CHAPTER – I

INTRODUCTION

1.0 Project Proponent

M.P. State Mining Corporation Ltd. is a M.P. State Govt. enterprise. Its responsibility is to develop mineral projects in the State. This coal block has been allotted to them by Govt. of India vide letter no 13016/23/2006-CA-1 dt 02.08.2006 (Annexure-1).

1.1 Importance of Project:

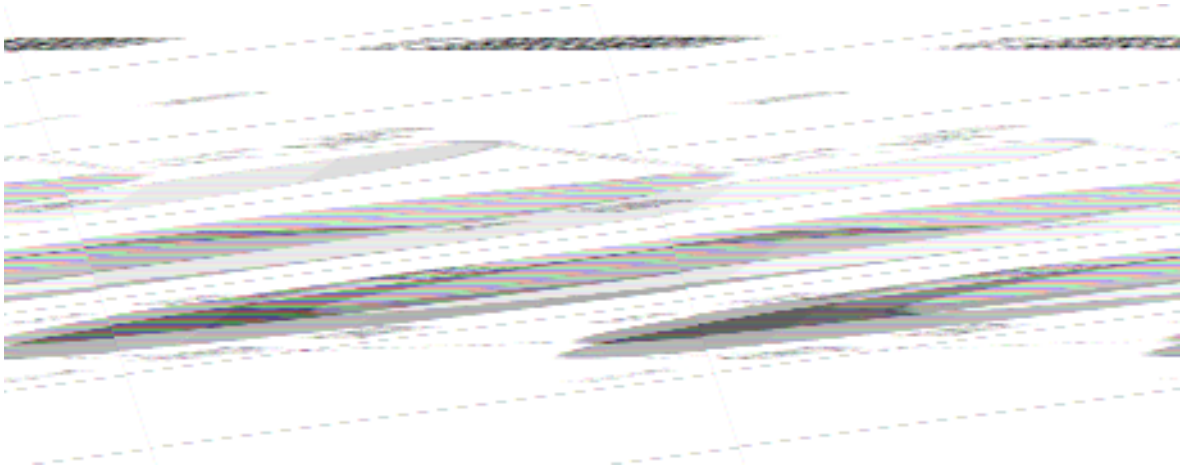
DEMAND SCENARIO – COAL

In India, share of thermal Energy is 71 %, Hydro - 25 %, Nuclear - 3 % and wind - 1 % of the 104917.50 MW of overall installed power generation capacity in the country about 59386 MW is coal based and 2745 MW is lignite based totaling to 62131 MW.

Commercial energy consumption in India has grown from a level of about 28 % to 68 % of the total energy in the last four and half decades. The current per capita primary energy consumption in India is about 243 kilograms of oil equivalent kgoe/year, which is well below that of developed countries. Driven by the rising population, expanding economy and a quest for improved quality of life, energy usage in India is expected to rise to around 450 kgoe/year in 2010. Conservation restriction on Hydro projects and geopolitical perception of nuclear power, coal will continue to occupy centre stage of India's energy scenario. The soaring demand for power will necessitate tripling of the installed generation capacity from 101000 to 292000 MW over the next two decades. At least two thirds of this power will have to come from the thermal sources – coal, oil and gas. This will mean a spiraling cost of imported fuels, including coal. Even doubling of domestic coal production would not be sufficient to meet the demand.

The overall growth in demand for all forms of fuel will mirror the growth in the power sector. Even under the alternative scenario, the total coal demand will

nearly double and both oil and gas demand will triple. There does not appear to be any alternative to coal for meeting the energy needs of the country in the foreseeable future.



A) National Context:

India aims at annual growth rate of over 9%. To sustain the projected rate of growth , it is necessary that core sector industries including coal, steel and power grow at the matching rate. One of the raw material for power generation is power grade coal. Dongri Tal-II coal Block has power grade coal reserve. Coal produced from this mine will feed to proposed thermal power plant. India has sufficient reserve of power grade coal. In the present energy scenario in the country , coal appears to be only environmentally safe , reliable and cheap source for generation of commercial energy. Alternative to mining coal from the block is import of power grade coal that has following limitations.

- Expensive as compared to indigenously mined coal.
- Limited port capacity to handle imported coal.

In this context, mining of coal from this Block is important in national context.

B) Regional context :

Madhya Pradesh state is comparatively a less developed state. Agriculture in the state mostly depends on monsoon and hence large agricultural area are monocropped. In absence of proper facility for irrigation, and poor quality of soil , agriculture yield is low. Since agriculture is mostly confined to monsoon season , people dependent on it are idle during non-monsoon season. There is need for alternate source for employment in the area for balanced growth of the region. Since state, particularly this region, is rich in coal. Coal mining projects and coal based industries will provide much needed source for employment. This will also lead to development of infrastructure in the area and also state will earn revenue for state in terms of cess, royalty & sales tax.

1.2 Size of Project:

The Block has a geological reserve of 51.32 MT. and the leasehold area is 1392Ha. The mine has been planned with a capacity of 2.9 MTY with an average stripping ratio of 15.73 cum/T. The estimated life of the project is 17 years. As per provisions of EIA Notification 2006, all “A” category project need Prior Environmental Clearance from Ministry of Environment & Forest (MOEF). This project is category “A” project & requires environmental clearance (E.C.) from MOEF. In pursuance to prescribed procedure for obtaining E.C. from MOEF Form - I & Pre-feasibility Report was submitted to MOEF for obtaining Terms of Reference (TOR) for EIA studies. Form-I was presented before EAC (T & C) of MOEF on 29.04.10. MOEF has issued TOR for EIA studies vide letter No. J-11015/266/2008-IA.II (M) Dated – 28.05.2010 (**Annexure A**). This EIA/EMP report has been prepared in compliance to the TOR issued and covers all activities of open cast mine with rated capacity of 2.9 MTY.

1.3) Terms of Reference Compliance Status

The MOEF determined the TOR for EIA Studies for the Project & conveyed it vide their letter J-11015/61/2010 – IA. II (M) dated 28.05.2010. A draft EIA / EMP has been prepared in Compliance to the given TOR. **Table 1.1** gives status of para wise compliance to the TOR.

TABLE 1.1

TOR COMPLIANCE STATUS

Sl. No.	TOR	COMPLIANCE
(i)	An EIA-EMP Report would be prepared for **2.9 MTPA** rated capacity in an ML/project area of 1392Ha based on the generic structure specified in Appendix III of the EIA Notification 2006.	The EIA/EMP has been prepared for proposed OCP with rated capacity of 2.9 MTPA in leashold area of 1392 ha on generic structure specified in APP III of EIA notification 2006. This include mining lease area of 1392 Ha & 51 Ha of land.
(ii)	An EIA-EMP Report would be prepared for 2.9 MTPA rated capacity cover the impacts and management plan for the project specific activities on the environment of the region, and the environmental quality – air, water, land, biotic community, etc. through collection of data and information, generation of data on impacts including prediction modeling for **2.9 MTPA** of coal production based on approval of project / Mining Plan for 2.9 MTPA. Baseline data collection can be for any season except monsoon.	The EIA/EMP covers assessment of impact and management plan for project specific activities on environment of region. EIA covers air , water , land & biotic attributes of environment. Mining plan for project has been submitted to MOC for approval.
(iii)	A map specifying locations of the State, District and Project location.	Plate – I shows state , district & project.

(iv)	A Study area map of the core zone and 10km area of the buffer zone (1: 50,000 scale) clearly delineating the major topographical features such as the land use, surface drainage of rivers / streams / nalas / canals, locations of human habitations, major constructions including railways, roads, pipelines, major industries / mines and other polluting sources. In case of ecologically sensitive areas such as Biosphere Reserves / National Parks / WL Sanctuaries / Elephant Reserves, forests (Reserved/ Protected), migratory corridors of fauna, and areas where endangered fauna and plants of medicinal and economic importance found in the 15 km area of the buffer zone should be given.	Plate – III shows study area including core zone and 10 km beyond project area shows Roads , Rivers , Nalas , Habitation Forest , Railway line etc There is no ecologically sensitive area within 15 km radius.
(v)	Land use map (1: 50,000 scale) based on a recent satellite imagery of the study area may also be provided with explanatory note of the land use. Satellite imagery per se is not required.	Plate V – shows the landuse map of study area based on satellite imagery of jan 2010.
(vi)	Map showing the core zone delineating the agricultural land (irrigated and un-irrigated, uncultivable land (as defined in the revenue records), forest areas (as per records), along with other physical features such as water bodies, etc should be furnished.	Plate IX - shows land use map of core zone with nalas, roads etc. There is no forest land within core zone.
(vii)	A contour map showing the area drainage of the core zone and 2-5 km of the buffer outside the lease/project area) should also be clearly indicated as a separate map.	Plate VI – Shows the topographical map of core zone showing drainage pattern.
(viii)	A detailed Ste plan of the mine showing the	Plate – VIII shows

	various proposed green belt, safety Zone, buildings, infrastructure, CHP, ETP, Stockyard, township/ colony (Within and adjacent to the ML), undisturbed area and if any, in topography such as existing roads, drains/ natural water bodies are to be left undisturbed along with any natural drainage adjoining the lease/ project and modification of thereof in terms of construction of embankments/ bunds, proposed diversion/ rechannelling of the water courses, etc., approach roads, major haul roads, etc. In case of any proposed diversion of nallah/canal/ river, the proposed route of diversion/ modification of drainage and their realignment, construction of embankment etc. should also be shown on the map. Similarly if the project involves diversion of any road/ railway line passing through the ML/project area, the proposed route of diversion and its realignment should be shown.	component of mine including town ship , green belt , water bodies diversion of nala CHP, etc. Proposed route of diversion of nala is shown in the plate. There is no proposal to divert any Road / Railway line.
(ix)	Break up of lease /project area as per different land uses and their stage of acquisition.	Para 3.12.1 shows the break-up of lease are as per land use.
(x)	Break-up of lease/ project area as per mining operations.	Break-up of Lease area as per mining operation is given Para 4.3.
(xi)	Impact of changes in the land use due to the start of the projects if much of the land being acquired is agricultural land/ forestland/ grazing land.	Impact of change in land use due to project covered at Para 4.3
(xii)	Baseline environment data covering ambient air	Impact of change in land

	quality (PM 10, PM2.5, Sox, Nox and heavy metals, noise water have been monitored during March 10 to June 10.	use due to project covered at Para 4.3
(xiii)	Map of the study area (1: 50,000 scale) (core and buffer zone clearly delineating the location of various stations superimposed with location of habitats, other industries / mines, polluting sources. The number and location of the stations in both core zone and buffer zone should be selected on the basis of size of lease/ project area, the proposed impacts in the downwind (air) / downstream (surface water)/ ground water regime (based on flow). One station should be in the upwind/ upstream/ non-impact/ non-polluting area as a control station. The monitoring should be as per CPCB guidelines and parameters for water testing for both ground water and surface water as per ISI standards and CPCB classification wherever applicable.	Plate IV shows location of various environmental monitoring stations. Air monitoring stations have been located on downwind and water monitoring stations on downstream side. Air monitoring stations have been located both on upwind and downwind direction. Similarly, water quality monitoring stations have been fixed on upstream and down stream direction the monitoring has been done as per CPCB norms.
(xiv)	Study on the existing flora and fauna in the study area (10km) carried out by an institution of relevant discipline and the list of flora and fauna duly authenticated separately for the core and buffer zone and a statement clearly specifying whether the study area forms a part of the migratory corridor of any endangered fauna. If the study area has endangered flora and fauna, or if the project falls within 15 km of an ecologically sensitive area, then a	Flora and Fauna has been studied in study area through field survey. No endangered flora or fauna has been found in study area. There is no ecologically sensitive area within 15 km areas.

	comprehensive Conservation Plan should be prepared and furnished along with comments from the CWLW of the State Govt.	
(xv)	Details of mineral reserves, geological status of the study are and the seams to be worked, ultimate working depth and progressive stage-wise working scheme until end of mine life should be reflected on the basis of the approved rated capacity and calendar plans of production from the approved Mining Plan. Geological maps and sections should be included. The progressive mine development and final mine closure plan should also be shown in figures.	Details of mineral reserve given in chapter - II the mining method , life of mine & mine closer plans are given as per mining plan. Mining plan submitted to MOC for approval. Para 2.4.1 – Coal Reserve. Para 7.4 - Mine Closure Plan
(xvi)	Details of mining methods, technology, equipment to be used, etc., rationale for selection of that technology and equipment proposed to be used vis-à-vis the potential impacts.	Details of mining method , equipments to be used are given in Para 2.10 to Para 2.15 in Chapter-II.
(xvii)	Impact of mining on hydrology, modification of natural drainage, diversion and channeling of the existing rivers/ water courses flowing though the ML and adjoining the lease / project and the impact on the existing users and impacts of mining operations thereon .	Impact of mining on hydrology given at Para 4.5. Two local Nalas flowing through the leasehold will be diverted.
(xviii)	Detailed water balance should be provided. The break up of water requirement for the	Detailed Water balance are given at Para

	various mine operations should be given separately.	4.10.7. Water demand for project given at para 4.4.1.
(xix)	Source of water for use in mine, sanction of the competent authority in the State Govt. and impacts vis-à-vis the competing users.	Ground Water will be used for potable demand at industrial site (5 KLD) and township (100 KLD) since the area falls in white zone ,no permission is required. for drawl of ground water.
(xx)	Impact of mining and water abstraction use in mine on the hydrogeology and groundwater regime within the core zone and 10 km buffer zone including long-term modeling studies on. Details of rainwater harvesting and measures for recharge of groundwater should be reflected in case there us a declining trend of groundwater availability and/ or if the area falls within dark/ grey zone.	Impact on ground Water given at Para 4.5.3 Rain water harvesting and ground water recharge details given at Para 4.16. The area falls in white zone.
(xxi)	Impact of blasting, noise and vibrations.	Detailed Noise - 4.12 Vibration – 4.13 Blasting – 4.9 B
(xxii)	Impacts of mining on the AAQ, predictive modeling using the ISCST-3 (Revised) or latest model.	Detailed at Para 4.2
(xxiii)	Impacts of mineral transportation – within and outside the lease / project along with flow-chart	Impact of mineral transport covered at

	indicating the specific areas generating fugitive emissions. Impacts of transportation, handling transfer of mineral and waste on air quality, generation of effluents from workshop, management plan for maintenance of HEMM, machinery, equipment Details of various facilities to be provided in terms of parking, rest areas, canteen, and effluents/ pollution load from these activities.	Para 4.2 Management of work shop effluent at Para 4.10 Parking, Rest Shelter, Canteen and First Aid Center to be provided at mining site. (Ref Para 4.17)
(xxiv)	Details of waste generation – OB, topsoil – as per the approved calendar programme, and their management shown in figures as well explanatory chapter with tables giving progressive development and mine closure plan, green belt development, backfilling programme and conceptual post mining land use. OB dump heights and terracing should based on slope stability studies with a max of 28^0 angle as the ultimate slope. Sections of dumps (ultimate) both longitudinal and cross section) with relation to the adjacent area should be shown.	Generation of OB & their disposal given at Para 2.18 Green Belt – para 4.14 post mining land use Para – 4.11.3. Back filing schedule – Table 2.7
(xxv)	Impact and management of wastes and issues of re-handling and backfilling and progressive mine closure and reclamation.	As discussed at management of mine waste - para 2.18 mine closure Chapter-VII. Para 7.4
(xxvi)	Flow chart of water balance. Treatment of effluents from workshop, township, domestic wastewater, mine water discharge, etc. Details of STP in colony and ETP in mine. Recycling of water to the max possible extent.	Water Balance 4.10.7 STP – 4.10.6 ETP – 4.10.1

(xxvii)	Occupational health issues. Baseline data on the health of the population in the impact zone and measures for occupational health and safety of the personnel and manpower for the mine.	Being Generated.
(xxviii)	Disaster Management Plan	Chapter – VII Para 7.2
(xxix)	Integrating in the Env. Management Plan with measures for minimizing use of natural resources – water, land, energy, etc.	Land reclamation & Recycling of treated water recommended. Para 4.18
(xxx)	Progressive Green belt and a forestation plan (both in text, figures as well as in tables prepared by MOEF). And selection of species (local) for the afforestation/ plantation programme based on original survey/ landuse.	Para 4.14 deals with Green Belt
(xxxi)	Conservation Plan for the endangered/ endemic flora and fauna found in the study area and for safety of animals visiting / residing in the study area and also those using the study area as a migratory corridor.	No endangered or endemic flora & fauna has been found. Hence no conservation plan prepared.
(xxxii)	Final Mine closure issues, post mining land use and restoration of land / habitat to pre-mining. A Plan for the ecological restoration of the area post mining and for land use should be prepared with detailed cost provisions.	Mine Closure Plan given chapter VII mine closure plan covers measure for ecological restoration.
(xxxiii)	Including cost of EMP (capital and recurring) in the project cost and for progressive and final mine closure plan.	Cost of EMP given on Para 10.3
(xxxiv)	Details of R&R. Detailed project specific R&R Plan with data on the existing socio- economic status of the population (including tribals, SC/ST, BPL families) found in the study area and broad plan for resettlement of the	Detailed Socio economic Survey of PAFs Under progress. Package for PAFs given in Chapter VII Para 7.3.

	displaced population, site for the resettlement colony, alternate livelihood concerns/ employment for the displaced people, civic and housing, amenities being offered, etc and costs along with the schedule of the implementation of the R&R Plan.	This will be in compliance to MP State R&R policy.
(xxxv)	Public Hearing should cover the details of notices issued in the newspaper, proceedings/ minutes of public hearing, the points raised by the general public and commitments made by the proponent should be presented in a tabular form. If the Public Hearing is in the regional language, an authenticated English Translation of the same should be provided.	Public Hearing to be conducted. this will be complied with
(xxxvi)	In built mechanism of self-monitoring of environmental regulations.	Environmental monitoring plan given in chapter - VI
(xxxvii)	Status of any litigations/ court cases filed /pending on the project.	There is no legal case relating to this project
(xxxviii)	Submission of sample test analysis of : Characteristics of coal – this includes grade of coal and other characteristics – ash, S and heavy metals including levels of Hg, As, Pb, Cr etc.	Being tested.
(xxxix)	Copy of clearances/ approvals – such as Forestry clearances, Mining Plan Approval, NOC from Flood and Irrigation Dept. (if req.), etc. as annexures to the Mining Questionnaire, wherever applicable. If clearances are awaited, then copy of the application made should be furnished.	Mining plan submitted to MOC for approval. No forest land required.

CHAPTER – II

PROJECT PROFILE

2.0 Location & Communication

The Dongri- Tal II Coal block (West of Suliyari- Belwar block) covering an area of about 30.09 sq km is located in the southern part of the Main Basin of Singrauli Coalfield. Administratively, it is situated in Singrauli Tahsil of Singrauli district of Madhya Pradesh and falls in the Survey of India Topo sheet No. 64 I/1 and 64/I/5 on R.F. 1:50000. The block is bounded by the following geographic co- ordinates.

Latitude : $23^0$56' 32" to 23^0 56' 25.2 N"

Longitude : 82^0 15' 31" to 82^0 18' 42.7E"

(Plate – I Index Map Plate - II Location Map). The block is approachable by all weather road from Saria (30km), Sidhi (80km) and Singrauli (67km). Katni- Chopan railway line passes through Saria village which is the nearest railway station from the block. The nearest town Waidhan, which is the Block headquarter (45Km) is connected by a fair weather road. Sidhi - Waidhan road via Parasia village is the nearest state highway to the present block. The Singrauli town is connected to Katni (100km), Satna (30km), and Varanasi (210km) by National Highways. The block is traversed by number of fair weather and forest roads. The important villages in the block are Dongri, Tal, Ronhal, Jhalri, Behru, Bindul, Digwah, Bajauri, Jalpani, Siktatola etc.

2.1 Topography and Drainage

The Dongri- Tal II block exhibits gently undulating topography. The entire area is covered by soil. The elevation of the ground varies from 392.59m to 476.21m in the north – eastern part of the block (Ref. **Plate – IV**. For Topographical Map of Core Zone).

The Singrauli coalfield is located in the drainage area of Sona and Rihand rivers and their tributaries. One of the tributaries of Sona river, Gopad river flows(S-N) on western side of the block. The block is traversed by Jharia nala in the north- western part. Hurdul nala traverses through the block from North- west, central and eastern part of the block, while Jharia nala traverses from north- western part to south- central and to the south- eastern part of the block. All the three nalas in the block flow westerly and ultimately drain into the Gopad River. All these nalas originate from Mahadeva hill ranges located in the eastern part of the block and drain all along with plain. Gopad River is perennial and all other nalas are seasonal **(Plate III shows topography of block).**

2.2 Geology of Dongri Tal - II (phase – I) coal block

Dongri Tal- II block is located in the southern part of main basin of Singrauli Coalfield. The entire block is covered by sandy soil on plains of Barakar formation. The geological set up is thus evolved on plains of Barakar formation. The geological set up is thus evolved solely on the basis of subsurface data generated during exploration activities. The geological succession evolved on the basis of exploration data generated in the block is given in the **Table 2.1**

Table No. 2.1- Geological Succession in Dongri Tal- II (Phase-I) Block

Formation	Thickness (m)	Lithology
Recent to sub- recent	1.00-9.00	Soil, alluvium
Intrusives	15.00-31.86	Dolerite dyke
Barakars	9.00- 221.00	Fine, medium and coarse grained feldspathic, grey sundstone, micaceous and laminated at places, Grey shale, fire clay, intercalation of shale and sandstone and carbonaceous shales with coal seams.
Talchir	>8	Tillite, fine grained sandstone, siltstone, shale
Pre- Cambrian	Not intersected	Phyllites, quartzintes, schists & gneisses

2.2.1. Description of Formation in Dongri Tal - II (phase – I) block.

The description of different geological formations encountered in boreholes drilled in Dongri- Tal-II (Phase-I) block is given below.

- **Talchir Formation:** The rocks of Talchir formation are not exposed within the block. However, it has been encountered in borehole MJT-53 The thikness of Talchir as intersected in this borehole is 8.00M and it is represented by greenish grey shale. Talchir formation is unconformably overlain by Barakar formation.
- **Barakar Formation:** Barakar formation is intersected in all the 88 boreholes drilled in this block and is exposed at places in Hurdul nala flowing through the northern part of the block. Thickness of Barakar formation as intersected in boreholes varies from 9- 221m . Barakar formation consists of fine to coarse grained white to grey feldspathic sandstone , shale , carbonaceous shale and coal horizons.

