

Environmental Impact Assessment of Expansion of Limestone Opencast Mining from 2.0 MTPA to 5.0 MTPA Project of Lafarge Umiam Mining Private Limited: *Village Nongtraï, District East Khasi Hills, Meghalaya*

Environmental Consultant: ERM India Private Limited, Gurgaon- NABET
Accredited as per certificate No. NABET/EIA/1316/RA007 Valid Up to
December 19, 2016

Lafarge Umiam Mining Pvt. Ltd.
A company of **LAFARGE** and **CEMENTOS MOLINS**

Executive Summary (in English)

November 2015

www.erm.com

0 **EXECUTIVE SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT STUDY OF THE PROPOSED EXPANSION OF LIMESTONE MINING FROM 2.0 MTPA TO 5.0 MTPA, NONGTRAI, EAST KHASI HILLS DISTRICT, MEGHALAYA**

A) Introduction

- 1) Lafarge Umiam Mining Private Limited (LUMPL), a company incorporated in India as a 100% subsidiary of Lafarge Surma Cement Ltd (LSC) of Bangladesh, has set up a limestone mine in Meghalaya, India for extraction and export of limestone for a cross-border cement manufacturing plant of LSC in Bangladesh. The limestone mine in India with cement plant in Bangladesh was originally sponsored by Lafarge Group, France⁽¹⁾, Cementos Molins, Spain, Islam Group, Bangladesh and Sinha Group, Bangladesh and financed by International Finance Corporation (IFC – The World Bank Group), the Asian Development Bank (ADB), German Development Bank (DEG), European Investment Bank (EIB) and the Netherlands Development Company (FMO).
- 2) The Nongtraï limestone mine was initially started by Lum Mawshun Minerals Pvt. Ltd. (LMMPL), incorporated in 1994 under the Indian Companies Act, 1956. The Foreign Investment Promotion Board of India (FIPB) in the year 1998 granted permission to LSC to invest 74% in the equity capital of LMMPL. Two Indian local partners hold the rest 26% equity shares. LMMPL acquired the land lease and mining right for setting up of Nongtraï limestone mine. All approvals obtained by LMMPL were subsequently transferred to LUMPL as the operating company. FIPB also granted permission to LSC for setting up of 100% subsidiary/operating company (i.e. LUMPL) for carrying out long term mining operations.
- 3) LUMPL is currently mining limestone as per the approved limestone production capacity of 2.0 million tonnes per annum (MTPA). The run-of-the-mine is crushed to (-) 80mm and transported through a long belt conveyor (LBC) of 17 km (of which 7 km lies within the territory of India and remaining 10 km within Bangladesh) to a cement plant of LSC located at Chattak in Bangladesh. The Nongtraï limestone mine in India and cement plant in Bangladesh were set up under the agreement/arrangement between the Government of India and the Government of Bangladesh.

B) Mine Location

- 4) The mining lease area falls within Nongtraï Village, Mawsynram Block, Shella Confederacy, East Khasi Hills District, Meghalaya, India. The mining site is located at the foothills of the southern fringe of the Meghalaya Plateau in East Khasi Hills District adjoining the plains of Bangladesh. The mine lease area of 100 hectares (Ha) lies between Latitude 25°11'17.40"N to 25°11'49.90"N and Longitude 91°36'52.10"E to 91°37'29.20"E as shown in *Figure 0.1*. The international border between India and Bangladesh lies at 1.5 km (from the nearest location) to south of the mine site.
- 5) The mine site is located at 15 km (aerial distance) southwest of Cherrapunjee (the nearest town) and 14 km (aerial distance) from Mawsynram. The mine site is accessible from Shillong by an all-weather metalled road connecting Shella Bazaar through Cherrapunjee at a distance of nearly 96 km. There is a narrow pedestrian suspension bridge across the Umiam River connecting Shella Bazaar to the mine site. The mine site is also approachable from Shillong, through Mawsynram and Nongtraï by a metalled road of nearly 110 km.
- 6) Nongtraï Village is located to the north-northwest at about 2.5 km (aerial) distance, while Shella Bazaar is located to the east at approximately 1.5 km (aerial) distance. The Phlangkaruh Village (Hamlet of Nongtraï Village) and Mawrynkhang Village are located at 1.0 km to the south and northeast of the mine respectively while Pyrkan is located at 1.4 km to SE of the mine.
- 7) No national park or wildlife sanctuary is located within 10 km radius from the mine site. As per the Flora and Fauna study conducted, the site is not a habitat /corridor for endangered /rare /endemic species.

(1) Recently, in July 2015, Lafarge and Holcim groups merged to form LafargeHolcim

C) Project Related Approvals

- 8) The mining lease was granted to LMMPL in January 2002 over an area of 100 Ha for 30 years, which was subsequently transferred to LUMPL on February 28, 2002 through transfer deed.
- 9) The Environmental Clearance was granted to LMMPL by (MoEFCC)⁽¹⁾ on August 09, 2001 for limestone mining of 2.0 MTPA. The Environmental Clearance was subsequently transferred from LMMPL to LUMPL on July 30, 2002 and the Environmental Clearance was partially modified by MoEFCC on April 19, 2010.
- 10) On April 30, 2007, the Chief Conservator of Forests (CCF), Regional Office MoEFCC, Shillong upon re-determination of the Project area as a “deemed forest”, directed to stop the mining activities on account of the fact that there was no Forest Clearance under the Forest (Conservation) Act, 1980. Subsequent to the direction of closure, LUMPL stopped all mining activities and also made “without prejudice” application under Section 2 of the Forest (Conservation) Act, 1980 in May 2007 for the Forest Clearance. In June 2007, LUMPL filed an Application before the Hon’ble Supreme Court of India, in IA no. 1868 in Writ Petition (C) No. 202 of 1995 praying for expeditious processing of the Forest Clearance application.
- 11) On April 22, 2010 MoEFCC, based on the recommendations of the State Government, Forest Advisory Committee (FAC) and Central Empowered Committee (CEC), issued to LUMPL the Stage-I Forest Clearance.
- 12) On July 06, 2011, the Hon’ble Supreme Court in its judgment [IA 1868 of 2007 in WP (C) No. 202 of 1995] stated that....“In terms of the order of this Court dated 12.12.1996, an Expert Committee was in fact formed by the State of Meghalaya vide notification dated 8.1.1997 with the Principal Chief Conservator of Forests as its Chairman. On 10.2.1997, the State of Meghalaya had addressed a specific letter to the Khasi Hills Autonomous District Council, which as stated above is a Constitutional Authority, stating that the land in question was reckoned as non-forest land and the Council was asked to clarify whether the area in question under the mining lease fell in the forest as per the records of the Council. The Council by its letter dated 28.4.1997 had informed the State Government that the area in question did not fall in the forest. Apart from the said letter, the Chairperson of the Expert Committee appointed by the State of Meghalaya being the Principal Chief Conservator of Forests also submitted his report in which it was expressly stated that the mining lease granted by the State Government did not fall in the forest. Since the mining lease granted by the State did not fall in the forest, the State Government did not submit any proposal to the Central Government under Section 2 of the 1980 Act as it treated the site in question as falling on the outskirts of the forests. It is almost after nine years that there was a change of view on the part of MoEF under which the report of the Expert Committee headed by the Principal Chief Conservator of Forests was given a go-by. Between 1997 and 2007, the view which prevailed was that the project site stood located on the outskirts of the forests.”
- 13) During the pendency of the matter of IA no. 1868 in WP (C) 202 of 1995 in the Hon’ble Supreme Court, MoEFCC vide order F. No. 07-31/2007 dated March 30, 2010 constituted a Committee headed by Mr BN Jha, CCF, RO Shillong and the report was submitted by MoEFCC to the Hon’ble Supreme Court. Amongst other contexts the report stated that, “...According to the report, M/s. Lafarge has been contributing for the benefits of the village as well as for all the villagers by way of payment of rent for the use of the community land as well as towards the price of limestone exported to Bangladesh. The figures of such payments are also indicated in the report. Further, the report states that mining is not having any adverse effect on the human life. According to the report, any impact can be minimized through a study of the Bio-Diversity Management Plan as well as Catchment Area Treatment Plan prepared and executed in a time bound manner. ...”
- 14) Pursuant to the directions of the Hon’ble Supreme Court vide order dated April 26, 2010, reports submitted by various authorities as well as compliance status of various conditions imposed by MoEFCC (including payment of compensatory afforestation, penal compensatory afforestation and NPV with interest), were placed before the Expert Appraisal Committee on June 29, 2010 and July 21, 2010. According to the minutes of Expert Appraisal Committee, “the conditions and environmental safeguards stipulated by MoEF while

(1) Recently Ministry of Environment and Forest has been renamed as "Ministry of Environment, Forests and Climate Change" (MoEFCC). Accordingly, in this document, new acronym of MoEFCC has been used as against the earlier used acronym of MoEF.

according environmental clearance on 9.8.2001 and 19.4.2010 were comprehensive enough to mitigate any adverse impacts of the project and to protect the environment if implemented effectively. The minutes of the meeting of the Expert Appraisal Committee dated 21.7.2010 also recites that various reports were considered by the Committee..." The Hon'ble Supreme Court also reviewed the environmental clearance process wherein "the court observed that we are satisfied that parameters of intergenerational equity are satisfied and no reasonable person can say that the impugned decision to grant stage-I forest clearance and revised environmental clearance stood vitiated on account of non-application of mind by MoEF. On the contrary the facts indicate that the MoEF has been diligent that, MoEF has taken requisite care to protect the environment and in the circumstances we uphold the stage I forest clearance and revised environmental clearance granted by MoEF." The Hon'ble Supreme Court in its judgment upheld the Environmental Clearance granted to LUMPL by MoEFCC on August 09, 2001 read with the modified Environmental Clearance dated April 19, 2010 and Stage-I Forest Clearance dated April 22, 2010.

