CHAPTER – IV

EXISTING ENVIRONMENTAL SCENARIO

4.0 EXISTING ENVIRONMENTAL SCENARIO

4.1 Socio -Economic Profile

The Socio economic profile within 10 km. radius of the project is based on 1991 census report. Land use pattern, economic profile and civic amenities details are based on 1991 census data.

4.1.1 Social Profile

The details of village-wise demographic profile is given as in *Annexure-I* and represented in *Figure-1*. Summarised details are as follows:

Development Block/ Parameters	**Pondi Development Block**	**Total Study Area**
Population	32036 (100)	32036 (100)
Male (% of total population)	16332 (50.98)	16332 (50.98)
Female (% of total population)	15704 (49.02)	15704 (49.02)
Scheduled Caste (% of total population)	829 (2.59)	829 (2.59)
Scheduled Tribes (% of total population)	27546 (85.98)	27546 (85.98)
Others (% of total population)	3661 (11.43)	3661 (11.43)
Literates (% of total population)	5796 (18.09)	5796 (18.09)
Illiterates (% of total population)	26240 (81.91)	26240 (81.91)

Note: Figures in parenthesis are in percentage.

Out of 32036 persons, 50.98 % are male and 49.02 % are female. The Scheduled castes account for 2.59 % of total population and the scheduled tribes for 85.98 %. About 18.09 % population is literate. Cross sectional analysis reveals that schedule tribes population is higher than schedule castes. Illiteracy is very high, i.e., 81.91 % of the total population.

4.1.2 **Economic profile**

The details of village-wise economic status of population is given in *Annexure-II* and represented in *Figure-2*. Summarised details are as follows:

Development Block /Parameters	Pondi Development Block	Total Study Area
Population	32036(100)	32036(100)
Main workers (% of total population)	13847(43.22)	13847(43.22)
Male (% of main worker)	9935(71.75)	9935(71.75)
Female(% of of main worker)	3912(28.25)	3912(28.25)
Marginal workers (% of total population)	1772(5.53)	1722(5.53)
Non-workers(% of total population)	16417(51.25)	16417(51.25)

Note: Figures in parenthesis are in percentage.
The data reveals that 43.22 % of the population are main workers and 5.53 % are marginal workers, the rest 51.25 % are non-workers.
Analysis of data also indicates that the marginal workers are maximum and to the extent of 5.53 % of the total population. Main workers and Non-workers ratio is 1:1.19. This indicates poor economic status of the population.

4.1.3 **Work force pattern**

The details of village-wise workforce pattern are given as in *Annexure-III* and block-wise workforce pattern is summarised as follows:

Development Block/Parameters	Pondi Development Block	Total Study Area
Main workers	13847 (100)	13847 (100)
Cultivators (% of main worker)	10289 (74.30)	10289 (74.30)
Agricultural labourers (% of main worker)	2613 (18.87)	2613 (18.87)
Quarry & Mining Workers (% of main worker)	30 (0.22)	30 (0.22)
Others (% of main worker)	915 (6.61)	915 (6.61)

Note: Figures in parenthesis are in percentage.

The data reveals that in the study area, 74.30 % of main workers are cultivators supported by 18.87 % agricultural labourers, 0.22 % workers are engaged in mining & quarrying and 76.24% in household industries and other allied activities like live stock, forestry, transportation & storage, communication, trade and commerce, manufacturing processing services and repairs etc. The workforce pattern has shown as in *Figure-3*.

4.1.4 **Basic & civic amenities**

The village-wise amenities are detailed in *Annexure-IV*. However, basic and civic amenities available in the area of study are summarised as follows:

SL No.	Amenities	Pondi	Total
1	Educational Facilities		
	a. Primary School	46	46
	b. Middle School	4	4
	c. Secondary School	1	1
	d. Others	0	0
2	Medical Facilities (No.)		
	a. Dispensary	0	0
	b. Primary Health Centre	1	1
	c. Hospital	0	0
	d. Veterinary Hospital	0	0
3	Power Supply		
	a.Electricity for domestic purpose.	7	7
	b. Electricity for agriculture	0	0
4	Drinking Water (No. of villages)		
	a. Well	47	47
	b. Tube well/Hand pump	46	46
	c. Tap	0	0
	d. Tank	0	0
	e. River/Canal	2	2
	f. Nalla	2	2
5	Communication (No. of villages)		
	a. Pucca Road	14	14
	b. Kachha Road	36	36
	c. Bus stop	5	5
6	Post & Telegraphs (No.)		
	a. Post Office	2	2
	b. Telegraph Office	0	0
7	Recreational &cultural facilities(No)		
	a. Stadium	0	0
	b. Cinema	0	0
	c. Auditorium Hall	0	0
	d. Closed circuit TV	0	0

4.1.5 LAND USE PATTERN

a) Land use pattern in core zone:

The mining right of Vijay West underground project is 475.268 Ha. Within mining right, the surface right would be 9.00 Ha, and outside mining area, the land for the colony, that is contemplated about 17 km from the project, would be 13.10 Ha; however the site thereof is not identified yet. Land Use Plan is shown as *Plate -IV* and represented in *Figure 4a.*

Under CBA

Sl. No.	**Particulars**	**Land under CBA in Ha.**	**Remarks**
1	Mining Right	475.268	
2	Surface Right	9.000	Situated within the Mining Right
	SUB-TOTAL	**475.268**	
3	Land for Colony	13.10	Site not identified yet; however, the colony is 17 km from the project.
4	Land Use		
Forest-CJJ* & BJJ* (Ha)	**Tenancy (Ha)**	**Government (Ha)**	**Total (Ha)**
360.660	76.405+38.203	-	**475.268**
360.660	114.608.	-	**475.268**

* CJJ-Chhote Jhar ka Jungle, BJJ- Bade Jhar ka Jungle.

Crop compensation is to be paid for the tenancy land within mining area that would be affected by subsidence due to depillaring operation over panels and tenancy has not been proposed for purchase.

For construction of residential buildings, park & playground, etc. tenancy land would be required outside mining area.

b) BUFFER ZONE**:**

The buffer zone includes the aforesaid core zone and area situated within 10 kms radius from the centre of the core zone.

The detailed land use map is prepared based on the topo-sheets and then supplemented by information collected from the Forest department, Revenue department and Mouza maps of the neighbouring villages. Details are shown in *Plate-II.*

The census data of 1991 has been collected and utilised for knowing the land use pattern in the buffer zone. Village-wise land use pattern is given in *Annexure- V* and represented in *Figure 4b*. The summarised details are as follows:-

Sl.No.	Land use	Area (in Ha.)	% of total area
1.00	Forest land	19647.09	55.28
2.00	Irrigated agricultural land	0.00	0.00
3.00	Un-irrigated agricultural land	9309.32	26.19
4.00	Culturable Waste land	1984.63	5.58
5.00	Area not available for cultivation	4601.55	19.25
6.00	**TOTAL AREA**	**35542.59**	**100.00**

The data reveals that, out of total study area of 35542.59 Ha, around 55.28 % of the entire area is forest land, 26.19 % is un-irrigated agricultural land, 5.58 % is culture-able waste land and 19.25 % is not available for cultivation.

