DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

OF

Longtalang Limestone Mines

FOR

Production of 150000 TPA Limestone Minerals

At

Village- Thanghunai, Elaka - Nongtalang, P.O. + P.S.-Dawki

District-West Jaintia Hills, State- Meghalaya

Sponsor :

Sri Chui Pohlynjar

Village- Nongtalang, Elaka-Nongtalang

Dist.- West Jaintia Hills

Meghalaya.

Prepared by :

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(QCI –NABET ACCREDITED ENVIRONMENTAL CONSULTING ORGANIZATION, ACCREDITATION NO.- QCI/NABET/ENV/ACO/18/0727)

FOREWORD

Sri Chui Pohlynjar is proposing to operate a Limestone mine for the production of 150000 TPA Limestone Minerals over an area of 4.30 Ha. It is located in Village-Thanghunai, Elaka- Nongtalang, P.O. + P.S.- Dawki, District-West Jaintia Hills, State-Meghalaya.

SEIAA, Meghalaya issued ToR Vide letter ML/SEIAA/MIN/WJH/P-119/2020/4/1790 dated 25 February, 2021, which formed the basis of preparation of draft EIA report.

With a view to assess the potential environmental impacts due to proposed activities, Sri Chui Pohlynjar, Project Proponent has retained Indian Mine Planners & Consultants, Kolkata to undertake Environmental Impact Assessment studies for various environmental components, in order to identify the impacts and its mitigation measures. The report also envisages the prediction of the potential impacts due to the proposed activities.

The timely cooperation and assistance rendered by Sri Chui Pohlynjar is gratefully acknowledged.

Authorised Signatory

Place: Kolkata **Indian Mine Planners & Consultants**

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COMPLIANCE

The State Expert Appraisal Committee Meghalaya, considered the project at its meeting held on 08th February, 2021. Based on the consideration of the documents submitted and the presentation made by the project proponent, the committee prescribed the Terms of Reference, vide letter no. ML/SEIAA/MIN/WGP/P-119/2020/4/1790, dated February 25, 2021, for the preparation of EIA report. The approved TOR is as follows:

Sr. No.	Scope of ToR	Compliance/Report Reference
1.	Year wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification, 1994 came into force w.r.t. the highest production achieved prior to 1994.	Applied for fresh grant of lease. So it is not applicable for this Project.
2.	A copy of the document in support of the fact that the proponent is the rightful lessee of the mine should be given.	**Letter of Intent (LoI)** is attached as Annexure-2.
3.	All documents including approved mine plan, EIA and public hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management and mining technology and should be in the name of the lessee.	All documents are compatible with one another and are in the name of lessee.
4.	All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery/toposheet should be provided. Such an imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Toposheet restricted because of proximity of International boundary of India & Bangladesh. Google Map showing imagery of area is furnished in Plate **No. 1**. All Corner Coordinates are given in **Plate 3**.
5.	Information should be provided in Survey of India Topo-sheet in 1: 50000 scale indicating geological map of the area, geomorphology of landforms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil	Toposheet restricted because of proximity of International boundary of India & Bangladesh. Google Map showing imagery of area is furnished in Chapter 2 (Page No. 5). Rest information furnished in Chapter 2

	characteristics.	(Page No. 7, 8 & 9).
6.	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from state land use board or the concerned authority	No Objection Certificate **(Tradition)** is attached as Annexure-17.
7.	It should be clearly stated whether the proponent company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/violation of the environmental or forest norms/conditions. The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non compliances/violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	Lessee is Private Individual. Declaration for Environment Policy is attached as **Annexure-18**.
8.	Issues relating to Mine Safety, including subsidence study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	Furnished in **Chapter-4**, Page No.12-38
9.	The study area comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc should be for the life of mine/ lease period.	Details are given in **Chapter-3**, Page No.1 & **Chapter-4,** Page No.- 24-25

10.	Land use of the study area delineating forest area, agricultural land, grazing land, wild life sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Furnished in **Chapter-3**, Page No. 36-45 & **Chapter-4**, Page No. 22.
11.	Details of land for any overburden dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues if any, should be given.	No overburden dump is outside the mine lease. No R&R Plan is applicable
12.	A certificate from competent authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the project proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional office of the ministry to ascertain the status of forests, based on which, the certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the state forest department to assist the Expert Appraisal Committees.	A certificate from competent authority (**DFO Report**) in the State Forest Department has been attached as **Annexure-19**
13.	Implementation status of recognition of forest rights under the Scheduled tribes and the traditional forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	Not applicable
14.	A study shall be got done to ascertain the impact of the mining project on wild life of the study area and details furnished. Impact of the project on the wild life of the surrounding and any other protected area and accordingly detailed mitigative measures required should be worked out with cost implications and	Presented in Chapter-4, Page No. 27-30.

	submitted.	
15.	Location of National parks, Sanctuaries, Biosphere reserves, Wild life corridors, Ramsar Site Tiger/Elephant reserves (Existing as well as proposed), if any, within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wild life Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive area as mentioned above should be obtained from State Wild life Standing Committee of National Board of Wildlife and copy furnished.	No National parks, Sanctuaries, Biosphere reserves, Wild life corridors, Tiger/Elephant reserves within 10 km of Mine lease. (**Annexure-19)**
16.	A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease) shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indication the schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with state forest and wildlife department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Complied in Chapter 4, Page No. – 42 to 46. Authenticated list of Flora & Fauna attached as **Annexure-14**
17.	R&R plan/compensation details for the project affected people (PAP) should be furnished. While preparing the R&R plan the revenant …….Rehabilitation & Resettlement policy should be kept in view. In respect of SCs/STs and other weaker section of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmers	Not applicable

	prepared and submitted accordingly, integrating the sect oral programmers of line departments of the state Government. It may be clearly brought out whether the village (s) located in the mine lease area will be shafted or not. The issues relating to shifting of village (s) including their R&R and socio-economic aspects should be discussed in the Report.	
18.	One season (non-monsoon) [I.e. March-May (summer season) October-December(Post Monsoon season); December-February (winter season)] primary baseline data on ambient air quality as per CPCB Notification of 2009, Water quality, Noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring station within 500m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM-10 particularly for free silica should be given.	Furnished in **Chapter-3**
19.	Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and impact of movement of vehicles for transportation of mineral. Of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Given in **Chapter-4**.

20.	The water requirement for the project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the project should be indicated.	Given in **Chapter 4**, Page No.21
21.	Necessary clearance from the competent Authority for drawl of requisite quantity of water for the project should be provided.	Not required.
22.	Description of water conservation measures proposed to be adopted in the project should be given. Details of rainwater harvesting proposed in the project, if any should be provided.	Furnished in EIA report, in **Chapter 4**, Page No. 21.
23.	Impact of the project on the water quality, both surface and ground water, should be assessed and necessary safeguard measures, if any required, should be provide.	Furnished in EIA report, in **Chapter 4**, Page No. 19 to 21.
24.	Based on actual monitored data, it may clearly be shown whether working will intersect ground water. Necessary data and documentation in this regard may be provided. In case the working will intersect ground water table, a detailed Hydro Geological Study should be undertaken and Report furnished. The report inter-alia shall include details of the aquifers present and impact of mining activates on these quivers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	Working Depth will be 25 m only (**Chapter 4,** Page No.19). Hence working will not intersect ground water.
25.	Details of any stream, seasonal or otherwise, passing through the lease area and modification/diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	Furnished in (**Chapter 4,** Page No.19 to 21).
26.	Information on site elevation, working depth, ground water table etc. should be providing both in AMSL and bal. A schematic diagram	Geological Plan & Section of Approved Mine Plan has been attached as **Annexure-20**

	may also be providing for the same.	
27.	A time bound progressive Greenbelt Development plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the project phase wise plan of plantation and compensatory a forestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	Furnished in (**Chapter 4,** Page No.27 & 29)
28.	Impact on local transport infrastructure due to the project should be indicated. Projected increase in truck traffic as a result of the project in the present road network (including those outside the project area) should be worked out, indication whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project proponent shall conduct of transportation study as per Indian Road Congress Guidelines.	Furnished in (**Chapter 4,** Page No.26)
29.	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Furnished in (**Chapter 2,** Page No.12 & 15)
30.	Conceptual post mining land use and reclamation and restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Furnished in (**Chapter 4,** Page No.21 & 28)

31.	Occupational Health impacts of the project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Furnished in (**Chapter 4,** Page No.33 & 34) & **Chapter 9,** Page No.10
32.	Public health implications of the project and related activates for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	Furnished in (**Chapter 4,** Page No.33 & 34) & **Chapter 9,** Page No.10
33.	Measures of socio economic significance and influence to the local community proposed to be provided by the project proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Furnished in (**Chapter 4,** Page No.31 & 32)
34.	Detailed Environmental Management plan (EMP) to mitigate the environmental impacts which should inter alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed project.	Furnished in **Chapter 9.**
35.	Public Hearing points raised and commitment of the project proponent on the same along with time bound Action plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP report of the project.	Furnished in **Chapter 7.**
36.	Details of litigation pending against the project, if any, with direction/order passed by any court of law against the project should be given.	None

37.	The cost of the project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Complied in **Chapter 2 & 9**
38.	A Disaster Management Plan shall be prepared and included in the EIA/EMP Report.	Complied in **Chapter 7**
39.	Benefits of the project if the project is implemented should be spelt out. The benefits of the project shall clearly indicate environmental, social, economic, employment potential, etc.	Complied in **Chapter 9**
40.	The Action plan on the compliance of the recommendations of the CAG as per Ministry's circular No.J-11013/71/2016-IA.I (M) dated 25.10.2017 need to be submitted at the time of appraisal of the project and included in the EIA/EMP Report.	Complied in **Chapter 9**
41.	Compliance of the ministry's office Notification No. CSR-94 (E) dated 25.01.2018-mandatory implementation of Dust mitigation measures for construction and demolishing activates.	Complied in **Chapter-4**
42.	The activities and budget earmarked for corporate Environmental Responsibility (CER) shall be as per Ministry's OM No. 22-65/ 2017-IA.II (M) dated 01.05.2018 and the action plan on the activates proposed under CER shall be sub submitted at the time of the project included in the EIA/EMP Report.	Complied in **Chapter 9**
43.	Compliance of the Ministry, office Memorandum No.F:3-50/2017-IA.III (Pt) dated 30.05.2018 on the judgment of honorable Supreme Court, dated the 2nd August, 2017 in writ petition (Civil) No. 114 of 2014 in the matter of common cause versus Union of India needs to be submitted and included in the EIA/EMP Report.	Complied

1.0. INTRODUCTION

1.1. Preamble

Nongtalang Limestone Mines project is for mining of limestone mineral by Semi mechanized opencast method with drilling and blasting. The applicant of the project is Sri Chui Pohlynjar; owner of Nongtalang Limestone Mines is the authorized signatory. The Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Sri Chui Pohlynjar on dated Jowai 08.02.2019 vide letter no. JH/8/MMMCR-2016/2016-17/869/B/2419 attached as **Annexure-2**. He has applied for an Environment Clearance after obtaining the necessary approval of the Mining Plan and Progressive Mine Closure Plan from the Directorate of Mineral Resources, Meghalaya vide letter no. DMO-J/5/MM/Mining Plan/2019/8, dated 09.05.2019 attached as **Annexure-3**. The project area is of private land category. No forest area is involved. The mine will be in operation as per the Mining Plan approved by Director of Mineral Resources, Meghalaya. This EIA report is for production capacity up to 150000 TPA as per the Pre-feasibility Report. This is a new mining proposal. The owner of the mine carried out the mining of Limestone for supplying to consumers in producing lime. The Limestone from the mines shall be utilised in the lime burning and construction activities.

The mine lease area is less than 50 ha, hence project comes under Schedule no. 1 (a) Category "B" as per EIA Notification 2006. Mining will commence after obtaining EC and other statutory clearance. As per DMO (Directorate of Mineral Resources) Jowai Report No. DMO-J/5/MM/Mining Plan/2019/27, dated 21 August 2019 lease area comes under cluster. DMO Report is attached as **Annexure-4**. The details of lease within a distance of 500 m from the periphery of applied lease area is as follows-

Table- 1.1

S.N.	Approved Mining Plan	Area (hectares)	Mineral	Distance from the approved mining Plan of Sri Chui Pohlynjar (meters)
1	Shri Aron Myrehiang	2.55	Limestone	178
2	Shri Lahmon Tongper	3.20	Limestone	12
3	Shri Sumon Pohduna	4.00	Limestone	7
4	Smt. Plenty K. Pyngrope	30.0	Limestone	422

1.2. General Information on Mining of Minerals

In India, the total resources of limestone of all categories and grades as per UNFC system as on 1.04.2010 are estimated at 184,935 million tonnes, of which 14,926 million tonnes (8%) are under reserve category and 170.009 million tonnes (92%) are under remaining resource category. Karnataka is the leading state having 28% of the total resources followed by Andhra Pradesh (20%), Rajasthan (12%), Gujarat (11%), Meghalaya (9%), Chhattisgarh (5%) and remaining 15% by other states. Gradewise, cement grade has leading share of about 69% followed by open hearth (SMS) & blast furnace (BF) grade (12%) and chemical grade (3%). Remaining 16% are others, not-known and unclassified grades. There were 717 reporting mines in 2013-14. Andhra Pradesh was the leading producing state accounting for (21%) of the total production of limestone, followed by Rajasthan (20%), Madhya Pradesh (13%), Tamil Nadu (9%), Gujarat, Karnataka and Chhattisgarh (8% each). Himachal Pradesh and Maharastra (4% each) and the remaining 5% was contributed by Odisha, Meghalaya, Uttar Pradesh, Jharkhand, Kerala, Bihar, Assam and J&K.

1.3 Environment Clearance

For any developmental activity there is necessity to get environmental clearance from the competent authority as per EIA Notification 2006 and its subsequent amendments. The environmental clearance process is required for 39 types of projects and covers aspects like screening, scoping and evaluation of the upcoming project. The main purpose is to assess impact of the planned project on the environment and people and to try to abate/minimize the same.

1.4 Terms of Reference

The Terms of Reference is prescribed for Project seeking Environmental Clearance (EC) under the provision of the Environment Impact Assessment Notification, 2006 (except for project under item No. 8-a). The Terms of Reference issued after approval of the Ministry/SEIAA is based on the recommendation of the Expert Appraisal Committee (EAC) / State Expert Appraisal Committee (SEAC). In the present case the State Expert Appraisal Committee, Meghalaya (SEAC) in its ToR meeting followed by SEIAA' meeting issued TOR letter vide no. ML/SEIAA/MIN/WJH/P-119/2020/4/1790 dated 25 February, 2021 for undertaking detailed EIA study for the purpose of obtaining environmental clearance in accordance with the provisions of the EIA Notification; 2006.The TOR issued and its compliance is attached as **Annexure-1** of the EIA report.

1.5 Public Consultation

Public consultation refers to the process by which the concerns of local affected persons and others who have plausible stake in environmental impacts of mining are ascertained with the view to take into account all the material concerns in the project or activity design as appropriate. Public Hearing for the proposed project was conducted on ..... Public Hearing Minutes along with its compliance is attached at Annexure 8 of EIA report.

1.6 Need for EIA

Every anthropogenic activity has some impact on the environment. More often it is harmful to the environment than benign. However, mankind as it is developed today cannot live without taking up these activities for his food, security and other needs. Consequently, there is a need to harmonise developmental activities with the environmental concerns. Environmental impact assessment (EIA) is one of the tools available with the planners to achieve the above-mentioned goal. EIA integrates the environmental concerns in the developmental activities right at the time of initiating for preparing the feasibility report. EIA can often prevent future liabilities or expensive alterations in project design. EIA is the essential tool for assessment of environmental parameters with respect to mining project or activity. This study is done on the basis of examination of compliance of the project to the applicable national standards, laws of regulations and required mitigation measures. On the basis of assessment of all relevant environmental parameters environmental management plan is proposed.

1.7 Post-Environmental Clearance Monitoring

The project managements are required to submit half-yearly compliance reports in respect of the stipulated prior environmental clearance terms and conditions to the regulatory authority concerned on 1st June and 1st December of each calendar year. All such compliance reports submitted shall be public documents. The latest such compliance report shall be displayed on the website of the concerned regulatory authority.

1.8 Transferability of Environmental Clearance

A prior environmental clearance granted for a specific project or activity to an applicant may be transferred during its validity to another legal person entitled to undertake the project or activity on application by the transferor or the transferee

with a written "no objection" by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which the prior environmental clearance was initially granted, and for the same validity period. The present project is a new case and no prior Environmental Clearance was granted earlier. The lessee is applying for environmental clearance, on the basis of application submitted Terms of reference were already granted by the competent authority to project proponent. In case of transfer of EC to another person it shall be noted that the EC granted shall hold all the conditions as it were and the time limit will remain the same.

1.9 Generic Structure of Environmental Impact Assessment Document

As per the guideline of EIA notification of the MoEF&CC dated 14th September 2006 as amended Dec 2009, the generic structure of the EIA document should be as under-

- Introduction
- Project Description
- Description of the Environment
- Anticipated Environmental Impact & Mitigation Measures
- Analysis of Alternatives (Technology and site)
- Environmental Monitoring Programme
- Additional Studies
- Project Benefits
- Environmental Management Plan
- Summary & Conclusion
- Disclosure of Consultants engaged

The present report contents are as per generic structure of the guideline given above.

1.10 Details of Project Proponent

Sri Chui Pohlynjar, is the applicant of the project. Applicant is a Private Individual.

Correspondence & Registered Address
Sri Chui Pohlynjar
Village- Nongtalang, Elaka Nongtalang, P.O.+ P.S. – Dawki
Dist.- West Jaintia Hills
Meghalaya.
Email-

1.11 Brief Description of Project

The proposed project is for mining of Limestone mineral at the maximum rate of 150000 TPA in an area of 4.30 ha. The mining will be done by open cast semi mechanized method with drilling and blasting. Detail description is given in Chapter 2.

1.12 Regulatory Compliances: Environmental Legislations Applicable In Development Sector

The environmental consideration in any development process has become a necessity for achieving sustainable development. To achieve these goals, the Ministry of Environment & Forests, Govt. of India, has enacted various acts, legislations, guidelines and standards from time to time. The principal environmental regulatory agency in India is the Ministry of Environment & Forests, New Delhi. MoEF&CC formulates environmental policies and accords environmental clearances for different projects. Organization's adherence to laws, regulations, guidelines and specifications relevant to its business is a part of regulatory compliance. Applicant will strictly follow all the law, regulations, guidelines and standards designed by MoEF&CC and concerned agencies. Applicant is well aware that violations of regulatory compliance regulations will result in legal punishment, including federal fines.

Table 1.2

Name	Scope and Objective	Key Areas	Operational Agencies/Key Player	Implications on our project
Water (Prevention and Control of Pollution) Act, 1974 and amendments	To provide for the prevention and control of water pollution and enhancing the quality of water	Control sewage and industrial effluent discharges	Central and State Pollution Control Boards	Yes, compliance of EC conditions will be done and PP will initiate monitoring of water quality at regular intervals
Air (Prevention and Control of Pollution) Act,1981 and amendments	To provide for the prevention and control of air pollution	Controls emission of air pollutants	Central and State Pollution Control Board	Yes, compliance of EMP and EC conditions will be done. Action onwards control of pollution and monitoring of Air quality will be taken up as per EMP given in the EIA report.
Noise Pollution	Noise	Control of	Central and	Yes, compliance of

(Regulation & Control) Rule2000 and amendments	pollution control	noise pollution in residential, commercial, industrial and silent zones	State Pollution Control Board	EMP and EC conditions will be done. Action towards control of Noise pollution and monitoring will be taken up as per EMP given in the EIA report.
Forest (Conservation) Act, 1988 and amendments	To consolidate acquisition of common property such as forest, halt India's rapid deforestation and resulting environmental degradation	Regulates access to natural resources, state has a monopoly right overland, categories forests, restriction on reservation and using forest for no forest purpose	State Government and Central Government	No, The lease is "non forest" land
Wildlife (Protection) Act, 1972 and amendments	To protect wildlife	Creates protected areas (national parks / sanctuaries) categories of wildlife which are protected	State Government and Central Government.	No
Ancient Monuments and Archaeological sites &Remains Act,1958 and amendments	To protect ancient monuments of national heritage / importance	Conservation of cultural and historical remains found in India	Archaeological Survey of India	NA, There is no ancient monument within the lease area.
Hazardous & other Wastes (Management & Trans boundary Movement) Rules, 2016	Health and safety	Assessment of hazardous materials and management	Central and State Pollution Control Board	Yes, compliance of EMP and EC conditions will be done. Action towards Management and disposal of Hazardous waste will be duly complied with.
Plastic Waste	Recyclable	Assessment of	Central and	No

Management Rules, 2016	Waste	Recyclable Plastic material.	State Pollution Control Board	
Solid Waste Management Rules, 2016	Bio-degradable waste Management	Assessment of organic waste material and its management.	Central and State Pollution Control Board	Yes, compliance of EMP and EC conditions will be done. Action towards Management and disposal of Municipal waste will be duly complied with.
Biological Diversity Act, 2002 and amendments	Biodiversity conservation	Disclosure of species survey or collection activities to the National Biodiversity Authority	MoEF, New Delhi and State Forest Departments	Yes, compliance of EMP and EC conditions will be done.
Environment (Protection) Act, 1986 and amendments	To provide for the protection and improvement of environment	An umbrella legislation, supplements pollution laws	Central government nodal agency, MoEF can delegate to state departments of environment	Yes, EIA report has been prepared for the project. Yes, CTO from State Pollution Control Board will be obtained.
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 and amendments	The new legislation will guide all land acquisitions of central and state governments, bringing in stricter norms and increasing landowners' compensation significantly.	Fair compensation to the assets acquired and proper rehabilitation and resettlement of PAFs with improvement in post acquisition social and economic status	Central and State Government	NA, no habitation exists, therefore compensation on account of land ownership is not applicable.
EIA Notification 14th Sep 2006 and amendments	Environment Impact Assessment	Environmental Protection	Project Development, State and Central Government	Yes, EIA report has been prepared for the project. Once the EC is granted, compliance of EMP and EC conditions will be done.

2.0 PROJECT DESCRIPTION

2.1 GENERAL

The proposed project is for mining of limestone mineral from lease area of 4.30 ha. The maximum production from the mine will be 150000 MT/annum. Mining of mineral will be done by opencast semi mechanized method. The applicant of the project is Sri Chui Pohlynjar, owner of Nongtalang Limestone Mine is the authorized signatory. The Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Sri Chui Pohlynjar on dated Jowai 08.02.2019 vide letter no. JH/8/MMMCR-2016/2016-17/869/B/2419. He has applied for an Environment Clearance after obtaining the necessary approval of the Mining Plan and Progressive Mine Closure Plan from the Directorate of Mineral Resources, Meghalaya vide letter no. DMO-J/5/MM/Mining Plan/2019/8, dated 09.05.2019. The copy of approval letter of the mining plan is given at **Annexure no. 3** of the EIA report.

The project area is of private land category. No forest area is involved. The mine will be in operation as per the Mining Plan approved by Director of Mineral Resources, Meghalaya. This EIA report is for production capacity up to 150000 TPA as per the approved mining plan.

The latitude of the project area is N 25°13'11.536" TO N 25°13'27.249″and longitude is E 92°04'25.468" TO 92°04’29.105"E with maximum contour of 900 mRL and minimum contour of 700 mRL. The area falls in the Survey of India Topo-sheet no. 83C/4 (Restricted topo sheet). The lease area forms a part of the individual owned land. The proposed land is a Non forest Land according to Divisional Forest Officer, Jaintia Hills (T) Division, Jowai (Ref No. JH/S.Querry/2009-10/476/B/1983, Dated 30.11.2018.

The proposed mine area is a Block (Polygon) shaped land and falls under "Non forest land".

The project comes under Schedule no. 1 (a) and category B as the mine area is less than 50 ha.

2.2.1 Nature of the Project

This is a mining project covered under Schedule 1(a), Category ‘B’ according to Environment (Protection) Act 1986 as amended dated 14th September 2006, and subsequent amendments. The proposed project is for mining of limestone mineral at the rate of 150000 MT/annum. The extent of mining lease area is 4.30 Ha., which comprises of non forest land. The estimated project cost is about Rs 35.00 Lacs.

2.2.2 Demand of the Project

The limestone boulder have a great demand in the local open market as well as for supply to the neighbouring state as building and construction material for various construction purposes as well as for supply to limestone kilns. This contributes direct revenue accruals to the state as well as central exchequer in the form of royalty, GST and cess. The limestone mine will also provide several direct and indirect employments to the local people in the area.

2.2.3 Scope of Study

As per EIA Notification 2006 every entitled project has to undergo four stages of Environmental Clearance 1) Screening 2) Scoping 3) Public Consultation 4) Final Appraisal. After the initial process of determination of extent of project and its categorization comes the scoping part. During scoping the Expert Appraisal Committee determine detailed and comprehensive Terms of Reference (TOR) addressing all relevant Environmental concerns for the preparation of an Environment Impact Assessment (EIA) Report in respect of the project or activity for which prior environmental clearance is sought. The Committee has determined the Terms of Reference on the basis of the information furnished in the prescribed Form-1 and PFR. EIA Report has been prepared covering all the points directed in the issued Terms of Reference. The TOR from SEIAA, Meghalaya was granted vide letter no. ML/SEIAA/MIN/WJH/P-119/2020/4/1970 dated 25 February, 2021. Tor letter for the mine and TOR compliance has been enclosed with EIA report. Baseline study was conducted earlier than Issuance of ToR during October- 2020 to December 2020.

2.2 TYPE OF THE PROJECT

Present proposal pertains to open cast semi mechanized mining with drilling and blasting of limestone in district West Jaintia Hills, Meghalaya. The lease having an area of 4.30 Ha. is located Village- Nongtalang, Thanghunai area, District-West Jaintia Hills, State- Meghalaya and comes in Schedule S.No. 1(a), Category-B, for obtaining the environmental clearance.

Land Classification:

The elevation range within the lease area is 900 mRL highest contour to 700 mRL lowest contour. The mineral is exposed in the whole lease area. The area is hilly and stony and falls under "non forest land". The details of land classification of 4.30 Ha. of M.L. area is given below:

Table 2.1

Classification of Land within leasehold			
Private Land			
Forest Land	**Non- Forest Land (Barren Land)**	**Deemed Forest land**	**Agriculture land**
Nil	4.30 Ha	Nil	Nil

2.3 LOCATION OF THE PROJECT

The existing mining site is located in West Jaintia Hills district of Meghalaya State. The location map is shown in figure 2.1. The Google Image of the project is shown in figure 2.2. The detailed Environmental Setting is shown in Table 2.2.

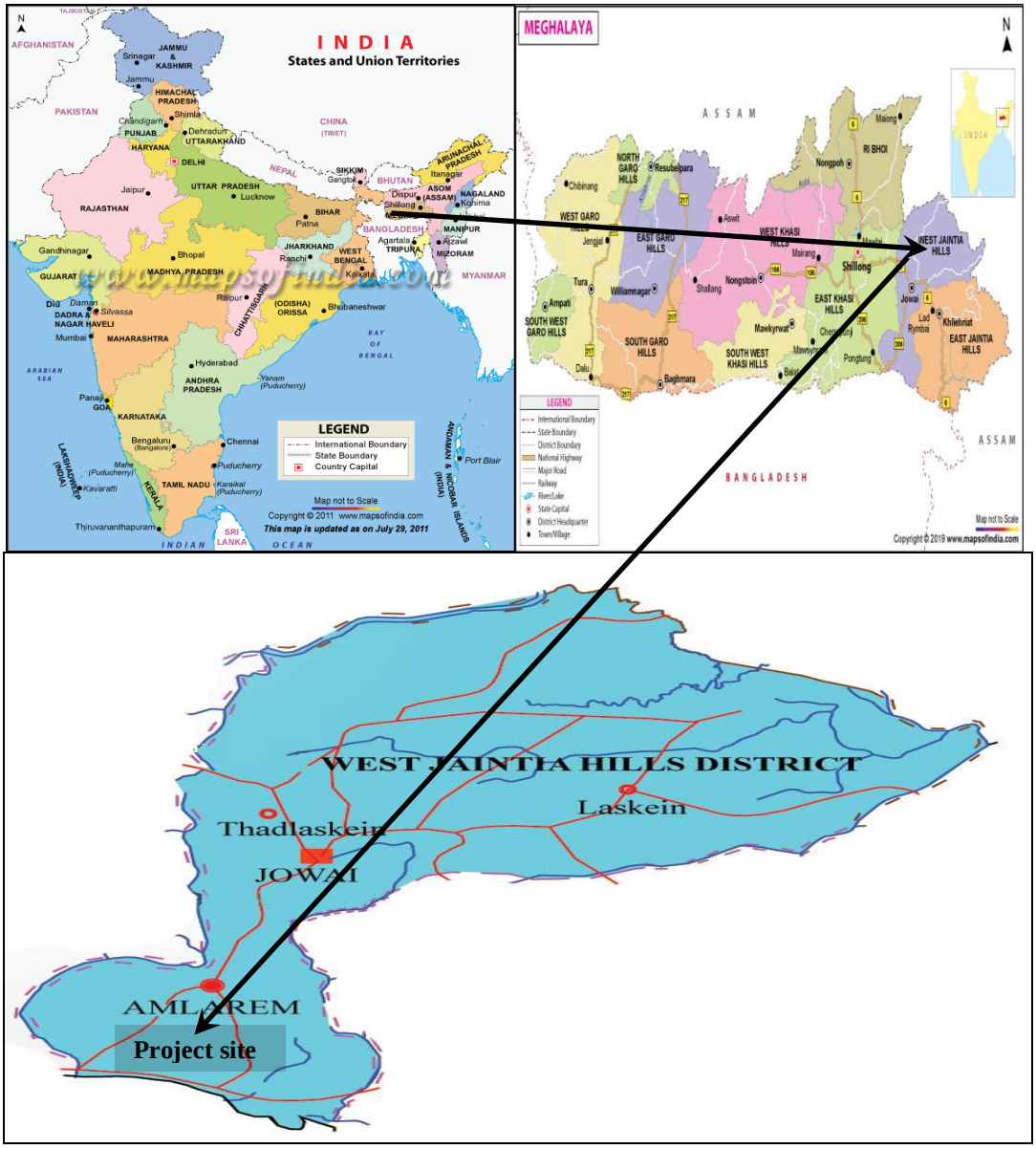


Figure 2.1: Location Map

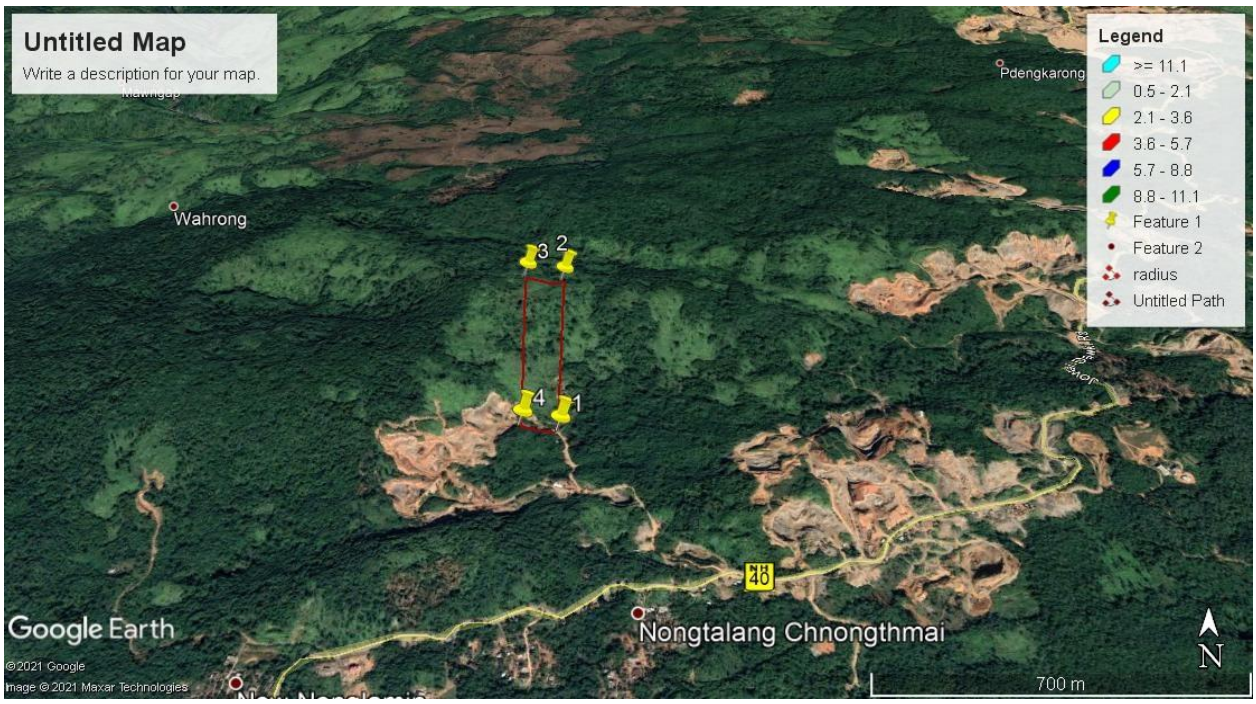


Figure 2.2 : Google Image

Table 2.2 Environmental Setting

Sr. No.	Particulars	Details
1	Location	Village-Thanghunai Nongtalang Elaka District- West Jaintia Hills State- Meghalaya.
2	Khasra No.	-
4	Total area	4.3.0 Hectares
5	Village	Nongtalang
6	District	West Jaintia Hills
7	State	Meghalaya
8	Site elevation above MSL	Minimum Elevation- 700 m Maximum Elevation- 900 m
9	Geographical location in toposheets	83 C/4
10	Nearest representative IMD station	Cherrapunji, Meghalaya (35 km W)
11	Site topography	The elevation range within the lease area is 900mRL highest contour to 700 mRL. The area is hilly and stony.

12	Nearest highway	NH-40- (0.50 Km S)
13	Nearest railway station	Guwahati Railway Station (111 Km NW)
14	Nearest airport	Umroi Airport (54 Km NW)
15	Nearest river/ Nalla	Wah Umngot River (7.0 Km SW)
17	Nearest port	No within 10 km radius
18	Nearest town	Nongtalang (1.5 km SW)
20	District headquarters	Jowai (27 km NE)
21	Nearest state/national boundaries	Bangladesh International Boundary (4.20 km S)
22	Nearest major city with 2,00,000 population	Jowai (27 km NE)
23	Nearest village	Nongtalang
24	Villages within 1 km radius	New Nonglamin
25	Distance from sea coast	Beyond 10 km radius
26	Hills/valleys	Lease area is Hill only
27	Nearest tourist place	Cherrapunji (35 km W)
28	Archaeologically important places	None within 10 km radius
29	Protected areas as per wildlife protection act 1972 (tiger reverses, elephant reserve, biospheres, national parks wildlife sanctuaries, community reserves & conservation reserves)	Nil in 10 km radius
30	Reserved/protected forests	None
31	Seismicity	Seismically this area is categorized under zone-V.
32	Defence Installations	None

2.4 SIZE OF THE PROJECT

The proposal is to mine limestone mineral from the lease area 4.30 Ha the rate of 150000 TPA/455 TPD by open cast semi mechanized method with drilling and blasting.

2.5 LEASEHOLD AREA

Topography

The elevation range within the lease area is 900 m mRL highest contour to 700 mRL lowest contour. The mineral is exposed in the whole lease area.

Drainage

Drainage in the lease area is easterly. General drainage outside the area is almost easterly. The area is hilly and stony. Area is broken by nalahas/Nadi in the five kilometres periphery is illustrated on plate-2.

Existing Land Use of the Core Zone

It is a non forest land, involving 4.30 Ha. The surface plan is attached as Plate no.4.

Table 2.3, Existing Land use of the Mine lease area

Category	Area (Hectares)
Quarry	0.00
Road	0.01
Total area in use	**0.01**
Balance Un-used area	4.29
Total	**4.30**

2.6 GEOLOGY

Regional Geology

In a regional scale the area forms a part of the Meghalaya Plateau exposing geological milieu representing Precambrian to Tertiary sequence in this part of West Jaintia Hills District of Meghalaya.

Table: Summarized Regional Geological set-up

Geological Age	Group Name	Formation Name	Rock Type
Palaeocene-Eocene	Jaintia	Kopili Shella Langpar	Argillaceous sediments Dominantly limestone with sandstone Calc. sandstone calc siltstone with sandy l.St
Up Cretaceous	Ultrabasic		
Cretaceous Jurassic	Khasi Group Sylhet trap	Mahadek	Thick units of conglomerate with Impersistent interbands of sandstone Volcanic trap with vesicles
Pre-Cambrian	Khasi Greenstone Shillong Group		Epidiorite, meta-dolerite, diorite dykes Thick pile of quartzite
Proterozoic Archaean	Khasi Greenstone Shillong Group		Epidiorite, meta-dolerite, diorite dykes Thick pile of quartzite
Proterozoic Archaean	Assam Meghalaya Gneissic Complex		Para and ortho-gneiss,migmatite,mica schist

Archaean Gneissic Complex is exposed west of Jarain and along narrow bands SE of Mawpyut, and also south and SE of Nongtalang, in the northern side of Dawki Fault. Extensive exposure of quartzite is noticed from north of Thadlaskein to south of Jowai. Primary sedimentary structures like compositional banding, graded bedding, cross-stratification are visible within the Shillong Group. Khasi Greenstone represented by amphibolite and meta dolerite and occur as concordant bodies within quartzite. Khasi Greenstone locally alters to biotite-chlorite schist. North of Mawpyut village there are exposures of ultramafic rock. Cretaceous sediments occur as inliers SE and SW of

Amlarem much south of Jowai. Younger granitoids and amphibolites are seen SE and SW respectively of Thadlaskein and around Mawpyut there are exposures of grey granite gneiss and ultrabasic rock. Cretaceous sediments of Jadukata Formation expose along Pynursla –Dawki Road and the younger Mahadek Formation occur as inliers SE and SW of Amlarem. Small exposure of basic intrusive in the form of Sylhet Trap is seen in Nongtalang. Except the aforesaid rock types, the whole parts of the Districts are covered by sediments of the Tertiary age with the age ranging from Palaeocene to Eocene. Around Sohmynting and Mawpyut there are thick sequences of capping of coal bearing Shella Sandstone Formation over the quartzite, granitoid and ultramafic, some of which are locally extracted. Bottom-most Langpar Formation is exposed along Muktapur-Syndai road with calcareous sandstone, grey shale, sandy shale with thin coal seams whereas Sylhet (=Shella) Limestone Formation dominates the Southern part, South of Amlarem three limestone Members are exposed with variable thickness. Argillaceous Kopili Formation is mainly exposed along Dawki- Muktapur section. The area has undergone severe tectonic activities during pre- and post-Tertiary period because of which the area is highly faulted along E-W and NE-SW direction amongst which the Dawki Fault runs south of the block in E-W direction.

Local Geology

The proposed mining area is small and exposes only the limestone of the Sylhet limestone formation. Table provides a glimpse of the Geology that is seen in the area.

Table-: Local Geological set-up in the block

Geological Age	Group Name	Formation Name	Summarized Rock Type
Recent	Newer Alluvium	Unclassified	Unconsolidated soil, scree material
Eocene	Jaintia Group	Sylhet (=Shella)	Top part with grey/white limestone Bottom part with dark /steel grey limestone

The block exposes a monotonous litho-package of marly limestone. Limestone is greyish in colour, hard and compact. At places the limestone is steel grey in colour. Fossil content is minimum with nummulites, discocyclina and with occasional crystals of calcite. It is difficult to trace bedding plane as the surface is covered with thick calcareous deposition. Extensive weathering results in formation of 'karst topography' on the surface resulting in spiked surface along slopes. Solution cavities, caverns, stylolites with variable magnitude and wave length are some of the other features seen on the limestone Overburden constitutes of unconsolidated fragments, boulders, angular pebbles overlain by brownish soil horizon that rarely exceeds one meter in thickness.

Soil type:

- The soils of the hills are derived from gneissic complex parent materials; they are dark brown to dark reddish-brown in colour, varying in depth from 50-200 cm. The texture of soils varies from loamy to fine loamy. The soils of the alluvial plains adjacent to the northwest and southern plateau are very deep, dark brown to reddish-brown in colour and sandy-loam to silty-clay in texture
- Meghalaya soils are rich in organic carbon, which is a measure of nitrogen supplying potential of the soil, deficient in available phosphorous and medium to low in available potassium. Most of the soils occurring on higher altitudes under high rainfall belt are strongly acidic due to intense leaching. These soils are not suitable for intensive crop production.
- There is not much difference in fertility classes of the soils of the State. Four soils fertility classes, namely, High Low Medium (HLM), High Medium Medium (HMM), Medium Medium Low (MML), Medium Low Medium (MLM) have been established from the soil test data so far compiled in the Soil Testing Laboratory of the State.

Exploration carried out & Future Exploration

None.

2.6.1 Geological Reserves

The reserves are computed for proved and probable categories.

Table 2.4

Category of Resource	Mineable Reserves in Tonnes
Proved Mineral Reserves	900000
Probable Mineral Reserves	400000
Total Mineable Reserves	**1300000**

2.6.2 Mineable Reserve

As per approved mining plan mineable reserves are 1300000 Tonnes.

2.6.2 Life of Mine

The mineable reserve of the mine area is 1300000 tonnes. Taking the maximum production target of 150000 tonnes and taking 330 as the average no. of working days per annum, the life of mine is estimated to be about 9 years.

2.7 PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION

Mining as proposed will be undertaken after getting the Environmental Clearance and other statutory clearances. Thereafter the project will be implemented as per the directions/guidelines issued by SEIAA, Meghalaya while granting the EC.

2.8 TECHNOLOGY AND PROCESS DESCRIPTION

The process of limestone mining will be opencast semi mechanized mining. Drilling and blasting will be done to break hard limestone.

2.8.1 Mining Method

Semi Mechanized open cast mining will be undertaken with drilling and blasting.

❖ The width of each bench shall always be maintained to be not less than the height which is 5 m.

❖ Since the deposit in this area is massive and compact in nature, it is proposed to carry out only opencast semi-mechanized mining during this plan period, i.e. five years.

❖ **Drilling and Blasting** The operations like drilling of shot holes, sorting of stone and breaking of large sized boulders will be excavated using hydraulic rock breakers and excavators with deploying of Jack hammer drilling. Both Deep Hole and short hole blasting is proposed.

