EIA & EMP Of Kathara OCP
(Kathara Area)
Central Coalfields Limited

Leasehold area (Ha)	Mine Capacity (MTPA)	
	Normative	Peak
792.81	0.96	1.90

(July, 2009)

Prepared at

Regional Institute – III
Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Ltd.)
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SUMMARISED DATA

1.0 **MINING PARAMETER**

i. Name of the Project	: KATHARA OCP PROJECT
ii. Coalfield	: East Bokaro Coalfields
iii. Locality	: Bermo Block, Bokaro District, Jharkhand State
iv. Company	: Central Coalfields Ltd.
v. Mineable Reserve	: Extracted Coal - 55.81 MTe.
	: Balance Reserves – 7.43 Mte.
vi OB Volume	: 33.05 M.Cum.
	: Balance 10.00 M.Cum.
x. Average grade of coal (ROM)	: W-III
xi. Main Consumer	: Kathara Washery
xii. Method of Mining	: Mechanised O/C
xiii. Manpower	: 823
xiv. Displaced persons	: Nil
xv. Initial cost	: 102.37 Crore (as per PR- June'1989)
xvi. Balance Life of the Mine	: 8 years

2.0 ENVIRONMENTAL PARAMETERS: - Environmental data generation for this project has been Done for summer season by :

i)Baseline Environmental Data Generation - M/s.PDIL,Dhanbad

ii) Socio - Economic Studies – St.Xavier's College Research Centre, Ranchi

iii) Flora – Fauna Study- M/s.PDIL,Dhanbad

(A) Micro-meteorology:

i . Predominant Wind Direction:	From North- West direction
ii . Temperature:	Ranging from 280.7^{0}K to 307.9^{0}K Avg. temp.- 295.4^{0}K
iii . Relative humidity:	39.6 to 58.9%. Avg.-48.9%
iv. Rainfall:	Maximum rainfall- 20 mm Avg.- 0.23 mm
v. Cloud cover:	Mostly clear sky.
vi. Atmospheric Pressure(Ave.)	751 mm of Hg

(B) AIR QUALITY:-

Sl. no.	Sampling station	Location code	Maximum Concentration in µg/m3							
			SPM		RPM		SO2		NOX	
			Max	Min.	Max	Min.	Max	Min.	Max	Min.
1	Core zone	SA - 1	245	101	90	38	17.1	8.4	27.4	11.9
2	Core zone	SA – 2	253	141	85	52	21.3	9.8	27.9	13.0
3	Mahalibandh Village	SA – 3	140	95	55	34	12.4	4.7	20.2	9.4
4	Ambatanr Village	SA – 4	150	103	60	37	9.3	5.3	19.6	9.7
5	Nayadih Villagea	SA – 5	143	107	57	35	12.6	6.2	19.5	10.5
6	Kathara Colony	SA - 6	150	99	58	35	10.0	4.5	16.7	8.1

- Date of sampling : Dec'2008 - March'2009

(C) WATER QUALITY

Sl.No	Sampling location	Code	pH	Turbidity NTU	TSS mg/l	TDS mg/l	Oil & Grease mg/l	D.O mg/l	BOD mg/l, 3day,27^0 mg/l
1	Mine Water Discharge – Kathara OCP	MW_1	6.8	10	10	533	3	-	< 2
2	Workshop Discharge Water – Kathara OCP	MW_2	6.9	12	30	552	6	-	< 2
3	Damodar River – 100m Upstream	SW-1	7.1	5	10	197	BDL	6.2	< 2
4	Damodar River – 100m Downstrem	SW-2	7.2	5	12	173	BDL	6.0	< 2
5	Kathara Village – Hand Pump	GW-1	7.2	< 5	6	340	NT	-	-
6	Ambatanr Village – Hand Pump	GW-2	7.3	< 5	7	350	NT	-	-

- Date of sampling : Dec'2008 - March'2009

(D) Noise Level (Leq Noise-Leverl)

Sl. No.	Location Code	Location Zone	Duration	Noise level			
				Max. L_{eq}. Noise Level dB(A)		Max .Peak Noise Level dB(A)	
				Max.	Min.	Max.	Min.
01.	SN_1	Core zone - Kathara Project Office	Day	60.1	57.8	67.4	65.8
			Night	48.5	45.9	57.1	55.6
02.	SN_2	Core zone – Kathara OCP Workshop	Day	62.3	60.1	69.2	67.8
			Night	49.5	47.5	61.5	59.8
03.	SN_3	Mahalibandh Village	Day	54.8	54.2	62.1	61.5
			Night	44.1	43.9	52.3	50.1
04.	SN_4	Ambatanr Village	Day	53.9	52.4	61.8	59.2
			Night	43.2	41.9	50.4	48.5
05.	SN_5	Nayadih Village	Day	52.6	51.7	58.2	57.4
			Night	41.2	40.5	46.9	45.3
06	SN_6	Kathara Colony	Day	54.8	53.9	61.2	59.8
			Night	44.8	42.6	49.5	47.8

(E) Soil Quality

Sl No.	Parameters	Ranges	Sl No.	Parameters	Ranges
1	Texture class	Sandy clay Loam	5	Organic Carbon %	0.56 to 0.89
2	Plastic limit (%)	9.5 to 12.8	6	Phosphorus kg/Ha	11.6 to 14.4
3	PH	7.1 to 7.8	7	Potassium kg/Ha	126.3 to 187.7
4	Elect. Conductive(m-mhos/cm at 20^0C)	0.31 to 1.22 mhos/cm	8	Nitrogen kg/Ha	125.0 to 215.0

(3) Land

Land requirement:- Total land requirement for the Kathara OCP is 792.81 Ha. Including safety zone.

Land requirment

Forest land,Ha	Non forest land,Ha	Total,Ha
-	792.81	792.81

(4) Population Composition: As per Primary Survey and Census 2001

(There is no village in core zone)

Sl. No.	Description	Buffer Zone	
		As per Census 2001 outside Core Zone(one) no. of village surveyed	As per Census 2001 All village(46 villages)
1	**Population**	20441	217164
a	Male	10767 (52.67%)	114389 (52.70 %)
b	Female	9674 (47.32%)	101045 (4730%)
2	**Schedule Caste**	2712 (13.26%)	35888 (16.52%)
3	**Schedule Tribe**	1031 (5.04 %)	22238(10.24%)
4	**Others**	16698 (81.68%)	159038(73.24%)

EXECUTIVE SUMMARY

1. The Kathara OCP is a running project, which is working in the East Bokaro Coalfield.

2. Mining in Kathara Block was started in the year 1944 by M/s. Anderson Wright and Company on behalf of M/s. Kathara Coal Company. A few inclines were started in Kargali and Bermo seam from the out-crop (Near present Quarry no.2 area) after putting some trial trenches. From 1949, M/s. Tata Iron & Steel Company worked this block, but no systematic mining was started except a few more trial pits and trenches.

   The Govt. of India acquired this colliery under the coal bearing area (acquisition and development) Act 1957 vide declaration SRO No. 3810 Dt: 23.11.1957

   The history of Kathara is very old. At various times, various Project Report had been made for different capacity.

   Finally, an intrim report was prepared in May' 1988 for capacity of 1.90 MTY and approved in July' 1988 for an additional capital of 19.85 Crores.

3.

The project is located in Bokaro District of Jharkhand. By road, the project is about 110.00 Km North-East of Ranchi, the capital city of Jharkhand. The project is connected by NH-2 road at Bagodar (30Km) away. The Ramgarh-Dhanbad road is also connected by 20 Km. metalled road. It is also connected with Bokaro Thermal Power Station on Barkakana-Gomoh Loop Line.

The nearest railway station from the project is Bokaro Thermal Power Station of SE Railway, 6.0 Km towards north-east on Gomoh-Barkakana loop line. However, the Kathara block has its own Railway Siding. (Refer plate-I)

4. Buffer zone comprising the area within a redial distance of 10 km. from quarry edge of Core zone having 46 villages including 2 villages adjoining of the core zone and covering a total area about 314Sq.Km

5. A total of drilling of 22,972.13 metre were drilled in 139 boreholes in Kathara block covering an area of 4.00 Sq.KM. with average density of 35/Sq.Km.

6. The rated capacity for Kathara OCP has been planned many times for various production at various stage in PR of CMPDI,R.I-III, Ranchi but at this stage, finally a production of 0.96 MTPA of coal is planned.

7. Mining system

Considering the technical parameters of the quarry , i.e. gentle dipping of the seam (12^0 to 25^0) balance life of the mine 8 years, thickness of the seams and partings, inclined slicing method with Shovel-Dumper combination has been proposed in this quarry. Coal & OB after considering the mining and geological conditions, Shovel - Dumper mining system has been envisaged for working in this opencast mine as the working would be with multiple seams, moderately flat gradient of 12^0 to 25^0. of the coal seams, variable

thickness of OB / partings.

8. The balance mineable reserve has been estimated as 7.43 M.Tes corresponding to a volume of OBR of 29.86 M.m^3 at an average stripping ratio of 4.02 m^3 /Te.

9. **Linkage** of this coal is to Kathara Washery for onward transportation to steel & other ancillaries i.e. TPSs, Captive Power plant , Cement Factory, Sponge Iron, Fertilizer etc. in North India.

10. **Total Initial Capital** outlay up to target year had been estimated of Rs.102.37 Crore as per PR'1989.

11. **Man-power** requirement for the project is 823 nos. up to target year.(3 shifts working of 330 days annually)

12. Land requirement: requirement for the Kathara OCP is 792.81 Ha.

Land requirement

Forest land,Ha	Non forest land,Ha	Total,Ha
-	792.81	792.81

13. **Rehabilitation** is nil. All village are acquired long ago. There is no population in the Core Zone as per Socio-Economic Report.

14. **Total water** requirement for the project is 0.66 MGPD.

Water requirement

Total water requirement0.66 MGPD(3000m3/day)	Potable water demand- 0.55 MGPD(2500m3/day)
	Industrial water demand- 0.11 MGPD(500m3/day)

15. **For pumping** and drainage of mine waters through lagoons, Sumps etc. are as under:

a) Pumps 540m3/hr, H=150m, 315 KW with 3.3 KV Elect. – nos.-9

b) Pumps 400 m3/hr ,240 KW with Elect– nos.-6

c) Pumps 300 m3/hr ,112 KW with Elect., – nos.-8

d) Pumps 200 m3/hr with Elect. – nos.-2

e) Pumps 100 m3/hr ,30 KW with Elect. – nos.-3

f) Pumps 40 m3/hr ,11 KW with Elect., – nos.-5

g) Priming pumps 50m3/hr. H=16 m, 4.5 KW with 440 v Elect.– nos.-2

h) Slurry pumps, 100 m3/hr x 45 m head x 30 KW– nos.-3

16. Power supply - Kathara Colliery has 3 nos. quarry sub- station for distribution of power to quarry equipment.

1. Sub-station no.1 – 2x1MVA 11/3.3 KV
2. Sub-station no.2 – 3x2MVA 11/3.3 KV
   - 1x5MVA 11/6.6 KV
3. Sub-station no.3 – 2x2MVA 11/3.3 KV

The elecricity are provided from DVC & M/S IFPL

17. Base line environmental data Air, water, noise and soil have been generated by PDIL, Dhanbad. Air, water and noise monitoring have been done at six locations while soil test have been done at three places. Socio-Economic Studies & Flora – Fauna study is done by St. Xavier's College Research center, Ranchi and R& C, Chennai respectively.

18. **All environmental** data of Air, water, noise and soil have been found well within the prescribed limit.

19. **Meteorological Status**: Dominated wind direction is North - West. Maximum rainfall is 20 mm during study period, humidity vary from 39.6% to 58.9%. Avg. Humidity is 48.9%. Mostly, clear sky is predominant during the study period. Temperature varies from 280.7^0K to 307.9^0K.

20. No endanger or endemic species of flora and fauna are found in Core and buffer zone.

21. Impact on air, water noise, land, flora & fauna and socio- economic environment was studied in core zone and buffer zone for mining as well as non-mining activities. Identification of impacts has been given in chapter-IV.

22. **Environmental** control measures for Air, Water, Noise and land reclamation has been discussed and suggested in chapter no.-IV of EMP.

23. Risk assessment and management are described for safety rules against mine inundation, fire, road accidents and other measures in chapter -VII. Training should be provided regarding safety measurement to the personnel who are working in mine.

24. Environmental monitoring organizations such as State Pollution Control Board, monitoring in area level, project level are being provided for the pollution such as air, water, noise etc.

CHAPTER-XII

COST ESTIMATE **Appendix-F**

ESTIMATED CAPITAL EXPENDITURE ON ENVIRONMENTAL PROTECTION MEASURES

A-CAPITAL EXPENDITURE

Name of the Project: Kathara OCP **Departmental**

I	**COST OF REHABILITATION**		
a	Total no. of families to be rehabilitated	00	
	CAPITAL ESTIMATES		**(Amount in Rs.Lakhs)**
Sl.No.	**Description**	**Amount**	**Remarks**
1	Compensation of land to be acquired for rehabilitation		
2	Cost of development of land plots including Schools, Township, Roads etc.		
3	Shifting allowance		
4	Lump sum grant		
5	Payment of lump sum grant of Rs. 50,000/- each for such family (i.e.00 nos.) who want to shift at the place of their own choice instead of the above mentioned in sl.nos.1 to 4 as per CIL rehabilitation policy	0.00	Appendix-A.8.1
6	Lump sum assistance to eligible PAPs to establish self employment through the provisions of infrastructures or formation of co-operatives @5% of rehabilitation cost	0.00	Appendix-A.8.1
	SUB-TOTAL	**0.00**	
II	**COST OF COMPENSATORY AFFORSTATION**		
a	Forest Land Required For the Project Ha.	0.00	
d	Density of forest:	0.3	
e	No. of trees at 100%density	2000	
f	Forest in safety zone	0.00	
	CAPITAL ESTIMATES		
Sl.No.	**Description**	**Amount**	**Remarks**
1	Cost of forest growth & capital NPV (for forest density 0.3) for (150.44-123.50)=26.94 Ha @ Rs.7.84 Lakh/Ha	0.00	
2	Cost of afforstation @Rs55101/-per Ha.for double the forest land of 26.94 Ha.that is 53.88 ha.@ 55101Lakh	0.00	
3	Cost of affrostation in safety zone is 1.5 times of the safety zone area that is 1.5x5.72=8.58 Ha.@ Rs.55101 .	0.00	
	Cost of enrichment of forest, fencing and maintenance of 7.5m strip of actual safety zone @ Rs.516.41 per running metre that is 7627 m.	0.00	
	SUB-TOTAL	**0.00**	Appendix-A.8.1
III	**CAPITAL FOR RESTORATION**		
	HEMM for Reclamation ---		
1	1 No. Dozer 410 HP	-	Appendix-E
2	1 No. FE Loader 5-6 Cum	-	Appendix-E

3	Spare Engines & Contigency	-	
4	Biological reclamation of over burden dump @ Rs 90,000/-per Ha for 85.76 Ha.	77.18	Appendix-A.8.1
	SUB-TOTAL	**77.18**	
IV	**CAPITAL FOR ANTI-POLLUTION MEASURES IN MINE AND INDUSTRIAL AREA**		
1	2 Nos. water sprinkler (wide spray system 28 KL)	-	Appendix-E
2	Industrial sewage treatment in workshop	-	Appendix-A.8.3
3	Water supply distribution system	-	Appendix-A.8.3
4	Dust suppression & extraction in coal handling plant & feeder breaker	-	Appendix-A.3.4
5	Nallah diversion, Sedimentation lagoon, Check/ Flood Dam, Storm Drain etc.	30.00	Appendix-A.8.1
6	Other Development measures	50.00	Appendix-A.8.1
	SUB-TOTAL	**80.00**	
V	**CAPITAL FOR ANTI-POLLUTION MEASURES IN TOWNSHIP**		
1	Colony Sewage treatment	-	Appendix-A.8.3
2	Storm water drain/ Garland drain/Lagoon etc.	25.00	Appendix-A.8.3
3	Water treatment plant & Distribution system	-	Appendix-A.8.3
4	Other Development measures.	10.00	Appendix-A.8.1
	SUB-TOTAL	**35.00**	
VI	**OTHER PROVISIONS**		
1	Base line data generation and monitoring works	15.00	Appendix-A.8.1
2	Cost for Arboriculture	10.00	Appendix-A.8.1
3	Housing for personnel for pollution control	-	Appendix-B&A.2.1
4	Rain Water Harvesting	20.00	Appendix-A.8.1
	SUB-TOTAL	**45.00**	
VII	**COMPENSATION FOR TENANCY LAND**		
	Compensation of tenancy land	**0.00**	Appendix-A.1
VIII	**FINANCIAL IMPACT**		
	CAPITAL		
1	Cost of rehabilitation	**00.00**	
2	Cost of compensatory afforestation	**00.00**	
3	Cost of restoration	**77.18**	
4	Cost of Anti-pollution measures in mine & Industrial area	**80.00**	
5	Cost of Anti-pollution measures in township	**35.00**	
6	Other provisions	**45.00**	
7	Compensation for Tenancy Land	**00.00**	
	TOTAL CAPITAL	**237.18**	

CHAPTER – I
Introduction

1.0 Identification of project & Project Proponent-

Kathara Opencast project is running project on the basis of earlier approved report in the East Bokaro Coalfields of C.C.L of Bokaro district of Jharkhand state. CCL is properitor of the mine and it is a subsidiary company of Coal India Limited. Coal India Limited Is a Public sector Undertaking of central government and functioning under the Ministry of Coal of India.

1.1 Purpose of the Project

Liberalization of economy by Govt. of India has generated wide spread interests for private and public sector investments in different industries. As such, there is an appreciable increase in the number of upcoming new industries in both private and public sectors. This has resulted in a sharp increase in the demand of coal in CCL. Running of this Kathara OCP (1.90 MTY) is therefore, necessary in a view to fulfill the above indicated growth in demand of coal.

1.2 Brief description of the project

Mining in Kathara Block was started in the year 1944 by M/s. Anderson Wright and Company on behalf of M/s. Kathara Coal Company. A few inclines were started in Kargali and Bermo seam from the out-crop (Near present Quarry no.2 area) after putting some trial trenches. From 1949, M/s. Tata Iron & Steel Company worked this block, but no systematic mining was started except a few more trial pits and trenches.

The Govt. of India acquired this colliery under the coal bearing area (acquisition and development) Act 1957 vide declaration SRO No. 3810 Dt: 23.11.1957
The history of Kathara is very old. At various times, various Project Report had been made for different capacity.

Finally, an intrim report was prepared in May' 1988 for capacity of 1.90 MTY and approved in July' 1988 for an additional capital of 19.85 Crores.

1.2.1 Size of the project

The mine has been designed to produce at the rate of 1.90 MTY on the basis of three factors as follows:

a) Demand of coal
b) Coal reserves and stripping ratio
c) Mining and technical capacity of the mine

The design of the mine is mainly based on lay & deposition of coal seams and intervening partings of the block as estimated in the Geological report and the HEMM productivity norms adopted in CIL mines.

1.2.2 Location

The Kathara Block is located on the south-western part of of the existing Bokaro Coalfield and is bounded by latitudes 23^0 45' 19".N to 23^0 46' 22" N and longitudes of 85^0 51' 16" E to 85^0 52' 32" E . The Kathara Block mentioned here consists of Kathara quarry area, part of Unhitdih Zone-1 and West of Uchitdih Zone-I and north of Kathara Quarry No.3

Damodar river is passing in its southern side .

1.2.3 Importance of Project for country

Due to liberalization and globalisation of the economy in the country, there are sudden surge in different industries & power demand. In our country, 80% of total power demand is met by thermal power station. This trend is expected to continue for at least another 50 Years. . So, to meet the power demand, it would require more thermal power stations and consequently more coal. There is already shortage of indigenous coal and it expected to shortfall to 260 Mt. in XI year plan. To meet the coal demand, it is very important to increase the coal production by opening the new mines or expanding of old project. So, opening of Kathara OCP is being sought because it is technically and economically viable.

Due to increasing its production of this coal mine, power generation would be increased by 500 to 600 MW that will be sufficient to feed one big city or 4 to 5 big steel plants or other big factories. Thus, this will be very much helpful in the development of economical condition of country. More over, this will generate employment opportunity at three places, first at mining place, second at power generation plant and third at user place. This will also increase the economical condition of these three places with the improvement in basic need of people such that communication, education and medical facilities.

Thus, we can see that opening of this mine is very important in the economical development of country.

1.3 Base line environment Scenario

For describing the base-line (present) environmental scenario following data has been used:

- ► **Air Quality**
  - Fresh one season base line data for air (Winter season, 2008 -2009)
- ► **Water Quality**
  - Fresh one season data on water quality (Winter season, 2008 -2009)
- ► **Noise level**
  - Fresh one season base line data of noise (Winter season, 2008 -2009)
- ► **Socio-Economic Profile**
  - Based on fresh survey conducted (Winter season, 2008 -2009)
- ► **Land use pattern**

- Using Remote Sensing Data (For Buffer & core zone).

► **Flora & fauna**

- Based on fresh study conducted (Winter season, 2008 - 09)

1.3.1 Source of Data

Various types of data and drawing are used for preparation of environmental management plan (EMP) for Kathara OCP. These data are collected from different department of CMPDI and other offices. Some of data have been generated through outsourcing to other agency. Following are the main sources of the data: -

(A) Base-line environmental data generation for Air, water, noise and soil study were done by Project & Development India Limited, Sindri for Winter season, 2008 - 2009

(B) Hydro-geological study was done by the Exploration Department of RI-3, CMPDI.

(C) St. Xavier's College Research Centre, Ranchi , did the study for socio-economic of the area for winter seasons, (2008 – 09).

(D) Study for flora & fauna was done by Richardson & Cruddas (1972) Ltd, Chennai, . summer 2006

(E) The land use pattern was done through remote sensing by CMPDI (HQ), Ranchi.

(F) Mining related data is based on the Kathara PR and datas provided by the field at present condition.

CHAPTER- II

Project description

2.0 Type of project

This is open cast coal mining project for the peak capacity of 1.9 MTPA & nominal rated capacity of 0.960 MTY and would excavate balance reseve of 7.43 Mt of coal from mine seams i.e. Kargali Seam during life span of the mine of 8 years with the help shovel - dumper combination

2.1 Need of the Project

Liberalisation of economy by Govt. of India has generated wide spread interests for Private and Public Sector investment in different industries. As such, there is an appreciable increase in the number of upcoming new industries in both Private and Public Sectors. This has resulted in a sharp increase in the demand of coal in CCL. Running of this Kathara OCP (1.90 MTY) is , therefore, proposed with a view to fulfill the above indicated growth in demand of coal.

2.2 Location

The Kathara Block is located on the south-western part of of the existing Bokaro Coalfield and is bounded by latitudes 23^0 45' 19".N to 23^0 46' 22" N and longitudes of 85^0 51' 16" E to 85^0 52' 32" E . The Kathara Block mentioned here consists of Kathara quarry area, part of Unhitdih Zone-1 and West of Uchitdih Zone-I and north of Kathara Quarry No.3

Damodar river is passing in its southern side.

2.3 Project Boundary

The final stage quarry plan showing boundary of the quarry has been given vide drg. No. R I -3/OCM/894-000382. Mine boundary of all the projects are as follow.-

Boundaries of Mine:

Eastern

On the East, the quarry bottom edge has been fixed along the faultF3-F3.

Southern

The quarry bottom edge has been fixed in the incrop of Kargali seam.

Western

On the West, the surface edge of the quarry has been fixed at a distance of 60 m from the outskirts of Jhirki and Gowala Toli villages.

Northern

The final stage plan has been prepared by fixing the quarry bottom at RL of 100 m on the floor of Kargali Seam.

2.4 Operational Magnitude

The mine has been planned to produce at the nominal rated capacity of 0.96 MTY. The design of the mine is mainly based on lay & deposition of coal seams and intervening partings of the block as estimated in the Geological report and the HEMM productivity norms adopted in CIL mines.

The over the next 8 years, total volume of OB to be removed is estimated as 10 M.cum.

2.5 Approval & Implementation Schedule

Implementation schedule of excavation programme for Coal & OB is shown in the table no:- 2.5.The balance total quantity of coal and OB removal are 7.43 Mt_e and 10.00 Mm^3 respectively.

Table No.-2.5

Year	Coal (Mty)	OB (Mm^3)
2008 – 09	0.96	1.28
2009 – 10	0.96	1.34
2010 – 11	0.96	1.15
2011 - 12	0.96	1.53
2012 – 13	0.96	1.37
2013 - 14	0.96	1.19
2014 -15	0.96	1.12
2015 - 16	0.71	1.02
Total	7.43	10.00

2.6 Technology & Process description

The Geological & Mining Characteristics of the Kathara OCP under consideration are favourable for opencast mine field development at optimum condition of mining operations for the entire life of proposed opencast mine. Opencast mining method involves drilling and blasting.

Considering the geo-mining characteristics of the mining block i.e.

(a) 5 Nos. of seams with varying thickness
(b) Variable gradient of the seams
(c) Short strike length
(d) Quarrying being done followed by backfilling of OB

Shovel-Dumper mining system has been envisaged in this quarry.

2.7 Project Description –

This opencast mine is already in operation extending in the dip direction upto Uchitdih 'A' entering in Kargali Seam for minning. About 55.809 M te of coal has already been extracted

from this quarry corresponding to 245.60 Mcum of overburden at a working stripping ratio of 4.02 cum/te (Average).

2.8 **Project Component**

(A) Land

The land required for the Project Kathara OCP(0.96MTY) has been estimated as 792.81 Ha. There is no forest land in this project.

Socio –Economic Report prepared in June ,summer 2006 by St. Xavier's College Research Center, Ranchi Indicates that there is no village in the core zone. The land details are given by the project as follows:-

Table No.- 2.8.1

Present Land Use

Sl.No.	Type of Land	Unit in Ha
1	Forest Land	0.00
2	Tenancy Land	112.42
3	GMK Land	56.72
4	Nationalised Land	623.67
	Total	792.81

As per remote sensing

LAND PATTERN	AREA (Ha)
WATER	26.1711
DENSE FOREST	0
OPEN FOREST	15.8193
SCRUBS	106.0692
WASTE LAND	90.2771
CROP LAND	22.0158
FALLOW LAND	26.244
MINING	120.4308
OB	178.0218
PLANTATION ON OB	17.9
RURAL SETTLEMENT	25.3692
URBAN SETTELEMENT	160.3071
SAND	0.1458
COAL DUMP	4.0095
Total	792.7807

The break-up of Land Use (in Ha) is given in the below table.

Table No.- 2.8.2

Break-up of Present Land Use Pattern (in Ha)

Sl. NO.	Description	Forest land (Ha)	Non-Forest land (Ha)	Total Land (Ha)
1	Quarry(including field-up area, Sump, Haul Road	-	123.73	123.73
2	Quarry Top Extension	-	60.47	60.47
3	OB Dump	-	85.76	85.76
4	Plantation on OB Dump	-	66.00	66.00
5	Colony	-	122.87	122.87
6	Washery	-	7.96	7.96
7	Workshop	-	4.40	4.40
8	Railway Siding	-	11.04	11.04
9	Power Plant	-	11.38	11.38
10	Project Stock Under Fire	-	3.37	3.37
11	Drains with Sump/ Ponds	-	7.37	7.37
12	Ponds	-	2.22	2.22
13	Roads	-	33.29	33.29
14	Haul Road (Outside)	-	3.00	3.00
15	Further Extension / Development/ Green Belt	-	249.95	249.95
	Total**		**792.81**	**792.81**

** Nationalised properties

(C) INFRASTRUCTURE

The mine site infrastructure includes the power distribution system, water supply, sewerage, communications, roads, workshops, stores, offices and other buildings.

(D) POWER SUPPLY

Heavy Earth moving Machines consume significant power in opencast project. Coal crushing & material handling facilities , mine dewatering , workshop, offices , colony etc. add to the total power demand of the project . it is proposed that that the opencast project will get from DVC, Bokaro Thermal Station JSEB substation .The Sub-station of capacity 3x3 MVA, 33/11KVA, which receives power at 33 KV, which transform power to 11 KV for distribution to various project of the area.

(E) WATER SUPPLY

The potable and industrial water requirement for the project has been assessed up to target as follows ;

(i) Potable / Domestic water demand - 2500 Cum/ day

(ii) Industrial water demand – 500 Cum /day

There is an existing system of water supply system.

(a) Source of Water Requirement for Township :

Water supply will be done through existing water supply system.

(b) Source of Industrial Water Demand :

Mine water / abandon mine water / ground water and surface water will be utilised. Main source of Water Supply is from Konar River.

(F) ROAD NETWORK

(a) Main Road

A PWD road is passing through the northern side of mining area from Tenughat to Jharandih. Besides this, there are existing metallic road to the adjoing villages.

(b) Colony Road

All colony are well connected with roads to various destinations .

(c) Haul Road

There are existing Haul in the project, which are well maintained.

2.9 Geology

2.9.1 General Geology

The Kathara block lies on the soutern limb of the main synclinal basin of the East Bokaro Coalfield, the axis of which runs in almost E-W direction. The southern limb of the Coalfield is not well preserved excepting in the Kathara and adjacent block where sedimentary sequence is represented by rocks of Barakar and Karharbari formations.

2.9.2 Status of Exploration

The area of the block is approximately about 4.00 Sq.Km. The total no. of 139 bore-holes has been done comparising of a total length of 22,972.13m by various agencies i.e. IBM, NCDC & CCL.

Table –2.9.2

Agency	Details of drilling	
	No of BH	Meterage (m)
IBM	115	16780
NCDC	16	2860.51
CCL	8	910.49
Total	139	22972.13

The Kathara block has average density 35 boreholes per Sq Km.

Several Grs / Reports/ Short Notes have been prepared for the Kathara block by IBM, NCDC,CMPDI and CCL in the past.

Based on all the previous work done, GR on Kathara block with special reference to qurriable potentiality of Kargali sea was made in November' 83 by CMPDI.

2.9.3 Geology of Kathra Block

The Kathara block is located in the soutern part of East Bokaro Coalfield and lies on the northern limb of main synclinal basin of the field. The block under consideration is occupied by the rocks of Igneous Intrusives, Karharbari & Barakar formations of lower Gondwana apart from soil and alluvium of the recent era.

The Metamorphics are exposed along the western part of the block.

2.9.4 Geological Sequence of coal Seam in Tapin Block.

The sequence of the coal seams with intervening partings in the Kathara block is given under.

Formation	Stage	Sequence of coal seams	Vertical thickness (in m)	No.of boreholes encountered	Remarks
1	2	3	4	5	6
	Jarangdih stage	Jarangdih	2.89	1	
		Parting	11.02		
		Jarangdih new	1.78	1	In two splits
		Parting	22.17		
		Jarangdih 6’	2.11 – 3.02	2	
		Parting	15.18 – 17.18		
		Jarangdih	0.99	2	
		Parting	44.46 – 44.69		
Barakar Formation	Kathara Stage	Swang ‘A’	0.20 - 0.89	3	
		Parting	18.08 – 21.53		
		Swang ‘B’	0.30 – 1.01	6	
		Parting	38.45 – 51.99		
		Swang ‘C’	0.50 – 2.59	19	
		Parting	27.30 – 53.48		
		Upper Kathara	0.11 – 3.85	21	
Barakar Formation	Kathara Stage	Parting	34.49 – 76.44		
		Kathara	1.22 – 6.18	63	
		Parting	14.75 – 38.71		
		Uchitdih	0.74 – 3.10	61	
		Parting	4.34 – 28.88		
		Uchitdih ‘A’	0.24 – 2.44	46	
		Parting	31.57 – 38.94		
		Kargali (Full Seam)	24.25 – 50.59	30	
		Parting			
		Kargali Top	8.42 – 29.54	50	
		Parting	1.15 – 38.14		
		Kargali Bottom	6.38 – 27.76	53	
		Parting	20.89 -26.37	42	

Only Kathara & Kargali seams are workable. 55.81 MT of coal is extracted since inception. Kathara seam is exhausted in the lease area. The balance reserve of coal is left on in only Kargali seam.

2.9.5 COAL QUALITY

The grade of coal is W – III.

2.9.5 COAL RESERVES

This is a running project. Till March'08, 55.81 MT coal was extracted from the mine & remaing 7.43 MT is to be extracted from the mine.

2.9.7 OVERBURDEN

A total of leftout of 10.00 million Cum of overburden is estimated in the Project.

2.9.8 STRIPPING RATIO

a) Total Balance Mineable Reserves	:	7.43 MT
b) Total Balance Volume of OBR	:	10.00
c) Stripping Ratio (Average)	:	1.34 Cum/t

2.10 Major Affected Parameter of Environment

Worst affected assignment parameters due to coal mining activities are Air, water and land.

Air- One of the worst affected environmental attributes in mining project is air, which gets polluted due to blasting, excavating, transporting, loading & unloading of coal and OB. This activitivities of mining create the pollution by increasing the SPM level in the environment. This is low fugitive in nature and settled quickly and more over this is not harmful gas.

Water- Water gets polluted from the effluent of mine water, workshop, Township etc. Now these days mine plan is being prepared in such a way that there is zero effluent discharge in dry days. In rainy days, effluent is allowed to discharge only after proper treatments. More over these pollutants are only physical in nature. The form of TSS, which are easily filterable, are not much harmful to human or aquatic life.

The impact on ground water based on field observations made ranges from 150 to 200m from the mine cut. Due to poor hydraulic conductivity and specific yield of aquifer formation around this quarry, the influence on ground water is steep and extends to about 150 to 250 m from the mine cut. Beyond the distance of about 250m there is no impact of mining on ground water.

Land- Land is the worst affected parameter in the mining projects. Mining activities completely changes the topographic and characteristics of the land. It will create void at one side and form huge OB, like mountain on other side. This gives the bad appearance as well as air pollution due to wind erosion.

Over Burden dumps (external or Internal) needs the continuous parallel process (progressive) of reclamation with mining works till the closer of mines. After closer of mine, it

needs reclamation of whole area to improve the over all aesthetics view in such away that area become the source of income for the local inhabitant.

2.11 Environmental Pollution Mitigation Measures

Development activities are of prime importance for the economic growth and fulfillment of basic needs of the society and take a nation forward but at the same time, give rise to many environmental problems. The exploitation of mineral resources through surface or underground mining is invariably associated with a number of wide ranging environmental problems, which results in an impact on the surrounding environmental components. Therefore, while implementing the developmental project environmental aspects of the project must be taken into account and due attention must be paid to protect the environment. Baseline status of the environment is the basic step in this direction. This helps in assessing the existing environmental conditions of the study area and identifying the critical environmental attributes, which would be monitored after implementation of the project.