4.1.6 SAMPLE SURVEY-SOCIOECONOMIC

4.1.6.1 **Household sample survey**

The sample households have been selected by multistage sampling method. There are total of 35 villages within the 10 km radius and out of that 11 villages were selected for the household survey. Only two villages (Kendai & Sukbahar, a Muhalla of Bijadand) are found in the core zone and other 10 villages are selected in the buffer zone. Wherever possible, the data pertaining to both the villages have also been used for interpretation.

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

4.1.6.2 **Methodology**

For the household sample survey, eleven villages were selected randomly. Adopting proportionate sampling method 8.33% of the households in each village has been interviewed. Out of 11 villages selected for the sample study, one village is in the core zone and 10 are in buffer zone. Care has been taken to select the sample villages to give a spatial representation. While deciding the number of sample households a minimum of 5 houses were interviewed, if 8.33 percent is lower than 5 households. If number of households is more than 31, (on the basis of 8.33 percent) only 31 households are interviewed. This is to follow scientific statistical reasoning. On the basis of household sample survey, inferences are made about occupation, health aspects, religion, community, income, expenditure, family size and environmental problems of

the study area. The household sample survey villages are given as in (Annexure-IV-A).

4.1.6.3 Present status and validation of households in Core Zone

Only one village is found in core zone of proposed project area. A total of 50 households are found in this village and out of that 21 households are interviewed. The status of households (8.33% of total, proportionate sampling method following scientific statistical reasoning) are presented below.

A. **Family size**

In core zone village, about 45% of families each are having family size of 5 & 6 members, about 20% of 4 member family. The average family size is around 5 to 6 members in each family.

B. **Age and Sex composition**

Based on household sample survey in core zone village, about 30% each people are found in the age group of 16-25 & 51 to 80 each. The age group of > 80 years is found to be about 10% each.

The male and female population is almost in equal ratio.

C. **Religion and Community**

Based on household sample survey, mostly Hindus were found (about 95%) in the core zone.

BC & ST are found to be about 55% each. The SCs are found to be 10% in core zone village.

D. **Literacy**

Based on household survey in core zone village, the male literacy was found to be much more (about 45%) than female literacy (about 25%). About 50% are found to be illiterate.

E. **Education**

Based on household sample survey, the education level is mainly primary level and higher secondary in core zone village. About 35% are primary level and 15% are found to be up to higher secondary level.

F. **Occupational structure**

Based on household survey, mostly workers are found in core zone villages (about 60%) and cultivation is the main occupation of about 40 to 45%.

G. **Housing Pattern**

Based on household sample survey, the houses are mostly tiles roofed with earth floor and mud walls.

H. **Income level**

In the core zone village, mostly the income level was found to be less than Rs 1000 per month, as many of the people are labours.

I. **Land use pattern and Agriculture yield**

Based on household sample survey, land use in core zone village is mainly Barren land and agricultural land. The crops are mainly rice and maize. The source of irrigation is mainly rainwater and well water. The agriculture yield is found to be fair.

J. **Infrastructural facilities**

(i) **Drinking Water**

Based on household sample survey, the drinking water source in core zone village is mainly open well and hand pumps.

(ii) **Educational Institutions**

In the core zone village, primary school is available for education.

(iii) **Health care facilities**

Based on household sample survey, primary dispensary is not available at village. Sarma (2 km) is the nearby place for health check-up for this village.

(iv) **Power supply**

The power supply facility is available at this village.

(v) **Transportation**

Bus facilities are available to core zone.

(vi) **Communication**

The core zone village is not having post and telegraph facilities and the post office is available nearby place at Korbi of about 2 km distance.

4.1.6.4 **Household sample survey report in total study area**

(i) **Family size**

The family size analysis reveals that medium size families are more common than large or small size families. About 40% of the families are having family size of 6 members. About 30% each of the families are in the range of 5 & 7

members and about 5% families are having 4 & 8 members. Therefore, average family size is around 4 to 7 members.

(ii) **Age and Sex composition**

All the sample survey villages show that there is a large working population. But at the same time all sample household have to support large dependent population (16-25 members). People in the age group of 26-50 and old aged (more than 80 years) categories are considerably less. Male-Female ratio is fairly balanced almost in all villages.

(iii) **Religion and Community**

Hindus are the main religious group in the study area. Among 905 of total household belongs to Hindu families and others are Muslims. Among the communities STs are larger than any other communities. STs are found to be around 60% and above in most of the villages. BC are found to be 30% and SC population is about 15%.

(iv) **Literacy**

About 35% of the population is found to be literate. Only pockets of lower literacy areas, with less than 20% of the population are found in the region. From the household survey results, it reveals that male literacy is about 55% and female literacy is about 25%. The literacy is fairly wide spread and very few villages register lower number of literates.

(v) **Education**

The impact of education is that a sizeable population is promoted to primary level of education. Higher secondary education is for selective people but equally wide spread. The household sample survey results reveals that 35% of the people have undergone primary education and 10% of the people had undergone higher secondary education. 55-70% of the total household survey people were illiterate.

4.2 METEOROLOGICAL TRENDS:

Meteorological data for the last decade have been collected from the nearest Pendra Meteorological Observatory, which is situated approximately 70 km. from the Vijay West project. Refer to ***Annexure VI.***

Data with respect to monthly maximum mean temperature, monthly minimum mean temperature, rainfall and no. of rainy days are given as in ***Annexure VI*** .

Meteorological data for 5 years (1991-95) have been collected from the nearest Pendra Meteorological Observatory, which is situated approximately 50 km. from the project.

4.2.1 Rainfall

The highest rainfall recorded in a month during the last decade was 538.1 mm in June, 1994. The annual average total rainfall of the region was about 1430 mm. Maximum rainfall recorded during the year 1994 was 1931 mm.

Generally, the rainy months are July, August and September, which spreads over to June and October with some rainfall.

4.2.2 Temperature

During the summer season, the temperature often rises to 43.90^0C. Occasional dust storms and afternoon thunder showers bring considerable relief from heat, and the maximum temperature drops appreciably with the onset of monsoon.

January is the coldest month with the maximum and minimum temperatures at about 25.10 ^{0}C and 4.90 ^{0}C respectively. The area also receives cold waves for a few days in the winter when minimum temperatures fall to 4.9 ^{o}C to 5.40 ^{o}C.

4.2.3 Wind pattern

Generally maximum calm days recorded during October to December with the highest wind speed in May and June.

