KJS Cement Limited
Works - NH-7, Vill-Amilia Lakhwar,
Tehsil-Maihar,Distt-Satna (MP) 485771
Tel:-07674-292010, 292025,
292009,292020
Fax : 07674-292024
info@kjscement.com
www.kjscement.com

KJS/EMD/ECCOMP9.008/MoEF/11/2013

Date: 23.11.2013

To,
The Regional Officer,
Ministry of Environment & Forests,
Kendriya Paryavaran Bhavan, Link Road No. 3,
E-5, Ravi Shankar Nagar,
Bhopal – 462016

Sub: Submission of Environmental Clearance Compliance & Environmental status report for Bhatia Limestone Mine (9.008 Ha).

Ref: Environmental Clearance Letter F. No. 372/EPCO-SEIAA/09, Dated: 16th December 2009.

Sir,

We hereby submit the following document for your kind perusal.

1. Status of Compliance of the stipulated Environmental Clearance conditions.
2. Half Yearly Environmental status Report (April – September 2013)

The Above documents are available on our company's website (www.kjscement.com).

Thanking You,

Yours Faithfully,
For M/S KJS Cement Limited.

N.K. Sharma
VP (HR-P&A)

Encl: 1) Status of EC Compliance. (Copy in CD)
2) Half yearly Environmental Status Report (April - September 2013). (Copy in CD)

CC to,

1. Member Secretary,
   MP State Environment Impact Assessment Authority,
   Pollution Control Board Building,
   Paryavaran Parisar E-5 Arera Colony,
   Bhopal - 462003

2. Zonal Officer,
   Central Pollution Control Board,
   3rd Floor, Sahkar Bhawan, North TT Nagar,
   Bhopal – 462003

3. Member Secretary,
   M.P. Pollution Control Board,
   Paryavaran Parisar, E-5, Arera Colony,
   Bhopal (M.P.)

Half Yearly EC Compliance Status Report for the Period of April – September 2013

Bhatia Limestone Mine
(Area 9.008 Ha)

Village-Amilia, Tehsil-Maihar, Dist- Satna (M.P)
Phone- (07674) 233947

November, 2013

Table of Contents

ENVIRONMENT CLEARANCE - HALF YEARLY COMPLIANCE STATUS REPORT

(APRIL - SEPTEMBER 2013)

KJS Cement Limited

BHATIA LIME STONE MINE (9.008 HA)
KJS CEMENT LIMITED

ENVIRONMENT CLEARANCE - HALF YEARLY COMPLIANCE REPORT FOR THE PERIOD OF APRIL - SEPTEMBER 2013

Compliance report for the period April – September 2013 to the conditions stipulated in the Environmental Clearance granted by SEIAA, MP, MoEF vide letter F.No. 372/EPCO-SEIAA/09 Dated 16/12/2009.

A. Specific Conditions

Sr. No.	Stipulated condition	Compliance status
01.	No two pits shall be simultaneously worked i.e. before the first is exhausted and reclamation work completed, no mineral bearing area shall be worked.	Agreed. No two pits shall be worked simultaneously.
02.	After exhausting the first mine pit and before starting mining operations in the next pit, reclamation and plantation works in the exhausted pit shall be completed so as to ensure that reclamation, forest cover and vegetation are visible during the first year of mining operations in the next pit. This process will follow till the last pit is exhausted. Adequate rehabilitation of mined pit shall be completed before any new ore bearing area is worked for expansion.	Is being complied with.
03.	Adequate buffer zone shall be maintained between two consecutive mineral bearing deposits.	Agreed. Is being complied with.
04.	Sprinkling of water on haul roads to control dust will be ensured by the project proponent.	Is being complied with.
05.	Minimum 600 plants 0.4 ha Annually will be planted in the first five years by the project proponent.	Is being complied with.
06.	By the end of the lease period 33% of the areas should be brought under plantation.	Agreed / Tree plantation is under progres and by the end of lease period 33% of th area would be covered by plants/trees.
07.	Blast vibrations study shall be conducted and submitted to the Regional office of the Ministry within six months. The study shall also provide measures for prevention of blasting associated impact on nearby houses and agricultural fields.	Please refer to **Annexure I**
08.	Need based assessment for the nearby villages shall be conducted to study economic measures which can help in upliftment of poor sections of society. Company shall provide separate budget for community development	Separate fund has been provided toward community development activities programme. We have carried out number c work pertaining to community development

	activities.	
09.	Land-use pattern of the nearby villages shall be studied, including common property resources available for conservation into productive land. Action plan for abetment and compensation for damage to agricultural land common property land (if any) in the nearby villages, due to mining activity shall be submitted to the Regional office of the Ministry within six months. Annual status of implementation the plan and expenditure thereon shall be reported to the Regional Office of the Ministry.	Mining lease area does not possess any forest growth & hence there are no chances of loss due to mining activity. The core zone of the area is barren land hence no change in land use pattern, not significant. For land use pattern study of nearby villages please refer to **Annexure II.**
10.	Maintenance of village roads through which transportation of minerals are undertaken shall be carried out by the company regularly at its own expenses the roads shall be black topped.	Is being Complied with.
11.	Rain water harvesting shall be undertaken to recharge the ground water source. Status of implementation shall be submitted to the Regional Office of the Ministry within six months and therefore every year from the next consequent year.	Old mined out pit is being utilized for rain water harvesting to recharge the ground water.
12.	Measures for prevention and control of soil erosion and management of silt shall be undertaken. Protection of dumps against erosion shall be carried out with geo textile matting or other suitable material, and thick plantations of native trees and shrubs shall be carried out at the dump slopes. Dumps shall be protected by retaining walls.	No active dump shall be kept for longer period and the dump will be stabilized through grasses and shrubs. Garland drain and retaining wall shall be provided wherever required and we assure you that we shall carry out same as per submission and as per approved mining plan.
13.	Trenches/ garland drains shall be constructed at foot of dumps and coco filters installed at regular intervals to arrest silt form being carried to water bodies. Adequate number of Check Dams Gully Plugs shall be constructed across seasonal/perennial nallahs (if any) flowing through the ML area and silts arrested. De-silting at regular intervals shall be carried out.	Is being complied with.
14.	Garland drain of appropriate size, gradient and length shall be constructed for both mine pit and for waste dump and sump capacity shall be designed keeping 50% safety margin over and above peak sudden rainfall (based on 50 years data) and maximum discharge in the area adjoining the mine site. Sump capacity shall also provide adequate retention period to allow proper settling of silt material. Sedimentation pits shall be constructed at the corners of the garland drains and de-silted at regular intervals.	Is being complied with.
15.	Ground and surface water (if any) in and near the core zone (within 5.0 km of the lease) shall be regularly monitored for contamination and depletion due to mining	Ground and surface water in & near cor zone is being monitored on quarterly basi for contamination and depletion due t

	activity and records maintained. The monitoring data shall be submitted to the Regional Office of the Ministry regularly, Further, monitoring points shall be located between the mine and drainage in the direction of flow of ground water shall be set up and records maintained.	mining activity and records are kept. The monitoring data shall be submitted to the Regional Office of the ministry.
16.	Cultivable waste land within 5 km radius of the lease shall be identified and developed into productive land and made available to villages. Status of implementation shall be submitted to the Regional Office of the Ministry within three months from start of production.	Agreed. Status of implementation shall be submitted to the Regional office of the ministry.
17.	Fugitive dust generation shall be controlled. Fugitive dust emission shall be regularly monitoring at locations of nearest human habitation (including schools and other public amenities located nearest to sources of dust generation as applicable) and records submitted to the Regional Office of the Ministry regularly.	Fugitive dust emission is being controlled by spraying water, plantation along mining lease and periodic maintenance of haulage road. Fugitive dust emission is being monitored regularly at locations of nearest human habitation and records are being submitted to the RO of the ministry regularly.
18.	Baseline data for air quality shall be maintained and RSPM level in air quality in the nearby human habitation (Villages) shall also be monitored along with other parameters.	Is being complied with.
19.	Transportation of minerals shall be done by covering the trucks with tarpaulin or other suitable mechanism so that no spillage of mineral/dust takes place.	Is being complied with.
20.	Occupational health and safety measures for the workers including identification of work related health hazards, training on malaria eradication, HIV, and health effects on exposure to respirable mineral dust on the workers shall be conducted and records maintained including health records of the workers. Awareness programme for workers on Impact of mining on their health and precautionary measures like use of personal equipments etc. shall be carried out periodically Review of impact of various health measures shall be conducted followed by follow up action wherever required.	Is being complied with. Regular checkup of the employees is in practice and medical assistance has been provided. First aid facilities along with medical assistance including provision of ambulance in emergencies are provided. Awareness program for workers on impacts of mining on their health and precautionary measures like use of personnel protective equipments etc is being carried out periodically.
21.	The project proponent will ensure following action to be taken as committed during public hearing. (a) Employment to local labors, or priority basis.	Complied with. Priority to local labors is given for employment.
22.	Top soil/solid waste shall be stacked properly with proper slope and adequate safeguards and shall be utilized for backfilling (wherever applicable) for reclamation and rehabilitation of mined out area. Top soil shall be separately stacked for utilization later for reclamation and shall not be stacked along with over burden.	The top soil is being stored properly and adequate protection measures are provided for accumulated top soil and the same shall be utilized for backfilling, reclamation and rehabilitation of the mined out area.

