Environmental Impact Assessment
&
Environmental Management Plan

FOR

CHATTARPUR – I & II UNDERGROUND EXPANSION PROJECT
(PATHAKHERA AREA, WESTERN COALFIELDS LIMITED)
(Expansion in production from 0.41 MTPA TO 1.00 MTPA and Enhancement of mine lease area from 356.370 ha to 825.338 ha)

SEPTEMBER– 2008

Prepared by :-

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CHAPTER – I

INTRODUCTION

1.0 INTRODUCTION: -

The projects were approved for 0.21 & 0.20 MTPA level of production with a capital investment of Rs. 19.25 crores & Rs. 20.76 Crs for Chattarpur – I & II UG mine respectively. The mines have produced 0.181 & 0.21 Mt during last year i.e. 2006-07. Now the mines are likely to produce 0.45 & 0.24 MTPA of coal respectively. In view of the maximum / peak production capacity achievable from these mines, environment clearance is being solicited for 1.00 MTPA for Chattarpur – I & II UG combined.

The FROM -I was discussed in the EAC meeting held on 28.07.2008 and TOR from MOEF has been received vide letter dated 26.8.2008. This EMP has been prepared based on the TOR and the generic structure as specified in the EIA notification 2006.

1.2. LOCATION: -

The existing Chhatarpur mine no. I UG & Chhatarpur mine no. II UG mines are situated adjacent to each other in Pathakhera Coalfields, which lies in between latitudes 22 Deg. 7' N to 22 Deg. 10' N and longitudes 78 Deg. 03' E to 78 Deg. 6' 45'' E as per Survey of India Topo Sheet no. 55 J/4. The area falls in Betul district of Madhya Pradesh state.

1.3. COMMUNICATION: -

Both these mines are well connected by both road and rail communication. The nearest railhead is Ghodadongri Railway Station about 12 km away, which is about 230 kms away from Nagpur on Delhi-Chennai Grand – Trunk line of Central Railway.

1.4 MARKETABILITY & JUSTIFICATION

Following table shows the deficit in availability of non-coking coal, excluding middlings from the various mines of WCL: (Source: Annual Plan 2007-08 of WCL prepared by WCL Planning Department in September 2006)

(Fig. in Mt)

Sl. No.	Parameter	YEAR					
		2007-08	2008-09	2009-10	2010-11	2011-12	2016-17
1.	**Demand for coal**	47.480	50.140	50.440	50.480	50.480	50.460
2.	Availability of coal	41.590	42.240	42.930	43.730	44.230	44.210
3.	Surplus/Deficit (+/-)	(-)5.890	(-)7.900	(-)7.510	(-)6.750	(-)6.250	(-)6.250

From the above tables, it is clear that there is a deficit in the availability of non-coking coal from the mines of WCL as a whole in general and from the mines of Pathakhera Coalfield in particular. The deficit is increasing every year inspite of taking into account the production from future expansion projects like Chattarpur – I & II U/G.

The transport of coal by consumers from far-off coalfields will burden the already overloaded national road/rail network. Thus, it is in the national interest to open new mines/projects nearby or expand the nearby existing/completed projects urgently so as to meet the requirement of coal from power and various other sectors.

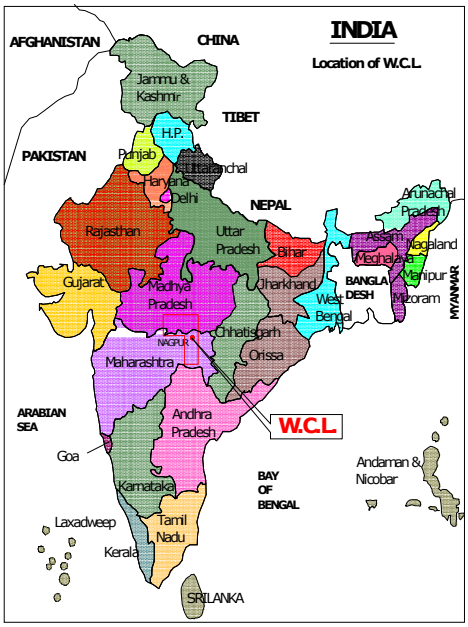
Some of the neighbouring mines of Pathakhera Area are likely to be closed or on the verge of closure in near future, hence it is essential to gainfully employ the surplus manpower, machinery and other infrastructure of these exhausting mines. In view of the above, it is necessary to expand the production capacity of Chattarpur – I & II U/G Mine for gainful utilization of the above as well as bridging the gap between the coal demand and coal availability to the extent of planned coal production from the expansion U/G Mine. Therefore, marketability of coal from the mine will not be a problem.

1.5 SOURCES OF DATA

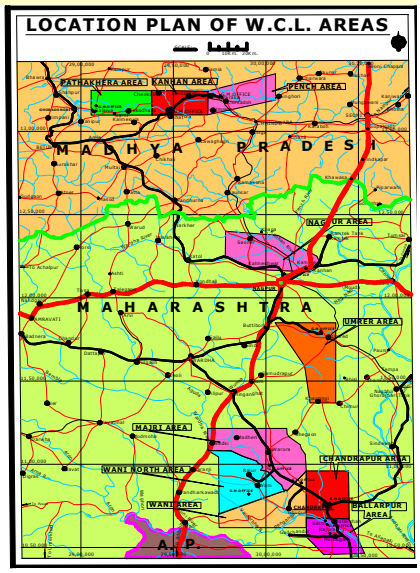
This report has been formulated using various data from the following sources:

Sl. N	Type of Data	Sources
1	Mining and economic parameters and other miscellaneous data	CMPDIL and Kanhan Area, WCL.

2	Environmental data including meteorological data, air quality, dust fall rate, water quality and noise level data.	Environmental-data generation for nearby Mohan(Maori) UG of Kanhan Area of WCL, carried out through CMPDI.
3	Socio-economic study & Land use/cover mapping buffer zone.	Census data 2001 & base line Socio - Economic survey.
4	Flora and fauna	Survey Report prepared by the competent authority in this field.
5	Surface hydrology and hydrogeology	CMPDIL, RI- IV, Nagpur.
6	Meteorological data	Environmental-data generation for nearby Mohan(Maori) UG of Kanhan Area of WCL, carried out through CMPDI.
7	Land use/cover mapping core zone.	As per State Govt. Record, data supplied by the concerned WCL area office.



LOCATION MAP OF WCL



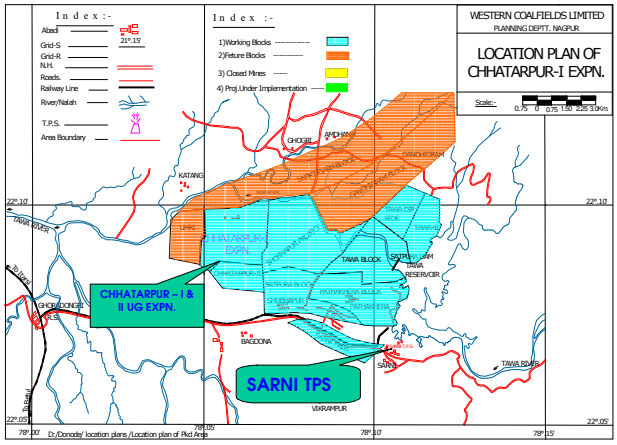
WCL AREAS(10)

MADHYA PRADESH(3)

- Pathakheda
- Pench
- Kanhan

MAHARASHTRA(7)

- Nagpur
- Umrer
- Wani
- Wani North
- Majri
- Chandrapur
- Ballarpur



CHAPTER – II
PROJECT DESCRIPTION

2.0. GEOLOGY & RESERVE:-

The brief description of geology is as under:-

2.1 Regional Geology

Pathakhera Coalfield is the western-most extension of Pench-Kanhan-Tawa Valley Coalfield and is situated in Betul district of Madhya Pradesh. The Coalfield is located in the Southern limb of Satpura-Gondwana basin. The generalized stratigraphic sequence of the coalfield is as follows:-

Age	Formation	Lithology
Recent	Alluvium	Soil
Upper Creetaceous to Eocene	Intrusives	Dolerite dykes
Unconformity		
Upper Permian	Bijori	Mostly sandstone
Lower Perimian	Moturs	Medium to coarse grained sandstone, greenish at places, choclate, greenish and variegated clay.
	Barakars	Medium to coarse grained fine grained towards bottom, shale, intercalations and coal seams.
Upper Carboniferous	Talchirs	Greenish shale and fine grained sandstone
Unconformity		
Pre-Cambrian	Quatzites	

The Metamorphics and Talchirs are exposed in the South-Western and South-Eastern parts of the coalfields. Barakar formation occupies the central part of the coalfield while the Motur occupies the major part of the coalfield in the north. Major portion of the coalfield is soil covered except the eastern hilly section.

A number of dolerite dykes with a general trend of E-W and NE-SW traverse the coalfield. Some of these dykes are exposed in the Tawa river in the north.

2.2 Geological Set-up of the Block

a) Barakar formation.

The formation predominantly consists of medium to coarse grained, white to grey coloured sandstone, with shale, carbonaceous shale and coal seams. On the basis of lithological assemblage the Barakar formation is broadly divided into three sub-divisions. The upper part of formation which is about 100-110 m thick is composed of medium to coarse grained sandstone with occasional shale bands. The middle part is about 120 m thick and consists of sandstone, shale and their intercalations and the coal seams. The lower part of the formation is about 250 m thick and is composed of fine grained garnetiferous sandstone with few thin shale and coal bands. The important coal horizons of the coalfield are confined in the middle section of about 120 m of the formation.

b) Motur-Formation

Motur formation is predominantly arenaceous in nature and consists of medium to coarse grained sandstone with greenish clay bands. The upper part of the Motur formation, however, contains pink and chocolate coloured clay beds.

The sandstone of Motur and upper part of the Barakar are quite similar in appearance. They are almost in distinguishable in boreholes cores. However, the boundary between two formations is generally marked at lower most persistent thin clay bed in Motur formation. This clay beds occurs about 100-110 m above the upper workable coal seam.

c) Intrusives

The presence of dolerite dykes in Pathakhera coalfield has been established on the basis of both surface (exposures along Tawa river) as well as underground workings. Within block though no exposure has been found, 5 boreholes have intersected Dolerite dykes.

In view of the susceptibility of Dolerite to Magnetic survey, the same was carried out to locate and determine the trend and thickness etc. Only one thick dyke was located and its trend and the deciphered extension has been provided in seam folio plates. In addition, dolerites have been encountered in afew boreholes (e.g. CMPC-31, 261 and 265 etc.) which can not be correlated to the above dyke. Hence, the possibility of occurrence of more dykes in the area cannot be discounted.

2.3 Structure

The Pathakhera Coalfield is situated in the southern limb of the East-West trending Satpura Gondwana basin, which is also the western continuation of Pench-Kanhan Valley Coalfield. Major part of the coalfield is soil covered except for the eastern and north eastern part. The structural interpretation of the coalfield has, therefore, been established almost entirely on sub-surface data accruing from boreholes and underground workings. The lay and disposition of the coal bearing barakars has been arrived at the floor of the most consistent and workable coal horizon namely lower workable seam in this coalfield.

The following major structural features have already been established in Pathakhera Coalfield:-

i) The monoclinally northerly dipping Barakar formation in Pathakhera Coalfield trend E-W with significant local variations in their dip and strike including reversal of dip direction associated with anti and synforms.

ii) Board antiforms have been deciphered in the undeground workings of Satpura-II mine and

iii) Coal bearing barakars are trending NNE-SSW towards the east in the vicinity of Tawa Extension/Tawa bloks dipping WNW with angles varying between 1.5^0 to 15^0 with general dip of 5^0. The strike of bed curves to attain almost E-W trend in the central part of the coalfield i.e. in

Pathakhera mine I and II, Satpura Mine-I, eastern part of Satpura Mine-II etc. The westward continuation of the strike around the vicinity of Satpura-II mine shows the development of a broad dome-like antiform which merges westwards into an E-W trending northwardly dipping monoclinical surface. Further towards west two roughly ENE-WSW elongated synforms with a corresponding antiform west of their axis of elongation have been interpreted within the Umri block. Hinge faults upto throw of 150 m are present.

2.3.1 Strike and Dip

the general strike of coal seam as revealed by floor contour is E-W dipping to the north at a gradient of 1 in 7 to 1 in 8. The strike of coal seam in the eastern part of the proposed area is NE-SW dipping towards NW. The gradient in this area is 1 in 6 towards north.

In the southern part of the middle of combined Chhatarpur-I & Extension block including Umri block, the strike of the coal seam varies from ENE-WSW to NE-SW to NNE-SSW dipping towards north-west. The gradient in the rise side is steeper and it flatterns out in the dip side.

In the north-central and central part of the combined block, complete reversal of the dip towards south has been found. The strike of the formation in this area swings from NE-SW in the eastern part to NW-SE in the western part.

In the extreme western part, the strike is almost N-S in the northern side with easterly/south easterly dip and in southern side, strike swings to NW-SE to E-W with southerly dipping.

2.4 Description of Coal Seams

In Pathakhera Coalfield, four main persistent coal seams in addition to thin carbonaceous horizons have been deciphered. The four main seams are IA Seam, Bagdona Seam, Lower Workable Seam and upper Workable Seam in ascending order. The younger two seams i.e. Lower Workable Seam and upper Workable Seam are by far the most consistent Bagdona Seam is generally workable in the central and eastern parts of the coalfield and is generally unworkable in the Southern and Western parts of the coalfield. The lower most seam i.e. IA Seam is mostly unworkable in the coalfield but has attained workable thickness in the western and eastern part of the coalfield. The generalized sequence of coal seams in the coalfield is furnished in the following table

Thickness Ranges of Coal Seams and Partings in Pathakhera Coalfield

Seam/Parting	Thickness (m)
Upper Workable Seam	1.0 – 2.5
Parting	12 – 20
Lower Workable Seam	1.5 – 5.0
Parting	40 – 60
Bagdona seam	<1.0 – 2.5
Parting	35 – 55
IA Seam	<1.0 – 2.0

Chattarpur – I UG

Name of the seam being worked :Lower Workable seam.

Seam thickness range (m) : 2.2 m to 3.0 m.

Extractable reserves (as on 01/04/07) :8.815 Million Tonnes.

Chattarpur – II UG

Name of the seam being worked :Lower & Upper Workable seam.

Seam thickness range (m) : 0.9 m to 5.6 m.

Extractable reserves (as on 01/04/07) :3.20 Million Tonnes.

2.5 METHOD OF MINING:-

Chattarpur - I UG

The entire coal winning operations are carried out below ground. The method of work is Bord & Pillar with coal winning by Blasting – off the solids and coal loading by Load Haul Dumpers (LHDs) at the face onto pony belt conveyors. Pony belt Conveyors load coal onto gate belt conveyor and finally coal is brought to surface through series of haulages. The depillaring is by proposed by Caving.

Chattarpur – II UG

The entire coal winning operations are carried out below ground. The method of work is Bord & Pillar with coal winning by Blasting – off the solids and coal loading by manual means at the face onto coal tubs. Coal Tubs load coal onto gate belt conveyor through tippler and finally coal is brought to surface through series of conveyors. The depillaring is done by Caving.

2.6 PRODUCTION PERFORMANCE OF THE MINE OF THE LAST SIX YEARS:-

Chattarpur – I UG

Year	Coal (Mt.)
2001-2002	0.112
2002-2003	0.096
2003-2004	0.123
2004-2005	0.116
2005-2006	0.143
2006-2007	0.181

Chattarpur – II UG

Year	Coal (Mt.)
2001-2002	0.191
2002-2003	0.160
2003-2004	0.173
2004-2005	0.180
2005-2006	0.217
2006-2007	0.213

2.7. PRODUCTION TARGET: -

The projected production target of the combined mine is 1.00 MTPA for the balance life of mine.

2.8. DISPATCH: -

The entire coal being produced by the mine is being dispatched to MPPGCL, TPS at Sarni by road, which is about 10 km from pithead.

2.9 LAND STATUS: -

Mining Right :

	Type of Land Use	Land Use before Mining (ha)	Land Use During Mining (ha)	Change in Land Use
1.	Govt & other Land	I – 550.17 II – 35.967 = 586.137	Under ground Mining+ infrastructures in Surface Right Area as shown below.	NO Except for surface right portion as shown below.
2.	Forest land	I – 91.03 II – 148.171 = 239.201	Under ground Mining+ infrastructures in Surface Right Area as shown below.	NO Except for surface right portion as shown below.
	Total	825.338		

Chattarpur – I UG – 641.200 ha
Chattarpur – II UG – 184.138 ha

Surface Right: (Already included in Mining Right Area shown above)

	Type of Land Use	Land Use before Mining (ha)	Land Use During Mining (ha)	Change in Land Use
1.	Govt & Other Land	I – 6.610 II – NIL = 6.610	For Mine Entry & Infrastructures	Constructed Infrastructures
2.	Forest land	I – 4.144 II - 6.134 =10.278	-- DO --	-- DO --
	Total	16.888		

Land under mining right and Surface right area has been notified under CBA Acts, 1957 and acquired under FC Act, 1980 as follows :-

Mine name	Land type (ha)		Total (ha)
	Govt. Land & Others	Forest	
Chattarpur – I UG	153.995	51.213	205.208
Chattarpur – II UG	32.707	118.455	151.162
Chattarpur – I UG & II Combined	186.702	169.668	356.370

Forest clearance for 169.668 ha has been obtained vide letter no F5/48/97/10/3 dated 03.01.2000.

Additional Land proposed for expansion of these two UG Mines has already been notified under mining right under CBA Act, 1957, and only permission under FC Act, 1980 is to be taken for this land to work below in UG mining system. –

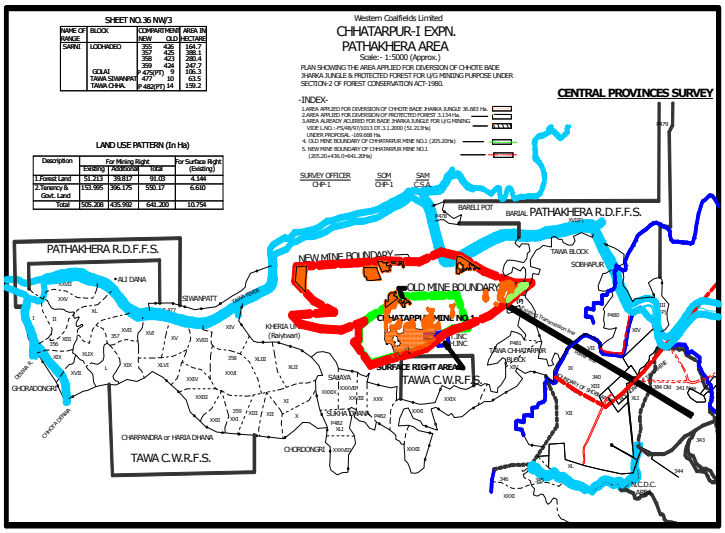
Mine name	Land type (ha)		Total (ha)
	Govt. Land & Others	Forest	
Chattarpur – I UG	396.175	39.817	435.992

Chattarpur – II UG	3.260	29.716	32.976
Chattarpur – I UG & II Combined	399.435	69.533	468.968

As mentioned in earlier paragraph, 468.968 ha has already been notified under CBA Act, 1957 and only clearance under FC Act, 1980 for UG mining will have to be taken for 69.533 ha.

2.10 . <u>EXISTING MANPOWER: -</u>

The existing manpower of Chattarpur – I UG is 452 & that of Chattarpur – II UG is 919 nos. (As on 01/04/2007).



<u>CHAPTER – III</u>

<u>EXISTING ENVIRONMENTAL SCENARIO</u>

3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 AMBIENT AIR QUALITY

Base line & Existing Scenario – Base line ambient air quality w.r.t. the mine under consideration has also been generated during the pre monsoon season at five locations during 2006 covering the core and Buffer zone. The ambient air quality data thus generated reveal that the quality of ambient air is well within the permissible limits.
The details of Base Line data generated is as given below :-

3.1.1 SCOPE AND METHODOLOGY

Preamble

The scope of the study and the present report covers the detailed characterisation of the existing environmental status in the operating Chhatarpur-I & II UG project area for major environmental components viz. micrometeorology, ambient air quality, water quality, noise level and soil quality.

Micrometeorology

As a part of this study, micrometeorology and microclimatic parameters were recorded by installing a meteorological station at core zone. Data of wind velocity, wind direction, ambient temperature, relative humidity and cloud cover were recorded at hourly intervals in a day throughout the study period. Further rainfall also has been recorded and reported.

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

Ambient air quality

To assess the ambient air quality status, monitoring stations were identified on the basis of meteorology in the upwind and downwind direction as well as to represent the cross sectional scenario of the project site. Based on the production activities, the parameters chosen for assessment of air quality are Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x) and Carbon monoxide (CO).

Calibrated Respirable Dust sampler (with an average flow of 1.2 - 1.4 m^3/min.) was used for monitoring of SPM & RPM and a tapping provided in the hopper of the same sampler was utilised for sampling of SO_2 and NO_x with proper flow controller (1 LPM).

A field laboratory for the purpose of calibration of equipment and standardisation of analytical procedures was also established. A digital imported CO detector was used for monitoring of CO. SPM & RPM were monitored on 24 hourly basis and gaseous pollutants on 8 hourly basis for 2 days in a week for 12 weeks as per the guidelines of CPCB / MOEF. Collected samples are analysed on the day of sample collection with the following procedure.

SPM & RPM

Ambient air laden with suspended particulates enters the Respirable Dust Sampler (RDS) through the inlet pipe of sampler by means of high flow rate blower (1.2 to 1.4 m^3/min). As the air passes through the cyclone, coarse, non-respirable dust (size > 10 microns) is separated from the air stream by centrifugal forces acting on the solid particles. These separated particles fall through the cyclone's conical hopper and collect in the sampling bottle placed at bottom. The fine dust forming the respirable fraction (size <10 microns) of the Total Suspended Particulates passes through the cyclone and is carried by the air stream to the Glass Microfibre Filter Paper. The Respirable Particulate Matter (RPM) is retained by the filter and the carrier air exhausted from the system through the blower. The mass concentration (µg/m^3) of Suspended Particulate Matter (non-respirable dust and respirable dust) and Respirable Particulate Matter in the ambient air is computed by measuring the mass of collected particulates and the volume of air sampled.

