

**DRAFT ENVIRONMENTAL IMPACT  
ASSESSMENT REPORT  
&  
ENVIRONMENTAL MANAGEMENT PLAN**

**FOR**

**EXPANSION OF RAWAN-JHIPAN LIMESTONE MINE  
(ML AREA - 722.834 HECTARES)  
LIMESTONE PRODUCTION CAPACITY  
FROM 2.8 MTPA TO 7.5 MTPA**

**AT**

**VILLAGE - RAWAN  
TEHSIL - SIMGA  
DISTRICT - RAIPUR (CHHATTISGARH)**

**STUDY PERIOD : WINTER SEASON  
(DECEMBER-2009 TO FEBRUARY-2010)**

**APPLICANT**



**M/s. GRASIM INDUSTRIES LTD.**

**(UNIT: GRASIM CEMENT - RAIPUR),  
P.O. GRASIM VIHAR, VILLAGE-RAWAN,  
DISTT. : RAIPUR - 493196 (CHHATTISGARH)**

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## **B. EIA REPORT**

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**No. J-11015/ 17/2009- IA. II(M)**  
**Government of India**  
**Ministry of Environment & Forests**

Tel no. 24363973

E mail: [plahujarai@yahoo.com](mailto:plahujarai@yahoo.com)

Paryavaran Bhavan, C.G.O. Complex,  
Lodi Road, New Delhi-110003.

Dated the October 26, 2009

To

The Asst. Vice President (Mine)  
M/s Grasim Cement,  
B-23, Ravi Nagar, Pandri,  
Jeevan Bima Marg, Raipur(C G) 492004

Fax no. 07726-288215

E mail: [gramsimcement@adityabirla.com](mailto:gramsimcement@adityabirla.com)

**Sub: Expansion of captive Rawan Jhipan Limestone mine of M/s Grasim Cement, Village Rawan, District Raipur in Chhattisgarh (2.8 MTPA to 7.5 MTPA)- reg amendment in TOR.**

Sub:

This is to inform that the proposal was considered by the Expert Appraisal Committee-2(Mining) during its 1<sup>st</sup> meeting held during 29-30<sup>th</sup> September, 2009 for determination of the Terms of Reference(TORs) for undertaking detailed EIA study in accordance with the provisions of the Environmental Impact Assessment Notification dated 14<sup>th</sup> September, 2006.

2. The Committee has suggested following specific Terms of Reference (TORs) for preparation of the Environmental Impact Assessment (EIA) report and Environment Management Plan (EMP), in respect of your above mentioned project.

- i) Executive summary of the project indicating relevant details shall be provided and issues raised in public hearing along with action plan to address the same shall be provided in tabular form including requisite allocation of funds.
- ii) Detail contact address of the project proponent including telephone numbers, e-mail ID etc shall be provided. Request for consideration for environmental clearance or any other communication regarding the project shall be made by the project proponent/ authorised person and not by its legal representative / consultant.
- iii) A copy of lease deed allocated (lease execution) in the name of the company shall be provided along with mining plan (including progressive mine closure plan).
- iv) Exact coordinates of the mine location shall be indicated
- v) Status of compliance to environmental clearance accorded for 2.8 MTPA shall be submitted.
- vi) Layout plan indicating break-up of lease area indicating area for excavation for mining, waste dump, mineral storage, top soil storage, green belt, infrastructure and roads shall be provided

- vii) Photograph of the mine lease area, where mining activity is proposed to be undertaken shall be provided.
- viii) Satellite imagery or authenticated map indicating drainage, cropping pattern, water bodies (rivers, nallhs, ponds etc.), location of nearest villages, **national parks, wildlife sanctuaries, tiger reserves, biosphere reserves, heritage sites etc** in the core and buffer zone shall be provided.
- ix) Detailed action plan for reclamation of mined pit before working subsequent mineral bearing area shall be prepared.
- x) Action Plan for preservation of buffer zone to be maintained between two consecutive mineral bearing deposits shall be prepared.
- xi) Approved mining plan including progressive mine closure plan shall be provided along with EIA report. Letter of approval from IBM shall also be enclosed.
- xii) Detailed drawings indicating geological formation of Ores with respect to ground water table shall be submitted.
- xiii) **Action plan for identification of unskilled local youth for employment in various forms by imparting training as part of CSR activity instead of bringing skilled workers from outside shall be explored and action plan prepared.**
- xiv) Detailed action plan for demarcation and vegetation of 50 m barrier all along the side of the lease (inside the lease) facing nallahs/rivers (if any) running across or adjacent the lease shall be prepared.
- xv) Action Plan for ambient air quality monitoring shall be prepared, which shall constitute of adequate stations in core and buffer zones.
- xvi) Action plan for control of fugitive dust generation shall be prepared. The plan shall consist of schedule and methodology of monitoring of fugitive dust emission at locations of nearest human habitation (including schools and other public amenities located nearest to sources of dust generation as applicable).
- xvii) Detailed plan for raising Shelter belt i.e Wind Break of 30 m width and consisting of at least 5 tiers around lease facing the human habitation / agricultural fields (if any in the vicinity) etc. shall be submitted.
- xviii) A scientific mining scheme for every 5 years for the life of the mine shall be prepared.
- xix) Scheme for Rain water harvesting including road map for mplementation shall be prepared.
- xx) Action plan for maintenance of village roads through which transportation of ores are undertaken to be carried out by the company regularly at its own expenses shall be prepared.
- xxi) Measures for prevention and control of soil erosion and management of silt shall be prepared. Assessment of total silt load likely to be generated shall be carried out. Proposal for protection of dumps against erosion by geo textile matting or other suitable material and plantations of native trees and shrubs at the dump slopes shall be prepared.
- xxii) Trenches/ garland drains proposed to be constructed at foot of dumps and installation of materials like coco filters at regular intervals to arrest silt from being carried to water bodies shall be prepared. Proposal for adequate number of Check Dams and Gully Plugs proposed to be constructed across seasonal / perennial nallahs (if any) flowing through the ML area shall be prepared. De-silting schedule at regular intervals shall be also provided.

- xxiii) Private land owners profile from whom surface rights or other wise land has been acquired (if any) shall be provided along with compensation package formulated for sustainable livelihood.
- xxiv) Land-use pattern of the nearby villages shall be studied, including identification of common property resources available for conversion into productive land and action plan for abatement and compensation for damage to agricultural land/ common property land (if any) in the nearby villages, due to mining activity shall be prepared.
- xxv) Need based assessment for the near by villages shall be conducted to study economic measures which can help in upliftment of poor section of society. Income generating projects consistent with the traditional skills of the people besides development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such programme. This will be in addition to vocational training for individuals imparted to take up self employment and jobs. Separate budget for community development activities and income generating programmes shall be specified.
- xxvi) Implementation of 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 mineral dust etc. shall be prepared, including record keeping procedures. Awareness programme for workers on impact of mining on their health and precautionary measures like use of personal equipments etc. to be carried periodically shall also be submitted.
- xxvii) Green belt development and selection of plant species shall be as per CPCB guidelines. Herbs and shrubs shall also form a part of afforestation programme besides tree plantation. Details of year wise afforestation programme including rehabilitation of mined out area shall be prepared.
- xxviii) The questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall be filled up and submitted in complete.

Besides the above, the below mentioned general points will also to be followed:-

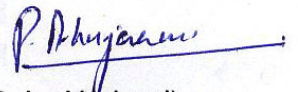
- a) All documents to be properly referenced with index, page numbers and continuous page numbering.
- b) Where data are presented in the report especially in tables, the period in which the data were collected and the sources should be indicated.
- c) Where the documents provided in a language other than English, an English translation should be provided.
- d) Approved mine plan along with copy of the approval letter for the proposed capacity should also be submitted.
- e) While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II(I) dated 4<sup>th</sup> August, 2009, which are available on the website of this Ministry should also be followed.

3. The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.



4. The above specific Terms of Reference (TOR), if not already mentioned in the model TOR, shall be addressed by the proponent. The specific TORs shall be incorporated in the Draft EIA/EMP report. The draft EIA report shall be submitted to the State Pollution Control Board for conducting public hearing . The final EIA report along with the issues raised during the public hearing and response of the project proponent in tabular form shall be thereafter submitted to the Ministry along with requisite documents for appraisal by the EAC-2 (Mining) for consideration of environmental clearance in accordance with the provisions of the EIA notification dated September 14, 2006.

Yours faithfully,



(Dr.P. L. Ahujarai)  
Director

Copy to: The Chairman, Chhattisgarh Environment Conservation Board, Nanak Niwas, Civil Lines, Raipur, Chhattisgarh.

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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### **ToR REPLY**

**With reference to the information/ToR desired vide letter no. J-11015/17/2009-IA II (M) dated 26<sup>th</sup> Oct, 2009 for the Expansion of Captive Rawan Jaipan Limestone Mine (from 2.8 MTPA to 7.5 MTPA) of M/s Grasim Cement, Village Rawan, District Raipur (Chhattisgarh), our reply and clarifications are as under:**

**Point No: i Executive Summary of the project indicating relevant details shall be provided and issues raised in public hearing along with action plan to address the same shall be provided in tabular form including requisite allocation of funds.**

**Reply:** Executive Summary of the project has been enclosed as **Annexure 1.** Public Hearing for this limestone mine has to be conducted as per the New EIA Notification 14th September 2006.

**Point No: ii Detail contact address of the project proponent including telephone numbers, e-mail ID etc shall be provided. Request for consideration for environmental clearance or any other communication regarding the project shall be made by the project proponent/ authorized person and not by its legal representative / consultant.**

**Reply :** Detailed Contact address of M/s Grasim Industries Ltd is :

M/s Grasim Cement,  
(A Unit of Grasim Industries Ltd.)  
P.O.Grassim Vihar, Village- Rawan,  
Distt. Raipur (C.G.)  
**Pin Code:** 493196  
**Telephone No:** 07726 – 288217, 288220  
**E-mail:** [vijaykumar.mali@adityabirla.com](mailto:vijaykumar.mali@adityabirla.com)

**Point No: iii A copy of lease deed allocated (lease execution) in the name of the company shall be provided along with mining plan (including progressive mine closure plan)**

**Reply :** Lease was executed on 4.12.1993 and will expire on 03.12.2013.

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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**Point No: iv Exact coordinates of the mine location shall be indicated.**

**Reply :** Exact coordinates of the mine location are as given below:

- **Latitude** : 21 °33' to 21 °35' N
- **Longitude** : 81 °58' to 82 °00" E

**Point No: v Status of compliance to environmental clearance accorded for 2.8 MTPA shall be submitted.**

**Reply :** Compliance report with reference to the environmental clearance accorded for Rawan Jhipan Limestone mine with production capacity of 2.8 MTPA by MoEF, New Delhi vide Letter No. J-11015/70/2003-IA-II (M); dated 15th April, 2005 is being submitted to the respective authorities on regular basis.

**Point No: vi Layout plan indicating break up of lease area indicating area for excavation for mining, waste dump, mineral storage, top soil storage, green belt, infrastructure, and roads shall be prepared.**

**Reply:** Present land use breakup of the lease area is given as under:

S. No.	Land Use Category	Present Land use (In ha)
1.	Top Soil Dump	2.66
2.	OB/Screen Reject Dump	28.66
3.	Excavation (Voids only)	69.71
	Reclamation (Backfilled)	1.23
	Total excavated area	70.94
4.	Road	6.28
5.	Built up area	1.72
6.	Town Ship Area	0
7.	Afforestation (Green Belt / Avenue Plantation)	91.99
8.	Mineral Storage	Nil
9.	Undisturbed area	517.904
<b>Total</b>		<b>722.834</b>

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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Surface Geological Plan indicating the same is enclosed herewith the Draft EIA/EMP Report as **Annexure 3 (A)**.

**Point No: vii Photograph of the mine lease area, where mining activity is proposed to be undertaken shall be provided.**

**Reply:** Photograph of the mine lease area, showing area to be mined out, existing green belt, reclaimed dumps, haulage roads, existing benches, garland drains, settling tank etc. are incorporated in Draft EIA/EMP Report as **Annexure 4**.

**Point No: viii Satellite Imagery or authenticated map indicating drainage, cropping pattern, water bodies (river, nallahs, ponds etc) location of nearest villages, national parks, wildlife sanctuaries, tiger reserves, biosphere reserves, heritage sites etc. in the core and buffer zone shall be provided.**

**Reply:** No national parks, wildlife sanctuaries, tiger reserves, biosphere reserves or heritage site is falling within the core zone as well as within the buffer zone.

Land use pattern of the core zone as well as buffer zone per the satellite imagery is given in the tables below:

#### LAND USE OF THE CORE ZONE

LANDUSE	AREA (in Hectares)	AREA (in %)
Water Bodies	21.746	3.01
Plantation	111.260	15.39
Crop Land	6.370	0.88
Fallow Land	1.360	0.19
Open Scrub	193.425	26.76
Vegetation	24.210	3.35
Open Waste Land	244.603	33.84
Mine Quarry	119.860	16.58
TOTAL	722.834	100.00



Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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### LAND USE OF THE BUFFER ZONE

LANDUSE	AREA (in Hectares)	AREA (in %)
Water Bodies	988.99	2.16
Plantation	460.26	1.00
Crop Land	19957.43	43.56
Fallow Land	14571.94	31.81
Industry	50.86	0.11
Human Settlement	540.50	1.18
Open Scrub	2421.97	5.29
Vegetation	98.87	0.22
Open Waste Land	6331.33	13.82
Dense Scrub	32.40	0.07
Mine Quarry	253.32	0.55
Stone Waste	105.70	0.23
<b>TOTAL</b>	<b>45813.57</b>	<b>100.00</b>

Details of the same are incorporated in Chapter III, Item no. 3.2 of Draft EIA/EMP Report.

**Point No: ix Detailed action plan for reclamation of mined out pit before working subsequent mineral bearing area shall be prepared.**

**Reply:** Action plan for reclamation of mined out pit has been prepared. Stage Wise Land Use and Reclamation Area (Ha.) is as given in the table below:

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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### LAND: STAGE WISE LAND USE AND RECLAMATION AREA (HA.)

S. No.	Land Use Category	Present	At the end of 5 <sup>th</sup> Year	At the end of life of mine
1.	Top Soil Dump	2.66	2.66	Nil
2.	OB/Screen Reject Dump	28.66	40.36	40.32
3.	Excavation (Voids only)	69.71	163.06	307.954
	Reclamation (Backfilled)	1.23	1.23	251.00
	Total excavated area	70.94	164.29	558.954
4.	Road	6.28	6.28	10
5.	Built up area	1.72	1.72	1.72
6.	Town Ship Area	0	0	0
7.	Afforestation (Green Belt /Avenue Plantation)	91.99	96.99	111.840
8.	Mineral Storage	Nil	Nil	Nil
9.	Undisturbed area	517.904	407.404	Nil
	<b>Total</b>	<b>722.834</b>	<b>722.834</b>	<b>722.834</b>

*Source: Scheme of Mining & progressive mine closure plan*

Details of the same are incorporated in Chapter IV, Item no. 4.2.4.2 of Draft EIA/EMP Report.

**Point No: x Action Plan for preservation of buffer zone to be maintained between two consecutive mineral bearing deposits shall be prepared.**

**Reply:** The mineralized zone of the proposed mine is continuous, which will be fully exploited. There will be no disturbance to any part of land beyond our ML boundary.

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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**Point No: xi Approved mining plan including progressive mine closure plan shall be provided along with EIA report. Letter of approval from IBM shall also be enclosed.**

**Reply:** Modified Scheme of Mining including progressive mine closure plan has been approved from IBM vide letter no 314 (3)/2009-MCCM (CZ)/MP/MS/PMCP-16 dated 4.12.09 for the period (2009-2014) for the enhanced limestone production capacity of 7.5 MTPA. Copy of the approval letter has been attached herewith the Draft EIA/EMP Report as **Annexure 5.**

**Point No: xii Detailed drawings indicating geological formation of Ores with respect to ground water table shall be submitted.**

**Reply:** Surface Geological Plan indicating formation of Ores & ground water table are enclosed as ***Annexure 3 (A).***

**Point No: xiii Action plan for identification of unskilled local youth for employment in various forms by imparting training as part of CSR activity instead of bringing skilled workers from outside shall be explored and action plan prepared.**

**Reply:** Action plan for identification of unskilled local youth for employment in various forms by imparting training is as under:

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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### FORMAT FOR CONDUCTION OF TRAINING PROGRAMME

TRAINING PROGRAMMES	1st Year			2nd Year			Total amount (Rs. In Lacs)
	No. of Villages	Qty	Amt	No. of Villages	Qty	Amt	
1. Short term courses for <u>skill up gradation</u> .							
2. <u>Vocational training</u> (Dairy, Poultry, bee keeping)							
3. Providing <u>training to unemployed education youth</u> in spoken English language and personality development to enable them to appear for interviews.							

**Point No: xiv Detailed action plan for demarcation and vegetation of 50 m barrier all along the side of the lease (inside the lease) facing nallahs/rivers (if any) running across or adjacent the lease shall be prepared.**

**Reply:** There is no nalla/river running either across or adjacent to the Mining lease area.

**Point No: xv Action Plan for ambient air quality monitoring shall be prepared, which shall constitute of adequate stations in core and buffer zones.**

**Reply :** Ambient air quality monitoring will be carried out as per conditions stipulated in Environmental Clearance Letter issued by MoEF, Consent issued by SPCB as well as according to CPCB guidelines. Action Plan for Ambient Air Quality Monitoring according to the revised NAAQAS dated 16.11.09, is enclosed as **Annexure 6**.

**Point No: xvi Action plan for control of fugitive dust generation shall be prepared. The plan shall consist of schedule and methodology of monitoring of fugitive dust emission at locations of nearest human habitation (including schools and**

**other public amenities located nearest to sources of dust generation as applicable).**

**Reply :** Ambient Air Quality Monitoring will be conducted on regularly basis to assess the quality of ambient air. Fugitive dust management is done by following ways; same will be followed for the proposed expansion:

### **ACTION PLAN FOR FUGITIVE DUST EMISSION**

<b>S. No.</b>	<b>Source of generation of fugitive emissions</b>	<b>Action Plan Proposed</b>
1.	Drill Operations	<ul style="list-style-type: none"> <li>DM 30 &amp; ICM 260 drills used for blast hole drilling has an inbuilt vaposal system to suppress the dust generated at the source itself.</li> <li>Drill speeds is being regulated as per manufacturer's guidelines.</li> </ul>
2.	Blasting	<ul style="list-style-type: none"> <li>Use of suitable explosives and overcharging of blast holes is avoided.</li> <li>Heavy duty (under high pressure) water spraying is done on the blasted muck pile (before loading by excavator) to suppress the dust.</li> <li>Rock breaker is used for breaking over size boulders in order to reduce dust and noise generation, which otherwise would be generated due to secondary blasting.</li> </ul>
3.	Loading / Unloading / Transportation	<ul style="list-style-type: none"> <li>Water spraying is being done on haul roads and during unloading to suppress the dust effectively.</li> <li>Dust suppression on haul roads is done by the means of two no. of water tanker of 12</li> </ul>

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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		<p>KL and 8 KL capacity. Proposal for lying of Permanent water sprinkling system on the main haul roads to crusher dump hopper is under consideration.</p> <ul style="list-style-type: none"> <li>Overloading of transport equipment is prevented in order to stop spillage.</li> <li>Development of green belt/plantation on the sides of approach roads, around office complex, and workshop area which arrests dust.</li> </ul>
4.	Crusher	<p>Water is being sprayed in the form of a fine jet to suppress the dust generated while unloading of dumpers at crusher hopper. Bag filters are also installed in the crushing circuit to suppress the dust generated while crushing and during transportation of limestone from one conveyor to other. Apart from this, curtains are also provided to cover the dump hopper so as to it can minimize the dust exposure away from the hopper.</p> <ul style="list-style-type: none"> <li>Operators and attendants are being provided with dust mask.</li> </ul>

**Source: Scheme of Mining & progressive mine closure plan**

For monitoring the effectiveness of management, fugitive dust emission monitoring would be done and details of the methodology as already been detailed in the reply of point no. xv.

**Point No: xvii Detailed plan for raising Shelter belt i.e Wind Break of 30 m width and consisting of at least 5 tiers around lease facing the human habitation / agricultural fields (if any in the vicinity) etc. shall be submitted.**

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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**Reply:** Details regarding the same have been incorporated in Chapter VIII of Draft EIA/EMP Report, item no. 8.2.5.

**Point No: xviii A scientific mining scheme for every 5 years for the life of the mine shall be prepared.**

**Reply :** Modified Scheme of Mining including progressive mine closure plan has been approved from IBM vide letter no 314 (3)/2009-MCCM (CZ)/MP/MS/PMCP-16 dated 4.12.09 for the period of (year 2009 to year 2014) for the enhanced limestone production capacity of 7.5 MTPA. Details re regarding to earlier approved scheme of mining has been mentioned in the table given below:

#### **APPROVALS OF EARLIER MINING SCHEMES**

<b>S.No.</b>	<b>Topic</b>	<b>Letter ref. no.</b>	<b>Approval Date</b>
1.	Scheme of Mining till 31.03.2004	314(3)/96-MCCM (C)/MP/Scheme-15	18.08.1999
2.	Modified approved scheme of mining	314(3)/ 2003-MCCM(C)/S-10	10.11.2003
3.	Scheme of Mining till 31.03.2009	314 (3)/2004-MCCM(C)/S-3	04.11.2004
4.	Modified approved scheme of mining	314(3)/ 2006-MCCM (CZ)/S-22	24.05.2007
5.	Scheme of Mining for 1.04.2009 to 31.03.2014 (for 3.2 MTPA Limestone Production capacity)	314/ (3)/2008-MCCM (CZ)/S-30	21.05.2009
6.	Modified Scheme of Mining for period of 2009-2014 for the production @ 7.5 MTPA	314 (3)/2009-MCCM (CZ)/MP/MS/PMCP-16 dated	4.12.09

**Source: Scheme of Mining & progressive mine closure plan**

**Point No: xix Scheme for Rain water harvesting including road map for implementation shall be prepared.**

**Reply:** GIL has adopted following method for rain water harvesting in this mine:

- Garland drain & 4 Nos. settling tank have been constructed around working pit, OB soil dump and the dump is also scientifically vegetated to avoid soil erosion and water so collected is used for plantation.
- Periodical testing of mine water is being carried out to check its quality.
- Sump with capacity of 7 lac m<sup>3</sup> has been designed taking into account of Peak sudden rainfall and maximum discharge in the area and adequate retention period to allow proper settling of silt material
- Ground water level is being monitored by piezometers in the project area
- Roof water harvesting is done at hospital, school building, shopping complex, CCR building, Mine office and Rawan Panchayat Bhawan.



Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production

**At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)**

ToR Reply



**Google image showing Grasim limestone mine and water harvesting the lower bench**



**Rain Water harvesting in the lower bench**

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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**Point No: xx Action plan for maintenance of village roads through which transportation of ores are undertaken to be carried out by the company regularly at its own expenses shall be prepared.**

**Reply: Existing transport Infrastructure & traffic density**

GRASIM CEMENT unit is located at village Rawan, Tehsil Simga, District, Raipur of Chhattisgarh state, which is about 17 km away from nearest Railway station Bhatpara. Nearest National Highway (NH – 6) is 70 km from the mine site. The place is well connected to other parts of the country by road, rail and air.

Traffic density study was conducted for approach road connecting Rawan limestone mine and Cement Plant to Rawan Village and further Bhatpara. Total no. vehicles observed during 10.00 am to 6.00 pm were 601, including 83 Scooter, 280 Motor cycles, 73 cars, 22 Buses, 84 Trucks, 31 Tractor Trolley, 12 Dumpers and 16 Bull Carts.

### **Impact on Local Transport Infrastructure**

The limestone and rejects from quarry will be transported to the limestone crusher and dumps located in the Mining lease area, respectively. Crushed limestone will be transported to the Cement Plant via belt conveyors. 25,000 Tonnes of limestone will be handled per day & the same will be transported from quarries to crusher via 12 dumpers (50/60 tons capacity) with 35 / 42 trips per day.

So no involvement of village roads for the mining activity, besides this Dust suppression on haul roads is done by the means of two no. of water tankers. Proposal for lying of Permanent water sprinkling system on the main haul roads to crusher dump hopper is under consideration.



#### WATER SPRINKLING ON HAUL ROAD

**Point No: xxi** Measures for prevention and control of soil erosion and management of silt shall be prepared. Assessment of total silt load likely to be generated shall be carried out. Proposal for protection of dumps against erosion by geo textile matting or other suitable material and plantations of native trees and shrubs at the dump slopes shall be prepared.

**Reply:** In order to prevent and control soil erosion following measures are taken:

- A total quantity of 2, 87,250 m<sup>3</sup> of overburden soil has been generated. Total 9,000 m<sup>3</sup> has been stacked systematically as multi level dumps.
- One of the dump has been completely afforested. The dumps are provided with drain and settling tank. Apart from the above 2, 78,250 m<sup>3</sup> quantity has been used in green belt area for better growth of the vegetation over there.
- Stone pitching has been done all around the dump to prevent denudation of soil and to provide stability to the dump.

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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- Toe drains with suitable baffles are provided all along the toe of dumps to arrest the soil from dump slope being carried by rain water and causing siltation downstream.
- All loose material slopes are provided with plantation by making contour trenches to check soil erosion due to wind as also rains. Native trees and shrubs are preferred for the same.
- Coconut fiber as geotextile matting will be provided to stabilize and provide strength to loose soil. This will hold moisture from evaporation and help in seed germination and growth of vegetation. Later on it will also act as manure and enhance soil fertility and permeability.
- The coco – filters will be installed at the foot of dumps to arrest and prevent silt deposition and provide clean water reducing total suspended solid level. De-silting will be done at regular intervals.
- Top soil generation for the next five years 2009 -2014, is given below :

**QUANTITY OF TOP SOIL TO BE GENERATED  
DURING THE YEAR 2009-2014**

S. No.	Year	Quantity of top soil to be generated (m <sup>3</sup> )
1.	2009-2010	100000
2.	2010-2011	100000
3.	2011-2012	100000
4.	2012-2013	100000
5.	2013-2014	100000

***Source: Scheme of Mining & progressive mine closure plan***

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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- Top soil stacking will be done by retreating method of dumping to facilitate early reclamation of the above. The terraces will be provided an inward slope of 2% to facilitate drainage of the rain water. Pits of 0.5 x 0.5 x 0.5m will be made at an interval of 3m. The prepared pits will be filled with soil and cow dung mixed in the ratio of 3:1 along with small quantities of BHC. Saplings of Accacia Siamea and Acacia Auriculiformis will be planted.

**Point No: xxii Trenches/ garland drains proposed to be constructed at foot of dumps and installation of materials like coco filters at regular intervals to arrest silt from being carried to water bodies shall be prepared. Proposal for adequate number of Check Dams and Gully Plugs proposed to be constructed across seasonal / perennial nallahs (if any) flowing through the ML area shall be prepared. De- silting schedule at regular intervals shall be also provided.**

**Reply:** In order to arrest silt from being carried to water bodies, the following measures are taken.

- Toe drains with suitable baffles are provided all along the toe of dumps to arrest the silt from dump slope being carried by rain water and causing siltation.
- In future, Coco-coir blankets will be used for slope stability and growth of vegetation on waste dumps.
- The coco – filters will be installed at regular interval at the foot of dumps to arrest and prevent silt deposition and provide clean water reducing Total Suspended Solid level. De-silting will be done at regular intervals.

**Point No: xxiii Private land owners profile from whom surface rights or otherwise land has been acquired (if any) shall be provided**

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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**along with compensation package formulated for sustainable livelihood.**

**Reply:** Mining Lease area of 722.834 ha was executed on 04.12.1993. The ML area has already been acquired by the company. The details of village-wise occupancy of the lease area are given in Table below:

**VILLAGE-WISE AREA AND OCCUPANCY OF THE LEASE AREA**

<b>Dist &amp; State</b>	<b>Taluka</b>	<b>Village</b>	<b>Area (Hect.)</b>	<b>Ownership/occupancy (Hect.)</b>
Raipur (C.G.)	Simga	Rawan	239.114	Govt.land : 69.101 Pvt.land : 170.013
Raipur (C.G.)	Simga	Jhipan	183.140	Govt.land : 49.880 Pvt.land : 133.260
Raipur (C.G.)	Simga	Pendri	189.906	Govt.land : 36.707 Pvt.land : 153.199
Raipur (C.G.)	Simga	Kasihidih	72.229	Govt.land : 2.744 Pvt.land : 69.485
Raipur (C.G.)	Simga	Phunderdih	38.445	Govt.land : 1.085 Pvt.land : 37.360
<b>TOTAL</b>	<b>722.834 Hects.</b>			

*Source: Scheme of Mining & progressive mine closure plan*

**Point No:xxiv** Land-use pattern of the nearby villages shall be studied, including identification of common property resources available for conversion into productive land and action plan for abatement and compensation for damage to agricultural land/ common property land (if any) in the nearby villages, due to mining activity shall be prepared.

**Reply:** The study area consists of Agricultural fallow land at some places, which can be converted into Agricultural crop land by providing proper resources/ assistance to the farmers. The following practices shall be carried out to increase the productivity of the study area:

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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- Awareness for new methodologies of the agricultural practices viz. mixed farming, crop rotation and agricultural cropping pattern suitable for the study area.
- Providing seeds, manure and fertilizers from different sources.