23.	Over burden (OB) shall be stacked at earmarked dump site(s) only and shall not be kept active for long period. The maximum height of the dump shall not exceed 20 m, each stage shall preferably be of maximum 10 m and overall slope of the dump shall not exceed 28^0. The OB dump shall be backfilled. The OB dumps shall be scientifically vegetated with suitable native species to prevent erosion and surface run off. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Regional Office of the Ministry of Environment & Forests on six monthly basis.	Is being complied with.
24.	Slope of the mining bench and ultimate pit limit shall be as per the mining scheme approved by Indian Bureau of Mines.	Is being complied, as per mining scheme approved by Indian Bureau of Mines.
25.	Adequate plantation shall be raised in the ML area, haul roads, OB dump sites etc. Green belt development shall be carried out considering CPCB guidelines including selection of plant species and in consultation with the local DFO / Agriculture Department. Herbs and shrubs shall also form a part of afforestation programme besides tree plantation. The company shall involve local people for plantation programme. Details of year wise afforestation programme including rehabilitation of mined out area shall be submitted to the Regional Office of the Ministry every year.	Is being complied with. Plantation is under progress in mine lease area, haul roads, over burden dump sites etc. Green belt development is being carried out as per CPCB guidelines including selection of plant species. Details of year wise afforestation programme including rehabilitation of mined out area is attached herewith. **Annexure III**
26.	Regular monitoring of ground and surface water sources for level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year i.e. pre-monsoon (April-May), monsoon (August) post-monsoon (November) and winter (January) and the data thus collected shall be regularly sent to MoEF, Central Ground Water Authority and Regional Direction Central Ground Water Board.	Is being complied with. We are regularly monitoring ground & surface water quality. Data on piezometric study and quality of water shall be submitted to MoEF, CGWA and Regional Director CGW Board.
27.	The wastewater from the mine shall be treated to conform to the prescribed standards before discharging in to the natural stream. The discharged water from the Tailing Dam (if any) shall be regularly monitored and report submitted to the Ministry of Environment & Forests, Central Pollution Control Board and the State Pollution Control Board.	No wastewater generated from mine.
28.	Hydro-geological study of the area shall be reviewed annually. In case adverse effect on ground water quality and quantity is observed mining shall be stopped and resumed only after mitigating steps to contain any adverse impact on ground water is implemented.	Agreed. Hydro-geological study of the area shall be reviewed. In case of adverse effec on ground water quality and quantity, mining shall be stopped and resumed only afte mitigation.

29.	Vehicular emissions shall be kept under control and regularly monitored. Vehicles use for transportation of minerals and others shall have valid permissions as prescribed under Central motor Vehicle Rules, 1989 and its amendments. The vehicles transporting minerals shall be covered with a tarpaulin or other suitable enclosures so that no dust particles / fine matters escape during the course of transportation. No overloading of minerals for transportation shall be committed. The trucks transporting minerals shall not pass through wild life sanctuary (if any in the study area).	Is being complied with. The vehicles transporting minerals are covered with a tarpaulin or other suitable enclosures so that no dust particles / fine matters escape during the course of transportation. No overloading of minerals for transportation.
30.	Prior permission from the Competent Authority shall be obtained for extraction of ground water (if any).	Agreed. Noted for compliance.
31.	Action Plan with respect to suggestions/improvements and recommendations made during public consultation/hearing (as agreed) shall be submitted to the Regional Office of the Ministry and the State Govt. within six months.	**Implementations status of suggestions, improvement and recommendations made and agreed during public hearing** No households will be displaced or required to be rehabilitated. Mining will result in loss of mainly waste land. As the mining activity is being done since past 10 years already the socio-economic conditions of the area has improved. Lot has been done by lessee in the field of environment, health, education etc. Implementation status of action plan is given below. ➢ Employment to the local people has been provided on priority basis as per their qualification, eligibility and skills. ➢ Excavated mine pit is being used as water reservoir, which will be provided to villagers as and when required. ➢ Water spraying system is provided for the spraying the water over haul road and village road to control the fugitive dust emission. ➢ Tree plantation is under progress, action plan & implementation status is attached herewith. Please refer to annexure? ➢ M/s KJS cement Ltd. has carried out number of welfare activities in the area like: o Donation of ambulance to district hospital Satna. o Donation of Rs 10 Lac to District hospital Satna. o Free medical checkup and medicine distribution on regular basis at village

		Amilia, Bhatia, Girgita etc. o Provision for ambulance facilities to surrounding villagers o Provision of one shav vahan. o Distribution of uniform to school children at village Amilia. o Distribution of sarees to villagers at village Amilia. o Donation of Rs 5 Lac to Ram Mandir. o Donation of Rs 15 Lac to Ma Sharda Devi Temple Managing Committee.\ We assure you that more facilities would be provided as per expectation of local people in consideration with local panchayat.
32.	A final mine closure plan, along with details of Corpus Fund, shall be submitted to the Regional office of the Ministry of Environment & Forests, 5 years in advance of final mine closure for approval.	Agreed. Noted for compliance.

B. General Conditions

Sr. No.	Stipulated condition	Compliance status
01.	No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment & Forest.	Agreed. Noted for compliance.
02.	No change in the calendar plan including excavation, quantum of mineral and waste shall be made.	Is being complied with.
03.	Mining will be carried out as per the approved mining plan by India Bureau of Mines.	Mining is being carried out as per approvec mining plan by IBM.
04.	Four ambient air quality-monitoring station shall be established in the core zone as well as in the buffer zone for RSPM, SPM, SO_2, NO_x monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with the State Pollution Control Board.	Is being complied with. Regular ambient ai monitoring is being carried out in core zon as well as in buffer zone.
05.	Data on ambient air quality (RSPM, SPM, SO_2, NO_X) should be regularly submitted to the Regional office of the Ministry located at Bhopal and the State Pollution Control Board/Central Pollution Control Board once in six months.	Data on ambient air quality is bein submitted regularly to the RO of th ministry, Bhopal and the SPCB/CPCB onc in six months. **Annexure IV.**

06.	Fugitive dust emissions from all the sources shall be controlled regularly. Water spraying arrangement on haul roads, loading and unloading and at transfer pointes shall be provided and properly maintained.	Water spraying arrangement on haul roads, loading, unloading and at transfer points is provided & properly maintained to control fugitive dust emission.
07.	Measures shall be taken for control of noise levels below 85 dBA in the work environment. Worker engaged in operations of HEMM, etc. shall be provided with ear plugs muffs and health record of the workers shall be maintained.	Is being complied with. Noise levels are below 85 dBA in the work environment. Ear plug muffs are provided for the workers engaged in operation of HEMM etc.
08.	Industrial waste water (workshop and waste water from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated19th may, 1993 and 31st December, 1993 or as amended form time to time oil and grease trap shall be installed before discharge of workshop effluents.	There is no wastewater generation from mine as workshop has not provided in the mining lease area (No oil & grease generation). Septic tank & soak pit arrangement has been provided for the domestic wastewater generated.
09	Personnel working in dusty areas shall be provided with protective respiratory devices and they shall also be imparted adequate training and information on safety and health aspects.	Is being complied with. Personnel working in dusty areas are provided with protective respiratory devices and adequate training and information on safety and health aspects is given.
10.	Provision shall be made for the housing the labors within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile , toilette, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after completion of the project.	No temporary / permanent housing with necessary infrastructure and facilities for the labors are required as labors are local and residing in nearby villages. However necessary rest shelter and other facilities are provided in the mining lease area.
11.	A separate Environmental Management Cell with suitable qualified personnel shall be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.	Complied with.
12.	The project authorities shall inform to the Regional Office of the Ministry located at Bhopal regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Agreed. Noted for compliance.
13.	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year wise expenditure shall be reported to the Ministry and its Regional Office located at Bhopal.	Agreed
14.	The Regional Office of the Ministry located at Bhopal shall monitor compliance of the stipulated conditions. The project authorities shall extend full cooperation to the officer (S) of the Regional office by furnishing the requisite data / information / monitoring reports.	Agreed
15.	A copy of clearance letter will be marked to concerned Panchayat/local NGO, if any from whom suggestion/ representation has been received while processing the proposal.	Complied with.

