

1.0 INTRODUCTION AND BACKGROUND

1.1 Scope of Report :

The report covers an area of 4.9 ha., pertaining to shale mine in Shella, East Khasi Hills District, Meghalaya. It is aimed at presenting reclamation principles, approach and limitations and also focusing on the legislative requirements, policies, guidelines and environment and social management. The ultimate objective of preparation of a 'Mine Reclamation and Closure Plan' is to provide a design for management of each of the problem areas and also a schedule of work programmes including estimated cost involved thereof.

1.2 Reclamation Principles :

The areas of resources affected by mining should be returned to a safe and productive condition through rehabilitation. The process of reclamation should be an ongoing activity throughout the life of the mine operation. The reclamation principle can only be translated into action by appropriate technology, which may include re-contouring and re-vegetation of degraded land surfaces. Containment of toxic waste and prevention of soil erosion and acid drainage, are other components.

1.3 Care and Maintenance and Closure Rehabilitation Options :

On the cessation of mining, a process of decommissioning with a follow up programme of reclamation/rehabilitation should start. Once the design of reclamation is successfully implemented, appropriate care and maintenance rules are to be framed for long term benefit of the local community. This should include adoption of preventive measures against slope failure, managing toxicity of tailings or waste rock which may limit re-vegetation and preventing acid drainage from abundant pits, tailings etc.

A participatory management for care and maintenance of the reclaimed area may ensure a process of benefit sharing specially from the forest, that are to be grown, as a major work component of reclamation plan.

A study has to be undertaken to examine the best options for closure and rehabilitation. This has been carried out during preparation of Environment Management Plan. The best option of rehabilitation of the disturbed area has subsequently been recommended. It involves afforestation and improvement of quality of life.

1.4 Approach, Limitation :

As a consequence to the mining operation, the mineral reserve would be exhausted or may stand at a position when it becomes uneconomic to mine and closure becomes inevitable. As a welcome change from the earlier practice, a mine reclamation and closure plan may help to restore the mined-out area. Rehabilitation techniques should include re-contouring and re-vegetation of degraded land surface, containment of wastes through vegetative barriers there by preventing erosion or acid drainage. The

approach will also include water management measures through recontouring. The limitation for such a programme may be due to inherent characteristics of local geomorphology and prohibitive cost of ongoing and post-decommissioning rehabilitation. However, such limiting factors should not hinder the process and it has to be ensured through the aims of rehabilitation programme, that social impact study is carried out. Decommissioning and mine closure may lead to loss of income and curtailment of essential services which were built up, during operation of the mine viz. water supply, sewerage, electricity and healthcare etc. The ideal objective should be transfer of ownership of such services to the local system of Governance and continuance of such services on an agreed users-pay principle.

1.5 Project Description :

The project, proposed by M/S Lum Mawshun Minerals Pvt. Ltd. (LMMPL), is basically targeted to establish a 1.2 MTPA Cement Plant in Bangladesh; while the main raw material, limestone, is proposed to be mined over an area of nearly 100 ha in East Khasi Hills, Meghalaya, India, the quality of limestone demands an enrichment through admixture with Shale. To achieve this target a 4.9 ha Shale mine area has been identified, located between the latitudes $25^{\circ}11'25''\text{N}$ and $25^{\circ}12'00''\text{N}$ and longitudes $91^{\circ}37'28''\text{E}$ and $91^{\circ}38'01''\text{E}$. The mine area falls under Shella village and lies on the western side of the Umiam River, about 2 Km. NW of village Shella Bazar. The location map of showing Shale – mining site is given in the Figure-1, 2 & 9.

Mining Reserve

The minerable mining reserve (Figure-3) has been calculated at 72,35,374.03 M.T. up to 40 m datum as against reserve of 88,61,849.04 M.T under Proven, Probable and Possible reserve. The average rated capacity of the mine is 3,70,721.53 M.T. per annum on first 5 years plant production and the life of the mine is expected to be about 5-6 years with a lease right extending over 30 years.

The method of mining would be opencast and it is to be carried out from the top most benches gradually moving downwards; each bench will be 3.0 m. high and about 15.0 m wide. The mining equipment to be used includes 0.9 m^3 shovels and 10 ton dumpers would be used for transportation. The total quantity to be transported would be to the order of 40,000 tones per month.

The entire mining operation involving top slicing and partial mechanization of the query through deployment of light tippers, would be a completely dry operation, as such no water would be required and consequently no waste water is likely to be generated.

It is estimated that the entire mined out material would be used in one way or the other and no over burden dump would be created.

About 60 skilled/unskilled workers would be deployed for the proposed mine in two working shifts of 8 hours.

2.0 LEGISLATIVE BEST PRACTICE STANDARD AND CORPORATE CONSIDERATION

2.1 Legislative Requirement :

The guidelines laid down for post operative phase of mining (MoEF, Government of India, 1982) states that “Once the mining operation are over, the land should be rehabilitated for productive uses like agriculture, forestry, pasturage, pisciculture, recreation, setting up of wild life habitats/sanctuaries, etc.”.

The mining project during pre-operational phase, operational phase and post-operational phase are governed by the following extant legal instruments, viz.

1. The Water (Prevention and Control of Pollution) Act, 1974 and Rules, 1975.
2. The Forest (Conservation) Act, 1980 and Rules, 1981.
3. The Air (Prevention and Control of Pollution) Act, 1981 and Rules, 1982.
4. The Environment (Protection) Act and Rules, 1986.
5. The Environment Impact Assessment Notification, 1994 amended till date under EPA, 1986.
6. The Factories Act and amendments, 1948, 1987.
7. The Public Liability Insurance Act, 1991.
8. The National Environment Tribunal Act, 1995.
9. The Environmental Standard Notification, 1993, 1996.
10. The Hazardous Waste (Management and Handling) Rules, 1989 amended 2000.

Besides the environment related laws, mines and minerals legislations pertaining to environment may also be considered for the present purpose. These include:

1. Mines and Minerals (Regulation and Development) Act, 1957.
2. Mines Act, 1952 and Rules, 1953.
3. Mineral Concession Rules, 1960.
4. Mineral Conservation and Development Rules, 1958.
5. Prohibition of Mining Operations in Ecologically Fragile Areas.

Details of the above mentioned legislative requirements are given in the **Annexure I**

2.2 World Bank Policies and Guidelines :

A number of World Bank stipulated environmental and social policies and procedures are applicable to mining projects. A list of most important policies and guidelines are given below (Environment Department, The World Bank, update no. 22, March 1998):

1. OD 4.01 Environmental Assessment: Policy and procedures for EA., whereby potential impacts are taken into account in selecting, siting, planning, and designing projects.

2. OP/BP/GP 4.02 Environmental Action Plans: Policy to encourage and support borrowers to prepare, implement, and maintain environmental action plans, which should be reflected in Bank operations.

3. OP/BP 4.04 Natural Habitats: Policy to support the protection, maintenance, and rehabilitation of natural habitats. The Bank does not finance projects that involve the conversion of designated critical natural habitats.

4. OP 4.07 Water Resource Management: Policy to promote economically viable, environmentally sustainable, and socially equitable water management.

5. GP 4.11 Cultural Property: The Bank's general policy regarding cultural properties is to assist in their preservation and avoid significant damage or elimination of irreplaceable cultural property.

6. 4.20 Indigenous Peoples: Policy to ensure that indigenous peoples benefit from development project, and their projects' potentially adverse effects are avoided or mitigated.

7. OD 4.30 Involuntary Resettlement: Policy and procedure on Bank staff and borrower responsibilities towards displaced persons in operations involving involuntary resettlement.

In addition, a number of World Bank guidelines outlined in the 'Pollution Prevention and Amendment Handbook' are also of relevance, including the following:

Guidelines on Mining and Milling (Open Pit and Underground), Coal Mining Processing, Coal washing, etc.: Guidelines relating to, inter alia, liquid effluents, air emissions, management of tailings, erosion and reclamation, and occupational health and safety.

2.3 Corporate Statements :

The corporate environmental policy of Lafarge is based on concept of sustainable development and revolves around the following main themes (Lafarge and the Environment, March 2000):

- **Regulation:** Lafarge will respect local laws, standard and regulation. Lafarge pledges to work with government authorities to evaluate the benefits and costs of environmental legislation and discuss the priorities and schedules for effective implementation. Lafarge will also set up own internal standards to correspond to the internationally recognized criteria. They will be applied systematically to new and modified units.
- **Environmental Technologies:** Lafarge is committed to reduce the emission and impact of operation upon the environment and the communities in the areas of operation. It pledges to devote a significant part of technical resources to develop clean technologies, better pollution control and for efficient reduction.

- **Sparing use of Natural Resource:** This objective is a major thrust of Lafarge's efforts. Actions include a policy of reuse of by-products and residual wastes as substitute for natural raw materials and fossil fuels, as well as energy efficient production processes.
- **Research and Innovation:** The Group's efforts in the area of research and innovation are directed at every phase of the product life cycle (extraction, processing, distribution, use and disposal or reuse). To cover these various phases, the Group devotes a substantial share of its technical resources to advance its expertise in clean technologies, and pollution abatement.
- **Demanding "Lafarge Standards":** Intent on staying ahead of local regulations on the five continents on which it operates, Lafarge defines its own environmental standards, which it applies to all new units and major plant upgrades. In every case, Lafarge standards are at least as stringent as international regulations.
- **Risk Reduction:** Lafarge takes special care to ensure that its facilities and sites blend smoothly into their natural or urban environment. Moreover, potential hazard and the risk of accidental pollution are systematically assessed at every installation in order to implement effective preventive measures, to be designed.
- **Training and Evaluation:** In addition to training and awareness programmes directed at its employees, Lafarge defines special action plans to conduct regular reviews of environmental performance and measure the progress achieved. Objectives in the area of environmental protection are established for various levels of site management personnel, and their success in attaining those objectives is taken into account during individual performance reviews.
- **Communication:** Lafarge will establish communication strategy to provide clear information to all stakeholders including staff, local authorities, local interest groups, media and general public.
- **Assessment of Results:** Environmental protection goals and objectives will be established for all units, plants and managers and would be assessed at least annually.

The central group is to ensure that each unit develop its own environment policy and implement its own action plan. Each operation unit will carry out the major policy objectives and would be subjected to environmental audit.

2.4 Best Practice Standards :

According to GSR 801 (E), EPA, 1986, dated Dec. 31, 1993 the State Pollution Control Boards follow the guidelines mentioned below, for enforcing the standards specified under Schedule IV:

1. In case of lime-kilns of capacity more than 5 tpd and up to 40 tpd, the particulate matter emission shall be within $500 \mu\text{g}/\text{Nm}^3$.
2. In case of stone crushing units, the suspended particulate matter contribution value at a distance of 40 m from a controlled, isolated as well as from a unit located in a cluster, should be less than $600 \mu\text{g}/\text{Nm}^3$.

These units must also adopt the following pollution control measures:

- Dust contaminant cum suspension system for the equipment.
- Construction of wind breaking walls.
- Construction of the metalled roads within the premises.
- Regular clearing and wetting of the ground within the premises.

2.5 Environmental and Social Management :

The potential social and environmental issues associated with mining and mineral processing operations are highly significant and complex to manage, as the extent of impact due to mining activities may continue up to post-closure period of the operation, varying throughout the stages of project implementation.

Most of the mining operations share a number of common stages or activities, each of which have potentially adverse impacts on the natural environment, social and cultural conditions, on the health and safety of mine workers, or communities in the environs of the mine. These adverse impacts may be largely on the indigenous peoples.

The potential adverse impact of each of the mining activities includes impacts on air quality, hydrology and water quality, ecology and biodiversity, social and cultural conditions, human health, natural resources and infrastructure.

So, in principle the areas or resources affected by mining should be returned to a safe and productive condition through rehabilitation, which may or may not involve a return to pre-mining conditions and reclamation should be an ongoing activity through out the life of the operation as well as after decommissioning.

Rehabilitation techniques include: re-contouring and re-vegetation of degraded land surfaces; containment of toxic or acid generating wastes through the use of physical or vegetative barriers to prevent erosion or acid drainage; and long term water management measures through recontouring or by physical barriers to help contain wastes. Issues in developing a reclamation plan should include:

- ❑ Long term stability of slopes and surface materials.
- ❑ Safety issues relating to open pits, shafts, subsidence, toxic or radiological hazards.
- ❑ Physical characteristics, nutrient status and inherent toxicity of tailings or waste rock which may constrain revegetation.
- ❑ Potential for acid drainage from abandoned pits and shafts, tailings and waste rock dumps (as a consequence of oxidation of sulphides contained in the ore or wastes).
- ❑ Costs of ongoing and post decommissioning rehabilitation.

The socio-economic aspects of decommissioning are also important, particularly where the existence and economic survival of large communities may depend on a mine. Aside from loss of incomes, the provision of services such as water, sewerage,

electricity and health care may be directly linked to the mine. All these issues should be featured in the post-closure plan, which should be adequately funded.

Potential environmental and social impacts of mining activities are illustrated in the following matrix.

Matrix: Potential Environmental and Social Impacts of Mining Activities (related to reclamation and closure)

	MINING ACTIVITIES	Regrading and re- contouring	Stabilization of waste dumps and tailing	Mine closure
POTENTIAL ACTIVITIES				
Air Quality				
Increased ambient particulates (TSP & PM-10)		•		
Increased ambient Sulfur dioxide (SO ₂)				
Increased ambient Oxides of Nitrogen (NO _x)				
Increased ambient heavy metals				
Hydrology, hydrogeology & water quality				
Altered hydrologic regimes		•		
Altered hydrogeological regimes				
Increased heavy metals, acidity or pollution		•	•	
Increased turbidity (suspended solids)		•	•	
Risk of groundwater contamination			•	
Ecology and Biodiversity				
Loss of natural habitats & biodiversity				
Loss of rare and endangered species				
Effects of induced development on ecology				
Effects on riverine ecology and fisheries				
Impacts due to effluents or emissions		•	•	

	MINING ACTIVITIES	Regrading and re- contouring	Stabilization of waste dumps and tailing	Mine closure
Social concerns				
Resettlement issues				
Effects on indigenous people				
Loss of cultural heritage or religious sites				
Loss of livelihood				•
Induced development issues				
Effects on aesthetics and landform				
Noise issues				
Occupational & public health concerns				
Occupational health and safety concerns				
Hazards from process chemicals or explosives				
Potential increase in disease vectors				
Increased potential or respiratory disorders				
Resource issues				
Effects of subsidence on surface resources				
Agricultural land loss				
Loss of forestry resources				
Effects on surface water resources				
Effects on ground water resources				
Disruption to infrastructure				
Effects on fisheries				

2.5.1 Air Quality Management

For maintenance of an acceptable ambient air quality in the mining area, it is desirable that air quality should be monitored on a regular basis to check it vis-à-vis the standards prescribed by the country authority, Central Pollution Control Board (CPCB)

In India, ambient air quality data should show that the concentrations of SPM, SO₂, CO and NO_x are within the stipulated CPCB standards. The proposed mining operations and related activities are expected to add to the levels of air borne particulate. However, the addition of gaseous pollutants due to the proposed activities is expected to be relatively low under controlled operation.