2.2.2. Shale , carbonaceous shale and coal horizons.

- **Igneous Intrusive -** The igneous intrusives in this block occurs as intersected in boreholes MPC – 31 (31.86 m) and MPC 73 (15.00 m).
- **Soil & Alluvium -** Major part of the block is covered by a layer of soil and alluvium, the thickness of soil ranges from 1.00 m to 9.0 m.

2.2.2.1 Coal seams

Regional drilling in Dongri- Tal-II (Phase-I) block by MECL has revealed the presence of eight carbonaceous horizons viz; VII top, VII middle VII bottom, VI, Local II, V and III belonging to Barakar Formation. Out of these only two seams viz. VIII and VII-B has attained workable thickness (>1m.) in almost entire block. The remaining carbonaceous horizons are thin (<1m.) and impersistent in major part of the block and hence not workable. The workable seams VIII and VII bottom are mainly composed of coal, shaly coal, Carbonaceous shale and shale. The coal is dull in appearance, high in moisture and is of non-coking type.

2.2.2.2 Sequence of Coal Seams

The variation in thickness of coal seams and their intervening partings intersected in boreholes drilled by MECL & GEOLOGICAL AND MINING CONSULTANCY within the block has been given in **Table 2.2** Part thickness of seam/intervening parting due to fault/ sub crop has not been considered.

Table – 2.2. Sequence of Cost Seams and Partings

S.No	Coal Seams	Thickness of coal Seam (m)		Thickness of parting (m)	
		Minimum	Maximum	Minimum	Maximum
1	VIII	0.89	2.84		
	Parting			12.62	31.17
2	VII Top	0.08	0.63		
	Parting			1.78	5.28
3	VII Middle	0.11	2.26		
	Parting			1.05	13.43
4	VII Bottom	0.56	3.99		
	Parting			16.16	24.90
5	VI	1.10	1.00		

	Parting			6.05	9.17
6	Local II	0.20	0.23		
	Parting			27.59	37.68
7	V	0.20	1.25		
	Parting			47.42	
8	III	0.30			

2.2.2.3.The seams have been described in descending order:-

A). Seam VIII

Seam VIII is the uppermost coal seam in the block. It overlies seam VII Top with a paring of 12.62m to 31.17m. This seam occurs in the northern part of the block between faults F2 and F9 and has attained workable thickness (>1m) in almost entire area of its occurrence except in two boreholes MPC-1 (0.89m) and MPC-44(0.98m). In the western part the seam VIII has been intersected in 37 boreholes. The seam incrops in the eastern part of the block. The full seam thickness varies from 0.89m to 2.84m (prevalent thickness range is 1-2m). The seam roof consists dominantly of sandstone. The floor consists mainly of shale and intercalation of shale and sandstone. The depth of occurrence of seam is from 24.13m to 107.05 within the block.

The Moisture content of seam VIII varies from 5.3% to 11.5% (prevalent M% is 7% to 9%). The ash% in seam varies from 10.6% to 32.7% (Prevalent Ash% is 13% to 19%). The UHV varies from 3504 to 6678 Kcal/Kg. The grade varies from E to A (Prevalent grade is D to B). the seam is devoid of bands except in borehole MPC-2 in which 0.32m. sandstone band occurs.

B). Seam VII-T

Seam VII-T underlies seam VIII with a parting of 12.62m to 31.17m. This seam is thin, impersistent and unworkable. Out of 88 boreholes drilled in the block this seam has been encountered in only 9 boreholes, where, its thickness is recorded from 0.08m to 0.63m.

C). Seam VII- Middle

Seam VII- middle underlies seam VII- Top with a parting of 1.78m to 5.28m. and occurs at depth range of 8.60 to 125.19m. The thickness of this seam varies from 0.11m to 2.15m . This seam is thin and impersistent and has attained workable thickness in only two boreholes and hence, is of no economic significance.

D). Seam VII- Bottom

Seam VII- Bottom is the most important seam and has attained workable thickness in almost entire area. Seam VII-B underlies Seam VII- Middle with parting of 1.05m to 13.43m. It has been intersected in 68 boreholes wherein, its thickness is recorded from 0.56m to 3.99m. (prevalent thickness range is 1.5 to 2.5m) in the depth range of 11.15m to 126.87m. The roof of this seam mainly consists of sandstone and intercalation of sandstone and shale. The floor consists mainly of intercalation of sandstone and shale, shale and sandy shale in the depth range of 1.15m to 126.87m.

The moisture content of the seam varies from 3.5% to 8.6%(prevalent range is 5.5% to 7.5%). The Ash % ranges between 11.0% to 38.5% (prevalent range being 15% to 25%). The UHV varies from 2897 to 6375 kcal/kg and the grade varies from F to A (prevalent range C). The seam is generally free of dirt bands However, only in few boreholes thin bands of shale / carb. Shale/ sandstone occur.

E). Seam VI

Seam VI underlies seam VII- Bottom with a parting of 16.16m to 24.90m. The thickness of seam VI varies from 0.10m to 1.26m. This

seam has been encountered in 21 boreholes wherein, workable thickness (>1m0 is only in 2 boreholes hence, not workable.

F). Seam Local- II

Seam Local- II is a thin seam. It underlies Seam VI after a parting of 6.05m to 9.17m. Its thickness varies from 0.20m to 0.23m in the 4 boreholes of MECL.

G). Seam V

Seam V occurs below seam Local-II after a parting of 27.59m to 37.68m. It has been intersected in only 3 boreholes in which its thickness varies from 0.20m to 1.13m.

H). Seam III

Seam III has been intersected below seam V with a parting of 47.2n. Its thickness is 0.30m.

2.4 Coal Reserves

Based on 88 boreholes drilled in Dongri Tal-II (phase-I) block 8 carbonaceous horizons has been established to exist. Out of these, only two seams, viz; VIII and VIIB are workable (>1m) in almost entire area hence, their potentiality has been assessed.

The shallowest and deepest intersection has been recorded as 24.13m, to 107.05m for Seam VIII and 10.73m to 126.87ms for Seam VIIB. The block has been assessed for potentiality in accordance with norms for the opencast proposition quarriable.

2.4.1. Basic Assumptions

- The quarry depth is considered upto floor of seam- VIIB.

- The workable thickness considered for opencast mining is 1m. However, small patches, where the seam thickness is less than 1m, have also been included for reserve estimation.

- The iso-chores for effective thickness after excluding >1m, carbonaceous shale (M+Ash >55%) and >0.15m. obvious dirt bands (M+Ash >75%) were drawn in accordance with norms for I_{100} basis, reserves estimation.

- No barrier is left for Hurdul nala as the same will have to be diverted to win the coal.

- Reserves have been estimated separately for seam VIII and VII-Bottom sector wise, depth wise and grade wise in proved category.

- A 5% deduction has been made from the gross proved reserves to arrive at the net-in- situ proved reserves available in the block for open cast potential. Based on above, the gross geological reserves of coal in the block, are detailed depth- wise and grade wise is given below:-

Seam- wise depth-wise Gross Geological Reserves in Mt.)

Seam	**Depth (m)**			
	0-50	50-100	100-150	Total
VIII	-	5.342	6.103	11.445
VII Bottom	15.886	7.620	8.323	31.829
Total	15.886	12.962	14.426	43.274

Grade wise Goss Geological Reserves (in Mt.)

Seam	**Grade (Non-Coking)**						
	A	B	C	D	E	F	Total
VIII	0.496	4.196	4.243	1.924	0.586	0.00	11.445
VII Bottom	0.278	9.688	16.259	4.340	1.187	0.077	31.829
Total	0.774	13.884	20.502	6.264	1.773	0.077	43.274

2.5 Overburden

Overburden consists of predominantly sandstone with minor amount of shale, carbonaceous shale and thin coal bands. Besides, the overburden also includes sandy soil, weathered rocks and dirt bands within the coal seam. While computing total overburden, carbonaceous shale with >1m thickness and shale/ sandstone with >0.15m thickness have been excluded to arrive at the effective thickness of the coal seam.

Overburden upto seam VII-Bottom has been calculated from Iso-overburden plans. (Ref. **Table 2.2** for thickness of parting and overburden).

2.6 The mine boundaries of the envisaged option are as follows:-

Block Boundaries

North: The surface limit of the mine has been plotted with reference to the Fault no. F5-F5. The batter has been taken at an appropriate angle.

West: The surface limit of the mine is 7.50m away from the block boundary and then the resultant floor boundary has been envisaged.

East: The surface limit of the mine is 7.50m away from the block boundary and then the resultant floor boundary has been envisaged.

South: The mineable floor has been kept at the incrop of Seam VII and sub-sequent surface boundary has been plotted.

Based on above basic assumption, the mine parameters for opencast mine are given at **Table 2.3.**

Table 2.3. Opencast Mine Main Parameters

Sl. No.	Parameters	Unit	Value
1	Maximum depth	M	125
2	Maximum strike length:		

	Along the Mine Floor	Km	4.49
	Along the Mine Surface	Km	4.65
3	Minimum Strike length:		
	Along with Mine Floor	Km	2.74
	Along the Mine Surface	Km	2.89
4	Maximum dip rise length:		
	On the Mine Floor	Km	3.11
	On the Mine Surface	Km	3.35
5	Minimum dip rise length:		
	On the Mine Floor	Km	1.45
	On the Mine Surface	Km	1.65
6	Area :		
	On the Mine Floor	ha	1043
	On the Mine Surface	Ha	1132

2.7 Coal Conservation

For improving coal conservation aspect, it is suggested that High Wall Mining Could be considered to extract coal blocked in the High wall barriers, to maximize coal which otherwise can not be mined by surface or underground methods. The rate of production and quantum of available coal is not indicated at this stage as such situation would arise at the end of life of mine, when advances in technology are likely to bring in improved recovery.

2.8 Geological and Mining Characteristics

The Geological & mining Characteristics of the quarriable block for the proposed OCP are given in table 2.4 below. Two seams i.e. Seam VIII to VII-B are considered for open cast mining.

Table – 2.4

Mining and geological characteristics of the Quarriable Block

Sl No	Particulars	Units	Quarry		
			Min.	Max.	Usual
1	Thickness of coal seam 9/Avg.)				
	VIII	M	0.97	2.02	1.49
	VIIB	M	0.98	3.51	2.12
II	Thickness of Top OB & parting (Avt.)				
	Hard OB	M	21.67	106.08	61.08
	Part bet VIII & VII B	M	21.31	46.76	27.77

Based on available data, seam VIII occurs in the depth range of 21.67m to 106.08m. The parting between seam VIII and VII B varies from 21.31m to 46.76m.

In phase- II, Separate mining plan will be prepared and method of mining will be decided based on the available geological data.

2.9. Mineable Coal Reserves- Volume of OBR and Stripping Ratio

The total opencast mineable reserves are estimated as 37.99 Mt. The corresponding OBR has been envisaged at 597.41 Mcum at an average stripping ratio of 15.73 cum/t.

The detailed break up of seam wise net geological reserve in given below:-

Seam Name	Coal (MT)
VIII	10.741
VII B	29.244
TOTAL	39.985 = 39.99

Seam wise and grade wise net geological reserve within the pit has been given below:-

Seam	Grade (Non- Coking)						
	A	**B**	**C**	**D**	**E**	**F**	**Total**
VIII	0.48	3.92	3.95	1.81	0.58	0.00	10.74
VII Bottom	0.28	8.92	14.96	3.98	1.04	0.07	29.25
Total	0.76	12.84	18.91	5.79	1.62	0.07	39.99

Mining loss of 5% from mineable reserve has been taken to arrive at the opencast mineable reserves.

Due to multiple seams of different thickness, mining loss has been estimated for each seam separately to arrive at Mineable Coal reserves.

Mining Loss depends on:

a) Loss of coal in roof and floor of seam.
b) Loss of coal while cleaning out OB dirt from coal bench.
c) Loss of coal during selective mining of >1 bands.
d) Loss of coal during transportation.

The detailed break up of seam wise mineable reserves are given below:

Seam Name	Coal Tonnes (MT)
VIII	10.204
VII B	27.782
TOTAL	**37.986 = 37.99**

Seam wise and grade wise mineable reserve within the pit has been given below:-

Seam	Grade (Non- Coking)						
	A	**B**	**C**	**D**	**E**	**F**	**Total**
VIII	0.46	3.72	3.75	1.72	0.55	0.00	10.20
VII	0.27	8.48	14.21	3.78	0.99	0.07	27.79

Bottom							
Total	0.73	12.20	17.96	5.50	1.54	0.07	37.99

Dongri Tal- II (Phase-I) coal block has been divided into 5 sectors for better understanding of the coal deposit and stripping ratio over life of the mine. Sector wise, seam wise mineable reserve is given below:-

Seam Name	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Total (MT)
VIII	0.00	0.00	2.88	2.90	4.42	10.20
VII B	1.83	6.79	9.21	3.62	6.33	27.78
Total	1.83	6.79	12.10	6.52	10.74	37.99

Geological model has been developed on geological model software. All reserve calculation has been done using geological model developed for Dongri Tal-II (phase-I) opencast project.

Due to barrier left from block boundary, coal has been blocked in the barrier. Seam wise net geological reserve blocked in the barrier

Summary of Coal Reserves

A. Gross Geological Reserve **43.274 Mt**

B. Net Geological Reserve **41.110 Mt**

C. Net Geological Reserves blocked in barrier and Batter and not considered for mining **1.125 Mt**

D. Available net Geological reserve for opencast **39.985 Mt**

E. Mining Losses @ 5% **1.999 Mt**

F. >Quarriable Mineable reserves **37.986 Mt**

2.10 Opencast Mine Design.

2.10.1 Relevant factors considered for Mine design

i) Multi-seam deposit.

ii) Frequent movement of equipment from one bench to other

iii) Limited availability of land for external dump.

2.10.2 Rated Capacity

Dongri Tal-II (Phase-I) opencast project has been prepared for a rated capacity of 2.9 MTY of ROM Coal. This output is prima facie considered technically feasible because of its favorable geo-mining conditions like:

(i) Thickness of various seams.

(ii) Their disposition & its splits.

(iii) Comparatively adequate strike length and with deployment of higher size HEMM.

(iv) Mineable coal reserves etc.

2.10.3 Design Criteria for Operations.

(Based on Indian Practice & Norms and Equipment as per Mining Plan)

The design criteria adopted in this project is as follows:-

- Number of annual working days --- 330
- Number of daily shifts /day --- 3
- Duration of each shift (hours) --- 8

The opencast mine would be worked on the 3-shift/day and seven days/week round the year for coal extraction and overburden removal.

2.11 Life of Mine

For the rated output of 2.9 Mty, the life of the mine has been estimated as 17 years including built up period of four years & reducing trend of coal production (i.e. production phase out) in start and finishing year of the mine. before infrastructure facility like approach road, drinking water, electricity, etc will be established.

2.12 Mining System

The geo-mining conditions considered are given below:

- Two coal seams
- Adequate strike length.
- Presence of thin coal seams
- Thickness of OB/partings.

Based on the above factors the Mining system has been worked out. The top OB benches above top most seam would be worked in horizontal slicing method. Coal and its intervening parting will be extracted by inclined slicing method.

2.12.1 Mining Methodology adopted for Mining System

Out of the two seams, Seam VII has been considered as the basal seam for the mining pit. Haul roads will be made along with floor.

Inclined slicing method has been envisaged to remove the partings and coal for entire life of the project. In case of upper OB benches. Excavation through horizontal slicing method has been proposed. In the top OB benches waste will be transported directly to the identified dumping place. From other horizontal benches, the OBR will be transported through batter of the high wall and then to respective internal dumping places.

2.13 Calendar Plan of Excavation and Production Programme.

The summarized calendar programme of excavation is given in Table 2.5 which has been developed based on adopted sequence of open cast mine development at optimum condition of mining operation in the block.

Table No- 2.5

	Coal		OB(Adjusted)		
Year	Coal	Cumm. Coal	Cumm. OB	Running SR	Average SR
1	0.50	0.50	6.00	12.00	12.00
2	1.00	1.50	18.00	12.00	12.00
3	2.90	4.40	54.00	12.41	12.27
4	2.90	7.30	90.00	12.41	12.33
5	2.90	10.20	126.00	12.41	12.35
6	2.90	13.10	162.00	12.41	12.37
7	2.90	16.00	198.00	12.41	12.38
8	2.90	18.90	246.00	16.55	13.02
9	2.90	21.80	294.00	16.55	13.49
10	2.90	24.70	342.00	16.55	13.85
11	2.90	27.60	390.00	16.55	14.13
12	2.90	30.50	448.50	20.17	14.70

13	2.90	33.40	507.00	20.17	15.18
14	2.41	35.81	555.43	20.10	15.51
15	1.00	36.81	575.43	20.00	15.63
16	0.60	37.41	586.93	19.17	15.69
17	0.58	37.99	597.41	18.07	15.73
	37.99			**15.73**	

The total mineable coal reserves have been estimated at 37.99 Mt at the corresponding OBR of 597.41 Mm^3 at an average SR of 15.73 m^3/t. The rated output of 2.9Mty would be achieved in 3rd year of quarry excavation (excluding construction period)

2.14 Equipment Selection

The following options have been considered for selection of equipment for the period.

1) Dragline
2) Bucket wheel excavator
3) Surface miner
4) Shovel dumper combination
5) Crushing conveying

Deployment of Dragline

The possibility of deploying dragline(s) at the project was examined. Dragline deployment has not been considered feasible due to:-

(i) Dragline is suitable for flat deposits preferably having a gradient not more than 7^0 to permit back dumping of OB in de-coaled area. The OB is usually dumped on seam floor very near to the coal bench, leaving space sufficient only for water drainage and also to reduce mixing of OB with coal. If the coal seam gradient is not flat, the dumped OB will slide towards the coal area preventing coal besides being dangerous.

(ii) The strike length of the property should be 1.5 to 2 kms and more so that the dragline is not required to be frequently shifted from one end to the other.

(iii) The property should be free from geological disturbances. A dragline system works with a rigid operational geometry and frequent changes in the geometry may be difficult to implement without heavy loss of efficiency.

(iv) Not suitable for Multi- Seam working.

(v) The Property should be large enough to ensure the life of about 25 years or more so that heavy capital investment can be recovered.

The block has sufficient strike length, favorable gradient but due to occurrence of two seams with parting of only about 25m and high capital investment, dragline, operation is not favorable for this block.

- **Deployment of Surface Miner for Coal Mining**

Surface miner is suitable for flat and thin seams. The limiting gradient is 1 in 10 or flatter. Also, surface miners require large coal exposures which are possible only with flat deposits. For 2.9 MTPA, only one surface miner would be required, for which sufficient working place/ coal exposure would be required. Because of the favorable gradient, the use of Surface Miners is recommended for this deposit.

Also application of Surface Miner is recommended because of presence of thin and good quality coal seams.

Ideally, Surface Miner requires regular working space of about 400 meters long and 60 meters wide for its optimum use. The high wall angle will be at 45 degree in this case. This bench geometry with overall working angle flatter which results in generation of more OB compared to Shovel-Dumper combination.

Considering above, Surface miner has been recommended for Coal extraction.

- **Shovel Dumper Combination**

  This option considers use of shovel dumper combination with inclined as well as horizontal slicing pattern for coal and intervening parting. This will also facilitate water drainage to sump formed along with haul road. Top OB benches would be developed in horizontal slicing pattern for complete life of the mine. It can be seen that coal seams are flat. It has been proposed to remove interburden parting by incline slicing method.

  The system is flexible and can be used in condition of varying thickness of seam and partings and also steep gradients. The flexibility of the operations enables geological disturbances to be negotiated without much loss of efficiency. Shovel-dumper system is very flexible.

2.15 List of Major HEMM

Major mining machineries upto target year is given in T**able 2.6**

Table- 2.6 (List of HEMM)

Sl No.	Particulars	Size/Cap	Total	Year wise phasing				
				1	2	3	4	5
A	Overburden							
1	Diesel Hydraulic Shovel	12 Cum	12	2	4	12	12	12
2	Rear Dumper	120 T	74	13	26	74	74	74
3	Drill	250 mm	7	1	3	6	7	7
4	Dozer	410 hp	2	1	2	2	2	2
5	Wheel dozer	320 hp	2	1	1	2	2	2
B	Coal							
1	Surface Miner	2200	1	1	1	1	1	1
2	Rear Dumper	35 T	6	4	5	5	6	6
3	Front end loader	4.5 cum	1	1	1	1	1	1
4	Diesel Drill	160 mm	1	1	1	1	1	1
C	Common							
1	Grader	280 hp	2	1	1	1	2	2

Table- 2.6 contd.

2	Crane	50T	1				1	1
3	Crane	30T	2			1	2	2
4	Crane	10/8/5 T	3	1	1	1	3	3
5	Diesel B'hoe	0.9-1.2 Cum	2	1	1	1	2	2
6	Vibratory compactor	25 T	2	1	1	1	2	2
7	Fork lift truck		2	1	1	2	2	2
8	Tyre handler				1	2	2	3
9	Mobile maintenance Van		3	1	1	2	3	3
10	Water sprinkler	28 kl	10	1	2	4	6	10
11	Fuel browser	12 KL	4	1	1	2	3	4
12	Tipping Truck	8 T	4	1	1	2	2	4
13	Dozer	410 HP/850 HP (2+2)	4	1	1	2	4	4
14	Fire Tender		2		1	1	2	2
D	Reclamation							
1	Grader	280 HP	2					2
2	Dozer	410 HP	2					2
3	Water Sprinkler	28 KL	6					6

2.16 Drilling & Blasting

Drilling & Blasting would be required in only OB benches before excavation by shovel as surface mining has been proposed for coal extraction. Top OB benches would be developed in horizontal slicing pattern for complete life of the mine. It has been proposed to remove inter-burden parting by incline slicing method for entire life of the mine.

2.16.1 Overburden

Top O.B benches and intervening parting will be of 15 m height where 250 mm Blast hole drill will be used for drilling blast holes. Blasting pattern depends upon the nature and hardness of rock and varies from mine to mine. Expert agency like CMPDIL, CMRI, Indian School of Mines will be engaged to design best suited blasting pattern after field trials.

Average Annual OB including main burden

And partings at 15.58m^3/t stripping ratio : 48.18 Mcum

Avg weekly OB Removal : 868885 cum

Type of Explosives : Bulk Explosives Slurry/emulsion

Power Factor assumed – Overburden : 0.3Kg/cum

3.33 Cum/Kg

Weekly Explosive Required for OB : 260 Tonnes.