16.	State Pollution Control Board shall display a copy of the clearance letter at the Regional office, District Industry Centre and Collector's office /Tehsildar's Office for 30 days.	Agreed.
17.	The project authorities shall advertise at least in two local newspapers widely circulated one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of the State Level Environment Impact Assessment Authority (SEIAA) website at www.mpseiaa.nic.in and a copy of the same shall be forwarded to the Regional Office of the Ministry located in Bhopal.	Complied with.
18.	The Project authority has to submit half yearly compliance report of the stipulated prior environment clearance terms and conditions in hard and soft copy to the SEIAA of M.P. on 1st June & 1st December of each calendar year.	Is being complied with. We are regularly submitting half yearly compliance report of the stipulated prior environmental clearance terms and conditions.
19.	The ministry or any other competent authority may alter / modify the above conditions or stipulate any further condition in the interest of environment protection.	Agreed.
20.	Concealing factual data or submission of false / fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provision of Environment (Protection) Act, 1986.	Agreed.
21.	Any appeal against this environmental clearance shall lie with the National Environment Appellate Authority, if preferred, within a period of 30 days as prescribed under section 11 of the National Environment Appellate Authority Act, 1986.	Agreed.
22.	The above conditions will be enforced inter-alia, under the provisions of the water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act 1981, the Environment (Protection) Act 1986 and the Public Liability Act, 1991 along with their amendments and rules.	Agreed.

Annexure I

Blast Vibration Study

Annexure I

Blast Vibration Study

Ground Vibration

When an explosive charge is fired in a hole, stress waves propagate radically in all directions and cause the rock particles to oscillate. This oscillation is felt as ground vibration. The mining operations using deep hole drilling and blasting using delay detonators are bound to produce ground vibrations.

Blasting, in addition to easing the hard strata, generates ground vibrations and instantaneous noise. Ground vibrations from mine blasting may be expressed by amplitude, frequency and duration of blast. The variables, which influence ground vibrations, are: controllable and non-controllable. The non-controllable variables include: general surface terrain, type and depth of overburden and wind. Similarly, the controllable variables include: type of explosives, charge per delay, delay interval, direction of blast progression, burden, spacing and specific charge and coupling ratio.

The ground vibration due to the nearby existing mining activities are measured by MCW as the Peak Particle Velocity (PPV), and are compared vis-a-vis the circular no. 7, issued by director general of mines safety for safe level criteria. The study concludes that the ground vibrations generated by blasting during the mining operations are well within the standard prescribed by DGMS.

In order to assess vibration measurements at mines, a study of similar capacity of mine was considered. As per studies, the details of charge, the waveform of the event are enclosed as per the DGMS specifications as per the technical circular No. 7071997.

Table-4.6
DGMS Specifications for Blasting for Different Structures

Type of Structures	Dominant Excitation Frequency		
	<8Hz	8-25 Hz	> 25 Hz
a) Buildings/ Structures not belonging to the lessee			
Domestic Houses/ Structures (Kaccha, Brick & Cement)	5	10	15
Industrial buildings (RCC & Framed Structure)	10	20	25
Objects of Historical Importance and Sensitive Structures	2	5	10
b) Buildings belonging to the owner with limited span of life			
Domestic Houses/ Structures (Kacha, Brick & Cement)	10	15	20
Industrial Buildings (RCC & Framed Structure)	15	25	50

Source: DGMS Specifications as Technical Circular No. 7071997

On carrying out the vibration measurement studies to evaluate the peak particle velocity of the blasted materi during the process of blasting is given in the table below.

Table-4.7
Observed Readings for Vibration measurements

Axis	Dominant Frequency	Peak Particle Velocity (mm/sec)
Radial	20.8 Hz	3.92
Vertical	37.5 Hz	6.30
Transverse	34.2 Hz	3.09

Interpretation & Discussions

The study revealed that the vibrations are within the limits. Ground vibration, fly rock, air blast, noise, dust and fumes are the deleterious effects of blasting on environment. The explosive energy sets up a seismic wave in the ground, which can cause significant damage to structures and disturbance to human occupants. It causes major damages to the pit configuration too.

When an explosive charge is fired in a hole, stress wave propagates radically in all directions and cause the rock particles to oscillate. This oscillation is felt as ground vibrations. The ground vibration due to the existing mining activities are measured by MCW as the Peak Particle Velocity and are compared vis-a-vis the circular no. 7 issued by Director General of Mines safety for safe level criteria. The study concludes that the ground vibrations generated by blasting during the mining operations are well within the standards prescribed by DGMS. Ground vibrations are not likely to affect the structure in the vicinity of mine lease area.

While the core area has no structures, the structures adjacent to mine are of concrete structures like workshop, office store etc. These structures will not be affected by the ground vibrations as they will be away from the nearest face of the mine and being of good construction.

Mitigation measures
By adopting controlled blasting, the above said problems are greatly minimized. Choosing proper detonating system and optimizing total charge and charge/delay also minimize the impact. Regular monitoring o magnitude of ground vibrations and air blast by "Minimate" is carried out. Hence, the impact of the min blasting is insignificant on the surrounding area.

Annexure II

Land Use Pattern of Nearby Villages

Annexure II

Land Use Pattern of Nearby Villages

Land Use

Present landuse pattern of the 9.008 hectares mining lease area is as given below:

Table-3.12

Land Use Pattern of Mining Lease Area

Items	Existing	At the end of lease period
Total lease area	**9.008ha**	
Proved Geological Reserve	1156881 tonnes	-
Proved recoverable reserve	922183T	-
Ultimate depth of mining	3.5m	6m
Ultimate pit slope	55	55
Area under dumps	Nil	nil
Area under pits	1.02ha	5.1864ha
Overburden quantity	3565cum	117330cum
Area to be reclaimed	Nil	1.5ha
Infrastructure & Road	0.10	0.10
Mineral storage	Nil	Nil
Plantation	0.01	2.173ha

The study area covers about 24380 ha. For computation of the land use pattern in the study area based on the village-wise land-use data given in the census records, the geographical area of all settlements covered within the study area, though many villages in the peripheries of the circular study area are partially covered. Perfect

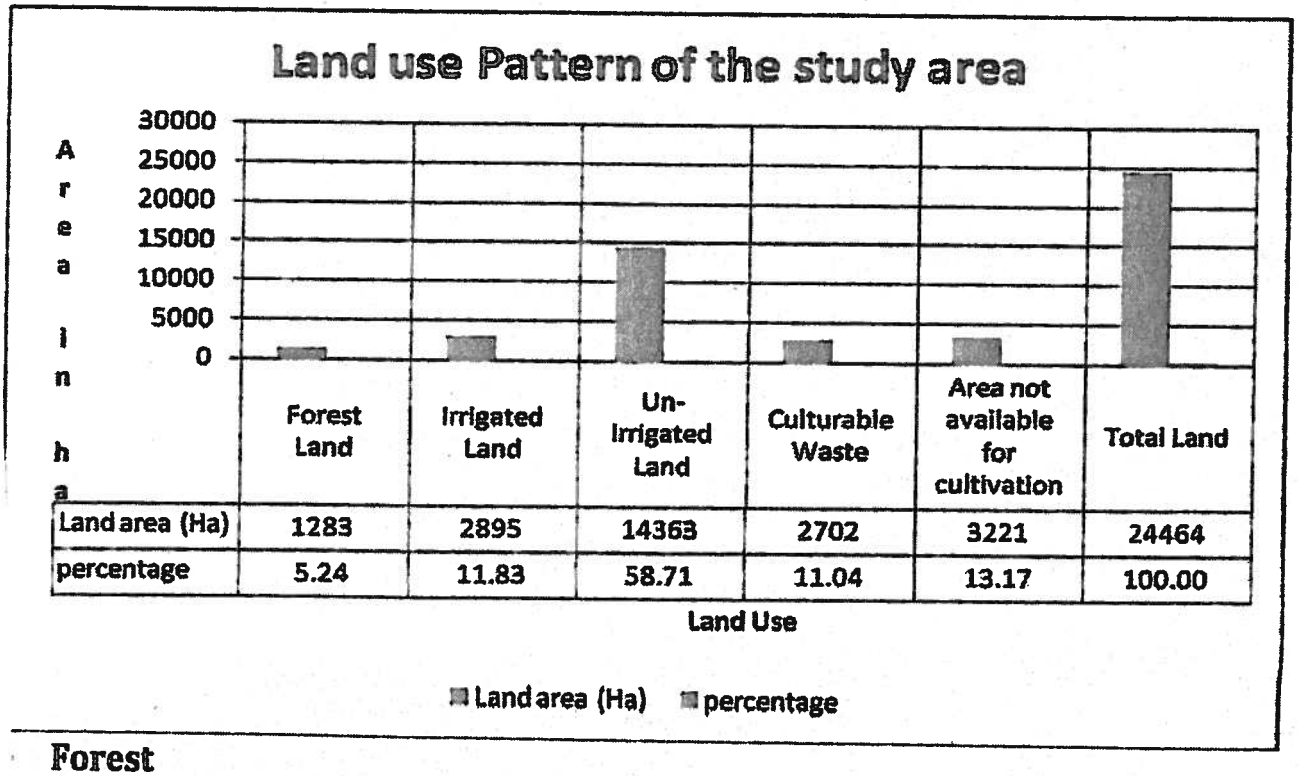
delineation and quantification of land uses for the partially covered parts of villages of the study area is not possible, hence the entire village area is considered for the study, irrespective of its coverage within the village boundary.