- 15) The Hon'ble Supreme Court directed to set up a Special Purpose Vehicle (SPV) under the Chairmanship of the Chief Secretary, Meghalaya and the SPV shall follow the principles and procedure presently applied for utilization of CAMPA money. The account will be audited by the Accountant General, Meghalaya. The money will be kept in interest bearing account with a Nationalized Bank. The Accountant General and the SPV shall file an Annual Report before this Hon'ble Court detailing all the work done by it in relation to the welfare projects mandated upon it including the development of health, education, economy, irrigation and agriculture in the project area of 50 kms solely for the local community and welfare of Tribals. The User Agency is to deposit with the SPV a sum of Rs.90/- per tonne of the limestone mined from the date on which mining commenced.
- 16) On July 29, 2011, MoEFCC issued a letter to resume the mining operation inter-alia pending grant of formal Stage II Forest Clearance. MoEFCC subsequently granted Stage II Forest Clearance on February 29, 2012 to LUMPL for diversion of 116.589 Ha forest land for Nongtra Limestone Mine and other ancillary activities.

D) Project Proposal

- 17) LUMPL is proposing expansion of the limestone mining from 2.0 MTPA to 5.0 MTPA capacity from existing 100 Ha of Nongtra limestone mine lease area. The crushed limestone will continue to be transported through existing elevated LBC, by upgrading it to carry the enhanced capacity through engineering and operational modifications, to the cement plant of LSC in Bangladesh.
- 18) The cement demand in Bangladesh is expected to grow around 8% during next 5 years in line with the corresponding GDP growth rate at 6% to 6.5% in Bangladesh. There are no limestone deposits in Bangladesh and cement is produced by grinding units using imported clinker and limestone. With the proposed expansion, LSC will be able to increase its cement market share, which is currently 7.5%.
- 19) The estimated cost of the expansion Project is INR 194 Crores (considering base year 2015), which includes cost for Pollution Control and Environmental, Health and Safety management and contingency cost for the expansion Project. An estimated annual recurring cost of INR 2.10 Crores will be incurred for mitigations and environmental performance verification through monitoring and auditing.

E) Requirement of EIA Study

- 20) Mining of minerals under item 1(a)(i) (for an A category project) Schedule to the EIA Notification 2006 as amended to date requires prior Environmental Clearance from MoEFCC, Government of India based on an EIA study conducted as per the terms of reference approved by the Expert Appraisal Committee (EAC) (Mining) of MoEFCC. Accordingly, an EIA study has been conducted for the expansion Project (2.0 MTPA to 5.0 MTPA) as per scoping – the Terms of Reference (ToR) approved by EAC through MoEFCC letter dated April 30, 2013, revalidated through minutes of EAC meeting of March 16-18, 2015 for period up to April 29, 2016. Scoping for the EIA study suggested an area of influence due to the Project activities to remain within 10 km radius from the mine site.

F) Project Description

F.1 Site Description & Mine Development

- 21) The land of 139.026 Ha (of which 116.589 Ha has been designated as the forestland) already leased /purchased by LUMPL for the existing 2.0 MTPA limestone mining operations will continue to remain the same for the 5.0 MTPA operations, hereinafter referred to as the Project or the proposed expansion Project. A greenbelt of 100 m all along the mine is being maintained as per the requirement of Environmental Clearance issued by MoEFCC for 2.0 MTPA. No additional land will be taken up on lease for the expansion Project.
- 22) The mine site elevation levels currently vary from 70 m to 186 m (as against elevation levels varying from 70 m to 190 m RL prior to start of mining) and relatively receives high rainfall [7,680 millimetre (mm) per annum average of last 5 years from 2010 to 2014]. The combination of high rainfall, elevated topography and limestone geology has caused the mine site and surrounding area as strongly Karstified. The mine is devoid of overburden and the limestone available is of cement grade. As per the scheme of mining (2013-2018) approved by IBM for 5.0 MTPA, in-situ recoverable reserves are 132.57 million tonnes. The life of the mine will be approximately 27 years from 2015 or 24 years from 2017-18 when 5.0 MTPA production will be started.

F.2) Mining Method

- 23) At present limestone production of 2.0 MTPA is being done using mechanized opencast mining method, which will continue to be applied for 5.0 MTPA within the existing 100 Ha of mine lease area. The opencast mining method covers development of bench height of 10 m and maintaining bench width of no less than 20 m. The mining method includes drilling, blasting, breaking, loading, hauling, crushing and transportation through LBC.
- 24) For the expansion Project drilling of holes in benches is done as per the production requirement keeping burden and spacing of 2.5 m x 3.0 m with well-planned drill-hole pattern keeping each hole of 110 mm diameter up to 11 m depth (including 1 m additional sub grade drilling) for optimum results using state-of-the-art drill machines.
- 25) No secondary blasting is involved instead hydraulic rock breakers will continue to be used for secondary breaking of blasted rock fragments for the 5.0 MTPA production.
- 26) No overburden waste generation is involved as the mine is devoid of overburden. Very small quantity of topsoil/soil trapped in crevices or fissures is present, which is being reused for plantation within the green belt and other areas. A shed is being maintained for storage of recovered trapped soil.

F.3) Explosives Storage

- 27) High explosives and ammonium nitrate storage magazines are being maintained under licences from PESO. No change in capacities of high explosive magazine and ammonium nitrate are proposed for the production of 5.0 MTPA.

F.4) Crusher

- 28) For 2.0 MTPA, a crusher of nominal design capacity of 800 tonnes per hour (TPH) is being maintained for crushing of the run-of-mine (ROM) limestone from 400 mm to (-) 80 mm size. For the 5.0 MTPA, a new crusher (impactor or equivalent type) of 1,500 TPH design capacity (1,260 TPH nominal capacity) will be installed adjacent to the existing crusher to produce 95% (-) 80 mm size. Dust Suppression System (dry fog type) is proposed to handle dust generated in the main crusher and dump hopper section.

F.5) Long Belt Conveyor

- 29) For transportation of crushed limestone, a long belt conveyor is operative for 2.0 MTPA production with utilization capacity of 800 TPH as nominal and 960 TPH as design capacity with average belt speed of 4.0 m/second. For 5.0 MTPA, the existing long belt conveyor will be upgraded to expand the utilization capacity to 1,260 TPH as nominal and 1,385 TPH as design capacity with belt speed increased up to 6.0 m/sec by making engineering/ technical modification.

F.6) Buildings Description

- 30) For 2.0 MTPA, there exist buildings related to mine office complex; workshop and utilities. For 5.0 MTPA, same buildings and utilities shall be used while some of the buildings and utilities will be shifted from 15 years onwards within the existing land.

F.7) Lighting Arrangement

- 31) For 2.0 MTPA operations, adequate portable lighting arrangements are made at the mine faces while fixed lighting arrangements have been provided at certain locations. Solar lighting arrangement has been provided in and around the magazine area. LUMPL has also fixed flood lighting along the eastern periphery to provide adequate illumination along the eastern, central and western parts of the mine lease. For 5.0 MTPA operations, LUMPL will continue to maintain adequate lighting arrangements in the working and other areas including along LBC.

F.8) Manpower Requirement

- 32) For 2.0 MTPA mining, LUMPL has employed 547 personnel (direct and contractual employment). This includes local people from Nongtraí, Shella and other surrounding villages. For the expansion Project, total employment will be over 629 personnel (direct and contractual employment).

F.9) Shift Operations & Number of Working Days

- 33) The 2.0 MTPA mining is done in two shifts operative on an average six working days per week. The 5.0 MTPA mining is proposed to be completed in three shifts on maximum six working days per week.

F.10) Power Requirement

- 34) For 2.0 MTPA limestone production, power requirement of 2.0 megawatt (MW) is generated onsite as captive power through 1,250 kVA diesel generators. For 5.0 MTPA limestone production, the power requirement is estimated to increase to 4.0 MW, which will be generated as captive power through 1250 kVA diesel generators. A power supply is being maintained from Meghalaya State Electricity Board (MeSEB) for lighting purposes which will continue to be used for 5.0 MTPA mining capacity.

F.11) Water Requirement

- 35) Water requirement for 2.0 MTPA operations is 150 m³/day which for 5.0 MTPA operations will be 200 m³/day and will continue to be sourced from the Phalangkaruh River and or the Umiám River.

G) Embedded Environmental Controls

- 36) Embedded environmental controls refer to those controls/mitigation which are inbuilt as part of the Project design. **Table 0.1** lists down embedded controls being or proposed to be adopted by LUMPL for the expansion Project.

Table 0.1 Embedded Controls

SN	Description	Embedded Controls
1	Drilling of Holes	<ul style="list-style-type: none">▪ Use of state of the art drill machines▪ Wet drilling
2	Basting	<ul style="list-style-type: none">▪ Use of non-electric (NONEL) shock tube initiating system▪ Charge per delay kept within the permissible limit▪ Elimination of secondary blasting and use of rock breakers instead▪ Use of blast muffles and proper stemming column to control fly-rocks▪ Ground vibration/ air overpressure with each blast▪ Periodically engaging CIMFR for expert advice on efficient blasting performance
3	Operation of HEMM	<ul style="list-style-type: none">▪ Preventive maintenance and optimized use

SN	Description	Embedded Controls
4	Transportation of Limestone through Haul Road	<ul style="list-style-type: none"> Use of automatic water sprinkling system Use of water tankers for water sprinkling on approach road to the mine and in working pit area
5	Crushing operations	<ul style="list-style-type: none"> Provision of dust suppression system while unloading of limestone to crusher hopper Water spraying in the intermediate belts
6	Transportation of Limestone through LBC	<ul style="list-style-type: none"> LBC will continue to be provided with concave belt fully covered from top and partially covered from sides with take-off point maintained with water spraying system to arrest fugitive dust emissions
7	Domestic wastewater treatment	<ul style="list-style-type: none"> Operation of five Package Sewage Treatment Plants (STPs) to treat domestic wastewater from residential set ups and at mine's office.
8	Industrial wastewater treatment	<ul style="list-style-type: none"> Operation of an Effluent Treatment Plant (ETP) for treatment of wash wastewater generated from the workshop
9	Solid Waste	<ul style="list-style-type: none"> Provision of disposal of biodegradable wastes for use in piggeries; Provision of disposal of non-biodegradable solid waste in Shillong Municipal Waste bin as per approval obtained from Shillong Municipality. Paper wastes, waste tyres, used conveyor belt and metal scrap are sold to vendors. Sewage sludge is being used as manure in plantation.
10	Hazardous waste	<ul style="list-style-type: none"> Provision of temporary storage of hazardous wastes Disposal of hazardous waste as per MSPCB authorization.
11	Ecology - Plantations	<ul style="list-style-type: none"> Plantation of 30,108 saplings both inside and outside the mine.
12	Progressive Mine Closure	<ul style="list-style-type: none"> Implementation of Progressive mine closure to be done by undertaking plantation activities in the mined out benches. It is therefore proposed that upper benches of mined out pit are reclaimed by afforestation. It is estimated that approximately 16,240 suitable plant species will be planted from 6th year onwards as per suggestion of the department of forests as part of progressive mine closure plan.