Suggested Pattern is given below:

Blast Hole Spacing : 8 to 10 m

Blast Hole Burden : 7 to 8 m

Drilling should be suitably distributed in all OB benches to provide requisite work load for each shovel.

2.16.2 Coal

160 mm drills will be used for drilling blast holes in Coal benches. In case blasting is required in coal benches, Field trials will be required by expert agency for designing best suited pattern in coal as well.

Annual Coal Production : 2.9 Mt

Production/day considering 330 days a year : 8788 T

Type of Explosives : Bulk Slurry/Emulsion

Powder Factor (assumed)	:	0.2 Kg/cum
	:	5 Cum/Kg

Suggested pattern for blasting in coal is given below:

Blast hole spacing	:	6 m
Blast hole Burden	:	5 m

2.17 Storage of Explosives

It is envisaged that the blasting operation will be carried out by SMS (Site Mixed Slurry) and will be transported to the mine site by the explosives agency. Magazine will be required only for storage of detonators, detonating fuse, cast boosters, cord- relays, etc.

Magazine of 10 T capacity is to be provided for storing detonating fuses, detonators and other explosives etc. for secondary blasting.

2.18. Disposal of Waste

2.18.1 Overburden Dump

The first guiding principle of designing dump planning has been followed as minimum degradation of existing land asset due to mining operation and accordingly attempt has been taken to place minimum OB waste in external dump outside the coal block area. In the initial years, when sufficient void to the floor of the basal Local seam is not created, the OB spoil generated will be accommodated in external dump area to the southern side of the workings area and then putting overburden in the void to the floor of the basal seam as internal dump after some year. The second guiding principle is slope stability of the Dump. Overall height of internal OB dump is 150 m from the deepest point of the mine floor, (FRL is 300) out of which only 30m is above quarry surface on western side, whereas on eastern side the surface RL itself is about +450. There are two decks of external dump, out of which bottom bench is about 25 m in height and top most bench is about 30 m height. Each tier of internal OB dump is of 30m height and beam width has been increased to 30m. This feature has increased

overall stability of the dump at its final stage. Overall slope of dump has been planned at 27 degree and slope of each OB bench has been planned at 37 degree.

Thirdly, in pre-mining stage itself, deep garland drain around dump will be created to arrest water, A wharf wall of 2m height and 1 m wide will be erected along the periphery of the bottom tier at surface level and the slopes and the berms will be vegetated, Gullies will be provided to guide water from higher tier to lower and so on.

The overburden / Waste stripping operation will start firstly with top soil removal which will be stacked separately for reclamation purposes.

It has been proposed to start mining by driving one access trenches. Internal dump will start once sufficient void space gets available from 4th year of mine operation. This de-coaled area can be used for internal dumping. Initially overburden will be placed at external dump shown in Mine Site Layout Plan. For first three years of mine operation, OB will be accommodated in external dump only. Only 0.50 M-cum of OB will be placed in internal dump during 3rd year. In 4th year, majority of the OB will be dumped in internal dump and only 5.52 M-cum will be accommodated in external dump out of total 36.00 M-cum overburden. In 5th year, all 36.0 M-cum OB can be placed in the de-coaled area of quarry and there will not be any external dump. There will not be any external dump from 5th year onwards.

Total volume of overburden has been worked out as 597.41 Mcum out of which 538.39 Mcum will be placed in decoaled area as internal dump and rest 59.02 Mcum will be dumped in external dump. It can be seen that external dump volume is less as compared to internal dump. Reasons for accommodation of more OB in internal dump are:

a) Flat gradient of coal seam
b) More strike length of the mine
c) Adequate dip-rise extent of mine

The phased programme of OBR indicating external and internal dump is given in **Table 2.7.**

Table 2.7. Dumping schedule (Figure in Mcum)

Year	External Dump	Cumulative	Internal Dump	Cumulative	Total OB	Total OB Cumulative
		External Dump		Internal Dump		
	(Mcum)	(Mcum)	(Mcum)	(Mcum)	(Mcum)	(Mcum)
1	6.00	6.00	0	0	6.00	6.00
2	12.00	18.00	0	0	12.00	18.00
3	35.50	53.50	0.50	0.50	36.00	54.00
4	5.52	59.02	30.48	30.98	36.00	90.00
5	0.00	59.02	36.00	66.98	36.00	126.00
6	0	59.02	36.00	102.98	36.00	162.00
7	0	59.02	36.00	138.98	36.00	198.00
8	0	59.02	48.00	186.98	48.00	246.00
9	0	59.02	48.00	234.98	48.00	294.00
10	0	59.02	48.00	282.98	48.00	342.00
11	0	59.02	48.00	330.98	48.00	390.00
12	0	59.02	58.50	389.48	58.50	448.50
13	0	59.02	58.50	447.98	58.50	507.00
14	0	59.02	48.43	496.41	48.43	555.43
15	0	59.02	20.00	516.41	20.00	575.43
16	0	59.02	11.50	527.91	11.50	586.93
17	0	59.02	10.48	538.39	10.48	597.41
Total	59.02		**538.39**		**597.41**	

2.19 Pumping and Drainage

The pumping system of this Opencast mine has been designed to dewater the inflow of water due to precipitation falling within the active pit limit during the monsoon season.

The monsoon period extends from June to September with an average rainfall of 1132.7mm.

The planning of de-watering of the mine has been done in such a way that as far as possible the working faces and haul roads remain dry. The lay out of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self-drainage of water to the lowest level of the quarry.

The intake of rainwater to the opencast mine is non- uniform during the year. The maximum rainwater intake will be during the period of about four months (June to September) in a year.

The main pumps will handle the quantity of water inflow during a day of peak rainfall in monsoon in excess of sump capacity and the accumulated water in the sump will be pumped in 4-5 days.

Assessment of volume of water to be pumped

Volume of rain water entering to the mine and accumulating in the quarry (make of water) has been assessed on the basis of the following formula:

Q = A x H x m^3/day

Where, A - Catchment area in m^2

H - Maximum daily precipitation in m

- Run-off co-efficient

The run off co-efficient ( ) has been considered as below:

For mined out area	:	0.60
For internal dumped area	:	0.15
For external dumped area	:	0.15
For area beyond excavation	:	0.10

2.20. Coal Evacuation:

Coal transportation system will have three components

a) Coal transportation from Coal face to Quarry surface

Coal from quarry will be transported through haul road provided in the quarry duly connected to various coal benches through temporary ramps. Coal dupers would move up the access trench and on the surface up to the discharge hoppers of feeder breaker.

b) Coal transportation from Quarry surface to Coal Handling Plant
Coal will be sized to (-) 100 mm in feeder breaker / surface miner.

c) Coal transportation from Coal Handling Plant to Power Plant
It is proposed to transport coal crushed by feeder breaker /surface miner to power plant by Railway line.

CHAPTER - III

DESCRIPTION OF ENVIRONMENT

3.1 Introduction:

The project under consideration is a category "A" project as per provision of EIA notification and subsequent amendments; this requires environmental clearance (EC) from MOEF. A project specific EIA/EMP in compliance to the terms of reference (TOR) issued by MOEF is to be prepared for obtaining E.C from MOEF. The TOR, a copy of which is attached at (Annexure II). requires generation of baseline environment data in respect of following attributes for one season.

- **Micro-Meteorology.**
- **Ambient Air Quality**
- **Surface and Ground Water Quality**
- **Noise Level**
- **Soil Quality**
- **Flora & Fauna**
- **Land use Pattern**

Accordingly base line environmental quality data have been generated for one season (15^{th} March 10 to 15^{th} June 10).

3.2 Scope & Methodology

Scope

MPSMCL has proposed to undertake coal mining at Dongri Tal-II (Phase-I) Coal Mining project. Keeping in view of concern for Environment and to comply with the statutory requirement of the MOEF, MPSMCL has proposed to identify the possible environmental impacts arising out of the proposed coal mining by conducting the Environmental Impact Assessment Study (EIA).

The scope of the study includes detailed characterization of various environmental components such as air, noise, water, land and socio economic within 10 km radius around the mining block. The main objectives of characterization of environmental components are:-

- To assess the existing baseline status of air, water, noise, land and socio-
  economic environment.
- To identify and quantify significant impacts due to various mining operations on various environmental components through prediction of impacts.
- To evaluate the beneficial and adverse impacts of the coal project.
- To evaluate and check the Environmental Management Plan (EMP) detailing control technologies and measures to be adopted for mitigation of adverse impacts if any, as a consequence of the operation of the mine.
- To design Post Project Monitoring Programme for regulating the environmental quality within the limits in the proposed coal project and help in sustainable development of the area.

Methodology

Any change in the present activity is expected to cause impacts on surrounding environment. The impacts may be adverse or beneficial. In order to assess the impacts, a detailed Environmental Impact Assessment study has been conducted within an area of 10 km radius around Dongri Tal II (Phase I) Coal Mining project.

The various steps involved in Environmental Impact Assessment study of this coal mining are divided into the following phases:

- Identification of significant environmental parameters and assessing the
  existing status within the impact zone with respect to air, water, noise,

soil, radiation and socioeconomic components of environment.

- Study of various activities of the opencast mining to identify the areas leading to impact/change in environmental quality
- Quantification/prediction of impact for the identified activities to study level of impact on various environmental components.
- Evaluation of impacts after superimposing the predicted/quantified scenario over the baseline scenario.
- Formulation of Environmental Management Plan for implementation in the operational phase of the mine.

The methodology adopted for studying the various individual components of environment is described below.

3.3 Micrometeorology

As a part of this study, micro meteorology and microclimatic parameters were recorded by installing a meteorological station near Core zone, on the terrace of a house at Bijauri. Data of wind velocity, wind direction, ambient temperature, relative humidity, cloud cover and rainfall data were recorded at hourly intervals along with atmospheric pressure for 24 hours for the study period.

Wind velocity and wind direction were recorded using cup anemometer and wind vane respectively. Ambient temperature was noted by wet and dry bulb thermometer. Relative humidity was measured by hygrometer. An aneroid barometer was used for measuring atmospheric pressure and a self-recording rain gauge was used for rainfall data collection. Cloud cover data was collected by visual inspection.

3.4 Ambient Air Quality

To assess the ambient air quality status in study area monitoring stations were identified on the basis of wind direction in meteorology in the upwind and downwind direction as well as to represent the cross sectional scenario of the project site. As per National Ambient Air Quality Standards for coal mines (GSR No- B-29016/20/90/PCI-I dt.18th Nov. 2009 & TOR the parameters chosen for assessment of air quality are Suspended Particulate Matter (SPM), Respirable Particulate Matter (PM10 & PM2.5), Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx).and Hg , Pb , Cr ,& As.

Calibrated Respirable Dust samplers (with an average flow of 1.2 - 1.4 m^3 / min.) were used for monitoring of SPM, RPM and a tapping provided in the hopper of the same samplers was utilized for sampling of SO_2 and NO_X with proper flow controller (1Litre / min). A temporary field laboratory for the purpose of calibration of equipments and standardization of analytical procedures was also established. All the parameters were monitored on 24 hourly basis, for 2 days in a week for 12 weeks. Collected samples were analyzed on the day of sample collection with the in procedure prescribed in relevant BIS.

Methodology used for monitoring is as specified in the standards mention in National Ambient Air Quality Standards (NAAQS), IS 5182 (part II) – 1969 for Sulphur dioxide, IS 5182 (part IV) – 1973 for Suspended Matter, IS 5182 (part V) – 1975 for sampling of Gaseous Pollutants and IS 5182 (part VI) – 1975 for Nitrogen Oxides.

3.5 Water Quality

Water samples were collected as per standard procedure {IS: 3025 (part I) – 1987} and analyzed as per procedures outlined in relevant volume of BIS 3025 / NEERI / standard Methods (AAPHA).

3.6 Noise Levels

dB(A) Leq value day time and night time were monitored at different locations with the help of Integrated Noise Level Meter.

3.7 Soil Quality

To assess the baseline soil quality, three samples were collected from different types of soil, at three depths at each sampling location (30 cm, 60 cm and 90 cm below ground level) by auger sampler. The samples were analysed for chemical and engineering parameters.

3.7 Micro Meteorological Status

3.7.1 Rationale Behind Sampling

Meteorological parameters are important factors in the study of air pollution. The transport and diffusion of the pollutants in the atmosphere are governed by meteorological factors. Including wind velocity; wind direction and atmospheric stability which are known as primary/basic meteorological parameters since the dispersion and diffusion of pollutants depend mainly on these factors. Factors like ambient temperature, humidity, rainfall, atmospheric pressure, etc., are known as secondary meteorological parameters as these factors control the dispersion of the pollutants indirectly by affecting the primary factors. Thus, to assess the air pollution impact it becomes essential to collect the above-mentioned meteorological parameters in the project area.

Micrometeorological and microclimatic parameters were recorded by installing a meteorology station near core zone on the terrace of a house at Bijauri, as it represents the prevailing micrometeorological aspects of the study area. During the study period, hourly reading of wind velocity, wind direction, temperature, humidity, cloud cover, atmospheric pressure and rainfall data were recorded and reported.

3.7.2 Data presentation & analysis

The micrometeorological data thus collected has been processed and analyzed as per standard procedures. The seasonal wind distribution is given in the **Table - 3.1.** The seasonal wind rose and shift wise wind roses (day time and night time) are shown in Fig.III.1and III.2 respectively.

TABLE NO. 3.1 SEASONAL WIND DISTRIBUTION

Project : Dongri Tal-II (Phase-I) O/C

Season : Summer 2010

Wind Direction	**Wind Velocity, Km/Hrs (% Duration)**		
	< 1.0	**1.0 – 5.0**	**5.1 – 10.0**
NNE	55.40	5.08	0.05
NE		5.02	-
ENE		9.67	0.05
E		0.98	-
ESE		1.39	0.05
SE		0.60	-
SSE		1.07	-
SSW		3.32	0.10
SW		2.26	0.05
WSW		2.95	0.20
WNW		5.67	0.15
NNW		3.39	0.25
NW		2.25	0.05
Season	**55.40**	**43.65**	**0.95**

Meteorological data collected during the study reveal the following status:

Wind Direction: Predominant winds are from east northeast / west northwest quadrant.

Wind Velocity: Wind velocity readings are ranging from <1 kmph to 6.6 kmph.

Temperature: Temperature values are ranging from 6.0 to 35.5°C.

Relative Humidity: The average relative humidity values are in the range of 59.8 – 76.8%.

Cloud Cover: Mostly clear sky is predominant during the study period.

Atmospheric Pressure: The atmospheric pressure values are ranging from 755.6 to 758.5 mm of Hg.

Rainfall: There is 1.0 mm of rainfall for a day during the study period.

3.7.3 Summary

The sky was mostly clear during the study period. The wind velocity readings are ranging from <1.0 km/ph to 6.6 km/ph. Predominant wind is from east northeast / west northwest quadrant. The maximum temperature recorded was 35.5°C and the minimum was 6.0°C. The average relative humidity values are in the range of 59.8 to 76.8 %.

Table 3.2 given the abstract of metrological data.

TABLE NO. 3.2

ABSTRACT OF METEOROLOGICAL DATA

Project : Dongri Tal O/C **Season : Post monsoon 2010**

Date	Wind Velocity (% Duration)			Wind Velocity (Km/Hrs)			Ambient Temperature (°C)			Average Relative Humidity (%)	Wind Direction (From)	Sky Appearance	Average Rainfall (mm)
	< 1.0	1 – 5	5.1– 11	Min.	Max.	Avg.	Min.	Max.	Avg.				
15/16.03.2010	45.79	54.21	-	< 1.0	3.2	1.8	15.0	31.5	21.9	62.0	ENE	Clear	0
16/17.03.2010	54.13	45.87	-	< 1.0	2.1	1.4	15.0	31.5	21.9	61.9	ENE	Clear	0
18/19.03.2010	41.62	58.38	-	< 1.0	3.2	1.9	15.0	31.5	21.9	62.0	SW	Clear	0
20/21.03.2010	49.96	50.04	-	< 1.0	3.2	2.1	14.0	33.5	22.5	59.8	SSW	Clear	0
22/23.03.2010	45.79	54.21	-	< 1.0	3.9	2.2	14.5	33.5	22.0	64.0	ENE	Clear	0
24/25.03.2010	41.62	58.38	-	< 1.0	2.2	1.4	15.0	32.5	22.1	63.3	SW	Clear	0
26/27.03.2010	54.13	45.87	-	< 1.0	1.9	1.3	15.5	33.0	22.4	64.6	NE	Clear	0
28/29.03.2010	74.98	25.02	-	< 1.0	1.9	1.4	15.0	32.5	22.8	61.6	SE	Clear	0
30/31.03.2010	49.96	50.04	-	< 1.0	4.8	3.0	14.5	35.5	23.0	62.4	NW/WNW	Clear	0
1/2.04.2010	33.28	66.72	-	< 1.0	3.1	1.6	15.0	35.0	23.1	62.3	NE	Clear	0
3/4.04.2010	29.11	70.89	-	< 1.0	2.9	1.8	16.0	35.5	23.9	61.8	NW	Clear	0
5/6.04.2010	49.96	50.04	-	< 1.0	4.1	2.1	15.0	33.5	23.6	63.8	NNW/ENE	Clear	0
7/8.04.2010	49.96	50.04	-	< 1.0	4.5	2.2	14.5	32.5	22.1	68.3	NE/NNE	Clear	0
9/10.04.2010	49.96	50.04	-	< 1.0	3.4	1.9	15.0	33.0	23.9	64.5	ENE	Clear	0
11/12.04.2010	54.13	45.87	-	< 1.0	4.8	2.5	15.0	32.0	23.1	61.0	SSW	Clear	0
13/14.04.2010	37.45	62.55	-	< 1.0	3.4	1.5	15.0	34.0	23.3	63.3	ENE	Clear	0
15/16.04.2010	54.13	45.87	-	< 1.0	3.5	1.8	14.0	34.0	22.7	63.4	NE	Clear	0
17/18.04.2010	54.13	45.87	-	< 1.0	3.9	1.6	14.0	33.0	22.2	65.6	ENE	Clear	0
19/20.04.2010	33.28	66.72	-	< 1.0	3.8	1.8	14.0	32.5	22.5	65.2	ENE	Clear	0
21/22.04.2010	58.30	41.70	-	< 1.0	2.4	1.6	13.0	30.5	21.0	66.3	NNW	Clear	0
23/24.04.2010	49.96	50.04	-	< 1.0	4.2	1.7	13.0	28.5	19.9	69.7	ENE	Clear	0
25/26.04.2010	54.13	45.87	-	< 1.0	2.8	1.7	13.0	28.5	20.6	66.6	SSW	Clear	0
27/28.04.2010	54.13	45.87	-	< 1.0	2.3	1.6	13.5	28.0	20.1	66.6	SSW	Clear	0
29/30.04.2010	41.62	58.38	-	< 1.0	2.1	1.6	14.0	25.0	18.7	71.0	SSE/SSW	Clear	0
1/2.05.2010	41.62	58.38	-	< 1.0	4.7	4.2	14.5	27.5	20.5	65.8	ENE	Clear	0
3/4.05.2010	58.30	41.70	-	< 1.0	3.1	2.3	15.0	30.0	21.8	66.6	ENE	Clear	0
5/6.05.2010	54.13	45.87	-	< 1.0	3.8	1.9	14.0	29.5	20.4	67.3	ENE	Clear	0
7/8.05.2010	58.30	41.70	-	< 1.0	3.5	2.0	13.0	29.5	20.1	67.6	WNW	Clear	0
9/10.05.2010	58.30	41.70	-	< 1.0	2.2	1.7	13.0	30.0	20.2	69.1	NE	Clear	0
11/12.05.2010	58.30	41.70	-	< 1.0	2.6	1.7	13.0	29.5	20.2	65.7	WNW	Clear	0
13/14.05.2010	54.13	45.87	-	< 1.0	2.6	1.6	13.5	29.5	20.4	64.9	ENE	Clear	0

TABLE NO. 3.2 (Contd.)

Date	Wind Velocity						Ambient Temperature (°C)			Average Relative Humidity (%)	Wind Direction (From)	Sky Appearance	Average Rainfall (mm)
	(% Duration)			(Km/Hrs)									
	< 1	1 – 5	5.1 – 11	Min.	Max.	Avg.	Min.	Max.	Avg.				
15/16.05.2010	66.64	33.36	-	< 1.0	2.3	1.4	13.0	29.0	20.4	67.8	NE	Clear	0
17/18.05.2010	58.30	41.70	-	< 1.0	2.2	1.5	13.5	28.5	20.5	68.3	NNE	Clear	0
19/20.05.2010	70.81	29.19	-	< 1.0	2.6	1.7	12.5	28.5	20.4	64.2	ENE	Clear	0
21/22.05.2010	54.13	45.87	-	< 1.0	4.6	1.8	13.0	30.0	20.4	65.9	NE	Clear	0
23/24.05.2010	45.79	54.21	-	< 1.0	3.1	1.6	12.5	28.0	19.6	66.2	NE/ENE	Clear	0
25/26.05.2010	74.98	25.02	-	< 1.0	2.2	1.7	12.5	28.5	19.6	66.2	WSW	Clear	0
27/28.05.2010	62.47	37.53	-	< 1.0	4.1	3.0	12.0	27.5	19.2	66.6	ENE	Clear	0
29/30.05.2010	45.79	54.21	-	< 1.0	4.6	3.4	11.0	27.5	19.3	70.8	NNE	Clear	0
31/1.06.2010	62.47	37.53	-	< 1.0	3.5	2.1	11.0	28.0	18.6	68.8	NE/NNE	Clear	0
2/3.06.2010	79.15	20.85	-	< 1.0	2.6	2.1	11.0	27.5	19.1	68.3	NNW	Clear	0
3/4.06.2010	62.47	37.53	-	< 1.0	4.8	2.8	11.0	27.5	18.2	70.3	ENE	Clear	0
5/6.06.2010	54.13	45.87	-	< 1.0	3.9	2.5	11.0	27.5	17.5	70.2	ENE	Clear	0
7/8.06.2010	74.98	25.02	-	< 1.0	2.2	1.6	10.5	27.5	17.2	70.3	NE	Clear	0
9/10.06.2010	70.81	29.19	-	< 1.0	3.5	2.1	10.0	27.0	16.6	69.5	NNE	Clear	0
11/12.06.2010	62.47	37.53	-	< 1.0	3.1	1.9	10.0	26.0	17.3	71.5	WNW	Clear	0
13/14.06.2010	66.64	33.36	-	< 1.0	4.9	3.0	9.0	26.0	16.6	70.5	ENE	Clear	0
15/16/06.2010	66.64	33.36	-	< 1.0	4.4	2.4	9.0	26.0	16.5	72.4	WNW	Clear	0
17/18.06.2010	70.81	29.19	-	< 1.0	2.4	1.9	9.0	25.5	16.3	70.8	NE/ENE	Clear	0
19/20.06.2010	62.47	37.53	-	< 1.0	3.2	2.0	9.5	25.5	17.1	70.0	NW	Clear	0
21/22.06.2010	66.64	33.36	-	< 1.0	3.4	2.3	9.0	24.5	16.1	73.6	WNW	Clear	0
23/24.06.2010	66.64	33.36	-	< 1.0	3.4	2.2	8.5	25.5	15.9	70.8	WSW	Clear	0
25/26.06.2010	62.47	37.53	-	< 1.0	3.2	1.7	8.5	26.5	16.8	70.4	NNE	Clear	0
27/28.06.2010	70.81	29.19	-	< 1.0	3.2	2.3	9.0	25.5	16.0	70.1	SW	Clear	0
29/30.06.2010	70.81	29.19	-	< 1.0	4.2	2.7	9.5	25.0	16.6	72.6	SW/WSW	Clear	0
1/2.07.2010	62.47	37.53	-	< 1.0	3.3	2.1	10.0	26.0	17.7	71.3	NE/ENE	Clear	0
3/4.07.2010	66.64	33.36	-	< 1.0	3.6	2.5	10.0	25.0	16.1	72.6	WNW	Clear	0
5/6.07.2010	66.64	33.36	-	< 1.0	2.7	1.9	9.5	25.0	16.0	71.7	ENE	Clear	0
7/8.07.2010	62.47	37.53	-	< 1.0	4.3	3.7	9.0	24.5	16.3	70.5	ENE	Clear	0
9/10.07.2010	70.81	29.19	-	< 1.0	4.4	2.9	8.0	25.0	16.5	69.0	WNW	Clear	0
11/12.07.2010	74.98	25.02	-	< 1.0	2.3	1.5	9.0	24.0	15.6	69.8	NNE/ENE	Clear	0
13/14.07.2010	58.30	41.70	-	< 1.0	2.4	1.6	9.5	24.5	15.9	70.0	NE/NW	Clear	0

.