NO_2 (Jacob & Hocheiser modified method)

Ambient air is bubbled at the rate of 0.5-1.0 l/min in an Impinger containing a solution of Sodium Hydroxide and Sodium Arsenate. The resultant Nitrite Ion is reacted with Phosphoric acid, Sulphanilamide and N-ethylene diamine di-hydro chloride to form a coloured complex. The absorbance is measured in a Spectrophotometer at a wavelength of 540 nm. The concentration of NO_2 is then calculated by using standard graph.

SO_2 (Modified West & Gaeke Spectrophotometer method)

Ambient air is bubbled at the rate of 0.5 -1.0 l/min in an Impinger containing a scrubbing solution of Sodium - Tetra Chloro Mercurate. The resultant compex is reacted with P-Rosaniline and Formaldehyde to form coloured Pararosaniline methyl sulphuric acid. The absorbance of the solution is measured in a Spectrophotometer at a wavelength of 560nm. The SO2 is then calculated from standard graph.

Values for both SO_2 & NO_2 in air sample, below 6 µg/m^3 has been reported as Below Detectable Limit (BDL).

CO : An imported digital CO detector is used for monitoring of CO (Digital dragger).

Water quality

Water samples were collected and analysed as per procedures outlined in IS-2488/ IS-3025 / AWWA / APHA. Sterilized bottles were used for collection of water sample for bacteriological analysis, stored in icebox and transported to the laboratory for the analysis. Parameters like pH, Temperature, Dissolved Oxygen, Residual Chlorine, Conductivity, Free Ammonia, Total Hardness, Calcium Hardness and Magnesium Hardness were analyzed in the field while collecting the samples. MPN index of Coliforms are determined in the laboratory as per standard methods.

Noise levels

Ambient noise level measurements in four co-ordinal directions were carried out using B&K sound level meter (Model 2237), with windscreen during daytime as well as night time.

Noise measurements were made at 1.5 m above ground and about 3m away from walls, buildings or other sound reflecting sources. During the mid day time at the blasting time of the mine, 30 readings were taken at an interval of one minute for 30 minutes and average value has been reported.

Ambient noise levels are compared with Air quality standards in respect of noise for residential area.

Soil quality

To assess the baseline soil quality, soil samples were collected from identified locations in core & buffer zones using augers at depths 30, 60 and 100 cms. The samples were analyzed for chemical parameters like pH, EC, N, P, K and engineering parameters like textural class, bulk density, liquid limit, field capacity, wilting coefficient and available water storage capacity.

3.2 MICROMETEOROLOGICAL STATUS

3.2.1 Rationale behind sampling

Meteorological parameters are important factors in the study of air pollution. The transport and diffusion of the pollutants in the atmosphere are governed by meteorological factors. Factors like 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.

Micrometeorological and microclimatic parameters were 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 etc., were recorded and reported. Further daily rainfall has been recorded and reported.

3.2.2 Data presentation & analysis

The micrometeorological data thus collected has been processed and analyzed as per standard procedures. The seasonal wind distribution is given in the Table - 3.2.2. The abstract of micrometeorology data is furnished in Table below. The seasonal wind rose has also been shown below.

Table – 3.2.2 : Seasonal wind distribution data.

Season : Summer 2006
Location : Core zone

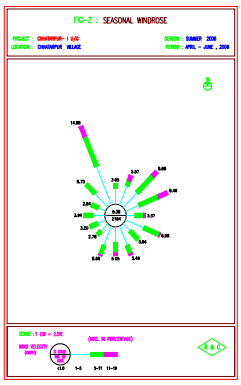
Wind Direction	Wind Velocity, Kmph (% Duration)			
	< 1.0	**1 – 5**	**5 – 11**	**11 – 19**
N	9.38	2.74	0.91	-
NE		3.66	4.12	1.10
E		1.60	1.60	0.37
SE		1.83	2.11	-
S		2.74	1.83	0.48
SW		1.86	0.92	-
W		2.29	1.65	-
NW		3.44	2.29	-
NNE		3.66	0.91	1.00
ENE		2.74	3.89	1.93
ESE		3.66	3.21	0.09
SSW		3.66	1.83	0.09
WSW		1.60	1.60	-
WNW		1.47	1.37	-
NNW		7.33	5.68	1.97
SSE		3.66	1.60	0.23
Season	**9.38**	**47.94**	**35.54**	**7.14**

The following is the summary of the analysis of the micrometeorological data collected at Core zone.

Meteorology station : Corezone	
Climatic conditions	Summer season (April`06 – June`06)
Predominant wind direction (from)	NNW
Calm condition (%)	9.38
Predominant prevailing wind range (Kmph)	1-5
Wind speed (Kmph)	
i) Minimum	<1.0
ii) Maximum	12.2

Temperature (°C)	
i) Minimum	24.0
ii) Maximum	44.5
Mean relative humidity (%)	
i) Minimum	11.0
ii) Maximum	92.0
Total rainfall (cm)	8.98

The wind rose diagram is given as below :-



3.3 AMBIENT AIR QUALITY STATUS

Preamble

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

The monitoring stations were identified on the basis of meteorology in the upwind and downwind direction as well as to represent the cross sectional scenario of the project site. The monitoring network was designed based on the available meteorological and climatological norms of predominant wind direction and wind speed of the study region.

The parameters selected for analysing the air quality status are Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur dioxide (SO_2), Nitrogen oxides (NO_x) and Carbon monoxide (CO). As per the existing norms, air quality monitoring was carried out on 24 hourly basis for SPM & RPM and 8 hourly basis for SO_2, NO_x & CO samples for two days in a week for twelve weeks in the season. The location details of ambient air quality monitoring stations are given in the Table below.

Details of Ambient air quality monitoring stations
(Location & Bearing)

Sl. No.	Location Name	Location Code	Direction (from Site)	Distance (Km)

1.	Corezone	A1	-	-
2.	Satpura	A2	SE	6.0
3.	Chorpandra	A3	SSW	4.6
4.	Shanthipur	A4	NNW	4.5
5.	Ghogri	A5	NE	4.0
6.	Bhogaikhapa	A6	E	5.5

Rationale behind sampling

(i) Core zone (A_1): This location is situated at the core zone and it is selected to assess the immediate effects of active mining and the present data will help to know the increase in pollution levels due to the ongoing mining operation through post project monitoring.

(ii) Satpura village (A_2): This location is situated at 5.2 km distance from the mine towards South East (SE) direction and it was selected for air quality monitoring to assess baseline status of the populated area in downwind direction.

(iii) Chorpandra village (A_3): This location is situated at a distance of 4.6 km towards South- South West (SSW) direction from mine site. It was selected to assess the possible pollution due to nearby mining activity and transportation roads.

(iv) Shanthipur village (A_4): This location is situated about 4.5 km distance from site towards Nort-North West (NNW) direction. The data will help to know the extent of pollution, if any, due to mining operations in nearby area and presents the baseline status at this area.

(v) Ghogri village (A_5): This location is situated at a distance of 4.0 km towards North - East (NE) of operating mine area. It was selected to assess the impact of air pollutants due to nearby mining and transportation activities and to know the baseline air quality status of this area.

(vi) Bhogaikhapa village (A_6) : This location is situated at a distance of 5.5 km East (E) of the mine area. It was selected to assess the impact of air pollutants due to nearby mining and to know the baseline air quality status of this area.

Data presentation & analysis

The ambient air quality namely SPM, RPM, SO_2, NO_X & CO data collected are furnished in Annexure-I and the abstract of the same is given in the Table below.

Abstract of ambient air quality

Unit :µg/m³

Location name & Code	Min.	Max.	95th Per.	98th Per.	AM	GM	SD
SPM Concentration							
Corezone (A1)	304	352	346	352	323.0	322.8	12.3
Satpura (A2)	96	156	154	156	128.5	127.3	17.7
Chorpandra (A3)	102	152	150	152	127.3	126.4	15.3
Shanthipur (A4)	94	124	124	124	109.8	109.4	8.3
Ghogri (A5)	94	132	124	132	109.4	108.8	11.1
Bhogaikhapa (A6)	82	132	126	132	104.1	103.3	13.5
RPM Concentration							
Corezone (A1)	104	119	119	119	112.5	112.4	4.4
Satpura (A2)	34	51	49	51	44.6	44.5	3.9
Chorpandra (A3)	38	49	49	49	44.0	43.9	3.4

Shanthipur (A4)	36	46	45	46	41.6	41.5	2.2
Ghogri (A5)	35	47	46	47	39.0	38.9	3.1
Bhogaikhapa (A6)	29	37	37	37	33.1	33.0	2.3
SO2 Concentration							
Corezone (A1)	5.0	7.5	7.3	7.5	6.3	6.3	0.6
Satpura (A2)	4.9	9.0	8.7	8.8	6.4	6.3	1.4
Chorpandra (A3)	4.7	6.3	6.2	6.3	5.5	5.5	0.4
Shanthipur (A4)	4.6	8.4	6.3	8.4	5.4	5.4	0.7
Ghogri (A5)	4.2	5.9	5.4	5.6	4.9	4.9	0.3
Bhogaikhapa (A6)	4.0	5.7	5.4	5.7	5.05.0	0.3	
NOx Concentration							
Corezone (A1)	9.6	12.9	12.1	12.6	11.2	11.2	0.7
Satpura (A2)	7.4	9.7	9.5	9.6	8.6	8.6	0.6
Chorpandra (A3)	6.8	10.4	10.1	10.3	9.2	9.2	0.7
Shanthipur (A4)	6.5	9.1	8.5	8.9	7.7	7.7	0.5
Ghogri (A5)	6.2	8.5	8.3	8.5	7.5	7.5	0.6
Bhogaikhapa (A6)	6.2	9.1	8.6	8.9	7.5	7.4	0.7

Note : All CO values were found to be below the detectable limit of 144.5µg/m^3

Core zone

SPM and RPM values are ranging from 304 µg/m^3 to 352 µg/m^3 and 104 µg/m^3 to 119 µg/m^3 respectively. SO_2 and NO_x values are varying between 5.0 to 7.5 µg/m^3 and 9.6 to 12.9 µg/m^3 respectively. CO values are found to be below detectable limit of <114.5 µg/m^3 in this location.

All the values are found to be well within the Standards for Coalmines stipulated by Ministry of Environment & Forests (MoEF).

Buffer zone :

SPM and RPM values are ranging from 82 µg/m^3 to 156 µg/m^3 and 29 µg/m^3 to 51 µg/m^3 respectively. SO_2 and NO_x values are varying between 4.0 – 9.0 and 6.2 – 10.4 µg/m^3 respectively. CO values are found to be below detectable limit of <114.5 µg/m^3 at all locations.

While comparing with CPCB norms for Residential and Rural areas, all SPM, RPM, SO_2, NO_x and CO values are well within the prescribed limits.

Summary

In general, all SPM, RPM, SO_2, NO_x and CO values are found to be well within the prescribed limits of CPCB.

AIR QUALITY DATA

Season : Summer 2006

Location : Core zone (A1) Period : April `06 - June`06

Unit: µg/m^3

WEEK	DATE	SPM (24 Hrly)	RPM (24 Hrly)	SO2	NOx	SO2	NOx	SO2	NOx	SO2	NOx	CO (24-hrly)
				Ist Shift	Ist Shift	II-Shift	II-Shift	III-Shift	III-Shift	24-hrly	24-hrly	
I	06/07.04.2006	315	108	6.4	10.6	6.8	10.9	6.2	9.6	6.5	10.4	<114.5
	07/08.04.2006	326	112	6.8	11.2	7.2	11.3	6.0	10.3	6.7	10.9	<114.5

II	13/14.04.2006	320	110	6.3	11.8	6.8	11.9	5.7	10.4	6.3	11.4	<114.5
	14/15.04.2006	346	115	5.9	10.7	6.3	10.8	5.2	10.1	5.8	10.5	<114.5
III	20/21.04.2006	352	118	6.6	11.6	6.8	11.7	5.6	10.8	6.3	11.4	<114.5
	21/22.04.2006	346	116	6.4	10.1	6.5	11.4	6.0	9.6	6.3	10.4	<114.5
IV	27/28.04.2006	320	110	7.1	11.6	7.3	11.9	6.4	10.1	6.9	11.2	<114.5
	28/29.04.2006	328	113	6.9	11.9	6.8	12.1	5.9	10.2	6.5	11.4	<114.5
V	04/05.05.2006	336	117	7.4	12.1	7.5	12.4	6.4	11.3	7.1	11.9	<114.5
	05/06.05.2006	321	115	7.3	12.6	7.5	12.9	6.5	12.2	7.1	12.6	<114.5
VI	11/12.05.2006	319	112	7.0	11.9	7.2	11.9	6.7	11.4	7.0	11.7	<114.5
	12/13.05.2006	306	106	6.0	11.4	6.5	11.9	5.7	10.9	6.1	11.4	<114.5
VII	18/19.05.2006	325	117	6.8	12.1	6.9	12.1	5.4	11.4	6.4	11.9	<114.5
	19/20.05.2006	316	113	6.2	10.9	6.5	11.4	5.0	10.2	5.9	10.8	<114.5
VIII	25/26.05.2006	328	116	6.4	10.7	6.6	10.9	6.1	10.1	6.4	10.6	<114.5
	26/27.05.2006	320	119	6.0	11.3	6.2	11.2	5.7	10.4	6.0	11.0	<114.5
IX	01/02.06.2006	304	104	5.9	10.8	6.1	11.3	5.2	10.2	5.7	10.8	<114.5
	02/03.06.2006	327	116	6.3	11.6	6.5	11.9	5.8	10.8	6.2	11.4	<114.5
X	08/09.06.2006	306	108	6.5	11.9	6.8	12.1	5.2	10.7	6.2	11.6	<114.5
	09/10.06.2006	316	112	6.4	11.2	6.5	11.4	5.0	10.9	6.0	11.2	<114.5
XI	15/16.06.2006	310	107	6.1	10.9	6.2	11.2	5.0	10.9	5.8	11.0	<114.5
	16/17.06.2006	321	119	6.0	11.4	6.2	11.7	5.3	10.3	5.8	11.1	<114.5
XII	22/23.06.2006	318	106	5.9	10.9	6.4	11.2	5.4	9.6	5.9	10.6	<114.5
	23/24.06.2006	326	111	6.1	11.7	6.5	11.9	5.7	10.1	6.1	11.2	<114.5

AIR QUALITY DATA

Season : Summer 2006

Location : Satpura (A2)

Period : April `06 - June`06

Unit: µg/m^3

WEEK	DATE	SPM (24 Hrly)	RPM (24 Hrly)	SO2	NOx	SO2	NOx	SO2	NOx	SO2	NOx	CO (24-hrly)
				Ist Shift	Ist Shift	II-Shift	II-Shift	III-Shift	III-Shift	24-hrly	24-hrly	
I	06/07.04.2006	124	48	5.2	8.6	5.4	8.9	8.2	8.4	6.3	8.6	<114.5
	07/08.04.2006	136	51	5.6	9.1	5.7	9.2	8.6	8.6	6.6	9.0	<114.5
II	13/14.04.2006	118	46	5.1	8.4	5.3	8.8	8.1	8.0	6.2	8.4	<114.5
	14/15.04.2006	106	45	5.4	9.4	5.5	9.6	8.6	8.9	6.5	9.3	<114.5
III	20/21.04.2006	104	44	5.3	9.0	5.4	9.2	8.4	8.7	6.4	9.0	<114.5
	21/22.04.2006	125	47	5.8	9.4	5.9	9.5	8.6	8.1	6.8	9.0	<114.5
IV	27/28.04.2006	138	49	5.4	8.7	5.4	8.9	8.2	8.1	6.3	8.6	<114.5
	28/29.04.2006	146	47	5.9	9.1	5.8	9.2	8.7	8.4	6.8	8.9	<114.5
V	04/05.05.2006	156	49	6.2	9.6	5.9	9.7	9.0	8.2	7.0	9.2	<114.5
	05/06.05.2006	149	46	5.8	9.2	5.4	9.4	8.8	7.9	6.7	8.8	<114.5
VI	11/12.05.2006	152	48	5.9	9.1	5.9	9.2	8.7	8.2	6.8	8.8	<114.5
	12/13.05.2006	144	47	5.6	9.0	5.7	9.2	8.6	8.4	6.6	8.9	<114.5
VII	18/19.05.2006	138	46	5.4	8.7	5.5	8.9	8.2	8.2	6.4	8.6	<114.5
	19/20.05.2006	154	48	6.2	9.3	6.2	9.5	8.6	9.1	7.0	9.3	<114.5
VIII	25/26.05.2006	138	42	5.8	9.1	5.9	9.3	8.7	8.6	6.8	9.0	<114.5
	26/27.05.2006	134	44	5.4	8.8	5.7	8.9	8.2	8.1	6.4	8.6	<114.5
IX	01/02.06.2006	117	41	5.2	8.3	5.4	8.5	8.0	8.0	6.2	8.3	<114.5
	02/03.06.2006	129	40	5.0	8.3	5.1	8.6	8.4	7.6	6.2	8.2	<114.5
X	08/09.06.2006	105	39	4.9	7.8	5.3	7.9	7.6	7.4	5.9	7.7	<114.5
	09/10.06.2006	134	43	5.3	8.2	5.4	8.5	8.1	7.6	6.3	8.1	<114.5
XI	15/16.06.2006	126	42	5.4	8.6	5.7	8.7	7.6	7.8	6.2	8.4	<114.5
	16/17.06.2006	96	34	4.9	7.7	5.2	7.9	6.9	7.4	5.7	7.7	<114.5
XII	22/23.06.2006	102	41	5.3	8.6	5.5	8.7	8.1	8.1	6.3	8.5	<114.5
	23/24.06.2006	114	44	5.4	8.7	5.6	8.9	7.4	8.2	6.1	8.6	<114.5

AIR QUALITY DATA

Season : Summer 2006

Location : Chorpandra (A3)

Period : April `06 - June`06

Unit: $\mu g/m^3$

WEEK	DATE	SPM (24 Hrly)	RPM (24 Hrly)	SO2	NOx	SO2	NOx	SO2	NOx	SO2	NOx	CO (24-hrly)
				Ist Shift	Ist Shift	II-Shift	10-Jan	III-Shift	III-Shift	24-hrly	24-hrly	
I	06/07.04.2006	126	45	6.1	10.1	6.2	10.3	5.8	9.4	6.0	9.9	<114.5
	07/08.04.2006	116	43	5.9	9.6	6.3	9.7	5.4	9.2	5.9	9.5	<114.5
II	13/14.04.2006	105	41	5.4	9.4	5.7	9.5	5.2	9.0	5.4	9.3	<114.5
	14/15.04.2006	136	47	5.8	9.6	6.1	9.7	5.6	9.0	5.8	9.4	<114.5
III	20/21.04.2006	128	45	5.5	9.4	5.8	9.5	5.0	9.1	5.4	9.3	<114.5
	21/22.04.2006	146	49	5.8	10.1	6.2	10.3	5.4	9.6	5.8	10.0	<114.5
IV	27/28.04.2006	135	46	5.2	9.6	5.5	9.7	5.0	9.2	5.2	9.5	<114.5
	28/29.04.2006	126	44	5.1	9.4	5.4	9.5	4.9	9.0	5.1	9.3	<114.5
V	04/05.05.2006	146	48	4.9	8.9	5.3	9.2	4.8	8.2	5.0	8.8	<114.5
	05/06.05.2006	152	49	5.5	9.3	5.7	9.6	5.2	9.1	5.5	9.3	<114.5
VI	11/12.05.2006	138	44	5.7	9.8	5.9	9.9	5.4	9.4	5.7	9.7	<114.5
	12/13.05.2006	148	48	6.0	9.3	6.2	9.4	5.8	9.0	6.0	9.2	<114.5
VII	18/19.05.2006	146	48	6.1	9.8	6.3	10.1	5.4	9.0	5.9	9.6	<114.5
	19/20.05.2006	150	49	5.8	9.4	5.9	10.4	5.4	8.6	5.7	9.5	<114.5
VIII	25/26.05.2006	128	42	5.6	9.6	5.9	9.6	5.2	8.2	5.6	9.1	<114.5
	26/27.05.2006	116	40	5.2	9.4	5.5	9.3	5.0	8.4	5.2	9.0	<114.5
IX	01/02.06.2006	120	41	4.9	8.9	5.3	9.3	.4.7	8.2	5.1	8.8	<114.5
	02/03.06.2006	116	40	5.1	9.3	5.4	9.6	5.0	9.0	5.2	9.3	<114.5
X	08/09.06.2006	108	38	5.4	9.4	5.7	9.5	5.2	8.4	5.4	9.1	<114.5
	09/10.06.2006	113	41	5.6	9.7	5.9	10.1	5.4	8.1	5.6	9.3	<114.5
XI	15/16.06.2006	125	44	5.2	6.8	5.5	7.6	5.0	7.0	5.2	7.1	<114.5
	16/17.06.2006	116	43	5.4	9.2	5.7	9.9	5.1	8.4	5.4	9.2	<114.5
XII	22/23.06.2006	102	39	4.9	9.4	5.1	9.5	4.7	8.6	4.9	9.2	<114.5
	23/24.06.2006	112	42	5.3	8.9	5.5	9.4	5.1	8.2	5.3	8.8	<114.5