No public building and monuments exist in and around the lease area. There is no habitation in the lease area.

As the mining operation will be carried out by Open cast method & drilling / blasting will be used only for mineral. There is no overburden. Particulate Matter as well as gaseous emission will be maintained well within the prescribed limits.

Out of total mining lease area i.e. 722.834 ha, mining will be confined to an area of 558.954 ha. The dust generated during the mining operation will be settled down within the core zone & will not affect agricultural activities within the buffer zone.

These impacts within the core zone may be in terms of dust fall, rain water runoff and resulting erosion. To restrict such impacts within the core zone proper mitigation measures are proposed to be taken.

- Dust suppression will be done properly by regular sprinkling of water on haul roads. Wet drilling, proper maintenance of transportation vehicles will help reduce fugitive emissions so is not to affect the quality of the soil of the surrounding agricultural fields.
- Garland drains with siltation pits will be formed around the excavated area to channelize the water inside the mined out pit. Thus the mined out pit will act as a large siltation pond and only clean water will overflow through the drains, which will not harm agricultural land.

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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- Heavy duty (under high pressure) water spraying will be done on the blasted muckpile (before loading by excavator) to suppress the dust.

All these measures will result in minimal impact to agricultural land/ common property land in the nearby villages in the study area.

The same has been incorporated in Chapter IV, Item no. 4.2.4 of Draft EIA/EMP Report.

**Point No: xxv Need based assessment for the nearby villages shall be conducted to study economic measures which can help in upliftment of poor section of society. Income generating projects consistent with the traditional skills of the people besides development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such programme. This will be in addition to vocational training for individuals imparted to take up self employment and jobs. Separate budget for community development activities and income generating programmes shall be specified.**

**Reply:** As practiced at other cement plants & mines of GIL, social welfare activities have been taken up on a large scale at Grasim Cement - Raipur.

GIL act as a catalyst for accelerating the all-round development process in these villages. It has provided services to ensure that the full-benefits of development schemes of Government and other agencies reach the villagers.

The socio welfare activities are handled by a full time mixed husband-wife team of village development officials who monitor the programme and gives necessary back-up support. The programmes has made broad based by involvement of local groups and government agencies to the maximum extent possible.



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GIL had contributed a lot in the development of the area, table mentioned below shows the condition of the villages before the intervention of the plant and present condition after the community initiatives and rural development activities undertaken by the management of GIL:

### SOCIAL IMPACT ASSESSMENT

S. No.	Condition of the villages before intervention	Present Condition of the Villages
<b>Education</b>		
	<ul style="list-style-type: none"> <li>• Low literacy level (48 to 50 %)</li> <li>• High drop out level</li> <li>• Lack of school buildings</li> <li>• Lack of teaching staff</li> <li>• Lack of motivational system for talented students</li> </ul>	<ul style="list-style-type: none"> <li>• Adequate Number of Schools buildings</li> <li>• Competition among students</li> <li>• Balanced Teachers – Students ratio</li> <li>• Selection of village students in Navodaya School, Mana</li> <li>• Distribution of Mid-day meals in systematic way</li> <li>• Increased literacy level and reduced drop out level</li> </ul>
<b>Health &amp; Family welfare</b>		
	<ul style="list-style-type: none"> <li>• No medical services for the local people</li> <li>• Lack of health centres</li> <li>• Low interest of health workers and maintenance towards medical services</li> </ul>	<ul style="list-style-type: none"> <li>• Treated all the TB patients and eliminated the chances</li> <li>• Ensured Pulse-polio vaccination to all the eligible kids</li> <li>• Minimized the cataract patients in the area</li> <li>• Increased awareness of people on Family Planning drive</li> <li>• Hepatitis-B vaccination to all the eligible kids of nearby villages</li> <li>• Increased awareness level of the people on HIV/AIDS</li> </ul>
<b>Sustainable livelihood &amp; Agriculture</b>		
	<ul style="list-style-type: none"> <li>• Low income level of the local people</li> <li>• Lack of motivation for self employment</li> <li>• Traditional agriculture system</li> <li>• Dependency on single crop</li> <li>• Drinking water problem</li> <li>• Low depth of ponds</li> <li>• Unemployment</li> </ul>	<ul style="list-style-type: none"> <li>• Increased awareness level &amp; standard of living of people</li> <li>• Adequate employment opportunities</li> <li>• Increased capacity of the water bodies</li> <li>• Adequate drinking water, No. of Bores &amp; hand-pumps</li> <li>• Created self-employment opportunities for youths</li> <li>• Increased awareness on multi-cropping</li> </ul>

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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Infrastructure		
	<ul style="list-style-type: none"> <li>No pacca houses</li> <li>Lack of roads</li> <li>Lack of community buildings</li> <li>Lack of stairs near ponds</li> <li>Poor condition of village tracks</li> </ul>	<ul style="list-style-type: none"> <li>All villages are well connected with Pacca roads</li> <li>All village ponds have stairs</li> <li>All the villages are having community buildings</li> <li>Most of the villages have concrete street lanes</li> <li>Increased No. of Pacca houses in villages</li> </ul>
Social Issues		
	<ul style="list-style-type: none"> <li>Low awareness level of the people</li> <li>Lack of motivation to local artists</li> <li>No care for handicapped people</li> </ul>	<ul style="list-style-type: none"> <li>Distributed tricycles to all the handicapped persons</li> <li>Increased No. of cultural &amp; Social activities</li> <li>Awareness level of the women and adolescent girls increased</li> </ul>

Details have been given in Draft EIA/EMP Report, Chapter no. IV, item no. 4.2.5.

Rural developmental activities carried out during year 2008 – 2009 and proposal for the year 2010 is given below:

#### EXPENDITURE TOWARDS SOCIO ECONOMIC ACTIVITIES

S. No.	Parameters	Parameters of work done	Expenditure 2008-09 (Rs.)	Till Date 01.04.09 (Rs.)	Expenditure Proposed- 2009-10 (Rs.)
1.	Housing	<ul style="list-style-type: none"> <li>Repairing of and community buildings</li> <li>Repairing of Roads</li> <li>Indira Awas/ Gobar Gas Plant</li> </ul>	72000	1264250	800000
2.	Water Supply	<ul style="list-style-type: none"> <li>Mines water in villages</li> <li>Repairing of Bore-wells and pumps/ water supply</li> <li>Water Harvesting (Deepening of pond and construction of stairs near pond)</li> </ul>	84000	1139000	300000 430000
3.	Health, Safety & Medical	<ul style="list-style-type: none"> <li>Family Planning Camps</li> <li>Medical facilities to</li> </ul>	169000	1650222	675000

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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	Facilities	villagers ➤ Cataract Operations,			
4.	Education & Training	➤ Distribution of Tatpattis to local schools, Scholarship to village students, Asist. In construction of school buildings/ boundry/ shed, Coaching for Navodaya school, Silai & Tailoring Training, Agriculture training to farmers & Distribution of uniform to student.	237000	2975950	750000
5.	Employment /Training to local inhabitants	➤ Self Employment camp, Training for repairing of Motor Cycle/Two wheeler, Training for repairing of Electronic items and TV/Mahila Bal Vikas camp	19000	205500	90000
6.	Recreation & Sports	➤ Inter-School Sports meet, Distribution of Musical items to Mahila Mandals, Inetr-village sports, Religious function in village	57000	344200	110000
7.	Others	➤ Cattle camp & feed training, Distribution of Tricycles/sewing machine etc	27000	558900	40000

The same has been incorporated in Chapter VII, item no. 7.2 of Draft EIA / EMP Report.

**Point No: xxvi Implementation of 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 mineral dust etc. shall be prepared, including record keeping procedures. Awareness programme for workers on impact of mining on their health and precautionary measures like use of personal equipments etc. to be carried periodically shall also be submitted.**

Reply: Occupational health and safety (OHS) is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. The goal of all occupational health and safety programs is to foster a safe work environment.

**Occupational health hazards at mine site:**

Mining activity experiences risk of a number of hazards. Some examples of such hazards are as under:

- Exposure to dust
- Exposure to High temperatures;
- Noise exposure;
- Physical Hazards;
- Vehicular movements and blasting related issues.

These mainly impact on those working within the mine although health hazards can also impact on local communities.

**Implementation of Occupational health and safety measures:**

Occupational Health & Safety measures result in improving the conditions under which workers are employed and work. It improves not only their physical efficiency, but also provides protection to their life and limb. GIL considers the following safety measures:

- Safety clauses in contract order
- To depute dedicated safety team
- Inspection and maintenance of equipments and accessories
- Pre placement and periodic health check up
- Removal of unsafe conditions and prevention of unsafe acts
- Detailed analysis of each and every incident
- To provide standard PPEs and ensure its uses
- Periodic inspection by internal and external safety experts
- Celebrations of various safety events for awareness

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production <b>At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)</b>	ToR Reply
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- An effective and clearly audible means of giving warning, in case of fire, to every person shall be provided in the factory. A free passage—way giving access to each means of escape in case of fire shall be maintained for the use of all workers in the factory.
- Medical facilities & first aid boxes will be established in the mine premises.
- Pits, Sumps, openings in floor etc. which may be a source of danger, shall be either securely covered or securely fenced. Securely fencing a pit means covering or fencing it in such away that it ceases to be a source of danger.

**Besides, following points will be taken care of during mine operation for assuring safety of workers:**

- Health Awareness Programmes and Surgical Camps (Eye Camps, Cleft Lips Correction Camps, Dental Camps, Pulse Polio Camps, Etc.)
- Periodical medical examination is being conducted for the existing mine as per DGMS in Form –O in addition to the initial medical exam which was carried out at the time of joining. The same practice will be continued for enhanced production capacity.
- The mine workers will be provided all necessary PPE, especially dust masks for their safe guard from dust, Ear Plugs/Ear Muffs for noise and measures for other hazards. The fresh employees when taken will be thoroughly medically examined under initial medical examination and thereafter during continuation of employment; the periodic medical examination will be conducted. The examination includes apart from the general observation, the Chest X-ray, Lung function Test, Spirometry, Auditory will be conducted and the record of the same will be maintained and submitted to the concerned authorities.

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- Under initial vocational training, the workers are given training related to all safety and health aspects pertaining to their vocation and thereafter every quarter, special training courses/ Awareness programme for Malaria eradication, HIV and health effects on exposure to mineral dust will be organized for employed person as well as for nearby villagers.
- The Occupational Health Surveillance Programme: A team of qualified doctors and nurses visit periodically for health check up of all the workers, team and its records is maintained properly.
- GIL management has decided to invest Rs 6,75,000 during the year 2009-10 towards health and safety measures.

**Point No: xxvii Green belt development and selection of plant species shall be as per CPCB guidelines. Herbs and shrubs shall also form a part of afforestation programme besides tree plantation. Details of year wise afforestation programme including rehabilitation of mined out area shall be prepared.**

Reply: Till now, about 94.67 ha area has been covered under Green belt/ plantation.

At the end of life of mine around 403.16 ha will be covered by plantation by planting around 987340 trees.

A large number of ornamental plants have also been planted to provide visual aesthetics.

Continuous efforts are being done by horticulturist to promote green belt in & around the mine lease area.

A green belt of tree plantation around the mine site (also along the lease boundary in downwind direction) has helped to arrest the particulate matter in the area and hence attenuate the pollution to a great extent as it work as a wind break.

Plantation has been done along the haul roads, mines boundary, pits.

Expansion of Captive Rawan-Jhipan Limestone Mine (ML Area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA limestone production  
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ToR Reply



## PLANTATION ALONG HAUL ROADS



## AFFORESTATION/ PLANTATION

The following plant species has been planted according to CPCB guidelines:

**PLANTS SPECIES PLANTED IN THE PLANT AS WELL AS COLONY AREA**

S. No.	NAME OF THE PLANTS
<b>Forestry Plant</b>	
1.	Teak
2.	Sisoo
3.	Karanga
4.	Peltaform
5.	Casia siamia
6.	Kadamba
7.	Nilgiri
8.	Gliricidia
9.	Bahunia
10.	<i>Accasia auriculifarmis</i>
11.	Kaner
12.	Subabool
13.	Amaltas
14.	Ashok
15.	Bamboo
16.	Casurina
17.	Champa
18.	Gulmohar
19.	Neem
20.	Rain tree
21.	Alasthomia
22.	Sirasa



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<b>Fruits</b>	
23.	Mango
24.	Guava
25.	Lemon
26.	Musambi
27.	Awala
28.	Bel
29.	Anar
30.	Ber
<b>C-bio diesel plants</b>	
31.	<i>Jatropha curcus</i>

### Ecology: Stage wise Cumulative Plantation

#### REQUIREMENTS FOR PLANTS FOR AFFORESTATION AND RECLAMATION

Year	Un-worked Area Green Belt		Outside Dumps		Inside Dumps (Backfilled)		Top Soil Dumps		Total	
	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees
Existing	91.99	229975	1.45	2500	1.23	3075	-	-	94.67	235550
I	1.00	2500	-	-	-	-	-	-	1.00	2500
II	1.00	2500	-	-	-	-	-	-	1.00	2500
III	1.00	2500	-	-	-	-	-	-	1.00	2500
IV	1.00	2500	-	-	-	-	-	-	1.00	2500
V	1.00	2500	-	-	-	-	-	-	1.00	2500
VI th year onward	14.85	37125	38.87	77740	249.77	624425	-	-	303.49	739290
<b>Total</b>	<b>111.84</b>	<b>279600</b>	<b>40.32</b>	<b>80240</b>	<b>251</b>	<b>627500</b>	<b>-</b>	<b>-</b>	<b>403.16</b>	<b>987340</b>

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**Point No: xxviii The questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall be filled up and submitted in complete.**

Reply: The questionnaire for environmental appraisal of mining projects will be submitted to the MoEF, New Delhi along with Final EIA/EMP Report.

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# **CHAPTER-I**

## **INTRODUCTION**

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### **1.1 PURPOSE OF THE REPORT**

Environmental Impact Assessment (EIA) is defined as a systematic identification & evaluation of the potential impacts of the projects, plans, programmes, or legislative actions related to the Physical-Chemical, Biological, Cultural and Socio-economic components of the total environment. The primary purpose of the EIA process also called, as the NEPA process is to encourage the consideration of the environment & planning, decision-making and for ultimate actions, which makes project environmentally friendly.

It is the evaluation of various impacts and the resultant natural and induced changes, as simply and precisely as possible, for optimising the development to the environment. By virtue of EIA, the patterns, directions, strengths and lags of the casual relationships existing among all the relevant variables are studied.

It also helps in the determination of additional project components that may be required to restore, maintain or extend the resources. EIA is useful for decision making, as it is based on understanding the environmental implications including social, cultural and aesthetic concerns, which could be integrated with the analysis of the project costs and benefits.

The sole purpose of Environmental Impact Assessment report is to assess the beneficial and adverse impacts of the project on the existing environmental systems and to propose appropriate pollution control measures to ensure a secure, hale and hearty environment.

To keep the Environment congenial for better standard of living, the provisions have been made in the constitution of India and many

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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enactments have taken place, so that, industrialization may not have adverse impact on the environment. Law requires that every project proponent must take environmental clearance from Ministry of Environment and Forests (MoEF), New Delhi, before starting up any project. The environmental clearance is also mandatory for the expansion, modernization or renewal projects. The conditions are applicable as per the MoEF Guidelines and EIA Notifications issued and amended time to time.

There are many Acts / Rules / Notifications issued by MoEF, few of them are mentioned below:

1. Environment (Protection) Act, 1986
2. Environment (Protection) Rules, 1986
3. Water (Prevention & Control of Pollution) Act, 1974
4. Air (Prevention & Control of Pollution) Act, 1981
5. Environmental Impact Assessment (EIA) Notification, dated 27<sup>th</sup> January, 1994
6. New Environmental Impact Assessment (EIA) Notification, dated 14<sup>th</sup> September 2006 as amended on 1.12.2009.

So, as per the recent EIA Notification dated 14<sup>th</sup> September 2006, it is mandatory to have the Environmental Clearance for any new industry or the expansion of the industry from Ministry of Environment & Forests, Government of India, New Delhi.

Grasim Industries Ltd. has proposed expansion in the production capacity of limestone from 2.8 MTPA to 7.5 MTPA in the existing Rawan-Jaipan Limestone Mine (ML area: 722.834) at Village: Rawan-Jaipan, Tehsil: Simga, Distt.: Raipur (Chattisgarh). As per the New EIA Notification 14<sup>th</sup> September 2006, this project falls under Category A (1a) (3).

To carry out systematic & environment friendly mining all the aspects of mining such as Geology, Exploration, Reserve, Use of Mineral, Mining,

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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Blasting, Environment Management Plan, Progressive Mine Closure Plan, Reclamation plan, Plantation, Conceptual plan has been reviewed in following chapters keeping in view of 7.5 million tones/ annum Limestone production from Rawan-Jaipan Limestone Mine at Village: Rawan-Jaipan, Tehsil: Simga, Distt.: Raipur (Chattisgarh).

## **1.2 IDENTIFICATION OF PROJECT & PROJECT PROPONENT**

### **1.2.1 Contact Details of the Project Proponent**

- **Address:**  
M/s Grasim Cement,  
(A Unit of Grasim Industries Ltd.)  
P.O.Grasim Vihar, Village- Rawan,  
Distt. Raipur (C.G.)
- **Pin Code: 493196**
- **Telephone No:** 07726 – 288217, 288220
- **E-mail: vijaykumar.mali@adityabirla.com**

### **1.2.2 Introduction of the Project**

M/s Grasim Cement has an existing Cement Plant Complex comprising of Cement Plant (3.3MTPA), Captive Thermal Power Plant (30 MW) & Limestone Mine (ML area: 722.834ha & limestone production capacity: 2.8 MTPA) in village Rawan, Tehsil Simga, District Raipur (C.G.).

Environmental Clearance for existing limestone production capacity (i.e. 2.8 MTPA) has been accorded by MoEF, New Delhi vide Letter No. J-11015/70/2003-IA-II (M); dated 15th April, 2005. (Copy of the same has been enclosed as **Annexure 7**).

Grasim Cement management is proposing for a Brown Field Integrated Cement Project in the existing Cement Plant premises by expansion in Cement production capacity from 3.3 MTPA to 6.5 MTPA, Clinker from 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30 MW to 80 MW & D.G.

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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Set 12 MW (2x6 MW) at village Rawan, Tehsil Simga, District Raipur (C.G.).

In order to fulfill the additional limestone requirement for enhanced Clinker production capacity, GIL has proposed to increase limestone production capacity of Rawan-Jhipan limestone mine from 2.8 MTPA to 7.5 MTPA i.e. 4.7 MTPA.

### **1.2.3 History of Mining Lease**

Grasim Cement possesses mine lease for limestone in an area of about 722.834 ha mining lease was executed on 04.12.1993 and will expire on 03.12.2013.

The limestone mine is working with the required clearances/consents from MoEF & SPCB for its present capacity.

The existing limestone production capacity of the mine is 2.8 MTPA for which Environmental Clearance has been accorded by MoEF, New Delhi [MoEF F.No. J-11015/70/2003-IA-IIM; dated 15<sup>th</sup> April, 2005].

Compliance reports for the same are being submitted to the concerned authorities on regular basis.

Grasim Cement is now proposing for expansion in its existing Rawan-Jhipan Limestone Mine (from 2.8 MTPA to 7.5 MTPA, area 722.834 ha), to fulfill the limestone requirement for the increased Clinker production capacity of own Grasim Cement Plant.

The renewal of Consent to Operate is obtained from Chhattisgarh Environment Conservation Board under, section 21 of the Air (Prevention and Control of Pollution) Act, 1981 and section 25/26 of the water (Prevention and Control of Pollution) Act, 1974 of the present Production Capacity (2.8 MTPA) of mine (Letter No. 1215/ TS/ CECB/2008 & Letter No. 1217/ TS/ CECB/2008).

Modified Scheme of Mining including progressive mine closure plan has been approved from IBM vide letter no 314 (3)/2009-MCCM (CZ)/MP/MS/PMCP-16 dated 4.12.09 for the period (2009-2014) for the

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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enhanced limestone production capacity of 7.5 MTPA. Copy of the letter has been enclosed as **Annexure 5** with the Draft EIA/EMP Report.

Details of the status & stage of regulatory clearances is given below:

**Table No. 1.2.3**

**STAGE OF REGULATORY CLEARANCES**

S. No.	Topic	Letter ref. no.	Date
1.	Approved Mining Plan from IBM	RAP/LST/MPLN-283/NGP	22.06.1993
2.	Commencing of mining operation	-	05-02-1994
3.	Modified Mining Plan approval from IBM	314(3)/95-MCCM(C)/MP-11	02.12.1996
4.	Scheme of Mining till 31.03.2004	314(3)/96-MCCM(C)/MP/Scheme-15	18.08.1999
5.	Modified approved scheme of mining	314(3)/ 2003-MCCM(C)/S-10	10.11.2003
6.	Scheme of Mining till 31.03.2009	314 (3)/2004-MCCM(C)/S-3	04.11.2004
7.	Environment Clearance from MoEF for expansion from 1.6 MTPA to 2.8 MTPA production of limestone.	No. J-11015/70/2003-IA-II (M)	15.04.05
8.	Modified approved scheme of mining	314(3)/ 2006-MCCM(CZ)/S-22	24.05.2007
9.	Scheme of Mining for 1.04.2009 to 31.03.2014 (for 3.2 MTPA Limestone Production capacity)	314/ (3)/2008-MCCM(CZ)/S-30	21.05.2009
10.	Modified Scheme of Mining has also been approved from IBM.	314 (3) / 2009-MCCM(CZ) / MP / MS / PMCP - 16	4.12.09

#### **1.2.4 Name, Address & Status of Applicant**

M/s Grasim Cement

(A Unit of Grasim Industries Ltd.)

P.O.Grasim Vihar, Village- Rawan,

Distt. Raipur (C.G.)

Aditya Birla Group is India's second largest business house, with turnover of over Rs. 200 billion; asset base valued at over Rs. 180 billion and nearly 65000 employees in 15 countries. Committed for being a global benchmark group, the Aditya Birla Group reaches out the core sector in India – in industries integral to the nation's growth – Cement, Aluminum, Fertilizers, Viscose Staple Fiber, Textiles, Petroleum Refining, Power, Telecommunications, Industrial, Chemicals and Financial Services. Aditya Birla Group is committed to provide clean & green environment, all of its units in India and abroad contributes as a global responsibility for environment protection. The group has the pride to have the first ever Cement Plant in India awarded with ISO-14001 Certificate for Environment Management System. In order to maintain the balance in the eco-system, legislation have been enacted, compliance of which would not only allow sustainable development for current needs but also leave options open for the prosperity.

It is among India's largest business houses operating in the country for over 5 decades and globally from nearly 30 years with turnover of over Rs. 200 billion; asset base valued at over Rs. 180 billion and nearly 65000 employees in 15 countries and shareholders are around 7,00,000.

Grasim Cement, an ISO 9002 & 14001 certified company is a unit of Grasim Industries Ltd. with one of their cement manufacturing unit at village Rawan, Tehsil Simga, district Raipur in Chhattisgarh state with existing gross cement production capacity of 3.3 MTPA.



Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha) Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	Draft EIA/EMP Report
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## 1.3 BRIEF DESCRIPTION OF THE PROJECT

### 1.3.1 Details of Environmental Setting

TABLE-1.3.1

S. No.	Particulars	Details
<b>LOCATION</b>		
1.	A. Village	Rawan
	B. Tehsil	Simga
	C. District	Raipur
	D. State	Chhattisgarh
2.	Latitude	21 °33' to 21 °35' N
3.	Longitude	81 °58' to 82 °00" E
4.	Toposheet No.	64 G/14, 64 K/2
5.	General ground level	276 mRL
6.	Land use of the Lease area (in hectares)	
	Govt. Waste Land (in hectares)	159.517 ha
	Agriculture Land (Private Land) (in hectares)	563.317 ha
	<b>Total Lease Area (in hectares)</b>	<b>722.834 ha</b>
<b>DETAILS OF THE STUDY AREA</b>		
7.	Nearest National Highway	NH-6 (70 km)
8.	Nearest Railway Station	Bhatapara – 17 km (South-East)
9.	Nearest Town	Raipur– 85 km
10.	Ecological Sensitive Areas	None within 10 km radius
11.	Nearest Water Body	Mahanadi Canal
12.	Source of Water	Mine Sump Water / Bore Well
13.	Soil Texture	Loamy Clay
14.	Seismic Zone	Zone II
Requirements of the Project		
<b>CLIMATOLOGY</b> <b>(WINTER SEASON: DECEMBER 2009 TO FEBRUARY 2010)</b>		
15.	A. Temperature	11.4 °C - 30.2 °C

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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	B. Relative Humidity At 8:30 hrs. At 17:30 hrs.	37% to 95% 28% to 81%
16.	Dominant Wind Direction	From NE
<b>REQUIREMENT FOR THE PROJECT</b>		
17.	Water Requirement	Total water requirement after enhancement of production capacity will be 350 KLD. <b>Source:</b> Water will be sourced from stored water in the mining pit & for drinking purpose existing bore well will be used (CGWA permission has been obtained).
18.	Manpower Requirement	Existing Man power is 96 persons. No additional Man power will be required for the project.
19.	Project Cost	
20.	Total Cost of the Project	Rs 40 Crores
21.	EMP Cost <ul style="list-style-type: none"> <li>Capital Cost</li> <li>Recurring Cost</li> </ul>	Rs 60 Lacs Rs 10 Lacs

### 1.3.2 Importance to the country and region

In India, limestone of cement grade quality is not evenly distributed, but occurs in large clustered deposits mainly in seven states viz. Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Karnataka, Gujarat, Rajasthan and Maharashtra. The result has been that cement plants have been located in these states, proximity, or favorably placed, in relation to location of the plant.

Cement production during the year 2008-09 was 181.61 MT against 168.31 MT in the previous year 2007-08, registering a growth of 7.9%. Clinker production during the year under review was 138.77 MT registering a growth of 6.97% over the previous year's 129.73 MT Clinker stock in

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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March 2009 was 5.45 MT almost at the same level as that of the previous year's 5.49 MT.

**TABLE-1.3.2 (A)**  
**PERFORMANCE HIGHLIGHTS – 2008-09**  
**(EXCLUDING MINI AND WHITE CEMENT PLANTS)**

	Details	Unit	Quantity
A	Capacity at the end of Mar' 09 (Previous year 197.76)	MT	219.17
	Additional in 2008-09	MT	21.41
	Growth	%	10.83
B	Cement Production (Previous year 168.31)	MT	181.61
	Highest ever in a month (Mar'09)	MT	18.13
	Growth	%	7.90
	Clinker Production (Previous year 129.73)	MT	138.77
C	Capacity Utilization (Previous year 94)	%	88
D	Stock at the end of Mar'09		
	Cement (Previous year 1.08)	MT	1.09
	Clinker (Previous year 5.49)	MT	5.45
	Highest Clinker Stock in Dec. 08	MT	7.38
E	Exports		
	Cement (Previous year 3.65)	MT	3.20
	Clinker (Previous year 2.37)	MT	2.90
	Consumption (Domestic Despatches) (Previous year 164)	MT	177.98
	Per Capita Consumption (2008) (kg)		156

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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**TABLE-1.3.2 (B)**

**LAST FIVE YEARS OF CEMENT INDUSTRY**

<b>S.No.</b>	<b>Particular</b>	<b>2003-04</b>	<b>2008-09</b>	<b>Compound Growth (%)</b>
1.	Installed Cement Capacity (MT)	145.81	219.17	8.49
2.	Operative Cement Capacity (MT)	138.18	214.13	9.16
3.	Capacity Utilization	82%	88%	
4.	Rail Dispatches (MT)	39.28	68.33	11.71
5.	% Rail Share of Total Dispatches	33.5%	37.7%	
6.	PPC Production (MT)	52.13	120.79	18.30
7.	% of PPC Production (MT)	44.4%	66.5%	
8.	PBFS Production (MT)	11.26	15.18	6.16
9.	% of PBFS to total Cement Production	9.6%	8.4%	
10.	Coal Receipt against Linkage (MT)	13.35	14.29	1.37
11.	% of Coal Receipt against Requirement	70.8%	48.3%	
12.	Cement Production using Captive Power	46.07	102.59	17.36
13.	% of Total Cement Production using Captive Power	39.2%	56.5%	

The expansion is important for the growth of the region and country, looking at the national as well as regional market demand scenario and the abundance of cement grade limestone in Rawan, Grasim Cement Limestone Mines.

### **1.3.3 Location and Approach to the Mine**

GRASIM CEMENT unit is located at village Rawan, Tehsil Simga, District, Raipur of Chhattisgarh state, which is about 17 km away from nearest Railway station Bhatapara. Nearest National Highway (NH – 6) is 70 km from the mine site. The place is well connected to other parts of the country by road, rail and air.

The nearest airport is Raipur, which is about 70 km from mine site.

Nearest post office with telegraph & telephone facilities are available at Rawan village.

#### **1.4 SCOPE OF EIA STUDY**

Application (Appendix – I/Form – I/ToR and Pre – Feasibility Report) for obtaining Environmental Clearance from Ministry of Environment & Forests, New Delhi for this mining project was submitted on 12.01.2009. TORs has been issued by EAC (Industry) MoEF, vide letter No. No. J-11015/17/2009 - IA. II (M) dated 26<sup>th</sup> Oct, 2009, the same has been incorporated in the Draft EIA/EMP Report, pg. no. 1-5.