The land use is classified into four types – viz. forests, area under cultivation, culturable waste and the area not available for cultivation. The land under cultivation is further sub-divided into two types viz. irrigated and un-irrigated. The land-use pattern of the study area is given in **Table-3.13 and 3.14.**

Table – 3.13

Land-use Pattern in the Study Area

S. N.	Particulars	Study Area (ha)	Percentage Coverage
1.	Forest Land	2323	
2.	Land under Cultivation		
	a) Irrigated Land	3746	
	b) Un irrigated Land	13233	
3.	Culturable Waste Land	2732	
4.	Area not available for cultivation	2346	
	Total Area	24380	



Forest

Forest occupies considerable portion of the study area. Miner part of the forest is spreading in Satna districts of the study area. The forest area of the study area is about 2323 ha which works out to about 5.24% of the total area.

- **Land Under Cultivation**

  Altogether 16979 ha area consisting of irrigated and un-irrigated lands are used for cultivation in the study area. This works out to about 70.54% of the study area. The irrigated land is only 3746 ha and works out to be about 11.83% of the total area. Major sources of irrigation for these irrigated lands are tons nadi, water pumped out from the well, water holding abandoned mine pits, dug wells and bore wells. Canal irrigation is almost absent in the core study area. Lift irrigation is practiced from all these sources. The un-irrigated land is about 13233 ha and works out to about 58.71% of the study area.

- **Culturable Waste**

  This category of land mainly consists of the lands suitable for cultivation, which however not been brought under cultivation at any time.

  The area under this category is about 2732ha in the study area. This works out to about 11.04% of the study area. The existing share of this category of lands in the study area indicates that the land in the study area is moderately utilized for cultivation purposes.

- **Land Not Available for Cultivation**

  The areas not covered under any of the above land use categories and the land covered under urban uses form this type of land use. Altogether 2346 ha land in study area is not available for cultivation. The share of this category of land works out to about 13.71% of the study area.

Detail of land use pattern of the study area has been given in **Table 3.14** as below;

Table 3.14

LANDUSE PATTERN IN STUDY AREA (AREA IN HECTARES)

Name of village	Area of Village (Hectares)	House Hold	Forest (by Source)	Total Irrigated Area	Unirrigated Area	Culturable Waste	Area not available for cultivation
Mauhariya	101	2	0.00	7.00	78.00	5.00	11.00
Semri	172	61	0.00	23.00	135.00	4.00	10.00
Paraswahi	544	319	0.00	50.00	333.00	88.00	73.00
Jarmohra	203	122	0.00	25.00	146.00	15.00	17.00
Kasei	144	45	0.00	52.00	58.00	30.00	4.00
Devri Khurd	97	74	0.00	6.00	79.00	5.00	7.00
Devri Kalan	431	245	0.00	27.00	274.00	47.00	83.00
Piparhat	488	77	123.00	39.00	162.00	130.00	34.00
Mantolwa	263	232	16.00	144.00	79.00	8.00	16.00
Beldara	304	409	0.00	158.00	88.00	22.00	36.00
Patiya	128	68	25.00	9.00	78.00	8.00	8.00
Dhanwahi Kalan	404	268	125.00	18.00	203.00	30.00	28.00
Tilaura	228	387	0.00	63.00	118.00	19.00	28.00
Silauti	262	97	0.00	46.00	157.00	38.00	21.00
Jurwan	221	108	0.00	54.00	131.00	15.00	21.00
Pahadi	612	329	0.00	50.00	194.00	215.00	153.00
Atarhara	136	99	0.00	113.00	15.00	2.00	6.00
Naraura	203	231	0.00	20.00	120.00	31.00	32.00
Banshipur	577	310	169.00	152.00	172.00	44.00	40.00
Balrampur	157	54	30.00	36.00	48.00	27.00	16.00
Basadi	182	19	92.00	28.00	42.00	8.00	12.00
Magraura	464	305	0.00	22.00	365.00	37.00	40.00
Deora	721	227	106.00	117.00	433.00	31.00	34.00
Amatola	306	67	0.00	37.00	225.00	22.00	22.00
Barethi	405	194	0.00	43.00	323.00	19.00	20.00
Uphari	188	84	0.00	13.00	159.00	6.00	10.00
Piparwah	269	69	0.00	17.00	229.00	2.00	21.00
Jarmohra	351	30	0.00	54.00	225.00	43.00	29.00
Kanyari	344	148	0.00	52.00	155.00	120.00	17.00
Bhatgawan	359	219	0.00	18.00	243.00	59.00	39.00
Kansa	481	231	0.00	29.00	360.00	64.00	28.00
Gobri	589	345	0.00	44.00	422.00	53.00	70.00
Karuwa	632	300	0.00	125.00	350.00	129.00	28.00
Kartaha	347	208	0.00	72.00	186.00	75.00	14.00
Bheda	1144	390	53.00	60.00	834.00	149.00	48.00
Karsara	149	73	0.00	2.00	112.00	22.00	13.00
Gobariya	230	76	0.00	0.00	205.00	8.00	17.00
Bathiya	789	265	0.00	53.00	384.00	172.00	180.00
Karaundi Dubey	263	123	0.00	62.00	162.00	13.00	26.00
Tamoriya	198	3	0.00	55.00	88.00	41.00	14.00
Chapna	364	213	0.00	75.00	229.00	24.00	36.00
Karaundi Jahila	174	38	0.00	72.00	79.00	8.00	15.00
Jamtal	407	259	0.00	160.00	174.00	41.00	32.00
Kanchanpur	440	271	0.00	170.00	157.00	47.00	66.00
Rigra	556	329	0.00	102.00	357.00	52.00	45.00

Dubehi	285	218	0.00	40.00	206.00	11.00	28.00
Katiya Khurd	141	41	0.00	24.00	93.00	5.00	19.00
Jariyari	2215	866	581.00	253.00	1178.00	106.00	97.00
Narwar Kalan	462	168	238.00	35.00	158.00	11.00	20.00
Karaundi Kapnadan	590	277	0.00	41.00	176.00	86.00	287.00
Nadan Sharda Prasad	600	456	0.00	133.00	328.00	90.00	49.00
Nadan Shiva Prasad	488	325	0.00	78.00	386.00	1.00	23.00
Jarua Narwar	100	119	0.00	34.00	60.00	2.00	4.00
Khudara	125	49	0.00	28.00	91.00	0.00	6.00
Sirmili	144	41	0.00	26.00	115.00	0.00	3.00
Barahiya	344	376	0.00	51.00	274.00	19.00	0.00
Jura	612	513	0.00	117.00	420.00	20.00	55.00
Kharaundhi	150	49	0.00	45.00	89.00	7.00	9.00
Madai	1396	428	670.00	128.00	232.00	172.00	194.00
Barkula	701	202	95.00	139.00	261.00	174.00	32.00

Annexure III

Greenbelt Development Plan

Annexure III

Greenbelt Development Plan

Greenbelt Development Plan:

The plantation matrix adopted for the green belt development includes pits of 0.3m x 0.3m x 0.3m m size with the spacing of 2.0 m x 2.0m. In addition, earth filling and manure may also be required for the proper nutritional balance and nourishment of the sapling. It is also recommended that the plantation has to be taken randomly and the landscaping aspects could be taken into consideration.

Afforestation work has already been done at the mine overburden dumps, along dumper haulage roads, old quarry, avenue plantation, colony and in the plant premises and along the plant boundary as a part of an ongoing programme. In the dump soil samples were collected and then soil samples were collected and then soil types were identified as chocolate brown clay and yellowish brown clay contaminated with limestone / sandstone particles.

For the purpose of pollution attenuation green belt shall be developed in three tires as stated below.

First Tire:- Shrub species having good level of air pollution tolerance limits, which is referred to as tolerance zone.

1. Broken or interrupted e.g. palm varieties in between the shrub species at regular intervals in the first tire.
2. Dropping canopy e.g. Polyalthiya longifloia.

Second tire:- Trees having fast growth potential with conical canopy called dispersion zone.

1. Round type e.g. Ficus species
2. Flat topped canopy e.g. Cassia fistula.

Third tire:- These having hairy leaves, thick and round canopy called as absorption zone.

1. Cylindrical type e.g. dalbergia species would be planted in between the trees in the third tire.
2. Chimney type e.g. Eucalyptus species outer rows of the third tire.
3. Conical type e.g. Casuarina, peripheral rows of the third tire.

➔ **Selection criteria of plant species for green belt development plan**

The selection of plant species for the development depends on various factors such as climate, elevation an soil. Area falls under the tropical region and thus the plants that area adapted to these conditions should b selected. The plant should exhibit following characteristics in order to be selected for plantation.

- The species should be fast growing and providing optimum penetrability.
- The species should be wind firm and deep rooted.
- The species should form a deep canopy.
- As for as possible, the species should be indigenous and locally available.
- Unit shall plant at least 1500-2000 saplings per Ha with local species.
- The species tolerance to air pollutants like SPM, SO_2 and NOX should be preferred.
- The species should be permeable to help create air turbulence and mixing within the belt.
- There should be no large gaps foe the air to spill through.