AIR QUALITY DATA

Season : Summer 2006

Location : (A4)Shandipur

Period : April `06 - June`06

Unit: µg/m^3

WEEK	DATE	SPM	RPM	SO2	NOx	SO2	NOx	SO2	NOx	SO2	NOx	CO

		(24 Hrly)	(24 Hrly)	Ist Shift	Ist Shift	II-Shift	II-Shift	III-Shift	III-Shift	24-hrly	24-hrly	(24-hrly)
I	06/07.04.2006	105	41	5.1	7.6	5.3	7.9	4.9	7.0	5.1	7.5	<114.5
	07/08.04.2006	114	43	5.6	7.9	5.7	8.1	5.2	7.2	5.5	7.7	<114.5
II	13/14.04.2006	106	40	6.1	8.1	6.3	8.4	5.8	7.8	6.1	8.1	<114.5
	14/15.04.2006	124	44	5.8	8.4	5.9	8.7	5.5	8.0	5.7	8.4	<114.5
III	20/21.04.2006	105	42	6.0	8.9	6.3	9.1	5.6	8.4	6.0	8.8	<114.5
	21/22.04.2006	109	39	5.4	7.6	5.9	7.6	5.1	7.2	5.5	7.5	<114.5
IV	27/28.04.2006	95	36	5.1	7.5	5.4	7.8	4.9	7.1	5.1	7.5	<114.5
	28/29.04.2006	106	42	5.3	8.3	5.7	8.5	5.2	7.8	5.4	8.2	<114.5
V	04/05.05.2006	112	44	5.0	8.4	5.3	8.7	4.8	7.9	5.0	8.3	<114.5
	05/06.05.2006	118	41	4.9	7.6	5.2	7.9	4.6	7.0	4.9	7.5	<114.5
VI	11/12.05.2006	124	45	5.4	7.6	5.5	8.0	5.1	7.2	5.3	7.6	<114.5
	12/13.05.2006	116	42	5.7	8.1	5.8	8.5	8.4	7.9	6.6	8.2	<114.5
VII	18/19.05.2006	105	41	5.2	7.6	5.4	7.9	8	7.2	6.2	7.6	<114.5
	19/20.05.2006	106	39	5.6	7.5	5.9	7.6	8.4	7.5	6.6	7.5	<114.5
VIII	25/26.05.2006	112	42	4.9	7.2	5.3	7.5	4.7	7.0	5.0	7.2	<114.5
	26/27.05.2006	109	40	4.7	7.6	5.0	7.7	4.6	7.4	4.8	7.6	<114.5
IX	01/02.06.2006	112	43	5.0	8.1	5.1	8.3	5	7.9	5.0	8.1	<114.5
	02/03.06.2006	124	46	4.9	7.6	5.3	7.9	4.8	7.2	5.0	7.6	<114.5
X	08/09.06.2006	116	42	5.0	7.7	5.3	7.9	4.9	6.9	5.1	7.5	<114.5
	09/10.06.2006	108	41	5.2	7.2	5.5	7.8	5	7.1	5.2	7.4	<114.5
XI	15/16.06.2006	112	44	5.6	7.5	5.9	7.9	5.4	6.9	5.6	7.4	<114.5
	16/17.06.2006	106	42	5.7	7.1	5.8	7.0	5.3	6.5	5.6	6.9	<114.5
XII	22/23.06.2006	96	40	4.9	7.3	5.3	7.5	4.9	6.7	5.0	7.2	<114.5
	23/24.06.2006	94	39	5.3	7.0	5.5	7.3	5.1	6.8	5.3	7.0	<114.5

AIR QUALITY DATA

Season : Summer 2006

Location : Ghogri (A5)

Period : April `06 - June`06

Unit: µg/m^3

WEEK	DATE	SPM (24 Hrly)	RPM (24 Hrly)	SO2	NOx	SO2	NOx	SO2	NOx	SO2	NOx	CO (24-hrly)
				Ist Shift	Ist Shift	II-Shift	II-Shift	III-Shift	III-Shift	24-hrly	24-hrly	
I	06/07.04.2006	114	39	4.9	7.6	5.2	7.9	4.9	6.9	5.0	7.5	<114.5

	07/08.04.2006	106	37	4.8	7.7	5.3	8	4.7	6.8	4.9	7.5	<114.5
II	13/14.04.2006	124	41	4.7	7.9	5.1	8.2	4.6	7.1	4.8	7.7	<114.5
	14/15.04.2006	118	38	4.6	8.4	4.9	8.3	4.4	7.5	4.6	8.1	<114.5
III	20/21.04.2006	106	37	4.6	8.0	4.8	8.1	4.3	7.6	4.6	7.9	<114.5
	21/22.04.2006	96	36	5.1	7.6	5.3	7.9	5	7.0	5.1	7.5	<114.5
IV	27/28.04.2006	118	40	5.3	7.9	5.5	8.1	4.9	6.8	5.2	7.6	<114.5
	28/29.04.2006	124	42	4.7	6.9	4.9	7.3	4.5	6.4	4.7	6.9	<114.5
V	04/05.05.2006	123	42	5.2	7.4	5.5	7.5	5	7.1	5.2	7.3	<114.5
	05/06.05.2006	105	38	4.8	7.9	4.9	8.2	4.7	6.9	4.8	7.7	<114.5
VI	11/12.05.2006	106	38	4.6	8.1	5.0	8.5	4.4	7.6	4.7	8.1	<114.5
	12/13.05.2006	94	35	4.7	7.2	4.9	7.5	4.6	6.8	4.7	7.2	<114.5
VII	18/19.05.2006	96	36	5.0	7.9	5.2	8.3	5	6.5	5.1	7.6	<114.5
	19/20.05.2006	102	38	4.6	7.2	4.9	7.5	4.5	7.1	4.7	7.3	<114.5
VIII	25/26.05.2006	118	36	4.7	7.9	5.1	8.1	4.3	6.4	4.7	7.5	<114.5
	26/27.05.2006	98	36	5	8.1	5.2	8.4	4.7	7.0	5.0	7.8	<114.5
IX	01/02.06.2006	102	38	4.9	7.5	5.1	7.9	4.3	7.0	4.8	7.5	<114.5
	02/03.06.2006	115	42	4.7	7.6	4.9	7.8	4.5	6.8	4.7	7.4	<114.5
X	08/09.06.2006	124	46	4.4	7.2	4.9	7.4	4.2	6.4	4.5	7.0	<114.5
	09/10.06.2006	132	47	5.1	7.9	5.3	8.2	4.7	6.2	5.0	7.4	<114.5
XI	15/16.06.2006	98	39	5.6	8.2	5.9	8.5	4.9	7.3	5.5	8.0	<114.5
	16/17.06.2006	104	40	5.2	8.0	5.4	8.3	5	7.0	5.2	7.8	<114.5
XII	22/23.06.2006	96	36	4.9	7.6	5.2	7.7	4.8	6.9	5.0	7.4	<114.5
	23/24.06.2006	106	39	5.1	7.9	5.4	8.2	4.9	6.3	5.1	7.5	<114.5

AIR QUALITY DATA

Season : Summer 2006

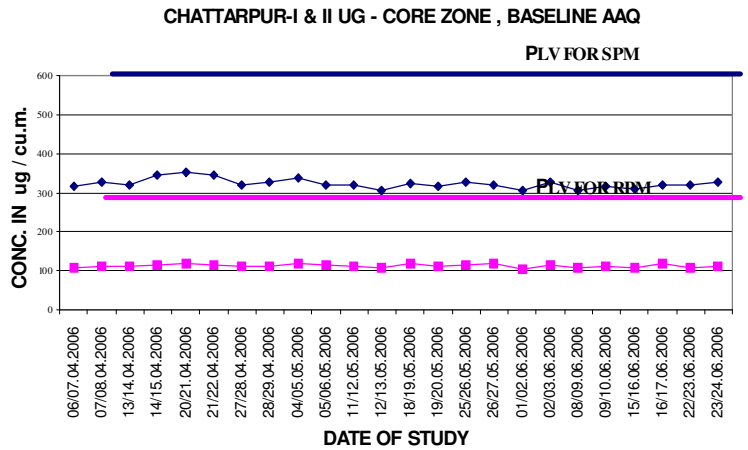
Location : Bhogaikhapa (A6)

Period : April `06 - June`06

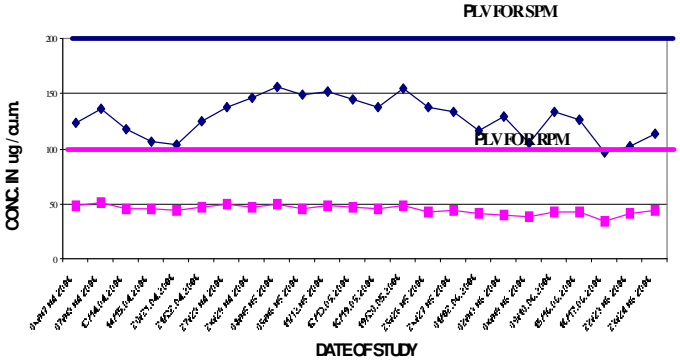
Unit: µg/m^3

WEEK	DATE	SPM (24 Hrly)	RPM (24 Hrly)	SO2	NOx	SO2	NOx	SO2	NOx	SO2	NOx	CO (24-
				Ist Shift	Ist Shift	II-Shift	II-Shift	III-Shift	III-Shift	24-hrly	24-hrly	hrly
I	06/07.04.2006	96	34	5.1	7.6	5.3	7.9	4.9	7.4	5.1	7.6	<114
	07/08.04.2006	94	33	4.9	7.2	5.2	7.4	4.8	6.9	5.0	7.2	<114

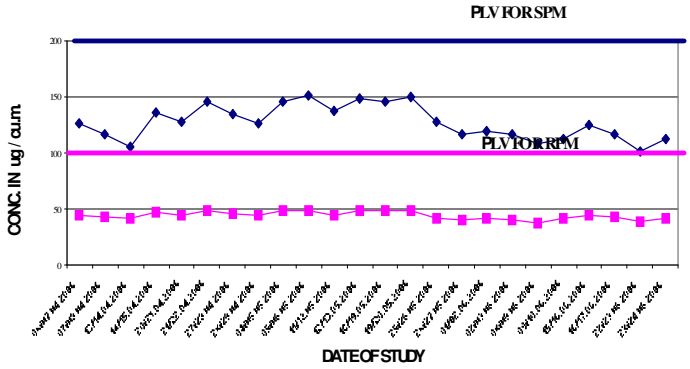
II	13/14.04.2006	82	30	4.5	7.0	4.9	7.2	4.4	6.4	4.6	6.9	<114
	14/15.04.2006	106	36	4.2	6.9	4.5	7.3	4.0	6.3	4.2	6.8	<114
III	20/21.04.2006	112	37	4.6	6.5	4.9	6.8	4.6	6.2	4.7	6.5	<114
	21/22.04.2006	96	34	4.7	6.8	5.1	6.9	4.6	6.4	4.8	6.7	<114
IV	27/28.04.2006	92	33	5.1	7.4	5.4	7.4	5.0	6.9	5.2	7.2	<114
	28/29.04.2006	90	31	5.0	7.2	5.2	7.2	4.8	6.4	5.0	6.9	<114
V	04/05.05.2006	86	29	4.8	7.6	4.8	7.9	4.4	6.7	4.7	7.4	<114
	05/06.05.2006	95	30	4.6	7.5	4.9	7.6	4.3	6.7	4.6	7.3	<114
VI	11/12.05.2006	102	31	4.7	7.0	5.1	7.4	4.5	6.5	4.8	7.0	<114
	12/13.05.2006	118	34	5.0	6.8	5.0	7.2	4.6	6.2	4.9	6.7	<114
VII	18/19.05.2006	115	33	5.2	7.4	5.3	7.6	5.0	6.8	5.2	7.3	<114
	19/20.05.2006	126	37	4.9	7.3	4.9	7.5	4.8	6.9	4.9	7.2	<114
VIII	25/26.05.2006	96	33	5.3	8.0	5.4	8.2	5.0	7.2	5.2	7.8	<114
	26/27.05.2006	100	35	5.2	8.4	5.3	8.5	4.8	7.6	5.1	8.2	<114
IX	01/02.06.2006	108	34	5.5	8.9	5.7	9.1	4.7	7.0	5.3	8.3	<114
	02/03.06.2006	116	35	5.3	8.5	5.4	8.6	4.6	8.2	5.1	8.4	<114
X	08/09.06.2006	105	32	5.4	8.3	5.7	8.5	4.7	7.6	5.3	8.1	<114
	09/10.06.2006	86	30	5.1	7.9	5.3	8.1	5.0	7.5	5.1	7.8	<114
XI	15/16.06.2006	125	34	4.9	7.4	5.0	7.5	4.8	7.1	4.9	7.3	<114
	16/17.06.2006	132	36	5.2	8.1	5.3	8.3	5.1	7.6	5.2	8.0	<114
XII	22/23.06.2006	112	32	5.4	8.6	5.5	8.7	5.2	8.0	5.4	8.4	<114
	23/24.06.2006	108	31	5.0	7.9	5.2	8.3	5.0	7.5	5.1	7.9	<114

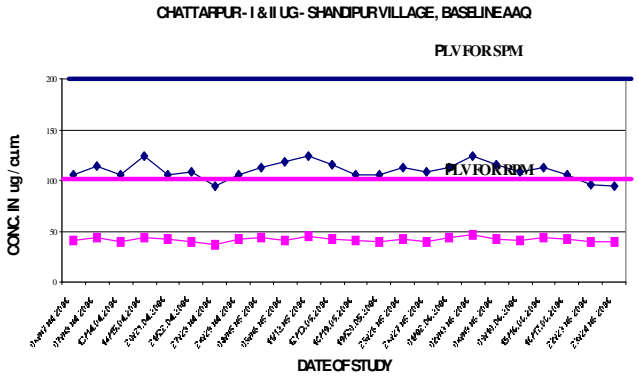


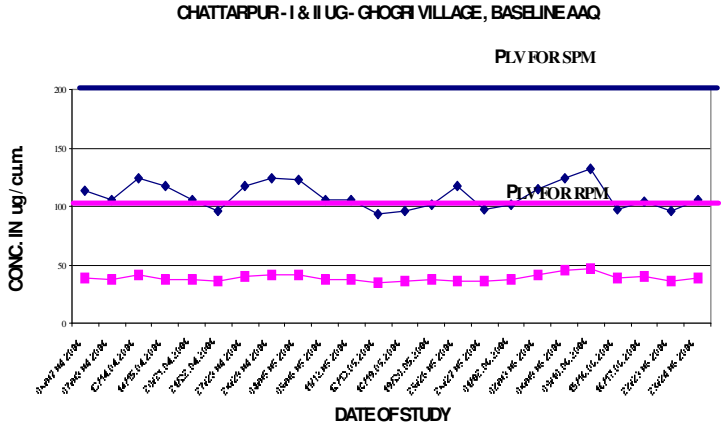
CHATTARPUR- I & II UG- SATPURA VILLAGE, BASELINE AAQ

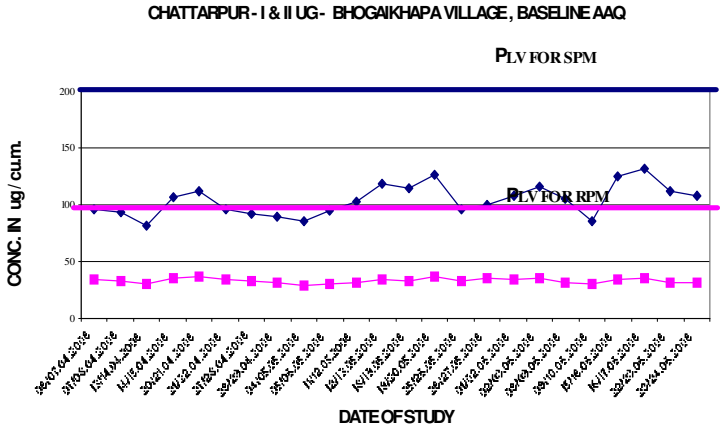


CHATTARPUR- I & II UG- CHORPANDRA VILLAGE, BASELINE AAQ

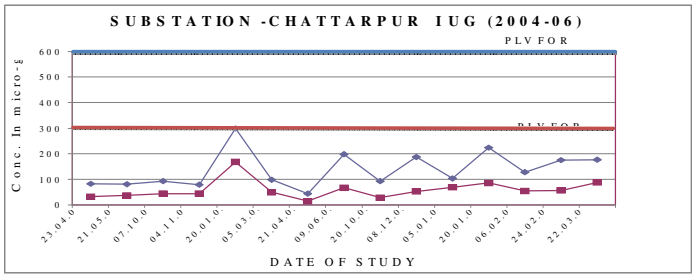


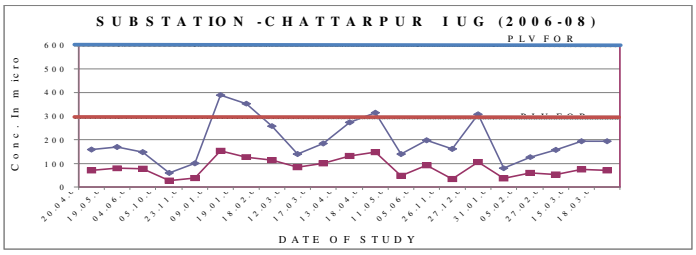


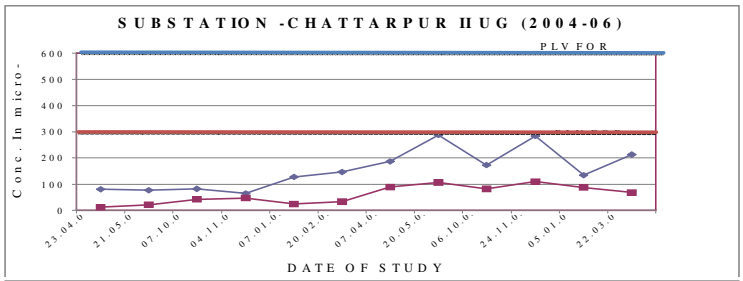


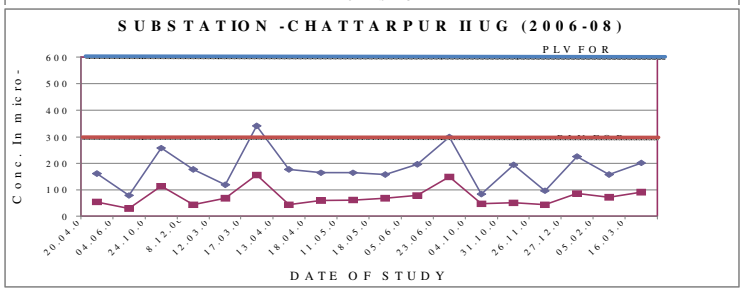


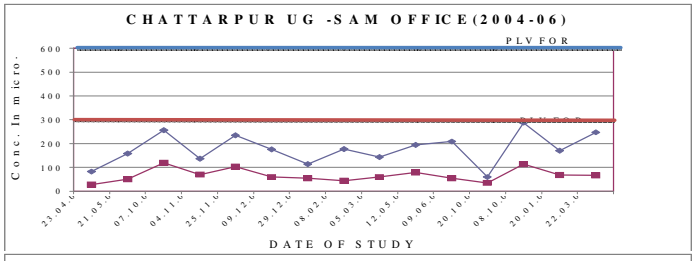
The existing environmental air quality for CO, SO2, Nox, SPM and RPM (including fugitive emissions) are being monitored continuously as per Environmental Protection (Amendment) Rule, 2000 in the mine area every fortnight and analysis result of which show that the various quality parameters are well within the permissible limits. The data in the graphical form for last four years are depicted below ;-

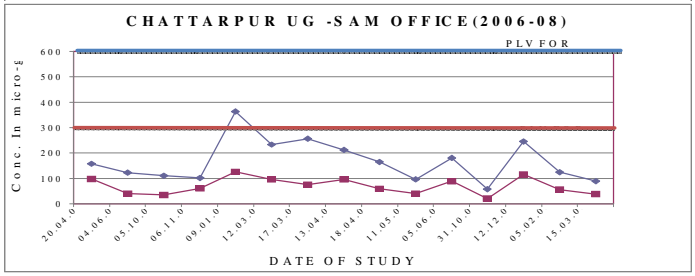












Therefore, it can be safely concluded that even after substantial increase in the production (resulting in increase in traffic density), the impact on one of the physical environmental attribute; i.e. ambient air will be insignificant.

Further, it can be inferred that the various pollution control measures already undertaken have been proved to be effective, which has arrested the deterioration of the ambient air quality in the mine activity area even after substantial increase in the production level.

So it may be predicted that the ambient air quality will have no harmful effect on human being, flora and fauna, soil quality, surface structures and aesthetic value of the surrounding environment as suitable mitigatory measures will be taken during the enhanced production to make the operations eco-friendly.

The existing practice of fortnightly monitoring of ambient air quality will continue with the expansion project also and the results will be examined critically so as to identify the affected area and mine authorities will thereafter be able to take appropriate control measures to minimize the adverse effects, if any, as far as possible.

3.4 WATER QUALITY: -

A) Base line & Existing Scenario - In order to assess the **baseline water quality** w.r.t the mine under consideration, five sampling locations were fixed during 2006 covering surface as well as ground water sources in the buffer zone. The quality of water has been found to be well within the permissible limits.

BASE LINE WATER QUALITY STATUS

Rationale behind sampling

The open cast mine workings at Chhatarpur-I & II UGP are below the ground water table. Therefore the operating mine will exert some impact on ground water conditions/ regime. Any adverse impact or pollution consequence of water will have serious effect on the environment. Hence, it becomes important to assess the water quality periodically in the mining area. Thus, to assess the water quality, five locations are identified and samples (6 Nos.) were collected and analysed for physico-chemical and heavy metal parameters. Bacterial examination was also carried out to find out the Coliform contamination (if any) at water sources. The water quality assessment has been made from the following monitoring stations

Mine effluent in April 2006	-	W1
Mine effluent in June 2006	-	W2
Pathakhera – Borewell	-	W3
Shobapur - Tankwater	-	W4
Tawa river U/S	-	W5
Tawa river D/S	-	W6

Data presentation & analysis

The detailed water quality data generated are given in tables below. The abstract of water quality status is furnished below.

Summary

At all locations, Oil and grease, phenolic compounds, cyanides, sulphides and insecticides are found to be absent and all heavy metal values except Iron and Zinc are found to be below the detectable limit. In general, the water quality at all five locations are found to be well within the prescribed norms of GSR: 422 (E), IS: 10500 - 1991 and IS: 2296 - 1982.

The existing quality of mine pumped out water is being continuously monitored as per Environmental Protection (Amendment) Rule, 2000 every fortnight and the analysis results show that the quality is well within the permissible limits of Indian Standards.

With enhanced production from the mine, the quality of mine pumped out water is not going to change, as such the impact of enhanced production from the mine on water quality will be insignificant.