H) Environmental Baseline

H.1) Study Area

- 37) The general study area considered for the purpose of baseline study ranges up to 10 km from the mine lease boundary. The study area partially occupies the Community Development (CD) blocks of Shella Bholaganj and Mawsynram both under East Khasi Hills District.

H.2) Regional Geomorphology

- 38) The mine lease area is located at the southern fringe of the Shillong Plateau. The regional geomorphology from Shillong in the north to the floodplains of the Umiam River in India (a tributary of the Surma River in Bangladesh) covers the following
- North to south flowing incised rivers;
 - Shillong plateau at an elevation of 1800 m amsl,
 - Caenozoic sediment hills at elevation range of 200 m to 1800 m amsl,
 - Foot slopes and alluvial fans at elevation range of 50 m to 200 m amsl; and
 - Low lying plains of Bangladesh at elevation range of 5 m to 50 m amsl.

H.3) Geology

- 39) The mine and surrounding area comprise of Langpar, Shella and Kopili Formations. The Langpar and Shella formations comprise alternating series of sandstone and limestone. The Kopili Formations mainly consists of alterations of thin sandstone and shale with rare thin limestone bands. The Shella Formation consists of six lithological units i.e. Prang Limestone; Nurpuh Sandstone; Umlatdoh Limestone; Lakadong Sandstone; Lakadong Limestone; and Therria Sandstone. The mine lease area contains the Prang limestone, the topmost layer of the Shella Formation. There exists west to east running band of limestone on both sides of Umiam River. This limestone belongs to the Shella Formation and comprises of Prang and Umlatdoh limestone.

- 40) To the south of the mine, this limestone is bound by the thinly bedded Kopili Formation. To the west, however, the Kopili Formation is overlying the Shella Formation conformably. To the north of the mine area, a steep gradient is found. The terrain rises by several hundreds of meters. To the east of the mining area, there is Umiam River, followed by Prang limestone signature running for another few kilometres. The Prang limestone – Narpuh sandstone contact as well as the Narpuh sandstone – Umlatdoh limestone contact exists. At the southern end of the mine area, the Prang limestone bed is overlaid by the Kopili Formation. The boundary between Prang limestone and Kopili shale here is marked by an E-W trending fault.

H.4) Tectonic & Regional Seismicity

- 41) As per the 2002 Bureau of Indian Standards (BIS) map, whole of Meghalaya State falls in Zone V. Zone V covers the areas with the highest risks zone.

H.5) Topography

- 42) The topography of the region is marked by rugged hilly terrain rising from the low altitudes of the plains on the south and up to 700 m amsl. The general elevation of the mine site currently varies from 70 m to 186 m reduced levels (RL) (as against the 70 m to 190 m at the time of start of the mining). A steep scarp bounds the northern margin of the mine block. On the higher escarpment of Nongtra Village is located.
- 43) The mine site and surrounding area is largely covered by karstified limestone. Karst features displayed in the area include dissolution features of the limestone. The mine area devoid of overburden has moderate slopes and dominated with karst topography resulting in less probability of siltation and erosion into the Phlangkaruh catchment.
- 44) The twin sinkholes in the area fall in the categories solution dolines and collapse dolines, located outside to the south of the mine area. The highest point at the rim of the twin sinkholes lies at approximately 63 m RL while the bottom of the twin sinkholes is at approximately 20 m RL. The west - east length of twin sinkholes is approximately 200 m. A cave exists down on the western edge of the sinkhole. The collapse dolines belong to a long passed tectonic phase with a subsequent relatively long period of tectonic rest.

H.6) Catchment Areas - Drainage & Hydrology

- 45) As per Upper Catchment Area Treatment Plan, CIMFR & NEERI, May 2010 for Nongtra limestone mine, there is a catchment area of 253 km² (covering the territory of India) within 10 km radius study area of the mine site relates mainly with three catchments i.e. (i) catchment of Umiam River system spread over in an area of 103.46 km² (40.89%) which includes two sub-watersheds (ii) catchment of Phlangkaruh spread over in an area of 5.62 km² (2.22%), and (iii) remaining catchments including of Khasimara River spread over in an area of 144 km² (56.92%). The catchment area of Phlangkaruh is part of Umiam River system which together with Khasimara joins Surma River in Bangladesh which ultimately joins Meghna River in Bangladesh.
- 46) The mine site relates to the catchment of Phlangkaruh River, which is initiated with three perennial springs located at approximately 270 m to south of the mine at 22 m RL.

H.7) Hydrogeology

- 47) There is no clear surface water drainage pattern in the mine area. Water from mine and surrounding area having karstified limestone forms no obvious surface drainage, thus indicating infiltration rates to be very high or complete. The water percolating into the limestone follows cavities along the joints and bedding planes and forms a kind of phreatic and highly variable water table.
- 48) LUMPL has installed piezometers at three locations to the south of the mine to monitor sub surface water levels. The water levels fluctuate during rainy and dry seasons although these remain at elevations higher than that of the springs throughout the year.

H.8) Landuse

- 49) Landuse pattern of 10 km radius from Nongtraï limestone mine within the Indian territory measures a total area of 253 km² covering dense forest area of 39.8%, sparse forest of 20%, agriculture and fallow land area of 14.6%, scrub and grass land of 16.3%, barren land of 4.0%, river and dry bed area of 2.82%, built up area of 1.4% and opened mines and exposed rock area of 1.2%.

H.9) Soil & Sediments

- 50) The core zone is practically devoid of any soil cover. Very small quantity of topsoil/soil trapped in crevices or fissures is present. The land is mostly rocky and the rock is wholly limestone. The adjoining areas surrounding the core zone have almost similar structural features.
- 51) Ten soil and four sediment samples were collected from the study area. The observed soil and sediment quality of samples were found to be within acceptable levels.

H.10) Climate & Meteorology

- 52) The climate of Nongtraï limestone mine and surrounding area is of sub-tropical type and is influenced by hilly topography on the western, northern and eastern sides and flood plains of Bangladesh to the south. Cherrapunjee (located 15 km to NNE) and Mawsynram (located 14 km to N) are the locations receiving highest rainfall in the world. Seasonal variation is experienced in the region with Pre-monsoon season prevailing during March to April; Monsoon during May to mid - October; Post monsoon during mid - October to end December; and Winter season during end December to February.
- 53) Based on meteorological data collected by LUMPL at the mine site from 2010 to 2014, winter season starts from end December and continues till the end of February. January is observed as the coldest month with a minimum temperature of 3.0°C (observed on January 10, 2013) and maximum temperature of 40.2°C (observed on May 7, 2012). The annual average temperature varied from 16.0°C to 29.1°C. The relative humidity varied from 11.1% (observed in March) to 94.2% (observed in August).
- 54) The average of five years annual rainfall was observed as 7,780 mm and maximum 24 hourly rainfall observed was 689 mm (observed on July 15, 2012). On an average there are 150 rainy days in a year (a day is considered as rainy day when 2.5 mm or more of rainfall occurs).
- 55) The prevailing winds blow from north, north-northwest, north-northeast, northeast, south, south-southeast and south-southwest. Average wind speed ranged from 0.3 m/sec to 5.9 m/sec while the maximum wind speed observed during the 5 years period is 55 m/sec. The maximum mean wind speed is observed in April while the minimum mean wind speed is observed in December. The status of Wind and Cyclone in the study area falls under Very High Damage Risk Zone.
- 56) Flood hazards are low in the hilly area while in plains of Bangladesh flood hazards are high due to high rainfall in the region. The mine site and immediately surrounding area being hilly in terrain is not prone to floods.

H.11) Ambient Air Quality & Dust Fall

- 57) Ambient air quality was monitored at eight locations in 10 km radius from the mine site. The 24 hourly averages of PM₁₀ (respirable particulate matter of size less than 10 µm), PM_{2.5} (respirable particulate matter of size less than 2.5 µm); SO₂ (Sulphur Dioxide); NO_x (Oxides of Nitrogen); and 8 hourly average CO (Carbon Monoxide) were observed well within the corresponding National Ambient Air Quality Standards (NAAQS).
- 58) Dust fall monitored at the mine's office (monitored continually on monthly basis for three months) varied from 9.84 g/m²/month to 10.31 g/m²/month.

H.12) Ambient Noise Quality

- 59) The baseline noise monitoring in the study area was carried out at 10 locations (8 residential areas in surrounding villages and one each at the mine's office and at the approach road to the mine) on two occasions continuously for 24 hours in October and December.
- 60) The equivalent ambient noise levels for day time (Leq day) in the residential areas varied from 46.0 dB(A) to 54.8 dB(A) as against the corresponding standard for residential areas of 55 dBA while equivalent noise levels for night time Leq night varied from 39.6 dB(A) to 49.1 dB(A) as against the corresponding standard for residential areas of 45 dBA. The Leq day levels were observed well within the prescribed norms for residential areas. The Leq night levels 49.1 dB(A) and 47.8 dB(A) observed at Shella Bazaar and 45.9 dB(A) observed at Duba Village are relatively high and are expected to be attributed to flow of Umiam River located nearby.
- 61) For the two industrial locations i.e. mine's office and approach road to the mine, Leq day ranged from 61.0 dB(A) to 64.8 dB(A) as against 75 dB(A), the corresponding limit for industrial area. The Leq night ranged from 54.8 dB(A) to 61.7 dB(A) as against 70 dB(A) the corresponding limit for industrial area.