Mitigation measures are broadly divided into two categories namely preventive measures and suppressing measures. Stress has been given on adoption of preventive measure, which is more effective and economical. In this EMP various type of preventive as well as suppressing measures has been advised for different type of source of pollution for all environmental attributes such that Air, Water, Noise & Vibration, Land. These mitigation measures have been discussed broadly in the respective chapters.

CHAPTER - III

PRESENT ENVIRONMENTAL SCENARIO

3.0 INTRODUCTION

The Kathara Block is located on the south-western part of of the existing Bokaro Coalfield and is bounded by latitudes 23^0 45' 19".N to 23^0 46' 22" N and longitudes of 85^0 51' 16" E to 85^0 52' 32" E . The Kathara Block mentioned here consists of Kathara quarry area, part of Unhitdih Zone-1 and West of Uchitdih Zone-I and north of Kathara Quarry No.3

Damodar river is passing in its southern side .

This is open cast coal mining project for the nominal rated capacity of 0.960 MTY and would excavate balance reseve of 7.43 Mt of coal from mine seams i.e. Kargali Seam during life span of the mine of 8 years with the help shovel - dumper combination

To describe the present environmental scenario or base line environmental data, one full season data of Winter season (December'08 - March'2009) have been generated, collected and analysed and summarized.

Base line data for following environmental attributes have been generated.

- ✓ Micrometeorological Data
- ✓ Air Quality
- ✓ Water Quality
- ✓ Noise Quality
- ✓ Soil Quality

3.1 MICROMEOTEROLOGY

Micro-Meteorological Parameters are important factors in the study of air pollution. The transport and diffusion of the pollution in the atmosphere are governed by metrological factors. Factors wind velocity, wind direction and atmospheric stability 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.

3.1.1 Parameter Monitored

Following Micrometeorological parameters have been monitored :-

- Wind Speed
- Temperature
- Relative humidity
- Rainfall
- Cloud Cover

3.1.2 Monitoring Schedule & Frequency

Micrometeorological and microclimatic parameters are recorded by installing a meteorology station in core zone 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 are recorded and reported.

3.1.3 Methodology

As a part of this study, micrometeorology and microclimatic parameters are recorded by installing a meteorological station. Data of wind velocity, wind direction, ambient temperature, relative humidity, cloud cover and atmospheric pressure are recorded at hourly intervals along with rainfall data for 24 hrs. for the study area.

A mechanical wind recorder (Woelfler type, M/s. Wilh Lambrecht, W. Germany) was used to record wind speed and direction continuously during the sampling period. The wind run and direction are recorded on a wax-coated chart roll. Hourly average wind direction and speed were computed from the recorded chart rolls and tabulated. From these, the average wind speed and the dominant wind directions for the individual sampling periods were computed. Ambient temperature is noted by wet and dry bulb thermometer. Relative humidity is measured from hygrometer. An aneroid barometer is used for measuring atmospheric pressure and a self-recording rain gauge is used for rainfall data collection. Cloud cover data is collected by visual inspection.

3.1.4 Results

Summarised Micro-Meterological data is tabulated in the following table

TABLE -3.1.4 (Sheet - 1)

ABSTRACT OF MICROMETEOROLOGICAL DATA

Project: KATHARA OCP **Season:** Winter (2008-2009) **Month:** December 2008

Date	Wind Velocity (m/s)							Predominant Wind Direction (From)	Temperature (°K)			Relative Humidity (%) Average	Rainfall (mm)	Cloud Cover (Oktas)	
	Min.	Max.	Avg.	% Duration					Min.	Max.	Avg.			Lowest	Highest
				< 0.5	0.6-1.5	1.6-2.5	> 2.6								
26.12.08	< 0.5	1.7	0.96	29.28	62.40	8.32	-	NW	280.7	298.8	289.7	55.6	0	0	0
27.12.08	< 0.5	1.8	0.97	29.28	62.40	8.32	-	W	281.5	299.1	290.1	58.9	0	0	0
28.12.08	< 0.5	2.0	1.11	25.12	62.40	12.48	-	WNW	282.6	299.3	290.7	57.9	0	0	0
29.12.08	< 0.5	1.9	1.24	37.60	41.60	20.80	-	W	281.8	299.6	289.6	58.3	0	0	0
30.12.08	< 0.5	2.0	1.17	25.12	54.08	20.80	-	SW	281.7	299.3	289.7	58.3	0	0	0
31.12.08	< 0.5	1.7	1.29	33.44	37.44	29.12	-	N	282.3	299.5	290.2	58.5	0	0	0

3.1.5 Seasonal Wind distribution

Seasonal wind distribution of Kathara OCP at Core Zone in Winter season (Jan – Feb 2009) is given in table below :

TABLE – 3.1.6 (Sheet - 2)

ABSTRACT OF MICROMETEOROLOGICAL DATA

Project: KATHARA OCP **Season:** Winter (2008-2009) **Month:** January 2009

Date	Wind Velocity (m/s)							Predominant Wind Direction (From)	Temperature (°K)			Relative Humidity (%) Average	Rainfall (mm)	Cloud Cover (Oktas)	
	Min.	Max.	Avg.	% Duration					Min.	Max.	Avg.			Lowest	Highest
				< 0.5	0.6-1.5	1.6-2.5	> 2.6								
01.01.09	< 0.5	1.7	0.98	33.44	62.40	4.16	-	W	282.7	299.8	291.3	57.6	0	0	0
02.01.09	< 0.5	1.8	1.07	33.44	58.24	8.32	-	ESE	283.6	299.8	291.6	56.6	0	0	0
03.01.09	< 0.5	2.0	1.15	29.28	49.92	20.80	-	NW	282.8	299.5	291.3	58.6	0	0	0
04.01.09	< 0.5	1.9	1.18	33.44	45.76	20.80	-	E	283.6	299.5	291.9	54.9	0	0	0
05.01.09	< 0.5	1.6	0.87	25.12	70.72	4.16	-	WSW	284.5	300.0	292.4	54.7	0	1	2
06.01.09	< 0.5	1.8	1.09	29.28	54.08	16.64	-	W	284.4	300.3	292.4	55.0	0	0	0
07.01.09	< 0.5	1.9	1.00	25.12	62.40	12.48	-	SW	283.9	301.1	292.0	54.7	0	0	0
08.01.09	< 0.5	2.1	1.14	33.44	45.76	20.8	-	N	284.1	300.2	292.3	56.6	0	1	2
09.01.09	< 0.5	1.9	1.05	29.28	58.24	12.48	-	ENE	283.5	300.3	292.3	56.1	0	0	0
10.01.09	< 0.5	1.9	1.03	25.12	58.24	16.64	-	W	283.5	300.6	291.7	56.6	0	0	0
11.01.09	< 0.5	2.7	1.27	20.96	58.24	20.8	-	NW	283.7	300.8	291.9	52.5	0	1	2
12.01.09	< 0.5	2.0	1.05	16.80	62.40	20.8	-	NNE	284.0	300.1	292.1	54.4	0	0	0
13.01.09	< 0.5	2.2	1.12	29.28	49.92	20.8	-	NE	282.7	300.9	292.2	55.0	0	0	0
14.01.09	< 0.5	2.5	1.08	29.28	54.08	16.64	-	W	283.6	300.8	292.5	55.0	0	1	2
15.01.09	< 0.5	2.4	1.21	29.28	49.92	20.8	-	NNW	285.0	301.2	293.3	52.1	0	0	0
16.01.09	< 0.5	2.5	1.41	29.28	33.28	37.44	-	NW	285.5	300.3	293.3	52.5	0	0	0
17.01.09	< 0.5	2.3	1.39	29.28	37.44	33.28	-	WNW	285.1	301.2	293.5	51.0	0	0	0
18.01.09	< 0.5	1.8	1.12	33.44	45.76	20.8	-	N	284.6	300.9	293.1	53.0	0	1	2
19.01.09	< 0.5	2.5	1.31	25.12	41.60	33.28	-	NW	285.8	301.3	293.6	50.7	0	0	0
20.01.09	< 0.5	2.5	1.36	29.28	37.44	33.28	-	W	286.2	302.7	294.0	51.8	0	0	0
21.01.09	< 0.5	2.5	1.58	29.28	29.12	41.60	-	SW	286.0	301.3	293.8	51.3	0	0	0
22.01.09	< 0.5	2.4	1.29	25.12	45.76	29.12	-	SE	286.1	301.2	293.7	53.8	0	0	0
23.01.09	< 0.5	2.4	1.46	25.12	33.28	41.60	-	NW	285.6	300.9	293.4	53.3	0	0	0
24.01.09	< 0.5	1.7	1.03	29.28	62.40	8.32	-	N	285.8	301.9	293.5	52.1	0	1	2
25.01.09	< 0.5	2.0	1.15	37.6	41.60	20.8	-	SW	286.9	301.2	294.0	50.5	0	0	0
26.01.09	< 0.5	2.4	1.33	33.44	37.44	29.12	-	W	287.0	301.2	294.0	50.5	0	0	0
27.01.09	< 0.5	2.4	1.50	25.12	33.28	41.60	-	SW	287.5	300.9	294.1	48.6	0	0	0
28.01.09	< 0.5	2.4	1.42	29.28	37.44	33.28	-	SSW	287.8	302.8	294.8	50.4	0	0	0
29.01.09	< 0.5	2.1	1.10	33.44	49.92	16.64	-	S	287.8	302.8	294.8	50.2	0	1	2
30.01.09	< 0.5	2.4	1.17	16.80	58.24	20.80	-	NW	288.0	303.8	295.6	50.4	0	1	2
31.01.09	< 0.5	2.5	1.45	29.28	37.44	33.28	-	W	288.1	302.9	294.9	50.8	0	1	2

TABLE –3.1.7 (Sheet - 3)

ABSTRACT OF MICROMETEOROLOGICAL DATA

Project: KATHARA OCP **Season:** Winter (2008-2009) **Month:** February 2009

Date	Wind Velocity (m/s)							Predominant Wind Direction (From)	Temperature (°K)			Relative Humidity (%) Average	Rainfall (mm)	Cloud Cover (Oktas)	
	Min.	Max.	Avg.	% Duration					Min.	Max.	Avg.			Lowest	Highest
				< 0.5	0.6-1.5	1.6-2.5	> 2.6								
01.02.09	< 0.5	2.4	1.27	25.12	45.76	29.12	-	SW	288.0	303.3	295.2	48.7	0	0	0
02.02.09	< 0.5	2.1	1.28	29.28	37.44	33.28	-	N	288.1	303.4	295.3	47.7	0	0	0
03.02.09	< 0.5	2.0	1.14	29.28	45.76	24.96	-	NW	288.3	303.4	295.3	48.5	0	1	2
04.02.09	< 0.5	2.5	1.40	37.60	29.12	33.28	-	WSW	287.2	303.7	294.7	50.7	0	0	0
05.02.09	< 0.5	2.7	1.30	12.64	49.92	37.44	-	W	287.6	302.5	295.5	50.7	0	0	0
06.02.09	< 0.5	2.4	1.25	25.12	45.76	29.12	-	SW	287.4	303.9	295.4	49.0	0	0	0
07.02.09	< 0.5	2.4	1.31	29.28	41.60	29.12	-	NW	287.2	303.9	295.8	48.7	0	0	0
08.02.09	< 0.5	1.6	0.92	25.12	66.56	8.32	-	NNE	287.3	303.7	295.6	48.8	0	0	0
09.02.09	< 0.5	2.1	1.09	29.28	49.92	20.8	-	W	287.9	303.6	295.5	47.3	0	0	0
10.02.09	< 0.5	2.5	1.46	29.28	37.44	33.28	-	ENE	287.6	303.9	295.9	49.8	0	1	2
11.02.09	< 0.5	2.3	1.29	25.12	45.76	29.12	-	NW	286.5	303.6	294.4	50.2	0	0	0
12.02.09	< 0.5	2.4	1.32	25.12	41.60	33.28	-	S	287.2	303.3	294.9	48.2	0	0	0
13.02.09	< 0.5	2.4	1.22	37.60	33.28	29.12	-	SSW	287.3	304.3	295.4	50.2	0	0	0
14.02.09	< 0.5	2.5	1.44	25.12	37.44	37.44	-	SW	288.0	303.5	295.0	49.3	0	1	2
15.02.09	< 0.5	2.5	1.25	20.96	49.92	29.12	-	WNW	288.7	303.7	295.6	49.4	0	0	0
16.02.09	< 0.5	2.4	1.32	29.28	41.60	29.12	-	NW	289.0	303.8	295.7	48.3	0	0	0
17.02.09	< 0.5	2.1	1.29	33.44	33.28	33.28	-	SE	289.1	303.6	295.9	48.3	0	0	0
18.02.09	< 0.5	2.4	1.23	29.28	45.76	24.96	-	N	289.2	304.8	296.7	45.2	0	0	0
19.02.09	< 0.5	2.5	1.38	20.96	41.60	37.44	-	NE	289.1	304.9	296.8	49.3	0	0	0
20.02.09	< 0.5	2.4	1.31	16.80	45.76	37.44	-	NW	289.3	305.3	297.6	48.4	0	0	0
21.02.09	< 0.5	2.5	1.61	29.28	29.12	41.60	-	W	289.1	304.9	297.5	49.3	0	1	2
22.02.09	< 0.5	2.5	1.44	20.96	37.44	41.60	-	SSE	289.3	305.3	297.8	49.1	0	0	0
23.02.09	< 0.5	2.3	1.24	25.12	45.76	29.12	-	E	289.7	305.7	298.2	48.1	0	0	0
24.02.09	< 0.5	2.1	1.22	29.28	41.60	29.12	-	NW	287.9	305.9	296.9	49.7	0	0	0
25.02.09	< 0.5	2.1	1.31	33.44	37.44	29.12	-	NNW	288.0	304.3	296.4	49.5	0	0	0
26.02.09	< 0.5	2.6	1.59	25.12	29.12	45.76	-	WNW	288.6	304.6	296.7	48.6	0	1	2
27.02.09	< 0.5	2.5	1.26	33.44	49.92	16.64	-	W	288.4	305.1	296.4	49.0	0	0	0
28.02.09	< 0.5	1.9	1.26	25.12	45.76	29.12	-	NW	288.8	304.9	297.0	47.0	0	0	0

TABLE –3.1.8 (Sheet - 4)

ABSTRACT OF MICROMETEOROLOGICAL DATA

Project: KATHARA OCP **Season:** Winter (2008-2009) **Month:** March 2009

Date	Wind Velocity (m/s)							Predominant Wind Direction (From)	Temperature (°K)			Relative Humidity (%) Average	Rainfall (mm)	Cloud Cover (Oktas)	
	Min.	Max.	Avg.	% Duration					Min.	Max.	Avg.			Lowest	Highest
				< 0.5	0.6-1.5	1.6-2.5	> 2.6								
01.03.09	< 0.5	2.5	1.30	33.44	37.44	29.12	-	NW	290.1	305.5	297.9	44.6	0	0	0
02.03.09	< 0.5	3.1	1.40	20.96	45.76	29.12	4.16	W	290.3	305.5	298.0	44.6	0	1	2
03.03.09	< 0.5	3.5	1.81	25.12	33.28	33.28	8.32	ESE	290.4	305.6	298.1	43.5	0	0	0
04.03.09	< 0.5	3.2	1.59	29.28	29.12	37.44	4.16	NW	290.4	305.8	298.2	43.1	0	1	2
05.03.09	< 0.5	2.0	1.26	29.28	41.60	29.12	-	SE	290.6	305.6	298.3	43.1	0	0	0
06.03.09	< 0.5	3.1	1.51	25.12	41.60	29.12	4.16	N	291.3	305.5	298.7	42.0	0	0	0
07.03.09	< 0.5	3.6	1.64	33.44	33.28	24.96	8.32	NW	291.3	305.7	298.7	42.0	0	1	2
08.03.09	< 0.5	3.1	1.69	16.80	29.12	49.92	4.16	W	290.8	306.0	298.2	41.0	0	0	0
09.03.09	< 0.5	2.4	1.36	29.28	33.28	37.44	-	NE	291.5	306.4	298.8	42.0	0	1	2
10.03.09	< 0.5	3.4	1.89	33.44	24.96	33.28	8.32	E	291.4	305.7	298.6	41.5	20	1	4
11.03.09	< 0.5	3.1	1.54	29.28	33.28	33.28	4.16	NW	291.8	306.0	299.1	40.6	0	1	2
12.03.09	< 0.5	2.5	1.39	33.44	33.28	33.28	-	SSW	291.5	305.7	298.8	41.6	0	0	0
13.03.09	< 0.5	3.1	1.76	25.12	24.96	45.76	4.16	SW	292.4	306.1	299.4	40.6	0	0	0
14.03.09	< 0.5	3.1	1.75	29.28	24.96	41.60	4.16	W	292.0	306.0	299.0	40.6	0	0	0
15.03.09	< 0.5	2.5	1.51	25.12	37.44	37.44	-	SW	292.0	306.2	299.2	40.7	0	0	0
16.03.09	< 0.5	3.1	1.48	12.64	45.76	37.44	4.16	NW	291.9	306.0	298.9	40.6	0	1	2
17.03.09	< 0.5	2.5	1.58	20.96	33.28	45.76	-	WNW	292.1	306.3	298.8	42.2	0	0	0
18.03.09	< 0.5	3.1	1.54	25.12	37.44	33.28	4.16	WSW	292.2	306.0	298.8	42.5	0	0	0
19.03.09	< 0.5	2.5	1.23	33.44	41.60	24.96	-	NW	292.3	307.1	299.4	40.7	0	0	0
20.03.09	< 0.5	2.4	1.31	37.60	37.44	24.96	-	NNW	292.3	307.3	299.4	40.7	0	0	0
21.03.09	< 0.5	3.3	1.62	25.12	33.28	37.44	4.16	S	292.5	307.2	299.5	41.1	0	0	0
22.03.09	< 0.5	2.5	1.36	29.28	41.60	29.12	-	NW	292.4	307.3	299.6	40.7	0	1	2
23.03.09	< 0.5	2.4	1.42	29.28	33.28	37.44	-	SSE	293.0	307.7	299.9	39.6	0	0	0
24.03.09	< 0.5	2.2	1.24	29.28	45.76	24.96	-	NW	299.2	307.9	300.1	41.5	0	0	0
25.03.09	< 0.5	2.1	1.48	33.44	24.96	41.60	-	SW	292.6	307.4	300.6	39.6	0	0	0

3.2 Present Air Quality Scenario

The objectives of this programme was to monitor present level of air pollution in the core & buffer zone at identified monitoring stations, as a base line environmental data to be compared in future and for taking suitable mitigation measure.

3.2.1 Parameters Monitored

Following air quality parameters have been monitored

- Resparable Particulate Matters (RPM)
- Suspended Particulate Matters (SPM)
- Nitrogen Oxide (NOx)
- Sulpher-di-oxide (SO_2)

3.2.2 Ambient Air Quality Monitoring Stations

Ambient air quality monitoring stations have been selected considering following factors

- Prevailing wind direction. The wind rose diagram is attached.
- Location of mining activities
- Location of recipients
- Topography
- Distance from mining area.

Following six stations were selected based on above considerations and tabulated below:-

Following table show the station and location of monitoring stations for air quality are given in Table 3.2.2

Table 3.2.2

AMBIENT AIR QUALITY STATIONS

(LOCATIONS & BEARINGS)

Details of Sampling Locations

Project Site: Kathara O/C **Period:** Winter (Dec 2008-March 2009)

Location Code	Location Name	Direction & distance w.r.t Project Site	Height of Sampling Point (m)	Description
SA_1	Kathara Project Office (Core Zone)	-	3.0	Industrial area
SA_2	Kathara OCP Workshop (Core Zone)	-	3.0	Industrial area
SA_3	Mahalibandh Village	NW,1.0 km	3.0	Residential area
SA_4	Ambatanr Village	S, 1.5 km	3.0	Residential area
SA_5	Nayadih Village	SE, 2.5 km	3.0	Residential area
SA_6	Kathara Colony	NE,1.7 km	3.0	Residential area

3.2.3 Monitoring Schedule & Frequency

All parameters were monitored on 24 hr. basis for continuously two day in each week at all location for one complete season (Winter 24 days). Parameters were monitored for four weeks continuously two day in each week.

3.2.4 Methodology

The techniques used for measurement of pollutants may be summarized as under:

TABLE – 3.2.4

Measurement Techniques

S.No	Parameters	Code of Practice	Sampler	Instruments used for Analysis
1.	SPM	IS: 5182 (Part-IV)	RDS Sampler with Cyclone Separator	Balance, Desiccator
2.	RPM	IS: 5182 (Part-IV)	RDS Sampler with Cyclone Separator	Balance, Desiccator
3.	SO_2	IS: 5182 (Part-V)	RDS Sampler	Spectrophotometer
4.	NO_x	IS: 5182 (Part-V)	RDS Sampler	Spectrophotometer

Calibration chart have been prepared for all gaseous pollutants. The calibration is carried out whenever new absorbing solutions are prepared.

The techniques used for ambient air quality monitoring and their minimum detectable level.

3.2.5 Results

The detailed ambient air quality data, as a base line data have been tabulated in the **table no. 3.2.5.**

Summarised air quality data have been given in the following table:--

Table –3.2.5

AIR QUALITY

Sl.no.	Sampling station	Location code	Maximum Concentration in µg/m3							
			SPM		RPM		SO2		NOX	
			Max	Min.	Max	Min.	Max	Min.	Max	Min.
1	Core zone	SA - 1	245	101	90	38	17.1	8.4	27.4	11.9
2	Core zone	SA – 2	253	141	85	52	21.3	9.8	27.9	13.0
3	Mahalibandh Village	SA – 3	140	95	55	34	12.4	4.7	20.2	9.4
4	Ambatanr Village	SA – 4	150	103	60	37	9.3	5.3	19.6	9.7
5	Nayadih Villagea	SA – 5	143	107	57	35	12.6	6.2	19.5	10.5
6	Kathara Colony	SA - 6	150	99	58	35	10.0	4.5	16.7	8.1

- Date of sampling : Dec'2008 - March'2009

3.2.6 Representation of Air Quality Data

i) Statically Representation of ambient Air Quality Data for SPM, RPM, SO_X, and NO_X with percentile value have been given in **table no. 3.2.6(a)**

ii) Detailed Representation of Air Quality data for SPM, RPM, SO_X, and NO_X are given in **table no. 3.2.6 (b) to 3.2.2(g).**

Table – 3.2.6(a)

AMBIENT AIR QULITY STATUS

Period : Winter (Dec2008 - March2009) **Unit:µg/m^3**

Sl. No.	Pollutant	Location Code	Min.	Percentile value											Max.	Arithmetic Mean	Geometric Mean	Standard Deviation	CPCB Limit	% Exceeding CPCB Limits
				10	20	30	40	50	60	70	80	90	95	98						
01.	SPM	SA - 1	139.0	167.4	181.8	184.9	197.4	214.5	218.8	227.4	239.2	253.8	261.4	273.3	283	209.3	206.3	36.1	500	0
		SA - 2	170.0	175.3	184.2	196.3	207.2	212.0	220.2	225.5	234.2	243.7	254.2	261.9	267.0	211.8	210.1	27.6	500	0
		SA - 3	101.0	108.6	112.0	114.9	118.0	124.0	128.8	132.2	138.8	143.0	143.9	148.3	152.0	124.6	123.8	14.0	200	0
		SA - 4	82.0	89.2	92.6	94.0	99.4	103.0	106.6	108.1	109.4	114.5	116.9	138.1	156.0	103.4	102.6	14.5	200	0
		SA - 5	92.0	106.3	109.8	123.4	126.6	130.0	134.2	136.1	137.4	143.8	150.1	155.3	159.0	127.3	126.2	16.3	200	0
		SA - 6	99.0	105.3	111.2	115.0	120.0	120.5	125.8	129.3	133.4	140.4	144.4	148.2	151.0	122.7	121.9	13.9	200	0
02.	RPM	SA - 1	50.0	60.0	62.6	69.6	72.6	79	80	82	84.6	91.1	93.7	96.7	99	75.5	74.5	12.6	150	0
		SA - 2	60.0	63.8	69.6	70.9	72.0	75.0	78.6	81.0	81.4	88.5	90.0	90.0	90.0	75.6	75.1	8.6	150	0
		SA - 3	36.0	40.6	46.2	47.9	49.0	50.5	52.0	55.0	56.8	58.7	59.9	61.1	62.0	50.6	50.2	6.8	100	0
		SA - 4	33.0	34.0	35.2	37.0	37.2	38.0	39.8	40.1	42.2	45.7	48.6	49.5	50.0	39.3	39.0	4.7	100	0
		SA - 5	33.0	39.0	42.0	42.9	46.2	48.5	51.4	53.1	56.8	59.7	62.6	65.2	67.0	49.0	48.3	8.7	100	0
		SA - 6	34.0	40.0	41.0	41.9	44.0	47.5	49.0	49.3	52.8	55.4	57.7	58.5	59.0	46.8	46.3	6.8	100	0
03.	SO_2	SA - 1	7.7	8.53	8.9	9.49	9.82	9.95	10.28	11.21	11.96	12.74	14.2	15.6	16.4	10.6	10.4	2.1	120	0
		SA - 2	7.1	9.3	10.1	10.5	11.2	12.1	12.9	13.3	14.1	16.3	17.3	18.7	19.8	12.3	12.0	2.9	120	0
		SA - 3	6.3	6.6	7.4	8.4	8.6	9.4	9.6	10.3	10.3	11.4	11.4	11.9	12.3	9.1	8.9	1.7	80	0
		SA - 4	6.3	7.0	7.9	8.3	8.9	9.3	9.8	10.4	11.3	12.0	12.4	12.4	12.4	9.4	9.2	1.8	80	0
		SA - 5	5.8	5.9	6.1	6.3	6.4	6.8	6.9	7.1	7.3	8.0	8.3	8.4	8.4	6.8	6.7	0.8	80	0
		SA - 6	6.1	6.2	6.4	6.9	7.4	7.6	8.1	8.1	8.3	9.0	9.3	9.4	9.4	7.6	7.5	1.0	80	0
04.	NO_X	SA - 1	11.5	12.73	15.18	15.4	16.8	16.95	18.5	19.84	21.48	23.62	24.2	25.7	27	18.0	17.5	4.1	120	0
		SA - 2	11.5	13.5	14.9	15.9	16.4	17.2	17.4	19.1	20.5	21.5	21.8	22.8	23.7	17.4	17.1	3.2	120	0
		SA - 3	10.3	11.3	11.8	12.3	12.7	13.2	13.4	14.3	14.3	15.5	16.2	16.8	17.3	13.3	13.2	1.7	80	0
		SA - 4	10.3	11.2	11.6	12.3	12.6	13.3	13.4	13.8	15.0	15.5	16.1	16.3	16.4	13.2	13.1	1.8	80	0
		SA - 5	9.3	9.8	10.2	10.3	10.4	10.8	11.2	11.3	11.9	12.2	12.3	12.8	13.3	10.9	10.9	1.0	80	0
		SA - 6	11.4	13.1	13.3	13.4	14.2	14.5	15.3	16.1	16.6	18.3	19.1	19.7	20.1	15.1	15.0	2.2	80	0

TABLE – 3.2.6(b)

Air Quality Data

Period: Winter (Dec 2008-March 2009) **Location:** Kathara Project Office-Core Zone (SA_1)

WEEK	DAY	DATE	CONCENTRATION OF AIR POLLUTANTS, µg/m³			
			SPM	RPM	SO_2	NOx
I	Fri/Sat	26/27.12.08	203	67	10.7	15.7
	Sat/Sun	27/28.12.08	245	90	10.1	12.4
II	Fri/Sat	02/03.01.09	200	81	17.1	21.0
	Sat/Sun	03/04.01.09	176	54	13.3	20.2
III	Fri/Sat	09/10.01.09	206	68	10.5	19.2
	Sat/Sun	10/11.01.09	181	70	15.2	27.4
IV	Fri/Sat	16/17.01.09	189	73	12.0	24.7
	Sat/Sun	17/18.01.09	193	68	13.5	23.2
V	Fri/Sat	23/24.01.09	101	38	13.2	23.6
	Sat/Sun	24/25.01.09	142	56	10.5	17.0
VI	Fri/Sat	30/31.01.09	147	50	9.2	15.4
	Sat/Sun	31/01.01/02.09	183	61	11.0	17.7
VII	Fri/Sat	06/07.02.09	180	63	12.3	15.8
	Sat/Sun	07/08.02.09	127	45	10.2	13.1
VIII	Fri/Sat	13/14.02.09	145	56	9.0	17.2
	Sat/Sun	14/15.02.09	112	43	9.8	17.5
IX	Fri/Sat	20/21.02.09	220	77	10.6	15.8
	Sat/Sun	21/22.02.09	224	64	8.4	17.2
X	Fri/Sat	27/28.02.09	177	57	11.5	13.2
	Sat/Sun	28/01.02/03.09	135	46	10.6	11.9
XI	Fri/Sat	06/07.03.09	146	57	11.9	24.2
	Sat/Sun	07/08.03.09	173	60	9.3	19.9
XII	Fri/Sat	13/14.03.09	156	46	10.9	17.2
	Sat/Sun	14/15.03.09	151	53	9.3	20.6

	SPM	RPM	SO_2	NOx
No of observations ⇨	24	24	24	24
Minimum Concentration ⇨	101	38	8.4	11.9
Maximum Concentration ⇨	245	90	17.1	27.4
Average ⇨	171.3	60.1	11.3	18.4
98^{th} percentile ⇨	235.3	85.9	16.2	26.2

TABLE - 3.2.6(c)
Air Quality Data

Period: Winter (Dec 2008-March 2009) **Location:** - Kathara OCP-Workshop- Core Zone (SA_2)

WEEK	DAY	DATE	CONCENTRATION OF AIR POLLUTANTS, µg/m^3			
			SPM	RPM	SO_2	NOx
I	Fri/Sat	26/27.12.08	198	61	13.4	18.9
	Sat/Sun	27/28.12.08	177	64	14.3	20.9
II	Fri/Sat	02/03.01.09	167	65	12.8	18.2
	Sat/Sun	03/04.01.09	230	72	11.6	16.9
III	Fri/Sat	09/10.01.09	178	58	18.4	23.9
	Sat/Sun	10/11.01.09	223	76	20.4	27.0
IV	Fri/Sat	16/17.01.09	181	71	21.3	27.9
	Sat/Sun	17/18.01.09	215	69	16.4	22.8
V	Fri/Sat	23/24.01.09	178	73	17.3	22.7
	Sat/Sun	24/25.01.09	186	72	13.6	18.8
VI	Fri/Sat	30/31.01.09	161	71	10.8	14.8
	Sat/Sun	31/01.01/02.09	149	56	9.8	13.0
VII	Fri/Sat	06/07.02.09	172	59	11.4	17.9
	Sat/Sun	07/08.02.09	190	77	14.3	21.2
VIII	Fri/Sat	13/14.02.09	253	85	16.3	21.9
	Sat/Sun	14/15.02.09	218	82	13.4	17.4
IX	Fri/Sat	20/21.02.09	229	84	15.3	20.9
	Sat/Sun	21/22.02.09	249	82	13.2	24.8
X	Fri/Sat	27/28.02.09	141	52	14.3	21.0
	Sat/Sun	28/01.02/03.09	148	61	17.3	22.0
XI	Fri/Sat	06/07.03.09	169	64	18.2	20.9
	Sat/Sun	07/08.03.09	197	73	14.3	22.8
XII	Fri/Sat	13/14.03.09	218	80	17.4	23.7
	Sat/Sun	14/15.03.09	225	82	16.3	21.0
			SPM	**RPM**	**SO_2**	**NOx**
No of observations ⇨			24	24	24	24
Minimum Concentration ⇨			141	52	9.8	13.0
Maximum Concentration ⇨			253	85	21.3	27.9
Average ⇨			193.8	70.4	15.1	20.9
98th percentile ⇨			251.2	84.5	20.9	27.5

TABLE - 3.2.6(d)
Air Quality Data

Period: Winter (Dec 2008-March 2009) **Location:** Mahalibandh Village (SA_3)

WEEK	DAY	DATE	CONCENTRATION OF AIR POLLUTANTS, µg/m³			
			SPM	RPM	SO_2	NOx
I	Fri/Sat	26/27.12.08	121	44	9.1	16.9
	Sat/Sun	27/28.12.08	112	44	8.7	16.1
II	Fri/Sat	02/03.01.09	140	43	11.3	13.6
	Sat/Sun	03/04.01.09	132	48	12.4	20.2
III	Fri/Sat	09/10.01.09	116	41	11.6	14.5
	Sat/Sun	10/11.01.09	117	43	11.3	13.1
IV	Fri/Sat	16/17.01.09	111	42	7.1	13.8
	Sat/Sun	17/18.01.09	128	46	8.7	9.5
V	Fri/Sat	23/24.01.09	100	45	11.7	14.5
	Sat/Sun	24/25.01.09	130	40	11.3	9.5
VI	Fri/Sat	30/31.01.09	106	34	6.8	11.5
	Sat/Sun	31/01.01/02.09	125	45	9.3	13.8
VII	Fri/Sat	06/07.02.09	121	47	4.7	9.4
	Sat/Sun	07/08.02.09	134	55	8.7	11.5
VIII	Fri/Sat	13/14.02.09	129	54	6.6	11.0
	Sat/Sun	14/15.02.09	110	44	10.5	13.0
IX	Fri/Sat	20/21.02.09	120	54	6.2	12.8
	Sat/Sun	21/22.02.09	121	39	7.8	11.5
X	Fri/Sat	27/28.02.09	106	37	8.7	16.0
	Sat/Sun	28/01.02/03.09	132	48	8.1	12.9
XI	Fri/Sat	06/07.03.09	122	39	6.6	13.0
	Sat/Sun	07/08.03.09	134	51	5.6	12.2
XII	Fri/Sat	13/14.03.09	105	42	6.0	14.5
	Sat/Sun	14/15.03.09	95	34	5.5	13.8

	SPM	RPM	SO_2	NOx
No of observations ⇨	24	24	24	24
Minimum Concentration ⇨	95	34	4.7	9.4
Maximum Concentration ⇨	140	55	12.4	20.2
Average ⇨	119.5	44.1	8.5	13.3
98^{th} percentile ⇨	137.2	54.6	12.1	18.7

TABLE – 3.2.6(e)

Air Quality Data

Period: Winter (Dec 2008-March 2009) **Location:** Ambatanr Village (SA_4)