TABLE NO. 3.2 (Contd.)

Date	Wind Velocity						Ambient Temperature (°C)			Average Relative Humidity (%)	Wind Direction (From)	Sky Appearance	Average Rainfall (mm)
	(% Duration)			(Km/Hrs)									
	< 1	1 – 5	5.1 – 11	Min.	Max.	Avg.	Min.	Max.	Avg.				
15/16.07.2.2010	74.98	25.02	-	< 1.0	3.5	2.4	9.0	24.5	16.0	70.6	NNW	Clear	0
17/18.07.2010	54.13	45.87	-	< 1.0	3.8	2.1	9.5	24.0	16.3	71.0	NNE	Clear	0
19.20.07.2010	45.79	54.21	-	< 1.0	3.2	2.1	10.0	25.0	17.1	69.1	SW	Clear	0
21.22.07.2010	45.79	54.21	-	< 1.0	3.4	2.1	10.0	25.0	16.4	70.6	WNW	Clear	0
23/24.07.2010	54.13	37.53	8.34	< 1.0	5.6	3.3	10.0	24.0	16.2	71.0	NNE	Cloudy	0
25/26.07.2010	66.64	25.02	8.34	< 1.0	5.6	3.1	10.0	20.0	14.6	74.0	ENE	Cloudy	1.0
27/28.07.2010	66.64	33.36	-	< 1.0	4.5	2.6	8.0	22.0	15.4	73.5	WNW	Clear	0
29/30.07.2010	66.64	33.36	-	< 1.0	3.6	2.3	8.0	22.5	14.8	73.0	ENE	Clear	0
31.07/1.08.2010	62.47	33.36	4.17	< 1.0	5.1	2.8	7.0	21.0	13.3	76.4	NNW	Clear	0
2/3.08.2010	66.64	33.36	-	< 1.0	3.1	2.2	7.0	21.0	13.6	75.5	NNE	Clear	0
4/5.08.2010	62.47	37.53	-	< 1.0	3.4	2.2	7.0	22.0	13.7	76.5	WNW	Clear	0
6/7.08.2010	66.64	29.19	4.17	< 1.0	5.2	3.1	6.0	23.0	14.0	76.8	WSW	Clear	0
8/9.08.2010	70.81	16.68	12.51	< 1.0	6.6	4.4	6.5	24.5	14.4	75.2	WSW	Clear	0
10/11.08.2010	54.13	33.36	12.51	< 1.0	5.5	3.5	8.0	24.0	14.6	71.5	NNE	Clear	0
12/13.08.2010	62.47	25.02	12.51	< 1.0	5.7	3.9	8.5	25.0	15.8	70.8	WNW	Clear	0
14/15.08.2010	62.47	33.36	4.17	< 1.0	5.3	2.9	7.0	24.5	15.7	72.8	WSW	Clear	0
16/17.08.2010	66.64	25.02	8.34	< 1.0	5.2	3.0	7.0	24.5	14.6	74.1	NNW	Clear	0
18/19.08.2010	79.15	20.85	-	< 1.0	3.3	2.3	7.5	24.5	15.4	72.2	WNW	Clear	0
20/21.08.2010	66.64	33.36	-	< 1.0	2.7	1.9	9.0	25.0	16.2	72.8	NNE/ENE	Clear	0
22/23.08.2010	62.47	37.53	-	< 1.0	3.2	2.2	6.0	25.0	14.9	74.0	NNE	Clear	0
24/25.08.2010	54.13	45.87	-	< 1.0	4.3	2.3	6.5	24.0	14.6	74.1	WNW	Clear	0
26/27.08.2010	58.30	41.70	-	< 1.0	3.9	2.3	7.5	24.0	14.9	71.7	WSW	Clear	0
28/29.08.2010	62.47	37.53	-	< 1.0	3.6	2.4	7.0	22.0	14.1	74.3	NE	Clear	0
30/31.08.2010	62.47	37.53	-	< 1.0	3.8	2.3	6.5	23.0	13.9	72.5	NNW	Clear	0
1/2.09.2010	62.47	37.53	-	< 1.0	3.7	2.2	6.5	25.0	14.4	72.3	NNW	Clear	0
3/4.08.2010	58.30	41.70	-	< 1.0	3.6	1.9	6.0	24.0	14.0	72.7	NNW	Clear	0
5/6.08.2010	62.47	37.53	-	< 1.0	3.9	2.3	6.0	24.0	14.4	72.7	NNE	Clear	0
7/8.08.2010	49.96	50.04	-	< 1.0	4.7	3.5	6.0	24.0	14.4	72.7	NW/WNW	Clear	0
9/10.08.2010	62.47	37.53	-	< 1.0	3.9	2.0	6.0	24.0	14.1	72.6	NW	Clear	0
11/12.08.2010	58.34	41.66	-	< 1.0	4.8	2.7	6.0	24.0	14.1	72.7	WNW	Clear	0
Season	**55.40**	**43.65**	**0.95**	**< 1.0**	**6.6**	**2.2**	**6.0**	**35.5**	**18.1**	**69.1**	**ENE/ WNW**	**Clear**	**1.0**

3.8 Ambient Air Quality Status

3.8.1 Rationale Behind Sampling

The objective of the ambient air quality monitoring is to assess the existing levels of air pollutants as well as the regional background concentration in the project area. Air pollution forms an important and critical factor to study the environmental issues in the mining areas. Air quality has to be frequently monitored to know the extent of pollution due to mining and allied activities. The ambient air quality monitoring is carried out at six stations.

The monitoring stations were identified on the basis of meteorology in the upwind and downwind direction as well as to represent the cross sectional scenario of the project site. The monitoring network is designed based on the available meteorological and climatological data of predominant wind direction and wind speed of the study region available from nearest IMD station at Waidhan.

The parameters selected for analyzing the air quality status are Suspended Particulate Matter (SPM), Respirable Particulate Matter (PM10 & PM2.5), Sulphur dioxide (SO_2) and Nitrogen oxides (NO_x) and hg , Pb , Cr ,and As . The ambient air quality monitoring stations are shown in the plate IV.

Siktatola (A_1): This location is inside the core zone of the mining site and is selected to assess the effects of pollutants in core zone due to the mining related activities. The present data will help to know the increase in pollution levels due to mining operation activities.

Gurwani(A_2): This location is situated at about 2.1 km distance from the proposed mining site towards north northeast direction. It is selected for air quality monitoring to assess the effects of pollutants in the populated area. This station is on upwind direction.

Mungattigaon (A_3): This location is at a distance of about 1.5 km away form the proposed mining area towards east northeast direction. It is selected for base line study to assess the effect of pollutants in the populated area on downwind direction.

Sajawara (A_4): This location is situated at a distance of about 0.7 km towards southeast direction from the proposed mine area. It is selected to assess the effect of pollutants in the populated area.

Mohanban(A_5): This location is situated about 0.5 km distance from the site towards northwest direction and is selected to assess the air quality on upwind direction.

Chakia (A_6): This location is situated about 2.0 km distance from the site towards southwest direction and is selected to assess the effects of pollutants on the habitat on downwind direction.

The present assessment data will help to know the extent of pollution, if any, due to the mining operations in the nearby area.

3.8.2 Data presentation & analysis

The ambient air quality monitoring stations (locations & bearing) are given in **Table No. 3.3.** Ambient air quality abstract is given in the Table – 3.4.

TABLE NO. 3.3 AMBIENT AIR QUALITY MONITORING STATIONS (LOCATIONS & BEARING)

Project : Dongri Tal-II (Phase-I) O/C

Sl. No.	Category	Location Name & Code	Distance (from Site), Km	Direction (w.r.t. site)
1	Core zone	SIKTATOLA(A_1)	-	-
2	Buffer zone	GURWANI (A_2)	2.1	NNE

3		MUNGATTIGAON(A_3)	1.5	ENE
4		SAJAWAR(A_4)	0.7	SE
5		MOHANBAN (A_5)	0.5	SW
6		CHAKIA (A_6)	2.0	W

TABLE NO. 3.4 ABSTRACT OF AMBIENT AIR QUALITY

Project : **Dongri Tal-II (Phase-I) O/C**

Season : Pre monsoon 2010

Unit : $\mu g/m^3$

Category	**Location Name & Code**	**Min.**	**Percentile Value**		**Max.**	**AM**	**CPCB / MoEF Limits**
			95th	**98th**			
	SPM Concentration						
Core zone	Siktatola(A_1)	78	107	110	110	98.33	500
Buffer zone	Gurwani (A_2)	78	105	106	106	96.33	200
	Mungattigaon(A_3)	77	106	110	110	97.67	200
	Sajawar(A_4)	80	104	106	106	96.67	200
	Mohanban (A_5)	74	106	109	109	96.33	200
	Chakia (A_6)	78	107	107	107	97.33	200
RPM Concentration							
Core zone	Siktatola(A_1)	38	51	53	53	47.33	250
Buffer zone	Gurwani (A_2)	37	50	51	51	46.0	100
	Mungattigaon(A_3)	38	52	53	53	47.67	100

	Sajawar(A_4)	38	51	53	53	47.33	100
	Mohanban (A_5)	36	52	53	53	47.0	100
	Chakia (A_6)	38	51	53	53	47.33	100
SO_2 Concentration							
Core zone	Siktatola(A_1)	5.8	7.7	8	8	7.17	120
Buffer zone	Gurwani (A_2)	5.6	7.5	7.6	7.6	6.9	80
	Mungattigaon(A_3)	5.5	7.6	7.7	7.7	6.93	80
	Sajawar(A_4)	5.4	7.4	7.5	7.5	6.77	80
	Mohanban (A_5)	5.2	7.6	7.6	7.6	6.80	80
	Chakia (A_6)	5.8	7.6	7.8	7.8	7.07	80
NO_x Concentration							
Core zone	Siktatola(A_1)	7.5	9.9	9.9	9.9	9.10	120
Buffer zone	Gurwani (A_2)	7.5	9.2	9.4	9.4	8.7	80
	Mungattigaon(A_3)	7.3	9.2	9.4	9.4	8.63	80
	Sajawar(A_4)	7.3	9.4	9.9	9.9	8.87	80
	Mohanban (A_5)	7.5	9.6	9.8	9.8	8.97	80
	Chakia (A_6)	7.5	9.8	9.9	9.9	9.07	80
PM 2.5							
Core Zone	Siktatola(A_1)	24.6		32.2	28.5		60
Buffer Zone	Gurwani (A_2)			33.4	28.2		60
	Mungattigaon(A_3)			34.1	29.5		40
	Sajawar(A_4)			34.8	32.3		60
	Mohanban (A_5)			35.2	31.8		60
	Chakia (A_6)			36.3	30.4		60

Note :- The level of Hg , Pb , Cr , and As in atmosphere was found to be below detection level.

Core Zone:

SPM and RPM values are ranging from 78 $\mu g/m^3$ to 110 $\mu g/m^3$ and 38 $\mu g/m^3$ to 53 $\mu g/m^3$ respectively. SO_2 and NO_x values are varying between 5.8 – 8.0 and 7.5 – 9.9 $\mu g/m^3$ respectively. Level of PM_{10} – $PM_{2.5}$ varies from 47.33 mg/m^3 to 28.5 mg/m^3.

Buffer zone:

SPM and PM10up values are ranging from 74 $\mu g/m^3$ to 110 $\mu g/m^3$ and 36 $\mu g/m^3$ to 53 $\mu g/m^3$ respectively. SO_2 and NO_x values are varying between 5.2 – 7.8 and 7.3 – 9.9 $\mu g/m^3$ respectively. The level of Hg , Pb , Cr , As were BDL. Level of $PM_{2.5}$ has been found to be 28.2 mg to 32.3 mg/m^3.

While comparing with MoEF/ CPCB norms, all SPM, RPM, SO_2 and NO_x values are well within the prescribed limits of CPCB

3.8.3 Summary

In general, all SPM, SO_2 and NO_x values are found to be well within the prescribed limits stipulated by CPCB for residential and rural area.

3.9 WATER QUALITY STATUS

3.9.1 Rationale Behind Sampling

Water quality monitoring stations have been selected on upstream and down stream site of Gopad River.

Any adverse impact or pollution consequence of water will have serious effect on the environment. Hence, it becomes important to assess the water quality periodically in the mining area. Thus, to assess the water quality, five

locations were identified and samples were collected and analyzed for physico-chemical and heavy metal parameters. Bacterial examination is also carried out to find out the coliform contamination (if any) at water sources. The water quality assessment has been made from the three different locations. The water quality monitoring locations are shown in Plate – IV.

3.9.2 Data presentation & analysis

Ground Water

The ground water quality status and ground water quality data is furnished in Tables 3.5 and 3.6.

TABLE NO. 3.5 GROUND WATER QUALITY STATUS

Project : **Dongri Tal-II (Phase-I) O/C**

Season : Pre monsoon 2010

Sl. No.	Parameter	Concentration Range & Norms	
		Result	IS: 10,500 - 1991 Norms (Permissible)
1.	pH	6.60 – 6.65	6.5 – 8.5
2.	Total Hardness (as $CaCO_3$), mg/l	24.72 – 38.36	300
3.	Total Alkalinity (as $CaCO_3$), mg/l	28 – 39	600
4.	Total Dissolved Solids, mg/l	56 – 86	500
5.	Chlorides (as Cl), mg/l	9 – 16	250
6.	Sulphates (as SO_4), mg/l	4 – 9	200

7.	Fluorides (as F), mg/l	0.50	1.0
8.	Iron (as Fe), mg/l	0.20 – 0.25	1.0
9.	Nitrate (as NO_3), mg/l	5.0 – 5.5	100
10.	E. Coli, MPN/100ml	Absent	Absent

TABLE NO. 3.6 GROUND WATER QUALITY DATA

Project : Dongri Tal-II (Phase-I) O/C

Date of sampling : 05 /06/2010

Sl. No.	Parameter	**Result**		**IS: 10500-1991 Norms***
		Bijauri Bore Well (W_1)	**Jhalri Dug Well (W_2)**	
1	pH	6.60	6.65	6.5 – 8.5
2	Colour, Hazen	<5	<5	5/25*
3	Odour	Agreeable		Unobjectionable
4	Turbidity, NTU	5	5	5/10*
5	Dissolved Solids, mg/l	56	86	500/2000*
6	Residual free Chlorine, mg/l	Nil	Nil	0.2 Min
7	Chloride (as Cl), mg/l	9	16	250/1000*
8	Fluoride (as F), mg/l	0.50	0.50	1.0/1.5*
9	Sulphate (as SO_4), mg/l	4	9	200/400*
10	Cyanide (as CN), mg/l	<0.05	<0.05	0.05
11	Pesticides, mg/l	<0.001	<0.001	Absent/0.001*
12	Phenols (as C_6H_5OH), mg/l	<0.001	<0.001	0.001/0.002*

13	Chromium (as Cr^{6+}), mg/l	<0.01	<0.01	0.05
14	Copper (as Cu), mg/l	<0.01	<0.01	0.05/1.5*
15	Selenium (as Se), mg/l	<0.01	<0.01	0.01
16	Arsenic (as As), mg/l	<0.01	<0.01	0.05
17	Cadmium (as Cd), mg/l	<0.01	<0.01	0.01
18	Mercury (as Hg), mg/l	<0.001	<0.001	0.001
19	Lead (as Pb), mg/l	<0.01	<0.01	0.05
20	Zinc (as Zn), mg/l	0.29	0.25	5/15*
21	Alkalinity (as CaCO3), mg/l	28	39	200/600*
22	Iron (as Fe), mg/l	0.20	0.25	0.3/1.0*
23	Hardness (as CaCO3), mg/l	24.72	38.36	300/600*
24	Calcium (as Ca), mg/l	6.6	8.7	75/200*
25	Magnesium (as Mg), mg/l	2	4	30/100*
26	Nitrate (as NO_3), mg/l	5.0	5.5	45/100*
27	Manganese (as Mn), mg/l	< 0.01	< 0.01	0.1/ 0.3*
28	Boron (as B), mg/l	< 0.001	< 0.001	1 / 5*
29	Aluminium (as Al), mg/l	< 0.01	< 0.01	0.03/0.2*
30	E. Coli, MPN/100ml	Absent	Absent	Absent

Note: Desirable / * Permissible limit in the absence of alternate source

Surface water

The surface water quality status and surface water quality data is given in **Table No.3.7 and 3.8**

TABLE NO. 3.7 SURFACE WATER QUALITY STATUS

Project : **Dongri Tal-II (Phase-I) O/C**

Season : Pre monsoon 2010

Sl. No.	Parameter	Concentration Range & Norms	
		Result	**IS: 2296-1982 for Inland surface water (Class C)**
1.	pH	6.50 – 7.25	6.5 – 8.5
2.	Total Dissolved solids, mg/l	24 – 48	1500
3.	Dissolved Oxygen, mg/l	6.0 – 6.4	4.0
4.	BOD - 3 days, 27^{o}C, mg/l	3.0	3.0
5.	Chloride (as Cl), mg/l	12 – 15	600
6.	Flouride (as F), mg/l	0.50 – 0.60	1.5
7.	Sulphate (as SO_4), mg/l	1.0	400
8.	Zinc (as Zn), mg/l	0.50	15
9.	Iron (as Fe), mg/l	1.5 – 1.7	5.0
10.	Nitrates (as NO_3), mg/l	21 – 30	50

TABLE NO. 3.8 SURFACE WATER QUALITY DATA

Project : Dongri Tal-II (Phase-I) O/C

Date of sampling : 6 / 6 / 2010

Sl. No.	Parameters	**Result**			**IS: 2296 -1982 for inland surface water (Class C) Norms**
		Gopad River U/S (W_3)	**Gopad River D/S (W_4)**	**Pond Water (W_5)**	
1.	pH	7.25	7.16	6.50	6.5 – 8.5
2.	Colour, Hazen	15	15	20	300
3.	Total Dissolved Solids, mg/l	46	48	24	1500
4.	Dissolved Oxygen, mg/l	6.2	6.4	6.0	4.0
5.	BOD - 3 days, @ 27^{o} C mg/l	3.0	3.0	3.0	3.0
6.	Chloride (as CI), mg/l	13	15	12	600
7.	Fluoride (as F), mg/l	0.50	0.50	0.60	1.5
8.	Sulphate (as SO_4), mg/l	1.0	1.0	1.0	400
9.	Nitrates (as NO_3), mg/l	21	23	30	50
10.	Copper (as Cu), mg/l	<0.01	<0.01	<0.01	1.5
11.	Arsenic (as As), mg/l	<0.01	<0.01	<0.01	0.2
12.	Lead (as Pb), mg/l	<0.01	<0.01	<0.01	0.1
13.	Zinc (as Zn), mg/l	0.50	0.50	0.50	15
14.	Iron (as Fe) mg/l	1.7	2.0	1.5	5.0

Ground / Drinking water quality

At both the locations, pH is found to be 6.60 and 6.65. Total Hardness is 24.72 and 38.36 mg/l. Chlorides and Sulphates are found to the maximum extent of 16 mg/l and 9 mg/l respectively. Phenolic compounds, Cyanides and Insecticides are found to be absent. Heavy metal values except Iron and Zinc are found to be below the detectable limit. E-coli was found to be absent.

All the values were found to be well within the permissible limit of IS: 10500, 1991 norms.

The detail of ground water is given below:

1. At present, there is meager ground water abstraction from the core (lease area) zone by way of 5 open wells operated manually for drinking use by the villagers.

Surface water quality

pH is ranging between 6.5 and 7.25. BOD values are found to be 3.0 mg/l. Chlorides are ranging between 12 to 15 mg/l. Sulphates are found to be 1.0 mg/l. Heavy metal values except Iron are below the detectable limit.

All the values are found to be well within the IS: 2296 class C norms.

There is only one stream flowing on the northern boundary of the lease area and would need diversion so as to be away from the mining area. This will be diverted a little so that it flows unobstructed.

3.9.3 Summary

At all locations, Phenolic compounds, Cyanides, Sulphides and Insecticides are found to be absent. Heavy metal values except Iron and Zinc are found to be below the detectable limit.

In general, the water quality at all locations is found to be well within the prescribed norms of IS: 10500 - 1991 and IS: 2296 - 1982.