H.13) Surface Water Quality

- 62) The surface water quality was assessed for drinking water parameters (IS:10500) by collecting and analysing 12 samples collected from four locations once every month for three months from upstream and downstream of Phlangkaruh and Umiam Rivers. The analysis of the samples showed, the designated best use classification of CPCB remaining with Classes A and B.

H.14) Groundwater Quality

- 63) The ground water quality was assessed for drinking water parameters (IS: 10500) by collecting and analysing 15 samples once every month for three months from five locations. The analysis of the samples showed, all the parameters conforming to IS 10500.

H.15) Wash Wastewater Quality

- 64) Wash wastewater from maintenance workshop section of the Nongtrai limestone mine showed the results conforming to the general wastewater discharge norms.

H.16) Traffic

- 65) To and fro traffic was monitored on two occasions on main haul road between mine and crusher and PWD approach road between transit house and mine site. The average hourly to and fro traffic on haul road was observed 70 nos. while on PWD road between transit house and the mine was observed 8 nos. Access to mine is through PWD road.

H.17) Ecology

- 66) Ecological surveys were done by Northern Eastern Hill University (NEHU), Shillong during monsoon season beginning May 25, 2014 to September 17, 2014 and by ERM in 2013 by covering mining lease core zone and surrounding area of 10 km radius (buffer zone) similar to what was done by NEHU in the year 2010.
- 67) Six types of Forests have been observed (i) Tropical moist-deciduous forest - forests occurs in the lower elevations of the study site especially in the core zone, (ii) Tropical semi-evergreen forest – that occurs in the buffer zone up to an elevation of 800 m, (iii) Subtropical broadleaved forest – that occurs at an elevation range of 900–1800 m amsl in the buffer zone, (iv) Forest gardens and orchards – that is common near the human settlements in the buffer zone, (v) Riparian forests – that occurs along banks of the rivers Umiam and Phlangkaruh in the buffer zone., (vi) Savanna forest – that is found in area surrounding the long conveyer belt. As per UNEP-WCMC global classification of forests, there are four types of forests in study area i.e. (i) Tropical Lower Montane Forest (forest type-13), (ii) Tropical Semi-evergreen Moist-Broadleaf

forest(forest type-16), (iii) Deciduous/Semi-deciduous Broadleaf Forest(forest type-21), and (iv) Sparse Trees and Parkland (forest type-24).

- 68) From the study area (core and buffer zones), a total of 438 plant species belonging to 122 families were recorded. Of these, 143 species were trees ($\geq 5\text{cm dbh}$), 67 were shrubs, 126 herbs, 65 climbers, 8 lianas, 22 epiphytes, 4 bamboo and other palms, 1 rattan, and 2 parasitic species. In the core zone, a total of 162 species belonging to 74 families were recorded which include 56 tree, 32 shrub and 40 herb species, 21 climbers, 2 lianas, 1 rattan, 7 epiphytes, and 3 bamboo and other palm species. All the plant species recorded in core zone were also found in the buffer zone.
- 69) Of the 438 species, the total number of species that are economically important was 190. Four species encountered during floristic survey in the buffer zone were classified under the threat category. As per the Indian Red Data Book, only one species falls under the threatened category of species i.e. *Elaeagnus conferta* which has been categorized as endangered category. According to IUCN Red List, two species i.e. *Saraca asoca* and *Delonix regia* are under vulnerable category and one species i.e. *Aglaia edulis* is under lower risk/near threatened category. However, none of these species was recorded from the quadrats laid in the sampling area for vegetation analysis. No species from the core zone is listed in the Red Data Book of India and IUCN Red List of threatened species.
- 70) As per survey of water bodies by NEHU, the study area showed presence of 59 algal species of which 34 species belonged to Bacillariophyceae, 10 species belonged to Chlorophyceae, 6 species of Cyanophyceae, 8 species of Euglenophyceae and only 1 species of Chrysophyceae. Of these species, only one species belonging to class Chrysophyceae was collected from the core area. All the algal species observed were present in the buffer zone.
- 71) The faunal diversity revealed the presence of 15 species of mammals, 88 species of birds, 8 species of reptiles, 7 species of amphibians, 75 species of butterflies, 17 species of fishes. Of all the faunal species, Oriental Pied Hornbill (*Anthracoceros albirostris*), Blood Pheasant (*Ithaginis cruetus*), Mountain Bamboo Partridge (*Bambusicola fytchii*), Hill Myna (*Gracula religiosa*) fall under Schedule I category of the Wildlife Protection Act (1972) but listed under Least concern category of IUCN.

H.18) Socioeconomics

H.18.a) Methodology of Socioeconomic Assessment

- 72) A participatory approach was adopted to establish the social baseline for the study area by collecting primary information through sample surveys of households, interviews with project affected personnel (originally affected during initial setting up of the mines), discussions with Durbar members, village elders, and women group members, other community members and government representatives, focus group discussions were held with villagers from Nongtra, Shella and outside Shella area, collecting secondary information and discussions were held with LUMPL personnel and contractors. The social baseline information was collected through visits done by ERM professionals from April 28 to May 5, 2014. Secondary baseline information was collected through pertinent literature survey.
- 73) The Project and surrounding area falls within two CD Blocks of Shella Bholaganj Block and Mawsynram Block with their respective headquarters at Cherrapunjee (Sohra) and Mawsynram. The land of the mine site falls under Nongtra Village of Mawsynram CD Block while most of the land under the long belt conveyor falls under Shella Village of Shella Bholaganj CD Block. The headquarters of the district is located in Shillong. Nongtra and Shella Villages Durbars are part of the Shella Confederacy which is an association of nine village durbars.

H.18.b) Villages and Demography of the Study Area

- 74) The Nongtra mine and the crusher area (community land) fall under the Nongtra Durbar. For the proposed mine expansion, there is no additional land being leased/purchased and therefore no additional families being directly affected due to the Project and no R&R involved.
- 75) Nongtra Limestone Mine lease area, related infrastructure and part of the LBC belong to community of Nongtra Village. As per Census of India records, the total number of households (of 10 villages under Shella and 1 village under Nongtra Durbars) was 433 in the year 2001 and 534 in the year 2011 while the

total population was 2,197 in the year 2001 and 2,648 in the year 2011. The Phlangkaruh is the nearest village having approximately 20 households (with population of 100) from the mine site at about 1 km.

- 76) As per census of 2011, the average sex ratio (number of females per 1000 males) and literacy rate of villages under Shella Durbar is 1,032 and 88% respectively while that of Nongtrai Village sex ratio and literacy rate is 1,049 and 93.4% respectively. The scheduled tribe population of villages under Shella Durbar is 97.1% while that of Nongtrai Village it is 99.4%.
- 77) In the plains surrounding the LBC, the area has non-Khasi population. Non-Khasi population is engaged in most of the agriculture production (including vegetables etc.) and horticulture harvest. The fresh produce of vegetables on haat⁽¹⁾ days generally comes from the labour effort of non-Khasis.

H.18.c) Literacy

- 78) The fairly good literacy rate is attributed to the schools (primary and secondary) available in the area. Private schools operated by Christian missionaries and trusts like Ramkrishna Mission are key factors attributed to the good literacy rate and spread of education in the area.
- 79) In addition, LUMPL has been supporting in scaling up education facilities in Nongtrai and Shella Villages e.g. setting up of secondary school in Nongtrai, enhancement of school teachers' salaries, providing books, school uniforms sets, and furniture. Scholarships have also been provided.

H.18.d) Health Infrastructure

- 80) Health infrastructure in the study area comprises of a network of public and private institutional set up (like sub centres, dispensaries and health centres operated by trust) responsible for health care delivery in the area. The Public Health Centre (PHC) in Disong Village has a well-established set up with trained medical practitioners, mid wives and health volunteers. There is a sub-centre at Sohlap to cover a population of about 2,240. Also there is a 30-bedded facility in Ichamati CHC.
- 81) Consultations with the medical staff in the PHC, discussions with private medical practitioner and community leaders confirmed that there has been an improvement in the nutritional levels. Most of the families in Shella and Nongtrai durbar have availed of the facilities provided by the mobile medical van (LUMPL initiative) and are of the opinion that it has positively contributed as the health facilities in the area. Lesser number of cases of nutritional deficiencies are now reported in the local PHC and the other health centres.

H.18.e) Community Development Programme by LUMPL

- 82) The community development activities have been carried out by LUMPL with a focus on Health Services; Educational Support; Infrastructure Improvement; Income generation programs – development of skill sets, training and awareness programs and sponsoring social and cultural events.
- 83) The CSR activities from 2006 to present have been taken up in 12 villages. Activity planning for development work is mostly based on need assessment carried out as per local requirement of the durbars/ local community and LUMPL guidelines. The Joint Committee for Community Development (JCCD) has been constituted representing the members appointed by the respective Durbars and LUMPL's CSR team both in Nongtrai and Shella Village Durbars to plan and implement the community development activities.
- 84) LUMPL operates a mobile medical van (manned by full time medical doctor, a trained nurse and necessary diagnostic devices) to provide medical services in each of the Project surrounding villages of Shella and Nongtrai Durbars. LUMPL provided health services by visits of Doctors and Nurse and free of cost medicines to cover the following schedule:
- a) Nongtrai (sometimes neighbouring villages as well) – Twice a week
 - b) Mawryngkhong (covers 3-4 other villages – Nongrum, Nongnong) – Once a week
 - c) Umsaw (includes 7-8 other villages) – Once a week
 - d) Shella Bazaar (most of Shella and other neighbouring villages) – Once a week
 - e) Shella (Jasir, Jamew, Duba, Disong) – Once a week

(1) Haat day refers to the local market day of the village.

