

CHAPTER-6

ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

6.1 ENVIRONMENTAL IMPACTS

6.1.1 Introduction

The proposed project would create impacts on the environment in two distinct phases :

- i) During the construction phase which may be regarded as temporary or short-term;
- ii) The other during the operation stage which would have long-term effects.

The environmental impacts in this study have, as such, been discussed separately for the construction phase and the operation stage of the mining project. The construction phase impacts are related to the opening of the new shale mine at Shella, East Khasi Hills District in Meghalaya.

6.2 IMPACT ON SOIL

Impact on soil will be localized i.e. around the mine site. Generally soil in study area is found only on the crevices and fissures while the rest of the area is rocky. So likelihood of any adverse impact from soil erosion and disturbance in quality is remote. However, the impacts that will occur are reversible as the impacts will be felt in the initial stages of mine operation, i.e. till the vegetative cover is developed. The summary of impact assessment on soil is stated in Table-6.2.1.

Table-6.2.1

Summary of Impact on Soil

Impact Area	Nature of Impact ¹	Targets/interests ²	Magnitude and extent ³	Overall significance ⁴
Derogation of soil quality	Cumulative contamination with dust, surface run-off, reversible	Soil quality, flora and fauna, including grazing livestock	Localised near sources; small contribution to existing background levels, provided dust control. No solid waste generation and no overburden would be felt.	Minor
	Physical effects on soils due to top soil removal, nutrient loss; irreversible	Soil quality, flora	Site areas only	Moderate.

- 1 Description; short or long term; reversible or permanent; associated with construction, operation, decommissioning, cumulative, accidental etc.
2. Targets and interests potentially affected.
3. Adverse or beneficial; small, large, etc; very localized (sites only), local, regional national.
4. Overall significance against (criteria minor; moderate, some significance).

6.3 IMPACT ON LANDUSE

The project site includes the shale mine area (4.9 hectares) and the study area zone of 10 km radius with betel nut plantation and limited agrarian land use. The proposed mining operation will change the topography and the landscape of shale bearing area and its immediate vicinity in the core zone only.

Due to the crusher, no major topographical change is likely to take place except some levelling and construction of structures.

6.3.1 Landuse in Buffer Zone

No adverse impacts are anticipated on land use of buffer zone due to the proposed mining operations, as all the mining activities will be confined to core zone only. The land to be diverted from its present use towards opening of the new mine is 4.9 hectares, which has a moderate vegetative cover. Large scale plantation and afforestation around the site would largely offset any damage to the visual landscape. Therefore, impact on landuse due to mining would be felt minimal.

6.4 IMPACT ON HYDROLOGY AND WATER QUALITY

The proposed project lies in sub-tropical region surrounded by natural watercourses, springs and waterfalls. The main drainage in the study area is governed by the Phlangkaruh river and the Umium river along with its tributaries.

Due to long monsoon climate 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.

There is no perennial water stream within the mine area. The Phlangkaruh river originating in the area is anticipated to carry 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 will, however, stabilise the drainage pattern also.

6.4.1 Impacts on 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 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 within the water samples.

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

As the 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.

6.4.2 Impacts on Ground Water

The potential impacts 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. In general, the entire study area is devoid of borewells for the water sources and as such, the likely chances of the contaminants reaching the groundwater are very rare.

6.5 IMPACTS ON AIR QUALITY

6.5.1 Impact During Construction

Particulate matter would be the predominant pollutant affecting the air quality during this phase. Undesirable gases such as SO₂, NO_x and CO would be generated mostly by the automobile traffic; however, this is not expected to lead to any tangible effects, particularly, if the traffic is scheduled to avoid unnecessary congestion in the area.

The soils of the project area, being generally sandy loam in texture, is likely to generate a small quantities of dust, during the major earth excavation programmes and especially during the dry season. It is recommended that access roads be given suitable surface treatment to curb dust generation; sprinkling of water from trucks or other suitable means should be undertaken at the sites for suppression of fugitive dust. Suitable plantations should be initiated around the site for arrestation of air borne dust, which would also contribute to improving the aestheticity of the area.

6.5.2 Impact During Operation

The mining operations, especially the use of the various equipments, result in pollutant emissions, both of the particulate type as well as the gaseous forms of SO₂ and NO_x.

For study of the impact on air quality due to such mining activities, several ambient air monitoring stations were set up as illustrated in Exhibit-5.8.1. The monitoring, conducted over winter season revealed that while the average SPM levels varied between 52 to 76 microgramme/cubic metre, the 95 percentile values ranged between 64 to 88 microgramme/cubic metre.

Correspondingly, the dustfall rate ranged between 0.1264 to 0.1309 MT/Km²/month.