BLASTING:

Blasting is one of the most critical activities of any mining operation. For forming the working benches, drilling and blasting is done in the limestone deposit over the specified floor level. The depth of drilling and the quantity of explosive to be charged are determined so that after the blasting is carried out, the breakage of limestone will be upto the proposed floor levels.

Drilling will be done by controlled air operated down-the-hole drills and blasting by site mixed Ammonium Nitrate Fuel oil (ANFO) explosives. After sufficient numbers of holes have been drilled, the mining site is cleared of all persons except the blasting crew who will do their work of charging the holes with explosives and adequate charge in each hole.

After the blasting operation is over, an all clear signal is given to let people come and resume normal work in the mine. However, it is necessary that the blasting personnel first check the blasted site in case there is a misfire. In such an event the all clear signal is not given and the blasting crew have to make the area around the misfire safe before the all clear signal is given.

The blasted boulders are carried by dumpers to the desired destination and the blasted face is dressed properly to prepare the area for another round of drilling and blasting.

Safety precautions in blasting

- The blasting personnel, including the helpers, shall use hard hats (safety helmets) as well as mining boots while on duty.
- The mine shall be evacuated of all workers except the blasting crew, before blasting work is taken up.
- The blasting personnel should always use the blasting shelter for taking protection during blasting operation.
- A warning signal by siren or whistle shall be sounded before the charge is blasted.
- After blasting is over, all the shot holes shall be examined if there is any misfire taking place. The place shall be made safe before the all clear signal is sounded.

2.8.2 Past Production

It is a new mine for which Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Sri Chui Pohlynjar on dated 08.02.2019 vide letter no. JH/MMMCR-2016/2016-17/869/B/2419 for grant of Mining Lease over an area of 4.30 Ha. in Village-Thanghunai, Elaka Nongtalang, District- West Jaintia Hills, State- Meghalaya for mineral Limestone. There is no past production of mineral from this mine.

2.8.3 Proposed Production

It is proposed to produce a maximum of 150000 TPA of Limestone per year.

Table 2.5

Year	Proposed Production in Tonnes
1 year	150000
2 year	165000
3 year	180000
4 year	200000
5 year	220000
Total	**915000**

Production schedule for remaining life of the mine will be 150000 tonnes/year.

2.8.4 Details of mining activities with respect to block wise, Calendar Wise, Zonal wise

Mining will be opencast semi mechanized with drilling and blasting with maximum production of 150000 tonnes per year. The proposed production for the planned five years are given as under-

Year	ROM Limestone (Tonnes)	Total Waste, @1:0:3 (Tonnes)	Soil @20 % (Tonnes)	Blendable Limestone @ 20% (Tonnes)	Reject S/S etc. @60% (Tonnes)
2019-20	150000	45000	9000	9000	27000
2020-21	165000	50000	10000	10000	30000
2021-22	180000	55000	11000	11000	33000
2022-23	200000	60000	12000	12000	36000
2023-24	220000	65000	13000	12000	40000
Total	**915000**	**275000**	**55000**	**54000**	**166000**

2.8.5 List of Equipment

The list of machines as existing and additional to be used is as follows:

Table – 2.6

List of Machinery to be used

Sl. No.	Equipments	Capacity	No. of Machineries
1	Compressor air operated jackhammer drill	-	6
2	Diesel operated Compressed air	250 Cu.m	2
3	Dump Truck	10 MT	4
4	Hydraulic excavator	0.9 Cu. m	2
5	Crawler Chain mounted bull dozer	250 HP	1
6	Explosive Van	-	1
7	Car	-	2
8	Jeep	-	2
9	Water Tanker/ Sprinkler	-	2
10	Wheel mounted Tractor trailer combination		1

2.9 WASTE MANAGEMENT

The waste generation from the proposed project is given in the table below:

2.9.1 Waste Generation:

Waste generation from the proposed project is given below which will comprise of soil

Table 2.7; Total waste generation during the plan period

Year	Production of Stone in Tonnes	Production of waste in Tonnes
1st	150000	45000
2nd	165000	50000
3rd	180000	55000
4th	200000	60000
5th	220000	65000
Total	**915000**	**275000**

2.9.2 Waste Management

Total 275000 MT of waste will be generated during plan period. The generated waste will be utilized for maintenance of existing road of surrounding areas and will be back filled for reclamation.

2.10 RECLAMATION & RESETTLEMENT MEASURES

Green Belt development

Plantation will be done in the 7.50 m barrier zone along the periphery of the mining lease area and on the backfilled area after final closure of the mines. Locally thriving plants will be used for the purpose.

Table 2.8

Sl. No.	Year of Plantation	Target of Plantation	Spacing	Area of Plantation	Remarks
1	First	298	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
2	Second	298	2.5 m	Safety/Barrier Zone	
3	Third	298	2.5 m	Safety/Barrier Zone	
4	Fourth	298	2.5 m	Safety/Barrier Zone	
5	Fifth	298	2.5 m	Safety/Barrier Zone	
TOTAL		**1490**			

Resettlement

As there is no habitation and the entire area is under non forest land. Hence no resettlement will be done.

Water Conservation

The main ore body is limestone which is impervious in nature; hence water accumulated in the quarry during rainy season will help in recharging the ground water.

2.11 GENERAL FEATURES:

The raw inputs which will be mainly consumed in this mining project are diesel, water and explosives whose quantity and source of supply are discussed under following headings:

2.11.1 Power, Water Requirement

Power Requirement

No electrical energy will be required. However 100 liters of HSD will be required for daily operation of the machines such as jack hammer, rock breakers etc.

Water Requirement

Total water requirement is about 5.00 KLD (1.0KLD Domestic Uses) + 2.0 KLD (Dust Suppression) & 2.0 KLD (Green Belt) from nearby water sources. Water for drinking purpose will be met from nearby villages. For sprinkling & plantation water will be taken from Private tanker.

Table 2.9; Requirements of Raw Materials

Inputs	Approx Quantity required per day
High Speed Diesel Requirement	
Diesel	100 Liters (at peak production)
Water Requirement	
Water for Drinking	1.0 KLD
Water for Sprinkling	2.0 KLD
Water for green belt development	2.0 KLD

2.11.2 Use of Mineral

India possesses a wide spectrum of dimensional stones that include granite, marble, sandstone, limestone, slate, and quartzite, spread out all over the country. The limestone boulder have a great demand in the local open market as well as for supply to the neighbouring state as building and construction material for various construction purposes as well as for supply to limestone kilns.

2.11.3 Proposed Transportation and Infrastructure

Transportation

There is existing approach roads which goes up to the quarry. Trucks/ tippers will be brought in the quarry and OB/ waste would be loaded on trucks/ tippers on surface near the top bench. Total 4 tippers of 10 T capacities will be deployed to transport the minerals from quarry to stockyard.

Infrastructure: The details of Existing and proposed infrastructure is given below:

Existing Infrastructure: The details area given below:

Physical Infrastructure: There is existing road NH-40 is 0.5 Km S from the mine site. No physical infrastructure exists at the mine site.

Social Infrastructure: The Medical facility such as PHC is located in Dawki & CHC facility is available in Nongtalang only. Primary and Secondary Schools are located in Nongtalang village at a distance of about 1.5 kms and higher studies like colleges are available only in Jowai the district Sub divisional Headquarters at a distance of about 27 kms.

Proposed Infrastructure: The details area given below:

Physical Infrastructure: Site services such as temporary rest-shed, blasting shed etc. will be developed during mining.

Social Infrastructure: Proposed mining in the area will facilitate development of other small ancillary industries like Workshop, administrative building, machine shops, auto repair garages etc. Local shops are available in all villages.

2.12 HUMAN RESOURSE:

This project would provide employment to around 36 persons which include Mining Engineers, Executives, Skilled, Semi-Skilled and Unskilled laborers and indirect employment, in contractual works & transport to the local population.

2.13 PROJECT COST:

The project cost is about Rs. 35.0 lakhs. The breakup of the project cost is given below:

Table – 2.10; Project Cost

Sl. No.	HEAD	CAPITAL (In Rs)
1	Land	2,00,000/-
2	Road & Temporary Structures	3,00,000/-
3	Tools & Machinery	29,00,000/-
4	Miscellaneous	1,00,000/-
TOTAL		**35,00,000/-**

3.1 INTRODUCTION

EIA report contains a detailed description of existing environment that would be or might be affected directly or indirectly by the proposed project. Environmental baseline monitoring is a very important stage of EIA. Environmental baseline monitoring, during the operational phase, helps in judging the success of mitigation measures in protecting the environment.

The intention of environmental baseline monitoring is not just to describe all baseline conditions but to emphasis on the collection and description of baseline data on those environmental parameters that are important and are likely to be affected by the proposed project activities and is included in impact assessments. The baseline values/characteristics of the environmental parameters are discussed in this chapter -3.

3.2 METHODOLOGY

It would be apt to reiterate here that the environmental indicators mostly seen for Core and Buffer Zone separately. The area, which is going to produce impact that is mining lease is considered as core zone, whereas the surrounding area, which is going to absorb the impact is considered as Buffer Zone. As per ToR, the buffer zone is 10 km all around of mining lease area in this case.

For the present study, all the sampling locations are marked with the help of topographical maps. The land use/ land cover map has been generated on 1:50,000 scale using Satellite imagery, topographical maps, Survey of India and ground truth information. The baseline environmental quality has been assessed during **Post Monsoon Season (Oct 2020 to Dec 2020).** Meteorological data of IMD station at Cherrapunji, Meghalaya has been used for the study. Samples of air, water and soil from the site and nearby areas has been collected and analyzed for the study of existing condition. Primary and secondary data collection has been done by the Ecology and Biodiversity team for the study of flora and fauna in the core and Buffer Zone.

The baseline data is generated through field study within the impact zone (Core Zone and Buffer Zone) for various components of the environment viz. Air, Noise, Water, Land, Ecology and Socioeconomic. The baseline environmental quality has been assessed in a study area of 10 Km radius distance from the project site. While generating the baseline status of physical and biological environment of the study area, the concept of impact zone has been considered. The impact zone selection is based on preliminary screening and modeling studies. The methodology for evaluation of various environmental facets has been discussed under the same parameter for convenience.

It would be in fitness of things to start this chapter with Meteorology as the data collected from IMD is used for selection of sampling station.

3.3 METEOROLOGY

A) Long Term Meteorological Data

The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as input for air quality prediction. Historical data on meteorological parameters also plays an important role in identifying the general meteorological regime of the region.

The year may broadly be divided into four seasons:

Winter season : December to February

Summer season : March to May

Monsoon season : June to September

Post-monsoon season: October to November

Methodology

On-site monitoring was undertaken for various meteorological parameters as per BIS and IMD guidelines to generate the site-specific data. The generated data was then compared with the meteorological data obtained from Cherrapunji, Meghalaya.

Sources of Information

Secondary information for the last thirty year's (1971-2000) meteorological conditions was collected from the nearest IMD station at Cherrapunji. Pressure, temperature, relative humidity, rainfall, wind speed and direction data's are incorporated in the report. The meteorological data, rainfall data, climatological data and solar energy and surface meteorology for the study area collected from IMD Cherrapunji is presented in **Table-3.1, Table-3.2, Table-3.3 and Table-3.4** respectively.

Analysis of IMD Data Cherrapunji

The Indian Meteorological Department records the data at two times a day viz. 08:30 hr and 17:30 hr, while the site-specific data was recorded at an hourly interval. Comparison of the site-specific data generated during the study period vis-à-vis the data monitored by IMD shows that by and large these are comparable.

Temperature & Relative Humidity

The winter seasons sets in towards end of November and continues till mid of February. The last week of December to first week of January is the coolest period of the year, with lowest minimum temperature falling as low as -1.0^{0}C (20th Jan 1993). Temperature gradually rises after February. March to June is the summer season. This is also referred to as Pre-monsoon season. During this time the highest maximum temperature may rise to 30.2^{0}C (26th May 1962). From the post monsoon of October, the mean temperature falls gradually marking the onset of the winter season. The average humidity, during the monsoon season is about 78% – 96%. The humidity in Pre-monsoon (March-May) is about 64-84%. Generally the weather during the other seasons is more or less dry and in the comfortable zone.

TABLE 3.1 METEOROLOGICAL DATA FROM IMD, CHERRAPUNJI (1971-2000)

Month	Mean Station Level Pressure in hPa	Mean Relative Humidity in %	Mean High Cloud Amount in oktas	Mean Highest temp in ^{0}C	Mean Lowest temp in ^{0}C	Extreme Highest temp in ^{0}C	Extreme Lowest temp in ^{0}C
January	871.5	60	1.9	19.0	3.7	26.7	-1.0
February	870.7	61	2.3	20.8	4.8	28.9	0.3
March	870.0	64	2.9	24.1	8.0	30.6	0.6
April	868.9	78	4.9	24.8	10.5	28.3	3.9
May	866.9	84	5.9	25.8	12.2	30.2	3.3
June	864.0	93	7.0	26.1	15.1	29.2	9.2
July	863.8	96	7.4	26.0	16.5	28.6	10.0
August	865.0	92	6.9	27.0	16.5	29.5	6.0
September	868.0	89	6.3	26.6	15.5	31.1	12.4
October	870.9	73	3.8	26.0	12.2	29.9	7.8
November	872.4	62	2.4	24.3	8.8	26.9	3.7
December	872.6	61	1.8	20.6	5.4	24.0	1.7

(Source: Climatological data 1971-2000, Indian Meteorological Department)

Rainfall

Annual rainfall over the basin varies between 817 and 2992 mm with an average of 968 mm, of which 84% occurs during the monsoon season. The monsoon starts in end of May and continues till September. The maximum amount of rainfall and maximum rainy days occur in July (Table 3.2).

TABLE: 3.2 RAINFALL DATA FOR FROM IMD, CHERRAPUNJI (1971-2000)

Month	Total Rainfall in the month in mm	Heaviest 24 hrs rainfall in mm	No. of Rainy days in the month (days with rainfall > 2.4 mm)
January	16.3	97	1.4
February	52.9	376.9	3.0
March	327.0	587.4	7.9
April	817.2	644.2	16.1
May	1313.8	812.0	20.2
June	2511.7	1563.0	24.1
July	2992.3	838.2	28.2
August	1914.4	853.4	24.6
September	1034.8	985.5	19.1
October	539.4	594.0	8.4
November	74.0	332.2	2.1
December	25.6	189.7	1.0

(Source: Climatological data 1971-2000, Indian Meteorological Department)

Wind Speed / Direction

Overall Wind Rose data for study area (IMD, Cherrapunji data) is shown in Table-3.1. Wind is normally light to moderate in the area as observed from the winter season. During January, the predominant winds are Easterlies and north-Easterlies in major part of the area. In February, winds are in different directions in different parts of the area. However, the predominant directions are SW and E. The wind data collected at the site for the study period (Dec-2019 to Feb-2020) is presented in the form of Wind rose diagram in Figure 3.2.

TABLE 3.3 CLIMATOLOGICAL DATA FROM IMD, CHERRAPUNJI (1971-2000)

Month	No. of days in wind directions								Average wind speed in kmph
	N	NE	E	SE	S	SW	W	NW	
January	1	22	28	11	4	13	9	2	4.0
February	1	13	20	8	4	28	17	1	5.9
March	1	9	10	7	6	39	19	3	7.4
April	1	10	8	9	7	42	13	4	7.5
May	2	13	12	10	5	32	13	2	6.1
June	2	11	16	12	8	29	7	2	6.5
July	1	9	12	14	11	37	5	1	7.4
August	1	14	20	16	8	23	4	1	5.9
September	1	14	21	12	5	22	8	2	4.7
October	2	23	31	11	3	13	6	0	3.9
November	1	24	41	10	2	9	5	1	3.8
December	1	24	40	13	2	8	3	1	3.7

(Source: Climatological data 1971-2000, Indian Meteorological Department)

B) Micro-Meteorological Data

The meteorological data for wind speed and direction were collected in and around the core zone during the study period simultaneously AAQ monitoring. The predominant wind direction is from S, SW & SSW. The brief data are represented in Table below:

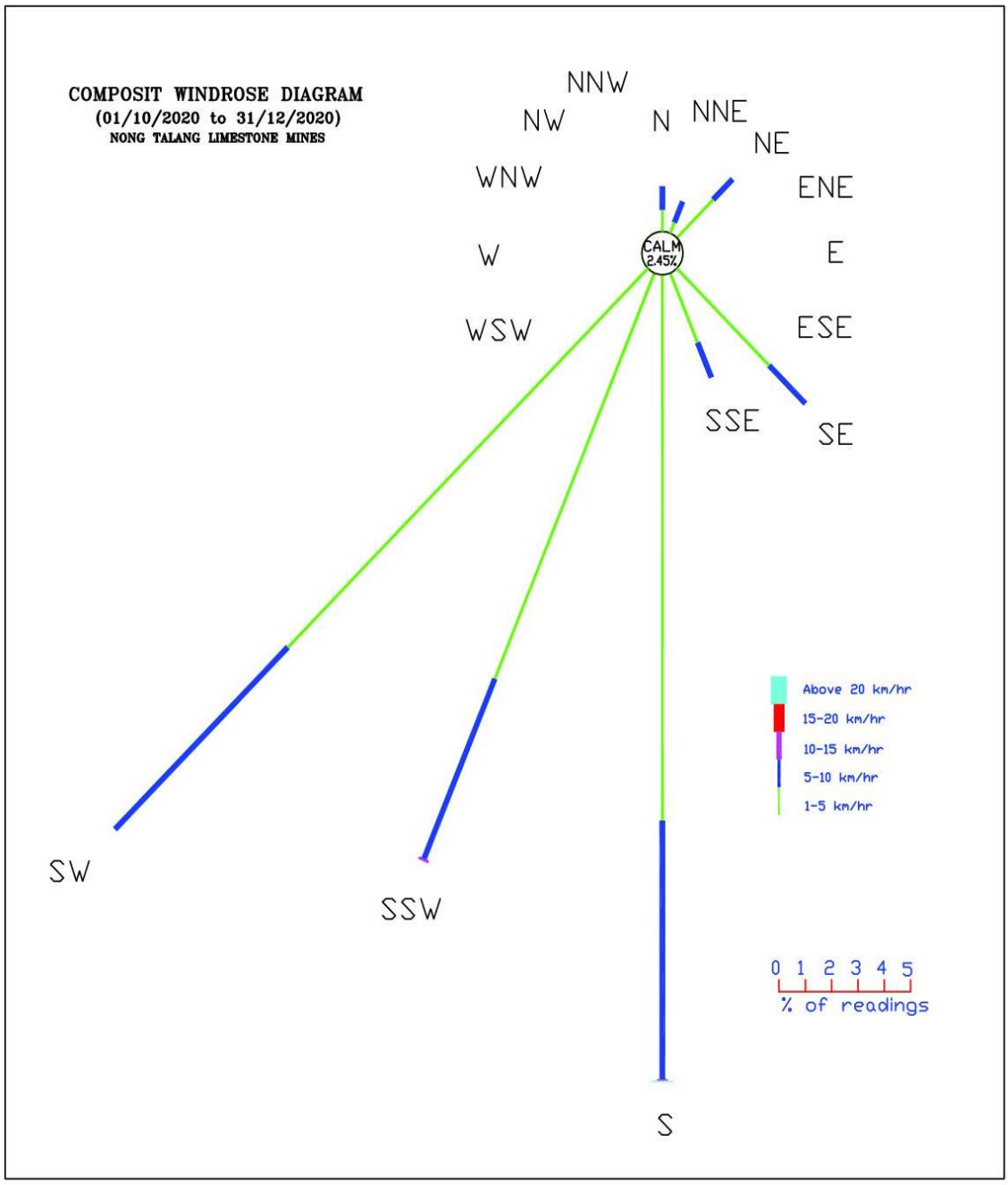
Table 3.4; Micro Meteorological Data

Month	Temperature(°C)			Humidity (%)			Wind speed (km/hr)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
1st -31st Oct 2020	19	36	28.3	60	98	80.3	0	11	4.91
1st -30th Nov 2020	13	33	22.7	50	89	67.4	0	12	4.45
1st -31st Dec 2020	10	29	19.5	50	96	72.2	1	54	4.95

i. **Temperature:** Temperature of the area varied from 10.0^{0}C to 36.0^{0}C.

ii. **Relative Humidity:** Humidity of the area varied from 50.0 % to 98.0%.

iii. **Wind Speed:** Wind speed was in the range of 0.0 Km/hr to 54.0Km/hr.



Seasonal Wind rose Diagram:Oct 2020–Dec 2020

3.4 AMBIENT AIRQUALITY

The ambient air quality monitoring was carried out at 8 stations for the month of October 2020 to December 2020. The guidelines for selections of ambient air monitoring stations given in IS – 5182 part 14, 2000 were followed. These guidelines state that, "when the objective of air sampling is to identify the contribution from specific sources of pollution, the sampling locations should be located in upwind and the downwind direction of such sources".

As per the guidelines, the location of air quality monitoring stations should satisfy the following conditions:

1. The site should be representative of the area selected;
2. The stations should be selected in a way so as to yield data that can be compared with another;
3. Certain physical requirements should be satisfied at the site.

3.4.1 Sampling Stations

To select the air sampling locations, meteorological data with respect to temperature, relative humidity, wind speed and direction plays a vital role. Predominant wind direction plays an important role in determining location of monitoring stations. The monitoring stations were located in areas that were downwind from the source. Location of Air sampling stations are shown below —

Table 3.5; Sampling locations for Ambient Air Quality

Location	Name of the Location	Distance & Direction w.r.t Proposed Mine	Classification
AAQ I	Core Zone	0.0 KM-C	Project Area
AAQ 2	Wahlyngdoh Village	3.0 K M – W	Residential
AAQ 3	Amtapoh Village	3.4 K M - N	Residential
AAQ 4	Amralang Village	3.6 K M – NE	Residential
AAQ 5	Nongtalang Village	1.6 K M – SW	Commercial
AAQ 6	Nongtalang Chnongthmai Village	0.5 K M – SE	Residential
AAQ 7	Amdoh Village	3.3 K M – S	Residential
AAQ 8	Thanghunai Village	0.03 K M- SW	Commercial

However, the predominant wind direction is S, SW & SSW and to study the maximum impact of the project on nearest localities, the sampling location was selected in the North, NE, South & SSW direction. As from the field visit it is found that the maximum habitat is located in the South & South-West directions. To study the present ambient air scenario eight ambient air locations were selected.

3.4.2 Ambient Air Sampling Locations

Figure 3.1; Ambient Air sampling locations on 10 Km Google satellite imagery

3.4.3 Sampling Procedure

Time averaged in-situ sampling was adopted by passing a known volume of air through a trap, and a collecting medium (filter paper). Respirable Dust Sampler& Fine Particulate sampler was used for the purpose.

This procedure was adopted because there are no short-term variations and low concentration of gaseous pollutants was expected.

3.4.4 Analytical methods followed for ambient air quality monitoring:

I. **Particulate Matter ($PM_{2.5}$): (USEPA Quality Assurance Hand Book (Vol.II) Part II, Quality Assurance Guideline Document, 2.12):** Particulate Matter ($PM_{2.5}$) was analyzed by Gravimetric Method. Particulate matter was collected on the 46.2 mm dia glass micro fiber Filter Paper. $PM_{2.5}$value is determined from the values of volume of air passes through Fine Particulate Sampler.

II. **Particulate Matter (PM_{10}) (IS: 5182 Part 23:2006):** Particulate Matter (PM_{10}) was carried out by Respirable Dust sampler as per IS: 5182(Part 23):2006. Particulate matter was collected on the GF/A Filter Paper. Particles with aerodynamics diameter less than the cut-point of the inlet are collected by the filter. The mass of these particles is determined by the difference in filter weight prior to and after sampling.

III. **Sulphur dioxide (SO_2) (IS: 5182; Part – II – 2001):** Sulphur dioxide is absorbed by aspirating a measured air sample through a solution of Potassium or sodium tetrachloro-mercurate, TCM. This procedure results in the formation of a dichlorosulphite mercurate complex. The Sulphite Ion produced during sampling is reacted with sulphamic acid, formaldehyde and pararosaniline to form an azo dye and then determined colorimetricaly.

IV. **Nitrogen Oxides (IS: 5182; Part – VI – 2006):** Nitrogen dioxide is collected by bubbling air through a sodium hydroxide- sodium arsenite solution to form a stable solution of sodium Nitrite. The Nitrite Ion Produced during sampling is reacted with hydrogen peroxide, Sulphanilamide and NEDA to form an azo dye and then determined calorimetrically.

3.4.5 Ambient Air Quality Results

At each station of ambient air quality was monitored twice a week of 3 months **(Oct 2020 to Dec 2020)** 24 hourly at uniform intervals.

Table 3.6; Ambient Air quality results of $PM_{2.5}$ & PM_{10}

Location	Min.	Max.	98 Percentile	Mean	Min.	Max.	98 Percentile	Mean
	$PM_{2.5}$ (Standard – 60 µg/m³)				PM_{10}(Standard – 100 µg/m³)			
A1	25	34	34.0	29.2	60	80	79.1	69.6
A2	22	29	29.0	25.6	62	73	73.0	67.7
A3	22	31	31.0	25.0	56	76	76.0	65.5
A4	21	30	30.0	25.6	59	78	78.0	68.1
A5	27	38	38.0	32.8	62	86	85.5	72.9
A6	24	36	36	29.7	63	81	81.0	73.0
A7	22	28	28.0	24.7	58	75	75.0	67.0
A8	25	36	36	27.8	61	81	81.0	70.0

Table-3.7; Ambient Air quality results of SO_2 & NO_x

Location	Min.	Max.	98 Percentile	Mean	Min.	Max.	98 Percentile	Mean
	SO_2(Standard – 80 µg/m³)				NOx(Standard – 80 µg/m³)			
A1	5.1	7.3	7.1	6.3	7.6	9.6	9.5	8.8
A2	5.0	6.1	6.1	5.5	7.3	9.3	9.2	8.2
A3	4.3	6.9	6.5	5.5	7.1	8.7	8.6	7.9
A4	4.5	7.2	6.8	5.7	7.5	10.1	9.7	8.6
A5	5.8	7.9	7.5	6.7	7.9	12.6	11.8	10.0
A6	5.4	7.1	6.9	6.2	7.4	11.4	11.2	9.1
A7	4.8	6.9	6.6	5.6	7.2	9.6	9.2	8.4
A8	5.1	7.0	6.8	6.0	7.8	10.5	10.1	8.9

(Source of Standards: G.S.R 826(E) dated 16th November 2009 of MoEF, Laboratory engaged: Envirocheck, Kolkata (NABL Accredited).

3.4.6 Data Interpretation

Results of Core & Buffer Zone are shown in above tables & further are explained below.

PM_{10}:

The results of PM_{10} of all locations are showing variations from 73.0 μg/m^3 in the Wahlyngdoh Village to 85.5 μg/m^3 in the Nongtalang Village the results are within the limits of National ambient air quality standards. The variation of PM_{10} concentration has shown in Table-3.6

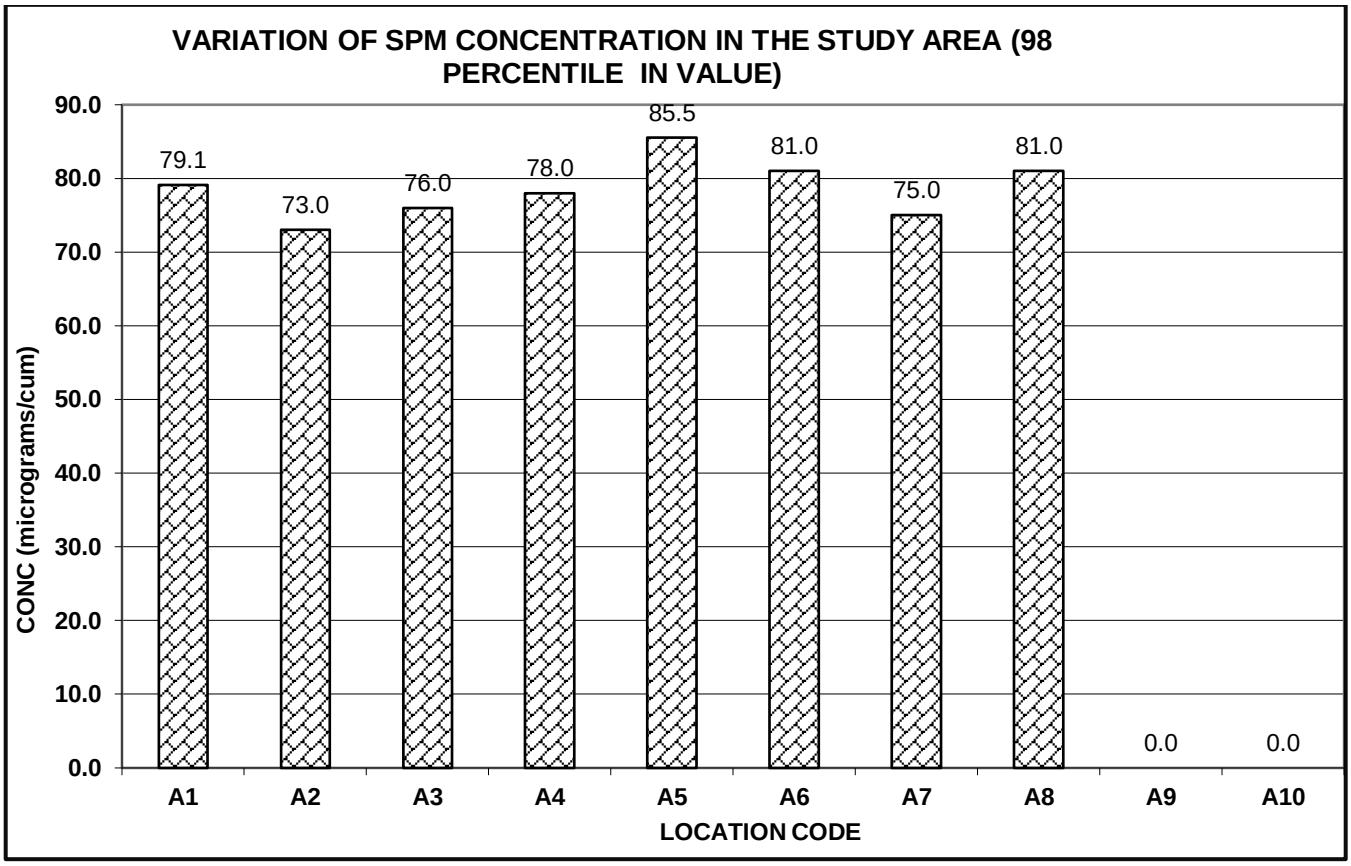


Figure 3.2; Variation of PM_{10} Concentration in the Study area

PM2.5:

The results of $PM_{2.5}$ of all locations are showing variations from 28.0 µg/m^3 in the Amdoh Village to 38.0 µg/m3 in the Nongtalang Village. However, the results are within the limits of National ambient air quality standards. The variation of $PM_{2.5}$ concentration has shown in Table-3.6

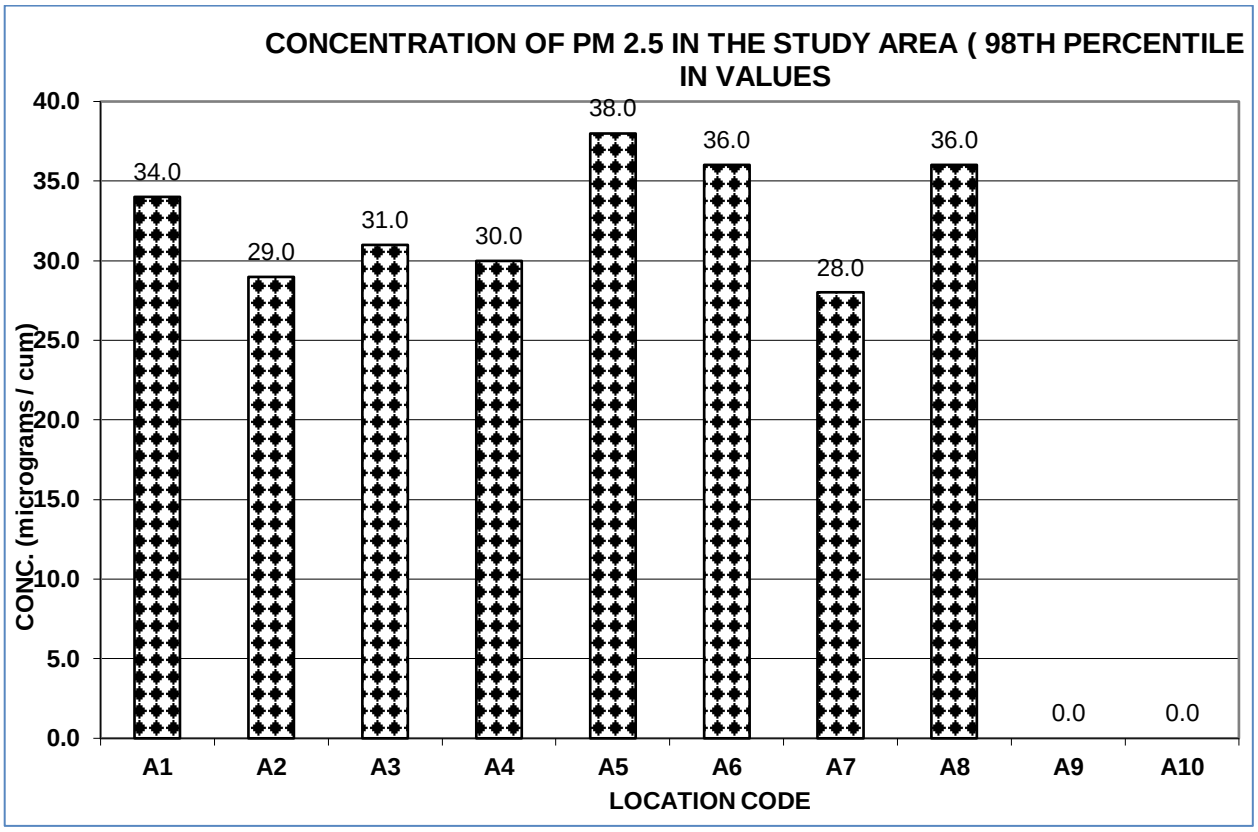


Figure 3.3; Variation of $PM_{2.5}$ Concentration in the Study area

SO2:

The results of SO_2 of all locations are showing variations from 6.1 μg/m^3 in the Wahlyngdoh Village to 7.5 μg/m3 in the Nongtalang Village. However the results are within the limits of National ambient air quality standards. The variation of SO_2 concentration has shown in Table-3.7.

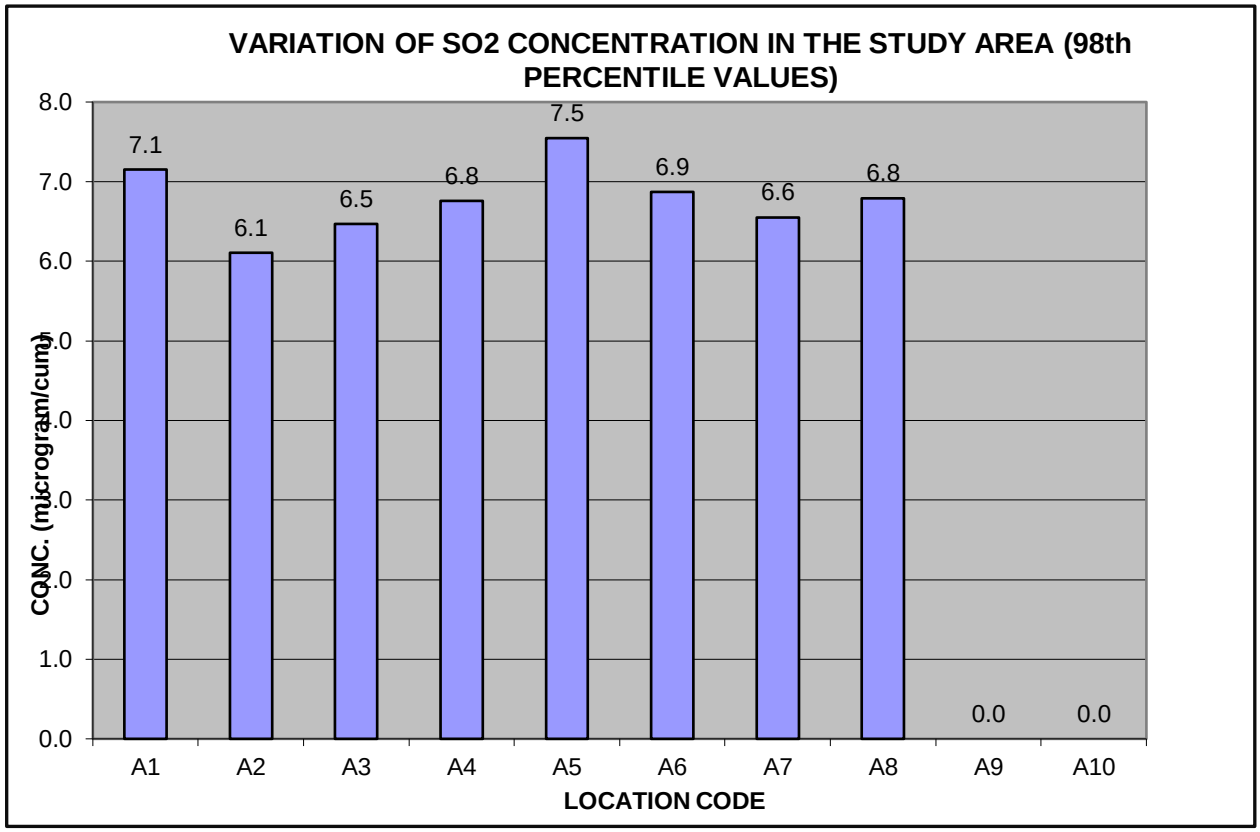


Figure 3.4; Variation of SO_2 Concentration in the Study area

NO2:

The results of NO_2 of all locations are showing variations from 8.6 μg/m^3 in the Wahlyngdoh Village 11.8 μg/m^3 in the Nongtalang Village. However, the results are within the limits of National ambient air quality standards. The variation of NO_2 concentration has shown in Table-3.7

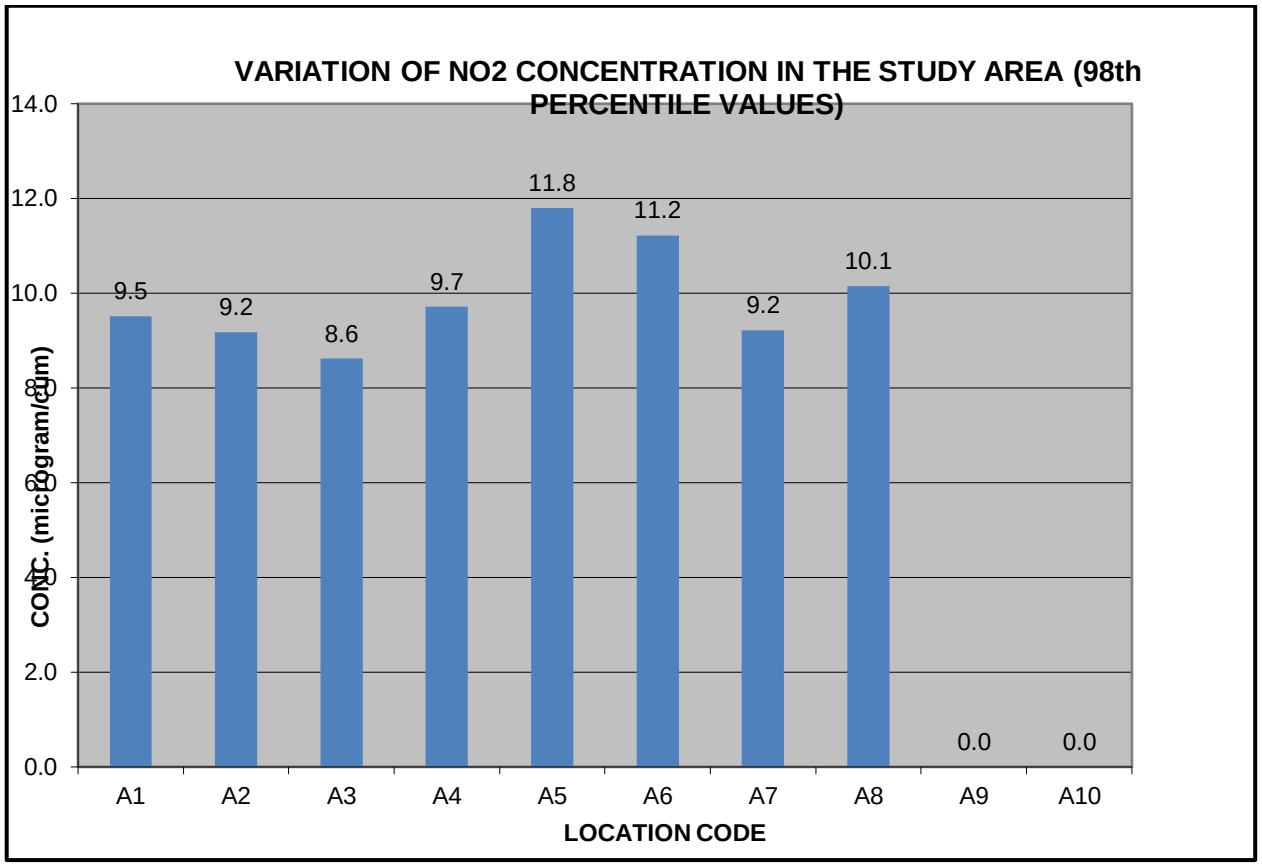


Figure 3.5; Variation of NO_2 Concentration in Study area

3.5 NOISE QUALITY

Noise Measurement Locations: To assess the noise level of the proposed area, following stations were selected. Location of Noise sampling stations are described below and location are given below.

LOCATIONS OF NOISE SAMPLING STATION

Table 3.8; Sampling Location for Noise Quality

Location Code	Name of the Location	Distance & Direction w.r.t Proposed Mine	Classification
ANL I	Core Zone	0.0 KM-C	Project Area
ANL 2	Wahlyngdoh Village	3.0 K M – W	Residential
ANL3	Amtapoh Village	3.4 K M - N	Residential
ANL 4	Amralang Village	3.6 K M – NE	Residential
ANL 5	Nongtalang Village	1.6 K M – SW	Commercial
ANL 6	Nongtalang Chnongthmai Village	0.5 K M – SE	Residential
ANL 7	Amdoh Village	3.3 K M – S	Residential
ANL8	Thanghunai Village	0.03 K M- SW	Commercial

To study the present ambient air scenario 8 ambient Noise locations were selected.