4.2.4 Humidity

The relative humidity varies as from 42 to 90 % in monsoon and 19 to 61 % in summer. The details have been given as in the *Annexure VI.*

4.3 Micro-meteorology Data

4.3.1 Location & Rationale of sampling

Micrometeorological and microclimatic parameters are recorded by installing a meteorology station at the building terrace in the Kendai village (core zone) as it represents the prevailing micrometeorological aspects of the study area. During the study period, hourly reading of wind velocity, wind direction, temperature, humidity, cloud cover, atmospheric pressure and rainfall data are recorded and reported.

The location of the Micro-meteorological stations for Air, Water, Noise and Soil is shown in *Fig.-5.*

4.3.2 Methodology of Sampling

Wind direction was observed using wind vanes and velocity by using Anemometer at hourly intervals and data was plotted as wind roses as shown in *Figure-6*. The maximum and minimum relative humidity for each sampling day was also recorded along with temperature by using wet and dry bulb thermometer. The micro-meteorological data of the project area is given as in *Annexure-VII*.

4.3.3 Observations

During Winter Season

The maximum observed temperature in the area was 31.0^{o}C and the minimum was 7.0^{o}C. The maximum relative humidity was 94% and the minimum was 31%. The velocity of wind recorded between less than 1 km/hr to 9.2 km/hr. The direction of wind in majority of observation time was from NW to SE.

4.3.4 Meteorological Trends

Meteorological data for the twelve years duration recorded at nearest IMD station, Umaria, have been studied with respect to minimum and maximum temperature and for monthly and annual rainfall and number of rainy days. Details are given as in Annexure-VI.

a) Temperature Trends

It is observed that the lowest minimum temperature recorded was 0.80^{o}C in January (1993). The highest maximum temperature recorded was 46.9^{o}C in May (1998).

b) Rainfall Trends

The maximum and minimum average rainfall as observed in the twelve years duration (1989-2000) were 373.5 mm in the month of August and 10.39 mm in the month of April respectively.

4.4 Environmental Quality

The pre-mining environmental quality with respect to ambient air, water, noise level and soil has been studied through an external agency M/s. Richardson & Cruddas (1972) Ltd., Chennai, Govt. of India Undertaking.

4.4.1 Ambient Air Quality

a)Location & Rationale of Sampling

The monitoring stations are identified on the basis of meteorology in the upwind and downwind direction as well as to represent the cross sectional scenario of the project site.

The monitoring network is designed based on the available meteorological and climatological norms of predominant wind direction and wind speed of the study region.

Following sampling sites as shown in *Figure-5* were selected for ambient air monitoring:

Kendai village (VA_1): This location is situated in the proposed mining area. It is selected to assess the immediate effects in the active mining area and the present data will help to know the increase in pollution levels due to mining operation activities.

Putipakhana village (VA_2): This location is situated at 3.5 km distance from site towards South West direction and it is selected for air quality monitoring to assess the effect of pollutants in the populated area.

Bardapakhana village (VA_3): This location is situated at a distance of 3.5 km towards Nothwest direction from proposed mine area. It is selected for baseline study to assess the effect of pollutants in the populated area.

Baskatiya village (VA_4): This location is situated at a distance of 4.5 km towards North direction from proposed mine area. It is selected to assess the effect of pollutants in the populated area.

Chhaparpara village (VA_5): This location is situated at 5.0 km distance from site towards East direction and it is selected to assess the effect of pollutants. The present assessment data will help to know the extent of pollution, if any, due to mining operations in the nearby area and due to loading operation.

b) <u>Methodology of Sampling & Analysis</u>

To assess the ambient air quality status, monitoring stations are 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 (SO2), Oxide of Nitrogen (Nox) and Carbon Monoxide (CO).

Calibrated Respirable Dust Sampler (with an average flow of 1.2 - 1.4 cu. m. per minute) is used for monitoring of SPM, RPM and a tapping provided in the hopper of the same sampler is utilised for sampling of SO2 and Nox with proper flow controller (1 L /min).

c) <u>RPM & SPM</u>

Calibrated Respirable Dust Sampler with Whatman GF/A microfibre filter paper is used for the determination of RPM. RPM is a measure of particulate matter having size < 10 micron.

The dust particles having size > 10 micron is being collected in the cyclone and measured. This along with RPM value gives total SPM.

d) Sulphur Dioxide

Sulphur dioxide is collected in a scrubbing solution of sodium tetrachloro-mercurate and is allowed to react with HCHO and then with para-rosaniline hydrochloride. The absorbance of the product red-violet dye is measured using digital spectrophotometer at a wavelength of 560 nm.

e) Oxides of Nitrogen

Nitrogen oxides as nitrogen dioxide are collected by bubbling air through sodium hydroxide solution to form a stable solution of sodium nitrite. The nitrite ion produced during sampling is determined using digital spectrophotometer at a wavelength of 540 nm by reacting the exposed absorbing reagent with phosphoric acid, sulphanilamide and N (1-naphthyl) ethylamine di-hydrochloride.

f) Carbon monoxide

An imported digital CO detector is used for monitoring of CO.

4.4.2 Ambient Air Quality Standards

The National Ambient Air Quality Standards (NAAQS) for residential area are given below:

AMBIENT AIR QUALITY STANDARDS

concentration in µg/cum

Area	Category	SPM	RPM	SO_2	NOx
A	Mining area	500	250	120	120
B	Residential & Rural	200	100	80	80

4.4.3 Observations

Kendai Village (VA_1): At this location, SPM & RPM values are ranging from 66-86 mg/m^3 and 16-22 mg/m^3 respectively. SO_2 values are in the range of 9-15 mg/m^3 and NOx values are in the range of 11-17 mg/m^3. All CO values are found to be below the detectable limit of 114.5 microgram per cu. m. Observations are tabulated as in *Annexure-VIII* and the observations are summarised as follows:

Putipakhana Village (VA_2): At this location, SPM & RPM values are ranging from 69 to 90 mg/m^3 and 17 to 23 mg/m^3 respectively. SO_2 values are ranging from 7-13 mg/m^3 and NOx values are found to be in the range of 9-15

mg / m^3. All CO values are found to be below the detectable limit of 114.5 microgram per cu. m.

Bardapakhna Village (VA_3): At this location, SPM & RPM values are ranging from 65-85 mg/m^3 and 15 to 22 mg/m^3 respectively. SO_2 values are ranging between 7-14 mg/m^3 and NOx values are in the range of 11-17 mg/m^3. All CO values are found to be below the detectable limit of 114.5 microgram per cu. m.

Baskatiya Village (VA_4): At this location, SPM & RPM values are ranging from 66 to 85 mg/m^3 and 16 to 21mg/m^3 respectively. SO_2 values are ranging between 8-14 mg/m^3 and NOx values are ranging between 10-17 mg / m^3. All CO values are found to be below the detectable limit of 114.5 microgram per cu. m.

