to ascertain the local complaints/suggestions and to confirm the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the ESMP. The MPWD shall maintain proper documentation and justifications/reasons in all such cases.	Contractor	Verification reports;	MPWD
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	➢ 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	Contractor	Borrow area EC copy; Approved management and closure plan	MPWD /CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				Environmental Clearance for borrow areas. ➢ The borrow area will be operated as per the MoEFCC guidelines[9] issued by the concerned SEAC and SEIAA.			
13	Identification of construction material transportation route	Community Health and Safety	Inconveniences and safety issues to the public due to the material transport vehicles.	➢ 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. ➢ The local communities need to be consulted with prior information on any likely inconveniences.	Contractor	Approved route plan; Community consultation record	MPWD/CSC
14	Identification of sites for debris disposal or wastes generated from construction camps and site offices	Land and Water environment	Pollution due to indiscriminate dumping of wastes. Wastes entering water bodies and groundwater causing pollution	➢ MPWD Division and the Contractor are responsible for identifying a suitable area in consultation with local administration to dispose of the wastes from labour camps, construction sites and site offices. ➢ The locations of dumping sites should be selected with following considerations i) Unproductive/wastelands preferred , ii) away from residential areas (at least 1km downwind side), iii) are not designed forest or other eco-sensitive areas, Iv) do not affect natural drainage courses , v) no endangered/rare flora is impacted vi) are not lowlands, natural depressions which	Contractor	Approved disposal site and its management plan; NOC, Agreement with landowner; Waste disposal records;	MPWD/CSC

[9] https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/1001_19032025024958.pdf

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				are natural sinks ➢ Drainage channels should not be used for dumping ➢ Local Authorities should be consulted about the location of debris disposal sites before finalizing the locations. ➢ The topsoil of 15cm shall be removed before any works are carried out Reuse topsoil for slope stabilization and landscaping. ➢ Dispose of debris only at approved low-lying barren areas located at least 1 km downwind of settlements and away from drainage channels. ➢ Avoid dumping in water bodies, wetlands, or near agricultural fields. ➢ Regularly monitor disposal sites to prevent contamination and visual pollution.			
15	Relocation of Utility and Common Property Resources (CPR)	Utility Service	Loss of services from utilities and common property resources for the public	➢ When the utilities/ Common Property Resources need to be shifted, they will be shifted in consultation with the communities and with least inconvenience to the public. ➢ If any displacement of Utility/CPRs is required, they will be relocated with prior approval of the concerned agencies. The relocation site identification will be in accordance with the choice of the community. ➢ Restrict utility shifting to daytime hours to avoid safety risks at night. ➢ The scheduling of the construction works will be shared with the line department (MePDCL, PHE and Telecom Departments) for ensuring uninterrupted services during construction.	Contractor/ MPWD Division	Records of Relocation completion.	MPWD/ PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				➢ 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	➢ Make arrangement for New Jersey barriers/ Water filled barrier, MS steel barricades (2 m high) , signage, and warning lamps at work sites. ➢ Prepare a Generic Community Health and Safety Plan (CHS Plan) along with the Work Methodology and Work Plan. The Work Plan should not be approved without an approved CHS Plan. ➢ Schedule high-risk activities during off-peak hours to minimize traffic congestion. ➢ Develop posters for Community Awareness. Conduct community awareness campaigns before any temporary road closure or service disruption. ➢ Every RFI should be accompanied with a site specific OHS, CHS and Traffic Safety Plan, which should define the site-specific measures which were implemented. Without these plans being implemented the works should not be approved.	Contractor	Community Health Safety Plan	MPWD/PMU
CONSTRUCTION							
1	Crushers, Hot mix Plants &	Air Pollution	Impacts due to establishment and	➢ The Contractor shall submit a detailed layout plan for all such sites and seek prior approval before entering into a formal agreement with a	Contractor	Approved layout plan; Valid	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
	Batching Plants		operation of plants and equipment	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 emissions have 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.		NOCs/Consents; Dust suppression records; Air quality monitoring reports	
2	Operation of Borrow Areas	Topsoil and land	Impacts due to improper operation and closing of borrow areas	➢ Borrow areas shall be selected as specified in the guidance in The Contractor should submit the EC, a copy of agreement with the landowner, borrow area management and closure plan before initiating any kind of borrowing activities. ➢ The Borrow are should comply with the conditions set in the EC/ SoP from MoEF&CC. ➢ 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 MoEF&CC 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	Contractor	EC and lease copies; Approved Borrow area restoration and Closure plan	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				construction; and ➢ Prohibit disposal of topsoil at dumping sites.			
3	Operation of Quarries	Physiography and Geology	Impacts due to improper management, operation and closing of quarries	➢ The Contractor shall only source material from quarries approved by PMU(indicated in the Pre-Construction stage) ➢ The challans for the royalty paid against the material used shall be included in the IUFR / Bills submitted for payments. ➢ In case of new quarry fo the project the Contractor has to obtain EC and other relevant permits and licenses. ➢ Incase 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.	Contractor	Quarry permit, EC; Safety inspection report; Haul road maintenance record, dust suppression measure, geotagged photos	MPWD/PMC/CSC
4	Dismantling of Bridges/ Culverts/ Structures, Hill Cutting	Landuse and Land quality	Impacts due to improper dismantling and disposal	➢ All necessary precautions shall be taken while working near cross-drainage channels, to prevent earthwork, stonework, construction materials from obstructing cross-drainage at rivers, streams, and drainage systems, or from causing flooding. ➢ Any material which have 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	Contractor	Debris disposal/reuse records; Approved Site restoration plan; Photographic documentation.	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				removed by end of day the and shall be demarcated with, crash barrier and traffic safety beacons. However, such sites cannot be left for more than 2 days. ➢ Reusable materials (e.g., steel, stones, 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. ➢ The site should incorporate proper retaining structures, such as toe walls and catch drains, to prevent sliding and erosion.			