The reply / clarification of all the points suggested as per ToR letter have been incorporated in this EIA/EMP Report at respective places.



## **CHAPTER-II**

### **PROJECT DESCRIPTION**

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#### **2.1 TYPE OF THE PROJECT**

This mining project falls under Category A (1a) (3) as per New EIA Notification 2006. It is proposed to seek Environmental Clearance for proposed Expansion of Rawan - Jaipan Limestone Mine (ML area: 722.834 ha), from 2.8 MTPA to 7.5 MTPA of limestone production.

Environmental Clearance has been granted to this existing mine for limestone production capacity of 2.8 MTPA from vide MoEF letter no J-11015/70/2003-IA-IIM; dated 15<sup>th</sup> April, 2005.

Modified Scheme of Mining including progressive mine closure plan has been approved from IBM vide letter no 314 (3)/2009-MCCM (CZ)/MP/MS/PMCP-16 dated 4.12.09 for the period (2009-2014) for the enhanced limestone production capacity of 7.5 MTPA.

#### **2.2 NEED FOR THE PROJECT**

During the current financial year 2009—10, GRASIM CEMENT Management has taken the strategic decision for production capacity enhancement by adding second line of clinkerisation along with addition of cement mills. It is expected that the second line of the plant for expansion of clinker and cement capacity will come in force from 4<sup>th</sup> year of the present scheme period i.e. during the year 2012 to 2013. It is proposed that the cement and clinker capacity will be in tune of 6.5 MTPA from the present capacity of 3.3 MTPA and 2.07 MTPA for cement and clinker. The limestone requirement from the Mine to cater the plant requirement inclusive of capacity enhancement will be 7.5 MTPA.

Hence, to cater the increased Mine Production Requirement, this modification is being proposed.

## 2.3 Location

Village : Rawan

Tehsil : Simga

District : Raipur

State : Chattisgarh

Latitude : 21°33' to 21°35' N

Longitude : 81°58' to 82°00' E

Lease Area : 722.834 ha

Railway line : Bhatapara – 17 km (South-East)

Toposheet Number No : 64 G/14, 64 K/2

General ground Level : 276 mRL

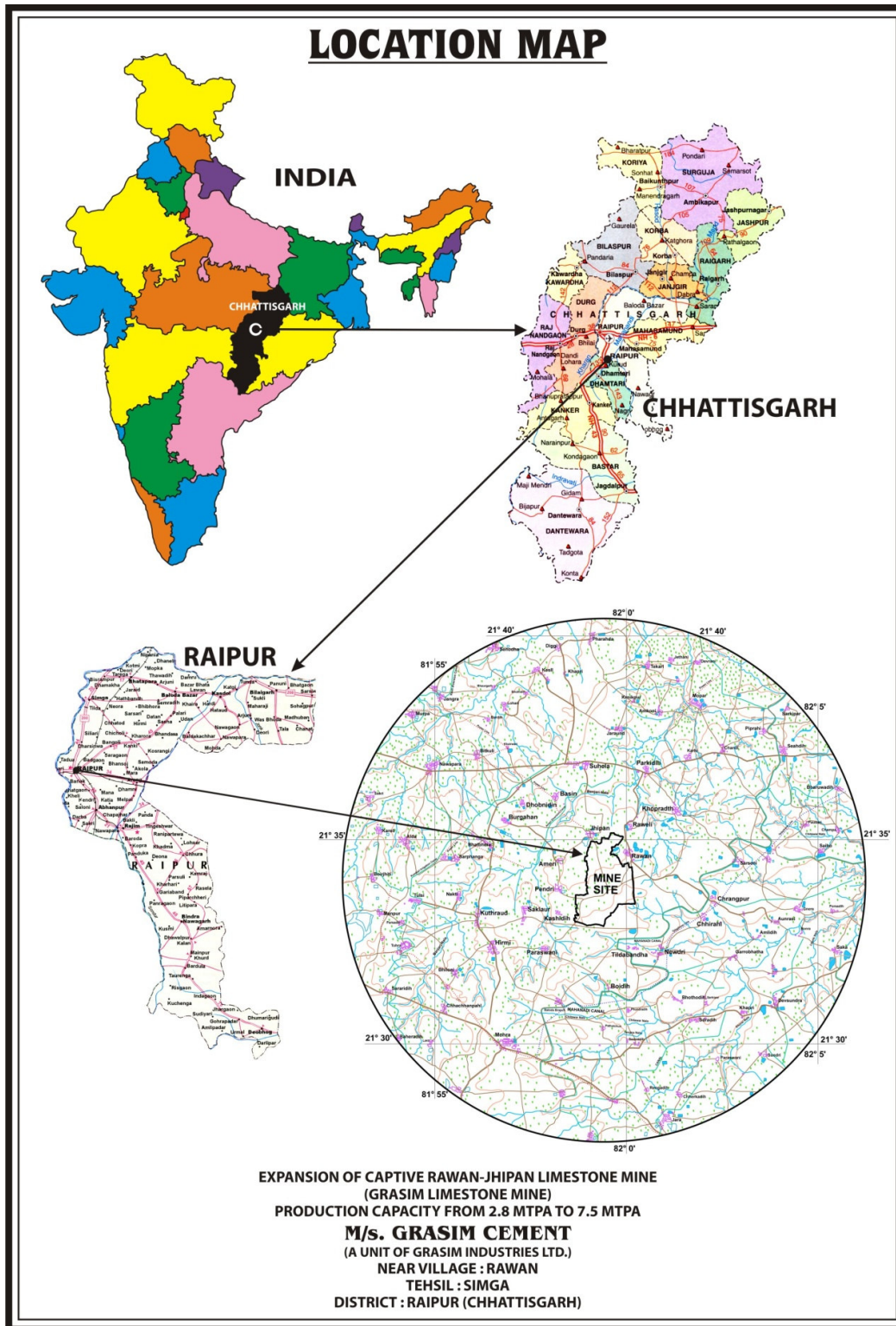
The details of village-wise occupancy of the lease area are given in Table below:

**TABLE: 2.3**  
**VILLAGE-WISE AREA AND OCCUPANCY OF THE LEASE AREA**

Dist & State	Taluka	Village	Area (Hect.)	Ownership/occupancy (Hect.)
Raipur (C.G.)	Simga	Rawan	239.114	Govt.land : 69.101 Pvt.land : 170.013
Raipur (C.G.)	Simga	Jhipan	183.140	Govt.land : 49.880 Pvt.land : 133.260
Raipur (C.G.)	Simga	Pendri	189.906	Govt.land : 36.707 Pvt.land : 153.199
Raipur (C.G.)	Simga	Kasihidih	72.229	Govt.land : 2.744 Pvt.land : 69.485
Raipur (C.G.)	Simga	Phunderdih	38.445	Govt.land : 1.085 Pvt.land : 37.360
<b>TOTAL</b>	<b>722.834 Hects.</b>			

Source: Scheme of Mining & progressive mine closure plan

### 2.3.1 Location Map



**Figure no.: 2.3.1 (Location Map)**



## 2.4 REQUIREMENTS FOR THE PROJECT

### 2.4.1 Land Area Details

Lease area is 722.834 ha. Details related to the type of land are as under:

**TABLE – 2.4.1**

**TYPE OF LAND**

Forest Land (ha.)	Govt. Wasteland (ha.)	Private Land (ha.)	Total Area (ha.)
Nil	159.517 ha	563.317	722.834 ha

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

### 2.4.2 Water Requirement

Total water requirement for the proposed enhancement project will be 350 KLPD. Water will be sourced from stored water in the mining pit & for drinking purpose existing bore well will be used.

**TABLE – 2.4.2**

**WATER REQUIREMENT**

S. No.	Purpose	Existing Requirement (KLD)	Additional Requirement for proposed expansion (KLD)	Total Requirement (KLD)
1.	Dust Suppression & Mining Activity	130	50	180
2.	Workshop	10	15	25
3.	Drinking	4	2	6
4.	Green Belt Development	94	45	139
	<b>Total</b>	<b>238</b>	<b>112</b>	<b>350</b>

GIL have obtained CGWA permission for abstraction of water from the ground @ 1500 m<sup>3</sup> per day for their limestone mine and cement manufacturing unit at Village: Rawan, Tehsil : Simga, Distt: Raipur (Chattisgarh), copy of the approved letter has been enclosed as **Annexure 8.**

### 2.4.3 Man Power Requirement

The existing manpower working in mine is about 96. In the expansion, there will not be any increase in manpower.

### 2.4.5 Extent of Mechanization

The following machinery & equipments will be required for mining operation:

**TABLE: 2.4.5**  
**LIST OF MACHINERY**

S. No.	Machine	Make	Quantity	Capacity
1.	Excavator	L&T komatsu, Tata EX	05	6.0 Cu. Mtr.
2.	Rock Breaker	Atlas Copco	01	HB 4200
3.	Loader	HM 2071	01	5.74 Cu. Mtr.
4.	Dumper	Cat, BEML, Komatsu	12	50/60 T
5.	Drill Rig	DM-30	01	152 MM dia
6.	Drill Rig	ICM-260	01	115 MM dia
7.	Dozer	BEML 155	02	350 HP
8.	Dozer	BEML D-65	02	170
9.	Water Tanker	TATA-TRUCK	02	12 KL
10.	Diesel Tanker	TATA-TRUCK	01	9 KL
11.	Explosive Van	TATA-TRUCK	01	9.45 Tons
12.	Tyre handler	Voltas	01	3 Ton
13.	Vibromax	L&T 1107D	01	110 HP
14.	Dewatering Pump	-	05	-

Source: Modified Scheme of Mining & Progressive Mine Closure Plan

#### 2.4.5.1 Maintenance Requirement

The proposed method of mining operation will be mechanized opencast, the machineries to be deployed are Hydraulic rock breaker, Excavator, Dozer, Explosive Van and Tippers etc. which will be used for drilling, digging, loading and transport purposes. Existing workshop within the

lease area shall be utilized for day to day maintenance requirement of the above said machines.

## 2. 5 GEOLOGY OF THE AREA – REGIONAL GEOLOGY

The limestone deposit of the present area of investigation belongs to the Chandi formation of the Raipur group in the Chhattisgarh Basin. This formation is found in the Central part of the basin. In this deposit, the litho units are undisturbed, horizontal to gently dipping.

The Chhattisgarh super group of rocks belongs to the 'Puranas' of Proterozoic age. These rocks are generally un-fossiliferous, un-metamorphosed with slightly deformed sediments resting unconformably over the Archaeans. Ball (1877) and King (1885) were the first to describe the geology of the Chhattisgarh Basin and considered these sediments as equivalents to the Vindhya. Later a detailed survey by Dutt (1964), proposed the first comprehensive stratigraphic succession of "Chhattisgarh Series" as given below:

Raipur Shale and limestone

Khairagarh Sandstone

Gunderdehi Shale

Charmuria limestone

Chandrapur Sandstone

Recent studies show that the Chhattisgarh Super Group of rocks can be correlated with the Lower Vindhya, Indravati, Kurnool and Bhima of Peninsular India due to its lithological similarities and cyclic nature of sedimentation (Kruezer et al). The regional geological succession of Chhattisgarh Basin is as under (K.S.Murthy-1980)

CHHATTISGA		Tarenga Formation – 18m		Pink and Purple shale
		Chandi Formation- +670m	Nipania Member	Purple Limestone
			Pendri Member	Grey Limestone
			Newari Member	Pink Limestone

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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RH SUPER GROUP  (MIDDLE PROTEROZOIC)	RAIPUR GROUP	Gunderdehi Formation – +430m	Dotopar Member	Pink & Purple shale/Grey shale
		Charmuria Formation – +490m	Sirpur Member At the base	Grey Limestone With Buff Clay
	-----UNCONFORMITY-----			
	CHANDRAPUR GROUP	Kansa Pather/Kondkera Formation- +125m		White sandstone
		Chapordih Formation - +15m		Reddish brown and Olive green sandstone
		Lohardih Formation- 240m		White pebbly sandstone
	-----UNCONFORMITY-----			
ARCHAEAN	Intrusives		Granites, Veins of Pegmatites, Quartz, Epidote and basic dykes.	
	Chilpi Sonakhan Group		Banded Magnetite quartzites, Rhyolites, Basalts etc.	

Source: Modified Scheme of Mining & Progressive Mine Closure Plan

### 2.5.1 Local Geology

Most of the lease area is covered by thick soil. However in the northern part of the main line, grey limestone is fairly exposed, whereas the limestone is exposed as thin patches towards the southern side of the main line. Based on surface geological mapping and also on the information gathered from the drill hole intersections, the sequence of the different litho units observed in the area of investigation is given in Table below.

**TABLE- 2.5.1**  
**LOCAL GEOLOGY**

	Litho Units	Thickness in mtr.	
		Min.	Max.
Chandi formation	Overburden soil/yellowish brown clay	0.5	13.0
	Buff coloured shale	0.5	7.0
	Grey limestone	0.5	18.0
	Chocolate limestone	17.0	28.0
	Chocolate shaly limestone	18.0	not bottomed

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

The delineation of the different limestone bands is predominantly on their colour and intensity of shale partings. In some cases, the quality of the limestone is also considered while recognizing and demarcating the extension of the different litho units. The surface geological plan showing the details are annexed as [Annexure 3 \(A\)](#).

## **2.6 TOPOGRAPHY & DRAINAGE PATTERN**

The topography of the area is almost flat with [General](#) ground level as 276 m AMSL. The mining lease comprises of both private and Government waste lands and has no permanent water course flowing through the area.

The Mahanadi and Seonath rivers flow around 40 km East and 36 km West of the area, respectively. The drainage is mostly dendritic in nature and takes north - [westerly](#) course in the north and south – easterly course in the south. The drainage is controlled mainly due to two raised outcrops. One in the north – eastern corner while another in the western limestone area. The drainage is well developed due to high rainfall and clayey of soil.

## **2.7 DETAILS OF MINING**

### **2.7.1 Exploration carried out in the ML area**

The exploratory drilling for confirmation of quality to increase the confidence level has been started in the year 2007-2008. Previously the grid pattern of the exploration was 200 X 200 m, now it is being carried to 100 X 100 m grid interval. The approximate drilling meterage will be in

tune of 5000 meters. The work is in progress and expected to be completed at the end of year 2010.

## 2.7.2 Grade of limestone

For the purpose of estimation of reserves, the limestone deposit occurring in the area was divided in the following categories depending on the grade of the limestone:

**Table No: 2.7.2**  
**Categories of Limestone**

S. No.	Category	Grade
1	Cement Grade Limestone	CaO >45%
2	Sub-Marginal grade Limestone	CaO 42-45%
3	Low grade Limestone	CaO 36-42%
4	Reject grade Limestone	CaO <36%

## 2.7.3 Estimation of Reserves

The cement grade limestone has been classified on the basis of CaO and Lime Saturation Factor (LSF) content, both of which are vital monitoring parameters during the manufacturing process of cement. Gross reserves for cement grade limestone would necessarily consist of grey limestone and chocolate within mining lease. The litho units such as topsoil, interstitial clay and sub-grade limestone (<0.85 LSF) comprises waste material or reject.

Since Grasim Cement would require limestone bearing 1.06 LSF at the plant; the mineable reserves as per the UNFC classification were derived accordingly and given below. Based on the statistical studies on estimated quality together with valuable input from feedback exercises, the

LSF cut off was decided to be 0.90 at pithead and further it has been reworked and decided to be 0.85 LSF at pithead.

## 2.7.4 Mineable Reserve & Anticipated life of mine

As per the approved modified mining scheme the mineable reserve as on 01.04.09 are as under.

**TABLE NO.: 2.7.4**  
**MINEABLE RESERVES**

Quantity in Million Tonne

	Classification	Code	Quantity
<b>A</b>	<b>Mineral Reserves</b>		
	a. Proved Mineral Reserve	111	151.12
	b. Probable Mineral Reserves	122	10.90
	<b>Total</b>		<b>162.02</b>

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

The mineable reserve comes out to be 162.02 Million Tonnes with the proposed rate of production of 7.5 MTPA. The life of the mine is anticipated as approximately 22 years.

## 2.7.5 Use of mineral

The limestone produced from the mine will be used as captive source of raw material for the manufacture of cement in [Grasim Cement – Rawan](#).

## 2.8 Proposed method of mining

Mining will be carried out by mechanized opencast method to produce limestone @ 7.5 Million Tonnes per annum by deploying heavy earth moving machinery and deep hole drilling & blasting.

## **2.8.1 Sequence of Mining**

- Top soil removal for direct usage or stacking at designated place.
- OB removal & dumping at designated dump. It will include separation & removal of shale/clay visible partings in lower benches & dumping at OB Dump.
- Drilling & Blasting.
- Loading of ROM in Dump trucks.
- Transportation of ROM to Crusher for unloading in Apron Feeder Hopper.
- Separation of shale/clay particles (screen reject) by combination of primary & secondary screen system & dumping at designated place.
- Crushing of Limestone.
- Transportation of Limestone by belt conveyor system.

### **2.8.1.1 Drilling**

Drilling is carried out by DM-30 and ICM –260 drill machines.

### **2.8.1.2 Blasting**

Blasting is carried out with slurry explosives, Site Mixed Emulsion (SME) and Ammonium Nitrate Fuel Oil (ANFO). NONEL system is extensively used in blasting.

### **2.8.1.3 Loading & Transportation**

Loading will be done by L&T Komatsu PC-1250 hydraulic Excavators or Tata Ex-1200 apart from present L&T 300 CKD Poclain. Transportation will be carried out by deploying 50/60 Ton capacity dumpers of Cat, Komatsu and BEML apart from present HM 1035 & Tata Euclid EH-600 dumpers.



#### **2.8.1.4 Limestone Crushing**

L&T make 1024 KW single stage impactor crusher of 850 TPH capacity will be suitably replaced by 1300/1500 TPH for crushing along with 2 nos. of double deck Vibrating screen. (-)14/16/20 mm size material is separated as screen rejects depending upon the season and (+) 14/16/20 mm to (-) 75 mm size crushed material is transported to plant along with the crushed material by 3.8 km long cross country belt conveyor. (-) 14/16/20 mm size material is stacked at the screen reject dump in well designated place. The percentage generation of the screen reject is generally in tune of 10% while the nature of the screen reject is clayey material predominantly consisting of the deleterious materials such as Shale, chert, clay etc.

The top RL of the ground level is gradually sloping down towards the north and western direction of the mining lease area. To overcome the situation the bench height has been made uniformly at 8 mtrs. as +270,+262,+254,+246 for first, second, third, and fourth bench respectively after removal of top soil and OB as already described in presently applicable modified mining scheme.

#### **2.8.1.5 Yearly pit-wise development plan proposed to next Five years depicted on plans and sections**

Presently there are four production benches in the pit. The modified working limit proposed for the year 2009-10, 10-11, 11-12, 12-13 and year 2013-2014 will be confined within the North 250 to 1590 and East 850 to 1800, North 200 to 1630 and East 850 to 1748, North 150 to 1660 and East 808 to 1748, North 80 to 1740 and East 700 to 1748 and North 15 to 1780 and East 650 to 1748 respectively.

#### **2.8.1 Production and Development plan for the next Five years is given below**

Production and development plan for the next five years is as shown in the table below:

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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**TABLE: 2.8.2**

**PRODUCTION AND DEVELOPMENT PLAN FOR THE NEXT FIVE YEARS**

Year	ROM	Screen rejects	Production	Overburden	Stripping ratio (t/t)
2009-10 (1 <sup>st</sup> Year)	36,00,000	4,00,000	32,00,000	10,00,000	1:0.44
2010-11 (2 <sup>nd</sup> year)	36,00,000	4,00,000	32,00,000	12,00,000	1:0.50
2011-12 (3 <sup>rd</sup> year)	36,00,000	4,00,000	32,00,000	15,00,000	1:0.59
2012-13 (4 <sup>th</sup> Year)	75,00,000	8,00,000	67,00,000	18,00,000	1:0.39
2013-14 (5 <sup>th</sup> year- till end of lease period)	50,00,000	5,50,000	44,50,000	20,00,000	1:0.57
<b>Total</b>	<b>23300000</b>	<b>2550000</b>	<b>20750000</b>	<b>7500000</b>	<b>1:0.48</b>

Source: Modified Scheme of Mining & Progressive Mine Closure Plan

### **2.8.3 Year wise generation of the overburden soil and screen rejects**

The lease area is underlain by the OB cover and intercalation of the same along with shale is also found in the limestone of the lower benches due to which the quality of the limestone gets deteriorated. To overcome this, GC has to remove the OB cover before feeding it to crusher and pass through the screening system to remove the deleterious material such as shale and clay from the limestone as screen reject.

**TABLE: 2.8.3**

**YEARISE GENERATION OF WASTE**

Year	Overburden	Screen reject	Top Soil
2009-10 (1 <sup>st</sup> Year)	1000000 MT	400000 MT	100000 m <sup>3</sup>
2010-11 (2 <sup>nd</sup> year)	1200000 MT	400000 MT	100000 m <sup>3</sup>
2011-12 (3 <sup>rd</sup> year)	1500000 MT	400000 MT	100000 m <sup>3</sup>
2012-13 (4 <sup>th</sup> Year)	1800000 MT	800000 MT	100000 m <sup>3</sup>
2013-14 (5 <sup>th</sup> year- till end of lease period)	2000000 MT	550000 MT	100000 m <sup>3</sup>
<b>Total</b>	<b>75,00,000 MT</b>	<b>25,50,000 MT</b>	<b>500000 m<sup>3</sup></b>

Source: Modified Scheme of Mining & Progressive Mine Closure Plan

### 2.8.3.1 REMOVAL OF OVERBURDEN, REJECT AND TOP SOIL

Top soil is being removed by the Back Hoe Shovel. Top soil is transported to the Green Belt all along the lease boundary and dumped in manner so that the soil can hold the water quantity for longer period. This in turn help to grow plants in a faster way.

Waste material such as OB and Screen reject will be transported by dumpers to their respective dumps where they will be unloaded. Maximum height of the terraces will be kept at 6/8 m for screen reject and overburden soil dumps. The cumulative year wise areas covered under the above dumps are given in table below:

**TABLE: 2.8.3.1**  
**YEARWISE AREA TO BE COVERED UNDER DUMPS**

Year	Overburden dump area increment in ha	Screen reject dump are increment in ha
2009-10	4.80	5.7
2010-11	1.20	0
2011-12	0	0
2012-13	0	0
2013-14 (till end of lease period)	0	0
<b>Total</b>	<b>6.00</b>	<b>5.7</b>

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

The existing dumps are located over the area which is non mineable as it contains shaly limestone at very depth of O.B. at places. Due to space constraints, In the future the material of the existing OB dump can be used for the back filling.

## 2.8 Conceptual Plan

### 2.8.1 Ultimate pit limit

#### 2.8.1.1 Ultimate Depth of Pit

The ultimate depth of the mine pit will be 36m bgl (240 m RL).

### 2.8.2 Waste generation & Disposal

Total 77.77 million tons OB/Mineral Rejects will be generated up to the life of the mine. OB/rejects will be partly used for backfilling purpose & rest will be dumped in 0.40.32 ha land within the lease area. Dumps will be stabilized followed by plantation after maturation of dumps. Top soil will be stacked separately & will be used for plantation purpose. There will be no top soil dump at the end of life of mine.

### 2.8.3 Land Use Pattern of ML Area (in Hectares)

Table: 2.8.3  
ENVIRONMENTAL IMPACT  
Land: Stage wise Land use and Reclamation Area (Ha.)

S. No.	Description	Landuse				
		Plantation	Public Use	Water Body	Undisturbed	Total
1.	Top Soil Dump	Nil	-	-	-	Nil
2.	Waste Dump	40.32	-	-	-	40.32
3.	Excavation (Voids) Reclaimed (Backfilled)	- 251.00	-	307.954 -	-	307.954 251.00
4.	Road	-	10.00	-	-	10.00
5.	Built up area	-	1.72	-	-	1.72
6.	Town Ship Area	-	-	-	-	-
7.	Afforestation (Green Belt /Avenue Plantation)	111.840	-	-	-	111.840
8.	Mineral storage	-	-	-	-	-
9.	Undisturbed Area	-	-	-	-	-
	<b>Total</b>	<b>403.16</b>	<b>11.72</b>	<b>307.954</b>	<b>-</b>	<b>722.834</b>

Source: Modified Scheme of Mining & Progressive Mine Closure Plan

## **2.9 SITE SERVICES**

The site services at the mines will be as follows: -

### **2.9.1 Canteen / Rest Shelter**

A good canteen has been provided in the nearby mines office premises for the employees to take food and rest. The canteen is well equipped and it provides services at subsidized rates. In addition to this, washing places has also been provided in the canteen. Suitable steps have been taken to maintain the canteen in a clean and hygienic condition.

### **2.9.2 Drinking Water**

In order to cater to the needs of the drinking water, sufficient; water is made available to the mines workmen. A number of outlets for water has been provided at the crusher, garage, mines office canteen and steps has been taken to ensure that water is always available during the working hours.

### **2.9.3 Urinal & Lavatory**

Sufficient number of urinals and lavatories are there at mines and garage premises.

### **2.9.4 Adequate lighting arrangement**

Adequate lighting arrangements (including portable lighting towers) have been made at quarry face, haulage roads, dumps and garage as per the statutory requirement.

### **2.9.5 Vocational Training Center**

A fully fledged vocational training center comprising the facilities listed below has been provided in mine lease area. All the provisions of mines VTC rules 1960 are complied with:

1. Lecture room;

2. Discussions hall;
3. Model room;
4. Library;
5. Laboratory;
6. Toilet; and
7. Adequate training materials like slides, cassettes, maps, charts, Flanner boards etc.

### **2.9.6 First Aid Room**

A First Aid Room has been constructed at the mine with the equipment as specified in the Second Schedule of Mines rule. A qualified and experienced person is in-charge of the First Aid Room for attending to persons during any accident. In addition, First Aid boxes containing the equipment as specified in the third Schedule of the Mines rule, 1955 has been provided at Mines Garage.

### **2.9.7 Maintenance Workshop**

All the large earth moving equipment has been maintained in good working order at the workshop / garage from nearby mines. The garage / workshop have been equipped with necessary tools and equipment etc. For maintenance work at site, a well equipped maintenance van with greasing as well as diesel and oil filling facilities has been provided.

## **2.10 MITIGATION MEASURES**

### **2.10.1 Air Pollution Control**

- Efficient in-built wet drilling system has been provided in the drills and operated in day hours only.
- Operators utilizes closed AC cabin and dust mask also provided to be used when needed.

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- Dust generated during blasting is instantaneous in nature and is immediately dissipated.
- Controlled blasting is being done.
- Rock breaker is being used to avoid secondary blasting.
- Haulage road are adequately sprayed with water by either water tanker or water sprinkler. Both side of the road have been planted to arrest airborne dust. Operators are provided with dust masks.
- Development of Green belt/plantation along the haul roads, mine office to arrest dust.

### **2.10.2 Water Pollution Control**

Adequate control measures are being adopted to check not only the wash-off from soil erosion but also uncontrolled flow of mine water. The measures to be adopted are:

- Garland drain & 4 Nos. settling tank have been constructed around working pit, OB soil dump and the dump is also scientifically vegetated to avoid soil erosion and water so collected is used for plantation.
- Selection of waste dumps site has been done by keeping distance from watercourses in the area
- Periodical testing of mine water is being carried out to check its quality.
- Sump with capacity of 7 lac m<sup>3</sup> has been designed taking into account of Peak sudden rainfall and maximum discharge in the area and adequate retention period to allow proper settling of silt material
- Ground water level is being monitored by piezometers in the project area
- Roof water harvesting is done at hospital, school building, shopping complex, CCR building, Mine office and Rawan Panchayat Bhawan.
- Oil/water separator has been provided in the workshop and is used for green belt development after proper treatment.

### 2.10.3 Noise Pollution Control

All precautions are being taken to keep noise levels within the prescribed standards:

- Drilling machines are having closed AC cabins, operators have been provided with earplugs/earmuffs for use during drilling operation.
- Noise generated due to blasting is impulse type which is controlled by putting adequate stemming column.
- Rock breakers are used for reduction of oversize boulders thereby avoiding secondary blasting, which generates irritating noise.
- Persons working in high noise zone are equipped with earplugs/earmuffs.
- Regular measurement of noise level is proposed near drilling equipment and other heavy earth moving machinery & steps will be taken to improve maintenance of all equipments so that noise level remain within permissible limits.
- Plantation of trees on internal roads and barriers.

### 2.10.4 Land Reclamation

The activity will affect the present landscape of the ML area. The original topography of the ML area will be affected mainly due to the actual mining operation.

At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir.

Out of total lease area i.e. 722.834 ha, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.



## 2.10.5 Plantation

Plantation will be done along roads, pits, and periphery of lease area. Out of total ML area of 722.834 ha, 403.16 hectare area will be covered under plantation & green belt development.

The following species to be planted in the Green belt *Ziziphus mauritiana* (Bar), *Acacia arabica* (Babul), *Ficus bengalensis* (Bargad), *Dalbergia sissoo* (Shisham), *Embllica officialis* (Amla), *Ficus religiosa* (Pipal), *Tamarindus indica* (Imli), *Azadirachta indica* (Neem) etc. Plantation shall be carried out as per CPCB guidelines.