WEEK	DAY	DATE	CONCENTRATION OF AIR POLLUTANTS, µg/m^3			
			SPM	RPM	SO_2	NOx
I	Fri/Sat	26/27.12.08	137	48	6.0	19.4
	Sat/Sun	27/28.12.08	119	44	5.6	14.6
II	Fri/Sat	02/03.01.09	124	51	7.4	18.2
	Sat/Sun	03/04.01.09	148	46	8.3	13.9
III	Fri/Sat	09/10.01.09	135	47	6.7	13.0
	Sat/Sun	10/11.01.09	124	48	9.3	18.0
IV	Fri/Sat	16/17.01.09	127	46	7.4	11.0
	Sat/Sun	17/18.01.09	144	49	6.7	12.2
V	Fri/Sat	23/24.01.09	116	42	8.3	13.9
	Sat/Sun	24/25.01.09	146	54	7.4	13.4
VI	Fri/Sat	30/31.01.09	129	39	5.3	9.7
	Sat/Sun	31/01.01/02.09	132	46	7.4	13.3
VII	Fri/Sat	06/07.02.09	129	44	5.7	11.2
	Sat/Sun	07/08.02.09	150	60	7.7	15.5
VIII	Fri/Sat	13/14.02.09	137	58	6.3	14.1
	Sat/Sun	14/15.02.09	118	37	8.4	17.3
IX	Fri/Sat	20/21.02.09	136	48	7.4	16.6
	Sat/Sun	21/22.02.09	128	47	6.6	19.6
X	Fri/Sat	27/28.02.09	113	44	8.4	14.5
	Sat/Sun	28/01.02/03.09	148	52	6.8	13.1
XI	Fri/Sat	06/07.03.09	138	47	6.7	14.6
	Sat/Sun	07/08.03.09	150	53	6.6	12.9
XII	Fri/Sat	13/14.03.09	113	45	7.4	15.1
	Sat/Sun	14/15.03.09	103	39	5.3	11.3

	SPM	RPM	SO_2	NOx
No of observations ⇨	24	24	24	24
Minimum Concentration ⇨	103	37	5.3	9.7
Maximum Concentration ⇨	150	60	9.3	19.6
Average ⇨	130.7	47.2	7.0	14.4
98th percentile ⇨	150.0	58.9	8.9	19.5

TABLE – 3.2.6(f)

Air Quality Data

Period: Winter (Dec 2008-March 2009) **Location:** Nayadih Village (SA_5)

WEEK	DAY	DATE	CONCENTRATION OF AIR POLLUTANTS, µg/m³			
			SPM	RPM	SO_2	NOx
I	Fri/Sat	26/27.12.08	131	41	12.6	19.5
	Sat/Sun	27/28.12.08	122	39	10.6	15.6
II	Fri/Sat	02/03.01.09	118	41	11.3	14.3
	Sat/Sun	03/04.01.09	139	44	6.6	12.9
III	Fri/Sat	09/10.01.09	124	45	7.5	13.2
	Sat/Sun	10/11.01.09	127	48	9.5	12.6
IV	Fri/Sat	16/17.01.09	118	45	8.2	18.5
	Sat/Sun	17/18.01.09	135	50	9.5	16.6
V	Fri/Sat	23/24.01.09	107	42	9.8	17.2
	Sat/Sun	24/25.01.09	134	56	11.5	12.5
VI	Fri/Sat	30/31.01.09	113	46	8.6	11.9
	Sat/Sun	31/01.01/02.09	135	53	8.8	13.4
VII	Fri/Sat	06/07.02.09	135	46	9.4	14.4
	Sat/Sun	07/08.02.09	141	48	8.5	15.1
VIII	Fri/Sat	13/14.02.09	143	53	11.8	14.1
	Sat/Sun	14/15.02.09	124	40	10.7	15.4
IX	Fri/Sat	20/21.02.09	127	47	9.5	13.6
	Sat/Sun	21/22.02.09	131	46	7.9	11.3
X	Fri/Sat	27/28.02.09	116	35	8.9	12.5
	Sat/Sun	28/01.02/03.09	139	57	10.9	15.6
XI	Fri/Sat	06/07.03.09	126	47	9.9	10.5
	Sat/Sun	07/08.03.09	141	55	7.8	13.8
XII	Fri/Sat	13/14.03.09	119	50	6.2	13.6
	Sat/Sun	14/15.03.09	109	43	9.7	14.8

	SPM	RPM	SO_2	NOx
No of observations ⇨	24	24	24	24
Minimum Concentration ⇨	107	35	6.2	10.5
Maximum Concentration ⇨	143	57	12.6	19.5
Average ⇨	127.1	46.5	9.4	14.3
98^{th} percentile ⇨	142.1	56.7	12.2	19.0

TABLE – 3.2.6(g)

Air Quality Data

Period: Winter (Dec 2008-March 2009) **Location:** Kathara Colony (SA_6)

WEEK	DAY	DATE	CONCENTRATION OF AIR POLLUTANTS, µg/m³			
			SPM	RPM	SO_2	NOx
I	Fri/Sat	26/27.12.08	120	49	7.0	9.1
	Sat/Sun	27/28.12.08	135	46	5.0	8.1
II	Fri/Sat	02/03.01.09	131	47	8.0	14.5
	Sat/Sun	03/04.01.09	131	41	9.5	12.1
III	Fri/Sat	09/10.01.09	109	43	7.7	9.6
	Sat/Sun	10/11.01.09	140	52	4.5	10.8
IV	Fri/Sat	16/17.01.09	110	35	6.6	12.1
	Sat/Sun	17/18.01.09	127	48	6.9	13.1
V	Fri/Sat	23/24.01.09	99	40	10.0	16.7
	Sat/Sun	24/25.01.09	124	43	5.9	8.6
VI	Fri/Sat	30/31.01.09	105	41	7.4	9.1
	Sat/Sun	31/01.01/02.09	148	57	5.9	10.2
VII	Fri/Sat	06/07.02.09	142	58	6.7	11.6
	Sat/Sun	07/08.02.09	133	56	7.7	13.6
VIII	Fri/Sat	13/14.02.09	150	50	5.6	8.9
	Sat/Sun	14/15.02.09	147	50	7.6	12.0
IX	Fri/Sat	20/21.02.09	119	42	7.9	12.8
	Sat/Sun	21/22.02.09	144	45	5.9	9.1
X	Fri/Sat	27/28.02.09	129	44	6.7	10.6
	Sat/Sun	28/01.02/03.09	131	48	7.0	9.6
XI	Fri/Sat	06/07.03.09	116	45	6.8	9.0
	Sat/Sun	07/08.03.09	133	47	5.9	10.6
XII	Fri/Sat	13/14.03.09	140	39	5.5	9.6
	Sat/Sun	14/15.03.09	116	48	4.8	8.8

	SPM	RPM	SO_2	NOx
No of observations ⇨	24	24	24	24
Minimum Concentration ⇨	99	35	4.5	8.1
Maximum Concentration ⇨	150	58	10.0	16.7
Average ⇨	127.0	46.4	6.8	10.8
98^{th} percentile ⇨	149.1	58.0	9.8	15.7

3.2.7 Observation

A close study, analysis & interpretation of air quality data in conjunction with corresponding micro-meteorological data help to draw following conclusions.

A comparison of the observed data with the Air Quality standards show that level of all air pollutants in the study area are well within the prescribed limits of CPCB for residential and rural area. Level of NO_X & SO_X are very low. SPM & RPM level has been observed within limits.

3.3 PRESENT WATER QUALITY SCENARIO

Water sources are the naturally available commodity over and in the form of rain water, streams, pond aquifer, underground water etc. In the study area, Grab sampling method was adopted in case of ground water system like Hand Pumps. The sample from Hand pump were collected from running condition. Integrated sampling method was adopted in case of surface water system.

The operation of the mine and allied services would affects the water resources in many way at the project area in respect of its quality & its regime.

3.3.1 Water Quality Assessment

Main source of water in the study area include surface water source i.e. Damodar River and ground water resources i.e.Mine Water ,Hand Pump & Workshop Discharge . Water samples from these resource have been sampled and tested.

3.3.2 SAMPLING AND ANALYTICAL METHODS

Grab sampling method was adopted in case of ground water system like Hand Pumps. The samples from Hand pumps were collected from running condition. Integrated sampling method was adopted in case of surface water system.

Some of the parameters such as temperature, pH, DO, Free Chlorine etc. which were liable to change with time were analyzed at site with the help of an analytical kit while some others in the field laboratory set up at place of stay. One set of “Preserved” samples were taken to PDIL’s laboratory at Sindri for analysis of the remaining parameters.

The following methods were adopted for analysis:

(i) Standard methods for examination of water and waste water, published by APHA, American Water Works Association and Water Pollution Control Federation of USA.

(ii) IS-2488 (Part-I, II & III), 1968.

(iii) IS-2488 (part-IV).

3.3.2 Sampling Locations:

For assessing the water quality, six location water-sampling locations were selected and samples were collected for analysis. All these stations are shown in the plate attached.

Table no. 3.3.2.

SL. NO.	LOCATION NAME	LOCATION CODE
01.	Kathara Village- Hand Pump	GW_1
02.	Ambatanr Village- Hand Pump	GW_2
03.	Damodar River – Upstream (Confluence with mine water)	SW_1
04.	Damodar River – Downstream (Confluence with mine water)	SW_2
05.	Mine Water Discharge- Kathara OCP	MW_1
06.	Workshop Discharge	MW_2

3.3.3 Rational Behind Sampling

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, six locations are identified and samples are collected and analyzed for physico-chemical and heavy metal parameters.

The water sampling points were selected in consultation with the CMPDIL officials. The different sources of water were identified for water quality survey depending on their use for potable/industrial purposes and considering likely impact on these sources due to project activities. There may be increased turbidity in the down stream area during the construction period. Based on these considerations, it was thought necessary to assess the existing quality of different water sources of the project area and its surroundings. The water quality monitoring stations are given in the Table –3.3.2

3.3.4 Water Quality Monitoring Results & Analysis:

A) Highlight of Results for base line data for water quality is given below-

Highlight of the all location have been summarized below

Table No.-3.3.4(A)

Sl .No	Sampling location	Code	pH	Turbidity NTU	TSS mg/l	TDS mg/l	Oil & Grease mg/l	D.O mg/l	BOD mg/l, 3day,27^0 mg/l
1	Kathara Village- Hand Pump	GW_1	7.2	< 5	6	340	NT	-	-
2	Ambatanr Village- Hand Pump	GW_2	7.3	< 5	7	350	NT	-	-
3	Damodar River – Upstream (Confluence with mine water)	SW_1	7.1	5	10	197	BDL	6.0	< 2
4	Damodar River – Downstream (Confluence with mine water)	SW_2	7.2	5	12	173	BDL	6.2	< 2
5	Mine Water Discharge- Kathara OCP	MW_1	6.8	10	10	533	3	-	< 2
6	Workshop Discharge	MW_2	6.9	12	30	552	6	-	< 2

B) Analysis of results

a) pH: The value of pH for all samples have been found to be well within the prescribed limits.

b) Total suspended Solid (TSS): Level of T.S.S. has been found to be within the prescribed limit.

b) Total Dissolved Solid (TDS): TDS level has been found to be within the limit but on higher side during dry days. This may be because of low discharge.

c) Biological Oxygen Demand

BOD level has been found to be within the prescribed limits.

d) Chloride

Level of Chloride in all samples has been found to below the prescribed level.

e) Sulphate (As SO_4):

Sulphate level in all samples has been found to be within the tolerance level.

f) Total Nitrogen (As N):

Level of this parameter in all samples has been found to be within the tolerance level.

g) Heavy Metals: All heavy metals have been found to be within the prescribed limitS.

In general, at all locations the water quality are found to be well within the prescribed norms .

(C) Comprehensive results of all parameters for all locations are tabulated in the following tables.

Showing the test results of Mine water & Workshop discharge and compared with MoEF standard schedule - VI.

TABLE –3.3.4(C)

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

Period: December 2008 to March 2009

(Wherever not specified, characteristics are expressed in mg/l, maximum)

SL. NO.	PARAMETERS	ANALYSIS RESULTS		DETECTION LIMIT	IS:10500 Desirable/ Permissible Limits
		GW_1	GW_2		
PHYSICAL					
1	pH	7.2	7.3	-	6.5-8.5
2	Temperature (^oC)	27	27	-	-
3	Colour, (HU)	None	None	-	5/25
4	Odour	Unobjec.	Unobjec.	-	Unobjectionable
5	Taste	Agreeable	Agreeable	-	Agreeable
6	Turbidity (NTU)	<5	<5	-	5/10
7	Total Suspended Solid	6	7	-	-
8	Total dissolved solids	340	350	-	500/2000
CHEMICAL					
1	P- Alkalinity as $CaCO_3$	0	0	-	-
2	Total Alkalinity as $CaCO_3$	222	230	-	200/600
3	Chloride as Cl	40	36	-	250/1000
4	Sulphate as SO_4	34	38	-	200/400
5	Nitrate as N	1	2	-	10/22
7	Fluoride as F	<1.0	<1.0	-	1.0/1.5
8	Total Hardness as $CaCO_3$	246	240	-	300/600
9	Calcium Hardness as $CaCO_3$	140	140	-	75/200*
10	Mag. Hardness as $CaCO_3$	106	100	-	30**
11	Total Kjeldhal Nitrogen as N	5.6	4	0.1	-
12	Sodium as Na	28	34	-	-
13	Potassium as K	5	6	-	-
14	Silica as SiO_2	15	14	-	-
HEAVY METALS					
1	Iron as Fe	0.10	0.12	-	0.3/1.0
2	Manganese as Mn	NT	NT	0.05	0.1/0.3
3	Chromuim as Cr^{6+}	NT	NT	0.01	0.05
4	Lead as Pb	NT	NT	0.05	0.05
5	Zinc as Zn	0.32	0.36	-	5.0/15
6	Cadmium as Cd	NT	NT	0.01	0.01
7	Copper as Cu	NT	NT	0.02	0.05/1.5
8	Nickel as Ni	NT	NT	-	0.01
9	Arsenic as As	NT	NT	0.01	0.05
10	Selenium as Se	NT	NT	0.01	0.01
OTHERS					
1	Mineral Oil	NT	NT	-	0.01/0.03
2	Phenolic Compound	NT	NT	0.001	0.001/0.002
3	Coliform Organisms (MPN/100ml)	<100	<100	-	Absent

Note: 1) BDL – Below Detectable Level. 2) NT- Not Traceable
3) '*'- Calcium as Ca 4) '**'- Magnesium as Mg

TABLE – 3.3.4(c)

PHYSICO-CHEMICAL CHARACTERISTICS OF SURFACE WATER QUALITY

Period: December 2008 to March 2009

(Wherever not specified, characteristics are expressed in mg/l)

SL. No.	PARAMETERS	ANALYSIS RESULTS		DETECTION LIMIT	Limit as per IS: 2296 Class 'C'
		SW1	SW2		
PHYSICAL					
1	pH	7.1	7.2	-	6.5-8.5
2	Temperature (^{O}C)	28	28	-	*
3	Colour, (HU)	6	9	-	300
4	Odour	Unobj.	Unobj.	-	*
5	Turbidity (NTU)	5	5	-	*
6	Total Suspended Solids	10	12	-	*
7	Total dissolved solids	197	173	-	1500
CHEMICAL					
1	P- Alkalinity as $CaCO_3$	0	0	-	*
2	Total Alkalinity as $CaCO_3$	94	108	-	*
3	Chloride as Cl	24	20	-	600
4	Sulphate as SO_4	40	12	-	400
5	Nitrate as N	1	1	-	50
6	Total Phosphate as PO_4	<1.0	<1.0	-	
7	Fluoride as F	<1.0	<1.0	-	1.5
8	Total Hardness as $CaCO_3$	132	80	-	*
9	Calcium Hardness as $CaCO_3$	70	44	-	*
10	Magnesium Hardness as $CaCO_3$	62	36	-	*
11	Dissolve Oxygen	6.0	6.2	-	4.0
12	C. O. D.	16	18	-	*
13	BOD, mg/l, 3 days at $27^{o}C$	<2	<2	-	3.0
14	Total Kjeldhal Nitrogen as N	6	5	-	
15	Sodium as Na	16	29	-	*
16	Potassium as K	3	5	-	*
17	Silica as SiO_2	14	15	-	*
HEAVY METALS					
1	Iron as Fe	0.04	0.04	-	5.0
2	Manganese as Mn	BDL	BDL	0.05	*
3	Total Chromuim as Cr	BDL	BDL	0.006	0.05
4	Lead as Pb	BDL	BDL	0.04	0.1
5	Zinc as Zn	0.12	0.13	-	15.0
6	Cadmium as Cd	BDL	BDL	0.01	0.01
7	Copper as Cu	BDL	BDL	0.02	1.5
8	Nickel as Ni	BDL	BDL	-	*
9	Arsenic as As	BDL	BDL	0.01	0.2
10	Selenium as Se	BDL	BDL	0.01	0.05
11	Cyanide as CN	BDL	BDL	0.02	0.05
12	Mercury as Hg	BDL	BDL	0.001	*
OTHERS					
1	Oil & Grease	BDL	BDL	0.1	0.1
2	Phenolic Compound	BDL	BDL	0.001	0.005
3	Coliform Organisms (MPN/100ml)	2.1×10^3	2.0×10^3	-	5000

Note: **1)** BDL – Below Detectable Level; **2)** NT – Not Traceable **3) *** - Limit Not Specified

TABLE – 3.3.4(c)

PHYSICO-CHEMICAL CHARACTERISTICS OF MINE WATER DISCHARGE

Period: December 2008 – March 2009

(Wherever not specified, characteristics are expressed in mg/l)

SL. NO.	PARAMETERS	ANALYSIS RESULTS		DETECTION LIMIT	MOEF STANDARD SCHEDULE-VI
		MW1	MW2		
	PHYSICAL				
1	pH	6.8	6.9	-	5.5-9.0
2	Temperature (^{O}C)	26	28	-	Te<Ts+5^{o}C
3	Colour, (HU)	9	12	-	*
4	Odour	Unobj.	Unobj.	-	Unobjectionable
5	Turbidity (NTU)	10	12	-	*
6	Total Suspended Solids	10	30	-	100
7	Total dissolved solids	533	552	-	*
	CHEMICAL				
1	Total Alkalinity as $CaCO_3$	380	396	-	*
2	Chloride as Cl	28	30	-	*
3	Sulphate as SO_4	80	76	-	*
4	Nitrate as N	1	2	-	10
5	Dissolve Phosphate as PO_4	<1.0	<1.0	-	5.0
6	Fluoride as F	<1.0	<1.0	-	2.0
7	Total Hardness as $CaCO_3$	432	420	-	*
8	Calcium Hardness as $CaCO_3$	264	260	-	*
9	Magnesium Hardness as $CaCO_3$	168	160	0.04	1.0
10	C. O. D.	22	24	-	250
11	Total Kjeldhal Nitrogen as N	7.6	7.9	0.01	100
12	B. O. D.(3 days at 27^{0} C)	<2	<2	-	30
13	Sodium as Na	30	40	-	*
14	Potassium as K	6	7	-	*
15	Sulphide as S	NT	NT	0.01	2.0
16	Ammonical Nitrogen as N	1.20	1.86	0.02	50
	HEAVY METALS				
1	Iron as Fe	0.6	0.8	-	3.0
2	Manganese as Mn	BDL	BDL	0.1	2.0
3	Lead as Pb	BDL	BDL	0.4	0.1
4	Zinc as Zn	1.2	1.6	-	5.0
5	Copper as Cu	BDL	BDL	0.5	3.0
6	Nickel as Ni	BDL	BDL	0.1	3.0
7	Mercury as Hg	BDL	BDL	0.01	0.01
8	Cyanide as CN	BDL	BDL	0.01	0.2
9	Arsenic as As	BDL	BDL	0.01	0.2
10	Selinium as Si	BDL	BDL	0.01	0.05
11	Vanadium as V	BDL	BDL	0.01	0.2
12	Cadamium as Cd	BDL	BDL	0.002	2.0
13	Chromium as Cr^{+6}	BDL	BDL	0.1	0.1
14	Total Chromium as Cr	BDL	BDL	0.006	2.0
	OTHERS				
1	Oil & Grease	3	6	-	10
2	Phenolic Compound	<0.1	<0.1	0.001	1.0

Note: **1)** BDL – Below Detectable Level; **2)** NT – Not Traceable

3.3.5 Water pollution source

Core zone and surrounding of the proposed project is almost free from industrialization and urbanization. So there is no industrial or urban waste effluent.

Since there is some scatter villages, so there is some typical rural domestic effluent. Pollution from this effluent is negligible.

3.3.6 Water Demand & Generation of Waste water:

The mine requires water for portable & industrial use. Total water requirement for both purposes has been estimated as 3000 Cum /day. The break-up is given below in Table 3..3.6

TABLE 3.3.6

WATER REQUIREMENT

Total Water Requirement – 3000Cum per day	Domestic/Portable Water Demand- 2500Cum/day
	Industrial Water Demand – 500 Cum/day

Appropriate treatment system has been constructed to treat the waste waters before they are reused or disposed off.

3.3.7 Status of Hydrology in in study Area :

In order to study the status and behavior of ground water table, inventory of existing groundwater observation structures such as Mine Water, Open Well ,Hand Pump and surface water bodies, surface ponds and streams within the Katharal Project area was undertaken.

In order to study the water table variation, representative Open wells were selected and marked on the base map with their details recorded for future reference. A detailed hydro geological reports has been prepared for the same.

3.3.8 Ground Water Balance of Kathara Project Area

The area of buffer zones of Kathara project is covered both by Gondwana as well as Archaean formation. The area covered by Gondwana formation is 38 % and that of Archaean by 62%. The recharge through rainfall in geographical area (Rg) of 314 Sq Km covered by above geological formations is taken as 13 % and 8 % respectively for Gondwana formation and Achaean formation. The water budget for the area as given in the table – 3.9.0.1 reveal that the net annual ground water available for recharge of ground water is **31.7** MCM (Million Cubic Metre) against which the ground water draft is 5.832 MCM. Therefore, the balance of ground water in the area available for ground water recharge in the area. is to the tune of about **25.862** MCM as given in the Table – 3.3.8. This balance of ground water raises the water table from 4 to 4.5 m in the area.

Table – 3.3.8

Ground water Budgeting for Kathara Project.

(All Figures in Million Cubic Meters per Year i.e. Mcm)

A	Ground Water Recharge	
	Recharge through rainfall in geographical area (Rg) of 314 Sq Km area covered by different geological formations: i. Barakar formation : 120 Sq.Km x 1200 mm rainfall x 13% infiltration = 18.72 MCM ii. Arachaean formation : 194 Sq.Km x 1200mm x 8% infiltration = 18.62 MCM	37.3
	Natural discharge & other losses (15% Rg)	(-) 5.6
	Net annual ground water recharge	**31.7**
B	Ground Water Draft	
	1. Net Irrigation Use i. Proportional for 70.72 Ha area @ 145 Cum 0.01 ii. (-20%) Return flow to ground water 0.002	0.008
	2. Community Use i. Projected Population (174745) @70lpd fo rone year = 4.5 MCM ii. Cattle population (10% of item 'i') = 0.45 MCM iii Domestic and industrial demand of mine = 0.30 MCM	5.25
	3. Net mine discharge in core and buffer zone i. Net mine discharge at @ 2000 cu.m/day = 0.73 (max. expected inflow of ground water) ii. 20% return flow to the ground system = 0.15	0.58
	Net Annual Ground Water Draft (1+2+3)	**5.838**
C	Balance available for annual ground water recharge (A-B)	**say 25.862**

A comprehensive hydrological study has been conducted by RI-3,CMPDI to evaluate pre and post mining scenario of the study area. As per the hydrological study, water table of the study area varies from 1.00 m to 12.62 m in Pre monsoon season and from 0.05 m to 5.19 m in Post monsoon season.

	Max.	Min.
➢ In Pre monsoon –	1.00 m	12.62 m
➢ In Post Monsoon –	0.05 m	5.19 m

3.4 PRESENT NOISE LEVEL SCENARIO

Mining activities are always associated with occupational health hazards. Exposure to high noise level is one of them. With high mechanisation of coal mines in India, the noise hazard is gradually increasing. Again, blasting of coal and O.B. in coal mines is not only a source of noise hazard but also a major source of safety hazards to man and material. To carry out mining operation in an environmental friendly manner, it is essential to adopt proper noise abatement and blasting vibration control plan.

3.4.1 Present Noise Level Measurement

As part of the occupational health and safety measures certain safeguards and standards have been laid down to mitigate noise pollution in working environments. To know the pre-mining background of ambient noise level of proposed mines and surrounding environment, six locations were selected. The location were selected in such away that it represent commercial, residential and sensitive zone like Hospital and schools.

The noise level monitoring stations and location code are given below

Table no. –3.4.1

NOISE LEVEL MONITORING STATIONS

Sl. No.	Location Zone	Location Code
01.	Kathara Project Office - Core Zone	SN_1
02.	Kathara OCP Workshop - Core Zone	SN_2
03.	Mahalibandh Village	SN_3
04.	Ambatanr Village	SN_4
05.	Nayadih Village	SN_5
06.	Kathara Colony	SN_6

3.4.2 Results and Observations

Max .Peak Noise Level recorded at day and night time are tabulated in the table 3.4.2

Table no. 3.4.2

Summary of Observations- (Core Zone)

Sl. No.	Location	Minimum dB(A)		Maximum dB(A)		Average dB(A)	
		Day	Night	Day	Night	Day	Night
Industrial Area							
01.	Kathara Project Office - Core Zone	**57.8**	**45.9**	60.1	48.5	59.0	47.2
02	Kathara OCP Workshop - Core Zone	60.1	47.5	**62.3**	**49.5**	61.2	48.5

Summary of Observations- (Buffer Zone)

Sl. No.	Location	Minimum dB(A)		Maximum dB(A)		Average dB(A)	
		Day	Night	Day	Night	Day	Night
Residential Area							
01.	Mahalibandh Village	54.2	43.9	54.8	44.1	54.5	44.0
02.	Ambatanr Village	52.4	41.9	53.9	43.2	53.2	42.6
03.	Nayadih Village	**51.7**	**40.5**	52.6	41.2	52.2	40.9
04.	Kathara Colony	53.9	42.6	**54.8**	**44.8**	54.4	43.7

(a) Observations:

From the results, the sound levels for core zones were observed in the range of **57.8** dB (A) to **62.3** dB (A) during day time and **45.9** dB (A) to **49.5** dB (A) during night time, these levels are in good compliance with prescribed levels of 75 dB (A) during day time and 70 dB (A) during night for industrial area.

Similarly, the sound levels in close vicinity of the project area were observed in the range of **51.7** dB (A) to **54.8** dB (A) in day time & **40.5** dB (A) to **44.8** dB(A) in the night time, which were well within the prescribed permissible levels of 55 dB(A) (Day) and 45 dB(A) (Night) for residential areas.

4.5 Land Use/Cover Mapping Based on Remote Sensing Data

Introduction

Land is the most important natural resource endowment on which all human activities are based. Therefore, knowledge on different type of land use as well as its spatial distribution in the form of map and statistical data is vital for spatial planning and management of land and its optimal use. In mining industry, the need for information on land use /cover pattern has gained importance due to the all-round concern on environmental impact of mining. The information on land use inventory that includes type, spatial distribution, aerial extent, location, rate and pattern of change of each category of land is of paramount importance for formulating Environmental Management Plan (EMP) of a mining project. The existing information available on land use is mainly in the form of statistical data based on the compilation of village record that are inadequate and do not provide an up-to-date information on changing land use pattern and process. As a result, preparation of Environmental Management Plan (EMP) becomes difficult.

Realising the need of creating an environmental data base for mining area with respect to land, water, forest, communication network, built-up land; land use map of Buffer zone of Kathara OCP covering 10km. radius using *remote sensing data* has been prepared. This map will form the database for present land use pattern and in assessing the impact of Kathara OCP on land use pattern in future for formulating the remedial measures, if any.

Data Source

The following data are used in the present study:

- **Primary Data** Satellite data [IRS-P6/LISS-III; Band# 1,2,3,4; Path#106, Row#55; Date 06-1-2008; was used as primary data source for the study. The raw satellite data was obtained from NRSA, Hyderabad, on CD-ROM media.

- **Secondary Data**

  Secondary (ancillary) and ground data constitute an important baseline information in remote sensing, as they improve the interpretation accuracy and reliability of remotely sensed data by enabling verification of the interpreted details and by supplementing it with the information that cannot be obtained directly from the remotely sensed data. The following secondary data were used in the study:

  (i) Survey of India topographical map – 73E/13, 73E/14, Vicinity map supplied by CCL showing village boundary, road and drainage.

Data Processing

Data processing involves the following major steps:

(a) Geometric correction, rectification and georeferencing;
(b) Image enhancement;
(c) Training set selection;
(d) Signature generation and classification;
(e) Creation/overlay of vector database;
(f) Validation of classified image;
(g) Final thematic map preparation.

Land Use Classification

The array of information available on land use/cover requires to be arranged or grouped under a suitable framework in order to facilitate the creation of a land use inventory and mapping. Further, to accommodate the changing land use/cover pattern, it becomes essential to develop a standardised classification system that is not only flexible in nomenclature and definition, but also capable of incorporating information obtained from the satellite data and other different sources.

The present framework of land use/cover classification has been primarily based on the '***Manual of Nationwide Land Use/ Land Cover Mapping Using Satellite Imagery***' developed by National Remote Sensing Agency, Hyderabad. Land use map was prepared on the basis of image interpretation carried out based on the satellite data for the year 2001.Folowing land use/cover classes are identified in buffer zone of Kathara OCP.

Table 1: Land use/cover classes identified in buffer zone of Kathara OCP

	Level -I	***Level -II***
1	Settlement	1.1 Rural
		1.2 Urban
		1.3 Industrial
2	Vegetation Cover	2.1 Dense Forest
		2.2 Open Forest
		2.3 Scrubs
		2.4 Plantation under social forestry
		2.5 Plantation on OB
3	Agricultural Land	3.1 Crop land
		3.2 Fallow Land
4	Wasteland	4.1 Waste Upland
		4.2 Sand Bodies
		4.3 Gullied Land
		4.4 Ash Pond
5	Mining Area	5.1 Coal Quarry
		5.2 Barren OB Dump
		5.3Coal Dump
6	Water bodies	6.1 River/Streams

Data Analysis

Satellite data of 6 January 2008 was processed using ERDAS 9.3 image processing system in order to interpret the various land use/cover classes present in the study area. Detail analysis was carried out only for the buffer zone covering 10 km. radius (419.92 Km^2) from the centre of Kathara OCP. The area of buffer zone considered for the detail analysis is marked on the map. The area of each land use/cover class was calculated using ERDAS IMAGIN 9.3 s/w and tabulated in Table-2 and shown in Fig.1

Table 2: Area of Land use/cover class during November 2008 in buffer zone of Kathara OCP

Land Use/cover Class		Area	
Level -I	***Level -II***	***Area in Km^2***	***%***
(1) Settlement	(i) Rural	11.64	2.45
	(ii) Urban	28.27	5.96
	(iii) Industrial	2.65	0.56
	Sub-total:	**42.56**	**8.97**
(2) Vegetation Cover	(i) Dense Forest	22.92	4.83
	(ii) Open Forest	97.41	20.53
	(iii) Scrub	155.58	32.79
	(iv) Plantation on OB Dumps	2.8	0.59
	(v) Plantation under social forestry	7.12	1.50
	Sub-total:	**285.83**	**60.25**
(3)Agricultural Land	(i) Agriculture Land	75.33	15.88
	(ii) Fallow Land	1.45	0.31
	Sub-total:	**76.78**	**16.18**
(4) Wasteland	(i) Waste Upland	8.19	1.73
	(ii) Gullied LAnd	6.31	1.33
	(iii) Sand bodies	6.29	1.33
	(iV) Ash Pond	0.34	0.07
	Sub-total:	**21.13**	**4.45**
(5) Mining Area	(i)Coal Quarry	3.78	0.80
	(ii) Barren OB Dump	4.85	1.02
	(iii)Coal Dump	0.24	0.05
	Sub Total	**8.87**	**1.87**
(6) Water bodies	Water bodies	39.27	8.28
Total:		**474.44**	**100.00**

Settlement

All the man-made constructions covering the land surface are included under this category. Settlement has been divided in to three classes' viz. Rural, Urban and Industrial. Rural settlement covers 11.64 km^2. area where as urban settlement covers 28.27 km^2. and industrial area covers only 2.25 km^2. Analysis indicates that only 8.97 % area of buffer zone are covered by settlements.

Vegetation cover

It is an area bearing an association predominantly of trees and other vegetation type capable of producing timber and other forest produce. Vegetation cover is classified into the following three sub-classes based on crown density as per modified FAO-1963 (Food & Agricultural Organisation of United Nations) norms: (a) dense forest (crown density more than 40%), (b) open/degraded forest (crown density between 10% to 40%), and (c) scrubs (crown density less than 10%). Plantation on Ob Dump and Plantation under social forestry are also included under this category.

Analysis of the satellite data reveals that total area of vegetation cover in the buffer zone is 285.83 $Km^{2;}$ out of which 22.92 Km^2 (4.83%) is the dense forest, 97.41 Km^2 (20.52%) is the open forest and 115.74 Km^2 (32.79%) is the scrubs. 2.8 Km^2 (0.59%) area covered by plantation on OB dumps and 7.12 Km^2 (1.50%) area covered by plantation under social forestry.

Agriculture land

Land primarily used for farming and production of food, fibre and other commercial and horticultural crops falls under this category. It includes crop land and fallow land. Croplands are those agricultural lands where standing crop occurs on the date of satellite imagery. Crops may be either kharif or rabi. Fallow land are also agricultural land which is taken up for cultivation but temporarily allowed to rest, un-cropped for one or more seasons.

Analysis of the data indicates that the total area of agriculture land is 76.78 Km^2 (16.18%) in the buffer zone.

Wasteland

Wasteland is a degraded and under-utilised class of land that has deteriorated on account of natural causes or due to lack of appropriate water and soil management. Wasteland can result from inherent/imposed constraints such as location, environment, chemical and physical properties of the soil or financial or other management constraints (NWDB, 1987).

Analysis of the data reveals that the area of waste upland is 8.19 Km^2 (1.73%) in the buffer zone which can be utilised for plantation or converted in to agricultural land by appropriate water and soil management. 6.31 Km^2 (1.33%) area is covered by gullied land 6.29 Km^2 (1.33%) area is covered by sand bodies & 0.34 Km^2 (0.07%) area is covered by ash pond.