Chhaparpara Village (VA_5): At this location, SPM & RPM values are ranging from 66 to 87 mg/m^3 and 16 to 21 mg/m^3 respectively. SO_2 values are ranging between 7-13 mg/m^3 and NOx values are found to be in the range of 9-17 mg/m^3. All CO values are found to be below the detectable limit of 114.5 microgram per cu. m.

At all the above mentioned locations ambient air quality was found satisfactory with parameters within the CPCB limits prescribed for SPM, SO_2, NO_x.

4.5 Water Quality

Locations & Rationale of Sampling

Water samples were collected from different locations in and around the area representing ground and surface water sources. Locations of water samples are shown in *Figure-5.*

Well water, Kendai Village (VW_1): In order to assess the ground water quality near the proposed mine area, this location is selected for baseline study.

Bore well, Kendai village (VW_2): In order to assess the ground water quality near the proposed mine area, this location is selected for baseline study.

Bamni River U/S (VW_3): In order to assess the surface water quality near the proposed mine area, this location is selected for baseline study.

Bamni River D/S (VW_4): In order to assess the surface water quality near the proposed mine area, this location is selected for baseline study.

Katal Nalla (VW_5): In order to assess the surface water quality near the proposed mine area, this location is selected for baseline study.

Water is a vital commodity for the survival of vegetation, animals and human beings, and it is also essential for proper balance of the eco-system itself. As such, any adverse impact on water quality of surrounding surface and ground water sources due to mining activity will have serious consequences on the environment. Hence it is imperative to study the base line water quality of the regimes likely to be influenced by the proposed mining and allied activities.

4.5.1 Methodology of Sampling & Analysis

In order to assess the water quality, the entire year was divided into four seasons, viz; Pre-monsoon, Monsoon, Post-monsoon and Winter. Samples were collected from different locations in one season during winter (Dec 02-Jan 03) and analysed.

From the surface water sources, after removal of floating/extraneous materials, 3 litres of representative water samples were collected in plastic cans as per IS:2296 and transported to laboratory for physico-chemical analysis. At the time of collection, parameters like pH, temperature and Dissolved Oxygen were measured in the field. For determination of BOD and bacteriological analysis, 250 ml. pre-sterlised bottles were used and care was taken to maintain cool temperature by keeping the bottles in ice boxes during transportation to the laboratory for analysis. Physico-chemical and bacteriological parameters for drinking/ground water were compared with IS: 10500.

4.5.2 Indian Standards for Water

Water samples analysed for various parameters were compared with different Indian Standards. Results of surface water samples were compared with IS 2296 and MOEF standards. Ground water samples were compared with IS: 10500 (tolerance limits specified for drinking water).

4.5.3 Observations

Observations are tabulated as in *Annexure-IX* and the observations are summarised as follows:

Well water, Kendai village (VW_1): pH is found to be 7.21. Chloride and Sulphate values are 46 mg/l and 3 mg/l respectively. Oil and grease, phenolic compounds, cynides, sulphides and insecticides are found to be absent and all heavy metal values are found to be below detectable limit. While comparing with IS:10500, all values are found to be well within limit.

Bore well, Kendai village (VW_2): pH is found to be 6.81. Chloride and Sulphate values are 50 mg/l and 5 mg/l respectively. Oil and grease, phenolic compounds, cynides, sulphides and insecticides are found to be absent and all heavy metal values are found to be below detectable limit. . While comparing with IS:10500, all values are found to be well within limit.

Bamni River U/S (VW_3): pH is found to be 7.08. Chloride and Sulphate values are 20 mg/l and 8 mg/l respectively. Oil and grease, phenolic compounds, cynides, sulphides and insecticides are found to be absent and all heavy metals (except Iron) values are found to be below detectable limit. Iron value is found to be 0.26 mg/l. BOD and COD values are found to be 2 mg/l and 26 mg/l respectively While comparing with IS:2296, all values are found to be well within limit.

Bamni River D/S (VW_4): pH is found to be 7.12. Chloride and Sulphate values are 30 mg/l and 6 mg/l respectively. Oil and grease, phenolic compounds, cynides, sulphides and insecticides are found to be absent and all heavy metals (except Iron) values are found to be below detectable limit. Iron value is found to be 0.26 mg/l. BOD and COD values are found to be 4 mg/l and 40 mg/l respectively While comparing with IS:2296, all values are found to be well within limit.

Katal Nalla (VW_5): pH is found to be 7.23. Chloride and Sulphate values are 26 mg/l and 12 mg/l respectively. Oil and grease, phenolic compounds, cynides, sulphides and insecticides are found to be absent and all heavy metals (except Iron) values are found to be below detectable limit. Iron value is found to be 0.31 mg/l. BOD and COD values are found to be 2 mg/l and 30 mg/l respectively While comparing with IS:2296, all values are found to be well within limit.

4.6 Noise levels

4.6.1 Locations & Rationale of Sampling

Noise levels were recorded at five different locations. Locations are shown in *Figure-5.*

VN_1: Kendai Village
VN_2: Putipakhana Village.
VN3: Bardapakhna Village
VN_4: Baskatiya Village
VN_5: Chaparpara Village

Noise level variation in a mining area vary depending on different activitie such as, extraction of coal, movements of machinery, equipment and vehicles, as well as due to activities in the workshop, transportation etc. Under this project, the major activities are under ground activities. There would be very less noise generating activities at the surface.

4.6.2 Methodology of Sampling And Analysis

Noise levels were measured by Noise Level Meter continuously for 24 hrs. at hourly intervals, in decibels under 'A' weighted average. Values were reported as equivalent day, night and day-night noise levels.

4.6.3 Noise Level Standards

Acceptable Ambient Noise levels as per Environment Protection Act GSR 1063(E) Schedule III are as follows:

SL. NO.	CATEGORY OF AREA	LIMITS IN dB(A)	
		Day time (6.00 am to 9.00 pm)	Night time (9.00 pm to 6.00 am)
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45
4	Silence Zone	50	40

4.6.4 Observations

Data of all the one season (winter season) is given as in *Annexure-X* and the observations are summarised as follows:

Kendai Village (VN_1): The Leq noise levels recorded are ranging from 38.1 to 46.1 dB(A). The peak noise levels are ranging between 39.7 and 48.7 dB(A).

Putipakhana Village (VN_2): The Leq noise levels recorded are ranging from 36.9 to 44.9 dB(A). The peak noise levels are ranging between 38.8 - 47.9 dB(A).

Bardapakhna Village (VN_3): The Leq noise levels recorded are ranging from 36.0 to 44.6 dB(A). The peak noise levels are ranging between 37.1 - 46.1 dB(A).

Baskatiya Village (VN_4): The Leq noise levels recorded are ranging from 37.1 to 44.9 dB(A). The peak noise levels are ranging between 38.7 - 47.6 dB(A).