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				➢ Adequate drainage must be provided through surface and subsurface channels to control runoff. Temporary barriers or silt fences shall be provided to prevent debris from entering watercourses. ➢ Muck should be deposited in layers, compacted, and stabilized using vegetation or geo-textiles to minimize dust and erosion. ➢ Access roads should be provided to ensure safe transport of muck, and the site should be fenced and clearly demarcated. ➢ Upon completion, the associated disposal sites shall be restored to their original condition or as directed by the Engineer			
5	Road scraping and dismantling	Bituminous waste disposal	Impacts due to hazardous wastes	➢ The contractor shall maintain records of quantities generated, transported, and disposed of, along with details of the disposal site and approvals obtained. ➢ Bituminous waste shall be collected and stored temporarily in impermeable, lined containers or areas to prevent leaching or contamination of soil and groundwater. ➢ Scrapped Bituminous Material shall be reused in asphalt mix design/ subbase, strengthening of shoulders as directed by CSC. other lower order roads ➢ 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	Contractor	Records of Waste reused/disposed; Details of approved disposal site; Photographic documentation.	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				➢ Periodic inspections shall be carried out to ensure compliance with waste management guidelines. ➢			
6	Storage of Fuel and Repair of vehicles	Soil pollution due to Oil and fuel spills from construction equipment and plants or storage of Hazardous waste.	. Contamination of Soil	➢ Construction plants, workshops, and fuel storage areas shall be located at least 500 m away from any surface water body and environmentally sensitive locations. ➢ Oil interceptors shall be installed at construction camps, vehicle parking, and washing areas to trap oil and grease before wastewater is discharged. ➢ All fuel and lubricant storage tanks shall be placed on impermeable platforms or within bunded (contained) areas. ➢ The Storage area should be covered and have restricted access ➢ The area should be bunded to contain 110% of the capacity of storage. ➢ The area should be provide 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	Contractor	Spill log; Waste oil disposal records; Fuel storage inspection record. Photographic documentation.	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				available for inspection. ➢ Stormwater runoff from fuel and equipment storage areas shall be directed through oil-water separators before discharge.			
7	Operation of Plant , Machinery and equipment	Generation of Hazardous Waste	Contamination of land and soil	➢ Used oil and lubricants shall be collected, stored in labelled, leak-proof containers, and handed over only to authorized aggregators/recyclers for disposal in compliance with applicable hazardous waste regulations. ➢ Records of waste oil generation and disposal shall be maintained and made available for inspection. ➢ Returns shall be submitted to comply with the Hazardous Waste Permit.	Contractor	Hazardous waste permits, records and returns	PMC/CSC
8	Operation of Vehicles and earthwork during construction	Air Pollution - Dust Generation	Dust generation will cause air pollution and will have impacts on health and safety.	➢ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ➢ Water should be sprinkled regularly (3 time a day) on the work sites. ➢ Plying of vehicle on unpaved surface should be prohibited. ➢ Speed limits shall be enforced for construction vehicles within and near project sites to reduce dust generation. ➢ Personal protective equipment (PPE) such as masks shall be provided to all workers exposed to dusty environments. ➢ Air quality monitoring shall be conducted periodically to ensure compliance with prescribed air quality standards. ➢ Community complaints related to dust shall be recorded, and addressed promptly. ➢ The Contractor should keep records of	Contractor	Air quality monitoring reports; Dust suppression log; PPE compliance records	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				community grievances due to dust, runoff separately and mitigations adopted.			
9	Operation of Vehicles, plant, and machinery	Emissions	The emissions from vehicles and construction equipment will pollute the air causing health and safety issues as well.	➢ Fitness and PUC of the vehicles and equipment's need to be ensured. ➢ Maintain all equipment and vehicles regularly; prohibit use of old or poorly maintained machinery; use low-sulphur fuel ➢ 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.	Contractor	Valid PUC certificates; Equipment maintenance log; Emission test results	MPWD/PMC/CSC
10	Operation of construction Camp and construction activities	Contamination of Surface / Ground Water	Discharges from construction activities and construction camps/ labour will lead to surface/groundwater pollution.	➢ All the debris resulting from construction activities and labour camp shall be removed from the site and disposed at approved sites (by CSC/ PMC/ PMU) away from water bodies, on a regular basis to prevent them from getting into surface runoff. ➢ The Contractor shall maintain the sanitation facility in good conditions. Covered and enclosed facility shall be provided for washing and bathing. ➢ The sanitation facility and waste management facility to be shall be maintained in construction camp. ➢ Construction labours should be restricted from polluting the water sources or misusing the sources. ➢ Bentontie slurry is prohibited during piling work.	Contractor	Water quality monitoring report; Waste disposal records; Camp inspection records. Photographic documentation.	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				➢ Any slurry used in piling works should be in closed systems. It should not be allowed, to enter waterways. The residual slurry shall only be disposed of in lined pits, It should not be dumped near agriculture lands. ➢			
11	Air Quality	Deteriaoration of Air Quality	Emission	➢ LPG shall be used as fuel for cooking of food at construction labour camp instead of fuel wood. ➢ DG sets should meet the specification mentioned by CPCB from time to time			
12	Sourcing Water for project	Surface Water resources	Over extraction or exploitation of ground/surface water will lead to water scarcity.	➢ Contractor to ensure optimum and judicious use of water; ➢ The Contractor shall install and keep the water meter running at the point of extraction, main consumption areas. A log of water abstraction and ➢ Discourage labour from wastage of water and applicable prior approvals shall be obtained from concerned authorities. ➢ Rainwater harvesting structures shall be installed at construction camps and plant sites to promote sustainable use of water. ➢ Awareness programs shall be conducted for laborers and staff on responsible water use and conservation practices. ➢ Records of daily water consumption shall be maintained as part of regular reporting.	Contractor	Water consumption log; Permission for water source; Installation of Rainwater harvesting structure	MPWD/PMC/CSC
13		Coffer dam to make dry	Change in the flow pattern and quality	➢ Selecting the right location for the cofferdam to minimize its impact on the environment. ➢ Using environmentally friendly materials to construct the cofferdam eg. Biodegradable/	Contractor	Worksite inspection record;	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
		working space for bridge work	of water, effect on local habitat	reusable materials can be used instead of concrete. ➢ Restoring the environment after construction. This may involve replanting vegetation and removing any debris.		Restoration completion record	
14	Operation of Vehicle , Plant and Machinery	Noise	Noise from construction vehicles, plant and equipment will lead to noise pollution and cause health and safety issues	➢ Staging of construction equipment and unnecessary idling of machinery within noise-sensitive areas shall be avoided wherever possible. ➢ All plants and equipment used in construction (including third-party units) must conform to 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	Contractor	Noise level test report; PPE usage record; Complaint register; vehicles, plants and equipment maintenance records.	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				construction sites as per the approved monitoring schedule, and results shall be submitted to the Project Management Consultant (PMC) and Project Management Unit (PMU) for review and compliance verification.			
15	Operation of DG Sets	Noise and Air	Noise	➢ The contractor must use silent DG sets as prescribed by the Central Pollution Control Board (CPCB). ➢ If a silent DG set is not available, noise shall be controlled by providing an acoustic enclosure or acoustically treated housing. ➢ The acoustic enclosure shall be constructed with suitable materials of adequate thickness, supported by a structural or sheet-metal base, and insulated with fire-retardant acoustic foam. ➢ The acoustic enclosure/acoustic treatment shall be designed to provide a minimum 25 dB(A) insertion loss or to meet ambient noise standards, whichever is higher. ➢ Each DG set shall be provided with a proper exhaust muffler to further reduce noise emissions. ➢ The DG set shall be properly sited to minimize its noise impact beyond the premises, ensuring compliance with ambient noise standards at the nearest receptor. ➢ A routine and preventive maintenance schedule shall be prepared and followed in consultation with the DG set manufacturer to ensure that noise levels do not deteriorate			