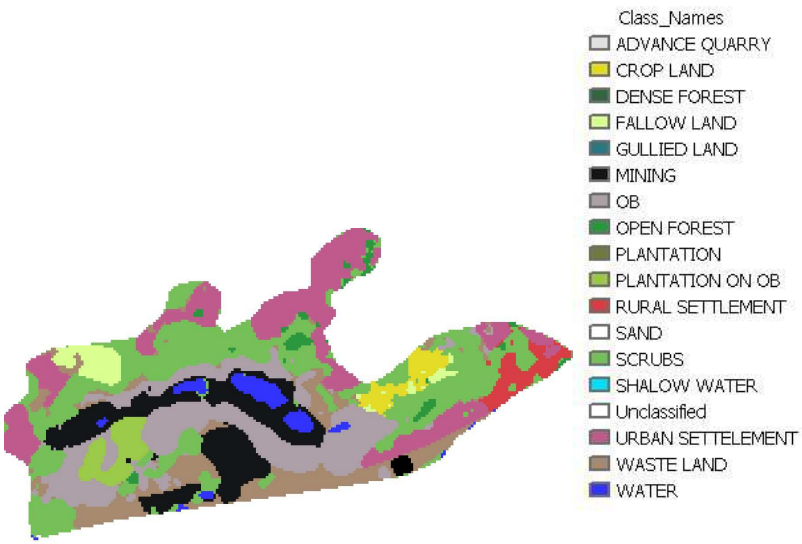
Mining Area

Mining area covers coal quarry, coal dump and barren OB dumps. Analysis of the data reveals that 3.78 Km^2 (0.80%) area is covered by coal quarry, 0.24 Km^2 (0.05%) area by coal dump & 4.85 Km^2 (1.02%) area by OB dumps. Total mining area covers 8.78 Km^2 (1.87%) of the study area.

Water bodies

A number of small impounded water tanks, rivers and streams are present in the buffer zone. Area c
bodies is 2.67 Km^2 (0.64%) in the study area.

The analyses of Core Zone of the project are as follows:



3.6 PRESENT SCENARIO OF LAND

The proposed mining and allied activities will alter the land use pattern in and around the mining areas in various ways. Topography and land scenario changed completely due to digging of open pits and overburden in the form of large heap

Soil characteristics such that, erosion aspects, soil fertility etc. have direct bearing on the environment.

Knowledge of present land use pattern, soil parameters would be very much helpful for the planning and implementation of reclamation plan.

By keeping the above aspects in view, three locations are selected as to represent the entire area. The soil samples were collected and analyzed for fertility stations.

3.6.1 Present scenario of Land use

This is a running mine. The block is very rugged and has many hills and valleys. The height of the land varies different at different distance. The Damodar river is the in the south of the project. The general shape of the ground is towards south.

Table – 3.5.1

Land use pattern of the project

S.No.	Item	Area (Ha.)
1.	WATER	26.1711
2.	DENSE FOREST	0
3.	OPEN FOREST	15.8193
4.	SCRUBS	106.0692
5.	WASTE LAND	90.2771
6	CROP LAND	22.0158
7	FALLOW LAND	26.244
8	MINING	120.4308
9	OB	178.0218
10	PLANTATION ON OB	17.9
11	RURAL SETTLEMENT	25.3692
12	URBAN SETTELEMENT	160.3071
13	SAND	0.1458
14	COAL DUMP	4.0095
15	**Total Leasehold Area**	**792.78**

The land would be degraded only on account of mining only i.e. for quarry, for OB dump, workshop, etc.

3.6.2 Top Soil Characteristics

Soil characteristics, such that erosion aspects, soil fertility etc. have direct bearing on the environment. Knowledge of soil parameters is essential for the planning and implementation of afforestation. Further, major mining activities affect the soil regime of the surrounding areas directly or indirectly. Hence, it becomes important to study the soil characteristics.

By keeping the above aspects in mind, three locations have been selected as to represent the entire area in such a way that different type of soil could be taken that support different type of species of vegetation. The soil samples of following three sites have been e collected and analyzed.

Table no. 3.5.2

Location of soil samples station

SL. NO.	LOCATION NAME	LOCATION CODE
01.	Core Zone – OB Dump Kathara OCP	SS_1
02.	Jhirki Village – Agricultural land	SS_2
03.	Ambatand Village - Agricultural land	SS_3

3.6.3 SAMPLING AND ANALYTICAL METHODS

Surface and sub-surface (profile) soil samples (0-30, 30-60 and 60-90 cms) were collected by digging a pit at the appropriate location with the help of a spade and a "Khurpi". The samples were brought to the laboratory and air dried for a few days. The air dried samples were then ground in an agate mortar with the help of a wooden hammer and passed through 2 mm (10 mesh) sieve. The coarser materials were rejected and the sieved material was sampled by the standard cone and quartering method. The processed samples were analyzed for the following parameters according to the standard methods:

1] Soil Reaction (pH)

The pH of the soil suspension (1 : 2 soil : water ratio) was determined with the help of a glass calomel electrode pH meter.

2] Electrical Conductivity

The conductivity of the soil suspension (1 : 2 soil : water ratio) was determined with the help of a conductivity meter and the results expressed in millimhos per cm.

3] Available Phosphorus

Either of the two methods were followed for extraction of available soil P, namely

(i) Bray & Kurti's (for acid soils) in which dilute acid fluoride solution was used, and

(ii) Olsen's (for alkaline soils) in which sodium bicarbonate solution was used.

After extraction, the P concentration was determined colorimetrically by chlorostannous reduced molybdophosphoric blue colour method, and the results expressed as kg./Ha.

4] Available Potassium

Available Potassium K, was extracted by neutral, normal ammonium acetate solution and determined flame photometrically and the results expressed as kg./Ha.

5] Available Nitrogen

Available Nitrogen N, was determined following alkaline potassium permanganate distillation method, and the results expressed as kg./Ha.

6] Organic Carbon

Organic Carbon C, in soil was determined titrimetrically by the chromic acid-wet oxidation method of Walkley and Black, and the results expressed as percent of C in soil.

7] Plasticity Index

Liquid Limit (LL) and Plastic Limit (PL) were determined with the help of the Liquid Limit Apparatus and the Plasticity Index (PL) was calculated from the difference between the two values.

8] Grain Size

Grain size analysis were carried out by sieving and Bouyoucos Hydrometer method and the results expressed as percent of sand, silt and clay in the soil.

9] Soil Texture

Soil texture was determined from the triangular diagram after USDA.

3.6.4 HIGHLIGHTS OF ANALYTICAL RESULTS

The analytical results have been presented in Tables – **3.6.4**

The highlights of some of the parameters as depicted in analytical results presented in Tables – 01 to 03 are given hereunder:

(i) Texture

The texture of the soils varied through sandy clay to clay loam.

(ii) pH

The pH of the soils ranged between 7.1 and 7.8.

(iii) Electrical Conductivity

The electrical conductivity varied from 0.31 to 1.22 m-mhos/cm.

(iv) Organic Carbon

The organic carbon ranged between 0.56 and 0.89%.

(v) Phosphorus as P_2O_5

The concentration of Phosphorous varied between 11.6 to 14.4 Kg/Ha.

(vi) Potash as K_2O

The concentration of Potash ranged between 126.3 and 187.7 Kg/Ha.

(vii) Nitrogen as N

The concentration of N varied between 125.0 and 215.0 Kg/Ha.

From the above, it is observed that the soil quality would support vegation.

5.5 OBSERVATIONS

The observed characteristics of soil samples collected from three different locations are presented hereunder:

TABLE – 3.6.4 (a)

CHARACTERISTICS OF SOIL

Location: Core Zone – OB Dump Kathara OCP – SS_1 **Period:** December'08 – March'09

Sl. No	Parameters	Observed Value		
		SS_1		
		(0-30cm)	(30-60cm)	(60-90cm)
1	Soil Texture	Sandy Clay	Sandy Clay	Sandy Clay
2	**Grain Size,%**			
	a) sand	78.1	80.5	79.5
	b) Silt content	9.7	9.3	9.7
	c) Clay content	12.2	10.2	10.8
3	Porosity, %	42.4	44.3	45.6
4	Bulk Density, g/cm^3	0.82	0.89	0.92
5	pH	7.1	7.6	7.7
6	Elect. Conductivity, (m-mhos/cm at 20^OC)	0.38	0.36	0.31
7	Water holding capacity %	6.0	6.5	6.7
8	Liquid Limit (%)	14.1	14.3	14.8
9	Plastic Limit (%)	9.5	9.9	9.8
10	Infiltration Rate (cm/hr.)	--	1.0	--
11	Field Capacity (%)	8.0	8.1	8.3
12	Wilting Co-efficient (%)	14.1	14.3	14.8
13	Available Magnesium, Kg/Ha	2.6	2.9	3.7
14	Organic Carbon %	0.76	0.79	0.89
15	Sodium Adsorption Ratio (meq/l)	8.2	7.6	7.2
16	Cation Exchange Capacity, meq/100g	4.4	4.2	3.6
18	Nitrogen as N, kg/ha	145.0	135.0	125.0
19	Phosphorous as P_2O_5, kg/ha	11.6	12.4	11.9
20	Potash as K_2O, kg/ha	127.2	126.3	132.7

TABLE – 3.6.4 (b)

CHARACTERISTICS OF SOIL

Location: Jhirki Village – SS_2 **Period:** December'08 – March'09

Sl. No	Parameters	Observed Value		
		SS_2		
		(0-30cm)	(30-60cm)	(60-90cm)
1	Soil Texture	Clay Loam	Clay Loam	Clay Loam
2	**Grain Size,%**			
	a) sand	13.6	12.2	12.3
	b) Silt content	32.8	34.9	34.9
	c) Clay content	53.6	52.9	52.8
3	Porosity, %	39.9	40.1	41.0
4	Bulk Density, g/cm^3	0.88	0.91	0.93
5	pH	7.4	7.5	7.8
6	Elect. Conductivity, (m-mhos/cm at 20^OC)	1.06	1.19	1.22
7	Water holding capacity %	8.3	8.5	8.7
8	Liquid Limit (%)	17.3	17.8	18.2
9	Plastic Limit (%)	9.8	10.7	12.8
10	Infiltration Rate (cm/hr.)	--	2.0	--
11	Field Capacity (%)	8.0	8.7	9.4
12	Wilting Co-efficient (%)	0.59	0.58	0.65
13	Available Magnesium, Kg/Ha	3.6	4.0	4.3
14	Organic Carbon %	0.56	0.59	0.62
15	Sodium Adsorption Ratio (meq/l)	4.4	4.0	3.5
16	Cation Exchange Capacity, meq/100g	4.3	4.1	3.5
18	Nitrogen as N, kg/ha	195.0	207.0	215.0
19	Phosphorous as P_2O_5, kg/ha	13.2	14.7	14.4
20	Potash as K_2O, kg/ha	175.0	181.2	186.0

TABLE – 3.6.4 (c)

CHARACTERISTICS OF SOIL

Location: Ambatanr Village – SS_3 **Period:** December'08 – March'09

Sl. No	Parameters	Observed Value		
		SS_3		
		(0-30cm)	(30-60cm)	(60-90cm)
1	Soil Texture	Clay Loam	Clay Loam	Clay Loam
2	**Grain Size,%**			
	a) Sand	11.5	11.4	12.3
	b) Silt content	33.2	34.2	36.3
	c) Clay content	55.3	54.4	51.4
3	Porosity, %	40.2	41.5	42.2
4	Bulk Density, g/cm^3	0.90	0.93	0.96
5	pH	7.4	7.5	7.6
6	Elect. Conductivity, (m-mhos/cm at 20^OC)	1.10	1.14	1.20
7	Water holding capacity %	7.9	7.6	8.5
8	Liquid Limit (%)	16.9	17.4	18.0
9	Plastic Limit (%)	10.1	10.5	11.7
10	Infiltration Rate (cm/hr.)	--	2.2	--
11	Field Capacity (%)	8.2	8.5	9.2
12	Wilting Co-efficient (%)	0.62	0.59	0.63
13	Available Magnesium, Kg/Ha	3.9	4.2	4.5
14	Organic Carbon %	0.62	0.60	0.64
15	Sodium Adsorption Ratio (meq/l)	4.2	4.1	3.9
16	Cation Exchange Capacity, meq/100g	4.9	5.2	3.9
18	Nitrogen as N, kg/ha	199.0	201.4	199.7
19	Phosphorous as P_2O_5, kg/ha	13.0	14.2	14.1
20	Potash as K_2O, kg/ha	179.3	187.7	185.8

Important parameter and their properties of soil quality are given in following tables.

TABLE - 3.6.4 (d)

Sl No.	Parameters	Core zone – OB Dump Kathara OCP- SS_1	Jhirki Village – SS_2	Ambatanr Village –SS_3
1	**Texture**	Sandy clay Loam	Clay Loam	Clay Loam
2	**Plastic limit (%)**	9.5 – 9.9	9.8-12.8	10.1 – 11.7
3	**pH**	7.1-7.7	7.4-7.8	7.4-7.6
4	**Elect. Conductive**	0.31-0.38	1.06-1.22	1.10-1.20
5	**Organic Carbon**	0.76-0.89	0.56-0.62	0.60-0.64
6	**Phosphorus**	11.6-12.4	13.2-14.7	13.0-14.2
7	**Potassium**	126.3-132.7	175.0-186	179.3-187.7
8	**Nitrogen**	125.0-145.0	195.0-215.00	199.0-201.4

3.6.5 Observation

Above analytical report of soil quality suggest that it would support vegetation growth.

CHAPTER - IV
ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

4.0 INTRODUCTION

In this chapter, an attempt has been made to identify the source of environmental pollution and their impact assessment level on human beings, animals and plants in general due to running of this mine in the study area. The environment and their likely mitigation measures in coal mining industries, largely deteriorate the air, water, noise and land quality so, consequently, the ecology. Hence, discussion has been made on preventive and control measures are to be taken for above environmental attributes.

Mitigation measures are broadly divided into two categories namely preventive measures and suppressive measures. Stress has been laid down on adoption of mitigation measures, which are more effective and economical. Detailed description of some of mitigation measures being taken in the various activities are given below:

4.1 Impact assessment on air environment

The operation of this mine generates series of activities which have impact on air quality in the area. Sources of air polluting activities in the study area have been identified and listed below.

4.1.1 Source Identification & description

Broadly there are two types of sources that impact on the air quality-

(A) Mining sources

(B) Non- mining sources

(A) Mining sources-

There are number of operational open coal mines with other industries within the study area. They are as follow-

i) Karo OCP

ii) Konar OCP

iii) Bermo OCP etc

Most of the activities associated with the mining operation, generate pollution and affect air quality. These affect are listed below :–

a) Drilling

It has been discussed in previous section that blast holes are drilled both in overburden / parting strata & coal seams for blasting purposes. Drilling operations generate dust.

b) Blasting

Explosives are used in blasting for removal of Overburden and mining of Coal. Blasting operation also generates dust and noxious gases.

c) Coal Transportation in pits

Blasted mass of coal is loaded at coal face by shovels on Dumpers for transportation to crusher site. Loading of coal at face and off loading at crusher site are also source for dust.

d) Coal Crushing

Run-of-Mine Coal are crushed to pre-determined size. Coal from upper seams are crushed at Crusher house . This operation are a source for generation of coal dust.

e) Coal Dumps

There is a provision for coal storage arrangements. Blowing wind over the coal dump generate coal dust in dry conditions.

f) Overburden Handling

Blasted overburden from the quarry are moved to the dumping site by haul trucks. At dump site, the overburden materials are dumped, dozed, leveled & graded to predetermined level. The overburden handling cycle consisting of all above operations generate dust.

g) Overburden Dumps

Overburden dumps formed as described above are vegetated. Until the time O.B. dumps are vegetated, they constitute a source for dust generation.

h) Haul Roads

Haul roads are major source for dust generation in an open cast coalmines. Haul roads located at surface, are being used for OB transportation only from excavation site to dump site.

i) Transportation by Roads

A dedicated railway siding for transportation of product coal from mine to consumer has been envisaged. Till the coal is being transported by truck from the mine to the nearest railway siding. There is a dedicated back-topped road for this purpose.

j) Coal Loading on Wagons

The product coal brought by trucks are off loaded at railway siding. Thereafter, it is loaded to wagons by shovels. This is another source for dust generation.

(B). Non - Mining Activities

Major non- mining activities contribute to air pollutants are listed below :

i) Road & Rail Traffic

A large number of Diesel operated trucks are being used for transportation of coal and other materials in the area. Road traffic generate noxious gases and SPM in the area. Rail traffic generates coal dust during loading operation.

ii) Other Industries

There are other industries particularly coal based industries i.e. fire brick, coke manufacturing units etc. They produce smoke, SPM and Noxious gases into the atmosphere**.**

iii) **Domestic Fuel**

In the area, coal and firewood are basic source of domestic fuel. Use of such domestic fuel lead to generation of smoke and noxious gases in the area.

4.2 Air Pollution Impact Assessment

All the sources for air pollution are low level and weak. They are combination of area, line and point sources. The air quality, in ambient situation around coal mine, have similar sources that have been monitored for a number of mines for last several years. And it has been found that effect of coal mining on ambient air quality is limited to within 2 Km. beyond the leasehold of mine. The aerial dispersal of dust generated in coalmines also depend on micro-meteorological condition prevailing at that time.

Most of above sources generate dust. Sources of NO_x and SO_2 are due to operation of diesel / petrol based HEMMs and burning of coal only.

It may be seen from baseline environmental data and monitoring data given at previous chapter that the level of noxious gases are low.

The level of SPM / RPM at various monitoring stations is well below the prescribed level. Hence, the air environment has still capacity to absorb the further pollution load.

4.2.1 AIR QUALITY IMPACT PREDICTION

Present area is running mine and major industry activity is going on. Baseline air quality data have been generated for Winter Season- 2008 -09. It is tried to access the air quality impact prediction during running of the mine by using ISCST-3 version of USEPA.

4.2.1.1 Meteorological Data

The meteorological data recorded in core zone of Kathara OCP for Winter season 2008 - 09.The data reveals that calm condition prevails for 28.35%. The predominant wind direction are from North-West (15.09%)

4.2.2.2 Emission Factor and Increase in Ground Level Concentration of TPM

The various operations associated with coal mining result in generation of significant amount of fugitive dust. The dust generation from a particular activity depend upon a number of parameters such as moisture content, silt content, weight of the vehicle, wind velocity, wind direction, etc. The reliable emission factor data or equations for Indian mining conditions have not yet been developed. In this report, the emission factors for Total Suspended Particulates (TSP) mentioned in the study titled "Air quality impact assessment for opencast coal mines", sponsored by the Ministry of Environment and Forest, N. Delhi has been used for estimation of total dust generation due to mining activities. The PM -10 load has been found out by assuming that the respirable fraction in TSP is 50%. This assumption is also supported by the air monitoring data of various coalfields. This study was conducted by the Centre of Mining Environment, ISM Dhanbad. The list of emission factors utilized for the calculation of the dust generation is as follows :-

Table - 1.0: TPM Emission Factor for Various Mining Operations

Source	Material	TPM Emission Factor	Unit
Top soil removal	Soil	0.029	Kg/te
Overburden removal			
Drilling	O.B.	0.59	Kg/hole/day
*Blasting	O.B.	0.00022(A)15,A=area being blasted in sq.m.	Kg/day
Dumper loading by shovel	O.B.	0.018	Kg/te
Transportation in haul road	O.B.	2.25	Kg/vkt
Unloading	O.B.	0.001	Kg/te
Coal Extraction			
Drilling	Coal	0.10	
*Blasting	Coal	0.00022(A)15, A=area being blasted in sq.m.	Kg/day
Loading in dumper	Coal	0.185	Kg/te
Transportation in haul road	Coal	2.25	Kg/te
Coal unloading	Coal	0.033	Kg/te
Size reduction			
Crushing point & feeding point	Coal	2.00	Kg.te

Conveyor point	Coal	0.075	Kg/te
Unloading point of conveyor belt	Coal	1.15	Kg.te
Wind erosion			
Coal stockyard	Coal	2.33	Kg/ha/d
OB dumps (Not reclaimed)	O.B.	2.33	Kg/ha/d

*USEPA emission factor equation, 1988.

(A)**Estimated Control Factors**

The estimated control factors used while calculating TSP generated by various mining operations has been given below :

Table 2.0 : Estimted Control Factors for Various Mining Operations

Operation/Activity	Control method and emission reduction
Scrapers on top soil	50% control when soil is naturally or artificially moist.
Hauling	50% for level I watering (2 litres/m2/h)
Crushing Point and feeding point	>90% for enclosures and dust extraction system
Dust generation at the conveyor point	>90% for enclosures and dust extraction system
Dust generation at unloading point	>90% for enclosures and dust extraction system
Pit retention	50% for TSP
	5% for PM - 10 (Respirable fraction)

```
CO STARTING
CO TITLEONE CONCENTRATION OF TPM FOR KATHARA OCP[1.9MTY]
CO MODELOPT DFAULT CONC   RURAL
CO AVERTIME  1 24
co terrhgts elev
co flagpole 0.0
CO POLLUTID TPM
CO DCAYCOEF      .00000000
CO RUNORNOT run
CO ERRORFIL ERRORS.LST
CO FINISHED

SO STARTING

**        SRCID  SRCTYP    XS      YS       ZS
**        -----  ------  -----   -----    -----
SO LOCATION TOPSOIL  AREA   9950.00   7190.00   .0000
SO LOCATION OBDRILL  AREA   9824.00   7220.00   .0000
SO LOCATION OBBLAST  AREA   9824.00   7220.00   .0000
SO LOCATION  OBLOAD  AREA   9824.00   7220.00   .0000
SO LOCATION OBTRAN1  AREA   9808.00   7222.00   .0000
SO LOCATION OBTRAN2  AREA   9490.00   7418.00   .0000
SO LOCATION OBTRAN3  AREA   9248.00   7424.00   .0000
SO LOCATION OBTRAN4  AREA   9137.00   7391.00   .0000
SO LOCATION OBTRAN5  AREA   9214.00   7244.00   .0000
SO LOCATION OBTRAN6  AREA   9133.00   7090.00   .0000
SO LOCATION OBUNLOD  AREA   9133.00   7090.00   .0000
SO LOCATION CODRILL  AREA   9824.00   7220.00   .0000
SO LOCATION COBLAST  AREA   9824.00   7220.00   .0000
SO LOCATION  COLOAD  AREA   9824.00   7220.00   .0000
SO LOCATION COTRAN1  AREA   9808.00   7222.00   .0000
SO LOCATION COTRAN2  AREA   9490.00   7418.00   .0000
SO LOCATION COTRAN3  AREA   9248.00   7424.00   .0000
SO LOCATION COTRAN4  AREA   9348.00   7696.00   .0000
SO LOCATION COTRAN5  AREA   9621.00   7861.00   .0000
SO LOCATION COTRAN6  AREA   9914.00   8005.00   .0000
SO LOCATION COTRAN7  AREA   9969.00   7810.00   .0000
SO LOCATION COTRAN8  AREA  10162.00   7701.00   .0000
SO LOCATION COUNLOD  AREA  10162.00   7701.00   .0000

**        SRCID    QS      HS     XINIT   YINIT
**        -----   ----     ----   -----   -----
SO SRCPARAM TOPSOIL 0.003360  1.0      11.     10.
SO SRCPARAM OBDRILL 0.000303  5.0      40.     10.
SO SRCPARAM OBBLAST 0.000047  5.0      40.     10.
SO SRCPARAM  OBLOAD 0.004398  1.0      40.     10.
SO SRCPARAM OBTRAN1 0.000045  3.0     400.     50.
SO SRCPARAM OBTRAN2 0.000045  1.0     400.     50.
SO SRCPARAM OBTRAN3 0.000045  1.0     400.     50.
SO SRCPARAM OBTRAN4 0.000045  1.0     400.     50.
SO SRCPARAM OBTRAN5 0.000045  5.0     400.     50.
SO SRCPARAM OBTRAN6 0.000045  5.0     400.     50.
SO SRCPARAM OBUNLOD 0.000036  5.0     400      50
SO SRCPARAM CODRILL 0.000046  1.0      31.     20.
SO SRCPARAM COBLAST 0.000061  1.0      31.     20.
SO SRCPARAM  COLOAD 0.001412  1.0      31.     20.
```

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SO SRCPARAM COTRAN1 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN2 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN3 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN4 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN5 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN6 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN7 0.000057  5.0     200.     25.
SO SRCPARAM COTRAN8 0.000057  5.0     100.    100.
SO SRCPARAM COUNLOD 0.001412  5.0     100.    100.

SO EMISUNIT     1.000E+06 (GRAMS/(SEC-M**2))      micrograms/cubic-meter

SO SRCGROUP ALL
SO FINISHED

RE STARTING
RE DISCCART  11661.  8177.  1.5    1.5
RE DISCCART  10658. 10877.  1.0    1.5
RE DISCCART  20159.  8295.  0.5    1.5
RE DISCCART  16352.  5403.  1.5    1.5
RE DISCCART  14034.  4174.  1.0    1.5
RE DISCCART   7242. 10759.  1.5    1.5
RE DISCCART   8149.  7638.  1.5    1.5
RE DISCCART  10225.  4557.  1.0    1.5
RE DISCCART   7968.  4013.  0.5    1.5
RE DISCCART  16936.  9994.  1.5    1.5
RE DISCCART  11474.  6973.  1.0    1.5
RE DISCCART   4541.  7880.  1.5    1.5
RE DISCCART  13208.  9128.  1.5    1.5


RE FINISHED

ME STARTING
ME INPUTFIL  raj.met  (4I2,F5.0,F8.4,F6.1,I2,2(1X,F6.1))
ME ANEMHGHT     10.0 METERS
ME SURFDATA  99999  2006          SURFNAME
ME UAIRDATA  99999  2006          UAIRNAME
ME WINDCATS    1.54    3.09    5.14    8.23   10.80
ME FINISHED


OU STARTING
OU RECTABLE ALLAVE FIRST  SECOND  THIRD  FOURTH  FIFTH
OU MAXTABLE ALLAVE  50
OU PLOTFILE 24  ALL  FIRST  Kat.DAT
OU FINISHED

**********************************
*** SETUP Finishes Successfully ***
**********************************
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*** ISCST3 - VERSION 02035 *** CONCENTRATION OF TPM FOR KATHARA OCP[1.9MTY]
*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: raj.met
FORMAT: (4I2,F5.0,F8.4,F6.1,I2,2(1X,F6.1))
SURFACE STATION NO.: 99999 UPPER AIR STATION NO.: 99999
NAME: SURFNAME NAME: UAIRNAME
YEAR: 2006 YEAR: 2006

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
06	06	01	01	0.0	0.00	292.3	4	50.0	50.0	0.0000	0.0	0.0000	0	0.00
06	06	01	02	0.0	0.00	294.5	4	175.0	175.0	0.0000	0.0	0.0000	0	0.00
06	06	01	03	0.0	0.00	295.0	3	409.0	409.0	0.0000	0.0	0.0000	0	0.00
06	06	01	04	135.0	0.60	298.2	3	636.0	636.0	0.0000	0.0	0.0000	0	0.00
06	06	01	05	135.0	0.90	300.1	3	850.0	850.0	0.0000	0.0	0.0000	0	0.00
06	06	01	06	135.0	1.30	300.8	1	1048.0	1048.0	0.0000	0.0	0.0000	0	0.00
06	06	01	07	180.0	1.80	301.9	1	1227.0	1227.0	0.0000	0.0	0.0000	0	0.00
06	06	01	08	157.0	52.40	302.8	1	1383.0	1383.0	0.0000	0.0	0.0000	0	0.00
06	06	01	09	135.0	3.10	303.8	1	1514.0	1514.0	0.0000	0.0	0.0000	0	0.00
06	06	01	10	135.0	2.50	306.0	1	1618.0	1618.0	0.0000	0.0	0.0000	0	0.00
06	06	01	11	135.0	2.40	304.8	1	1692.0	1692.0	0.0000	0.0	0.0000	0	0.00
06	06	01	12	180.0	2.40	303.9	3	1735.0	1735.0	0.0000	0.0	0.0000	0	0.00
06	06	01	13	112.0	51.80	302.8	3	50.0	50.0	0.0000	0.0	0.0000	0	0.00
06	06	01	14	180.0	2.40	302.0	2	45.0	45.0	0.0000	0.0	0.0000	0	0.00
06	06	01	15	225.0	1.80	301.5	1	45.0	45.0	0.0000	0.0	0.0000	0	0.00
06	06	01	16	315.0	1.60	299.8	1	45.0	45.0	0.0000	0.0	0.0000	0	0.00
06	06	01	17	45.0	1.30	299.1	1	40.0	40.0	0.0000	0.0	0.0000	0	0.00
06	06	01	18	225.0	0.90	298.1	2	40.0	40.0	0.0000	0.0	0.0000	0	0.00
06	06	01	19	135.0	0.60	296.7	3	45.0	45.0	0.0000	0.0	0.0000	0	0.00
06	06	01	20	135.0	0.70	295.8	4	45.0	45.0	0.0000	0.0	0.0000	0	0.00
06	06	01	21	135.0	0.60	294.8	4	45.0	45.0	0.0000	0.0	0.0000	0	0.00
06	06	01	22	180.0	0.60	293.8	4	50.0	50.0	0.0000	0.0	0.0000	0	0.00
06	06	01	23	225.0	0.70	292.8	5	50.0	50.0	0.0000	0.0	0.0000	0	0.00
06	06	01	24	225.0	0.60	291.9	6	50.0	50.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

*** CONCENTRATION OF TPM FOR KATHARA OCP[1.9MTY] ***

*** THE MAXIMUM 50 1-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***

INCLUDING SOURCE(S): TOPSOIL , OBDRILL , OBBLAST , OBLOAD , OBTRAN1 , OBTRAN2 , OBTRAN3 , OBTRAN4 , OBTRAN5 , OBTRAN6 , OBUNLOD , CODRILL , COBLAST , COLOAD , COTRAN1 , COTRAN2 , COTRAN3 , COTRAN4 , COTRAN5 , COTRAN6 , COTRAN7 , COTRAN8 , COUNLOD ,

** CONC OF TPM IN MICROGRAMS/CUBIC-METER **

RANK	CONC (YYMMDDHH) AT	RECEPTOR (XR,YR) OF TYPE	RANK	CONC (YYMMDDHH) AT	RECEPTOR (XR,YR) OF TYPE
1.	646.27277 (06060122) AT	(10225.00, 4557.00) DC	26.	3.44056 (06060110) AT	(11474.00, 6973.00) DC
2.	387.51767 (06060120) AT	(14034.00, 4174.00) DC	27.	2.80337 (06060109) AT	(11474.00, 6973.00) DC
3.	387.51767 (06060121) AT	(14034.00, 4174.00) DC	28.	2.48156 (06060117) AT	(10658.00, 10877.00) DC
4.	312.79599 (06060119) AT	(14034.00, 4174.00) DC	29.	2.38167 (06060110) AT	(14034.00, 4174.00) DC
5.	168.22409 (06060114) AT	(10225.00, 4557.00) DC	30.	2.37240 (06060111) AT	(14034.00, 4174.00) DC
6.	162.72824 (06060116) AT	(7242.00, 10759.00) DC	31.	2.31651 (06060117) AT	(16936.00, 9994.00) DC
7.	63.13411 (06060119) AT	(11474.00, 6973.00) DC	32.	2.05264 (06060109) AT	(14034.00, 4174.00) DC
8.	62.58578 (06060118) AT	(7968.00, 4013.00) DC	33.	0.38967 (06060114) AT	(7968.00, 4013.00) DC
9.	53.92271 (06060115) AT	(7968.00, 4013.00) DC	34.	0.13656 (06060113) AT	(14034.00, 4174.00) DC
10.	50.93871 (06060117) AT	(13208.00, 9128.00) DC	35.	0.13610 (06060106) AT	(16352.00, 5403.00) DC
11.	46.33922 (06060117) AT	(11661.00, 8177.00) DC	36.	0.13110 (06060107) AT	(7968.00, 4013.00) DC
12.	45.55768 (06060112) AT	(10225.00, 4557.00) DC	37.	0.07755 (06060108) AT	(10225.00, 4557.00) DC
13.	40.34438 (06060104) AT	(14034.00, 4174.00) DC	38.	0.07634 (06060106) AT	(10225.00, 4557.00) DC
14.	40.34172 (06060105) AT	(14034.00, 4174.00) DC	39.	0.04585 (06060110) AT	(16352.00, 5403.00) DC
15.	26.15770 (06060104) AT	(11474.00, 6973.00) DC	40.	0.04566 (06060111) AT	(16352.00, 5403.00) DC
16.	26.15770 (06060105) AT	(11474.00, 6973.00) DC	41.	0.03951 (06060109) AT	(16352.00, 5403.00) DC
17.	8.24717 (06060116) AT	(8149.00, 7638.00) DC	42.	0.02682 (06060115) AT	(8149.00, 7638.00) DC
18.	7.98923 (06060106) AT	(11474.00, 6973.00) DC	43.	0.02571 (06060110) AT	(10225.00, 4557.00) DC
19.	7.07125 (06060106) AT	(14034.00, 4174.00) DC	44.	0.02561 (06060111) AT	(10225.00, 4557.00) DC
20.	6.75847 (06060107) AT	(10225.00, 4557.00) DC	45.	0.02216 (06060109) AT	(10225.00, 4557.00) DC
21.	5.35524 (06060113) AT	(11474.00, 6973.00) DC	46.	0.00375 (06060108) AT	(14034.00, 4174.00) DC
22.	5.33162 (06060113) AT	(16352.00, 5403.00) DC	47.	0.00141 (06060108) AT	(11474.00, 6973.00) DC
23.	4.83509 (06060120) AT	(11474.00, 6973.00) DC	48.	0.00040 (06060112) AT	(7968.00, 4013.00) DC
24.	4.83509 (06060121) AT	(11474.00, 6973.00) DC	49.	0.00000 (00000000) AT	(0.00, 0.00)
25.	3.56728 (06060111) AT	(11474.00, 6973.00) DC	50.	0.00000 (00000000) AT	(0.00, 0.00)

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

*** THE MAXIMUM 50 24-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): TOPSOIL , OBDRILL , OBBLAST , OBLOAD , OBTRAN1 , OBTRAN2 , OBTRAN3 ,
OBTRAN4 , OBTRAN5 , OBTRAN6 , OBUNLOD , CODRILL , COBLAST , COLOAD , COTRAN1 , COTRAN2 , COTRAN3 ,
COTRAN4 , COTRAN5 , COTRAN6 , COTRAN7 , COTRAN8 , COUNLOD ,

** CONC OF TPM IN MICROGRAMS/CUBIC-METER **

RANK	CONC (YYMMDDHH) AT	RECEPTOR (XR,YR) OF TYPE	RANK	CONC (YYMMDDHH) AT	RECEPTOR (XR,YR) OF TYPE
1.	56.31122c(06060124) AT (	14034.00, 4174.00) DC	26.	0.00000 (00000000) AT (	0.00, 0.00)
2.	41.28764c(06060124) AT (	10225.00, 4557.00) DC	27.	0.00000 (00000000) AT (	0.00, 0.00)
3.	7.74896c(06060124) AT (	7242.00, 10759.00) DC	28.	0.00000 (00000000) AT (	0.00, 0.00)
4.	7.06080c(06060124) AT (	11474.00, 6973.00) DC	29.	0.00000 (00000000) AT (	0.00, 0.00)
5.	5.57284c(06060124) AT (	7968.00, 4013.00) DC	30.	0.00000 (00000000) AT (	0.00, 0.00)
6.	2.42565c(06060124) AT (	13208.00, 9128.00) DC	31.	0.00000 (00000000) AT (	0.00, 0.00)
7.	2.20663c(06060124) AT (	11661.00, 8177.00) DC	32.	0.00000 (00000000) AT (	0.00, 0.00)
8.	0.39400c(06060124) AT (	8149.00, 7638.00) DC	33.	0.00000 (00000000) AT (	0.00, 0.00)
9.	0.26661c(06060124) AT (	16352.00, 5403.00) DC	34.	0.00000 (00000000) AT (	0.00, 0.00)
10.	0.11817c(06060124) AT (	10658.00, 10877.00) DC	35.	0.00000 (00000000) AT (	0.00, 0.00)
11.	0.11031c(06060124) AT (	16936.00, 9994.00) DC	36.	0.00000 (00000000) AT (	0.00, 0.00)
12.	0.00000 (00000000) AT (	0.00, 0.00)	37.	0.00000 (00000000) AT (	0.00, 0.00)
13.	0.00000 (00000000) AT (	0.00, 0.00)	38.	0.00000 (00000000) AT (	0.00, 0.00)
14.	0.00000 (00000000) AT (	0.00, 0.00)	39.	0.00000 (00000000) AT (	0.00, 0.00)
15.	0.00000 (00000000) AT (	0.00, 0.00)	40.	0.00000 (00000000) AT (	0.00, 0.00)
16.	0.00000 (00000000) AT (	0.00, 0.00)	41.	0.00000 (00000000) AT (	0.00, 0.00)
17.	0.00000 (00000000) AT (	0.00, 0.00)	42.	0.00000 (00000000) AT (	0.00, 0.00)
18.	0.00000 (00000000) AT (	0.00, 0.00)	43.	0.00000 (00000000) AT (	0.00, 0.00)
19.	0.00000 (00000000) AT (	0.00, 0.00)	44.	0.00000 (00000000) AT (	0.00, 0.00)
20.	0.00000 (00000000) AT (	0.00, 0.00)	45.	0.00000 (00000000) AT (	0.00, 0.00)
21.	0.00000 (00000000) AT (	0.00, 0.00)	46.	0.00000 (00000000) AT (	0.00, 0.00)
22.	0.00000 (00000000) AT (	0.00, 0.00)	47.	0.00000 (00000000) AT (	0.00, 0.00)
23.	0.00000 (00000000) AT (	0.00, 0.00)	48.	0.00000 (00000000) AT (	0.00, 0.00)
24.	0.00000 (00000000) AT (	0.00, 0.00)	49.	0.00000 (00000000) AT (	0.00, 0.00)
25.	0.00000 (00000000) AT (	0.00, 0.00)	50.	0.00000 (00000000) AT (	0.00, 0.00)

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF TPM IN MICROGRAMS/CUBIC-METER **

GROUP ID	AVERAGE CONC (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	646.27277 ON 06060122: AT (10225.00, 4557.00, 1.00, 1.50)	DC	NA
	HIGH 2ND HIGH VALUE IS	387.51767 ON 06060121: AT (14034.00, 4174.00, 1.00, 1.50)	DC	NA
	HIGH 3RD HIGH VALUE IS	312.79599 ON 06060119: AT (14034.00, 4174.00, 1.00, 1.50)	DC	NA
	HIGH 4TH HIGH VALUE IS	40.34438 ON 06060104: AT (14034.00, 4174.00, 1.00, 1.50)	DC	NA
	HIGH 5TH HIGH VALUE IS	40.34172 ON 06060105: AT (14034.00, 4174.00, 1.00, 1.50)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***
** CONC OF TPM IN MICROGRAMS/CUBIC-METER **

GROUP ID	AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	NETWORK OF TYPE	GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	56.31122c	ON 06060124: AT (14034.00, 4174.00, 1.00, 1.50)	DC	NA
	HIGH 2ND HIGH VALUE IS	0.00000	ON 00000000: AT (0.00, 0.00, 0.00, 0.00)		
	HIGH 3RD HIGH VALUE IS	0.00000	ON 00000000: AT (0.00, 0.00, 0.00, 0.00)		
	HIGH 4TH HIGH VALUE IS	0.00000	ON 00000000: AT (0.00, 0.00, 0.00, 0.00)		
	HIGH 5TH HIGH VALUE IS	0.00000	ON 00000000: AT (0.00, 0.00, 0.00, 0.00)		

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

****
*** ISCST3 Finishes Successfully ***
****

4.2.2.4 Resultant Impact

In the following table resultant impact assessment have been computed.