Chhaparpara Village (VN_5): The Leq noise levels recorded are ranging from 38.1 to 44.3 dB(A) . The peak noise levels are ranging between 39.8 and 46.8 dB(A).

4.7 SOIL QUALITY

4.7.1 Rationale of 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 near project via Forest Land, Core Zone (VS_1); Barren land, Core Zone (VS_2) and Agriculture Land, Kendai village (VS_3) for soil testing. Locations are selected in such a way that different type of soils for supporting different species of vegetation is covered.

4.7.2 Methodology of Sampling

Soil samples were collected at 100 cms of depth in disturbed and undisturbed conditions. Approximate 2 kg of sample was collected from each location and carried out in polythene bags. Infiltration tests were conducted in the site itself and for other parameters, analysis was carried out in laboratory as per standard procedures.

4.7.3 Locations & Rationale of Sampling

Locations of sampling:

Soil samples were collected from three different locations. Locations are shown in *Figure-5,* observations are tabulated as in *Annexure-XI* and the observations are summarised as follows:

Forest Land, Core Zone (VS_1): At this location, pH is found to be within the range of 7.12 - 7.23. Nitrogen, Phosphorous and Potassium contents are found to be in range of 230-243 kg/ha, 18.3 - 19.2 kg/ha and 92-95 kg/ha respectively. Organic compound is found to be in the range of 1.0 -1.20 %. Textural class is found to be Clay Loam. The soil quality at this location would support vegetation.

Barren Land, Core Zone (VS_2): At this location, pH is found to be within the range of 6.83-6.90. Nitrogen, Phosphorous and Potassium contents are found to be in range of 110-125 kg/ha, 9.6-9.9 kg/ha and 82-86 kg/ha respectively. Organic compound is found to be in the range of 0.6 to 0.9 %. Textural class is found to be Clay Loam. The soil quality at this location would support vegetation after suitable reclamation.

Agriculture Land, Core Zone (VS_3): At this location, pH is found to be within the range of 7.10-7.21. Nitrogen, Phosphorous and Potassium contents are found to be in range of 230 - 240 kg/ha, 40.1-41.3 kg/ha and 138 - 141 kg/ha respectively. Organic compound is found to be in the range of 1.3-1.32 %. Textural class is found to be Clay Loam. The soil quality at this location would support vegetation.

4.8 FOREST, FLORA & FAUNA

360.660 Ha of the forest land is involved within the mining area, and it is a part of Asara Reserved Forest in Pasan range of North Bilaspur Forest

Division. Forest Area within the mine take area includes parts of compartment Nos. 191,192,193,194,195 & 198. The area contains mainly Sal forest of M.P Quality III & IV (a & b) a few mixed forests of M.P. quality IV (a). 80 % of the area is covered by vegetation. Sal, Dhaora, Mahua, Aonla, Tendu & Bija are major species of flora in this area.

FLORA

The forest cover in buffer zone is about 19647.09 Ha.There are no endangered species of Flora in the Buffer zone.

FAUNA/WILD LIFE

Wide variety of wild animals like panther, bear, deer, antelope, wolf, hyena & jackal is found; however, there is no endangered species found in the region. In the Buffer Zone
the forest cover is 19647.09 Ha.It includes parts of Asara Reserved & Protected Forest of North Bilaspur Forest Division (Now Korba). The authenticated list of Flora & Fauna collected from DFO, Korba has been given as in *Annexure-XII.* Summarised details are given hereunder:

A. Flora	**Core Zone**	**Buffer Zone**
1. Agricultural crops		*Kharif, Rabi, etc.*
2. Commercial crops		*Sugar cane, Ground nut, etc.*
3. Plantation		*Existing*
4. Natural vegetation / forest type		*Type III &IV*
5. Grass lands		*Barbhusi, Kans, etc.*
6. Endangered species		*None*
7. Endemic species		*Sal, Saja, Arjun, Bahera, etc.*
8. Others (Specify)		
B. Fauna		
1. Total listing of faunal elements		*Given as in Annexure-XII of Vol. II*
2. Endangered species		*None.*
3. Endemic species		*Hyaena,Jackal,Hare,etc.*
4. Migratory species		*None.*

5. Details of aquatic fauna, if applicable		*Fishes, Water snakes, etc.*

Flora

Sl.No.	Particulars	Names
1	Agricutural crops	Kharif, Rabi, etc.
2	Commercial crops	Sugar cane, Ground nut, etc.
3	Plantation	Existing
4	Natural vegetation/ forest type	Type III &IV
5	Grass lands	Barbhusi, Kans, etc.
6	Endangered species	None
7	Endemic species	Sal, Saja, Arjun, Bahera, etc.

Fauna

Sl.No.	Particulars	Names
1	Endangered species	None
2	Endemic species	Hyaena, Jackal, Hare, etc.
3	Migratory species	None
4	Details of aquatic fauna, if applicable	Fishes, Water snakes, etc.

4.9 Hydrogeology

4.9.1 Surface Water

Drainage pattern in the area is controlled by Hasdeo river which flows southerly and lies to the east of the block at about 8.0 km. Similarly, a high order stream Bamni river which flows northerly exists in the west of the block at about 4 km. joining the Hasdeo river in the north far beyond the buffer zone.

The mine is located on a topographical high. Numerous streamlets/ nallas flowing radially from this high constitute the main drainage pattern. These streamlets join with the three main streams "Bamni river in the west, Katai nalla in the north and Teti Nadi in the South-east which in turn flow into the master drainage Hasdeo river. Other rivers and nalas that drain the buffer zone are Kalewa nalla, Samjhar nalla and Bakai nalla etc.

The drianage is mostly dendritic in nature', and the drainage pattern existing in the core and the buffer zone of the proposed Vijay West UG mine project area is shown in Plate No. II.

4.9.2 Ground Water

Aquifer System - The formations within the study areas are Gondwanas, Talchirs and Metamorphics. Major portion of the area is occupied by Gondwanas and the rest by Talchirs and Metamorphics. The project area, situated on Barakar sand stone formation, comprises soil cover, weathered mantle and sand stone of different grain sizes with shale beds and coal seams.

The weathered mantle and sand stone beds are saturated, and behave as aquifers whereas the shale beds and coal seams as aquicludes. Due to stratification and with the presence of aquicludes (shale/coal), a multi-aquifer system is developed.

There are four numbers of coal seams present in the block; namely, Seam -IV, Seam -III,Seam-II and Seam-I, whereas Seam-III, Seam-II (Top) & Seam-I are prominent, and have been selected for underground mining.

The alluvium formation and weathered Barkar formation comprising mainly of loosely cemented and poorly consolidated grey coloured medium to coarse grained sandstone lying above the seam-IV with a thickness varying from 4.45 m to 60.04 m behave as unconfined aquifer. This unconfined aquifer is potential and prolific. The lower formations, consisting of compact and medium to coarse grained sandstone with impersistent carbonaceous shale and coal seam with secondary porosity, behave as semi-confined to confine in nature.