MINE/WASTE WATER QUALITY DATA (Summer 2006)

Location : Mine effluent

S. No	Parameter	Unit	Result		General Standards for discharge of Effluents into Inland Surface water GSR 422(E)
		Date of Sampling	21.04.06	15.06.06	

1.	Colour & Odour	Pt-Co	<5 & Odourless		-
2.	Suspended Solids	mg/l	24	14	100
3.	Particle size of suspended solids	Shall pass 850 micron ISI sieve	100% are passing through 850 micron ISI sieve		Shall pass 850 micron ISI sieve
4.	Dissolved solids (inorganic)	mg/l	810	720	-
5.	pH	-	7.69	7.49	5.5-9.0
6.	Temperature	^{o}C	31.0	31.0	5°C above water temperature
7.	Oil & Grease	mg/l	Nil	Nil	10
8.	Total residual chlorine	mg/l	Nil	Nil	1.0
9.	Ammonical Nitrogen (as N)	mg/l	0.44	0.29	50
10.	Kjeldahl nitrogen	mg/l	1.86	1.46	100
11.	Free ammonia (as NH_3)	mg/l	Nil	Nil	5.0
12.	BOD - 3 Days at $27^{o}C$	mg/l	5	3	30
13.	COD	mg/l	29	19	250
14.	Arsenic (as As)	mg/l	<0.01	<0.01	0.2
15.	Mercury (as Hg)	mg/l	<0.001	<0.001	0.01
16.	Lead (as Pb)	mg/l	<0.01	<0.01	0.01
17.	Cadmium (as Cd)	mg/l	<0.01	<0.01	2
18.	Hexavalent Chromium (as Cr^{6+})	mg/l	<0.001	<0.001	0.10
19.	Total Chromium	mg/l	<0.001	<0.001	2.0
20.	Copper (as Cu)	mg/l	<0.001	<0.001	3
21.	Zinc (as Zn)	mg/l	<0.01	<0.01	5
22.	Selenium (as Se)	mg/l	<0.01	<0.01	0.05
23.	Nickel (as Ni)	mg/l	<0.01	<0.01	3
24.	Boron (as B)	mg/l	<0.01	<0.01	-
25.	Percent Sodium	mg/l	33.13	31.81	-
26.	Residual Sodium Carbonate	mg/l	Nil	Nil	-
27.	Cyanides (as CN)	mg/l	Nil	Nil	0.2
28.	Chloride (as Cl)	mg/l	128	104	-
29.	Fluorides (as F)	mg/l	0.41	0.20	2
30.	Dissolved Phosphates (as PO_4)	mg/l	0.18	0.12	5.0
31.	Sulphates (as SO_4)	mg/l	75	56	-
32.	Sulphides (as S)	mg/l	Nil	Nil	2
33.	Phenols (as C_6H_5OH)	mg/l	Nil	Nil	1.0
34.	Bio-assay test	90%survival of fish after 96 hours in 100% effluent	100%survival of fish after 96 hours in 100% effluent		90%survival of fish after 96 hours in 100% effluent
35.	Manganese (as mn)	mg/l	Nil	Nil	2.0
36.	Iron (as Fe^{+2})	mg/l	0.96	0.78	3.0
37.	Vanadium (as V)	mg/l	Nil	Nil	0.2
38.	Nitrate Nitrogen	mg/l	0.49	0.30	10

GROUND WATER QUALITY DATA (Summer 2006) Sampling Date : 15.05.2006

S.No	Parameter	Unit	Result		IS: 10500-1991 Norms
			W3	W4	
1	pH	-	7.56	7.77	6.5 – 8.5
2	Colour	Hazen Units	<5	<5	10
3	Temperature	^{o}C	30.0	31.0	-
4	Turbidity	NTU	6	6	10
5	Total suspended solids	mg/l	-	<2	-
6	Total dissolved solids	mg/l	520	957	500
7	Total volatile solids	mg/l	-	-	-
8	Dissolved Oxygen	mg/l	4.24	4.40	-
9	BOD - 3 days at $27^{o}C$	mg/l	<2	<2	-
10	COD	mg/l	9	10	-
11	Oil & grease	mg/l	Nil	Nil	-

12	Residual chlorine	mg/l	Nil	Nil	0.2
13	Chloride (as CI)	mg/l	90	147	250
14	Flouride (as F)	mg/l	0.04	0.12	1.0
15	Sulphate (as SO_4)	mg/l	20	36	200
16	Sulphide (as S)	mg/l	Nil	Nil	-
17	Cyanide (as CN)	mg/l	Nil	Nil	0.05
18	Insecticides/pesticides	mg/l	Nil	Nil	Absent
19	Phenols (as C_6H_5OH)	mg/l	<0.001	<0.001	0.001
20	Chromium (as Cr)	mg/l	<0.01	<0.01	0.05
21	Copper (as Cu)	mg/l	<0.01	<0.01	0.05
22	Selenium (as Se)	mg/l	<0.01	<0.01	0.01
22	Arsenic (as As)	mg/l	<0.01	<0.01	0.05
23	Barium (as Ba)	mg/l	<0.01	<0.01	-
24	Cadmium	mg/l	<0.01	<0.01	0.01
25	Nickel (as Ni)	mg/l	<0.01	<0.01	-
26	Boron (as B)	mg/l	<0.01	<0.01	-
27	Mercury (as Hg)	mg/l	<0.001	<0.001	0.001
28	Silver (as Ag)	mg/l	<0.01	<0.01	-
29	Lead (as Pb)	mg/l	<0.01	<0.01	0.05
30	Zinc (as Pb)	mg/l	<0.01	0.02	5
31	Alkalinity to phenolphthalein	mg/l	Nil	Nil	-
32	Alkalinity to methyl orange	mg/l	220	310	200
33	Iron (as Fe)	mg/l	0.12	0.16	0.3
34	Total Hardness Temporary Hardness Permanent Hardness	mg/l	160 220 -	360 310 50	300 - -
35	Calcium (as Ca)	mg/l	44	100	75
36	Magnesium (as Mg)	mg/l	12	30	30
37	Total Nitrogen (as N)	mg/l	Nil	Nil	-
38	Percent sodium	%	43.45	31.39	-
39	Coliform organisms	MPN/100ml	-2-	-0-	Absent
40	Sodium,(as Na)	mg/l	74	96	6.5 – 8.5
41	Potassium (as K)	mg/l	39	60	10

W3- Borewell – Pathakera **W4- Tank water - Shobapur**

SURFACE WATER QUALITY DATA (Summer 2006)

Sampling Date : 25.05.2006

Sl. No.	Parameter	Unit	Tawa river U/s	Tawa River D/s	IS:2296-1982 Tolerance limits for Inand Surface water (Class C)
1	pH	-	7.95	7.29	6.5 – 8.5
2	Colour	Hazen Units	40	44	300
3	Temperature	^oC	30.5	31.5	-
4	Turbidity	NTU	44	48	-
5	Total suspended solids	mg/l	32	40	-
6	Total dissolved solids	mg/l	644	680	1500
7	Total volatile solids	mg/l	10	12	-
8	Dissolved Oxygen	mg/l	5.44	5.13	4.0
9	BOD - 3 days, 27^oC	mg/l	2	2	3.0
10	COD	mg/l	16	18	-
11	Oil & grease	mg/l	Nil	Nil	-
12	Residual chlorine	mg/l	Nil	Nil	-
13	Chloride (as CI)	mg/l	122	135	600
14	Flouride (as F)	mg/l	0.22	0.29	1.5
15	Sulphate (as SO_4)	mg/l	30	35	400
16	Sulphide (as S)	mg/l	Nil	Nil	-
17	Cyanide (as CN)	mg/l	<0.01	<0.01	0.05
18	Insecticides/pesticides	mg/l	Nil	Nil	Absent

19	Phenols (as C_6H_5OH)	mg/l	<0.001	<0.001	0.005
20	Chromium (as Cr)	mg/l	<0.01	<0.01	0.05
21	Copper (as Cu)	mg/l	<0.01	<0.01	1.5
22	Selenium (as Se)	mg/l	<0.01	<0.01	0.05
22	Arsenic (as As)	mg/l	<0.01	<0.01	0.2
23	Barium (as Ba)	mg/l	<0.01	<0.01	-
24	Cadmium	mg/l	<0.01	<0.01	0.01
25	Nickel (as Ni)	mg/l	<0.01	<0.01	-
26	Boron (as B)	mg/l	<0.01	<0.01	-
27	Mercury (as Hg)	mg/l	<0.001	<0.001	-
28	Silver (as Ag)	mg/l	<0.01	<0.01	-
29	Lead (as Pb)	mg/l	<0.01	<0.01	0.1
30	Zinc (as Pb)	mg/l	0.07	0.09	15
31	Alkalinity to phenolphthalein	mg/l	Nil	Nil	-
32	Alkalinity to methyl orange	mg/l	302	315	-
33	Iron (as Fe)	mg/l	1.04	1.17	50
35	Calcium (as Ca)	mg/l	60	68	-
36	Magnesium (as Mg)	mg/l	28	22	-
37	Total Nitrogen (as N)	mg/l	0.20	0.29	-
38	Percent sodium	%	30.08	30.66	-
39	Coliform organisms	MPN/100ml	<1100	<1100	5000
40	Sodium (as Na)	mg/l	60	62	-
41	Potassium (as K)	mg/l	30	35	-

3.4.1 GROUND WATER REGIME

The details of ground water regime of the mine area including the surroundings are as given below: -

a) Groundwater Conditions:

Groundwater occurs in the area below water table in the intergranular pore spaces of semi-consolidated sandstone and their secondary porous structures. It exists under both confined and unconfined conditions. The unconfined aquifer extending down to a depth of about 25 m bgl occurs in detrital mantle / moturs / barakars and it is catering the domestic requirement of the area. This is followed by semiconfined / confined aquifer mostly in Barakars at greater depths.

The available data mostly pertains to the unconfined aquifer. Depth to water table ranges from 1.5 m to 4.0 m bgl in the post-monsoon season and it attains deepest level varying from 5.0 m to 12.0 m bgl in pre-monsoon months resulting a fluctuation of 4.0 m to 10.0 m between the two seasons. It was observed that the water levels are relatively deep and large zone of fluctuation of water table in the southern and western part of the study area while they become shallow and low order respectively towards north. Based on the topographic spot elevations and water levels tentative water table map was constructed to understand the ground water behavior.

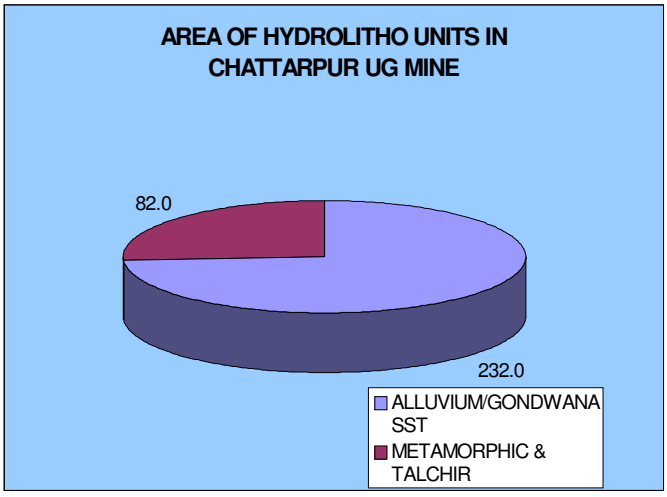
Water table has a configuration similar to that of topography but with reduced relief. The water table elevation ranges from 396 m to 420 m above MSL in the plain area. It was observed that the groundwater flow direction is towards north and north-west with hydraulic gradients indicative of low hydraulic gradient are confined to the southern sector with hill ranges while flat gradients suggestive of better hydraulic conductivity are in the remaining area. Groundwater divide trending NW-SE is identified along the hill ranges and it is separating the Tawa and Phopas sub-basins. Normally the region of groundwater devide is of poor hydraulic conductivity zone. It was reported that the dugwells tapping the unconfined aquifer are not sustaining for long pumping suggesting poor potentiality.

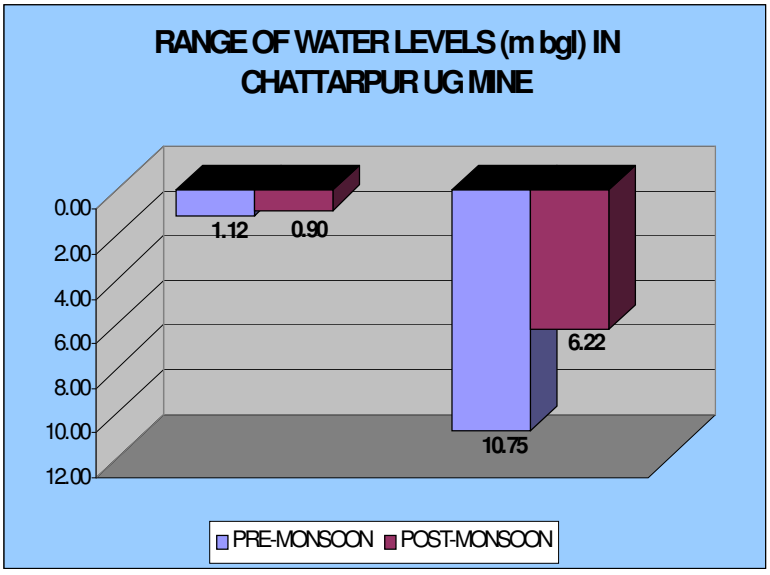
Sufficient data is not available in respect of confined aquifer occurring in Barakars for worth interpretation. However, some hand pump bore wells drilled down to a depth of about 60 m in the area proved to be with better yield ranging from 0.5 LPS to 3 LPS for moderate draw down.

It is inferred that the Barakars are with better groundwater potential in comparison to the Moturs which are highly mixed formations of mottled shale / clayey and sandstone.

The water is alkaline in nature with pH value more than 7 and they are of good quality with low TDS concentration. They are judged to be potable and suitable for domestic and agriculture use.

In the light of the above data, it is inferred that the southern sector of the study area is in the recharge zone which is with relatively deep water levels and large zone of fluctuation while the northern portion is in the discharge belt where the reverse phenomena is observed. This statement is corroborated by the presence of effluent Tawa River flowing in the immediate north of the block and the projected groundwater devide in the southern sector.





AQUIFER PARAMETERS OF CHATTARPUR UG MINE

ACQUIFER PARAMETER	UNCONFINED	CONFINED / SEMICONFINED
TRANSMISSIVITY (m^2/day)	6.20	1.2×10^{-1}
HYDRAULIC CONDUCTIVITY(m/day)	1.50	2.0×10^{-3}
SPECIFIC YIELD	0.03	1.0×10^{-3}

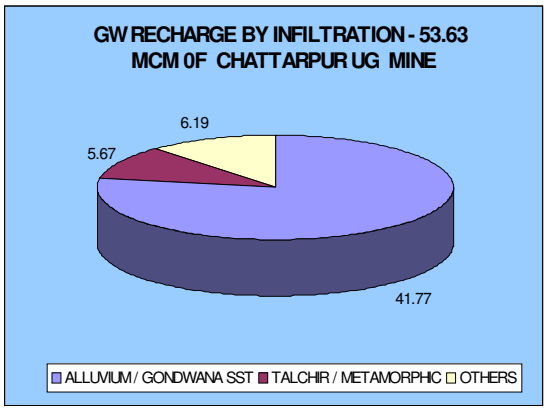
Status of Groundwater:

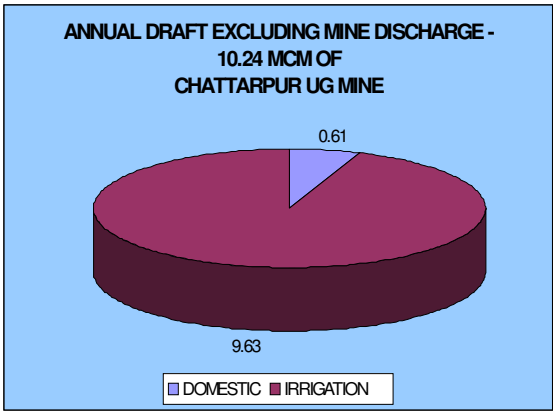
Groundwater availability has direct relation to the socio-economic development of the area. Therefore, groundwater balance estimation was attempted for this study area too.

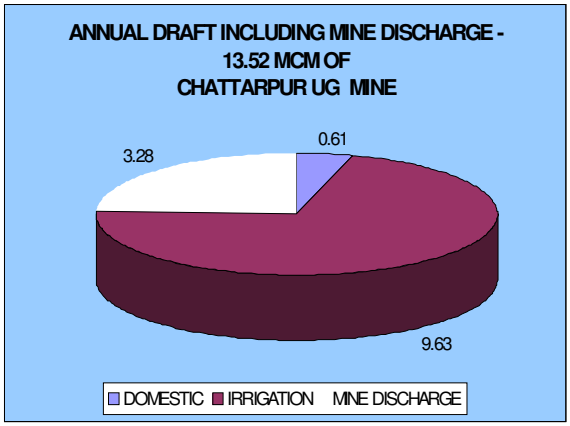
Precipitation is the main source of groundwater recharge in the area. The area enjoys an average annual rainfall of about 1050 mm. The quantum of recharge depends on various factors like nature of soil cover, geology, topography, vegetation, intensity of rainfall etc. The total quantum of rainfall occurring over the proposed influence area of 314 sq. km. is about 330 million cubic meters (MCM) and the amount of recharge to groundwater may be about 15% of the total, which works out to 42.5 MCM. Normally, 75% of the gross recharge is available for safe groundwater extraction as per Groundwater Estimate Committee and it comes to 37 MCM.

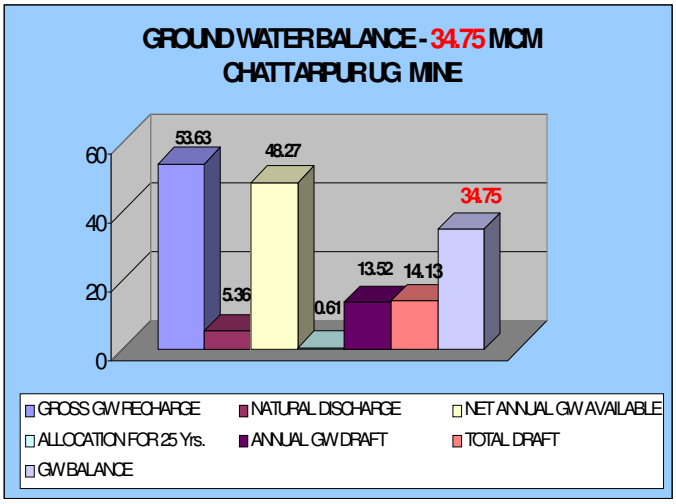
Groundwater utilization/withdrawal is computed from the domestic consumption of human and cattle population since irrigation is practically negligible in the area. Presently mining activity is in progress in the close proximity of Chhatarpur block, the groundwater effluent of the mine is also considered as a part of groundwater draft. Groundwater pumped out of the existing mines in the proposed influence area worked out to 27.60 MCM. The domestic annual draft is estimated by considering human population of about 30,000 (1981 census + incremental rate) and cattle (including sheep & goat) population of about 15860 with a daily requirement of 40 and 20 litres respectively and it is arrived at 0.60 MCM. The total groundwater draft of the area amounts to 28.20 MCM.

The excess groundwater available for future development is about 8.8 MCM, which has to be assessed from time to time during different stages of mining activity.









3.5 AMBIENT NOISE QUALITY:-

Base line & Existing Scenario - The baseline ambient noise quality w.r.t. the mine under consideration has also been generated during the pre – monsoon season during 2006 at five locations covering the core and Buffer zone. The ambient noise quality data thus generated reveal that the quality of ambient noise is well within the permissible limits.

BASE LINE NOISE LEVEL STATUS

Rationale behind sampling

To know the background ambient noise level at the operating Chhatarpur-I & II UGP and surrounding environment, 12 locations (one in core zone and eleven in buffer zone) were identified for baseline study.

The noise level monitoring stations are given below.

Corezone		-	N_1
Satpura	-	N_2	
Chorpandra	-	N_3	
Shanthipur		-	N_4
Ghogri	-	N_5	
Bhogaikhapa	-	N_6	
Badalpur		-	N_7
Nadiyagwari	-	N_8	
Pathakhera		-	N_9
Bagdona		-	N_{10}
Siwanpat		-	N_{11}
Ghoradongri	-	N_{12}	

Data presentation & analysis

The generated noise level data are given below and the abstract is furnished in Table below.

Noise level status

Sl. No.	Zone	Noise level (db(A))		Noise level Standards	
		Daytime	Night Time	Daytime	Night Time
1.	Corezone	61.5 – 64.5	55.2 – 58.2	75	70
2.	Buffer zone	42.3 – 51.6	34.3 – 41.3	55	45

L_{eq} noise levels at day time and night time are ranging from 42.3 to 64.5 dB(A) and 34.3 to 58.2 dB(A) respectively in the study area. While comparing with IS: 4954-1986 norms for acceptable outdoor noise levels in residential area, these values are found to be within the limits.

NOISE LEVEL DATA

Season : Summer 2006, Location : Core Zone (N1)

Sampling Date : 25.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	64.3	67.2
2		10-14	63.8	65.6
3		14-18	61.5	65.3
4	Night	18-22	58.2	61.1
5		22-02	56.7	60.8

6		02-06	55.2	60.4

Season : Summer 2006, Location: Satpura village (N2)

Sampling Date : 25.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	48.2	50.1
2		10-14	50.4	53.6
3		14-18	51.6	54.4
4	Night	18-22	41.3	43.1
5		22-02	36.7	39.6
6		02-06	35.8	38.2

Season : Summer 2006, Location:Chorpandra village(N3)

Sampling Date : 25.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	44.6	47.8
2		10-14	42.3	46.1
3		14-18	48.6	49.4
4	Night	18-22	39.1	41.7
5		22-02	36.2	40.6
6		02-06	36.8	41.1

Season : Summer 2006, Location : Shanthipur Village (N4)
Sampling Date : 26.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	44.3	47.9
2		10-14	45.4	48.2
3		14-18	44.9	49.4
4	Night	18-22	38.4	40.8
5		22-02	36.8	39.7

6		02-06	35.6	38.5

Season : Summer 2006, Location : Ghogri Village (N5)

Sampling Date : 26.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	43.5	46.8
2		10-14	44.8	47.0
3		14-18	42.6	48.5
4	Night	18-22	36.5	39.3
5		22-02	34.3	38.1
6		02-06	35.1	38.7

Season : Summer 2006, Location Name : Bhogaikhapa Village (N6)

Sampling Date : 26.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	44.6	47.3
2		10-14	46.1	49.8
3		14-18	45.4	48.6
4	Night	18-22	37.8	39.4
5		22-02	36.7	38.6
6		02-06	35.9	38.1

Season : Summer 2006, Location Name : Badalpur Village (N7)

Sampling Date : 26.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	45.4	48.2
2		10-14	46.7	49.6
3		14-18	44.6	48.4
4	Night	18-22	37.9	40.5
5		22-02	35.9	39.7
6		02-06	34.8	38.8

Season : Summer 2006, Location Name : Nadiyagwari Village (N8)

Sampling Date : 26.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	48.7	50.6
2		10-14	49.1	51.4
3		14-18	48.3	50.5
4	Night	18-22	38.3	40.4
5		22-02	37.6	39.8
6		02-06	38.1	40.6

Season : Summer 2006, Location : Pathakhera Village (N9)

Sampling Date : 25.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	48.8	50.1
2		10-14	45.7	48.4
3		14-18	47.9	49.8
4	Night	18-22	39.6	41.5
5		22-02	38.5	40.7
6		02-06	37.9	39.8

Season : Summer 2006, Location : Bagdona Village (N10)

Sampling Date : 25.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	47.6	50.4
2		10-14	48.9	51.2
3		14-18	47.2	49.6
4	Night	18-22	39.6	41.7
5		22-02	38.3	40.5
6		02-06	37.8	39.9

Season : Summer 2006, Location : Siwanpat Village (N11)

Sampling Date : 25.05.2006

Sl. No.	Time (Hrs.)	L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)

1	Day	06-10	48.6	51.2
2		10-14	49.9	51.8
3		14-18	47.8	49.7
4	Night	18-22	39.6	41.2
5		22-02	38.7	40.5
6		02-06	38.3	39.4

Season : Summer 2006, Location : Ghoradongri Village (N12)

Sampling Date : 26.05.2006

Sl. No.	Time (Hrs.)		L_{eq} Noise Level, dB(A)	Peak Noise Level, dB(A)
1	Day	06-10	48.6	50.3
2		10-14	49.9	51.0
3		14-18	48.1	50.6
4	Night	18-22	39.6	41.8
5		22-02	38.3	40.5
6		02-06	37.9	40.3

Summary

While comparing with IS: 4954 -1986 norms for acceptable outdoor noise levels in residential area, the Leq values are found to be within the limits.