All the parameter are within limit.

Table no. - 4.2.2.4

Sl. No.	Pollutant	Present status $\mu g/m^3$ *	Assessment Increamental $\mu g/m^3$	Resultant $\mu g/m^3$
1.	SPM	241.00	56.31	297.31

*****Max.Value taken

4.3 Impact Assessment on Water Environment

The operation of mining and allied activities of this project would have impact on water quality through generation of waste water in the surrounding area in the ways discussed below. The source of such polluted liquid effluent have their impact on water quality

4.3.1 Impact due to Generation of waste water (Effluent)

Running of mines and allied activities require the water for industrial and domestic purpose. So, there is waste water generation in following ways. The source of such polluted liquid effluent have their impact on water quality are described below :–

i) Domestic effluents

Domestic effluents are the effluent from residential and service buildings. These effluents cannot be discharged either on land or inland water sources without proper treatment. So, every unit of the colony has been provided with septic tanks, soak pit & inspection chamber. One sewerage treatment plant is present in the colony also for treating the domestic effluents.

Necessary test of the domestic wastewater shall be done periodically to maintain its quality.

Colony is within the core zone.

ii) Industrial Effluents

The workshop has been provided in the project for washing all the HEMM. The liquid effluent generated at washing stations and workshop would be polluted with high concentration of suspended solid, oil & grease. These effluents should not be discharged outside. It is to be treated in Settling tank & oil & grease trap. It is near the proposed Workshop. Periodical check -up of this discharge of water would be made to maintain its quality.

TABLE – 4.3.1(i)

Surface Water at a Glance

Parameters	Range of recorded Concn. (Results expressed in mg/l except pH)		
	Minimum	Maximum	Limit as per IS: 2296 Class 'C'
pH	7.1	7.2	6.5-8.5
Total Hardness	80	132	-
Total dissolved Solids	173	197	1500
Chloride as Cl	20	24	600
Sulphate as SO_4	12	40	400
Nitrate as N	1	1	50
Iron as Fe	0.04	0.04	5.0

iii) Mine Drainage effluent

Mine pit would collect water from three sources namely direct precipitation, surface run - off from surrounding area and seepage from various deep-seated strata to the dip most point. This water shall be pumped out to the two sump of approximate storage capacity of 120MGL. This water after settling of suspended solids shall be released into Damodar river.

TABLE –4.3.1(ii)
Mine Discharge Water at a Glance

Parameters	Range of recorded Concn. (Results expressed in mg/l except pH)		
	Minimum	Maximum	Limits As per MOEF Notification
pH	6.8	6.9	5.5-9.0
Total dissolved Solids	552	553	-
Biochemical Oxygen Demand (3 days at 27^0 C)	<2	<2	30
Chemical Oxygen Demand	22	24	250
Chloride as Cl	28	30	-
Sulphate as SO_4	76	80	-
Nitrate as N	1	2	10
Iron as Fe	0.6	0.8	3

4.3.2 Impact due to generation of waste caused by surface run-off

i) Surface Run – off from OB dump

The surface run-off from the OB dump and neighboring area would be polluted with suspended and dissolved solid. This polluted run - off would be channelized thro' the settling tank and subsequently drain into local drainage system leading to Damodar river.

ii) Surface Run – off from coal stack area

The surface run-off from the coal stack area and neighboring area would be polluted with suspended and dissolved solid. This polluted run-off would be channelized thro' the settling tank and subsequently drain into local drainage system leading to Damodar river.

iii) Surface run-off from built- up area

The surface run-off from the built-up area would be polluted with suspended and dissolved solid. This polluted run - off would be channelized thro' the proposed domestic sewage treatment plant already constructed in the existing colony. There is no likelihood of pollution on account of domestic sewage from core zone. The surface run-off would ultimately drain into local drainage system leading to Damodar river.

iv) Surface run-off from mining area

Within the leased hold area, run-off is differentiated into "Clean" area and "dirty" area run-off. "Dirty" area run-off is water coming from stockpile, reclamation, and open cut mining areas etc. and carries suspended and dissolve particles. This polluted run - off would drain into settling tank before discharging it into natural drainage course i.e. Damodar river

"Clean" areas run-off is kept away from entering "dirty" areas through the use of diversions

drains and allowed to drain out into the river directly.

4.3.3. Impact on water sources

i) Impact on surface water quality

The only source of water entering the areas under consideration, are as a result of perception. All nalas have been diverted around the open cut workings, thus reducing the influx of run-off onto the mine site. In addition, diversion drains are used wherever possible to divert clean water run-off around dirty areas to drain out into natural watercourses. Other effluent from industrial and domestic area will be treated before allowing flowing in river. Thus, there is no significant deterioration in the surface water quality.

ii**) Impact on Ground Water Quality**

Quarry operation would not have any impact on ground water quality chemically. Only suspended solids i.e. coal particles would be there and which would be separated by flowing it through sedimentation lagoons.

4.3.4. Impact on Ground Water due to open cast mining

The mining activity causes damage to aquifer materials due to excavation by digging a pit for coal mining under water table condition. This may incise one or more water bearing horizons, which in turn results into induced flow of ground water towards the mine pit. Potential effects of coal mining activities on ground water as well as on surface water include changes in the ground water and surface water storage and modification of rate of relative quantities of direct runoff and ground water runoff.

Continuous dewatering or pumping from the mine leads to lowering of the water table or lowering of piezometric head of the aquifer present above the working coal seam. The aerial extent and long term effect of mining on ground water flow depend on the type of aquifer, its aquifer parameters such as transmissivity, hydraulic conductivity, sp. Yield of the formation, climatic conditions, drainage pattern etc.

The impact on ground water based on field observations made ranges from 150 to 200m from the mine cut. Due to poor hydraulic conductivity and specific yield of aquifer formation around this quarry, the influence on ground water is steep and extends to about 150 to 250 m from the mine cut. Beyond the distance of about 250m there is no impact of mining on ground water.

4.3.5 Conclusion on Water quality Impact Assessment

Sources for waste water and sewage including industrial and domestic have been described above. A brief description of their treatment has also been described in next chapter. Most of the wastewater after treatment is recycled for use within the project.

The surface water quality & effluent being released are monitored regularly. The quality has been found to be complying to prescribed standards.

Hence the pollution levels in the water are well within the prescribed limits & water environment has capacity to take additional pollution load may cause by opening of the project.

So, no serious impact on the water pollution have been envisaged.

4.4. Impact Assessment on Noise environment

4.4.1. General

Noise is usually defined as unwanted sound or undesirable sound in the society's normal day to day activities.

Modern mining involves large-scale utilization of high power machinery operation. These machine involve in generation of structural and aerodynamic noise. Such a noise raises the sound pressure level within the mine and neighboring area. Often these high level noises are prone to cause psychological harm to the people. Many psycho-somatic diseases have relationship such a high noise level.

4.4.2 Methodology to establish noise level exposer: -

Person deployed in surface, mine quarry and underground mining are exposed to no. of noisy activities. If the duration of person exposed to the activities are known, the noise dose of the person can be calculated from the predicated or measured noise level of these activities.

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

4.4.2.1. Intermittent Noise: - Fluctuating noise level with pick value 5 to 15 dBA higher than the back ground noise level may be less damaging than the steady noise level with same equivalent sound level therefore while analyzing the effect of noise on a person working in the mine industry one need to study the intermittent noise of various activity involve.

4.4.3. Sources for Noise Pollution

In coal mining operations, there are several activities / equipments that are source for high noise level. Inventory of these noise producing activities/ equipments are listed & described below: -

- **Drills**: There is provision of several drills for drilling blast holes both in coal seams & OB strata.
- **Shovels** - Shovels have been provided in the project for loading coal and OB materials into trucks.
- **Dumpers** - Dumpers are being used for transporting coal /OB materials from mining area to designated places.
- **Blasting** - In order to loosen the coal OB strata, blasting is being done using explosives. They are instantaneous source for high noise level. Blasting is done once in a day specially during noon time.
- **Other sources** - There are several operations within the workshops that produce noise. But these sources are enclosed & hence its spread is confined.

4.4.4 Type of Noise

Above mining associated activities are the main sources of noise pollution and it may be classified into three categories.

a) Continuous Noise.

b) Intermittent Noise.

c) Impulse Noise.

4.4.5. Noise level of Different Equipment

In order to carry out the noise impact analysis, these HEMMs have been monitored for noise level that they generate.

The monitored noise level corresponding to these HEMMs are listed below –

Table-4.4.6

Sl. No.	Description	Noise level (dBA)	Location
1.	250mm dia Rotary Blast Hole Electric drills for OB	90 - 100	Operator cabin
2.	160 - 200 mm dia Rotary Blast hole drill for coal	85 - 100	Operator cabin
3.	5.0 Cum Electric Rope Shovel	80 - 90	Operator cabin
4.	3.2 Cum Hydraulic Shovel	85 - 92	Operator cabin
5.	50T Rear Dumpers for overburden transportation from face to Backfill area within the pit.	80 - 85	10 m away
6.	35T Rear Dumpers for coal transportation from the face to feeder breaker on mine pit top.	75 - 85	10 m away
7.	Blasting	100 - 120	
8.	scrapper	92-104	Operator cabin
9.	Rotary drill	72-100	Operator cabin
10	Jaw crusher	90-100	Operator cabin
11	Front Loader	87-101	15 m away

4.4.6 Summary

It may be seen from the above table that these HEMMs produce high level of noise. These noise levels are above the prescribed 8-hourly tolerance level. It is also evident that when a combination of these equipments will work at various mining activity centers, the net noise level will be slightly higher than the noise level generated by any individual equipment. Thus noise level around immediate vicinity of activity centers would be above the prescribed tolerance level.

4.4.7 Impact of Noise Level

Besides the adverse effect on health (both mental and physical) the noise has other adverse impact on many attributes of the environment. So the level of noise is an important indicator of the quality of environment. Because of the serious consequences of too noisy environment, the adverse effect of noise need close examination. The adverse effect of increase noise stress can be classified as follows:

Table – 4.4.7

Describing the effect of noise on human being

Type of effect	Consequences
A. Health effect	
i) Auditory effects	- Permanent / temporary hearing loss - Tinnitus (ringing in the ears)
ii) Non-auditory effects	- Vasoconstriction - Gastro- intestinal modification - Endorine stimulation - Respiratory modification - Galvanic skins resistance alt
iii) Masking effects	- Aural - face to face, telephone - Visual distortion, colour blindness - Signals communication interference
iv) Task interference	- Reduced production - Increased error rate - Extended output
v) Sleep Interference	- Electroence phalographic modification (EEG) - Sleep stage alteration - Awakening - Medication
vi) Personal Behavior	- Annoyance - Anxiety - nervousness - Fear - Misfearsance
(B). Economical Effect	- Damage to physical objects - Structural impairment - Property devaluation - land use incompatibility
(C). Effect on fauna environment	- Physiological effect - Disturbance of natural habitat

4.4.8. Conclusion on Noise Impact Assessment

As discussed above chances of further impact on noise level very low, more over the sources for noise generation as described above, are limited to operational area within the active mining area around the mine pit. The distance of villages/ settlements around the mine are away from active mining areas. Hence these activities have negligible impact on noise level in ambient scenario. However workers, who are supposed to render for high level of noise exposer, would be provided suitable mitigation measures as given below:

- Proper designing of plant & machinery by providing in-built mechanisms like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment.
- Routine maintenance of equipment.
- Rational deployment of noise generating plant and machinery.

- Greenbelts around the quarry, infrastructure sites and service building area besides avenue plantation on both sides of the roads to maintain noise level at night time within the limit for the inhabited localities situated at a very close proximity.
- HEMMs with sound proof cabins.
- Chute linings in CHP.
- Personal protective devices to all the persons working in high noise areas.
- Regular monitoring of noise levels at various points.

4.5 Impact Assessment On Ground Vibration Environment

In coal mines, vibration is produced mainly due to blasting used for breaking the rock strata/coal strata. Only a part of energy released by blasting is utilised for useful work i.e. breaking of rock strata / coal strata. Rest of the energy is wasted on ground vibration, noise and air blasting. Effects of noise has already been considered in the previous paragraphs. The effects of vibration and air blasting would be considered here.

Ground vibration are caused by two elastic waves namely surface and body waves which are produced by explosion. Body waves are further classified into two types - namely, compression waves and shear waves. Surface waves travel over the surface of the rock while body waves travel through the mass of rock. It is the surface waves which produce largest ground vibration. Ground vibration depends on the following factors -

- Charge weight
- Geology
- Blast geometric
- Method of initiation
- Delay interval

Ground Vibration effect assessment

Effect of vibration, produced by blasting is similar to earthquake but it power of shocks depend upon the following condition:

a) Duration of shock
b) Charge exploded
c) Distance from shot point
d) Geology conditions

Since vibration produced by blasting is impulse in nature and charged exploded is not very high and more over the nearest habitant is almost 500 m. away from the shot point, so effect of ground vibration almost negligible.

4.6 Impact Assessment on Land environment

The proposed mining and allied activities will alter the land use pattern in and around the mining complex in various way. It is further exaggerated by urbanization, ballooning population, development of infrastructure, etc. Following are the main reason, which impact on the land.

1) Topography and land scenario changed completely due to digging of open pits and overburden in the form of large heap
2) Top soil in and around of surroundings area of mining complex is disturbed due to impact of mining , solid waste and liquid waste and OB dump discharged over the land.
3) Change in the surface and underground drainage pattern due to alteration in topography that subsequently alter soil quality.

As we see from above discussion that we loss the land in two ways,

a) Loss of top soil
a) Loss of land due to degradation

4.6.1 Impact assessment on top soil

Top layer of the earth surface, few meter thick is known as top soil that support vegetation growth. Mining activities damaged the soil regime of the surrounding area directly or indirectly. It damages the soil characteristics, soil fertility, moister contents etc.

Following are the source that damage the soil characteristics:

(A) Under the normal circumstances, the top soil and sub soil is dug out first from quarry area and deposited at the dump sites and buried deep at the bottom of the dump. Thus the large quantity of top soil get lost.

(B) The opening of mines would generate a series of activities that produce air pollution, waste water effluent which ultimately degrade the top soil as well as land.

(C) Opening of mines will provide large opportunity for the job, so population would increase in many fold and will lead to creation of slump, which will ultimately damage the land as well as top soil.

4.6.2 Assessment for Degraded land

The total land requirement for the project works out to be 792.81 Ha. The detailed item wise break-up of total land requirement for the project is given below in Table – 4.6.2

Table No.-4.6.2

Break-up of Present Land Use Pattern (in Ha)

Sl. NO.	Description	Forest land (Ha)	Non-Forest land (Ha)	Total Land (Ha)
1	Quarry(including field-up area, Sump, Haul Road	-	123.73	123.73
2	Quarry Top Extension	-	60.47	60.47
3	OB Dump	-	85.76	85.76
4	Plantation on OB Dump	-	66.00	66.00
5	Colony	-	122.87	122.87
6	Washery	-	7.96	7.96
7	Workshop	-	4.40	4.40
8	Railway Siding	-	11.04	11.04
9	Power Plant	-	11.38	11.38
10	Project Stock Under Fire	-	3.37	3.37
11	Drains with Sump/ Ponds	-	7.37	7.37
12	Ponds	-	2.22	2.22
13	Roads	-	33.29	33.29
14	Haul Road (Outside)	-	3.00	3.00
15	Further Extension / Development/ Green Belt	-	249.95	249.95
	Total**		**792.81**	**792.81**

** Nationalised properties

All land under the project is already acquired long ago. So, GMK & Tenancy land has no significant in this case. There is also no forest land in the leasdhold boundry.

4.7. Impact Assessment on Socio - economic profile

As soon as the mineral is discovered, proved and its mining potential is established, the impact on the society of the mineral bearing area start.

The human society has various attributes such that population, education, religion, cultural, sex-ratio, employment, income and expenditure etc. and most of which are affected by mining activities.

Beside the coal mining activities, there are other associated activities run in the parallel such that coal based industry, washery, transportation, development of business, colony and shopping complex etc.

This mining associated activities in the area have both negative and positive effect on

society. Action has been taken to minimize the negative impact on the society.

4.7.1 Positive impact

i) Coal Production

Due to the development of this project, the country would produce about 0.96MT of extra coal yearly, which will be utilized for industrial purposes.

ii) Employment

With running of the project in the area, direct and indirect opportunities for employment are always present there. In addition to the direct employment in the project, there will be indirect job opportunities in the shape of starting the ancillary industries and their infrastructures.

iii) Infrastructure development

There are well developed connected network inside the colony & with outside of the area such as Tenughat, Asnapani etc

With opening of the project, better road network have been developed. Road passing through the project is diverted to the northern side of the Lease hold boundary to smooth flow of the vehicles of the area.

The power network in the project area are provided to the nearest villages by captive power plant in the project.. With running of the project helps in overall development of the Core and Buffer zone.

iv) Education

Educational facilities have developed greatly since the inception of the project. The project gives a resulting effect into opening of primary school and middle school etc. In the region there are various middle and high school of DAV and other group.

v) Health Care

The project has a full fleadge Hospital for the workers, staff & officers. More over, the project has also run welfare work in health facilities by providing the free health check-up and distribution of free medicines to villager time to time and also organise the free medical check-up camp in the interior villages.

(vi) National Economy

Power is one of the most important inputs for overall development of the nation. In Indian scenario, thermal power remains the economically viable alternative for commercial energy. Thus mining of power grade coal cannot be avoided in present scenario. Import of power grade coal would cost the nation valuable foreign exchange

and landed cost of the imported cost is more than indigenous coal. Moreover import of coal would also mean loss of employment opportunities.

(vii) State Economy

The coal industry pays cess and royalty on per tonne of coal mined to the State Govt. Moreover, the share of the income tax paid by the employees of the project goes to the State Exchequer.

The state also earns revenue by way of collection of other taxes like vehicle taxes, road permit etc.

4.7.2 Negative Impact

i) Loss of Land

Land is the first necessity for any project to get start. The proposed project have already acquired the land of 792.81 Ha.There is no forest land in the acquired area.

ii) Environmental Pollution

The project/mining activities would develop environmental pollution in the area of water, noise, degradation of land etc. which may affect the ecology system of this area. As discussed above ,no major environmental pollution or changed in ecology system are envisaged.

iii) Displacement of Population

There is no displacement of persons. They had already given jobs and economic compensation long long ago.

4.8 Impact assessment on Biotic environment

4.8.1 General :

Mining and allied activities have effect both on biotic and aquatic environment. The assessment of impact on a biotic or physical environment including air, water, land etc. have been covered in previous sections. This section is devoted to assessment of impact on biotic environment and mitigation measures to confine this impacts to a minimum possible.

The impact study covers two aspects of biotic environment i.e. Impact on flora & impact on fauna.

4.8.2 Impact on Flora & Fauna

The area is already in use by mining since pre-independence, so the impact on flora and fauna is negligible that leads to damage flora and thereby driving away the fauna.

Following are the main reasons, which impact on the flora and fauna:

1) Cleaning of area for development the infrastructure, colony, quarry, etc may require the removal of vegetation cover, forest and land pattern thereby driving away the fauna.
2) High level noise and vibration due to HEMM and blasting scare the fauna that finally force the fauna to move for safer places.
3) Urbanisation, ballooning population, development of infrastructure etc. damage the habitant pattern of fauna, feel the disturbance in their activities and find difficulties to get their food. These problems force them to go away to safe places
4) Besides the terrestrial ecology the aquatic ecology is also get affected by mining activities due to discharge of mining effluent and other residential effluent.

4.8.3 Impact assessment on flora & fauna

As mentioned in previous chapter the study area is classified as class 'B' forest as such there is no rare, endangered or endemic species of flora & fauna is found during the study.

There is no danger to aquatic life in core zone due to absence of any water body within it.

There are no bio sanctuaries, national parks, bio- sphere reserve and major 'gene pool' in the study area including core zone, so there is no major loss of flora and fauna.

As stated above, the impact of mining activities on floral environment are mostly confined to core zone.

Area of this degraded land would be same as envisaged in the original project report.

The impact on flora due to mining activities will lead to reduction in vegetation cover which shall be later reclaimed by plantation.

4.9 ENVIRONMENTAL POLLUTION CONTROL MEASURES

The causes of pollution, generated in the surrounding environment and their impact due to mining and allied activities, have been discussed in details in preceding chapter. Certain control and protective measures are to be taken during generation of pollution to maintain the sustainable ecology.

Coal mining industries, largely deteriorate the air, water, noise and land quality, so, consequently the ecology. Hence, in this chapter, discussion has been made on preventive and control measures are to be taken for above environmental attributes.

Mitigation measures are broadly divided into two categories namely preventive measures and suppressive measures. Stress has been laid down on adoption of mitigation measures, which are more effective and economical. Detailed description of some of mitigation measures being taken in the various activities are given below :

4.9.1 Air Pollution Control Measures

Air Pollution Control Measures are broadly divided into two categories namely preventive measures and suppressive measures. Main stress has been laid down on adoption of preventive measures which are more effective, economical and eco-friendly, however, suppressive measures have also been taken.

4.9.2 Preventive Measures

Detailed description of source generating pollution in air due to mining and allied activities and their preventive measures are given below :

(A) Drilling Operation

Drilling of blast holes both in OB strata and coal seams with Drills, constitute one of the major source for dust generation. It is proposed to procure Drills, which are fitted with dust collection and disposal unit. This fixture collects dust in bags, which can be replaced once it is full.

(B) Blasting

In order to minimize generation of dust during blasting and its better dispersal in atmosphere, following steps are to be taken :

i) Number of blast holes & their geometry has to be designed for each blasting, considering the mass of material to be removed and also their geological formation.

ii) The quantity of explosives i.e. charge weight for each blasting are to be determined correctly & used. Over charging of blast holes cause formation of fine dust of OB & Coal. For this purpose, excavation category of both OB & Coal has been determined.

Mitigation measures listed at (i) & (ii) above would help in minimizing formation of coal & OB dust.

iii) It is suggested that blasting operation should preferably, be carried out during noon time. This will ensure proper ventilation of dust & consequently better dispersion & dilution. This should be avoided during period of possible temperature inversions i.e. morning & evening.

(C) Haul Roads

In opencast mines, a movement of HEMMs on haul roads is major source for dust generation. It account almost 40% of total dust generation in coal mining activities. In order to check dust from this source, following mitigation measures are suggested:

i) It is suggested to sprinkle water regularly on haul road. For this purpose, two no. water sprinkler of 28 KL capacity has been provided for the mine.

A Pilot Project has been taken up to test efficiency of using chemicals as dust suppressor. Once their effectiveness is established, they should be used with water for dust suppression.

ii) It is suggested to maintain the haul road regularly. Pot holes should be filled up and graded with graders.

iii) spill over Coal or OB should be removed regularly from the road**.**

iv) It is suggested to provide avenue plantation on both sides of the haul road. This should include 3 rows of trees with shrubs.

These avenue plantation act as wind shield & prevents from blowing away of dust from roads.

D) Coal Crushing

Coal crushing will generate coal dust. In order to suppress the coal dust produced in the process, following measures are suggested.

Water jets will be provided in the Feeder Breaker and crushing area to control the dust during dumping and crushing of coal. Necessary water tanks and pumps will be provided.

E) Coal Handling Plant

The following measures would have to be taken to check dispersal of dust :-

(a) It is proposed to provide water jets at all transfer points. Moisture in coal will prevent dust from being air borne.

(b) It is proposed to enclose the belt conveyor from both sides and top, this will prevent the coal dust from mass at belt to be air borne.

(c) In the wagon loading arrangements, the height of fall should be minimised by using chutes.

F) Coal Stock

Coal stock near the surge bunker is another source for generation of coal dust. Following mitigation measures are recommended:-

It is suggested to provide green belt consisting of 3 rows of trees around the bunker & surrounding area for coal stock. This will break the blowing of wind & prevent the dust from being air borne. Moreover, the trees would absorb airborne dust.

G) Reclaiming Overburden Dump

Overburden materials produced while mining of coal is dumped either outside the open pit or dumped within the decoaled pit. These materials are generally dumped in loose form consisting of different sizes, ranging from very fine to large particles.

Smaller particles are generally carried out to different places by wind action and pollute surrounding air. Therefore, it is suggested to reclaim the OB dump as soon as dumping operation finishes to check wind erosion.

On perusal of the impact assessment in the Para of this Section, it is evident that the mining and allied activities associated with this project would have impact on ambient

air quality. The main air pollutant would be Suspended Particulate Matter (SPM)

4.9.3 Suppressive measure

After adoption of various suitable preventive measures like dust suppression, wet drilling, controlled blasting etc. against the air polluting activities arising due to mining operation, it is also necessary to use some suppressive measures to mitigate any residual effect of pollution. Green belt is one of the natural suppressive and economical measures mentioned here.

4.9.3.1 Green Belt

Various preventive mitigation measures have already been recommended to control air pollution caused by mining activities. Green belts have proved effective to suppress the air pollution, soil erosion, water pollution and it has also effective in carbon sequestration. Green belts provide much needed fuel wood, fodder, food, forest, minor forest produce (MFP), and non wood forest products (NWFP). Different type of green belts have been provided in the project area at strategic locations which are described below.

(A) Avenue Plantation (AP)

This includes plantation of Trees/Hedges on both sides of different road i.e. Haul road, Link road to mine, access road to township and Township roads.

Objectives of providing avenue plantation are:

1) They act as wind shield and thus breaks wind speed. This helps in prevention of dust at road surface from getting air borne.

2) They provide shade.

3) They absorb air borne dust.

4) They absorb noise energy and thus reduce noise pollution

Details of different type of avenue plantations proposed in the project are detailed below

(i) Avenue Plantation along Haul Road (APH)

It is proposed to provide three rows of trees on both sides of Haul Road. In addition one row of hedges is to be provided on leeward side.

(ii) Avenue Plantation along Township Roads (APT)

It is proposed to provide one row of trees along both sides of the township roads. The total no of trees (approx.5250 saplings) to be planted along the roads would be maintained in a 3meter wide green belt on both sides of the road. Species of trees/hedges recommended for Avenue Plantation are listed in table 4.9.4

(B) Strip Plantation (SP) -

Strip plantations are single/ multiple row linear Plantation provided around the area, likely to generate air pollutant.

Basic objectives of providing strip plantation are -

- To act as wind shelter and prevent air pollution.
- To act as a natural sink to absorb dust and sequester carbon.
- To act as a medium to absorb noise energy and reduce noise pollution.

Types of Strip Plantation

Various types of strip plantation to be used in this Project are described below :

i) Strip Plantation around Mine Pit (SPM)

This type of strip plantation are to be provided around the quarry. This would consist of 10 rows of trees.

ii) Strip Plantation around Service Buildings (SPB)

These green belts are to be provided around Service buildings, industrial complex etc. These green belts help in protecting the buildings from air pollution generated by mining activities.

This would consist of at least in 2 rows of trees.

iii) Strip plantation along Streams (SPS)

A number of local streams pass through the Mining area. The terrain being hilly, the banks are steep and thus they are subjected to erosion during heavy rainfall.

With this in view, it is proposed to provide multi row strip plantation along the banks of local streams. It is proposed to maintain approx. 1.8 Km. Long and 3 meter wide strip plantation along the Damodar River bank on the Core zone side and the no of saplings comes to approx. 1400. Some low height shrubs are also proposed to be planted for effective soil conservation.

(C) Block Plantation (BP)

There are some plots of land within project area and the township for which no specific use has been identified. It is proposed to use them for mixed plantation. Such block plantation include block plantation in Township (BPT), block plantation in Interface Area (BPI). Interface area is the strip of land between active mining area and nearest village/ human habitation.

i) Block Plantation in Townships- (BPT)

a) Broad objectives of providing (BPT) are :

i) Improvement of the general environment

ii) Improvement in aesthetics view.

iii) Source for fruits & fodder.

ii) Block Plantation in Mining Area (BPM)

These block plantations are located within the project area.

a) Broad objectives of these block plantation are:

i) Control of air pollution

ii) Checking the soil erosion

iii) Improve ground water recharge/water table

iv) Act as shelter belt

III) Block Plantation in Interface Area (BPI)

As per land use plan, the affected villages in core zone are screened by providing a green belt in interface area for protecting the villages from environmental pollution.

a) Basic objectives of block plantation in interface (BPI) are :

i) Check environmental pollution.

ii) Provision of a visual barrier between mining area and villages.

iii) Provision of a source for minor forest produce (MFP) and non wood products (NWP)

4.9.4 Selection of species-

A great attention is required for selection of species for the plantation above the physically reclaimed land. Any wrong selection of species would adversely affect reclamation programme/pollution control measure.

Choice of species depend upon various factors.

The selection plant species for reclamation of land depend upon the various factors such as goal of achievement, characteristics of soil, location, ultimate land use etc. In present context the species should have :

1) Economic important

2) Aesthetics value

3) Ecologically sound

4) Matching with the indigenous habitants

5) Sources of fruits & fodder.

Along with the above, the species should be:

1) Able to survive in high pollution land.

2) Suitable to the local climate.

3) Requirement to the local habitant.

4) Matching with indigenous habitant.

The species selected for aforestation on the OB dumps and also in the other areas should be of mixed type having a combination of fast and slow growing species with an ultimate aim to have triple storey plantation i.e. a combination of species of tall, intermediate and short height. A list of the species suggested for afforestation is placed below. However, in any case monoculture will not be adopted, because ecologically these are more unstable communities.

As far as possible, only local species like Amla, Chiroj, Imli, Mahua, Jamun, Kusum etc. are proposed to be planted. List of some suggested plants with their botanical name are given in the following table according to situation and needs.