2.5.1.1 Controlling Dust Levels

Dust would be generated during mining, crushing operations, and also during handling and transportation of the material. The suggested control measures include:

Mine

Dust suppression systems (water spraying) will be adopted at

- Faces/sites while loading;
- Use of sharp teeth for shovels;

Stock-piles

- Mist sprays will be provided at appropriate places for preventing dust pollution during handling and stockpiling of shale.

Haulage

- Regular water spraying on haulage roads during transportation of shale up to conveyor belt system by water sprinklers will be carried out.
- Transfer points shall be provided with appropriate hoods/chutes to prevent dust emissions.
- Dumping of shale should be done from an optimum height (preferably not too high) so as to reduce the dust blow.

Crusher

- Crusher will be provided with “Bag Filters” to arrest any dust emission. The dust emission level will be kept within the prescribed standard of $150 \mu\text{g}/\text{Nm}^3$.
- Water sprinkling system will be provided to check any fugitive emissions from the crushing operation.

Belt Conveyor

- Close conduit type conveyor belt will be used for transportation of crushed material to Cement plant at Chattak, Bangladesh. The belt and idlers will be maintained in proper condition so as to avoid spillage of material and prevent any fugitive emissions.

Greenbelt

Even with the various dust suppression measures in place, dust generated from mine faces, are difficult to control. Therefore, in addition to the above mitigative measures, it is proposed to have plantation in and around the mine site, crushing, loading and unloading facilities, corridor of belt conveyor route and in abandoned mine area during reclamation process.

It is expected that plants with 10m, 20m and 30m height can reduce dust pollution by 50%, 70% and 80% respectively. A combination of these, with appropriately selected

species would be planted depending on the requirements and the extent of the problem.

2.5.1.2 Controlling CO Levels :

The concentration of CO in the ambient air was below detectable limits during pre-mining period at all the air quality monitoring locations. Expected increase in the CO concentration is very low, as CO emissions from mining operations are less compared to other pollutants. Heavy and light vehicles are the major sources of CO in the mine. All vehicles and their exhausts would be well maintained and regularly tested for pollutant's concentration.

2.5.1.3 Controlling NOx Levels

NOx emissions in the mine mainly occur during blasting operations. However, no blasting would be required in the present mining operations. The only other source of NOx would be due to vehicular emissions, which will be controlled appropriately.

2.5.1.4 Occupational Health & Safety Measure to Control Dust Inhalation

All the above precautions would be adopted to prevent dust generation at site and to be dispersed in the outside environment. However, for the safety of workers at site, engaged at the strategic locations/dust generation points like loading & unloading points, crushing etc, dust masks would be provided. Dust masks would prevent inhalation of RPM thereby reducing the risk of lung diseases and other respiratory disorders. Regular health monitoring of workers will be carried out by the company.

2.5.1.5 Noise Pollution Control

The present ambient noise level recorded in and around the proposed mine shows that the ambient noise levels are well within the stipulated limits of CPCB, Govt. of India.

Within an operational mine, major noise sources are operation of mine machinery and equipment, crushing units and belt conveyor. Noise generation may be for an instant, intermittent or continuous periods, with low to high decibels.

To keep noise generation in control, latest sophisticated technology and equipment have been considered. Dumpers etc with larger capacities will be acquired to reduce the number of operational units at a time, thereby reducing the noise generating sources.

The equipment systems will include cabins to ensure that the operators and other work persons, in and around the operating equipment, have comfortable workstations.

To keep the ambient noise levels within the permissible limits of 75 dB (A), the following measures would be adopted :

- Innovative approaches of using improvised plant and machinery designs, with in-built mechanism to reduce sound emissions like improved silencers, mufflers and closed noise generating parts.
- Procurement of dumpers and other equipment with noise proof system in operator's cabin.
- Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas.
- Regular and proper maintenance of noise generating machinery including the transport vehicles and belt conveyors, to maintain the noise levels.
- Siting of mine colony, buildings and other infrastructure away from the noise sources with the probability of sound waves being directed towards them being least.
- Provision should be made for noise absorbing pads at foundations of vibrating equipment to reduce noise emissions.
- Thick plantation should be provided at the mine periphery, within the mine area along the roads and all around the working areas, to screen the noise.

Shella village is the nearest human habitat located at about 2.0 km away from the proposed mine area. The noise generation from the mine may be of concern to the inhabitants.

2.5.1.6 Occupational Health and Safety Measures to Control Exposure to Noise

To protect the workers from exposure to high levels of noise, following measures would be adopted: `

- Provision of protective devices like ear muffs/ear plugs to workers who cannot be isolated from the source of high intensity noise.
- Confining the noise by isolating the source of noise as discussed above.
- Reducing the exposure time of workers to the higher noise levels by shift management.

2.5.2 Control of Ground Vibration & Fly Rocks/Boulders

As no blasting phenomena would be involved, there would be no major ground vibrations that would need to be controlled.

2.5.3 Land Management

Land degradation is one of the major adverse impacts of open cast mining in the form of excavated voids and also in the form of waste dumps. Land reclamation plan must, therefore, be implemented simultaneously with the mining activities.

2.5.3.1 Land Reclamation

One of the requirements of MMIRD Act, 1957 in India is to ensure simultaneous reclamation of land along with other mining operations. To reduce the time gap between land excavation and reclamation, year wise programme of excavation including shale, topsoil and overburden has to be charted out.

Land degradation is one of the major adverse impacts of open cast mining. Any effort to control adverse impacts would be incomplete without an appropriate land reclamation strategy.

The first step in a successful reclamation programme is to decide the post reclamation land use. In this case it is considered appropriate to convert the land under a cover of dense vegetation, keeping in view the following :

- Area is rich in vegetation and further plantation would match with the existing environment;
- Trees absorb CO₂, contribute oxygen, purify the air, conserve the soil and prevent its erosion. Trees promote precipitation and add to stabilization of slopes;

Keeping the above in view, the land reclamation shall be carried out with an emphasis on plantation. At any point of time the area under disturbance shall be kept at minimum. This would be achieved by ensuring reclamation of excavated area concurrently with mining activities by reducing the gap between the first damage (mining) and the first repair (reclamation) to the bare minimum.

The disturbed land including the area disturbed due to excavation, dumping, construction of haul roads, ramps, structures etc would be fully reclaimed before finally abandoning the mine. The reclamation process shall take at every stage availability of land after mining :

- One year for preliminary soil work;
- Another four years for landscaping and stabilisation of plantation.

Thus every mined out area shall be fully reclaimed within five years of completion of mining operations in a phased manner,

During post mining period, all the disturbed areas will be reclaimed before decommissioning/abandoning the mine, excluding the buildings office etc., which

will be left as such to be later used as social infrastructures by the population in the vicinity. The belt conveyors, crushing plant and material handling system will be dismantled and reclaimed.

2.5.3.2 Soil Conservation Measures

To prevent soil erosion and wash-off of dump-fines from freshly excavated benches and dumps following measures would be adopted:

- Garland drains will be provided around the mine wherever required to arrest any soil from the mine area being carried away by the rain water;
- Toe drains "with suitable baffles will be provided all along the toe of the soil dumps to arrest any soil from the dump slopes being carried away by the rain water;
- Special local stone paved chutes and channels will be provided, wherever required, to allow controlled descent of water, especially from the top of the slope to the foothills;
- Bench levels will be provided with water gradient against the general pit slope, to decrease the speed of storm water and prevent its uncontrolled descent.
- Gully formations, if any, on sides of the benches may be provided with check dams of local stone or sand filled bags. The inactive slopes will be planted with bushes, grass, shrubs and trees after applying top soil to prevent soil erosion; Loose material slopes will be covered by plantation by making contour trenches at 2 m interval to check soil erosion both due to wind and rain;
- Retaining walls (concrete or local stone) will be provided, around the stockpile or wherever required, to support the benches or any *loose* material as well as to arrest sliding of loose debris.

2.5.4 Hydrology, Hydrogeology & Water Quality

Surface water will be pumped from the Phlangkaruh River to meet the requirement for the mine and its infrastructure. LMMPL proposes to install a pump for meeting the water requirement, both for industrial and domestic usage. No ground water extraction will be needed for the mining operation. So the possibility of lowering ground water table is nil.

2.5.4.1 Water Quality

The potential impact on the surface water quality is likely to be due to higher load of suspended solids. Source of suspended solids would be:

Wash off from Shale Dumps

During the heavy rainfall the wash-off from the shale dumps will lead to the adjoining surface water body. This is likely to increase the alkalinity of the water and also increase the suspended solids.

Management: Therefore, landscape of the shale dumping area should be shaped, capped and graded, so as to prevent soil erosion along with the run-off.

Oil Spillage from Maintenance Workshops

Oil spillage from the workshop in the wastewater will add to the pollution load resulting in oil and grease contamination of surface water from mine infrastructural facilities.

Management: To treat the wastewater, if any, it will be led to pass through a bar screen followed by oil trap where oil content of wastewater will be recovered. This will be followed by subsequent treatment before final discharge. Once the oil is removed and the wastewater generating from the workshop is treated, it will have negligible impact on the environment.

Effluent from Mine Infrastructure

The associated infrastructure is not anticipated to cause depletion of water resources (both ground and surface water), as the requirement for water will be met from the water of perennial Phlangkaruh river. Sanitary waste water generated from various facilities, if discharged without proper treatment will have adverse impact on the surface and ground water quality' and could lead to water borne diseases, etc.

Management: All the wastewater will be treated in the effluent treatment plant. Regular monitoring of mine water quality will be done to prevent and control the pollution of the nearby surface water. Monitoring results will also form the basis for adoption of appropriate treatment process and up-gradation of treatment facilities developed, in due course of time.

Impact of Polluted Water

The polluted water generally contains objectionable odour and colour. It may also be acidic, toxic and highly turbid. Such water is unfit for drinking or any other use. In some cases these may also contain pathogenic micro-organisms, which pose potential health hazard.

Management: As the daily quantities of water used will be small and there will be treatment of effluent generated which is proposed to be used for watering the green belt plantation, hence, the opencast mining operation will not disturb the natural drainage pattern of the core and buffer area, both upstream and downstream. As such the inhabitants of the area depending on river water are expected to be unaffected due to mining operations at Shella block.

2.5.4.2 Impacts of Mining on Ground Water

The potential impact of mining would have negligible impact on the ground water, as the site and its adjoining areas are located at an elevated topography. Coupled with mine run-off management planning and regional geology, the likely chances of the contaminants reaching the groundwater are very rare. In general, the entire study area will be devoid of bore wells for the water sources.

2.5.5 Ecology and Biodiversity

Ecological surveys in the core zone and buffer zone, reveal no exceptional features of wildlife interest. The surveys were based on the following seven evaluation criteria (Table-2)

Table-2 : Ecological Criteria & Observations

Land use	Extent of modification by man. The area is classed as semi natural agricultural land.
Size	The land taken for the proposed mining is not large in the context of the surrounding.
Diversity	A number of different floral species present. But the higher vertebrate species composition is poor.
Rarity	There is no endemic, rare or threatened species in the proposed mining area.
Proximity	There are no Reserve forest, Wildlife sanctuary, National Park or Biosphere Reserve within the core or buffer area.
Potential value	Ability to improve, possibly with active management is foreseen. After restoration of mining area will increase habitat condition.
Intrinsic appeal	Species weightage for more popular species. There are no exceptional species present.

Management of Mining Area

Project proposals include number of measures to restore the disturbed area and also improvement of the habitat. Under the afforestation plan, it is proposed to develop a plantation around the mining area. The plantation not only adds up as an aesthetic feature, but also acts as a pollution sink.

The main aim of the plantation of the mined out areas is to stabilise the area to protect it from rain and wind erosion. The plantation not only adds up an aesthetic feature, but eliminating fugitive emissions will also help noise control. It also improves the habitat for the wildlife. Local community will benefit from collection of non-wood forest products (NWFP).

2.5.6 Social Issues and Management

The impacts of social related issues can be listed under following categories:

- Resettlement issues
- Effects on indigenous people
- Loss of livelihood
- Induced developmental issues
- Effects on aesthetics and landforms
- Noise issues

Management of Social Issues

Resettlement issues

No home or dwelling units lie in any of the any land required for the mining purposes. As such, the project would not result in any displacement of population who would have required to be provided with rehabilitation or compensation.

Effects on indigenous people

LMMPL estimates that it will need approximately 25 skilled workers from outside the district (representing approximately 50% of the workforce). Many workers, particularly from Shillong in Meghalaya State, will probably not bring their families preferring to return home on bi-monthly or monthly basis. This will reduce the effects on indigenous people.

Loss of livelihood

Loss of livelihood by LMMPL mining project is not significant, due to the fact that no home or dwelling units lie in this area. Again the area is a shale rock covered with vegetation. This area is not used for agricultural or other purposes. On the other hand it will create job opportunity for the local people and increase potentiality of income generation downstream.

Induced developmental issues

The proposed site for the colony is approximately 2 km south of the mine site, which is uninhabited area, covered with scrub and isolated land from the nearby settlements. The isolated location of the colony area will help in reducing any potential cultural conflicts, which may arise between the incoming workers and the residents of the area.

Effects on aesthetics and landforms

On-going land reclamation and afforestation activity will improve the aesthetics and landforms of the mining site and surrounding areas.

Noise issues

Noise pollution control measures will reduce the impact on local people.

3.0 MINE RECLAMATION AND CLOSURE PLAN

3.1 Reclamation Objective and Land Use :

The objective of the reclamation is to ensure mitigation of adverse impact in the post mining scenario. Residual problems from surface mining in general may include erosion, weathering, water logging and failure of remaining high walls, waste pile

slopes etc. Other problems may include ground water seepage from the abandoned mine working, disruption of aquifers etc.

The present land use (Figure-4) of the core zone of the proposed mining area shows forestland without any human population while the buffer zones has village, plantation and agricultural land. No adverse impact is foreseen in the buffer zone due to proposed shale mining operation, as all the mining activities will be confined to the core zone of 4.9 ha (Figure-5).

The ongoing reclamation with the projected 3 phase work plan is likely to ensure stabilization of the mine area through a process of afforestation. The plant species have been carefully selected for soil binding and prevention of erosion. Additional benefit of afforestation besides reclaiming the land to the erstwhile use as forestland, are expected from non-wood forest produces which are deemed useful for the local community. Details of the reclamation through afforestation are given elsewhere (3.6).