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				with use.			
16	Tree Felling	Loss of trees and Plantation works	Cutting of trees can lead to loss of biodiversity.	➢ No tree felling should be carried out without permission of the Forest Department, GoMM. ➢ 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
17	Removal of Vegetation	Terrestrial Flora and Fauna	Construction activities and workers may cause harm to flora and fauna.	➢ All the workers will need to be oriented and monitored by the contractor so as not to cause any harm to the flora and fauna. ➢ Hunting and fuel wood collection will be strictly prohibited	Contractor	Worker awareness attendance; Wildlife sighting log	MPWD/PMC/CSC
18	Discharges from Construction	Aquatic Fauna	Construction activities and workers may cause harm to fauna.	➢ 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 ➢ Any works affecting aquatic habitat will be	Contractor	Work timing records; Site inspection checklist	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				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.			
19	Construction Activities	Occupational Health and Safety	When Occupational Health and Safety are compromised the associated risks from accidents and incidents could affect health and safety of the workers and others on constriction/ project sites. Improper first aid facilities on the sites could affect health and safety of workers and others.	➢ The Contractor would prepare OHS plan and other required plans as per the WBs guidelines. ➢ All the laborers 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 and their use shall be ensured. ➢ All construction sites should be barricaded properly. ➢ Smoking should be prohibited near areas of fire or explosion risk. ➢ Sufficient supply of potable water should be	Contractor	Approved OHS plan; OHS training log; PPE checklist; Awareness programme and Health inspection reports	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				ensured for all workers and employees on-site. ➢ Ensure a First Aid room at the camp and first aid kits is 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.			
20	Community Health and Safety	Community Safety	The safety aspects like (i) safety of road users including pedestrians and cyclists (ii) safety of cattle; (iii) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the construction stage. Children are most vulnerable to	➢ Plants and equipment will be installed sufficiently away from the settlements. ➢ Proper caution signage, barricading, delineators, lightings etc. will be installed at construction zone and temporary diversions. ➢ Hard barricading will be provided at construction zone near habitation area and public roads, and the same will be maintained throughout the construction period. ➢ Proper traffic management will be ensured near roads of the Construction zone. ➢ Road safety education will be imparted to drivers running construction vehicles. In case of negligent driving, suitable action will be taken. ➢ Speed restrictions shall be imposed on project vehicles to control speeding. ➢ Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/	Contractor	Safety signage installed; Community complaint register; Traffic control records	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
			injury due to vehicular accidents.	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.			
21	Emergency Response system	Emergency Response system	Absence may result to increased incidents, injury, economic loss etc.	➢ Develop and implement ERS ➢ Train personnel and Establish communication channels ➢ Systematic planning and training for emergencies.	Contractor	Approved ERP; Emergency drill and training report; Incident response record	MPWD/PMC/CSC
22	Health Management	Health Management – Communicable Diseases	The water fringe areas provides suitable habitats for the growth of vectors of various diseases, which is likely to increase the incidence of water-borne diseases.	➢ There would be possibility of the transmission of communicable diseases due to migration of labour population from other areas at the construction site. ➢ Agreement shall be made with nearby health centre or hospital for emergency treatment. ➢ Special Measures for COVID 19 should be strictly followed at the camp and construction site.	Contractor	Health screening record; Awareness session log; Medical report; Agreement with nearby hospital	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
23	Risk of Natural Hazards	Risk of Natural Hazards	The project area is at risk from floods and Earthquakes.	➢ Protection of Agriculture Land near roads/ bridges. ➢ The mitigation measures should be adopted as per norms of State Disaster Management Authority, Government of Meghalaya.	Contractor	Site assessment report; Record of Compliance with SDMA norms	MPWD/PMC/CSC
24		Risk of Force Majeure Combine with previous	These unforeseen risks can have both adverse environmental and social impacts	➢ All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. ➢ 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		Hygiene	Impacts related to unhygienic surroundings	➢ At every workplace, good and sufficient water supply shall be maintained to avoid waterborne diseases to ensure the health and hygiene of workers. ➢ Adequate drainage, mobile toilets shall be provided at workplace. ➢ Preventive Medical care shall be provided to workers. ➢ Proper Hygiene shall be maintained	Contractor	Sanitation inspection record; Hygiene logbook	MPWD/PMC/CSC
26		Traffic Management	Unplanned and unmanaged traffic diversion and detours can result in public nuisance.	➢ Before start of the construction, proper traffic management plan will be prepared and submitted to MPWD for approval. Secure assistance from local police for traffic control during the construction. ➢ Necessary signage and barricading will be provided for safety of road users. ➢ Contractor will ensure that no construction materials and debris are lying on the road. It	Contractor	Approved TMP; Signage/barricade checklist; Traffic incident register; geotagged photos	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				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 centers. ➢ The contractor will ensure that the diversion/ detour is always maintained in running conditions, particularly during the monsoon to avoid disruption to traffic flow.			
27		GBV-SEAH Risks	GBV-SEAH risks may arise due to labor influx	➢ Ensure labor camps are away from settlement areas ➢ Ensure that every worker working in the project has been given an orientation on the Worker's Code of Conduct, especially on GBV and SEAH, and has signed the Code of Conduct. ➢ Conduct periodic awareness programs targeted at women laborers 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.	Contractor	Signed CoC register; GBV training log; GBV complaint record	MPWD/PMC/CSC
28	Works carried out near the Archeological	Chance Finds	There is a possibility of Cultural relics, Chance finds at the	➢ If any cultural remains of geologic or archaeological interest are found, Stop work immediately. ➢ CSC and MPWD shall be immediately informed	Contractor	Chance find report; Notification	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
	Properties or chance finds		construction sites. Without proper plan these artefacts may be misused by contractor/ workers.	of such discovery and carry out the instructions for dealing with the same		records	
29	Engagement of labour	Compliance to Labour Welfare Laws and reporting	Workplace accidents and injuries, unsafe working condition, loss of productivity etc.	➢ Establish a policy and ensure the compliance within the organization, from the top to the lowest-level employee, understands the importance of complying with labour laws and reporting. ➢ Employees should be trained on their rights and responsibilities under labour laws. ➢ Employees should have a way to report violations of labour laws without fear of retaliation. This could be a hotline, an email address, or a suggestion box. ➢ 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	Labour law compliance record; Training attendance record	MPWD/PMC/CSC
30	Engagement of Labour	Labour Influx	Strain on infrastructure, such as housing, healthcare, and education;	➢ 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.	Contractor	Labour License and registration records; Local labour hiring records.	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
			social tension, as new arrivals compete with locals for jobs and resources.	➢ Maximum use of local labours			
31	Site-specific stakeholder engagement and consultation	Community participation, transparency, and inclusion of affected persons, including Indigenous communities (FPIC compliance)	Lack of information sharing, unresolved grievances, and reduced community participation in project activities	➢ Establish and implement a structured system of regular consultation meetings at the site level in line with ESS10 and FPIC requirements under ESS7. ➢ Conduct meetings at least twice a month with PAPs, traditional leaders, women and youth groups, and local institutions. ➢ Share project information, discuss construction-related impacts, review implementation of mitigation measures, and address concerns through the GRM. The process will also be used to track adherence to agreed FPIC commitments and ensure culturally appropriate engagement throughout project implementation.	Contractor/ CSC/ PWD	Meetings conducted per month Attendance records with representation of Indigenous communities, women, and vulnerable groups Number of issues raised and resolved Availability of documented meeting records (MoMs)	MPWD/ PMC
32	Grievance Redressal	GRM	Increased impunity, conflict and violence; Loss of trust and confidence	➢ Establish a grievance redressal mechanism ➢ Ensure that the mechanism is impartial and independent ➢ Provide adequate support to people who use the mechanism ➢ Communicate effectively with people about	Contractor	GRM register; Grievance resolution records	MPWD/PMC/CSC