I.1) LUMPL Payments to SPV

85) LUMPL has deposited to SPV a sum of INR 114.25 Crore up to September 30, 2015.

J) Impact Assessment & Mitigations

J.1) Methodology Used for Impact Assessment

86) The criteria that has been developed to evaluate impacts due to the expansion Project, together with existing operations of the mine on various environmental components is based on assessment of Magnitude (severity) of impact i.e. actual change taking place to the environment; and the sensitivity/importance/value of receptors or the affected resource.

J.1.a) Impact Significance Description

87) Impact significance description is as following:

- a) An impact of **negligible significance** is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
- b) An impact of **minor significance** is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude will remain well within applicable standards.
- c) An impact of **moderate significance** has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is As Low As Reasonably Practicable (ALARP).
- d) An impact of **major significance** is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/ sensitive resource/receptors. Acceptability of impact of major significance depend on positive effects of the Project in other words to evaluate (by stakeholder and or regulators) to what extent positive effects overweigh acceptability of major negative impact.

J.1.b) Project Activities Considered

88) The impact process initiated with the scoping. Impacts have been identified for the potential changes in the environment that could be expected from the Project (expansion from 2.0 MTPA to 5.0 MTPA) related activities (as defined in summarized in serial no. F on Project Description) assuming that the changes due to the existing activities have already been captured in the baseline and continue to remain the same till the operation of the expansion Project.

J.1.c) Impacts Assessment

89) An interaction matrix has been developed for identification of the potential interactions each Project activity may have on the range of resources/ receptors within the Area of Influence for the Project. The impacts assessed include as covered in **Table 0.2**:

Table 0.2 Summary Impact Assessment

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
1	Ambient Air Quality			
	<p>Air emissions of PM₁₀ (particulates of size less than 10 microns), PM_{2.5} (particulate of size less than 2.5 microns), sulphur dioxide (SO₂), oxides of nitrogen (NO_x) and carbon monoxide (CO) include:</p> <ul style="list-style-type: none"> Area source: Fugitive emissions from drilling, blasting, loading and unloading operations Line source: Emissions from moving vehicles on haul road and approach road Point sources: Emissions from stacks of crusher, dust collection system on transfer points on moving belt, diesel generators. 	<p>The resultant air quality (sum of maximum predicted incremental ground level concentrations using AERMOD model and observed average baseline) at the surrounding settlements/locations has been assessed as following:</p> <ol style="list-style-type: none"> PM₁₀ : 57.5 to 79.5 µg/m³ [against 24 hourly NAAQS of 100 µg/m³] PM_{2.5} : of 21.3 to 30.7 µg/m³ [against 24 hourly NAAQS of 60 µg/m³] SO₂ : 5.1 to 6.8 µg/m³ [against 24 hourly NAAQS of 80 µg/m³] NO_x : 10.8 to 13.5 µg/m³ [against 24 hourly NAAQS of 80 µg/m³] CO : 213.5 to 426.0 µg/m³ [against 8 hourly NAAQS of 2000 µg/m³] <p>The resultant ambient air quality will remain within the National Ambient Air Quality Standards (NAAQS) at all the surrounding settlements/ locations.</p>	<p>Drilling of Holes & Blasting</p> <ul style="list-style-type: none"> Use of state of the art drilling machines Use of good quality explosives Ensuring proper stemming after charging of explosives Water sprinkling after blasting <p>Crusher and LBC:</p> <ul style="list-style-type: none"> In built high efficiency dust suppression system Implementation of water fogger system while unloading of dumpers Provision of hoods/chutes at transfer points Water spraying at transfer points Provision of close conduit type belt conveyor for conveying of limestone <p>Captive Power Generation- DG Sets</p> <ul style="list-style-type: none"> Use of low sulphur HSD fuel oil <p>Stock-piles</p> <ul style="list-style-type: none"> Water spraying at the stock piles <p>Mines</p> <ul style="list-style-type: none"> Water spraying through rain gun while loading and unloading; Maintaining green belt of 100 m width <p>Haulage</p> <ul style="list-style-type: none"> Water sprinkling through fixed sprinklers as well as through water tankers Preventive maintenance of mine machinery Speed of hauling vehicles to be limited to 20 km/ hour. <p>Work Environment</p> <ul style="list-style-type: none"> Use of dust mask (of appropriate type) for personnel working in dust prone area. 	Minor
2	Noise Quality			
	<p>Noise emission sources for the expansion Project include the following:</p> <ul style="list-style-type: none"> Point sources include mining machinery operations Area sources include crusher plant, LBC 	<p>The resultant noise quality i.e. logarithmic sum of maximum predicted incremental noise level using SoundPlan model and observed (day and night time equivalent noise baseline) at the surrounding</p>	<ul style="list-style-type: none"> Ensure proper design of blast hole drilling pattern and blast geometry Use of NONEL technique with TLD detonators. Blasting operations to be carried out only during the day time between 1300 to 1500 hours. 	Minor

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
	<p>take off point, workshop, parking areas</p> <ul style="list-style-type: none"> ▪ Volume sources include diesel generators room ▪ Line sources: Movement of heavy machinery and light vehicles and transportation through LBC 	<p>settlements/locations has been assessed as following:</p> <ul style="list-style-type: none"> ▪ Day and night time equivalent noise levels (Leq day and Leq night) at settlements in the surrounding areas will remain within the prescribed standards of 55 dB(A) for day time and 45 dB(A) for night time. ▪ Noise levels from LBC would remain within the prescribed limits beyond 300 m. 	<ul style="list-style-type: none"> ▪ Scheduled maintenance of HEMM and other equipment (as per original equipment manufacturers specifications) ▪ Periodical inspections of LBC and replacing worn out idlers ▪ Provision of soundproof enclosures for HEMM ▪ Provision of vibration absorbing pads at foundations for new crusher ▪ Provision of acoustic enclosures for diesel generators ▪ Use of ear muffs ▪ Maintenance of green belt of 100 m 	
3	Ground Vibrations, Air Overpressure and Fly rocks			
	<p>Blasting using explosive charge is the main source of ground vibrations, air overpressure and fly rock generation</p>	<ul style="list-style-type: none"> ▪ The ground vibration will remain less than Directorate General of Mine and Safety (DGMS) permissible limit of 10 mm/second (for 8 to 25 Hz of frequency). ▪ Air overpressure levels will remain within DGMS prescribed limit of 134 decibel Linear (dBL) at the settlements in the surrounding. 	<ul style="list-style-type: none"> ▪ Exercise strict control on burden, spacing and stemming column orienting all blast drill holes ▪ To contain fly rocks, stemming column should not be less than the burden of the hole, and the blasting area should be muffled when blasting is to be done on edges. ▪ Blasting is to be conducted only in the daytime and will not be carried out when strong winds are blowing or in the event of overcast or lightening. ▪ Charge per hole not to exceed 63 kg/ hole as per CIMFR recommendation. ▪ To ensure that when mining in the southern area (300 m above southern boundary), the blasting parameters will be re-determined by entrusting a study by CIMFR. However, an area of 100 m perimeter along the sinkhole will always be kept as undisturbed. ▪ Surrounding village houses and nearby structures will be regularly inspected for any visual cracks on walls or distortion of cave and twin sinkholes. 	Minor
4	Land Subsidence			
	<p>Lowering of land surface, in this case of limestone mine site or surrounding area, which may be caused due to creation of voids underneath rocks as a result of natural disturbances or human activities.</p>	<ul style="list-style-type: none"> ▪ As per study conducted by CIMFR, considering the four main causative factors of pot-hole subsidence i) presence of voids at shallow depth of cover, ii) weak overburden, iii) geological discontinuities; and iv) water seepage, the potential ratings of pot holes subsidence falls in low category. 	<ul style="list-style-type: none"> ▪ Regular check of cavities using a monitoring schedule while drilling. ▪ LUMPL to conduct drilling of 32 small diameters holes during next two years at select locations (as approved by IBM) to further investigate the cavernous /voids underneath the mine. ▪ LUMPL is to periodically preferably once in 5 year get subsidence related monitoring conducted by a reputed agency like CSIR-CIMFR. 	<p>Minor.</p> <p>With the further investigation, the assessment on subsidence will have to be redone.</p>

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
			<ul style="list-style-type: none"> Use borehole camera to assess the location and extent of any subsurface voids. 	
5	Land use and Topography	<ul style="list-style-type: none"> The expansion Project does not entail changes in landuse of any additional area other than that existing for the ongoing limestone mining (of 2.0 MTPA). The topography of existing unbroken and broken limestone mine lease area will be changed from existing up to 170 m RL to 90 m RL for 5.0 MTPA as was envisaged for 2.0 MTPA mining. With mine decommissioning and post mine closure positive impacts are expected on landuse of the Project related area. 	<ul style="list-style-type: none"> The upper benches of the mine will be progressively reclaimed starting from 6th year onwards ` Greenbelt of 100 m all around the limestone mine of 100 Ha will continue to remain maintained as per the requirements of one of the conditions of previous EC issued by MoEFCC. 	Minor
6	Drainage (during Mine Development, Mining and Post Mine Closure)			
	<p>The Project site mainly falls in the catchment of Phlangkaruh River and partly in the catchment of Umiam River covering upper northern part of the mine together with storm water coming from north outside the mine. The unbroken part of the mine site is governed by karst topography and is characterized by rapid infiltration of water into joints, fissures and fractures. The infiltration rate is observed to be almost complete as it flows to the south of the mine.</p>	<p>Mining Phase:</p> <ul style="list-style-type: none"> Up to 21st year of mining for 5.0 MTPA mining, rainfall related drainage will continue to flow from the mine site into the north to south flowing through approximately 0.7 km² of mine lease area into the catchment of Phlangkaruh River and remaining 0.3 km² of the mine site will continue to flow west to east (of the mine) into Umiam River. As mining progresses, assuming all rainwater falling on the mine area is intercepted and discharged into Phlangkaruh after treatment (through silt traps in the storm water drain), the Phlangkaruh stream flow drainage will not be influenced as it will be guided along the mine benches and channelled into the Phalangkaruh. 	<ul style="list-style-type: none"> LUMPL is to ensure proper drainage is planned prior to start of development of new benches; Prior to start of mining from northern side (21st to 25th year) which will alter drainage through northern part, LUMPL is required to construct a garland drain to guide rainwater from outside the mine continue to flow west to east into the Umiam River. The garland drain will prevent rainwater entering into the mine from outside and maintain flow from mine area into Umiam River. As the mine is developed, from 11th year onwards, a north - south garland drain need to be constructed inside along central point of eastern periphery with the provision of silt traps and check dams as included in pit position plans for 11th -15th year, 16th– 20th year With the development of the mine and operations reaching lower levels of benches, LUMPL is required to construct bunds along the benches to guide the water flow and avoid situation of water inundation within the flat areas of the benches; Ensure proper slope is maintained towards the lowest elevation at a given point of time for ultimate north – south flow of water from the mine site. Provide silt traps before water merges into 	<p>Mining Phase Negligible (with mitigations in place) .</p> <p>Post mine closure</p> <p>Minor (for the time being, it needs to be reassessed as per the approval of final mine closure plan prior to end of the mine life.)</p>