Shrubs and grass shall also be grown on the top and over the slopes of waste-dumps, located in the applied area. The waste land shall be developed into green land by planting trees and shrubs.

**Table: 2.10.5**

### Ecology: Stage Wise Cumulative Plantation

Year	Un-worked Area Green Belt		Outside Dumps		Inside Dumps (Backfilled)		Top Soil Dumps		Total	
	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees
Existing	91.99	229975	1.45	2500	1.23	3075	-	-	94.67	235550
2009-10	1.00	2500	-	-	-	-	-	-	1.00	2500
2010-11	1.00	2500	-	-	-	-	-	-	1.00	2500
2011-12	1.00	2500	-	-	-	-	-	-	1.00	2500
2012-13	1.00	2500	-	-	-	-	-	-	1.00	2500
2013-14	1.00	2500	-	-	-	-	-	-	1.00	2500
VI th year onward	14.85	37125	38.87	77740	249.77	624425	-	-	303.49	739290
Total	111.84	279600	40.32	80240	251	627500	-	-	403.16	987340

Source: Modified Scheme of Mining & Progressive Mine Closure Plan



## **CHAPTER-III**

### **DESCRIPTION OF THE ENVIRONMENT**

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#### **3.0 INTRODUCTION**

The main objectives of describing the environment, which may be potentially affected, are (i) to assess present environmental quality and the environmental impacts and (ii) to identify environmentally significant factors that could preclude project development. The chapter contains information on existing environmental scenario for the following parameters.

1. Water Environment
2. Micro – Meteorology
3. Air Environment
4. Noise Environment
5. Soil Environment
6. Land Environment
7. Biological Environment
8. Socio-economic Environment

To achieve these objectives, our team monitored the environmental parameters within the core zone and buffer zone (10 km. radial distance) from the mine site in accordance with the Guidelines for EIA issued by the Ministry of Environment & Forests, Govt. of India.

This chapter and the related discussions contain the results of field studies carried out during the Winter Season- December, 2009 to February, 2010.

### **3.1 STUDY AREA AT A GLANCE**

The study area is 10 km radius known as buffer zone has been measured from the boundary of the mine site in every direction. The buffer zone area falls in Tehsil Simga of Raipur district.

#### **1. General Particulars:**

- ◆ Village : Rawan
- ◆ Tehsil : Simga
- ◆ District H.Q. : Raipur
- ◆ State : Chattisgarh
- ◆ Latitude : 21°33' to 21°35' N
- ◆ Longitude : 81°58' to 82°00' E

#### **2. Demography (10 km radius of the mine site)**

- ◆ Total Population : 36565
- ◆ Number of Households : 10068
- ◆ Scheduled Castes : 15.80%
- ◆ Scheduled Tribes : 6.98%
- ◆ Literates : 57.23%
- ◆ Workers : 40.78%

#### **3. Climatology**

**During study period (Winter Season – December, 2009 to February, 2010)**

- i) Minimum Temperature : 11.4 °C
- ii) Maximum Temperature. : 30.2 °C
- iii) Relative Humidity (%)
  - At 08:30 hrs : 37% to 95%
  - At 17:30 hrs : 28% to 81%
- iv) Dominant Wind Direction : From NE

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### **3.2 Landuse/Land Cover Study**

The present Land use / Land cover map for the proposed project activity of Grasim Cement is prepared by current vintage of satellite image, which has helped in the study of present land use pattern of the study area. This report will also help in assessing the impact on land use pattern in the study area due to the proposed project activity.

#### **(A) DATA USED**

Indian Remote Sensing satellite IRS P6 LISS IV MX digital FCC (False Color Composite) of current vintage data has been used for preparation of Land use/ Land cover thematic map of present study area. Survey of India toposheet as a reference map on 1:50,000 scale has been used for preparation of base layer data like road, rail network, village and mine site and for geo referencing of satellite image.

#### **Technical Details**

- Satellite Image - IRS P6 LISS IV MX

#### **(B) METHODOLOGY**

Land use / Land cover map preparation, Base map creation; Geometric and Radiometric correction of satellite image has been processed using ERDAS Imagine 9.2 Software.

Salient features of the adopted methodology are given below:

- Acquisition of satellite data.
- Preparation of base map from Survey of India toposheets.
- Data analysis using visual interpretation techniques.
- Ground truth studies or field checks.
- Finalization of the map.
- Digitization using heads up vectorisation method.
- Area calculation for statistics generation.

### 3.2.1 Interpretation of Remote Sensing Data

Satellite images are composed of array of grid, each grid have a numeric value that is known as digital number. Smallest unit of this grid is known as a pixel that captures reflectance of ground features represent in terms of Digital number, which represent a specific land features. Using image classification technique, the satellite data is converted into thematic information map based on the user's knowledge about the ground area.

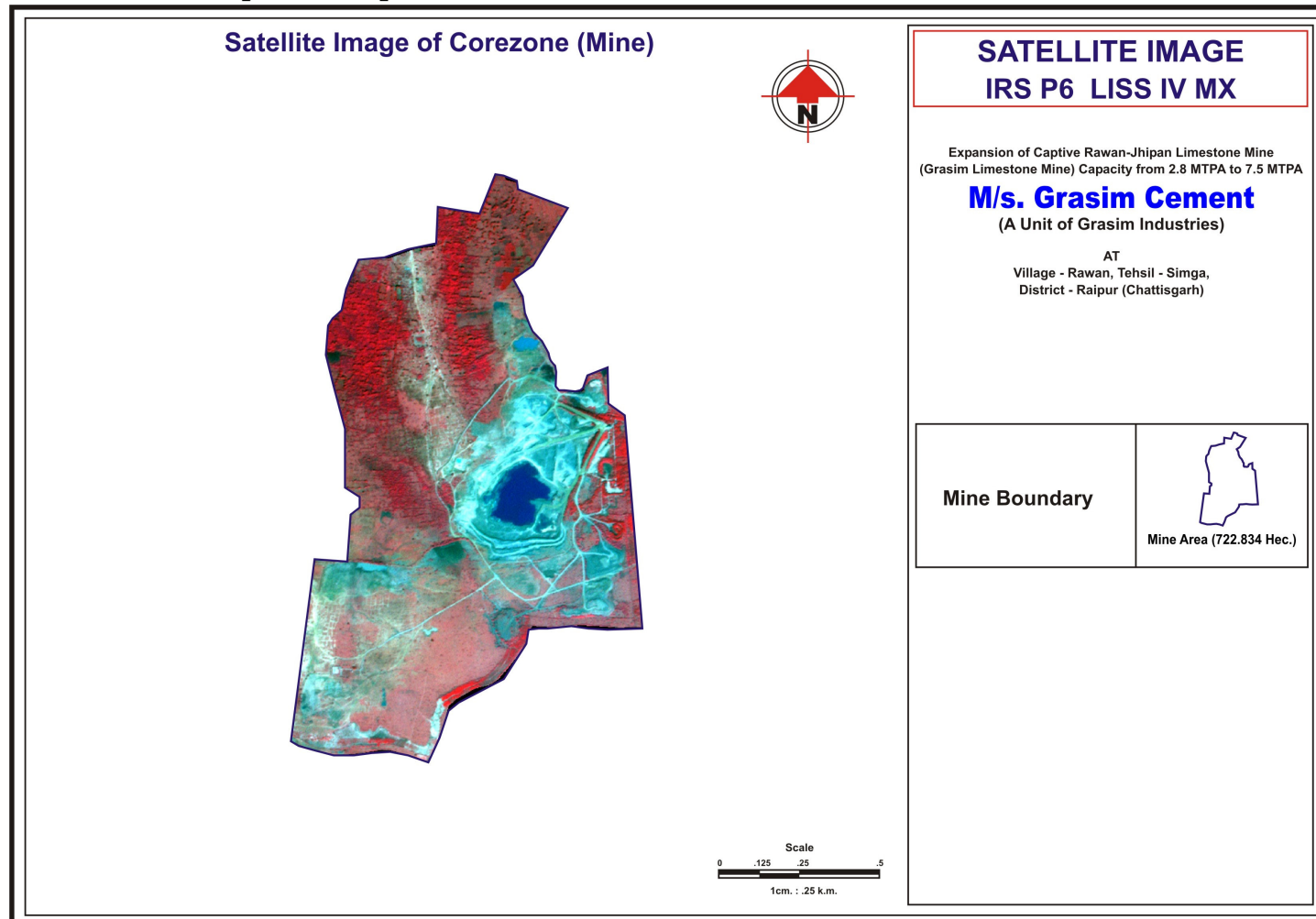
Hybrid technique has been used i.e. visual interpretation and digital image processing for identification of different land use and vegetation cover classes based on spectral signature of geographic feature. Spectral signature represents various land use class. Image interpretation keys are developed based on image characteristics like color, tone, size, shape, texture, pattern, shadow, association etc, which enables interpretation of satellite images for ground feature. Training sites are then assigned based on their spectral signature and interpretation elements.

- Following classes have been used for the Land use. Land cover Map: Water Bodies, Plantation, Agriculture Land, Fallow Land, Protected Forest, Human Settlement, Scrub Land, Stony Waste, Vegetation, Open waste land & Industrial area. Using image classification algorithm land use map is then generated.

Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)  
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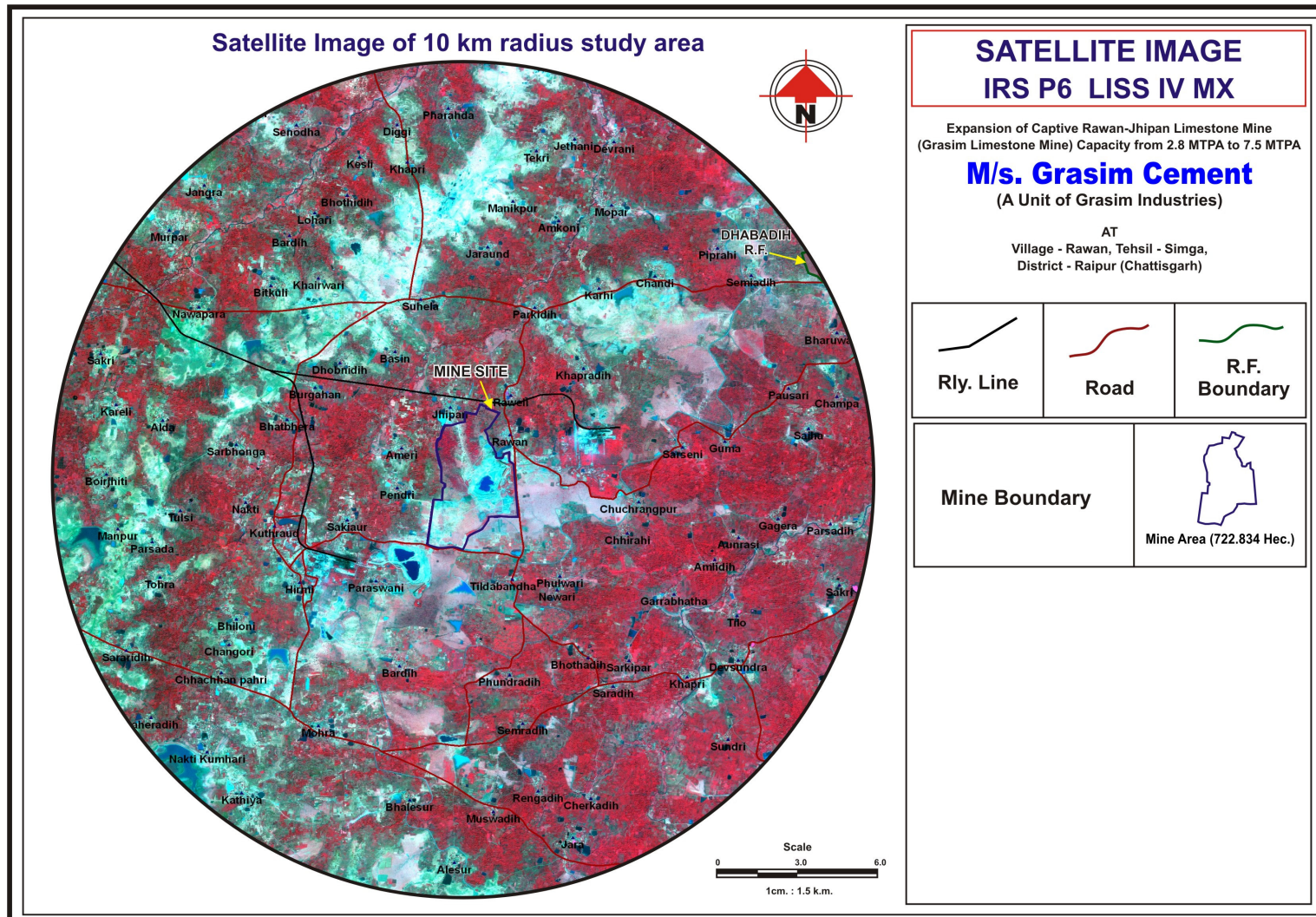
### 3.2.2 False Colour Composite Map



**Figure no. 3.2.2 (A) Satellite Imagery of Core Zone**

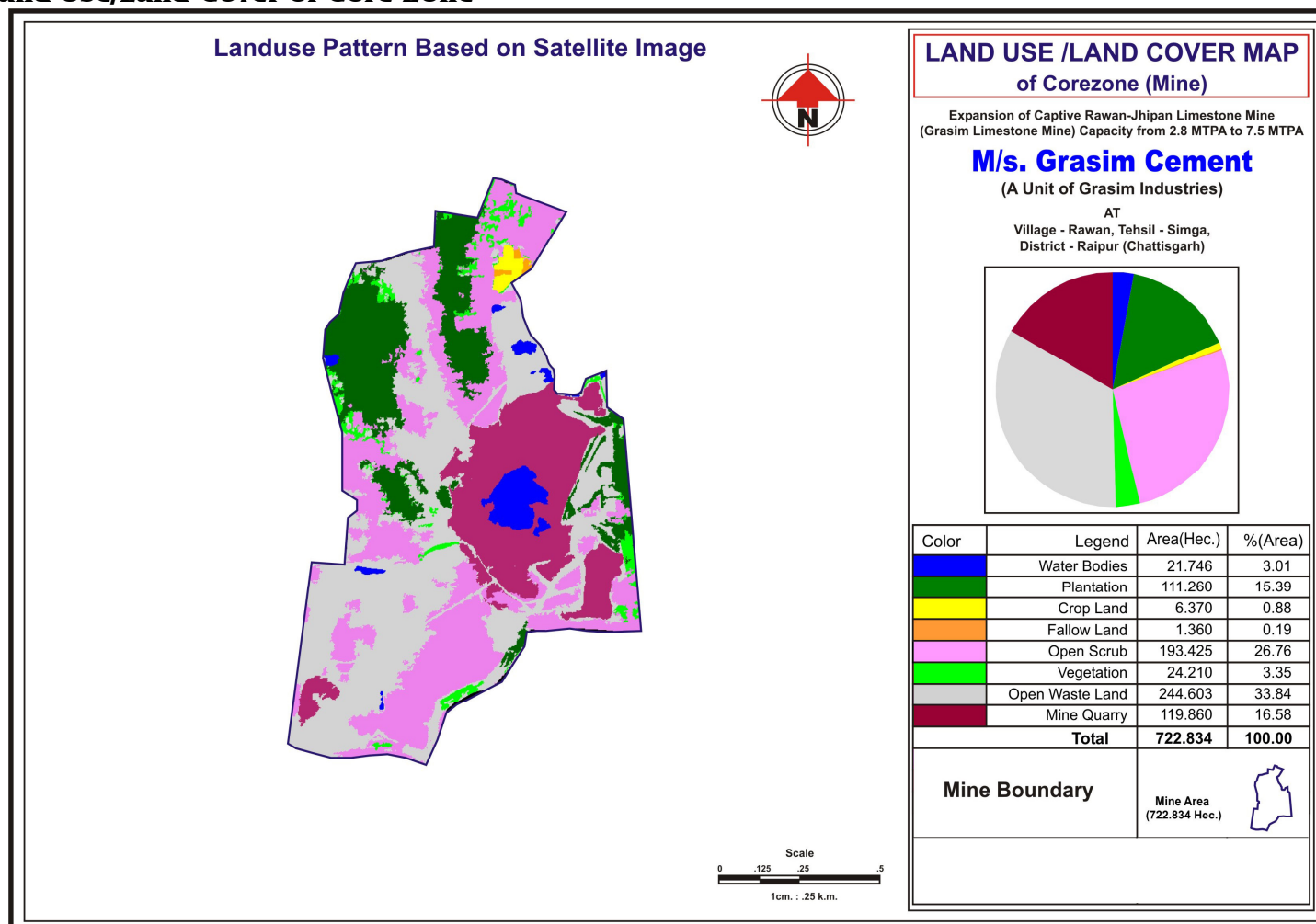
**Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)**  
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**Figure no. 3.2.2 (B) Satellite Imagery of Buffer Zone**

### 3.2.3 Land Use/Land Cover of Core Zone



**Figure no. 3.2.3 Land Use /Land Cover Map of Core Zone**



### 3.2.3.1 Land Use/ Land Cover Details of the Core Area

The land use land cover details of the lease area are given below:

**Table: 3.2.3.1**

**Land use/land cover area statistics of mine lease**

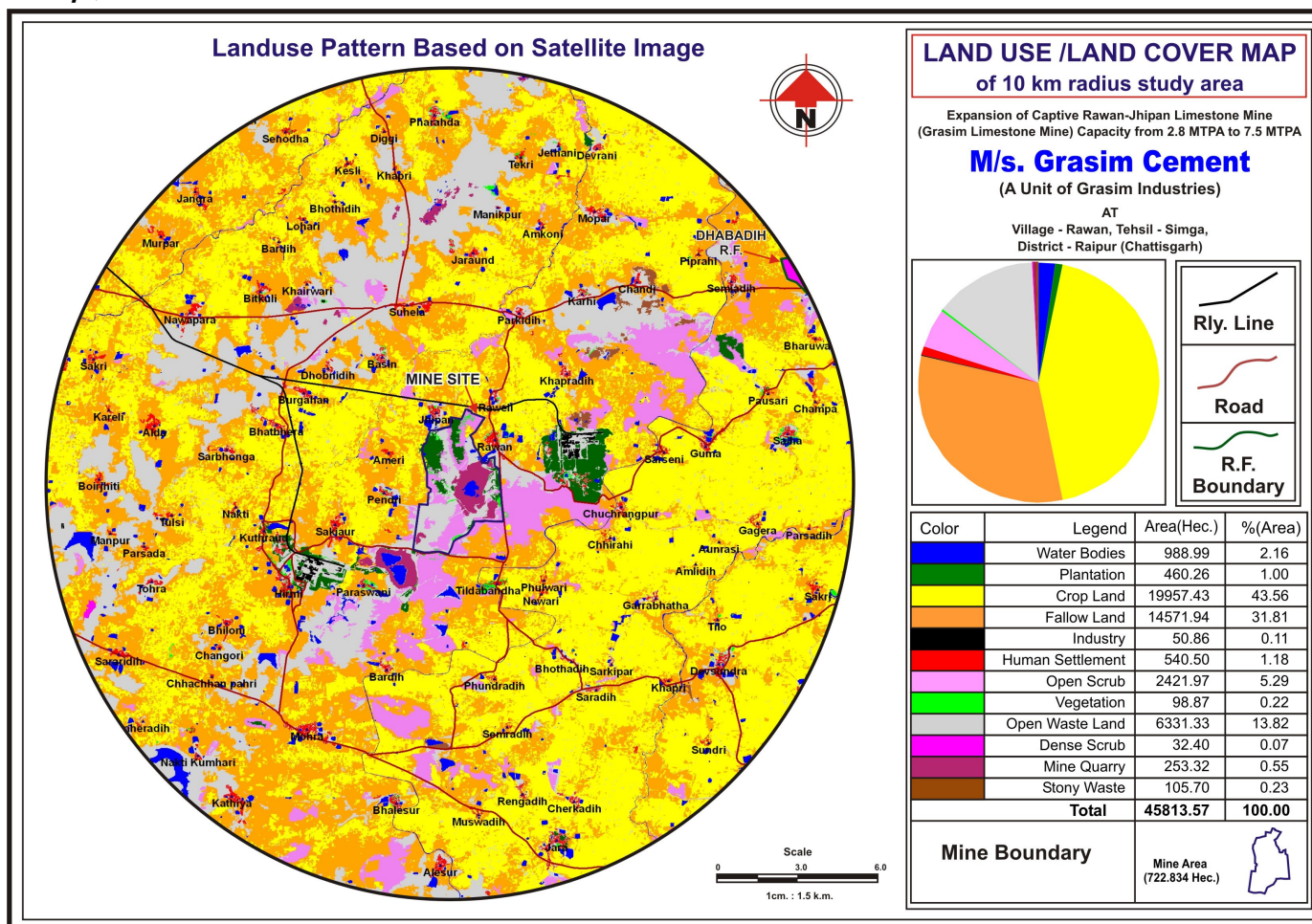
<b>LANDUSE</b>	<b>AREA (in Hectares)</b>	<b>AREA (in %)</b>
Water Bodies	21.746	3.01
Plantation	111.260	15.39
Crop Land	6.370	0.88
Fallow Land	1.360	0.19
Open Scrub	193.425	26.76
Vegetation	24.210	3.35
Open Waste Land	244.603	33.84
Mine Quarry	119.860	16.58
<b>TOTAL</b>	<b>722.834</b>	<b>100.00</b>

*Source: Satellite Imagery*

**Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)**  
**Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA**  
 At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)

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### 3.2.4 Land Use/Land Cover of Buffer one



**Figure no. 3.2.4 Land Use /Land Cover Map of Buffer Zone**

### 3.2.4.1 Land Use/ Land Cover Details of the Buffer Zone

The land use land cover details of the Buffer Zone are given below:

**Table: 3.2.4.1**

**Land use/land cover area statistics of Buffer Zone**

<b>LANDUSE</b>	<b>AREA (in Hectares)</b>	<b>AREA (in %)</b>
Water Bodies	988.99	2.16
Plantation	460.26	1.00
Crop Land	19957.43	43.56
Fallow Land	14571.94	31.81
Industry	50.86	0.11
Human Settlement	540.50	1.18
Open Scrub	2421.97	5.29
Vegetation	98.87	0.22
Open Waste Land	6331.33	13.82
Dense Scrub	32.40	0.07
Mine Quarry	253.32	0.55
Stone Waste	105.70	0.23
<b>TOTAL</b>	<b>45813.57</b>	<b>100.00</b>

*Source: Satellite Imagery*

## 3.3 PHYSIOGRAPHY AND DRAINAGE

The terrain of the study area is gently to moderately sloping and having gentle slope. Overall drainage of the area is moderate and of dendritic type. There is no major water body in the subject area.

Geologically, the study area is a gently undulating to almost a plain area with general elevation ranging from 260 – 283 meters above mean sea level with General ground level as 276 m AMSL. The mining lease comprises of both private and Government waste lands and has no permanent water course flowing through the area.

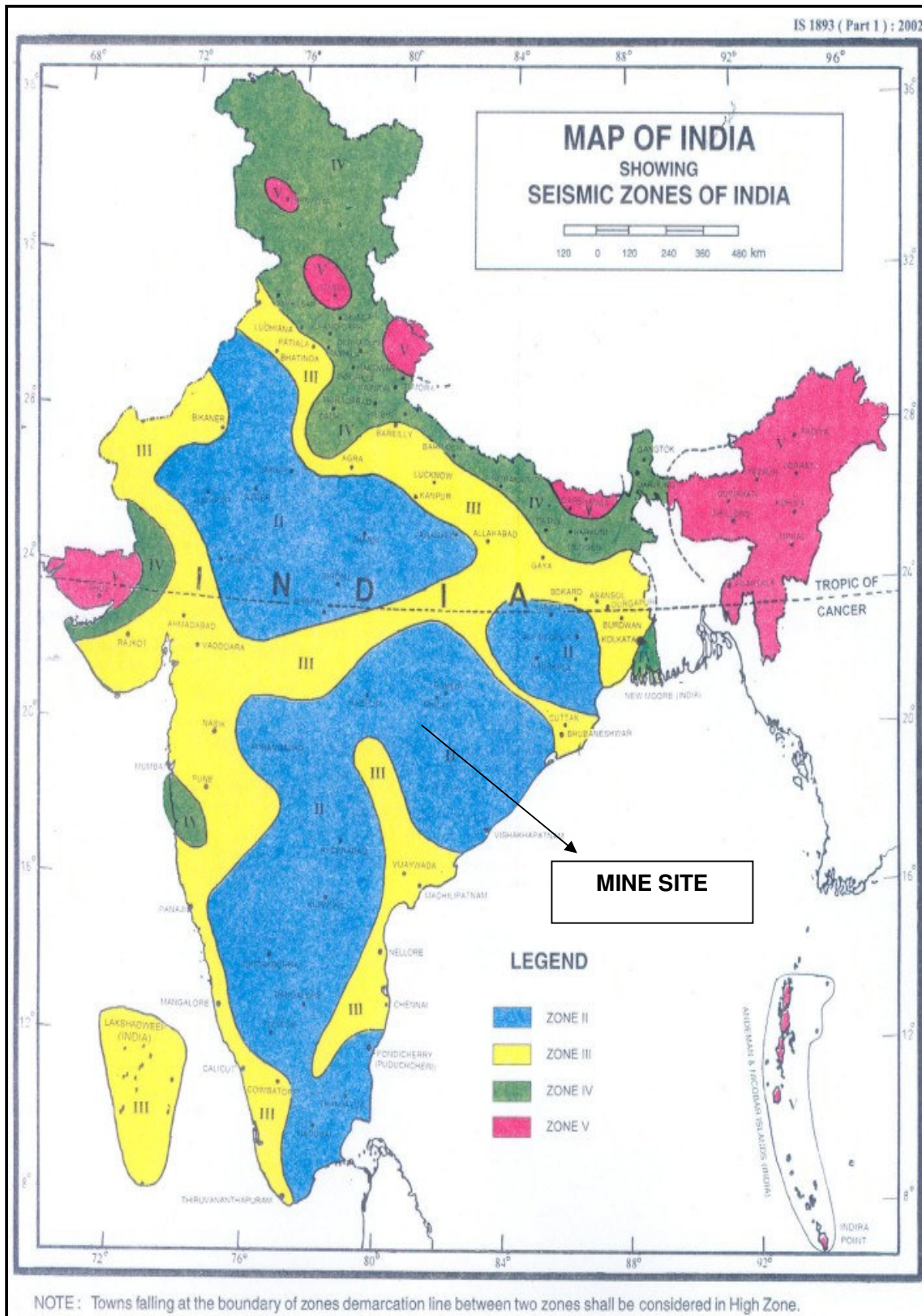
<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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The Mahanadi and Seonath rivers flow around 40 km East and 36 km West of the area, respectively. The drainage is mostly dendritic in nature and takes north - westerly course in the north and south – easterly course in the south. The drainage is controlled mainly due to two raised outcrops. One in the north – eastern corner while another in the western limestone area.

### **3.4 Seismicity of Area**

Chhattisgarh has very low rates of seismic activity. In recent years, tremors from earthquakes in neighbouring states have been felt, most notably in 1954. Minor seismic activity has been recorded in the vicinity of Chiraikund and Muirpur along the border with Madhya Pradesh. A few faults which form the eastern section of the Narmada-Son Fault Zone have shown movement during the Holocene epoch. Another active fault is the Tatapani Fault which trends in an east-west direction in the vicinity of Manpura in Sarguja district. In the south, the Godavari fault, which forms the northern flank of the Godavari Graben run through the southern part of the state and is also active.

The seismic hazard map of India was updated in 2000, by the Bureau of Indian Standards (BIS). The main change in the map for the state of Chhattisgarh was the merging of Zones I and II under which much of the state falls. A sliver of the district of Dantewara lies in Zone II. Parts of the northern districts of Bilaspur, Janjgir, Jashpur, Korba, Korla and Sarguja lie in Zone III. Since the earthquake database in India is still incomplete,



**Figure no. 3.4 (Seismic Zoning Map of India)**

especially with regards to earthquakes prior to the historical period (before 1800 A.D.), these zones offer a rough guide of the earthquake hazard in any particular region and need to be regularly updated.

The following list briefly outlines known earthquakes in this region which either had observed intensities of V or higher (historical events) or had known magnitudes of M 4.5 or more (instrumented events). General locations are provided for historical events for which "generalized" epicentral co-ordinates are available. Some events which were significant for other reasons are also included. This list will be updated whenever newer information is available. Please note that Magnitude and Intensity are NOT THE SAME. All events are within the state or union territory covered on this page unless stated otherwise.