3.2 Socio Economic Consideration :

The mine being opened in a predominantly forest land with no settlements or habitation would not result in the generation of any oustees or displaced population, who would otherwise have been required to be rehabilitated and provide with adequate compensation.

Social setup in the Project area

In the surrounding areas of the mine, over 80% of the population belong to the Khasi tribe and its sub tribes with agriculture as the main occupation. A segment of the Garo ethnic group and the Bengali migrants from Bangladesh form the rest 20% of the population. The average population per household is 5-6. The ratio of male to female is nearly 1:1 (number female per 1000 male in Shella is 954). The literacy rate in Shella is 50% on an average and female education is comparatively higher than that of other Indian states. Medical facilities such as dispensaries, maternity home, child welfare etc. are available at the local public health centre. Inadequacy of water supply, electricity, sanitation and transport is very much apparent.

The main working class segment comprises of persons engaged in plantation and orchards. 48% of the land is occupied by plantation or cultivation. Most of the lands are natural rain fed. In Shella and Bholaganj area, Kharif (summer crop) consists of maize, Tejpata (bay leaf), Betel nuts and paddy and black & white pepper, several varieties grow in these area and protected by the villagers. These are sold in local market as non-timber forest produces (NTFP) with a prospect to export to Bangladesh. Banana grows wild in foothills. Shella area is also famous for orchards with potential to grow oranges, peaches and guava. Limestone mining is the other occupation of the people in the area. Animal husbandry is practiced for self-consumption. The study area is renowned for the betel nut cultivation and the variety grown in the foothills has the distinction of very good quality. The foothills are cultivated for turmeric and are regarded as one of the most productive areas of the district.

Infrastructural facilities are very poor in this area, however 70% villages have educational facilities in the village at primary level. All the villagers have tap water as drinking water source. Shella is also well connected by roads.

Employment Opportunity

Proper publicity of the beneficial aspects of the project, particularly for the local people and highlighting the new opportunities of livelihood would largely defuse any social discontent. During the mining operations, total number of work force requirement will be 60. Some of the skilled labour would probably be imported from outside the study area and would have to be given accommodation near the construction sites. But bulk of the labour force would comprise of unskilled/semiskilled workers, a substantial number of whom would presumably be recruited from the surrounding areas.

The compensation for the land to be used for the shale mining will be paid to the individual property owners on mutually agreed upon terms.

Socio Economic Welfare Assistance

The proposed project shall enhance the prospects of employment of unskilled and semi-skilled workforce from the local area. The development of basic amenity viz. Roads, transportation, electricity, drinking water, proper sanitation, educational institutions, medical facilities, entertainment, etc., will be enhancing the quality of life.

3.3 Tailing dam, Open pits, Dumps and Stockpiles :

3.3.1 Tailing Dams & Dumps

No wet processing is envisaged and therefore no tailings dam is envisaged throughout the life of the mine.

It may be noted that there is no overburden and the entire mining will comprise shale/siltstone that will be consumed. As the area has mixed flora, whatever topsoil is available within the area will be removed and stored separately. The topsoil dump of 0.38 ha will be a temporary storage. Some quantities of topsoil will be used for plantation development (a width of 7.5m within the lease boundary). The rest will be stored for reclamation at the end of the life of mine that is expected to be about 5 to 6 years. Since the topsoil will need to be stored beyond one season and since the area is prone to heavy rains, management of topsoil dump will assume significance. In order to maintain the fertility of the topsoil, a vegetation cover will be created by growing local grass and shrubs. Once the topsoil from the dump is utilized, the same area will be afforested.

3.3.2 Stockpiles

Whatever shale/siltstone that will be mined will be despatched on a day to day basis to the adjacent Nongtraï Limestone Mine ROM stockpile area from where it will be transported to the crusher and onto belt conveyor to cement plant. Thus, no temporary storage (except for the topsoil dump which has been discussed earlier) or stockpile is envisaged here (Figure 8).

3.4 Accommodation, Roads, Processing Plant and Ancillary Facilities (Figure 8) :

The workers in the quarry will either come from nearby towns or will be accommodated in the proposed Nongtraï Limestone mines colony. Thus, even after the Shella Shale Quarry is closed, the colony will continue to cater to Nongtraï Limestone Mines. Similarly, the crushing plant installed for Nongtraï Limestone Mine will be used for shale crushing and therefore, the crushing plant will continue to cater the Nongtraï Limestone Mines. The proposed shale / siltstone excavation is shown in Table -3.

Table- 3: Annual Schedule of Excavation

Year	Shale / Siltstone excavated (tonnes)
1 st	527,908
2 nd	234,574
3 rd	419,484
4 th	403,440
5 th	268,200

Two areas of about 40 m X 30 m and 100 m X 40 m have been earmarked outside the mining lease boundary for servicing the mining equipment and providing rest shelter. Except for these, the administrative, diesel, etc. services will be catered from Lafarge's adjacent Nongtraï Limestone Mine. The entire area available within the lease area of 4.9 ha will be utilized for mining after leaving the statutory 7.5 m width along the lease boundary. The pit area will be separated by a suitable vegetative belt, to reduce the migration of pollutants. Afforestation would also be done along out-of-pit service roads and around the service areas with planting started at the beginning of mine operation in a planned way. The reclaimable areas available during mining and final mine closure phases are shown in Table-4.

In order to minimise the effect of run-off from the disturbed mining areas, drainage channels will be constructed around the pit limits. To prevent erosion of fines from freshly excavated areas, gully formations on sides of benches shall be provided and the water will then be guided to a sump at the bottom most bench, where the fines will be settled. Pumps of adequate capacity will be provided for draining the water from the sump.

Table 4: Reclamation %age of Disturbed Area/Other Areas Planned for Afforestation

During	Area	Disturbed	Cumulative	Afforestation Area Planned (Ha)
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Period (Year)	disturbed for mining (Ha)	area available for reclamation (Ha)	Reclaimable Area as % of Cumulative Disturbed Area	Undisturbed within lease	Around Service Areas	Top soil dump area
1	2.59	-	0%	1.33	0.20	-
2	0.98	0.60	23%	-	-	-
3	-	0.20	22%	-		-
4	-	-	22%	-		-
5	-	-	22%	-		-
End of 5	-	2.77	100%	-	0.34	0.38
Total	3.57	3.57	100%	1.33	0.54	0.38

The Table above shows that at the end of first year itself some of the top benches that would have extended up to its limit become available for afforestation (0.6 Ha). At the end of second year, further about 0.20 Ha owing to lower benches reaching their ultimate limit. Mining will be restricted to within 3.57 Ha out of the 4.9 Ha lease area. This is owing to leaving a 7.5m width area all along the lease boundary from within as well as leaving about 0.47 Ha around the nala area. The total undisturbed area (inclusive of within lease area and outside lease area) proposed for afforestation is 1.53 hectares. This entire area can be afforested during the first year of mining itself. At the end of 5 years (Figure 10) reclamation by afforestation can be taken up over 0.34 Ha utilised for service purposes, 0.38 Ha utilized for storing topsoil in dump and balance of the disturbed mining area of 2.77 Ha. The stage-wise afforestation and reclamation plan period-wise is given in the Table-4, (Figure-6, 11 & 12) above.

The pre-closure mine area reclamation plan (MRP) (Figure-7) will cover the following areas during mining activity:

- Open pit areas
- Areas undisturbed within the lease (that will not be disturbed through out life of mine)
- Service Areas
- Top soil dump

The reclamation will involve:

- Storage of Topsoil generated from within the lease area and & Procurement of Topsoil from outside, as and when necessary.
- Preparing the areas planned for afforestation;
- Preparing the abandoned mining benches for afforestation;
- Re-carpeting, planting of vegetation and afforestation as required.

The quantum of topsoil estimated to be generated during mining is (35700 sq. m x 0.40 m assumed) 14280 cum. This material will be stored at the area (75 m x 50 m) as shown in figure above. In order to preserve the topsoil in the dump from deteriorating, a vegetation cover will be created by growing local grass and shrubs. The topsoil requirement period-wise may be estimated based on the reclaimable areas proposed in Table-4. If more topsoil is required for afforestation at the end of the life of the mine, additional topsoil may be procured from outside. The topsoil shall be stacked in such

as way so as to provide maximum surface area for higher biological activity and to have slopes capable of sustaining vegetation to avoid erosion and gully formation.

Topsoil requirement for filling up 1600 pits per ha. (81.25 m³ of manure and soil per ha.) The quantum of plantations period-wise may be estimated according to Table-4.

Protection of Reclaimed Area: The reclaimed and afforested area needs to be protected from soil erosion and plant diseases. Check bunds, masonry chutes, protected drains will be built to help prevent soil erosion and washing away of soil nutrients during precipitation events. Plants will be sprayed with pesticides to protect them from diseases. Soil working and manuring will be done whenever necessary.

3.5 Acid Rock Drainage Management :

As the water coming out at Phlangkaruh is alkaline, no separate provision for management of acid rock drainage is made. As such no acidic run-off is envisaged on account of mining.

3.6 Rehabilitation of Disturbed Areas :

The Restoration plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area. The objectives of the restoration plan are :

- To reclaim the mined out areas by planting trees which are indigenous in nature;
- To provide a green belt around the periphery of the mine areas crushing, loading-unloading points and conveyor belt corridor to combat dispersal of dust in the adjoining areas;
- To protect the erosion of the soil;
- To conserve moisture for increasing ground water recharging;
- To restore the ecology of the area;
- To restore aesthetic beauty of the locality;
- To meet the requirement of fodder, fuel and timber of the local community;

3.6.1 Selection of Appropriate Species

Species have been selected and restoration programme developed in order to ensure a diverse and robust polyculture forest is developed after mining. Species that are native to the area have been given preference. At the same time the species which have dust tolerance have also been focused on; growth rates of the species have also been considered as the area needs to be covered very quickly. The area is also full of shale and will be uneven after completion of mining, and the base is likely to have residual shale and be devoid of any top- soil and nutrition. As such the species which can survive in such adverse conditions have been selected.

After considering all the aspects stated above, the following species are recommended to be planted in the area in phased manner, according to availability of land, on completion of mining of shale at various stages. **All the species recommended are selected from indigenous flora.** The species are listed in Table –5

Table-5 : Suitable Tree species

Sl. No.	Scientific Name	Local Name	Proposed Percentage
A.	Trees		
1.	<i>Alstonia schoilaris</i>	Megong; Rabert	5%
2.	<i>Albizia procera</i>	Chikrashi	5%
3.	<i>Albizia odoratissima</i>	Luaipap	10%
4.	<i>Artocarpus chaplasha</i>	Pang-band; Phang-araung	10%
5.	<i>Artocarpus heterophyllous</i>	Bogamodar; Deing sang	5%
6.	<i>Bauhinia purpurea</i>	Champ; Leihao-peisang	5%
7.	<i>Chukrasia tabularis</i>	Jinge-kaung; Kanthlyen-kung	10%
8.	<i>Duabange grandiflora</i>	Orang-phop	10%
9.	<i>Gmelina arborea</i>	Poma	5%
10.	<i>Erythrina arboresceus</i>	Betel nut	5%
11.	<i>Michelia champaca</i>	-	5%
12.	<i>Sterculia villosa</i>	Hiku	5%
13.	<i>Tetrameles nudiflora</i>	-	5%
14.	<i>Tonna ciliata</i>	-	5%
15.	<i>Areca catechu</i>	Bol-matra, Dudhkhuri	10%
B.	Bamboos		
16.	<i>Dendrocalamus hamiltonii</i>	Amliso	10%
17.	<i>Bambusa khasiana</i>	Amliso	10%
C.	Shrubs		
18.	<i>Holarrhena antidysenterica</i>	Amliso	60%
D.	Grass		
19.	<i>Thyssonolena maxima</i>	Amliso	20%

3.6.2 Availability of Area for Restoration

A total area of 4.9 ha from where the Shale Mining will be done, is available for afforestation. The entire area is proposed to be mined within 5 years at the initial phase. It is presumed that the area for restoration will be available in phased manner as soon as the mining process and the area available for afforestation 1.53 ha at 1st year, 0.60 ha at 2nd year, 0.20 ha at 3rd Year and another 2.77 ha at the end of 5th year.

As the area is having sporadic stunted trees with considerable blanks in between, it is proposed in the Environmental Management Plan to provide a green belt along the periphery of the mining areas, crushing, loading and unloading points and also corridor of belt conveyor with suitable fast growing and dust tolerance species to arrest the residual dust particles even after the various dust control measures proposed to be taken. So the total area under afforestation will be:

Mine Lease areas	: 4.90 ha
Disturbed area for mining	: 3.57 ha
Undisturbed within lease	: 1.33 ha
Service areas	: 0.54 ha
Top soil dump area	: 0.38 ha

Total areas : 5.82 ha

According to the approved mining plan the area which will be available for afforestation at various stages of the mining operation are given below (Table-6)

Table -6 : Availability of Afforestation Area

Mining Area			Around service areas (ha)	Top soil dump area (ha)	Total area at different year (ha)	To be taken up for afforestation at the year of mining
At the end of the year of mining	Area available for afforestation at the year of mining (ha)	Undisturbed area within lease (ha)				
01	-	1.33	0.20	-	1.53	03
02	0.60	-	-	-	0.60	04
03	0.20	-	-	-	0.20	05
05	2.77	-	0.34	0.38	3.49	07
Total	3.57	1.33	0.54	0.38	5.82	-

3.6.3 Nursery

As there is no Forest Department nursery in the area, there is no possibility of obtaining the desired seedlings. As such, a nursery is proposed to be established by the Mining Company. Land for nursery to be procured nearest to the planting site. If possible the existing nursery proposed to be established for Limestone Project may be utilised.

An area of 0.05 ha will sufficient for the required nursery. The area should be as close as possible to the plantation site. On the other hand, a source of water for watering the seedlings is an essential criteria. Attempts should be made to create an earthen dam near about or within the mining lease area to store the water, where the nursery is to be located. The stored water in the earthen dam will be utilised in watering the plantation seedlings during the dry period of the year. If it is not feasible to create the earthen dam the nursery may be located down on the bank of river Phlangkaruh which is situated nearby. Following points are to be noted for afforestation programme.

Keeping these key requirements in mind, efforts to determine an exact location for the nursery are currently ongoing and discussions with local people/ site suitability evaluation is being carried out.

The following are key points to be noted for afforestation programme.

3.6.3.1 Seed

For successful afforestation, good nursery stock is essential. For this purpose good matured seeds from genetically superior trees are required. Seeds will be collected mostly from the Forest Department and if some seeds are not available with them, then those are to be collected from the reputed seed suppliers. A time schedule is to be followed according to the availability of seeds, as per their maturity and viability.