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
		Post mine closure: <ul style="list-style-type: none"> The mine site will have moderate slope towards the south along the flow direction of the Phlangkaruh. 	cavities down to the south of the mine lease area; <ul style="list-style-type: none"> Ensure fortnightly cleaning of silt traps and check dams, particularly during monsoon period from May to mid-October. Prior to mine closure, LUMPL is ensure following mitigations: <ul style="list-style-type: none"> Revisit the plan of converting left out area of approximately 67 Ha into a water reservoir as it possess risk of hydraulic loading of the water in the reservoir. LUMPL is to work out other possible use of the land in discussion with the stakeholders and as per prior approval of IBM. Connect drainage through a silt trap into the southern flowing garland drain from the area currently meant for mine's Project office into the natural drain leading to Phlangkaruh River. 	
7	Surface Water Resources and Discharges			
	<ul style="list-style-type: none"> Withdrawal of 200 m³/day of water from Phlangkaruh River or Umiam River the Project Domestic wastewater generation of approximately 60 m³/day; and Wash wastewater generation of 10 m³/day 	<ul style="list-style-type: none"> With the prevailing water flow available and limited downstream users of the Phlangkaruh River, the impact of withdrawal of water from Phlangkaruh is expected to be low. The impact of discharge of treated domestic and wash wastewater is considered to be low. 	<ul style="list-style-type: none"> To conduct periodically performance evaluation of package STPs and ETP and regularly conduct monitoring of untreated and treated wastewater quality. Reuse of wash wastewater in haul road sprinkling Reuse of rain harvested water for domestic purposes Workers deputed onsite will be instructed to practice for optimal use of water. 	Minor
8	Siltation due to Surface Runoff from Mine Site			
	The key sources of erosion and sediment discharges include: <ul style="list-style-type: none"> Surface runoff from haul roads; Runoff from scree generated during mining activities including drilling and blasting Runoff from vehicular maintenance workshops. Runoff from demolition of activities during mine decommissioning phase 	Mining Phase <ul style="list-style-type: none"> Likelihood of any adverse impact from soil erosion and disturbance are expected to be low. The mine lease area being devoid of overburden, there is some potential of solution erosion of limestone in dissolved form. As the limestone rock in the mine is very hard and comes under non erodible category, limestone alone does not contribute to particulate sediment load 	Mining Phase <ul style="list-style-type: none"> Construction of garland drains to prevent water entering into the mine from outside for the peak flow and provided with check traps. Bench levels to be provided with water gradient against the general pit slope. Top/trapped soil recovered from unbroken mine area shall continue to be stored for reuse in plantation. Regular water sprinkling and compaction will continue to be carried out on the haul road. Bunds will be erected on outer edge of the exhausted benches. Also to provide a bund/barrier along the southern boundary. 	Mining Phase: <ul style="list-style-type: none"> Minor Post mine closure <ul style="list-style-type: none"> Negligible.

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
		<ul style="list-style-type: none"> The amount of fine particles from drilling and blasting is expected to be less than 1 m³ (dry basis) (on given heavy rainfall day) which is partly susceptible to be eroded with rainfall. <p>Decommissioning & Post Mine Closure</p> <ul style="list-style-type: none"> Post mine closure phase, the silt erosion probability will be low due to cleaned surface. 	<ul style="list-style-type: none"> Construction of drains around freshly excavated areas and haul road. Plantation of shrubs along the garland drains inside as well outside the mine site. <p>Decommissioning & Post Mine Closure</p> <ul style="list-style-type: none"> Plan decommissioning activities during non-monsoon months only. Connect drainage through a silt trap into the southern flowing garland drain from the mines Project office into the natural drain leading to Phlangkaruh River. Ensure fortnightly cleaning of silt traps and check dams, particularly during monsoon period from May to mid October 	
9	Waste Generation and Soil, Subsurface & Sediment Contamination			
	<p>Potential sources of health risk and contamination of soil, subsurface and sediments include the following sources:</p> <ul style="list-style-type: none"> Improper handling, storage and disposal of domestic and industrial waste. Spillage of Hazardous wastes like used oil and ETP sludge storage shed; Spillage of High-speed diesel and lubricating oil storages; Discharge of untreated wastewater – domestic and industrial from workshop. 	<ul style="list-style-type: none"> Domestic waste, if not properly handled and disposed of, it may cause health risks to Project personnel and people of the surrounding area. Hazardous substances include used/waste oil, hydraulic lube fluids, diesel, grease and oil containing rags, if improperly managed may result in spills and may cause soil, subsurface sediment contamination thus posing local water quality and human health risks to downstream water users. 	<ul style="list-style-type: none"> Ensure daily segregation, collection and disposal of domestic waste. Continue to dispose off domestic waste to Shillong Municipal Waste Collection Bins. Disposal of hazardous wastes is continued to be done through MSPCB authorized vendors. All diesel and lube oil storage to be adequately managed and supervised to avoid any situation of spillage. All such storages are to be maintained with spill collection sumps, which need to be regularly cleaned. 	Minor.
10	Hydro- geological Resources			
	<ul style="list-style-type: none"> No springs or perennial water sources exist within the mine lease area. Three springs appear at 22 m RL down across the PWD road to the south of the mine at 270 m from the southern boundary of the mine site. The springs are charged through water flow from Nongtraí escarpment; Phalangkaruh is one of the small, independent water basins forming a separate drainage system along the 	<ul style="list-style-type: none"> Mining will be restricted to 90 m RL much above the water spring levels of 22 m RL and located 300 m away from the active mining area. Based on observations made through monitoring of piezometers, it shows water levels remaining much above the Phlangkaruh spring reduced levels. This indicates that the mining operation will not significantly affect the perennial water flow to the springs at the head of 	<ul style="list-style-type: none"> While mining 300m away from the southern boundary, the blasting parameters will be re-determined by entrusting a study to CIMFR. An area of 100 m perimeter along the sinkhole will always be kept as undisturbed. Comply with blasting control related mitigation measures. To continue to maintain existing recharging pit developed as part of rain water harvesting. 	Minor

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
	southern margin of the hills	<p>the Phlangkaruh River.</p> <ul style="list-style-type: none"> Blasting induced vibrations may disturb hydrogeology. However, by restricting the mining to a depth of 90 m RL, the impacts would be low on the springs and subsurface system. 		
11	Ecology & Wildlife			
	<p>The mine site is designated as forest area. LUMPL has obtained forest clearance for 116.580 Ha of land under 2.0 MTPA mining operations. Based on field studies conducted recently based on Flora and Fauna Report of NEHU, 2015, six types of forests are identified in the study area. For the 5.0 MTPA, no additional forest land is involved.</p>	<p>Ecological impacts have been assessed to cover the following:</p> <ul style="list-style-type: none"> Impact on forestland and habitat loss; Impact on water resources and related biodiversity; Impacts from wastes; Effect of noise and disturbance to faunal group; Impact of vehicular movement; Impact of dust emission on plants, habitats and associated faunal biodiversity; Impact on threatened species of wildlife; and Impact on local natural resources due to workforce engagement <ul style="list-style-type: none"> The mine area gives an impression of a degraded forest area because most of the trees are stunted due to absence of any mineral soil. Most of the impacts identified were of low to moderate impact. In order to mitigate these impacts, appropriate mitigation measures have been suggested. 	<ul style="list-style-type: none"> Top/trapped soil recovered from fissures and cavities in the upper strata will continue to be preserved for future use in reclamation of the mined out area and for greenbelt development plantation. Flora and Fauna Report of NEHU, 2015 suggested an additional amount of INR 30 lakhs to be spent for conservation measures on avifauna habitat improvement in the study area by fixing at least 500 nest boxes. To continue be maintained a nursery for development of saplings in the surrounding areas as well as in the greenbelt. To continue to create overall awareness education to keep the surrounding environment neat and clean and also follow the above mentioned mitigation measures. The progressive mine reclamation will continue to be undertaken starting from 6th year onwards. The mine will be fully reclaimed before final mine closure. The process of closure will be initiated 5 years prior to the decommissioning time. The final mine closure plan will be prepared in consultation with the Village Durbars and approval of concerned regulatory agencies as per the concept of Sustainable Development. The accommodations will continue to be facilitated with waste disposal point to avoid dumping of unwanted waste materials into the forest and nearby water bodies. 	<p>Overall impact significance on ecology and wildlife during mine development and mining activities of the proposed expansion Project is considered to be Minor.</p> <p>Overall impact significance on ecology and wildlife during mine decommissioning and post mine closure is considered to be Positive.</p>
12	Socio-economics & Community Health & Safety			
	<ul style="list-style-type: none"> Land-based activities; Community health & safety; Support to health and education 	<p>Mining Phase</p> <ul style="list-style-type: none"> No additional land is proposed; hence no social impact on account of land 	<ul style="list-style-type: none"> Mining Phase Provision of medical health related support services as well as education promotional activities to Nongtrai, Shella and 	Positive.