**Table No. 3.4: History of Earthquakes in Chhattisgarh**

S.N	DATE	Area and District	Latitude & Longitude	Time (OT)	Magnitude	Depth (kms)
1.	05 January, 1954	Gorka-Konta area, Dantewara, Chhattisgarh	18.000 N, 18.000 N		M <sub>L</sub> 4.0 (5).	
2.	12 February, 1996	Lemru area, Korba, Chhattisgarh	22.616 N, 82.893 E	20:39:54	M <sub>L</sub> 4.3 (7)	33.0
3.	22 May, 1997	Jabalpur-Kosamghat area, Madhya Pradesh	23.083 N, 80.041 E	22:51:28.	M <sub>W</sub> 5.8 (7)	36.0
4.	10 October, 2000	Surta-Ambikapur area, Chhattisgarh	23.060 N, 82.917 E	06:11:32	M <sub>B</sub> 4.5 (7).	5.4
5.	10 June, 2001	Ambikapur area, Chhattisgarh	23.030 N, 83.154 E	01:12:18	M <sub>L</sub> 3.6 (3)	16.5
6.	12 June, 2001	Konokjora-Sundargarh area, Orissa,	22.240 N, 83.918 E	12:41:00	M <sub>W</sub> 4.7	025.5
7.	13 April, 2007	Jaldega-Dharamjaygarh area, Chhattisgarh	22.700 N, 83.200 E	11:49:42	M <sub>?</sub> 3.1	10.0
Acronyms Used: OT=Origin Time, MW=Moment Magnitude, MB=Body Wave Magnitude, ML=Local Magnitude, M?=Magnitude Type unknown						

According to GSHAP data, the state of Chhattisgarh falls in a region of low seismic hazard with the exception being moderate hazard in areas along the Maharashtra and Andhra Pradesh state borders. As per the 2002

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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Bureau of Indian Standards (BIS) map, this state also falls in Zones II & III. Historically, parts of this state have experienced seismic activity in the M4.0 range. The largest instrumented Earthquake in last 10 years in Chhattisgarh was of 10 October 2000 at Surta-Ambikapur area, Chhattisgarh, located to the north-east of Korba. This event had a magnitude of 4.5 (7). Apart from this no other major event is recorded in this area. Thus there is no prominent activity in this area. The mine site is far from any active faults or thrusts and hence makes the site to fall in seismic safe zone. Hence the risk of earthquake at the site is minimal and so the site is safe.

### **3.5 INSTRUMENT USED FOR ENVIRONMENTAL BASELINE DATA COLLECTION**

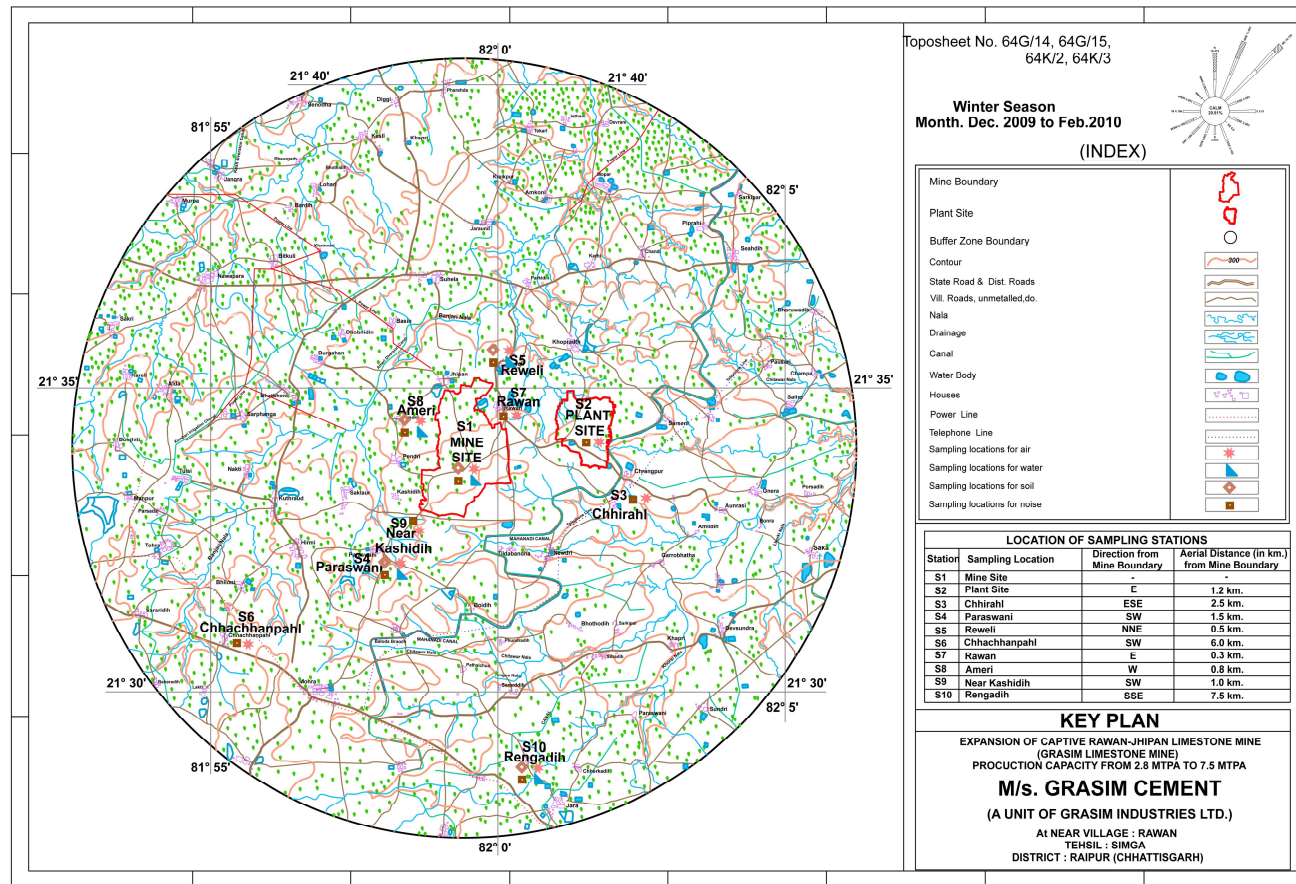
The following instruments were used at the site for environmental baseline data collection work.

1. Respirable Dust Collector with attachment for gaseous Pollutants, Envirotech APM 460.
2. Fine Particulate Matter (FPM) Sampler
3. Digital D.O. Meter Model – 831 E.
4. Dry and Wet Bulb Thermometer.
5. Sound Level Meter Model SL – 4010
6. Micro Meteorological Station Model Enviro Wm 251
7. Water Level Indicator
8. GPS

In addition to the above samples collected, the data on land use, vegetation and agricultural crops were also collected by the field team by meeting with a large number of local inhabitants in the study area and different Government departments / agencies. This provided an excellent opportunity to the members of the field team for obtaining an intimate feel of the environment of the study area.



### 3.5.1 KEY PLAN



**FIG 3.5.1: KEY PLAN**



### **3.6 WATER ENVIRONMENT**

#### **3.6.1 Hydrology**

The occurrence of ground water is different in different formation and rock types. The weathered and fractured zone provides scope of ground water storage and movement. In the area, ground water occurs under phreatic condition in weathered portion and semi-confined to confined conditions in fractures/cavernous part of rocks i.e. limestone and shale at depths.

#### **3.6.2 Surface Water**

The Mahanadi Canal is nearby the mine area, in which water is available in rainy season only. There is no major river in the 10 km radius study area & hence surface water sampling was not carried out for the project activity.

Rainfall is the only direct source of ground water recharge for the study area. While, two major rivers i.e. Mahanadi (40 km, E) recharges the ground water of the Raipur district.

#### **3.6.3 Ground Water Quality**

The sources of potable water are the tube-wells & dug-wells in the area. Samples were collected from the available water resources around the mine area. The samples were collected & tested from different sites.

The quality of ground water was studied by collecting eight water samples from representative open dug wells and tube wells. The water sampling stations are shown below:

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP</b> <b>Report</b>
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**TABLE -3.6 (A)**

**GROUND WATER SAMPLING STATIONS**

**STUDY PERIOD – WINTER SEASON (DECEMBER, 2009 TO FEBRUARY, 2010)**

<b>Station</b>	<b>Sampling Location</b>	<b>Direction from Mine Site</b>	<b>Aerial distance in km. From Boundary of Mine Site</b>
GW1	Rawan Jhipan Mine Site	-	-
GW2	Plant Site	E	1.2
GW 3	Chhirahi Village	ESE	2.5
GW 4	Paraswani Village	SW	1.5
GW 5	Raweli Village	NNE	0.5
GW6	Chhachhanpahl	SW	6.0
GW7	Rawan Village	E	0.3
GW 8	Ameri Village	W	0.8
GW 9	Near Kasahidih Village	SW	1.0
GW10	Rangadih Village	SSE	7.5

**TABLE No.: 3.6 (B)  
GROUND WATER QUALITY  
STUDY PERIOD – WINTER SEASON (DECEMBER, 2009 TO FEBRUARY, 2010)**

S. No.	PARAMETERS	SAMPLING STATIONS										Specification as per IS:10500	Detection Limit
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW9	GW10		
1.	pH	7.70	7.66	7.68	7.52	7.69	7.32	7.78	7.81	7.75	7.76	6.5-8.5	0.1-13.9
2.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	-
3.	Colour (Hazen Unit)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5 (Max,25)	5.0 – 100 Hazen Units
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5.	NTU	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5 (Max. 10)	1-100 NTU
6.	TDS (mg/l)	468	498	472	468	446	465	469	485	480	471	500 Max. (2000)	1.0 – 1000 mg/l
7.	Conductance (µSiemens/cm)	850	905	858	851	810	845	852	881	875	856	-	-
8.	Total Hardness as CaCO <sub>3</sub> (mg/l)	255.10	298.5	266.8	255.7	222.6	245.1	244.3	299.7	287.9	289.4	300 Max. (600)	1 – 1000 mg/l
9.	Calcium as Ca <sup>+2</sup> (mg/l)	48.10	62.4	79.33	65.2	66.1	55.6	55.3	50.2	54.24	56.34	75, Max. (200)	1 – 200 mg/l
10.	Magnesium as Mg <sup>+2</sup> (mg/l)	32.42	42.79	33.97	22.16	13.84	25.53	25.51	41.87	32.25	35.46	30, Max. (100)	1 – 100 mg/l
11.	Fluoride as F <sup>-</sup> (mg/l)	0.46	0.64	0.55	0.53	0.51	0.53	0.48	0.52	0.50	0.53	1.0, Max (1.5)	0.02 – 10 mg/l
12.	Chlorides (as Cl), mg/l	37.30	75.10	42.91	51.00	38.16	37.12	32.26	36.21	35.64	32.16	250 max. (1000)	0.5 – 100 mg/l
13.	Nitrates (as NO <sub>3</sub> ) mg/l	9.86	8.56	10.00	10.46	10.6	9.6	10.6	11.52	10.57	11.43	45, max. (100)	0.1 – 5.0 mg/l

**Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)  
Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA  
At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)**

**Draft EIA/EMP  
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14.	Sulphate as SO <sub>4</sub> <sup>2-</sup> (mg/l)	23.80	29.92	17.12	19.34	15.23	20.11	20.12	18.66	19.32	22.53	200, Max (400)	1 – 50 mg/l
15.	Iron as Fe (mg/l)	0.10	0.08	0.10	0.08	0.07	0.08	0.07	0.09	0.06	0.07	0.3, Max (1.0)	0.02 – 10 mg/l
16.	Alkalinity as CaCO <sub>3</sub> mg/l	140.22	255.5	160.74	168.50	152.23	148.77	133.22	141.23	138.54	144.41	250 (600)	0.5 – 1000 mg/l
17.	Phosphate	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
18.	Sodium as Na (mg/l)	88.2	93.10	89	98	115	101	98.1	102.5	99.5	101.7	-	-
19.	Potassium as K (mg/l)	23	29	31	24	30	31	25	26	24	27	-	-
20.	Copper as Cu (mg/l)	0.02	0.03	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.05 (max. 1.5)	0.02 – 15 mg/l
21.	Manganese as Mn (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 (max. 0.3)	0.10 – 5.0 mg/l
22.	Lead as Pb (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 (No relaxation)	0.05 – 10mg/l
23.	Zinc as Zn (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	5 (Max. 15)	0.1 – 10.0 mg/l
24.	Chromium as Cr (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05 (No relaxation)	0.01 – 20 mg/l
25.	Aluminum as Al (mg/l)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03 (max. 0.2)	0.03 – 5.0 mg/l
26.	Boron (mg/l)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1 (max. 5)	0.5-10mg/l
27.	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH) (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001 (max. 0.002)	0.01 – 0.50 mg/l
28.	Anionic Surfactants (mg/lit)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02(max.1.0)	0.02-10.00 ppm
29.	Hexa Chromium (mg/lit)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05(No relaxation)	0.01-20.0 ppm
30.	Nickel (mg/lit)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	0.2-10.0 ppm

**Source:** Field sampling & analysis report

A review of the above chemical analysis reveals that there is not much variation in chemical composition of water tapped from shallow open wells and from tube wells. The ground water from all sources remains suitable for drinking purposes as all the constituents are within the limits prescribed by drinking water standards promulgated by Indian Standards IS: 10500. Analysis results of ground water reveal the following: -

- pH varies from 7.32 to 7.81
- Total hardness varies from 222.6 mg/l to 299.7 mg/l
- Total Dissolved Solids varies from 446 mg/l to 498 mg/l

All parameter values in ground water sources are well and within the permissible limits laid by Ministry of Health, Govt. of India, for potable water.

### **3.7 METEOROLOGY**

Meteorology plays a vital role in affecting the dispersion of pollutants, once discharged into the atmosphere. Since meteorological factors show wide fluctuations with time, meaningful interpretation can be drawn only from long-term reliable data. Such source of data is the Indian Meteorological Department (IMD), which maintains a network of meteorological stations at several important locations. The nearest IMD station to the study area is located at Raipur. The Meteorological parameters were obtained for **Winter Season (Dec. 09 to Feb. 10)** from this station is temperature, humidity, rainfall, wind speed, and wind direction, recorded at two synoptic hours i.e. 8:30 and 17:30 hours.

#### **3.7.1 Climate**

Raipur has a tropical wet and dry climate. Temperatures remain moderate for most of the year, apart from the summer from March to June, which can be extremely hot. The city receives about 1400 mm of rain, mostly in the monsoon season from late June to early October. Winters last from November to January and are mild, although lows can fall to 5 °C (42 °F).

There is only one observatory located in Raipur which is about 90 km away from the cement plant maintained by Indian Metereology Department.

### **3.7.2 Rainfall**

The area enjoys tropical climate with hot summer followed by well-distributed rainfall through South-West monsoon season. The winter commences from December and last till the end of February. The period from March to the end of May is hot season. The monsoon season starts from the middle of June and last till the end of September. The annual rainfall of the area is around 730 mm. The rainfall generally increases from the north-west to the south-east. About 94 percent of the annual rainfall is received during the period June to October, July and August being the rainiest months. The variation in annual rainfall from year to year is very large. On an average there are 60 - 80 rainy days in a year. During the south-west monsoon season, the relative humidity is generally (08:30 am) 72% and (17:30 pm) 45% and during the rest of the year, the air is dry. The rainfall data is been given in Table-below.

**TABLE: 3.7.2  
ANNUAL RAIN FALL**

<b>YEAR</b>	<b>RAINFALL (mm)</b>
1999	855.8
2000	759.8
2001	871.0
2002	711.8
2003	723.4
2004	624.6
2005	704.8
2006	725.1
2007	506.2
2008	732.1

**Source:** Grasim Cement Plant Observatory

### **3.7.3 Wind Speed / Wind Rose Diagram**

Wind speed and wind direction data recorded during the study period is useful in identifying the influence of meteorology on the air quality of the area. Based on the collected meteorological data, relative percentage frequencies of different wind directions are calculated and plotted as wind roses for eight hourly and twenty four hour duration respectively. Maximum and minimum temperatures including percentage relative humidity were recorded simultaneously.

The observed wind pattern during the study period is described below and is plotted for the study period. The predominant over all wind patterns for the study period is from **North East direction**. Wind speed during this period varies from 3 km/hr to 14 km/hr.

### **3.7.4 Micro-Meteorology at Site**

Meteorological station was set-up at site to record surface meteorological parameter during study period (Dec, 09 to Feb, 10).

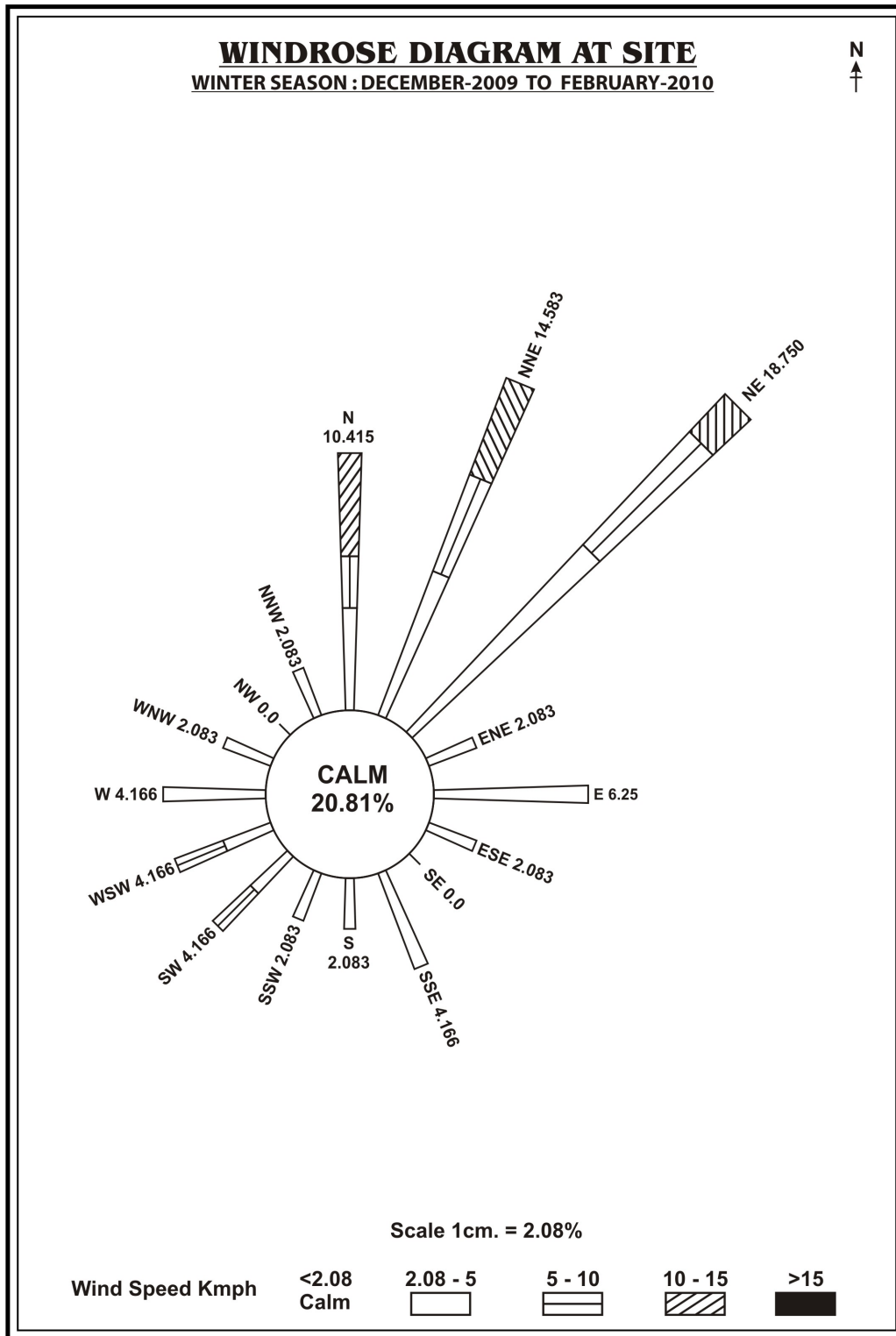
The wind recorded during the survey period at the site is more or less according to the trend indicated in wind rose diagram according to the trend indicated in wind rose diagram. The details of the hourly wind speed & wind direction as follows:

**TABLE No.: 3.7.4**  
**MICRO-METEOROLOGY AT MINE SITE**  
**STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)**

DATE	DETAILS				WIND SPEED & DIRECTION			
	TEMPERATURE °C		RELATIVE HUMIDITY %		8:30 Hrs.		17:30 Hrs.	
	Max.	Min.	8:30 Hrs.	17:30 Hrs.	Direct	Speed km/hr.	Direction	Speed km./hr.
05.12.2009	27.4	11.4	93	49	N	09	NE	03
06.12.2009	26.3	13.3	65	51	CALM	00	CALM	00
13.12.2009	25.1	13.2	70	53	NE	09	NNE	14
14.12.2009	25.3	12.5	54	44	CALM	00	CALM	00
22.12.2009	25.6	12.9	50	39	N	04	W	05
23.12.2009	23.4	13.4	52	30	SW	08	E	04
30.12.2009	24.1	14.1	61	41	SSW	07	N	12
31.12.2009	24.8	13.9	53	48	NE	08	NNE	07
05.01.2010	24.6	13.6	64	76	SSE	04	CALM	00
06.01.2010	26.9	13.4	59	81	NNE	04	NE	07
15.01.2010	26.2	14.0	67	68	E	03	CALM	00
16.01.2010	27.0	13.2	72	44	N	03	SW	03
24.01.2010	26.3	12.9	95	39	CALM	00	N	11
25.01.2010	27.1	14.1	84	28	NNE	04	NNW	06
30.01.2010	27.0	13.9	58	39	SSE	03	NNE	03
31.01.2010	27.2	14.4	46	33	CALM	00	E	04
07.02.2010	28.0	15.1	46	43	NE	04	WSW	03
08.02.2010	27.9	15.2	37	66	ENE	04	NE	03
11.02.2010	28.5	15.8	69	59	CALM	00	WNW	04
12.02.2010	28.8	16.5	54	60	NE	03	S	03
20.02.2010	28.5	16.9	57	64	NNE	08	W	04
21.02.2010	28.4	17.0	61	43	WSW	07	NNE	11
25.02.2010	29.5	17.4	63	54	CALM	00	ESE	04
26.02.2010	30.2	18.1	75	48	NE	12	NE	04

Source: Micrometeorology Station at Mine Site





**Figure 3.7.4: Wind rose Diagram at Mine Site**

### 3.7.5 Mixing Height & Inversion Height

Mixing height is the height to which significant mixing of added pollutants occurs within the atmosphere. Mixing height depends on basic meteorological parameters, surface turbulent fluxes and physical parameters, and follows a diurnal cycle.

Inversion may be defined as the “departure from the usual increase or decrease of an atmospheric property with altitude.” It usually refers to an increase in temperature with increasing altitude, which is a departure from the usual decrease of temperature with height.

Mixing height is as given in below & Inversion height has been taken as 450 m in the night.

**TABLE: 3.7.5**

**MIXING HEIGHT FOR THE MINE SITE  
 STUDY PERIOD (DEC, 09 TO FEB, 10)**

Time (Hours)	Mixing Height (m)
0500	100
0600	100
0700	150
0800	200
0900	400
1000	850
1100	1000
1200	1500
1400	1500
1500	1500
1600	2000
1700	2000
1800	1500
1900	400

**Source:** CPCB publication, “Spatial Distribution Of Hourly Mixing Depth Over Indian Region”, PROBES/88/2002-03

### **3.8 AMBIENT AIR ENVIRONMENT**

#### **3.8.1 Air Quality**

The ambient air quality with respect to the study zone of 10 km radius around the mine site forms the baseline information. The various sources of air pollution in the region are dust rising from unpaved roads, domestic fuel burning, vehicular traffic, agricultural activities, other industries, etc.

The prime objective of baseline air quality monitoring is to assess existing air quality of the area. This will also be useful in assessing the conformity to standards of the ambient air quality during the mine operations.

The baseline status of the ambient air quality has been assessed through scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- *Meteorological conditions.*
- *Topography of the study area.*
- *Likely impact area.*

#### **3.8.2 Ambient Air Monitoring**

Ambient air monitoring was carried out on monthly basis in the surrounding areas of mine site to assess the ambient air quality at the source. To know the ambient air quality at a larger distance i.e. in the study area of 10 km. radius, air quality survey has been conducted at 10 locations over a period of Winter season (Dec, 09 to Feb, 10). The ambient air quality monitoring stations were set up at the following locations which are shown in key plan & their direction & distance are shown in below.

Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha) Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	Draft EIA/EMP Report
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**TABLE NO.: 3.8.2 (A)**  
**LOCATIONS OF AAQ MONITORING STATIONS NEAR MINE SITE**  
**STUDY PERIOD – WINTER SEASON (DEC,09 TO FEB, 10)**

Station	Sampling Location	Direction from Mine Site	Aerial distance in km. From Boundary of Mine Site
SA1	Rawan Jhipan Mine Site	-	-
SA2	Plant Site	E	1.2
SA3	Chhirahi Village	ESE	2.5
SA4	Paraswani Village	SW	1.5
SA5	Raweli Village	NNE	0.5
SA6	Chhachhanpahl	SW	6.0
SA7	Rawan Village	E	0.3
SA8	Ameri Village	W	0.8
SA9	Near Kasahidih Village	SW	1.0
SA10	Rengadih Village	SSE	7.5

TABLE NO.: 3.8.2 (B)

AMBIENT AIR QUALITY MONITORING

STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

(Unit in  $\mu\text{g}/\text{m}^3$ )

Station	Sampling Location	PM10		PM2.5		SO <sub>2</sub>		NO <sub>x</sub>	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
SA1	Rawan Jhipan Mine Site	<b>82.76</b>	61.72	<b>38.10</b>	21.30	13.4	9.3	18.3	11.3
SA2	Plant Site	70.86	52.86	33.50	21.10	<b>16.30</b>	11.20	<b>21.00</b>	14.30
SA3	Chhirahi Village	64.80	45.12	30.50	20.50	11.5	6.7	14.5	<b>8.4</b>
SA4	Paraswani Village	50.13	32.08	24.28	<b>18.49</b>	11.8	6.6	13.3	10.2
SA5	Raweli Village	52.67	<b>31.87</b>	25.10	<b>18.40</b>	11.6	5.9	14.3	8.6
SA6	Chhachhan Pahri	60.77	37.12	28.12	19.25	11.9	8.8	14.7	9.9
SA7	Rawan Village	61.32	40.36	30.00	20.00	12.9	8.00	14.8	10.3
SA8	Ameri Village	48.32	32.09	25.00	18.81	10.3	<b>5.50</b>	12.6	8.5
SA9	Near Kasahidih Village	52.87	33.12	26.40	18.50	12.2	7.2	12.7	8.7
SA10	Rengadih Village	60.42	36.53	28.29	17.41	11.5	8.3	13.1	8.9

**TABLE NO.: 3.8.2 (C)  
NATIONAL AMBIENT AIR QUALITY STANDARDS**

S. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		Method of Measurement
			Industrial Area, Residential Rural & Other Areas	Ecologically Sensitive Area (Notified by Central Govt.)	
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO <sub>2</sub> ), µg/m <sup>3</sup>	Annual Average * 24 hours **	50 80	20 80	1. Improved West and Gacke Method. 2. Ultraviolet fluorescence
2	Oxides of Nitrogen as NO <sub>2</sub> , µg/m <sup>3</sup>	Annual Average * 24 hours **	40 80	30 80	1. Modified Jacob & Hochheiser (Na-Arsenite) Method 2. Chemiluminescence (Gas phase)
3	Particulate Matter (size less than 10µm) or PM <sub>10</sub> , µg/m <sup>3</sup>	Annual Average * 24 Hours **	60 100	60 100	1. Gravimetric, 2. TOEM, 3. Beta attenuation.
4	Particulate Matter (size less than 2.5µm) or PM <sub>2.5</sub> , µg/m <sup>3</sup>	Annual Average* 24 Hours **	40 60	40 60	1. Gravimetric, 2. TOEM, 3. Beta attenuation.
5	Ozone (O <sub>3</sub> ), µg/m <sup>3</sup>	8 Hours ** 1 Hours *	100 180	100 180	1. UV Photometric, 2. Chemiluminescence, 3. Chemical Method.
6	Lead (Pb), µg/m <sup>3</sup>	Annual Average * 24 Hours **	0.50 1.0	0.50 1.0	1. AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper. 2. ED-XRF using Teflon filter
7	Carbon Monoxide (CO), mg/m <sup>3</sup>	8 Hours** 1 Hours	02 04	02 04	Non Depressive Infrared (NDIR) Spectroscopy
8	Ammonia (NH <sub>3</sub> ), µg/m <sup>3</sup>	Annual Average* 24 hours **	100 400	100 400	1. Chemiluminescence (Gas phase) 2. Indophenol blue method
9	Benzene (C <sub>6</sub> H <sub>6</sub> ), µg/m <sup>3</sup>	Annual Average*	05	05	1. Gas Chromatography based continuous analyzer, 2. Adsorption and Desorption followed by GC analysis.
10	Benzo(a) Pyrene (BaP) – Particulate Phase only, ng/m <sup>3</sup>	Annual Average*	01	01	Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m <sup>3</sup>	Annual Average*	05	06	AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper.
12	Nickel (Ni), ng/m <sup>3</sup>	Annual Average*	20	20	AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper.

\* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

\*\* 24 hourly / 8 hourly values should be met 98% of the time in a year. However 2% of the time, it may exceed but not on two consecutive days.

### 3.8.3 Result

The concentration of PM<sub>2.5</sub> for all the 10 AAQM stations ranges between 18.40 to 38.10 µg/m<sup>3</sup>. The concentration of PM<sub>10</sub> for all the 10 AAQM stations ranges between 31.87 µg/m<sup>3</sup> to 82.76 µg/m<sup>3</sup>.