3.6.3.2 Seedlings

Two years old tall seedlings are to be planted for afforestation. For the purpose polythene tube of size 22.5 cm x 15 cm with thick gauge is to be procured and the seedlings are to be raised in the polythene tubes after filling the same with imported good earth and cow-dung manure in 3:1 proportion.

3.6.3.3 Small sized Seeds

For small sized seeds (e.g. *Alstoria*, *chukrasia spp*), the seeds are to be sown in mother beds, after pretreatment and to be pricked out in polythene tubes, while the bigger seeds are to be dibbled in the polythene tubes directly.

3.6.3.4 Weeding, Cleaning and Howing

Weeding, cleaning, howing of seedlings and application of oil cake are to be done occasionally to boost up the growth of the seedlings. Sorting, shifting and culling of seedlings to be done to avoid penetrating the root in the nursery soil and to get genetically superior seedlings of uniform height.

At least one permanent staff (*Mali*) is to be recruited beside casual staff, and maintained for upkeepment of the nursery at the project cost.

3.6.4 Planting Technique

3.6.4.1 Soil Work

The mine-area is almost devoid of any topsoil. Hence the soil will not be available after mining. Further after mining it is expected that the excavated area will be having some rocky outcrop.

The excavated area left out after mining is to be terraced and contour bunding is to be done with the rubbish (stone dust) and boulder particles at the site preferably at 10 m interval. Planting pits of size 45 cm x 30 cm at the top, 30 cm x 30 cm at the bottom and 45 cm deep are to be dug at 2 m apart lines and 2.5 m apart in line in staggered manner. No pits should be dug along contour bund, which will be used for sowing seeds and planting broomstick shrubs and bamboos. As the area is expected to have some rocky outcrop in the bottom strata, the help of drill machine may be resorted to in such cases, where it is not possible to dig the planting pits manually. The planting pits are to be filled up with good imported earth mixed with cow-dung in 3:1 proportion. If it is difficult to procure cow-dung, then sane may be replaced by leaf compost, which may be prepared at the nursery site.

3.6.4.2 Planting Pattern

Contour bund made after terracing will be planted with rootstalk of *Thysonolena maxima*; *Holarrhena antidysenterica* are to be planted along contour bund at 1 m apart. Rhizomes of *Bambusa khasiana* / *Dendrocalamus hamiltonii* are to be planted

along the contour bund at 10 m apart. Seeds of Chukrasia may also be sown along the contour bund.

The tall seedlings (2 years old) raised in the nursery are to be planted in the planting pits at the onset of monsoon. The species should be planted with suitable design as per nursery stock. Planting should be completed by the month of May. Replacing of casualties should be done as and when vacancy occurs.

3.6.4.3 Tending Operation

During first year 100 grams of chemical fertilizer should be applied to each plant in two doses while 1st and 2nd weeding, cleaning and mulching is done after one month interval of planting. 3rd weeding, cleaning and mulching without chemical fertilizer is also to be done after two months of 2nd mulching in the first year. Composition of the chemical fertilizer is to be ascertained after testing the soil of the planting site. Protection of seedlings against grazing is to be done by providing watch & ward personnel. Fire protection measure is to be taken during dry season. Plantation is also to be irrigated by laying a water pipe line from the identified water source with the help of pump once in a week during dry season from November to April.

During the 2nd year replacing casualties are to be done again. Weeding, cleaning and mulching is to be done two times during the year (during the months of June and September). Protection against grazing, fire and system of irrigation should be continued as has been recommended for the 1st year.

During 3rd year of plantation weeding and mulching of seedlings are again to be done twice (June & September). Fire protection measures are to be taken from November to April.

During 4th and 5th year fire protection measure is to be taken from November to April.

All the plantation and nursery works, both for the Limestone and Shale mine, are to be done under the direct supervision of a senior and experienced Forest Ranger who may be taken on deputation from the State Forest Department.

3.6.5 COST NORM FOR CREATION OF PLANTATION UNDER LMMPL MINING PROJECT FOR 1 HA

1 ha = 1600 seedlings & 400 seedlings by sowing
space – 2 m apart line and 2.5 m apart seedlings in line
1 man-day = Rs. 50.00

A.	Preliminary work	
1.	Cost of survey and demarcation including fixing of boundary marks at strategic points	Rs. 100.00

2.	Cost of cleaning of debris and terracing the land and making contour bunding with the debris at 10 m apart	Rs. 1000.00
3.	Cost of digging planting pits in hard lime stone area with occasional drilling by driller as and where necessary at a spacing of 2.5 m apart in line and 2 m apart line (leaving contour bund) of size 45 cm x 30 cm at top; 30 cm x 30 at bottom cm and 45 cm deep over 1600 nos. @ 3.50 each.	Rs. 5600.00
4.	Cost of making one camp hut	Rs. 400.00
5.	Cost of making inspection path	Rs. 150.00
6.	Cost of supply of the following for filling up planting pits including carriage up to site:	
	a) good earth 60.75 cu m or say 61.00 cu m @ Rs. 50/- per cu m	Rs. 3050.00
	b) cowdung manure / leaf compost 20.25 cu m @ Rs. 100/- per cu m	Rs. 2025.00
7.	Cost of filling up planting pits with good earth and cowdung manure / leaf compost in a proportion of 3:1 mixed intimately over 1600 Nos @ Rs. 0.50 each	Rs. 800.00
8.	Cost of supply of tools and plants	Rs. 200.00
9.	Cost of supply of seeds for sowing along contour bund	Rs. 105.00
	Total	Rs. 13430.00
B.	Creation	
1.	Cost of sowing seed along contour bund including hoeing lines covering seed, and also planting root stalk of Broom stick and <i>Holarrhena</i> spp. at 1m apart and planting Bamboo rhizome at 10m apart along contour bund including collecting of the same	Rs. 150.00
2.	Cost of planting poly potted seedlings including carrying from nursery to plantation site, digging holes, taking out the poly pot and planting with proper pressing complete (1600 & 200 for filling vacancies) = 1800 nos. @ Rs. 0.50	Rs. 900.00
3.	Cost of supply of chemical fertilizer to boost up the growth of the plantation 160kg @12.50 per kg including (carriage up to site)	Rs. 2000.00
4.	Weeding cleaning & mulching the seedlings	
	a) with the application of chemical fertilizer 1600 nos. @ Rs. 0.50 per plant x 2 times	Rs. 1600.00
	b) without application of chemical fertilizer 1600 nos. @ Rs. 0.45 per plant	Rs. 720.00
5.	Cost of fire protection during dry and windy season from November to March in the creation year and April of the following year including sweeping of fire line	Rs. 1000.00

6.	Cost of laying and watering the plants during dry season from Nov. to March in the creation year and April of the following year once a week = 26 weeks (with the help of pump)	Rs. 2000.00
7.	Watching over the plants from grazing from June to March = 10 months	Rs. 2800.00
	Total	Rs. 11,170.00
C.	Second year of plantation	
1.	Cost of infilling vacancies in mortality areas including carriage of seedlings from nursery 200 nos. @ Rs 0.50 each	Rs. 100.00
2.	Cost of weeding, cleaning and mulching the seedlings 1600 nos. @ Rs. 0.45 each x 2 times	Rs. 1440.00
3.	Cost of fire protection of the area from November to March of 2 nd year & April of the following year including sweeping of fire line	Rs. 1000.00
4.	Cost of watering the plants during dry season with the help of a pump once in a week from November to March of 2 nd year & April of the following year = 26 weeks	Rs. 2000.00
5.	Cost of watching over the plants from grazing from April to March = 12 months	Rs. 2360.00
	Total	Rs. 6900.00
D.	Third year of plantation	
1.	Cost of weeding, cleaning and mulching the seedlings 1600 nos. @ Rs. 0.45 each x 2 times	Rs. 1440.00
2.	Cost of fire protection of the area from November to March of 3 rd year & April of the following year including sweeping of fire line	Rs. 1060.00
	Total	Rs. 2500.00
E.	Fourth year of plantation	
1.	Cost of fire protection of the area from November to March of 4 th year & April of the following year including sweeping of fire line	Rs. 1000.00
	Total	Rs. 1000.00
F.	Fifth year of plantation	
1.	Cost of fire protection of the area from November to March of 5 th year & April of the following year including sweeping of fire line	Rs. 1000.00
	Total	Rs. 1000.00

Abstract

a) Preliminary works

Rs. 13,430.00

b) 1 st year	Rs. 11,170.00
c) 2 nd year	Rs. 6900.00
d) 3 rd year	Rs. 2500.00
e) 4 th year	Rs. 1000.00
f) 5 th year	Rs. 1000.00
Grand Total	Rs. 36,200.00 per ha

3.6.6 COST NORM FOR CREATION OF NURSERY UNDER LMMPL MINING PROJECT (for 1 ha plantation = 1 bed)

Size of bed = 15m x 1.30m

Size of Poly bag = 22.5cm x 15cm

One man day = Rs. 50.00

A.	Preliminary Works	
1.	Cost of preparation of tube bed of size 15m x 1.30m x 0.2m deep for placing Polly bags	Rs. 75.00
2.	Cost of preparation of mother bed 5m x 1.30m x 0.20m, deep, pulverizing the soil, mixed with grinded cow dung manure / leaf compost and sowing the required seeds after pretreatment complete	Rs. 50.00
3.	Cost of supply of polythene tube bags of size 22.5cm x 15cm of thicker gauge = 4kg @ 90/- per kg	Rs. 360.00
4.	Cost of supply of the following including transportation of the same up to the nursery site	
	a) cow dung manure 0.90cum @ Rs. 100/- per cum	Rs. 90.00
	b) god earth 2.50 cum @ Rs. 50/- per cum	Rs. 125.00
5.	Cost of filling up polythene tube after pulverising the good earth & cow dung manure and mixing the same intimately in 3:1 proportion over 2000 nos. @ Rs. 25/- per – nos.	Rs. 500.00
6.	Cost of supply of required seeds of desired species	Rs. 100.00
7.	Cost of goat proof fencing net including cost of wooden fencing posts, erecting, fixing, filling etc. complete including cost of staples	Rs. 50.00
8.	Cost of picking out seedlings from mother bed to polythene tubes/dibbling seeds in the polythene tube over 2000 nos. @ Rs. 5/- per – nos.	Rs. 100.00
9.	Cost of making shed for protection of seedlings from scorching sunlight	
	a) Material cost	Rs. 50.00
	b) Labour cost	Rs. 100.00
	Total	Rs. 1600.00

B.	1st Year	
1.	Cost of weeding, cleaning and hoeing the base of the seedlings including application of oil cake 3times @ 50/- per bed per time	Rs.150.00
2.	Cost of sorting, shifting and culling of seedlings and arranging them according to their height in the bed 3 times	Rs.300.00
3.	Cost of watering the seedlings	Rs.100.00
4.	Miscellaneous Cost e.g. Insecticide, fungicide, oil cake etc.	Rs.50.00
	Total	Rs.600.00
C.	2nd Year	
1.	Cost of breeding, cleaning and hoeing the base of the seedlings 2times @50/-per bed per time.	Rs.100.00
2.	Cost of sorting, shifting and culling of seedlings and arranging them according to their height in the bed over 2 times @ Rs.100 per bed per time	Rs.200.00
3.	Cost of watering the seedlings for 4 month	Rs.100.00
	Total	Rs.400.00

Abstract

A. Preliminary Works	Rs.1600.00
B. 1 st Year	Rs.600.00
C. 2 nd Year	Rs. 400.00
Grand Total	Rs.2600.00 per bed

N.B. Water by pipeline to the nursery site will be provided from the existing supply line provided to the staff and other purpose.

3.6.7 : Budget for Afforestation

At the end of the year of mining	Type of work (nursery/ plantation)	Area (ha.)	Nature of work	Rate per ha. (Rs.)	Amount (Rs.)	Total amount for the year (Rs.)
01	Nursery	1.53	Preliminary nursery work	1,600	2,448.00	2,448.00
02	Nursery	1.53	1st year nursery work	600	918.00	
	Nursery	0.60	Preliminary nursery work	1,600	960.00	
	Plantation	1.53	Preliminary plantation work	13,430	20,548.00	22,426.00
03	Nursery	1.53	2nd year nursery work	400	612.00	
	Nursery	0.60	1st year nursery work	600	360.00	
	Nursery	0.20	Preliminary nursery work	1600	320.00	
	Plantation	1.53	1st year creation work	11,170	17,090.00	

At the end of the year of mining	Type of work (nursery/ plantation)	Area (ha.)	Nature of work	Rate per ha. (Rs.)	Amount (Rs.)	Total amount for the year (Rs.)
	Plantation	0.60	Preliminary plantation work	13,430	8,058.00	26,440.00
04	Nursery	0.60	2nd year nursery work	400	240.00	
	Nursery	0.20	1st year nursery work	600	600.00	
	Plantation	1.53	2nd year maintenance work	6,900	10,557.00	
	Plantation	0.60	1st year creation work	11,170	6,702.00	
	Plantation	0.20	Preliminary Plantation work	13,430	2,686.00	20,305.00
05	Nursery	0.20	2nd year nursery work	400	80.00	
	Plantation	1.53	3rd year maintenance work	2,500	3,825.00	
	Plantation	0.60	2nd year maintenance work	6,900	4,140.00	
	Plantation	0.20	1st year creation work	11,170	2,234.00	10,279.00
06	Nursery	3.49	Preliminary nursery work	1600	5,584.00	
	Plantation	1.53	4th year maintenance work	1,000	1,530.00	
	Plantation	0.60	3rd year maintenance work	2,500	1,500.00	
	Plantation	0.20	2nd year maintenance work	6,900	1,380.00	9,994.00
07	Nursery	3.49	1st year nursery work	600	2,094.00	
	Plantation	1.53	5th year maintenance work	1,000	1,530.00	
	Plantation	0.60	4th year maintenance work	1,000	600.00	
	Plantation	0.20	3rd year maintenance work	2,500	500.00	
	Plantation	3.49	Preliminary Plantation work	13,430	46,871.00	51,595.00
08	Nursery	3.49	2nd year nursery work	400	1,396.00	
	Plantation	0.60	5th year maintenance work	1,000	600.00	
	Plantation	0.20	4th year maintenance work	1,000	200.00	
	Plantation	3.49	1st year creation work	11,170	38,983.00	41,179.00
09	Plantation	0.20	5th year maintenance work	1,000	200.00	
	Plantation	3.49	2nd year maintenance work	6,900	24,081.00	24,281.00
10	Plantation	3.49	3rd year maintenance work	2,500	8,725.00	8,725.00
11	Plantation	3.49	4th year maintenance work	1,000	3,490.00	3,490.00
12	Plantation	3.49	5th year maintenance work	1,000	3,490.00	3,490.00

At the end of the year of mining	Type of work (nursery/ plantation)	Area (ha.)	Nature of work	Rate per ha. (Rs.)	Amount (Rs.)	Total amount for the year (Rs.)
Grand Total						2,24,65 2.00

[N.B. The budget estimate is prepared on the basis of prevailing labour rate and market rate of materials. This is subject to increase due to increase in labour and material rate at the time of execution of the works.]