SN	Impact Sources	Impact Prediction	Mitigation Measures	Residual Impact Significance
	<p>activities;</p> <ul style="list-style-type: none"> ▪ Employment opportunities; ▪ Payment of rent (royalty) to Nongtraï and Shella Village Durbars; ▪ Payment to SPV and improvement of infrastructure in the surrounding areas. 	<p>requirement is anticipated.</p> <ul style="list-style-type: none"> ▪ All villages surrounding the Nongtraï limestone mine and associated facilities are well separated at a distance of 1 km and beyond from the mine site. Community health and safety impacts due to the Project activities will be minimized through embedded and mitigation measures. <p>Mine Decommissioning & Post Mine Closure</p> <ul style="list-style-type: none"> ▪ Post mine closure, the mine and related area will be decommissioned and reclaimed with proper utilization and recovery of lost ecological value of the Project components as per the mine closure plan approved by IBM. ▪ The reclaimed land involved for the Project and related components will be given back to Nongtraï and Shella Durbars, impact of mine decommissioning and closure will be positive. ▪ However, given the case, that post mine closure, the payments to communities and SPV will cease, resulting in some adverse socioeconomic impact. 	<p>surrounding villages.</p> <ul style="list-style-type: none"> ▪ Employment Opportunities: Positive impact is expected of the Project in terms of additional employment opportunities. ▪ Payment of rent (royalty) to Nongtraï and Shella Village Durbars: ▪ Payment to Special Purpose Vehicle (SPV). <p>Mine Decommissioning & Post Mine Closure</p> <ul style="list-style-type: none"> ▪ The reclaimed land involved for the Project and related components will be given back to Nongtraï and Shella Durbars. ▪ To minimize impacts of mine closure on socioeconomic benefits of the Project, LUMPL will develop awareness and communicate to its stakeholders of the closure of the mine operations at least 5 years ahead of the mine closure. 	

K) Cumulative Impacts

- 90) No active mining operations exist within the immediate surrounding of Nongtraï limestone mine. LUMPL has got a lease of shale mine of 4.9 Ha of 0.3 million tonnes per annum capacity located approximately 0.6 km to SE of the Nongtraï limestone mine. The mine has been lying closed since 2009 pending determination of forest status of the area. With the given current scenarios, no cumulative impacts have been included.

L) Risk Assessment

- 91) A detailed risk assessment has been conducted for the limestone mining and related activities. Risk analysis for residual risks has been done and where an extreme or high risk is identified, the hazard due to an activity, task or sub task is reassessed with control measures in place. A range of hazards that could potentially occur at the site from the existing and proposed expansion Project activities have been identified with possible causes and their probability of occurrence. The hazards have been tabulated to prioritise the residual risks and evaluate these levels against the concept of 'As Low as Reasonably Practicable' (ALARP). To minimize the severity of each of the hazard, control measures have been included covering prevention and response measures.
- 92) For unplanned external hazards, some control measures with respect to natural hazards which are in-built in the Project design have been considered. However, it is difficult to assess probability and severity of risk due to unplanned external events. Considering worst case scenario, Emergency Response Plan has been prepared for responding to the unplanned internal/external hazards.

M) Project Benefits

- 93) The benefits of the project include development of the infrastructure and facilities to villagers of local people. The financial benefits of the expansion Project include as per the following Table:

Table 0.3 Financial Benefits of the Project (Million)

S. N.	Nature of Payment	Payment Rate (INR)	Annual Payment (2.0 MTPA) (INR)	Annual Payment (5.0 MTPA) (INR)
1	Payment to Nongtraï Durbar	13/ tonne	26	65
2	Payment to Shella Durbar	Lump sum	10	10
3	Royalty to the State Government	80/ tonne	160	400
4	State Mineral Cess	40/tonne	80	200
5	Payment for SPV (Special Purpose Vehicle)	90/ tonne	180	450
6	Welfare Cess to Welfare & Cess Commissioner (Ministry of Labour)	1/ tonne	2	5
	Total (1 to 6):		458	1130
	Say		45.8 Crore	113.0 Crore

N) Environmental Management & Monitoring Plan

- 94) An environmental management and monitoring plan (EMP) has been developed with the established requirements of environmental management system covering Planning, Implementation, Checking and Review thus to ensure continual improvement. The EMP defines LUMPL's Environment Policy, Group's Health and Safety Rules, Group's Sustainability Ambition, 2020 and reference of applicable regulatory requirements, organization for environment, health safety and social security related performance. The EMP summarises potential impacts associated with the proposed expansion Project and clearly sets out the corresponding control/ mitigating measures that need to be implemented; and to set out organization structure. Specific management plans including Biodiversity and Wildlife Conservation Plan (as part of Flora and Fauna Report of NEHU, 2015), Ground Vibrations Control Plan (as part of Blasting study by

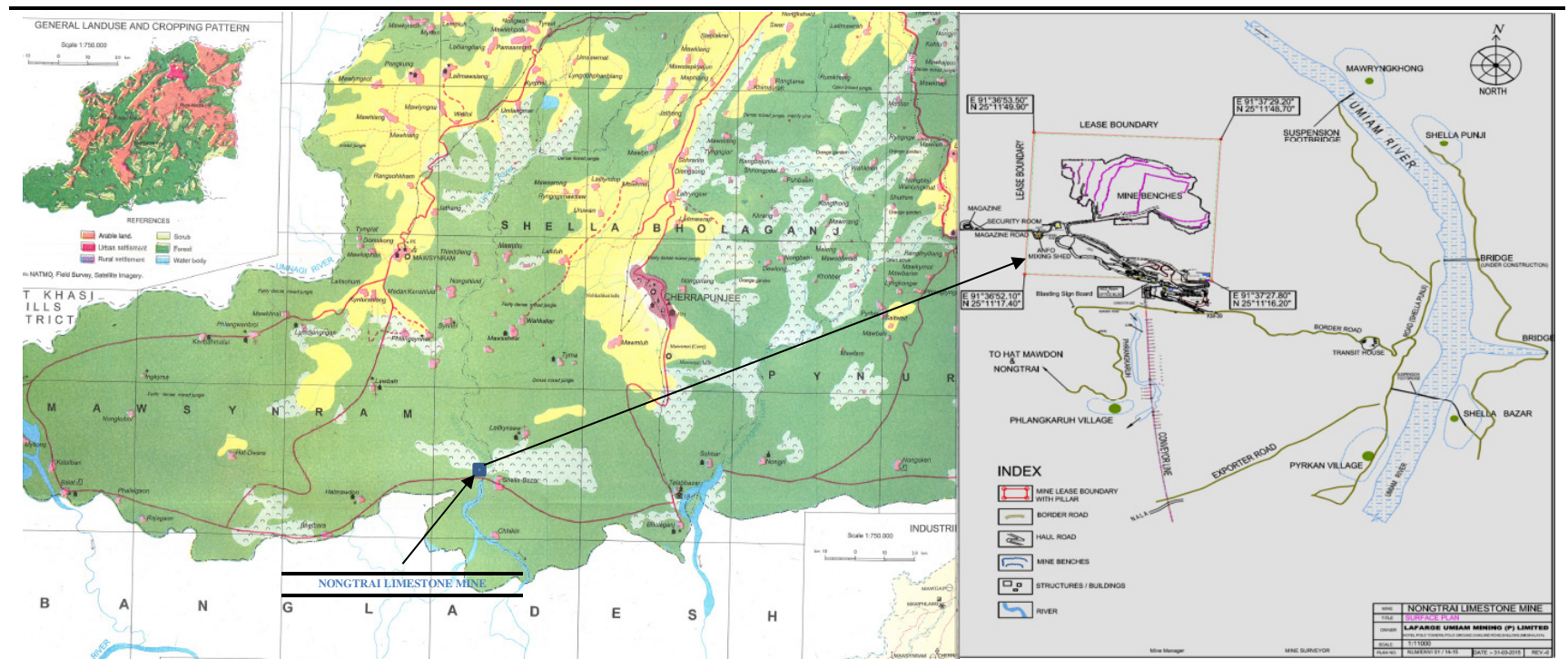
CIMFR, 2015), Emergency Response Plan and Progressive Mine Closure Plan have been included in the EMP.

- 95) The monitoring plan includes monitoring through internal and external resources covering ground vibration, air emissions, ambient air quality, noise quality, water and wastewater quality, ecology and social parameters.
- 96) The EMP will be a “live” document. It will be reviewed and updated as needed to provide effective management of environmental issues. It will be reviewed by the Project team prior to start of any activity related to proposed expansion Project in consultation with LUMPL’s environment, health & safety and community relations departments. Periodic review and audits will be done for effective management of environment system and accordingly, where required during the Project life cycle, the EMP will be updated as needed to provide effective management of environmental issues. Implementation of the EMP will involve LUMPL, its contractors and service providers. The overall responsibility of compliance of the requirement lies with LUMPL.