3.5.1 Locations of Noise Sampling Stations

The location of Noise sampling is shown below in the 10km radius map.

Figure 3.6; Noise sampling Locations on 10 Km Google satellite imagery

3.5.2 Methodology

At each station noise level was monitored for 24-hours simultaneously. For each measurement, dB (A) readings was taken for every 15 minutes for 24 hrs ones in a season to get Leq values.

Table 3.9; Noise quality results

S. No.	Locations	L_{eq} noise level dB(A)	Maximum noise level dB(A)	Day time (6.00 A.M to 10.00P.M)	Night time (10.00 P.M to 6.00A.M)
				Standard (L_{eq} in dB(A)	Standard (L_{eq} in dB(A)
ANL1	**Core Zone**	55.0	60.6	55.8	42.6
ANL2	**Wahlyngdoh Village**	53.6	59.3	54.3	41.7
ANL3	**Amtapoh Village**	54.8	60.6	55.8	41.8
ANL4	**Amralang Village**	54.7	60.2	55.6	41.8
ANL5	**Nongtalang Village**	55.9	62.8	57.1	42.0
ANL6	**Nongtalang Chnongthmai Village**	54.9	61.2	56.1	40.8
ANL7	**Amdoh Village**	54.8	60.0	55.7	42.1
ANL8	**Thanghunai Village**	55.1	61.0	55.8	42.9

(Source of Standards: CPCB standards for Noise Pollution (Regulation & control) Rules, Laboratory: Envirocheck, Kolkata (NABL Accredited)

3.5.3 Data Interpretation:

The Ambient Noise Quality results are summarized above**.** The results are discussed below:

Core Zone: The details are given below:

Core Zone: ANL1: The ambient noise level during day time at the proposed project site was 55.0 dB (A) which are within the standard limit of Industrial area~75 dB (A). During night the noise level at the project site ranges from 42.6dB (A) which is within the night-time noise standard limit of 70dB (A).

No mining activity was observed at the site.

Buffer Zone: The details are given below:

ANL2: The noise level at **Wahlyngdoh Village** is 53.6 dB (A) which is less than the day time noise standard limit of residential area are ~ 55 dB (A). During night the noise level was recorded 41.7 dB (A) which is less than the night time noise standard limit of residential area are ~ 45 dB (A).

ANL3: The noise level at **Amtapoh Village** is 54.8 dB (A) which is less than the standard limit of residential area ~ 55 dB (A). During night the noise level was recorded 41.8 dB (A) which is less than the night-time noise standard limit of ~ 45.0 dB (A).

ANL4: The noise level at **Amralang Village** is 54.7 dB (A) which is less than the standard limit of residential area ~ 55 dB (A). During night the noise level was recorded 41.8 dB (A) which is less than the night-time noise standard limit of ~ 45.0 dB (A).

ANL5: The noise level at **Nongtalang Village** is 55.9 dB (A) which are within the standard limit of commercial area~65 dB (A). During night the noise level at the project site ranges from 42.0 dB (A) which is within the night-time noise standard limit of 55 dB (A).

ANL6: The noise level of **Nongtalang Chnongthmai Village** is 54.9 dB (A) which is less than the day time noise standard limit of residential area are ~ 55 dB (A). During night the noise level is 40.8 dB (A) which is less the night time noise standard limit of residential area are ~ 45 dB (A).

ANL7: The noise level of **Amdoh Village** is 54.8 dB (A) which is less than the day time noise standard limit of residential area are ~ 55 dB (A). During night the noise level is 42.1 dB (A) which is less the night time noise standard limit of residential area are ~ 45 dB (A).

ANL8: The noise level of **Thanghunai Village** is 55.1 dB (A) which is lower than the standard limit of commercial areas of ~ 65 dB (A). During night the noise level is 42.9 dB (A) which is within the standard limits of commercial area ~ 55 dB (A).

3.6 Ground Water

The occurrence of ground water is directly related to the geological setup and structure. It would be in fitness of things to assess the geology before going to the hydrology of the area. Further ground water is controlled by the various factors influencing it regionally; therefore, it would be wise not to divide the study in core and buffer zone.

3.6.1 Geology:

Regional Geology

In a regional scale the area forms a part of the Meghalaya Plateau exposing geological milieu representing Precambrian to Tertiary sequence in this part of West Jaintia Hills District of Meghalaya.

Table: Summarized Regional Geological set-up

Geological Age	Group Name	Formation Name	Rock Type
Palaeocene-Eocene	Jaintia	Kopili Shella Langpar	Argillaceous sediments Dominantly limestone with sandstone Calc. sandstone calc siltstone with sandy l.St
Up Cretaceous	Ultrabasic		
Cretaceous Jurassic	Khasi Group Sylhet trap	Mahadek	Thick units of conglomerate with Impersistent interbands of sandstone Volcanic trap with vesicles
Pre-Cambrian	Khasi Greenstone Shillong Group		Epidiorite, meta-dolerite, diorite dykes Thick pile of quartzite
Proterozoic Archaean	Khasi Greenstone Shillong Group		Epidiorite, meta-dolerite, diorite dykes Thick pile of quartzite
Proterozoic Archaean	Assam Meghalaya Gneissic Complex		Para and ortho- gneiss, migmatite, mica schist

Archaean Gneissic Complex is exposed west of Jarain and along narrow bands SE of Mawpyut, and also south and SE of Nongtalang, in the northern side of Dawki Fault. Extensive exposure of quartzite is noticed from north of Thadlaskein to south of Jowai. Primary sedimentary structures like compositional banding, graded bedding, cross-stratification are visible within the Shillong Group. Khasi Greenstone represented by amphibolite and meta dolerite and occur as concordant bodies within quartzite. Khasi Greenstone locally alters to biotite-chlorite schist. North of Mawpyut village there are exposures of ultramafic rock. Cretaceous sediments occur as inliers SE and SW of Amlarem much south of Jowai. Younger granitoids and amphibolites are seen SE and SW respectively of Thadlaskein and around Mawpyut there are exposures of grey granite gneiss and ultrabasic rock. Cretaceous sediments of Jadukata Formation expose along Pynursla –Dawki Road and the younger Mahadek Formation occur as inliers SE and SW of Amlarem. Small exposure of basic intrusive in the form of Sylhet Trap is seen in Nongtalang. Except the aforesaid rock types, the whole parts of the Districts are covered by sediments of the Tertiary age with the age ranging from Palaeocene to Eocene. Around Sohmynting and Mawpyut there are thick sequences of capping of coal bearing Shella Sandstone Formation over the quartzite, granitoid and ultramafic, some of which are locally extracted. Bottom-most Langpar Formation is exposed along Muktapur-Syndai road with calcareous sandstone, grey shale, sandy shale with thin coal seams whereas Sylhet (=Shella) Limestone Formation dominates the Southern part, South of Amlarem three limestone Members are exposed with variable thickness. Argillaceous Kopili Formation is mainly exposed along Dawki- Muktapur section. The area has undergone severe tectonic activities during pre- and post-Tertiary period because of which the area is highly faulted along E-W and NE-SW direction amongst which the Dawki Fault runs south of the block in E-W direction.

Local Geology

The proposed mining area is small and exposes only the limestone of the Sylhet limestone formation. Table provides a glimpse of the Geology that is seen in the area.

Table-: Local Geological set-up in the block

Geological Age	Group Name	Formation Name	Summarized Rock Type
Recent	Newer Alluvium	Unclassified	Unconsolidated soil, scree material
Eocene	Jaintia Group	Sylhet (=Shella)	Top part with grey/white limestone Bottom part with dark /steel grey limestone

The block exposes a monotonous litho-package of marly limestone. Limestone is greyish in colour, hard and compact. At places the limestone is steel grey in colour. Fossil content is minimum with nummulites, discocyclina and with occasional crystals of calcite. It is difficult to trace bedding plane as the surface is covered with thick calcareous deposition. Extensive weathering results in formation of 'karst topography' on the surface resulting in spiked surface along slopes. Solution cavities, caverns, stylolites with variable magnitude and wave length are some of the other features seen on the limestone Overburden constitutes of unconsolidated fragments, boulders, angular pebbles overlain by brownish soil horizon that rarely exceeds one meter in thickness.

3.6.2 Hydrology

The hydrogeological formation of the study area comprised of Granite Gneiss and intrusive of Archean Proterozoic, Quartzite of Paleo-Meso-Proterozoic of Shillong group, Granite of Neo Proterozoic- early Proterozoic, Sandstone and Limestone of Paleocene-Eocene age. The presence of weak planes like fractures and joints in these hard rock formation forms the principal aquifer in the area. The ground water in the district occurs under unconfined, semi confined to confined conditions. Study of dug wells and exploration data reveals the presenceof phreatic/shallow and deep fractured aquifers in the district.

(**Source:** Central Ground Water Board, India)

3.6.3 Ground water Development

Ground water exploration has been carried out in different parts of the district to delineate the potential aquifers and their geometry and to determine the hydrogeological parameters of the aquifer systems. Before NAQUIM programme started in the district, 5 EW and 1 OW were constructed and as a part of data gap generation 5 EW were constructed during the course of study. Details of the exploratory wells are presented below. The summarized details of Ground Water Exploration carried out in the district are given below-

Table 3.10: Summarised Details of Ground Water Exploration

Sl. No.	Location	Block	District	Latitude	Longitude	RL (m)	Type	Lithology
1	Raliang	Laskein	West Jaintia Hills	25°30′05.4″	92°23′56.2″	1276	Depression	Granite Gneiss
2	Madanrwan	Laskein	West Jaintia Hills	25°32′23.1″	92°28′08.8″	1041	Depression	Granite Gneiss
3	Niawkmai	Laskein	West Jaintia Hills	25°32′58.2″	92°29′59.8″	981	Depression	Granite Gneiss
4	Banmuhur	Laskein	West Jaintia Hills	25°31′46.1″	92°32′33.7″	906	Depression	Sandstone
5	Nongringkoh	Laskein	West Jaintia Hills	25°29′11.0″	92°30′54.2″	1082	Depression	Granite Gneiss
6	Shangpung	Laskein	West Jaintia Hills	25°28′49.6″	92°21′11.3″	1260	Depression	Sandstone
7	Thadlaskien	Thadlaskein	West Jaintia Hills	25°29′42.6″	92°10′13.4″	1368	Depression	Quartzite
8	Tyrsang	Thadlaskein	West Jaintia Hills	25°32′04.7″	92°08′52.3″	1328	Fracture	Quartzite
9	Lad Mukhla	Thadlaskein	West Jaintia Hills	25°30′37.0″	92°09′52.6″	1344	Depression	Quartzite
10	Mukhla	Thadlaskein	West Jaintia Hills	25°30′20.5″	92°10′17.9″	1362	Depression	Quartzite
11	Nartiang	Thadlaskein	West Jaintia Hills	25°34′09.7″	92°12′23.5″	1204	Depression	Quartzite
12	Moobakhon	Thadlaskein	West Jaintia Hills	25°38'37.4″	92°17′12.6″	1045	Depression	Quartzite
13	Namdong	Thadlaskein	West Jaintia Hills	25°39'33.0″	92°19′36.4″	990	Depression	Quartzite
14	Khonsaro	Thadlaskein	West Jaintia Hills	25°41'09.2"	92°20′49.4″	963	Depression	Quartzite
15	Saitsama	Thadlaskein	West Jaintia Hills	25°43'15.2"	92°23′01.9″	891	Depression	Quartzite
16	Khanduli	Thadlaskein	West Jaintia Hills	25°43'11.5"	92°24′55.0″	859	Depression	Quartzite
17	UmsyneirSaitsama	Thadlaskein	West Jaintia Hills	25°43'21.1"	92°23′46.7″	878	Depression	Quartzite
18	Mukoh	Thadlaskein	West Jaintia Hills	25°40'25.5"	92°21′01.1″	960	Depression	Quartzite
19	Nongbah	Thadlaskein	West Jaintia Hills	25°31'22.0"	92°14′56.7″	1313	Fracture	Granite Gneiss
20	Jowai	Thadlaskein	West Jaintia Hills	25°26'30.37"	92°11′20.47″	1263	Depression	Quartzite
21	Mostam	Amlarem	West Jaintia Hills	25°24'42.5"	92°10′14.0″	1318	Depression	Sandstone
22	Shkendyrsit	Amlarem	West Jaintia Hills	25°21'49.2"	92°08′51.5″	1304	Fracture	Sandstone
23	Umjarang	Amlarem	West Jaintia Hills	25°18'52.38"	92°07′49.51″	1142	Fracture	Sandstone
24	Dawki	Amlarem	West Jaintia Hills	25°11'11.8"	92°01′08.6″	28	Fracture	Sandstone
25	Amlari	Amlarem	West Jaintia Hills	25°11'00.68"	92°08′59.83″	418	Fracture	Limestone

It may be clearly observed that the ground water development in the region, in which lease area falls in safe category.

3.6.4 Water Conservation & Artificial Recharge-

During rains the water will be collected in the pit and same shall be re-use for various activities during non- rainy days.

3.7 WATERQUALITY

The various indicators of water quality form one of the most important tools for impact assessment in future, therefore it is imperative to assess the existing water quality of both ground and surface water occurring in the core and buffer zone. The details of the study of water quality are given below:

3.7.1 Sampling station

To assess the water quality of the proposed area, following 8 stations (6 ground water & 2 surface water) were selected. Location of Water sampling stations is described below and location below:

Table 3.11; Sampling locations for water quality

Station No.	Location	Classification	Distance & Direction from Project site	Environmental Significance
GW1	Core Zone	Tube Well	0.0 KM-C	Existing Ground Water quality at Core zone
GW2	Amtapoh Village	Tube Well	3.4 K M - N	Existing Ground water quality at Buffer zone
GW3	Amralang Village	Tube Well	3.6 K M – NE	
GW4	Nongtalang Village	Tube Well	1.6 K M – SW	
GW5	Amdoh Village	Tube Well	3.3 K M – S	
GW6	Thanghunai Village	Tube Well	0.03 K M- SW	
SW1	Wah Umngot River (DS) near Dawki	Surface Water	9.3 KM-W	Existing Surface water quality at Buffer zone
SW2	Wah Umngot River (DS) near Dawki	Surface Water	6.4 KM-SW	

Surface Water: To assess the surface water quality of the proposed area, stations were selected. All the stations were taken in the buffer zone as core zone did not have any surface water body. Location of surface water sampling stations is shown in the map—

3.7.2 Criteria of Selection of sampling Locations:

Water sampling locations were selected on the basis of following criteria: source of water, flow of water, geological structure (hydrogeology), use of water, depth of water table etc.

Ground water samples were collected from 6 locations. Core zone (Tube Well), Amtapoh Village (Tube Well), Amtapoh Village (Tube Well), Nongtalang Village (Tube Well), Amdoh Village (Tube Well), & Thanghunai Village (Tube Well).

Surface water was collected from Upstream & downstream to study the chemical parameters. During surface water sampling flow of water pays an important role. In present study, source of surface water is Umngot River.

3.7.3 SURFACEWATER

The core zone does not have any surface water body. However, following water bodies were observed across the buffer zone in the vicinity of the mining lease.

Wah Umngot River

The Wah Umngot River is about 9.3 km from lease area towards West.

3.7.4 Sampling Locations:

The sampling locations have been shown on 10km radius Map.

Figure 3.7; Water sampling Locations on 10 Km Google satellite imagery

3.7.5 Sampling Frequency and Sampling Techniques:

As per the standard practice grab sampling was done for 6 locations, and integrated Sampling River. Water samples were taken as per the Standard Methods (IS & APHA, 23nd Edition 2012). Necessary precautions were taken for preservation of samples.

The physical parameters viz. pH, temperature and conductivity were measured at site using portable water analyzer.

As evident from the sampling locations for water quality assessment represented surface and groundwater. The results of water quality assessment are presented below:

3.7.6 Groundwater Quality Results

The water quality assessment was done based on the IS-10500, the analysed parameters were compared with IS-10500 to assess portability of the water available in the area. The detailed results are given in the **Annexure-6.** The results of water quality assessment for the parameters, which were found close to the limiting values as per IS-10500 are presented and discussed here. The results of the 6 sample of ground water in core and buffer zone are given as ahead —

3.7.7 Ground Water Quality results of Core and Buffer Zone

SN	Parameter	Unit	IS:10500-93 Drinking Water Standards	Core Zone of Chui Pohlynjar (GW1)	Amtapoh Village (GW2)	Amralang Village (GW3)	Nongtalang Village (GW4)	Amdoh Village (GW5)	Thanghunai Village (GW6)
1.	pH Value	-	6.5 to 8.5	6.8	6.6	6.7	6.9	6.9	6.8
2.	Turbidity NTU	NTU	5 (10)	0.5	0.6	0.5	0.6	0.7	0.5
3.	Electrical Conductivity at 25^0C	µS/cm	-	610.40	670.00	662.30	655.20	668.50	612.0
4.	Apparent Colour	Hazen	5	<1	<1	<1	<1	<1	<1
5.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
6.	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7.	Total Dissolved Solids (TDS)	mg/l	500 (2000)	445.00	475.00	456.00	462.00	440.00	447.00
8.	Total Hardness (CaCO3)	mg/l	300 (600)	262.00	269.00	275.00	277.00	272.00	266.00
9.	Iron (as Fe)	mg/l	0.3 (1.0)	0.21	0.20	0.19	0.21	0.22	0.20
10.	Chlorides (as Cl)	mg/l	250 (1000)	34.10	37.20	41.30	40.40	35.30	37.10
11.	Calcium (as Ca)	mg/l	75 (200)	40.10	42.60	51.20	46.30	44.30	40.40
12.	Magnesium (as Mg)	mg / l	30 (100)	21.90	20.80	22.10	21.90	22.80	21.30
13.	Sulphate (as SO4)	mg / l	200 (400)	20.40	19.40	20.60	22.30	21.20	21.20
14.	Nitrates (as NO3)	mg / l	45	4.10	3.80	3.70	4.20	5.10	3.90
15.	Fluoride (as F)	mg / l	1.0 (1.5)	0.48	0.58	0.61	0.59	0.63	0.49
16.	Total Alkalinity (CaCO3)	mg /l	200 (600)	165.00	171.00	160.00	161.00	168.00	169.00
17.	Free Residual Chlorine	mg /l	Min 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
18.	Copper as(Cu)	mg /l	0.05 (1.5)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
19.	Manganese as (Mn)	mg /l	0.1 (0.3)	0.03	0.04	0.04	0.03	0.03	0.03
20.	Mercury as (Hg)	mg / l	0.001	< 0.0005	< 0.0003	< 0.0004	< 0.0005	< 0.0005	< 0.0003
21.	Cadmium as (Cd)	mg / l	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
22.	Selenium as (Se)	mg / l	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
23.	Arsenic as (As)	mg / l	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
24.	Lead as (Pb)	mg / l	0.05	< 0.005	< 0.004	< 0.005	< 0.005	< 0.005	< 0.005
25.	Zinc as (Zn)	mg / l	5 (15)	< 0.1	< 0.2	< 0.3	< 0.3	< 0.3	< 0.3
26.	Chromium as (Cr)	mg / l	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
27.	Aluminium as (Al)	mg / l	0.03 (0.2)	0.008	0.006	0.007	0.006	0.006	0.006
28.	Boron as (B)	mg / l	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

29.	Cyanide as (CN)	mg / l	0.05	< 0.003	< 0.003	< 0.004	< 0.005	< 0.005	< 0.004
30.	Total Coliform	MPN/ 100 ml	Nil	< 1	< 1	< 1	< 1	< 1	< 1
31.	Phenolic Compounds	mg / l	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
32.	Anionic Detergents	mg / l	0.2(1.0)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
33.	Polynuclear aromatic Comp (as PAH)	µg / l	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
34.	Mineral Oil	mg / l	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Table 3.12; Core and Buffer Zone Water quality results

3.7.8 Data Interpretation of Ground water quality (Core & Buffer zone):

The Ground water quality results clearly explain that:

Core & Buffer zone ground water results: is taken as the area within 10 km radius from the proposed project site. Collected samples are from ground water sources.

1. The Ground water quality at location **GW1 (Core Zone of Chui Pohlynjar, Tube Well Water)** shows that parameters like Total Hardness (262.0 mg/l); Total dissolved solids (445.0 mg/l), Magnesium (21.90 mg/l), & Alkalinity (165 mg/l) is well within drinking water standards (IS: 10500).
2. The Ground Water results in the location **GW2 (Amtapoh Village, Tube Well Water)** shows all parameters within the permissible range.
3. The Ground Water results in the location **GW3 (Amralang Village, Tube Well water)** shows all parameters within the permissible range.
4. The Ground Water results in the location **GW4 (Nongtalang Village, Tube Well Water)** shows all parameters within the permissible range.
5. The Ground water quality at location **GW5 (ML of Amdoh Village, Tube Well Water)** shows all parameters within the permissible range.
6. The Ground water quality at **GW6 (Thanghunai Village, Tube Well Water)** shows parameters within the permissible range.

The detailed tables are given at Annexure no.8.

3.7.9 Surface Water Quality Results:

The surface water quality assessment was done based on the IS-10500 as well as on CPCB Surface Water Criteria; the analyzed parameters were compared with IS-10500 to assess portability of the water available in the area also against the norms of CPCB for surface water. The detailed results are given in the **Annexure -8.** The results of water quality assessment for the parameters, which were found close to the limiting values as per IS-10500, are presented discussed here —

Table 3.13: Surface water Quality results of Wah Umngot River

S. No.	Parameters	Unit	As Per IS:2296: 1992 Category - C	SW1 (Upstream)	SW2 (Downstream)
1.	Colour	Hazen units	300	<1	<1
2.	Odour	-	Un - Objectionable	Agreeable	Agreeable
3.	Turbidity NTU	NTU	-	0.7	0.8
4.	pH Value	-	6.5 to 8.5	7.10	7.20
5.	DO	mg / l	≥ 4	7.5	7.7
6.	BOD (3d, 250C)	mg / l	3	2.60	2.90
7.	COD	mg / l	-	6.50	6.80
8.	Total Hardness (CaCO3)	mg / l	-	97.3	99.2
9.	Oil and Grease	mg / l	0.1	<1	<1
10.	Iron (as Fe)	mg / l	50	0.19	0.17
11.	Chlorides (as Cl)	mg / l	600	64.10	63.20
12.	Electrical Conductivity at 25^0C	µs/cm	-	465.50	470.10
13.	Total Dissolved Solids (TDS)	mg / l	1500	288.00	299.00
14.	Calcium (as Ca)	mg / l	-	26.30	29.50
15.	Magnesium (as Mg)	mg / l	-	7.10	7.60
16.	Sulphate (as SO4)	mg / l	400	23.20	25.10
17.	Free residual chlorine	mg / l	-	< 0.1	< 0.1
18.	Nitrates (as NO3)	mg / l	50	2.70	2.82
19.	Fluoride (as F)	mg / l	1.5	0.31	0.29
20.	Free Ammonia (as NH3)	mg / l	-	<1.0	<1.0
21.	Copper as(Cu)	mg / l	1.5	< 0.02	< 0.02
22.	Manganese as (Mn)	mg / l	-	0.09	0.09
23.	Cadmium as (Cd)	mg / l	0.01	< 0.001	< 0.001
24.	Selenium (as Se)	mg / l	0.05	< 0.001	< 0.001
25.	Arsenic as (As)	mg / l	0.2	< 0.01	< 0.01
26.	Mercury as (Hg)	mg / l	-	< 0.0003	< 0.0003
27.	Lead as (Pb)	mg / l	0.1	< 0.005	< 0.005
28.	Zinc as (Zn)	mg / l	15	< 0.3	< 0.3
29.	Boron as (B)	mg / l	-	< 0.1	< 0.1
30.	Chromium as (Cr +6)	mg / l	0.05	< 0.03	< 0.03
31.	Cyanide as (CN)	mg / l	0.05	< 0.005	< 0.005
32.	Phenolic Compounds	mg / l	0.005	< 0.001	< 0.001
33.	Anionic Detergents as MBAS	mg / l	1	< 0.001	< 0.001
34.	Total Coliform	MPN/100 ml	5000	< 1	< 1

35.	Polynuclear aromatic Comp (as PAH)	ppb	-	< 0.03	< 0.03

Source: Laboratory: Envirocheck, Kolkata(NABL Accredited)

All the parameters marked with *** are also compared with the surface water quality criteria of CPCB, this is for all classes 'A' to 'E" is shown as below:

S.No.	Parameters	Unit	CPCB Surface water quality criteria				
			Class 'A'	Class 'B'	Class 'C'	Class 'D'	Class 'E'
1	pH Value	-	6.5-6.8	6.5-8.5	6.5 – 9.0	6.5-8.5	6-8.5
2	BOD	mg/l	≤2	≤3	≤3	-	-
3	DO	mg/l	≥6	≥5	≥4	-	-

3.7.10 Data Interpretation of surface water quality (Buffer zone):

The Surface water quality of the **Umngot river** shows that all the parameters are within the CPCB Water Quality Criteria Class of water 'A', 'B', 'C', 'D' & 'E'. BOD of Upstream and Downstream water (2.60 mg/l & 2.90 mg/l) of the river, which is less than CPCB Water Quality Criteria Class of water 'C'; DO of upstream & downstream water (7.45mg/l& 7.7 mg/l) is acceptable as per CPCB Water Quality Criteria Class of water 'A'.

3.8 Topography:

The elevation range within the lease area is 900 m mRL highest contour to 700 mRL lowest contour. The mineral is exposed in the whole lease area.

Drainage-

Drainage in the lease area is easterly. General drainage outside the area is almost easterly. The area is hilly and stony. Area is broken by nalahas /Nadi in the five kilometers periphery is illustrated on plate-2.

3.9 SOIL QUALITY

To assess the soil quality of the proposed area, following stations were selected. Soil profile and quality was studied at 6 different locations.

3.9.1 Sampling location:

Location of Soil sampling stations is described below.

Table 3.14; Sampling location for soil quality

Station No.	Location	Distance & Direction from Project area	Project area / Study area	Environmental Significance
S1	Core Zone	0.0 KM-C	-	Existing Soil quality at core zone
S2	Amtapoh Village	3.4 K M - N	Agricultural Land	Existing Soil quality at Buffer zone
S3	Amralang Village	3.6 K M – NE	Agricultural Land	
S4	Nongtalang Village	3.6 K M – NE	Agricultural Land	
S5	Amdoh Village	3.3 K M – S	Agricultural Land	
S6	Thanghunai Village	3.3 K M – S	-	

3.9.2 Locations of soil sampling stations:

Location of Soil sampling stations are shown in the map below and described ahead —

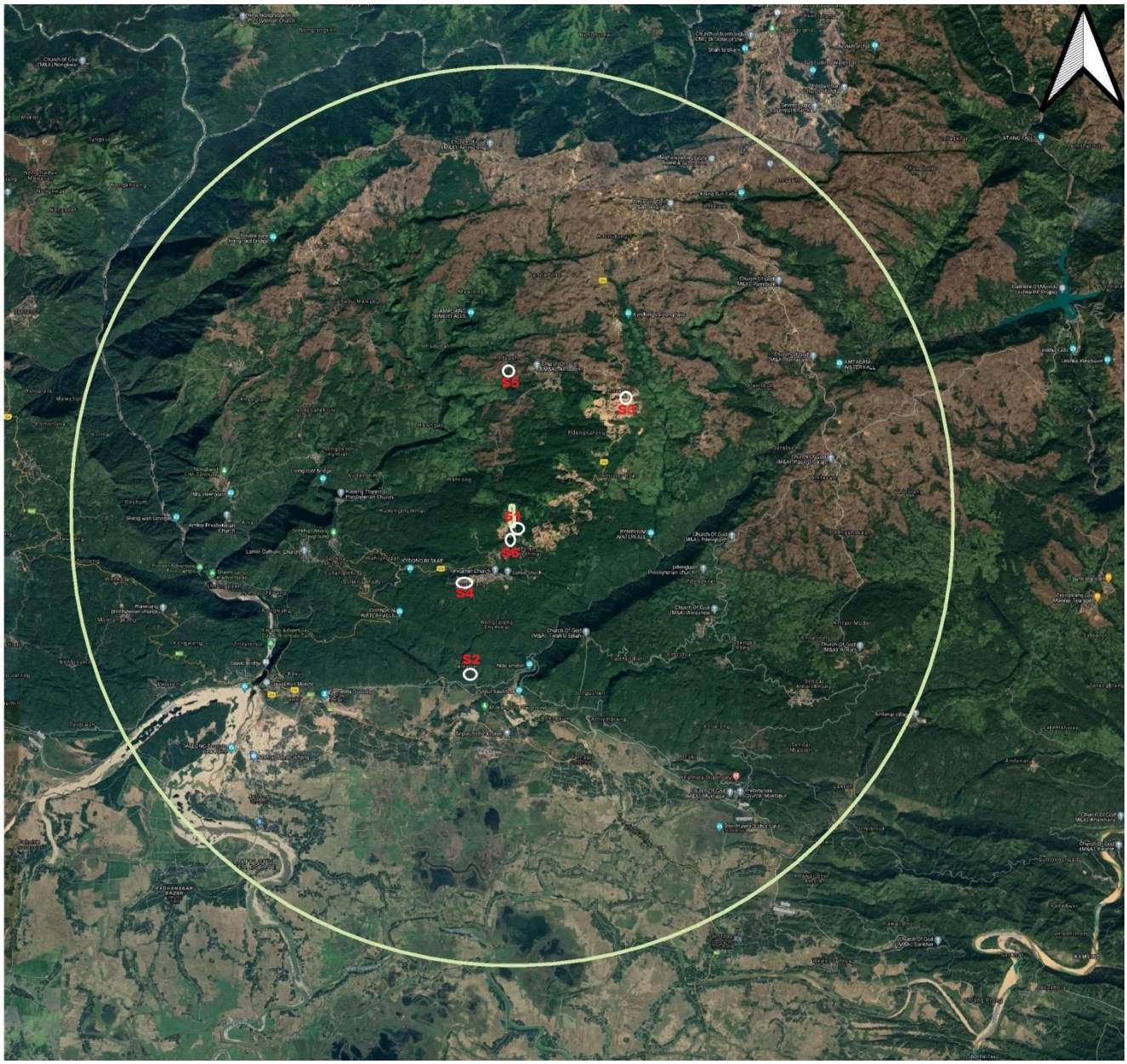


Figure 3.8; Soil sampling locations on 10 Km Google Satellite image

3.9.3 Sampling procedure & Analysis:

Augur method was used and samples were collected at 15 cm depth after removing the upper crust. Sample from each spot were well mixed with hand on a clean polythene sheet. About 1 kg of soil was retained after process of quartering. This sample was kept for some time for air-drying at room temperature, stored in polythene bag with label at the top. Samples were analyzed for bulk density, pH, nitrogen, phosphorus, calcium, magnesium and organic contents.

The soil quality assessment has been carried out at 6 locations were identified for collection of soil samples from the study area. The sampling locations are shown in Figure-3.8. and their distances and bearings from the project site are listed in Table 3.14

Physical Characteristics of soil

Physical characteristics of soil are delineated through specific parameters viz. bulk density, moisture, Infiltration rates and texture are presented in Table 3.15.

Regular cultivation practices increase the bulk density of soils thus inducing compaction. This results in reduction in water percolation rate and penetration of roots through soils. The soils with low bulk density have favourable physical conditions where as those with high bulk density exhibit poor physical conditions for agriculture crops. The bulk density of the soil in the study area ranged between 1.42 to 1.49 gm/cm³ which indicates favourable physical condition for plant growth.

TABLE 3.15
PHYSICAL CHARACTERISTICS OF SOIL

S. No.	Location	Bulk Density gm/cm³	Moisture %	Infiltration Rates cm/hr	Texture
1	Core Zone	1.46	6.1	47.00	Loamy Sand
2	Amtapoh Village	1.42	7.2	41.00	Clay Sand
3	Amralang Village	1.49	6.3	44.00	Loamy Sand
4	Amralang Village	1.45	7.4	47.00	Loamy Sand
5	Amdoh Village	1.47	7.1	43.00	Loamy Sand
6	Thanghunai Village	1.49	6.3	47.00	Loamy Sand

Chemical Characteristics of soil

Data collected for chemical characteristics of soils through selected parameters viz. pH, EC, Total Organic, cations and anions are presented in Table 3.16 & 3.17.

pH is an important parameter indicative of alkaline or acidic nature of soil. It greatly affects the microbial population as well as solubility of metal ions and regulates nutrient

availability. Variation in the pH of the soil in the study area is presented in Table 3.16 and it is found to be neutral to slightly acidic (6.2 to 7.2).

Electrical conductivity, a measure of soluble salts in the soil is in the range of 339.0 μs/sec to 361.0 μs/sec as seen in Table 3.16. The important cations in the soil are calcium and magnesium whose concentrations range from 1.60 to 2.40 meq/100g and 3.30 to 4.20 meq/100g respectively.

Organic matter present in soil influences its physical and chemical properties and is responsible for stability of soil aggregates. Total Organic Carbon and nitrogen are found in the range of 1.41 – 1.51 % and 26.30– 29.70 mg/100g. This shows that soil is moderately good in organic and nutrient contents. Plant requires some of the heavy metals at microgram level for their metabolic activities. These heavy metals are termed as micronutrients. Their deficiency becomes a limiting factor in plant growth, but at the same time their higher concentration in soil leads to toxicity.

TABLE 3.16
CHEMICAL CHARACTERISTICS OF SOIL IN STUDY AREA

S. No.	Location	pH	EC (μs/sec)	Org. C	Cl	SO4	Ca	Mg
				%			meq/100g	
1	Core Zone	6.60	355.0	1.43	0.077	0.033	1.60	3.70
2	Amtapoh Village	6.80	361.0	1.47	0.083	0.039	2.40	3.30
3	Amralang Village	6.70	344.0	1.45	0.089	0.041	2.10	4.10
4	Nongtalang Village	6.70	344.0	1.51	0.089	0.031	2.28	4.20
5	Amdoh Village	6.90	339.0	1.43	0.078	0.039	2.20	3.90
6	Thanghunai Village	6.70	351.0	1.41	0.080	0.040	1.70	3.70

TABLE 3.17 FERTILITY STATUS

S. No.	Location	Organic Carbon (%)	Nitrogen (mg/100g)	Phosphorus (mg/100g)	Potassium (mg/100g)
1.	Core Zone	1.43	29.40	0.89	0.55
2.	Amtapoh Village	1.47	28.10	0.74	0.62
3.	Amralang Village	1.45	26.50	0.83	0.59
4.	Nongtalang Village	1.51	28.20	0.89	0.61
5.	Amdoh Village	1.43	26.30	0.92	0.68
6.	Thanghunai Village	1.41	29.70	0.86	0.61

The soil quality of the core & Buffer one is discussed below:

Soil Quality Results: Core Zone: The result shows that pH is 6.6.The availability of many plant nutrients in the soil changes as a result of reactions in the soil, which are largely controlled by soil pH. Amount of primary nutrients like Organic Carbon 1.43 %, the available nitrogen 29.40 mg/100g is lower in range, the available Potassium 0.55 mg/100g is moderate in range while available Phosphorous 0.89mg/100g is higher in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen and potassium.

Buffer Zone: The result shows that texture of soil has clay loam texture. pH ranges from 6.70 to 6.90. Amount of primary nutrients like Organic carbon 1.41% to 1.51%, the available nitrogen 26.30 to 29.70 mg/100g, the available phosphorus 0.74- 0.92mg/100g is higher in range while Available Potassium 0.59 to 0.68 meq/100g is lower in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen, available potassium.

3.10 LAND USE

Core Zone Land Use: The core zone consists of total 4.30 Ha. The classification of the land is Private, Barren & Non- Forestland.

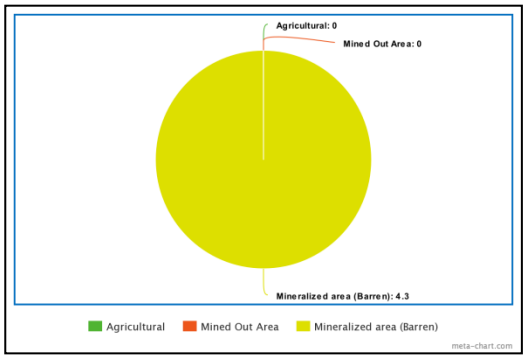
Classification of Land within leasehold			
Government Land		Private Land	
Forest Land	Non- Forest Land (Barren Land)	Barren land	Agriculture land
Nil	Nil	4.30 Ha.	Nil

The land use of the core zone is given below:

Land Use of the Core Zone

It is a non forest land, involving 4.30 ha. The surface map is attached as **Plate 4.**

Existing Land use of the Mine lease area (in %)



Land Use	Area in Ha. (existing)
Agricultural	Nil
Mined Out Area	Nil
Mineralized area (Barren)	4.30
Total	**4.30**

Figure 3.9; Existing Land Use of Core Zone

Land use of Buffer Zone:

Information on land use/ land cover is the basic prerequisite for land resource evaluation, environmental assessment, utilization and management. As a precursor, it is necessary to understand the 'cause and effect' of the transformations through scientific studies. The scope of the present study is limited to mapping the current land use / land cover pattern, their assessment, spatial distribution and extent using remote sensing and GIS techniques. The land environment will mainly deal with the land use, land cover within core and buffer zone.

3.10.1 Methodology

Image processing software and GIS Software were used for the project. Image Processing Software was used for digital processing of the spatial data. Digital image processing techniques were applied for the mapping of the land use/land cover classes of the provided area from the satellite data. The methodology applied comes under following steps:

- Satellite imageries for the Area of Interest were created through image processing software.
- Geometric correction includes correction for geometric distortions due to sensor, earth geometry variations and conversion of the data to real world coordinates.
- Image enhancement is one of the important image processing functions primarily done to improve the appearance of the imagery to assist in visual interpretation and analysis.
- Google image is used as a reference map for base layer preparation.
- Visual interpretation technique has been used for digitization of geographical feature for different land use and vegetation cover classes based on spatial pattern of geographic feature.

TABLE 3.18; Land Use

S No.	Category	Area in SQ Km	Area In Ha	Percentage
1	Forest land	0	0	0
2	Area under Non-Agricultural Uses	7.80	780.00	100.00
3	Barren & Un-cultivable Land	0	0	0
4	Permanent Pastures and Other Grazing Land	0	0	0
5	Land Under Misc. Tree Crops etc.	0	0	0
6	Culturable Waste Land	0	0	0
7	Fallows Land other than Current Fallows	0	0	0
8	Current Fallows	0	0	0
9	Net Area Sown	0	0	0
	Total	**7.80**	**780.00**	**100.00**

3.10.2 Results and Conclusions:

Land use Buffer zone:

The land use/ land cover map has been generated on 1:50,000 scale using Satellite Imagery and ground truth information. Based on the methodology developed for the present land use/ land cover, categories have been grouped under the following major land use/land cover categories.

The land use distribution in the buffer zone of 10 Km radius (from periphery) is given in the table given ahead.

Forest Land:

Based on Satellite Imagery and ground truth no forest land was found in 10 km radius area. **Area under Non-Agricultural Uses:**

Based on Satellite Imagery and ground truth Non-Agricultural land their area extent has been extracted. The Non-Agricultural area is about 780 hectares which is 100 percent of the total 10 km radius study area.

Barren & Un-cultivable Land:
Based on Satellite Imagery and ground truth no Barren & Un-cultivable Land was found in 10 Km radius.

Permanent Pastures and Other Grazing Land:
Based on Satellite Imagery and ground truth no Permanent Pastures and Other Grazing Land were found in 10 Km radius.

Land Under Misc. Tree Crops etc.:
Based on Satellite Imagery and ground truth no Land under Misc. Tree Crops etc was found in 10 Km radius.

Culturable Waste Land:
Based on Satellite Imagery and ground truth no Culturable Waste Land was found in 10 Km radius.

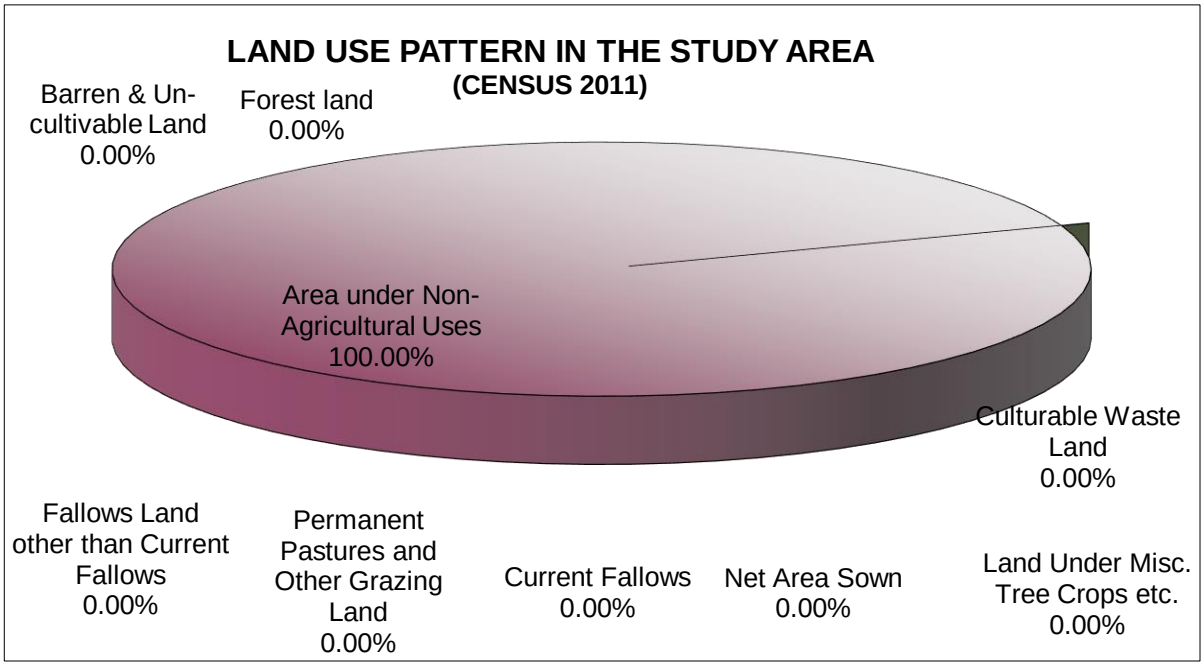
Fallows Land other than Current Fallows:
Based on Satellite Imagery and ground truth no Fallows Land other than Current Fallows was found in 10 Km radius.

Current Fallows Land:
Based on Satellite Imagery and ground truth no Current Fallows Land was found in 10 Km radius.