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
				the mechanism			
33	Monitoring and Reporting Mechanism	Monitoring and Reporting (Monthly/ Quarterly)	Monitoring environmental attributes like (Air, Water, Noise & soil microbiology) and proper reporting are important for the successful ESMP implementation	➢ The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per Monitoring Plan prepared. ➢ Regular submission of CESMP implementation monitoring report	Contractor	Monthly/quarterly ESMP compliance report; Monitoring data records	MPWD/PMC/CSC
Operation Phase							
1		Debris and Waste from Clearing/ Closure of Construction Site, Labor Camps, Disposal Sites, and Borrow Areas	Land and soil contamination due to improper waste disposal; Aesthetic degradation; Health risks to nearby communities	➢ Contractor shall prepare and implement a Site Restoration Plan approved by the Engineer. ➢ On completion of works, all temporary structures, debris, and wastes shall be cleared. ➢ Disposal pits and sanitation trenches shall be filled, compacted, and sealed. ➢ Topsoil removed during construction shall be re-spread to aid vegetation regrowth. ➢ Native grass or trees shall be planted to stabilize restored areas and improve aesthetics.	Contractor	Site clearance restoration records and closure NOC; Geotagged photos	MPWD
2		Soil Erosion due to Runoff over Steep	Loss of fertile topsoil; Siltation of nearby water bodies;	➢ Regularly inspect slopes and embankments for erosion signs. ➢ Implement bioengineering measures like turfing, and vegetation planting. ➢ Provide stone pitching, retaining walls, or	Contractor	Reports on Erosion inspection; implementation	MPWD