Noise level studies are being made continuously every fortnight as per Environmental Protection (Amendment) Rule, 2000 and it is found that the results are well within the tolerable limits.

3.6 SOIL QUALITY

Rationale behind sampling

Soil characteristics, erosion aspects, soil fertility etc., have direct bearing on the environment. Knowledge of soil parameters is essential for the planning and implementation of 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 view, three locations are selected in the core and buffer zone. Locations are selected in such a way that different type of soils for supporting different species of vegetation are covered. The soil quality monitoring stations are furnished below and are shown in Fig. - 2.

Corezone (Barren Land)	-	S_1
Chhatarpur-I & II (Agri.)	-	S_2
Chhatarpur-I & II (Forest)	-	S_3

Data presentation & analysis

The soil quality data collected are given in tables belowand status of the soil quality is furnished in Table below.

Soil quality status

S.No.	Parameters	Range of Concentration
1	pH	8.72 – 9.14
2.	Organic Carbon (%)	1.62 – 1.78
3.	Potassium (mg/kg)	0.002 – 0.022
4.	Nitrogen (mg/kg)	0.103 – 0.864
5.	Available magnesium (mg/kg)	0.91 – 3.49
6.	Texture Class	Sandy Silt / Clayey Silt

Summary

The soil quality in the project area appears to be good and would support after suitable reclamation measures.

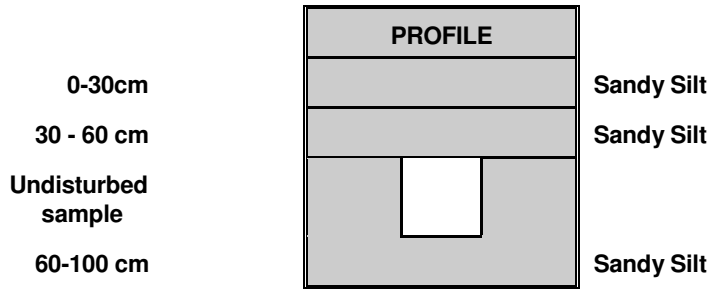
SOIL QUALITY DATA

Season : Summer

Location : Barren land, Core Zone (S_1) Sampling Date : 18.05.2006

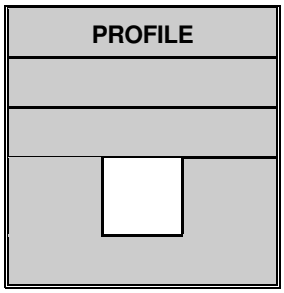
Sl. No.	Parameter	Depth, cm		
		0-30	30-60	60-100
1.	pH	9.05	8.82	8.72
2.	Electrical conductivity (m-mhos/cm at 20°C)	0.416	0.432	0.461
3.	Nitrogen,mg/kg	0.114	0.107	0.103
4.	Phosphorus, mg/kg	0.562	0.576	0.594
5.	Potassium, mg/kg	0.002	0.002	0.002
6.	Total magnesium, mg/kg	1.11	1.03	0.91
7.	Organic carbon (%)	1.72	1.75	1.78
8.	**Grain size distribution**			
	Sand(%)	23.65	22.54	21.76
	Silt (%)	61.84	59.42	58.76
	Clay (%)	14.51	18.04	19.48
9.	Textural class	Sandy Silt		
10.	Bulk density (g/cc)	1.16	1.19	1.21
11.	Liquid limit (%)	17.9	18.0	18.0
12.	Plastic limit (%)	11.9	12.1	12.6
13.	Infiltration rate (cm/hr)		2.4	
14.	Field capacity (%)	8.1	8.3	8.0
15.	Wilting co-efficient (%)	0.8	0.8	0.7

16.	Available water storage capacity (%)	7.2	7.5	7.3



Season : Summer
Location : Agricultural Land, Chhatarpur (S_2) SamplingDate : 18.05.2006

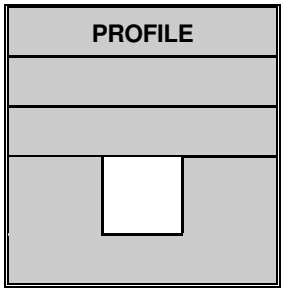
Sl. No.	Parameter	Depth, cm		
		0-30	30-60	60-100
1.	pH	8.9	8.92	8.94
2.	Electrical conductivity (m-mhos/cm at 20°C)	0.024	0.021	0.019
3.	Nitrogen, mg/kg	0.816	0.839	0.864
4.	Phosphorus, mg/kg	1.12	1.09	1.08
5.	Potassium, mg/kg	0.022	0.019	0.017
6.	Total magnesium, mg/kg	1.76	1.74	1.72
7.	Organic carbon (%)	1.69	1.72	1.76
8.	**Grain size distribution**			
	Sand (%)	21.46	18.34	17.62
	Silt (%)	33.49	32.54	29.26
	Clay (%)	45.05	49.12	53.12
9.	Textural class	Clayey Silt		
10.	Bulk density (g/cc)	1.14	1.17	1.19
11.	Liquid limit (%)	18.19	18.76	19.12
12.	Plastic limit (%)	13.46	13.58	13.52
13.	Infiltration rate (cm/hr)		2.8	
14.	Field capacity (%)	6.9	6.5	6.2
15.	Wilting co-efficient (%)	0.7	0.6	0.6
16.	Available water storage capacity (%)	6.2	5.9	5.6



Season : Summer
Location : Forest Land, Chhatarpur (S_3) Sampling Date : 18.05.2006

Sl. No.	Parameter	Depth, cm		
		0-30	30-60	60-100
1.	pH	9.04	9.09	9.14
2.	Electrical conductivity (m-mhos/cm at 20°C)	0.346	0.359	0.365
3.	Nitrogen, mg/kg	0.264	0.276	0.294

4.	Phosphorus, mg/kg	1.26	1.22	0.16
5.	Potassium, mg/kg	0.002	0.002	0.002
6.	Total magnesium, mg/kg	3.29	3.42	3.49
7.	Organic carbon (%)	1.64	1.62	1.62
8.	**Grain size distribution** Sand (%) Silt (%) Clay (%)	 13.48 62.87 23.65	 11.89 60.26 27.85	 9.86 59.46 30.68
9.	Textural class	Clayey Silt		
10.	Bulk density (g/cc)	1.62	1.65	1.59
11.	Liquid limit (%)	18.26	17.65	17.26
12.	Plastic limit (%)	14.13	14.26	14.33
13.	Infiltration rate (cm/hr)		2.1	
14.	Field capacity (%)	8.4	8.6	8.6
15.	Wilting co-efficient (%)	0.7	0.5	0.6
16.	Available water storage capacity (%)	7.7	8.1.	8.0



3.7 LAND ENVIRONMENT

LAND USE PATTERN (CORE ZONE)

SL. NO	TYPE OF LAND	EXISTING LAND USE PATTERN			PROPOSED LAND USE PATTERN FOR ADDITIONAL LAND			LAND USE PATTERN AFTER PROPOSED EXPANSION		
		AREA (HA)	PURPOSE	USAGE	AREA (HA)	PURPOSE	USAGE	AREA (HA)	PURPOSE	USAGE
1.	GOVT. LAND & OTHERS	186.702	Underground Mining	Mining Right	399.435	Underground Mining	Mining Right	586.137	Underground Mining	Mining Right
2.	GOVT. LAND & OTHERS	6.610	Infrastructure	ALL Right	NIL	NIL	NIL	6.610	Infrastructure	ALL Right
3.	FOREST LAND	159.39	Underground Mining	Mining Right	69.533	Underground Mining	Mining Right	228.923	Underground Mining	Mining Right
4.	FOREST LAND	10.278	Infrastructure	ALL Right	NIL	NIL	NIL	10.278	Infrastructure	ALL Right
TOTAL .....MR TOTAL .....AR (Incl. In MR)		339.482 16.888		MR AR	468.968 NIL		MR AR	808.45 16.888 (Incl. In MR)		MR AR
TOTAL LEASE AREA		356.370			468.968			825.338		

CHAPTER – IV

ANTICIPATED ENVIRONMENTAL IMPACTS AND POLLUTION CONTROL MEAURES

4.1 IMPACT ON AMBIENT AIR QUALITY –

The base line data generated at five locations covering the core zone and the buffer zone discussed in the previous chapter reveals that the levels of various parameters are well within the permissible limits. It can be inferred from the same that ambient air quality in and around the mine site under consideration has not been affected adversely due to continuing mining operations and it has been achieved by implementing various pollution control measures effectively. The same has been further corroborated by the existing ambient air quality data generated at the site as well as in the surrounding area also presented in the graphical form in previous chapter. It may be worthwhile to mention here that during the balance life of the mine with a maximum projected production of 1.00 MTPA, the existing pollution abatement measures will continue to be taken with necessary augmentation/ strengthening so that the ambient air quality level remain well within the permissible limits.

AAQ - IMPACT ASSESSMENT

PRESENT AAQ SCENARIO –
WITHIN THE PERMISSIBLE LIMITS;

- ✓ **THE LIKELY LEVEL OF POLLUTANTS – WITHIN THE PERMISSIBLE LIMITS;**
- ✓ **ADVERSE IMPACT ON AAQ – INSIGNIFICANT DUE TO MINING OPERATIONS AS PER AAQM RESULTS.**
- ✓ **HOWEVER REGULAR AAQM & MITIGATION MEASURES WILL BE CONTINUED DURING BALANCE LIFE .**

4.1.1 AIR POLLUTION CONTROL MEASURES

The following mitigative measures have already been undertaken:

(a) Mobile water sprinklers has been put into use.

(b) Coal transportation by road to Sarni TPS (7Km) has been totally black-topped;

(c) Avenue plantation along coal transportation roads.

(d) Covering of coal transportation trucks by tarpaulin has been implemented and avoiding overloading of trucks;

(e) Dry sweeping of coal transportation road is also done regularly.
(f) Fortnightly monitoring of AAQ.

All these measures indicated above will continue to be maintained so that the adverse impacts on ambient air and noise become insignificant.

4.2 IMPACT ON WATER QUALITY –

The major causes of water pollution in an underground mine can be summarized as below:

h) Mine pumped out water

ii) Discharge from colony

Mine Pumped out Water: So far as these UG mines are concerned, the strata seepage water first gets accumulated in mine sump in underground workings, which provides for initial settlement of suspended particles. Thereafter clear water is pumped out and fed into the surface sedimentation pond.

The present quality of pumped out water from both the UG mines are being monitored as per Env. Protection Amendment Rule, 2000. The data generated during the period during 2006-07 & 2007-08 has been considered. The details of these data are given below.
The results indicate that observed values of different parameters of mine water discharge are well below the permissible limit.

The quality of mine pumped out water is anticipated to remain within the permissible limits, as such the possibility of any adverse effect on natural watercourses is ruled out.

Domestic Effluents: To deal with the domestic effluents, adequate sewerage disposal scheme has been made in the township by providing Septic tank & soak pit for each residential unit.

WATER QUALITY ANALYSIS – MINE DISCHARGE(CH – I)

S.N.	PARAMETERS	ANALYSIS RESULTS(10/06)	ANALYSIS RESULTS(12/07)	STANDARDS FOR DISCHARGE – PART A SCH - VI
1	pH	7.02	7.6	5.5 – 9.0
2	Temperature (0c)	28.1	21.8	Te < Ts + 5 ^{0}c
3	Colour (Hz)	10	Acceptable	*
4	Odour	Unobj'ble	Unobj'ble	Unobjectionable
5	Turbidity (NTU)	6.0	3.0	*
6	Conductivity (us/cm)	870	930	*
7	Total Suspended Solids (mg/l)	64.0	32	100
8	Total Dissolved Solids (mg/l)	560.0	652	*
9	Oil & Grease (mg/l)	BDL	BDL	10
10	Dissolved Oxygen (mg/l)	4.7	4.6	*
11	C.O.D. (mg/l)	120	50	250
12	B.O.D. 3 days at 27 ^{0}c (mg/l)	< 5	< 5	30
13	Total Residual Chlorine (mg/l)	BDL	BDL	1 (Max.)
14	Ammonical Nitrogen (mg/l)	0.09	0.10	50
15	Total Kjeldahl Nitrogen (mg/l)	3.21	3.17	100
16	Free Ammonia (mg/l)	BDL	BDL	5.0
17	Arsenic (mg/l)	BDL	BDL	0.2
18	Lead (mg/l)	BDL	BDL	0.1
19	Cadmium (mg/l)	BDL	----	2

WATER QUALITY ANALYSIS – MINE DISCHARGE(CH – I)

S.N.	PARAMETERS	ANALYSIS RESULTS(10/06)	ANALYSIS RESULTS(12/07)	STANDARDS FOR DISCHARGE – PART A SCH - VI
20	Hexavalent Chromium (mg/l)	BDL	BDL	0.1
21	Total Chromium (mg/l)	BDL	BDL	2
22	Copper (mg/l)	BDL	BDL	3
23	Zinc (mg/l)	0.10	0.12	5
24	Selenium (mg/l)	BDL	BDL	0.05
25	Nickel (mg/l)	BDL	BDL	3
26	Fluoride (mg/l)	1.69	1.12	2
27	Dissolved Phosphate (mg/l)	0.02	0.04	5
28	Sulphide (mg/l)	0.01	0.01	2
29	Iron (mg/l)	BDL	BDL	3
30	Manganese (mg/l)	BDL	BDL	2
31	Vanadium (mg/l)	BDL	------	0.2
32	Nitrate Nitrogen (mg/l)	2.2	2.2	10
33	Sulphate (mg/l)	218	176	*
34	Chloride (mg/l)	108	96	*
35	Phenolics Compounds (mg/l)	BDL	BDL	1

WATER QUALITY ANALYSIS – MINE DISCHARGE(CH– II)

S.N.	PARAMETERS	ANALYSIS RESULTS(10/06)	ANALYSIS RESULTS(12/07)	STANDARDS FOR DISCHARGE – PART A SCH - VI
1	pH	7.18	7.8	5.5 – 9.0
2	Temperature (0c)	27.8	21.6	Te < Ts + 5 ^{0}c
3	Colour (Hz)	6	Acceptable	*
4	Odour	Unobj'ble	Unobj'ble	Unobjectionable
5	Turbidity (NTU)	4.0	3.0	*
6	Conductivity (us/cm)	560	620	*
7	Total Suspended Solids (mg/l)	24	30	100
8	Total Dissolved Solids (mg/l)	336	372	*
9	Oil & Grease (mg/l)	BDL	BDL	10
10	Dissolved Oxygen (mg/l)	5.0	4.4	*
11	C.O.D. (mg/l)	40	50	250
12	B.O.D. 3 days at 27 ^{0}c (mg/l)	< 5	< 5	30
13	Total Residual Chlorine (mg/l)	BDL	BDL	1 (Max.)
14	Ammonical Nitrogen (mg/l)	0.10	0.1	50
15	Total Kjeldahl Nitrogen (mg/l)	3.25	3.37	100
16	Free Ammonia (mg/l)	BDL	BDL	5.0
17	Arsenic (mg/l)	BDL	BDL	0.2
18	Lead (mg/l)	BDL	BDL	0.1
19	Cadmium (mg/l)	BDL	----	2

WATER QUALITY ANALYSIS – MINE DISCHARGE(CH – II)

S.N.	PARAMETERS	ANALYSIS RESULTS(10/06)	ANALYSIS RESULTS(12/07)	STANDARDS FOR DISCHARGE – PART A SCH - VI
20	Hexavalent Chromium (mg/l)	BDL	BDL	0.1
21	Total Chromium (mg/l)	BDL	BDL	2
22	Copper (mg/l)	BDL	BDL	3
23	Zinc (mg/l)	BDL	BDL	5
24	Selenium (mg/l)	BDL	BDL	0.05
25	Nickel (mg/l)	BDL	BDL	3
26	Fluoride (mg/l)	0.98	1.11	2
27	Dissolved Phosphate (mg/l)	0.02	0.06	5
28	Sulphide (mg/l)	0.01	0.01	2
29	Iron (mg/l)	BDL	BDL	3
30	Manganese (mg/l)	BDL	BDL	2
31	Vanadium (mg/l)	BDL	------	0.2
32	Nitrate Nitrogen (mg/l)	2.2	1.8	10
33	Sulphate (mg/l)	126	90	*
34	Chloride (mg/l)	48	60	*
35	Phenolics Compounds (mg/l)	BDL	BDL	1

WQ - IMPACT ASSESSMENT

PRESENT WQ SCENARIO –
WITHIN THE PERMISSIBLE LIMITS;

- ✓ **THE LIKELY LEVEL OF POLLUTANTS – WITHIN THE PERMISSIBLE LIMITS;**
- ✓ **ADVERSE IMPACT ON WQ – INSIGNIFICANT DUE TO MINING OPERATIONS AS PER AAQM RESULTS.**
- ✓ **HOWEVER REGULAR WQM & MITIGATION MEASURES WILL BE CONTINUED DURING BALANCE LIFE .**

4.2.1 WATER POLLUTION CONTROL MEASURES

As seen from Analysis Data, the mine pumped out water does not contain significant pollution load and the discharge water quality even without treatment is quite satisfactory. However, if required in future, the abatement measures would be strengthened.

EXISTING WATER POLLUTION CONTROL MEASURES

❑MINE WATER – SEDIMENTATION

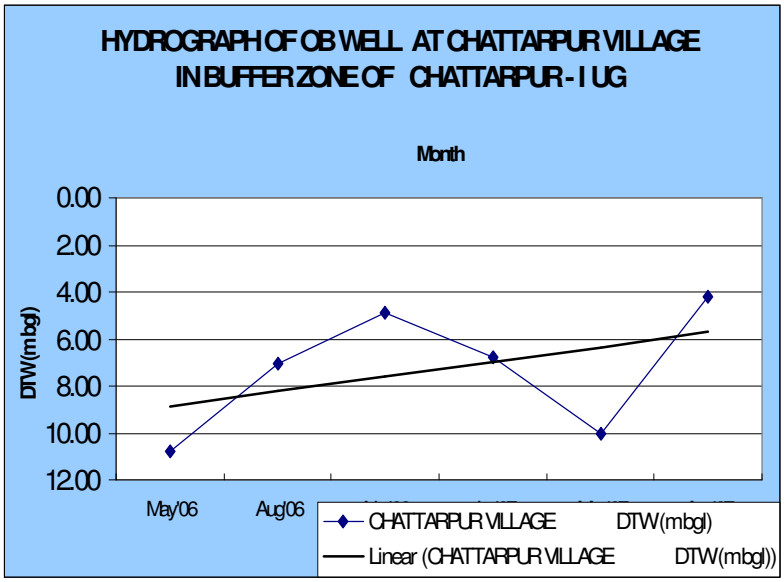
✓SEDIMENTATION - AT MINE SUMP IN UG WORKINGS & SURFACE SEDIMENTATION TANK.

DOMESTIC SEWAGE EFFLUENT:

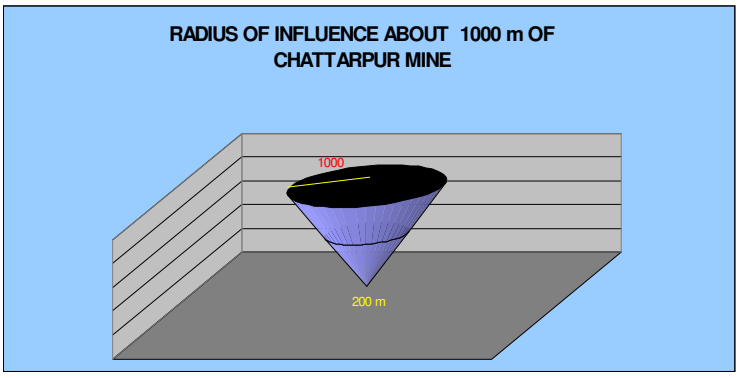
✓DOMESTIC SEWAGE TREATMENT - INDIVIDUAL SEPTIC TANK & SOAK PIT

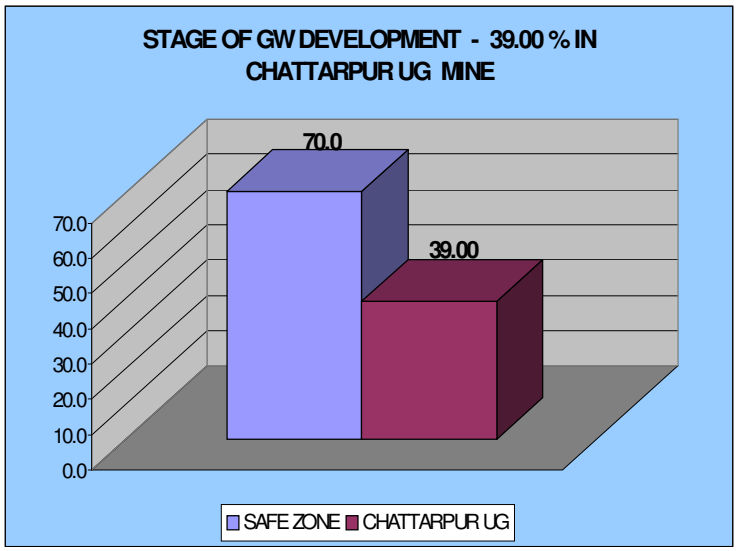
Effect of mining on ground water regime:

Precise influence zone could not be calculated due to non-availability of required deep aquifer parameters. The effect on groundwater regime due to under ground mining will be considerably low order and of temporary nature. The original regime will be redeveloped in due course after reclamation. Therefore, the influence area considered for socio-economic study (10 km radius) was presumed to be safe for groundwater impact assessment and the same is considered for groundwater resource evaluation too.