Net Area Sown:

Based on Satellite Imagery and ground truth no Sown Land was found in 10 Km radius.

Figure 3.10, Land use Map of 10 Km Buffer Zone



3.11 ECOLOGY & BIODIVERSITY:

Complete study has been done and given below on the ecological environment of the study area.

3.11.1 Introduction on Ecology and Biodiversity:

The Ecology and Biodiversity is the study of mechanisms that regulates biodiversity and allow for the maintenance of ecosystem functioning in our changing world. In the web of life and natural ecology, the diversity, density and abundance of plants and animal species are decisive factors for assessing the bio diversity of any area. Documenting local species that are ecologically important may be helpful in restoration and planning of greenbelt development. With the help of actual field observations and published reports, a list of Flora and Fauna existing in the core zone and buffer zone was prepared.

An ecological survey of the study area was conducted, particularly with reference to listing of species and assessment of the existing baseline ecological conditions in the study area. The main objective of the ecological survey is aimed at assessing the existing flora and fauna components in the study area. Data has been collected through extensive survey of the area with reference to flora and fauna. With the

change in environmental conditions, the vegetation cover as well as animals reflects several changes in its structure, density and composition. The proposed project is for mining of Limestone mineral at Thanghunai, Elaka- Nongtalang P.O.+ P.S.- Dawki, District-West Jantia Hills, Meghalaya.

Objectives of Biological Studies:

The present study was undertaken with the following objectives:

- To assess the nature and distribution of vegetation in and around the project site (within 10 km. radius)
- To assess the species richness, biodiversity (within 10 km radii)

To achieve the above objectives a study area was undertaken. The different methods adopted were as follows:

- Compilation of secondary data with respect to the study area from published literature and various government agencies;
- Generation of primary data by undertaking systematic ecological studies in the area.

Selection of Sampling Location for the study of Flora and Fauna:

- **Core Zone:** Core Zone is considered as the areas where Limestone Mine is proposed. The proposed project is a mining of Limestone mineral by semi mechanized opencast method with drilling and blasting at Thanghunai, Elaka-Nongtalang P.O.+ P.S.- Dawki, District-West Jantia Hills, Meghalaya.
- **Buffer Zone:** The zone falling within 10 km radius around the project area is Buffer Zone. For Study and sampling purpose, buffer zone is further divided in 1 Km and 5Km.

Introduction of the project highlighting the Environmental sensitivity:

- The proposed project is a mining of Limestone mineral by semi mechanized opencast method with drilling and blasting at Thanghunai, Elaka- Nongtalang P.O.+ P.S.- Dawki, District-West Jantia Hills, Meghalaya. There is no Wildlife Sanctuary in 10 km radius & and 1 water bodies Umngot River (7.0 Km, SW).

Type of Forest

Meghalaya, situated in the north eastern region of India is a narrow stretch of land, running between Bangladesh on the South and West and Assam on the North and East, Meghalaya lies between 24° 58′ N to 26° 07′N latitudes and 89° 48′E to 92° 51′ E longitudes. The state has three distinct regions namely, Garo Hills, Khasi Hills and Jaintia Hills. The climate is monsoonic with distinct warm-wet and cold dry periods and soil largely lateritic. The forests of Meghalaya can be broadly grouped into

tropical, subtropical and temperate types. The Indian Institute of Remote Sensing have classified the vegetation of Meghalaya into tropical evergreen, tropical semi-evergreen, tropical moist deciduous, subtropical broad leaved, subtropicalpineandtemperateforesttypes,grasslandsandsavanna.Theentireforestrichi nplantlike*Mesua ferrea, Terminalia myriocarpa, Vitex peduncularis, Mecheliachampaca, Amoorawallichii*etc which have economical and medicinal significanceand animal biodiversity like Hoollock Gibbon, Serow, Slow Loris, Sloth Bear, Irrawaddy Squirrel, Otter, Mongoose, varieties of fruit Bats etc.

3.11.2 Methodology for the study of Flora and Fauna:

Methodology for Study of Flora:

During the study, the floral composition of the area was evaluated through primary survey. The study area was divided according to habitat types followed by the random sampling method, surveys, exploration, collection, and preparation of specimens toward building an inventory of floral diversity of the area. Phyto sociological studies were conducted to assess the composition, diversity, distribution, and their status in the nature. This was cross-checked with the traditional knowledge of the people of the study region.

Methodology for study of Fauna:

Different species were observed at different timing during the day

Bird: Birds were watched during dawn.
Nocturnal and Burrowing animals: After Sunset.

Animals: Morning & Evening

Collection of Secondary Data

Secondary data is collected from the Forest Department, Working Plan of the Area other relevant records such as plantation journals and records of wild life / forest offence cases.

Cropping Pattern: The main crops grown in nearby areas are Wheat, rice, pulses, potatoes and pulses. In terms of productivity, rice is the predominant crop in Meghalaya. Beside these crops fruits like Banana, Citrus etc. and vegetables are also cultivated.

3.11.3 Description of Core Zone with flora and Fauna Details:

Flora of core Zone:

The density of the plant in core zone in general is very low due to rocky terrain and low soil content. In the core zone, place where mining is to be done is vacant land with patches of *Trema orientalis, Schimawallichii, Saccharum arundinaceum*.

Flora of Buffer Zone:

The floral found in the whole of the study area are representative of the Tropical Lower Montane Forest, Tropical Semi-Evergreen, Moist-Broadleaf Forest, Tropical Deciduous/Semi-Deciduous, Broadleaf Forest and Tropical Sparse trees. The forest besides the study area is quite dense. The general survey has shown extreme biotic pressure in the area due to limestone mining (excavation), leading to widespread reduction of trees in the area.

Due to heavy rainfall in the region, there is a admixture of trees in the broad leaved evergreen forest. The common species found in the area are of *Castonopeisindica, Castonopeishystrix, Derris robusta, Macaranga denticulate, Schimawallichii& Musa superba.*

The height of the dominant trees ranges from 4m to 9m which generally grow densely alongwith Musa superba and *Clerodendron* species. Numerous climbers are found in the area and they usually exhibit mesophytic adaption. The forest stands are dominated mostly by a Mimosaceae tree species of *Albizia*. Very few stands are dominated by *Tectona* and *Bombax ceiba* tree species. Overall forest areas are characterised by high species diversity. All the stands are dominated by *Castonopsis indica,Castonopsishytrix, Derris robusta, Macaranga denticulate* or *Schima*. There is no degraded forest because of heavy rainfall alongwith high intensity sunlight.

Perennial grasses like *Cynodondactylon* and *Saccharum spontaneum* of Poaceae family grow in this area. A thin layer of grass growth can be noticed after the rains. Various types of woody growth along with shrubs also can be noticed in the area. There are no threatened species in the area. List of Flora (Trees, Shrubs, Herbs, Climber, Ornamental spices) in the Core zone and Study area has been given as follows Table 3.19

In the Buffer Zone varieties trees, shrubs, herbs, Ornamental plants, weed and grasses such as *Bombax ceiba, Castanopsis indica, Citrus sp., etc.*

Table 3.19, Flora (Trees, Shrubs, Herbs Ornamental spices) of Buffer Zone

Trees: *Acacia auriculiformis, Actinodaphneobovata, Ailanthus grandis, Alangium chinensis, Albizia lucida, Albizia lebbeck, Alstoniascholaris, Anthocephaluschinense, Aralia armata, Ardisia nerifolia, Artocarpus heterophyllus, Azadirachta indica, Bauhinia acuminate, Bauhinia purpurea, Bischofiajavanica, Bombax ceiba, Bridelia tomentosa, Butea monosperma, Callicarpa arborea, Caralliabranchiata, Caryotaurens, Castanopsis indica, Castanopsis tribuloides, Cinnamomum bezolghota, Cinnamomum obtusifolium, Cyathea sp. Cynometrapolyandra, Dalbergia sp., Dalbergia sisso, Duabanga grandiflora, Delonix regia, Drypetesassamica, Dysoxylumbinectariferum, Elaeocarpus aristatus, Elaeocarpus sp., Englegardtia spicata, Exbucklandiapopulnea, Ficus benghalensis, Ficus elmeri, Ficus geniculata, Ficus hirta, Ficus hispida, Ficus religiosa, Ficus rumphii, Garugagamblei, Ficus sp., Garcinia acuminata, Gmelina arborea, Grewia disperma, Grewia sp., Hevea brasiliensis, Hydnocarpuskurzii, Lagerstroemia parviflora, Leucaena leucocephala, Licuala peltata, Litsaeasebifera, Litseacitrita, Litsealaeta, Litseasalicifolia, Litsea sp., Macaranga denticulate, Macropanaxdisperma, Magnolia hodgsonii, Mallotustetracoccus, Mangifera indica, Meliosma sp., Oroxylum indicum, Ostodespaniculata, Pandanus sp., Persea sp., Pithecellobium sp., Pongamia pinnata, Premnamilleflora, Prunus acuminata, Psidium guajava, Pterospermumacerifolium, Pterospermum lancifolium, Quercus lancifolia, Quercus spicata, Rhus javanica, Sapiumbaccatum, Sarcospermagriffithii, Saurauiaroxburghii, Saurauia sp., Schimawallichii, Shima sp., Spondias pinnata, Sterculia villosa, Streospermumchelenoides, Strobilanthusanisophyllus, Symplocosracemosa, Syzygiumcumini, Syzygium sp., Terminalia bellerica, Terminalia chebula, Terminalia myriocarpa, Tetramelesnudiflora, Toona ciliata, Toona febrifuga, Travesiapalmata, Trema orientalis, Villebrunea frutescens, Vitex negundo, Vitex pedunculata, Vitex sp., Wallichiidensiflora, Wendlandiapaniculata&Xerospermum sp.*
Shrubs: *Ageratum conyzoides, Allamanda cathartica, Allophylus sp., Alpinia sp. Amblyanthusgrandulosus, Ardisia crispa, Ardisia nerifolia, Ardisia paniculata, Aroides sp., Baliospermummontana, Baliospermum sp., Boehmaria sp., Breynia patens, Breynia vitis-idaea, Buddleja asiatica, Calotropis gigantia, Calotropis procera, Cassia alata, Cassia tora, Cassia occidentalis, Citrus sp., Clerodendroncolebrookianum, Clerodendronviscosum, Clerodendrum sp., Clorophytumkhasianum, Coffea sp., Coixlacryma-jobi, Datura metal, Dendrocalamushamiltonii, Dendrocnide sinuate, Dracaena angustifolia, Elaegnusconferta, Eupatorium odoratum, Helixantheraligustrina, Hibiscus macrophyllus, Holmskioldia sanguine, Homonoia riparia, Hymenodictyon sp., Ilex sp., Jasminium sp., Jatropha curcas, Lantana camara, Leea aspera, Leea indica, Manihot esculenta, Melastomamalabathricum, Morinda angustifolia, Mussaendaroxburghii, Nyctanthusarbortristis, Ocimumgratissimum, Ophiorrhiza sp., Phoenix sylvestris, Rauwolfia serpentine, Rubus alceifolius, Rubus ellipticus, Rubus lucens, Saccharum spontaneum, Saccharum arundinaceum, Salamona sp., Saurauia sp., Scoperia dulcis, Sidarhombifolia, Solanum torvum, Strobilanthesanisophyllus, Xerospermumglabratum*
Herbs: *Alternanthera sessilis, Amaranthus spinosus, Amaranthus viridis, Ambrosia artemesifolia, Amischotolypemollissima, Amorphophalusbulbifera, Amorphophalus sp., Arundinagraminifolia, Begonia hatacoa, Begonia sp, Bidens biternata, Bidens pilosa, Blachnum sp., Boehmeria glomerulifera, Boehmeria sp., Calamus flagellum, Calamus*

leptospadix, Caraxcruciata, Castosspeciosus, Chenopodium sp., Coleus sp., Commelinabenghalensis, Commelina sp., Crassocephalumcrepidioides, Cyathula prostrate, Dichrocephala integrifolia, Dracenatrifasciata, Drymeriadiandra, Diplezium esculentum, Elatostemamonandrum, Eleusine indica, Erigeron Canadensis, Eupatorium adenophorum, Eupatorium odoratum, Euphorbia hirta, Euphorbia sp., Fagopyrum dibotrys, Fimbristylisdichotoma, Floscopa scandens, Fagopteris auriculata, Ferns sp., Forrestia sp., Globba multiflora, Globbaclarkeii, Hedychium sp., Jasminum sp., Laporteacrenulata, Leea indica, Leea sp., Licuala peltata, Luduwigiaoctovalis, Lycopodium sp., Maesa indica, Maesa sp., Melastomamalabathricum, Mannihot esculenta, Mimosa himalayana, Morinda angustifolia, Musa sp., Osbeckia sp., Osbekia crenata, Oscimum sanctum, Oxalis corniculata, Oxyspora sp., Ophiorrhiza sp., Phrynium capitata, Phryniumpubenervae, Pinangagracilis, Polygonum chinense, Pteris sp., Randia sp. Rhynchotecumellipticum, Rubus rugosus, Rungia sp., Scoparia dulcis, Selaginella monospora, Selaginella sp., Solanum torvum, Spilanthuspaniculata, Tabernaemontanadivericata, Thysanolaena maxima, Trevesia palmate, Triumfettapilosa, Urena lobata, Wallichiadensiflora, Sida acuta, Sida cordata, Spilanthespaniculata, Tridax procumbens, Vernonia cineraria & Viola betonicifolia
Climbers: *Acacia oxyphylla, Acacia pinnata, Acacia prunascens, Acampe sp., Aeschynanthus sp., Agapetes sp., Ampelocissusbarbata, Asplenium nidus, Bauhinia scandens, Bauhinia vahlii, Byttneria aspera, Calamus leptospadix, Cayratiapedata, Cissampelos pareira, Combretum dasystachyum, Cryptolepis sinensis, Diascoreaalata, Diascoreabulbifera, Dendrobium sp., Derris sp., Diascorea sp., Entada rheedei, Ficus sp., Gnetum scandens, Hedyotis scandens, Hodgsonia macrocarpa, Hoya sp., Ipomea nervosa, Jasminium flexile, Leeacompactiflora, Luisea sp., Lygodiumflexuosum, Lygodiumfluxuosa, Melocalamuscompectiflorus, Melothria heterophylla, Merremiaumbellate,Microsorumsp.,Mikania micrantha, Milletia cinerea, Mucuna sp., Nepenthes khasiana, Paederia scandens, Parabaenasagittata, Pegia nitida, Piper thomsonii, Poikilospermumsuaveolens, Poranapaniculata, Pothos sp., Raphidophoradecursiva, Raphidophoralancifolia, Rubus alceifolius, Sceffleravenulosa, Smilexlancifolia, Tetrastigma angustifolia, Tetrastigmaleucostophylum, Tetrastigmaserrulatum, Thunbergia grandiflora &Zizyphusoenoplia*
Grasses: *Apludamutica,Bambusatulda, Cymbopogon martini, Cynodondactylon, Cyperus compressus, Cyperus cyperinus, Cyperus rotundus, Dendrocalamushemiltonii, Dendrocalamusstrictus, Digitariabicornis, Heteropogoncontortus&Neohouzeauahelferii*
Epiphytes: *Aeschynanthus parasitica, Agapetessetigera, Aglaomorphacoronus, Asplenium nidus, Bulbophyllumcareyanum, Dendrobium densiflorum, Erialasiopetala, Hoya parasitica, Liparis viridiflora, Microsorum punctatum, Pholidota articulate, Pathos cathcartii, Pyrrosiaadnascens, Pyrrosiaflocculosa, Rhaphidophoracalophyllum, Rhaphidophora lancifolium, Rhynchostylis retusa, Cuscutareflexa&Vanda roxburghaii*
Hydrophytes: *Nelumbo nucifera & Nymphaea stellata*

The complete table is given in detail at **Annexure 14 of the EIA report**

3.11.4 Study of Fauna:

Fauna in core zone: - During study, it was found that the faunal diversity in the core site was limited to Butterflies, insects, some species of mammals & reptile. The core site has avifauna species like crow, pigeon, sparrow parrot, etc.

Table 3.20, Fauna (Mammals, Aves, Reptiles Amphibians, Fishes, Insects & Mollusca) of Study Area

Mammals: *Canis aureus, Cannomys badius, Callosciuruserythraeus, Crocidura attenuate, Suncus murinus, Felis chaus, Funambulus pennant, Funambulus palmarum, Herpestesedwardsi, Lepus nigricollis, LutraLutra, Muntiacusmuntjak, Mus booduga, Mus musculus, Niviventerfulvescens, Ratufa bicolor, Rattus nitidus, Rattus rattus, Rhinolophus affinis, Rhinolophus hipposideros, Vulpes bengalensis, Presbytis entellus & Presbytis pileatus*
Aves: *Acridotheres tristis, Bambusicolafytchii, Ketupaflavipes, Cinnyris asiaticus, Columba livia, Coracias bengalensis, Corvus splendens,Eudynamysscolopaceus, Milvus migrans, Francolinuspondicerianus, Hirundorustica, Dendronanthus indicus, Passer domesticus, Psittaculakrameri, Pycnonotuscafer, Scolopaxrusticola, Alcedoatthis&Streptopelia chinensis*
Reptiles & Amphibians: *Amolopsafghanus, Bufo parietalis, Bufo stomaticus, Bufoidesmeghalayana, Bungarus caeruleus, Calotes versicolor, Sinomicrurusmacclellandi, Natrixnatrix, Rhacophorus maximus, Hylaranagaroensis, Odorranalivida, Varanus bengalensis, Chameleon sp., Calotes maria, Mobuyacarinata, Microhyla ornate, Najanaja, Ptyasmucosus, Ptyctolaemusgularis*
Fishes: *Danio rerio, Catlacatla,Danioaequipinnatus, Danio dangila, Labeodero, Labeorohita, Labeofimbriatus, Mystusaor, Mystusvittatus& Puntius shalynius*
Insecta: *Acridaturrita, Acontia marmoralis, Orthetrumluzonicum, Agriocnemispygmaea, Apiscerana, Ariadne merione, Ceriagrioncoromandelianum, Euploca core, Euremabrigitta, Graphiumsarpedon, Halpe kumara, Heterojinussemilaetaneus, Holochlora indica, Ischnura aurora, Matapadruna, Musca domestica, Papilioarcturus, Periplaneta Americana, Pseudagrionrubriceps, Apodemiamejicanus& Vespa orientalis*
Mollusca: *Bellamyabendalensis, Cypraea limacine & Turbo marmoratus*

The complete table is given in detail at **Annexure 14 of the EIA report.**

3.11.5 Photographs of Study Area:

Vegetation in the study area

3.11.6 Endangered Species:

There are is no schedule I Species of Fauna found in both core as well as buffer zone. Monkey of Schedule II is the only threatened species. There are no threatened species of plants also.

3.11.7 Cropping Pattern:

The main crops grown in nearby areas are Wheat, rice, potatoes and pulses. In terms of productivity, rice is the predominant crop in Meghalaya. Beside these crops fruits like Banana, Citrus etc. and vegetables are also cultivated.

3.12 SOCIO-ECONOMICSCENARIO

The proposed project is for mining of limestone mineral from lease area of 4.30 ha. The maximum production from the mine will be 150000 TPA. Mining of mineral will be done by opencast semi mechanized method. The applicant of the project is Sri Chui Pohlynjar has applied for mining lease for minor mineral (Limestone) in her privately owned land over an area of 4.30 Ha.

The latitude of the project area N 25°13'11.536" TO N 25°13'27.249″and longitude is E 92°04'25.468" TO 92°04’29.105"E with maximum contour of 900 ASL and minimum contour of 700 ASL.

3.12.1Demographic profile

There is no habitation within the project area, i.e., the area of land acquired for the project. Hence, no rehabilitation will be required.

In the study area, i.e. the area falling within radius of 10 km from the proposed power plant, there are 71 inhabited revenue villages. Out of the 71 villages, 5 falls under Pynursla tehsil of East Khasi Hills district and 66 in Amlarem tehsil of west

Jaintia Hills district of Meghalaya. Demographic profile of individual villages as per Census 2011 Census records, are presented in **Annexure 12**. A summary of the same is presented in Table 3.21. Distribution of population & percentage of literates, and the percentage of SC & ST population are presented through pie graphs in Fig 3.11 and 3.12 respectively and tabulated in Table 3.22.

TABLE 3.21
TEHSIL WISE POPULATION

District	Tehsil	Total Population	Male	Female
East Khasi Hills	Pynursla	2722	1316	1406
West Jaintia Hills	Amlarem	28827	14335	14492
Grand Total		**31549**	**15651**	**15898**

TABLE 3.22
DEMOGRAPHIC DETAILS OF STUDY AREA

Description	Total	% of total population
No. of households	5716	
Total population	31549	100
Male Population	15651	49.61
Female Population	15898	50.39
Females/1000 males	1015.72	-
Family size, persons/family	5.52	-
Schedule caste	445	1.41
Schedule Tribe	28519	90.41
Total literates	19167	60.75
Male literate	9430	29.89
Female literate	9337	30.86

FIG 3.11 : LITERACY LEVEL IN THE STUDY AREA
(CENSUS 2011)

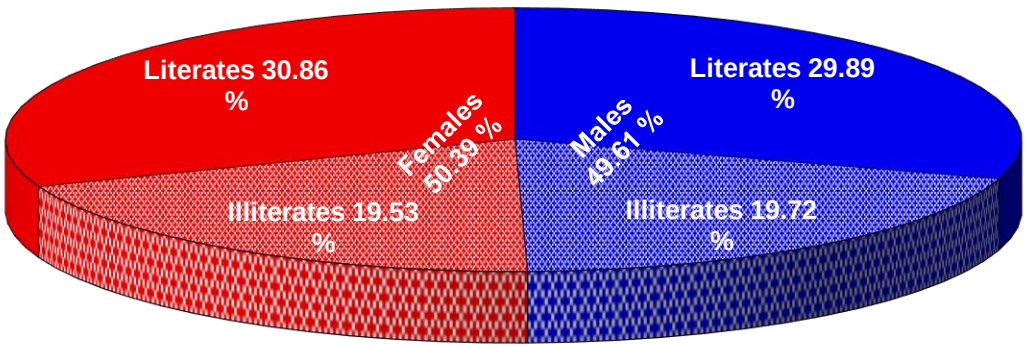
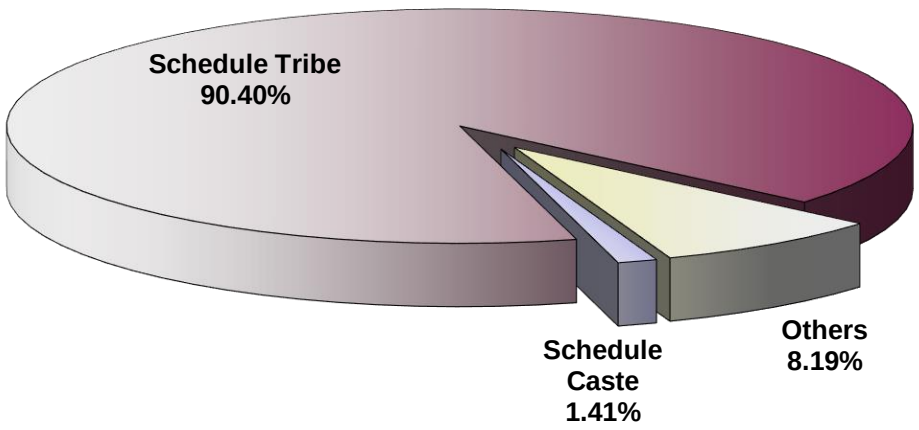


FIG 3.12 : BREAK UP OF SC & ST IN THE STUDY AREA
(CENSUS 2011)



Salient features of the demographic profile are as follows:

a) There is a slight predominance of Females (50.39%) to males (49.61%)

b) Schedule tribes form a large part of the population, about 90.40% of the total population.

c) Female literacy rate is higher than male literacy rate.

d) Schedule caste population is 1.41% of total population

3.12.2 Employment and occupation

Employment pattern and occupation are the two main indicators of the economic profile, and the same for the individual villages based on 2011 Census data, are presented in **Annexure 15**. Pie diagrams showing employment pattern and occupation are depicted in Fig 3.13, 3.14, 3.15 & 3.16. A summary of employment pattern and occupation for the study area is presented in Table 3.23.

TABLE 3.23
SUMMARY OF EMPLOYMENT AND OCCUPATION IN STUDY AREA

Description	Total	% of total population
Main workers	9138	28.96
Marginal workers	4545	14.41
Non-workers	17866	56.63
Total	**31549**	**100.00**
Break-up of Main workers		
Cultivator	2582	28.26
Agricultural labour	1964	21.49
Household industries	77	0.84
Other workers	4515	49.41
Total	**9138**	**100.00**
Break-up of Marginal workers		
Cultivators	535	11.77
Agricultural labour	1613	35.49
Household industries	51	1.12
Other workers	2346	51.62
Total	**4545**	**100.00**

FIG 3.13 : EMPLOYMENT PATTERN IN THE STUDY AREA
(CENSUS 2011)

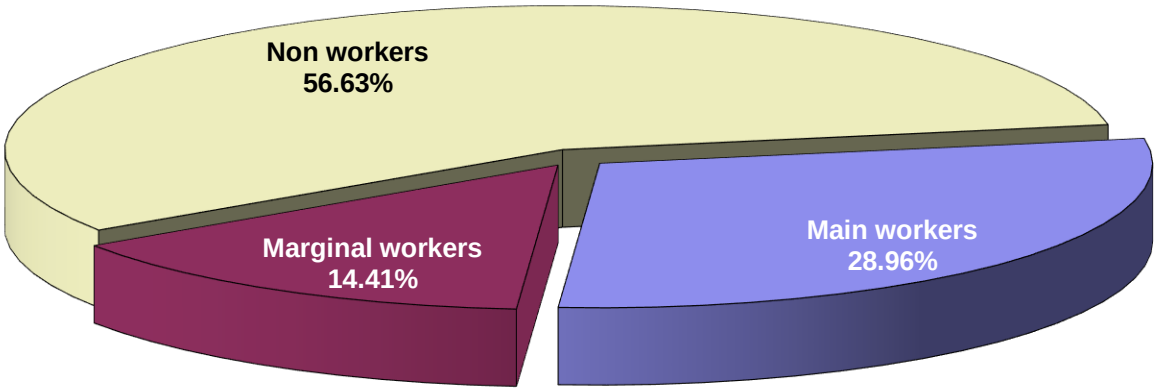


FIG 3.14 : BREAK UP OF MAIN WORKERS IN THE STUDY AREA
(CENSUS 2011)

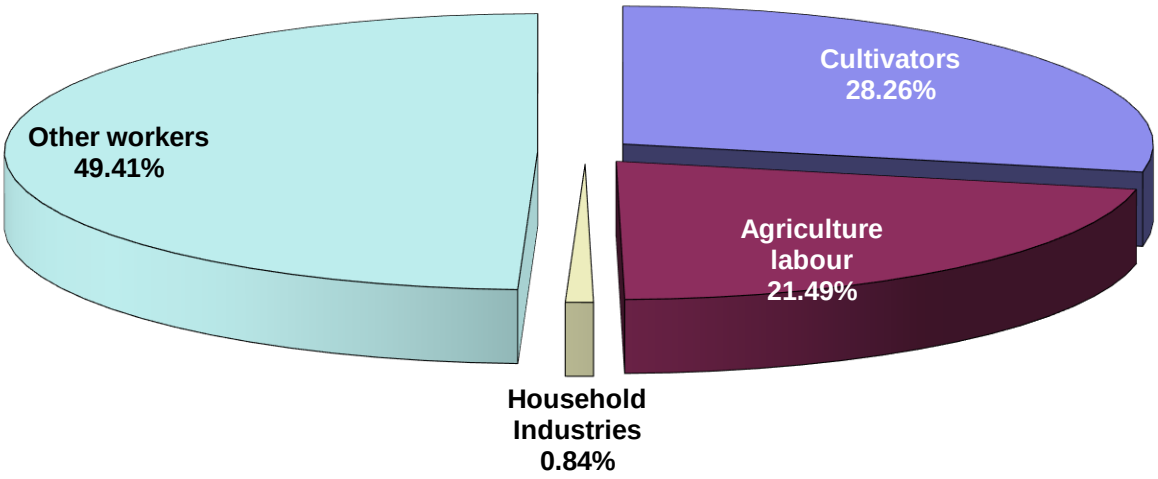


FIG 3.15 : BREAK UP OF MARGINAL WORKERS IN THE STUDY AREA
(CENSUS 2011)

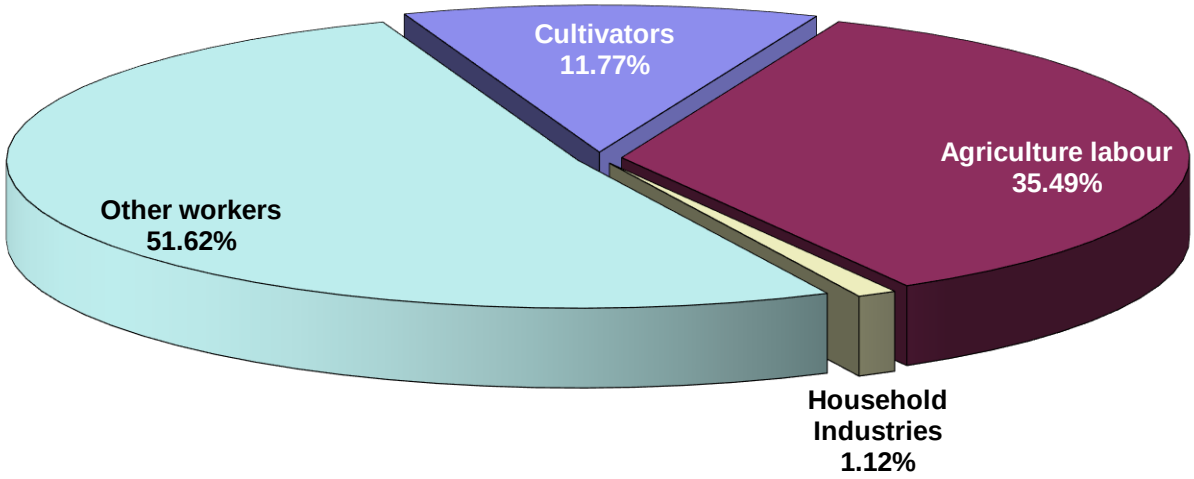
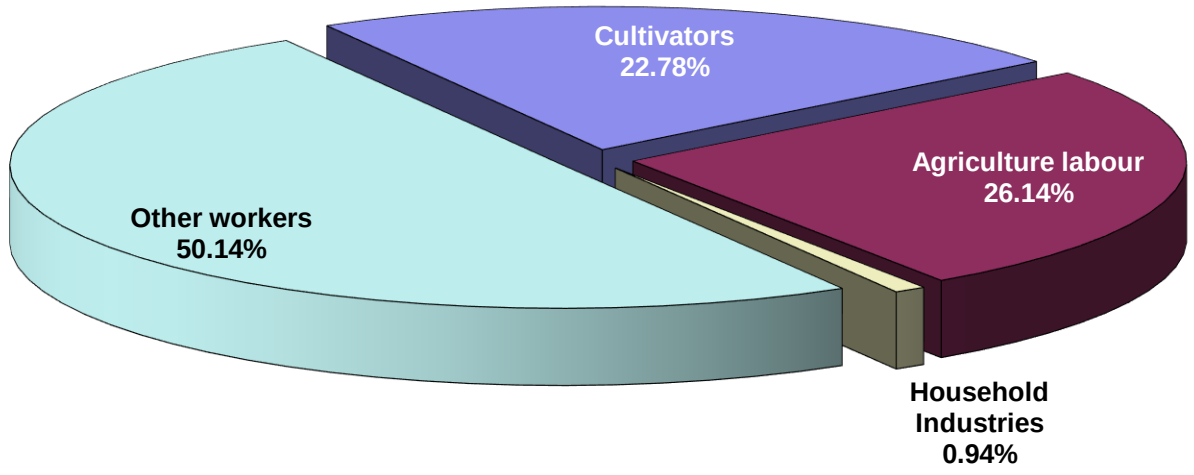


FIG 3.16 : BREAK UP OF TOTAL WORKERS (Main & Marginal) IN THE STUDY AREA
(CENSUS 2011)



3.12.3 Amenities

Details of amenities available in the individual villages are given in **Annexure 16.** A summary of the same is as follows:

- Educational facilities in the study area comprise of 91 Pre primary schools, 87 Primary Schools, 30 Middle Schools, 15 secondary schools & 5 senior secondary school,
- For drinking water, hand pump are used is 1, tap water treated is 39, tap water un treated is 32, well water is 23, tank water is 7, tube well water is 1, 11 river water, 18 spring water and 8 other water sources.
- Census data for power supply shows that from the total villages, 66 villages have power supply for domestic purpose.
- Census data for post and telegraph facilities shows that there are 13 villages have sub post offices & 11 telephone connections.
- There are 29 pucca roads, 61 Kachha roads,14 MDR, 9 ODR, 17 SH and 15 AWR to villages in the study area.
- Census data for medical facilities shows that there are 1 CHC, 2 PHC, 6 PHSC, 3 MCWC, 3 family welfare centers, in the study area.
- Census data for communication shows that there are 3 Public Bus service and 7 Private Bus service in the study area.
- Census data for Banks/credit societies shows that there are 3 commercial, 3 co-operative banks, 27 Self Help Group in the study area.

3.13 PLACES OF TOURISM /HISTORICAL /ARCHAEOLOGICAL IMPORTANCE

There are no historical/tourist or religious places or places of archaeological importance in core zone of the proposed Limestone Mine. However there are some important places for tourists such as follows:

1. **Thlu Muwi-** This stone bridge built by U Mar Phalyngki and U Luh Lamare under the orders of the Jaintia King. It is about 15 KM in North East of lease area. Because of the rise of the Muwistream during the monsoon a bridge was required to be built for the King's journey from Jaintiapur to Nartiang. The bridge consists of huge well hewn granite stone slabs perched on equally similar pillars. Beside the stone bridge is also the Muwi Waterfalls.

2. **Nartiang Monoliths**- It is about 41.5 KM in the North-East Direction. Monoliths exist throughout the length and breadth of the Khasi and Jaintia Hills. However, the biggest collection of monoliths or Megalithic stones in one single area is to be found north of the Nartiang market. These consists of Menhirs (Upright stones) Moo Shynrang and Dolmens (flat stones in the horizontal position) locally known as Moo Kynthai. Within the perimeter of these Megalithic collection stands the tallest Menhir erected by U Mar Phalyngki a trusted lieutenant of the Jaintia King to commemorate his victory in battle. Other monoliths were erected by U Mar Phalyngki, U Luh Lyngskor Lamare and various clans of Nartiang village between 1500A.D.and l835A.D.

3. **Lalong Park**- It is about 31 KM in the North East of the lease area. The Park is located about 8 kms from Jowai. It is known for its sacred grove and for its setting which overlooks the beautiful Pynthorwah Valley. Through the Special DRDA Tourism Project the District Administration have taken step to beautify the park by creating infrastructure such as water dams and canals, toilet facilities with changing rooms, hoardings, jungle clearance which has attracted tourist far and wide. A water eco park is also taking shape with an intention to change Ialong into a major Tourism Hub of the District.

3.14 INDUSTRIES IN THE STUDY AREA

There are a few Limestone mines in the vicinity of the proposed Limestone Mine. They are as follows:

TABLE 3.24; INDISTRIES IN THE STUDY AREA

Sl No	List of industries	Type of Industries	Distance
1.	Sri Aron Myrechiang	Limestone Mine	178 m
2.	Sri Lahmon Tongper	Limestone Mine	12 m
3.	Sri Sumon Pohduna	Limestone Mine	7 m
4.	Smt. Plenty K Pyngrope	Limestone Mine	422 m

3.15 TRAFFICDENSITY

The traffic study was done in the nearby road ascertain the present traffic was on the road and thereafter impact be because of addition of traffic due to the operation of Project.

The traffic density for Dawki-Jowai Road & Approach Road is given in Table below.

Monitoring location and methodology

Traffic density monitoring station was located as follows:

Table 3.25; Trafic density monitoring station

Location	Name of the Location	Distance & Direction w.r.t Proposed Mine	Remarks
TD I	Between ML &Approach Road	0.3 KM-SE	Village Road
TD 2	Dawki-Jowai Road (NH-40)	0.6 K M – SE	NH-40

Traffic density measurements were made continuously for 24 hours by visual observation and counting of vehicles under four categories, viz., heavy motor vehicles, light motor vehicles, two/three wheelers and cycles. As traffic density on the roads is low, two skilled persons were deployed simultaneously during each shift – one person on each of the two directions for counting the traffic. At the end of each hour, fresh counting and recording was undertaken. Thus, total numbers of vehicles per hour under the four categories were determined. A summary of the traffic density monitored during survey period is given in Table 3.26.

TABLE 3.26
TRAFFIC DENSITY

Traffic vehicle	No. of vehicles per day	
	TD I	TD 2
H.M.V.	32	170
L.M.V.	18	82
Two/three wheelers	24	84
Grand Total	**74**	**336**

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 GENERAL

Any economic development project has some environmental implications adverse or beneficial. An impact can be defined as any change in physical, chemical, biological, cultural and/or socio-economic environment that can be attributed to activities related to alternatives under study for meeting the project needs. The operations involved in proposed project are studied in details before implementation.

The objective of impact identification is to specify areas that are likely to be affected by the implementation of the project. Impact methodology provides an organized approach for prediction and assessing these impacts. The nature of the impacts due to said project activities are identified. This will help to minimize and mitigate the further additional pollution load due to the proposed project on surroundings. The objectives of impact identification are as follows:-

- To ensure compliance with regulations.
- To provide a comprehensive coverage of a full range of impacts, including social, economic and physical.
- To distinguish between positive and negative, large and small, long term and short term, reversible and irreversible impacts.
- To identify secondary, indirect and cumulative impacts as well as direct impacts.
- To consider impacts within the constraints of an area's carrying capacity.

4.2 DETAILS OF INVESTIGATED ENVIRONMENTALIMPACTS

The project activities influencing the following environmental attributes have been studied and their impacts on the following attributes have been assessed.

- Air Quality
- Noise Quality
- Water Quality
- Land use
- Soil Quality
- Biotic Condition
- Socio-Economic Condition
- Traffic Condition

The mining and allied activities in the proposed project area have influence on the above environmental attributes. These activities include:

- Site preparation
- Excavation
- Loading and Transportation

The magnitude of the proposed mining activity being small is not likely to create any serious impacts on the existing environmental set up of the area. However, the likely impacts of the proposed mining and allied activities on the various environmental parameters are discussed with the help of Monitoring done during **October 2020 to December 2020.**

4.3 AIRENVIRONMENT

Any surface mining, including opencast coal mining has always been a dusty business. Sources of particulate matter in open cast mine are excavation, transportation, handling, loading and hauling operation. Dust generation due to mining operation occurs within the mine pit, from overhaul roads as well as dumping areas. At the same time, the HEMM operations and truck movement will release air emissions from their exhausts also. The impacts due to the above listed activities are already occurring at the site as mine is in operation.

Operations that will cause addition to the pollution load in air in the form of particulate matters, SO_2, NOx etc. are:

- Operation of additional diesel fuel based equipments and vehicles
- Removal of vegetation and soil from excavation area
- Handling & transport of additional mineral and waste material (within/ outside of project)
- Dumping activities
- Drilling and blasting

Existing ambient air quality data on various sections of the project was collected to establish a baseline database **(October 2020 to December 2020)** for parameters PM_{10}, $PM_{2.5}$, SO_2, and NO_x values were analyzed**.** Samples were collected from 8 sampling locations:

Core Zone: The value of $PM_{2.5}$ is ranging from 25-34 μg/m^{3}and mean value is 29.2 μg/m^3 against standard limit of 60 μg/m^3. Value of PM_{10} is ranging from 60.0 -80.0 μg/m^{3}and mean value is 69.6 μg/m^{3}against standard limit of 100 μg/m^3. The mean value of SO_2 is 6.3 μg/m^{3}against standard limit of 80 μg/m^3& mean value of NOx is 8.8 μg/m^3 against standard limit of 80 μg/m^3.

Buffer Zone: The results of the Buffer Zone shows that PM_{10} was maximum at Nongtalang Chnongthmai Village (within prescribed standard limits) and Amtapoh Village were minimum. The $PM_{2.5}$ is ranging from 24.7-32.8/μg/m^3.PM_{10} is ranging from65.5-73.0μg/m^3.The SO_2 is ranges from 5.5-6.7 against standard limit of 80μg/m^3 & NOx ranges from 7.9-10.0 μg/m^3 against standard limit of 80 μg/m^3. These are within standard limits of National ambient air quality standards.

The values of both the parameters are well within prescribed limits.

4.3.1 Impact on air quality of the area

- Generation of suspended particulate matter during mining operations, material storage, transportation and handling (loading/unloading)
- Generation of SO_2, NOx due to fuel burning
- Generation of dust due to drilling blasting
- Deterioration in ambient air quality due to project
- Health impacts to workers working at dust generation area.
- Accidental Spillage of mineral during loading and unloading

For estimating the increase in the air pollutants, air quality prediction modeling has been carried out using Aermod model.

Aermod Model

AERMOD is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for the following: settling and dry deposition of particles; downwash; point, area, line, and volume sources; plume rise as a function of downwind distance; separation of point sources; and limited terrain adjustment. Aermod operates in short-term mode.

Model Input Data: For the modeling purpose, the total fugitive particulates (suspended particulate matter i.e., SPM) has been estimated and PM_{10} and $PM_{2.5}$ have been proportioned with respect to it. SO_2 and NO_2 from machinery operation have also been modeled. This modelling has been done for the maximum possible excavation and material handling in any given year during plan period.

This modeling has been done considering 150000 TPA from Nongtalang Limestone Mine from 4.30 Ha. Annually 330 working days with 6 hourly one shift has been considered as per approved Mining Plan. The assumptions, input data and other details are given in **Annexure 13** along with GLC isopleth maps and the results are summarized in **Table 4.1** for PM_{10}, $PM_{2.5}$, SO_2 and NO_2. While the GLC at various air quality locations are given in Table 4.2 below.