As far as the gaseous pollutants SO<sub>2</sub> and NO<sub>2</sub> are concerned, the promulgated CPCB limit of 80 µg/m<sup>3</sup> for residential and rural areas has never surpassed at any station. The SO<sub>2</sub> concentrations are in the range of 5.50 µg/m<sup>3</sup> to 16.30 µg/m<sup>3</sup> and the NO<sub>2</sub> concentration in the range of 8.4 µg/m<sup>3</sup> to 21.00 µg/m<sup>3</sup> for all the 10 AAQM stations.

### 3.9 NOISE ENVIRONMENT

Noise often defined as unwanted sound, interferes with speech communication, causes annoyance, distracts from work, disturb sleep, thus deteriorating quality of human environment. Noise Pollution survey has therefore been carried out.

Noise levels were measured near highways, residential areas and other settlements located within 10 km radius around the mine site

In order to know the baseline noise levels, in and around the mine site, noise levels were measured at the plant site and also at villages in the study area. Table-below shows the locations of the noise monitoring stations of the study area.

Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha) Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	Draft EIA/EMP Report
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**TABLE No.: 3.9 (A)**

**NOISE MONITORING STATIONS**

**STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)**

Station	Sampling Location	Direction from Mine Site	Aerial distance in km. From Boundary of Mine Site
SN1	Rawan Jhipan Mine Site	-	-
SN2	Plant Site	E	1.2
SN3	Chhirahi Village	ESE	2.5
SN4	Paraswani Village	SW	1.5
SN5	Raweli Village	NNE	0.5
SN6	Chhachhanpahl	SW	6.0
SN7	Rawan Village	E	0.3
SN8	Ameri Village	W	0.8
SN9	Near Kasahidih Village	SW	1.0
SN10	Rengadih Village	SSE	7.5

There are several sources in the 10 km radius of study area, which contributes to the local noise level of the area. Traffic, cement plant, activities at limestone mines as well as activities in near by villages and agricultural fields add to the ambient noise level of the area.

Noise monitoring data along with relevant standards are given in following table-below.



<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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**TABLE No.: 3.9 (B)**

**AVERAGE NOISE LEVEL**

**STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)**

S. No.	LOCATIONS	NOISE LEVEL Leq. dB (A)	
		Day Time (6:00 a.m. to 10:00 p.m.)	Night Time (10:00 p.m. to 6:00 a.m.)
SN1	Rawan Jhipan Mine Site	55	43
SN2	Plant Site	71	53
SN3	Chhirahi Village	47	36
SN4	Paraswani Village	48	39
SN5	Raweli Village	47	41
SN6	Chhachhanpahl	51	41
SN7	Rawan Village	49	40
SN8	Ameri Village	46	41
SN9	Near Kasahidih Village	48	39
SN10	Rengadih Village	49	41

**TABLE No.: 3.9 (C)**

**CPCB NOISE STANDARDS**

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6:00 AM to 10:00 PM  
 2. Night Time is reckoned between 10:00 PM to 6:00 AM  
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.  
 Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

### **3.9.1 Result**

Ambient noise levels were measured at 10 locations around the proposed mine site. Noise levels varies from 46 to 71 Leq dB(A) during day time and during night time noise levels ranges from 39 to 53 Leq dB(A). Thus noise levels at all locations were observed to be within the prescribed limits.

From the above study and discussions it can be concluded that noise levels in the study area are well within the prescribed limits as prescribed by the CPCB and State Pollution Control Board.

## **3.10 SOIL ENVIRONMENT**

### **3.10.1 Soil Quality and Characteristics**

The information on soils has been collected from various secondary sources and also through primary soil sampling analysis of which is described in this section.

For studying the soil profile of the region, 10 locations were selected to assess the existing soil conditions in and around the mine area representing various land use conditions. The concentrations of physical and chemical parameters were determined. In addition to the above, information on the availability of water sources at sampling locations were also collected.

The sampling locations have been finalized with the following objectives:

- To determine the baseline soil characteristics of the study area; and
- To determine the impact of industrialization on soil characteristics.

Quality of the soil in the area is showing a marked diversity in nature depending upon the parent rock and climatic conditions prevailing in different parts of the district. The analysis results of the soil samples collected are given in table below.

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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**TABLE No.: 3.10.1 (A)**  
**SOIL MONITORING STATIONS**  
**STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)**

<b>Station</b>	<b>Sampling Location</b>	<b>Direction from mine Site</b>	<b>Aerial distance in km. From Boundary of Mine Site</b>
SS1	Rawan Jhipan Mine Site	-	-
SS2	Plant Site	E	1.2
SS3	Chhirahi Village	ESE	2.5
SS4	Paraswani Village	SW	1.5
SS5	Raweli Village	NNE	0.5
SS6	Chhachhanpahl	SW	6.0
SS7	Rawan Village	E	0.3
SS8	Ameri Village	W	0.8
SS9	Near Kasahidih Village	SW	1.0
SS10	Rengadih Village	SSE	7.5

**TABLE No.: 3.10.1 (B)  
SOIL ANALYSIS REPORT  
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)**

S. No.	Parameters	Sampling Locations									
		RAWAN JHIPAN MINE SITE	PLANT SITE	CHHIRAHI	PARASWANI VILLAGE	RAWELI VILLAGE	CHHACHHANPAHL	RAWAN VILLAGE	AMERI VILLAGE	NEAR KASAHIDIH VILLAGE	RENGADIH
01.	pH (1:2 Soil Water Suspension)	7.78	<b>7.82</b>	7.59	7.70	7.62	7.66	7.65	7.72	7.63	<b>7.55</b>
02.	Colour	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown
03.	Electrical Conductivity, milli siemens	0.33	0.36	0.34	0.36	0.38	0.37	0.38	0.42	0.39	0.35
04.	Organic Carbon, %	0.88	<b>0.92</b>	0.83	0.84	0.80	<b>0.71</b>	0.80	0.79	0.76	0.79
05.	Nitrogen as N <sub>2</sub> , kg/Ha	310	348	298	300.1	269	253	298.5	288.5	276.1	296.1
06.	Soil Texture	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay
07.	Phosphorus as P <sub>2</sub> O <sub>5</sub> , kg/Ha	30.2	33	28.3	29.0	27.6	28.0	26.3	25.5	23.60	27.62
08.	Potassium as K <sub>2</sub> O, kg/Ha	128.1	148.2	115.2	120.6	126.1	122.7	109.2	116.5	105.6	115.3
09.	Calcium as Ca, mg/100gm	7.55	8.87	6.21	6.76	6.02	5.88	5.56	5.20	4.58	5.14
10.	Magnesium as Mg, mg/100gm	3.12	3.58	2.58	2.99	2.47	2.36	2.26	2.18	2.30	2.34
11.	Chloride as Cl, mg/100gm	13.20	15.23	12.50	15.54	13.67	12.2	12.10	11.60	11.25	10.46

**Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)  
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12.	Sodium mg/100gm	4.10	3.25	3.58	3.99	3.52	3.14	3.50	2.58	2.38	2.34
13.	Bulk Density, gm/cc	1.29	1.26	1.30	1.27	1.30	1.25	1.29	1.28	1.30	1.24
14.	WHC(%)	42.16	46.12	40.5	42.23	41.20	43.13	42.5	41.6	38.10	38.5
15.	Manganese as Mn, mg/100gm	7.15	8.28	6.58	7.05	7.10	6.77	7.36	7.38	5.20	6.73
16.	Copper as Cu, mg/100gm	2.68	3.21	3.10	2.41	3.01	3.11	3.60	2.82	3.48	2.72
17.	Lead as Pb, mg/100gm	0.68	0.56	0.38	0.43	0.39	0.54	0.48	0.42	0.40	0.41
18.	Chromium as Cr, mg/100gm	0.30	0.28	0.32	0.30	0.29	0.26	0.31	0.33	0.34	0.37
19.	Cadmium as Cd, mg/100gm	0.12	0.10	0.14	0.11	0.13	0.12	0.15	0.12	0.11	0.13
20.	Zinc as Zn, mg/100gm	5	4	4	6	5	4	6	4	4	4

**TABLE No.: 3.10.1 (C)**  
**STANDARD SOIL CLASSIFICATION**

S.No.	Parameters	Classification
1.	pH	<4.5 extremely acidic 4.51 – 5.0 very strong acidic 5.01 – 5.5 strongly acidic 5.51-6.0 moderately acidic 6.1 – 6.5 slightly acidic 6.51-7.3 Neutral 7.31-7.8 slightly alkaline 7.81-8.5 moderately alkaline 8.51 – 9.0 strongly alkaline >9.0 Very strongly alkaline
2.	Salinity Electrical Conductivity (mho/cm) 1 mho/cm = 640 ppm	Up to 1.0 average 1-2 harmful to germination 2-3 harmful to crops
3.	Nitrogen (kg/ha)	Up to 50 very less 51-100 less 110-150 good 151-300 better >300 sufficient
4.	Phosphorus (kg/ha)	Up to 15 very less 15 – 30 less 31-50 medium 51-65 on average sufficient 66-80 sufficient >80 more than sufficient
5.	Potassium (kg/ha)	0-120 very less 120-180 less 180-240 medium 241-300 average 301-360 better >360 more than sufficient

Soil is the media for supplying the nutrients for plant growth. Nutrients are available to plants at certain pH and pH of soils can reflect by addition of pollutants in it either by air, or by water or by solid waste or by all of these. In order to establish the baseline status of soil characteristics, soil samples were collected at 10 sampling locations. The analysis results show that soil is neutral in nature as pH value ranges from 7.57 to 7.82, with organic carbon 0.71% to 0.92%. The concentration of Nitrogen, Phosphorus & Potassium has been found to be in good amount in the soil samples. Soil texture is sandy loam.

### **3.11 BIOLOGICAL ENVIRONMENT**

#### **3.11.1 Introduction**

Anthropogenic activities tend to bring instability in the species composition and functioning of ecosystem. The first component to be affected directly as well as indirectly and in a short, medium and long time span would be the biotic component of the area. This sets a cyclic process, which may aggravate the situation unless corrective measures are adopted.

Generation of base-line data and knowing the type and extent of pollutants would be the first step of the environmental study report. The biological assessment is trustworthy and acceptable method to understand the impact of surroundings. This leads to suggesting remedial measures for minimizing impact.

#### **3.11.2 Flora**

The area is generally devoid of large trees. At places a few trees, bushes, etc. of local nature have been observed.

Besides the trees, natural vegetation grows mostly during monsoon and fades away with the onset of summer. These include grasses and shrubs, which are wild and grazed by animals. The study area has no rare, endangered species of flora. Name of some of the plant species & fauna species are mentioned below.

**TABLE – 3.11.2**  
**PLANT SPECIES FOUND IN STUDY AREA**

S.No.	Name of Plant Species	Local Name
<b>TREES</b>		
1.	<i>Acacia nilotica</i>	Babul
2.	<i>Tectona grandis</i>	Sagwan
3.	<i>Terminalia tomentosa</i>	Saja
4.	<i>Madhuca indica</i>	Mahua
5.	<i>Spondias pinnate</i>	Amera
6.	<i>Emblica officialis</i>	Amla
7.	<i>Acacia catechu</i>	Kher
8.	<i>Terminalia arjuna</i>	Arjun
9.	<i>Terminalia belerica</i>	Bahera
10.	<i>Aegle marmelos</i>	Bel
11.	<i>Acacia arabica</i>	Babul
12.	<i>Ficus religiosa</i>	Pipal
13.	<i>Albizzia odoratissima</i>	Chichwa, kela siris
14.	<i>Anogeissus latifolia</i>	Dhaora
15.	<i>Tamarindus indica</i>	Imli
16.	<i>Ficus glomerata</i>	Gular
17.	<i>Capparis sepiaria</i>	Kanker
18.	<i>Gmelina sepiaria</i>	Gamari (khamar)
19.	<i>Dalbergia sisso</i>	Sisam
20.	<i>Ficus bengalensis</i>	Bargad
21.	<i>Syzygium cumini</i>	Jamun
22.	<i>Lynnea coromandelica</i>	Moyen (Gunja)
23.	<i>Azadirachta indica</i>	Neem
24.	<i>Butea monosperma</i>	Palas
25.	<i>Shorea robusta</i>	Sal (Sarai)
26.	<i>Boswellia sp.</i>	Salai
27.	<i>Salmaia malabarica</i>	Semal
28.	<i>Diospyros melanoxylon</i>	Tendu
29.	<i>Eucalyptus sp.</i>	Safeda
30.	<i>Mangifera indica</i>	Mango
31.	<i>Anthocephalus cadamba</i>	Kadam
<b>SHURBS</b>		
32.	<i>Abrus precatorius</i>	Ghumchi



33.	<i>Achyranthes aspera</i>	Chirchitta
34.	<i>Calotropis procera</i>	Akund/Mada
35.	<i>Ipomoea purpurea</i>	Tall morning glory
36.	<i>Lantana camara</i>	Besharm
37.	<i>Mimosa pudica</i>	Mimosa
38.	<i>Ocimum basilicum</i>	Ban Tulsa
39.	<i>Peganum harmata</i>	Harman
40.	<i>Ziziphus mauritiana</i>	Bar

The red data book of species does not include any of these species. However, biotic inference in this area will pose a problem of migration of these animal species. As the above given species are not endemic, rare or endangered, an inevitable developmental activity may be undertaken with all the precautionary measures of ecological sustainability e.g. controlled noise level, controlled air pollution and green belt development.

### 3.11.3 Fauna

The area hosts various types of animals. The species of fauna generally found in the area are given in table:

**TABLE No.: 3.11.3**  
**FAUNA OF STUDY AREA**

S. No.	Common Name	Zoological Name	Schedule as per Wild life Act 1972
<b>Core zone</b>			
1.	Brahminy myna	<i>Sturnus pagodarum</i>	Schedule IV
2.	Hare	<i>Lepus nigricolis F</i>	Schedule IV
3.	Wall Lizard	<i>Hemidactylus brookii</i>	-
4.	Rat	<i>R. rattus</i>	Schedule V
<b>Buffer Zone</b>			
1.	Brahminy myna	<i>Sturnus pagodarum</i>	Schedule IV
2.	Common Babblers	<i>Turdoides caudatus</i>	Schedule IV
3.	Black drongo	<i>Dicrurus adsimilis</i>	Schedule IV
4.	White bellied	<i>Dicrurus caerulescens</i>	Schedule IV

	drongo		
5.	Red vented bulbul	<i>Pycnonotus cafer</i>	Schedule IV
6.	Wall Lizard	<i>Hemidactylus brookii</i>	--
7.	Spotted dove	<i>Streptopelia chinensis</i>	Schedule IV
8.	Brown wood dove	<i>Streptopelia senegalensis</i>	Schedule IV
9.	House crow	<i>Corvus splendens</i>	Schedule V
10.	Little erget	<i>Egretta garzetta</i>	Schedule IV
11.	Cotton teal	<i>Nettapus coromandelianus</i>	Schedule IV
12.	Hare	<i>Lepus nigricolis F</i>	Schedule IV
13.	Rat	<i>R. rattus</i>	Schedule V

### 3.12 ECOLOGICAL SENSITIVE AREAS

No National Parks / Wildlife Sanctuary / Protected Forests fall within 10 km. radius of the mine site.

### 3.13 SOCIO-ECONOMIC ENVIRONMENT

Socio-economic environment includes description of demography, available basic amenities like housing, health care services, transportation, education and cultural activities. Information on the above said factor has been collected to define the socio-economic profile of the study area (10 km radius).

#### 3.13.1 Demography

The population as per 2001 Census records is 36565 (for 10 km radius buffer zone). Scheduled Caste fraction of the population of the study area (10 km) is 15.80% and Scheduled Tribe 6.98%. Percentage of literacy is 57.23% and that of workers those actually engaged in occupation is 40.78% including, 30.43% of Main workers & 10.35% of marginal workers. Rest 59.22% of the total population, are considered as non-workers.

**TABLE NO: 3.13.1**

**DEMOGRAPHY DETAILS OF STUDY AREA**

Name	'Total Population'	'Total SC Population'	'Total ST Population'	'Total Literates'	'Total Illiterates'	'Total Working Population'	'Total Main Worker'	'Total Marginal Worker'	'Total Non Worker'	'Number of Household'	Sexratio	'Literacy Rate'	'Male Population'	'Female Population'
Tulsi	1630	78	9	858	772	736	716	20	894	316	1038	64.2	800	830
Bhothdih (Chaurenga)	354	0	93	156	198	135	95	40	219	77	934	51.8	183	171
Aurethi	1560	315	21	804	756	723	621	102	837	279	1000	63.6	780	780
Pousari(Bhainsa)	501	27	97	224	277	245	221	24	256	94	1159	55.3	232	269
Bhanwargarh (Bhawargarh)	352	38	50	180	172	178	178	0	174	71	1058	64.7	171	181
Tekari	636	2	124	368	268	283	264	19	353	125	1032	68.9	313	323
Amakoni	698	91	94	327	371	268	262	6	430	154	1102	58.8	332	366
Diggi	517	507	1	244	273	258	201	57	259	106	936	63	267	250
Khapri	168	161	0	95	73	75	72	3	93	29	888	73.6	89	79
Bhothdih Alias Titahid	282	14	27	150	132	119	112	7	163	51	1169	67	130	152
Kesli(Shikari)	1028	123	198	615	413	450	366	84	578	208	1056	71.3	500	528
Lohari	655	95	4	345	310	275	83	192	380	134	1282	64	287	368
Nawapara	2087	247	170	1172	915	852	781	71	1235	366	1011	69.3	1038	1049
Bardih(Bitkuli)	309	35	215	163	146	121	75	46	188	73	943	62.5	159	150
Suhela	1867	235	76	1169	698	717	419	298	1150	372	1058	76.7	907	960
Basin	664	206	29	361	303	278	133	145	386	160	1075	63.9	320	344
Chandi	700	17	180	351	349	313	270	43	387	163	1201	65.1	318	382
Khapradih	1171	81	0	726	445	512	257	255	659	215	978	75.1	592	579
Jhipan	1441	211	84	838	603	662	404	258	779	266	942	71.8	742	699
Raweli	862	249	37	494	368	402	373	29	460	148	928	72.1	447	415
Rawan	4712	282	93	3002	1710	1755	1509	246	2957	1108	889	80.7	2495	2217

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Khairwani	186	1	127	138	48	90	79	11	96	36	1214	86.8	84	102
Dhobnidih	411	172	0	261	150	178	148	30	233	70	860	75.7	221	190
Budgahan	814	148	46	503	311	283	124	159	531	194	943	71.2	419	395
Bhat Bhera	1214	127	188	714	500	537	341	196	677	268	1010	68.9	604	610
Ameri	578	148	9	298	280	306	239	67	272	118	993	62	290	288
Kuthraud	2615	499	171	1719	896	893	590	303	1722	577	969	82.4	1328	1287
Saklor	1765	253	28	966	799	755	608	147	1010	323	937	70.5	911	854
Pendri	600	184	16	242	358	276	96	180	324	132	1182	51.4	275	325
Kasahidih	144	138	0	59	85	65	28	37	79	37	1000	52.2	72	72
Hirmi	4318	489	291	2374	1944	1529	1091	438	2789	864	906	71	2266	2052
Bardih(Hirami)	772	241	42	484	288	359	160	199	413	157	1032	75.2	380	392
Paraswani	954	364	31	526	428	285	211	74	669	167	1013	72.1	474	480
<b>Total</b>	<b>36565</b>	<b>5778</b>	<b>2551</b>	<b>20926</b>	<b>15639</b>	<b>14913</b>	<b>11127</b>	<b>3786</b>	<b>21652</b>	<b>7458</b>	<b>1022</b>	<b>-</b>	<b>18426</b>	<b>18139</b>
<b>%</b>	<b>-</b>	<b>15.80%</b>	<b>6.98%</b>	<b>-</b>	<b>-</b>	<b>40.78%</b>	<b>30.43%</b>	<b>10.35%</b>	<b>59.22%</b>	<b>-</b>	<b>-</b>	<b>57.23%</b>		

*Source: Census 2001*

### **3.13.2 Health & Diseases**

Details were collected regarding health status of the study area & it was found that though common diseases like Malaria, Viral Fever, Typhoid, Pneumonia, fungal infections, cholera are found to occur but no major disease / endemic diseases were noticed with the study area.

### **3.13.3 Industries Falling with 25 Km Radius of the Area**

Few industries are located near 25 km radius of the mine site, these are listed as shown in the table below:

- Ultratech Cement Ltd., Cement Plant, Hirmi (10km)
- Ultratech Cement Ltd, Captive Limestone Mine (10km)
- Ambuja Cement Ltd., Cement Plant, Ravaana (22 km)
- Ambuja Cement Ltd., Captive Limestone Mine, Ravaana (22 km)
- Lafarge India Pvt.Ltd., Arasmeta Cement Plant, Sonadih, (25 km)
- Lafarge India Pvt.Ltd., Arasmeta Captive Limestone Mine, (25 km)
- Stone Crushers within 25 km radius – approximate 35 in number
- Rice Processing Plants

Proposed Industries within 25 km radius are as follows:

- Grasim Cement, Rawan, Guma Limestone mine (5 km)
- Grasim Cement, Rawan, Kukurdih Limestone mine
- Shree Cement Ltd., Integrated Cement Project
- JayPee Cement Ltd., Integrated Cement Project, Devsundra
- Emami Cement Ltd. Integrated Cement Project, Risda

### **3.13.4 Basic Amenities**

1. Most of the villages are electrified.

2. The social activities such as literacy camps, family planning and eye camps have been organized both by the local government bodies and industries in association with voluntary agencies.
3. Telephone and Telegraph facilities are available.
4. Medical facilities are available in the nearby towns
5. Almost all the villages in the buffer zone are electrified. L.T. power is being supplied for drawing water from a large number of tube wells sunk around the important village of the buffer zone, for irrigation purpose. Most of the tanks and ponds as well as the river water are being utilized for irrigation.
6. **Development programmes:** Housing schemes for weaker section, plantation under Social Forestry Scheme, establishment of primary health centers under Rural Welfare scheme development of roads, supply of drinking water, sinking tube wells/etc., are some of the important programmes of the government.



## **CHAPTER-IV**

# **ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

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### **4.1 INTRODUCTION**

The environmental parameters likely to be affected by mining are related to many factors, i.e. physical, social, economic, agriculture and aesthetic. Opencast mining involves extraction of underneath minerals; it's dumping and dumping of waste along with other operations, viz traffic network, and other vehicular movements. All the operations can disturb environment of the area in various ways, such as removal of mass, change of landscape, displacement of human settlement, flora and fauna of the area, surface drainage, and change in air, water and soil quality. While for purpose of development and economic upliftment of people, there is need for establishment of industries and mining, but these have to be environmental friendly. Therefore it is essential to assess the impacts of mining on different environmental parameters, before starting the mining operations, so that abatement measures could be planned in advance for eco-friendly mining in the area.

The likely impacts on different environmental parameters due to this mining project are discussed below.

### **4.2 ENVIRONMENTAL IMPACT ASSESSMENT & MITIGATION MEASURES**

The mining activities cause environmental problems such as degradation of land, deteriorating air, water and soil quality, affecting the biological and socio-economic environment of the area. The impacts of mining on various environmental parameters were assessed and are given below:

#### **4.2.1 IMPACT ON AIR QUALITY & MITIGATION MEASURES**

Some dust pollution may be generated during drilling, blasting, crushing and transportation and loading activities. The air pollution may come across due to vehicular movement for transportation of mineral, so care has to be taken by proper mitigating measures to contain it within limits.

##### **4.2.1.1 Cumulative Impact through Mathematical Modelling for Integrated Project**

###### **4.2.1.1.1 Air Pollution Modelling**

Prediction of impacts on air environment has been carried out employing mathematical model based on a steady state Gaussian plume dispersion model designed for multiple point sources for short term. In the present case, AERMOD version 6.4 dispersion model based on steady state gaussian plume dispersion, designed for multiple point sources and developed by United States Environmental Protection Agency [USEPA] has been used for simulations from Industrial sources.

###### **4.2.1.1.2 Pollutants/Model Options Considered For Computations**

The model simulations deal with major pollutant Particulate Matter (PM<sub>10</sub>), SO<sub>2</sub> & NO<sub>2</sub> emitted from the proposed projects all together i.e, Cement plant, and Lime stone Mining together.

###### **4.2.1.1.3 Model Options Used For Computations**

The options used for short-term computations are:

- ❖ The plume rise is estimated by Briggs formulae, but the final rise is always limited to that of the mixing layer;
- ❖ Stack tip down-wash is not considered;
- ❖ Buoyancy Induced Dispersion is used to describe the increase in plume dispersion during the ascension phase;
- ❖ Calms processing routine is used by default;



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- ❖ Wind profile exponents is used by default, 'Irwin';
- ❖ Flat terrain is used for computations;
- ❖ It is assumed that the pollutants do not undergo any physico-chemical transformation and that there is no pollutant removal by dry deposition;
- ❖ Washout by rain is not considered;
- ❖ Cartesian co-ordinate system has been used for computations; and
- ❖ The model computations have been done for 20 km with 500-m interval.

#### 4.2.1.1.4 Model Input Data

The emission details are given in Table – 4.4.4.3 and 4.2.1.1.4 (B).

**TABLE- 4.2.1.1.4 (A): Cement Project Emissions**

S. NO	STACK ATTACHED	A.P.C. EQUIPMENT INSTALLED	PM EMISSION CONCENTRATION mg/Nm <sup>3</sup>	EFFICIENCY OF THE EQUIPMENT (%)
EXISTING CEMENT PLANT & CPP			(Existing Details)	
1.	Kiln/Raw Mill	ESP	70	99.89
2.	Coal Mill	ESP	72	99.79
3.	Clinker Cooler	ESP	56	99.76
4.	Cement Mill	ESP	64	99.98
5.	CPP boiler	ESP	27	99.90
PROPOSED CEMENT PLANT & CPP			(Design Details)	
1.	Kiln/Raw Mill	Bag Filter / ESP	50	99.99
2.	Coal Mill	ESP	50	99.99
3.	Clinker Cooler	ESP	50	99.99
4.	Cement Mill	ESP	50	99.99
5.	CPP BOILER	ESP	100	99.99

**TABLE 4.2.1.1.4 (B): Lime Stone Mining Emissions**

Ore	MTPA	7.5
Total Working Days	number	300

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Activity rate	t/hr	1562.5
<b>Uncontrolled emission</b>		
Emission factor	gm/t	23.6
Emission Rate	g/sec	10.24
Area of influence	Sq.m	3079740
Area Source Emission rate	gm/sec/Sq.m	0.000003324
Controlled Emissions	gm/sec/Sq.m	0.000001108

#### 4.2.1.1.5 Modelling Procedure

Prediction of ground level concentrations (glc's) due to proposed Cement plant and Mining has been made by AERMOD version 6.4 as per CPCB guidelines. It is US-EPA approved model to predict the air quality. The model uses rural dispersion and regulatory defaults options as per guidelines on air quality models (PROBES/70/1997-1998). For this study uniform polar receptors on flat terrain have been assumed.

Meteorological inputs required are hourly wind speed and direction, ambient temperature, stability class, and mixing height. The model details are as follows.

#### 4.2.1.1.6 Gaussian Plume Model

The AERMOD version 6.4 model is based on a numerical integration over the area in the upwind and cross wind directions of Gaussian plume formula. This can be applied to the Point, Area, Line, Volume sources (& other forms of area sources) simultaneously and their resultant incremental concentration of the pollutant can be predicted.

#### 4.2.1.1.7 Extrapolation of Wind Speed

Wind speed at stack level is calculated by power law as given below.

$$U_{\text{stack}} = U_{10}(\text{Stack height}/10)^p$$

Where  $U_{10}$  is the wind speed at 10 meter level and  $p$  is the power law coefficient (0.07, 0.07, 0.10, 0.15, 0.35 and 0.55 for stability classes A,B,C,D,E and F respectively) as per Irwin for rural areas (USEPA, 1987).

#### 4.2.1.1.8 Stability Classification

Hourly stability is determined by wind direction fluctuation method as suggested by Slade(1965)and recommended by CPCB (PROBES/70/1997-1998).

$$\sigma_a = W_{dr}/6$$

$\sigma_a$ , is standard deviation of wind direction fluctuation,  $W_{dr}$  is the overall wind direction fluctuation or width of the wind direction in degrees. The table for stability classes is given as under.

Stability Class	$\sigma_a$ (degree)
A	> 22.5
B	22.4 – 17.5
C	17.4 – 12.5
D	12.4 – 7.5
E	7.4 – 3.5
F	< 3.5

#### 4.2.1.1.9 Dispersion Parameters

Dispersion parameters  $\sigma_y$  and  $\sigma_z$  for open country conditions (Briggs, 1974) are used as the project is located on a flat terrain in a rural area. Atmospheric dispersion coefficients vary with downwind distance (x) from emission sources for different atmospheric stability conditions. (CPCB – PROBES/70/1997-98).