While losing the mine the entire forestry asset so created may be handed over to the Village Durbar for future maintenance of the same. A management plan is to be prepared after the trees are established and before handing over to the Village Durbar. While preparing management plan the following aspect are to be considered:

1. The forest should be maintained as protection forest.
2. Collection of fodder and fuel wood to the local people may be allowed at a nominal cost to be decided by the Village Durbar.
3. Only dead, dying and diseased trees may be removed to meet the need of the timber to the local people.
4. Picnic/tourism may be developed and allowed to the general people under certain terms and conditions with a levy of certain fees.

3.7 Water and Waste Management :

3.7.1 Water Management

3.7.1.1 Natural Water Resources of the Area

The proposed project lies in sub-tropical region surrounded by natural watercourses, springs and waterfalls. The outflow water from the proposed mine area will fall into a drainage net of phlangkaruh river which culminates into Umium river. The main drainage system in the study area is governed by the Phlangkaruh River and Umiam River along with its tributaries.

The proposed mine site comprises of Karst topography which can be characterized by presence of fissure, joints, cavities. Natural vertical movement of the water to greater depths occur through: shaft flow (where open shafts or funnels connect to caves or larger cavities at greater depths), vadose trickles (the water descend through solution widened joints and reach caves as fast drips of streamlets) and vadose seepage (that feed slow drips in caves below and that may take months to respond to rainfall events). There is also a set of three springs appearing at south at an elevation of 22 mRL. These springs appear even during non-rainy season showing their link with some surface water drainage . It has been reported by folklore of Nongtraï village that water from Fotsgnet near their village links with water springs, which forms a rivulet called Phlangkaru stream.

Due to a long monsoon season and high amount of rainfall the area is prone to surface runoff and soil erosion that ultimately will lead to the river systems flowing along the gorges and the foothills.

3.7.1.2 Wastewater from Mine

There is no perennial water stream within the mine area. The Phlangkaruh river originating in the foothills of the mine area is expected to be loaded with additional sediment due to surface runoff during rainy season. During the rains the storm water may carry solids and debris from the opencast mine area in the absence of any control measures. The rehabilitation of excavated land and final land restoration as per plan will, however, stabilize the drainage pattern also.

3.7.1.3 Impact & Management of Surface Water

The potential impact on the surface water quality is likely to be due to higher load of suspended solids. Sources of suspended solids would be :

- Discharge of mine runoff during rains to the surface water channels
- Wash off from shale stock piles during rainy season

During the heavy rainfall the wash off from the shale stockpile will lead to the adjoining surface water body. This is likely to increase the alkalinity of the water and also increase the suspended solids within the water samples.

Therefore, landscape of the shale dumping area will be shaped, capped and graded, so as to prevent soil erosion along with runoff.

As shale mining project would not generate any waste water, there would be no impact on the surface water quality of the nearby streams. As such the inhabitants of the area depending on river water are expected to be unaffected due to mining operations.

3.7.1.4 Ground Water Management

The potential impacts of mining would have negligible effects on the ground water, as the site and its adjoining areas are located at an elevated topography. In general, the entire study area is devoid of bore wells for the water sources and as such, the likely chances of the contaminate reaching the groundwater are very rare.

3.7.2 Waste Management

No overburden would be generated during mining that would require disposal. The entire material mined would be used in some form other. As a result, there would be no generation of solid waste in the mining process. Even the minimum amount of waste generated will be utilized for reclamation, restoration and rehabilitation of the terrain, without affecting the drainage and water regimes. Waste may be used as road metal or construction aggregates, after crushing to proper size. Terracing of dumps

will be accompanied by stabilisation of the slopes and terraces using proper vegetation.

3.8 Monitoring Programme :

Regular monitoring of the important environmental and socio-economic parameters, even after decommissioning of the mine is very much important to evaluate the effectiveness of the Environmental Management Programme (EMP). Socio-economic parameters can be monitored through physical survey.

Reclamation monitoring is an inherent requirement of mine decommissioning and closure plan and it includes constant inspection of the following:

- Restoration of land surface (drainage, slope, stability),
- Revegetation (cover, type, vigor) and
- Groundwater (recovery, quality).

In case of surface mining, the above ground heap leach operations have additional requirements, such as:

- Visual checking of pile slopes and toe for leakage,
- Down gradient surface water sampling, and
- Reclamation of pile after flushing and/or neutralizing (slope and vegetative cover).

Monitoring results will also form the basis for adoption of appropriate treatment process and up-gradation of treatment facilities developed in due course of time.

In the present project regular monitoring stations will be set up to evaluate the effectiveness of environment management plan. The schedule, duration and the parameters to be monitored are illustrated in the following Table-7.

Table – 7 : Monitoring schedule and Parameters

Sl. No.	Description of Parameters	Schedule of Monitoring
A.	Air Quality (SPM, RPM, CO, SO ₂ , NO _x)	
1.	In the vicinity of the mine	One sample over 24 hours continuous duration, once a week throughout the year.
2.	Within the mine	One sample over 24 hours continuous duration, twice in a week throughout the year.
3.	In the surrounding areas covering three locations 120 ⁰ apart, close to the nearest habitation.	One sample over 24 hours continuous duration, twice in a week throughout the year.
B.	Water Quality	

Sl. No.	Description of Parameters	Schedule of Monitoring
1.	Water stored in the mine area	Twice a week for selected parameters like, pH, TSS, TDS, COD, BOD and oil and grease. The detailed analysis should be carried out once in three months.
2.	Surface and ground water quality in the vicinity of the mine area for water potability conforming to drinking water standard IS: 10500:1991.	Once in three months.
C.	Ambient Noise Level	Quarterly
D.	Inventory of flora	Once in two years in the project monitoring area.
E.	Soil quality	Once in year on all reclaimed area and adjoining villages.
F.	Socioeconomic condition of local population – physical survey.	Once in two years.

4.0 WORK PROGRAMME, BUDGET AND SCHEDULE

4.1 Ongoing Reclamation :

Appropriate reclamation work will be taken up during operational period in the phased manner to reduce the impact of mining. The following reclamation work will be taken up during the mining operation:

- Soil Conservation measure (starting from 2nd year of mining operation)
- Afforestation programme in phased manner (starting from 2nd year of mining operation)
- Reclamation of pile after flushing and/or neutralizing (slope and vegetative cover)
- Solid waste management (from 1st year)
- Air and sound pollution control measure (from 1st year)

- Management of water quality & Wastewater treatment (from 1st year)
- Social related issues (Compensation, income generation opportunity, influx of migrants, cultural conflict, etc.)

4.2 Site Configuration at Cessation of Mining :

At the cessation of mining, a furrow measuring 490 m x 100 m will be formed. The site configuration at the end of mining is given in Plate 9. At the end of mining the benches below 94 m RL on western side and below 85 m RL on the eastern side will be completely filled. The benches above 85m RL will be contoured by necessary back filling. This material can be procured from the river beds.

4.3 Decommissioning and Closure Facilities:

A closure plan for the Shella Shale Quarry and the associated infrastructure including the service area and temporary topsoil dump is described below:

All the structures that include excavators, rest shelter and workshop will be removed and the corresponding area graded, topsoil and seeded. That is there will be no structures abandoned and left as it is. All other infrastructural facilities including crushing and conveying, colony, etc. that are partly used for Shella Shale Quarry are located as a part of Nongtraí Limestone Mine Complex and these will continue to remain and cater for limestone mining activities. Table-3 below gives the decommissioning and closure of facilities specific to this quarry project and the proposed action for the same.

Table –8 : Decommissioning & Closure of Facilities and Proposed Actions

Task	Decommissioning & Closure of facilities	Actions to be taken
A	Infrastructure specific to this Quarry # Service Area # Hard Standing Area # Connecting roads # Excavators	The service area will be completely dismantled and the hard standing areas will be developed for reclamation by afforestation. The connecting roads will be retained for public use.

Table-9 below gives the post mining land use with environment management.

Table-9 : Post Mining Land Use with Environment Management

No	Land Use	Land Use (Ha)		Total Area (Ha)
		Forest/Plantation	Public Use	
Within Mining Lease area of 4.9 Ha				
1	Mined out Area	3.57	-	3.57
2	Undisturbed area within mining lease	1.33	-	1.33
Outside Mining Lease Area				
3	Service Area	0.54	-	0.54
4	Top soil dump area	0.38	-	0.38
5	Connecting roads	-	0.65	0.65

4.4 Fall Back Strategies :

The specific infrastructure for the Shella Shale Quarry will be retained for further use if Lafarge decides to apply for larger lease area in the adjoining areas for continuing to extract shale. If the area of 4.9 Ha is also retained as part of the new larger lease area then instead of resorting to back-filling, mining can be continued at deeper levels by expanding the operational area. This alternative is possible if Lafarge decides to work in the same region for further shale sourcing and obtains necessary permissions from various government agencies as per applicable Acts.

4.5 Schedule of Operation and Cost :

Estimating the costs of pre-abandonment reclamation plan: The mining costs will include procurement of boulders and sand for back-filling. Some amount of dozing will be required for contouring and battering of slopes by dozer. If dozing is preferred to be done by dozer, approximately Rs 800/hr can be taken as the expenses involved for dozing about 200 cum in one hour. As topsoil will be generated during mining, this can be utilized for reclamation. Depending on the adequacy of topsoil, additional topsoil requirement, if any, can be sourced from nearby areas.

The schedule of operation for decommissioning and its related costs are estimated in Table –10 below:

Table-10 : Schedule of Operation for Decommissioning & its Cost

Task	Operation	Cost Basis	Cost (Rs)
A	Dozing	Dozing: 600 hrs @ Rs 800/hr	5,40,000

4.6 Management Supervision :

The Management Supervision plan includes:

- Monitoring objectives,
- Monitoring schedule, and
- Effective implementation.

Monitoring objectives: The project authority will set up regular monitoring stations to assess the ambient levels of environmental parameters during on –going reclamation phase and after the cessation of mine. It provide useful information on the following aspects:

- It helps to verify the warnings on environment presented in the study
- It helps to indicate warnings of development of any alarming environmental situations and thus provide opportunities for adopting appropriate control measures. The post project monitoring will be conducted in various categories of environment is discussed in above section.

Monitoring schedule: To evaluate the effectiveness of environmental programme, regular monitoring of the important environmental parameters will be taken up.

Effective Implementation: For effective implementation and mid-term corrective measures, if required, monitoring and control of programme implementation will be taken up.

The Supervision will follow the guideline provided by OD 13.05 on project supervision issued from the World Bank. Supervision will based on project conditionality. Project legal documents will provide much of the framework to support and enforce supervision. The supervision plan also will ensure linkage with project implementation plan and environmental covenants agreed to by the project authorities as the condition for receiving any external financial support.

LEGISLATIVE FRAMEWORK**National Mineral Policy on Protection of Environment in Mines**

The first significant step by Government of India towards management of environmental concerns associated with the exploitation of mineral resources, was the constitution of a Working Group on "Mining and the Environment" by the Department of Science and Technology (DS&T). The group submitted the recommendations in 1981, which were included in legislation related to development of mines i.e. *Mineral Conservation and Development Rules (MCDR), 1988 and amendments*. Under these rules, chapter 5 is completely dedicated to environment protection.

The National Mineral Policy, 1993 for non fossil and non atomic minerals, prohibits mining operations in identified ecologically fragile and biologically rich areas and strip mining in forest areas. The latter could be permitted only when accompanied by a comprehensive time bound reclamation programme. It states further that

- EMP should have adequate measures for minimising environmental damage by restoration of mined areas and by plantation in accordance with the prescribed norms;
- as far as possible, reclamation and afforestation should proceed with the prescribed norms; and
- efforts should also be made to convert old disused mine sites into forests and other forms of land use.

Mineral Concession Rules, 1960

The MCR rules layout the provisions for assessment and payment of compensation which are as given below:

Payment of compensation to owner of surface right

The Rules provide for payment of annual compensation to land losers by the holder of a prospecting license or mining lease. The said compensation amount is to be decided by an officer appointed by the state government. The MCR Rules lay down the following principles:

In case of agricultural land, the amount of annual compensation is to be worked out on the basis of average annual net income from the cultivation of similar land for the previous three years.

In case of non-agricultural land, the amount of annual compensation is to be worked out on the basis of average annual letting value of similar land for the previous three years.

Assessment of compensation for damage to the land

There is a provision in the Act for payment of damages (to the mining block by the lessee) after the termination of the lease. After the termination of a mining lease, the State Government assesses the damage, if any, done to the land by mining operations and determines the amount of compensation payable by the lessee to the occupier of the surface land. Such an assessment is to be made within a period of one year from the date of termination of the mining lease. The assessment is to be carried out by an officer appointed by the State Government.

Mines & Minerals Legislation Pertaining to Environmental Protection

The environmental protection provisions covered under different legislation pertaining to mining are defined in the following subsections:

Mines & Minerals (Regulations & Development) Act, 1957

Mines and Minerals (Regulations & Development) Act (MMRD), 1957 as amended in 1986 and 1994 is the major act covering specific provisions relating to protection of environment in mines. Requirement of a "Mining Plan" for fresh grant or renewal of any mining lease was incorporated in the amended act. Salient features relating to mine environment are enumerated below:

Section 4A(1): Where the State Government, after consultation with the Central Government, is of the opinion that it is expedient in the interest of regulation for mines and mineral development, preservation of natural environment, control of floods, prevention of pollution or to avoid danger to public health and communications or to ensure safety of buildings, monuments or other structures or such other purposes as the State Government may deem fit, it may, by an order, in respect of any minor mineral, make premature termination of prospecting licence or mining lease with respect to the area or any part thereof covered by such licence or lease.

Section 5(2): No mining lease shall be granted by the State Government unless it is satisfied that there is a mining plan duly approved by the Central Government for the development of mineral deposits in the area concerned.

Section 18(1): It shall be the duty of the Central Government to take all such steps as may be necessary for the conservation and systematic development of minerals in India and for the protection of environment by preventing or controlling any pollution which may be caused by prospecting or mining operations and for such purposes the Central Government may, by notification in the Official Gazette, make such rules as it thinks fit.