Table- 4.9.4

Sl. No.	**Plant suitable for Avenue & strip plantation**	**Plant suitable for block plantation in mining area**	**Plant suitable for block plantation in township & village side**
	Name of plants	**Name of plants**	**Name of plants**
1	Zizyphus mauritiana(Ber)Shrub	Emblica officinalis (Amla)	Emblica officinalis (Amla)
2	Acacia auriculaeformis Cassia tora (Evergreen)	Buchanania latifolia (Chiroj)	Buchanania latifolia (Chiroj)
3	Syzygium cumunil (Jamun) S.persica (Evergreen)	Tamarindus indica (Imli)	Tamarindus indica (Imli)
4	Hardwickia binata (Anjan)	Artocarpus lakoocha	Artocarpus lakoocha
5	Delonix regia (Gulmohar)	Madhuca indica (Mahua)	Madhuca indica (Mahua)
6	Ficus religiosa (Pipal)	Eugenia jambolina (Jamun)	Eugenia jambolina (Jamun)
7	Acacia Nilotica (Babul) (Evergreen)	Ricinus communis (Arandi)	Ricinus communis (Arandi)
8	Azadirachta indica (Nim) (Evergreen)	Terminalia Belerica (Bachera)	Terminalia Belerica (Bachera)
9	Eucalyptus cirtiodara	Pongamia Glabra	Pongamia Glabra
10	Gravellea robusta	Schleichera oleosa (Kusum)	Schleichera oleosa (Kusum)
11	Pithecellobium dulce (Evergreen)	Emblica officinalis (Amla)	Aegla marmelis (Bel)
12	Zizyphus mauritiana(Ber)Shrub	Buchanania latifolia (Chiroj)	Terminalia chebula (Harra)
13		Tamarindus indica (Imli)	Zizyphus xylopyra (Ber)
14		Artocarpus lakoocha	Acacia catchu (Khair)
15			Artocarpus integrifolia (Kathal)
16			Pterocarpus marsupium (Bija sal)

17			Azadirachta indica (Nim)
18			Buchania latifolia (Piar)
19			Mangifera indica (Mango)
20			Terminalia tormentosa (Asan)
21			Diospyras melanaxylon (Kend)
22			Butea frondosa (Palas)
23			Terminalia arjun (Arjun)
24			Zyzyphus mauritiana (Ber)
25			Albizia lebbeck (Siris)
26			Albizia procera (White siris)
27			Moringa oleifera (Sahjan)
28			Leucaena latisiliqua (Subabul

4.10 Management for Water Environment.

4.10.1General

It is discussed in the last chapter that the operation of the mines and allied activities will be polluting the water resources, generally by the following three ways.

A) Effluent from the various sources

B) surface run-off from dirty area

C) Disturbance in local hydrology

4.10.2 Water pollution control measure

So keeping the above view, following control measures have been envisaged right from the planning stage.

i) Mine lay out has been so planned in such a way to prevent water pollution as much as possible.

ii) Preventing from mixing of clean and dirty water by making of suitable diverting channel..

iii) Recycling of polluted water after treatment, zero effluent from workshop, CHP, etc.

iv) The quality of effluents should conform to standards laid down in IS- 4764 (Tolerance limit for sewage effluents discharged into inland surface water & IS -2490 tolerance limit for industrial effluents discharged into Inland surface water.

Following are the various type of water control measures, which have been suggested in the taken in the project.

(1) Control measure for waste water (effluent)

(a) Municipal Sewage

Septic tank and soak pits have been provided for the treatment of municipal sewage. Every housing unit have been provided with septic tank and the outflow is led through soak pit.

(b) Industrial Sewage

The water used for washing of dumpers and other HEMM's is being collected through surface drains. It is allowed to pass through oil and grease traps. The outflow is collected in a

sedimentation tank of sufficient capacity. The outflow from the sedimentation tank is recycled for industrial, reclamation and other purpose.

(c) Mine Drainage

During the dry weather season, the quantity of mine discharge is not so high to discharge. Some collected mine would be used for dust suppression on road and other purpose. In rainy season the mine water is collected lagoon made on lowest working seam then excess water is pumped in a sedimentation lagoon created on the surface of quarry . The overflow should conform to IS 2490 & it is be directed to the natural drainage course which finally join Damodar river. The size of the lagoon should be large enough to accommodate monsoon mine drainage water. The Lagoon shiold be dredged & cleaned during dry season.

(2) Control measure for surface run-off

(a) Surface run-off from leased out area

Within the above regions, run-off is differentiated into "Clean" area and "dirty" area run-off. "Dirty" area run-off is water coming from stockpile, reclamation area, open cut mining areas etc. and, therefore, normally require treatment prior to discharge. "Clean" areas run-off is water, which passes through the undisturbed area and would be prevented from entry to "dirty" areas through the use of diversions drains and allowed to discharge the water into nearest natural drain directly because it does not need treatment.

(b) Run - off from Coal/ O.B. Dumps

Drains are provided around the coal/O.B. dump to check the surface run -off flowing into it and also to collect run-off coming from the dump-sites. This drain conveys the intercepted water into sedimentation lagoon.

(c) Run -off from Built - up Areas

Open drains have been provided along the roads, in workshop, and other service buildings. These drains will collect the water from built up area and lead it to natural drains.

(3) Control measure for depleting of ground water

Scheme for rain water harvesting has been proposed in this project. This shall be implemented in the leased hold area. There has been check dam and recharge well for this purpose.

(4) Control measure for quality of water

Regular monitoring would be done on surface water bodies, up stream and down stream of river/ nala, open well and ground water to assure the quality of water and accordingly control measure would be taken to ascertain the quality of water.

4.11 Noise Mitigation Measures

Sources of noise & their impact on work zone & ambient locations have been discussed earlier. It is obvious that impact of noise arising out of mining and allied activities is mostly confined to work zone or mine lease area. The results of noise monitoring shows that level of

noise at various ambient locations are within the prescribed level, even though some mitigation measure have been suggested.

(A) Mine Area

(a) The high quarry edges would act as noise screen. It will create noise shadow on leeward side.

(b) It is proposed to enrich this forest cover and also plant trees in non forest area around the mine area. Thus a forest cover of 300 m would be created to absorb noise energy & reduce the noise level on Leeward side.

(B) Coal processing Area

It is proposed to take following noise abatement measures in this area.

(a) Enclose the crusher so that noise generated by the crusher is not allowed to travel

(b) Enclose the conveyor belt on sides & top. This would prevent spread of noise generated by moving belt.

(c) Plant two rows to trees on either side of the conveyor.

(d) Fix rubber linings on chutes. This reduces noise generation.

(a) The foundations of vibratory equipments are to be designed with isolators. This would prevent generation of ground vibration created by equipments.

(C) Road

Coal trucks would ply on this road to transport coal from the Feeder Breaker to loading point. Thus noise would be generated by moving trucks. Following are some mitigation measures.

(a) It is proposed to plant three rows of trees on either side of the road.

(b) This road is to be black topped & maintained in good conditions.

(c) Engine of the dumper will be maintained properly to reduce the noise.

(D) Dumps Area

It is proposed to provide a green belt of 100m width between dump site and the village located in the near by vicinity side.

(E) General

In addition to above proposed site specific noise abatement measures, a number of other measures are also proposed. They are discussed below.

(a) It has been observed that the ill-maintained HEMMs are sources for high noise level. It is recommended to keep the vehicles in good running conditions. Regular scheduled & repair maintenance should be carried out at prescribed interval.

(b) During the procurement stage, the equipment specification should include a clause on maximum noise level of the equipment.

(c) The cabins of HEMMs should be sound proof & it should be maintained properly.

(d) Persons working in work zone and likely to be exposed to high noise level should be supplied with ear plugs.

(e) Persons working in high noisy environment should be rotated. This system has limited applicability in mines in view of skill requirements of various jobs, job grading system etc.

(b) In work zone, noise protective outfits are supplied to workmen operating under high noise zone.

4.11.1 Blasting & Vibration Control Plan

Only a part of energy released by blasting is utilised for useful work i.e. breaking of rock strata. Rest of the energy is wasted on ground vibration, noise and air blast. Effects of noise has already been considered in the previous paragraphs. The effects of vibration and air blast would be considered here. Ground vibrations are caused by two elastic waves namely surface and body waves are further classified into two types, namely compression waves and shear waves. Surface waves travel over the surface of the rock. It is the surface waves which produce largest ground vibration. Ground vibration depends on the following factors :

* Charge weight
* Geology
* Blast geometry
* Method of initiation
* Delay interval

4.11.2 Factors for Safe Blasting

The following factors would be taken into account while blasting is planned :

- Quantity of explosive -
  Over charging has to be avoided. For rock strata it is around 0.3 kg/cum.
- Stemming length.
  Stemming material to be used is sand.
- Initiation system.
  Use of millisecond delay detonator between rows and between holes in the same row.
- Blasting time.
  The blasting should be done at a fixed time. Blasting is to be avoided during active hours. It should be carried out when there is favorable weather condition. Adverse wind direction, low cloud ceiling, temperature inversions etc. should be avoided.

If the factors mentioned above are considered during planning for blasting, it is expected that vibration would not cause damage to any structure or annoyance to the people in the neighboring villages.

A safe blasting zone has been kept around the periphery of the mine pit. The zone is 300m wide and this zone would be left open for safety purposes. All the important infrastructures located within this safety zone have been designed taking into consideration the irrational effects.

4.12 LAND RECLAMATION & MANAGEMENT

As we know open cast mining completely change the topography of the area i.e. Create large open deep excavation pit and huge high O.B. dumps. As the dump materials are in loose state and surface do not conforms to natural angle of repose. So in this conditions, unless they are treated, are venerable to erosion caused by blowing wind and surface run-off. Continuous erosion of deep slope may lead to slope failure causing loss of property and life. Such a untreated dumps constitute a potential source air and water pollution and safety hazard for employee.

The proposed mine and allied activities would alter the land use pattern of 792.81 Ha. of non-forest land. This change will be for doing quarry operation, O.B. dumping, infrastructure and haul road. Hence, land reclamation scheme would be done for:

- Conservation & Reclamation of top soil
- Reclamation of O.B. dumps (external & Internal)
- Reclamation of degraded land, quarry pits and etc.

4.12.1 Objectives

Broad objectives of the land reclamation scheme envisaged for the project are summarised below :

Land derelicted by mining operation are potential source for air & water pollution. One of the basic objectives of the reclamation scheme for the land is to make the affected land useful.

a) Dereliction of land renders the affected land non-productive. Land reclamation process would turn them to be gainfully productive.
b) Mining & dumping process damage the biotic environment of the affected area, thus upsetting the local ecology. The land reclamation process is designed to restore the disturbed ecology of the area.

4.12.2 Conservation & Reclamation of Top Soil

Top soil is essential for the biological growth on any land. Mining operation disturbs the top soil in the area and unless due care is taken, it is likely to be lost on account of improper handling and its burial under the overburden or mine spoil dumps. In a reconstructed soil,

spreading a layer of top soil is essential as OB/mine spoil can not sustain vegetation. Hence a top soil is proposed to be conserved for its reuse.

General practice for top soil conservation are :

A) Assessment - Evaluating the quality of the top soil relating to its usefulness for soil reconstruction scheme.

B) Time - Determination of time phase for removal of top soil and suggest methods to be used for its removal.

C) Removal -To conserve the top soil, first it will be scrapped out from quarry and dump site before drilling and blasting with the help of scrapper every year before on – set of monsoon and should be stacked at safe place so as it can be available when ever required for reclamation and other purpose. After physical reclamation of lands a 400-500 mm thick layer of top soil would be spread over to make the land suitable for biological reclamation.

D) Storage - For longer period storage of top soil it would need some preventive measure to save it from the deteriorating of quality. If top soil have to store for more than one year then it will be planted with Grass and other small plants on the top of the soil, berm and slope and it should be stacked at safe places in layers.

4.12.3 Reclamation of O.B. Dumps

Over Burden dumps (external or Internal) needs the continuous parallel process of reclamation with mining works till the closer of mines. After close of mines it needs reclamation of whole area to improve the over all aesthetics view in such away that area become the source of income for the local inhabitant.

On account of quarry & overburden & coal stock, the degradation of land is 273.33 Ha.

Out of 273.33 Ha. of land, 66.00 Ha(approx). of land of OB has been reclaimed by plantations. And this process is continued upto the last stage of land reclaimation.

There is vacant land & green belt of about 249.95 Ha already in the project itself.

4.12.4 Reclamation of Degraded Land

The proposed mining and allied activities would alter the land use pattern completely of 269.96Ha. of land for the use of digging of quarry & OB dump. Land use pattern of the 272.90 Ha. would be modified for the making the infrastructures i.e. haul roads, office, workshop, colony, washery, Rly. Siding,FBC power plant , coal stock, lagoon roads etc.

There are 249.95 Ha of vacant land & green belt in the core zone.

Reclamation for these above land will be discussed here.

Plantation has been done on 66.00 Ha of land on the OB dump already.

It has been already stated in above that the land reclamation scheme has been designed to reclaim quarry and OB dump area. Land reclamation may be defined as a process to

restore the degraded land (other than quarry and O.B.dump) to productive, useful, non-polluting and aesthetic uses. Land Reclamation does not mean restoration of the degraded land to the pre-mining land pattern.

There are several options available for land use pattern for reclaimed land. Factors discussed below have been considered for selection of appropriate land use pattern for reclaimed land.

(i) Pre-mining land use pattern
(ii) Properties of top soil/sub-soil
(iii) Socio-economic factors
(iv) Availability of technology for reclamation
(v) Climatic condition
(vi) Existing Flora & Fauna in the area.

The option for using the reclaimed dumps and backfilled area for agricultural purpose (As pre-mining condition) have been ruled out due to the following reasons :-

- **Quality of topsoil/sub-soil is poor**. The reclaimed land which is very different from the pre-mining condition cannot sustain crops generally grown in the area earlier without improvement and development of various soil horizons. The development of soil for agriculture would take time.
- **The area has less irrigational facilities**. The agriculture in the area is done mostly under rain-fed condition. The quality of soil of the region is poor and yield per hectare is low. So agriculture may prove an uneconomic venture as compared to afforestation.
- **The reclamation is carried out concurrently with mining operation**. Carrying out agriculture within mining activity area by releasing the reclaimed land in phase wise manner is not safe and advisable.

In view of the above, it was decided that the land would be reclaimed for raising mixed plantation that helps in :

- Restore disturbed ecology
- Accumulating nutrients in plants as well as in soils ;
- Fulfill the local demands of forest produce.
- Changing in soil structures due to activities of plants and animals ;
- Reducing toxicity levels of soil.
-

4.12.5 Procedure for Land Reclamation

Land reclamation is essentially an activity running concurrently with dump formation or back filling process. As the dump materials are in loose state and slopes does not conform to natural angle of repose at this condition, unless they are treated, and they are subject to erosion caused by agencies namely blowing wind and surface run-off.

Continuous erosion of dump slopes may lead to slope failure causing loss to property and life. Such type untreated dumps constitute potential source for air and water pollution and safety hazard for employees. With this in view, the dumps are proposed to be reclaimed physically and biologically.

The total quantity of OB from this mine is estimated to be 42.64 M m^3. The management of OB shall be as given below:

S No.	Particulars	OB in M m^3	Remarks
1	OB already removed & dumped	360.43	Externally
2	OB yet to be removed & dumped	10.00	Externally & internally
Total estimated OB		**370.43**	-

An additional financial provision of Rs 237.18 Lakh has been made for physical, biological reclamation and for others requirement during minning of the mineed out area.

4.12.5.1 Physical Reclamation

Physical reclamation is first stage of land reclamation. In this stage of reclamation, the geometrical shape of the dump is altered to render it suitable for biological reclamation and make it stable and safe. Once the determined level are attained in the backfilled area, it is to be properly leveled and graded. Top soil layer (450-600 mm thick) is to be spread over the prepared surface. Now this is ready for biological reclamation. In addition, proper drainage arrangements are made for collection and disposal of run-off from dump body. Process of physical reclamation of external OB dump and internal dump are discussed below :-

(A) OB Dump

(i) **Reshaping of the Backfilled Area /de-graded land**

In normal course, dumped materials assume face slope equivalent to Angle of Repose of material which is about 35 deg.-40 deg. This is not optimal to check erosion and to grow vegetation. Greater is the slope, higher would be erosion. It is thus proposed to flatten the slope to 27 deg. To 28 deg. This can be done by dozer, adopting cut and fill method.

(ii) Grading and Compaction of Flat Surface

The flat surface at the top of the dump is compacted and properly graded. The gradient at top should be about 2%.

(III) Drainage Scheme

Un-vegetated dumps experience heavy erosion due to surface run-off leading to siltation and other associated problems, which renders the dump unsuitable for

biological reclamation. Surface run-off from such dumps are laden with silt load which pollutes the streams and choke them. It is, therefore, suggested to provide proper drainage system for dumps.

(a) Catch Drain

An open drain (1 x 0.5m) is to be provided on inner edge of the ramp. Ramps are provided with cross slope towards the bench slope. This drain will collect water from ramps and bench slopes and carry them to Foot drain at the bottom of the dump.

(b) Foot Drain

A foot drain (3x1.5m) is to be provided at the bottom of the dump all round. This drain collects surface run-off from Dump. This drain is connected to sedimentation lagoon. Overflow from sedimentation lagoon will flow into natural drain i.e.Damodar River.

(iv) Top Soil Spreading :

Once the dump has been reshaped as per design and drainage arrangements are made; a layer of top soils (30-45 cm thick) is spread over the dump surface. This is dozed and leveled uniformly.

With the spreading of top soil layer, the physical reclamation of the dump is over & it is ready for biological reclamation.

(B) Biological Reclamation :

Biological reclamation of the dump constitutes second & final stage of land reclamation scheme. Basic objectives of biological reclamation may be grouped into two classes namely: Short - Term objectives and Long Term objectives.

Short-term Objectives

Short term objectives of biological reclamation are summarised below :

a) To grow quick growing grasses which can check the soil erosion from the dump surface.

b) To grow leguminous plants, that can improve the soil quality.

c) To grow grasses / herbs that can provide shelter & food to the wild life.

d) To establish different life form that can restore the disturbed ecology of the area.

Long Term Objectives

Long term objectives of biological reclamation are briefed below :

a) To grow trees that can yield fodder, fuel, food and timber for construction of houses and making agricultural implements.

b) To grow trees that can afford site protection on long-term basis.

c)To grow trees of diverse species that can restore and maintain the local ecology.

4.13 Plantation Technique :-

As soon as the physical reclamation is over, biological reclamation of the land is taken up. Biological Reclamation is carried out in following order.

a) The area to be planted is to be fenced to protect plants / seeding from grazing. If the area is not protected, efforts for biological reclamation may not be successful.
b) For plantation of trees, holes (450 x 450 x 450) are dugged at (5m x 5m) spacing. These holes duggged in April / May. Neem cakes are used in these holes as insecticide. The holes are be left as such till the break of the monsoon.
c) Once monsoon breaks, seedlings are planted & holes filled with the prepared & amended soil.
d) During monsoon, there is no need for regular watering.
e) Regular weeding & hoeing are done.
f) Along with the plantation of trees, grasses and shrubs are planted on the reclaimed land.

4.14 Conservation Plan For Flora & Fauna

. The leasehold area of mine (Core zone) covers 729.81. of land where as buffer zone covers 395.07 Km^2. Core zone area is actually Block of Bermo. Buffer zone comprising the area within a radial distance of 10 km from the periphery of the core zone. The project lies in the north part of Damodar river. The proposed Kathara OC Project falls under Bokaro District of Jharkhand State. The district of Bokaro was created in 1991 out of Dhanbad and Giridih district. The forest type of the Kathara OC Project area may be classified as - Northern dry mixed deciduous forest and dry plain Sal forest.

Our scope of work is limited to preparation of conservation plan for flora and fauna specially for endangered and endemic species in the above core zone and buffer zone only.

4.14.1 Major feature in the study area:-

No major historical monuments or public interest places are present in the study area. There are no National Park, Tiger or Elephant Reserve and corridor for animals of schedule I & II under the wild life (Protection) Act.1972

The concern area may be considered as the industrial area because the various type industrial activities are going on i.e.. mining and their allied activities.

4.14.2 Flora & Fauna in the study area: -

Study for flora and fauna has been done by PDIL, Sindri in winter season (Dec'08–March'09) Depending upon the type of species, the forest of the Buffer Zone in study area belongs to Northern dry deciduous forest and dry Sal forest.

(A) Flora –

Main agricultural crops are Rice, Maize , and Arhar ,khesari, Coriander ,Garlic Urad Sarison Tisi, Brinjal , Tomato, ,Kohra, kundri, Kakri, Kathal, Ber, Bel etc. .

Main constituent of the forest are Palas, Sal, Sisum, Bel, Babul, Khair, Mahua, Semal, , Jamun, Neem, Imli, Gamhar, Bargad, Kathal, Arjuna , Amra, Kusum Karanj,Mango,Piple,Amla Kendu ,Kadam etc.

State forest Deptt. and soma local autrorities like CCL planted vegitation in the buffer zone of the Kathara OCP. They are Khair, Babul, Kadam Neem,Gararo ,Barabans, Semal,Amaltas, , Shisham,Gulmohar,Bans,Eucaliptus, Gamhar, Babul Karanj etc.

There is no any endangered and endemic species of floras are found in this area.

(B) Fauna-

The terrestrial fauna in the core zone and buffer zone includes common vertebrates and invertebrate. In the survey schedule of the fauna no difference at species level was noted between the core zone fauna and buffer zone fauna. The area concerned as per the animal ranges covered is within the distribution exist of most of the recorded species.

Most of the birds are non-resident in the area and have their nesting sites within the buffer zone.

No endemic, endangered and migratory species are found as per wild life protection Act 1972.

4.14.3 Conservation measure

The mission of every ecological restoration project is to re-establish a functional eco-system that contains sufficient bio-diversity by natural process in response to changing environmental condition. For this, necessary arrangement would be made for development of the indigenous habitant and to protect them by manipulating the topography of land to a required extent and providing a special treatment to rectify the problem of drainage system and adverse soil conditions. In broad way, ecological restoration needs a set of activities. Following are the some work component for development of indigenous habitat.

(A) Physical reclamation

Due to opening of the opencast mine, topography of land and forest changed completely. For the development indigenous habitat, first of all it is necessary to reclaim the land physically to suit local habitant. Following are the some works involve in the physical reclamation.

- Site assessment
- Design of target habitat
- Fencing of the area
- Development of Drainage system
- Land escaping
- Making of Ponds

Above physical work will encourage the ground fauna to build / rebuild their dwelling site again.

(B) Biological Reclamation

As forest/vegetation cover have vital role in environmental stability, ecological balance and sustainability, the physical/technical reclamation of the degraded land would be further strengthened by biological reclamation for conserving the environment. Biological reclamation will improve the soil fertility of the degraded land and would help tree plantations.

Following are the some works involve in the biological reclamation

- Green Belt Around the Mine
- Enrichment of plant in buffer zone
- Plantation over O.B. dump
- Plantation along all type of road

Above biological reclamation work will augment the flora condition and would also give the sense of protection to Fauna.

4.14.4 Selection of species-

A great attention is required for selection of species for the plantation above the physically reclaimed land. Any wrong selection of species would adversely affect reclamation programme/pollution control measure.

Choice of species depend upon various factors.

The selection plant species for reclamation of land depend upon the various factors such as goal of achievement, characteristics of soil, location, ultimate land use etc. In present context the species should have:-

- Economic important

- Aesthetics value
- Ecologically sound
- Matching with the indigenous habitants

Along with the above, the species should be:-

- ✓ Able to survive in high pollution land.
- ✓ Suitable to the local climate.
- ✓ Requirement to the local habitant.
- ✓ Matching with indigenous habitant.

The species selected for forestation on the OB dumps and also in the other areas, should be of mixed type having a combination of fast and slow growing species with an ultimate aim to have triple storey plantation i.e. a combination of species of tall, intermediate and short height. A list of the species suggested for afforestation is placed below. However, in any case monoculture will not be adopted, because ecologically these are more unstable communities.

.4.14.5. Development of indigenous habitat

It is always be better to develop indigenous habitat because it will survive in the local climate better way than any other variety and would also help in biodiversity as well as in stabilizing the ecology of the region.

For this, necessary environment condition would be created in such way that would provide suitable shelter, food and protection from human being and others.

Following provision would be done to provide suitable environmental conditions

(A) Shelter-

Artificial shelter such that hole, burrow etc. will be constructed and some fauna will be left there. This will attract some other fauna also to build their dwelling.

(B) Food -

Other basic needs for fauna is food. The targeted fauna will survive only if it get sufficient food of his liking. So such type of food trees would be planted that is favorite to the targeted fauna .

(C) Drinking water-

Sufficient quantity of water would be provided to the targeted faunas at various convenient places to them by means of making ponds & springs.

(D) Protection-

Some fencing of dense trees, stone wall or barbed wire would be done to minimize the entry of man and animal in the core zone area. A vigil watch will be kept on killing of the animals and help from forest/police department will be sought.

4.14.6 Fire protection :-

Fire can destroy entire flora & fauna (micro& macro) and life supporting potential in the forest area. To save the forest and mine from the fire, suitable measure as per site condition would be taken.

For prevention of fire, adequate number of fire fighting extinguisher with expert personal would be provided. All employees and local villagers will be trained for fire fighting and encouraged to report any fire to mines authority/forest/police department.

4.14.7 Maintenance

Time to time achievement of work will be reviewed. A expert team with local people will visit the site periodically, assess the achievements and give the suggestion for further improvement. Accordingly, necessary action would be taken.

Ponds and water bodies will be cleaned after rainy season. New trees will be planted in place of damaged / dead trees. Arrangements will be made for watering the plants in the summer time as well as sprinkling of chemical to protect from insects.

4.14.8 List of Species Suggested for afforestation

Table – 4.14.8

Sl.No.	Common Name	Botanical name	Purpose
1.	Garari	*Cleistanthus collinus*	Fuel wood
2.	Sidha	*Lagerstroemia parviflora*	Fuel wood
3.	Bara bans	*Bambusa arundinacea*	Fodder, fuel & builsing materials
4.	Bans/Bamboo	*Dendrocalamus strictus*	Fodder, fuel & builsing materials
5.	Subabool	*Luceana leucocephala*	Fooder
6.	Jamun	*Syzigium cumimii*	Food value for faunal spp
7.	Aonla	*Emblica officinalis*	Food value for faunal spp
8.	Aam	*Mangifera indica*	Food value for faunal spp
9.	Guava	*Psidium guajava*	Food value for faunal spp
10.	Peepal	*Ficus religiosa*	Food and shelter
11.	Imli	*Tamarindus indica*	Food and shelter
12.	Lasora	*Cordia dictotoma*	Food and shelter

Sl.No.	Common Name	Botanical name	Purpose
13.	Arjun	*Terminalia arjuna*	Food and shelter
14.	Kusum	*Schleichera oleosa*	Food and shelter
15.	Bar	*Ficus benghalensis*	Food and shelter
16.	Ber	*Zizyphus jujuba*	Food
17.	Gulhar	*Ficus glomerata*	Food
18.	Mahua	*Madhuca latifolia*	Food value for faunal spp
19	Anjan	*Cenchrus ciliaris*	Fodder
20.	Motaminijhar	*Arundinella setosa*	Fodder
21.	Kus	*Chrysopogon gryllus*	Fodder, thatching
22.	Doob	*Cynodon dactylon*	Pasture

CHAPTER - V

Analysis Of Alternative

5.0 General

Mining works are site-specific project. Minerals lies beneath the earth surface at the fixed area and extraction of that mineral needs excavation in the area. So, there are a little choice left for the alternative sites. Final site selection is depend on the suitability, quantity and quality of mineral. Coal is the back bone for power industries in our country. Almost 80% power is generated through the thermal power stations. This situation will remain for at least another 50 years.

Liberalization of power sector by Govt. of India has generated wide spread interests for private and public sector investments in power generation. As such, there is an appreciable increase in the number of upcoming new thermal power projects in both private and public sectors. This has resulted in a sharp increase in the demand of power grade coal in the country. So, under the emergency of coal production program CCL has to revised its Area Wise production output target. The running of the project to extract remaining coal i.e. 7.43 Mte is a necesity of the time to fulfill the above indicated growth in demand.

An opencast mine in the name of Kathara OC is in operation in the proposed property of East Bokaro Coalfield. Upto March 2008, 55.81 MT of Coal has already been extracted from this quarry corresponding to 360.432 Mcum of overburden.

Reason for selecting this project

Following are the reason behind for selecting this project.

1. This was an already existing & running opencast..
2. This is in close vicinity of all others existing projects.
3. It consist good power grade coal.
4. Its formation support for opencast mining.
5. Its economics are favorable for mine.
6. All-important infrastructures exist.
7. It will partly fulfill the revised target of East Bokaro Coalfield Area, CCL.
8. Land is either barren land or of poor qualities.
9. No rehabilitation of human population is involved.
10. Favourable enviroment is existed for mining.

Economics

As per PR, June' 1989 & Field-datas

Sl. No	Particulars	Coal & OB Departmental
1	Initial Capital Outlay Up to target year In Crores	102.37
2	Specific Investment (Rs/T)	1023.68
3	Capital Cost of P&M (Rs.Crores)	86.47
4	Man Power requirement (target year)	1200
5	Av.Cost of Production(Rs./te)	
6	i) At 100% level of output	378.57
7	ii) At 85% level of output	420.09
8	E.M.S. (Rs.)	124.93
9	Year of Achieving target production	Running mines

The Kathara block is located in the soutern part of East Bokaro Coalfield and lies on the northern limb of main synclinal basin of the field. The block under consideration is occupied by the rocks of Igneous Intrusives, Karharbari & Barakar formations of lower Gondwana apart from soil and alluvium of the recent era.

The Metamorphics are exposed along the western part of the block.

The sequence of the coal seams with intervening partings in the Kathara block is given under.

Formation	Stage	Sequence of coal seams	Vertical thickness (in m)	No.of boreholes encountered	Remarks
1	2	3	4	5	6
	Jarangdih stage	Jarangdih	2.89	1	
		Parting	11.02		
		Jarangdih new	1.78	1	In two splits
		Parting	22.17		
		Jarangdih 6'	2.11 – 3.02	2	
		Parting	15.18 – 17.18		
		Jarangdih	0.99	2	

		Parting	44.46 – 44.69		
Barakar Formation	Kathara Stage	Swang 'A'	0.20 - 0.89	3	
		Parting	18.08 – 21.53		
		Swang 'B'	0.30 – 1.01	6	
		Parting	38.45 – 51.99		
		Swang 'C'	0.50 – 2.59	19	
		Parting	27.30 – 53.48		
		Upper Kathara	0.11 – 3.85	21	
Barakar Formation	Kathara Stage	Parting	34.49 – 76.44		
		Kathara	1.22 – 6.18	63	
		Parting	14.75 – 38.71		
		Uchitdih	0.74 – 3.10	61	
		Parting	4.34 – 28.88		
		Uchitdih 'A'	0.24 – 2.44	46	
		Parting	31.57 – 38.94		
		Kargali (Full Seam)	24.25 – 50.59	30	
		Parting			
		Kargali Top	8.42 – 29.54	50	
		Parting	1.15 – 38.14		
		Kargali Bottom	6.38 – 27.76	53	
		Parting	20.89 -26.37	42	

Only Kathara & Kargali seams are workable. 55.81 MT of coal is extracted since inception. Kathara seam is exhausted in the lease area. The balance reserve of coal is left on in only Kargali seam.

The grade of coal is W – III.

COAL RESERVES

This is a running project. Till March'08, 55.81 MT coal was extracted from the mine & remaing 7.43 MT is to be extracted from the mine.

OVERBURDEN

A total of 10.00 million Cum of overburden is estimated in the Project.

Mining Method:

The Geological & Mining Characteristics of the Kathara OCP under consideration are favourable for opencast mine field development at optimum condition of mining operations for the entire life of proposed opencast mine. Opencast Mining method involves drilling and blasting.
Considering the geo-mining characteristics of the mining block i.e. a

(a) 5 No. of seams with varying thickness
(b) Variable gradient of the seams
(c) Short strike length
(d) Quarrying being done followed by backfilling of OB

Shovel – Dumper mining system has been envisaged in this project for extention of coal and removal of OB.

CHAPTER - VI

ENVIRONMENTAL MONITORING ORGANISATION

6.1 Monitoring Schedule

The construction of the project will have impact on various environmental attributes the result of which would be degradation of quality of environment. In order to minimise such adverse impacts and maintain the environmental qualities within the specified limit, mitigation measures have been taken. The assessment of impacts and recommendation measures are based on a number of assumptions, some of which are controlled by natural process, are dynamic system and hence is difficult to be predicted. In such circumstances, future environmental scenario is difficult to be modeled. This necessitates continuous monitoring of environmental parameters. Basic objectives of such monitoring are as follows –

- To check level of pollution at different time.
- If level of pollution is found to be high, need for necessary modification in mitigation measures arises.
- Test efficacy of different mitigation measures

  It is suggested to follow the guidelines given below for environmental monitoring are as follows -

6.2 Air Quality Monitoring

(A) Parameters - SPM, RPM
- SO_2, NOx

(B) Frequency & Duration - One samples in every season in a year (Quarterly basis)

(C) Monitoring Station - At least three monitoring stations would be selected.

6.3 Water Quality Monitoring

Under the programme, the water from the discharge point of lagoons (i.e. through settling tanks of mine water discharging) for mine discharge water and surface run - off from dumps, etc. to be sampled & tested and compared with CPCB standards for industrial effluents. The water from Damodar river is sampled & tested. The tests will be compared with IS: 2296 standards. Above samples will be collected in all four seasons.

Following six water monitoring stations have been selected.

SL. NO.	LOCATION NAME	LOCATION CODE
01.	Kathara Village- Hand Pump	GW_1
02.	Ambatanr Village- Hand Pump	GW_2
03.	Damodar River –Upstream (Confluence with mine water)	SW_1
04.	Damodar River –Downstream (Confluence with mine water)	SW_2
05.	Mine Water Discharge – Kathara OCP	MW_1
06.	Workshop Discharge – Kathara OCP	SW_2

6.4 Noise Level

Noise level would be monitored at all air monitoring stations.

The noise level will be recorded in dB(A) unit.