O) Conclusion

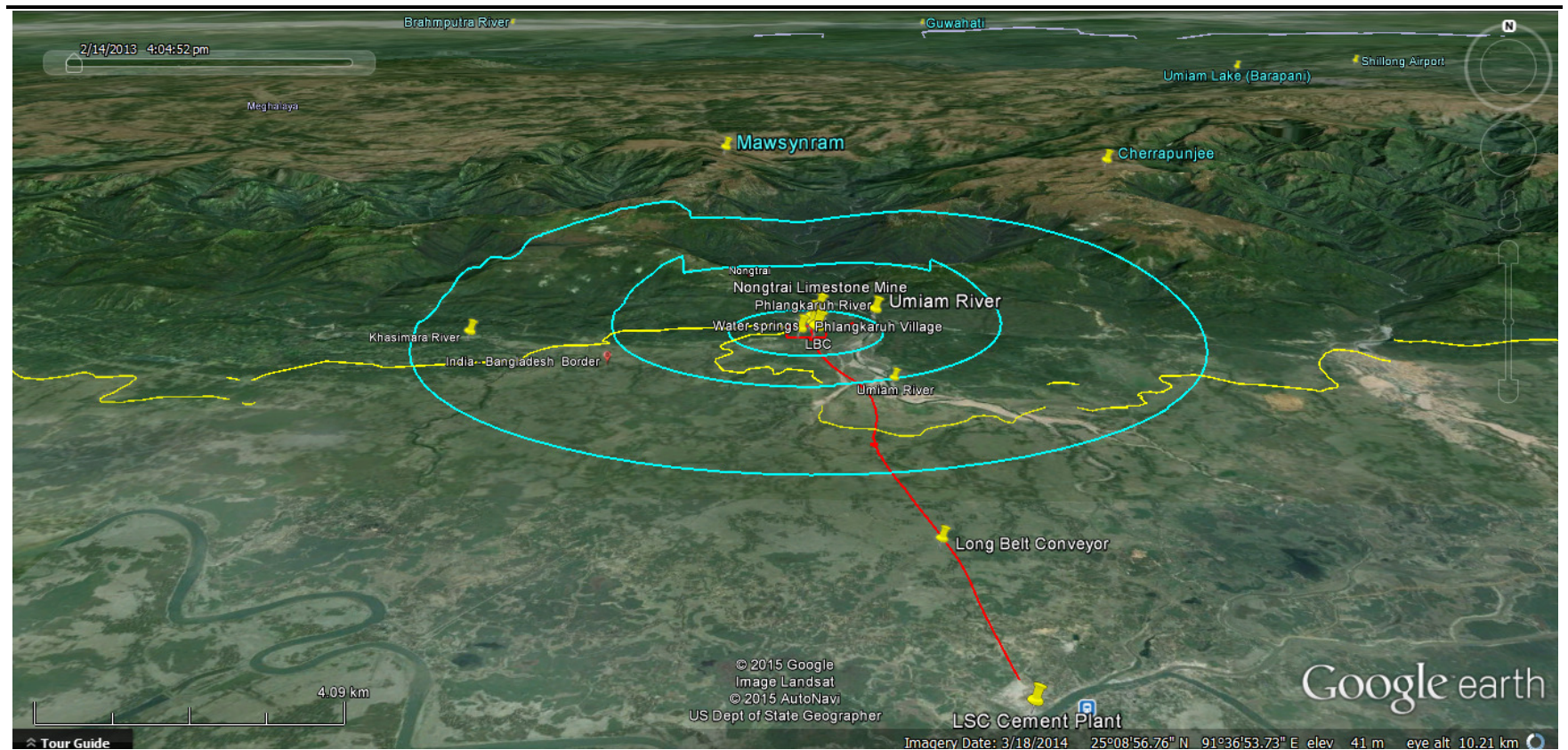
- 97) The proposed expansion Project has been planned to meet the market demand of cement production in Bangladesh. The proposed expansion Project will be undertaken within the footprint of existing limestone mine lease and related infrastructure area. The mining will be done as per the Scheme of Mining approved by IBM with mining depth restricted to 90 m RL. A detailed environmental impact assessment has been done, with mitigation measures in place to minimize adverse environmental impacts on resources and receptors in the surroundings. Some of the key and challenging impact assessment relates with drilling of 100 holes six days a week within 100 Ha of existing mine lease area, blasting, haul road transportation, crushing, and transportation through existing LBC during three shifts per day with 7200 hours of operations per year.
- 98) The Project will result in benefits to communities through annual rental, royalty & cess payments, payment to SPV for welfare activities, revenue generation for State Government of Meghalaya and Government of India through foreign exchange.
- 99) An Environmental and Monitoring Plan has been developed to ensure that systems will be in place for effective environmental and social performance by LUMPL for the expansion Project.
- 100) For the 5.0 MTPA expansions, the capital cost of the EMP has been worked out as INR 7.1 Crore while recurring cost has been worked out as INR 2.1 Crore.
- 101) Public consultation of the Project will be conducted by MSPCB based on draft findings of the EIA study. Upon completion of public consultation, final EIA report will be submitted to MoEFCC for appraisal of the Project for the proposed expansion capacity.

Figure 0.1 Location Map of LUMPL's Limestone Mine



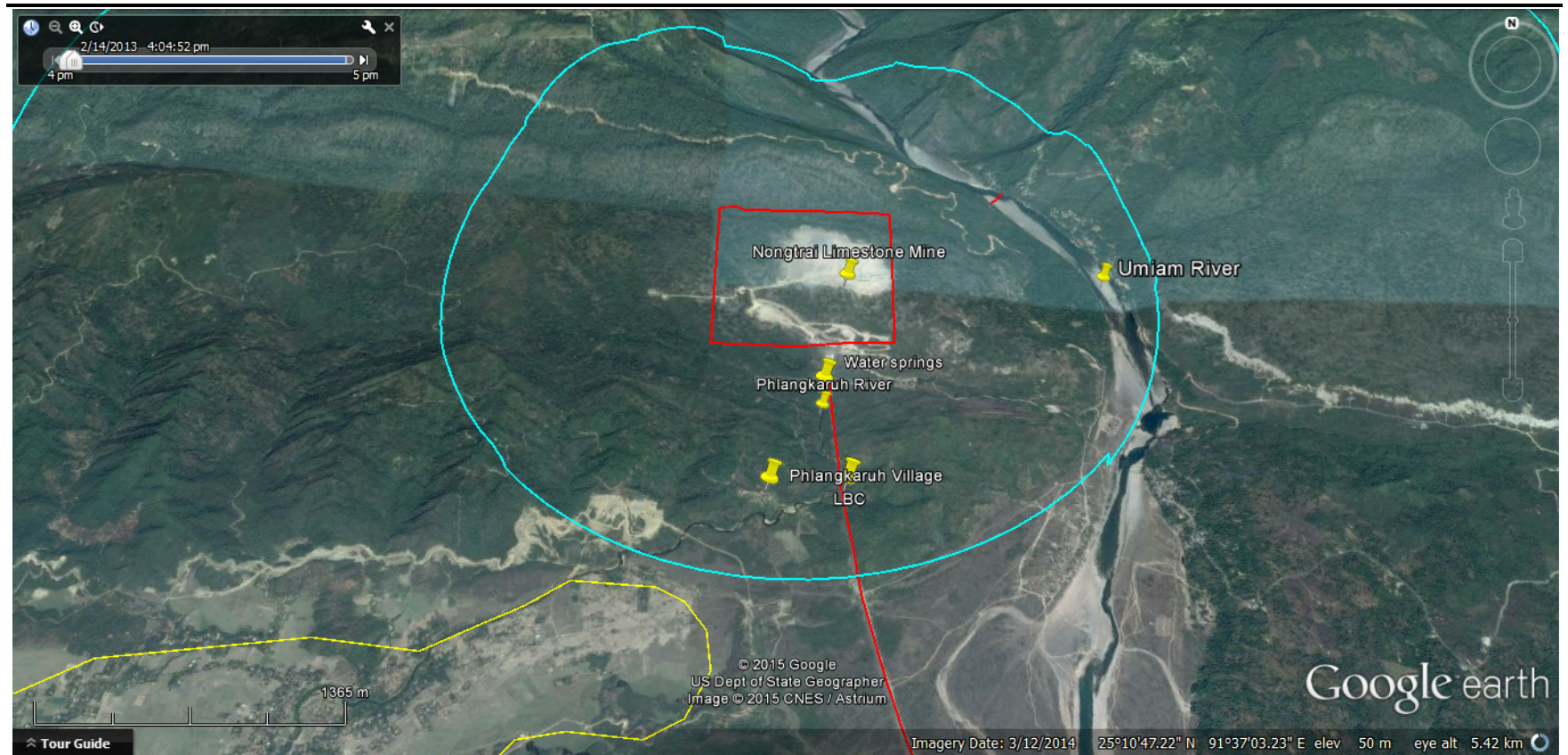
Source: Survey of India and LUMPL

Figure 0.2 Google Map showing Nongtrai Limestone Mine and Surrounding Area of 10 km radius



Source: Google earth

Figure 0.3 Google Map showing Nongtrai Limestone Mine and Surrounding Area of 10 km radius



Source: Google earth

**ERM has over 140 offices
Across the following
countries worldwide**

Argentina	Netherlands
Australia	Peru
Belgium	Poland
Brazil	Portugal
China	Puerto Rico
France	Singapore
Germany	Spain
Hong Kong	Sweden
Hungary	Taiwan
India	Thailand
Indonesia	UK
Ireland	USA
Italy	Venezuela
Japan	Vietnam
Korea	
Malaysia	
Mexico	

ERM India Private Limited

**Building 10, 4th Floor
Tower A, DLF Cyber City
Gurgaon – 122 002, NCR , India
Tel: 91 124 417 0300
Fax: 91 124 417 0301**

**Regional Office – West
102, Boston House,
Suren Road, Chakala
Andheri Kurla Road, Andheri (East)
Mumbai- 400093 India
Office Board Telephone: 91- 22 -4210 7373 (30 lines)
Fax: 91- 022- 4210 7474**

**Regional Office – West
702 Abhishree Avenue,
Near Nehru Nagar Circle, Ambawadi
Ahmedabad -380006 India
Tel: +91 79 66214300
Fax: +91 79 66214301**

**Regional Office -South
Ground Floor, Delta Block
Sigma Soft Tech Park
Whitefield, Main Road
Bangalore- 560 066, India
Tel: +91 80 49366 300 (Board)**

**Regional Office -East
4th Floor, Asyst Park,
GN-37/1, Sector-V,
Salt Lake City,
Kolkata 700 091
Tel : 033-40450300**

www.erm.com

ERM consulting services worldwide www.erm.com