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
		Slopes and Embankments	Slope instability or road damage	gabions where needed. ➢ Maintain effective drainage systems to reduce concentrated runoff.		of mitigation measures; Drain maintenance log	
3		Water Pollution from Road Runoff and Drainage into Water Bodies	Deterioration of surface and groundwater quality; Sediment and oil contamination in nearby streams or waterbodies	➢ Conduct regular water quality monitoring during operation phase. ➢ If pollutants exceed prescribed limits, install silt traps, or sedimentation chambers. ➢ Ensure roadside drains are cleaned and desilted regularly. ➢ Conduct public awareness to discourage waste disposal into water bodies.	Contractor	Water quality monitoring results; Drain cleaning records	MPWD
4		Dust Generation from Vehicular Movement	Deterioration of ambient air quality; Nuisance to roadside residents and vegetation; Reduced visibility	➢ Establish and maintain roadside plantation to serve as dust barriers. ➢ Maintain smooth road surfaces to minimize dust generation. ➢ Install signage discouraging over-speeding, which increases dust levels.	Contractor	Air quality results; Plantation survival record	MPWD
5		Air Pollution from Vehicular Emissions	Increased levels of NOx, SO_2, CO, and PM; Health impacts on local population; Deterioration of roadside vegetation	➢ Conduct ambient air quality monitoring at sensitive locations. ➢ Maintain green buffers along the corridor. ➢ Organize awareness campaigns for drivers on emission reduction and vehicle maintenance.	Contractor	Air quality results; Plantation survival record ; Awareness records	MPWD
6		Noise Pollution	Noise nuisance to	➢ Conduct periodic noise level monitoring. ➢ Provide noise barriers, dense plantation near	Contractor	Noise monitoring	MPWD