3.10. Noise Level Status

3.10.1 Rationale Behind Sampling

As part of the occupational health and safety measures certain safeguards have been incorporated to mitigate noise pollution in working environments. To know the background ambient noise level at the project and surrounding environment, noise levels are measured at all the ambient air monitoring locations for baseline study.

The noise level monitoring stations are shown in the **Plate - IV**

3.10.2 Data Presentation & analysis

TABLE NO. 3.9 NOISE LEVEL DATA

Project : **Dongri Tal-II (Phase-I) O/C**

Season : Pre monsoon 2010

Date of monitoring : 6 / 6 / 2010

Sl. No.	Location Details		L_{eq} Noise Level, dB(A)			
	Category	Name & Code	Day time	Night time	DGMS/CPCB LIMITS	
					Day time	Night time
1	Core Zone	Siktatola(A_1)	43.6	35.6	75	70
2	Buffer Zone	Gurwani (A_2)	43.2	35.2	55	45
3		Mungattigaon(A_3)	43.2	34.8		
4		Sajawar(A_4)	42.8	35.0		
5		Mohanban (A_5)	43.0	35.2		
6		Chakia (A_6)	43.2	35.0		

Core zone

L_{eq} noise levels at day time and night time are found to be 43.6 and 35.6 dB(A) respectively in the study area.

While comparing with occupational exposure limit of noise specified by Director General of mines safety (DGMS) / Scheduled III, Environment (Protection) Rules, 1986 – Ambient air quality standards in respect of noise at mine site , these values are found to be within the limits.

Buffer zone

L_{eq} noise levels for day time and night time are ranging between 42.8 to 43.2 dB(A) and 34.8 to 35.2 dB(A) respectively in the study area.

While comparing with Scheduled III, Environment (Protection) Rules, 1986 – Ambient air quality standards in respect of noise at residential areas / township norms, these values are found to be within the limits.

3.10.3 Summary

While comparing with occupational exposure limit of noise specified by Director General of mines safety (DGMS) / Scheduled III, Environment (Protection) Rules, 1986 – Ambient air quality standards in respect of noise at mine site, residential areas / township norms, these values are found to be within the limits.

3.11. Soil Quality Status

3.11.1 Rationale Behind Sampling

Soil characteristics, erosion aspects, soil fertility etc., have direct bearing on the environment. Knowledge of soil parameters is essential for the planning and implementation of aforestation. Further, major mining activities affect the

soil regime of the surrounding areas directly or indirectly. Hence, it becomes important to study the soil characteristics.

Keeping the above aspects in view, the following three different types of soil locations are selected. Forest land, Site (S_1), Agricultural land, Bijauri (S_2) and Agricultural land**,** Jhalri (S_3) soil.

The locations are selected in such a way that different types of for supporting different species of vegetation are covered. The soil quality monitoring stations are shown in the **Plate – IV.**

3.11.2 Data Presentation & analysis

The soil quality status is given in Table – 3.10 to 3.12.

TABLE NO. 3.10 SOIL QUALITY DATA

Project : **Dongri Tal-II (Phase-I) O/C**
Location : Fallow Land, Site (S_1)
Sampling Date : 06 / o6 / 2010

Sl. No.	Parameters	Depth, cm		
		0- 30	**30 - 60**	**60 – 90**
1.	pH @ 25°C (10% suspension)	6.72	6.75	6.73
2.	**Cation exchange capacity, meq/100gm**	11.5	11.6	11.5
3.	Electrical conductivity, (m-mhos/cm @ 20°C)	0.45	0.43	0.42
4.	Nitrogen available, kg/ha	115	114	112
5.	Phosphorous available, kg/ha	42	40	38
6.	Potash available, kg/ha	240	238	235
7.	Organic Carbon available (%)	0.70	0.68	0.72
8.	Grain size distribution Gravel (%)	36	35	35

	Sand (%) Silt & Clay (%)	25 39	25 40	24 41
9.	Textural class	Sandy Clay Loam		
10.	Bulk density (g/cc)	1.38	1.40	1.40
11.	SAR in Soil extract	10.50	10.56	10.40
12.	Field capacity (%)	7.4	7.6	7.8
13.	Wilting co-efficient (%)	0.6	0.5	0.5
14.	Available water storage capacity (%)	6.8	7.1	7.3

TABLE NO. 3.11 SOIL QUALITY DATA

Project : **Dongri Tal-II (Phase-I) O/C**

Location : Agriculture Land, Bijauri (S_2)

Sampling Date : 03 / 06 / 2010

Sl. No.	Parameter	Depth, cm		
		0- 30	**30 - 60**	**60 – 90**
1.	pH @ 25°C (10% Suspension)	6.80	6.76	6.79
2.	**Cation exchange capacity, meq/100gm**	11.8	11.6	11.5
3.	Electrical conductivity, (m-mhos/cm @ 20°C)	0.50	0.53	0.52
4.	Nitrogen available, kg/ha	117	120	118
5.	Phosphorous available, kg/ha	62	65	64
6.	Potash available, kg/ha	278	275	280
7.	Organic Carbon available (%)	0.75	0.78	0.79
8.	Grain size distribution Gravel (%) Sand (%) Silt & Clay (%)	 32 35 33	 31 39 30	 30 37 33
9.	Textural class	Sandy Clay Loam		
10.	Bulk density (g/cc)	1.33	1.32	1.30
11.	SAR in Soil extract	9.8	10.0	9.9
12.	Field capacity (%)	6.7	6.4	6.8
13.	Wilting co-efficient (%)	0.6	0.5	0.5
14.	Available water storage capacity (%)	6.1	5.9	6.3

TABLE NO.3.12 SOIL QUALITY DATA

Project	:	**Dongri Tal-II (Phase-I) O/C**
Location	:	Agriculture Land, Jhalri (S_3)
Sampling Date	:	03 / 06 / 2010

Sl. No.	Parameter	Depth, cm		
		0- 30	**30 - 60**	**60 – 90**
1.	pH @ 25°C (10% Suspension)	6.79	6.82	6.80
2.	**Cation exchange capacity, meq/100gm**	10.0	9.8	9.8
3.	Electrical conductivity, (m-mhos/cm @ 20°C)	0.52	0.53	0.50
4.	Nitrogen available, kg/ha	128	130	128
5.	Phosphorous available, kg/ha	68	65	64
6.	Potash available, kg/ha	280	285	278
7.	Organic Carbon available (%)	0.75	0.76	0.74
8.	Grain size distribution			
	Gravel (%)	33	35	33
	Sand (%)	40	39	40
	Silt & Clay (%)	27	26	27
9.	Textural class	Sandy Clay Loam		
10.	Bulk density (g/cc)	1.30	1.32	1.35
11.	SAR in soil extract	10.50	10.61	10.58
12.	Field capacity (%)	6.4	6.1	5.8
13.	Wilting co-efficient (%)	0.6	0.5	0.5
14.	Available water storage capacity (%)	5.8	5.6	5.3

3.11.3 Summary

The soil quality in the project area is good and would support vegetation after suitable reclamation measures and soil amendments.

3.12 Land use pattern

3.12.1) Land use pattern in core zone:

The leasehold area measures1392 ha and existing land use pattern is given below:

Waste Land	-	164.11 ha
Agriculture Land	-	282.19 ha
Fallow Land	-	880.09 ha
Settlement Land	-	38.06 ha
Water Body	-	27.25 ha
Total	**-**	**1392 ha**

3.12.2) Land use Pattern in Buffer Zone:

Land use pattern in buffer zone has been studied through remote sense imagery in Jan 10. Existing land use pattern in Buffer zone is given below.

Built – up Land	-	666.23 ha
Agriculture Land	-	15794.46 ha
Waste land	-	6882.86 ha
Forest land	-	25605.57 ha
Water land	-	1537 ha

Plate – V shows the land use pattern in study area.

3.13 Flora & Fauna:

Study of flora and fauna found in core and buffer zone has been carried out separately. In this project there are no forest land within the leasehold area i.e. core zone. Here the flora study is limited to agricultural crop in absence of forest cover in core zone. There is no habitat for wild life.

Mostly domesticated animals are found in the core zone. In category of fauna/mostly common birds have been found in core zone.

Table No- 3.13

List of Agricultural crops in Core zone:

Crop variety	Family name	Botanical name	Local/Trade name
Vegetables	Malvaceae	*Abelmoschus esculentus*	Bhendi
		Capsicum annum	Mirchi
	Solanaceae	*Solanum melongena*	Brinjal
Pulses	Fabaceae	*Phaseolus mungo*	Mung

Table No- 3.14

List of Cash (Commercial) Crops in Core zone:

Crop variety	Family name	Botanical name	Local /Trade name
Not Applicable	Na	Na	Na

Table No- 3.15

List of Agro Forestry species of Core Zone:

Family name	Botanical name	Local /Trade name
Annonaceae	*Annona squamosa*	Sitaphal
Caesalpiniaceae	*Tamarindus indica*	Bilayati Imli
	Caesalpinia pulcherima	Gulmohr
	Cassia saimea	N/a
Euphorbiaceae	*Phyllanthus emblica*	Awla
Fabaceae	*Dalbergia sisso*	Shesam
	Pongamia pinnata	Karanj
Graminae	*Bambusa arundinacea*	Bamboo
Mimosaceae	*Pithecellobium dulce*	Vilayati chinch
Moraceae	*Ficus carica*	Anjir
Moringaceae	*Moringa oleifera*	Munga
Punicaceae	*Punica granatum*	Anar
Verbenaceae	*Gmelina arborea*	Shivan
	Tectona grandis	Sagwan

Table No- 3.16

List of Endangered Flora of Core Zone

Family name	Botanical name	Local /Trade name
Not Applicable	Not present	Not present

Table No- 3.17

List of Endemic Flora of Core Zone

Family name	Botanical name	Local /Trade name
Not Applicable	Not present	Not present

Table No- 3.18

List of Flora (Natural Vegetation) of Buffer Zone

Family name	Botanical name	Local/Trade name
Anacardiaceae	*Semecarpus anacardium*	Bibba
Annonaceae	*Annona squamosa*	Sitaphal
Bignoniaceae	*Stereospermum xylocarpum*	Katori
Caesalpinaceae	*Bahunia racemosa*	Apta
	Cassia fistula	Bahawa
	Delonix regia	
	Hardwickia binata	Anjan
	Parkinsonia aculeate	Vedi-babul
	Tamarindus indica	Chunch
Simaroubaceae	*Ailanthus excels*	Maharukh
Combretaceae	*Anogiessus latifolia*	Dhawda
	Terminalia alata	Ain
	T. arjuna	Arjun/Kahu
	T. chebula	Hirda
Depterocarpaceae	*Shorea robusta*	Sal
Ebenaceae	*Diospyros melanoxylon*	Tendu
Euphorbiaceae	*Phyllanthus emblica*	Awla
Fabaceae	*Butea monosperma*	Palas
	Dalbergia paniculata	Dhobin
	D. sissoo	Sisam
	Erythrina variegate	Kasai
	Pongamia pinnata	Karanj

	Pterocorpus marsupium	**Bija**
Poaceae	***Bambusa arundinaceae***	**Katang bamboo**
Leeaceae	***Leea crispa***	**Kuram**
Lythraceae	***Lagerstroemia parviflora***	**Lendia/lenda**
Meliaceae	***Azadirachta indica***	**Neem**
	Melia azedarach	**Bakneem**
Mimosaceae	***Acacia arculiformis***	**Babul**
	A. catechu	**Khair**
	A.nilotica	**Babul**
	Albizzia lebbeck	**Sirish**
	A.odoratissima	**Shinchuva**
	A. procera	**Pandra**
	Cassia siamea	**Kashid**
	Leucaena leucocephala	**Subabul**
	Xylia xylocarpa	**Suria**
Moraceae	***Ficus benghalensis***	**Vad**
	F.racemosa	**Umber**
	F.religiosa	**Pipal**
	Ficus hispida	**Katgular**
Moringaceae	***Moringa citrifolia***	**Aal**
Myrtaceae	***Syzygium cumini***	**Jamun**
Palmae	***Borassus flabellifer***	**Sindhi**
Rhamnaceae	***Zizyphus mauritiana***	**Ber**
Rubiaceae	***Adina cordifolia***	
	Mitragyna parviflora	**Mundi**
Rutaceae	***Chloroxylon swietenia***	**Behura**
	Aegle marmelos	**Bel**
Sapindaceae	***Schleichera oleosa***	**Kusumb**
	Sapindus laurifolium	**Ritha**
Sterculiaceae	***Sterculia urnes***	**Karaj**
Tiliaceae	***Grewia tiliaefolia***	**Dhaman**
	Grewia disperma	**Chaturli**
Verbenaceae	***Tectona grandis***	**Sagwan**
	Gemelina arborea	**Gamari**

(b) Middle layer – Trees, Shrubs & Climbers

Family name	**Botanical name**	**Local/ Trade name**
Asclepidaceae	***Daemia extensa***	**Utaranvel**
Celastraceae	***Maytenus emarginata***	**Bharati**
Combretaceae	*Calycopteris floribunda*	**Gilibuli**
	Combretum ovilifolium	**Piwarvel**
Convolvulaceae	***Argyrea nervosa***	**Rakath vel**
Cuscutaceae	***Cuscuta reflexa***	**Amar vel**
	Ipomoea quiomeelit	**Ganesh vel**
	I. eriocarpa	**Boota**
	I.palmata	**Ghiabato**

	I.absucura	**Dopateluta**
Discoreaceae	***Dioscorea bulbifera***	**Akas vel**
Euphorbiaceae	***Kirganelia reticulate***	**Pitundi**
	Securenga virosa	**Dhani**
Fabaceae	***Abrus precartorious***	**Gunj**
	Butea superb	**Palas vel**
Flocourtiaceae	***Flacourtia indica***	**Kakai**
Minispermaceae	***Cocculus hirsutus***	**Vasan vel**
Nyctaginaceae	***Nyctanthus arbortristis***	**Kharasi**
Ascclepiadaceae	***Cryptolepis buchanani***	**Dhdhi**
Rhamnaceae	***Ventilago denticulate***	**Lokhandi**
	Zizypus juzuba	**Bhor**
	Z.oenoplia	**Eroni**
Tiliaceae	***Grewia hirsute***	**Gaturli**
Verbenaceae	***Lantana camara***	**Raimunia**
	Vitex negundo	**Nirgundi**

(c)Climbers

Family name	**Botanical name**	**Local / Trade name**
Caesalpiniaceae	***Bauhinia vahlii***	**Mahul**
	Caesalpinia decapetala	**Chilati**
Combretaceae	***Calycopteris floribunda***	**Gilibuli**
Cuscutaceae	***Cuscuta reflexa***	**Amar vel**
Convolvulaceae	***Ipomoea qumoclit***	**Ganesh vel**
Dioscoreaceae	***Dioscorea bulbifera***	**Gathalu**
	Dioscorea pentaphylla	**Musalkand**
Cucurbitaceae	***Momordica charantia***	**Karela**
Mimosaceae	***Acacia caesia***	**Gurar**
	Acacia pinnata	**Raoni**
Asclepiadaceae	***Cryptolepis buchanani***	**Dudhi**

(d) Ground layer – Shrubs & Herbs

Family name	**Botanical name**	**Local/ Trade name**
Acanthaceae	*Andropogon pumilus*	**Diwartan**
Amaranthaceae	***Achyranthus aspera***	**Chirchitta**
	Amaranrhus spinosus	**Kate chawli**
Caesalpinaceae	***Cassia tora***	**Kan kuti**
Asteraceae	***Tridax procumbens***	**Kamarmodi**
	Parthenium hysterophorus	**Gajar gawat**
	Spilanthus acmella	**Na**
Convolvulaceae	***Evolvulus alsinoides***	**Na**
	E.nummularis	**Na**
	Merremia emarginata	**Undir khani**

Euphorbiaceae	***Euphorbia hirta***	**Dhudhi**
	E.rosea	**Na**
Fabaceae	***Alyscicarpus monilifer***	**Na**
	Indigofera linifolia	**Na**
	I.cordifolia	**Na**
	Tephrosia hamiltonii	**Divali**
	Tephrosia purpuea	
Laminaceae	***Hyptis suaveolens***	**Na**
	Ocimum sanctum	**Tulsi**
	Ocimum bassilicum	**Rantulsi**
	Leucas biflora	**Na**
Liliaceae	***Gloriosa superb***	**Khadyanag**
Malvaceae	***Hibiscus lobatus***	**Na**
	Sida veronicaefolia	**Na**
	Sida acuta	**Na**
Pedaliaceae	***Martynia annua***	**Waghnakhi**
Mimosaceae	***Mimosa pudica***	**Lajavanti**
Nyctaginaceae	***Boerhavia diffusa***	**Na**
Oxalidaceae	***Oxalis corniculata***	**Tipani**
Rananculaceae	***Cleome viscose***	**Pivili tilwan**
Rubiaceae	***Borreria articularis***	**Na**
Solanaceae	***Datura metal***	**Kala dhotra**
	Physalis minima	**Na**
Zygophylaceae	***Tribulus terrestris***	**Goakru**

Table No- 3.19

List of Grasses and Sedges of Buffer Zone

Family name	Botanical name	Local /Trade name
Cyperaceae	***Kylliga tenufolia***	**Na**
	Scleria annularis	**Na**
Poaceae	***Apluda mutica***	**Phulkia**
	Aristida hystrix	**Na**
	Chloris barbata	**Na**
	Cymbapogon martini	**Tikhadi**
	Dactyloctenum aegyptium	**Na**
	Digitaria ternate	**Na**
	Eleusine indica	**Na**
	Eragrostiella bifaria	**Na**
	Eragrostis ciliaris	**Na**

Table No- 3.20

List of Endangered Flora of Buffer Zone

Family name	Botanical name	Local /Trade name
Not Applicable	Not present	Not present

Table No- 3.21

List of Endemic Flora of Buffer Zone

Family name	Botanical name	Local /Trade name
Not Applicable	Not present	Not present

Table No- 3.22

List of Medicinal & Economic Flora of Buffer Zone:

Family name	Botanical name	Local /Trade name
Rutaceae	*Aegle marmelos*	Bael Tree
Combretaceae	*Anogeissus latifolia*	Axle Wood
Burseraceae	*Boswellia serrata*	White Dammar (Lumban)
Anacardiaceae	*Buchanania lanzan*	Clumpang Nut Tree
Meliaceae	*Chloroxylon swietenia*	Satin Wood Tree
Papilionaceae	*Dalbergia paniculata*	Satpuria
Ebenaceae	*Diospyrous malanoxylon*	Ebony (Tendu)
Lythraceae	*Lagerstroemia parviflora*	Nandi (H)
Rutaceae	*Limonia elephantum*	Elephant-Apple
Annonaceae	*Miliusa tomentosa*	Kiru
Fabaceae	*Pterocorpus marsupium*	Kino Tree
Bombacaceae	*Salmalia malabaricum*	Semel (Red Silk Cotton)
Sapindaceae	*Schleichera oleosa*	Lac Tree
Sterculiaceae	*Stercula urnens*	Katheergum
Combretaceae	*Terminalia bellerica*	Belleric Myrobalam
Combretaceae	*Terminalia chebula*	Yellow Myrobalan

Table No- 3.23

List of Aquatic plants of Buffer Zone

Family name	Botanical name	Local/Trade name
Convolvulaceae	*Ipomoea aquatic*	Water spinach
Menyanthaceae	*Nymphoides indica*	Floating Leaf
Nelumbonaceae	*Nelumbo nucifera*	Lotus

2.0. TERRESTRIAL FAUNA:

2.1. Total Listing of Faunal elements:

Among the faunal groups avifauna of terrestrial origin is most conspicuous in all habitat types from deciduous forests to grass land communities. A few mammalian species of wildlife category have been found in buffer zone protected forest areas. No prominent aquatic fauna is reperesented from the project areas of core and buffer zones, however the aquatic habitats of perennial water bodies like streams and rivers, village ponds represented with few species of Fin-fish (Fishes), Shell-fish (Mollusc) and Prawns (Crustaceans) of seasonal occurrence.

2A. Fauna of Core Zone:

The observed fauna in the Core Zone is of common occurrence and abundantly seen in all terrestrial habitats. Checklist of groupwise faunal species of terrestrial habitats of Core zone is presented in table No- 3.25

Table No- 3.24

Checklist of Terrestrial Fauna of Core zone

(a) Mammals

Zoological name	Common name	Status in Wild life(Protection)Act
Rousettus leschenaulti	**Indian Fulvous Fruit- Bat**	**Schedule-V, Section 3**
Mus booduga	**Indian Field Mouse**	**Schedule-V, Section, 5**
Mus rattus rattus	**Common House Rat**	**Schedule-V, Section, 6**
Bandicota bengalensis	**Bandicoot Rat**	**Schedule-V, Section, 6**
Herpestes edwardsi	**Indian Grey Mongoose**	**Schedule-IV, Section, 6A**

(b) Birds

Zoological name	Common name	Status in Wild life(Protection) Act
Bubulcus ibis	**Cattle egret**	**Schedule-IV, Section,11**
Ardeola grayii	**Indian pond heron**	**Schedule-IV, Section,11**
Milvus migrans	**Black kite**	**Schedule-IV, Section,11**
Streptopelia chinensis	**Spotted dove**	**Schedule-IV, Section,11**
Alcedo atthis	**Small blue kingfisher**	**Schedule-IV, Section,11**
Halcyon smyrensis	**White-breasted kingfisher**	**Schedule-IV, Section,11**
Merops orientalis	**Small bee-eater**	**Schedule-IV, Section,11**
Acridotheres tristis	**Common myna**	**Schedule-IV, Section,11**
Sturnus contra	**Asian pied starling**	**Schedule-IV, Section,11**
Venellus indicus	**Red-wattled lapwing**	**Schedule-IV, Section,11**

Chardrius dubius	Little ringed flover	Schedule-IV, Section,11
Psittakula krameri	Rose ringed parakeet	Schedule-IV, Section,11
Pyccnonotus cafer	Red-vented bulbul	Schedule-IV, Section,11
Coracias benghalensis	Indian roller	Schedule-IV, Section,11
Turdoides caudatus	Common babbler	Schedule-IV, Section,11
Centropus sinensis	Crow pheasant	Schedule-IV, Section,11
Dicrurrus adsimilis	Black drango	Schedule-IV, Section,11
Carvus splendens	House crow	Schedule-V, Section,1
Apus affinis	House swift	Schedule-IV, Section ,11
Passer domesticus	House sparrow	Schedule-IV, Section,11

(c) Reptiles

Zoological name	Common name	Status in Wild life (Protection) Act
Not Applicable	Na	Na

(d) Amphibians

Zoological name	Common name	Status in Wild life (Protection) Act
Not Applicable	Na	Na

(e) Butter flies

Zoological name	Common name	Status in Wild life (Protection) Act
Not Applicable	Na	Na

2.2. Endangered Species (as per Wildlife (Protection) Act: No Endangered species was recorded from Core Zone of the Project areas.