TABLE 4.1
PREDICTED INCREMENTAL GROUND LEVEL CONCENTRATION (μg/m³) BY AERMOD MODEL

	X	Y	Elevation	PM_{10}	$PM_{2.5}$	SO_2	NO_2
At 100 m							
N	406749	2790197	826	3.28	1.89	0.17	0.34
NNE	406873	2790155	824	3.60	2.07	0.19	0.37
NE	406892	2789998	793	5.07	2.91	0.26	0.53
ENE	406893	2789914	767	4.45	2.56	0.23	0.46
E	406894	2789854	744	3.66	2.11	0.19	0.38
ESE	406895	2789794	721	2.93	1.69	0.15	0.30
SE	406896	2789707	703	1.77	1.02	0.09	0.18
SSE	406874	2789553	703	0.26	0.15	0.01	0.03
S	406749	2789516	723	0.42	0.24	0.02	0.04
SSW	406626	2789558	768	0.96	0.55	0.05	0.10
SW	406606	2789711	792	2.09	1.20	0.11	0.22
WSW	406605	2789794	808	2.06	1.18	0.11	0.21
W	406604	2789854	823	2.09	1.20	0.11	0.22
WNW	406603	2789915	843	1.86	1.07	0.10	0.19
NW	406601	2790002	844	1.97	1.13	0.10	0.20
NNW	406622	2790160	798	2.74	1.57	0.14	0.28
At 200 m							
N	406749	2790297	798	2.04	1.17	0.11	0.21
NNE	406915	2790255	830	1.65	0.95	0.09	0.17
NE	406991	2790101	798	2.57	1.48	0.13	0.27
ENE	406993	2789955	756	2.10	1.21	0.11	0.22
E	406994	2789854	727	1.35	0.78	0.07	0.14
ESE	406996	2789752	713	0.65	0.38	0.03	0.07
SE	406997	2789606	699	0.11	0.06	0.01	0.01
SSE	406915	2789455	697	0.04	0.02	0.00	0.00
S	406749	2789416	706	0.17	0.10	0.01	0.02
SSW	406585	2789458	765	0.43	0.25	0.02	0.04
SW	406508	2789613	797	0.78	0.45	0.04	0.08
WSW	406506	2789753	814	0.69	0.39	0.04	0.07
W	406504	2789854	827	0.86	0.49	0.04	0.09
WNW	406502	2789956	845	1.01	0.58	0.05	0.10
NW	406499	2790103	829	1.40	0.81	0.07	0.15
NNW	406581	2790258	776	1.18	0.68	0.06	0.12
At 300 m							
N	406749	2790397	774	1.16	0.67	0.06	0.12
NNE	406954	2790350	808	1.14	0.66	0.06	0.12
NE	407078	2790184	800	1.74	1.00	0.09	0.18
ENE	407092	2789997	747	1.13	0.65	0.06	0.12
E	407094	2789854	718	0.49	0.28	0.03	0.05
ESE	407096	2789711	709	0.11	0.06	0.01	0.01
SE	407082	2789522	703	0.02	0.01	0.00	0.00
SSE	406954	2789361	706	0.02	0.01	0.00	0.00
S	406749	2789316	697	0.10	0.06	0.01	0.01
SSW	406546	2789363	757	0.25	0.14	0.01	0.03

SW	406422	2789526	800	0.53	0.31	0.03	0.06
WSW	406406	2789712	813	0.42	0.24	0.02	0.04
W	406404	2789854	802	0.43	0.25	0.02	0.04
WNW	406401	2789998	837	0.67	0.38	0.03	0.07
NW	406414	2790189	805	1.11	0.64	0.06	0.11
NNW	406542	2790352	794	0.82	0.47	0.04	0.09
At 400 m							
N	406748	2790497	796	0.90	0.52	0.05	0.09
NNE	406993	2790444	778	0.79	0.45	0.04	0.08
NE	407156	2790262	799	1.30	0.75	0.07	0.13
ENE	407192	2790038	740	0.68	0.39	0.04	0.07
E	407194	2789855	711	0.20	0.11	0.01	0.02
ESE	407197	2789669	707	0.03	0.01	0.00	0.00
SE	407159	2789445	698	0.00	0.00	0.00	0.00
SSE	406992	2789268	706	0.00	0.00	0.00	0.00
S	406749	2789216	705	0.07	0.04	0.00	0.01
SSW	406507	2789269	727	0.15	0.09	0.01	0.02
SW	406344	2789449	796	0.39	0.22	0.02	0.04
WSW	406307	2789671	808	0.27	0.16	0.01	0.03
W	406304	2789854	785	0.22	0.13	0.01	0.02
WNW	406300	2790040	830	0.45	0.26	0.02	0.05
NW	406337	2790266	787	0.79	0.45	0.04	0.08
NNW	406504	2790445	821	0.60	0.34	0.03	0.06
At 500 m							
N	406748	2790597	825	0.75	0.43	0.04	0.08
NNE	407031	2790537	784	0.59	0.34	0.03	0.06
NE	407230	2790336	794	0.99	0.57	0.05	0.10
ENE	407291	2790079	742	0.44	0.25	0.02	0.05
E	407294	2789855	709	0.09	0.05	0.00	0.01
ESE	407298	2789627	713	0.01	0.00	0.00	0.00
SE	407233	2789371	692	0.00	0.00	0.00	0.00
SSE	407031	2789175	685	0.00	0.00	0.00	0.00
S	406750	2789116	708	0.05	0.03	0.00	0.01
SSW	406469	2789176	695	0.10	0.06	0.01	0.01
SW	406270	2789374	784	0.29	0.16	0.01	0.03
WSW	406208	2789630	804	0.18	0.10	0.01	0.02
W	406204	2789854	770	0.10	0.06	0.01	0.01
WNW	406199	2790081	824	0.31	0.18	0.02	0.03
NW	406263	2790340	795	0.63	0.36	0.03	0.07
NNW	406465	2790538	833	0.44	0.25	0.02	0.05
At 600 m							
N	406748	2790697	838	0.60	0.34	0.03	0.06
NNE	407069	2790630	794	0.47	0.27	0.02	0.05
NE	407304	2790410	775	0.77	0.44	0.04	0.08
ENE	407390	2790120	741	0.29	0.17	0.02	0.03
E	407394	2789855	714	0.05	0.03	0.00	0.01
ESE	407397	2789586	707	0.00	0.00	0.00	0.00
SE	407306	2789298	670	0.00	0.00	0.00	0.00
SSE	407069	2789082	660	0.00	0.00	0.00	0.00
S	406750	2789016	682	0.04	0.02	0.00	0.00

SSW	406430	2789084	674	0.07	0.04	0.00	0.01
SW	406197	2789301	759	0.22	0.13	0.01	0.02
WSW	406109	2789588	802	0.13	0.07	0.01	0.01
W	406104	2789854	776	0.05	0.03	0.00	0.01
WNW	406100	2790122	822	0.23	0.13	0.01	0.02
NW	406190	2790413	803	0.51	0.29	0.03	0.05
NNW	406427	2790631	791	0.34	0.20	0.02	0.04
At 800 m							
N	406748	2790897	791	0.35	0.20	0.02	0.04
NNE	407146	2790815	830	0.32	0.18	0.02	0.03
NE	407448	2790554	811	0.57	0.33	0.03	0.06
ENE	407584	2790201	784	0.15	0.09	0.01	0.02
E	407594	2789855	727	0.02	0.01	0.00	0.00
ESE	407590	2789507	727	0.00	0.00	0.00	0.00
SE	407450	2789154	684	0.00	0.00	0.00	0.00
SSE	407146	2788897	640	0.00	0.00	0.00	0.00
S	406750	2788816	631	0.02	0.01	0.00	0.00
SSW	406354	2788898	648	0.05	0.03	0.00	0.01
SW	406053	2789157	661	0.13	0.08	0.01	0.01
WSW	405915	2789508	732	0.07	0.04	0.00	0.01
W	405904	2789854	796	0.01	0.01	0.00	0.00
WNW	405906	2790202	802	0.13	0.08	0.01	0.01
NW	406045	2790557	829	0.34	0.20	0.02	0.04
NNW	406350	2790816	770	0.22	0.13	0.01	0.02
At 1000 m							
N	406748	2791097	779	0.26	0.15	0.01	0.03
NNE	407223	2791000	807	0.23	0.13	0.01	0.02
NE	407591	2790698	831	0.42	0.24	0.02	0.04
ENE	407774	2790280	793	0.09	0.05	0.00	0.01
E	407794	2789855	721	0.01	0.00	0.00	0.00
ESE	407780	2789428	718	0.00	0.00	0.00	0.00
SE	407593	2789011	659	0.00	0.00	0.00	0.00
SSE	407223	2788712	590	0.00	0.00	0.00	0.00
S	406750	2788616	585	0.01	0.01	0.00	0.00
SSW	406277	2788713	621	0.04	0.02	0.00	0.00
SW	405910	2789013	651	0.10	0.06	0.01	0.01
WSW	405726	2789429	711	0.04	0.02	0.00	0.00
W	405704	2789853	805	0.00	0.00	0.00	0.00
WNW	405716	2790281	792	0.09	0.05	0.00	0.01
NW	405902	2790700	803	0.24	0.14	0.01	0.03
NNW	406273	2791001	781	0.16	0.09	0.01	0.02
At 1200 m							
N	406748	2791298	782	0.20	0.11	0.01	0.02
NNE	407299	2791185	796	0.17	0.10	0.01	0.02
NE	407734	2790840	808	0.32	0.18	0.02	0.03
ENE	407962	2790358	804	0.05	0.03	0.00	0.01
E	407994	2789855	727	0.00	0.00	0.00	0.00
ESE	407968	2789351	693	0.00	0.00	0.00	0.00
SE	407736	2788869	649	0.00	0.00	0.00	0.00
SSE	407300	2788527	566	0.00	0.00	0.00	0.00

S	406750	2788416	601	0.01	0.01	0.00	0.00
SSW	406201	2788528	628	0.03	0.02	0.00	0.00
SW	405767	2788871	646	0.08	0.04	0.00	0.01
WSW	405538	2789351	698	0.02	0.01	0.00	0.00
W	405503	2789853	793	0.00	0.00	0.00	0.00
WNW	405528	2790359	776	0.06	0.03	0.00	0.01
NW	405759	2790842	750	0.18	0.10	0.01	0.02
NNW	406196	2791186	782	0.12	0.07	0.01	0.01
At 1400 m							
N	406748	2791498	800	0.17	0.10	0.01	0.02
NNE	407375	2791370	816	0.13	0.08	0.01	0.01
NE	407876	2790983	800	0.25	0.14	0.01	0.03
ENE	408149	2790436	820	0.03	0.02	0.00	0.00
E	408194	2789855	727	0.00	0.00	0.00	0.00
ESE	408155	2789273	684	0.00	0.00	0.00	0.00
SE	407878	2788727	612	0.00	0.00	0.00	0.00
SSE	407377	2788343	558	0.00	0.00	0.00	0.00
S	406750	2788216	537	0.01	0.00	0.00	0.00
SSW	406124	2788343	613	0.02	0.01	0.00	0.00
SW	405625	2788728	627	0.06	0.03	0.00	0.01
WSW	405350	2789274	689	0.02	0.01	0.00	0.00
W	405303	2789853	758	0.00	0.00	0.00	0.00
WNW	405341	2790436	738	0.04	0.02	0.00	0.00
NW	405617	2790984	768	0.14	0.08	0.01	0.01
NNW	406119	2791370	775	0.09	0.05	0.00	0.01
At 1600 m							
N	406752	2791698	812	0.14	0.08	0.01	0.01
NNE	407452	2791555	839	0.10	0.06	0.01	0.01
NE	408018	2791125	821	0.21	0.12	0.01	0.02
ENE	408336	2790513	812	0.02	0.01	0.00	0.00
E	408394	2789856	733	0.00	0.00	0.00	0.00
ESE	408341	2789196	678	0.00	0.00	0.00	0.00
SE	408020	2788585	569	0.00	0.00	0.00	0.00
SSE	407453	2788158	520	0.00	0.00	0.00	0.00
S	406741	2788016	483	0.00	0.00	0.00	0.00
SSW	406048	2788158	555	0.02	0.01	0.00	0.00
SW	405483	2788586	604	0.05	0.03	0.00	0.00
WSW	405164	2789196	662	0.01	0.01	0.00	0.00
W	405103	2789853	735	0.00	0.00	0.00	0.00
WNW	405155	2790513	683	0.03	0.02	0.00	0.00
NW	405475	2791126	776	0.11	0.06	0.01	0.01
NNW	406043	2791555	781	0.07	0.04	0.00	0.01
At 1800 m							
N	406747	2791898	838	0.12	0.07	0.01	0.01
NNE	407528	2791740	860	0.08	0.05	0.00	0.01
NE	408160	2791267	839	0.17	0.10	0.01	0.02
ENE	408522	2790590	770	0.02	0.01	0.00	0.00
E	408594	2789856	729	0.00	0.00	0.00	0.00
ESE	408527	2789119	661	0.00	0.00	0.00	0.00
SE	408162	2788443	498	0.00	0.00	0.00	0.00

SSE	407530	2787973	469	0.00	0.00	0.00	0.00
S	406751	2787816	459	0.00	0.00	0.00	0.00
SSW	405972	2787973	528	0.02	0.01	0.00	0.00
SW	405341	2788444	619	0.04	0.02	0.00	0.00
WSW	404978	2789119	629	0.01	0.00	0.00	0.00
W	404903	2789853	723	0.00	0.00	0.00	0.00
WNW	404968	2790590	710	0.02	0.01	0.00	0.00
NW	405333	2791268	752	0.09	0.05	0.00	0.01
NNW	405966	2791740	802	0.06	0.04	0.00	0.01
At 2000 m							
N	406747	2792098	843	0.10	0.06	0.01	0.01
NNE	407605	2791925	848	0.07	0.04	0.00	0.01
NE	408301	2791409	822	0.14	0.08	0.01	0.01
ENE	408708	2790668	759	0.01	0.01	0.00	0.00
E	408794	2789856	719	0.00	0.00	0.00	0.00
ESE	408713	2789042	626	0.00	0.00	0.00	0.00
SE	408304	2788302	437	0.00	0.00	0.00	0.00
SSE	407607	2787788	321	0.00	0.00	0.00	0.00
S	406751	2787616	440	0.00	0.00	0.00	0.00
SSW	405895	2787788	502	0.01	0.01	0.00	0.00
SW	405200	2788302	608	0.03	0.02	0.00	0.00
WSW	404792	2789042	647	0.01	0.00	0.00	0.00
W	404703	2789853	687	0.00	0.00	0.00	0.00
WNW	404782	2790667	710	0.02	0.01	0.00	0.00
NW	405191	2791410	695	0.07	0.04	0.00	0.01
NNW	405889	2791925	802	0.05	0.03	0.00	0.01
At 2500 m							
N	406747	2792598	854	0.07	0.04	0.00	0.01
NNE	407796	2792387	886	0.05	0.03	0.00	0.01
NE	408655	2791764	847	0.10	0.06	0.00	0.01
ENE	409172	2790860	762	0.01	0.00	0.00	0.00
E	409294	2789856	721	0.00	0.00	0.00	0.00
ESE	409177	2788851	528	0.00	0.00	0.00	0.00
SE	408659	2787948	147	0.00	0.00	0.00	0.00
SSE	407798	2787326	113	0.00	0.00	0.00	0.00
S	406751	2787116	394	0.00	0.00	0.00	0.00
SSW	405704	2787326	410	0.01	0.01	0.00	0.00
SW	404846	2787948	497	0.02	0.01	0.00	0.00
WSW	404328	2788849	611	0.00	0.00	0.00	0.00
W	404203	2789852	662	0.00	0.00	0.00	0.00
WNW	404318	2790859	725	0.01	0.01	0.00	0.00
NW	404837	2791763	675	0.05	0.03	0.00	0.01
NNW	405698	2792387	782	0.03	0.02	0.00	0.00
At 3000 m							
N	406746	2793098	857	0.05	0.03	0.00	0.00
NNE	407987	2792849	894	0.04	0.02	0.00	0.00
NE	409009	2792118	841	0.07	0.04	0.00	0.01
ENE	409635	2791052	775	0.01	0.00	0.00	0.00
E	409795	2789857	614	0.00	0.00	0.00	0.00
ESE	409641	2788659	285	0.00	0.00	0.00	0.00

SE	409013	2787594	372	0.00	0.00	0.00	0.00
SSE	407990	2786864	212	0.00	0.00	0.00	0.00
S	406752	2786616	260	0.00	0.00	0.00	0.00
SSW	405513	2786864	320	0.01	0.00	0.00	0.00
SW	404492	2787593	425	0.02	0.01	0.00	0.00
WSW	403865	2788657	564	0.00	0.00	0.00	0.00
W	403703	2789852	641	0.00	0.00	0.00	0.00
WNW	403855	2791050	627	0.01	0.00	0.00	0.00
NW	404482	2792117	807	0.04	0.02	0.00	0.00
NNW	405506	2792848	786	0.02	0.01	0.00	0.00
At 4000 m							
N	406745	2794098	893	0.03	0.02	0.00	0.00
NNE	408369	2793774	907	0.02	0.01	0.00	0.00
NE	409716	2792826	810	0.04	0.02	0.00	0.00
ENE	410560	2791437	772	0.00	0.00	0.00	0.00
E	410795	2789858	516	0.00	0.00	0.00	0.00
ESE	410566	2788277	535	0.00	0.00	0.00	0.00
SE	409721	2786887	450	0.00	0.00	0.00	0.00
SSE	408374	2785941	275	0.00	0.00	0.00	0.00
S	406752	2785616	19	0.00	0.00	0.00	0.00
SSW	405131	2785939	19	0.00	0.00	0.00	0.00
SW	403785	2786885	213	0.01	0.01	0.00	0.00
WSW	402940	2788273	458	0.00	0.00	0.00	0.00
W	402703	2789851	576	0.00	0.00	0.00	0.00
WNW	402929	2791433	747	0.00	0.00	0.00	0.00
NW	403774	2792824	853	0.03	0.02	0.00	0.00
NNW	405122	2793772	756	0.02	0.01	0.00	0.00
At 5000 m							
N	406745	2795098	936	0.02	0.01	0.00	0.00
NNE	408751	2794698	966	0.02	0.01	0.00	0.00
NE	410423	2793534	897	0.03	0.02	0.00	0.00
ENE	411485	2791820	831	0.00	0.00	0.00	0.00
E	411795	2789858	561	0.00	0.00	0.00	0.00
ESE	411491	2787894	532	0.00	0.00	0.00	0.00
SE	410429	2786180	406	0.00	0.00	0.00	0.00
SSE	408757	2785017	25	0.00	0.00	0.00	0.00
S	406753	2784616	31	0.00	0.00	0.00	0.00
SSW	404749	2785015	16	0.00	0.00	0.00	0.00
SW	403078	2786177	113	0.01	0.00	0.00	0.00
WSW	402016	2787889	260	0.00	0.00	0.00	0.00
W	401703	2789850	356	0.00	0.00	0.00	0.00
WNW	402004	2791815	753	0.00	0.00	0.00	0.00
NW	403066	2793531	868	0.02	0.01	0.00	0.00
NNW	404739	2794696	890	0.01	0.01	0.00	0.00
At 7000 m							
N	406743	2797098	1033	0.01	0.01	0.00	0.00
NNE	409515	2796547	1019	0.01	0.01	0.00	0.00
NE	411836	2794950	914	0.02	0.01	0.00	0.00
ENE	413333	2792588	844	0.00	0.00	0.00	0.00
E	413795	2789860	726	0.00	0.00	0.00	0.00

ESE	413341	2787130	532	0.00	0.00	0.00	0.00
SE	411845	2784767	242	0.00	0.00	0.00	0.00
SSE	409524	2783170	19	0.00	0.00	0.00	0.00
S	406755	2782616	13	0.00	0.00	0.00	0.00
SSW	403985	2783167	12	0.00	0.00	0.00	0.00
SW	401664	2784761	43	0.00	0.00	0.00	0.00
WSW	400167	2787122	259	0.00	0.00	0.00	0.00
W	399703	2789848	262	0.00	0.00	0.00	0.00
WNW	400155	2792579	732	0.00	0.00	0.00	0.00
NW	401650	2794945	947	0.01	0.01	0.00	0.00
NNW	403972	2796543	1002	0.01	0.00	0.00	0.00
At 10000 m							
N	406741	2800098	381	0.01	0.00	0.00	0.00
NNE	410660	2799319	559	0.01	0.00	0.00	0.00
NE	413956	2797073	1035	0.01	0.01	0.00	0.00
ENE	416105	2793738	682	0.00	0.00	0.00	0.00
E	416795	2789862	739	0.00	0.00	0.00	0.00
ESE	416114	2785984	412	0.00	0.00	0.00	0.00
SE	413968	2782647	42	0.00	0.00	0.00	0.00
SSE	410674	2780399	15	0.00	0.00	0.00	0.00
S	406757	2779616	13	0.00	0.00	0.00	0.00
SSW	402840	2780394	11	0.00	0.00	0.00	0.00
SW	399545	2782638	17	0.00	0.00	0.00	0.00
WSW	397396	2785971	219	0.00	0.00	0.00	0.00
W	396701	2789911	615	0.00	0.00	0.00	0.00
WNW	397381	2793725	118	0.00	0.00	0.00	0.00
NW	399527	2797064	314	0.01	0.00	0.00	0.00
NNW	402822	2799314	525	0.00	0.00	0.00	0.00
At AQ Stns							
AQ1	406704	2789779	763	15.98	9.19	0.83	1.66
AQ2	403821	2789112	598	0.00	0.00	0.00	0.00
AQ3	406651	2793273	870	0.04	0.02	0.00	0.00
AQ4	409203	2792673	880	0.04	0.03	0.00	0.00
AQ5	405581	2788327	624	0.04	0.02	0.00	0.00
AQ6	409342	2792008	841	0.05	0.03	0.00	0.01
AQ7	405737	2786285	151	0.01	0.00	0.00	0.00
AQ8	406573	2789275	710	0.13	0.07	0.01	0.01
Maximum				**15.98**	**9.19**	**0.83**	**1.66**

A perusal of above table shows that the incremental values of 15.98 μg/m^3, 9.19 μg/m^3, 0.83 μg/m^3 and 1.66 μg/m^3 for PM_{10}, $PM_{2.5}$, SO_2 and NO_2, respectively are anticipated at a distance of 100 m from the mine lease boundary.

TABLE 4.2

ANTICIPATED INCREMENTAL GLC VALUES AT THE AIR QUALITY MONITORING STATIONS (μg/m³)

Pollutant	Sampling Station	Maximum observed value	Incre-mental	Total	NAAQS Standards 2009
PM_{10}	AAQ1	80	15.98	95.88	100
	AAQ2	73	0.00	73.00	
	AAQ3	76	0.04	76.04	
	AAQ4	78	0.04	78.04	
	AAQ5	86	0.04	86.04	
	AAQ6	81	0.05	81.05	
	AAQ7	75	0.01	75.01	
	AAQ8	81	0.13	81.13	
$PM_{2.5}$	AAQ1	34	9.19	43.19	60
	AAQ2	29	0.00	29.000	
	AAQ3	31	0.02	31.02	
	AAQ4	30	0.03	30.03	
	AAQ5	38	0.02	38.02	
	AAQ6	36	0.03	36.03	
	AAQ7	28	0.00	28.00	
	AAQ8	36	0.07	36.07	
SO_2	AAQ1	7.3	0.83	8.13	80
	AAQ2	6.1	0.00	6.10	
	AAQ3	6.9	0.00	6.9	
	AAQ4	7.2	0.00	7.2	
	AAQ5	7.9	0.00	7.9	
	AAQ6	7.1	0.00	7.1	
	AAQ7	6.9	0.00	6.9	
	AAQ8	7.0	0.01	7.01	
NO_2	AAQ1	9.6	1.66	11.26	80
	AAQ2	9.3	0.00	9.3	
	AAQ3	8.7	0.00	8.7	
	AAQ4	10.1	0.00	10.1	
	AAQ5	12.6	0.00	12.6	
	AAQ6	11.4	0.01	11.41	
	AAQ7	9.6	0.00	9.6	
	AAQ8	10.5	0.01	10.51	

It can be seen from **Table 4.1** that after addition of the incremental GLC's to the existing air quality, the concentration of pollutants would increase, but still they would remain within the prescribed standards at all the sampling stations as per applicable standards.

4.3.2 Mitigation Measures

- *Drilling machines will be equipped with dust collector arrangement and wherever required wet drilling arrangement will be used to prevent generation and spreading of dust.*
- *Optimum blast design parameters will be adopted after study. Optimum stemming in blast holes will be done to minimize generation of dust and fly rocks.*
- *Blasting will be done during favorable atmospheric conditions and will be avoided during high windy periods, night times and temperature inversion periods.*
- *To avoid secondary blasting rock breaker will be used.*
- *Optimum bucket size loading equipment will be used which will reduce the number of bucket passes to fill the dumper and thus comparatively less dust will be generated during loading. This will also reduce the chances of spillage from the bucket.*
- *Water sprinkling over blasted pile of ROM will be done which will reduce dust generation during loading.*
- *Water tankers with suitable sprinkling system will be deployed along haul roads and other unworked areas to control fugitive emission. The sprinkling frequency will depend upon the humidity present in the atmosphere.*
- *Overloading of the dumpers and tippers will be avoided.*
- *The vehicles deployed for material transportation shall be spillage proof to avoid or minimize the spillage of the material during transportation.*
- *Personnel working on the drills and other mining activities will be provided with dust mask and other necessary Personal Protective Equipments (PPE). Health checkups will be done biannually to monitor the health of the workers.*
- *Plantation of local thriving species will be done in the 7.5m statutory boundary for arresting dust.*
- *Regular maintenance of vehicles and machinery will be done.*
- *Vehicles/equipment will be periodically subjected for emission tests and will have valid POLLUTION UNDER CONTROL certificates.*
- *Excavators and dumpers will have dust proof cabins to minimize dust exposure of workers.*
- *No impacts are expected on micro-climatic conditions of the project due to this small scale mining activity.*
- *Monitoring to ensure compliance with emission limits would be carried out during operation.*
- *Air Dispersion Modeling study has been carried out and report will be furnished.*

GLC CONTOURS OF PM_{10}

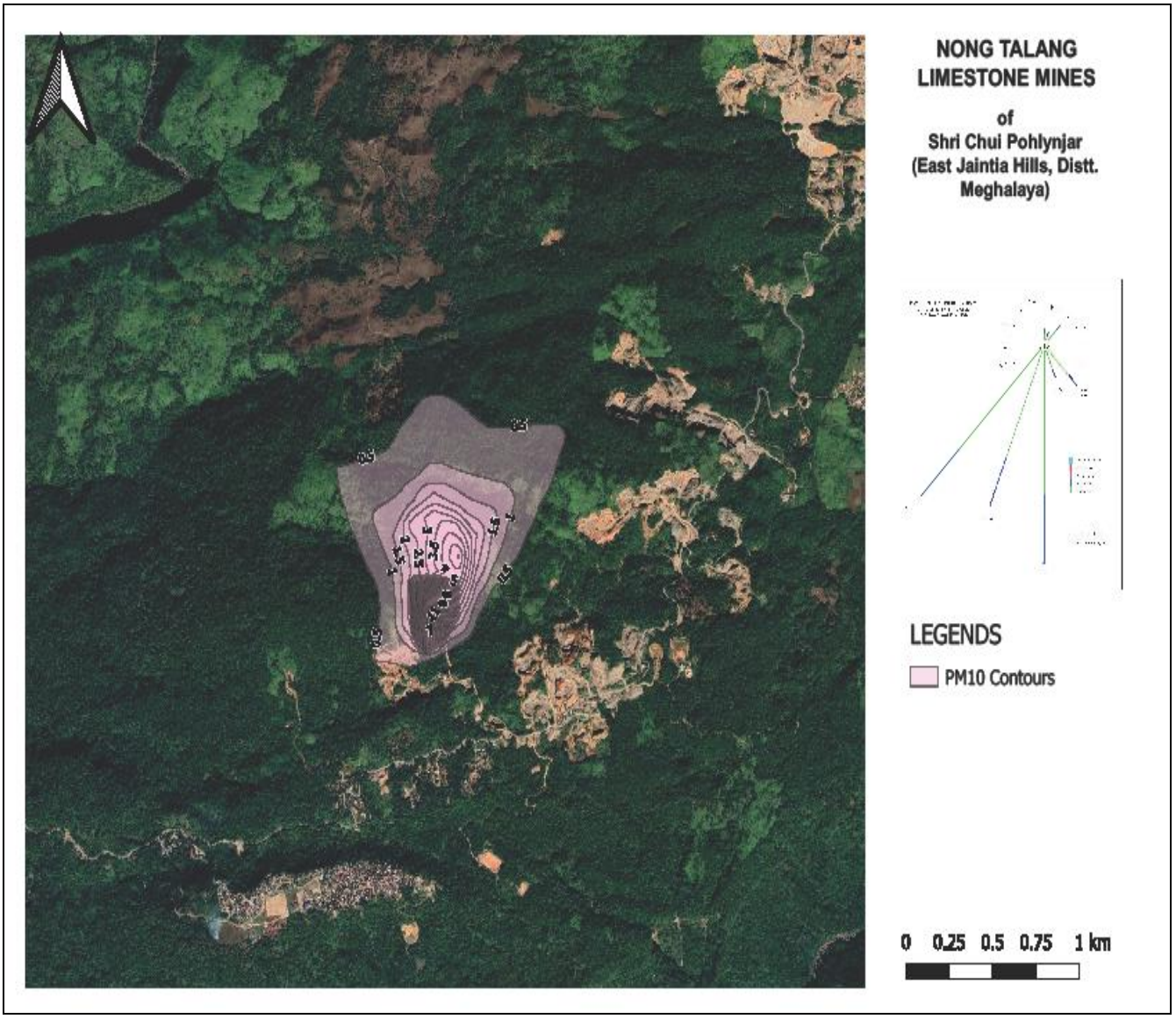


Figure 4.1; GLC Contours of PM_{10}

GLC CONTOURS OF $PM_{2.5}$

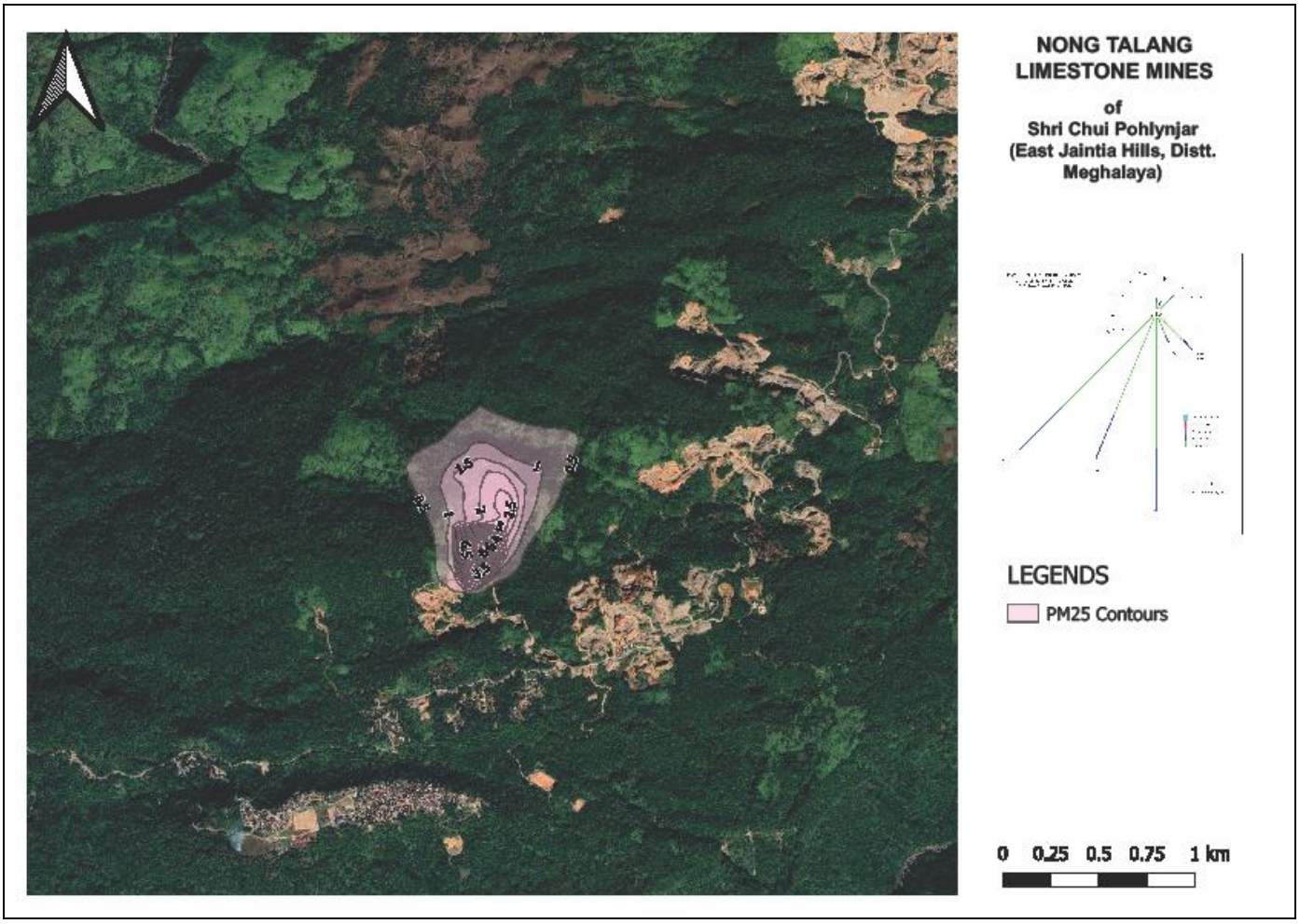


Figure 4.2; GLC Contours of $PM_{2.5}$

GLC CONTOURS OF NO_2

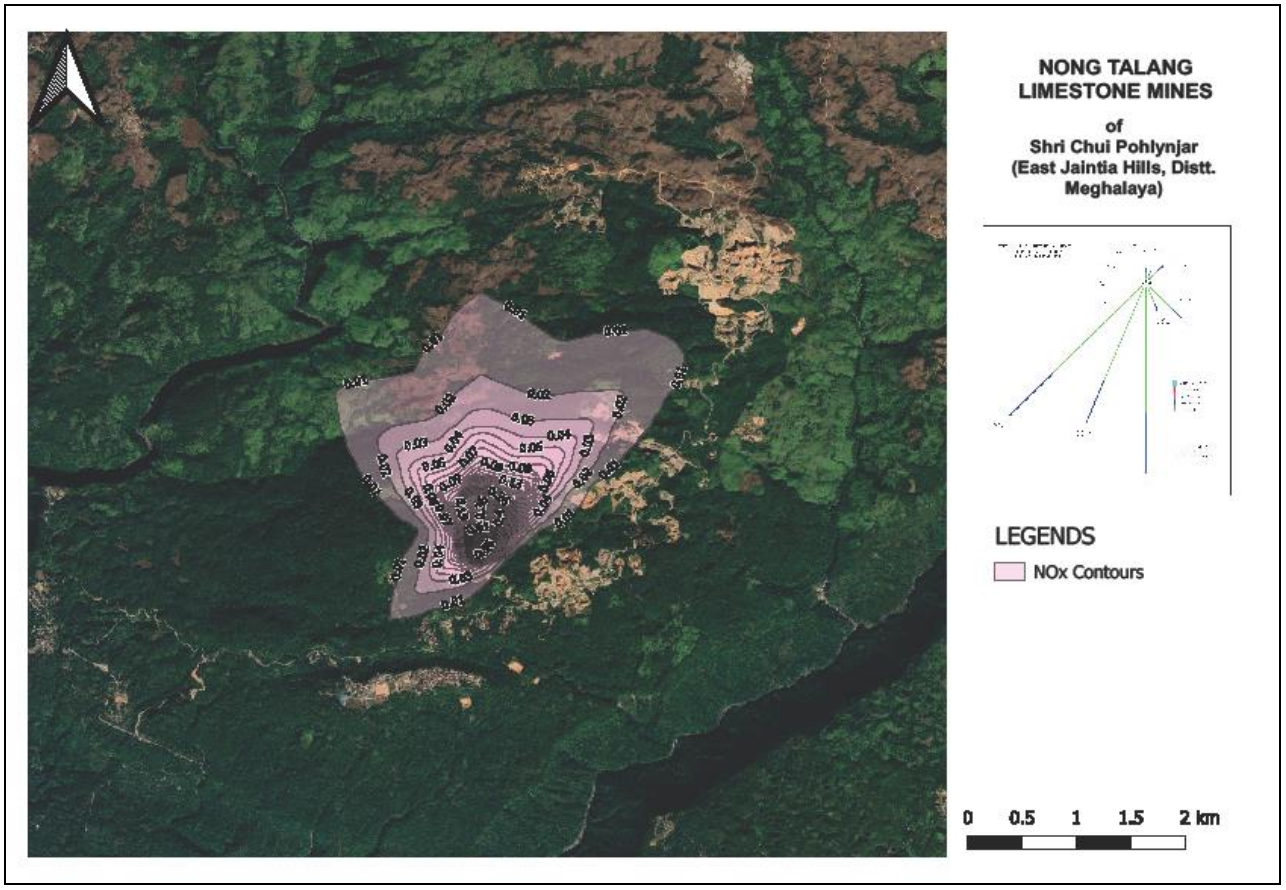


Figure 4.3; GLC Contours ofNO_2

GLC CONTOURS OF SO_2

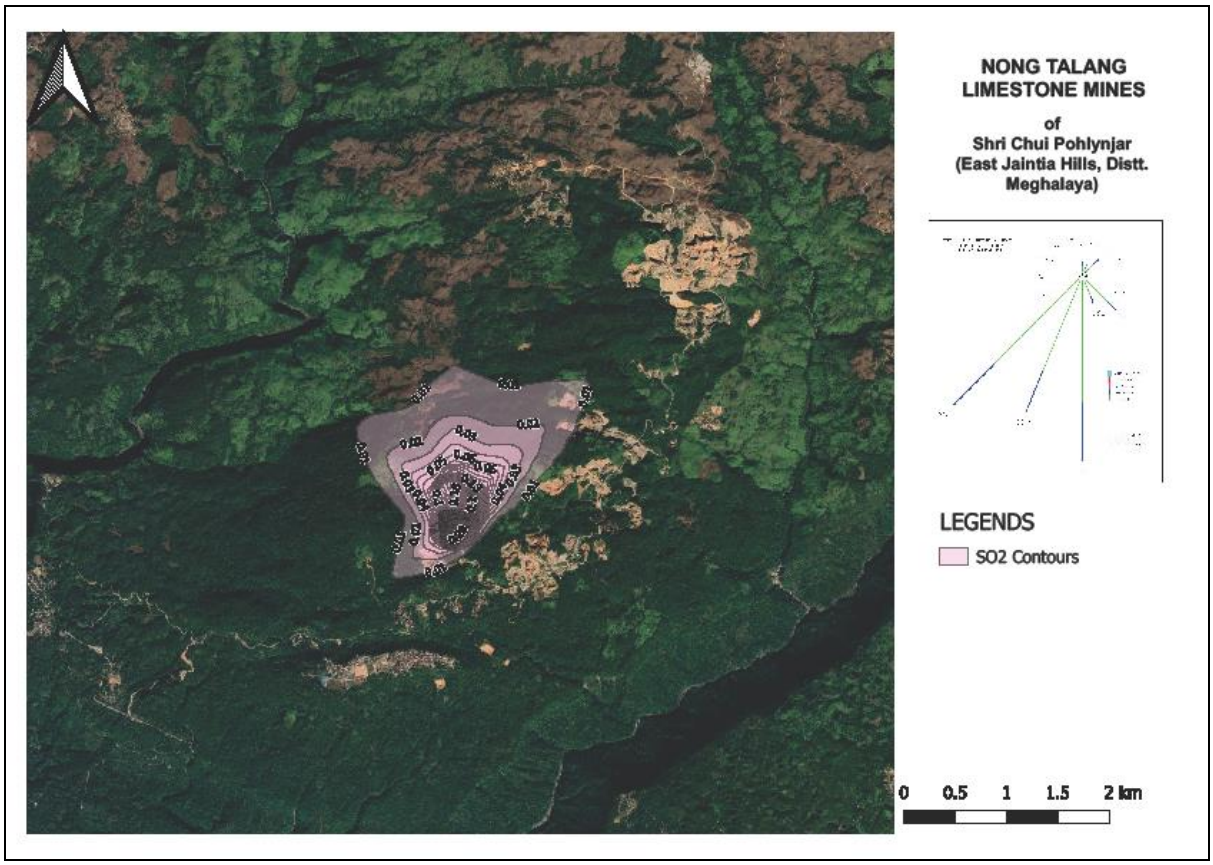


Figure 4.4; GLC Contours of SO2

From the results generated by AERMOD in form of Isopleth and results of same in table above show that maximum GLC of PM10/ PM2.5/ SO_2/ NO_2 after commencement of project does not have a significant impact on environment/ ambient air quality on sensitive receptors of the project.

Detailed Air Dispersion report is attached at **Annexure 13.**

4.4 NOISE &VIBRATION

4.4.1 Noise:

Environmental noise is a complex phenomenon because its intensity and characteristics vary with time loading and noise in buffer zone will be a result of transportation of the excavated mineral and local village activities. Depending upon the frequency as well as type of mining method to be applied along with the mining machinery and transportation vehicles. Ambient noise level in the core zone is likely to increase because of drilling & blasting operation, deployment of equipment such as heavy earth moving machineries,

4.4.2 Impact on noise quality

Generally, the main sources of noise and vibration in the mines occur due to drilling, blasting, mobile mining equipments, transportation, loading and unloading. Noise Quality study was conducted and the results are given below:

Noise Quality results: Samples were collected from 8 locations and the results show:

Core Zone: ANL1: The ambient noise level during day time at the proposed project site was 55.8 dB (A) which are within the standard limit of Industrial area~75 dB (A). During night the noise level at the project site ranges from 42.6 dB (A) which is within the night-time noise standard limit of 70dB (A).

Buffer Zone: The ambient noise level at day time are maximum at ML area of Nongtalang Village 57.1 dB(A) as per the standard limit of Commercial area are $\underset{\sim}{}$ 65 dB (A). The night time noise result at the locations is 42.0 dB (A) which is within the standard limits of industrial area $\underset{\sim}{}$ 70 dB (A).

In case of the proposed project additional likely impact of noise and vibration will be as follows:

- Mining can cause negative effect on noise quality in the area.
- Noise and vibration generated due to drilling and blasting activity involving Jack hammers drilling equipments.
- Noise and vibration due to mobile mining equipments like excavators, loaders.
- Noise generated due to transportation activity i.e. from dumpers, tippers, trucks and other vehicles.