The general hydro-geological units developed in the Vijay West UG mine area are as follows:

Hydro-geological Unit	**Formation**	**Thickness**
Phreatic aquifer	Soil & Alluvium, loosely cemented, poorly consolidated medium to coarse grained weathered sandstone & intercalation of shale and sandstone.	4.45 m– 60.04 m
Aquiclude	Coal seam-IV	0.40 m – 1.31 m
Aquifer	Medium to coarse grained sandstone, Shale / sandstone intercalation	8.95 m – 19.62 m
Aquiclude	Coal seam III - **(Working)**	0.13 m – 5.76 m
Aquifer	Fine to medium coarse sandstone	11.51 m – 21.03m
Aquiclude	Coal seam II(Top) - **(Working)**	0.51 m – 3.47 m
Aquifer	Fine grained sandstone, intercalation of shale and sandstone	0.34 m – 8.23 m
Aquiclude	Coal seam II(Bottom)	0.40 m – 2.80 m

Aquifer	Fine to medium coarse sandstone	2.31 m – 21.65 m
Aquiclude	Coal seam I - **(Working)**	0.29 m – 4.85 m

4.9.3 Aquifer Parameters

No detailed hydro-geological investigation has been carried out in the present mine block.

However, hydro-geological investigations were carried out by CGWB & CMPDI in Jamuna coalfield under S&T project," Studies on Groundwater Flow into Coal Mines." The aquifer parameters for the formation lying above the working seam (i.e. multi-aquifer) were reported as:

Transmissivity (T) : 175 m^2 / day
Permeability (k) : 5 m/day
Storage coefficient : 5.0×10^{-4}

So also, detailed hydro-geological investigations were carried out at Bartarai UG project, located in Jamuna-Kotma Area, the aquifer parameters for lower aquifer were evaluated by SECL and reported the permeability as 0.25 m/day. Refer fig. 7 *& 8.*

4.9.4 Ground Water Levels

The water table in the area conforms to the topography. As the mine is located on a topographical mound, the hydraulic gradient slants in all directions from the proposed mine. However, the water table gradient measured in northeast direction is 1.50×10^{-2}.

The District Groundwater Survey Unit, Bilaspur district has been monitoring the ground water levels in the region. The pre-monsoon and post-monsoon historical groundwater levels for the last 16 years (1988 - 2003) recorded at the nearest permanent observation wells (POW) Pasan and Korbi located within the buffer zone were collected and are given below:

(in metres) b.g.l.

Hydrograph Station/Year	Pasan(POW-94)			Korbi (POW-100)		
	Pre - Monsoon	Post - Monsoon	Fluctuation	Pre-Monsoon	Post-Monsoon	Fluctuation
1988	8.20	3.50	4.70	10.81	5.58	5.23
1989	9.85	8.10	1.75	9.36	5.80	3.56
1990	9.95	5.25	4.70	10.71	5.21	5.50

1991	10.20	5.08	5.12	10.80	6.50	4.30
1992	8.15	4.95	3.20	9.21	5.16	4.05
1993	9.00	5.83	3.17	9.10	1.66	7.44
1994	9.70	4.72	4.98	9.42	0.46	8.96
1995	9.50	5.55	3.95	-	-	-
1996	9.70	7.40	2.30	-	-	-

Hydrograph Station/Year	Pasan(POW-94)			Korbi (POW-100)		
	Pre - Monsoon	Post - Monsoon	Fluctuation	Pre- Monsoon	Post- Monsoon	Fluctuation
1997	9.30	6.15	3.15	-	-	-
1998	5.66	4.65	1.01	-	-	-
1999	6.95	5.60	1.35	-	-	-
2000	9.01	8.15	0.86	-	-	-
2001	9.60	6.15	3.45	-	-	-
2002	9.65	8.62	1.03	10.20	5.45	4.75
2003	11.60	3.35	8.25	8.05	3.60	4.45
Average	9.13	5.82	3.31	9.74	4.38	5.36

Average pre-monsoon water level in the block = 9.44 m

Average post -monsoon water level in the block = 5.10 m

Average water level fluctuation in the block = 4.34 m

The above mentioned data shows that the pre-monsoon water levels vary from 5.66m (1998, Pasan) to 11.60 m (2003 Pasan station) with an average of 9.44 m and Post monsoon water level data vary from 3.35 m (2003, Pasan) to 8.62 m (2002, Pasan station) with an average of 5.10 m. The average water level fluctuation varies from 0.86 m (2000, Pasan) to 8.96 m (1994, Korbi) with an average of 4.34 m in the Buffer zone.

4.9.5 Water level Trends

The Pre-monsoon and Post-monsoon water level trends of the above hydrograph stations are given in fig. 12(a) and 12(b). The pre-monsoon water levels of Pasan station show a marginal decline trend whereas the post-monsoon water level trend shows a normal trend. The decline in pre-monsoon water level may be attributed to increase in ground water utilization

due to increase in the local population.

The normal trend during post-monsoon period may be due to stable condition between ground water recharge and draft whereas, at Korbi, both the pre-monsoon & post-monsoon water-levels reveal an upward trend. This upward trend may be attributed to the water conservation and utilization of surface water for irrigation uses in the area.

Fig.9(a)