Mine Act, 1952; Mine Rules, 1953

Occupational health and safety aspects of mine are regulated by Indian Mines Act, 1952, and the guidelines issued by Directorate General of Mines Safety, subsidiary of IBM. The above Act has stipulations with respect to working hours, occupational diseases, periodic medical check up, employment of female and children, employment of medical and welfare officers etc.

Mineral Concession Rules (MCR), 1960

These rules are framed under the *MMRD Act* and thereafter requires that "Mining Plan" shall incorporate amongst others, a plan of the area showing the water courses, limits of reserved and other forest areas, density of trees, assessment of impact of mining activity of forest, land surface and environment including air and water pollution; details of scheme of restoration of the area by afforestation, land reclamation, use of pollution control devices and such measures as may be directed by the Central or the State Government from time to time.

Mineral Conservation and Development Rules, 1988 as amended

These rules were also framed under the parent *MMRD Act*. Under these rules, chapter 5 is completely dedicated to environment protection. The rules at present provide for generation of environmental baseline data even before the commencement of prospecting operations and preparation of an EMF incorporating proposals for prevention and control of air and water pollution, progressive reclamation and rehabilitation of land disturbed by prospecting operations, a scheme of plantation trees and such other measures as may be directed by the Central or State Government from time to time for minimising the adverse effect of prospecting operations on the environment.

Prohibition of Mining Operation in Ecologically Fragile Areas

Government of India has identified a number of areas/ eco-systems as ecologically fragile areas where mining cannot be generally recommended. In case, any person/ company is desirous of undertaking mining operations in the said areas, then, per the notification, an application has to be submitted to the Secretary, MoEF, New Delhi, specifying *inter alia* the details of the area and the proposed process or operation duly supported by an EIA & EMP and such other information as may be required by the Central Government.

There are few ecologically sensitive areas where mining has been prohibited either by the court's order or by a MoEF notification. Limestone mining in the ecologically fragile Doon valley in the State of Uttar Pradesh has been prohibited under orders from the Hon'ble Supreme Court, the apex court of the country. The Aravali mountain range covering the northern States of Rajasthan and Haryana is another ecologically sensitive area where mining operations (including renewals of mining leases) have been prohibited under a notification No. S.O. 319(E) dated 7th May, 1992 issued by the MoEF. Mining operations in all areas of Sariska National Park and Sariska Sanctuary in the state of Rajasthan have been prohibited by the Central Government under the Wild Life (Protection) Act, 1972 as they pose a threat to the ecology of the area and to the wild life.

PRIMARY ENVIRONMENTAL LEGISLATION

The Constitution of India directs the State to endeavour to protect and improve the environment and to safeguard the forest and wildlife of the country. Article 51(g) of the constitution states that *it shall be the duty of every citizen of India to protect and improve the national environment including forests, lakes, rivers and wildlife and to have compassion for living creatures*. The language of the Directive principles of the state policy (Article 47) also contains a specific provision, which commits the state to protect the environment.

In addition to Constitutional provisions, India has established a comprehensive set of laws for the management and protection of the environment. The Acts, Notifications, Rules and Amendments applicable for setting up a new mining industry or its expansion of an existing mine and for operation of a mine include the following:

General

- The Environment (Protection) Act and Rules, 1986
- The Environmental Impact Assessment (ETA) Notification, 1994- for Environmental Clearance and Amendments of EIA notification, 1997 - including the Environmental Public Hearing a mandatory for the 29 categories of industries.
- Forest (Conservation) Act, 1980
- The Air (Prevention and Control of Pollution) Act, Rules and Amendment, 1981,1982,1983,1987
- The Factories Act and Amendment, 1948,1987
- The Water (Prevention and Control of Pollution) Act and Rules, 1974,1975 The Water {Prevention and Control of Pollution) Cess Act and Rules, 1977, 1978,1991
- The Public Liability Insurance Act, 1991
- The Environmental Standards Notification, 1993,1996
- The Environmental Audit Notification, 1992
- Hazardous Waste Management and Handling Rules, 1989 and amendment rules 2000
- The Manufacture, Storage and Import of the Hazardous Chemical Rules , 1989 and amendment rules 2000
- The National Environment Tribunal Act, 1995

Note:

1. Some environment, health and safety related aspects are also covered under the Indian Factories Act, 1948.
2. MoEF has stipulated general discharge standards for water effluents and general emission standards for air emissions. These standards limit the concentration and volumes of the effluents and emissions released to the atmosphere. These standards could be made more stringent by the SPCBs based on the environmental sensitivity of a specific location.

3. The project proponents are required to take Consents (for both air and water) and No Objection Certificates (NOCs) from the relevant SPCBs before initiating any activity .

In addition to the above, CPCB has also specified National Ambient Air Quality Standards (NAAQS) for residential, commercial, industrial and sensitive zones for the country as a whole. All the major rivers of the country have also been classified based on the designated best use criteria (Five Designated Best Use Gasses from A to E). It is the responsibility of the respective State Governments to ensure that the water quality criteria are met per these specifications.

Major provisions in Primary Environmental Legislation

The *Environment (Protection) Act; 1986 including Rules 1986*

This Act is an umbrella legislation that provides a single focus for the protection of the environment and seeks to plug the loopholes of earlier legislation relating to the environment. Several sets of Rules relating to various aspects of the management of hazardous chemicals, wastes, micro-organisms etc have been included in this Act. The salient provisions of the Act are as follows:

- Central Government's powers to take necessary measures for the purpose of protecting and improving the quality of the environment and prevention, control and abatement of environmental pollution.
- Central Government's powers include:
 - Lay down standards for the quality of the environment, emissions or discharges of environmental pollutants from various sources;
 - Restrict or prohibit industries, operations or processes in specified areas;
 - Restrict or prohibit handling of hazardous substances in specified areas;
 - Lay down procedures and safeguards for the prevention of accidents, which may cause environmental pollution; and
 - Enter and inspect any industrial establishments, records, registers and documents to ensure effective implementation of the provisions of the Act.
- Central Government has powers to issue directions for
 - The closure and prohibition or regulation of an industry, operations or processes or;
 - Stopping or regulating the supply of electricity, water or any other service in the prescribed manner
- Industry to comply with such directions
- Restriction on discharge or emission of pollutants in excess of the prescribed standards
- Handling of hazardous substances in accordance with the prescribed procedures and safeguards
- Industry to furnish information to specified agencies in case of discharges, emission of pollutants in excess of the prescribed standards, already occurred or

likely to occur, resulting in environmental pollution, due to and unforeseen act or event

- Central Government has the power to recover, expenses incurred by it on remedial measures to prevent or mitigate environmental pollution from the defaulting industry, as arrears of land revenue or of public demand
- Central Government has the power to take samples of air, water, soil or other substances from any industrial plant of the purpose of analysis in the prescribed manner
- Bar on filing of any suit or legal proceedings against the Government or officials empowered by it for action taken in good faith, in pursuance of the Act.
- Bar of jurisdiction to Civil Court to entertain any suit or proceedings in respect of anything done, action taken or directions issued by the Central Government or any other authority empowered by it, in pursuance of the Act.

Industry, operations or process requiring consent under the Water Act or Air Act or Authorisation under the Hazardous Waste (Management and Handling) Rules, or both, to submit 'Environmental Statement' every year before September 30th for last financial year.

The Environmental Impact Assessment (EM) Notification of 1994

As per the notification as amended on 4 May 1994, new or expansion or modernisation of any activity falling in the 29 categories of Industries shall not be undertaken in any part of India unless it has been accorded environmental clearance by the Central Government in accordance with the procedures specified in the notification. As per the procedures, anybody who desires to undertake any project in any part of India or expansion or modernisation of any existing industry, a detailed project report which shall inter-alia include an Environmental Impact Assessment (EIA) report needs to be submitted.

Until January 1994, obtaining environmental clearance from the MoEF was only an administrative requirement intended for mega projects undertaken by the government or public sector undertakings. The EIA Notification issued in January 1994 with amendment in May 1994 makes carrying out EIA, a statutory requirement for 29 categories of activities (*Schedule 1*), which can be broadly categorised into the following sectors:

- industries;
- mining;
- thermal power plants;
- river valley development;
- ports; harbors and airports;
- communication;
- atomic energy;
- transport (rail, road, highway); and tourism (including hotels and beach resorts in the Coastal Regulation Zone).

As per the notification all projects listed under *Schedule -1* are required to:

- Obtain prior environmental clearance from the MoEF.
- Projects, which although fall under the de-licensed category of the New Industrial Policy but included in the 29 categories are also, required to obtain environmental clearance from the MoEF.
- Industrial projects where the investment is Rupees 500 million or above must receive MoEF clearance. The provisions of the notification do not apply to 17 of the 29 categories (Foundry industry does not fall in those 17 categories).
- Industrial activities including *mining* will be subjected to prior environmental clearance from MoEF unless they are reserved under Small Scale Industrial sector with investments less than Rupees 10 million. Industrial projects are further required to obtain a Letter of Intent (LoI) from the Ministry of Industry, and a No Objection Certificate (NOC) from the SPCB and state Forest Department if the location involves forest land. Once the NOC is obtained, the LoI is converted to an Industrial License by the state authorities. However, if the project falls under Schedule -1 of the EIA Notification, it must obtain an environmental clearance from the MoEF. Obtaining the necessary approvals from the MoEF is facilitated by set of "Siting Guidelines" which are issued by the MoEF.

The EIA Notification requires each project to submit a number of documents to the MoEF in order to obtain environmental clearance as follows:

- a) Feasibility / Project Report
- b) Site clearance (only for site-specific projects mentioned in the Notification)
- c) No Objection Certificate from the SPCB and other state authorities; Completed Environment Appraisal questionnaire; EIA Report and Environment Management Plan;
- d) Risk Analysis, Emergency Preparedness Plan (only in case of projects involving hazardous substances); and
- e) Rehabilitation plans where large-scale displacement of people is anticipated.

The EIA notification also outlined an environmental appraisal procedure as follows:

- a) the documents listed above are reviewed first by the multi-disciplinary staff in the MoEF. They may also visit the project site, and consult with experts as necessary;
- b) after the initial review, the proposals are placed before specially constituted committees of experts known as Environmental Appraisal Committee (EAC) for each sector. Besides the review of documents, the Committees may also undertake site visits, and directly interact with affected people and environment groups;
- c) the Committee also arrange public hearings to ensure public participation. Announcements for public hearings are made at least 30 days before through newspapers.
- d) after the above steps are completed, the Appraisal Committee makes a recommendation for approval or rejection of the project. The MoEF makes the final decision.

Whenever a project is given environmental clearance, a set of recommendations and conditions are stipulated by the Appraisal Committee which have to be complied with by the proponent once the project is commissioned. Project authorities are required to submit semi-annual compliance reports to the MoEF to enable the Ministry to monitor the implementation of the recommendations and conditions of environmental clearance. The six Regional Offices of the MoEF (*Bangalore, Bhubaneswar, Bhopal, Chandigarh, Lucknow, and Shillong*) assist the MoEF in monitoring of environmentally cleared projects. Cases of non-compliance of recommendations and conditions of environmental clearance are brought to the notice of the concerned SPCB for action.

Forest (Conservation) Act, 1980

The Forest (Conservation) Act (FCA), 1980 (No 69 of 1980) came into force on 25 October 1980 and was subsequently amended in 1988. Relevant provisions of FCA 1980, and the Rules made thereunder in 1981 provide for prevention of diversion of any forest land for non-forest uses including mining even though, of late, considerable relaxation has been granted by the Central Government. In all such cases, prior approval is required from Central and State Government. Under the Act, an Advisory Committee advises GoI for grant of approval and other matters connected with the conservation of forests.

Details pertaining to status and type of flora & fauna, map of the area, importance of the said area in the hydrology of the region, details of the proposed compensatory afforestation plan is to be filled in the prescribed proforma for diversion of forest land for non-forest usage. Per the amended Rules, Regional Officer Conservator of Forests can decide on the proposals involving forest land up to 5 hectares and in consultation with the State Advisory Group for forest land up to 5-20 hectares. For diversion of more than 20 hectares of forestland for non-forest use, Advisory Committee of MoEF examines the proposals. Compensatory afforestation is one of the most important conditions stipulated by the Central Government while approving proposals for diversion/dereservation of forest land for non-forest uses. Compensatory afforestation may be raised over degraded forestland having an area equal to the forest area diverted/dereserved.

The Air (Prevention and Control of Pollution) Act, 1981 Including Rules 1982 and 1983

The Act was enacted to prevent, control and reduce air pollution including noise pollution and to establish Boards at the States as well as Union Territories levels to achieve this. This Act prohibits the construction and operation of any industrial plant without the consent of SPCBs. The Act assigns powers and functions to the CPCB and the SPCBs for prevention and control of air pollution and all other related matters. In addition, the CPCB can exercise the powers and perform the functions of a State Board in the Union Territories. For the prevention and control of air pollution, the State Government, in consultation with the SPCB has the powers to set standards for emissions from automobiles, impose restrictions on use of certain industrial plants

and prohibit emissions of air pollutants in excess of the standards laid down by the SPCB. It can also make an application to the court for restraining persons from causing air pollution. In addition, it also has the power of entry and inspection, power to obtain information and power to take samples of air emissions and conduct the appropriate follow up. The CPCB, as well as the SPCBs are eligible for contributions from the Central as well as the State Government, respectively, to perform their functions appropriately. The Act also allows for appropriate penalties and procedures for non-compliance. The salient provisions of the Act are as follows:

- State Government's powers include:
 - To declare any area within the state as an *Air Pollution Control Area*
 - To prohibit use of any fuel or burning of any material which may cause air pollution in the Air Pollution Control Area.
- Restriction on establishment and operation of any industrial plant in an air pollution control area likely to emit air pollutant(s) into the atmosphere, without the prior consent of the SPCB
- SPCBs to make inquiries in respect of grant of consent in prescribed manner
SPCBs to grant consent within four months after the date of the receipt of an application complete in all respects
- Industry to comply with the conditions stipulated in the consent
- Restriction on emission of air pollutants in excess of the standards prescribed by SPCBs
- SPCBs right to make an application to the court for restraining an industrial plant, located in an air pollution control area, likely to emit air pollutants in excess of the prescribed standards
- Industry to furnish information to the SPCBs and other agency(ies) in case of emission of air pollutant(s) in excess of prescribed standards, having occurred or likely to occur, resulting in air pollution, due to an accident or an unforeseen act or event.
- PCBs rights include:
 - To enter and inspect any industrial plant, records, registers, or documents at all reasonable times;
 - To obtain any information related with the implementation of the provisions of the Act ;and
 - To take samples of air and emissions for analysis in the prescribed manner
- Industry to appeal to the Appellate Authority in case of grievances against the order made by SPCBs under the Act, within a specified time and in the prescribed manner.
- SPCBs power to issue directions for:
 - The closure, prohibition or regulation of any industry, operation or process or;
 - The stoppage or regulation of supply of electricity, water or any other service to an industry in a prescribed manner
 - Industry to comply with the directions of the SPCB
 - Bar of jurisdiction to Civil Court in respect of any matter within the purview of the Appellate Authority constituted under the Act and no grant

of injunction in respect of any action taken or proposed in pursuance of the Act

- Bar on filing of any suit or legal proceedings against the Government or Board officials for action taken in good faith in pursuance of the Act.
- SPCBs to maintain consent-register-containing particulars of consent issued and to provide access to industry at all reasonable hours.