Sl. No.	Activity	Environmental/ Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
		from Increased Traffic Movement	residents; Disturbance to schools, hospitals, and wildlife	sensitive receptors. ➢ Enforce "No Horn" zones near schools and hospitals. ➢ Maintain road surface to minimize noise due to uneven pavement.		results; Maintenance records	
7		Road Safety and Accident Risks	Traffic congestion; Increased likelihood of road accidents; Risk to pedestrians and local communities	➢ Install and maintain proper signage, reflectors, and road markings. ➢ Ensure adequate lighting at intersections and pedestrian zones. ➢ Provide speed control measures and pedestrian crossings in settlement areas. ➢ Conduct community road safety awareness programs.	Contractor	Accident record; Safety audit report; Awareness records	MPWD
8		Maintenance Waste from Roadside Maintenance, Drain Cleaning, or Repairs	Soil and water contamination from indiscriminate disposal; Visual pollution and clogging of drains	➢ Collect and dispose of maintenance waste at designated locations. ➢ Prohibit dumping into drainage channels or low-lying areas. ➢ Reuse or recycle suitable materials (e.g., asphalt, concrete, metal).	Contractor	Waste logbook; Disposal reccords	MPWD

8.3 Performance Indicators

Environmental and social components identified in affecting the environment and social conditions at critical locations have been suggested as performance indicators (PIs). For example, near the construction site, a thick layer of dust over the nearby vegetation/leaf is an indication that the dust control measures are not effective. The performance indicators shall be evaluated under three heads as;

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

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

8.4 Monitoring Plan for Environmental Conditions

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

For each environmental condition, the Monitoring Plan specifies the parameters to be monitored, the locations of monitoring sites, and the frequency and duration of monitoring. It also outlines the applicable standards, as well as the responsibilities for implementation and supervision. The Monitoring Plan, along with details of monitoring locations for environmental condition indicators during the construction and operation stages of the project, is presented in Table 8.2.

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)	4 locations for 3 Seasons* for 3 consecutive years	24 hours sampling	4 locations (Construction Plant Sites, settlements and Work Zones)	36	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			4 locations for 3 Seasons for 1 year.		At 4 locations during operation stage where monitoring had been done during construction stage	12	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
Water	Construction	As per Drinking Water Standards	Indian standards for inland surface waters (IS:2296,1982) and for drinking water (IS:10500-2012)	(surface water at 2 locations for 3 Seasons for 3 consecutive years. Ground water at 4 locations for 3 seasons for 3 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.	54	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			Surface water 2 locations for 3 Seasons for 1 year. Water (Ground water) at 4 locations		At locations where monitoring had been done during construction stage	18	Contractor through NABL accredited Laboratory and supervised by Construction

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
				for 3 Seasons for 1 year.				Supervision Consultant
Noise	Construction	Noise Levels on dB (A) scale	Noise rules 2000 by CPCB	4 locations for 3 Seasons for 3 consecutive years.	Leq in dB(A) of daytime and night-time	Near the working zones, sensitive receptors and construction plant sites.	36	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			4 locations for 3 Seasons for 1 year.		At 04 locations during operation stage where monitoring had been done during construction stage	12	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'	4 locations for 3 Seasons for 3 consecutive years.	Grab Sampling	Soil at 4 locations 3 times a year for 24 Months	36	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			4 locations for 3 Seasons for 1 year.		During operation stage where	12	Contractor through NABL accredited Laboratory and supervised by

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
						monitoring had been done during construction stage		Construction Supervision Consultant