Table No- 3.25

Checklist of Endangered species of Core zone

Zoological name	Common name	Status in Wild life(Protection) Act
Not Applicable	Na	Na

2.3. Endemic Species of the Project areas: No endemic species were observed in Core Zone.

Table No- 3.26

Checklist of Endemic species of Core zone

Zoological name	Common name	Status in Wild life (Protection) Act
Not Applicable	Na	Na

2.4. Migratory species of the Project areas: No migratory fauna observed in Core Zone of the project areas.

Table No- 3.27

Checklist of Migratory species of Core zone

Zoological name	Common name	Status in Wild life(Protection) Act
Not Applicable	Na	Na

2.5. Migratory corridors and Flight paths: The project site areas of the Core zone do not represent any migratory paths or corridors.

Table No- 3.28

Migratory Corridors of Core zone:

Name of the area	Location	Notified in Protected areas
Not Applicable	Na	Na

2.6. Breeding and Spawning grounds: No breeding and spawning grounds Core zone are located in the project areas of Core zone.

Table No- 3.29

Breeding and spawning grounds of Core zone:

Name of the area	Location	Notified in Protected areas
Not Applicable	Na	Na

2.7. Aquatic fauna of Core Zone: The following common varities of Fishes, Crustaceans and Mollusc species were observed in Core Zone.

Table No- 3.30

Checklist of aquatic fauna of Core Zone:

(a) Fishes:

Zoological name	Common name	Status in wild life(Protection)Act
Channa punctatus	Marad	Not Applicable
Mugil cephalous	Mullet	Not Applicable
Catla catla	Catla	Not Applicable

(b) Crustaceans

Zoological name	Common name	Status in wild life(Protection) Act
Macrobrachium rosenbergi	Freshwater Prawn	Not Applicable

(c) Mollusc

Zoological name	Common name	Status in Wild life(Protection) Act
Littorina sp.	Common snail	Not Applicable

2B. Fauna of Buffer Zone:

The peripheral areas of the buffer zone provided suitable habitats for the distribution of mammalian species of wildlife importance. The passerine bird's fauna is conspicuous in abundance and density in Buffer zone. The faunal elements of the Buffer zone are listed in Table 2.1b.

Table No- 3.31

Checklist of Terrestrial Fauna of Buffer zone

(a) Mammals

Zoological name	Common name	Status in Wild life(Protection) Act
Melursus ursinus	Sloth bear	Schedule-I, Part-I,Section,31C
Presbytis entellus	The Common Langur	Schedule-II, Part-I,Section,4A
Macaca mulatta	Rhesus macaque	Schedule-II, Part-I,Section,17A
Felis chaus	Jungle Cat	Schedule-II,Part-II,Section,2C
Vulpes bengalensis	Indian Fox	Schedule-II, Part-I,Section,1B
Canis aureus	Jackal	Schedule-II,Part-I,Section,2B
Hyaena hyaena	Striped Hyaena	Schedule-III, Section, 12
Sus scrofa	Wild Fig	Schedule, III, Section,12
Herpestes edwardsi	Indian Grey Mongoose	Schedule-IV, Section, 6A
Lepus nigricollis nigricollis	Black napped Hare	Schedule-IV, Section, 3A
Rousettus leschenaulti	Indian Fulvous Fruit- Bat	Schedule-V, Section 3
Mus booduga	Indian Field Mouse	Schedule-V, Section, 5
Mus rattus rattus	Common House Rat	Schedule-V, Section, 6
Bandicota bengalensis	Bandicoot Rat	Schedule-V, Section, 6

(b) Birds

Zoological name	Common name	Status in wild life(Protection) Act
Egretta alba	Larger egret	Schedule-IV, Section,11
Bubulcus ibis	Cattle egret	Schedule-IV, Section,11
Ardeola grayii	Indian pond heron	Schedule-IV, Section,11

Milvus migrans	**Black kite**	**Schedule-IV, Section,11**
Haliastur Indus	**Brahminy kite**	**Schedule-IV, Section,11**
Streptopelia chinensis	**Spotted dove**	**Schedule-IV, Section,11**
Alcedo atthis	**Small blue kingfisher**	**Schedule-IV, Section,11**
Halcyon smyrensis	**White-breasted kingfisher**	**Schedule-IV, Section,11**
Merops orientalis	**Small bee-eater**	**Schedule-IV, Section,11**
Dinopium benghalensis	**Common wood pecker**	**Schedule-IV, Section,11**
Acridotheres tristis	**Common myna**	**Schedule-IV, Section,11**
Upupa epops	**Common hoopoe**	**Schedule-IV, Section,11**
Sturnus contra	**Asian pied starling**	**Schedule-IV, Section,11**
Dendrocitta vagabond	**Indian tree pie**	**Schedule-IV, Section,11**
Venellus indicus	**Red-wattled lapwing**	**Schedule-IV, Section,11**
Chardrius dubius	**Little ringed flover**	**Schedule-IV, Section,11**
Psittakula krameri	**Rose ringed parakeet**	**Schedule-IV, Section,11**
Pyccnonotus cafer	**Red-vented bulbul**	**Schedule-IV, Section,11**
Coracias benghalensis	**Indian roller**	**Schedule-IV, Section,11**
Turdoides caudatus	**Common babbler**	**Schedule-IV, Section,11**
Centropus sinensis	**Crow pheasant**	**Schedule-IV, Section,11**
Dicrurrus adsimilis	**Black Drango**	**Schedule-IV, Section,11**
Carvus macrorhynchos	**Jungle crow**	**Schedule-IV, Section,1**
Carvus splendens	**House crow**	**Schedule—V, Section,1**
Passer domesticus	**House sparrow**	**Schedule-IV, Section,11**
Ploceus philippinus	**Baya weaver**	**Schedule-IV, Section,11**

(c) Reptiles

Zoological name	**Common name**	**Status in Wild life (Protection) Act**
Varanus benghalensis	**Indian monitor lizard**	**Schedule-II, Part-II**
Enhydris enhydris	**Smooth water snake**	**Schedule-IV, Section,12**
Natrix piscator	**Olive keel back snake**	**Schedule-IV, Section,12**

(d) Amphibians

Zoological name	**Common name**	**Status in Wild life (Protection) Act**
Bufo melanostictus	**Common toad**	**Schedule-IV, section,13**
Euphlyctis hexadactyla	**Common frog**	**Schedule-IV, section,13**

(e) Butter flies

Zoological name	**Common name**	**Status in Wild life(Protection) Act**
Danaus genutia	**Striped tiger**	**Schedule-IV, Section,18**
Antheria mylita	**Moth**	**Schedule-IV, Section,18**

2.2. Endangered species of the project areas: No endangered species were observed in Buffer zone of the Project.

Table No- 3.32

Checklist of endangered species of Buffer zone

Zoological name	**Common name**	**Status in Wild life(Protection) Act**
Not Applicable	**Na**	**Na**

2.3. Endemic Species of the Project areas: No endemic species were observed in Buffer zone of the Project.

Table No- 3.33

Checklist of Endemic species of Buffer zone

Zoological name	Common name	Status in Wild life(Protection) Act
Not Applicable	Na	Na

2.4. Migratory species: No migratory species of wildlife importance were observed in Buffer Zone.

Table No- 3.34

Checklist of Migratory species of Buffer zone

Zoological name	Common name	Status in Wild life(Protection) Act
Not Applicable	Na	Na

2.5. Migratory corridors and Flight paths of Buffer zone: No Migratory Corridors and Flight paths are located in Buffer Zone (Table 2.5b).

Table No- 3.35

Name of Corridors / Flight paths	Location	Protected Status
Not Applicable	Na	Na

2.6. Breeding and spawning grounds: No breeding and spawning grounds of wildlife fauna are located in Buffer Zone.

Table No- 3.36

Name of the breeding ground	Location	Protected status
Not Applicable	Na	Na

2.7. Aquatic fauna of Core Zone: The following common varities of Fishes, Crustaceans and Mollusc species were observed in Core Zone.

Table No- 3.37

Checklist of Aquatic Fauna of Buffer Zone:

(a) Fishes:

Zoological name	Common name	Status in wild life(Protection) Act
Channa punctatus	Spotted murrel	Not Applicable
Clarias batrachus	Magur	Not Applicable

Mugil cephalous	**Mullet**	**Not Applicable**
Labeo rohita	**Rohu**	**Not Applicable**
Labeo gonious	**Minor carp**	**Not Applicable**
Catla catla	**Catla**	**Not Applicable**

(b) Crustaceans

Zoological name	**Common name**	**Status in Wild life(Protection) Act**
Macrobrachium rosenbergi	**Freshwater Prawn**	**Not Applicable**
Macrobrachium malcolmsoni	**Small Prawn**	**Not Applicable**

(c) Mollusc

Zoological name	**Common name**	**Status in Wild life(Protection) Act**
Planoxis sulcatus	**Ground snail**	**Not Applicable**
***Littorina* sp.**	**Common snail**	**Not Applicable**

3.14 Socio -Economic Environment

Socio-economic studies is one of the important aspects of Environmental studies. The socio-economic parameters viz. Population growth, density, sex ratio, health, work force participation, occupational structure, literacy etc, play an important role in determining the impact of the proposed activity on the human population of the study area, directly or indirectly. These impacts may be beneficial or detrimental. As a part of Environmental study, it is imperative to analyze and predict the socioeconomic scenario.

Socio-economic environment includes description of demography, available basic amenities like housing, health care services, transportation, communication, education and cultural activities. Village wise demography at Dongrital -II (Phase-1) is given in the **Table 3.38** below:

Table 3.38

S.No.	NAME OF VILLAGE	No. OF FAMILIES	NO. OF HOUSES	POPULATION		SEX RATIO	NO. OF SCHOOL		DISPENSARY	AGANBARIES
				MALE	FEMALE	NO. OF FEMALES	PRIMAR	MIDDLE		

						PER 1000 MALES	Y			
1	DONGRI	359	365	1063	896	842.89	3	1	1	1
2	BAINSABURA	57	57	162	175	1080.24	1	NIL	NIL	NIL
3	DIGWAHA	62	63	208	181	870.19	1	NIL	NIL	NIL
4	BAZORI	15	15	54	45	833.34	NIL	NIL	NIL	NIL
TOTAL		493	500	1487	1297	906.665	5	1	1	1

The information on socio-economic aspects has been compiled from various secondary sources including various government and semi-government offices. There are four villages involved viz. **Dongri, Bhainsabuda, Digwah, & Bijaudi** in Dongri Tal –II (phase-I)**.** This is remote area from Singrauli district. A brief summary is given below.

The Community: Singrauli district comprise of mixed community in which there is large population of Scheduled Caste & Scheduled Tribe & Backwards. The Adivasi communities are mostly Gor & Panika settled here for long period. Their main occupation is agriculture and forest produce for their livelihood. The communities live in harmony but devoid of any development and modern facilities. They lead primitive custom and culture.

Life Style of Women: A striking feature of the Adivasi Community in Gondwana region hamlets are the relatively high status of the women. The women are quite mobile and work participation rates are quite high – they are engaged in work in the field as well as migrant labours. Women lead extremely busy lives and do most of the work relating to their livelihood.

Culture: Adivasis possesses a unique culture of their own. While traditional Hindu festivals such as Deshehra, Holi, Dipawali, Rakshabandhan & Janmasthmi etc. are celebrated in unique.

Life Pattern: Communities of these villages suffer from a high degree of economic deprivation. This is despite the fact that region receives plentiful rainfall in the monsoon. Unfortunately, the absence of rainwater harvesting methods means that rain water goes waste and water sources dry up by March – June. The migration can be categorized as daily migration as they have to go in search of employment in nearby village to get work and the five square kilometer a day. Alcoholism is high in the community also the consumption of tobacco.

Health: Health and attainment in the community is low. This is linked to the poverty levels in the area. The diet typically comprises of wheat, rice, yellow dal & vegetables. There is deficiency of Proteins Carbohydrates which is manifested in the form of Protein Energy Malnutrition (PEN). Thus, the incidence of *Marasmus* & *Kawashiorkor* is common. Water scarcity also leads to skin diseases, with scabies as one of the most common problems apart from abdominal pains & respiratory – track infection.

The village population places considerable faith in the traditional healer, the *bhagat*. The bhgat's knowledge is not belittled but it is to be accepted that he is unlikely to have superhuman curatives power, or that illness are attributable to spirits that have crept into one's body.

The third reason for poor health rests in the relatively inaccessible of health services. Private Medical Services are generally clustered around towns. Primary Health Center (PHCs) and their sub – centers may be better accessed but only relatively.

Services: Supply of electricity through Madhya Pradesh State Electricity Board was made in the villages through rural feeder but it is seldom energized there. The landline phone connections are non – existent but there is mobile phone communication available in these villages. Few years ago there was no approachable road to these villages. Due to difficulties in the traveling the villagers could not go to towns & cities. Recently the villages have been connected by Pradhan Mantri Gram Sadak Yojna.

Water Scarcity & Their Related Problems: The region is populated by many tribal groups. Inspite of natural beauty and heavy rainfall in the area (more than 1200 mm/year) many of the tribal hamlets located in the area face the problem of shortage of drinking water. These small tribal hamlets are suffering from this problem. The water shortage in these villages has led to various socio-economic problems related to their daily life.

- The lack of water availability in the region post monsoon has resulted in the shortage of drinking water.
- The lack of drinking water also resulted in the spread of various water borne diseases among villagers like jaundice, dehydration etc. due to non-availability of Primary Health Care facilities in the villages the patients have to suffer a lot and have bear heavy medical expanses in the treating themselves.
- The lack of water availability also resulted in low agriculture production due to non-availability of water for irrigation purposes.
- Water scarcity in village also resulted in the lack of fodder production and even the common pasture land in the nearby areas of villages dried up in summer season due to low water level. This has severely affected to livestock in villages.
- Over all the villagers have a low social status.

CHAPTER – IV

ENVIRONMENT IMPACT ASSESSMENT & MITIGATION MEASURES.

4.1) Introduction:-

Mining and allied activities related to this mine are likely to impact the quality of environment in study area. It is proposed to assess the likely impact of mining and allied activities related to the mine having capacity of 2.9 MTY on various environmental attributes i.e. ambient air, water, noise, land. Flora & fauna and socio-economic profile. For this purpose study area includes:-

Core zone which is leasehold area and buffer zone which is covered within 10 Km beyond the core zone.

Study area is shown in plate III.

4.2) Air Pollution Impact Assessment

It is proposed to assess the impact on ambient air quality using ISCST-III software developed by USEPA.

4.2.1) Emission Factors:-

Emission factors for SPM corresponding to various mining and allied activities have been taken from USEPA-44 document. These emission factors are corresponding to activities with control measures. **Table 4.1** gives the value of emission factors for different mining activities.

EMISSION FACTOR

TABLE NO. – 4.1

Drilling in Overburden	20 kg / day
Blasting Overburden & Coal	25.28 kg/ day
Loading coal & Overburden	981.52 kg / day
Coal dozing	26.56 kg/ day
Sub Total	**1063.36 kg/ day**
Considering 50% retention in quarry	531.68 kg/day
Considering this as area source	5.35 x 10 $^{-0.5}$ g/sqm/s
Internal Dump	1.32 x 10 $^{-0.5}$ g/sqm/s
Emission due to wind erosion	1.1 x 10 $^{-05}$ g/sqm/s
External Dump - /Dump formation	2.85 x 10^{-6} g/sqm/s
Wind erosion	1.39 x 10 -10 g/sqm/s
A haul road ext	3.56 x 10 -03 g/sqm/s
Internal Haul Road	7.12 x 10 -03 g/sqm/s
Coal Haul Road	0.00130 gm/sqm/s
Coal crushing	1.129/s

4.2.2) Micro – meteorological data:-

Hourly micro – meteorological data required as input to the software have been generated during baseline data generation programme.

4.2.3) Locations:-

Contribution of air pollutants have been assessed at those locations where the baseline ambient air quality has been generated.

4.2.4 Result:-

Table 4.2 gives the contribution of mining activities on different locations in terms of SPM.

Table 4.2
Prediction of SPM level

Sn.No.	Station	Baseline level (SPM in µg/m^3)	Contribution of project (SPM in µg/m^3)	Total level of SPM	Prescribed value
1.	2	3	4	5	6
I	Siktatola	110	-	-	500
II	Gurwani	106	2.1	108.1	200
III	Mungatigaon	110	1.9	111.9	200
IV	Sajwar	106	4.6	110.6	200
V	Mohanban	109	5.2	114.2	200
VI	Chakia	107	3.8	110.8	200

This means that level of SPM during operational Stagewill remain within prescribed limit.

4.3) Impact on Land use Pattern

Out of the total block area, about 1392 Ha will be required for the development of Dongri Tal-II (Phase-I) which would be utilized for different purposes to carry out the operations as stated in Table- 4.3. There will not be any requirement for forest land for development of Dongri Tal (phase I) opencast project.

Table - 4.3. Break- up of Land

Sl. No.	Particular	Total (Ha)
1	Mine excavation	1132.27
2	External Overburden	123.51
3	Barrier along mine Boundary	4.02
4	Surface infrastructure	20.23
5	Colony and its related infrastructure	41
6	Resettlement village	10
7	Rationalization	60.97
	Total	**1392.00**

During mining and allied operations, changes in above land status will be taking place due to the mining activities and construction of infrastructure described in Chapter-II.

These activities will affect 282 hactare of agricultural land and 1110 hactare of waste land and fallow land. After closure of mine about 1017 hactare of land would be reclaimed and afforested.

4.4) Impact on Water Resource

4.4.1) Water requirement

Total water demand for the project has been assessed as 965 KLD. Break-up of water requirement is given below.

A.1	Industrial Demand (KLD)		
	HEMM Washing	-	400
	Floor Washing	-	100
	Dust Suppression	-	300
	Green Belt	-	50
			850
A.2)	Potable	-	5
	Total	**-**	**855**
(B)	**Colony**		
B.1)	Horticultural demand	-	10

B.2)	Potable water demand	-	100
	Total	**-**	**110**

It is proposed to treat the effluent from different sources and recycle them for use. **Fig IV.5 & Fig IV.6** gives the water balance for the project. It may be seen from the water balance chart that at industrial site about 850 KLD of water will be available for recycling and hence net water demand for mine site during operational stage of mine will be 5 KLD. This water will be drawn from Ground water through 200mm dia deep tube wells. In the township water demand will be 100 KLD. Water required for horticultural purposes will be met by recycling treated water fro STP. The area falls in white zone as per CGWA. This area do not require prior approval for drawing water from ground water source.

4.5) Impact on Drainage pattern:-

Pre-mining drainage pattern in study area has been discussed earlier at Chapter-III Proposed mining activities are likely to affect the drainage pattern in study area. This is discussed below:-

i) **Diversion of Nala:**

A small stretch of hardal nala and Jheria, nala which presently flows through the leasehold area needs to be diverted to facilitate safe mining. The diverted course of the nala is shown in plate VIII. After diversion both the Nala will meet Gopad River. Thus the diversions of Nala will have no impact on hydrological pattern of the area, at the operational stage of mine entire surface run off from lease hold area will flow to Gopad River.

4.5.1) Impact of mining on Surface run-off pattern:-

During operational and post operational stage of mining, arrangements have been so made that surface run-off from the leasehold area and surplus mine water are used for ground water recharge and meeting the

part of water demand will find way to Gopad river. Thus the water regime of Gopad river is not going to be appreciably affected.

4.5.2) Impact on Water Quality:-

No untreated effluent are to be discharged to natural water system. Quality of treated effluent which includes mine water and surface run-off from mine area which will be discharged to natural system will conform to standards prescribed by MOEF for effluents. Thus there is no likely hood of pollution of surface or ground water resource due to mining activities.

4.5.3) Impact on Ground Water Profile

Mining activities will have effect on ground water system in following ways.

1. Ground water table will be intersected by mining during post monsoon period at the depth of 8 meters (422 mRL) below the general ground level (430 mRL) .

2. The maximum ground water inflow in the mining pit at conceptual stage when maximum depth of 100 meters (330 mRL) is achieved along with rain water accumulation, will be used for dust suppression, green land development and for recharging ground water storage of buffer zone.

3. The inflow of ground water in the mine at the conceptual stage will be much less than the long term ground water recharge of the lease area and is estimated to be less than the safe limit of 70 % of exploitation of the long term ground water recharge of lease area.

I) Withdrawal of water for industrial site and township. This demand is only 105 KLD. This demand is insignificant and will have no significant impact on ground water resource.

II) Mine water drainage will cause lowering of ground water level around the quarry.

Ground water profile at the stage of mine when mine water will be puped out defined by following equation:

$$Q = \frac{2.72\ T\ (H - hw)}{\log_{10} R/r_w}$$

Where – H- hw = Max ^{m} draw down of water level in pumping well
R - is radius of influence
r = radius of well. In this case r is taken as radius of circle having area equal to area of quarry.
Q = Discharge rate m^3/hr. In this case Q is 30000 KLD.
T = Transmissivity of aquifer = 85

In case of this mine is considered to be pumping well. Its radius works out to be 1410 m.
R = 1625 m
= 215m beyond Quarry edge.

III) Quarrying operation will intersect various aquifers in pit area. Ground water will seep into mine pit through the exposed aquifers. Seeped water will be collected in the pit which will be continuously pumped out. Continuous seepage of ground water through aquifers and pumping would depress the ground water land around the quarry. The profile of the depressed ground water will have an inverted cone shape.

4.6) Impact on Noise Level:-

Noise will be generated in mining area by

- Operation of HEMMs i.e. Shovel, dumper, surface miner etc. Their operations will be confined to mine lease area.
- Operation of cross country conveyor.

The level of noise produced by these equipments range between 70 to 90 dB (A) when measured at a distance of 3m from running equipments.

Impact of operation of these equipments on noise level in vicinity of mine will be minimal on account of following reasons.

- Provision of Green Belt around the operational area.
- Forest cover around the mine
- Sufficient distance (above 2 Km) between the equipments operational area & nearest human habitation.