ANTICIPATED AVERAGE MINE FLOW	1700 m^3/day
	0.62 MCM / year





4.3 NOISE QUALITY – IMPACT ASSESSMENT:

The base line ambient noise quality in the surrounding area of the mine under consideration has already been discussed in detail in the previous chapter as well as the existing ambient air quality data being generated continuously every fortnight at the nearby mine site also been considered and placed below.

NOISE LEVEL ANALYSIS

AT FAN HOUSE			AT COLONY		
DATE	NOISE LEVEL IN dB(A)		DATE	NOISE LEVEL IN dB(A)	
	DAY TIME	NIGHT TIME		DAY TIME	NIGHT TIME
07/10/2006	73.6	72.1	07/10/2006	54.0	48.6
24/10/2006	61.7	56.3	24/10/2006	54.2	43.8
06/11/2006	72.9	72.0	06/11/2006	50.3	41.8
23/11/2006	61.9	56.5	23/11/2006	53.6	43.2
08/12/2006	72.7	72.1	08/12/2006	50.2	41.6
21/12/2006	71.8	70.9	21/12/2006	53.6	41.8

NOISE LEVEL ANALYSIS

AT FAN HOUSE			AT COLONY		
DATE	NOISE LEVEL IN dB(A)		DATE	NOISE LEVEL IN dB(A)	
	DAY TIME	NIGHT TIME		DAY TIME	NIGHT TIME
10/01/2007	72.1	66.5	10/01/2007	53.1	42.4
18/01/2007	74.3	73.8	18/01/2007	53.8	41.9
07/02/2007	74.8	73.1	07/02/2007	51.6	41.8
18/02/2007	74.6	73.2	18/02/2007	51.5	41.7
12/03/2007	74.0	72.0	12/03/2007	53.0	43.9
17/03/2007	74.5	72.1	17/03/2007	54.1	44.0

NOISE LEVEL ANALYSIS

AT FAN HOUSE			AT COLONY		
DATE	NOISE LEVEL IN dB(A)		DATE	NOISE LEVEL IN dB(A)	
	DAY TIME	NIGHT TIME		DAY TIME	NIGHT TIME
13/04/2007	73.5	69.0	13/04/2007	52.7	42.0
17/04/2007	73.0	68.9	17/04/2007	52.0	41.5
12/05/2007	73.1	68.5	12/05/2007	51.0	41.2
17/05/2007	72.0	68.0	17/05/2007	51.5	41.0
05/06/2007	73.3	68.7	05/06/2007	50.1	41.3
22/06/2007	73.0	68.5	22/06/2007	51.2	41.7

NOISE LEVEL ANALYSIS

AT FAN HOUSE			AT COLONY		
DATE	NOISE LEVEL IN dB(A)		DATE	NOISE LEVEL IN dB(A)	
	DAY TIME	NIGHT TIME		DAY TIME	NIGHT TIME
04/10/2007	72.0	68.8	04/10/2007	53.0	43.0
31/10/2007	71.5	68.5	31/10/2007	52.5	42.2
02/11/2007	71.8	68.0	02/11/2007	54.1	42.8
25/11/2007	70.3	67.0	25/11/2007	54.8	45.0
10/12/2007	72.3	69.0	10/12/2007	51.8	41.5
26/12/2007	72.0	68.3	26/12/2007	52.0	42.0

NOISE LEVEL ANALYSIS

AT FAN HOUSE			AT COLONY		
DATE	NOISE LEVEL IN dB(A)		DATE	NOISE LEVEL IN dB(A)	
	DAY TIME	NIGHT TIME		DAY TIME	NIGHT TIME
08/01/2008	74.1	67.0	08/01/2008	54.1	42.8
30/01/2008	73.4	65.0	30/01/2008	53.6	42.2
04/02/2008	72.0	66.0	04/02/2008	52.0	42.6
26/02/2008	71.3	65.1	26/02/2008	52.8	42.0
14/03/2008	70.9	64.0	14/03/2008	53.0	41.5
17/03/2008	72.5	65.2	17/03/2008	51.9	40.8

From the analysis results it can be inferred that the contribution of the underground mining activities at the mine site towards ambient noise pollution in the immediate vicinity is negligible which has been further corroborated by the results of base line data. The ambient noise quality at different villages has been found to be well within the permissible limits. Hence it can be concluded that there is hardly any adverse impact on ambient noise quality due to underground mining activities at Chattarpur – I & II UG mines. With the proposed expansion of the UG mines, the noise level may increase due to increased handling of coal. But the control

necessary measures will continue to be taken at the mine and with continuous monitoring. As such, there will be insignificant/ negligible impact on ambient noise quality.

Blasting and Vibration:

The mine under consideration is an Underground mine having workings below ground and blasting in underground will be carried out in small quantities as such the impact of blasting and subsequent vibrations on the surrounding inhabitants is nil.

4.3.1 NOISE POLLUTION CONTROL MEASURES

To control noise pollution following measures have already been taken.

i) Preventive maintenance of vehicles and plants & machineries.
ii) As far as practicable provision of silencers, mufflers etc. in the equipment have been made. Personal protective gears to workmen exposed to high noise level have been provided.
iii) Provision of noise absorbing pads at the foundation of the vibrating equipments.
iv) Provision of green belts around the areas where excessive noise is likely to be produced will be helpful in minimizing propagation of noise.
v) Regular monitoring of noise level of the project area.

4.3.2 PLANTATION/GREEN BELT AS A MITIGATIVE MEASURE AGAINST ENVIRONMENTAL POLLUTION

Plantation is an important tool for abatement of air pollution, noise pollution and soil erosion. In addition to these, it also increases the aesthetics of the area. Based on the present quality of the soil, suitable amendment measures will be implied including adding fertilizers and manures to improve upon the quality of soil to support creation of green belts / plantation in the area.

Following areas have been taken up for plantation:

(a) Area where ornamental trees have been planted like colony area schools dispensary, community buildings, playground etc.

(b) Around colony roads, industrial buildings etc. different rows of trees including tall and fast growing variety along with ornamental and shady trees will be planted.

(c) Around industrial areas like workshop, CHP etc., green belt on both sides of roads have been developed with fast growing tall varieties of trees including a row of ornamental shady trees. Such green belts also act as sound dampener and dust dispersion barrier.

Width of green belt

a) Along the roads, 1000 saplings per kilometer of road length in two rows on both sides of road creating 3.0 m wide green belt on its both sides.

b) Around Colony & infrastructure – 2500 saplings per ha; width 5 m; 3 rows of plantation all around.

c) Vacant land - 2500 saplings per ha.

Species planted

a) Along roads – Neem, Cassia , Karanj , Ashoka etc.

b) Around colony & infrastructure – Neem , Khair , Subabul , Shivaneta etc.

c) Vacant land – Teak, Neem, Ber, Gulmohar.Awala etc.
Plantation of these trees will also take off some pressure on the nearby forests as far as firewood is concerned.

In an underground mine plantation is taken up in areas which are under All Right or under Surface Right. The area thus available is very small and considering all features within this small area, a very little space is made available for plantation. Moreover, the anticipated level of pollution is also significantly less as except for surface transport of coal no other mining activity

is made on surface. As such requirement of plantation for arresting the air and noise pollution is also significantly less.

Plantation has been carried out in area acquired under surface right covering1.30 ha in Chattarpur – I UG & 0.30 ha in Chattarpur – II UG.

4.4 LAND DEGRADATION

The earth's crust is subject to two main natural forces – vertical and lateral compression. In most natural conditions, these forces may be considered to be in equilibrium unless disturbed by natural phenomena or man-induced disturbance of strata equilibrium.

Underground mining being a man-induced disturbance, creates a void which may cause the overlying overburden to subside or to move vertically and laterally into excavated space. Thus, the subsidence may be defined as the lowering of strata including surface due to underground excavations. These movements of overlying strata will continue until the bulking of the rock material has closed the
space or the compressive forces have been placed again into a state of equilibrium.

Factors affecting Subsidence:

When the underground coal mining is employed, the stresses in the overburden strata above and on the floor strata below the opening will re-adjust and be subject to strata movement and deformation. Generally, within a certain limit above the excavated opening the strata breaks, this is called caving zone. Above the caving zone and within a certain height, there are numerous fractures parallel or perpendicular to the bedding plane, which is the fractured zone. The strata between the fractured zone and the surface deform continuously and are called the continuously deformed zone. Every point on the surface moves towards center of the excavated opening and forms a surface subsidence basin. This process is called strata movement. If this process refers to the surface, then it is called surface movement. The characteristics and severity of the strata and surface movements are mainly dependent on the following factors:

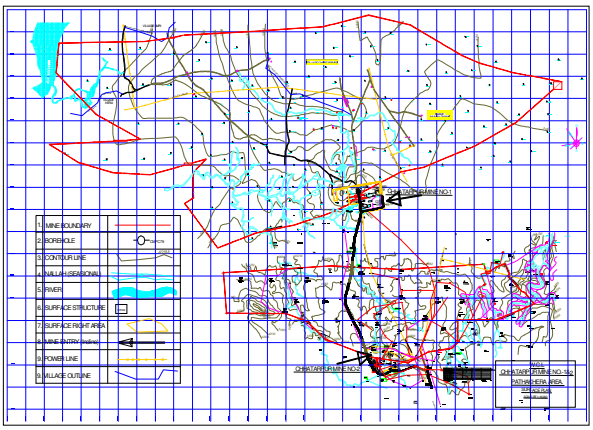
a) Thickness of the seams.
b) Percentage of extraction.
c) Depth of panel.
d) Width of panel.
e) Dip of the seam.
f) Method of working.
g) Nature of Goaf Support, caving or stowing.
h) Nature of Overlying Strata.
i) Geological disturbances.
j) Surface topography, etc.

Within the movement basin, the displacement that causes lengthening in horizontal strain (tensile strain) can be managed by controlling some of the above factors, viz. Percentage of extraction, width of panel, method of working, nature of goaf support. Moreover, the interval between extraction of two seams play an important role in multi-seam working, the overlying strata will tend to consolidate with rains and become stable for lower seam workings (in case the extraction of panels in lower seam is delayed by 1 – 3 years with respect to extraction in upper seam). In order to assess the quantum of subsidence, different formulae are in prevalence for different areas of coalfields, specific on consideration of above factors. However, the most relevant data will be information about subsidence behavior from adjacent mines, if anywhere the composition of super – incumbent strata and other parameters of coal seams are identical.

In this mines under consideration, as mentioned earlier extraction is to be carried out by Caving as per prevalent practice in all other operating UG mines of Patahkhera area. As such subsidence behavior in these mines will be indicative for Chattarpur - I & II. Underground mining in Pathakhera area has been going on for the last four decades and from the records following can be concluded: -

i) Subsidence takes place to a maximum extent of 1.0 - 3.0 m and it is uniform and gradual.
ii) It stabilizes and reaches a stage of equilibrium after about three years.

iii) Cracks occur on surface
iv) Vegetation/Plantation in general is undisturbed and continues to grow as before.



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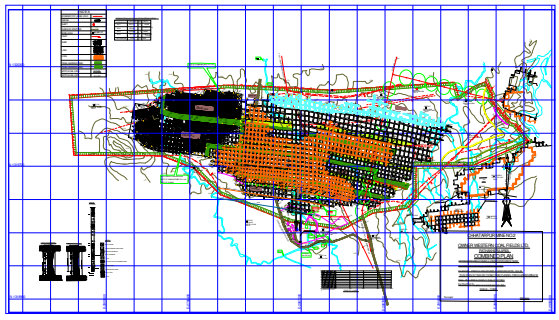


4.4.1 LAND RECLAMATION

Since underground mining method has been adopted, it is anticipated that no serious damage to the landscape and land use pattern will occur in this region except for minor changes in the surface profile in some portion of the land. It is proposed to leave solid barriers between the caved panels. According to the recent subsidence management practices the barrier width should be 12 times the extraction thickness or 0.15 times the depth, whichever is more.

The detailed control measures to be adopted for controlling the subsidence as far as possible is being discussed here. The following measures and precautions shall be taken:-

1) Around the depillaring area, co-related on the surface, protective bunds and garland drains shall be laid so that no water from surface enters the subsidence area and through the cracks to the working area.
2) The surface cracks shall be sealed up by using shale, clay or other suitable material.
3) Depressed portions shall be leveled up using soil or clay or other suitable material.

There are statutes to guide the development of seams below permanent structures, water bodies etc. so that the stability of the same is not endangered and also the safety of workings and workers below ground is ensured. In the project report the development of the seam has been planned in accordance with the statute.
It is also a statutory requirement to monitor subsidence regularly. For this purpose, grid pillars shall be located 30 m apart at the surface over the working panels and at intervals of 50 m beyond. Level sections shall be taken every month and plotted. These will provide information regarding progress of subsidence till stability or equilibrium conditions are reached.

LAND MANAGEMENT

- ✓ METHOD OF WORK :- BORD & PILLAR WITH CAVING
- ✓ SEAM THICKNESS :- 0.90 M TO 5.6 M
- ✓ DEPTH OF WORKING :- 45 M TO 230 M

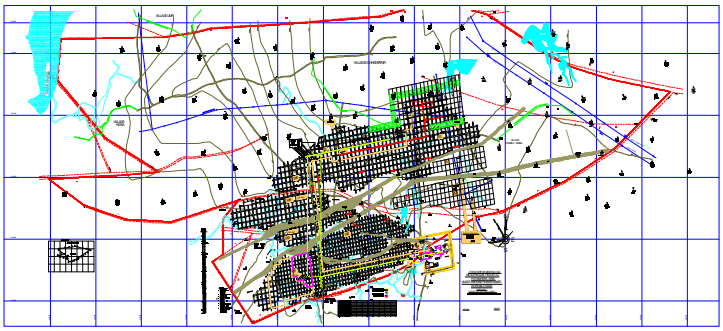
❖ ANTICIPATED SUBSIDENCE :-

I) SUBSIDENCE MAY TAKE PLACE TO A MAXIMUM EXTENT OF 1.0 M TO 3.0 M AND IT IS LIKELY TO BE UNIFORM AND GRADUAL.
II) IT WILL STABILISE AND REACHE A STAGE OF EQUILIBRIUM AFTER ABOUT 3 YEARS
III) CRACKS MAY OCCUR ON SURFACE
IV) VEGETATION/PLANTATION IN GENERAL IS LIKELY TO BE UNDISTURBED AND WILL CONTINUE TO GROW AS BEFORE.

LAND MANAGEMENT

❖ PRECAUTIONERY MEASURES :-

I) DEPILLARING OPERATIONS ARE AS PER DGMS PERMISSION
II) ALL DIRECTIONS OF DGMS STRICTLY FOLLOWED
III) AROUND THE DEPILLARING AREA CO – RELATED ON THE SURFACE, PROTECTIVE BUNDS AND GARLAND DRAINS ARE MADE
IV) THE SURFACE CRACKS ARE SEALED UP BY USING SUITABLE MATERIAL.
V) DEPRESSED PORTIONS ARE LEVELLED UP
VI) REGILAR MONITORING OF SUBSIDENCE MOVEMENTS AND RECORDS MAINTAINED.



The above mitigative measures, stipulations and their enforcement will result in effective monitoring of subsidence. Above all, depillaring is carried out only after taking due permission from DGMS and continued in accordance with the stipulations specified in the permission.
Plantation has been carried out in area acquired under surface right covering1.30 ha in Chattarpur – I UG & 0.30 ha in Chattarpur – II UG.

4.5 PROGRESSIVE MINE CLOSURE PLANNING

4.5.1 Preamble

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. insitu stress field, ground water, surface drainage system as well as the socio – economic condition. Although mining activities are usually short-term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mind set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues viz. reclamation & environmental protection, rehabilitation of disturbed area. Community implementation of mine closure plan will incur some extra cost, neglecting this aspects will lead to future problems of attending compensation or expensive socio-economic problems.

Hence, efforts are made to identify the likely impacts on geo- environmental and socio-political set up due to closure of the mine during the planning stage itself, so that it will offer an opportunity to generate resources for mitigative measures during closure of the mine.

4.5.2 OBJECTIVES OF MINE CLOSURE

Mine closure planning has to be done at the starting point of mining operations and needs periodic review and revision during the mine's entire life. The objectives of mine closure are as given below:

a) After the mining operations are completed, the mine site and the area should be reclaimed for productive after - use, which should be mutually acceptable to the mine owner and regulatory authorities duly fulfilling the stipulations in vogue.

b) To minimise or eliminate the environmental damage done by mine operations.

c) To protect public health and safety.

d) To minimise adverse socio-economic impacts.

4.5.3 MINE CLOSURE ACTION PLAN

The following actions have to be addressed in relation to mine closure planning:

a) It is suggested that mine openings & workings should be properly closed & sealed so as to prevent any danger to post mining uses of area.

b) Prior to surface demolition, a surface audit has to be undertaken on all surface structures for any hazardous materials like explosives, chemicals, etc.

c) A list of surface assets should be prepared and made available to the prospective buyers, which can ensure the sale of assets.

d) Necessary hydro geological studies which have been done to facilitate post-mining ground water recharge.

e) As a detailed component of the closure plan, a decommissioning plan is to be prepared preferably 5 years prior to tentative closure of mine which may be updated annually.

f) Development of a subsidence management plan taking care of the impacts of subsidence and safety of UG workings.

g) Withdrawal of all the equipment from U/G and capping of the shafts and inclines or openings to ensure safety.

h) The roads and railway lines which are not required after mining should be dismantled and the land should be brought into economic use after proper reclamation.

i) The drainage of the mine area in post mining period should be properly planned.

j) Due to closure of mining operation the persons directly employed in the mine will be surplus. It is suggested that suitable manpower plan may be formulated by the mining

company sufficiently before that closure of mine for re-deployment of work force in the other units of the company.

4.5.4 Closure cost: With the present mining method i.e, semi-mechanised Bord & Pillar method and Continuous Miner Technology, the closure cost is anticipated to be a large amount and this closure cost cannot be properly assessed and justified at this stage. Closure cost may be reviewed under the changing circumstances of Geological and Mining conditions and new legislative requirements at the time of actual closure of the mine. The actual expenditure likely to be incurred towards mine closure cost shall be assessed at the appropriate time i.e five years before the actual closure and necessary competent approval for provision of funds required shall be obtained.
However, based on the present situation a tentative estimate has been arrived at, which is given below:-

i) Incline closing -	Rs. 86400.00
ii) Subsidence / land management. -	Rs. 2000000.00

	Rs. 2086400.00 Say Rs. 21.00 lakhs. For each mine

However an amount of Rs. 1.00/te. has been proposed to be earmarked as corpus fund which will be utilised to undertake various closure activities as per the requirement at the time of actual closure.

4.6 EFFECT ON FLORA AND FAUNA

Due to under ground mining activities; the ecology is not likely to be disturbed directly or indirectly. The effect of subsidence due to underground operations will not have any adverse effects on the floristic composition because of geological setting & method of extraction and the statutory preventive measures as specified by **Director General of Mines Safety (DGMS**) which will be taken during the day to day operation of the mine to minimize the subsidence effect.

4.6.1 Conclusion: From the earlier paragraph, it can be inferred that there will be no adverse impact on physical environmental attributes.

4.6.2 PROTECTION OF FOREST LAND

Regarding protection of Forestland, the conditions as stipulated in the clearance letter of MOEF shall be strictly followed.

4.7 OCCUPATIONAL HEALTH

Periodical Medical Examinations are will be carried out on employees once in five years with the purpose of detecting and keeping records of diseases with specific importance to Coal Worker's Pneumoconiosis.

During P.M.E., the candidates are subjected to a complete clinical examination, (including acuity of vision and hearing), radiological examination of chest and routine examination of blood and urine.

In case some abnormality is detected during the course of the above examination, further investigations will be carried out, as required.

When a person is diagnosed as having a certain disease, he will be referred to the concerned specialist for confirmation and initiation of treatment.

If, on radiological examination, a person is suspected to be having Coal Worker's Pneumoconiosis, he will be referred to WCL Pneumoconiosis Board. There is a team of specialists specially trained in Pneumoconiosis, examine his x-rays and come to a conclusion as to whether he is having Coal Worker's Pneumoconiosis or not, compensation to be paid and his fitness or unfitness for continuing in his job.

Various National and International Days will be observed to increase awareness and educate general population (e.g. No Tobacco DAY / No Smoking day, World AIDS day, World Breast Feeding Week etc.).
Regular Family Welfare (L.T.T.) Camps will be organized with the help of State Govt.
Full co-operation will be extended to State Govt. for Pulse Polio immunization.
Medical facilities will be extended to non-employees in all sorts of acute emergencies.

Present set up of Occupational Health Services At WCL:

WCL is having occupational health committee at the corporate (HQ) level as well as at the unit (Area /Projectlevel).

At corporate level, the committee consists of the following: -

- Chief General Manager (Safety)
- Chief of Medical Services
- Periodical Medical Examination (PME) Incharge of HQ.

The committee scrutinizes the report of the area every quarter.
At Unit level, the committee consists of the following: -

- General Manager (Operations)
- Area Medical Officer
- Area Safety Officer
- Periodical Medical Examination (PME) Incharge of Area.

The above committee takes the review at area level every month. There are 11 hospitals having PME Centres in the hospitals. The PME Centres are well equipped with Spirometry (Lung Function test), Audiometry (for testing hearing impairment) along with the facilities for X – Ray & other bio – chemical tests.

The details are as follows: -

- Periodical Medical Examination (PME) Centres (Occupational Health Centres) – 11
- Nos. of Doctors engaged in Periodical Medical Examination - 11
- Nos. of Doctors trained in Periodical Medical Examination - 22
- Nos. of X – Ray machines (300 mA) - 9
- Nos. of X – Ray machines (500 mA) - 2
- Nos. of ILO film Tests - 10
- Nos. of Audiometer units - 7
  (4 units are under process of procurement)
- Nos. of Spirometer units - 8
  (3 units are under process of procurement)
- Nos. of Pathology Labs - 11
- Nos. of X – Ray technicians - 14
- Nos. of Laboratory Technicians - 22

All the PME Centres are fully computerised.