4.4.3 Mitigation Measures

- *Drilling equipments will be regularly maintained as per maintenance manual. Anti- vibration mounts for compressors will be provided.*
- *Optimum parameters for drilling and blasting will be designed to have controlled blasting which will reduce noise and vibrations.*
- *Blasting will be carried out when the wind conditions are favorable (i.e. when wind is blowing in opposite directions of inhabitated areas or in low velocity).*
- *Ear Muffs will be provided to the exhaust of wagon drills to minimize the noise level.*
- *Blasting operations will be carried out during the noon time when the temperature inversions are not likely to occur.*
- *Proper stemming will be done to reduce air blast.*
- *To check vibration, values of peak particle velocity will be maintained within the prescribed limit by DGMS.*
- *The excavators which will be used for loading will have noise proof cabin to avoid adverse effect to the operator. The helpers working near the excavators will be provided ear plugs and muffs. The maintenance of the excavators will be carried out as per manual.*
- *Proper free face will be maintained for optimal blasting which will also reduce noise and vibration.*
- *Periodical monitoring of noise and vibrations will be done.*
- *The dumpers, trucks and other transportation vehicles will be maintained in good running condition so that noise will be reduced to minimum possible level.*
- *Plantation of trees along the 7.5m periphery of the lease area and along the slope of the dump will be done to dampen the noise.*
- *Each blast will be carefully planned, checked and executed under the supervision of a statutory personnel.*
- *Road will be regularly maintained as better road will lead to less noise.*
- *Imposition of speed limit on heavy earth moving machineries near residential areas.*
- *Truck drivers will be instructed and trained to make minimum use of horns at the residential area.*
- *Vehicles will have anti-vibration mountings, vibration- damped panels.*
- *Timely maintenance of vehicles and their silencers to minimize vibration and sound.*
- *Phasing out of old and worn out machineries.*
- *Task rotation of workers will be done exposed to noise.*

4.5 WATERENVIRONMENT

The mining operations may have adverse impact on water regime. The important impacts on water regime include change in surface run-off and base flow relationship and possible contamination of surface run-off with excavated overburden. There is no river or water body flowing across the mine site. The nearest perennial water body is Wah Umngot river- 9.5 km SW from the mining site.

4.5.1 Hydro-geology of the area

The hydrogeological formation of the study area comprised of Granite Gneiss and intrusive of Archean Proterozoic, Quartzite of Paleo-Meso-Proterozoic of Shillong group, Granite of Neo Proterozoic- early Proterozoic, Sandstone and Limestone of Paleocene-Eocene age. The presence of weak planes like fractures and joints in these hard rock formation forms the principal aquifer in the area. The ground water in the district occurs under unconfined, semiconfined to confined conditions. Study of dug wells and exploration data reveals the presenceof phreatic/shallow and deep fractured aquifers in the district.
(Source: Central Ground Water Board, India)

GROUNDWATER DEVELOPMENT

Ground water exploration has been carried out in different parts of the district to delineate the potential aquifers and their geometry and to determine the hydrogeological parameters of the aquifer systems. Before NAQUIM programme started in the district, 5 EW and 1 OW were constructed and as a part of data gap generation 5 EW were constructed during the course of study. Details of the exploratory wells are presented below. The summarized details of Ground Water Exploration carried out in the district are given below-

Table 4.3: Summarized Details of Ground Water Exploration

Sl. No.	Location	Block	District	Latitude	Longitude	RL (m)	Type	Lithology
1	Raliang	Laskein	West Jaintia Hills	25°30′05.4″	92°23′56.2″	1276	Depression	Granite Gneiss
2	Madanrwan	Laskein	West Jaintia Hills	25°32′23.1″	92°28′08.8″	1041	Depression	Granite Gneiss
3	Niawkmai	Laskein	West Jaintia Hills	25°32′58.2″	92°29′59.8″	981	Depression	Granite Gneiss
4	Banmuhur	Laskein	West Jaintia Hills	25°31′46.1″	92°32′33.7″	906	Depression	Sandstone
5	Nongringkoh	Laskein	West Jaintia Hills	25°29′11.0″	92°30′54.2″	1082	Depression	Granite Gneiss
6	Shangpung	Laskein	West Jaintia Hills	25°28′49.6″	92°21′11.3″	1260	Depression	Sandstone
7	Thadlaskien	Thadlaskein	West Jaintia Hills	25°29′42.6″	92°10′13.4″	1368	Depression	Quartzite
8	Tyrsang	Thadlaskein	West Jaintia Hills	25°32′04.7″	92°08′52.3″	1328	Fracture	Quartzite
9	Lad Mukhla	Thadlaskein	West Jaintia Hills	25°30′37.0″	92°09′52.6″	1344	Depression	Quartzite
10	Mukhla	Thadlaskein	West Jaintia Hills	25°30′20.5″	92°10′17.9″	1362	Depression	Quartzite
11	Nartiang	Thadlaskein	West Jaintia Hills	25°34′09.7″	92°12′23.5″	1204	Depression	Quartzite
12	Moobakhon	Thadlaskein	West Jaintia Hills	25°38'37.4″	92°17′12.6″	1045	Depression	Quartzite
13	Namdong	Thadlaskein	West Jaintia Hills	25°39'33.0″	92°19′36.4″	990	Depression	Quartzite
14	Khonsaro	Thadlaskein	West Jaintia Hills	25°41'09.2"	92°20′49.4″	963	Depression	Quartzite
15	Saitsama	Thadlaskein	West Jaintia Hills	25°43'15.2"	92°23′01.9″	891	Depression	Quartzite
16	Khanduli	Thadlaskein	West Jaintia Hills	25°43'11.5"	92°24′55.0″	859	Depression	Quartzite
17	UmsyneirSaitsama	Thadlaskein	West Jaintia Hills	25°43'21.1"	92°23′46.7″	878	Depression	Quartzite
18	Mukoh	Thadlaskein	West Jaintia Hills	25°40'25.5"	92°21′01.1″	960	Depression	Quartzite
19	Nongbah	Thadlaskein	West Jaintia Hills	25°31'22.0"	92°14′56.7″	1313	Fracture	Granite Gneiss
20	Jowai	Thadlaskein	West Jaintia Hills	25°26'30.37"	92°11′20.47″	1263	Depression	Quartzite
21	Mostam	Amlarem	West Jaintia Hills	25°24'42.5"	92°10′14.0″	1318	Depression	Sandstone
22	Shkendyrsit	Amlarem	West Jaintia Hills	25°21'49.2"	92°08′51.5″	1304	Fracture	Sandstone
23	Umjarang	Amlarem	West Jaintia Hills	25°18'52.38"	92°07′49.51″	1142	Fracture	Sandstone
24	Dawki	Amlarem	West Jaintia Hills	25°11'11.8"	92°01′08.6″	28	Fracture	Sandstone
25	Amlari	Amlarem	West Jaintia Hills	25°11'00.68"	92°08′59.83″	418	Fracture	Limestone

(Source: Central Ground Water Board, India)

It may be clearly observed that the ground water development in the region, in which lease area falls in safe category.

4.5.2 Impact on water quality

- Additional load on water demand due to mining and allied activities
- Ground water quantity due to extraction for facilitating mining activity
- Ground water quality due to open defecation by mineworkers

Mine seepage and impact on ground water regime

Impact on surface water bodies through indiscrete disposal of liquid waste and suspended solids carried by flowing rainwater

It would be apt to reiterate here that the quality of ground water was not potable at many places in core and buffer zone as summarized below-

- **Ground Water Quality**: The samples were collected from 6 ground water locations and 2 surface water sources:

- **Core Zone: (Lease Area, Hand Pump Water)** shows that parameters like Total Hardness (262.0 mg/l); Total dissolved solids (445.0 mg/l), Magnesium (21.90 mg/l), & Alkalinity (165 mg/l) are well within drinking water standards (IS: 10500).
- **Buffer zone: Ground Water results:** All results were found within standard drinking water standards (IS: 10500).
- **Surface Water results in Buffer Zone:** The Surface water quality of the Upstream and Downstream water of Wah Umngot River is within prescribed CPCB Water Quality Criteria Class of water.

  The excavated material will not carry any reacting and harmful constituent leading to deterioration of chemical quality.

4.5.3 Mitigation measures

- Total water requirement is about 5.00 KLD (1.0KLD Domestic Uses) + 2.0 (Dust Suppression) & 2.0 KLD (Green Belt) from nearby water sources. Water for drinking purpose will be met from nearby villages. For sprinkling & plantation water will be taken from Private tanker.
- ***Conservation of Ground Water:*** *Mining will be restricted up to a depth of 25 m. Water stored in the mined out area will act as water recharging source in the area. Therefore, mining activity in the leasehold area will have positive impact on ground water.*
- *There is no possibility of mining encountering any surface/subsurface water body. However, during the course of mining, rainwater in the form of surface runoff will be there during monsoon only. No water from the quarry will be discharged to any natural water course directly. The accumulated rain water will partly be used for dust suppression and afforestation and limestone being pervious in nature much of the water will percolate below the quarry surface.*
- *To avoid contamination of ground water from the open defecation by workers, toilets will be provided for*

the workers at site with septic tank followed by soak pit.

- *To prevent silt being carried during monsoon period, series of plants would be planted.*

4.6 LAND ENVIRONMENT

Mine lease encompasses total area of 4.30 Ha. Mining will be open cast semi mechanized mining with drilling & blasting. There shall be maximum production of 150000 TPA from this mine. The project area is classified as "Non forestland".

4.6.1 Impact on land environment

Changes in the land use pattern will be caused due to the breaking, dislodging of rocks and transportation.

A) Impact on Land Use of Core Zone

As aforementioned, changes in the land use pattern are caused due to breaking, dislodging of rocks and transportation. The change /impact on land use pattern of core zone after the plan period is as follows:

Table 4.4Land Use: Core zone

Category	End of 5th year (In Ha)
Excavated Land	1.76
Greenbelt in safety barrier	0.93
Dump with Parapet wall & Garland Drain	0.03
Total Area in use	2.72
Balance unused area	1.58
Total Applied Lease Area	**4.30**

The change in land-use is graphically depicted in the figure given below —
Over all Changes in Land use of the core zone area

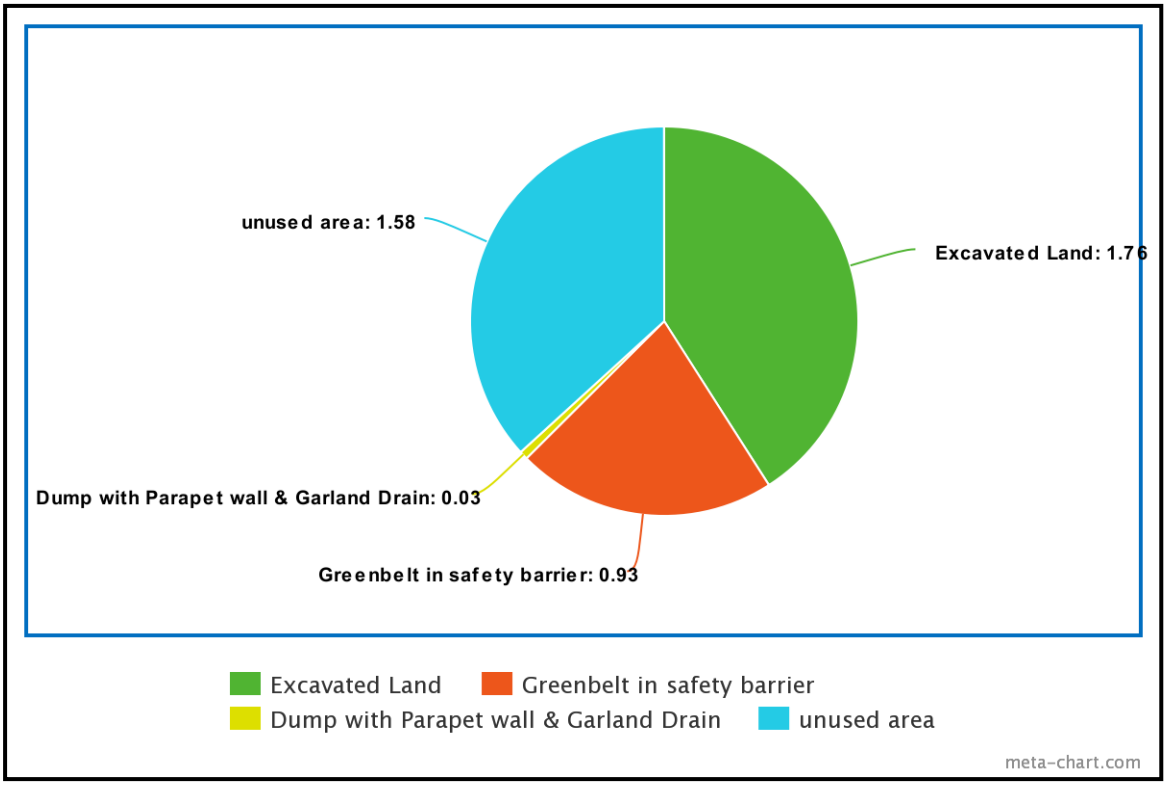


Figure 4.5; overall changes Land use of the core zone area

Impacts on Land Use: The possible impacts on land environment are —

- Effect on productivity of land due to mining by loss of topsoil.
- Dust generation due to mining cause dust cover problems on the nearby vegetation.
- Effect on public buildings of monuments if any.

4.6.2 Mitigation Measures

In order to prevent the environmental degradation of mine lease area and its surroundings, the following measures shall be taken;

- *The proposed project of limestone mining will definitely change the land use. However the area will be reclaimed by the following measures:*
  - *To minimize the effect of mining plantation will be in done along the 7.5m boundary of the mine*

area and after the exhaustion of the pit whole area will be reclaimed into green cover. After the conceptual mining there will be a mine void which will be extensively planted.

- *Mining operations will be confined strictly within the demarcated area.*
- *During Plan period some quantity of waste (275000 MT) will be excavated. The generated mineral will be utilized for maintenance of existing road of surrounding areas and will be back filled for reclamation.*
- *The dust generation due to the mining will be minimized by sprinkling of water through water sprinkler.*
- *No effect on public buildings or monuments is envisaged as there are no public buildings/ monuments in the close vicinity of the mining lease area.*

4.7 IMPACT ON SOILQUALITY

During Plan period no soil is being excavated. Mining operation and allied activities will not pollute the soil. However precautionary measures will be taken.

As no toxic substance will be generated or involved, the impact on soil quality is not likely to be more intensive than the existing level. The dust generated during loading and unloading operations and vehicular movements normally constitute heavier particles that would readily settle on very small areas within the plant itself. Raw material and product will also be stored. Thus negligible impact on soil quality is envisaged.

4.7.1 Mitigation Measures

- *Plantation shall be done on 7.5 m statutory boundary to increase quantity of humus in the area.*

4.8 SOLID WASTEMANAGEMENT

Due to the project there will be various kinds of solid wastes generated, which will cause adverse effects on environment and thereby cause pollution both on the surface and beneath. Littering of waste can cause contamination of water course. The types of wastes generated and their impacts on environment is discussed ahead—

Mine Waste generation: As per the scheme of mining, the waste generated at the end of plan period will be:

Alluvial Soil	: 55000 Tonnes
Siliceous Limestone	: 54000 Tonnes

Sandstone : 166000 Tonnes

***Table for Waste generation is given in Chapter 2 Table no.2.6.*

Domestic Solid Waste generation: This type of waste comprises of organic and inorganic materials such as paper, kitchen refuse, bottles, foils, packaging etc. There will be about 36 workers working at the mine site at any point of time. It is expected that about 5 Kg/day of solid waste will be generation on this account. Out of which, organic waste will be around 3.5 kg and remaining 1.5 kg waste will be recyclable and inert waste.

Hazardous waste generation: In proposed project hazardous waste will be mainly generated due to used oil generated from machineries used in mining. There will be deployment of machinery such as excavator; trucks, water tanker, light vehicles etc. and thus about 100 Lit/day of diesel will be required during peak mining days. Thus, daily used oil generation will be 1.7 litres/day.

Plastic waste and E-Waste will be given to approved vendor.

4.8.1 Mitigation Measures

- ***Mine waste:*** *During Plan period some quantity of waste (275000 MT) will be excavated. The generated waste will be utilized for maintenance of existing road of surrounding areas and will be back filled for reclamation.*
- *As per conceptual planning total area of 4.30 ha of the quarry area will be used to for mining. Afforestation will be carried out in the 1.50 ha of the land to develop green cover.*
- *Domestic Solid Waste generated due to mine workers will be collected in coloured bins of green and blue colour. Organic part of solid waste will be stored in green bins. There will be composting of biodegradable waste generated from both plant site and mine site will be undertaken and compost will be used for development of green belt in the plant as well as in the mine site.*
- *Inorganic waste such as wrappers, plastic waste, foils, etc will be stored in blue bins and will be sold to recycler authorized by CPCB.*
- *Mobile Toilets at the site will be maintained and waste water will be disposed off into septic tank followed by soak pit.*
- *Hazardous waste generated from the mine will be only used oil which will be stored into HDPE drums and used oil shall be sold only to the registered recycler.*
- *Mining machinery engaged will not be washed at the site as the machines will be hired from the dealer.*

4.9 TRANSPORTATION

Proposed production from the mine will be 150000 TPA. As the daily production from the mine will be 455 T. OB will be stacked separately at stack yard and mineral will be transported to market. There will be deployment of 4 no. of tippers of capacity 10 tones to.

The lease area has no habitation in close proximity so traffic on the roads is minimal. Steps will be taken to coordinate and organize traffic in the mining area and the mining trucks route, road repairing in coordination with govt. officials. Awareness campaign among dumper/truck drivers will be generated for clearance of road and lower down the pollution load due to transportation.

4.9.1 Anticipated Impact Due to plying of Hauling units and its mitigation measures:

The generated OB from site will be transported by Haul road to the waste dump location in the ML area using dumpers and the Limestone raised from the mine face will be transported by haul road up to the stock yard to be centrally located in ML area. The entire production of mine shall be moved to through dumpers.

The direct impact on the existing traffic load due to the proposed project will be only due to service vehicles moving outside ML area. Therefore, the traffic to & fro of proposed "**Nongtalang Limestone Mines**" will not create any traffic congestion.

4.9.2 Other Mitigation Measures:

- *To regulate the traffic, Sign boards shall be displayed for safety purposes during mineral transportation.*
- *The proposed increase in traffic density will not cause significant impact on the traffic since the connecting road and nearby N*H-40 *is capable of handling this increase in traffic density. The trucks will be properly covered with tarpaulin and overloading will not be allowed to avoid spillage on roads.*
- *Haul roads will be sprinkled with water to keep the dust suppressed.*
- *A supervisor will be appointed to regulate the traffic movement near the site.*
- *Speed breakers will be constructed accident prone areas to calm the traffic and its speed.*
- *Awareness campaign among dumper /truck drivers will be generated for clearance of road and lower down the pollution load due to transportation.*

4.10 BIOLOGICAL ENVIRONMENT

The details of impact and mitigation for the biodiversity in and around the lease area are given below:

4.10.1 Anticipated Impact on Flora

Mining can affect vegetation in the core zone. The mining activity will generate dust which may impact the nearby biological environment.

(A)Impact on Ecology:

There will hardly be any negative impacts on terrestrial eco-system comprising birds and animals as the ML area is only 4.30 Ha. On the contrary, with progressive growth of greenery, terrestrial eco-system will improve in course of time. Due to excess hunting of birds and animals, around, animal life is very less; hence adverse impact on biological environment will be negligible. The air pollutants will be the dust generated during earth moving activities and emissions from vehicles, portable diesel generators, etc.

Though the site is located within barren land, the impact zone is part of landscape involving rural areas. There is growth of vegetation and meager presence of fauna. Impacts on biological environment will be negligible. The dust emission will affect the effective photosynthesis and biological processes by covering the plant/tree leaves by thin dust layer during dry months which however will be washed away on rainy days. It may be noted that are plenty of rains, hence photosynthesis is not anticipated to be effected. Operation activities will have some impact on the eco-system as follows:

a. Impacts on fauna

Bright light and unusual noise during operation activity could shift the activity site of the birds and animals to little away from the location. Presence of water and food wastes during the day time will attract birds and animals. Due to excessive hunting the animals & birds are hardly seen on the fringes. They go deep inside the jungle and stay there. So, during the operation phase, there will hardly be any negative impact on the biological environment comprising birds and animals. On the contrary, with the progressive growth of greenery, biological terrestrial environment will improve in due course of time.

b. Impacts on flora

During operation phase, main pollutants will be emission from vehicles. There would be meager impact of such pollutants on vegetation and crops, since the predicted levels will be much less than the levels specified for industrial and mixed use areas. Waste water from domestic and other facilities will be released only after treatment.

c. Impact on Aquatic eco-system

Impact on Aquatic eco-system will be negligible as no polluted water will be released into natural drainage channels. The Project would adopt zero water discharge concept.

4.10.2 Mitigation Measures

Following measures are proposed to mitigate ecological impact

I. Plantation programme

To reduce the impact of air pollution, particularly the SPM content, it has been proposed to a green belt around Barrier/ safety Zone. Plantation will be carried out within the lease area where fugitive dust emissions are anticipated. Lawns and gardens will also be created near the office areas and other service areas like canteens, parking lot, etc. The plantation programme to be carried out is shown in Fig 4.7.

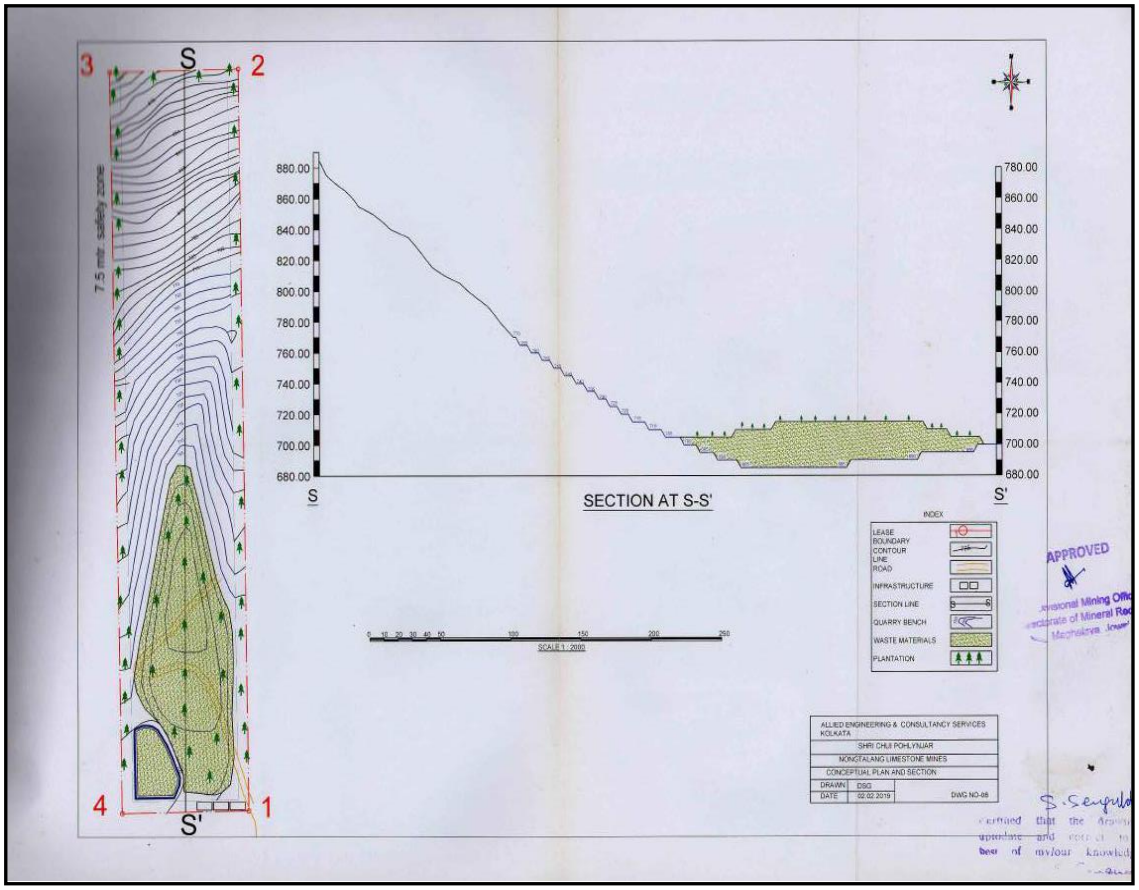
Special care has to be taken while planting trees, as regards the type and the number, within the plant premises in order to confine the pollutants to the area and prevent their dispersal. The number of trees to be planted as a part of the plantation programme is taken as 1490 trees for green belt and along roads.

In addition to the trees planted as mentioned in the above table, a variety of small flowering shrubs and plants will be planted in the gardens and lawns. These flowering plants will improve the aesthetics of the area. Year wise plantation programme is given in **Table 4.5**.

TABLE 4.5
YEAR WISE PROPOSED PLANTATION PROGRAMME

Sl. No	Year of Plantatio	Target of Plantation	Spacing	Area of Plantation	Remarks
1.	First	298	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
2.	Second	298	2.5 m	Safety/Barrier Zone	
3.	Third	298	2.5 m	Safety/Barrier Zone	
4.	Fourth	298	2.5 m	Safety/Barrier Zone	
5.	Fifth	298	2.5 m	Safety/Barrier Zone	
TOTAL= 1490					

Fig 4.6. Green Belt Development Programme



The selection of trees to be planted has to be done judiciously keeping in mind the adaptability of trees to the climate of the region. As mentioned in Chapter 3, the trees which are found in relative abundance as compared to the other species as well as species with proven survival rate will be preferred. Consultation with the forest officers and experts in the field will further help to identify the exact species to be planted, and these can be obtained from the nurseries in the nearby areas. The social aspects of requirements of fodder and fuel of the community will not be affected by this project.

II. **Wildlife conservation programme**

The list of animal diversity is prepared by visualizing and interviewing many local residents of nearby villages. Due to ban in poaching many animals have shown increasing trend. There is no schedule I species observed in the study area.

There are no threatened species of plants. Monkey of Schedule II is the only threatened species. No special measures are required except that the employees as well as the population of surrounding villages will be educated for conservation and protection of the Monkey through specially arranged camps and continuous campaign through posters at prominent places.

Some additional measures shall be taken as follows:

- *Mining will not affect flora in core and buffer zone because mining will be carried out within the demarcated area.*
- *In buffer zone there is good vegetation. Mining will be limited to the core zone. Therefore the flora and fauna will thrive in the buffer zone. Raw material will be transported in covered vehicles to market. Hence impact on surrounding flora will be minimal.*
- *The mined out area will be closed progressively along with reclamation of the land for the gainful use by developing green area. Thus, it is expected that the natural vegetation in the area will not be affected.*
- *A site reclamation plan will be developed that will addresses both interim and final reclamation requirements and that identifies vegetation, soil stabilization, and erosion reduction measures.*

4.10.3 Anticipated Impact on Fauna

- Noise from mining equipments, transportation, changes in land use may affect the migration of fauna.
- Mining may drive away the wild life from their habitat, and significantly affect wildlife.

4.10.4 Mitigation Measures

- *In core zone the land is non forest land which has vegetation and the mining activity will be carried*

out in that area. However, there is less biodiversity in the area hence mining will not adversely affect the fauna in the area.

- *There is no wild life sanctuary in 25 km radius circle. As per forest working plans and records from MoEF reveals that there are no wildlife sanctuaries or national parks or biospheres/ tiger reserves in 10-km radius from mine lease area. Plant species observed are common in nature and there is no endangered, threatened, protected or rare plant species recorded during field surveys and also from forest department records.*
- *Thus, the impact on the flora and fauna will be insignificant and addition of greenbelt may enhance the local aesthetic value in the region.*
- *To protect the fauna protective measures for reclamation and green belt development will be done. Emphasis will be given to local species & plants of economic importance.*
- *Measures for protection and conservation of wildlife species will be done by organizing awareness campaigns and vigilance program by involvement of community youth against poaching of animals.*
- *To check/reduce the impact of dust and noise, thick plantation cover will be developed which will provide acoustic buffer and therefore will dampen sound.*

4.11 SOCIO- ECONOMICENVIRONMENT

The impact of mining industry on socio-economic scenario has both the facets. On one hand it may degrade the fertile land leading to reduced agriculture income besides causing displacement. On the other hand being a commercial activity it provides opportunity for both direct & indirect employment. As mentioned earlier, there will be around 36 personnel, 80% staff will be employed from the local villages.

Impact of Mining:

- Socio Economic scenario of the study area should be done.
- Increase in dust generation due to transportation of the material by tippers and uncovered trucks.
- Increase in employment opportunities is a positive impact from the project.
- Impact on nearby habitat due to dust generation and mining activity
- Falling of children in mining pits
- Impact on agricultural fields due to mining activity

Mitigation Measures:

Results of Socio economic study: *Total 71 villages fall in the buffer zone. The study has been conducted*

by primary survey and secondary data source from Census of India 2011. The primary socio economic study has been conducted in 4 villages. The results are discussed below:

- ***Core Zone:*** *There is no habitation in the core zone*
- ***Buffer Zone****:* The total number of Households of the study area in rural village area is 5716 as per Census of India, 2011 data. The details are given below.
- **Population:**

  The total population of the study area is 31549 constituting 5716 households, implying that there are average 5.52 members per house. The average sex ratio of the study area is 1000/1015 as per census 2011.
- **Social Structure**

  The proportion of Scheduled Caste (SC) population within the study area is 1.41 % and the percentage of schedule Tribe (ST) is 90.41%.
- **Literacy**

- The total proportion of literate within the study area is 60.75% of total population. In percentage the male literacy 29.89% and the female literacy is 30.86% respectively within study area.
- The project will generate employment for total 36 people. In which apart from the statutory employment mostly the local people will be hired.
- Regular sprinkling of water in the roads will be undertaken to arrest the dust. Besides plantation around the mine area has been proposed which will help minimizing ill effect from dust.
- A separate transportation route is proposed which will not pass through the villages.
- Regular maintenance of vehicles will be undertaken.
- Green barrier of native species along existing Road passing through the lease area will be developed.
- Truck will be covered by Tarpaulin.
- Wire fencing for mining pits.
- Barricading by using wire fencing to restrict the children to go towards the mine site.
- The area of agricultural fields will not be disturbed by mining.

SOCIAL IMPACT ASSESSMENT

- There are various social impacts of mining which should be identified before starting any developmental activity. The mining is one of the activity for which if pros and cons are not properly assessed may not only result in deterioration of local environmental scenario but also may have long term affects on the socio-economic status of the locals such as loss of agriculture land, degradation of water quality, contamination of ground water and soil quality. Therefore, to prevent above problems following measures shall be undertaken:
- Ensuring developments contribute to economic growth and social development. The project will provide skill-based training to the locals and will generate chance of indirect employment in the area.
- During operation phase, there will be small influx of about 36 workers to the locality with ready income in cash. This work force will come from the surrounding areas. With the increased population and money supply, there will be need for daily consumption items as well as services, which have to be provided by suppliers from nearby locality. These developments will have both positive and negative impacts on the local socio-economic environment.

4.11.1 Impact on Occupational Health:

Impact on health:

Mining activity often leads to Respiratory disorders are occupational lung disease to miners, due to the inhalation of dust. There respiratory disorder that may happen to the miners in proposed case is Silicosis: This takes place due to breathing crystalline silica dust, which in severe cases can be disabling, or even fatal. When silica dust enters the lungs, it causes the formation of scar tissue, which makes it difficult for the lungs to take in oxygen. Miners may also suffer with occupational respiratory ailments, skin allergies etc, but the same are preventable if exposure is minimized. PP will take all the precautions as much possible to ensure healthy and safe environment for the mine workers. The chances of occurrence of disease due to dust generation can be minimized by providing Personal protective Equipment's to the workers and by organizing regular health check-up of the miners. The detailed measures to be followed are given below:

Preventive measures

- *Personal Protective equipments (such as dust mask, gloves, goggles, boots, earmuffs) shall be provided to the mine workers especially to those who are working at high noise & dust generation points.*
- *They will be guided and informed about the health hazards and the measures to cope up with them*

by conducting informative sessions.

Table 4.6: List of safety equipments

S.No.	Item	Equipment
1.	Face protection	Face Shield
2	Eye protection	Different types of goggles used for different purposes.
3.	Ear protection	Ear Plug, ear muff
4.	Leg Protection	Safely shoes, gum shoes
5.	Working at height	Safety belts
6.	Head Protection	Safety helmets
7.	Protection from Dust	Dust Mask
8.	Hand Protection	Rubber gloves

***Medical Check-up**: Pre-employment and periodic medical examinations shall be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazard.*

- *At the end of mining operation test will be conducted to assess health of workers.*
- *Workers will be informed and trained about occupational health hazards if identified.*
- *Any worker's health related problems will be properly addressed.*
- *The medical histories of all employees will be maintained in a standard format. Thereafter the employees showing symptoms of the diseases mentioned below will be subjected to medical examination. Mostly respiratory disorders are more likely therefore workers will be checked for respiratory diseases.*

4.12 PLANTATION/AFFORESTATIONPROGRAMME

Plantation of local thriving species will be done in the 7.5 m statutory boundary along the mine area. During the plan period about 0.93 ha area shall be planted whereas about 1.50 ha i.e. the entire lease area will be planted at ultimate stage. Precautionary measures will be taken for carrying of the afforestation made by regular watering in the afforested area,

to protect from grazing animals and proper manuring. The detail of afforestation scheme is given below-

Table 4.7; Proposed Plantation

Year of Plantation	Target of Plantation	Spacing	Area of Plantation	Remarks
First	298	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
Second	298	2.5 m	Safety/Barrier Zone	
Third	298	2.5 m	Safety/Barrier Zone	
Fourth	298	2.5 m	Safety/Barrier Zone	
Fifth	298	2.5 m	Safety/Barrier Zone	
TOTAL	**1490**			

4.13 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF ENVIRONMENTAL COMPONENTS

For a mining project of this type there would be significant irreversible environmental impacts of following nature:

- The primary and secondary impacts of the project.
- The project may involve potential environmental accidents associated.
- Use of Natural resources.

There are following irreversible and irreparable changes associated to mining and mitigation measures:

- **Land Use change and degradation of soil quality:** Mining causes change in land use resulting in mining pit which alters land use. As the mine area is only 4.30 ha hence there will be no backfilling. Instead of that soil will be spread and plantation will be done in the entire area at the ultimate stage.

- **Water Recharge Pit:** Till the conceptual period mining pit will be developed in the water recharge pit. During rains water will be collected in the pit and therefore result in overall development of water level of the area.
- **Loss of biodiversity:** Destruction or drastic modification of the original site and anthropogenic substances release can have majors impact on biodiversity in the area. Destruction of the habitat is the main component of biodiversity losses.
- **Green belt Development:** As per ultimate plan 7.5m of statutory boundary in the mining the area will be developed into green belt area and trees shall be planted. This will provide safe habitat for fauna and also provide fodder for the cattle of the nearby village people. Extensive plantation will be done in the entire area at the ultimate stage.
- **Fencing of the mining area:** Sometimes big pits result in accidents and animal falls into the pit. To protect them there shall be fencing done around the mining pit.
- **Contamination of ground or surface water:** There will be no contamination of ground water as the mining will be carried out above ground water table. The runoff from the mine is negligible so there will be no contamination of surface water.

4.14 ASSESSMENT OF SIGNIFICANCE OFIMPACTS

The environmental attributes which are likely to have an impact due to the proposed mine at Thanghunai, Elaka- Nongtalang, P.O.+ P.S.- Dawki, District-West Jantia Hills, State- Meghalaya. After taking proper measures the possible impacts are summarized below.

Table 4.8; Summary of Impacts and mitigation measures

S.No.	Proposed Activity/Parameters	Significance of Impacts
1	**Air Environment**	-
	PM_{10}	-
	SO_2	-
	NO_X	-
2	**Water Environment**	+ve
3	**Biological Environment**	-
	Flora (Vegetation)	+ve
	Fauna (Wildlife)	-
	Plankton	-
4	**Noise Environment**	-
5	**Socio-economic Environment**	

	(a) Social Status	+ve
	(b) Economic Status	+ve
	(c) Generation of Employment	+ve
	(d) Infrastructure Resource Base	+ve
6.	**Traffic Environment**	-

4.15 SUMMARY OF MITIGATION MEASURESPROPOSED

A brief description of mitigation measures is given ahead —

Table 4.8; Summary of Mitigation Measures Proposed

Air Environment	*There shall be generation of dust due to point and non-point sources thus following measures shall be adopted:* • *Workers will be provided with protective gears such as dust masks and goggles etc.* • *Regular water sprinkling* • *Plantation of trees will be done at dust generating points* • *Vehicles shall have PUC Certificate*
Noise Environmen	*Ambient noise level in the core zone is likely to increases. To prevent noise pollution:* • *Optimum blasting parameters will be adopted.* • *Ear muffs will be provided to the workers.* • *Plantation will provide acoustic buffer therefore plantation shall be done along the periphery.* • *Regular maintenance of equipments shall be done to reduce noise pollution.*

Water Environmen	*Possible impacts due to contamination on water quality due to runoff of storm water and mine seepage.* • *No effluent discharge from mine* • *No toxic chemicals in mineral to contaminate water.* • *Water collected during rains shall be used for sprinkling and plantation.* • *The mining will act as water recharge reservoir which will help in development of ground water in the area.* • *Mining will not intersect water table; hence there will be no impact on groundwater.*
Biological Environment	• *Mined out land reclamation shall be done by doing extensive plantation in the entire lease at the conceptual stage.*
Socio-Economic Environment:	*It is evident from social survey that population is mostly unemployed.* • *The project will generate employment for 36 people.* • *Regular medical examinations, schooling, better infrastructure etc. shall benefit employees as well as the locals in the area.*
Mine Waste Management	• *Mine waste will be stacked at separate stack yard and will be use for road construction and plantation.* • *Mining shall not be done during rains and there shall be construction of retaining wall and garland drain to prevent surface runoff.* • *Hazardous waste such as used oil shall be stored properly and sold to registered-processor.* • *Domestic waste water due to daily human activities which shall be properly disposed off into septic tanks followed by soak pits. Other domestic solid waste such as Wrappers, foils, leftover food material etc* • *Shall be collected in separate bins.*

5.0 ANALYSIS OF ALTERNATIVES

5.1 GENERAL

Analysis of alternatives involves a thorough study of the possible future conditions in the project study of the possible future conditions in the project area in response to a set of alignment alternatives without the project or status quo condition. Consideration of alternatives to a project proposal is a requirement of EIA process.

5.2 ANALYSIS OFALTERNATIVES

1. **Project Alternative:** The project is for mining of limestone mineral. The mineral from the mine will be transported directly to the Market. There is a growing demand of quality limestone mineral in the local open market as well as for supply to the neighboring state as building and construction material for various construction purposes as well as for supply to limestone kilns. There is a huge demand for the low-grade Limestone boulder for construction purposes and to be use in lime burning both for domestic use within the state as well as for supply to other neighboring town and villages. The supply of limestone boulder will meet the demand adequately when production is allowed by the concerned authorities.

   Site Alternatives: The mineral is site specific & the lessee has applied mining lease to mine stone for the specified lease area. Thus, no alternatives site is proposed.
   Mining activities shall be carried out based on local geology and availability of the mineral. There are following causes due to which this site is most suitable:

i) The project is site specific in view of occurrence of mineral.

ii) The exiting road network is closer to the deposit and hence no additional land is required for road connectivity.

2. **Technology Alternative:**

   Mining shall be done by open cast semi mechanized method with drilling and blasting. Optimum blasting parameters will be adopted.

3. **Water Alternatives:** The water requirement in the mine will be for 3 heads namely Water requirement for Domestic activities, green belt development and sprinkling. The domestic demand of about 1.0 KLD will be sourced from nearby villages. For sprinkling & plantation water will be taken from Private tanker.
4. **Fuel & Power Alternatives:** Looking at the project requirements the best fuel High speed diesel is proposed to be used.
5. **Employment Alternatives:** Local workers will be employed as per availability and suitability and if required employment can be outsourced.
6. **Material Transportation**: Within the mine site the mineral can be transported through conveyor belts etc. However, the lease is so small and production is very less therefore a conveyor belt will not be feasible.
7. **Road:** Metallic road can also be constructed in place of haul road for transportation of mineral from mine site to main metallic road.

5.3 ADVERSE IMPACT OF ALTERNATIVESTECHNOLOGY

The existing technologies for mining of mineral are most suitable hence no change in project technology is proposed.

Mitigation Proposed for Alternatives: There will be no change in the technology opted hence no mitigation is proposed.

5.4 SELECTION OFALTERNATIVE

There is no alternative technology proposed for the project as the mineral is found within the beds of the rocks. This is the safest and least expensive technology for the mining of limestone mineral from proposed mine.

6.0 ENVIRONMENTAL MONITORING PROGRAM

6.1 GENERAL

The monitoring programme is devised to ensure that the envisaged purpose of the project is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Monitoring plan for performance indicators and reporting system is presented in the following sections. The company has a well-defined environmental policy.

Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). 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 management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed.

The objectives of monitoring are:

- To identify the state of pollution within the mining lease area.
- To verify the result of the impact assessment study in particular with regards to new developments.
- Generate data for predictive or corrective purpose in respect of pollution.
- To assess and monitor the environmental impacts.
- To establish a database for future Impact Assessment Studies for new projects.

Mining: Mining of limestone mineral will be done as per approved mining plan to ensure safety of the workers and ambient environment.

- **Manual:** There shall be no manual mining.

Semi Mechanized: Mine shall be worked out by semi mechanized method with drilling and blasting. Shovels/Rock breakers, jack hammers, compressor and tippers will be used for mining operations.

Frequency & locations of environmental monitoring: Regular Monitoring of all the environmental parameters viz., air, noise, water and soil as per the formulated program based on CPCB and MoEF&CC guidelines will be carried out every year in order to cross check any changes from the baseline status. Monitoring program will be followed till the mining operations are continued. For implementation of the same Environment Monitoring Cell will be formed under control of the Mines manager. The job of this cell will be regular environmental monitoring and submission of environmental report, green belt development, etc. The plan for Monitoring is given in the following paragraphs:

6.2 PROPOSED MONITORING PROGRAMME

The details of the proposed program are given below:

6.2.1 Monitoring of Mining Parameters

Slope failure: Topographically, the mining lease area represents gently sloping terrain. The average highest altitude recorded in the lease area is above 900m ASL and the lowest of below 700 m ASL. The elevation difference is 200 m. However regular inspection (frequency and mechanism to be established) will be carried out to examine slope stability, mine faces, etc. A team constituting of Mines Manager will undertake monthly inspection.