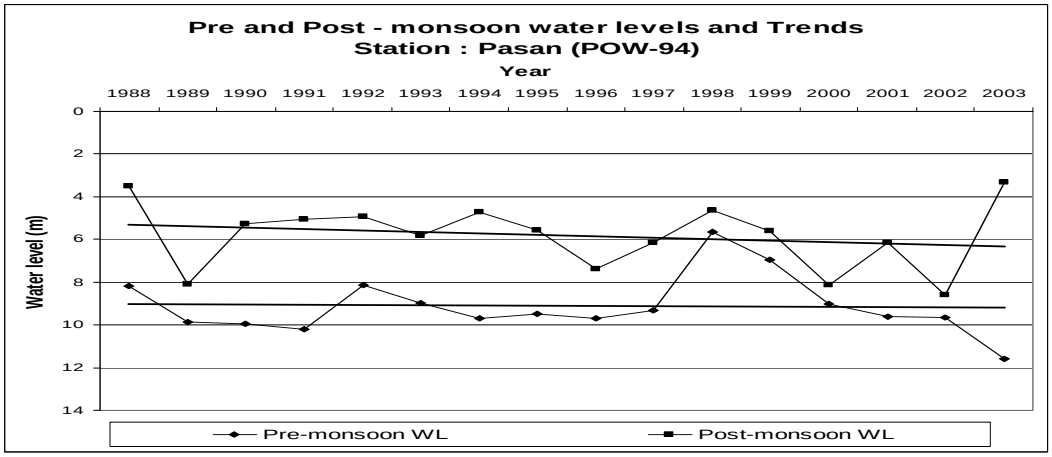
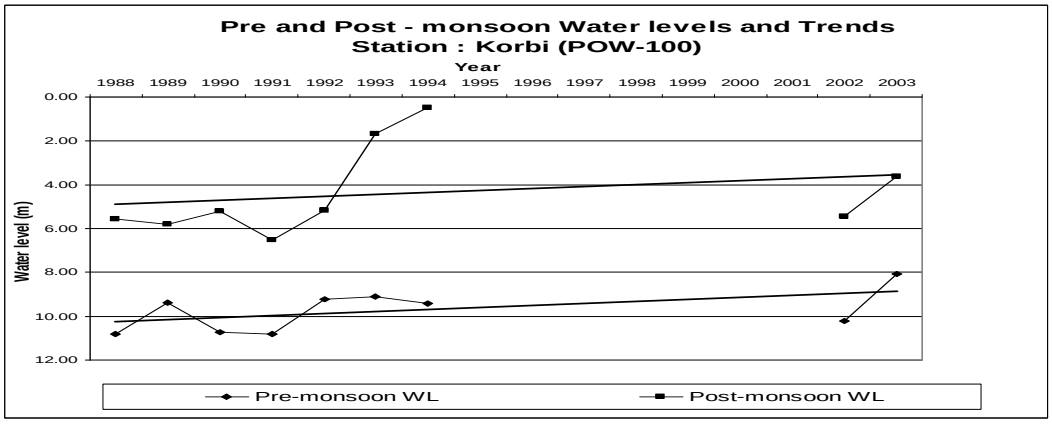


Fig.9(b)



4.9.6 Groundwater Resources Potential:

Rainfall is the major recharge source. The study area experiences in average annual rainfall of 1516 mm (year 1954-2000, Katghora meteorological

observatory). Part of the mine water is discharged into the local drainage renders 20% of recharge to the groundwater system as a return flow.

The annual ground water recharge by water level fluctuation method, as specified in GEC, 1997, for the study area was estimated as **38.78 M.Cum**. As the local ground water levels get affected near mine area, the recharge estimated by water level fluctuation method may not be authentic.

Hence, in the present context, the rainfall infiltration method will be more practical and reliable.

As reported in GEC Report 1997, for sandstone a rainfall infiltration factor of 11.5% and 8% for hard rock (gneiss and schist) were considered for the study area. Hilly area (2930 Ha with >20% slopes) has also been deducted from the buffer area. Accordingly, the gross recharge in the study area was estimated as 52.22 M.Cum. Of this, about 15% was considered as natural losses. The net recharge in the area was assessed as **44.39 M.Cum.**

As advised by CGWB, NCC Region, Raipur based on the ground water assessment reports prepared for Pondi administrative block, the net irrigation draft for the buffer zone was estimated as **0.21 M.cum**.

For calculating the domestic water consumption in the study area, the population was projected up to 2025 A.D. and the consumption rate was considered as 70 lpcd. Accordingly, the water demand for domestic use was estimated as **1.60** M.cum. The water consumption by the cattle population was considered as 10% of domestic use and estimated as 0.16 M.cum.

For industrial and domestic water demand by various mine projects falling within the buffer zone has been estimated as 0.49 M cum (1349 m^3 / day) and the most of this demand tantamount to 0.12 M cum(324 m^3 / day) is met through the treated mine discharge and the balance tube-wells.

The total annual mine discharge in the area through the existing and the proposed mine
was estimated at 4.41 M.Cum of which 0.12 M cum has been gainfully utilized by mines. The balance 4.29 M.Cum mine water will be discharged into the local drainage for various uses by the local population. Of this, about 20% (i.e. 0.86 M.Cum) is estimated as return flow to the ground water system.

Thus, the net annual mine discharge projected as **3.43** M.cum. And, the net groundwater recharge and draft for the buffer zone were estimated as **44.39**

and **5.89 M.Cum**. respectively. Thus, the balance available annual ground water recharge in the study area was assessed as **38.50 M.Cum**. The detailed groundwater balance with recharge and discharge estimate is shown in Table 1 and *Fig. 10.*

TABLE – 1

GROUND WATER BALANCE OF VIJAY WEST UG PROJECT AREA

(in M.Cum.)

A. GROUND WATER RECHARGE :

	Total Geographical Area	**:**	**355.42 sq.km**
i	Recharge in Sedimentary area :		
	Area covered under sedimentary rocks	:	264.94 sq.km
	Hilly area (>20% slope)	:	(-) 26.15 sq.km
	Area considered for recharge in sedimentary rocks	:	238.79 sq.km
	***Ground water recharge in* sedimentary rocks**	***:***	***41.63 M.Cum.***
	(238.79 sq.km x 1.516 m annual R.F x 11.50 % infiltration)		
ii	Recharge in Hard rock area		
	Area covered in hard rock terrains	:	90.48 sq.km
	Hilly area (>20% slope)	:	(-) 3.15 sq.km
	Area considered for recharge in hard rocks	:	87.33 sq.km
	Ground water recharge in in hard rocks	***:***	***10.59 M.Cum.***
	(87.33 sq.km x 1.516 m annual R.F. x 8 % infiltration)		
	Gross Recharge (Rg) in study area (i + ii) M.Cum.	***:***	***52.22***
	Natural discharges and other losses (15% of Rg)	:	- 7.83 *M.Cum.*
	Net Annual Groundwater Recharge M.Cum.	**:**	**44.39**

B. GROUND WATER DRAFT

1. **Net irrigation use** :
0.21

i) Proportional for 15,896 Ha non -command area: 0.26
(Derived from the irrigation draft of Ground water assessment report of Pondi Development Block)
ii) Return flow to ground water system (20% of i): (-)0.05
Net irrigation use : *0.21*

2. **Community use** : **2.25**

i. Projected population (by 2025 AD) 62,523 : 1.60
@ 70 lpcd for 365 days
ii. For cattle population[10% of item2 (i)] : 0.16
iii. Consumption for the mine projects *0.49*
(a) Through mine water discharge: 0.12
(b) Through tube-wells : 0.37

Cu.m./day

Mine	Demand			Mine water supply	Balance from other source	
	Domestic	Industrial	Total		Tube wells	River/other
Vijay West UG (Proposed)	331	418	749	204	545	-
Rani Atari UG	480	120	600	120	480	-
Total per day	811	538	1349	324	1025	-
Total per annum (M.cum)	0.296	0.196	0.49	0.12	0.37	-

Total Community use (i + ii + iii) : ***2.25***

3. **Net Mine Discharge** : **3.43**

Mine water pumping:
Vijay West UG (proposed) : 2.59
Rani Atari UG : 1.82
Total Pumping 4.41
Consumption by mines (-) 0.12
Net mine discharge : **3.43**

-

Net Annual Groundwater Draft (1+2+3) : 5.89 M.Cum

C. Balance Available Annual Groundwater Recharge (A-B)= 38.50 M.Cum

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4.9.7 Dynamic and Static Resources

Based on the GEC, 1997 recommendations and discussions with CGWB, N.C.C. Region, Raipur, the dynamic and static ground water resources for the core and buffer zones of the study area were estimated. Since the U/G Mine acts as sink and the inflow is mainly from the aquifer system lying above, the average mine depth may be considered as extractable depth for static resource estimation in core zone (i.e. Avg.mine depth: 78m - unconfined aquifer thickness 32.00 m = 46.00 m). Whereas, for buffer zone, the unconfined aquifer (32 m thickness) after adjusting the average pre-monsoon water level i.e.22.56 m. was considered extractable depth.