The *Water (Prevention and Control of Pollution), Act, 1974 including Rules, 1975 (as amended up to 1988)*

This Act provides for the prevention and control of water pollution and maintaining or restoring good water quality for any establishment. The Act assigns functions and powers to the CPCB and SPCBs for prevention and control of water pollution and all related matters. Subject to the provisions of the Act, the functions and powers of CPCB as well as the SPCBs have been delineated individually and with respect to each other. The salient provisions applicable to industrial establishments are as follows:

- SPCB has the right
 - To obtain any information regarding the construction, installation or operation of an establishment or treatment and disposal system;
 - To make samples of trade effluent for the purpose of analysis in the prescribed manner;
 - To enter and inspect any establishment, record, register, document or any other material object and
- To prohibit use of stream or sewer or land for disposal of polluting matter, not in accordance with the standards laid down by the SPCB
- Restriction on establishment and the operation of an industry, process or any treatment and disposal system without prior consent of the SPCB. SPCBs right to refuse or withdraw consent, for discharge of effluents Industry to comply with the conditions stipulated in the consents
- SPCBs grant consent within four months after the date of receipt of the application complete in all respects
- Establishments to appeal to the Appellate Authority, in case of grievances against the order passed by the SPCB regarding grant, refusal or withdrawal of the consent within the specified time in the prescribed manner. Establishments to furnish information to the SPCB and other specified agency (ies) in case of discharge of poisonous, noxious or polluting matter into a stream, sewer or land, occurred or likely to occur resulting in pollution due to an accident of any other unforeseen event.
- SPCBs right to issue orders restraining or prohibiting an establishment from discharging any poisonous, noxious or polluting matter; in case of emergencies, warranting immediate action.
- SPCBs power to make an application to the Court for restraining apprehended pollution of water due to likely disposal of polluting matter in a stream or on land.

- Bar of jurisdiction to Civil Court in respect of any matter under purview of the Appellate Authority constituted under the Act and no grant of injunction in respect of any action taken or proposed in pursuance of the Act.
- Bar on filing of any suit or legal proceedings against the Government or Board officials, for action taken in good faith in pursuance of the Act.
- SPCBs to make inquiries, in the prescribed manner, for grant of consent for discharge of effluents
- SPCBs have power to issue directions for
 - the closure prohibition or regulation of any establishment, operation or process or;
 - the stoppage or regulation of supply of electricity , water or any other service to an establishment in the prescribed manner.
- Industry to comply with the directions of the SPCB within the specified time.
- SPCBs to maintain a consent register containing particulars of the consent issued and to provide access to industry at all reasonable hours.

The *Water (Prevention and Control of Pollution), Cess Act, 1977 including Rules 1978 and 1991*

This Act provides for levy and collection of Cess on water consumed by persons carrying on certain industries and by the local authorities with a view to augment the resources of CPCB and SPCBs for the prevention and control of water pollution, constituted under the Water Act, 1974. It also covers specifications on affixing of meters, furnishing of returns, assessment of Cess, interest payable for delay in payment of Cess and penalties for non-payment of Cess within the specified time. The salient provisions of the Act are as follows:

- Only specified industry sectors to pay Cess on the quantity of water consumed for specific purposes at prescribed rates Any specified industry liable to pay water cess;
 - To affix meters of prescribed standards and at prescribed places by SPCBs for measurement of quantity of water consumed;
 - To furnish water Cess returns in the prescribed form at prescribed intervals;
 - To pay interest for delay in payments of Cess, not made within the specified time, as mentioned in the assessment order of the SPCB and
 - To pay penalty not exceeding the amount of Cess in arrears, for non-payment of Cess within the specified time as mentioned in the Assessment Order of the SPCB
- Specified industries entitled to 25% rebate in water cess, if they comply with the prescribed consent provisions and consume a quantity of water, which is not in excess of the prescribed quantity;
- SPCBs right to make inquiries for assessing water cess payable by any specified industry;
- SPCBs right to recover any amount due under the Act as arrears of land revenue from industry;

- SPCBs right of entry and inspection in pursuance of the provisions of the Act including testing of the correctness of the meters affixed;
- Industry to appeal to Appellate authority in case of any grievance against the Water Cess Assessment, within the specified time, in the prescribed manner .

The Hazardous Wastes (Management and Handling) Rules, 1989

The Act requires industries to classify wastes into categories and manage them as per the prescribed guidelines. The specific provisions of the Rules are as follows:

- Occupier's responsibility to ensure proper handling and disposal of hazardous wastes either by themselves, or through the operator of hazardous waste management facility
- Restriction on handling or hazardous wastes without prior authorisation from the SPCB
- SPCB has the power to suspend or cancel an authorisation for handling hazardous wastes, after providing an opportunity to show cause and recording the reasons thereof.
- SPCB has the powers to refuse grant of authorisation after providing reasonable opportunity of hearing to the occupier.
- Packaging, labelling and transportation of hazardous wastes to be done in the specified manner.
- State Government to identify sites for disposal of hazardous wastes within the states, and publish inventory containing relevant information
- Occupier generating hazardous wastes, or the operator handling the facility, to maintain records of such operations in the prescribed manner
- Occupier generating hazardous wastes, or the operator handling the facility, to submit annual returns in the prescribed forms
- Occupier or the operator handling facilities to report to the SPCB in the prescribed forms, in case of accident occurred at the hazardous waste handling site or during transportation.
- Specified procedures to be followed for import of hazardous wastes to be used for processing or reuse as raw materials
- Any person importing hazardous waste to maintain records of the imports in the prescribed form for inspection purposes by regulatory agencies
- An occupier's right to appeal to the Appellate Authority in the prescribed manner in case of grievance(s) against any order of suspension, cancellation or refusal of authorisation by SPCB

The Environmental Audit Notification of 1992

The MoEF through its notification No G.S.R. 329(E) dated March 13, 1992, incorporated Rule 11 on submission of Environmental Audit report by every industry as an amendment to the Environmental (Protection) Rules, 1986. This notification applies to every person carrying on an industry, operation or process requiring consent to operate under the Water Act, Air Act, or both or authorisation under the

Hazardous Wastes (Management and Handling Rules}, 1989, issued under the Environment (Protection} Act, 1986. The word *audit report* was later substituted by the word *Statement*. The Environment Statement is required to be submitted in a prescribed format (FORM V) by 30th September every year for the relevant financial year ending 31st March. The industries are required to furnish information about their activities, raw materials consumption, products, air and wastewater management, water consumption, solid and hazardous waste management, etc .in the Environmental Statement.

The Public Liability Insurance Act, 1991

The Public Liability Insurance Act, (PLI), 1991, imposes on the industry owner the liability to provide immediate relief in respect of death or injury to any person or damage to any property resulting from an accident while handling any of the notified hazardous chemicals. This relief has to be provided on "no fault" basis. Owner handling hazardous chemicals has to take an insurance policy of an amount equal to its "paid up capital" or up to Rs 500 millions, which ever is less. The policy has to be renewed every year. New undertakings have to take this policy before the commencement of the activity .The owner also has to pay an amount equal to its annual premium to the Central Government's Environment Relief Fund (ERF). The payment under the Act is only for the immediate relief; owners shall have to provide the final compensation, if any, arising out of the legal proceedings.

JURISDICTION FOR CONTRA VENTION OF ENVIRONMENTAL LEGISLATION

This section provides an overview of judicial responses for contravention of specific provisions of environmental legislation and includes the nature of penalties for specific contravention, liability for penalty and cognisance of offences by the courts.

Penalties for Contravention

Liability Jar Penalty: Offences by Industries

In case of an offence by an industry, every person who at the time of the offence was directly in-charge of, and was responsible for the industry's conduct of business, as well as the industry shall be liable for penalty. However, the provisions shall not be applicable if the person proves that the offence was committed without his knowledge, or that all due diligence was exercised to prevent the commission of the offence. In case of an offence committed by an industry, the Director, Manager, Secretary or other officers of the industry shall also be liable for penalties, if the offence can be attributed to neglect, consent or connivance on their part.

Cognizance of Offence

No court shall take cognisance of any offence under the Environmental Acts except on a complaint made by:

- a) The Pollution Control Boards/Central Government or Agencies authorised by it; or
- b) Any person who has followed the specified procedure before filing complaint to the court.

Specified Procedure

The person aggrieved has to give a notice of not less than sixty days in the prescribed form of the alleged offence and of his intention to make a complaint to the court, to the concerned authority.

Bar on Jurisdiction

The Water Act, 1974, and the Air Act, 1981

No civil court shall have jurisdiction to entertain any suit or proceedings in respect of any matter which an appellate authority constituted under these Acts is empowered to determine and no injunction shall be granted by any court or other authority in respect of any action taken or to be taken in pursuance of any power conferred by or under these Acts.

The Environmental (Protection) Act, 1986

No civil court shall have jurisdiction to entertain any suit or proceeding in respect of any thing done, action taken or order or direction issued by the Central Government or any other authority or officer in pursuance of any power conferred under this Act.

No suit, prosecution or other legal proceedings shall lie against the Government or any officer of the Government or SPCB, in respect of action taken in good faith pursuance of the Act.

Penalties for Contravention of Environmental Enactment

The Water Act, 1974 (Amended up to 1988)

i)	Non-furnishing of information required by the PCB for the purpose of this Act.	For first contravention	Imprisonment up to three months or fine up to Rs 10,000 or both.
ii)	Failure to comply with PCB's directions for providing information for the purpose of preventing or controlling pollution of water	For first contravention	Imprisonment up to three months or fine up to Rs.10,000 or both
iii)	Failure to comply with PCB's directions restraining or prohibiting the discharge of polluting matter into the stream or well or on land;	For first contravention	Imprisonment for one and half years to six years and with a fine.

OR	Failure to industry with Court's direction to restrain discharge of effluent on application by the SPCB;	After the conviction	first Additional fine up to Rs.5000 per day till the failure continues
OR	Failure to comply with PCB's direction for closure, prohibition or regulation of any industry, operation or process or the stoppage or regulation or supply of electricity, water or any other service.	-do-	-do-
	Damage to property of the Board, OR	-do-	Imprisonment up to 3 months or fine up to Rs.10,000/-
	Obstructing the PCB personnel from exercising their powers and functions OR		-do-
	Failure to intimate about the occurrences of any accident, OR		-do-
	Supplying false information while obtaining consent.		
v)	Interference in PCB's monitoring work by tampering with the monitoring equipment.		Imprisonment up to 3 months or fine up to Rs.10,000 or both.
vi)	Non-compliance with effluent standards prescribed by the PCB		Imprisonment for one and half to 6 years and fine.
vii)	Making new outlets and thus discharging effluent without consent of the PCB	For first contravention after first conviction	Imprisonment for 2 to 6 years and fine. Imprisonment for 2 to 7 years and fine.
viii)	Contravention of any of the provisions of this Act or any order or direction given under this Act for which no penalty has been prescribed	For first Contravention After this conviction	Imprisonment up to 3 months of fine up to Rs.10,000 or both Additional fine up to Rs.5,000/-per day till such failure continues.
	<i>The Water Cess Act, 1977</i>		
i)	Non-payment of cess within the specified		Fine not exceeding

[illegible]

	OR		up to Rs.10,000/- or both.
	Furnishing false information while seeking consent.		Imprisonment up to 3 months or fine up to Rs.10,000/- or both.
iii)	Contravention of any of the provisions of this Act or any order or direction for which no penalty has been prescribed	For the first contravention After first conviction	Imprisonment up to 3 months or fine up to Rs.10,000/- or both. Additional fine up to Rs.5,000/- per day till such failure continues.
<i>The Environmental (Protection) Act, 1986</i>			
	Failures to comply with any of the provisions of the Act/ directions/ orders issued thereunder	For the first contravention After first conviction	Imprisonment up to 5 years or fine up to Rs. lakh or both. Additional fine up to Rs. 5,000/- per day till such failure continues.
<i>The National Environment Tribunal Act, 1995</i>			
	Non compliance with any order made by Tribunal		Imprisonment for a term of three years or fine extending up to Rs.10 Lakh or both.

APPLICABLE ENVIRONMENTAL STANDARDS

The MoEF has the overall responsibility to set policy and standards for the protection of environment along with Central Pollution Control Board (CPCB). This includes air, noise, water, and hazardous waste standards. The relevant standards, which are of significance to the mining industry, are as follows:

Emissions Standards

The emissions standards for pollutants like Particulate matter, sulphur dioxide, carbon monoxide and oxides of nitrogen are given by CPCB in its document *Standards For Liquid Effluents, Gaseous Emissions, Automobile Exhaust, Noise And Ambient Air Quality -Pollution Control Law Series: PCI/4/1995-96, June 1997.*

Particulate Matter

There are no specific standards for particulate matter emission from mining industry, therefore, the emission of pollutants will be governed by General Standards for Discharge of Environmental Pollutants promulgated under the Environment Protection Rules (1993), which are enclosed in *Annex A*. As per the General Emission Standards, the standard for particulate matter emission concentration should not exceed 150 mg/Nm³.

Sulphur Dioxide (SO₂)

There is no specific standard for sulphur dioxide emission from mining industry, however, its emissions are governed by stack height criteria for SO₂ emission *i.e.* $H = 14 Q_{exp} 0.3$ where H is stack height in meters and Q is SO₂ emissions in kg per hour.

Carbon Monoxide (CO)

No specific standard for CO emission from foundries is available. However, in such case General Emission Standards are applicable. As per the General Emission Standards, the CO emission should be limited to 1% (v/v basis).

Oxides of Nitrogen (NO_x)

No specific standard for NO_x emission is available. The NO_x emission standards also do not figure in the General Standards for Discharge of Industrial Emissions, except for in case of Power Plants.

Ambient Air Quality Standards

The standards for National Ambient Air Quality (NAAQ) have been prescribed by CPCB vide Gazette Notification dated 11th April 1994. The prescribed Indian standards are given below in Table-11.