4.7) Impact on Flora & Fauna:-

There is no forest land within the lease hold area. Thus mining activities will not affect natural forest flora. Subsequently faunal habitat will also be not affected.

4.8) Solid Waste Generation & Management

Sources of solid waste generation in the mine include:-

a) Overburden materials removed from mine pit during mining operation.

b) Solid waste generated from ETP in mine site.

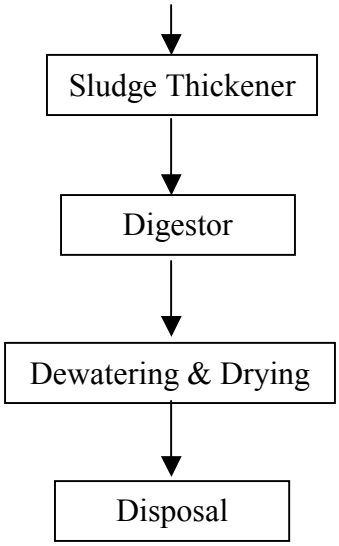
c) Solid waste generated from STP in township.

4.8.1) Overburden Material Management

As stated earlier in chapter-II, a total of –597.41 Mm^3 of overburden material will be removed during the life of the mine. The calendar plan for excavation has been given in Table – 2.5. A total of –538.39 Mm^3 of OB material will be used to backfill the decoaled pit balance would be stored in external dump.

4.8.2) Solid waste from ETP & STP:-

Sludge from ETP & STP will be first pass through sludge thickener & than to Digester sludge from digester will be dewatered & then disposed off:



Cross section of sand Drying Bed is given in Fig 4.7

4.9) Air Pollution Control Measures.

A.) Drilling :

In order to minimize the generation of dust from drilling operation in overburden / coal following mitigation measures are proposed.

Drilling equipment with in built mechanism for water jet are to be procured. With such equipments, the drilling site is sprinkled with water before drilling operation begin with the help of water jets fitted with drilling machine Wetting of drilling site will minimize generation of dust during drilling operations.

B.) Blasting :

Minimization of dust pollution due to blasting operation is to be achieved by following measures

I.) Optimization of explosive charge:-

The Purpose of blasting is basically to break the overburden rocks and coal seams into small fragments so that they can be removed. Dust is produced when amount of explosive used in blasting is more than that

required for breaking the coal/overburden mass. As such optimization of charge weight per blasting will avoid powdering effect caused by over charging the blast holes. With this in view characteristics of rock and coal mass have been studied & optimum quantity of explosive required per blasting have been calculated.

For minimizing the dust generation due to blasting operations, following mitigative measures are proposed.

(i) For each blasting operation the borehole geometry and their depth will be designed.

This design will take into consideration various factors including volume of material to be blasted and characteristics of rock. This will facilitate to avoid overcharging of blast holes Optimal charging of blast holes avoids powdering effect of explosive and subsequently generation of dust. For this purpose characteristics of rocks have been studied.

(ii) Blasting will be done once in a day at noon time. At this time, atmospheric condition are such that dust generated are dispersed over a large area. This will facilitate minimum dust pollution in the study once.

(iii) It is proposed that blasting will be avoided during cloudy conditions. During these condition, the atmospheric conditions are such that dust generated during blasting will not get spread over a large area. This will result into higher dust pollution is study area.

C.) Coal Handling :

i.) Loading of Blasted Coal on Dumper

Arrangements will be made to sprinkle water on the blasted coal mass before it is loaded on the dumper by shovel.

II.) Coal Crushing:

Coal mined by surface miner will not need crushing. Coal mined by blasting need crushing.

It is proposed to procure feeder breaker for crushing coal filted with water jets. Coal is wetted before crushing. This arrangement will minimize dust generation due to crushing operation.

III.) Coal Transportation :

Processed coal from the Feeder breaker to the receiving point of cross country conveyor will be transported by belt conveyor. Also coal mined by surface miner will be transported by Dumper.

The processed coal from the mine will be transported to the loading point near the proposed railway siding on north side of the mine by cross country belt conveyor. This will be tubular conveyor. Provision of Tubular conveyor minimizes dust generation during transportation by belt conveyor. Tubular conveyor which takes a semi circular shape when it carries coal.

D. Dust Generation from Haul Road

Movement of dump trucks carrying overburden materials and coal are major source of dust generation in an opencast coal mine. There are two types of Haul roads in an opencast coal mine.

a.) Temporary haul roads within the mine pit. Their alignment changes as mining operation advances. They are normally Katcha i.e., unpaved. They are aligned on mine floor.

b.) Haul road that runs on surface from mine entry to workshop, external O.B. Dump site are metalled and paved.

For haul roads following mitigation measures are recommended.

(I) Temporary Haul Road within Quarry.

- It is proposed that a layer of lateritic mooram of thickness 200 mm may be spread over the temporary haul road. This will reduce generation of dust from road surface due to movement of HEMMS.

- To sprinkle water by mobile water sprinkles regularly.

  In summer season, sprinkling should be at least five time a day.

  In other seasons, when there is no rain, sprinkling should be at least thrice a day.

- Regular grading of road and repair of pot holes to avoid dust generation during haulage by Trucks.

(II) Permanent Haul Road

- Fixed high pressure jets will be installed on both sides of the haul road along its alignment. They will be operated at least five times a day during summer season and three times a day during dry season.
- Road should be continuously maintained so that no pot holes develop.

  In general it is suggested that dumper carrying coal or O.B. material are not to be over loaded. Overloading leads to falling of coal or O.B. material on road which is later crushed and becomes source of dust generation.

(E) Paved Area:

Paved area within the lease area should be sprinkled with water at regular interval.

(F) Overburden Dump :

For control of dust from overburden dumps following mitigation measures are proposed.

(i) During the formation stage, it is proposed that the dump material is regularly leveled, dozed and graded. Movement of HEMM will compact the lose material. This will facilitate reduction in generation of dust by wind.

(ii) After dumping process is over the process for bio reclamation of dump should be initiated. Grass and plants would raised on physically reclaimed area of dump. Bio reclamation would arrest wind erosion learing to minimization of air pollution.

4.10.) Water Pollution Mitigation Measures.

4.10.1)Workshop effluent and floor washing

Estimated quantity of effluent generated in workshop and floor washing is 470 KLD. Effluent are to be collected through a network of open drain and led to effluent treatment plant. Flow sheet for proposed ETP is given in **Fig 4.1.**

The quality of treated effluent will conform to standards prescribed by MOEF.

Treated effluent will be collected in clean water tank. This will be recycled for use in floor washing and vehicle washing. Cross section of oil and grease separator is given in **Fig 4.2**

With above arrangements there will be no discharge of Effluent from workshop premises.

4.10.2) Mine Water:

During operation of mine, water will be collected in mine pit due to :-

- Rainfall over the quarry area.
- Seepage of Ground Water.

For ensuring safe and uninterrupted mining operation, continuous pumping arrangements will be made to drain out mine area.

It is proposed to store the pumped mine water in a sedimentation pond having a detention time of 2 hrs (D1).

The over flow water from the sedimentation pond will be collected in a clear water pond having storage of 2 days.

The sedimentation pond and clear water pond will be so located and designed that it will facilitate ground water recharge.

Water will be drawn from clear water pond to meet the industrial water demand for the project.

Surplus water from clear water Pond will flow into natural drain. Flow sheet for handling mine water is given in **Fig 4.3**

4.10.3.) Surface Run-off from External Dump.

A foot drain (2m × 1m) will be provided at the foot of external dump to collect surface run-off from the external dump.

Water collected in foot drain will be led to sedimentation pond (D1) having a detention time of 2 hrs. Treated water will be allowed to flow into natural drain.

4.10.4) Sewage Form Service Building

It is proposed to provide a septic tank with soak pit to take case of sewage to be generated in service Buildings at mining site.

4.10.5) Storm Water management:

In lease hold area of an opencast coal mine, there are “disturbed area” i.e. quarry area, external dump, haul road etc. surface run-off generated due

to rain in the disturbed area are like to contain suspended solid. While surface run- off from undisturbed are free from suspended solids.

The storm water drainage system within the leasehold area has been planned with following objectves : -

I. A network of open drains to be provided to intercept the surface run-off from undisturbed area so that they do not flow into “disturbed area” & get polluted. On north of the quarry, a nala flows. This will arrest surface run off from north side.

II. A network of open drains to be provided to intercept the surface run-off from “disturbed area” and direct it to sedimentation pond to treat it. Treated water will be allowed to flow into natural drains. Under the proposed drainage network following drains are proposed :-

Catch Drain

Open drain around the quarry on eastern & western side to intercept the surface run-off and prevent them to enter quarry. Intercepted water will be diverted to natural drain.

Foot Drain

Open drain around the external dump to collect surface run-off from the dump and direct them to sedimentation pond. Treated water from sedimentation pond will be allowed to follow to natural drains.

4.10.6) Township Sewage Treatment & Disposal

It has been estimated that township will produced ---75 KLD municipal sewage. It is proposed to provide Extended Aeration plant to treat the township Sewage. The proposed flow sheet for treatment of municipal sewage is given in **Fig –4.4**. **fig 4.A** gives cross section of proposed ETP. It is proposed to provide extended aeration treatment Plant to treat to sewage to be generated from township. This process requires less land,

less power and more efficient for treatment of bio-degradable mass. The treated water may be collected and used for horticultural purpose. Sludge produced in the process will be disposed of as discussed at Para 4.8.2 earlier. The treated sludge ay be used as bio – fertilizer.

4.10.7 **Water balance** at industrial site is given in Fig IV.5water Balance at township is given in **fig 4.6**

It may be seen that at industrial site water demand for workshop, green belt, dust suppression (850 KLD) will be met by recycling treated water and mine water. Only water demand for portable purposes (5 KLD) will be drawn from ground water. At the township water demand for horticultural purposes (10 KLD) will be met by recycling treated water. Only portable water (5 KLD) will be drawn from ground water. At the township site 75 KLD of treated water will be used for ground water recharge. At the mine site, 1820 KLD of treated water will be used for ground water recharge.

4.11) Land Reclamation

It is proposed to reclaim.

- External over burden dump.
- Back filled quarry.

Objective of land reclamation scheme are:

- To render the degraded land pollution free.
- To use the degraded land gainfully for productive purpose.
- TO restore the disturbed ecology.

With the above objective in mind, land reclamation scheme has been developed Degraded land is proposed to be reclaimed in two phases including.

- Physical reclamation phase.
- Bio – reclamation phase.

A brief on procedure to be followed for two phase of reclamation of external dump & backfilled area are given below.

4.11.1) External Dump Reclamation.

A.I) Physical Reclamation

The external dumps formation will be completed by 3rd year. It will accommodate 59.02 Mm^3 of overburden material. It will cover an area of 123.5 ha. Its total height will be 55 m and it will have two benches, lower bench will be 25 m & upper bench 30 m.

The dump face will have an angle of slope of 350. The overall slope will be 27 °. Once the dump attains its final height after 3rd year. The top flat surface will be dozed, graded and levelled, The flat surface will have a gradient of 1:300 mm towards center from edge. A 300 mm thick top soil cover will be spread over the prepared flat surface with this physical reclamation process is over.

A.2) Bio-reclamation

With spreading of top soil layer the surface is ready for bio-reclamation it is recommended to plant saplings of selected species by pit plantation technique. A circularpit of 0.6 m dia and 1m depth will be at spacing of 2m x 2m on both sides. It will be filled with a mixture of top soil and organic fertilizer. Sapplings would be planted in the prepared pit. Plantation should be done at the on set of monsoon.

4.11.2) Back filled Area Reclamation.

The internal dump will accommodate 538.39 Mm^3 of over burden material. The total height of internal dump will be 150 m from base.

On eastern side it will flush with ground level (+450 m).The internal dump will have 5 tiers each of 30 m height. Berm width has been kept as 30 m.

B.I) Physical Reclamation

Total Area of Internal dump available for reclamation is 822 Ha. Once the back filling with OB is over, the flat surface will be dozed graded and leveled with a gradient of 1:300. A layer of 300 mm thick topsoil will be spread over the leveled surface.

B.II) Bio-Reclamation

The procedure for bio-reclamation will be the same as for external dump described earlier.

4.11.3) Plant species:

For bio-reclamation of both the external and internal dump, it is proposed to use

i) At least 10 different species of trees that are found in existing forest on north of the mine area.(Native Species)

ii) Species of shrubs and creepers in exiting forest.

Species will be selected in consultation with state forest department.

4.11.4) Post Mining Land use Plan

After the land (external dump and internal dump) is reclaimed and mine closure process is complete, the post – mining land use pattern will be as given in Table 4.4 below.

Table No.- 4.4

Post Mining Land use Pattern

Sl. No.	Description	Plantation (Ha)	Public use (Ha)	Undisturbed (Ha)	Total (Ha)
1	Mine excavation	822.00		310.27	1132.27
2	Overburden Dumps	123.51			123.51
3	Reclaimed Embankment	4.02			4.02
4	Reclaimed Infrastructure, Magazine etc	4.05	8.11	5.07	17.23

5	Roads, drains, Silo etc		2.00		2.00
6	Settling Pond		1.00		1.00
7	Colony	11.73	46.74		59.47
8	Green Belt/ Plantation	51.50			52.50
	TOTAL	1017.60	57.85	316.34	1392.00

It may be seen from above that at the end of mine closure operation a total of 1017.60 ha of land will have good plantation cover.

4.12.) Noise Pollution Control

Management of Noise level

The following control measures will be adopted to obviate/minimize the impact on noise environment.

1. The operator's cabin of equipments like dumpers, shovel, etc. would be made sound proof.
2. Planting rows of native trees along roads, around quarry area and other noise generating centers to act as acoustic barriers.
3. Proper and regular maintenance of equipments to reduce noise level intensity.
4. Covering the impact surfaces of the crushers, chutes, screens, bins, etc. of the CHP with a resilient material like rubber to prevent noise generation.
5. Manufactures of equipment will be advised to provide in-built mechanism for reducing sound emissions.
6. Wet drilling and using sharp drill bits.
7. Where noise level exposure is more, workers will be provided with earmuffs.
8. Regular health check-up of workers will be undertaken.
9. Reducing the exposure time of workers to high noise levels by arranging time bound rotation of individuals.
10. Plantations within the project premises to dampen the noise levels.

4.13) Ground Vibration Control.

Loosening of rock mass will be done by the blasting of 10 to 15 m deep and 160/250 mm diameter blast holes. Millie-second delay detonators have been envisaged to minimize the ground vibration. Use of non electric detonators will be used wherever required. Blast vibration studies will be conducted to optimize the burden & spacing and explosive requirement so as to minimize the vibration effect due to the blasting.

Blasting will be carried out in a periodical manner so as to minimize the impact on the local habitants and the faunal species.

Fly rock is another possible damage causing outcome of blasting. There are many factors, which influence including these, explosive column with little stemming column, improper burden, loose material or pebbles near holes and long water columns in the holes.

The following control measures will be planned to reduce ground vibratory conditions to sustainable statutory limits.

- Drilling and charging pattern will be ideally formulated, with less explosive charge, etc., after field trials.
- Use of suitable initiating sequence and millisecond delay detonators.
- To contain fly rocks, stemming column will not be less than burden of the hole. Blasting area will also be muffled, if necessary, to stop fly rocks propagation.

4.14) Green Belt Development Plan

It is proposed to develop green belt at various location within the lease hold area for the purposes of controlling pollution. The locations of green belts are in lease area given below.

	Location	period	Area (Ha).
I.	Around the service area (Workshop, office etc) -	1st year	5.50
II.	Around the external dump -	1st & 2nd year	10.50
III.	Around the mine -	3rd to 5th year	35.50
IV.	Lease hold Area -	2nd to 4th year	30.00
V.	Around the township -	2nd year	11.73
			93.23 Ha

The green belt would be 25 m wide and have 10 rows of trees.

Green belt would be developed using appropriate native species.

4.15) Topsoil Management

Top soil is proposed to be removed separately and dumped outside the quarry in a manner so as not to loose its fertility. The top soil would be spread over the reclaimed land, afterward.

Top soil will be stored for initial four years and during subsequent years it will be directly spread over the reclaimed area. It has been envisaged to store top soil on non coal bearing area.

Top soil details:

1. Quantity : 15025 Mcum
2. Height of Top soil Benches : 10 meters.
3. Year of Reclamation : After 4th year of mine operation.

Top soil quantities generated for 1st 4 years of mine operation are as given table 4.5.

Top Soil Production

Table 4.5

Sl. No.	Year of mine operation	Top soil (Mcum)
1	1st	0.94
2	2nd	0.96
3	3rd	1.12
4	4th	1.25

4.16) Rain Water Harvesting and Ground Water Recharge:

It is proposed to install structures to facilitate ground water recharge in the area.

4.16.1)Source of Recharge Water:-

It is proposed to use following water for recharge of ground water.

a) Treated mine water.

b) Rain water/Surface run-off from overburden dump.

c) Surface Run-off from Dirty Area i.e. disturbed area and clean area i.e. undisturbed area.

4.16.2) Technique:

It is proposed to facilitate ground water recharge by spreading technique. For this purpose three sedimentation ponds are proposed. This sedimentation ponds will facilitate spread of water with 2 hrs of detention time. This will aid ground water recharge. These ponds will be located in “recharge area”. Similarly the clear water tank will also facilitate in ground water recharge.

4.17) Mine Site Facilities

It is proposed to provide certain facilities for benefits of workmen of project. These facilities will cover following:

i) Vehicle parking lot: It is proposed to provide paved area for parking of vehicles within the leasehold area.

ii) Rest shelter: IT is proposed to provide rest shelter for workmen, rest rooms, toilets and showers will be provided in rest shelter.

iii) First Aid Center: A first aid center will be provided in infrastructure area. This will be provided to attend to first aid needs for workmen.

iv) Canteen : A Canteen will be provided within mining lease area for workmen.

4.18) Natural Resource Management

Operation of the mine will require land (1392 hector) and water (KLD) a mine closure plan, out of 1392 hector of land, 1017.50 hector of land wound be afforested and 317 hector would be undisturbed. Balance 57.85 would be left for public use. The end of mining operations land resource will be optimally used. Similarly at the operational stage mine has been so planned. That wated waste water is treated & recycled for use. Thus at operational stage of mine , minesite will require only 5 KLD of water for drinking purpose and 100 KLD of water for drinking purpose in Township.

CHAPTER - V

ALTERNATIVE ANALYSIS

5.1) Site-Alternative:

Following facts are to be considered while alternative site for a mining project is to be studied & decided.

a) Mining project is essentially a site specific project. It has to be located where the mineable reserve of mineral and quantity required is available. In this respect, there is limited flexibility in selection of alternate site.

b) In current Indian scenario, selection of coal block for mining purpose is decided by Govt. of India. Project Proponent has to make a request to ministry of coal, Govt. of India for allotment of a suitable Coal Block having reserve of a given quality of coal which can produce required quantity of coal per annum for certain duration. Govt. of India alotts the coal block considering the request of project proponent and geographical location of the user industry. Dongri-Tal block has been allotted to us under above scheme. Under the circumstances as stated above, proponent has no role in selection of a coal Block for mining of coal. It has to develop the mine in a block which has been allotted to it by the Govt.

5.2) Alternate Technology:

1) **Method of Mining:**

There are two broad methods for mining of coal

- Open cast method
- Underground method

Open cast method of mining involves removal and disposal of overburden material before mining of coal. In this method of mining, there is higher percentage of extraction of reserve, higher rate of mining and it is safer

method. However, there is land degradation in terms of quarrying and space required for disposal of overburden material.

In underground method of mining, land degradation is minimal, but percentage extraction of reserve is low & it needs higher safety measures.

The selection of appropriate method is guided by geo-mining conditions. In case of this project, geo-mining condition is such that the mining can be done by opencast method.

2) Having decided the method of mining, as open cast mining, there are different available technology for mining of coal. These technologies have been discussed in detail in Para 2.4 under heading of Project Profile. On detailed discussion following technology has been selected:-

- Use of surface miner for coal mining.
- This is eco-friendly method of coal mining.
- Use of Shovel and dumper associated with use of blasting with explosives for removal and disposal of overburden material.

CHAPTER – VI

Environmental Monitoring Plan:

6.1 Introduction:

In the previous chapters, an exercise has been carried out to assess:

- The pre-mining environmental quality in the study area.
- The likely impact of mining and allied activities on various environmental attributes including physical, social, biotic and as a result of above exercise, a set of mitigation measures have been recommended to minimize such impact. These impact have been assessed using various tool including soft ware.

  All tools, used for assessment, have certain assumptions, and limitations. Keeping this in view, it is proposed to monitor the environmental attributes at operational stage of mine for following objective.
- To ensure that level of pollution in study area during operational stage of mine remains within the prescribed limit.
- To plan additional mitigation measure, if the level of any environmental attributes exceed the prescribed level.
- Measure efficiency of the mitigation measures. with above objectives , following environmental monitoring programme is proposed.

6.2 Ambient Air Quality Monitoring:

Parameter to be monitored

- SPM (Suspended particulate matters)
- RPM (Respirable Particulation matters) PM10 & PM2.5
- SO2 (Sulpher Di- oxide)
- NOX (Oxide of Nitrogen)

Frequency:

Once in a month or as prescribed by state pollution control bord.

Monitoring Stations:

Air quality will be monitored on all stations where ambient air quality were measured for base line data generation.

6.3 Water Quality Monitoring:

Frequency:
Once in a season

Parameters:

- Surface water - As per parameters prescribed in IS 2296
- Ground water - As per parameters prescribed in IS10500
- Effluent Discharge – As per parameter prescribed by MOEF.

Monitoring Stations:

Water Quality will be monitored on those station where samples were Collected for generation of base line data .

6.4 Noise Level:

A) Parameters
Noise level will be monitored in dB (A). unit.

B) Frequency
In a season in one day, one observation in morning & second observation in evening.

C) Monitoring station

Noise level will be monitored on all those stations where it was measured for base line data generation.

A quarterly report containing above information is to be submitted to SPCB in compliance to statutory requirement.

Apart from above, the progress of following activities are also to be monitored on half yearly basis.

a) Green Belt Development
b) Installation, Commissioning of pollution control facilities/ equipment as recommended in EIA/EMP.
c) Land Reclamation.
d) Resettlement & rehabilitation
e) Disposal of hazardous waste

6.5) Effluent Monitoring:

This project has been designed on zero discharge principal .Effluent will be treated and used. But there may be occasion. when due to mechanical or electrical failure or unprecedented heavy rain there may be some effluent that is not used in project. In that case, May will be tested as per MOEF.