##### *Rural Conditions*

Stability Class	$\sigma_y$	$\sigma_{az}$
A	$0.22x(1+0.0001x)^{-0.5}$	$0.20x$
B	$0.16x(1+0.0001x)^{-0.5}$	$0.12x$
C	$0.11x(1+0.0001x)^{-0.5}$	$0.08x(1+0.0002x)^{-0.5}$
D	$0.08x(1+0.0001x)^{-0.5}$	$0.06(1+0.0015x)^{-0.5}$
E	$0.06x(1+0.0001x)^{-0.5}$	$0.03x(1+0.0003x)^{-1}$
F	$0.04x(1+0.0001x)^{-0.5}$	$0.16x(1+0.0003x)^{-1}$

#### 4.2.1.1.10 Mixing Height

As site specific mixing heights were not available, mixing heights based on CPCB publication, “SPATIAL DISTRIBUTION OF HOURLY MIXING

DEPTH OVER INDIAN REGION”, PROBES/88/2002-03 has been considered for Industrial Source Complex model to establish the worst case scenario.

**MIXING HEIGHT FOR THE PROJECT SITE  
STUDY PERIOD (DEC, 09 TO FEB, 10)**

<b>Time (Hours)</b>	<b>Mixing Height (m)</b>
0500	100
0600	100
0700	150
0800	200
0900	400
1000	850
1100	1000
1200	1500
1400	1500
1500	1500
1600	2000
1700	2000
1800	1500
1900	400

*Source: CPCB publication, “Spatial Distribution Of Hourly Mixing Depth Over Indian Region”, PROBES/88/2002-03*

#### **4.2.1.1.11 Meteorological Data**

Data recorded at the continuous weather monitoring station on wind speed, direction, and temperature at one hour interval for the monitoring period was used as meteorological input.

#### **4.2.1.1.12 Presentation of Results**

In the present case model simulations have been carried using the hourly Triple Joint Frequency data. Short-term simulations were carried to estimate concentrations at the receptors to obtain an optimum description of variations in concentrations over the site in 10-km radius covering 16 directions.

The incremental concentrations are estimated for the monitoring period. For each time scale, i.e. for 24 hr the model computes the highest concentrations observed during the period over all the measurement points

The maximum incremental GLCs due to the proposed Cement Plant Captive Power Plant and Lime stone mining together for PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>x</sub> are superimposed on the maximum baseline PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>x</sub> concentrations recorded at the monitoring locations during the field monitoring period. The cumulative concentrations (baseline + incremental) after implementation of the project are tabulated below in Table- 4.4. The maximum GLCs after implementation of the proposed project are likely to be within the prescribed NAAQ standards.

**TABLE 4.2.1.1.12: Cumulative Concentrations (Baseline + Incremental)**

Sampling Locations	Monitored Maximum concentrations in ug/m <sup>3</sup>			Predicted incremental Maximum concentrations in ug/m <sup>3</sup>			Resultant Maximum concentrations in ug/m <sup>3</sup>		
	PM <sub>10</sub>	NO <sub>2</sub>	SO <sub>2</sub>	PM <sub>10</sub>	NO <sub>2</sub>	SO <sub>2</sub>	PM <sub>10</sub>	NO <sub>2</sub>	SO <sub>2</sub>
Plant Site	70.86	21.00	16.30	14.48	4.1	5.30	85.34	25.1	21.6
Mine Site	82.76	18.3	13.4	7.38	1.1	1.10	90.14	19.4	14.5

#### **4.2.1.2 Air Pollution Due To Mining**

##### **(i) Gaseous Pollution**

The gaseous pollutants (SO<sub>2</sub>, NO<sub>2</sub> and CO) are anticipated by HEMM like, excavator, dumpers, dozer and other transport vehicles. The ambient air quality was measured on 24 hourly basis for the gaseous pollutants.

##### **(ii) Suspended Particulate Matter**

The generation of dust is anticipated from various mining activities i.e. dozing, drilling, blasting, loading, haulage and other transport

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activities related to mining. These will increase  $PM_{10}/PM_{2.5}$  in the area if no mitigative measures are taken.

### (iii) ***Pollution due to mineral Crushing***

The limestone will be crushed in an existing crusher located within the ML area. The conveyor belt will have water sprinkling facility.

#### **4.2.1.3 Mitigation Measures for Air Pollution**

In the limestone mine, air pollution is caused mainly due to dust generation added with gaseous emission from mining activities like drilling, dozing, blasting, loading, haulage; crushing etc. following measure shall be adopted to mitigate air pollution generated due to the mining activities:

- Rock breaker will be used for breaking over size boulders in order to reduce dust and noise generation, which otherwise would be generated due to secondary blasting.
- Controlled blasting and optimisation of use of explosive energy will help in reducing the above emissions.
- Water spray on mine haul roads & proper maintenance of haul roads and machines.
- Ambient Air Quality Monitoring will be conducted on regularly basis to assess the quality of ambient air.

#### **4.2.2 IMPACT OF NOISE / VIBRATIONS & MITIGATION MEASURES**

##### **4.2.2.1 Impact of Noise on Working Environment**

With the proposed mining operations by drilling and blasting for mine development, excavation and transportation of mineral, it is imperative that noise levels would increase. However, the expected noise levels are not likely to have any effect from the occupational health point of view.

## **1. Noise Generated due to Drilling, Excavation and Transportation**

The drilling operations in the proposed limestone mine will be carried out by DTH Drill. The noise levels monitored in the similar mines at 10-m distance from different sources and in the operators cabin is given below:

### **Noise Generation Due to Drilling: -**

<b>Sr. No.</b>	<b>Name of the Equipment</b>	<b>Condition</b>	<b>Noise Levels dB(A)</b>
1	Hydraulic Excavator	Standing idle	85.4
		Loading the dumper	88.0
		Shifting of boulders	87.0
		Shifting	86.7
2	Dumpers	While being loaded	86.7
		Traveling with load	88.5
		Traveling without load	86.9
		Unloading at crusher	87.9
3	DTH drills	Operation	88.3
4	Air Compressor	Operation	85.6
5	Bulldozers	Dozing and moving	87.2

The noise levels in the working environment are compared with the standards prescribed by Occupational Safety and Health Administration (OSHA), which in turn are being enforced by Government of India through Model rules framed under the Factories Act. These standards were established with the emphasis on reducing the hearing loss. The acceptable limits are presented in following table. Hence, noise generated due to drilling may affect workers if equivalent 8-hr exposure is more than the safety dB(A). The noise levels generated by the mining equipment will be in dB(A)

### **Permissible Exposure in Cases of**

### Continuous Noise (CPCB, Govt. of India)

Duration Per Day (hours)	Sound Level in dB(A)
8	90
4	93
2	96
1	99
1/2	102

## 2. Noise Generated Due to Blasting

Noise generated from blasting is for a shorter duration and instantaneous. It takes less than 5 seconds to occur. Noise of blast is site specific and depends on type, quantity of explosives, dimensions of drill holes, degree of compaction of explosive in the hole and rock.

The noise levels during blasting operations are likely to be in high range at 50-200-m distance from the blast site. The noise levels tend to decrease with distance. As the blasting is likely to be done for very short time, the noise levels over this time would be instantaneous and short in duration.

## 3. Noise due to Crushing

The noise generated due to crushing activities is about 78.9 dB(A). 1024 KW single stage impactor crusher of 850 TPH capacity will be suitably replaced by 1300/1500 TPH for limestone crushing.

## 4. Noise Impact Analysis on Community

It is observed that high noise levels will be conformed to work zone areas only. It can be seen that noise levels get diffused rapidly with distance. The ambient noise levels recorded in and around the mine lease area are found to be 55.0 dB (A) and 43 dB (A) in daytime and



night time, respectively. The predicated noise levels indicate that there will not be an increment to the ambient noise levels.

In summary, it can be stated that the impact on the present noise levels due to mining operations will be restricted to the work zone areas only. The nearest settlement will be at 300 m away from the mining lease area where the predicted noise levels will be less than 30 dB(A) and the impact on the ambient noise levels will not be felt at the settlement areas due to masking effect with the existing noise levels. Hence the noise levels Impact due to the proposed mining operations on community is Insignificant.

#### **4.2.2.2 Impact of Vibration due to Blasting**

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.

When an explosive charge is fired inside the blast hole, it is converted into hot gases, which exert intense pressure on the blast hole walls. High intensity shock waves propagate radially in all directions and cause the rock particles to oscillate. This oscillation is felt as ground vibration. Controlled deep hole blasting will cause less vibrations.

Blasting, in addition to easing the hard strata, generates ground vibrations and instantaneous noise. Ground vibration from mine blasting is 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. 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 oscillation of rock particles is called Particle Velocity and its maximum value is called Peak Particle velocity (PPV), which is measured in

millimeter per second. The standards for safe limit of PPV are established by Director General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997. The safe level criteria PPV as mentioned in Circular No. 7 of DGMS is presented below: -

**Permissible Peak Particle Velocity (mm/s)**

S. No.	Type of Structure	Dominant excitation Frequency		
		< 8 Hz	8-25 Hz	> 25 Hz
<b>A)</b>	<b>Buildings/structures not belonging to the owner</b>			
1.	Domestic houses/structures (Kuchcha brick and cement)	5	10	15
2.	Industrial Buildings (RCC and framed structures)	10	20	25
3.	Objects of historical importance and sensitive structure	2	5	10
<b>B)</b>	<b>Buildings belonging to the owner with limited life span</b>			
1.	Domestic houses/structures (Kuchcha brick and cement)	10	15	25
2.	Industrial buildings (RCC & framed structures)	15	25	50

*Source: Approved Scheme of Mining & Progressive Mine Closure Plan*

As the distance increases the PPV value is likely to reduce. The ground vibrations generated by blasting during the mining operations will be well within standards prescribed by DGMS by controlled blasting. Ground vibrations are not likely to affect the structures in the vicinity of mine lease area.

By adopting controlled blasting, the problems will be greatly minimized and the impacts are also minimized by choosing proper detonating system, optimizing total charge and charge/delay.

#### **4.2.2.3 Mitigation Measures for Noise and Ground Vibration**

##### **4.2.2.3.1 Mitigation Measures to Reduce Ambient Noise Levels**

The following control measures will be adopted to keep the ambient noise levels well below the limits:

- Secondary blasting would be totally avoided and Hydraulic rock breaker will be used for breaking boulders.
- Controlled blasting with proper spacing, burden and stemming would be maintained.
- Minimum quantity of detonating fuse would be consumed by using alternatively Raydet/ Excel non-electrical initiation system.
- The blasting would be carried out during favorable atmospheric condition and less human activity timings.
- The prime movers/diesel engines would be of proper design and will be properly maintained.
- The operator's cabin would be safe guarded with proper enclosures to reduce the noise levels.
- A thick tree belt would be provided in phased manner around the periphery of the mine to attenuate noise.
- Trees would be planted on both sides of haul roads.

The noise level generated by blasting is only momentary and is about 100 dB, It was found that the noise level reduces to 50 dB from 90 dB within a distance of 80 m from source.

#### **4.2.2.3.2 Vibration Abatement and Fly Rocks**

The blasting operations in the proposed mine would be carried out by deep hole drilling and blasting using delay detonators, which reduce the ground vibrations. Further, the ground vibrations will be controlled by using modern shock tubes with delay non-electric detonators. The measures that are generally followed and currently proposed for abatement of ground vibration, air blast and fly rocks are detailed below:

- Blasting would be performed strictly as per the guidelines specified under blasting technology and Mines regulations;
- Overcharging would be avoided;
- Supervision of drilling and blasting operations to ensure design blast geometry;
- Sub-drilling would be kept just adequate to tear-off the bench bottom;
- The charge per delay would be minimized and preferably more number of delays would be used per blasts;
- Elimination of hole to hole propagation between charges;
- Blasting operations would be carried out only during day time as per mine safety guidelines;
- Proper warning signals would be used;
- Adequate safe distance from center of blasting would be maintained;
- During blasting, other activities in the immediate vicinity would be temporarily stopped;
- Drilling parameters like over burden, depth, diameter and spacing would be properly designed to give proper blast;
- Effective stemming of the explosives would be done in the drill holes;
- Electric detonators would be used;
- The explosives would have a high velocity of detonation, a density suited to its particular application, good fume characteristics, good water resistance and good storage qualities and resistance to atmospheric parameters.
- Studies would be conducted through recognized mining institute and recommended measures to minimize the fly rock would be adopted;
- Public complaints would be attended promptly.

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## **4.2.3 IMPACT ON WATER ENVIRONMENT & MITIGATION MEASURES**

### **4.2.3.1 Surface Water**

There are no first order streams passing through the lease area. So, surface drainage will not be affected by mining.

At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir.

It is therefore apparent that there will be negligible impact of mining on the surface water regime. Whatever water gets collected in the mining pit either as direct rainfall falling in the pit or groundwater inflow will be collected in a sump and pumped back for road spraying, green belt and for supplying to nearby villages.

The Mahanadi Canal is more than one km from the mine site, in which water is available in rainy season only. Hence, impact on surface water drainage is not envisaged. No waste water generation in the mining process is envisaged. The sanitary waste is being disposed off in the septic tanks via soak pits.

### **4.2.3.2 Ground Water**

The general ground level in the area is 276 mRL. The ground water table is 236 mRL (40 mbgl) while the workings in the area is proposed upto the ultimate depth of 240 mRL (36 m bgl). There will be no discharge of mine water. Mineral as well as overburden is non – toxic in nature.

### **4.2.3.3 Impact on Water Quality**

- **Impact on Surface Water Quality**

The wastewater generation in the mining process is not envisaged. The sanitary waste will be disposed off in the septic tanks via soak pits. The possibility of surface water contamination due to wash off from dumps is not envisaged.

- **Impact on Ground Water Quality**

Ground water pollution can take place only if the mining rejects contain toxic substances, which get leached by the precipitation water and percolate to the ground water table thus polluting it. Any nearby wells or other sources of water can be rendered unfit for drinking and even for industrial use.

This is not the case with this deposit as the mineral or topsoil does not contain any harmful ingredients. Moreover, limestone constitutes of fairly inert and chemically non-reactive ingredients. Industrial waste water generated from workshop shall be properly collected, treated so as to conform to the standards prescribed under GSR 422(E) dt 29.5.93 & 31.12.93 or as amended from time to time. Oil & grease trap shall be installed before discharge of workshop effluents

#### **4.2.3.4 Mitigation Measures for Water Environment**

Adequate control measures will be adopted to check not only the wash-off from soil erosion but also uncontrolled flow of mine water. The measures to be adopted are:

- Garland drain & 4 Nos. settling tank have been constructed around working pit, OB soil dump and the dump is also scientifically vegetated to avoid soil erosion and water so collected is used for plantation.
- Stone pitching has been done all around the dump to prevent denudation of soil and to provide stability to the dump.
- Toe drains with suitable baffles are provided all along the toe of dumps to arrest the soil from dump slope being carried by rain water and causing siltation downstream.
- All loose material slopes are provided with plantation by making contour trenches to check soil erosion due to wind as also rains. Native trees and shrubs are preferred for the same.
- Coconut fiber as geotextile matting will be provided to stabilize and provide strength to loose soil. This will hold moisture from evaporation

and help in seed germination and growth of vegetation. Later on it will also act as manure and enhance soil fertility and permeability.

- The coco – filters will be installed at the foot of dumps to arrest and prevent silt deposition and provide clean water reducing total suspended solid level. De-silting will be done at regular intervals.

The ground water table in the mine area is not likely to be affected, as no toxic chemicals are present in the rejects stacked. The domestic sewage from the canteen and toilets would be routed to septic tanks followed by soak pits.

#### **4.2.4 Impact on Soil / Land Use Pattern & Mitigation Measures**

##### **4.2.4.1 Impact on Soil Environment**

The area is quite high in overburden soil. In the mining lease area, the soil cover above the limestone deposit is less. About 5,00,000 cum of soil will be generated during the scheme period. The topsoil will be used for afforestation purpose.

Top soil is being removed by the Back Hoe Shovel and transported to the Green Belt all along the lease boundary and dumped in manner so that the soil can hold the water quantity for longer period.

##### **4.2.4.2 Landscape and Land Use pattern**

The activity will affect the present landscape of the ML area. The original topography of the ML area will be affected mainly due to the mining operation. 164.29 hectares of land will be utilised for quarrying / pitting for next five years period.

At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir.

At the conceptual stage 40.32 ha of land will be covered under Waste dump.

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Out of total lease area i.e. 722.834 ha, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.

**TABLE - 4.2.4.2**  
**ENVIRONMENTAL IMPACT**  
**Land: Stage wise Land use and Reclamation Area (Ha.)**

S. No.	Land Use Category	Present	At the end of 5 <sup>th</sup> Year	At the end of life of mine
1.	Top Soil Dump	2.66	2.66	Nil
2.	OB/Screen Reject Dump	28.66	40.36	40.32
3.	Excavation (Voids only)	69.71	163.06	307.954
	Reclamation (Backfilled)	1.23	1.23	251.00
	Total excavated area	70.94	164.29	558.954
4.	Road	6.28	6.28	10
5.	Built up area	1.72	1.72	1.72
6.	Town Ship Area	0	0	0
7.	Afforestation (Green Belt /Avenue Plantation)	91.99	96.99	111.840
8.	Mineral Storage	Nil	Nil	Nil
9.	Undisturbed area	517.904	407.404	Nil
	Total	722.834	722.834	722.834

*Source: Scheme of Mining & progressive mine closure plan*

#### **4.2.4.3 Action plan for abatement and compensation for damage to agricultural land/ common property land**

The study area consists of Agricultural fallow land at some places, which can be converted into Agricultural crop land by providing proper resources/ assistance to the farmers. The following practices shall be carried out to increase the productivity of the study area:

- Awareness for new methodologies of the agricultural practices viz.



mixed farming, crop rotation and agricultural cropping pattern suitable for the study area.

- Providing seeds, manure and fertilizers from different sources.
- No public building and monuments exist in and around the lease area. There is no habitation in the lease area.

As the mining operation will be carried out by Open cast method & drilling / blasting will be used only for mineral. There is no overburden. Particulate Matter as well as gaseous emission will be maintained well within the prescribed limits.

Out of total mining lease area i.e. 722.834 ha, mining will be confined to an area of 558.954 ha. The dust generated during the mining operation will be settled down within the core zone & will not affect agricultural activities within the buffer zone.

These impacts within the core zone may be in terms of dust fall, rain water runoff and resulting erosion. To restrict such impacts within the core zone proper mitigation measures are proposed to be taken.

- Dust suppression will be done properly by regular sprinkling of water on haul roads. Wet drilling, proper maintenance of transportation vehicles will help reduce fugitive emissions so is not to affect the quality of the soil of the surrounding agricultural fields.
- Garland drains with siltation pits will be formed around the excavated area to channelize the water inside the mined out pit. Thus the mined out pit will act as a large siltation pond and only clean water will overflow through the drains, which will not harm agricultural land.
- Heavy duty (under high pressure) water spraying will be done on the blasted muckpile (before loading by excavator) to suppress the dust.

All these measures will result in minimal impact to agricultural land/ common property land in the nearby villages in the study area.

#### 4.2.5 Socio - Economic Environment

As practiced at other cement plant & mines of GIL, social welfare activities have been taken up on a large scale at this project.

GIL acts as a catalyst for accelerating the all-round development process in these villages. It has provided services to ensure that the full-benefits of development schemes of Government and other agencies reach the villagers.

The socio welfare activities are handled by a full time mixed husband-wife team of village development officials who monitor the programme and gives necessary back-up support. The programmes has made broad based by involvement of local groups and government agencies to the maximum extent possible.

GIL had contributed lot in the development of the area, table mentioned below shows the condition of the villages before the intervention of the plant and present condition after the community initiatives and rural development activities undertaken by the management of GIL :

**TABLE: 4.2.5**

#### **SOCIAL IMPACT ASSESSMENT**

S. No.	Condition of the villages before intervention	Present Condition of the Villages
<b>Education</b>		
	<ul style="list-style-type: none"> <li>• Low literacy level (48 to 50 %)</li> <li>• High drop out level</li> <li>• Lack of school buildings</li> <li>• Lack of teaching staff</li> <li>• Lack of motivational system for talented students</li> </ul>	<ul style="list-style-type: none"> <li>• Adequate Number of Schools buildings</li> <li>• Competition among students</li> <li>• Balanced Teachers – Students ratio</li> <li>• Selection of village students in Navodaya School, Mana</li> <li>• Distribution of Mid-day meals in systematic way</li> <li>• Increased literacy level and reduced drop out level</li> </ul>
<b>Health &amp; Family welfare</b>		

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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	<ul style="list-style-type: none"> <li>No medical services for the local people</li> <li>Lack of health centres</li> <li>Low interest of health workers and maintenance towards medical services</li> </ul>	<ul style="list-style-type: none"> <li>Treated all the TB patients and eliminated the chances</li> <li>Ensured Pulse-polio vaccination to all the eligible kids</li> <li>Minimized the cataract patients in the area</li> <li>Increased awareness of people on Family Planning drive</li> <li>Hepatitis-B vaccination to all the eligible kids of near by villages</li> <li>Increased awareness level of the people on HIV/AIDS</li> </ul>
<b>Sustainable livelihood &amp; Agriculture</b>		
	<ul style="list-style-type: none"> <li>Low income level of the local people</li> <li>Lack of motivation for self employment</li> <li>Traditional agriculture system</li> <li>Dependency on single crop</li> <li>Drinking water problem</li> <li>Low depth of ponds</li> <li>Unemployment</li> </ul>	<ul style="list-style-type: none"> <li>Increased awareness level &amp; standard of living of people</li> <li>Adequate employment opportunities</li> <li>Increased capacity of the water bodies</li> <li>Adequate drinking water, No. of Bores &amp; hand-pumps</li> <li>Created self-employment opportunities for youths</li> <li>Increased awareness on multi-cropping</li> </ul>
<b>Infrastructure</b>		
	<ul style="list-style-type: none"> <li>No pacca houses</li> <li>Lack of roads</li> <li>Lack of community buildings</li> <li>Lack of stairs near ponds</li> <li>Poor condition of village tracks</li> </ul>	<ul style="list-style-type: none"> <li>All villages are well connected with Pacca roads</li> <li>All village ponds have stairs</li> <li>All the villages are having community buildings</li> <li>Most of the villages have concrete street lanes</li> <li>Increased No. of Pacca houses in villages</li> </ul>
<b>Social Issues</b>		
	<ul style="list-style-type: none"> <li>Low awareness level of the people</li> <li>Lack of motivation to local artists</li> <li>No care for handicapped people</li> </ul>	<ul style="list-style-type: none"> <li>Distributed tricycles to all the handicapped persons</li> <li>Increased No. of cultural &amp; Social activities</li> <li>Awareness level of the women and adolescent girls increased</li> </ul>

## 4.2.6 Biological Environment

No wildlife life sanctuary or national park or biospheres reserves are located within the study area.

Proposed enhancement of limestone mining project will cause loss of agricultural land falling within the ML area. Other than this, small shrubs, herbs & grasses growing in the ML area will be lost due to the proposed enhancement project.

Hence, there will be some impact on biological environment due to the mining activity. At the conceptual stage, 403.16 ha of land will be used for green belt / plantation, which will improve biological scenario of the area.

### 4.2.6.1 Greenbelt Development and Plantation Programme

Out of total ML area of 722.834 ha, 403.16 hectare area will be covered under plantation & green belt development.

The following species to be planted in the Green belt *Ziziphus mauritiana* (Bar), *Acacia arabica* (Babul), *Ficus bengalensis* (Bargad), *Dalbergia sissoo* (Shisham), *Emblia officialis* (Amla), *Ficus religiosa* (Pipal), *Tamarindus indica* (Imli), *Azadirachta indica* (Neem) etc. Plantation shall be carried out as per CPCB guidelines.

#### Ecology: Stage Wise Cumulative Plantation

Year	Un-worked Area Green Belt		Outside Dumps		Inside Dumps (Backfilled)		Top Soil Dumps		Total	
	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha)	Trees	Area (Ha.)	Trees
Existing	91.99	229975	1.45	2500	1.23	3075	-	-	94.67	235550
2009-10	1.00	2500	-	-	-	-	-	-	1.00	2500
2010-11	1.00	2500	-	-	-	-	-	-	1.00	2500
2011-12	1.00	2500	-	-	-	-	-	-	1.00	2500

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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2012-13	1.00	2500	-	-	-	-	-	-	1.00	2500
2013-14	1.00	2500	-	-	-	-	-	-	1.00	2500
VI th year onward	14.85	37125	38.87	77740	249.77	624425	-	-	303.49	739290
Total	111.84	279600	40.32	80240	251	627500	-	-	403.16	987340

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

## **4.2.7 Impact on Local Transport Infrastructure**

### **4.2.7.1 Existing transport Infrastructure & traffic density**

GRASIM CEMENT unit is located at village Rawan, Tehsil Simga, District, Raipur of Chhattisgarh state, which is about 17 km away from nearest Railway station Bhatapara. Nearest National Highway (NH – 6) is 70 km from the mine site. The place is well connected to other parts of the country by road, rail and air.

The nearest airport is Raipur, which is about 70 km from mine site.

Nearest post office with telegraph & telephone facilities are available at Rawan village.

Traffic density study was conducted for approach road connecting Rawan limestone mine and Cement Plant to Rawan Village and further Bhatpara. Total no. vehicles observed during 10.00 am to 6.00 pm were 601, including 83 Scooter, 280 Motor cycles, 73 cars, 22 Buses, 84 Trucks, 31 Tractor Trolley, 12 Dumpers and 16 Bull Carts.

### **4.2.7.2 Impact on Local Transport Infrastructure**

The limestone and rejects from quarry will be transported to the limestone crusher and dumps located in the Mining lease area, respectively. Crushed limestone will be transported to the Cement Plant via belt conveyors. 25,000 Tonnes of limestone will be handled per day &

the same will be transported from quarries to crusher via 12 dumpers (50/60 tons capacity) with 35 / 42 trips per day.

So no involvement of village roads for the mining activity, besides this Dust suppression on haul roads is done by the means of two no. of water tankers. Proposal for lying of Permanent water sprinkling system on the main haul roads to crusher dump hopper is under consideration.

As the mining lease (i.e. 722.834 ha) is near to the cement plant & proper mitigation measures will be adopted during transportation of limestone, no significant impact on public transportation is envisaged.

#### **4.2.7.3 Mitigation Measures**

- Proper maintenance of the haul roads from quarries to crusher is being done.
- Regular water sprinkling is being done on haul roads during transportation.
- The conveyor belt has water sprinkling facility.
- Conveyor belt from crusher to cement plant are being kept covered to prevent dust pollution.



***WATER SPRINKLING ON HAUL ROAD***

## **4.2.8 Occupational Health & Safety**

### **4.2.8.1 Occupational Health impact due to the mining project**

Healthy and safe working conditions are among the first expectations for sustainability, i.e. the expectation that risks in mining will not deprive workers of their livelihoods or of their quality of life. Occupational injuries and ill-health have huge social and economic implications for individuals, their families and their communities. They also have an adverse impact on the economy of the society as a whole.

Occupational accidents and health hazards can also affect public health and safety, and the environment. The effect on the health and safety of people, costs to the economy and impacts the environment. Efforts will be made to address occupational health and safety with broader social agenda for sustainable development.

Hazards, which are associated with poor engineering design, contribute to increased safety risks. Although health risks can be avoided by implementing controls at source in the work environment, designing such controls for mining environment presents considerable challenges because dust and noise are generated by mining itself. A range of control measures that act together to reduce exposure to such risks is therefore necessary. These could include methods for minimizing dust levels by reducing dust generation and methods for dilution, suppression, capture, and containment.

While significant uncertainties remain in controlling dust exposures and maintaining the effectiveness of controls, the use of appropriate personal protective equipment (PPE) is important.

#### **4.2.8.2 Proposed Mitigation Measures for Occupational Health & Safety Measures**

- The mine workers will be provided with all necessary PPE, especially dust masks for their safe guard from dust, Ear Plugs/Ear Muffs for noise and measures for other hazards.
- Under initial vocational training, the workers will be given training related to all safety and health aspects pertaining to their vocation and thereafter every quarter, special training courses/ Awareness programme for Malaria eradication and health effects on exposure to mineral dust will be organized for employed person as well as for nearby villagers.
- Periodical medical examination is being conducted for the existing mine as per DGMS in Form –O in addition to the initial medical exam which was carried out at the time of joining.
- Tests included in the examination are General Physical Test viz. height, weight, chest measurement, Blood Pressure/pulse, Eyes/ears, Abdomen, Nervous system, Urine/blood test/Lipid count, X ray, ECG etc.
- During periodical medical camps, medical assistance is provided to GIL employees as well as neighboring communities.





## **CHAPTER-V**

### **ENVIRONMENTAL MONITORING PROGRAMME**

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#### **5.0 INTRODUCTION**

Post Project Monitoring is an essential part to check the impact of any project activity. Hence monitoring of various environmental parameters will be carried out on a regular basis to ascertain the following:

- ❖ State of Pollution within the mine site and in its vicinity.
- ❖ Generate data for predictive or corrective purpose in respect of pollution.
- ❖ Examine the efficiency of pollution control system adopted at the site.
- ❖ To assess environmental impacts.

Monitoring will be carried out at the site as per the norms of CPCB.

Environmental Monitoring Programme is being conducted for various environmental components as per conditions stipulated in Environmental Clearance Letter issued by MOEF & Consent to Operate issued by SPCB. Six monthly compliance reports are being submitted for existing production capacity (i.e. 2.8 MTPA of limestone) & the same will be submitted for enhanced capacity on regular basis, to MoEF, New Delhi on 1<sup>st</sup> of June & 1<sup>st</sup> of December. Quarterly compliance Report for conditions stipulated in Consent to Operate will be submitted to SPCB on regular basis.