Similarly, SO₂ and NO_x monitoring at eight (8) stations revealed that the P95 results of these 2 parameters varied between 4.3 to 4.8 and 9.5 – 12.7 microgramme/cubic metre respectively. In order to quantify the contribution of the mining machineries being used in stability classes A and B and in the future to the overall levels of SO₂ and NO_x, mathematical modeling techniques were resorted to.

The Gaussian dispersion model (Pasquill/Gifford) version formed the basic framework of the computer model used for the computations. The overall mining area was divided into smaller areas considered as volume sources, situated at ground level. Thus the factor of plume rise, an important feature for emission through stacks was not applicable in this case.

Pasquill's stability classes (A and B) were used to find out the stability categories on the basis of surface wind speed (10 metres) and level of incoming solar radiation. The dispersion estimates were made following the assumption that the plume spread

has a Gaussian distribution in the horizontal and vertical planes of σ_y and σ_z respectively. The estimates of σ_y and σ_z as a function of downwind distance from the source were made after determining the stability classes. However, during this exercise, the following cautions were adopted to account for the volume nature of the sources :

- i) For all computations concerning a receptor located outside the mining area or at a distance of atleast 2 kms, each mine is considered as a single volume source with a single emission point and a wide initial lateral dispersion ($\sigma_{y0} = 600$ metres).
- ii) For any computations concerning a receptor located within shale mine or at a distance less than 2 kms, the mine is divided into smaller areas, each considered as a volume source, represented by a single emission point, with an initial lateral dispersion given by $\sigma_{y0} = 200$ metres).
- iii) In either case, an initial vertical dispersion given by $\sigma_{z0} = 20$ metres has been considered.

Using the above considerations, the short term (24 hour) concentrations due to release of such emissions were estimated, assuming wind blowing principally from one direction, in order to ascertain the incremental contributions to the ambient air monitoring data as well as to predict the 24-hourly concentrations due to the proposed mines, thus enabling comparison with the prevalent ambient air standards of the country.

It has been assumed that, as regards both SO_2 and NO_x , the emission rate of each mine was proportional to its mining activities. For practical purposes, this emission rate was assumed to be constant and established on the basis of the total power of engines operating in the mine. This methodology resulted in the emission levels of SO_2 and NO_x , presented in Section-4.11 earlier, which are also reproduced below :

Atmospheric Emissions

SO ₂ (kg/day)	NO _x (kg/day)
102	204

The resultant 24-hourly concentrations of SO_2 and NO_x , so determined for different stability conditions are presented in Table-6.5.1.

Expectedly, since these are ground level sources, the pollutant concentrations decreases exponentially with increasing distance from the source. It would be observed that while the maximum NO_x contributions vary between 1.5-3.18 microgramme/cubic metre, similar levels of SO_2 range between 0.75-1.59 microgramme/cubic metre, at a distance of 0.5 km from the source, between all the mines.

Thus, the superimposition of the projected concentrations of NO_x and SO₂ due to operation of the proposed mine would not lead to a substantial increase of the pollutant levels, existing in the area today. Particularly, the SO₂ levels which would increase to a maximum level of about 6.40 microgramme/cubic metre, would be well within the permissible standards of 120 microgramme/cubic metre for industrial areas.

Table-6.5.1

**Short-term 24 Hour Concentrations of NO_x & SO₂ from Mine Emissions
for Different Stability Conditions**

Wind Speed at 10 metres (m/sec)	Incoming Solar Radiation	Stability Class	Distance (km)	σ_y	σ_z	Concentration (microgramme/ cubicmetre)	
						SO ₂	NO _x
1.0	Strong	A	0.5	311	120	1.59	3.18
			1.0	411	220	0.66	1.32
			2.0	590	420	0.24	0.48
			4.0	1310	820	0.06	0.12
1.5	Strong	A	0.5	311	120	1.06	2.12
			1.0	411	220	0.44	0.88
			2.0	590	420	0.16	0.32
			4.0	1310	820	0.04	0.08
2.0	Moderate	B	0.5	282	70	1.50	3.00
			1.0	356	130	0.64	1.28
			2.0	492	250	0.24	0.48
			4.0	1150	520	0.05	0.10
4.0	Strong/ Moderate	B	0.5	282	70	0.75	1.50
			1.0	356	130	0.32	0.64
			2.0	492	250	0.12	0.24
			4.0	1150	520	0.02	0.04

6.6 IMPACTS ON ECOLOGY

6.6.1 Buffer Zone

Flora : The activity extending from the core-zone to buffer zone is transportation. No other direct effect on vegetation is anticipated.

Fauna : Faunal species as observed during the field survey are adapted to the human presence. Moreover, as the deviation in the land use pattern in buffer zone from the existing pattern is not large, any major impact on the fauna is not anticipated.