- Tree with high foliage density, leaves with larger leaf area and hairy on boith the surface.
- Ability to with stand conditions like inundation and drought.
- Soil improving plant (Nitrogen fixing, rapidly decomposable leaf litter).
- Attractive appearances with good flowering and fruit bearing.
- Bird and insect attracting tree saplings.
- Sustainable green cover with minimal maintenance.

➔ **Proposed plantation around the mining area:-**

The selection of plant species for plantation around the mining area needs to provide special attention. The priority should be given to local / indigenous species, which can support the local fauna. The main aim of plantation in the mined out areas is to stabilize the land to protect it from rain and wind erosion. As the leftover working area shall contain broken material and fine particles, stabilization against wind erosion is also a must. Plantation scheme broadly covers the following areas:

- Green belt around peripherals portions of mine and other built up structures.
- Afforestation of barren areas in the lease hold.
- Gardens, parks and haul road plantation.
- Plantation by way of reclamation / rehabilitation of mined out blocks.

Apart from the green belt and aesthetic plantations for fugitive emissions and noise control, all other massive plantation efforts shall be executed with the assistance and co-operation of the local community

➔ **Plantations species:** The plantation species shall be considered based on the following things.

- Adaptation to the geo-climatic conditions of the area.
- Mix of round, spreading, oblong and conical canopies.
- Different height ranging from 4m to 20m.
- Preferably evergreen trees.
- Fast growing trees.
- A thick canopy cover.
- Preferably of native origin.
- Having large leaf area index.

The different species that have history of good survival and growth under similar site conditions shall be planted. The suggested species for plantation are given below:

(1) Plant species for mine area and its boundary:-

➢ Acacia nilotica	➢ Leuciana leucocephala
➢ Albizzia species	➢ Morus indica / alba
➢ Acacia auriculiformis	➢ Prosopis species
➢ Azadirachta indicata	➢ Syzygium cuminii
➢ Annona sqamosa	➢ Tamarindous indica
➢ Bauhinia varigata	➢ Terminalia arjuna
➢ Butea monosperma	➢ Ziziphus species
➢ Cassia festula	➢ Carissa species
➢ Dalbergia sisso	➢ Feronia species
➢ Irythrina indica	➢ Phylanthus species

➢ Ficus bengalensis	➢ Madhuca species
➢ Ficus religeosa	➢ Magnifera species
➢ Grewia species	➢ Leuciana leucocephala

(2) Plant species for arresting dust:-

➢ Astonia scholaris	➢ Ficus religiosa
➢ Cassia fistula	➢ Butea monosperma
➢ Bauhinia purpuria	➢ Tamarindus indica
➢ Cassia siamea	➢ Melia azedarach
➢ Peltoferrum ferrugineum	➢ Azadirachta indica
➢ Polyalthia longifolia	➢ Terminalia arjuna

(3) Plantation to absorb sulphur dioxide (SO_2) emission:-

➢ Alstonia scholaris	➢ Poloyalthia longifolia
➢ Lagerstroemia flosreginae	➢ Terminalia arjuna
➢ Mimusops elangi	➢ Azardichta indica
➢ Albizia lebbeck	➢ Melia azedarach
➢ Ficus religiosa	➢ Poloaylthia longifolia

(4) Plantation to reduce noise pollution (for road side borders):-

➢ Alstona scholaris	➢ Polyalthia longifolia
➢ Lagerstroemia flosreginae	➢ Peltoferrum ferrugineum
➢ Mimusops elangi	➢ Cassia siamia
➢ Cassia fistula	➢ Melia azedarach
➢ Bauhinia purpuria	➢ Delonix regia
➢ Grew / tea pteridifolia	➢ Anthocephalus cadamba

➔ **Plantation schedule**

A stage wise comprehensive afforestation programme is prepared and shall be implemented. The location of the proposed green belt along with area of the green cover is given in the conceptual plan.

Environment impact & management **Ecology: Step wise cumulative plantation** **Requirements of plants for Afforestation / Reclamation**										
Year	**Un-worked area green belt**		**Backfilled area**		**Inside Dumps**		**Top soil dumps**		**Tatal**	
	Area (Ha)	**Trees**	**Area (Ha)**	**Trees**	**Area (Ha)**	**Trees**	**Area (Ha)**	**Trees**	**Area (Ha)**	**Trees**
Present	0.01	15	-	-	-	-	-	-	0.01	15
2009-2013	0.4	600	-	-	-	-	-	-	0.5	600
2014-2018	0.4	600	0.5	750	-	-	-	-	0.9	1350
2019-2023	0.4	600	0.5	750	-	-	-	-	0.9	1350

2024-mine life	0.26	296	0.5	750	-	-	-	-	0.76	1046
Total	**1.47**	**2111**	**1.5**	**2250**					**2.97**	**4361**

During the course of mine and after the mining the proposed plantation is at the rate of 1500 saplings per hectare, for which the density is 1500 saplings per hectare. The total number of saplings to be planted during the entire life of mine shall be 3130 Nos. The afforestation plan for the mining lease area is given in table.

	Reclaimed mine pit area		**Afforestation other than reclaimed area**	
	Area (Ha)	**No. of saplings**	**Area (Ha)**	**No. of saplings**
Presently			0.01	10
1 to 5 years	-	-	0.25	250
5 to 10 years	0.5	750	0.25	375
10 to the end of lease period	1.0	1500	0.163	245
Total	**1.5**	**2250**	**0.673**	**880**

The plantation will be done during rainy season July to September every year. The plantation will be done on dumps, around ultimate pit limits, in quarry and open area etc. Following precautions shall be taken for survival and protection of plants.

- Plantation shall be done during rainy season.
- Inter-cultural operation like weeding, soil turning basin making.
- Organic and inorganic fertilizers shall be put for proper development of plants.
- Spraying of insecticides, pesticides and growth regulators for disease free growth of plants.
- Pruning and trimming of plants shall be done at regular intervals.
- Barbed wire fences shall be provided around plantation and any fences damaged by miscreants and cattle shall be repaired frequently to prevent the animal nuisance.
- Watchman shall be employed to prevent the cutting of trees by outsiders and also control of public movement through planted area.

Annexure IV

Environmental Status Report

Annexure IV

Half yearly Environmental Status Report

Ambient air quality level (Bhatia 9.008 Core Zone)

Location 1 - Near Drilling Site						
Sr. No.	**Month**	**Date of Monitoring**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10} ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	03.04.2013	25	54.35	5.7	14
2.		06.04.2013	37.5	48.91	6.2	13.7
3.		10.04.2013	25	54.35	7.7	15.5
4.		12.04.2013	31.5	43.48	8.1	16.5
5.	May 2013*	07.05.2013	25	43.48	6.2	8.2
6.		10.05.2013	25	32.04	6.1	8.1
7.		15.05.2013	37.5	43.48	6.2	8.2
8.		18.05.2013	25	54.35	6.3	8.3
9.	June 2013*	03.06.2013	25	43.48	5.6	7.6
10.		08.06.2013	25	38.04	5.8	7.8
11.		14.06.2013	37.5	38.04	5.8	7.8
12.		22.06.2013	37	54.43	6.8	8.8
Minimum			**25**	**32.04**	**5.6**	**7.6**
Maximum			**37.5**	**54.43**	**8.1**	**16.5**
Mean			**29.66**	**45.70**	**6.37**	**10.37**
Standard Deviation			**5.98**	**7.59**	**0.78**	**3.44**
98 Percentile			**37.5**	**54.41**	**8.01**	**16.28**
13.	July 2013**	01.07.2013 - 02.07.2013	21.62	24.24	7.5	10.5
14.		04.07.2013 - 05.07.2013	20.36	30.18	5.2	7.2
15.		08.07.2013 - 09.07.2013	24.16	29.24	5.6	7.6
16.		11.07.2013 - 12.07.2013	23.24	28.18	7.5	7.5
17.		15.07.2013 - 16.07.2013	22.36	26.36	6.2	8.2
18.		16.07.2013 - 17.07.2013	27.18	27.28	6.1	8.1
19.		22.07.2013 - 23.07.2013	24.28	26.36	6.5	8.5
20.		26.07.2013 - 27.07.2013	23.18	29.18	6.3	8.3
21.	August 2013**	02.08.2013 - 03.08.2013	22.08	24.28	6.2	8.2
22.		05.08.2013 - 06.08.2013	22.07	23.18	5.8	7.8
23.		08.08.2013 - 09.08.2013	23.84	24.76	5.7	7.8