*Except Monsoon

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

Table 8.3: Social Monitoring Plan

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

		and resolution status; labour camp inspection compliance; OHS training coverage (%)		
Community Health & Safety	Contractor / CSC / MPWD	• Number of accidents/incidents affecting communities; traffic safety compliance; public safety measures at worksites; access-continuity complaints recorded/resolved; safety compliance near settlements/schools	Beneficiary tracking	Quarterly
Social Inclusion & Gender Stakeholder Engagement & Grievance Redressal	RAP Implementation consultant/ Contractor/ MPWD RAP Implementation consultant/ Contractor/ CSC/MPWD	• Participation of women in consultations and % of women engaged in livelihood activities • SEA/SH awareness training coverage (% workers trained) • Percentage of women among total project workforce, disaggregated by skilled, semi-skilled, and unskilled categories. • Data of average daily wages paid to women and men for comparable work (wage parity index) • Number of days women are engaged compared to men in similar roles. • Growth in women's income due to project participation. • Reduction in women's migration days (if they previously migrated for work). • Number of women gaining new market-oriented and employable skills. • Number of women accessing government schemes, agricultural interventions, or entitlements. • Improvement in women's asset ownership (productive and	Beneficiary tracking, Consultation records	Bi-annually

		household assets). • Percentage of women trained under the project, disaggregated by road safety training, livelihood enhancement training, and project-related technical or non-technical skills. • Percentage of women participants in stakeholder consultations, including consultations with Indigenous Peoples and FPIC processes where applicable under ESS7. • Percentage of women beneficiaries reporting improved mobility, perceived safety, and access to essential services, measured through periodic beneficiary feedback surveys. • Number and percentage of GBV/SEA/SH-related grievances received, resolved, and resolved within the stipulated timeframe, disaggregated by complainant gender and grievance type. • Increase in women's participation and leadership in local institutions and decision-making processes (membership, management roles, committees, etc.). • Improvement in women's representation in consultations and project-related decision forums.		
		• No. of community consultations held	GRM logs	Quarterly
Indigenous Peoples & Cultural Heritage	RP Implementation consultant/	• % of grievances resolved within timeline; average	Meeting records, video/audio	Ongoing

Indigenous Peoples & Cultural Heritage	Contractor/ MPWD RP Implementation consultant/ Contractor/ MPWD	grievance resolution time • Summary of affected IPs by impact type, gender, age, village, income, status, and household vulnerability including female-headed households. • Documentation of consultations with Indigenous communities and traditional institutions, FPIC meetings & community agreements • Number of meaningful consultations with IP, trainings, and IEC materials (e.g., brochures, flyers) disseminated. • % of IP women participants; vulnerable IPs attending • Documentation of negotiation process, participants, locations, and correspondence. • Evidence of broad support from community records of process, participants, and agreements. • Whether consultations were inclusive, gender-sensitive, free from coercion, and respectful of IP customs and languages.	evidence Site inspections, community feedback	Annually
Supply Chain/ Contractor Compliance	Contractor/ PMC/ CSC/ MPWD	• Confirmation of no child labour or forced labour in supply chain; contractor ESMP compliance reporting	Contractor audits, compliance reports	Annually
SEA/SH Risk Management	Contractor / PMC/ CSC / MPWD	• SEA/SH Code of Conduct compliance; SEA/SH complaints recorded and referred through survivor-centred GRM; SEA/SH awareness sessions conducted • Risks of SEA/SH to community members, particularly women and children by contractors'	Training records, GRM records, supervision reports	Quarterly

		workers during construction period; • Risks of workplace SH at all establishments by co-workers under the project		

8.6 Environmental And Social Management Plan Budget

An amount of Rs. 3,39,33,896, have been marked for ESMP budget. The detailed budget for the same have been presented in Table 8.4.

Table 8.4: Environmental and Social Management Plan Budget

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
A.	Monitoring Measures						
1	Air quality monitoring	Construction	No.	36	9,000	3,24,000	Civil works contract
		Operation	No.	12	9,000	1,08,000	Civil works contract
2	Noise levels monitoring	Construction	No.	36	3,000	1,08,000	Civil works contract
		Operation	No.	12	3,000	36,000	Civil works contract
3	Soil quality monitoring	Construction	No.	36	6,000	2,16,000	Civil works contract
		Operation	No.	12	6,000	72,000	Civil works contract
4	Ground and Surface Water	Construction	No.	54	7,000	3,78,000	Civil works contract
		Operation	No.	18	7,000	1,26,000	Civil works contract
	Subtotal (A)					13,68,000	
B.	Capacity Building						
1	EMSP implementation (1 days)	On Award of Contract	lump sum			Included in project safeguards capacity building	PIU Cost

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
2	Plans and Protocols Orientation (1 day)	At Beginning of Construction	lump sum			Included	PIU Cost
3	Experiences and best practices sharing	Once every Year for 2nd yr, 3rd yr , 4th yr , 5th yr	lump sum			Included	PIU Cost
4	Contractors Orientation to Workers on ESMP implementation and refresher program	Once every year or as directed by the PIU	Lump sum			Included	Civil works contract
5	Water Sprinkling Measures for Dust Suppression	Construction	Trips	No of trips to be decided by the Contractor (work areas and haul roads to be sprinkled as two times every day or as directed by the Engineer)	-	0	Civil works contract
6	Silt Fence along Water Bodies	Construction	Rm	500	331	---------	Civil works contract
	Subtotal (B)					----------	Civil works contract
C.	Construction Contractor ESMP Implementation						