Ground water drainage: The effectiveness of drainage system depends upon proper cleaning of all drains and sumps. Regular checking will be carried out to find any blockage due to silting or accumulation of loose materials. The drains will also be checked for any damage in lining / stone pitching etc. The environmental management cell defined will inspect the same and submit report to owner.

Blasting effect: Blasting is one of the most critical activities of mining operations. Therefore, Optimum drilling and blasting parameters have been developed taking into account different aspects generally adopted in similar cases to optimize the efficiency of blasting keeping the associated hazards at minimum.

6.2.2 Monitoring of Environmental Parameters:

The monitoring of environmental parameters will be undertaken as per guideline given in IBM CCoM's Circular Number 3/92.

Air Quality Monitoring: Air quality monitoring is essential for evaluations of the effectiveness of abatement program and to develop appropriate control measures. Particulate Matter (PM10 & PM2.5) will be monitored in continuation with Sulphur dioxide (SO_2) and Oxides of Nitrogen (NOx) monitoring in workplace and study area at 8 sampling locations.

Water Quality Monitoring: Water quality monitoring involves periodical assessment of quality of ground water and surface water. Parameters to be monitored are pH, Total Suspended solids, Chemical Oxygen Demand (COD), Oil &Grease, Phenolic compound, Copper, Fluoride, Manganese, iron, etc. Total collected samples 8; where 6 ground water samples and 2 surface water samples of nearby water bodies will be periodically studied to assess the impact of mining.

Noise Level Monitoring: Noise level monitoring is done for achieving the following objectives. To compare sound levels with the values specified in noise regulations. To determine the need and extent of noise control of various noise generating sources. Noise level monitoring will be done at 8 locations, the work zone to assess the occupational noise exposure levels and also at the noise generating sources like ore handling arrangements, maintenance workshop, nearby villages to assess the noise levels and their propagation for taking necessary control measures at the source.

Parameters: The noise level recordings are measured in dB(A) Leq values, where dB(A) denotes the time weighted average of the level of sound in decibels on scale A, which is related to human hearing.

Soil Quality: As a part of environmental monitoring soil sampling and analysis will be carried out from 6 no. of stations quarterly study shall be done.

6.2.3 Green Belt Development Monitoring

Monitoring of growth and survival rate of the plants planted for greenbelt development every year shall be done to replace the plants which are not grown. Following data shall be recorded every year:

- Area under plantation/vegetation
- Period of plantation
- Type of plantation: Trees, grass any other as seeds or saplings.
- Distance between plants

- Type & amount of fertilizer used
- Interval of watering
- Method and period of post plantation care
- Survival Rate
- Density of afforested land both pre & post plant condition

6.2.4 Occupational Health and Safety Monitoring

Concentration of Respirable dust in the workplace will be regularly measured as laid down by DGMS. Health checkup of the workers will be conducted at regular intervals. The information will be furnished to the relevant authority.

Environment Management Cell will also coordinate with general public, regulatory authorities, local administration to appraise environmental performance of the mine.

The plan of environmental monitoring for selected important parameters will be worked out as per format. **Table 6.1.**

The other steps for giving paramount importance to the occupational health and safety of mine worker are discussed as ahead—

- Use of safety/protective gears like rubber gloves, safety shoes, helmet, dust mask etc. will be a must. Routine check-ups to develop habit will be made by environmental cell.
- Regular training and refresher follow-ups on this regard will be given continuously to build the capacities of the mineworkers.
- Monitoring of quality of water, air, noise, and occupational health status of project personnel and surrounding habitations.
- Planned monitoring program to evaluate the effectiveness of various /specific aspects of technological/ mitigation measures.
- Plantation monitoring programme to ensure survival and growth rate of plantations.
- A plan for monitoring health of workers and community in vicinity will be drawn and submitted along with financial allocation. The details of the plan are discussed below.

Plan for monitoring health of workers:

It is proposed that at the outset of mine, all the workers will be medically checked. The History report of each employee will be made by the environment cell. This will include the X-Ray films also. A regular check-up of all the workers will be made as given ahead-

- Once in a year for all the workers having their work place close to the dust producing sites like and loading and unloading.
- Once in 2 years for all other workers

Any deviation will immediately be reported to mines manager for taking necessary and corrective action.

6.3 FREQUENCY OFMONITORING

The mining will be done in the existing old quarry both laterally and at depth. The mining can be started within 3-4 months after obtaining statutory clearances. No construction will be required therefore no environmental monitoring during the commencement phase is suggested.

Measurement Parameters, Frequency, Location & Cost of Measurements

Methodology of Monitoring Mechanism: Environmental monitoring at various locations, within the ML area and in the study area of 10 km radius will be carried out on a periodic basis. A comprehensive network for monitoring has been prepared. Sampling locations have been identified by considering the source of pollution due to mining operations, drainage pattern and topography of the area.

EMP implementation & monitoring: An internal monitoring team shall be constituted for implementing the monitoring plan of Rs. **1,20,000** rupees is expected for monitoring cost.

Table 6.1Environment Monitoring Schedule Details

Monitoring	Frequency of Monitoring	Methodology	Cost (Rs.)
Ambient Air Quality	Annually	Particulate Matter (PM2.5): USEPA Quality Assurance Handbook (Vol II) Part II, Quality Assurance Guideline Document 2.12 Publication 1988) Particulate Matter (PM10): IS: 5182; Part 23 :2006 Sulphur dioxide (SO2): IS: 5182 (Part – 2) – 2001 , Reaffirmed 2006 Nitrogen Oxides: IS: 5182(Part –6)-2006	48,000.00
Water Quality	Six Monthly	APHA 22nd Edition 2012:2120 B & C - 2012	20000.00
Noise Monitoring	Annually	As per IS: 9989(1986) reaffirmed 2001	20,000.00
Soil Monitoring	Annually	Texture, Electrical Conductivity, Bulk Density etc	22,000.00
		Total Costing	**120000.00**

- **Biological Environment Monitoring:** Monitoring shall be done regularly on the plantation and the records shall be maintained. The survival rate of trees will be checked and regular water sprinkling shall be done. There is provision of gardener to take care of the plantation in the area. There shall be fencing of pit done to avoid accidents to the nearby fauna.

- **Socio-economic Environment Monitoring:** Once in a year through physical survey for cross checking any adverse variation and prompt correctives. Health issues will be regularly addressed by organization of heath checkup camps shall be done.

Reporting Schedules of monitored data: The monitored data on air quality, water quality, soil quality and noise levels, will be periodically examined for taking necessary corrective measures. The monitored data will be submitted to State Pollution Control Board (SPCB). The post-project data will be submitted in half- yearly monitoring reports to the same.

6.4 INFRASTRUCTURE FOR ENVIRONMENTALPROTECTION

A full-fledged environmental cell with qualified and experienced personnel established at the company's beneficiation plant, which is located close by, will supervise and implement the environmental issues. This environmental cell is supported by a fully equipped laboratory to carry out the analysis. The proposed organization of the environmental cell should have manpower on regular basis.

6.5 ENVIRONMENTAL MONITORING CELL DETAILS

Environmental data shall be monitored initially by using an outside agency.

Environmental Monitoring System & Methodology: Based on the results of improvements of adversity in the environmental parameters, monitoring schedules and duration will be restricted, if necessary, after consulting with SPCB and MoEF&CC.

6.6 FUNCTIONS OF THE MONITORINGCELL

To carry out environmental monitoring at site for various environmental parameters as required either departmentally or through outside agencies. This will ensure that the environmental status of the core and buffer zone of the mine will be preserved in good status as per rules.

1. To observe the environmental control measures to be implemented.
2. To keep a watch on the flow patterns of drainage and surveillance on the efficiency of water

management system.

3. To study the effects of project activities on the environment.
4. To ensure implementation of plantation programme. Regular monitoring of survival rate of plants should also be carried out to achieve the desired result, for five years.
5. To keep records of monitoring etc. in a systematic way, so as to facilitate easy access, when needed by statutory agencies, etc.
6. Conducting environmental studies and reporting to SPCB.
7. To interact and liaise with State and Central Government Departments.
8. To ensure the availability of the necessary spares for the pollution control equipment all the time so as to keep the pollutants of the environment within the stipulated limits.
9. To identify the source of pollution and to take immediate action to prevent further pollution.
10. Conducting safety audits and programmes to create safety awareness in workers/staff.
11. Conducting regular health audits to detect any health problems promptly to the workers/ staff. This will reduce occupational health problems.
12. Parting training on safety and conducting safety drills to educate employees.
13. Carrying out socio-economic study once in three years in the surrounding areas to find out the benefits derived by the society due to the project and also to fulfill the deficiency, if any, immediately.
14. The recorded data from monitoring of air, water and noise will be submitted half yearly by project proponent to Ministry of Environment and Forests (Regional office) and the SPCB, respectively.

6.7 REPORTING SCHEDULE

The recorded data from monitoring of air, water and noise will be submitted half yearly by project proponent to Ministry of Environment and Forests (Regional office) and the SPCB, respectively.

6.8 EMP BUDGETARY COST ESTIMATE

The cost estimates give only the indication of the likely cost. The estimated environmental i.e. mainly monitoring and green belt development, cost of the project is as follows.

Table 6.2; Cost of Environmental Protection Measures

Sl. No.	Particulars	Annual Recurring Cost (Rs in Lakhs)
1.	Reclamation & Rehabilitation of excavated pits	0.30
2.	Soil Dump Management	0.40
3.	Plantation & greenbelt development	0.96
4.	Air, Water & Noise Quality Monitoring	0.60
5.	Water sprinkling	0.20
	Total	**2.46**

6.9 PROCUREMENT SCHEDULE

There shall be monitoring during operation phase. The sampling locations have already been mentioned in the report and a monitoring schedule has been proposed. Monitoring of the ambient environment shall be duly done. The P.P. will engage NABL accredited agency for carrying out regular monitoring as detailed in report.

7.0 ADDITIONAL STUDIES

7.1 GENERAL

The report has been prepared on the basis of ToR granted. All the studies proposed in the TOR of the mining project have been complied with and the same has been covered in the EIA report. We have included the additional studies covered for the proposed project such as risk assessment (RA), Disaster Management Plan (DMP), Social Impact Assessment in connection with mining and allied operations of the proposed project. It also covers dangers/ risks/ explosions/ accidents etc likely to arise from the project operations, including onsite and offsite emergency plans to meet the disastrous situations.

7.2 PUBLICCONSULTATION

Public hearing is very significant part of the process of public participation envisaged under the guidelines issued by MoEF&CC, Government of India. The public hearing for the project is proposed under the chairmanship of Smt. D. Phawa. MCS.ADC. East khasi Hills District. Shri S. Syiem, Asst. Environmental Engineer, Meghalaya State Pollution Control Board (MSPCB), Shillong was also present during Public Hearing. Public Hearing Minutes along with its Compliance is attached as Annexure 8 of EIA report.

The compliance of Public Hearing is given below:

S.No.	Name & Address	Questions asked/Comments/Suggestions from the Public	Reply and Commitment/ Action Plan along with budgetary provision made by Project Proponent
1			.
2.		.	
3			

7.3 RISKASSESSMENT

Human health and Environmental risk from developmental activities is mainly due to occurrence of some accident consisting of an event or sequence of events explosion, fire and toxic hazards. Risk analysis provides a numerical measure of the risk that a particular facility poses to the public. It begins with the identification of probable hazardous events at an operational area and categorization as per the predetermined criteria. The consequences of major events or accidents are calculated for different combinations of weather conditions to stimulate worst possible scenario. These predictions of consequences are combined to provide numerical measures of the risk for the entire facility. Risk assessment should be done on the basis of past accident analysis at similar projects, previous judgments and expertise in the field of risk analysis especially in accident analysis.

The possible risks in the case of mining projects are erosion, inundation/floods, accidents due to vehicular movement and accidents during mineral loading and transporting etc. Mining and allied activities are associated with several potential hazards to both the employees and the public at large. A worker in a mine should be able to work under conditions, which are adequately safe and healthy. At the same time the environmental conditions should be such as not to impair his working efficiency. This is possible only when there is adequate safety in mines.

7.3.1 Risk Management:

The following precautionary measures shall be taken to prevent any accident

- Elimination of the source of hazard.
- Substitution of hazardous process and materials by those which are less hazardous.
- Geographical/ physical isolation of hazards from vulnerable communities.
- Use of engineering controls to reduce the health risk.
- Adoption of safe working practices such as regular equipment maintenance.
- Use of Personal Protective Equipment should be mandatory.
- Top edge of opencast workings shall be kept properly fenced.
- Regular dressing of bench sides to ensure safety of workers employed within 5m or working face.
- Provision of safety belt or rope while persons are at work at the quarry sides or benches from where there are chances of falling down for more than 1.8m.
- Drafting and implementation of preventive maintenance schedule for various kinds of

machinery deployed in opencast workings.

- Provision of maintenance of properly laid haul roads with parapet wall fencing or guards and road signs at strategic points.
- Precautions against danger while traversing dumpers, excavators etc. by installing audio-visual alarms and appointment of spotters.
- Transportation of mineral within mine workings by vehicles under the direction, supervision and control of Mine Management only.
- Proper maintenance of vehicles and weekly examination by an engineer and daily examination by a competent person.
- Training and retraining (at specified interval) of the machinery operators.
- Adequate maintenance of electrical equipments.
- Adequate illumination after daylight.

7.3.2 Hazard Identification

It is a mining project which may have the following types of hazards associated with it.

Natural Hazards

- Earthquake
- Flooding – Heavy Rainfall/ Water Bodies
- Landslide

Man-Made Hazards

- Bench Slope Failure
- Vehicles and Machinery
- Loading and Excavation of Mineral
- Drilling and Blasting
- Fugitive Emissions from Mining Operations

7.3.3 Assessment of Risks involved during Mining and Mitigation Measures:

Factors of risk involved due to natural calamities and human induced activities in connection with mining operations are as under:

1.Earthquake

2.Floods

Risk Involved: There is always a risk of flash floods due heavy rain during rainy season.

Mitigation Measures: Limited mining will be done during rainy season**.**

3.Landslide

4.Open Cast Bench Slope Failure Risk Involved:

Reasons for failure are -

- Inadequate nos. of competent persons for carrying out statutory inspections.
- Lack of supervision.
- Failure to make and keep the quarry sides secure by proper benching, sloping and keeping benches of adequate height and width.
- Undercutting so as to cause dangerous covering.

Mitigation Measures:

- Bench height and width will be maintained as per approved Mine Plan so that not only slope of individual benches are maintained but over all safe pit slope be maintained.
- For determining factor of safety, the bench slopes will be monitored regularly by sensitive instruments at precise level at regular intervals to check for any possible ground movement.
- A well-developed drainage system over the lease hold area is to be ensured to check the water flow out of the lease area during rainy season.
- Adequate competent persons for carrying out statutory inspections will be deployed
- Monitoring and supervision of active mine benches and also exhausted benches will be made mandatory.
- Inspection report of the benches with suggested corrective measures to be place before the higher management from time to time.

5.Vehicular Movement

Risk Involved:

- Possibilities of road accidents are possible due to rash driving/brake failure/lack of visibility.
- Possibility of overloading may injure the passer-by public.
- Vehicles moving in a steep gradient or on benches of inadequate width.
- Accidents are common due to reversing of vehicles.

Mitigation Measures

- All transportation within the mining lease working will be carried out directly under the

supervision and control of the management.

- The vehicles will be maintained in good condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management.
- Road signs will be provided at each and every turning point up to the main road (wherever required).
- To avoid danger while reversing the equipments/ vehicles especially at the working place/loading points, stopper should be posted to properly guide reversing/spotting operating, otherwise no person should be there within 10m radius of machine.
- The maximum permissible speed limit shall been ensured.
- Overloading of material will be avoided.
- A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.
- Unauthorized persons will not be allowed to ride on vehicles
- Strict code of conduct will be put in place to avoid driving in intoxicated condition by drivers

6.Mineral Loading, unloading and Transportation/Use of machinery:

Risk Involved:

- Use of substandard equipment.
- Accident due to generation of fly rock.
- Attempt to clean moving parts of machinery.
- Non provision or removal of guards for moving parts of machinery.

Mitigation Measures

- All the equipments deployed at the mine will be of highest standard
- All the loading and operating machines will have horns and proper maintenance of mining machinery shall be done
- Height of the bench will be maintained as per approved mining plan to avoid over hanging of rocks.
- The mineral will be loaded in trucks mechanically and in safe manner to avoid fly rocks
- There shall be fencing of the mined out area to prevent any accident of mine nearby habitants of nearby village and their live stock.
- The complete mining operation will be carried out under the Management and control of experienced and qualified Mines Manager having Certificate of Competency to manage the mines granted by DGMS.
- All the provisions of Mines Act 1952, MMR 1961 and Mines Rules 1955, RMMCR 1986 and other laws applicable to mine will strictly be complied with.
- During heavy rainfall the mining activities will be closed.

• Strict code of conduct will be put in place so that no one goes near the moving part of machines for maintenance.
• Secured cabin will be provided to all operators to shield them from any fly rocks.

7.Drilling and blasting:

Risk Involved:

The mining will be done with semi mechanized method with drilling of shot holes, sorting of stone and breaking of large sized boulders will be excavated using hydraulic rock breakers and excavators with deploying of Jack hammer drilling.The short holes drilled by jackhammers are normally of 34 mm diameter. Burden and spacing will be 2.0 m & 2.5 m. Following risks are involved during drilling and blasting operation.

- During the movement of drill machines from one place to other place and during change of drill rods and bits
- Improper handling of explosives
- Improper burden and spacing resulting in to fly rocks and excessive noise and vibration
- Misfires during blasting
- Lack of statutory staff during blasting operation

Mitigation Measures

- Drilling manual will be put in place which will have detailed procedure for shifting of drill machines and its operation
- Explosives will be stored in the Magazine approved by Controller of Explosives
- Transportation of explosives from Magazine to place of blasting will be undertaken by an approved explosive vehicle under statutory supervision
- Burden and spacing will be kept as per the study conducted by the expert agency for designing the blasting parameters
- Misfires during blasting will be handled as per procedures laid down by DGMS
- All the persons working in the mine will be provided safety shoes and helmet to prevent them from fly rock.
- Explosives will be used and handled under strict vigilance of the Mining Engineer/ Assistant Mining Engineer.

8.Fugitive emissions:

Fugitive emissions take place during mining from following activities:

- Drilling and blasting of mineral using explosives.
- Excavation of mineral with the help of excavators results in fugitive emission.

Risk Involved:

Respiratory disorders on workers.

Mitigation Measures

- Regular water sprinkling will be done at dust generation points and on the haul road to control dust.
- Controlled drilling and blasting based on study conducted for the purpose shall be carried out to avoid excessive dust generation.
- Secondary drilling and blasting will be kept bare minimum.
- During loading and unloading workers involved in the activity will wear dust masks.
- Loaders will have closed cabins.
- Transportation in covered dumpers will be done.

7.3.4 Vulnerability Analysis

A vulnerability assessment is performed for the hazards associated with the project. The natural hazards cannot be prevented. However, vulnerability to the hazards can be substantially reduced by preparedness and mitigation measures.

Table7.1; Vulnerability Analysis

S.NO	HAZARDIDENTIFICATION	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1-25) (Hazards scoring 1-9 are less serious hazards & 9-25 are very serious hazards &require risk assessment)	Proposed General Mitigation Measure/ Control
	Natural hazard				
1	Flood	4	2	8	• Limited mining will be done during rainy season. • Pre-warning signs on possible heavy rains or floods or cyclones from the meteorological department will be followed. Hence during any such case the project site will be evacuated. Or if possible the excavated site will be fenced. • To prevent inadvertent entry of people near the excavated pits, long poles will be grouted as a sign of excavated site. • Warning signs in local language will be erected at the site to avoid any mishappening. Nearby villagers will be informed.

	Man-made hazards				
2	Opencast bench Slope Failure	2	2	4	• The depth of mining will be 20 m during Plan period and bench height will be maintained at 5m with overall pit slope will be kept at 45^0 as per mining plan. Hence, it is less likely that any slope failure will take place in this mine. However, slope failure study will be conducted through an accredited agency and an ongoing assessment of the stability of these slopes will be regularly done. • There shall be adequate supervising staff and mining operation will be done under strict supervision of the Mining Engineers and Asst. Mining Engineer to avoid any mishap. • For determining factor of safety, the bench slopes shall be monitored regularly by sensitive instruments at precise level at regular intervals to check for any possible ground movement. • Stability of benches and slope shall be ensured by full compliance of the mine plan duly approved by Director of Mineral Resources, Meghalaya.

3	Vehicular Movement	4	4	16	• All transportation within the mining lease working shall be carried out directly under the supervision and control of the management. • The vehicles will be maintained in good condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management. • Road signs will be provided at each and every turning point up to the main road (wherever required). • To avoid danger while reversing the equipment's/ vehicles especially at the working place/loading points, stopper shall be posted to properly guide reversing/spotting operating, otherwise no person shall be there within 10m radius of machine. • Reverse horns will be fitted in all vehicles. • The maximum permissible speed limit shall be ensured. • Overloading of material will be avoided. • A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents. • Edge protection will be done to prevent inadvertent movement. • Visibility defects can be eliminated by the use of visibility aids such as closed circuit television and suitable mirrors.
4	Fugitive Emissions during mine operations such as excavation and loading.	2	5	10	• Regular sprinkling shall be done with operations generating dust emission. • Dumpers shall be covered with tarpaulin during transportation of material and waste. • Dust masks shall be provided for operations involving high fugitive emissions or when required.

5	Mineral Loading and Excavation/ Machinery Operation/Slip and Trip of Workers in Working Areas	4	4	16	• Regular safety audit shall be carried out. • Only authorized personnel will be allowed in the operation area. • Vocational training shall be given to all operators and workers of the mine. Mining operations shall be carried out under proper supervision. • All the trucks loading and operating machines will have horns. • The mineral will be loaded in trucks mechanically *i.e.* by JCB during mining. There is least possibility of injury to the person during loading operation at mine. • Complete mining operation will be carried out under the Management and control of experienced and qualified Mines Manager. • During heavy rainfall the mining activities will be closed. • All persons in supervisory capacity will be provided with proper communication facilities. • Competent persons will be provided first aid kits which they will always carry. • Mobile Fencing shall be installed during Operation at the bench. • Signage shall be installed for all movement areas of machines and everyone on site will be made to wear PPE in these areas. • All machines and vehicles shall be maintained by the maintenance in charge.
6	Drilling & Blasting	4	3	12	• Drilling and blasting will be carried out intermittently. • Training shall be given for proper drilling operation • Proper PPE shall be used for drilling operation • Signage and restricted entry shall be done in areas of drilling operation • Blasting shall be done with proper safety measures and warnings.

7.4 DISASTER MANAGEMENTPLAN:

Safety of mine and the employees is taken care of by the mining rules & regulations as per Metalliferous mines regulations 1961, which are well defined with laid down procedure for safety, which when scrupulously followed safety is ensured not only to manpower but also to machines & working environment. Disaster Management Plans are prepared as proactive measures which help reduce effect of the accident/disaster and enable quicker recovery.

Plans for Disaster Management Onsite emergency planning:

An onsite emergency is caused by an accident or hazard that takes place within the plan area and the effects are confined to the plant area.

The onsite emergency plan consists of following key elements:

- Planning as per hazard analysis
- Preventive measures
- Emergency response procedure
- Recovery procedure

On Site plan shall be in place which includes the following:

a. Regular safety audit/inspection
b. Incident Response team and role and responsibility of each member
c. Procedures for taking care of incidents/emergencies
d. Mock drills
e. Assembly point
f. Communication system/arrangement with administrative and regulatory agencies, media and public etc.
g. Siren for declaring/closing emergency.
h. Regular training on first aid and evacuation etc.

Flood

- A training plan will be prepared for mine workers to cope up with the disaster.
- Limited Mining will be done during rainy season.
- Warning from meteorological department on possible heavy rains or floods or cyclones will be checked.
- There will be warning signs in local language will be erected at the site to avoid any mis happening.

Waste Dump Management

During plan period 2,75000 MT of waste will be generated. The generated mineral will be utilized for maintenance of existing road of surrounding areas and will be back filled for reclamation.

Fire Management

There shall be provision of mobile fire extinguishers at the mine office.

Explosive Handling

Explosives will be stored and handled as per standard method.

Training

Following training shall be provided to the workers from time to time:

- Safety Education &Awareness
- Holding annual safety weeks
- Imparting basic and refresher training to new and old employees respectively.

Communication

Supervisor will be provided with wireless/mobile phones to communicate in case of any abnormality.

Offsite Emergency Planning:

Offsite emergency plan defines the various steps to tackle any offsite emergencies which may affect surrounding areas of the project has to be prepared after due final discussion with local panchayat and revenue officials.

Offsite emergency planning mainly consists of –

a.Contact details of fire brigade, local police, hospitals, local district administration, factory inspector, state pollution control board, state electricity board etc.

b.Demographic details and topography map of the surrounding area.

c.Communication system/arrangement with above mentioned agencies, media and public.

Communication

The telephone numbers and addresses of adjoining mines, rescue station, police station, fire service station, local hospital, electricity supply agency and standing consultative committee members are also maintained for any emergency requirement.

Disaster Management Team

A standing consultative committee will be formed under the head of mines manager. The members consist of safety officer/medical officer/Asst. manager/ public relation officer/ Foreman/ and environmental engineer.

Roles and responsibilities of the team shall be-

- The management shall make cordial relations with the local authorities, hospitals etc. to help them during crisis.
- There will be communication facilities provided by the management at the mining site.
- A doctor and supporting staff will be there to provide first aid facilities to the workers in case of any mishap.
- Provision of Ambulance at the site with first aid facilities.

7.5 SOCIAL IMPACTASSESSMENT:

There are various social impacts of mining which should be identified before starting any developmental activity. The mining is one of the activity for which if pros and cons are not properly assessed may not only result in deterioration of local environmental scenario but also may have long term affects on the socio economic status of the locals such as loss of agriculture land, degradation of water quality, contamination of ground water and soil quality. Therefore to prevent above problems following measures shall be undertaken:

- Ensuring developments contribute to economic growth and social development. The project will provide skill based training to the locals and will generate chance of indirect employment in the area.

- Reducing project risks and providing greater certainty to the society by doing regular environmental monitoring, prediction of risks and hazards and their mitigation, etc.

- Planning for social and physical infrastructure; in proposed project CSR budget ensures provision of proper infrastructure with the help of local authorities such as, providing scholarship to students in nearby schools, organizing health awareness camps and medical camps, emphasis on use of clean toilets, plantation of trees etc.

- Proposed project will improve the quality of life of employees and retention of skilled workers; there is provision for providing training to workers and locals to have better health keeping, and organizing health check up camps for them to lead a healthy life.

- The project shall enhance competitive advantage and reputation, by implementing innovative approaches, setting high standards for other businesses and leaving a positive legacy beyond the life of the project;

- The proposed project shall comply with principles and standards.

7.6 REHABILITATION& RESETTLEMENTACTIONPLAN:

The lease area comprises of 4.30 ha which is deemed forest land. There is no habitation within the mine area. Hence no R&R is applicable.

7.7 CORPORATE SOCIALRESPONSIBILITY:

As mentioned earlier, the scale of operations are too small to produce significant impact excepting providing employment to few local residents. However, corporate social responsibility, welfare activities will be taken up. The social welfare activities will include assistance in-

Education

In order to improve the educational activities in the area, following assistance will be provided.

- School infrastructure including furniture, books, Computer, sports kit to to the nearby village school's needy students
- School dress to 30 students of nearby village school's.

Sanitations &drinking water facilities

- Installation/ Repair of Hand Pumps/ Tube Wells
- Water quality monitoring of wells and tube wells
- To educate people regarding proper use of drinking water

Medical Assistance: Assistance will be provided in organizing health camps

Medical camps –Medical camps will be organized from time to time in nearby village with free medicines and free health checkup.

Budgetary Provisions for CSR: 5% of project cost shall be spent under CSR. Total Project cost is 35.00 Lakhs and 5 % of Project Cost is 1, 75,000. Total 1, 75,000 Rs will be spent on CSR Cost breakup is given below:

Table7.2 Proposed CSR Budget

ACTIVITIES	COST (In Rs)
Quarterly medical checkup camp will be organized for the villagers of the nearby villages of the applied area by a qualified Doctor (M.B.B.S.) for minimum 100 nos of villagers @ Rs 20,000/- per quarter. Total 4 x 20,000/- = Rs 80,000/-	80,000.00
To promote education by providing Books, Copies, School Dresses to the nearby village school's needy students.	35,000.00
To promote the Swachch Bharat Mission, toilets will be made for the nearby villagers.	60,000.00
Total	**1,75,000.00**
Total for five years i.e. 5%of project cost	**1,75,000.00**

7.8 OCCUPATIONALHEALTH

Occupational health and safety deals with the safety and health of the persons employed at the work zone. Working in mines has harmful effects on the health of those employed and there are numerous diseases arising from employment in opencast mines such as various respiratory disorders like silicosis, manganese poisoning, hearing impairment, asthma etc. Some of the hazards are dust, vibration, noise, ergonomics etc.

The personnel employed in the mine are also exposed to a number of hazards at work which may cause them to be involved in an accident due to material handling, machinery etc. as mentioned in Risk Assessment. Accidents cause injuries and can be life-threatening to personnel. Thus occupational health and safety is a crucial aspect to be considered in mines for the well-being of the personnel involved. Proper measures will be taken for injury prevention decrease probability and severity of accidents.

7.8.1 Safety Audits and Accident Prevention

Regular safety audits shall be carried out at site to decrease possibilities of hazards causing accidents or injury. All mining activities shall be carried out under proper supervision of mining engineers and safety officers. All personnel involved in mining shall undergo training for mine safety.

7.8.2 Occupational Disease

The reported figures and surveys conducted by Directorate General of Mines Safety (DGMS) and other organizations like National Institute of Occupational Health (NIOH) etc. revealed that there have been some new trends in the occupational health scenario other than the conventional diseases like Respiratory disorders.

Following areas of occupational diseases are emerging with the changes in the mining industry:

- Noise induced hearing losses
- Health impact due to diesel particulates from emission of diesel operated vehicles and equipment
- Hand-arm vibration, whole body vibration due to use of drills, HEMM etc
- Presence of snakes and other reptiles in the mining area
- Polluted drinking water
- Excess working load and overtime
- Presence of mosquitoes in the lease area
- Sudden accident in the mining area causing personal injury

7.8.3 Health measures to be considered

- Sanitary facilities shall be well equipped with suppliers and employees shall be encouraged to wash frequently, particularly those exposed to dust.
- In the event of temporary closer, approaches will be fenced off and cautionary notice displayed in English and regional language.
- Rotation of workers exposed to dusty and noisy areas.
- First aid facilities in the mining areas.
- Provision of personal protection devices to the workers. The personal protection equipment being provided are–

Table7.3: List of safety equipments

S.No.	Item	Equipment
1.	Face protection	Face Shield
2.	Eye protection	Different types of goggles used for different purposes.
3.	Ear protection	Ear plugs, ear muffs
4.	Leg Protection	Safely shoes, gum shoes
5.	Working at height	Safety belts
6.	Head Protection	Safety helmets
7.	Protection from Dust	Dust Mask

- Periodic medical examinations shall be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazard. The medical examination required to carry out at the time of appointment of every employee. Provided that in case any dust related disease, test shall be conducted more frequently as the examination authority deems necessary.
- Medical camp will be organized for the worker every year.
- At the end of mining operation, test will be conducted to assess health of workers.
- Workers will be informed and trained about occupational health hazards, if identified.
- Any worker's health related problems will be properly addressed.
- The personnel working in dust prone areas will be examined every year as per the DGMS circular No.01 of 21.01.2010.
- Quick-Fix designed by OSHA's ergonomics standards will be followed to reduce work-related musculoskeletal disorders (MSDs).
- Rotation of workers exposed to high noise areas will be carried out.

- Lyophilized Polyvalent Anti snake venom serum will be available at the mine site for snakebites.

7.8.4 Activities posing risks during mining

1. Loading and Excavation of Mineral

Affected Personnel: All operators of machinery for loading and excavation are at high risk. All helpers and other personnel in the mine are at moderate to low risk.

S.no.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1	Injury due to Falling of rock from the boom of excavators	4	2	8	• Cabin shall be provided on all excavators/ other machinery so that no rocks hit the operator. • All operators and other workers in close proximity shall be trained in their jobs and wear all PPE.
2	Accidents due to bench Collapse Due to under cutting of Benches	1	2	2	• Undercutting shall be avoided by mine supervisor.
3	Accidents due to movement and operation of Heavy Machinery	4	4	16	• Signage in all movement areas of machines • Areas of movement of vehicles shall be marked and everyone in the site will be made to wear PPE at all times when present in these areas. • Only authorized/ designated personnel shall be allowed in the operation area • Reverse horn shall be installed on all machines prior to their deployment for operation • Vocational training to all operators and workers of the mine. Awareness programme for health effects on exposure to mineral dust will be organized for employed person a well as for nearby villagers.

4	Dust Exposure	2	5	10	• Personal Protective Equipment (Dust masks) shall be provided to workers • Dust suppression measures such as usage of dust collectors and water sprinkling shall be carried out in working areas.
5	Exposure to Noise	2	5	10	• Mining operation do not include any major source of generation of noise in the working area, drilling & blasting will be involved which will be intermittent thus noise levels are not of significant levels. However, ear plugs will be provided to all workers in the area. • Audiometry test of the workers shall be done regularly &medical health provided wherever required.

2. Transportation of Material

Affected Personnel: Drivers and operators of machinery are at high risk from this activity. All other personnel working in the mine are at moderate risk by this activity.

S.No.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1.	Injury due to falling of minerals from truck	4	2	8	• It shall be ensured by senior personnel that trucks are not overloaded. • Material outside the mine shall go in a covered truck; covering shall be done by tarpaulin.
2.	Accidents due to movement of vehicles	3	3	9	• Signage of vehicular movement areas. • PPE shall be worn by operators and Workers in these designated areas.
3.	Injury due to falling of machines/ vehicles from bench and in the working area	4	3	12	• Use of helpers during reverse operation of the machine • Working bench width shall be kept adequate to the width and turn of the vehicles/machines • Overcrowding of vehicles shall be avoided near loading areas.

4.	Brake Failure	3	1	3	• All vehicles/machines shall be Maintained by the maintenance in charge.
5.	Speed control	3	2	6	• Speed of vehicles will be restricted below 25 km/hr to mitigate dust generation while transporting of mineral.

3. Drilling

Affected Personnel: Two Operators in close proximity are at high risk due to the activity. Exposure area of 10m around the operation is at moderate risk due to drilling.

S.No.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1.	Accidents due to movement of Drilling Machine	4	3	12	• Personal Protective Equipment (PPE) shall be worn by operators at all times • Signage shall be put in all areas of operation • Designated areas are identified for movement of drilling machine and the drilling is restricted to these areas
2.	Inhalation of Dust	2	5	10	• PPE shall be worn by the operators at times of drilling operation. • Dust Collector is installed by the crawler manufacturer to collect coarse dust particles • If necessary, wet drilling might be used for the activities. This shall be decided as per the personal exposure levels (PEL).
3.	Falling off the edge of the bench	3	3	9	• Mobile Fencing shall be installed during operation at the bench • Proper training is given to all personnel involved for the drilling operation Working bench width shall be kept adequate to the width and turn of the vehicles/machines

4. Blasting

High explosive like ANFO with cartridge boosters will be used as blasting material. All safety measures shall be taken especially for storage. The storage is guarded and only authorized people will be allowed to enter.

S.no.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x25)	Proposed Mitigation
1.	Accidents during blasting such as Sudden blast shock to workers, Dangerous rock conditions after blast, presence of undetonated explosives, and/or initiators, fly rock etc.	4	4	16	• Drillers & blasters will be given protective gears eg. Helmets, goggles, gloves, boots, ear muffs and dust masks to avoid negative impacts of drilling and blasting. • Except for the crew other people's entry will be banned for at least 30 minutes before the blast initiation. • Pre-blast warnings will be given out loudspeaker. • All misfires will be safely removed, and other hazardous condition corrected or secured. • First-aid will be provided at the time.
2.	Injury due to Falling of rock from the boom of excavators	1	2	2	• Cabin shall be provided on all excavators/ other machinery so that no rocks hit the operator • All operators and other workers in close proximity shall be trained in their jobs and wear all PPE
3.	Accidents due to bench Collapse due to undercutting of Benches				• Undercutting shall be avoided by mine supervisor

4.	Accidents due to movement and operation of Heavy Machinery				• Signage in all movement areas of machines • Areas of movement of vehicles shall be marked and everyone in the site will be made to wear PPE at all times when present in these areas. • Only authorized/ designated personnel shall be allowed in the operation area • Reverse horn shall be installed on all machines prior to their deployment for operation. • Vocational training to all operators and workers of the mine.

5. Slope stability

Affected Personnel: All workers in the mine are at high risk with respect to this activity

S.No.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1.	Accidents due to slope stability	1	2	2	• Prior to start of mining operation there shall be a study carried out for fixing of parameters with respect to mining to maintain stability of slope • For determining factor of safety, the bench slopes shall be monitored regularly by sensitive instruments at precise level at regular intervals to check for any possible ground movement. • Stability of benches and slope shall be ensured by maintaining optimum overall slope of 45^0 and by full compliance of the mine plan duly approved by Director of Mineral Resources, Meghalaya.

6. Plan for Accidents

Mining site shall arrange for /provide at least the following to mitigate any accident that occurs due to operation:

1. First Aid facilities at site
2. Ambulance
3. Tie up with primary health center for immediate treatment
4. Strict implementation and training of a detailed on-site emergency plan. The Plan shall be prepared by a competent agency.

7. Monitoring Mechanism

Following Activities shall be done by the proponent as a proactive measure for mitigation of Occupational Risks:

- Six monthly monitoring of Exposure levels (Total Suspended Particulate, Fraction of Fine Dust {$PM_{2.5}$}, of high risk workers of all activities. In case necessary a onetime chemical speciation of the dust shall be done to measure levels of Sulphates, Lead, Nickel, Arsenic, Silicates in the dust collected etc.
- Six Monthly Health check-ups for all workers which includes Chest X-Ray, Lung Function Test, ENT Check-ups, Vision Check-ups, Audiometric Tests, Liver and Kidney Function Tests, ECG, Blood Sugar etc.
- Six Monthly Check-up of Drinking water for the site workers to ensure compliance to IS 10500:2012 standards.

7.8.5 Separate budget of Occupational Health

Table 7.4; Capital and Recurring Budget for Occupational Health

S.No	Description	Amount (Rupees In Lakhs)
1	Workers will be subjected to primary health check-up before they are employed to ascertain their health conditions. Thereafter, Regular Medical check-up will be organized for workers & villagers to evaluate the adverse impact if any on these persons due to proposed mining activity.	0.20
2	Workers will be provided with masks, gloves, goggles & ear muffs will be provided.	0.20
3	First Aid facility and training to workers.	0.10
4	Insurance for worker	1.00
	Total	**Rs. 1.50 Lakh**

7.8.6 Public Health Measures:

The mine is in the Thanghunai Village and the nearby habitant might get affected due to the working of mine hence a sum of Rs 0.20 Lakhs has been dedicated towards the betterment of local people.

Table 7.5 Recurring Budget for Public Health and Safety

Sr. No	Impact	Mitigation	Amount (In Lakhs)
1.	Health and Safety	• Health Check-up camps shall be organized.	Rs 0.20
Total			0.20 Lakhs

8.0 PROJECT BENEFITS

8.1 IMPROVEMENTS IN THE PHYSICALINFRASTRUCTURE

The roads connecting to lease area will be maintained by lessee. The community member of surrounding community especially the residents of Thanghunai village will have advantage in this regard. Improved road, communication facilities and provision of community development programmes such as health programme, communicable disease awareness and family welfare programmes will elevate the socio- economic conditions of the locals.

8.2 IMPROVEMENTS IN THE SOCIALINFRASTRUCTURE

The project activities will create awareness with the local people for preferring permanent services than periodical agricultural activities. The activities will help them to analyze the importance of education. With the increased amount of income people can send their children to nearby schools and colleges. These schools are taking care of the local students for their studies. The Project proponent has decided to improve the literacy level of the local elders also. The implementation of this project shall naturally augment the education status of the local people.

Social welfare measures

The social welfare measures will always strengthen the bond between the project proponent and the local population/ communities. The proposed mining project would contribute in implementing social welfare activities in collaboration with local bodies for better development within the study area. Following schemes shall benefit locals:

1. Approach roads will be developed at par with the mining site.
2. There shall be water supply arrangements and sanitation for the villagers.
3. The proponent will make provisions for contributions to the local schools, dispensaries for the welfare of the villagers.

8.3 EMPLOYMENT POTENTIAL

The project will contribute direct employment scope for about 36 persons including Managerial, skilled, semi-skilled and Maintenance personnel. The project will create indirect employment scope for many other persons.

8.4 SOCIO ECONOMIC BENEFITS ARISING OUT OF MININGACTIVITY

It would be apt to reiterate here that no human settlements will be disturbed due to proposed mining activity; consequently, no negative impacts will be applicable in this case. The benefits of mining activity will be similar to any industrial set-up. There will be opportunities of direct and indirect employments. However, the operations being semi mechanized will not generate large scale direct employment. As mentioned earlier there will be around 36 personnel, most of them will be skilled & semi-skilled. Total 80% staff will be employed from the local villages. The jobs, from which local community can be benefited, will be –

- ✓ Providing tippers for raw material transport from mine to the consumers.
- ✓ Maintenance services

- All personnel in worksites shall have protective gears like helmets, boots etc. so that injuries to personnel are minimized.
- Children and pregnant women shall not be allowed to work under any circumstances.
- Working will be carried out in one shift only and no personnel shall be allowed to work at site for more than 8 hours per day
- Materials pertaining to archeological / historical importance, Department of Archeology, Meghalaya Govt. shall be immediately informed.
- Any coins, artifacts or any other chance find will be notified by the workers. The work will be stopped and instruction will be taken from archeological department.

8.5 OTHER TANGIBLE BENEFITS

Environmental Benefits: Plantation will be carried out in the 7.5 m statutory boundary of the mine area which will not only increase the aesthetic beauty of the area but will also prove to be a hub of native bird's species. Mining will be carried out in a scientific manner which will not cause harm to the environment.

Other Benefits:

This project, on implementation shall help in increasing the overall income pattern of the neighboring people which shall indirectly help them to improve their living standards. Facilities like electricity and telephone are available in these interior/remote areas. No village people reside in them. However, barricading will be done to prevent any accident.