As per the Statute / Mines Act, 1952, all the workers are examined every five years and the disease profile is maintained in PME Centres in different colour codes as given below: -

- Yellow Card – Hypertension
- Green Card – Diabetes
- Red Card - Ischaemic Heart Disease

The pneumoconiosis cases are also followed up regularly by the PME Centres. Recently WCL has started PME every two & half years for underground workers between the age group of 50 to 60 years.

The mineworkers who have been detected with Hypertension or Diabetes or Ischaemic Heart Disease, the records of those workers are well maintained are advised to attend OPD regularly. Attendants of the patient are also advised to take care regarding the diet and medication of the patient.

Workers exposed to high decibel machineries i.e. more than 90 decibels and are found to have developed hearing impairment, are subjected to repeated audiometric tests. Chronic obstructive Pulmonary disease cases are followed by regular Pulmonary functions tests.

In suitable cases, as per the recommendation of the Apex Medical Board, the change of job is also suggested and implemented accordingly.

In addition, the Welfare Board of WCL time to time makes visits to different area hospitals & PME Centres so as take stock of the ground realities.

WCL is one of the nominees in the Governing Body of the National Institute of Miners Health (NIMH) An autonomous institute under Ministry of Coal & Mines Govt. of India, Nagpur.

Recently, NIMH has asked WCL for intervention study in coalmines of WCL.

WCL has already given consent to NIMH regarding carrying out the above-mentioned study.

The subject work by NIMH has already been started in two mines of WCL.

The workers, those are detected having lung diseases and hearing impairment, they are kept on constant monitoring & supervision under physicians and they are advised for periodical check – ups and necessary Pulmonary function tests & Audiometry tests are done time to time. NIMH is also going to help WCL in such cases.

CHAPTER- V

ENVIRONMENTAL MONITORING PROGRAMME

5.0 ENVIRONMENTAL MONITORING –

The environmental monitoring programme at present is being carried at the mine as per details given below: -

S. N.	Items	Parameters	Frequency	No. of Stations	Submission
1.	Ambient Air Quality Monitoring	SPM, RPM, SO2, Nox, CO & Fugitive dust	Every Fortnight as per Environment Protection (Amendment), Rule 2000	4	Quarterly Report are to be submitted to SPCB & MOEF
2.	Water Quality Monitoring	1) 4 Parameters viz. p H, Total Suspended Solids (TSS), Chemical Oxygen Demand (COD) & Oil and Grease. 2) 35 Parameters	Every Fortnight Once in a Year	3	Quarterly Report are to be submitted to SPCB & MOEF
3.	Noise Quality Monitoring	Noise Levels	Every Fortnight	2	Quarterly Report are to be submitted to SPCB & MOEF
4.	Environmental Statement		Annual		Annually Report is to be submitted to SPCB before 30th September.
5.	Ground Water Level Monitoring & Quality	Water Level & Quality Parameters.	Water Level – Quarterly. Water Quality – Yearly.	In Buffer Zone Villages.	Quarterly Report are to be submitted to SPCB & MOEF
6.	Compliance Report of EC Conditions.	All conditions both Specific & General	1st June & 1st December	Not Applicable	Half yearly Report are to be submitted to MOEF

CHAPTER- VI

ADDITIONAL STUDIES

6.0 INTRODUCTION:

Mining is a hazardous industry. There is risk to life and property associated with various mining and allied activities of the project. As such a detailed study has been carried out covering identification and assessment of risk, and recommendation of measures to prevent damage to life and property against such risks. They are discussed below.

6.1 PUBLIC CONSULTATION

To ascertain the concern of local affected and others who have a plausible stake in environmental impacts of the project / activity public consultation will be done at project site or close proximity for local affected persons with the following activities.

The process in which public would be directly involved or participate and indirect responses would be received through different modes of communications.

District Magistrate will preside over the Public Hearing process to get public concerns incorporated in the EIA report.

Videography of proceedings would be done and would be enclosed with the application for Expert Committee.

The proceedings will be signed by DM/ADM in the same day of hearing.

The proceedings will be displayed in web site and other Govt. offices.

6.2 Disaster Management

a) General

The mine is being operated in accordance with the provisions of Statute. The various issues regarding possible risks and corresponding safety measures are detailed out below.

b) Gassiness

- Both the existing mines have been categorized as Degree-II gassy mine and the proposed expansion mine is also expected to be of `Degree-II' gassiness.

- Regular gas survey is carried out as per statute.

- Adequate provision for self-rescuers has been made to enable everybody to carry it underground.

- Stone dust barriers are provided as per statute.

- Methanometer & other appliances related with mine environment for regular monitoring of methane in the mine has been provided for.

- All possible precautions are taken while working near dyke-affected zone so that accumulation of inflammable gas does not take place in the working faces.

c) Inundation

- The HFL of Tawa river near the proposed mine area is not available in any official record. However, verbal enquiries from villagers of Chhatarpur and Keria Umri village have revealed that there has never been any instance of the villages getting inundated.

- It is well known fact that the prospecting boreholes can be a source of danger, because later-on these get connected with u/g workings. Therefore, it is of paramount importance that these boreholes do not get connected with U/G galleries. In case some boreholes do get connected, these are suitably plugged preferably with cement grout. The boreholes from the surface are also suitably plugged, so that water from the surface does not find its way through these boreholes.

- A careful assessment of the danger of inundation from surface water is made before the onset of every rainy season & adequate precautions against such danger are clearly laid down & implemented.

- During rainy season, blockage of river, Jore, nallah or stream may occasionally occur on the upstream. Therefore, a constant watch is kept on the upstream of river/nallah & suitable precautions are taken accordingly.

d) Dust Suppression

Underground -

- The most effective method of dust suppression is to suppress the dust at the source of generation, before the dust becomes airborne. Arrangement for dust suppression in the form of water spraying has been provided at all working faces and transfer points in conveyor systems.

- For monitoring the level of dustiness and quality of dust, regular sampling and analysis of mine dust is done as per statute.

Surface –

Similarly on surface, as already indicated, except for coal transportation there is no other source of dust and the same is effective controlled by

i) Coal transportation through covered trucks,
ii) Avoiding Over – Loading of Trucks,
iii) Black topping of coal transportation road,
iv) Water spraying at vulnerable points/areas.

e) Spontaneous Heating

There is no history of fire or spontaneous heating in the existing mines or in any adjoining underground mine.
- The extraction of pillars to commence from the proposed limit of the mine or from the natural barriers created by faults.

- Preparatory stoppings will be kept ready at the out bye end of the sub-panel so that in case of outbreak of any U/G fire, the sub-panel can be abandoned & sealed off by constructing fire stoppings in the minimum possible time.

- Before commencement of depillaring operation, all the inflammable material will be cleaned and removed from the face.

- Isolation stoppings will be made quickly & effectively seal off every panel after completion of extraction & salvaging of material from all the sub-panels.

- Since caving method of mining has been proposed, cracks may appear on the surface. Therefore, efforts will be made to seal-off the cracks, so that air & water does not enter in the goaf through these cracks.

f) Subsidence

Caving is proposed as method of extraction in this mine. The depth of the mine varies from minimum 40m to maximum about 270m. The surface topography is mostly flat and some portion is covered with revenue forest.

The depillaring operations will be carried out strictly in accordance with the permission of DGMS and all the conditions will be implemented during actual operations. The monitoring of subsidence parameters will also be carried out and records will be maintained as per the directives of DGMS.

In the forest area, the minimum permissible strain value is 10 mm/m and if tensile strain is more than this value, NPV (Net Present Value) of the affected forestland is required to be paid to the State Forest Department. However, the payment of NPV will be as per the actual forestland affected by the subsidence with tensile strain more than 10 mm/m.
Depillaring operations due to caving may lead to subsidence cracks appearing on the surface during caving where depth of cover is less. It is proposed to fill these cracks by properly ramming with soil or other incombustible material. Additionally, constant monitoring of such area, especially during monsoon will be done to avoid entry of water through these cracks. Drainage channels will also be made so as to guide the water away from such subsided area.

TRAINING

The personnel directly responsible for handling emergencies are given training for making them better equipped for discharging their responsibilities. Coal Industry has set up a number of training institutes for imparting training to its employees. The training improves safety awareness among the workers and trains them to carry out their assignments safely.

MEDICAL AID

In Pathakhera Area a fully equipped hospital with qualified medical practioners & other equipments etc. is running very efficiently. Therefore, any medical urgencies can be attended without any problem.

COMMUNICATION SYSTEM

Efficient communication system based on VHF system has been provided for the project. This allows proper communication link between various work centers and helps in preventing accidents as well in taking early action.

SAFETY AWARENESS: To create safety awareness and impart education on safe practices, the following steps are being taken:

- Holding annual safety weeks.
- Imparting basic and refresher training to new and old employees respectively.

PREVENTIVE MEASURES:

(I) Adequate ventilation to dilute any possible emission of firedamps is of paramount importance, for this purpose suitable high capacity fans have been provided.

(II) Suppression of dust at the source by water spraying at different places in Underground.

(III) Proper statutory precautions are taken in the use of the explosives.

(IV) Use of fire resisting materials, and flameproof equipment for ventilation of mine workings.

(V) No combustion materials are being used in the construction of, or in connection with, any shaft lining, or any room housing any machinery/apparatus below ground.

(VI) In case of every fan (other than an auxiliary fan), installed below ground, the coal or other carbonaceous materials exposed in the sides, roof and floor, shall be covered with masonry or other adequate protection against fire, for a distance of not less than 5 m in every direction from the face.

(VII) No coal, shale or other carbonaceous material would be left/slacked below ground. Where removal of fallen coal out of the mine is not practicable, the area would be effectively sealed off.

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, which has been done for this project also.

(C) Preventive measures against identified risks as per statute have been envisaged.

(D) With adoption of such protective measures, the operation of the mine would be safe as well as environment friendly.

6.3 SOCIO-ECONOMIC IMPACT

The impact of this project will be positive on the overall socio-economic condition of the local as well as surrounding population of the project area.

Social Impact:

(a) Social: Being a labour intensive industry the migration of skilled and semi-skilled labourer from the nearby area may taken place. Since this zone is having number of working coalmines, the local villagers have also got trained for various skilled and semi-skilled jobs. People in and around the working mines have been settled and this has resulted in thorough mixing of different cultures, customers etc. and justifies the term "**Unity in Diversity**".

(b) Educational Facilities: In the buffer zone, there are many schools of different standards.

(c) Health Care Facility: For this project First Aid Center / Dispensary has been proposed in the project Report. Moreover, in the buffer zone dispensaries and medical aids are available for all the villages within a distance of 5/10 Kms. WCL is also running one Area Hospital.

(d) Other Amenities: This area is very well connected by rail & roads. There is a network of pucca and kutcha road catering to almost all the villages of the area. Electricity is available to almost all the villages. Drinking water is available from wells and bore wells.

With the working of this project & also other mines of Pathakhera Area, the surrounding area has been very well developed in respect of modern civic amenities.

Economic impact: A substantial percentage of population is dependent on mining industry directly or indirectly. Because of this mining project some of the local population may taken direct employment but a substantial impact will be on creation of indirect job opportunities and employment. In this area the local population will avail the indirect employment facilities with activities associated in mining and other construction jobs.

Large quantity of transport of coal takes place, which provides direct job opportunities for the local residents. In addition to the employees of the operating coal mines there are substantial floating population. Catering to the needs of these people there will be lot of opportunities for self-employment like dairy farming, poultry, growing of vegetables and of course trading of these products. This definitely will improve standard of living of local population.

Land & House Oustees: This is an expansion of operating underground mine and there is no House Oustees involved. The entire additional land will be acquired under mining right.

Other Socio – Economic Benefits:

a) There will be spontaneous economic stimulus in the area with the commencement of mining activities. Some traders and private enterprises will grown up in the area with this economic growth. Besides, the State exchequer derives financial revenue through royalty, sales tax etc and Central Govt. also being benefited by way of Central Sales Tax, Income Tax, Cesses etc.

b) There are several educational institutions of various standards managed by both public and private sectors / bodies in the area by WCL and State Govt.
Moreover, with further continuation of the project more and more developmental works are likely to be implemented which add to the social benefit/positive impact due to this project.

CONCLUSION –

From the details given in earlier paragraphs it can be concluded that the overall impact on environment due to the mining operations will be insignificant.

Peripheral development:

As per the present practices in WCL coal mines, adequate steps are being taken for the local villagers by providing various infrastructural and welfare facilities and giving assistance in health care in Pathakhera Area of WCL, under which the UG projects under consideration will be expanded for enhancement of production capacity.
The various development works like construction of Primary, School, Post office, Shopping center, diversion of cart track for villagers, establishment of bank, diversion of irrigation canal etc; have been completed, mainly for catering to the needs/socio-economic upliftment of the neighbouring population.

WELFARE WORKS DONE UNDER COMMUNITY DEVELOPMENT, SC/ST WORKS AT CHHATARPUR – I UG

S.N.	ACTIVITY / WORK	COMPLETION COST (Rs. Lakhs)	NAME OF VILLAGE	DISTANCE OF VILLAGE FROM MINE (KM)
COMMUNITY DEVELOPMENT WORKS				
1	Approach road for Chattarpur village	0.82	Chattarpur	1.5
2	WBM road from Chattarpur village to Dhumakhadan 1340 mtr	3.10	Chattarpur	1.5
3	Construction of 400 mtr WBM road from Bagdona to Chattarpur village	2.17	Chattarpur	1.5
4	One no. class room at middle school at Chattarpur village	1.50	Chattarpur	1.5
5	Repairing & tarring of 1080 mtr road at Chattarpur village	4.00	Chattarpur	1.5
	TOTAL	11.59		

WELFARE WORKS DONE UNDER COMMUNITY DEVELOPMENT, SC/ST WORKS AT CHHATARPUR – II UG

S.N.	ACTIVITY / WORK	COMPLETION COST (Rs. Lakhs)	NAME OF VILLAGE	DISTANCE OF VILLAGE FROM MINE (KM)
COMMUNITY DEVELOPMENT WORKS				
1	Community hall at Bagdona Village	2.47	Bagdona	2.0
2	Tarring of 500 m road at Bagdona Village	2.55	Bagdona	2.0
3	One no. class room at Primary school at Bagdona village	1.50	Bagdona	2.0
4	Tarring of 2000 m road at Salaiya Village	10.00	Saliya	2.0
	TOTAL	16.52		

WELFARE WORKS DONE UNDER COMMUNITY DEVELOPMENT, SC/ST WORKS AT CHHATARPUR – I UG

S.N.	ACTIVITY / WORK	COMPLETION COST (Rs. Lakhs)	NAME OF VILLAGE	DISTANCE OF VILLAGE FROM MINE (KM)
SC / ST DEVELOPMENT WORKS				
1	Tube well at Chattarpur village	0.31	Chattarpur	1.5
2	Balance payment of Chattarpur village Tube well	0.33	Chattarpur	1.5
3	Stop Dam at Shanker nallah	0.60	Saliaya	3.0
4	Installation of hand pump at Umari dhana	0.40	Umari dhana	
5	Installation of hand pump at Dhumakadhana	0.40		
6	Providing 10 nos. hand pumps at Shobhapur, Nandagowadi, Bichhuwa, Salaiya, Badgona, Chattarpur, Keriya, Umari, Dhumkadhana, Gram Khapa, Rajegaon	4.50	Shobhapur, Nandagowadi, Bichhuwa, Salaiya, Badgona, Chattarpur, Keriya, Umari, Dhumkadhana, Gram Khapa,	1.5 to 8.0

WELFARE WORKS DONE UNDER COMMUNITY DEVELOPMENT, SC/ST WORKS CHATTARPUR – I UG

S. N.	ACTIVITY / WORK	COMPLETION COST (Rs. Lakhs)	NAME OF VILLAGE	DISTANCE OF VILLAGE FROM MINE (KM)
SC / ST DEVELOPMENT WORKS				
7	Community hall in Chattarpur village	1.70		
8	5 nos. hand pumps at Shobhapur Kariya, Umari Dhumakadhana, Chattarpur, Salaiya	2.30	Shobhapur Kariya, Umari Dhumakadhana, Chattarpur, Salaiya	1.5 to 3.0
9	Shobhapur site – installation of 5 nos. hand pumps at:- Bichhuwa, Chattarpur, Keriya, Umari, Nadiyan, Salaiya	2.50	Bichhuwa, Chattarpur, Keriya, Umari, Nadiyan, Salaiya	1.5 to 3.0

WELFARE WORKS DONE UNDER COMMUNITY DEVELOPMENT, SC/ST WORKS AT CHHATARPUR – II UG

S.N.	ACTIVITY / WORK	COMPLETION COST (Rs. Lakhs)	NAME OF VILLAGE	DISTANCE OF VILLAGE FROM MINE (KM)
SC / ST DEVELOPMENT WORKS				
1	Making 2 nos. of class rooms in Bagdona Village	1.11	Bagdona	2.00
2	Tube- well at Bagdona Village	0.30	Bagdona	2.00
3	Installation of Hand – Pumps at Bagdona Village	0.40	Bagdona	2.00
4	Installation of hand pump at Salaiya Village	0.40	Salaiya	2.00
5	Providing 2 nos. of hand pumps to Salaiya & Bagdona	0.90	Bagdona & Salaiya	2.00

CHAPTER – VII
PROJECT BENEFITS

7.0 PROJECT BENEFITS

The benefits of the project can be summarized as below:-

- The physical infrastructure in the area will be improved substantially by following ways:-

Development of road, thereby improving the communication.
Improvement in Power, Telephone (including Mobile) facility.
Improvement in Health Care facility & Educational facility.
Improvement in Market / Trade & Business.
- The social infrastructure by way of cultural mixing of people of other states with local community glorifying "UNITY IN DIVERSITY".
- Substantial employment in the project & indirect employment for business & trading, contractor, transportation, vehicle contractor, nursery development.

CHAPTER - VIII

ENVIRONMENTAL COST – BENEFIT ANALYSIS

Ministry of Environment & Forests while issuing TOR has not specifically indicated for carrying out "Cost Benefit" Analysis, hence the same has not been carried out.

CHAPTER - IX

ENVIRONMENT MANAGEMENT PLAN

9.0 GENERAL

Close monitoring of the environment and implementation of various protective measures discussed in the report forms an important part of EMP. In the earlier chapters the causes of various pollutions along with the preventive and mitigating measures have been discussed. In this chapter description of the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored, after approval of the EIA is being discussed.

9.1 MONITORING ORGANISATION

To have a close watch on the environmental condition and implementation of the various measures suggested, a multi-disciplinary approach is essential.

(a) WCL headquarter acts as an apex body which supervises the activities relating to environment at project level through the General Manager.

(b) General Manager of the area coordinates the activities of various disciplines in the area to render all necessary assistance at the implementing level i.e. the Project. Area Nodal Officer (Environment) monitors all aspects of environment on behalf of the General Manager. He also takes suitable steps for generation of environment data along with its analysis and interpretations.

As far as plantation is concerned horticulturist with suitable backup staff shall be provided in the area for undertaking the plantation jobs including raising of a nursery. Plantation will have to be done on a large area. Therefore, it may be desired that an outside agency may have to be employed for this purpose. The horticulturist along with the supervisor shall only monitor and guide the agency for selection of site, treatment of soil, selection of species etc.

(c) Project Officer is responsible for mechanical reclamation of the area. He is also responsible for biological reclamation with the assistance of GM's office.

ORGANISATION FOR ENVIRONMENT MANAGEMENT

Sl. No.	Measures/Actions		Agency
1.	Environmental Control	1	Chief General Manager, Pathakhera Area
		2	Nodal Officer, (Environment), Pathakhera Area
		3	Sub Area Manager, Chattarpur – I & II UG
		4	Staff Officer (Civil), Pathakhera Area
		5	Environmental Cell (WCL H.Q.)
2.	Environmental Monitoring	1	Chief General Manager, Pathakhera Area
		2	Staff Officer (Civil), Pathakhera Area
		3	Nodal Officer (Environment), Pathakhera Area
		4	Sub Area Manager, Chattarpur – I & II UG
		5	Environment Cell of WCL Headquarters
		6	Environmental Laboratory of CMPDI, RI-IV
3.	Reclamation	1	Sub Area Manager, Chattarpur – I & II UG
		2	Nodal Officer (Environment), Pathakhera Area
		3	Environmental Supervisor
		4	Horticulturist

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EXECUTIVE SUMMARY
FOR

PUBLIC CONSULTATION
(As per TOR ISSUED BY MOEF VIDE LETTER DATED 26.08.2008)

FOR

CHATTARPUR – I & II UNDERGROUND EXPANSION PROJECT
(PATHAKHERA AREA, WESTERN COALFIELDS LIMITED)
(Expansion in production from 0.41 MTPA TO 1.00 MTPA
and Enhancement of mine lease area from 356.370 ha to 825.338 ha)

SEPTEMBER– 2008

Prepared by :-

ENVIRONMENT DEPARTMENT
WESTERN COALFIELDS LIMITED
COAL ESTATE, CIVIL LINES
NAGPUR - 440001

Executive Summary

1. INTRODUCTION: -

The projects were approved for 0.21 & 0.20 MTPA level of production with a capital investment of Rs. 19.25 crores & Rs. 20.76 Crs for Chattarpur – I & II UG mine respectively. The mines have produced 0.181 & 0.21 Mt during last year i.e. 2006-07. Now the mines are likely to produce 0.45 & 0.24 MTPA of coal respectively. In view of the maximum / peak production capacity achievable from these mines, environment clearance is being solicited for 1.00 MTPA for Chattarpur – I & II UG combined.

2. LOCATION: -

The existing Chhatarpur mine no. I UG & Chhatarpur mine no. II UG mines are situated adjacent to each other in Pathakhera Coalfields, which lies in between latitudes 22 Deg. 7′ N to 22 Deg. 10′ N and longitudes 78 Deg. 03′ E to 78 Deg. 6′ 45′′ E as per Survey of India Topo Sheet no. 55 J/4. The area falls in Betul district of Madhya Pradesh state.

3. COMMUNICATION: -

Both these mines are well connected by both road and rail communication. The nearest railhead is Ghodadongri Railway Station about 12 km away, which is about 230 kms away from Nagpur on Delhi-Chennai Grand – Trunk line of Central Railway.