Table-11 : National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air (µg/m ³)		
		Industrial Area	Residential, Rural & Other Areas	Sensitive Areas
Sulphur Dioxide (SO ₂) (µg/m ³)	Annual Average* 24 Hours**	80 120	60 80	15 30
Oxides of Nitrogen (NO _x) (µg/m ³)	Annual Average* 24 Hours**	80 120	60 80	15 30
Suspended Particulate Matter (SPM) (µg/m ³)	Annual Average* 24 Hours**	360 500	140 200	70 100
Respirable Particulate Matter	Annual Average* 24 Hours**	120 150	60 100	50 75

(Size less than 10 microns)				
Lead (Pb) ($\mu\text{g}/\text{m}^3$)	Annual Average* 24 Hours**	1.0 1.5	0.75 1.0	0.50 0.75
Carbon Monoxide (CO) ($\mu\text{g}/\text{m}^3$)	8 Hours 1 Hours**	5000 10000	2000 4000	1000 2000

NOTE

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly /8 hourly values should be met 98% of the time in a year. However 2% of the time, it may exceed but not on two consecutive days.

Ambient Noise Standards

Ambient standards with respect to noise have been notified by the MoEF vide gazette notification dated 26th December 1989. It is based on the weighted equivalent noise level (Leq). The standards are presented in Table-12.

Table- 12 : Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day Time*	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

* Day time is from 6 am to 9 p.m., Night time is 9.00 p.m. to 6.00 am

** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.

Noise Standards for Occupational Exposure

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act. These are given in Table-13 as follows.

Table –13 : Standards for Occupational Noise Exposure

Total Time of Exposure per Day in Hours (Continuous or Short term Exposure)	Sound Pressure Level in dB(A)
8	90

6	92
4	95
3	97
2	100
3/2	102
1	105
$\frac{3}{4}$	107
$\frac{1}{2}$	110
$\frac{1}{4}$	115
Never	>115

Note:

1. No exposure in excess of 115 dB(A) is to be permitted.
2. For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.

Wastewater Discharge Standards

The wastewater discharge from Limestone mining units is negligible. However, the discharge of wastewater from mining units will be based on General Standards for Discharge of Environmental Pollutants promulgated under the Environment Protection Rules (1993).

ENVIRONMENTAL PERMITS REQUIRED FOR MINING PROJECTS

The principal Environmental Regulatory agency in India is the Ministry of Environment and Forests (MoEF), New Delhi, which accords environmental clearance.

As per the policies and legal framework, for a mining industry following set of environmental approvals are necessary:

- Consent to Establish by the State Pollution Control Board (SPCB);
- Environmental Public Hearing proceedings by the SPCB;
- Approval of Mining Plan by the Bureau of Indian Mines;
- Site Clearance by the MoEF;
- Environmental Clearance by the MoEF;
- Forest Clearance by the MoEF, if project falls within forest land; and
- Consent to Operate by the SPCB.

Procedure for Environmental Clearance

Per the notification dated 27 January 1994 as amended on 4th May, 1994 issued under EPA, 1986, an environmental clearance is required for setting up projects listed in the

notification provided the investment cost is more than Rs 500 million. However, mining is one of the highly polluting industries listed in the Schedule and requires clearance irrespective of the investment cost. The application for clearance has to be made in a prescribed proforma (specified in Schedule II of the amendment) and is submitted to MoEF along with the project report which includes an EIA & EMP. MoEF examines the environmental implications of these operating/ new projects. The categories of mines which are referred to MoEF include:

- Mining projects of more than 5 hectare in area, of both public sector and private sector, financed partly or wholly by international funding agencies like World Bank, etc
- Mining projects of more than 5 hectare in area, of both public sector and private sector, needing forest clearance (In this case, the main objective is to assess the realistic minimum need of forest land).

For grant of Environmental Clearance from the State or Central Government, an application is to be submitted to MoEF (at the Centre) or Department of Environment (DoE, at the State level), with the following particulars:

- Filled in Application Form;
- NOC from the SPCB;
- Summary Project Report (one copy);
- EIA/EMP;
- Risk Analysis Report;
- Comprehensive Rehabilitation Plan -if more than 1,000 people are likely to be displaced, other wise only the summary plan;
- Commitment regarding availability of water and electricity from competent State authorities.

The EIA & EMP reports should be prepared in accordance with the guidelines issued by MoEF .

MoEF has constituted EAC for mining projects which gives recommendations for the projects under its purview based on technical assessment of documents and data furnished by the project authorities, supplemented by data collected during visits to sites, if undertaken, and interaction with the affected population and environmental groups, if necessary .EAC is not a statutory body, but only a recommending authority, generally with the following terms and conditions:

- to examine the environmental aspects of Mining Projects along with their EMP referred to MoEF and make recommendation for their approval or rejection;
- to suggest preventive and mitigative measures and pollution control devices including choice of appropriate technology for projects recommended for approval;
- to review and analyse EMP submitted in respect of the new Mining Projects; and

- to ensure, through appropriate monitoring mechanisms, that environmental safeguards proposed/ recommended are effectively implemented.

The committee is constituted of members drawn from MoEF, Indian Bureau of Mines, Institutes organisations dealing with mines and mining environment, mines safety and mining research, as well as eminent people connected with public life. It is headed by a very senior and eminent mining engineer. A Senior Officer of MoEF acts as the Member Secretary. The Committee may co-opt other experts to facilitate evaluation of the proposals, if there is any specific evaluation of the proposals and also if there is any specific requirement of expertise regarding technology / methodology, etc.

The assessment is completed within a period of ninety days from the receipt of the requisite documents and data from the project authorities. Based on the recommendations of the EAC (M), environmental clearance is granted by MoEF, with or without any additional safeguards, which are spelt out in the formal letters issued to the project proponent. MoEF, upon evaluation of the data would specify an insufficiency or inadequacy to the project proponent within 30 days from the date of submission of the proposal. The project would be reviewed as and when submitted along with the requisite data. It should be noted that submission of inadequate data for the second time would mean rejection of the project summarily. MoEF may also recommend the need for a public hearing within 30 days, from the date of receipt of the proposal.

However, at least one month's notice, in at least two newspapers, would be required for such a public hearing. If no comments are received from MoEF within the specified time limit, the proposal would be deemed to have been granted an 'Environmental Clearance' unconditionally. The clearance granted is valid for a period of five years for commencement of construction or operation. No construction work, preliminary or otherwise, relating to the setting up of the project is allowed to be undertaken till the environmental clearance is obtained.

Procedure for Forest Clearance

Prior approval of the Central Government is essential before a mining lease is granted in respect of any forest area. Under *the FCA, 1980*. Central Government is empowered to constitute Advisory Committee, headed by the Inspector General of Forests, MoEF, to advice government on the Forest Clearance issue. The existing provisions under FCA affecting mining operations are:

- Prior approval of the Central Government, before the grant of any mining lease.
- All proposals involving diversion/ de reservation of forest land up to 20 hectares; or proposals for clearing naturally grown trees in the forest area or portion thereof; are referred by the State Government to the relevant regional office of MoEF for clearance from the environmental angle.
- All proposals involving forest land of more than 20 hectares are referred to the Advisory Committee headed by the Inspector General of Forest, MoFF

- The Chief Conservator of Forests (CCF) of the concerned regional office can dispose of all proposals involving diversion/ dereservation of forest land only up to 5 hectares, except proposals for regularisation of encroachments and mining (including renewal of mining leases).
- Forest area required for safety zone for mining operations should not be part of the forest area proposed for diversion. Such area will have to be fenced at the cost of the project authority. Further, project authority have to deposit funds with the Forest Department for the protection and regeneration of such Safety Zone Area (SZA) and also bear the cost of afforestation in the degraded forest elsewhere.
- Compensatory afforestation is one of the most important conditions stipulated by the Central Government while approving proposals for diversion/ dereservation of forest land for non-forest uses. Compensatory afforestation shall be raised over degraded forest land on area equal to the forest area diverted de-reserved.
- The cost of compensatory afforestation has to be built into the project cost. The non-forest land identified for afforestation should be:
 - in compact patches and not too much scattered, preferably be adjacent to a forest area and be near as possible to the locality where diversion is allowed;
 - it has to be physically seen by the Divisional Forest Officer (DFO); and
 - certified to be suitable for afforestation.

There are specific guidelines for project proponents where diversion of forest land for mining activities is proposed. These include the following:

- Utmost care should be taken to avoid forest land or keep the forest land requirement to the minimum. The mine plan/ project layout should make maximum utilisation of the non-forest area, for locating different project units.
- Diversion of forest land for purposes of ancillary mining works like office building, workshop, magazines, residential colonies etc are not considered
- Justification for location of project in the forest land and justification for the same being the minimal area required for purpose including the alternatives examined and rejected, should be furnished to the Divisional Forest Officer for approval.
- The proposed forest area should not be a habitat of any endangered species of flora or fauna; or a corridor to the migratory routes of wild animals; and its loss should not impair important hydrological system/ catchment area.
- The distance of mining area from the perennial water courses, National and State Highways, National Parks and Sanctuaries should be away as far as possible. Major mining operations are not permitted within one km of National and State Highways.

The Central Government after considering the advice of the committee may grant approval to the proposals with or without conditions or reject the same.

Consents to Establish

The provision of '*Consent to Establish*' under the Water and Air Acts have been made obligatory after amendments to the Acts made in 1988 and 1987 respectively. Earlier, SPCBs were issuing separate NOCs for siting an industry and for adequacy and appropriateness of pollution control equipment and related measures. This requirement has now been replaced by the '*Consent to Establish*'. However, some SPCBs have not yet notified the amended rules. In such cases, the proponent is still required to obtain a NOC from the SPCB and not the '*Consent to Establish*'. For obtaining a NOC, an application is to be submitted to the SPCB with the following details:

- Application mentioning the purpose of NOC;
- EIA proforma specified by the SPCB, in quadruplicate; and
- Feasibility report.

Consent to establish for discharge of effluents, under the Water Act, 1974

All industrial units (operation, process or any treatment and disposal system) which are likely to discharge sewage or trade effluents into a stream, sewer or on land, are required to obtain 'Consent to Establish for Discharge of Effluents' under the Water Act, 1974 (amended in 1988). For obtaining this consent, an application is to be submitted to the concerned SPCB in the prescribed form along with the prescribed application fee.

Consent to establish for emission under the Air Act, 1981

All industrial units (operation or process) located in an Air Pollution Control Area (APCA) declared so by the concerned SPCB, and likely to emit air pollutants in the atmosphere, are required to obtain 'Consent to Establish for Emissions' under the Air Act, 1981 (amended in 1987). For obtaining this consent, an application is to be submitted to the concerned SPCB, in the prescribed form and along with the prescribed application fee.

After obtaining the 'Consent to Establish' and 'Environmental Clearance', the project proponents can begin work related to the setting up of the project. After this, a half yearly compliance report is to be submitted indicating effective implementation of the recommendations and connotations, subject to which the 'Environmental Clearance' has been granted by MoEF .

Environmental Public Hearing (Public Consultation)

The public participation in the EIA process has become mandatory as per latest notification SO 318 (E) dated 10 April 1997. As per the notification, the environmental public hearing process shall precede the grant of Consent to Establish. On receipt of application of Environmental Public Hearing and Consent to Establish, the SPCB constitutes Public Hearing Panel comprising of members representing:

- State Pollution Control Board
- State government department dealing with the subject
- District Collector or his nominee
- State government department dealing with the Environmental matters
- Members (maximum) of Municipality /Panchayat
- Senior Citizens from local area.

Following panel constitution, SPCB releases Notice for the EPH in two local newspapers inviting objections from the bonafide people likely to be affected by a project covered under EIA notification.

INSTITUTIONAL FRAMEWORK

MoEF and Ministry of Mines (MM) are the nodal ministries of Government of India (Gol) responsible for bringing out the legislation to mitigate and control environmental pollution during mining operations. Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) have been created for control of water and air pollution; Chief Conservator of Forest (Zonal Office of the Forest Department of Central Government) and District Forest Officer (DFO) of State Government are for forest conservation; Indian Bureau of Mines (IBM) for Mineral conservation and environment protection and approval of mining plan and State directorates of Geology and Mining for granting lease. A brief on major institutions responsible for planning, instituting, formulating, implementing, monitoring and enforcement of environmental laws and regulations is as follows:

- The MoEF, constituted in 1985, is the nodal agency at Central level for planning, promoting and co-ordinating environmental programmes, apart from policy formulation. A number of enforcement agencies assist MoEF in executing the assigned responsibilities. The specific functions of MoEF are as follows:
 - environmental policy planning;
 - ensure effective implementation of legislation;
 - monitoring and control of pollution;
 - environmental clearance for industrial and development projects;
 - promotion of environmental education, training and awareness; and
 - Forest conservation and development, and wildlife protection.
- MoEF, through its six regional offices located in the country, monitors the conditions stipulated in the letters issued by MoEF, while granting approval to various projects including mining projects.

- The CPCB, was established in September 1974, for the purpose of implementing provisions of the Water (Prevention and Control of Pollution) Act, 1974. The executive responsibilities for the industrial pollution prevention and control are primarily executed by the CPCB at the Central level, which is a statutory body, attached to the MoEF. The specific functions of CPCB are as follows:
 - prevent pollution of streams and wells;
 - advise the Central Government on matters concerning prevention, control and abatement of water and air pollution;
 - co-ordinate the activities of State Pollution Control Boards (SPCBs) and provide them with technical and research assistance;
 - establish and keep under review quality standards for surface and ground water and for air quality;
 - planning and execution of national programme for the prevention, control and abatement of Water and Air Acts; and
 - ensure compliance with the provision of Environmental (Protection) Act (EPA),1986.
- The SPCBs (for this project, it will be the Meghalaya Pollution Control Board, MPCB, with head office in Shillong) were constituted, to implement the Water Act in respective States of the Indian Union. SPCBs were also made responsible for implementation of Air Act and to a large extent the EPA. The specific functions of MPCB are as follows:
 - plan and execute state wide programmes for prevention, control and abatement of water and air pollution;
 - advise the State Government on prevention, control and abatement of water and air pollution and siting of industries;
 - ensure compliance with the provisions of relevant environmental legislation;
 - establish and review local effluent and emission standards; .ensure legal action against defaulters;
 - develop cost effective methods for treatment, disposal and utilisation of effluent.
- **National Environment Appellate Authority (NEAA)** was formed in March 1997, to act as a vigilant body for dealing with the representations, complaints, and appeals made by any person/body /NGO against the decisions of competent authorities (under the EP A), granting environmental clearance covered under the EIA notification. NEAA is also expected to avoid the delays arising out of protracted litigation involving development projects and affected people.
- MoEF has also made environmental public hearing mandatory for industrial developmental projects, (especially the new developmental projects), under the

EIA notification of January 1994 (as amended); thereby making the process more transparent to the public.