24.		11.08.2013 - 12.08.2013	22.18	22.24	5.6	7.6
25.		15.08.2013 - 16.08.2013	22.72	23.78	6.1	8.1
26.		18.08.2013 - 19.08.2013	24.18	25.24	6.2	8.2
27.		23.08.2013 - 24.08.2013	25.18	26.18	6.1	8.1
28.		26.08.2013 - 27.08.2013	24.24	26.18	5.7	7.7
29.	Sept 2013**	02.09.2013 - 03.09.2013	20.12	22.18	5.6	7.6
30.		05.09.2013 - 06.09.2013	22.23	23.16	3.2	5.2
31.		08.09.2013 - 09.09.2013	21.36	22.78	4.8	6.8
32.		11.09.2013 - 12.09.2013	22.24	24.24	4.7	6.7
33.		14.09.2013 - 15.09.2013	23.18	25.18	4.1	6.1
34.		18.09.2013 - 19.09.2013	23.18	25.24	5.2	7.2
35.		22.09.2013 - 23.09.2013	24.21	26.18	5.3	7.3
36.		26.09.2013 - 27.09.2013	22.34	23.36	5.4	7.4
Minimum			**20.12**	**22.18**	**3.2**	**5.2**
Maximum			**27.18**	**30.18**	**7.5**	**10.5**
Mean			**22.98**	**25.38**	**5.69**	**7.65**
Standard Deviation			**1.54**	**2.23**	**0.93**	**0.96**
98 Percentile			**26.26**	**29.74**	**7.5**	**9.58**

Location 2 - Near Blasting Site						
Sr. No.	**Month**	**Date of Monitoring**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10} ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	03.04.2013	25	38.04	5.8	11.9
2.		06.04.2013	37.5	54.35	6.7	11.1
3.		10.04.2013	37.5	38.04	7.4	12.6
4.		12.04.2013	25	48.91	5.3	16.8
5.	May 2013*	07.05.2013	25	43.48	5.2	7.8
6.		10.05.2013	37.5	54.35	5.8	12.2
7.		15.05.2013	37.5	38.04	5.2	7.6
8.		18.05.2013	25	43.48	6.7	8.9
9.	June 2013*	03.06.2013	37.5	54.43	6.1	8.1
10.		08.06.2013	37.5	48.91	6.3	8.3
11.		14.06.2013	25	43.98	6.3	8.3
12.		22.06.2013	37.5	43.98	6.7	8.7
Minimum			**25**	**38.04**	**5.2**	**7.6**
Maximum			**37.5**	**54.43**	**7.4**	**16.8**
Mean			**32.29**	**45.83**	**6.12**	**10.19**
Standard Deviation			**6.43**	**6.31**	**0.69**	**2.78**
98 Percentile			**37.5**	**54.41**	**7.24**	**15.87**
13.	July 2013**	01.07.2013 - 02.07.2013	21.36	24.24	5.2	7.3
14.		04.07.2013 - 05.07.2013	24.24	28.18	5.1	7.1
15.		08.07.2013 - 09.07.2013	23.16	25.18	5.3	7.3
16.		11.07.2013 - 12.07.2013	23.18	27.24	6.2	8.2
17.		15.07.2013 - 16.07.2013	24.18	26.18	4.2	6.2
18.		16.07.2013 - 17.07.2013	25.14	26.14	4.3	6.3
19.		22.07.2013 - 23.07.2013	24.13	28.18	4.3	6.3
20.		26.07.2013 - 27.07.2013	20.18	22.24	4.8	6.8
21.	August 2013**	02.08.2013 - 03.08.2013	23.18	25.24	5.7	7.7
22.		05.08.2013 - 06.08.2013	24.24	25.24	5.1	7.1
23.		08.08.2013 - 09.08.2013	24.18	26.18	5.2	7.2
24.		11.08.2013 - 12.08.2013	23.18	24.18	5.8	7.8
25.		15.08.2013 - 16.08.2013	22.18	23.18	5.7	7.7
26.		18.08.2013 - 19.08.2013	22.74	23.18	6.3	8.3
27.		23.08.2013 - 24.08.2013	23.26	24.24	6.3	8.3

28.		26.08.2013 - 27.08.2013	24.18	25.78	6.2	8.2
29.	Sept 2013**	02.09.2013 - 03.09.2013	23.21	25.16	6.2	8.2
30.		05.09.2013 - 06.09.2013	24.18	26.24	5.1	7.2
31.		08.09.2013 - 09.09.2013	22.36	23.16	3.4	5.4
32.		11.09.2013 - 12.09.2013	23.36	24.24	4.1	6.1
33.		14.09.2013 - 15.09.2013	22.78	23.78	4.2	6.2
34.		18.09.2013 - 19.09.2013	23.24	24.12	4.5	6.3
35.		22.09.2013 - 23.09.2013	21.36	22.36	5.1	7.1
36.		26.09.2013 - 27.09.2013	22.24	24.12	5.3	7.3
Minimum			**20.18**	**22.24**	**3.4**	**5.4**
Maximum			**25.14**	**28.18**	**6.3**	**8.3**
Mean			**23.14**	**24.91**	**5.15**	**7.15**
Standard Deviation			**1.13**	**1.63**	**0.80**	**0.81**
98 Percentile			**24.72**	**28.18**	**6.3**	**8.3**

Location 3 - Near Haulage Road						
Sr. No.	**Month**	**Date**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10}($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	03.04.2013	37.5	54.35	7.2	15.1
2.		06.04.2013	25	18.91	7.1	13.6
3.		10.04.2013	37.5	54.35	6.9	12.7
4.		12.04.2013	37.5	43.48	5.3	11.4
5.	May 2013*	07.05.2013	25	43.48	5.8	7.2
6.		10.05.2013	37.5	38.04	5.7	7.7
7.		15.05.2013	25	32.4	8.3	10.2
8.		18.05.2013	37.5	43.48	6.2	8.3
9.	June 2013*	03.06.2013	25	43.48	5.8	7.8
10.		08.06.2013	25	32.47	6.7	8.7
11.		14.06.2013	25	32.47	5.8	7.8
12.		22.06.2013	25	32.47	6.8	8.8
Minimum			**25**	**18.91**	**5.3**	**7.2**
Maximum			**37.5**	**54.35**	**8.3**	**15.1**
Mean			**30.21**	**39.12**	**6.46**	**9.94**
Standard Deviation			**6.43**	**10.12**	**0.85**	**2.64**
98 Percentile			**37.5**	**54.35**	**8.05**	**14.77**
13.	July 2013**	01.07.2013 - 02.07.2013	21.18	24.24	5.6	7.6
14.		04.07.2013 - 05.07.2013	20.17	22.13	5.7	7.5
15.		08.07.2013 - 09.07.2013	21.32	22.36	5.4	7.4
16.		11.07.2013 - 12.07.2013	24.16	25.18	5.7	7.7
17.		15.07.2013 - 16.07.2013	21.36	24.24	6.2	8.2
18.		16.07.2013 - 17.07.2013	20.18	23.18	6.5	8.5
19.		22.07.2013 - 23.07.2013	19.24	20.18	4.5	6.5
20.		26.07.2013 - 27.07.2013	18.8	22.24	5.7	7.5
21.	August 2013**	02.08.2013 - 03.08.2013	21.24	22.24	7.2	9.2
22.		05.08.2013 - 06.08.2013	20.18	21.36	5.3	7.3
23.		08.08.2013 - 09.08.2013	20.36	21.78	5.2	7.1
24.		11.08.2013 - 12.08.2013	21.36	22.28	6.2	8.2
25.		15.08.2013 - 16.08.2013	19.24	20.36	6.7	8.7
26.		18.08.2013 - 19.08.2013	19.78	20.74	6.1	8.1
27.		23.08.2013 - 24.08.2013	20.78	21.24	5.3	7.3

28.		26.08.2013 - 27.08.2013	21.74	23.18	74.9	6.9
29.	Sept 2013**	02.09.2013 - 03.09.2013	20.18	21.24	3.2	4.8
30.		05.09.2013 - 06.09.2013	21.26	22.18	3.1	4.1
31.		08.09.2013 - 09.09.2013	19.36	20.3.6	4.2	6.2
32.		11.09.2013 - 12.09.2013	19.24	20.24	4.1	6.1
33.		14.09.2013 - 15.09.2013	18.24	19.18	4.3	6.3
34.		18.09.2013 - 19.09.2013	19.24	20.36	4.1	5.9
35.		22.09.2013 - 23.09.2013	21.24	21.28	4.2	5.7
36.		26.09.2013 - 27.09.2013	22.18	23.38	4.3	6.1
Minimum			**18.24**	**19.18**	**3.1**	**4.1**
Maximum			**24.16**	**25.18**	**74.9**	**9.2**
Mean			**20.50**	**21.94**	**8.07**	**7.03**
Standard Deviation			**1.29**	**1.48**	**14.27**	**1.23**
98 Percentile			**23.24**	**24.76**	**43.75**	**8.97**