6.5. Organisation

East Bokaro Coalfield of CCL has number of existing coal projects and other industries also. Operation of all such industries may have adverse impact on local environmental attributes unless and untill proper multi-level organisations are set up for pollution control and regular environmental monitoring. The organization has been set-up at various level which are listed below:

6.5.1 State pollution Control Board

Jharkhand Government has already set up a Jharkhand State Pollution Control Board to monitor the water and air quality all over the State. Previously it was being looked after by Bihar state pollution control Board. The Board has set up zonal offices in important industrial places. These zonal offices have responsibility of environmental/ monitoring in the area under their command area. Liquid effluent samples have already been collected from two/three points from each colliery e.g. Workshop, Mine Sump and surface water course. They have drawn a plan for air quality monitoring also. Under the law, they have statutory powers to control the activities of industries to maintain the water and air quality. The CCL submits quarterly report on environmental monitoring to the Board and also Regional Office of Ministry of Environment and Forests (MOEF), Govt. of India.

6.5.2 Corporate Level

Central Coalfields Ltd. the owner of Kathara OCP has set up Environmental Cell headed by a CGM / GM at its Company HQ. The Cell will provides technical support that is required for environmental management, land reclamation and procurement / production of plant materials through the Company.

The CMPDI does the environmental monitoring work on behalf of CCL

..

6.5.3 Area Level

The CCL has been divided into a number of administrative units known as Area, each headed by a Chief General Manager. The CGM of an area, co-ordinates activities of a number of coal projects under his control. It is suggested that the CGM/GM of the area would co-ordinates the rehabilitation scheme in that area in liaison with the Chief of Revenue officer at corporate level and the concerned Project Officer.

6.5.4 Project Level

The environmental management activities would be carried out under the overall control of the Project Officer. Area Environment officer would be doing all environmental management activities with the equipments & manpower provided by the project officer of the Kathara project.

6.5.5 Afforestation and Plantation

Afforestation efforts require special skill and aptitude. Therefore, it has been suggested that the project authority would be only responsible for block and avenue plantations within the leasehold boundary of the project.

The main afforestation efforts (compensatory afforestation) have to be carried out by specialised organisation possessing forestry experience and expertise. The Forest department has been assigned the work of compensatory afforestation.

6.6 Environmental Management Cost

The cost of environmental management in the Project includes the following:

1. Cost of water, air control / mitigation measures.
2. Cost of physical & biological reclamation of mined out areas and external OB dump.
3. Cost of Arboriculture / Plantation.
4. Cost of generating environmental base line data.
5. Compensatory afforestation.
6. Cost of rehabilitations etc

CHAPTER - VII

Additional Studies

7.0 Public Consultation -

First persons who get affected for opening or closing of any type of industries are the local peoples. So, it is very necessary to inform the local people about the merit & demerit of proposed project.

Basic requirement for any open cast mining is land and need large amount of land. Generally there are three types of land exist i.e Forest land, Govt. land and public land. Local environment and economics depends on land. Acquisition of public land means, displacement of large number of persons as well as degradation of large area of land. It will definitely disturb the local ecology and would have effect the local habitants.

Hence, final opinion/consultation of local persons, who are affected directly or indirectly, should be taken. The public consultation shall have two component

a) **Public Hearing** – It will be done at the site or in the close proximity, district wise in prescribed manner for ascertaining concern of local people in the presence of local administration..

b) **Written Response** – Written response shall be obtained from other concernd persons having plausible stake in the environmental aspect of the project activities by placing on the website summary of EIA report prepared in the format given in appendix IIIA along with the application in prescribed form within seven days of the receipt of written request for arranging the public hearing.

7.1

7.1.1 Public Hearing

In this case, public hearing is not required because it is already running mine & land are aquired long long ago and compesation are alredy given.

7.2 Risk Assessment -

All industries are prone to accident and bear the various types of risk. Therefore it is very necessary to assess the type of risk involved, their intensity and level of devastation so as, the associated preventive measure can be planned in advance. Unfortunately, If any eventuality occurs, it will help to start rescue management works immediately.

7.2.1 Safety Rules

Mining operations are required to follow statutory mine safety rules administered by DGMS. In planning of the mine, care has been taken to comply with these rules. Planning & Design of electrical installation has been carried out conforming to the electricity safety rules.

7.2 .2 Mine Inundation

The mine pit would receive water from three sources namely direct precipitation over mine areas, surface run - off from surrounding area and seepage from lower strata. During heavy rain there might be situations when the mine would be flooded. This may cause loss of human life and equipments. To guard against this situation following steps would be taken.

(A) provision of Garland Drains around mine/quarry has been made. This will prevent surface run - off entering the mine pit.

(B) Provision of Pumps - Adequate number of pumps have been provided to drain mine water even during critical rainfall. The pumping calculation has been done taking into consideration the surface area of excavation of the two sectors separately and given in details in project report.

7.2.3 Fire

Accidental fires, cause loss of property and life. With this in view, adequate fire protective measures have been provided in the PR. Adequate number of fire extinguishers have been provided for store & other service buildings. While calculating total water demand for the project, provision for fire fighting has been made.

7.2.4 Road accidents

Road accidents cause for human and property losses. Therefore, roads have been planned and designed to prevent accident. Provision has been made for illumination of roads, road crossing etc. have been taken into account in road designs. The Haul Roads have been planned to keep the HEMM traffic away from the passenger traffic.

7.2.5 Slope Failure in Mine Pit

The exposed ends of the coal seams will be left with a safe slope to avoid slope failure and collapse of benches. Similarly, at the end of mining operation, safe terminal slope will be provided to avoid pit failure.

The spoil will be stacked in the internal dump space at the natural angle of repose and plantation will be made on the internal dumps to avoid the sliding of spoil. The barrier between toe of internal dump and coal production bench will be maintained at a minimum of 100m to ensure proper movement of the machineries. The surface of internal dump will be leveled and graded.

Coal and OB benches are proposed to be at an angle of 70^0 to the horizontal. The benches are proposed to be graded with a slope of 1 in 100 towards the sump to facilitate smooth flow of water towards the sump. The height and width of the main OB bench will be 15 m and 50 m in case of 20 cum elec. rope shovel. For coal, the bench height will be governed by the thickness of coal seam and will not be more than 12 m for this project.

7.2.6 Blasting

Controlled blasting techniques including muffled blasting will be adopted during blasting within 300 m zone but beyond 100m from the village, dwellings, surface structure, road etc. Total quantity of explosive to be detonated at a time will be so regulated that ground vibration which may affect the nearby surface structures, are kept within the stipulated limit. For proper blasting and minimizing the adverse side effects due to blasting, viz. noise, ground vibration, back-breaks, air blast, fly rocks, etc., the following precautions have been suggested to avoid dangerous situations:

- A safety zone for blasting has been provided around the quarry.
- Suitable drilling pattern.
- Before blasting is done, warning sound will be given so that people can move to safe places.
- Controlled blasting with site mixed slurry.
- Optimisation of maximum quantity of explosive in a blast hole.
- Blasting will be done during daytime. Frequency of blasting shall be influenced by the availability of the land (tenancy in particular), DGMS permission for use of explosive geo-mining conditions, method of mining and prevailing meteorological conditions.
- No blasting will be done during low cloud cover.
- Blasting shall be carried out with closer control of blasting parameters including desired fragmentation, permitted vibration, etc.

7.2.7 Explosive Handling

The present day technology of blasting with site mixed slurry (SMS) explosive shall be used with millisecond delay detonators that are initiated by shock tube initiation system. SMS is stored by the supplier as per GOI Notification. Further, transport and charging are also done by the supplier on the spot. Only priming will be done by the project authority.

7.2.8 Other Measures

Other measures have been recommended for avoiding risk in mine operation. They are discussed below :

(A) Illumination- Provision of proper illumination in quarry, OB dump area, along roads, in workshop and other work areas.

(B) Communication system - Efficient communication system (based on VHF System) have been provided for the project. This will allow proper communication link between various work centers and helps in avoiding accidents.

(C) Maintenance facilities – The proposed project require a substantial number of HEMMs for quarrying and transportation of coal and OB. A well equipped workshop has been provided for scheduled maintenance of HEMMs.

7.3 Training

Coal industry has set-up a network of training center right from the project level to corporate level for up-gradation in technical knowledge and know-how in the various fields. Time to time Coal India provides the training to his employees and others regarding safety rule/management through own net-work or from outside. More over safety week is celebrated every year to enhance the consciousness about the mine safety among executive , staff and other private workers

7.4 Medical- aid

The project has provided a well equipped hospital and qualified doctors. They can attend to medical emergencies arising out of accidents.

7.5 Conclusion

Following conclusions may be drawn from the above discussion:

(a) Coal mining is associated with a number of hazards

(b) These hazards can be identified and assessed.

(c) Preventive measures against identified risks have been provided .

(d) With adoption of such protective measures, the operation of the mine would be safe.

7.6 Socio – economic profile

Like any other large industry, mining projects have also an impact on socio-economic profile. In order to determine impact of project at the Macro level on socio-economic profile, is an important to study the demographic growth rate, religious composition, caste composition, literacy, employment pattern to assess the pre-mining, & post – mining operations of the project areas.

The baseline Socio - economic data generation was entrusted to *St. Xavier's College Research Centre, Ranchi.*

Baseline data for Socio-economic study is done in 10 km radius from the periphery of core zone of the proposed project, that surround 46 villages, were collected by surveying household survey, Check sampling, Block offices, District offices, 2001 census data and personal interaction with local peoples. Followings are the main points of house hold survey.

Check sampling was done in 46 villages in which there is no villages in core zone. This project is located in Census Town Tenu Dam- cum- Kathara as mentioned in the Census data of 2001.

250 households have been randomly selected for sample from different villages for socio-economic study. Out of them 40 house holds have been selected from core zone area i.e. Tenu Dam-cum-Kathara C.T. and 210 sample households from 6 villages of buffer zone area. It is notable that Kathara and Tenu Dam have been merged into one urban agglomeration in Census report 2001. They constitute Tenu Dam-cum-Kathara C.T.

(A) Core Zone :

Core Zone represents the area which is directly affected by mining and allied activities including open pit mining, external dump areas, Workshop, CHP, Roads etc. The core zone of the project is free from any villages . Damodar River is in the Southern direction.

.The total area of core zone measures about 792.81 Ha.

There is no population in the Core Zone as stated earlier. So, details of Population Composition does not arises.

(B) Buffer Zone :

Buffer zone is the area covered within a circle of 10 Km. radius from the periphery of the core zone.

The sample households have been selected by multistage sampling method. There are total of 46 villages within Buffer Zone and out of that 6 villages were selected for the household survey present in the Buffer Zone. Where ever possible, the data pertaining to both the villages have been also used for interpretation.

Other than household survey, village profile has been made with the help of interview guide. Caste information, economic activities, health status and other information have been estimated based on the village profile questionnaire.

(1) Village

Table showing the name of village in the buffer zone.

Table no. 7.6(T-1)

Sl. No.	Census Town No. (PLCN)	Name of Town
1	413010	Gumia
2	413020	Tenu Dam cum Kathhara
3	413040	Kurpania
4	413050	Jaridih Bazar
5	413060	Bermo
6	23545	Kachho
7	23873	Khudbera
8	23996	Khamarbendi
9	23620	Armo
10	23633	Karmatanr
11	23621	Lukubad
12	23546	Kanjkiro
13	23587	Navadih
14	23832	Pipradih
15	22866	Gobindpur
16	23547	Pilpilo
17	23800	Basaria
18	23799	Chalkari
19	23792	Chatugarha
20	23798	Khetko
21	23795	GharwatanrBaludih
22	24014	Biswanathdi
23	23797	Keswari
24	23733	Daridag
25	23796	Champi
26	23758	Tenu
27	23549	Chotkikuri
28	23817	Jaruatanr
29	23801	Jhujhko
30	23218	Jarma

31	23793	Samlata
32	23739	Hasir
33	23550	Palamu
34	23785	Jhirki
35	24123	Karmatanr
36	23657	Ambatanr
37	23039	Kasitanr
38	23794	Ulgara
39	23539	Nawadih
40	23738	Saram
41	23625	Rajabera
42	23732	Siari
43	23730	Dumri
44	23786	Jabra
45	24114	Nayaband/Pabratanr
46	23984	Bandhdi

There are two types of datas. One is based on Census 2001 & other is primary data as per Sample survey result in the core as well as in the buffer zone.

SOCIAL PROFILE OF CORE ZONE

Table no. 7.6(T-2)

SL. No.	Name of Village	No. of H. H.	Total Pop.	Male	Female	Total S.C. Pop.	Total S.T. Pop.	Literates	Male	Female	Family Size
1	Tenu dam cum Kathara	3524	20441	10767	9674	2712	1031	11105	7087	4018	5.80

Source – Census 2001

Table no. 7.6(T-3)

SL. No.	Name of C.T	No. of H. H.	Total Pop.	Male	Female	Total S.C. Pop.	Total S.T. Pop.	Literates	Male	Female	Family Size
1	Tenu dam cum Kathara	40	230	122	108	30	10	125	80	45	5.75

Source: Sample survey result

ECONOMIC PROFILE

Table no. 7.6(T-4)

SL. No.	Name of C.T	Populat-ion	Total work Pop.	Main Worker	cultivation	Agricultural Labourers	Other Worker
1	Tenu dam cum Kathara	20441	4203	3229	126	9	3035

Source – Census 2001

Table no. 7.6(T-5)

SL. No.	Name of Village	Populat-ion	Total work Pop.	Main Worker	Cultivator	Agricultural Labourers	Other Worker
1	Tenu dam cum Kathara	230	48	36	2	1	34

Source – Primary Data

SOCIAL PROFILE OF BUFFER ZONE

Table no. 7.6(T-6)

SL. No.	Name of Village	House holds	Total Pop.	Male	Female	S.C. Pop.	S.T. Pop.	Literates	Male	Female	Family Size
1	Jhirki	125	691	366	325	0	161	169	123	46	5.52
2	Keswari	116	574	293	281	273	301	83	65	18	4.94
3	Lukubad	166	1258	641	617	347	17	496	363	133	7.57
4	Palamu	787	4772	2466	2306	841	961	1374	994	380	6.03
5	Pipradih	264	1594	826	768	142	239	480	379	101	6.03
6	Karmatanr	19	123	63	60	0	0	41	34	7	6.47
Total		**1477**	**9012**	**4655**	**4357**	**1603**	**1679**	**2643**	**1958**	**685**	**6.10**

Source – Census 200

Table no. 7.6(T-7)

SL. No.	Name of Village	House holds	Total Pop.	Male	Female	S.C. Pop.	S.T. Pop.	Literates	Male	Female	Family Size
1	Jhirki	35	194	102	92	00	45	48	35	13	5.54
2	Keswari	35	172	88	84	82	89	25	20	5	4.91
3	Lukubad	40	300	153	147	84	04	118	86	32	7.05
4	Palamu	04	272	142	130	48	54	78	56	22	6.04
5	Pipradih	45	270	139	131	24	40	81	64	17	6.00
6	Karmatanr	10	65	33	32	00	00	22	19	03	6.05
Total		**210**	**1273**	**657**	**616**	**238**	**232**	**372**	**280**	**92**	**5.84**

Source : Sample survey result

ECONOMIC PROFILE OF SAMPLE VILLAGE WITHIN BUFFER ZONE

Table no. 7.6(T-8)

SL. No.	Name of Village	Populat-ion	Total work Pop.	Main Worker	Cultivator	Agricultural Labourers	Other Worker
1	Jhirki	691	125	75	1	77	0
2	Keswari	574	192	70	37	128	3
3	Lukubad	1258	225	91	2	0	89
4	Palamu	4772	1389	549	81	64	330
5	Pipradih	1594	573	231	168	7	48
6	Karmatanr	123	30	29	20	7	2
Total		**9012**	**2524**	**1145**	**309**	**283**	**472**

Source Census 2001

Table no. 7.6(T-9)

SL. No.	Name of Village	Populat-ion	Total work Pop.	Main Worker	Cultivator	Agricultural Labourers	Other Worker
1	Jhirki	194	35	21	1	22	0
2	Keswari	172	58	51	10	39	1
3	Lukubad	300	51	21	1	0	20
4	Palamu	272	78	30	5	4	18
5	Pipradih	270	97	38	28	1	53
6	Karmatanr	65	15	13	9	3	1
Total		**1273**	**334**	**174**	**54**	**69**	**93**

Source Primary data

ANNUAL FAMILY INCOME & SOURCE OF INCOME OF BUFFER ZONE AND CORE ZONE VILLAGE.

Table no. 7.6(T-10)

APPROX ANNUAL FAMILY INCOME IN RUPEES							SOURCE OF INCOME IN %		
SL. No	**Sample Village**	**Sample Size**	**<20000**	**20000 – 50000**	**50,000 – 100000**	**>100,000**	**Primary**	**Secondary**	**Tertiary**
1	Kathara	40	6	10	14	10	15	60	25
2	Jhirki	35	10	10	12	03	28.57	62.85	8.57
3	Keswari	35	07	11	15	02	20	74	5.71
4	Lukubad	40	02	12	15	11	05	67.5	27.5
5	Palamu	45	08	12	14	11	17	57.77	24.44
6	Pipradih	45	09	10	13	13	20	51.11	28.88
7	Karmatanr	10	02	04	04	00	20	80	00
	Total	**250**	**44**	**69**	**87**	**50**	**17.6**	**62.04**	**20**

Source Primary Data

7.7 Social impact Assessment

7.7.1 Positive impact

i) Coal Production

Due to the development of this project, the country would get 0.96 MTY more coal, and that would be utilized to generate more electricity that would be great helpful for the development of country.

ii) Employment

With running of the project in the area, direct and indirect opportunities for employment are always enhanced. In addition to the direct employment in the project, there are indirect job opportunities in the shape of starting the ancillary industries and their infrastructures

iii) Infrastructure development

Due to this industrial activities, there is a development of infrastructures which facilitate to develop the status of living of this area.

iv) Education

There will be increase in educational facilities by development of township resulting into opening of primary school and middle school etc.

v) Health Care

Project activities would develop health care facilities in the area by construction and set up of dispensaries and hospitals.

7.7.2 Negative Impact

i) Loss of Land

The running project has ruined the natural topography of the area due development of the mines and infrastructure, which would be finally degraded according to the development of mines.

ii) Environmental Pollution

The project/mining activities would develop environmental pollution in the area, such that Air, Water, Noise, degradation of land etc. may affect the ecological system of this area.

7.8 RESETTLEMENT AND REHABILITATION ACTION PLAN

Not applicable as no shifting of people is needed.

7.9 Present status of flora & fauna

Flora and fauna study

PHYSICAL SETTING OF THE PROJECT:

The Kathara OCP is situated in Bermo Block, district of Bokaro, in the state of Jharkhand.

Core zone

The core zone of the project is located in the Census Town Tenu Dam- cum – Kathara as mentioned in the Census data of 2001. There is Damodar River in the Southern side of the project..

Buffer zone

The buffer zone of the project is spread in radius of 10 km beyond the core Cone of Kathara OCP.

The buffer zone of Kathara O.C.P. is bounded by river Damoder in the south and river Konar in north, joining the former one neat core zone, making a triangular shape. Bokaro river also flows and joins river Konar. Another surface feature of the buffer zone is Tenughat Bokaro canal and huge reservoir of Tenughat Dam. Eastern Railway of Daltamgamj Branch passes through the area for.

DATA COLLECTION

The data for flora and fauna study of Kathara OCP has been done in the summer season -2009. Finding of the study are discussed hereunder briefly.

Agricultural crop/ commercial crops in the study area.

Agricultural crop plants in the study area.

Following plants are cultivated in the study area of OCP.

CORE ZONE : . Agricultural crops, Commercial crops, Plantation, Natural vegetation/ Forest type, Flora in the Buffer Zone of the project are given below in the Table.

Table No.(7.9 a)

Flora of Core Zone

A. Flora	Local Name	Botanical Name
1. Agricultural crops		
Cereals	Dhan (Paddy)	Oryza sativa
	Makka (Maize)	Zea mays
Pulses	Arhar (Pigeon pea)	Cajanus cajan
2. Commercial crops		
Vegetables	Kaddu	Lagenaria siceraria
	Baigan	Solanum melongena
	Tamator (Tomato)	Lycopersicum esculentum
	Bean	Lablab purpureus
	Jhinga	Luffa acutangula
	Kohra	Benincasa hispida
	Karela	Momordica dioica
	Kundri	Coccinia grandis
	Bhindi (Lady finger)	Hibiscus esculentus
Oil yielding plants	Sarson (Mustard)	Brassica compestris
Spices	Dhania (Coriander)	Coriandrum sativum
	Lahsun (Garlic)	Allium stivum
	Adrak (Ginger)	Zingiber officinale
	Haldi (Turmeric)	Curcuma domestica
Fruits	Aam (Mango)	Magnifera indica
	Amrud (Guava)	Psidium guajava
	Kathal (Jackfruit)	Artocarpus heterophyllus
	Bel	Aegle marmelos
	Ber (Jujube)	Ziziphus mauritiana
3. Plantation		
Planted by CCL	Ashok	Sarracca indica
	Neem	Azadirachta indica

	Aam	**Magnifera indica**
	Babul	**Acacia nilotica**
Planted under Social Forestry Scheme	**Palas**	**Butea frondosa**
	Shisham	**Dalbergia sisso**
	Neem	**Azadirachta indica**
	Amaltas	**Cassia fistula**
	Kathal	**Artocarpus intergrifolia**
	Gulmohar	**Delonix regia**
4. Natural vegetation / forest type		
Herbs	**Bantulsi**	**Ocimum cannum, etc**

Flora of Core Zone

A. Flora	**Local Name**	**Botanical Name**
Shrubs	**Galphuli**	**Moghania species**
	Putus	**Lantana camara**
	Dudhi	**Fimbristy obovata**
	Dhatura	**Zizyphus orenoplia**
Trees	**Shishum**	**Dalbergia sisso**
	Neem	**Azadirachta indica**
	Peepal	**Ficus religiosa**
	Palash	**Butea frondosa**
	Mahua	**Madhuca indica**
Grasses	**Baans**	**Dendrocalamus strictus**
	Doob	**Cynodon dactylum**
5.Endangered species	**Nil**	**Nil**
6. Endemic species	**Nil**	**Nil**

BUFFER ZONE: Agricultural crops, Commercial crops, Plantation, Natural vegetation/ Forest type, Flora in the Buffer Zone of the project are given below in the Table.

Table No.(7.9b)

Flora of Buffer Zone

A. Flora	**Local Name**	**Botanical Name**
1. Agricultural crops		
Cereals	Dhan (Paddy)	Oryza sativa
	Makka (Maize)	Zea mays
	Gehun (Wheat)	Triticum aestivum
Pulses	Arhar	Cajanus cajan
	Khesari	Lathyrus sativus

2. Commercial crops		
Vegetables	Kaddu	Lagenaria siceraria
	Baigan	Solanum melongena
	Tomato	Lycopersicum esculentum
	Bean	Lablab purpureus
	Jhinga	Luffa acutangula
	Parol	Luffa cylindrica
	Kohra	Benincasa hispida
	Karela	Momordica charantia
	Kakri	Momordica dioica
	Kundri	Coccinia grandis
	Kaddu	Hibiscus esculentus
	Bhindi	Hiabiscus esculentus
	Nenua	Luffa cylindrica
	Pyaz (onion)	Allium cepa
	Sem (Lima)	Phaseolus lunatus
	Kheera	Cucrbaltus sativus
	Phool Gobi	B. oleracea var, botrytis
Oil yielding plants	Sarson (Mustard)	Brassica compestris
Spices	Mirch (Capsicum)	Capsicum species
	Dhania (Coriander)	Coriandrum sativum
	Lahsun (Garlic)	Allium sativum
	Adrak (Ginger)	Zingiber officinale
	Haldi (Turmeric)	Curcuma domestica
Fruits	Aam	Magnifera indica
	Amrud (Guava	Psidium guajava
	Jamun (Black Berry)	Sysygium jambolana
	Kathal (Jackfruit	Articarous heterophyllus
	Bel	Angle marmelos
	Papaya	Carica papaya

Table (7.9b)
Flora of Buffer Zone

A. Flora	Local Name	Botanical Name
3. Plantation		
Planted by CCL	Babul	Acacia nilotica
	Shisam	Dalbergia sisso
	Mango	Magnifera indica
	Ashok	Sarracca indica
	Kathal	Artocarpus intergrifolia
	Gulmohar	Delonix regia
	Euclyptus	Eucalyptus globules
Planted under Social Forestry Scheme	Shisam	Dalbergia sisso
	Sal	Shorea robusta
	Babul	Acasia nilotica
	Karanj	Pongamia pinnata
	Semal	Bombax cieba
4. Natural vegetation / forest type		
Herbs	Ban tulsi	Ocimum basilicum
	Tulsi	Ocimum basilicum
Shrubs/Climbers	Akwan	Calotropis giganta
	Amarbel	Cascuta reflexa
	Dudhia Lar	Criptolepsis buchanani
	Dhawai (Icha)	Woodfordia fruticosa
	Harsingar	Nyctanthes chebula
	Khajur	Phonix acaulis
	Putus	Lantana camara
	Ram Datwan	Smilax macrophylla
	Dhela	Alangium salvifolium
Trees	Sal	Shorea robusta
	Khair	Acacia catechu
	Salai	Boswellia serrata
	Simal	Bombax malabaricum
	Mahua	Madhuca indica
	Palas	Butea monosperma
	Peepal	Ficus religiosa
	Asan	Terminalia tomentosa
	Imli	Tammarindus indica
	Kadam	Anthoosphalus cadamba
	Neem	Azadirachta indica

Table (7.9b)
Flora of Buffer Zone

A. Flora	Local Name	Botanical Name
Grasses	Cheranth	Heteropogon contortus
	Doob	Cynodon dactylum
	Bans/Bamboo	Dendrocalamus strictus
	Munj	Sacchanum munja
	Jharoo grass	Thysanolaena agrostis
	Jharu	Arumdinella setosa
	Chor kanta	Chrysopogon auciculatus
5.Endangered species	Nil	Nil
6.Endemic species	Saal	Shorea robusta
	Mahua	Madhuca indica
	Imli	Tammarindus indica

PLANTATION DONE BY FOREST DEPARTMENT & LOCALS

Core *Zone*:

Plantation are done by the CCL & forest department in the core zone of the Kathara OCP. About 66 Ha are covered by the plantation in the core zone, which can be seen above the above Table (7.9a).

Buffer Zone:

Planted vegetation in the Buffer zone of Kathara OCP is done by the State Forest Department seen in the above Table (7.9b).

ENDANGERED SPECIES

Core Zone : Nil

Buffer Zone : Nil

ENDEMIC SPECIES

Core Zone : Nil

Buffer Zone : Nil

FAUNA OF THE AREA

The data on fauna was collected based on field survey in the core and buffer zone (10 KM radius) and from local offices of forest department. The results of the study are given in Tables. separately for Core & Buffer Zone for fauna.

In the survey schedule of the fauna, no difference at species level was noted between the core zone fauna and buffer zone fauna. The area concerned as per the animal ranges covered is within the distribution exist of most of the recorded species.

Fauna of Core Zone (7.9c)

B. Fauna	Common Name	Zoological Name
1. Listed Under Wildlife Protection Act,1972		
Terrestrial Fauna		
Schedule-I	Nil	-
Schedule-II	Nil	-
Schedule-III	Nil	-
Schedule-IV	Newla	Herpestes edwardsi
	Five Striped Palm Squirrel	Funambulus pennanti
	Hare	Capralogus species
Schedule-V	Common Rat	Rattus species
Amphibians & Reptiles		
Schedule-II	Nil	-
Schedule-IV	Toad	Bufo melanostictus
	Krait	Bungras cocruleeus
Avi Fauna		
Schedule-IV	Common Sparrow	Passer domesticus
	Kabutar	Colombia livia
	Koel	Eudynamys scolopaceae
	Owl	Bubo bubo
Schedule-V	Common Crow	Corvus splendens
	Bat	Rousettus Leschenaultia
2. Not listed Under Wildlife Protection Act,1972		
Mammals / Domestic	Goat	Capra species
	Bull	Bos indicus
	Cow	Bos indicus
	Buffalo	Bubalus bubalis

Birds	Tota (Parrot)	Pisttaculus krameri
Aquatic fauna	Potia	Puntius Spp.
	Mangur	Clarias betrachus
	Garai	Channa punctatus
	Zebra fish	Danio Spp.
Invertebrates	Cockroach	Blata orientalis
	Madhumakkhi	Apis indica
	Tilchatta	Blata orientails
	Chinti	Solpopsis Spp.
	Honey bee	Apis dorsata
	Lahi	Kerria laxxa
	Birni	Polistis Spp.
	Jugnu	Photinus Spp.
	Gojar	Scolopendra Spp.
3. Endangered species	Nil	-
4. Endemic species	Nil	-
5. Migratory species	Nil	-

Fauna of Buffer Zone (7.9d)

B. Fauna	Common Name	Zoological Name
1. Listed Under Wildlife Protection Act,1972		
Terrestrial Fauna		
Schedule-I	Nil	-
Schedule-II	Lomdi (Common Fox)	Vulpes bengalensis
	Siyar (Jackal)	Vulpes vulpes
Schedule-III	Nil	
Schedule-IV	Mongoose	Herpestes edwardsi
	Squirrel	Funambulus pennanti
	Hare	Capralogus species
	Common Rat	Rattus species
	Bat	Rousettus Leschenaultia
	Mice	Mus Musculas
Amphibians & Reptiles		
Schedule-II	Common Lizards	Varanus species
	Cobra	Naja species
	Dhamon or Rat Snake	Ptyas Mucosus
Schedule-IV	Tode	Bufo melanostictus
	Karait	Bungurus Caeruleaus
	Water snake	Natrix piscator
	Dhorwa	Natrix Sp.
Avi Fauna		
Schedule-IV	Koel	Eudanmys colopacca
	Kathforwa (Golden wood-peker)	Dinopium benghalensis
	Common Sparrow	Pesser domesticus
	Bulbul	Pycnonotus Cafer
	Kabutar	Colombia livia
	Owl	Strigidae
	Ducks	Nettopus Coromandelianus
	Ban Murgi	Gallus gallus
	Mynas	Acruditheres tristis Linn.
Schedule-V	Common Crow	Corvus splendens

Fauna of Buffer Zone(7.9d)

B. Fauna	Common Name	Zoological Name
2. Not listed Under Wildlife Protection Act,1972		
Mammals (Domestic Animals)	Goat	Capra species
	Bull	Bos indicus
	Cow	Bos indicus
	Buffalo	Bubalus bubalis
	Dog	Canis familaris
	Sheep	Capra Sp.
	Pig	Sus scrofa
Birds (Domestic Birds)	Sparrow	Passer domesticus
	Duck	Nettopus Coromandelianus
Amphibian	Frog	Rana Tigerina
	Tree frog	Hyle Spp.
	Flying frog	Rhacopnonis Spp.
Aquatic fauna (Fishes)	Rohu	Labco rohita
	Catla	Cyprindiae
	Garai	Channa punctatus
	Mangoor	Clarias batrachus
	Pothia	Punctius ticta
	Bokwa	Eutropichttys baacha
	Zebra fish	Danio rerio
Invertebrates	Birni	Polistis Spp.
	Grosshopper	Hierogylphus banian
	Tidha	Schistocerca gregaria
	Moth,	Antheria mylita
	Black Bee	Apis dorsata
	Bee	Apis indica
	Stem Borer	Chilo auricilia
	Cockroach	Blata orientalis
	Madhumakkhi	Apis indica
	Chinti	Solpopsis Spp.
	Lahi	Kerria laxxa
	Jugnu	Photinus Spp.
	Gojar	Scolopendra Spp.
Aquatic Insect	Daphnia	Nepa Spp.
	Prawn	Chaetogaster
3. Endangered species	Nil	-
4. Endemic species	Nil	-
5. Migratory species	Tree Pipit	Anthus Trivialis
	Cuckoo	Cuculus Micropterus
	Ducks	Dendrosygna Javanica

The proposed project does not envisage destruction or displacement of any fauna species. Thus, indirect impact on fauna due to loss of habitat is not foreseen

Chapter - VIII
Project benefits

8.0 Introduction

The runniing of the Kathara OCP will enhance the socio-economic activities in the adjoining areas. This will result in following benefits

- Improvements in Physical Infrastructure
- Improvements in Social Infrastructure
- Increase in Employment Potential
- Contribution to the Exchequer
- Prevention of Illegal Mining
- Post-mining Enhancement of Green Cover

8.1 Improvement in physical infrastructure

8.1.1 Development of Road

(a) Different Road

There area well connected road with Tenughat, Asnapani as well as with colony. There are many roads, which is all connected with all existing infrastrature i.e. Hospital, Post Office, School, etc.

Existing Haul road is working with the quarry & OB Dump.

8.1.2 Improvement in Drinking Water

Company, on welfare mission have provided hand pump, open well fresh potable water and earthen tank for storage of rain water to be used for various purposes in the villages of study area. Various rain water scheme have been implemented to easy the water scarcity in the region.

Integrated water Supply scheme is already working in the area and water from this Integrated water Supply scheme is being supplied to the township of the collieries and in the adjoining villages

8.1.3 Improvement on medical facilities

Company has opened various dispensaries at project level and central hospital at area level. Regular medical check-up camps are organized here for local residents others. Time to time a group of expert doctor visit the local villages and provide the medical treatment on spot along with medicines. If required, called them to hospital for further medical check-up.

8.1.4 Improvement in educational facilities

CCL has assist to open the schools and colleges at various level near to project to facilitate the easy education for the wards of employees and others.

8.1.5 Improvement in communication facilities

Due to opening of project, communication facilities from one place to other, automatically improved. Presently various type communication facilities are available for Ranchi, Hazaribagh, Daltenganj, etc

8.1.6 Overall Improvement of Region

Running of mining project is leaded to semi urban like development in housing, roads, ancillary industries and improvement in social & living standards by providing opportunities of direct & indirect employment to local community.

8.2 Improvements in Social Infrastructure

There would be some obvious changes in various environmental parameters due to mining activity, increased economic activities, creation of new employment opportunities, infra-structural development, better educational and health facilities. Following are the specific impacts.

Socio-economic

Overall there will be positive impact in socio-economic area due to increased economic activities, creation of new employment opportunities, infra-structural development and better educational and health facilities. The impact in the Core Zone and Buffer Zone is due to the following-

Population dynamics

Due to direct and indirect employment potential, there is scope of migration of people into project area and in the peripheral regions, from nearby areas Mining activities, acceleration of the economic activities and urbanisation along with creation of new employment opportunities and bussiness may change the population dynamics of the area.

Standard of Living

The people will come in contact with migrated people. This may encourage higher aspirations among the people of the area. Accelerated economic activities and urbanization may increase quality of life and standard of living

Free from superstition

Contact with migrated person to local person availability of educational institution will facilitate to understand environment of outside that will help to come out from old superstition and existing bad practice of the area. This will improve their confidence for self reliant.

8.3 Employment Potential

Opening of mining project would provide the huge opportunity of direct or in-direct employment. It provide the multifarious type job for all type of persons in all fields i.s skilled, un-skilled or semi-skilled.