(Million cum.)

Water Resources	Core Zone	Buffer Zone
Dynamic	0.55	42.46
Static	5.87	220.72
Total	6.42	263.18

4.9.8 Groundwater Stage of Development

Except for coal mining, no major industrial development activity is located in the area. As per CGWB, NCC Region, Raipur, the total annual replenishable ground water resource in the Pondi Development Block, Korba district (where Vijay West UG proposed mine exists), was assessed as 356.70 M.cum.. It was also reported that the ground water development in the block is as 0.66 % and and falls within category "**White**"(Copy enclosed). As such the entire Chhattisgarh State is covered under the category “White”.

4.9.9 Mine Drainage

In sedimentary rocks, due to the stratification of formation the horizontal permeability (KH) is usually many fold higher than the vertical permeability (Kv). The permeable beds act as individual hydro-geological units and develop a multi- aquifer system.

Thereby, the groundwater velocity/flow along the bedding plane is higher than across the plane. During mine development, the sandstone beds existing above the roof of the Seam -IV and at places seam-III will be the major source for inflow into the mine. The presence of carbonaceous shale in the roof behaves as aquiclude and restricts the connection between the pheratic aquifer and the lower confining aquifers. Thereby only aquifer lying in the immediate vicinity of mine workings is largely drained, whereas, the pheratic aquifer is the least effected.

Only during depillaring activity (i.e. caving conditions), with the prominence of secondary porosity and increase in leakance, maximum inflow is anticipated. In

such conditions, the aquifer in the mine area may get interconnected and drained for a limited period. With sufficient recharge, the aquifers get recouped immediately.

The peak inflow (i.e. during monsoon period) into the proposed mine is estimated as 18,170 cum/day, whereas, the lean period pumping is estimated at 1652 cum / day. Thus, an average of 7083 cum / day will be discharged from the mine into the local ground surface/drainage. Of which, about 20% (i.e. 1417 cum / day) may be considered as return flow to the ground water system as recharge. Thus, about 5666 cum/day mine water is discharged and will be utilised by various uses in the area.

The annual mine water discharge rates from various mine in the study area are as follows:

Sl.No.	**Mine**	**Avg.Depth (m)**	**Annual Mine Discharge (M.cu.m.)**
1	Vijay West UG (Proposed)	78	2.59
2	Rani Atari UG	70	1.82
Total Mine pumping in the Area			**4.41**

Total mine water consumption for domestic and industrial uses is 0.12 M.cum, thereby reducing the mine discharge to 4.29 M.cum. After considering 20% (0.86 M.cum) of discharge as return flow to the groundwater system, the net mine discharge amounts to 3.43 M.cum. Thus, the net mine discharge of the proposed Vijay West U/G mine amounts to 4.96 % of the gross annual ground water recharge in the area.

Whereas, the total mine discharge from various mines in the area amounts to 8.45 % of gross recharge in the area. The mine water is discharged on surface after passing through the sumps and sedimentation tanks. Hence, no quality degradation of mine water is anticipated. The mine discharge will be gainfully utilised to meet the mine's domestic/ industrial and dust suppression needs. The balance will be discharged for the local public.

4.9.10 Probable Impact of Mining on Groundwater System

(a) Impact on Topography & Drainage

Subsidence due to total extraction of coal causes changes in topography and drainage by developing micro basins, subsidence fractures, ridges, pot holes etc. This alters the drainage of the area in micro level. Care is taken during mining activity to leave enough pillars in underground as barriers below main drainage/water body to avoid any damage to surface water bodies and main rivers / nalas are diverted. In deeper underground mines, the subsidence is barely noticeable on the surface.

(b) Impact on Aquifer System

Various methods of U/G mining activities may cause changes in aquifer geometry, water level in the vicinity of the mine and disturb ground water flow direction. This can also create secondary fractures and higher permeability zones within the aquifer. After the mining activity, the aquifer restores its original water level and mined out area acts as a good reservoir.\

In the present case, as the proposed Vijay West U/G project is deeper U/G mine, the impact of mining activity on unconfined aquifer will be marginal to negligible in the deep dip.

(c) Impact of Water Levels

When an impervious bed such as clay (shale) coal seams is present above the working seam the water level in the phreatic aquifer is not affected due to Bord and Pillar mining activity. In case of total extraction of coal (depillaring) and resultant subsidence cracks, the water may drain into the mine causing lowering of water table at the vicinity of the mine. Drawdown thus created may be limited to lesser area since the mine pumped out water is re-circulated into the phreatic aquifer by natural recharge. It is observed that after mining activity is over the water level restores to its original level. The radius of probable impact on water level under caving conditions is predicted using Sichardt formula (Table 4) for various hydraulic conductivity (k) values by the area and considering that the entire unconfined aquifer is de-saturated.

During mining, the formation near to the mine mouth only get disturbed and marginally dewatered. However, due to non-homogenic and non-isotropic nature of the aquifers, the radius of influence will be limited to a very small distance.

Table No.4 - Probable Impact of Mining on Groundwater Levels

Sl. No.	Project	Area	Avgerage Mine Depth(m)	Avg. Unconfined Aquifer thickness (m)	Radius of Influence (m) based on assumed `K' values	
					K=0.25 m/d	K=5.0 m/d
1	Vijay West UG(Prop)	Chirimiri	78	23.18	115	515
2	Rani Atari UG	- do -	70	23.25	118	529

(Radius of Influence is from the periphery of the mine)

With variation in aquifer/ mine geometry, return flow for mine discharge, abundant recharge potential and improved subsidence management, the zone of disturbance will be reduced further.

(d) Impact on Ground Water Quality

The groundwater chemistry indicates that the groundwater in the area is potable and does not contain any toxic elements. The underground mining activity does not induce any unwanted chemical or elements into the groundwater affecting the water chemistry except for total suspended solids (TSS), no serious pollutant has been observed in the mine water discharge. The discharge water of adjacent Rani Atari UG mine conforms to the MOEF standards.

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