Location 4 - Near Mine Office						
Sr. No.	**Month**	**Date**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10} ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	03.04.2013	25	48.91	7.3	11.5
2.		06.04.2013	37.5	54.35	7.8	14.3
3.		10.04.2013	25	43.48	7.4	14.1
4.		12.04.2013	37.5	48.91	6.4	12.1
5.	May 2013*	07.05.2013	25	38.04	6.2	8.2
6.		10.05.2013	25	32.47	6.8	8.8
7.		15.05.2013	25	32.47	5.2	8
8.		18.05.2013	25	32.47	5.1	8.1
9.	June 2013*	03.06.2013	25	43.48	7.2	9.2
10.		08.06.2013	37.5	38.04	6.2	8.2
11.		14.06.2013	25	38.04	5.8	7.8
12.		22.06.2013	25	43.48	5.8	7.8
Minimum			**25**	**32.47**	**5.1**	**7.8**
Maximum			**37.5**	**54.35**	**7.8**	**14.3**
Mean			**28.12**	**41.17**	**6.43**	**9.84**
Standard Deviation			**5.65**	**7.17**	**0.87**	**2.47**
98 Percentile			**37.5**	**53.15**	**7.71**	**14.25**
13.	July 2013**	01.07.2013 - 02.07.2013	21.24	23.24	4.5	6.5
14.		04.07.2013 - 05.07.2013	19.18	21.36	6.2	8.2
15.		08.07.2013 - 09.07.2013	18.24	20.18	3.2	5.2
16.		11.07.2013 - 12.07.2013	20.36	19.58	5.1	7.1
17.		15.07.2013 - 16.07.2013	21.36	18.26	5.4	7.8
18.		16.07.2013 - 17.07.2013	22.24	18.36	4.9	7.3
19.		22.07.2013 - 23.07.2013	22.18	19.38	5.8	7.8
20.		26.07.2013 - 27.07.2013	23.78	20.18	3.8	7.1
21.	August 2013**	02.08.2013 - 03.08.2013	18.24	20.18	6.2	8.2
22.		05.08.2013 - 06.08.2013	19.36	20.74	5.1	7.1
23.		08.08.2013 - 09.08.2013	18.78	20.12	5.4	7.4
24.		11.08.2013 - 12.08.2013	19.18	20.46	5.8	7.8
25.		15.08.2013 - 16.08.2013	19.78	20.18	5.7	7.7
26.		18.08.2013 - 19.08.2013	19.76	20.74	5.6	7.6
27.		23.08.2013 - 24.08.2013	20.18	21.28	5.2	7.2

28.		26.08.2013 - 27.08.2013	21.24	22.78	4.8	6.8
29.	Sept 2013**	02.09.2013 - 03.09.2013	18.21	19.24	6.1	8.1
30.		05.09.2013 - 06.09.2013	19.36	20.34	5.1	7.1
31.		08.09.2013 - 09.09.2013	19.58	20.18	5.2	7.2
32.		11.09.2013 - 12.09.2013	21.24	21.78	5.3	7.3
33.		14.09.2013 - 15.09.2013	22.36	23.24	4.2	6.2
34.		18.09.2013 - 19.09.2013	21.78	22.36	4.8	6.8
35.		22.09.2013 - 23.09.2013	21.24	22.18	4.7	6.7
36.		26.09.2013 - 27.09.2013	22.18	23.24	4.1	6.1
Minimum			**18.21**	**18.26**	**3.2**	**5.2**
Maximum			**23.78**	**23.24**	**6.2**	**8.2**
Mean			**20.46**	**20.81**	**5.09**	**7.17**
Standard Deviation			**1.53**	**1.45**	**0.75**	**0.71**
98 Percentile			**23.12**	**23.24**	**6.2**	**8.2**

Ambient air quality level (Bhatia 9.008 Buffer Zone)

Location 1 - Village Bhatia						
Sr. No.	**Month**	**Date of Monitoring**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10} ($\mu g/m^3$)**	**SO_2($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	05.04.2013	25	38.04	5.8	14
2.		08.04.2013	37.5	54.35	6.7	13.7
3.		18.04.2013	37.5	38.04	6.8	15.5
4.		20.04.2013	25	48.91	8.1	16.5
5.	May 2013*	08.05.2013	25	43.48	6.8	8.8
6.		11.05.2013	25	32.04	5.3	7.3
7.		16.05.2013	25	38.04	7.8	9.8
8.		20.05.2013	25.5	38.04	7.1	9.1
9.	June 2013*	04.06.2013	25	38.4	5.7	7.7
10.		10.06.2013	37.5	38.04	5.2	7.2
11.		18.06.2013	25	38.04	6.3	8.3
12.		22.06.2013	25	32.04	6.7	8.7
Minimum			**25**	**32.04**	**5.2**	**7.2**
Maximum			**37.5**	**54.35**	**8.1**	**16.5**
Mean			**28.16**	**39.78**	**6.52**	**10.55**
Standard Deviation			**5.63**	**6.39**	**0.91**	**3.38**
98 Percentile			**37.5**	**53.15**	**8.03**	**16.28**
13.	July 2013**	02.07.2013 - 03.07.2013	21.36	22.18	7.5	10.5
14.		05.07.2013 - 06.07.2014	21.36	23.23	6.2	8.2
15.		09.07.2013 - 10.07.2015	20.18	24.18	6.5	8.5
16.		12.07.2013 - 13.07.2016	20.32	22.17	6.3	8.3
17.		18.07.2013 - 19.07.2017	20.18	24.36	6.7	8.7
18.		22.07.2013 - 23.07.2018	19.24	23.24	5.2	7.2
19.		25.07.2013 - 26.07.2019	20.78	24.24	5.4	7.4
20.		28.07.2013 - 29.07.2020	20.42	23.18	5	7
21.	August 2013**	02.08.2013 - 03.08.2013	20.24	21.36	5.2	7.2
22.		05.08.2013 - 06.08.2013	21.36	22.24	5.3	7.3
23.		08.08.2013 - 09.08.2013	21.24	21.78	5.2	7.2
24.		11.08.2013 - 12.08.2013	20.18	21.18	5.1	7.1
25.		15.08.2013 - 16.08.2013	19.36	20.24	4.8	7.8

26.		18.08.2013 - 19.08.2013	18.24	19.36	4.9	6.9
27.		23.08.2013 - 24.08.2013	18.78	19.24	4.7	6.7
28.		26.08.2013 - 27.08.2013	20.18	21.24	4.5	6.5
29.	Sept 2013**	03.09.2013 - 04.09.2013	21.36	22.18	4.2	6.2
30.		06.09.2013 - 07.09.2013	19.24	20.24	4.3	6.3
31.		09.09.2013 - 10.09.2013	18.18	19.18	4.8	6.8
32.		12.09.2013 - 13.09.2013	19.15	20.15	4.2	6.2
33.		16.09.2013 - 17.09.2013	21.18	22.36	4.1	6.1
34.		19.09.2013 - 20.09.2013	19.36	20.58	5.1	7.1
35.		23.09.2013 - 24.09.2013	20.24	21.54	5.2	7.2
36.		27.09.2013 - 28.09.2013	21.36	22.78	5.7	7.7
Minimum			**18.18**	**19.18**	**4.1**	**6.1**
Maximum			**21.36**	**24.36**	**7.5**	**10.5**
Mean			**20.14**	**21.76**	**5.25**	**7.33**
Standard Deviation			**1.01**	**1.55**	**0.85**	**0.98**
98 Percentile			**21.36**	**24.30**	**7.13**	**9.67**

Location 2 - Village Jhal						
Sr. No.	**Month**	**Date of Monitoring**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10} ($\mu g/m^3$)**	**SO_2($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	05.04.2013	25	54.35	5.7	14
2.		08.04.2013	37.5	48.91	6.2	13.7
3.		18.04.2013	25	43.18	7.7	15.5
4.		20.04.2013	37.5	43.48	8.1	16.5
5.	May 2013*	08.05.2013	25	43.48	7.2	9.2
6.		11.05.2013	25	32.04	6.1	8.1
7.		16.05.2013	25	32.04	6.3	8.3
8.		20.05.2013	25	43.48	6.2	8.2
9.	June 2013*	04.06.2013	25	43.48	6.2	8.2
10.		10.06.2013	25	38.04	6.4	8.4
11.		18.06.2013	25	38.04	7.3	9.3
12.		22.06.2013	25	38.04	5.8	7.8
Minimum			**25**	**32.04**	**5.7**	**7.8**
Maximum			**37.5**	**54.35**	**8.1**	**16.5**
Mean			**27.08**	**41.54**	**6.6**	**10.6**
Standard Deviation			**4.86**	**6.42**	**0.77**	**3.29**
98 Percentile			**37.5**	**53.15**	**8.01**	**16.28**
13.	July 2013**	02.07.2013 - 03.07.2013	20.28	23.18	5.2	7.2
14.		05.07.2013 - 06.07.2014	21.36	23.24	5.6	7.6
15.		09.07.2013 - 10.07.2015	22.18	23.12	5.7	7.7
16.		12.07.2013 - 13.07.2016	23.78	24.24	5.8	7.8
17.		18.07.2013 - 19.07.2017	24.36	25.18	5.6	7.6
18.		22.07.2013 - 23.07.2018	20.28	21.36	5.2	7.2
19.		25.07.2013 - 26.07.2019	21.36	22.24	5.6	7.6
20.		28.07.2013 - 29.07.2020	20.24	21.38	7.2	10.2
21.	August 2013**	02.08.2013 - 03.08.2013	20.24	24.18	4.2	6.2
22.		05.08.2013 - 06.08.2013	19.18	21.24	4.3	6.3
23.		08.08.2013 - 09.08.2013	19.76	20.78	5.3	7.3
24.		11.08.2013 - 12.08.2013	20.18	21.36	5.2	7.2
25.		15.08.2013 - 16.08.2013	18.24	22.24	5.3	7.3
26.		18.08.2013 - 19.08.2013	19.36	20.18	5.7	7.7