CCL will provide direct employment to about 440 persons that include skilled, semi skilled and unskilled persons.

8.4 Other Tangible Benefits

Due to liberalization and globalisation in the country, there are sudden surge in power demand. In. our country, 80% of total power demand is met by thermal power station. This trend is expected to continue for at least another 50 Years. . So, to meet the power demand , it would require more thermal power stations and consequently more coal. Some other sector like, sponge iron sector and brick and other small scale sectors also need the coal, There is already shortage of indigenous coal and it expected to shortfall to 260Mt. in XI year plan

So, Central Coalfields Limited has pressure to increasing the power grade coal because. Continuing and augmentation of coal production from the mines of CCL will help to bridge the gap of demand and supply of superior power grade coal in India. To meet the growing demand of coal CCL has planned to increase its production capacity. Following are tangible bebefit of opening of this coal mining project, right from local area to country level.

a) Country level - Opening of this coal mine would help to increase the power generation by 500 to 600 MW that will be sufficient to feed one big city or 4 to 5 big steel plants or other big factories. Thus, this will be very much helpful in the development of economical condition of country.

b) Local level - More over, this will generate employment opportunity at three places, first at mining place second at power generation plant and third at user place. This will also increase the economical condition of these three places with the improvement in basic need of people such that communication, education and medical facilities.

Thus, we can see that opening of this mine is very important in the economical development of country.

Chapter - IX

Environment Management Plan

9.1 Introduction

For effective implementation, mid term corrective measures (if required), monitoring and control measure of environmental management plan depends on a time bound action programme. The success of environmental management plan depend on the well set- up organization with deeply involved persons. The objectives for creation of environmental plan are:

- To implement environmental control and protection measures.
- Subsequent environmental monitoring of the efficacy of various control measures.
- Plantation/green belt development.
- Land restoration.

Keeping this in view, organizational structure responsible for the implementation of environmental control and mitigation measures as well as monitoring of such implementation has been discussed in this chapter.

9.2 Organisation

Kathara Opencast is located in East Bokaro Coalfield of CCL, which has number of existing coal projects and other industries also. Operation of all such industries may have adverse impact on local environmental attributes unless and until proper multi-level organisations are set up for pollution control and regular environmental monitoring, full achievement can not be achieved. The organization has been set-up at various level which are listed below:

9.2.1 State pollution Control Board

Jharkhand Government has already set up a Jharkhand State Pollution Control Board to monitor the water and air quality all over the State. Previously it was being looked after by Bihar state pollution control Board. The Board has set up zonal offices in important industrial places. These zonal offices have responsibility of environmental/ monitoring in the area under their command area. Liquid effluent samples have already been collected from two/three points from each colliery e.g. Workshop, Mine Sump and surface water course. They have drawn a plan for air quality monitoring also. Under the law, they have statutory powers to control the activities of industries to maintain the

water and air quality. The CCL submits quarterly report on environmental monitoring to the Board and also Regional Office of Ministry of Environment and Forests (MOEF), Govt. of India.

9.2.2 Corporate Level

Central Coalfields Ltd. the owner of Kathara OCP has set up Environmental Cell headed by a CGM /GM at its Company HQ. The Cell is providing technical support that is required for environmental management, land reclamation and procurement / production of plant materials through the Company.

The CMPDI does the environmental monitoring work on behalf of CCL.

9.2.3 Area Level

The CCL has been divided into a number of administrative units known as Area, each headed by a Chief General Manager/ General Manager. The CGM/GM of an area, co-ordinates activities of a number of coal projects under his control. It is suggested that the CGM/GM of the area would co-ordinates the rehabilitation scheme in that area in liaison with the Chief of Revenue officer at corporate level and the concerned Project Officer.

9.2.4 Project Level

The environmental management activities would be carried out under the overall control of the Project Officer. Area Environment officer would be doing all environmental management activities with the equipments & manpower provided by the project officer of the Kathara project.

9.3 Scope of Management

The scope of environmental management plan includes the implementation of R&R, management of air, water, noise pollution control as well as management of surface drainage, industrial & Domestic waste, water treatment plant, ground water, land scaping, plantation, etc.

For the purpose of land reclamation and afforestation, the Project shall interact with different Government departments like department of agriculture, Forest Department etc. Guidelines and advice from Ministry of Environment and Forest.

For this purpose a time bound action Programme for environmental management will be prepared.

9.4 Monitoring & Control

For air, water and noise pollution control measures, samples will be collected and tested for all four seasons at strategic places representing all the categories of areas as indicated by CPCB. The implementation authority should be guided and advised as per the feed back data from these tests. The authority can take mid term correction & implementation, if necessary. If any measure problem arises, CMPDI may be consulted as and when necessary.

9.4.1 Monitoring Schedule

For air, water, noise and soil, quarterly monitoring is proposed. Following number of stations have been fixed for monitoring of environment for the proposed project.

Ambient Air	:	6 Stations (Quarterly)
Water	:	6 Stations (Quarterly for effluent & drinking water samples)
Noise	:	6 Stations (Quarterly)
Soil	:	3 Stations (Quarterly)

9.4.2 Plantation Monitoring

The project authority at field level will continuously monitor the growth and survival/mortality rates of the plantations till the end of 3 years or so. Once trees attain desired growth, no further monitoring will be required.

9.4.3 Action Plan for Land Reclamation and Plantation

The action plan delineates the quantum of overburden to be excavated, backfilled, the plantation schedules etc. Interaction with different Government Departments like Department of Agriculture, Jharkhand State forest department, Forest Research Institute would give additional technical guidelines. Guidelines from State and Central Ministry of Environment and Forest will be obtained for effective implementation of EMP.

9.4.4 Health Monitoring

A regular schedule will be programmed for monitoring health of the workers and staff associated with the mining operations and other connected industrial activities for identifying occupational diseases etc. in time and initiating remedial measures. Mobile ambulance will also be used for such programmes to monitor the health of the population around the area.

9.4.5 Compensation to land losers

The implementing authorities will ascertain that R&R work is going smoothly on time without any hindrance They are supposed to visit the rehabilitation site and nearby village to see quality and time schedule of the R & R works. They will also interact with people and will take their opinion, first hand and will act accordingly , if possible.

Chapter - X
Summary & Conclusion

10.0

Kathara Opencast project is one of oldest coal mine of the East Bokaro Coalfields of C.C.L in Bermo block, Bokaro district of Jharkhand state. Based on Geological Report, Kathara block lies in the East Bokaro Coalfield, which is an East-West elongated basin having axis plunging in the west. The northern limb with compratively shallower dips are very well preserved. The steeper dips coupled with greater frequency of disjunctives have resulted in partial trruncated southern limb of the basin. Kathara block is located in the westren part of the southern limb of the coalfield.

The zone of Kathara O.C.P. is bounded by river Damoder in the south and river Konar in north, joining the former one neat core zone, making a triangular shape. Bokaro river also flows and joins river Konar. Another surface feature of the buffer zone is Tenughat Bokaro canal and huge reservoir of Tenughat Dam. Eastern Railway of Daltamgamj Branch passes through the area

Due to liberalization and globalisation by Govt. of India in the country, there are sudden surge in industrial activities in private and public sector. As such, there is an appreciable increase in the number of upcoming new industries in both Private and Public Sectors. This has resulted in a sharp increase in the demand of power coal in CCL. Running of this Kathara OCP(0.96MTY) is ,therefore, essential to get washed coal. In our country, 80% of total power demand is met by thermal power station. This trend is expected to continue for at least another 50 Years. As per a study, it has been estimated that there would be a shortage of power grade coal for generation of electricity in the country. So, to meet the power demand, it would require more thermal power stations and consequently more coal.

This is generated employment at three places, first at mining place, second at consumption point and third at user place. This will also increase the economical condition of these three places with the improvement in basic need of people such that communication, education and medical facilities.

Thus, we can see that running of this mine is very important in the economical development of country.

10.1 Spoil Dump

Total OBR estimated for Kathara OCP is 255.60 Mcum. Out of which, 10.00.Mcum is left to extract in the OB Dump. Space for accommodating is available in Dump plan for Kathara OCP.The top level of OB Dump is from 330m to 350m.

10.2 Overall Mitigation Measures :-

Any opencast mining project particularly coal mines pollutes the various attributes of environment. Major affecting parameters are Air, Water, Noise and land. Detailed study about the effect due to pollution in these parameter have been discussed and various mitigation measures are suggested in respective chapter.

Precautions against the pollution are taken, right from the planning time of the project. Utmost care have been taken during the planning period so that there is least generation of pollution and suitable mitigation measures against the these pollutants..

10.2.1 Air ;- One of the environmental attributes in mining project is air which gets polluted due to blasting, excavating, transporting, loading & unloading of coal and OB. These activities of mining create the pollution by increasing the SPM level in the environment. This is low fugitive in nature and settled quickly and more over this is not harmful gas. Emission from the exhaust of vehicle spread SO_x and NO_X. The SOx and NO_X are fugitive in nature and disperse in atmosphere.

Preventing the air pollutions start right from the planning stage. It is envisaged that there would be good quality haul road with maximum slope 1:16 in general and coal transport is to be done by road. HEMM to be maintained on time schedule frame and low sulphur diesel would be used. This will reduce the emission from the exhaust of vehicle so the SO_X and NO_X.

During the operational time water sprinkling will be done regularly, Haul road and others road will be maintained and cleaned properly and regularly. Dust bag is to be used in drilling machine and blasting will be done at the time of maximum mixing height. All loading, unloading and transfer point will be wetted by water. These measures will reduce the generation of SPM to a large extent.

For preventing the SPM to spread, green belt along the quarry, haul road workshop, external OB dump, colony, etc would be developed (Plan enclosed).

10.2.2 Water:- Water is the another environmental attribute that gets polluted from the effluent of mine water, workshop etc. However, these pollutants are only physical in nature in the form of TSS, which are easily filterable and not much harmful to human or aquatic life. Generally, water does not get polluted chemically in Indian mines.

Preventing the water pollutions also start right from the planning stage. Planning is done in such a way that there is zero effluent discharge in dry days. Effluent will be recycled. In rainy days, effluent is allowed to discharge only after proper treatments. Storm water drain network in

the whole area, have been planned in such a way that the surface run-off flow from the dirty area do not get mixed up with clean area flow. Clean area water flow will be allowed to discharge directly in to natural drain, while the dirty area water flow will be treated properly before discharging into natural drain. These measures will reduce the surface water pollution to a large extent.

Other problems for water, due to opening mine is in increasing the depth of water table. As per detailed hydrological report, water table is not affected or disturbed due to typical Barakar formation. There is no problem for the population.

10.2.3 Land :- As we know open cast mining completely change the topography of the area i.e. It create large open deep excavation pit and huge high O.B. dumps. As the dump materials are in loose state and surface does not conforms to natural angle of repose. So in this condition, unless they are treated, are venerable to erosion caused by blowing wind and surface run-off. Continuous erosion of deep slope may lead to slope failure-causing loss of property and life. Such untreated dumps constitute a potential source of air and water pollution and safety hazard for employees.

Over Burden dumps (external or internal) needs the continuous parallel process of reclamation with mining works till the closer of mines. After closure of mines it needs reclamation of whole area to improve the over all aesthetics view in such a way that area become the source of income for the local inhabitant.

Land Reclamation does not mean restoration of the degraded land to the pre-mining land pattern.

There are several options available for land use pattern for reclaimed land. Factors discussed below would be considered for selection of appropriate land use pattern for reclaimed land.

(i) Pre-mining land use pattern
(ii) Properties of top soil/sub-soil
(iii) Socio-economic factors
(iv) Availability of technology for reclamation
(v) Climatic condition
(vi) Existing Flora & Fauna in the area.

Now, these days mine plan is being prepared in such a way that there is zero effluent discharge in dry days. In rainy days, effluent is allowed to discharge only after proper treatments. There will be increase in the depth of water table due to deep excavation for mining but this effect would occur up-to maximum extent of one Km. from the cutting edge of mine.

10.3 Mine Closure Plan

Mine closure encompasses rehabilitation process as an ongoing Programme designed to restore physical, chemical and biological quality disturbed by the mining to a level acceptable to all

concerned. It aims at leaving the area in such a way that rehabilitation does not become a burden to the society after mining operation is over. It must also aim to create as self-sustained ecosystem.

Mine closure operation is a continuous series of activities starting from day one of the initiation of mining project. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have had included most of the activities to be included in the progressive mine closure plan. Final mine closure plan as per statute, shall be considered to have its approval at least nine months before the date of proposed closure of mine. This period of nine months is reckoned as preparatory period for final mine closure operations.

10.4 Geological & Mining Characteristics

The Kathara block lies on the soutern limb of the main synclinal basin of the East Bokaro Coalfield, the axis of which runs in almost E-W direction. The southern limb of the Coalfield is not well preserved excepting in the Kathara and adjacent block where sedimentary sequence is represented by rocks of Barakar and Karharbari formations.

Boundaries of Mine:

Eastern

On the East, the quarry bottom edge has been fixed along the faultF3-F3.

Southern

The quarry bottom edge has been fixed in the incrop of Kargali seam.

Western

On the West, the surface edge of the quarry has been fixed at a distance of 60 m from the outskirts of Jhirki and Gowala Toli villages.

Northern

The final stage plan has been prepared by fixing the quarry bottom at RL of 100 m on the floor of Kargali Seam.

Summerised Data of Mines

Sl. No.	Particulars	Unit	Quarry
1	Coal	M.Tes	Extra. – 55.809M te Balance- 7.43 M Te
2	Volume of OBR	M.Cum	Balance- 10.00 M Te
3	Av. Stripping Ratio	Cum /te	4.02
4	Dip of Seams	Degree	12 - 25
5	Total Strike length of Quarry (PR-1989)	Km	3.00Km
6	Maximum Depth Quarry (PR-1989)	m	12-140
7	Existing Quaters	No.	1042
8	Man power	No.	823
9	Area of Leasedhold	Ha	792.81
10	Avg. Grade of Coal	ROM	Washery Grade-III
11	Main Consumer	-	Kathara Washery
12	Method of Mining	-	Shovel - Dumper

10.5 Infrastructure

10.5.1 Housing

There are 1042 houses against manpower strength of 823. Only revenue budget is needed for their maintenance.

10.5.2 Service

There are existing Hospital, Post Office, Bank, School, Community Centre, P.O. Office, Workshop, Sub-Station, Statutory Welfare & Community Hall.,Rest Shelter, officers Club, Workers Institute etc.

10.5.3 POWER SUPPLY

Heavy Earth moving Machines consume significant power in opencast project. Coal crushing & material handling facilities , mine dewatering , workshop, offices , colony etc. add to the total power demand of the project . it is proposed that that the opencast project will get from DVC, Bokaro Thermal Station JSEB substation .The Sub-station of capacity 3x3 MVA, 33/11KVA, which receives power at 33 KV, which transform power to 11 KV for distribution to various project of the area.

10.5.4 ROAD NETWORK

(a) Main Road

A PWD road is passing through the northern side of mining area from Tenughat to Jharandih. Besides this, there are existing metallic road to the adjoing villages.

(b) Colony Road

All colony are well connected with roads to various destinations .

(c) Haul Road

There are existing Haul in the project, which are well maintained.

10.5.5 Pumping & Drainage

The planning of dewatering the mine has been done in such a way that the working faces and haul roads in all quarries will remain dry as far as possible. The layout of the each quarry provide suitable gradient along the quarry floors and the benches to facilitate self- drainage of water to the sump at the lowest of the quarry.

It is proposed to provide garland drain along the quarry boundary to arrest water flowing into the mine from area beyond excavation.

During the heavy monsoon period, the work in the lower most bench may have to be stop as it will not be possible to pump out the entire make of water on the wettest day. Therefore, it is proposed to drawn a part of the lower most bench which would then act as sump.

Water accumulated in the sump will be pumped out to the surface and discharged into the nallah flowing outside the quarry and it will finally join to nearby Damodar river. It is proposed to create a sedimentation lagoon by constructing a series of check dams. Water overflowing the check dams would join river.The lagoon will help to separate the suspended solid from the mine water.

Chapter - XI
Discloser of Consultants

Regional Institute –III, CMPDI, is main consultant for the preparation of Project Report ,EIA/EMP ,structural and other works of Kathara OCP (0.96MTY) . Due to work load and shortage of manpower , CMPDI often off load the routine type of works to various Govt. / semi govt. , educational institutions and private agencies. RI- III ,CMPDI has off-loaded the work to the following agencies.

Table 11.1

Sl. No.	Name of Agency	Type of Agency	**Work Off-loaded**
A	Project & Development India Limited (PDIL), Sindri	Public Sector Undertaking (PSU) – Central Govt.	Base- line environmental data generation for Air, Water, Noise & Soil study for winter season, 2008- 09.
B	Richardson & Cruddas (1972) Ltd, Chennai	Public Sector Undertaking (PSU) – Central Govt	Study for flora & fauna of buffer & core zone area for summer 2009
C	*St. Xavier's College ,Research Center , Ranchi*	Educational Institution	Study for socio-economic of buffer & core zone area in for winter 2008 - 09

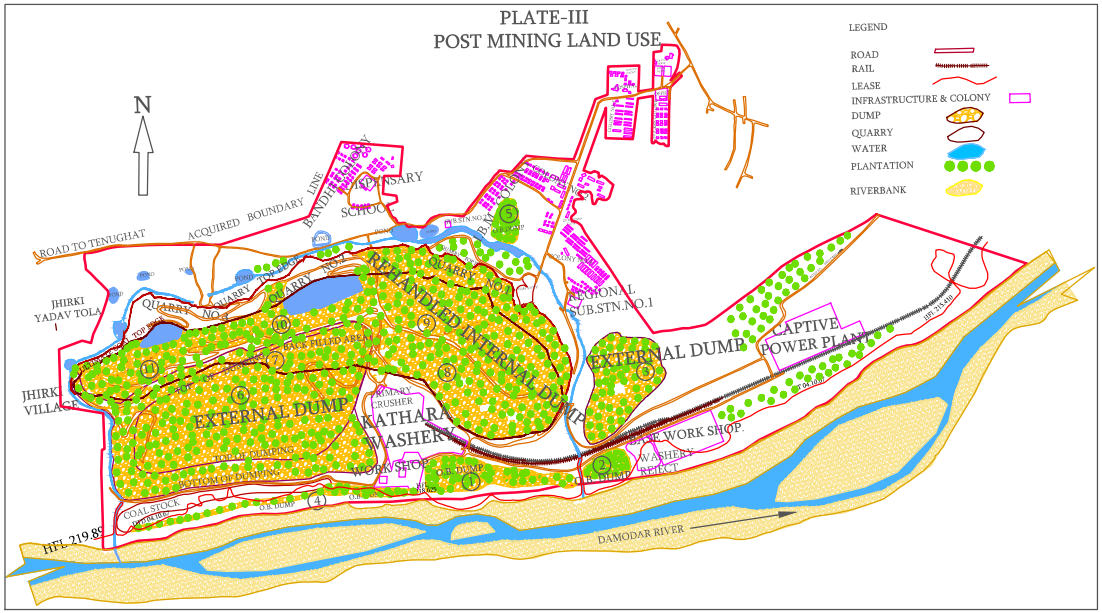
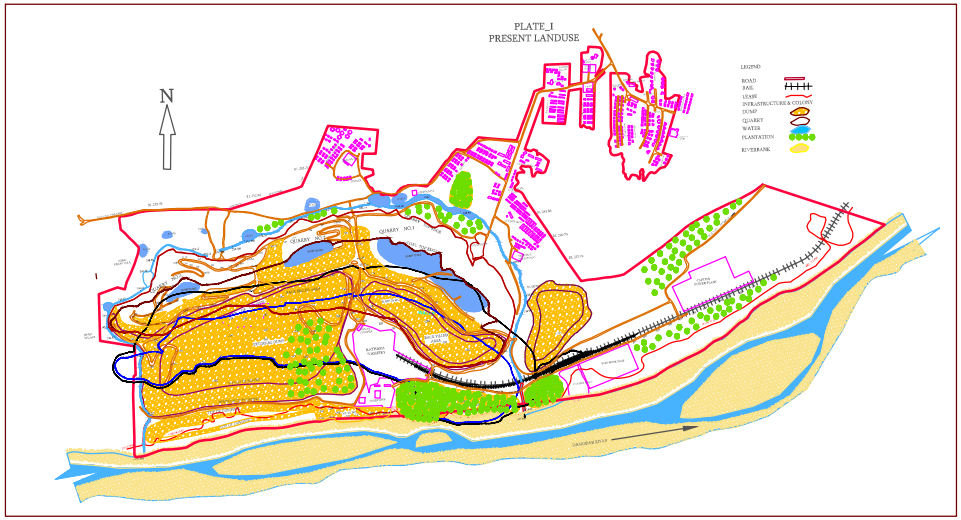
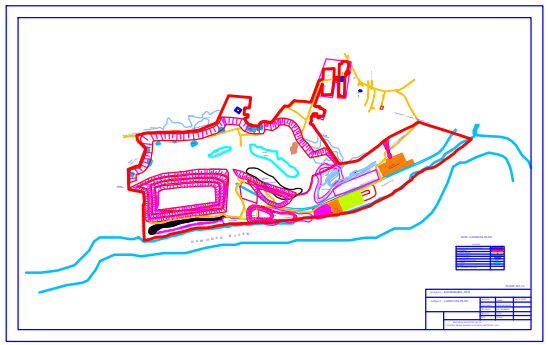


PLATE-III
POST MINING LAND USE
N
LEGEND
ROAD
RAIL
LEASE
INFRASTRUCTURE & COLONY
DUMP
QUARRY
WATER
PLANTATION
RIVERBANK
ROAD TO TENUGHAT
ACQUIRED BOUNDARY LINE
BANDHBERA COLLIERY
DISPENSARY
SCHOOL
QUARRY NO.3
QUARRY NO.2
QUARRY NO.1
REGIONAL SUB.STN.NO.1
JHIRKI YADAV TOLA
JHIRKI VILLAGE
RECLAIMED INTERNAL DUMP
EXTERNAL DUMP
EXTERNAL DUMP
CAPTIVE POWER PLANT
KATHARA WASHERY
CRUSHER
WORKSHOP
COAL STOCK
OIL DUMP
HFL 219.85
DAMODAR RIVER


PLATE_I
PRESENT LANDUSE
N
LEGEND
ROAD
RAIL
LEASE
INFRASTRUCTURE & COLONY
DUMP
QUARRY
WATER
PLANTATION
RIVERBANK



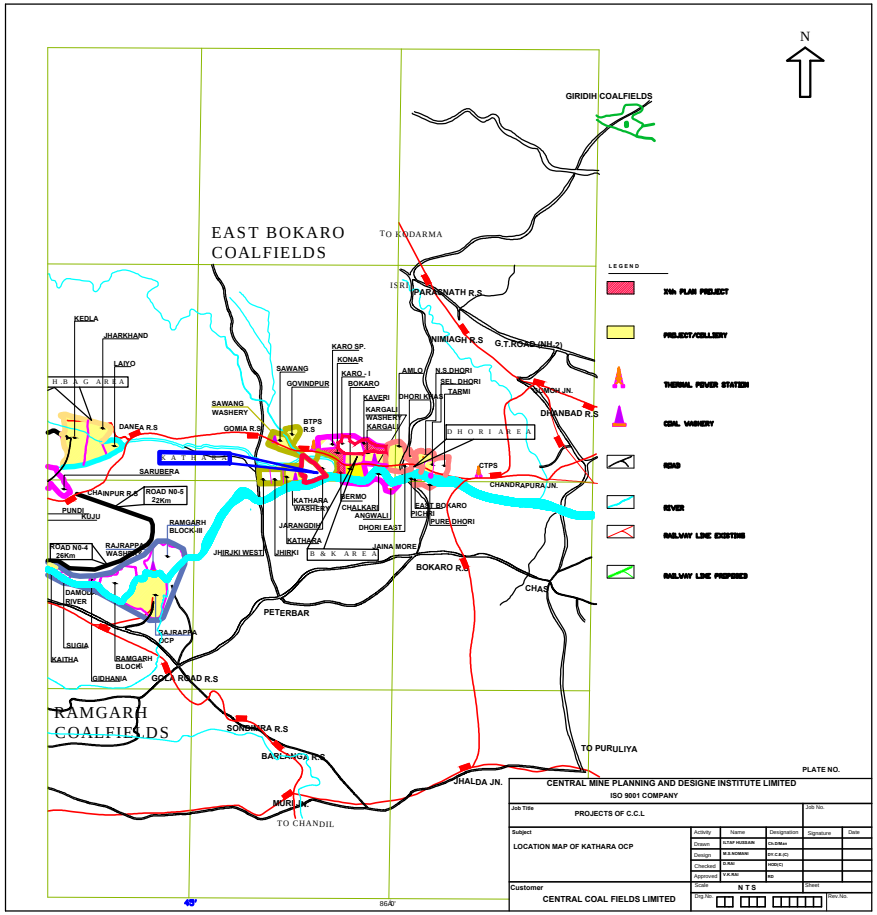
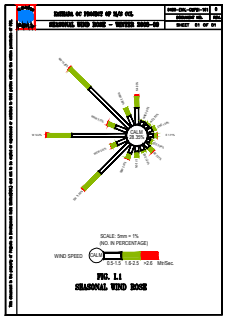


PLATE NO.

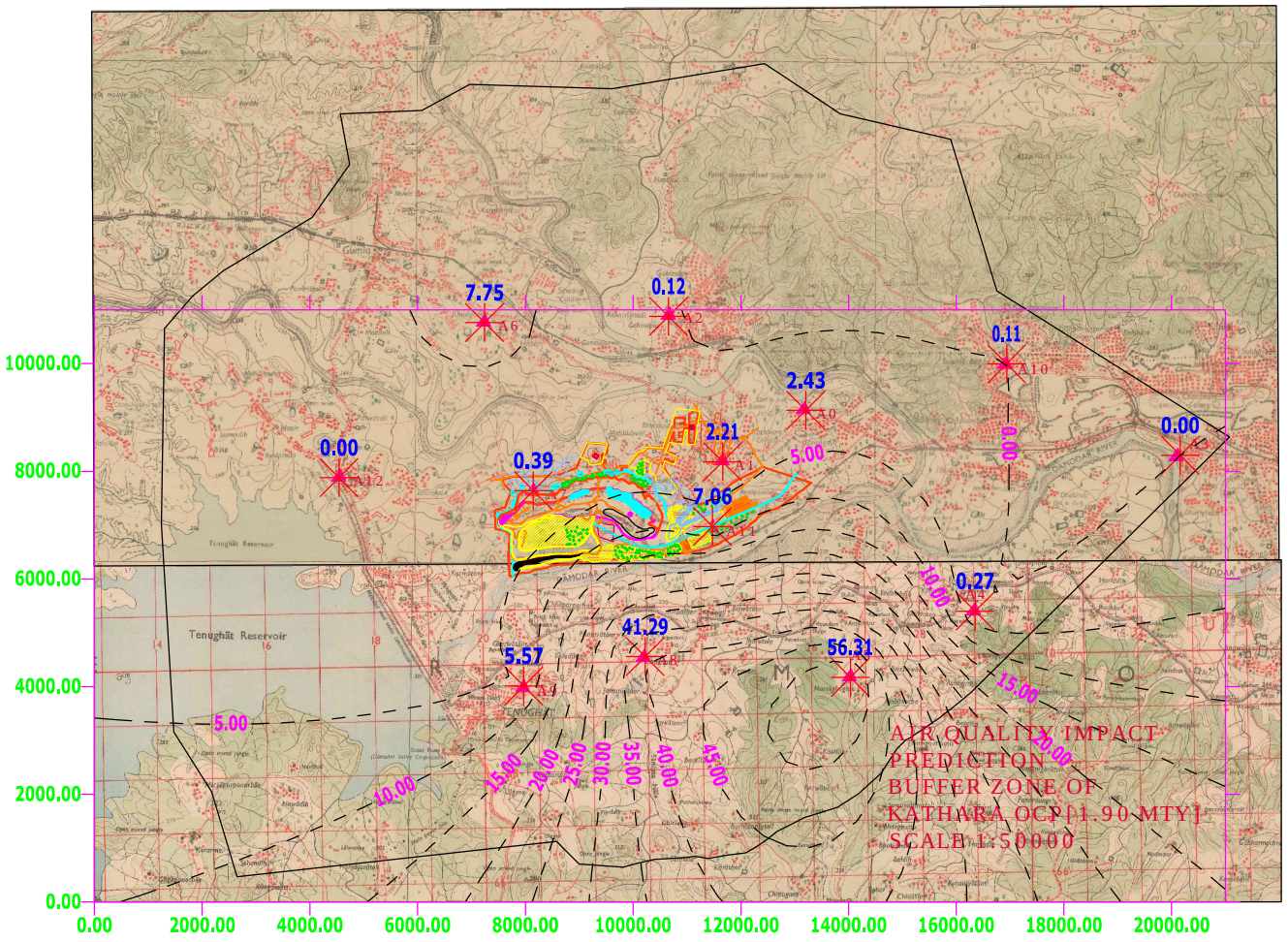
CENTRAL MINE PLANNING AND DESIGNE INSTITUTE LIMITED

ISO 9001 COMPANY

Job Title: PROJECTS OF C.C.L					Job No.	
Subject: LOCATION MAP OF KATHARA OCP	Activity	Name	Designation	Signature	Date	
	Drawn	S.TAP HUSSAIN	Ch.Draftsman			
	Design	M.S.SOMANI	Sr.C.E.(C)			
	Checked	D.N.V.	HOD(C)			
	Approved	T.K.RAI	MD			
Customer: CENTRAL COAL FIELDS LIMITED	Scale: N T S			Sheet		
	Drg.No.			Rev.No.		



SEASONAL & MONTHLY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0.12
0.11
2.43
2.21
0.00
0.39
7.06
0.00
0.27
41.29
5.57
56.31
Tenughāt Reservoir
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
10000.00
8000.00
6000.00
4000.00
2000.00
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12000.00
14000.00
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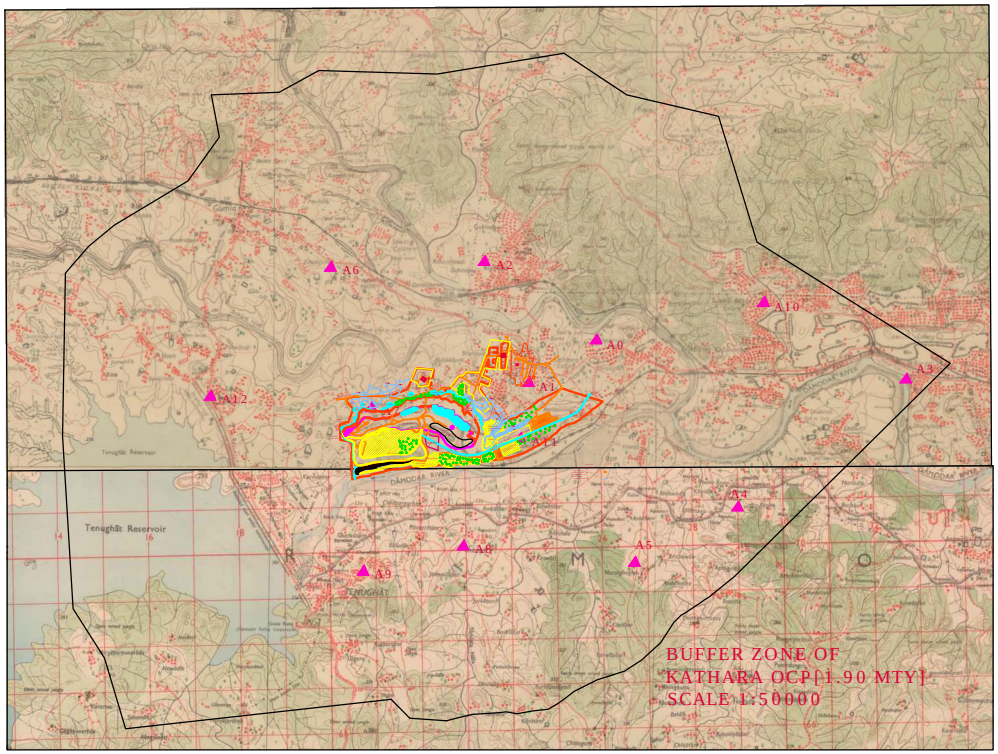
18000.00
20000.00
AIR QUALITY IMPACT PREDICTION BUFFER ZONE OF KATHARA OCP [1.90 MTY]
SCALE 1:50000


A6
A2
A10
A0
A1
A3
A12
A4
A5
A8
A9
Tenughat Reservoir
BUFFER ZONE OF
KATHARA OCP[1.90 MTY]
SCALE 1:50000

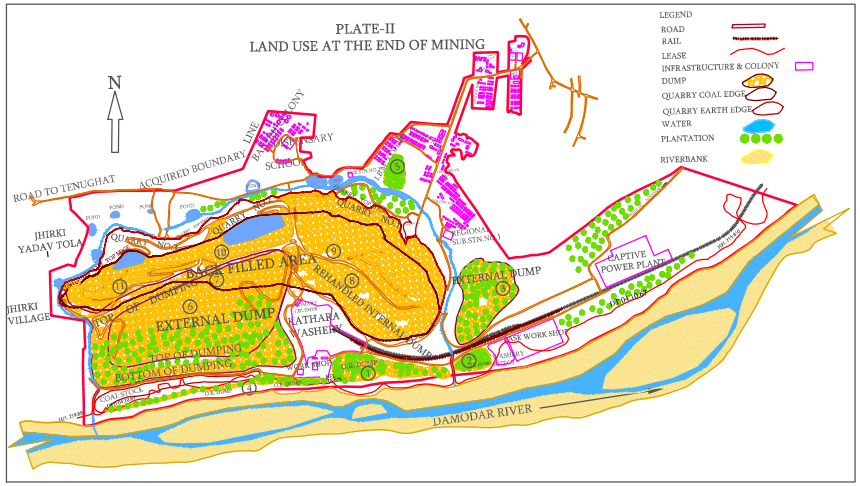


PLATE-II
LAND USE AT THE END OF MINING
N
LEGEND
ROAD
RAIL
LEASE
INFRASTRUCTURE & COLONY
DUMP
QUARRY COAL EDGE
QUARRY EARTH EDGE
WATER
PLANTATION
RIVERBANK
ROAD TO TENUGHAT
ACQUIRED BOUNDARY
JHIRKI YADAV TOLA
JHIRKI VILLAGE
BACK FILLED AREA
EXTERNAL DUMP
EXTERNAL DUMP
BATHARA WASHERY
CAPTIVE POWER PLANT
DAMODAR RIVER