9.1 ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) is a site-specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with environmental legislation. The Environment Management Plan (EMP) is required to ensure sustainable development in the study area. This chapter covers the genesis of pollution, the principal sources of pollution, the nature of pollution, the proposed measures required for meeting the prevailing statutory requirements of dust & gaseous emissions, waste water discharge characteristics, noise levels etc. for environmental management purpose in connection with the mining and mining related activities in the study area. For attaining the desired objective of good environmental quality in the study area, several management strategies in different phases are proposed and evaluated.

- Planned improvements including additional control measures
- Fugitive dust reduction on roads and internal roads for ore transport
- Progressive planning for the closure of mines

This section discusses the management plan for mitigation/abatement impacts and enhancement of beneficial impacts due to mining. The Environmental Management Plan (EMP) has been designed within the framework of various Indian legislative and regulatory requirements on environmental and socio- economic aspects. Environmental Management plan giving the environmental protection measures at mine to meet the stipulated norms of IBM/MoEF are detailed below.

9.2 MANAGEMENT OF LAND & POST MINING LANDUSE

The mine area is 4.30 ha of Non forest land. Initially as the mine is not functioning, the land use pattern is mainly negligible with few shrubs and small trees in patches. However, later due to mining operations, the land scape of the area changes. But this can be taken care of by developing a green belt on the safety barrier and afforestation of the mined out area.

The periphery/safety barrier of the mines including the safety residual benches will have green belt/plantation at interval of 2.5 m between one sapling planted and the next one. Also, saplings will be planted after back filling the periphery/safety belt sufficiently with soil. The saplings shall be of species of local variety which will have better growth and survival. Thus this will help in improving the environment and also the aesthetic beauty of the area post mining operations.

Proposed land use pattern after the plan period and conceptual land use is given below in the table:

LANDUSE :

Category	As on date(Hectares)	End of 5th Year (Hectares)	End of lease (Hectares)
Area to be excavated	0.00	1.76	2.80
Storage of top soil	0.00	0.00	0.00
Overburden dump	0.00	0.03	0.00
Mineral/Sub-grade stack	0.00	0.00	0.00
Infrastructure	0.00	0.00	0.00
Roads	0.01	0.00	0.00
Greenbelt	0.00	0.93	1.50
Reclamation	0.00	0.00	0.00
Others	0.00	0.00	0.00
Total	**0.01**	**2.72**	**4.30**

The entire produce of Limestone will be used as building material and according to its end use. During Plan period gritty soil removed will be dumped at south-western side with suitable precautions. Some quantity of the removed gritty soil would also be used for road dressing and plantation After conceptual period de-stoned area of quarry will be reclaimed to the extent possible. To prevent dump failure/soil erosion, toe-wall with weep-holes and garland drains will be provided towards lower side of the dumps to check the wash off during the rainy season.

9.2.1 Mine Closure

Mining will be carried out as per approved mining plan and Progressive Mine Closure Plan. The accumulated rain water in the pit will help in recharging the ground water. At present land is covered with patches of grass, soft broom and one or two standing 'tarew' trees which usually grow in limestone bearing lands. Usually in such lands, especially having heavy seasonal rainfall, there is very little soil cover. The soil is formed only in cavities and between limestone blocks. No trees would grow and flourish in such areas except the 'tarew' tree which has no value and cannot be used as firewood nor as timber because the wood of the 'tarew' is fibrous and soft. However, in the mined out spaces which have been backfilled with soil, hardwood trees and fruit trees can be planted.

The soil that is available during mine development and is stored in stack yards shall be used for backfilling the mined out spaces. On these backfilled areas, planting of saplings of local variety or suitable varieties shall be done to raise a plantation.

9.3 PROPOSED GREEN BELT DEVELOPMENTPLAN

- It is proposed to develop green belt in the 7.5 m boundary of the mine area. Precautionary measures will be taken for carrying of the afforestation by regular watering in the afforested area.
- Wire fencing will be done around trees to protect from grazing animals and proper manuring.
- The species survival will be monitored and dead plants will be replaced. The green belt development plan has been given below:

Proposed Plantation

Table 9.1; Proposed Plantation

Sl. No.	Yearof Plantation	Targetof Plantation	Spacing	Areaof Plantation	Remarks
1	First	298	2.5 m	Safety/BarrierZone	Planting in Zig Zag pattern
2	Second	298	2.5 m	Safety/BarrierZone	
3	Third	298	2.5 m	Safety/BarrierZone	
4	Fourth	298	2.5 m	Safety/BarrierZone	
5	Fifth	298	2.5 m	Safety/BarrierZone	
TOTAL		**1490**			

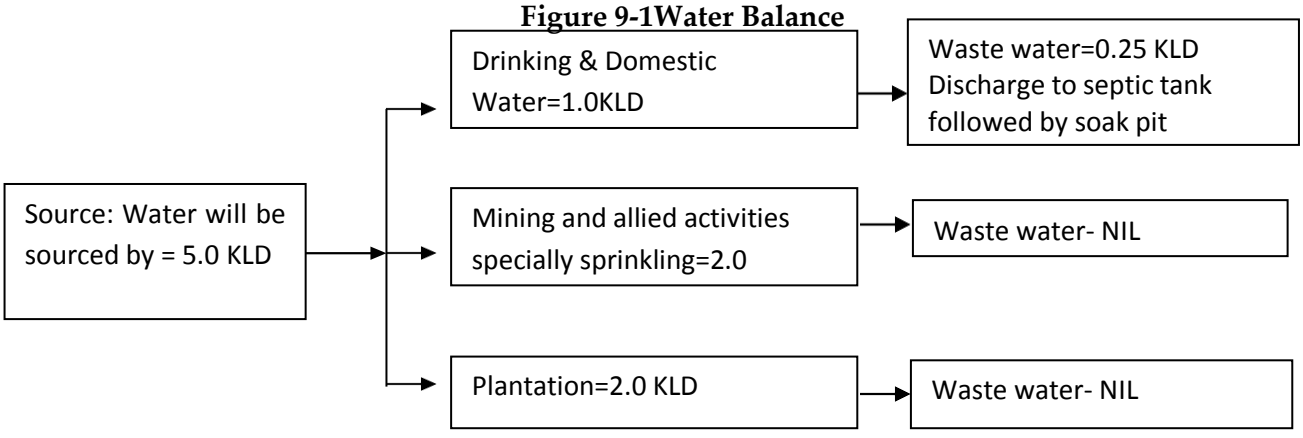
9.4 IMPACT ON HYDROLOGY OF THE AREA

The hydrogeological formation of the study area comprised of Granite Gneiss and intrusive of Archean Proterozoic, Quartzite of Paleo-Meso-Proterozoic of Shillong group, Granite of Neo Proterozoic- early Proterozoic, Sandstone and Limestone of Paleocene-Eocene age. The presence of weak planes like fractures and joints in these hard rock formation forms the principal aquifer in the area. The ground water in the district occurs under unconfined, semi confined to confined conditions. Study of dug wells and exploration data reveals the presenceof phreatic/shallow and deep fractured aquifers in the district.
(Source: Central Ground Water Board, India)

9.5 MEASURES FOR CONTROLLING WATER POLLUTION AND CONSERVATION OFWATER

- Water pollution from the mine can be mainly due to runoff during rainy season. Therefore to restrict the runoff into any surface water body precautionary measures will be taken up and no water from the quarry will be discharged to any natural water course directly.
- The accumulated rain water will partly be used for dust suppression and afforestation and limestone being pervious in nature much of the water will percolate below the quarry surface.
- Potable drinking water shall be sourced from the nearby villages. It is estimated that daily drinking/domestic water requirement will be about 1.0 KLD. Besides for sprinkling & green belt development water requirement will be 2.0 KLD and2.0 KLD respectively.

Figure 9-1Water Balance



- To prevent silt being carried during monsoon period, series of plants would be planted.
- **Conservation of Ground Water:** Mining will be restricted up to a depth of 20m. Water stored in

the mined out area will act as water recharging source in the area. Therefore, mining activity in the leasehold area will have positive impact on ground water.

- To avoid contamination of ground water from the open defecation by workers, toilets will be provided for the workers at site with septic tank followed by soak pit.

9.6 MEASURES FOR CONTROLLING AIRPOLLUTION

Major pollution in air quality is expected due to drilling, blasting, transportation, loading, unloading of mineral. Dust is likely to be generated during transportation for which water sprinkling shall be done. The mining area, due to its very nature and scale of operation is likely to marginally contribute towards air pollution in the area. The effect is analyzed and this effect is mostly due to fugitive emission. For the mine, the only pollution occurs from dust during vehicular traffic and loading of mineral. There is no other source for SO_2 and NOx except a little contributed by the vehicular traffic, which is well below the prescribed limits. Still, the following different control measures are proposed.

- Construction of well-compacted roads.
- Regular water spraying on roads by tankers.
- Drilling machines will be equipped with dust collector arrangement and wherever required wet drilling arrangement will be used to prevent generation and spreading of dust.
- Optimum blast design parameters will be adopted after study. Optimum stemming in blast holes will be done to minimize generation of dust and fly rocks.
- Blasting will be done during favorable atmospheric conditions and will be avoided during high windy periods, night times and temperature inversion periods.
- To avoid secondary blasting rock breaker will be used.
- Optimum bucket size loading equipment will be used which will reduce the number of bucket passes to fill the dumper and thus comparatively less dust will be generated during loading. This will also reduce the chances of spillage from the bucket.
- Plantation of local thriving species will be done in the 7.5m statutory boundary for arresting dust.

9.7 NOISE ABATEMENT

Noise will be generated due to drilling and blasting operation which will be done intermittingly, transportation and machineries. The results of ambient noise are within the permissible limits of industrial area. However, following measures will be adopted to abate noise effects.

- Proper and regular maintenance of excavators, tippers and other vehicles will be done. Green Belt will be developed (thick foliage) along the lease boundary.
- Drilling equipments will be regularly maintained as per maintenance manual. Anti-vibration mounts for compressors will be provided.
- Optimum parameters for drilling and blasting will be designed to have controlled blasting which will reduce noise and vibrations.
- Blasting will be carried out when the wind conditions are favorable (i.e. when wind is blowing in opposite directions of in habitated areas or in low velocity).
- Mufflers will be provided to the exhaust of wagon drills to minimize the noise level.
- Blasting operations will be carried out during the noon time when the temperature inversions are not likely to occur.
- Proper stemming will be done to reduce air blast.
- To check vibration, values of peak particle velocity will be maintained within the prescribed limit by DGMS.
- The excavators which will be used for loading will have noise proof cabin to avoid adverse effect to the operator. The helpers working near the excavators will be provided ear plugs and muffs. The maintenance of the excavators will be carried out as per manual.
- Proper free face will be maintained for optimal blasting which will also reduce noise and vibration.
- Periodical monitoring of noise and vibrations will be done.
- The dumpers, trucks and other transportation vehicles will be maintained in good running condition so that noise will be reduced to minimum possible level.
- Each blast will be carefully planned, checked and executed under the supervision of statutory personnel.

9.8 SOILCONSERVATION

At present land is covered with patches of grass, soft broom and one or two standing 'tarew' trees which usually grow in limestone bearing lands. Usually in such lands, especially having heavy seasonal rainfall, there is very little soil cover. The soil is formed only in cavities and between limestone blocks. No trees would grow and flourish in such areas except the 'tarew' tree which has no value and cannot be used as firewood nor as timber because the wood of the 'tarew' is fibrous and soft. However, in the mined out spaces which have been backfilled with soil, hardwood trees and fruit trees can be planted.

The soil that is available during mine development and is stored in stack yards shall be used for backfilling the mined out spaces. On these backfilled areas, planting of saplings of local variety or suitable varieties shall be done to raise a plantation.

9.9 SOLID WASTEMANAGEMENT

The entire produce of Limestone will be used as building material and according to its end use. During Plan period gritty soil removed will be dumped at south-western side with suitable precautions. Some quantity of the removed gritty soil would also be used for road dressing and plantation. After conceptual period de-stoned area of quarry will be reclaimed to the extent possible. To prevent dump failure/soil erosion, toe-wall with weep-holes and garland drains will be provided towards lower side of the dumps to check the wash off during the rainy season.

Table 9.2; Solid Waste Management

Year	Production of Stone in Tonnes	Production of waste in Tons
1st	150000	45000
2nd	165000	50000
3rd	180000	55000
4th	200000	60000
5th	220000	65000
Total	**915000**	**275000**

- Domestic Solid waste will be generated due to 36 workers who will be working at the site. This waste will be properly collected in coloured bins. The green bin waste or biodegradable waste will be composted by pit management and manure will be used in plantation. The blue bin waste will be sold to authorized recycler.

- Hazardous waste generation will be due to used oil which will be stored in HDPE drums and shall be sent to authorized re-processor.
- Other waste such as plastic waste E-waste will be separately stored and sent to authorized vendor.
- There will not be generation of any other type of waste from the mine site.

9.10 SOCIO ECONOMIC MEASURES

Social benefits will be anticipated from the proposed mining project in the surrounding villages includes; Employment generation and improve standard of living through welfare activities; Development of health, education, economy, and agriculture in 10 km study area w.r.t. project site for local community and welfare of tribal through implementation of social developments. Improvement in infrastructure like road etc. and activities through CSR will have positive impact.

Social benefits will also be anticipated by enhancing skill development, employee ability and rise in income level. The overall impact of the project on the socio-economics of the region has been discussed in Chapter – 4. Apart from overall beneficial impact of the project on the local people of the region, it is felt necessary to augment facilities in the fields of education, health and social awareness including concern for ecology. These are presented in an analyzing form in the following statement:-

Sl. No.	Environmental Attributes	Nature of Impact
a	Employment	Beneficial
b	Service, trade/commerce	- do -
c	Public utility/education, social awareness	Augmentation
d	Health care facilities	- do -

It is necessary to create awareness among the people. The beneficial aspects of the following measures that would be taken up by the mine as a periphery development project

- Family planning
- Abandonment of shift cultivation
- Planting of trees and social forestry
- Reduction in the consumption of fuel wood and encourage use of alternative fuels
- Use of clean and boiled water
- Reducing the consumption of alcohol
- Saving from earnings
- Personal hygiene
- Regular health check

In implementation of these measures, the mine management can contribute a lot on the overall socio- economic scenario of the region.

9.11 OCCUPATIONAL HEALTH & BUDGETALLOCATION

The proposed mining will be operated by fully mechanized methods with drilling and blasting by deploying man and machines. Hence, it is envisaged to take up the following precautionary measures.

Safety Audits and Accident Prevention

Regular safety audits shall be carried out at site to decrease possibilities of hazards causing accidents or injury. All mining activities shall be carried out under proper supervision of mining engineers and safety officers. All personnel involved in mining shall undergo training for mine safety.

Occupational Disease

The reported figures and surveys conducted by Directorate General of Mines Safety (DGMS) and other organizations like National Institute of Occupational Health (NIOH) etc. revealed that there have been some new trends in the occupational health scenario other than the conventional diseases like Respiratory disorders.

Following areas of occupational diseases are emerging with the changes in the mining industry:

- Noise induced hearing losses
- Health impact due to diesel particulates from emission of diesel operated vehicles and equipment
- Hand-arm vibration, whole body vibration due to use of drills, HEMM etc
- Presence of snakes and other reptiles in the mining area
- Polluted drinking water
- Excess working load and overtime
- Presence of mosquitoes in the lease area
- Sudden accident in the mining area causing personal injury

9.11.1 Health measures to be considered

- Sanitary facilities shall be well equipped with suppliers and employees shall be encouraged to wash frequently, particularly those exposed to dust.

- In the event of temporary closer, approaches will be fenced off and cautionary notice displayed in English and regional language.
- Rotation of workers exposed to dusty and noisy areas.
- First aid facilities in the mining areas.
- Provision of personal protection devices to the workers. The personal protection equipment being provided are–

S.No.	Item	Equipment
1.	Face protection	Face Shield
2	Eye protection	Different types of goggles used for different purposes.
3.	Ear protection	Ear plugs, ear muffs
4.	Leg Protection	Safely shoes, gum shoes
5.	Working at height	Safety belts
6.	Head Protection	Safety helmets
7.	Protection from Dust	Dust Mask

- Periodic medical examinations shall be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazard. The medical examination required to carry out at the time of appointment of every employee. Provided that in case any dust related disease, test shall be conducted more frequently as the examination authority deems necessary.
- Medical camp will be organized for the worker every year.
- At the end of mining operation, test will be conducted to assess health of workers.
- Workers will be informed and trained about occupational health hazards, if identified.
- Any worker's health related problems will be properly addressed.
- The personnel working in dust prone areas will be examined every year as per the DGMS circular No.01 of 21.01.2010.
- Quick-Fix designed by OSHA's ergonomics standards will be followed to reduce work-related musculoskeletal disorders (MSDs).
- Rotation of workers exposed to high noise areas will be carried out.
- Lyophilized Polyvalent Anti snake venom serum will be available at the mine site for snakebites.

9.11.2 Activities posing risks during mining

The activities have been detailed in Chapters 7, heading 7.8.4

1. **Plan for Accidents**

   Mining site shall arrange for /provide at least the following to mitigate any accident that occurs due to operation:

- First Aid facilities at site
- Ambulance
- Tie up with primary health center for immediate treatment
- Strict implementation and training of a detailed on-site emergency plan. The Plan shall be prepared by a competent agency.

2. **Monitoring Mechanism**

   Following Activities shall be done by the proponent as a proactive measure for mitigation of Occupational Risks:

- Six monthly monitoring of Exposure levels (Total Suspended Particulate, Fraction of Fine Dust {$PM_{2.5}$}, of high risk workers of all activities. In case necessary a onetime chemical speciation of the dust shall be done to measure levels of Sulphates, Lead, Nickel, Arsenic, Silicates in the dust collected etc.
- Six Monthly Health check-ups for all workers which includes Chest X-Ray, Lung Function Test, ENT Check-ups, Vision Check-ups, Audiometric Tests, Liver and Kidney Function Tests, ECG, Blood Sugar etc.
- Six Monthly Check-up of Drinking water for the site workers to ensure compliance to IS 10500:2012 standards.
- Under Occupational Health and safety, the mine workers will be subjected to primary health check-up before they are employed to ascertain their health conditions. There will be provision of First Aid Facility and Medical Insurance for workers
- The mine is in the Thanghunai the nearby habitant might get affected due to the working of mine hence a sum of Rs. 0.20 Lakhs has been dedicated towards organizing Health Check-up camps for local people and Supporting Public health care center in the nearby village.

9.12 TRANSPORTATION:

Proposed production from the mine will be 150000 TPA. As the daily production from the mine will be 455 T. Waste will be stacked separately at stack yard and mineral will be transported to market. There will be deployment of 4 no. of tippers of capacity 10 tonnes. The lease area has no habitation in close proximity so traffic on the roads is minimal. Steps will be taken to coordinate and organize traffic in the mining area and the mining trucks route, road repairing in coordination with govt. officials. Awareness campaign among dumper/truck drivers will be generated for clearance of road and lower down the pollution load due to transportation. Due to small lease area, less production, low movement of vehicle and only shift. Therefore, the traffic to & fro of proposed "**Nongtalang Limestone Mines**" will not create any traffic congestion.

9.13 IMPLEMENTATION ANDMONITORING

As the major attributes of environment are not confined to the project area alone, implementations of the proposed control measures and monitoring thereof have to be undertaken on a regional basis. The mine management will implement the control measures and monitor the efficacy within the lease area relating to the following specific areas as per the action plan.

- Collection of air and water samples at strategic locations with appropriate frequency and testing thereof. If the parameters exceed the permissible tolerance limits, corrective measures should be taken to arrest the pollution.
- Collection of soil samples at strategic location at least once in every year and testing thereof with regards to deleterious constituents, if any.
- Desiltation of drainage system and check dams.
- Measurement of water level fluctuation in the nearby dug wells and bore wells periodically.
- Plantation/ afforestation as per programme, regular watering of plants and fencing to protect them from animals.
- Measurement of noise levels at the mine site, stationery and mobile sources, mine office, canteen would be taken during day time only as mining operation will be carried out in one long dayshift.

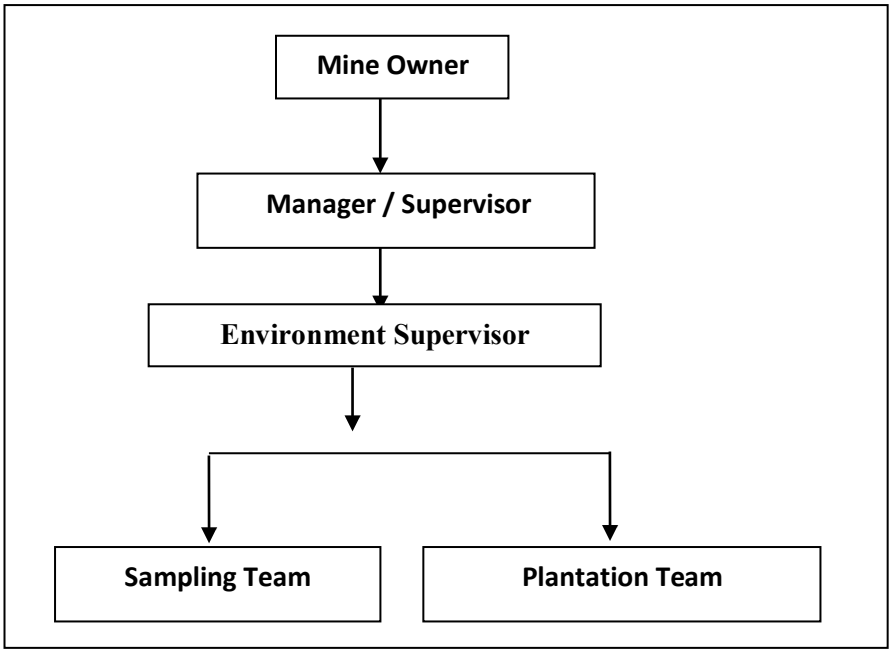
9.14 PLANS TO MAINTAIN BETTER ENVIRONMENT IN THE AREA

The environmental Policy has been prepared for better management of the environment. For maintaining better environment in the area the components relevant to the project that need to be taken into account include:

- Afforestation/plantation details of plantation/afforestation programme
- Reclamation of degraded land and quarries. Maintenance of haul roads etc.
- Monitoring of environmental parameters.

Organizational Chart (Environmental Management)

Organizational chart for environmental monitoring in the mining lease area, fiscal estimates for year-wise expenditure (both capital and recurring) and action plan to maintain better environment and to augment the environmental development, the following measures are suggested.



Organizational Structure of Environment Monitoring Cell (EMC)

9.15 EMP BUDGETARY COSTESTIMATES

The cost estimates presented in this section are for the recommendations made these cost estimates give only the indication of the likely cost. The estimated environmental cost of the project is as follows. The total cost of the project will be Rs. 35.0 Lakh. A fully fledged environmental cell will comply with the all the environmental monitoring jobs.

Table 9.3, Cost of Environmental Protection Measures as Annual Recurring Cost

Sl. No.	Particulars	Annual Recurring Cost (Rs in Lakhs)
1.	Reclamation & Rehabilitation of excavated pits	0.30
2.	Soil Dump Management	0.40
3.	Plantation & greenbelt development	0.96
4.	Air, Water & Noise Quality Monitoring	0.60
5.	Water sprinkling	0.20
	Total	**2.46**

9.16 CSR ACTIVITIES AND BUDGETARYALLOCATION

Corporate Social Responsibility: For social sustainability of any project, attentions need to be paid to the development of the society that existed before or builds up around the project area. The Corporate Social Responsibility is the internalization of the social and environmental effect of its operations through proactive pollution prevention and social impact assessment so that it is anticipated and avoided and benefits are optimized.

The concept is about companies seizing opportunities and targeting capabilities that they have built up for competitive advantages to contribute to sustainable development goals in ways that go beyond traditional responsibilities to shareholders, employees and the law. It is the active partnership of the company which defines the voluntary works with local communities as well as with regional and national Government and reciprocity based on trust and openness to reach agreed objectives and shared involvement.

Budgetary Provisions for CSR: 5 % of project cost i.e. Rs 35.0 lakhs is 1,75,000. Total Rs 1.75 lakhs shall be spent under CSR. However, higher amount is earmarked for CSR which is given below:

Table9.4 Proposed CSR Budget

ACTIVITIES	COST (In Rs)
Quarterly medical checkup camp will be organized for the villagers of the nearby villages of the applied area by a qualified Doctor (M.B.B.S.) for minimum 100 nos of villagers @ Rs 20,000/- per quarter. Total 4 x 20,000/- = Rs 80,000/-	80,000.00
To promote education by providing Books, Copies, School Dresses to the nearby village school's needy students.	35,000.00
To promote the Swachch Bharat Mission, toilets will be made for the nearby villagers.	60,000.00
Total	**1,75,000.00**
Total for five years i.e. 5%of project cost	**1,75,000.00**

CHAPTER-10 SUMMARY AND CONCLUSION

Introduction: The proposed project is for mining of limestone mineral from lease area of 4.30 ha. The maximum production from the mine will be 150000 TPA. Mining of mineral will be done by opencast semi mechanized method. Sri Chui Pohlynjar, owner of Nongtalang Limestone Mines is the authorized signatory. The Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Sri Chui Pohlynjar on dated Jowai 08.02.2019 vide letter no. JH/8/MMMCR-2016/2016-17/869/B/2419 He has applied for an Environment Clearance after obtaining the necessary approval of the Mining Plan and Progressive Mine Closure Plan from the Directorate of Mineral Resources, Meghalaya.

The project area is of private land category. No forest area is involved. The mine will be in operation as per the Mining Plan approved by Director of Mineral Resources, Meghalaya.

The project has been granted ToR by SEIAA vide Letter ML/SEIAA/MIN/WJH/P-119/2020/4/1790 dated 25 February, 2021. The latitude of the project area is N 25°13'11.536" TO N 25°13'27.249"and longitude is E 92°04'25.468" TO 92°04'29.105"E with maximum contour of 900 mRL and minimum contour of 700 mRL. The area falls in the Survey of India Topo-sheet no. 83C/4 (Restricted topo sheet). The lease area forms a part of the individual owned land. The proposed land is a Non forest Land according to Divisional Forest Officer, Khasi Hills (T) Division, Jowai (Ref No. JH/S.Querry/2009-10/476/B/1983, Dated 30.11.2018.

Reserves & Life of Mine: The geological reserves and its quality have been established by surface sampling and recently through quarry groove sampling. For Reserve estimation the Cross Sectional Method has been adopted. One section lines X-X has been drawn running across the Strike length. Thereafter, the sectional area of the section has been calculated.

Category of Resource	Mineable Reserves in Tonnes
Proved Geological Measured Mineral Reserves	900000
Proved Geological Mineable Mineral Reserves	400000
Net total Mineable Reserves	**1300000**

The mineable reserve of the mine area is **1300000** tonnes. Taking the maximum production target of 150000 tonnes and taking 330 as the average no. of working days per annum, the life of mine is estimated to be about 09 years.

Mining Method:

- Semi Mechanized open cast mining will be undertaken with drilling and blasting.
- The width of each bench shall always be maintained to be not less than the height which is 5 m.
- Since the deposit in this area is massive and compact in nature, it is proposed to carry out only opencast semi-mechanized mining during this plan period, i.e. five years.
- Drilling and Blasting - The operations like drilling of shot holes, sorting of stone and breaking of large sized boulders will be excavated using hydraulic rock breakers and excavators with deploying of Jack hammer drilling. Both Deep Hole and short hole blasting is proposed.To avoid fly rock problem at the edge of the hill, light charged muffle blasting shall be under taken.

Raw Material Required:

Inputs	Approx Quantity required per day
High Speed Diesel Requirement	
Diesel	100 Liters (at peak production)
Water Requirement	
Water for Drinking	1.0 KLD
Water for Sprinkling	2.0 KLD
Water for green belt development	2.0 KLD

Description of the Environment: The baseline data has been collected from October 2020 to December 2020. The details area given below:

i. **Temperature:** Temperature of the area varied from 10.0^{0}C to 36.0^{0}C.

ii. **Relative Humidity:** Humidity of the area varied from 50.0 % to 98.0%.

iii. **Wind Speed:** Wind speed was in the range of 0.0 Km/hr to 54.0Km/hr.

Ambient Air Quality Results: Samples were collected from 8 sampling locations during Baseline season from December 2019-February 2020. The results are given below:

Core Zone: The value of $PM_{2.5}$ is ranging from 25-34 µg/m^{3}and mean value is 29.2 µg/m^3 against standard limit of 60 µg/m^3. Value of PM_{10} is ranging from 60.0 -80.0 µg/m^{3}and mean value is 69.60 µg/m^{3}against standard limit of 100 µg/m^3. The mean value of SO_2 is 6.3 µg/m^{3}against standard limit of 80 µg/m^3& mean value of NOx is 8.8 µg/m^3 against standard limit of 80 µg/m^3.

Buffer Zone: The results of the Buffer Zone shows that PM_{10} was maximum at Nongtalang Chnongthmai Village (within prescribed standard limits) and Wahlyngdoh Village were minimum. The $PM_{2.5}$ is ranging from 24.7-29.7 µg/m^3. PM_{10} is ranging from 65.5-73.0 µg/m^3. The SO_2 is ranges from 5.5-6.7 against standard limit of 80µg/m^3 & NOx ranges from 7.9 -10.0 µg/m^3 against standard limit of 80 µg/m^3. These are within standard limits of National ambient air quality standards.

The values of both the parameters are well within prescribed limits.

Noise Quality results: Samples were collected from 8 locations.

Core Zone: The ambient noise level during day time at the proposed project site was 55.0 dB (A) which are within the standard limit of Industrial area~75 dB (A). During night the noise level at the project site ranges from 42.6 dB (A) which is within the night-time noise standard limit of 70dB (A).

Buffer Zone: Ambient Noise Level at day time are maximum at The noise level of Lease area of

Nongtalang Village is 55.9 dB (A) which are within the standard limit of Commercial area~65 dB (A).During night the noise level is 42.0 dB (A) which is within the night-time noise standard limit of 55 dB (A).

- **Ground Water Quality Results**: The samples were collected from 6 ground water locations and 2 surface water sources:

- **Core Zone: (Lease Area, Hand Pump Water)** shows that parameters like Total Hardness (262 mg/l); Total dissolved solids (445.0 mg/l), Magnesium (21.90 mg/l), & Alkalinity (165.0 mg/l)is well within drinking water standards(IS: 10500).
- **Buffer zone: Ground Water results:** All results were found within standard drinking water standards (IS: 10500).
- **Surface Water results:** The Surface water quality of the Upstream and Downstream water of Wah Umngot River is within prescribed CPCB Water Quality Criteria Class of water.

Soil Quality Results: The samples were collected from 6 locations:

Core Zone: The result shows that pH is 6.60. The availability of many plant nutrients in the soil changes as a result of reactions in the soil, which are largely controlled by soil pH. Amount of primary nutrients like Organic Carbon 1.43 %, the available nitrogen 29.40 mg/100g is lower in range, the available Potassium 0.55 mg/100g is moderate in range while available Phosphorous 0.89 mg/100g is higher in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen and potassium.

Buffer Zone: Data collected shows as below:

The result shows that texture of soil has sandy loam & clay loam texture. pH ranges from 6.70 to 6.90. Amount of primary nutrients like Organic Carbon 1.41% to 1.51%, the available nitrogen 26.3 to 29.70 mg/100g, the available phosphorus 0.74- 0.92 mg/100g is higher in range while Available Potassium 0.59 mg/100g to 0.68 mg/100g is lower in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen, available potassium.

Ecology and Biodiversity Results:

Flora Core Zone: The density of the plant in core zone in general is very low due to rocky terrain and low soil content. In the core zone, place where mining is to be done is vacant land with patches of *Trema orientalis, Schimawallichii, Saccharum arundinaceum, Xerospermum glabratum*.

Buffer Zone: Few species are trees, shrubs, herbs, Ornamental plants, weed and *Bombax ceiba, Castanopsis indica, Citrus sp etc.*

Fauna Core zone: During study, it was found that the faunal diversity in the core site was limited to butterflies, insects, some species of mammals & reptile and common avifauna such

as crow, pigeon etc.

Buffer Zone: Common fauna was reported in buffer zone.

Dust generation during mining and transportation may impact vegetation.

Socio Economic Study Results: Results of Socio economic study*:* Total 71 villages fall in the buffer zone. The study has been conducted by primary survey and secondary data source from Census of India 2011. The primary socio economic study has been conducted in 4 villages. The results are discussed below:

- ***Core Zone:*** *There is no habitation in the core zone*
- ***Buffer Zone****:* The total number of Households of the study area in rural village area is 5716 as per Census of India, 2011 data. The details are given below.
- **Population:**

  The total population of the study area is 31549 constituting 5716 households, implying that there are average 5.52 members per house. The average sex ratio of the study area is 1000/1015 as per census 2011.
- **Social Structure**

  The proportion of Scheduled Caste (SC) population within the study area is 1.41 % and the percentage of schedule Tribe (ST) is 90.41%.
- **Literacy**

  The total proportion of literate within the study area is 60.75% of total population. In percentage the male literacy 29.89% and the female literacy is 30.86% respectively within study area.
- **Traffic**

Location	Name of the Location	Distance & Direction w.r.t Proposed Mine	Remarks
TD I	Between ML &Approach Road	0.3 KM-SE	Village Road
TD 2	Dawki- Jowai Road (NH-40)	0.6 K M – SE	NH-40

Traffic density measurements were made continuously for 24 hours by visual observation and counting of vehicles under four categories, viz., heavy motor vehicles, light motor vehicles, two/three wheelers and cycles. As traffic density on the roads is low, two skilled persons were deployed simultaneously during each shift – one person on each of the two directions for counting the traffic. At the end of each hour, fresh counting and recording was undertaken. Thus, total numbers of vehicles per hour under the four categories were determined. A summary of the traffic density monitored during survey period is given in Table 3.26.

TABLE 3.26
TRAFFIC DENSITY

Traffic vehicle	No. of vehicles per day	
	TD I	TD 2
H.M.V.	32	170
L.M.V.	18	82
Two/three wheelers	24	84
Grand Total	**74**	**336**

Therefore, the traffic to &fro of proposed "**Nongtalang Limestone Mines**" will not create any traffic congestion.

Anticipated Impact and Mitigation Measures:

- **Land Environment:** Mining may cause land degradation. Hence, Green belt development shall be done from the top soil excavated during mining in the 7.5m statutory boundary and at ultimate stage whole area will be planted.

- **Water Environment:** Total water requirement in the proposed mining project is 5.0 KLD. Water for drinking purpose will be met from nearby villages. For sprinkling & plantation water will be taken Wah Umngot River.
- **Air Environment:** The air borne particulate matter is the main air pollutant contributed by opencast mining with drilling and blasting. Various emission sources are identified from the proposed mining operations. Therefore, sprinkling shall be done and workers will be given protective gears such as goggles, dust masks, gloves, and helmets.

- **Noise Environment:** The proposed mining operations will be carried by using latest equipments by open cast semi mechanized mining method. Hydraulic excavator will be used in excavation. Hence workers will be given protective gears such as goggles, dust masks, gloves, helmets and earmuffs. Plantation will be done to create cover from high noise.

- **Biological Environment:** Lease area is in Non Forest Land. There will be no impact on flora and fauna due to the proposed project.
- **Socio- Economic environment:** The project will enhance direct and indirect employment in the area. Therefore overall economic development is much likely after the commencement of the project.

- **Mine Waste:** The entire product of Limestone will be used in kilns for manufacturing of lime used as building materials. During Plan period some quantity of mineral rejects

(2,75,000 MT) will be excavated. The generated mineral will be utilized for maintenance of existing road of surrounding areas and will be back filled for reclamation. And to prevent erosion during rainy as well as windy season, the stack yard will be planted with small varieties of plantation and grasses to prevent such erosion.

Impacts due to transportation: The entire mineral will be transported to the market through trucks. Transportation shall be done by 4 tippers of 10 to 20 T capacities will be deployed to transport the minerals from quarry to stockyard. As per study done there will not be any congestion due to proposed project on the road.

Environmental Monitoring Programme: Environmental monitoring at various locations, within the mining lease area and in the study area of 10 km radius will be carried out on periodic basis. A comprehensive network for monitoring has been prepared. Sampling locations have been identified by considering the source of pollution due to mining operations, drainage pattern, topography of the area and biological environment.

Risk Assessment & Disaster Management Plan: Mining will be carried out by semi mechanized opencast mining, with mining equipments as hydraulic excavator, dumpers etc involving drilling and blasting. Mining will be done under strict supervision hence the rate of operational risks is minimal.

Rehabilitation and Resettlement- There will be no rehabilitation and resettlement on account of mining. There is no human habitation at the project site and the land is deemed forest land.

Project benefits: The proposed mining project has a significant positive impact on the socio-economic environment and it will help sustain the overall development of the area.

The proposed project significantly contributes the economic development by providing direct employment to 36 people and indirect employment to many more people in the area.

Environmental Management Plan: Preparation of Environmental Management Plan (EMP) is required for formulation, implementation and monitoring of environmental protection measures during and after commissioning of the proposed mining project. The project cost is Rs. 35 Lakh and the EMP capital cost Rs. 8.85 Lakh (Annual recurring cost).

Budget towards Corporate Social Responsibilities (CSR) will be Rs.1.75 Lakh as capital budget.

Green belt development has been initiated by the proponent 0.93 ha will be planted during plan period. However as per conceptual plan 1.50 Ha will be planted. Locally thriving species will be planted in consultation with forest department.

Among other environmental protection following measures are listed below:

- Sprinkling of water for dust suppression on mine haul roads.
- Regular Compaction & grading of haul roads and service roads to clear accumulation of loose material.
- Avoid overloading of dumpers and consequent spillage on the roads.
- Good maintenance of vehicles &machinery.
- Water sprinklers of fixed type will be provided at the mine approach roads from mine face / benches to crush hopper to prevent the generation of dust.

CHAPTER-11 DISCLOSURE OF CONSULTANTS

About Environmental Consultant

INTRODUCTION

Indian Mine Planners & Consultants, established by experienced environmental and related experts, provides specialized services in the field of Environment and Pollution Control for all types of **Mining of Minerals including opencast / underground mining**. Our transparent and professional approach, commitment to excellent quality and service, timely deliveries have contributed to create a name in the field of environment. A group of advisors from various disciplines with over 40 years of experience from organizations like Geological Survey of India, Various subsidiaries of Coal India Limited (CIL) including Central Mine Planning and Design Institute Limited (CMPDIL) & Indian School of Mines etc.

Indian Mine Planners & Consultants management, experience, excellence, professionalism and ultimate satisfaction has helped in achieving the heights of success in their specialized field of environment.

IMPCON also delivers advisory services in all aspects of geological exploration, geo-technical services, hydro-geology, mine planning and detailed design, electrical installations and maintenance, possible improvement area of mechanical performance of the high capacity mining machineries, civil and infrastructural job planning, choice of equipment for mining, manpower planning and finally total economics for project viability.

CORE TEAM

S. No	Functional Areas	Name of the expert/s	Involvement (Task)
1	FAE	Dr. N. B Chanda	Identification & Assessment of Impacts, suggestion Mitigation Measures
2	FAE	Ardhendu Shekhar Shannigrahi	Identification & Assessment of Impacts, suggestion Mitigation Measures
3	FAE	Sanjib Chattopadhyay	Identification & Assessment of Impacts, suggestion Mitigation Measures
4	FAE	James Nelson	Identification & Assessment of Impacts, suggestion Mitigation Measures
5	FAE	Gopal Chandra Das.	Identification & Assessment of Impacts, suggestion Mitigation Measures
6	FAE	Tapan Kumar Mishra	Identification & Assessment of Impacts, suggestion Mitigation Measures
7	FAE	Mrs. Nidhi Singh Rathod	Identification & Assessment of Impacts, suggestion Mitigation Measures

ACCREDITATIONS OBTAINED:

ISO-9001:2015 Certification

QCI – NABET Scheme for Accreditation of EIA Consultant Organizations

Declaration by Experts contributing to the EIA for proposed Nongtalang Limestone Mines (MLA: 4.30 ha.) located at 150000 TPA in 4.30 Ha) of Sri Chui Pohlynjar located at village Thanghunai, Elaka- Nongtalang, P.O.+ P.S.- Dawki, District-West Jaintia Hills, State- Meghalaya.

I, hereby, certify that I was a part of the EIA team under the capacity of EIA coordinator from that prepared the above EIA.

Signature

Dr. Nirode Behari Chanda (EIA Coordinator)

Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass, Kolkata- 700107

Team for EIA

	Name	Involvement (Period of task)
EIA Coordinator	Dr. Nirode Behari Chanda	I had visited the site and was involved in preparation of EIA. **Period of Involvement: December 2019– September 2020**
EIA Coordinator	Raj Narayan Biswas	I had visited the site and was involved in preparation of EIA. **Period of Involvement: December 2019– September 2020**

CERTIFICATE OF ACCREDITATION

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

Indian Mine Planners and Consultants

GE-61, Rajdanga Main Road, Behind Gateway Hotel, EM-Bypass, Kolkata 700107

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA/EMP reports in the following sectors:

Sl. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	Mining of minerals including opencast/ Underground mining	1	1 (a) (i)	A

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in IAAC minutes dated July 06, 2018 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/18/0727 dated August 13, 2018. The accreditation needs to be renewed before the expiry date Centre for Sustainable Development following due process of assessment.

Sr. Director, NABET
Dated: August 13, 2018

Certificate No.
NABET/EIA/1821/IA0037

Valid till
June 13, 2021

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

National Accreditation Board for Education and Training
(Member - International Accreditation Forum & Pacific Accreditation Cooperation)

Ref. No. -QCI/NABET/ENV/ACO/18/0727 August 13, 2018

To,

Indian Mine Planners and Consultants
GE-61, Rajdanga Main Road, Behind Gateway Hotel
EM-BYPASS, Kolkata 700107

Sub: Accreditation of EIA Consultant Organizations under NABET Scheme

Ref.: Your application dated Nov 17, 2017, subsequent correspondence on subject and office assessment at your premises on Feb 27-28 and supplementary assessment date June 14, 2018.

Dear Sir

QCI-NABET is hereby pleased to accredit Indian Mine Planners and Consultants as Category-A organization. Details of sectors mentioned in the Certificate of Accreditation.

The validity of accreditation is subject to continued compliance to the Scheme and the terms & conditions mentioned in **Annexure I to IV.**

NABET look forward for your association and continued support.

With best regards,

13/08/2018

A K Jha
Senior Director
QCI- NABET

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