27.		23.08.2013 - 24.08.2013	20.18	21.36	5.6	7.6
28.		26.08.2013 - 27.08.2013	21.24	22.18	5.1	7.1
29.	Sept 2013**	03.09.2013 - 04.09.2013	23.24	23.36	4.2	6.2
30.		06.09.2013 - 07.09.2013	21.36	21.56	4.5	6.5
31.		09.09.2013 - 10.09.2013	19.24	20.32	4.1	6.1
32.		12.09.2013 - 13.09.2013	20.18	21.58	4.2	6.2
33.		16.09.2013 - 17.09.2013	21.78	22.98	5.1	7.1
34.		19.09.2013 - 20.09.2013	20.14	21.56	5.3	7.3
35.		23.09.2013 - 24.09.2013	20.36	21.38	5.7	7.7
36.		27.09.2013 - 28.09.2013	20.36	21.18	5.1	7.2
Minimum			**18.24**	**20.18**	**4.1**	**6.1**
Maximum			**24.36**	**25.18**	**7.2**	**10.2**
Mean			**20.78**	**22.14**	**5.2**	**7.24**
Standard Deviation			**1.46**	**1.28**	**0.70**	**0.85**
98 Percentile			**24.09**	**24.74**	**6.55**	**9.14**

Location 3 - Village Silmili						
Sr. No.	**Month**	**Date**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10}($\mu g/m^3$)**	**SO_2($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	05.04.2013	37.5	54.35	7.2	15.1
2.		08.04.2013	25	48.91	7.1	13.6
3.		18.04.2013	37.5	54.35	6.9	12.7
4.		20.04.2013	37.5	54.35	7	13
5.	May 2013*	08.05.2013	25	32.04	7.3	10.3
6.		11.05.2013	25	32.04	7.3	10.2
7.		16.05.2013	25	32.04	7.4	10.4
8.		20.05.2013	25	32.04	5.1	7.1
9.	June 2013*	04.06.2013	25	43.48	6.4	8.4
10.		10.06.2013	25	38.04	6.2	8.2
11.		18.06.2013	25	32.04	5.6	7.6
12.		22.06.2013	25	32.04	5.2	7.2
Minimum			25	32.04	5.1	7.1
Maximum			37.5	54.35	7.4	15.1
Mean			28.12	40.47	6.55	10.31
Standard Deviation			5.65	9.95	0.84	2.73
98 Percentile			37.5	54.35	7.37	14.77
13.	July 2013**	02.07.2013 - 03.07.2013	19.24	21.24	4.5	6.5
14.		05.07.2013 - 06.07.2014	18.17	22.36	5.6	7.6
15.		09.07.2013 - 10.07.2015	19.38	22.18	5.8	7.8
16.		12.07.2013 - 13.07.2016	19.78	23.24	6.8	8.8
17.		18.07.2013 - 19.07.2017	20.36	20.78	4.3	6.5
18.		22.07.2013 - 23.07.2018	20.78	24.3	4.2	6.2
19.		25.07.2013 - 26.07.2019	20.36	23.24	4.6	6.6
20.		28.07.2013 - 29.07.2020	20.28	26.18	4.8	6.8
21.	August 2013**	02.08.2013 - 03.08.2013	19.24	20.18	5.2	7.2
22.		05.08.2013 - 06.08.2013	18.36	19.36	5.1	7.1
23.		08.08.2013 - 09.08.2013	19.78	20.24	5.3	7.3
24.		11.08.2013 - 12.08.2013	20.18	21.36	4.8	6.8
25.		15.08.2013 - 16.08.2013	21.36	21.78	4.7	6.7
26.		18.08.2013 - 19.08.2013	21.24	22.24	4.9	6.9

27.		23.08.2013 - 24.08.2013	21.36	22.74	4.1	6.1
28.		26.08.2013 - 27.08.2013	20.58	21.78	4.3	6.3
29.	Sept 2013**	03.09.2013 - 04.09.2013	19.16	20.14	3.8	4.8
30.		06.09.2013 - 07.09.2013	18.37	19.32	4.2	5.2
31.		09.09.2013 - 10.09.2013	19.15	20.15	4.1	5.1
32.		12.09.2013 - 13.09.2013	19.24	20.16	4.6	6.6
33.		16.09.2013 - 17.09.2013	19.78	20.28	3.8	4.8
34.		19.09.2013 - 20.09.2013	20.32	21.36	4.5	6.5
35.		23.09.2013 - 24.09.2013	21.18	21.78	4.8	6.8
36.		27.09.2013 - 28.09.2013	20.74	20.98	4.7	6.7
Minimum			**18.17**	**19.32**	**3.8**	**4.8**
Maximum			**21.36**	**26.18**	**6.8**	**8.8**
Mean			**19.93**	**21.55**	**4.72**	**6.57**
Standard Deviation			**0.95**	**1.61**	**0.67**	**0.92**
98 Percentile			**21.36**	**25.31**	**6.34**	**8.34**

Location 4 - Village Karsara						
Sr. No.	**Month**	**Date**	**$PM_{2.5}$ ($\mu g/m^3$)**	**PM_{10} ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**NO_X ($\mu g/m^3$)**
1.	April 2013*	05.04.2013	25	48.91	7.3	11.5
2.		08.04.2013	37.5	54.35	7.8	14.3
3.		18.04.2013	25	43.48	7.4	14.1
4.		20.04.2013	37.5	48.91	6.1	12.1
5.	May 2013*	08.05.2013	25	32.04	4.6	6.6
6.		11.05.2013	37.5	32.04	6.4	8.4
7.		16.05.2013	25	32.04	7.1	9.1
8.		20.05.2013	25	32.04	7.1	9.1
9.	June 2013*	04.06.2013	25	38.04	6.3	8.3
10.		10.06.2013	37.5	38.04	6.4	8.4
11.		18.06.2013	25	32.47	5.1	7.1
12.		22.06.2013	25	32.47	5.8	7.8
Minimum			**25**	**32.04**	**4.6**	**6.6**
Maximum			**37.5**	**54.35**	**7.8**	**14.3**
Mean			**29.16**	**38.73**	**6.45**	**9.73**
Standard Deviation			**6.15**	**8.15**	**0.95**	**2.62**
98 Percentile			**37.5**	**53.15**	**7.71**	**14.25**
13.	July 2013**	02.07.2013 - 03.07.2013	21.36	23.18	5.3	7.2
14.		05.07.2013 - 06.07.2014	22.18	24.24	5.7	7.4
15.		09.07.2013 - 10.07.2015	19.36	24.18	5.8	7.8
16.		12.07.2013 - 13.07.2016	20.18	23.18	5.6	7.6
17.		18.07.2013 - 19.07.2017	20.24	23.18	5.7	7.7
18.		22.07.2013 - 23.07.2018	21.36	24.17	5.1	7.1
19.		25.07.2013 - 26.07.2019	21.18	22.36	5.3	7.2
20.		28.07.2013 - 29.07.2020	21.78	23.15	5.2	7.3
21.	August 2013**	02.08.2013 - 03.08.2013	19.24	21.76	4.3	6.3
22.		05.08.2013 - 06.08.2013	18.36	21.36	4.1	6.1
23.		08.08.2013 - 09.08.2013	19.38	22.24	4.7	6.7
24.		11.08.2013 - 12.08.2013	20.24	20.78	4.6	6.6
25.		15.08.2013 - 16.08.2013	21.24	22.18	4.2	6.2
26.		18.08.2013 - 19.08.2013	21.84	22.58	5.3	6.8

27.		23.08.2013 - 24.08.2013	21.28	22.46	5.4	6.4
28.		26.08.2013 - 27.08.2013	20.58	20.89	4.1	6.1
29.	Sept 2013**	03.09.2013 - 04.09.2013	19.24	21.36	5.1	7.1
30.		06.09.2013 - 07.09.2013	20.16	21.24	4.8	6.8
31.		09.09.2013 - 10.09.2013	18.36	19.54	4.7	6.7
32.		12.09.2013 - 13.09.2013	17.58	18.12	4.3	6.3
33.		16.09.2013 - 17.09.2013	18.57	19.14	4.2	6.2
34.		19.09.2013 - 20.09.2013	19.36	20.36	5.2	7.2
35.		23.09.2013 - 24.09.2013	18.24	19.74	5.1	7.1
36.		27.09.2013 - 28.09.2013	19.18	21.24	5.3	7.3
Minimum			17.58	18.12	4.1	6.1
Maximum			22.18	24.24	5.8	7.8
Mean			20.02	21.77	4.96	6.88
Standard Deviation			1.31	1.63	0.54	0.52
98 Percentile			22.02	24.21	5.75	7.75

* 8 Hours Basis

** 24 Hours Basis