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
1	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0 mtr height at stipulated active site of the same project site, made with angle iron frame of 50x50x5mm and GI sheet of 0.63mm thick including primer painted initially, painting, lettering & border with reflective paint at the time of every shifting, traffic diversion arrangement, safety guard, suitable lightning arrangement during night, complete in all respect till completion of the project as per technical specification and direction of Engineer-In-charge and same shall be possessed by the contractor after completion of the Project	Construction	to be provided at each of the active sites by the Contractor (i.e. till the completion for the works)	To be decided by the contractor as per his schedule of works	-	0	Civil works contract
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	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
	in IRC SP 55: 2001. To be made available at all time at the work sites as required and directed by the engineer						
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	Construction	Numbers			----------	Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	and the partitions should be made of aluminums framework with FRP panels. The bio-digester tank should be approved by Defence Research & Development Organization (DRDO) or any other competent agency. The whole toilet shall be mounted on MS framework with skids; Overhead water tank shall be made of HDPE with proper arrangement of ball cock and mosquito proof cover. These should also be provided with two dustbins for wet and dry waste. The bio-digester toilets shall be mounted on 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

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
6	Provision of First Aid Kits for worksites	Construction	Nos			----------	Civil works contract
7	Provision and maintenance of waste collection bins in sets of 2 (blue and green) for collection of municipal solid waste generated at the worksite including cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc.	Construction	Nos			----------	Civil works contract
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.	170	--	--	Civil works contract
10	Three tier plantatation for Elephant Corridor	Construction				-------	Civil works contract

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
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)					---------	Civil works contract
D	Social Safeguards Implementation (Framework Instruments)						
1	Stakeholder engagement, consultations, disclosure, and GRM implementation (SEP)	Construction & Operation	-	-		5,00,000	As per SEP
2	Indigenous people development plan (IPDP)	Construction & Operation	-	-		1,26,20,000	As per IPDP of the Sub Project
3	Resettlement action Plan (RAP)	Construction	-	-		1,94,45,896	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)					3,25,65,896	
E	PIU ESMP Implementation cost						
	Environmental Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost	Costs Covered By
	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
	Biodivesity Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	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)					3,39,33,896	

8.7 Reporting System

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

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

8.8 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 REDRESS MECHANISM

9.1 Introduction

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

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

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 Ri Bhoi.
- 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 does not require environmental clearance or forest clearance.
- 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.
- 17 nos. of trees located within the existing Right of Way (RoW) on both sides of the road will need to be felled. To mitigate the ecological impact of tree felling, compensatory afforestation should be undertaken in line with applicable environmental regulations and guidelines.
- 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.
- The ESIA Consultant's field observations along the UJ road corridor have been effectively integrated into the DPR through chainage-specific design interventions, ensuring a balanced approach towards engineering adequacy, environmental safeguards, and community safety.
- Site-specific protection needs highlighted by the ESIA, particularly in agricultural and vulnerable zones, have been addressed through toe walls and protection works, ensuring slope stability and protection of adjoining land uses. Recommendations near sensitive receptors such as schools have been incorporated through zebra crossings and traffic calming measures.
- Overall, the DPR demonstrates strong alignment with ESIA observations, translating field-level concerns into practical, sustainable, and approval-ready design solutions, thereby ensuring environmental compliance, enhanced road safety, and long-term infrastructure resilience.

10.2 Recommendations

The following recommendations are made in accordance with the World Bank's Environmental and Social Standards (ESS) for the proposed Upgradation of Umsning - Jagi Road for Meghalaya Logistics and Connectivity Improvement Project (MLCIP), funded by the World Bank, to ensure environmentally sustainable and socially inclusive development outcomes:

- The Contractor should prepare a site-specific contractor Environmental and Social Management Plan called as C-ESMP based on final design and identifications of locations of construction camps, quarries and borrow areas etc. within one month from the date of entering into the contract.
- MPWD shall conduct required consultations regularly or as needed with all stakeholders, 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 E&S cell MPWD /PMC/CSC staff and district-level MPWD engineers on ESHS policies, regulations, and procedures for

implementing, monitoring, and reporting ESMP measures. This training is to be conducted during the pre-construction phase.

- Contractors will engage the experienced ES&HS Staff for ESMP implementation as well as to ensure imparting induction, work-specific and other required trainings to the workers;
- MPWD will support Project Affected Peoples (PAP) as per RAP prepared for the project road stretch.
- Contractor/ MPWD to ensure the compliance of applicable laws at State/National level and relevant policies and best practices.
- The shifting of public utilities will be planned in advance to maintain supply of electricity and telephone services to people without or minimum disruptions, with prior intimation through Media, newspaper and other mode of communication.
- MPWD to monitor the implementation and redress of grievances timely and amicably.
- The contractor to ensure safe access to vulnerable people such as elderly and people with disabilities during the construction stage.
- 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.