Prescribed parameters . before being discharge.

CHAPTER – VII
ADDITIONAL STUDIES

7.1 Introduction:

There are some other relevant and important issues with mining project that need to be addressed specifically. These issues are covered in this chapter of the report. The issues are:

- Disaster Management plan (DMP)
- Resettlement & Rehabilitation plan (RAP)
- Mine closure plan. (MCP)

7.2 Disaster Management plan:

Opencast mining project are associated with hazardous activities that may turn into a disaster. The mine has been planned & designed keeping the safety rules prescribed by director general of mines safety (DGMS) observing these rules will ensure minimization of occurrence of hazardous situation that may lead to disaster.

7.2.1) Stability of Benches, Quarry High Walls and Spoil dumps:

During quarry operations, it is necessary to adopt proposed mining parameters for the stability of benches, high-walls and spoil dumps. It is also mandatory to examine systematically the fencing of mine working, land slides and cracks between benches. It is required to maintain well graded and wide roads on benches keeping the width of working areas sufficient for spreading of blasted rock and movement of the mining and transport equipment.

During actual mining operation, systematic observations and regular monitoring of the condition of benches, high-wall slopes and spoil dumps shall be carried out and the dimensions shall be modified if necessary, to suit the local conditions. Recommended bench geometry for different HEMM have been found suitable in existing opencast mines in the country.

Following slopes have been recommended in this report considering the practices in the other mines.

Overall (Ultimate) pit slope (for 395m depth)	-	40^0
OB Bench	-	70^0
Coal Bench	-	70^0
Dump bench	-	37^0

Company would get studies of Physico- Mechanical properties of rocks done at operational stage of mine at IITs/ISM/CMRI/CMPDI or other institutes so that further stability study can be performed by expert.

7.2.2) Mine Inundation

1. A careful assessment is to be made against the danger from surface water before the onset of rainy season. The necessary precautions shall be clearly laid down and implemented. A garland drain will be provided to drain away the surface rain water from coming into the mine. Garland drain shall be provided around OB dumps and working mines to course the rain water to main streams.

2. Inspections for any accumulation of rain water, obstruction in normal drainage.

3. Standing order for withdrawal of working persons in case of apprehended danger.

4. During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places.

7.2.3) Flooding of Equipment:

During the heavy monsoon period, the mining operation in the lower-most benches may have to be stopped. Adequate pumping capacity on the basis of historical data of maximum rainfall and distribution of rainfall has been designed. But in case of unprecedented rainfall, machineries may

have to be withdrawn from lower benches temporarily and redeployed after dewatering in the lower benches again. Meanwhile they will be gainfully employed in the upper benches. For ensuring safety of the equipment while working out bottom horizons with no access to surface profile, the following measures shall be taken:

(1) Drivage of initial trenches and coal cutting on bottom benches shall be done during the dry season of the year.

(2) Ramps shall be made for quick shifting of equipment from bottom horizons, liable to be flooded during monsoon period to the top horizons.

Prevention of electric shocks:

During mining operations, all the statutory provisions of the Indian Electricity Rules 1956, and Indian Standards for installation and maintenance of electrical equipment etc. shall be observed.

7.2.4) Fire fighting and fire prevention:

In addition to statutory provisions, the measures for fire fighting and prevention of fires are as follows:

- Efforts are to be made not to loose any coal in O.B benches, and specially ledges of coal in inclined slicing system.
- Organization of special cell for systematic observation to examine and prevent fire.
- Removal of spillage of coal on benches and cleaning of coal horizons to prevent cases of coal heating
- Storage of lubricants and cotton waste in enclosed fire proof containers in working places.
- Provision of fire extinguishers and fire tenders.

- Delivery range of pump should have nozzles, strategically located, to tap water in case of emergency. Emergency organization shall be formed to deal with emergency during fire. The organization shall have names of responsible person along with their telephone numbers. Their duties shall be clearly specified and the persons shall be properly trained. Mock – rehearsals shall be held. A disaster management plan shall be prepared by the management and a CMG (Crisis Management Group) consisting of highly skilled & decision making persons shall be identified within the organization to tackle with such extreme situations.

7.3 Resettlement & Rehabilitation plan:

Details of the villages falling within Dongri Tal- II (Phase I) with no of houses has been summarized and given below:-

SL.NO	NAME OF VILLAGE	NO. OF HOUSES
1	BAZORI	15
2	DIGWAHA	63
3	DONGRI	365
4	BHAISANBUDA	57
	TOTAL	500

The acquisition of this land create various categories of project affected families (PAFs). They may be classified into following categories –

- Families those loose their land only.
- Families those loose their house (homestead land)
- Families those loose both land & house.
- Families those loose their livelihood on account of land acquisition.

Detailed ownership of private land has been found & is in process of being vetted by state revenue authorities. Once this process is complete, the list of families in different categories may be finalized.

7.3.1 Resettlement & Rehabilitation Action Plan:

This RAP will be developed for resettlement & rehabilitation of PAFs after the land records are vetted by state govt.

A.) Compensation Package:

Once the list of families belonging to different categories are finalized, compensation package for each categories will be worked out based on norms prescribed in Rehabilitation and Resettlement Policy of M.P. State Govt.

B.) Employment in Project:

Employment will be offered to eligible member of those project affected families who qualify for such employment as per norm given in approved state R&R policy.

C.) Resettlement Village:

A resettlement village will be developed for resettlement of eligible project affected families. This village is proposed to locate the village on north of proposed colony site (Ref plate VIII).

The resettlement village will have following facilities.

- Access road to village
- Internal road network
- Piped water supply arrangements
- Power supply network & road light
- Drainage system
- Sewage treatment plant
- A primary school
- A playground
- A community hall
- Primary health center
- Place of worship.

The village area will be graded, leveled & fenced.

Each family will be allotted one developed plot free of cost.

D.) Other Facilities:

In addition to providing job to eligible persons in the PAFs, the project proponent would arrange for additional measures for income generation for adult members of PAFs who do not get a job in project.

- Facilitate formation of self help groups (SHG).
- Allot shops constructed by proponents in their township to be allotted to SHG.
- Allot petty contracts during construction and operation of the mine to SHGs.
- Arrange for skill up gradation, scheme for income generation. Project proponent would facilitate setting up their business in service sectors supporting the township and mine operation.

7.4 Mine Closer Plan (MCP):

The main objective of preparing the mine closure plan is to ensure that surface profile, natural drainage system, air and water quality etc. of the region, as existed before the start of the project, are restored back as far as possible. The affect of the closure of the project should have least economic repercussions on the local people. To meet the entire cost, for such restoration of activities after the mine closure, a suitable mechanism is evolved so that the entire cost of such left over works is met through an escrow account opened, for the purpose as per the guideline issued by Ministry of Coal vide their Letter No.- 55011-01-CPM Dated- 27.08.2009.

Due to mining activities, that includes the extraction of coal by opencast mining Method, the following changes, especially with environmental issues in view, are likely to take place during the running life and after the closure of the mine.

i. The surface land profile would get disturbed due to practicing of open cast mining method and establishment of two external dumps of over burden.

ii. Undertaking of other construction activities associated with the projects, which were not there earlier.

iii. Noticeable change of quality of water as a result of coal project operations.

iv. A change in air quality due to industrial activities and pollution due to production of dust due to mining operations.

v. Occurrence and accumulation of waste materials like shale bands, coal dust at the stock yard and other toxic materials in workshops etc.

vi. Left out mining machineries, CHP etc. which may give an ugly look after the seizure of mining operations.

vii. Safety and security of the area after abandoning the coal mine.

The mine closure activities will be taken up in various stages as stated below:

a) Before the start of the project operations

b) During the operation of the project

c) At the end of O/C mining operations.

A.) Before the start of the project operations:

As soon as the project operations are taken up extensive tree plantation will be done on the mine barriers / boundaries, both side of the approach and haul roads, around coal handling plant, workshops, proposed coal dumps, settling tanks, residential areas and other places which will remain free from excavation and other associated mining activities.

B.) During the operation of the project:

During the project working there will be some adverse effect on the land use, surface features, quality of water, air and other ecological aspects. The

remedial measures to mitigate such adverse effect will be taken during the entire life of the operations of the mine.

C.) Mined out land:

The Surface area covered by ML of Dongri-Tal II (phase-1) project is about 1392 Ha and consists of only revenue land. The proposed mine will be worked by open cast mining method. The surface topography will undergo major changes that includes establishment of external dump, CHP, Coal Stack Yard and other mine infrastructures, backfilled areas, top soil stack and the final void.

D.) Air Quality Management:

Dust suppression measures will be effective. Plantation over the dump, around the area for surface infrastructure and around road area will mitigate air pollution.

E.) Water Quality Management:

The mining activity does not encounter any stream/nallas. As such accumulation of surface water is not envisaged in any quarry even during rainy season. Suitable garland drains will be made on the top bench to channelized the surface run-off during rainy season.

The following preventive measures will be adopted to maintain the water environment within statutory sustainable levels, during the project operational stages.

1. Maintaining proper gradient for drainage of water on the bench floors and construction of water drains using local material to prevent soil erosion and uncontrolled descent of water.

2. Construction of garland drains of suitable size around mine area and external dump with proper gradients to prevent rain water descent into active mine area.

3. Construction of settling ponds of adequate size to collect the mine discharge water to settle suspended solids and after necessary treatment, this can be used for dust suppression, green belt and other needs of project.

4. Construction of garland drain around coal stock yard/coal bunker.

5. Desisting of settling ponds/drains at regular intervals.

6. The high dump will be provided with inner slopes on top surface and through a system of drains and masonry chutes and channels, water will be allowed to descent into surrounding drains, so as to minimize the effects of erosion arising out of uncontrolled descent of water. The dump tops and sides of inactive areas will be progressively reclaimed with grasses and shrubs to prevent erosion.

7. Effluents from workshop, garage or wash areas will be treated through grease / oil traps and recycled for use again.

8. Suitable rain harvesting measures will be adopted for collection of rain and storm water in separate surface pond for suitable use of water in the pond for dust suppression / green belt, etc.

9. Check dams will be provided at vulnerable places to arrest erosion and sudden descent of water, as well as for recharge of ground water.

10. Separate sewage system and treatment plant for domestic and industrial sewage will be set up for proper treatment of these and for reuse in green belt, etc. The solid waste from sewerage plant will be used as manure for green belt.

11. Proper storage, transportation and handling of oil / grease to avoid spillage and consequent subsurface contamination.

    Garland drains around the quarry with settling tanks will arrest suspended solid matter. Effluents from the workshop, CHP will be collected and treated before discharge.

F.) Waste Management:

The first guiding principle of designing dump planning has been followed as minimum degradation of existing land asset due to mining operation and accordingly attempt has been taken to place minimum OB waste in external dump outside the coal block area. In the initial years, when sufficient void to the floor of the basal Local seam is not created, the OB spoil generated will be accommodated in external dump area to the southern side of the working area and then putting overburden in the void to the floor of the basal seam as internal dump after some year which has been discussed in this chapter .

The second guiding principle is slope stability of the Dump. Overall height of dump is 250 m from the deepest point of the mine floor, out of which only 30m is above quarry surface. There are two deck of external dump, out of which bottom bench is of 25 m height and top most bench is about 30 m height. Each tier of internal OB dump is of 30m height and berm width has been increased to 0m. This feature has increased overall stability of the dump at its final stage. Overall slope of dump has been planned at 27 degree and slope of each OB bench has been planed at 37 degree.

Thirdly, in pre-mining stage itself, deep garland drain around dump will be created to arrest water. A wharf wall of 2m height and 1 m wide will be erected along the periphery of the bottom tier at surface level and the slopes and the berm will be vegetated, Gullies will be provided to guide water from higher tier to lower and so on.

The overburden / Waste stripping operation will start firstly with top soil removal which will be stacked separately for reclamation purposes.

It has been proposed to start mining by driving one access trenches as shown in the 1^{st} to 5^{th} year stage plan. Internal dump will start once sufficient void space gets available from 4^{th} year of mine operation. This de-coaled area can

be used for internal dumping. Initially overburden will be placed at external dump shown in dump plan. For first three years of mine operation, OB will be accommodated in external dump only. 0.50 Mcum of OB will be placed in internal dump during 3rd year. In 4th year, majority of the OB will be dumped in internal dump and only 5.52 Mcum will be accommodated in external dump out of total 36.00 Mcum overburden. In 5th year, all 36.0 Mcum, OB can be placed in the decoaled area of quarry and there will not be any external dump. There will not be any external dump from 5th year onwards.

Total volume of overburden has been worked out as 597.41 Mcum. Out of which only 538.39 Mcum will be placed in decoaled area as internal dump and rest 59.02 Mcum will be dumped in external dump. It can be seen that external dump volume is less as compared to internal dump. Reason for more accommodation of dump internal dump are:

d) Flat gradient of coal seam

e) More strike length of the mine

f) Adequate dip-rise extent of mine

Final stage dump plan, as well as stage plans also shows the location of external/internal dumps in respective stage plan showing height as well as volume of dump.

7.4.1 Final closure activities:

(a) Infrastructure:

All structural and P&M will be removed for gainful use. Civil structures like office etc may be handed over to the State Government on closure of the mine.

(b) Disposal of Mining Machinery:

Nearly all mining machinery will be moved to other operating units. Only the scrap and non-usable machines will be auctioned.

(c) Safety and Security:

Security personnel will protect plantation and mine fencings. Annual contracts will be given for cleaning the garland drains prior to and during rainy season for first ten years after stoppage of opencast operation, so as to give sufficient time for the final dump to consolidate and vegetation to become self-sustaining.

7.4.2) Economic Repercussions Of Closer Of Mine & Manpower Retrenchment:

Skilled employees will be transferred to other units. Provision for proper employment, there shifting to other site will be made. Attempt will be taken to generate alternative job to nearby village population after giving proper training to them.

- Skill of unskilled employees will be developed, based on needs at other units and such persons may be redeployed there or they could follow self employment with help from the company.
- Suitable VRS or other compensation as per law then applicable in consultation with the District Labor Commissioner will be operative.

7.4.3 Time Schedule Of Abandonment:

Scheme will be made for proper dismantling of all surface infrastructures. All equipment including HEMM will be transferred to other site to utilize remaining life of the equipment.

A tentative time schedule for abandonment is depicted in the bar chart. It is proposed to dismantle all surface infrastructures in seven quarter. Actual execution of dismantling will be completed in seven quarter.

Abandonment Time Frame (Quarters)							
	1	2	3	4	5	6	7
Disposal of P& M							
Rehabilitation of worker							
Reclamation of quarry area							
Reclamation of dump area							
Top Soil Management							
Tailing Dump Management	Not required						
Disposal of office	Not required						

7.4.4 Abandonment Cost

As this is a PMCP, only tentative cost estimate has been done for the mine closure on approximate basis. The exact amount will depend on the price index during the actual time of mine closure.

Detailed Mine Closure Plan will be prepared 5 years prior to the actual closure of the mine.

Abandonment Cost of Opencast Mine	
Heads	**Amount in Rs lakhs**
Disposal of P & M including mobile machinery	649
Fencing all around the working area	79
Dismantling of structures/demolition and cleaning of sites	157
Landscaping	32
Biological reclamation	85
Rehabilitation of workers (to be transferred and absorbed in other projects)	152
Reclamation of Quarry	5064
Afforestation of dump area	1372
Top soil Management	660
Supervision for 3 years	94
Total	**8344**

In the Escrow Account to be opened against Mine Closure, in the first 17 years an amount of Rs 8344 Lacs computed for 1390 Ha of land for opencast mining at the rate of Rs. 6 Lacs per ha will be deposited in a designated Bank.

During last five years of mine operations, an amount equal to 8344 Lakhs will be withdrawn through Coal Controller in five equal installments towards the abandonment cost of the Opencast Mine.

Remaining amount in the Escrow account due to interest will be utilized for other reclamation programme after approval of the Final Plan by the Board of the Company.

7.4.5 Certificate:

The said closure plan complies with all statutory rules, regulations, orders made by Central and State Government, statutory organization etc. All measures proposed in this Mine will be implemented in a time bound measure as proposed.

CHAPTER – VIII

PROJECT BENEFITS

8.1) Introduction:

The opening of the mine will benefit the society at large in a number of ways that include.

- Employment opportunities in direct , secondary & tertiary sectors.
- Development of social & physical infrastructures.
- Economic prosperity of the area.

8.2) Employment opportunities:

The opening of the mine will open new opportunities in direct , secondary & tertiary sector. This will have a positive impact on socio-economic profile of the area where unemployment rate is high. The mine will offer jobs to member of project affected families people in the area.
Job opportunities will also be generated in secondary sector in the service sector that will support mining operation in the area.
In terminate sector , the sector that will support the township in term of shops, repair centers, repetable supplier, dairy, poultry etc. New economic opportunities will grow for local people. Infrastructure in the study area separate budget has been provided for this purpose.

8.3) Economic Prosperity of the area:

With grow in employment opportunities , skill development and opportunity for income generation supported by development in physical and social infrastructures, the economic prosperity in the area will get an impets.
Beside above the mine management will take up schemes for skill and entrepreneurship development of local people.

This will facilitate them for self employment two taking up income generation schemes of their own.

8.4) Social & Physical infrastructures.

Under the corporate social responsibility programme (CSR) the mine management is going to take up schemes in following areas in study area.

- Education
- Health Care
- Drinking Water
- Watershed Development
- Road

These schemes would improve the physical and social profile of study are.

CHAPTER – IX

ENVIRONMENTAL COST BENEFIT ANALYSIS

9.1 Introduction

Ministry of Environment & Forest has determined the terms of reference for environmental studies of the project. This TOR has been converged letter on J-11015/61/2010-1A II (M) dt 28.05.2010. The term of reference does not ask for environmental cost benefits analysis for the project and as per Stipulation of EIA Notification Sept. 06, in such cases there is no need for this exercise. As such this experience has not been done.

CHAPTER - X
Environment Management Plan

10.0 Introduction:

All the developmental, operational stage of the mine, several activities relating to environmental management of the project need to be managed properly.

This requires

- Proper organization.
- Exclusive Budget.

10.1 Organization:

An organization has to be created for the project to take care of following functions.

- Installation and commissioning of environmental Pollution control facilities / equipment.
- Operation & maintenance of pollution control facilities / Equipments.
- Land reclamation activities.
- Green Belt Development.
- R & R activities.
- Liaison with regulatory authorities and submission of statutory reports.

For performing above functions, an organization (Environmental Management cell) will be developed with an environmental engineer as head of cell. The cell will be reporting to the CEO. (Projects). There would be supervisors under the Head of cell to look after different function, Plant / Facility operational staff would be reporting to the supervisors.

Environment management cell will have different functional sub cells for specific function.

Sub cell I

i.) Pollution control - Operation & maintenance of pollution control plants & equipment.

Sub cell II

ii.) Horticulture - Development & maintenance of biological reclamation and green belt development.

Sub cell III

Environmental Monitoring - For environmental monitoring of project during operational stage of mine. This sub cell will also be responsible for submission of statutory reports to MOEF / SPCB.

R&R activities will be locked after by a different organization within the mine.

10.3. Budget:

For provision of pollution control facilities, procurement of equipments, Land reclamation, R & R, development of greenbelt etc. capital budget has been provided. The break-up of the capital budget is given below.

Capital Estimates		**Rs. lakhs**
	(a) R & R:	
i.	Cost of land for Rehabilitation site	10.00
ii.	Development of site	5.00
iii.	Infrastructure	
	• Internal Roads	20.00
	• Water Supply	15.00
	• Sanitation	10.00
	• Power Network	10.00

iv.	Community Buildings.	
	• Community House	5.00
	• Primary School	8.00
	• Primary Health Center	5.00
v.	Residential Houses	90.00
vi.	Reallocation Ad-hoc Grant	25.00
	(a) Sub Total	**203.00**

(b) Industrial sites:

i.	Mobile water sprinkler 2 no	75.00
ii.	Pollution control equipment for CHP	50.00
iii.	ETP for workshop	50.00
iv.	Drainage work	25.00
v.	Sedimentation Pond	25.00
vi.	Dust Suppression Measures for coal storage yard.	30.00
vii.	Green Belt	40.00
	(b) Sub Total	**295.00**

The construction of plants will be done by civil engg. Dept. of mine

Pollution control equipments will be procured by purchase Deptt.

Capital Estimates		**Rs. Lakhs**
(c)	**Township**	
i.	S T P	30.00
ii.	Green Belt	8.00
	(c) Sub Total	**38.00**

(d) Land Reclamation

i. Physical Reclamation

	(Toe wall, Foot Drain)	20.00
ii.	Bio Reclamation of Ext. Dump & Internal Dump	250.00
	(b) Sub Total	**275.00**

(e) Mine Closer Plan 8344.00 lacs

Revenue Budget :

i.	Operational expenses for equipments & Facilities	50.00
ii.	Env. Monitoring	10.00
iii.	Community Development	150.00
	Total	**210.00**

The Capital cost on environmental mitigation measure will be a part of the project cost. There will be provision for revision of capital estimates at operational stage of mine. Capital cost does not include cost of HEMMs required for land reclamation. This cost has been included in project cost under the Head “HEMM”.

CHAPTER – XI

DISCLOSURE OF CONSULTANTS

11.0 Name of Consulting Firm: Crystal Consultants
'Kshitij', Kashyap Vihar,
Opp. Ashok Nagar, Road, No. 3,
Ranchi – 834002

11.2 Name of Consultants:

1. Shishir Kumar : Ex - GM (Env.) CMPDI L
   B. Tech in Civil Engg. from BIT Mesra. Has worked as DY. G.M & GM (Env.) in CMPDIL for more them 20 years. He has been authoring & defending EIA/EMPs.
2. B.S. Upadhyay : Ex-CGM (Washery), C.I.L.
   B.Sc. Engg. (Mech), M.Sc. (Env.)
   Worked for about 30 years in the field of coal washery
3. Ravi Prakash : Ex. C.E. (Mining) C.I.L.
   Graduate Mining Engg.
   Worked as mine planner in C.I.L.
4. S.B.Singh : B.Sc. (Engg), M. Tech in Ind. Engg.
   from IIT, Delhi Worked as faculty member in the Department of Mech. Engg., NIT Patna. Having experience in preparation of Bankable project report, project analysis & evaluation, optimization and other allied activities. Also assisting in preparation and presentation of EIA/EMP.

The Consultans is Registerd with QCI as Environmental Consultants.