6.6.2 Core Zone

Flora : The flora, which grows in the core zone are mainly stunted shrubs and low girth trees in the crack and fissures of the mine. In the southern part of the mine area a patch of land around the existing sink hole comprises of dense growth of *Rowulfia serpentina*. The *Rowulfia*, also locally known as sarpagendha, is an important herb for the plant species and is also an important medicinal plant with anti toxic values and used for medical activity.

Fauna : The fauna, which is reported to be frequent in this area do not belong to the higher order. As a result no specific habitat or niche is affected. Therefore, during the operational stage precaution to reduce noise level and during final land restoration, development of favourable conditions such as water bodies, sheltering trees and shrubs shall be kept in view. The summary of impact assessment of Flora and Fauna is depicted in the Table-6.6.1.

Table-6.6.1

Summary of Impact Assessment : Flora and Fauna

Impact Area	Nature ¹	Targets/Interests ²	Magnitude ³ and extent	Overall Significance ⁴
Loss of habitat	Loss of vegetation land in core zone and relatively small area in the buffer zone for roads and transportation.	Flora and fauna, no known special interests or species. Improved microclimatic conditions.	Afforestation. Beneficial, Medium.	Moderate
Disturbance	Light noise. No waste water generation.	Breeding birds, and aquatic flora and fauna	Small aquatic ecology will not be affected by mining activity.	Minor

- 1 Description; short or long term; reversible or permanent; associated with construction, operation, decommissioning, cumulative, accidental etc.
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6.7 IMPACT ON DEMOGRAPHY AND SOCIOECONOMICS

6.7.1 Impact During Construction

Construction of any project invariably leads to socioeconomic changes. Large scale influx tend to change the economic status of the community.

The peak labour strength during the construction period of limestone and shale mines and belt conveyor may rise upto several hundred persons. 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. Bulk of the labour force would comprise of unskilled/semi-skilled workers, a substantial number of whom would presumably be recruited from the surrounding areas itself.

They would tend to establish themselves on any vacant land along access roads and near the mining site. This could lead to unplanned and haphazard development of shanties of various size and description with little or rudimentary sanitation facilities. This could result in the degradation of the physical and aesthetic environment.

Proper siting of the labour camps and provision of basic amenities of water supply, sanitation etc, would go a long way in curbing the degradation of the physical and aesthetic environment.

As stated earlier, the land in the shale mine area that would be diverted from its present status for openings of the new mine is primarily consisted of barren rocky land with no settlements. As such, the shale mine project would not result in any displacement of population or oustees who would have required to be provided with rehabilitation or compensation.

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.

6.7.2 Impact During Operation

The mine being opened in a 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 to provided with adequate compensation.

In addition, the project altogether will provide more job opportunities and better economic standards to the local people and others through improved infrastructural, community facilities, etc. Development of residential colony, creation of civic and welfare amenities like primary health care, communications, educational institutes, recreational facilities, etc by the project authorities, that will develop along with the project, will ensure better quality of life for the local population.

6.8 IMPACTS ON NOISE

Once the mine becomes operational, in addition to the noise produced from shale mine operations there would be various sources of noise in the area. These sources would be :

- Drilling
- Operation of HEMM
- Crusher and Workshop
- Vehicular Movement
- Belt Conveyor

Mining operations and the crusher would be the main sources of noise pollution. Noise due to vehicular movement will be intermittent, but will also add to the background noise levels.

Since the limestone mine would be a fully mechanized mine, it has been observed that mechanization of mining technology generally leads to higher noise levels if not properly controlled. Operation of drills, shovels, dumpers, pay loaders and dozers involve noise generation above 90 dB(A), which is the prescribed Threshold Limit Value (TLV).

It would be seen that at the mine site where heavy earth moving machinery is in operation, noise level is more than 90 dB(A). The noise level is within the tolerance limit at a distance of 15 to 20 m or so.

In this context, while selecting the monitoring station, at and around the proposed mine for ambient noise levels, Nongtraï, Mawryngkhong and Phlankaruah villages were also considered as they lie in near the proposed project site. These points have maximum L_{eq} as 63.9 dB(A), 51.6 dB(A) and 53.7 dB(A) respectively and are expected to be affected by the increase in noise levels. The background ambient noise level within the study area is primarily due to chirping of birds, vehicular movement and domestic activities. The data recorded at Mawryngkhong village is the minimum in the study area due to sparsely populated region.

As there is no blasting in the shale mining operation, the possibility of high intensity of noise is negligible. So the impact over the surrounding habitat would be minimal.

There will not be any noise impact from the proposed mine during night-time as the mine operation will be restricted to two shifts operation only and no machinery operation will take place during night time. The afforestation and plantation around the proposed mine would be planned which would serve the dual purpose of checking fugitive dust as well as noise pollution.