4. GEOLOGY & RESERVE:-

The brief description of geology is as under:-

Chattarpur – I UG

Name of the seam being worked :Lower Workable seam.

Seam thickness range (m) : 2.2 m to 3.0 m.

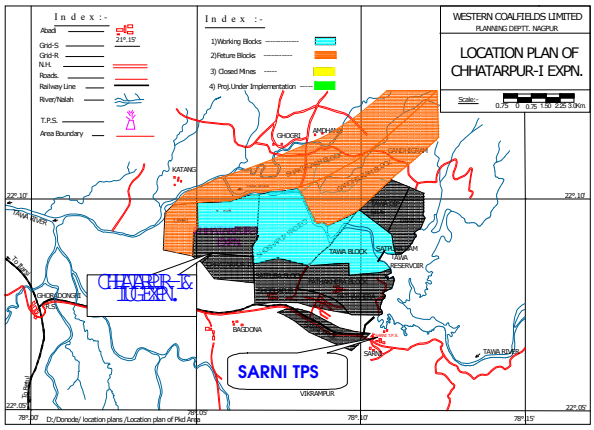
Extractable reserves (as on 01/04/07) :8.815 Million Tonnes.

Chattarpur – II UG

Name of the seam being worked :Lower & Upper Workable seam.

Seam thickness range (m) : 0.9 m to 5.6 m.

Extractable reserves (as on 01/04/07) :3.20 Million Tonnes.



5 METHOD OF MINING:-

Chattarpur - I UG

The entire coal winning operations are carried out below ground. The method of work is Bord & Pillar with coal winning by Blasting – off the solids and coal loading by Load Haul Dumpers (LHDs) at the face onto pony belt conveyors. Pony belt Conveyors load coal onto gate belt conveyor and finally coal is brought to surface through series of haulages. The depillaring is by proposed by Caving.

Chattarpur – II UG

The entire coal winning operations are carried out below ground. The method of work is Bord & Pillar with coal winning by Blasting – off the solids and coal loading by manual means at the face onto coal tubs. Coal Tubs load coal onto gate belt conveyor through tippler and finally coal is brought to surface through series of conveyors. The depillaring is done by Caving.

6. PRODUCTION PERFORMANCE OF THE MINE OF THE LAST SIX YEARS:-

Chattarpur – I UG

Year	Coal (Mt.)
2001-2002	0.112
2002-2003	0.096
2003-2004	0.123
2004-2005	0.116
2005-2006	0.143
2006-2007	0.181

Chattarpur – II UG

Year	Coal (Mt.)
2001-2002	0.191
2002-2003	0.160
2003-2004	0.173
2004-2005	0.180
2005-2006	0.217
2006-2007	0.213

7. **PRODUCTION TARGET: -**

The projected production target of the combined mine is 1.00 MTPA for the balance life of mine.

8. **DESPATCH: -**

The entire coal being produced by the mine is being dispatched to MPPGCL, TPS at Sarni by road, which is about 10 km from pithead.

9. LAND STATUS: -

Mining Right :

	Type of Land Use	Land Use before Mining (ha)	Land Use During Mining (ha)	Change in Land Use
1.	Govt & other Land	I – 550.17 II – 35.967 = 586.137	Under ground Mining+ infrastructures in Surface Right Area as shown below.	NO Except for surface right portion as shown below.
2.	Forest land	I – 91.03 II – 148.171 = 239.201	Under ground Mining+ infrastructures in Surface Right Area as shown below.	NO Except for surface right portion as shown below.
	Total	825.338		

Chattarpur – I UG – 641.200 ha
Chattarpur – II UG – 184.138 ha

Surface Right: (Already included in Mining Right Area shown above)

	Type of Land Use	Land Use before Mining (ha)	Land Use During Mining (ha)	Change in Land Use
1.	Govt & Other Land	I – 6.610 II – NIL = 6.610	For Mine Entry & Infrastructures	Constructed Infrastructures
2.	Forest land	I – 4.144 II - 6.134 =10.278	-- DO --	-- DO --
	Total	16.888		

Land under mining right and Surface right area has been notified under CBA Acts, 1957 and acquired under FC Act, 1980 as follows :-

Mine name	Land type (ha)		Total (ha)
	Govt. Land & Others	Forest	
Chattarpur – I UG	153.995	51.213	205.208
Chattarpur – II UG	32.707	118.455	151.162
Chattarpur – I UG & II Combined	186.702	169.668	356.370

Forest clearance for 169.668 ha has been obtained vide letter no F5/48/97/10/3 dated 03.01.2000.

Additional Land proposed for expansion of these two UG Mines has already been notified under mining right under CBA Act, 1957, and only permission under FC Act, 1980 is to be taken for this land to work below in UG mining system. –

Mine name	Land type (ha)	Total (ha)

	Govt. Land & Others	Forest	
Chattarpur – I UG	396.175	39.817	435.992
Chattarpur – II UG	3.260	29.716	32.976
Chattarpur – I UG & II Combined	399.435	69.533	468.968

As mentioned in earlier paragraph, 468.968 ha has already been notified under CBA Act, 1957 and only clearance under FC Act, 1980 for UG mining will have to be taken for 69.533 ha.

10.0 DESCRIPTION OF THE ENVIRONMENT

10.1 AMBIENT AIR QUALITY

A) Base line & Existing Scenario – Base line ambient air quality w.r.t. the mine under consideration has also been generated during the pre monsoon season at five locations during 2006 covering the core and Buffer zone. The ambient air quality data thus generated reveal that the quality of ambient air is well within the permissible limits.

The existing environmental air quality for CO, SO2, Nox, SPM and RPM (including fugitive emissions) are being monitored continuously as per Environmental Protection (Amendment) Rule, 2000 in the mine area every fortnight and analysis result of which show that the various quality parameters are well within the permissible limits.

Therefore, it can be safely concluded that even after substantial increase in the production (resulting in increase in traffic density), the impact on one of the physical environmental attribute; i.e. ambient air will be insignificant.

Further, it can be inferred that the various pollution control measures already undertaken have been proved to be effective, which has arrested the deterioration of the ambient air quality in the mine activity area even after substantial increase in the production level.

So it may be predicted that the ambient air quality will have no harmful effect on human being, flora and fauna, soil quality, surface structures and aesthetic value of the surrounding environment as suitable mitigatory measures will be taken during the enhanced production to make the operations eco-friendly.

The existing practice of fortnightly monitoring of ambient air quality will continue with the expansion project also and the results will be examined critically so as to identify the affected area and mine authorities will thereafter be able to take appropriate control measures to minimize the adverse effects, if any, as far as possible.

10.2 WATER QUALITY: -

A) Base line & Existing Scenario - In order to assess the **baseline water quality** w.r.t the mine under consideration, five sampling locations were fixed during 2006 covering surface as well as ground water sources in the buffer zone. The quality of water has been found to be well within the permissible limits.

The existing quality of mine pumped out water is being continuously monitored as per Environmental Protection (Amendment) Rule, 2000 every fortnight and the analysis results show that the quality is well within the permissible limits of Indian Standards.
With enhanced production from the mine, the quality of mine pumped out water is not going to change, as such the impact of enhanced production from the mine on water quality will be insignificant.

10.3 AMBIENT NOISE QUALITY:-

Base line & Existing Scenario - The baseline ambient noise quality w.r.t. the mine under consideration has also been generated during the pre – monsoon season during 2006 at five locations covering the core and Buffer zone. The ambient noise quality data thus generated reveal that the quality of ambient noise is well within the permissible limits.

Noise level studies are being made continuously every fortnight as per Environmental Protection (Amendment) Rule, 2000 and it is found that the results are well within the tolerable limits.

11.0 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

11.1 IMPACT ON AMBIENT AIR QUALITY –

The base line data generated at five locations covering the core zone and the buffer zone discussed in the previous paragraph also reveals that the levels of various parameters are well within the permissible limits. It can be inferred from the same that ambient air quality in and around the mine site under consideration has not been affected adversely due to continuing mining operations and it has been achieved by implementing various pollution control measures effectively. The same has been further corroborated by the existing ambient air quality data generated at the site as well as in the surrounding area. It may be worthwhile to mention here that during the balance life of the mine with a maximum projected production of 1.00 MTPA, the existing pollution abatement measures will continue to be taken with necessary augmentation/ strengthening so that the ambient air quality level remain well within the permissible limits.

11.1.1 AIR POLLUTION CONTROL MEASURES

The following mitigative measures have already been undertaken:

Mobile water sprinklers has been put into use.

Coal transportation by road to Sarni TPS (7Km) has been totally black-topped;

Avenue plantation along coal transportation roads.

Covering of coal transportation trucks by tarpaulin has been implemented and avoiding overloading of trucks;

Dry sweeping of coal transportation road is also done regularly.

Fortnightly monitoring of AAQ.

All these measures indicated above will continue to be maintained so that the adverse impacts on ambient air and noise become insignificant.

11.2 IMPACT ON WATER QUALITY –

The major source of water pollution in the underground mine is mine pumped out water. With enhanced production from the mine, the quality of mine pumped out water is not going to change, as such, the impact of enhanced production from the mine on water quality will be insignificant. Similarly, there is no increase in residential strength so, possibility of pollution due to domestic sewage during the balance life with enhanced production does not arise.

11.2.1 WATER POLLUTION CONTROL MEASURES

As seen from Analysis Data, the mine pumped out water does not contain significant pollution load and the discharge water quality even without treatment is quite satisfactory. However, if required in future, the abatement measures would be strengthened.

11.2.2 GROUND WATER REGIME

The details of ground water regime of the mine area including the surroundings are as given below: -

a) Groundwater Conditions:

Groundwater occurs in the area below water table in the intergranular pore spaces of semi-consolidated sandstone and their secondary porous structures. It exists under both confined and unconfined conditions. The unconfined aquifer extending down to a depth of about 25 m bgl occurs in detrital mantle / moturs / barakars and it is catering the domestic requirement of the area. This is followed by semiconfined / confined aquifer mostly in Barakars at greater depths.

The available data mostly pertains to the unconfined aquifer. Depth to water table ranges from 1.5 m to 4.0 m bgl in the post-monsoon season and it attains deepest level varying from 5.0 m to 12.0 m bgl in pre-monsoon months resulting a fluctuation of 4.0 m to 10.0 m between the two seasons. It was observed that the water levels are relatively deep and large zone of fluctuation of water table in the southern and western part of the study area while they become shallow and low order respectively towards north. Based on the topographic spot elevations and water levels tentative water table map was constructed to understand the ground water behavior.

Water table has a configuration similar to that of topography but with reduced relief. The water table elevation ranges from 396 m to 420 m above MSL in the plain area. It was observed that the groundwater flow direction is towards north and north-west with hydraulic gradients indicative of low hydraulic gradient are confined to the southern sector with hill ranges while flat gradients suggestive of better hydraulic conductivity are in the remaining area. Groundwater divide trending NW-SE is identified along the hill ranges and it is separating the Tawa and Phopas sub-basins. Normally the region of groundwater devide is of poor hydraulic conductivity zone. It was reported that the dugwells tapping the unconfined aquifer are not sustaining for long pumping suggesting poor potentiality.

Sufficient data is not available in respect of confined aquifer occurring in Barakars for worth interpretation. However, some hand pump bore wells drilled down to a depth of about 60 m in the area proved to be with better yield ranging from 0.5 LPS to 3 LPS for moderate draw down. It is inferred that the Barakars are with better groundwater potential in comparison to the Moturs which are highly mixed formations of mottled shale / clayey and sandstone.

The water is alkaline in nature with pH value more than 7 and they are of good quality with low TDS concentration. They are judged to be potable and suitable for domestic and agriculture use.

In the light of the above data, it is inferred that the southern sector of the study area is in the recharge zone which is with relatively deep water levels and large zone of fluctuation while the northern portion is in the discharge belt where the reverse phenomena is observed. This statement is corroborated by the presence of effluent Tawa River flowing in the immediate north of the block and the projected groundwater devide in the southern sector.

b) Effect of mining on ground water regime:

Precise influence zone could not be calculated due to non-availability of required deep aquifer parameters. The effect on groundwater regime due to under ground mining will be considerably low order and of temporary nature. The original regime will be redeveloped in due course after reclamation. Therefore, the influence area considered for socio-economic study (10 km radius) was presumed to be safe for groundwater impact assessment and the same is considered for groundwater resource evaluation too.

c) Status of Groundwater:

Groundwater availability has direct relation to the socio-economic development of the area. Therefore, groundwater balance estimation was attempted for this study area too.

Precipitation is the main source of groundwater recharge in the area. The area enjoys an average annual rainfall of about 1050 mm. The quantum of recharge depends on various factors like nature of soil cover, geology, topography, vegetation, intensity of rainfall etc. The total quantum of rainfall occurring over the proposed influence area of 314 sq. km. is about 330 million cubic meters (MCM) and the amount of recharge to groundwater may be about 15% of the total, which works out to 42.5 MCM. Normally, 75% of the gross recharge is available for safe groundwater extraction as per Groundwater Estimate Committee and it comes to 37 MCM.

Groundwater utilization/withdrawal is computed from the domestic consumption of human and cattle population since irrigation is practically negligible in the area. Presently mining activity is in progress in the close proximity of Chhatarpur block, the groundwater effluent of the mine is also considered as a part of groundwater draft. Groundwater pumped out of the existing mines in the proposed influence area worked out to 27.60 MCM. The domestic annual draft is estimated by considering human population of about 30,000 (1981 census + incremental rate) and cattle (including sheep & goat) population of about 15860 with a daily

requirement of 40 and 20 litres respectively and it is arrived at 0.60 MCM. The total groundwater draft of the area amounts to 28.20 MCM.

The excess groundwater available for future development is about 8.8 MCM, which has to be assessed from time to time during different stages of mining activity.

12.0 LAND DEGRADATION

The earth's crust is subject to two main natural forces – vertical and lateral compression. In most natural conditions, these forces may be considered to be in equilibrium unless disturbed by natural phenomena or man-induced disturbance of strata equilibrium.

Underground mining being a man-induced disturbance, creates a void which may cause the overlying overburden to subside or to move vertically and laterally into excavated space. Thus, the subsidence may be defined as the lowering of strata including surface due to underground excavations. These movements of overlying strata will continue until the bulking of the rock material has closed the
space or the compressive forces have been placed again into a state of equilibrium.

Factors affecting Subsidence:

When the underground coal mining is employed, the stresses in the overburden strata above and on the floor strata below the opening will re-adjust and be subject to strata movement and deformation. Generally, within a certain limit above the excavated opening the strata breaks, this is called caving zone. Above the caving zone and within a certain height, there are numerous fractures parallel or perpendicular to the bedding plane, which is the fractured zone. The strata between the fractured zone and the surface deform continuously and are called the continuously deformed zone. Every point on the surface moves towards center of the excavated opening and forms a surface subsidence basin. This process is called strata movement. If this process refers to the surface, then it is called surface movement. The characteristics and severity of the strata and surface movements are mainly dependent on the following factors:

Thickness of the seams.
Percentage of extraction.
Depth of panel.
Width of panel.
Dip of the seam.
Method of working.
Nature of Goaf Support, caving or stowing.
Nature of Overlying Strata.
Geological disturbances.
Surface topography, etc.

Within the movement basin, the displacement that causes lengthening in horizontal strain (tensile strain) can be managed by controlling some of the above factors, viz. Percentage of extraction, width of panel, method of working, nature of goaf support. Moreover, the interval between extraction of two seams play an important role in multi-seam working, the overlying strata will tend to consolidate with rains and become stable for lower seam workings (in case the extraction of panels in lower seam is delayed by 1 – 3 years with respect to extraction in upper seam). In order to assess the quantum of subsidence, different formulae are in prevalence for different areas of coalfields, specific on consideration of above factors. However, the most relevant data will be information about subsidence behavior from adjacent mines, if anywhere the composition of super – incumbent strata and other parameters of coal seams are identical.

In this mines under consideration, as mentioned earlier extraction is to be carried out by Caving as per prevalent practice in all other operating UG mines of Patahkhera area. As such subsidence behavior in these mines will be indicative for Chattarpur - I & II. Underground mining in Pathakhera area has been going on for the last four decades and from the records following can be concluded: -

Subsidence takes place to a maximum extent of 1.0 - 3.0 m and it is uniform and gradual.
It stabilizes and reaches a stage of equilibrium after about three years.
Cracks occur on surface
Vegetation/Plantation in general is undisturbed and continues to grow as before.

13.0 LAND RECLAMATION

Since underground mining method has been adopted, it is anticipated that no serious damage to the landscape and land use pattern will occur in this region except for minor changes in the surface profile in some portion of the land. It is proposed to leave solid barriers between the caved panels. According to the recent subsidence management practices the barrier width should be 12 times the extraction thickness or 0.15 times the depth, whichever is more.

The detailed control measures to be adopted for controlling the subsidence as far as possible is being discussed here. The following measures and precautions shall be taken:-
Around the depillaring area, co-related on the surface, protective bunds and garland drains shall be laid so that no water from surface enters the subsidence area and through the cracks to the working area.
The surface cracks shall be sealed up by using shale, clay or other suitable material.Depressed portions shall be leveled up using soil or clay or other suitable material.

There are statutes to guide the development of seams below permanent structures, water bodies etc. so that the stability of the same is not endangered and also the safety of workings and workers below ground is ensured. In the project report the development of the seam has been planned in accordance with the statute.
It is also a statutory requirement to monitor subsidence regularly. For this purpose, grid pillars shall be located 30 m apart at the surface over the working panels and at intervals of 50 m beyond. Level sections shall be taken every month and plotted. These will provide information regarding progress of subsidence till stability or equilibrium conditions are reached.

The above mitigative measures, stipulations and their enforcement will result in effective monitoring of subsidence. Above all, depillaring is carried out only after taking due permission from DGMS and continued in accordance with the stipulations specified in the permission.

Plantation has been carried out in area acquired under surface right covering1.30 ha in Chattarpur – I UG & 0.30 ha in Chattarpur – II UG.

14.0 . **EXISTING MANPOWER: -**

The existing manpower of Chattarpur – I UG is 452 & that of Chattarpur – II UG is 919 nos. (As on 01/04/2007).

15.0. SAFETY MEASURES

a) General

The mine is being operated in accordance with the provisions of Statute. The various issues regarding possible risks and corresponding safety measures are detailed out below.

b) Gassiness

- Both the existing mines have been categorized as Degree-II gassy mine and the proposed expansion mine is also expected to be of 'Degree-II' gassiness.

- Regular gas survey is carried out as per statute.

- Adequate provision for self-rescuers has been made to enable everybody to carry it underground.

- Stone dust barriers are provided as per statute.

Methanometer & other appliances related with mine environment for regular monitoring of methane in the mine has been provided for.

- All possible precautions are taken while working near dyke-affected zone so that accumulation of inflammable gas does not take place in the working faces.

c) Inundation

- The HFL of Tawa river near the proposed mine area is not available in any official record. However, verbal enquiries from villagers of Chhatarpur and Keria Umri village have revealed that there has never been any instance of the villages getting inundated.

- It is well known fact that the prospecting boreholes can be a source of danger, because later-on these get connected with u/g workings. Therefore, it is of paramount importance that these boreholes do not get connected with U/G galleries. In case some boreholes do get connected, these are suitably plugged preferably with cement grout. The boreholes from the surface are also suitably plugged, so that water from the surface does not find its way through these boreholes.

- A careful assessment of the danger of inundation from surface water is made before the onset of every rainy season & adequate precautions against such danger are clearly laid down & implemented.

- During rainy season, blockage of river, Jore, nallah or stream may occasionally occur on the upstream. Therefore, a constant watch is kept on the upstream of river/nallah & suitable precautions are taken accordingly.

d) Dust Suppression

Underground -

- The most effective method of dust suppression is to suppress the dust at the source of generation, before the dust becomes airborne. Arrangement for dust suppression in the form of water spraying has been provided at all working faces and transfer points in conveyor systems.

- For monitoring the level of dustiness and quality of dust, regular sampling and analysis of mine dust is done as per statute.

Surface –

Similarly on surface, as already indicated, except for coal transportation there is no other source of dust and the same is effective controlled by

Coal transportation through covered trucks,
Avoiding Over – Loading of Trucks,
Black topping of coal transportation road,
Water spraying at vulnerable points/areas.

e) Spontaneous Heating

There is no history of fire or spontaneous heating in the existing mines or in any adjoining underground mine.
- The extraction of pillars to commence from the proposed limit of the mine or from the natural barriers created by faults.

- Preparatory stoppings will be kept ready at the out bye end of the sub-panel so that in case of outbreak of any U/G fire, the sub-panel can be abandoned & sealed off by constructing fire stoppings in the minimum possible time.

- Before commencement of depillaring operation, all the inflammable material will be cleaned and removed from the face.

- Isolation stoppings will be made quickly & effectively seal off every panel after completion of extraction & salvaging of material from all the sub-panels.

- Since caving method of mining has been proposed, cracks may appear on the surface. Therefore, efforts will be made to seal-off the cracks, so that air & water does not enter in the goaf through these cracks.

f) Subsidence

Caving is proposed as method of extraction in this mine. The depth of the mine varies from minimum 40m to maximum about 270m. The surface topography is mostly flat and some portion is covered with revenue forest.

The depillaring operations will be carried out strictly in accordance with the permission of DGMS and all the conditions will be implemented during actual operations. The monitoring of subsidence parameters will also be carried out and records will be maintained as per the directives of DGMS.

In the forest area, the minimum permissible strain value is 10 mm/m and if tensile strain is more than this value, NPV (Net Present Value) of the affected forestland is required to be paid to the State Forest Department. However, the payment of NPV will be as per the actual forestland affected by the subsidence with tensile strain more than 10 mm/m.
Depillaring operations due to caving may lead to subsidence cracks appearing on the surface during caving where depth of cover is less. It is proposed to fill these cracks by properly ramming with soil or other incombustible material. Additionally, constant monitoring of such area, especially during monsoon will be done to avoid entry of water through these cracks. Drainage channels will also be made so as to guide the water away from such subsided area.

16.0 CONCLUSION:-

In view of the above, Public Consultation for Chattarpur – I & II UG Expansion Project, Tahsil – Ghoradongri, Dist. – Beitul of Madhya Pradesh State for enhancement of production capacity from 0.41 MTPA to 1.00 MTPA with Enhancement in land area from 356.370 ha to 825.338 ha may be conducted as per EIA Notification 2006 based on the TOR issued by MOEF vide its letter dated 26.08.2008.