#### **5.1 Formation of EMC (Environmental Management Cell)**

In order to maintain the environmental quality within the standards, regular monitoring of various environmental components is necessary. GIL has a full-fledged environmental management cell (EMC) reporting directly to Plant Manager for environmental monitoring and control. The EMC team takes care of pollution monitoring aspects and implementation of control measures.

A group of qualified and efficient engineers with technicians is deputed for maintenance, up keeping and monitoring the pollution control equipment, to keep them in working at the best of their efficiencies.

### **5.1.1 Responsibilities of EMC**

The responsibilities of the EMC include the following:

- i. Environmental monitoring of the surrounding area.
- ii. Commissioning of pollution control equipment.
- iii. Specification and regulation of maintenance schedules for pollution control equipment.
- iv. Ensuring that standards of are maintained.
- v. Developing the green belt.
- vi. Ensuring water use is minimized.
- vii. Carrying out the Environmental Management Plan.
- viii. Organizing meetings of the Environmental Management Committee and reporting to the committee.

## **5.2 MEASUREMENT METHODOLOGIES**

### **5.2.1 INSTRUMENT TO BE USED**

The following instruments will be used for data collection work in the monitoring schedule:

1. Respirable Dust Collector with attachment for gaseous Pollutants, Envirotech APM 460.
2. Fine Particulate Matter (FPM) Sampler
3. Digital D.O. Meter Model – 831 E.
4. Dry and Wet Bulb Thermometer.
5. Sound Level Meter Model SL – 4010
6. Micro Meteorological Station Model Enviro Wm 251
7. Water Level Indicator
8. GPS

In addition to the above instruments, the data on land use, vegetation and agricultural crops to be collected by the field team by meeting with a large number of local inhabitants in the study area and different government departments / agencies.

## **5.2.2 MONITORING PROGRAMME**

The post project Monitoring will include details of any major/ minor impact in the core zone and area within buffer zone for the following parameters: -

- Micro - meteorological data
- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Land use pattern within core zone and buffer zone including the cropping pattern.
- Monitoring of agricultural crops of the area (on yearly basis)
- Demography and socio-economic analysis based on last available census data for entire study area.
- Medical Check-up

### **5.2.2.1 MONITORING SCHEDULE**

Details of the Environmental Monitoring schedule, which will be undertaken for various environmental components, are detailed below:

**TABLE No.: 5.2.2.1**  
**POST PROJECT MONITORING**

<b>S. No.</b>	<b>DESCRIPTION</b>	<b>FREQUENCY OF MONITORING</b>
1.	Meteorological Data	Daily
2.	Ambient Air Quality at mine site	Quarterly/ Half Yearly
3.	Water Quality	Quarterly/ Half Yearly
4.	Noise Level Monitoring	Quarterly/ Half Yearly
5.	Soil Quality	Half Yearly/yearly
6.	Monitoring of Agricultural crops	Yearly
7.	Socio – economic status of nearby area	yearly

### 5.2.3 METHODOLOGY ADOPTED

Post project monitoring will be carried out as per conditions stipulated in Environmental Clearance Letter issued by MoEF, Consent issued by SPCB as well as according to CPCB guidelines. The mine site is considered as core zone and the area lying within 10 km radius from the mine site is considered to be the buffer zone where some impacts may be observed on physical and biological environment. In the Buffer zone slight impact may be observed and that too is occasional.

The following table is showing details of Post Project Monitoring programme:

**TABLE No.: 5.2.3**

Attributes	Sampling		Measurement Method	Test Procedure
A. Air Environment	Network	Frequency		
<b>Meteorological</b> <ul style="list-style-type: none"> <li>Wind speed</li> <li>Wind direction</li> <li>Dry bulb temperature</li> <li>Wet bulb temperature</li> <li>Relative humidity</li> <li>Rainfall</li> </ul>	Minimum 1 site in the project impact area	Regularly in one season by Weather Monitoring Station	Mechanical/automatic weather station	-
<b>Pollutants</b> <ul style="list-style-type: none"> <li>PM<sub>10</sub></li> </ul>	4 to 6 locations in the project impact area (Minimum 2 locations in upwind side, more sites in downwind side / impact zone)	Revised National Ambient Air Quality Standards (NAAQS) vide MoEF circular, dated 16.11.2009	Gravimetric method	-
<ul style="list-style-type: none"> <li>PM<sub>2.5</sub></li> </ul>			Gravimetric method	-
<ul style="list-style-type: none"> <li>SO<sub>2</sub></li> </ul>			EPA Modified West & Geake method	Absorption in Potassium Tetra Chloromercurate followed by Colorimetric

				estimation using P-Rosaniline hydrochloride and Formaldehyde (IS: 5182 Part - II).
• NO <sub>2</sub>			Arsenite modified Jacob & Hochheiser	Absorption in dill NaOH and then estimated colorimetrically with sulphanilamide and N (I-Nephthyle) Ethylene diamine Dihydrochloride and Hydrogen Peroxide (CPCB Method).
• CO			Non Dispersive Infra Red (NDIR) Spectroscopy	-

#### **B. Water Environment**

pH, Turbidity, Colour, Odour, Taste, TDS, Total Hardness, Calcium hardness, Magnesium hardness, Chloride, Fluoride, Sulphate, Nitrates, Alkalinity, Iron, Copper, Manganese, Mercury, Cadmium, Selenium, Arsenic, Cyanide, Lead, Zinc, Chromium, Aluminum, Boron, Phenolic compounds	Set of grab samples during pre and post-monsoon for ground and surface water for 10 km distance	Diurnal and Season wise	As per IS 10500-	Samples for water quality should be collected and analyzed as per : IS : 2488 (Part 1-5) methods for sampling and testing of Industrial effluents Standard methods for examination of water and wastewater analysis published by American Public Health Association.
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<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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<b>C. Noise</b>				
Noise levels at Day & night time -Leq dB (A)	Mine Boundary, High noise generating areas within the lease	Quarterly / Half yearly	As per CPCB norms	As per CPCB norms
<b>D. Soil</b>				
pH, Bulk Density, Soil texture, Nitrogen, Available Phosphorus, Potassium, Calcium, Magnesium, Sodium, Electrical Conductivity, Organic Matter, Chloride	4 to 6 locations in the project impact area	Yearly/half yearly	<b>As per USDA Method</b>	<b>As per USDA Method</b>
<b>E. Socioeconomic Status</b>	<b>Network</b>	<b>Frequency</b>	<b>Measurement Method</b>	<b>Test Procedure</b>
<ul style="list-style-type: none"> <li>• Demographic structure</li> <li>• Infrastructure resource base</li> <li>• Economic resource base</li> <li>• Health status: Morbidity pattern</li> <li>• Cultural and aesthetic attributes</li> <li>• Education</li> </ul>	Socio-economic survey is based on proportionate, stratified and random sampling method	Minimum for two phases of the project	Primary data collection through questionnaire	Secondary data from census records, statistical hard books, topo sheets, health records and relevant official records available with Govt. agencies

### 5.3 Locations of Monitoring Stations

The location of the monitoring stations will be selected on the basis of prevailing micro – meteorological conditions of the area like; Wind direction & wind speed, Relative Humidity, Temperature. 4 to 6 AAQM stations will be selected (including minimum 2 locations in upwind side,

more sites in downwind side / impact zone) to assess ambient air quality of the area. Noise level monitoring will be carried out on lease boundary & in high noise generating area within the lease. Water & soil monitoring locations will be decided on the basis of general slope of the area & drainage pattern. Locations for the post project monitoring shall be as under:

**TABLE NO.: 5.3**

<b>S. No.</b>	<b>Description</b>	<b>Location</b>
1.	Ambient Air Quality	Mine site, Villages in downwind direction from the mine site
2.	Meteorological data	Mine site
3.	Noise Level Monitoring	Mine Boundary, High noise generating areas within the Mine boundary
4.	Water Level & Quality	Nearby Surface & Ground water sources
5.	Health Check-up	Workers
6.	Monitoring of Agricultural crops	In the nearby area (on yearly basis)
7.	Socio – economic status	In the nearby area (on yearly basis)

## **5.4 DATA ANALYSIS**

Monitoring data analysis will be done as per CPCB guidelines by EPA approved laboratory & shall be submitted to concern authority (specified in Environment Clearance Letter issued by MoEF, & Consent issued by SPCB) on regular basis.

## **5.5 DETAILED BUDGET**

Grasim Industries Limited (GIL) is proposing expansion in the production capacity of limestone from 2.8 MTPA to 7.5 MTPA in the existing Rawan-Jaipan Limestone Mine (ML area: 722.834) at Village: Rawan-Jaipan, Tehsil: Simga, Distt.: Raipur (Chattisgarh).

- Capital cost of the expansion project is : Rs 40 Crores
- Capital Cost for EMP : Rs 60 Lacs
- Recurring Cost for EMP : Rs 10 Lacs



## **CHAPTER-VI**

### **ADDITIONAL STUDIES**

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#### **6.0 INTRODUCTION**

As per the New EIA notification dated 14.06.2006, the first technical presentation (for ToR approval) was held before EAC (I), New Delhi. The committee has suggested various additional Terms of References (ToRs) for the preparation of the Environmental Impact Assessment (EIA) Report and Environmental Management Plan (EMP) through its MoEF file no. J-11015/17/2009 - IA. II (M) dated 26<sup>th</sup> Oct, 2009.

The following Additional Studies have been done in reference to the additional Terms of References;

- A) Biological Study
- B) Hydro-geological Study & Rain water harvesting Plan
- C) Risk Assessment & Disaster Management Plan

#### **6.1 PUBLIC CONSULTATION**

As per the New EIA Notification dated 14<sup>th</sup> September, 2006, Public hearing for this project has to be conducted in accordance with the procedure to obtain the Environmental Clearance.

#### **6.2 BIOLOGICAL STUDY REPORT**

##### **6.2.1 Introduction**

The baseline study for the evaluation of the floristic and faunal diversity of the terrestrial environment of the study area within the 10 km radius from proposed expansion in the production capacity of limestone from 2.8 MTPA to 7.5 MTPA in the existing Rawan-Jaipan Limestone Mine (ML area: 722.834 ha) at Village: Rawan-Jaipan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh) was conducted.



<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh)	<b>Draft EIA/EMP Report</b>
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A natural ecosystem is a structural and functional unit of nature. It has components, which exist in harmony and survive by interdependence. Ecosystem has self – sustaining ability and controls the number of organisms at any level by cybernetic rules. The effect of this is that an ecosystem does not become imbalanced.

An ecological survey of the study area was conducted, particularly with reference to listing of species and assessment of the existing baseline ecological conditions in the study area. Considering the rich bio-diversity of organisms and their role in productivity and their importance for human livelihood, it is vital to protect and safeguard these dynamic ecosystems.

### **6.2.1.1 Biological Environment of Chhattisgarh State**

The state of Chhattisgarh, lying between 17° 46 ' N to 24° 6 ' N latitude and 80° 15 ' E to 84° 51 ' E longitude, has about 44 percent of its geographical area (135,224 sq. km) under forests and provides catchment to at least four main river systems, i.e., Mahanadi, Godavari, Narmada and Ganges. Major rivers of the state are Mahanadi, Indravati, Hasdeo, Sheonath, Arpa and Ibb. The climate of the state is generally sub humid with an annual rainfall ranging from 1200 to 1500 mm.

The forests of the state fall under two major forest types, i.e., Tropical Moist deciduous forest and the Tropical Dry deciduous forest. Sal (*Shorea robusta*) and Teak (*Tectona grandis*) are the two major tree species in the state. Other notable overwood species are Bija (*Pterocarpus marsupium*), Saja (*Terminalia tomentosa*), Dhawra (*Anogeissus latifolia*), Mahua (*Madhuca indica*), Tendu (*Diospyros melanoxylon*) etc. Amla (*Embilica officinalis*), Karra (*Cleistanthus collinus*) and bamboo (*Dendrocalamus strictus*) constitute a significant chunk of middle canopy of the state's forests.

Biogeographically, the state falls in Deccan bio-region comprising representative fauna of central India like the tiger (*Panthera tigris*), leopard (*Panthera pardus*), gaur (*Bos gaurus*), sambhar (*Corvus unicolor*), chital (*Axis axis*), nilgai (*Boselaphus tragocamelus*) and wild boar (*Sus scrofa*). The state is a proud possessor of rare wildlife like the wild buffalo (*Bubalus bubalis*) and hill myna (*Gracula religiosa*) which have been declared as the state animal and bird respectively.

## 6.2.2 Objectives of the study

The present study was undertaken with the following objectives:

- To assess the nature and distribution of vegetation in and around the proposed activity;
- To study of forest composition and block in the study area;
- To assess the biodiversity and to understand the resource potential;
- To ascertain migratory routes of fauna if any;
- Ethnobotanical survey in the villages to assess the usage plants;
- Possibility of presence of breeding grounds.

## 6.2.3 Methodology

To study the fauna and flora systematically from terrestrial locations in particular and from the study area (within 10 km. radius), following methodology was adopted.

### A. Flora

List of all plants from the study area was prepared and their habitats were recorded. The associations of plants and animals in communities were noted.

- To study herbaceous and woody vegetation systematically, standard methods of analyzing vegetation i.e. quadrat of different dimensions and line transector of appropriate lengths

were employed. Their numbers (quadrate) depend upon the requirement in specific cases.

- Identification of plants was done by referring to standard floras and consulting the experts when needed.
- The samples (specimen) were individually stored in separate blotting papers and put in the polythene bags. Each specimen carried the name of the species, time and date of collection and locations.

## **B. Fauna**

Animals were studied by following means:

- Actual sighting
- Pug marks
- Calls
- Droppings, burrows etc.
- By inquiring local people.

Larger animals and common birds in and around the study area were visually observed and recorded.

### **6.2.4 Core Zone**

Topographically the area of interest forms flat landscape of Chhattisgarh. The terrain of the study area is gently to moderately sloping and having gentle slope. Overall drainage of the area is moderate and of dendritic type. There is no major water body in the subject area.

Geologically, the study area is a gently undulating to almost a plain area. Gently dipping limestone outcrops were observed at some area while there is thin alluvial soil cover comprising mostly silty clays. The drainage is mostly dendritic in nature and takes north - westerly course in the north and south – easterly course in the south. The drainage is controlled mainly due to two raised outcrops. One in the north – eastern

corner while another in the western limestone area. The drainage is well developed due to high rainfall and clayey of soil.

### **6.2.5 Floral Diversity of the study area**

The climatic, edaphic and biotic variations with their complex interrelationship and composition of species, which are adapted to these variations, have resulted in different vegetation cover, characteristic of each region. The following account of floral diversity, based on field survey conducted, is not very comprehensive data and is aimed only to give a general pattern of vegetation of this region during the study period as a baseline data. Further, there is severe threat to the natural vegetation owing to the biotic pressure. Listing of the endangered, threatened and endemic species of flora in a locality and drawing the attention to the occurrence of such species, would aid in creating awareness amongst the local people as a whole to protect such species from extinction, and to take necessary measures for their conservation. This type of floristic study is an inventory for such purpose and their necessity.

#### **A. AQUATIC FLORA**

- **Core zone**

No aquatic flora was observed in the core zone as no major water body exists within the core zone.

- **Buffer zone**

Even though the study area has Mahanadi Canal is about 0.5 km from the project area, in which water is available in rainy season only. Two major rivers i.e. Mahanadi (40 km, E) & Godavari (30 km, W), not much hydrophytes vegetation was observed in the study area. The hydrophytes vegetation observed in the study area can generally be classified as;

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- a. **Free Floating Hydrophytes:** *Eichhornia crassipes*
- b. **Anchored Hydrophytes with floating shoots:** *Ipomea aquatic*
- c. **Anchored Hydrophytes with Floating Leaves:**, *Nelumbo nucifera*,
- d. **Emergent amphibious hydrophytes:** *Polygonum barbatum*, *P. glabrum*, *Typha angustata*, *Ipomea fistulosa*

## B. TREES & SHRUBS

Sal, Babul & thorny bushes are local varieties of trees available in the area. The common tree and shrub species found in the study area are *Azadirachta indica* (Neem), *Ficus religiosa* (Pipal), *Ficus bengalensis* (Bargad), *Emblica officinalis* (Anvla), *Dalbergia sissoo* (Shisham), *Acacia arabica* (babul), etc.

**Table: 6.2.5 (A)**

### FLORA OF THE STUDY AREA

S. No.	Name of Plant Species	Local Name
<b>TREES</b>		
1.	<i>Acacia nilotica</i>	Babul
2.	<i>Tectona grandis</i>	Sagwan
3.	<i>Terminalia tomentosa</i>	Saja
4.	<i>Madhuca indica</i>	Mahua
5.	<i>Spondias pinnate</i>	Amera
6.	<i>Emblica officinalis</i>	Amla
7.	<i>Acacia catechu</i>	Kher
8.	<i>Terminalia arjuna</i>	Arjun
9.	<i>Terminalia belerica</i>	Bahera

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10.	<i>Aegle marmelos</i>	Bel
11.	<i>Acacia arabica</i>	Babul
12.	<i>Ficus religiosa</i>	Pipal
13.	<i>Albizzia odoratissima</i>	Chichwa, kela siris
14.	<i>Anogeissus latifolia</i>	Dhaora
15.	<i>Tamarindus indica</i>	Imli
16.	<i>Ficus glomerata</i>	Gular
17.	<i>Capparis sepiaria</i>	Kanker
18.	<i>Gmelina sepiaria</i>	Gamari (khamar)
19.	<i>Dalbergia sisso</i>	Sisam
20.	<i>Ficus bengalensis</i>	Bargad
21.	<i>Syzygium cumini</i>	Jamun
22.	<i>Lynnea coromandelica</i>	Moyen (Gunja)
23.	<i>Azadirachta indica</i>	Neem
24.	<i>Butea monosperma</i>	Palas
25.	<i>Shorea robusta</i>	Sal (Sarai)
26.	<i>Boswellia sp.</i>	Salai
27.	<i>Salmalia malabarica</i>	Semal
28.	<i>Diospyros melanoxylon</i>	Tendu
29.	<i>Eucalyptus sp.</i>	Safeda
30.	<i>Mangifera indica</i>	Mango
31.	<i>Anthocephalus cadamba</i>	Kadam

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<b>SHURBS</b>		
32.	<i>Abrus precatorius</i>	Ghumchi
33.	<i>Achyranthes aspera</i>	Chirchitta
34.	<i>Calotropis procera</i>	Akund/Mada
35.	<i>Ipomoea purpurea</i>	Tall morning glory
36.	<i>Lantana camara</i>	Besharm
37.	<i>Mimosa pudica</i>	Mimosa
38.	<i>Ocimum basilicum</i>	Ban Tulsa
39.	<i>Peganum harmata</i>	Harman
40.	<i>Ziziphus mauritiana</i>	Bar

### **C. CULTIVATED CROPS**

The study area represents agricultural plain land. Green fields and lot of agricultural activities in the surroundings of villages are noticed. Rice is the main crop grown here. Base line data collected from Agriculture Department, Raipur and observed that area around the 10 Km. radius from the project site is majority distributed with following crops:

**Kharif Crops:** - Cotton, Wheat, Maize, Jowar, Moong, Sunflower, Sugarcane, Soya bean, Groundnut.

**Rabi Crops:** - Jow, Tarameera, Sarson, Bhindi, Channa, Pea, Tomato, Palak, Raddish, Gram.

Cropping pattern of the area depends upon the climatological conditions and need of the local population of the area. Sometimes cropping pattern may get changed during construction and operational phase because of particular requirement of specified anthropogenic activities.

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The study area shows typical agro climatic conditions. In spite of the agriculture being dependent mainly on monsoon and underground water, cultivation is the major occupation of this region. The land is monoculture in nature besides the above-mentioned crops, banana, papaya, bar, ginger, methi, chillies, tomato, carrots, soyabeans etc. are also grown in the area. The growth season of major crops are as shown in table given below:-

**TABLE: 6.2.5 (B)**

**GROWTH SEASONS OF MAJOR CROPS**

S. No.	Name of Crop	Plantation month	Harvest season
1.	Groundnuts	June-July	October
2.	Bajra	April	October
3.	Jowar	July	Oct.-Nov.
4.	Cotton	April	July-August

Most of the crops are grown on small farms (located near the village wells) where generally the work is done manually. A very little mechanized (with tractor) cultivation is also seen at times in certain areas.

**TABLE: 6.2.5 (C)**

**COMMON PULSES GROWN IN THE AREA**

S. No.	Common Name	Botanical Name	English Name
1.	Moong	Vigna radiata	Green gram
2.	Jowar	Sorghum japonicum	Sorghum
3	Moth	Vigna aconitifolia	Moth bean
4.	Urad	Vigna mungo	Black lentil



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**TABLE: 6.2.5 (D)**

**COMMON VEGETABLES GROWN IN THE AREA**

S.No.	Common Name	Botanical Name	English Name
1.	Adrak	<i>Zingiber officinale</i>	Ginger
2.	Pyaj	<i>Allium cepa</i>	Onion
3.	Tamatur	<i>Solanum lycopersicum</i>	Tomato
4.	Bhindi	<i>Polygonum persicaria</i>	Lady's Finger
5.	Matar	<i>Pisum sativum</i>	Pea
6.	Mooli	<i>Raphanus sativus</i>	Radish
7.	Methi	<i>Tigonella foenum-graecum</i>	Fenugreek
8.	Gajar	<i>Daucus carota</i>	Carrot
9.	Aloo	<i>Solanum tuberosum</i>	Potato
10.	Palak	<i>Spinacia oleracea</i>	Spinach

**TABLE: 6.2.5(E)**

**COMMON FRUIT TREES IN THE AREA**

S. No.	Common Name	Botanical Name	English Name
1.	Mango	<i>Mangifera indica</i>	Aam
2.	Banana	<i>Musa peridisica</i>	Kela
3.	Amrood	<i>Piper nigrum L</i>	Guava
4.	Sugarcane	<i>Saccharum</i>	Ganna
5.	Papaya	<i>Carica papaya</i>	Papita
6.	Ber	<i>Ziziphus mauritiana</i>	Ber

**TABLE: 6.2.5(F)**

**OILSEEDS**

Soyabean	Glycine max
Groundnut Pods	Arachis hypogaea
Sunflower Seed	Helianthus annuus

**D. ROADSIDE PLANT SPECIES:**

Plant species present on the roadsides and field boundaries include *Acacia Arabica* (Babul), *Albizzia procera* (Safed siris), *Eucalyptus sp.* (Safeda, nilgiri), *Ziziphus mauratiana* (Bar), *Calotropis procera* etc. In addition to this, many annual and perennial grasses are intermingled with the shrub/ tree species.

**E. WILDLIFE SANCTUARIES AND NATIONAL PARKS IN THE STUDY AREA**

There is no National Park or Wildlife Sanctuaries existing in the study area. In addition, no Biosphere reserves, Wildlife corridors, Tiger/Elephant reserves (existing as well as proposed), exist within 10 km of the project area.

**6.2.6 FAUNAL DIVERSITY OF THE STUDY AREA**

Fauna found in the Core zone during the biological survey is listed below:

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**TABLE: 6.2.6 (A)**

**FAUNA FOUND IN THE STUDY AREA**

S. No.	Common Name	Zoological Name	Schedule as per Wild life Act 1972
<b>Core zone</b>			
1.	Brahminy myna	<i>Sturnus pagodarum</i>	Schedule IV
2.	Hare	<i>Lepus nigricolis F</i>	Schedule IV
3.	Wall Lizard	<i>Hemidactylus brookii</i>	-
4.	Rat	<i>R. rattus</i>	Schedule V
<b>Buffer Zone</b>			
1.	Brahminy myna	<i>Sturnus pagodarum</i>	Schedule IV
2.	Common Babblers	<i>Turdoides caudatus</i>	Schedule IV
3.	Black drongo	<i>Dicrurus adsimilis</i>	Schedule IV
4.	White bellied drongo	<i>Dicrurus caerulescens</i>	Schedule IV
5.	Red vented bulbul	<i>Pycnonotus cafer</i>	Schedule IV
6.	Wall Lizard	<i>Hemidactylus brookii</i>	--
7.	Spotted dove	<i>Streptopelia chinensis</i>	Schedule IV
8.	Brown wood dove	<i>Streptopelia senegalensis</i>	Schedule IV
9.	House crow	<i>Corvus splendens</i>	Schedule V
10.	Little egret	<i>Egretta garzetta</i>	Schedule IV
11.	Cotton teal	<i>Nettapus coromandelianus</i>	Schedule IV
12.	Hare	<i>Lepus nigricolis F</i>	Schedule IV
13.	Rat	<i>R. rattus</i>	Schedule V

### **Other Fauna**

Though the large fauna like mammals, birds, reptiles and amphibians, which are found in the area and are known adequately but this cannot be said of the invertebrates, which are equally important for any ecosystem.

For example, the aquatic habitat although limited in its extent, the village ponds and pools, tanks and ditches in rainy season show a variety of aquatic animals. These water bodies do provide favorable habitats for the breeding of sponges, coelenterates, aquatic arthropods like crustaceans, mosquitoes, arachnids, etc.

### **6.2.7 WILDLIFE CONSERVATION**

The schedules of Wildlife Act (1972) classify the species such as rare, endangered, threatened, vulnerable etc. According to degree of threat of extinction Schedule – I contains those species, which need topmost priority, while II, III, IV and V have lesser degree of threat. Most of the avifauna are listed in Schedule – IV. No Schedule- I is observed in the study area. There are no migratory paths reported in the study area.

The following mitigation measures are being taken up for protection of fauna in the study area:

- Improvement of habitat that includes augmenting water sources, water regime development, eradication of weeds, and development and restoration of grasslands.
- Educate the local people to develop awareness to protect the animals;
- Formulate wild life protection committees in near by villages to control the poaching and hunting;
- Protect and regulate the herbivorous animals in the forest area as well as the project near to lease area; and

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- Formulate a wild life patrolling committee to monitor the wild animal movement.
- Mitigation of man-animal conflicts,
- Inoculation of domestic cattle against contagious diseases.

### **6.3 Hydrogeological Study**

Hydrogeological study has been conducted for the study area i.e. 10 km radius of the mine site. Major finding of the study are given as under:

- The regional water level ranges between 32m. to 35m. below ground level during the pre monsoon period. Post monsoon water levels are 26m to 28m below ground level.
- Based on results of hydrogeological survey conducted in the area, it appears that ground water occurs in water table condition in weak zones of medium hard & hard rock. In the investigated area, thickness of top soil is very less generally not more than 3m in mining lease area.
- For buffer zone (10 km radius) total recharge due to rainfall & irrigation return flow at normal rainfall works out to be 71.48 mcm/annum. Total discharge works out to be 30.77 mcm/annum & stage of development is 43%.
- Total gross dynamic reserves in the core zone, which includes mine area, have been estimated of the order of 0.867 mcm/annum. As ground water draft in core zone is nil it is because all the water requirement has been meet out from the rainwater collected in the sump
- Mining the area of core zone will have surplus exploitable ground water potential, indicates that mining activity will not affect ground water recharge and its ground water resources. No stream was

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encountered during the mining activity hence no diversion is required. This hardly affects surface water resources.

- Similarly, as no stored water will be released directly to water streams of nearby areas, possibilities of any siltation in natural streams and reduction of percolation is very less.
- Due to hard, crystalline and chemically resistant nature of limestone the water stored in the mining pit remains unpolluted and free from any toxic constituents. The overburden, mostly composed of very less alluvial material also does not contribute any pollutants from its waste. The waste dumps are located in such a way that there are no hindrances to flow of water bodies and streams.
- There is no possibility of any land subsidence due to heavy pumping or mining as the rocks are hard, compact, impervious and crystalline, which can be stand of its own. Beside that there is no heavy pumpage for ground water extraction.

Detailed Hydro-geological Study is enclosed herewith as **Annexure - 10** with the Draft EIA/EMP Report.

## **6.4 RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN**

### **6.4.1 DEFINITION**

A major emergency in a work is one, which has the intensity to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the work. It would normally require the assistance of emergency services to handle it effectively.

#### **6.4.2 SCOPE**

An important element of mitigation is emergency planning i.e. recognizing that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on site and off site that would need to be implemented in the event of an emergency.

Emergency planning is just one aspect of safety and cannot be considered in isolation.

#### **6.4.3 OBJECTIVE**

The overall objectives of the emergency plan are:

- (a) To localize the emergency and, if possible eliminate it;  
and
- (b) To minimize the effect of the accident on people and property.

Elimination requires well planned process/technology and its effective implementation, so that such situation should either not arises or if it comes, a pre warning is received for timely action in built or by preparedness for zeroing the effects.

Minimizing the effects may include prompt action, rescue, first aid, and evacuation, fire fighting and also passing on information promptly to people living nearby.

#### **6.4.4 IDENTIFICATION OF HAZARDS**

The possibility of the following may be there for such projects:

(a) Fire associated with storage of combustible material, lubricants, oil. Fire in magazine premises and nearby area.

(b) Accidents in the mine

To deal the above emergencies, the Emergency Plan is prepared.

#### **6.4.4.1 Disaster Due To Surface Fire**

The fire could be due to surface fire. Such case has so far not been reported. Likewise equipment sometimes catches fire which needs to be dealt.

#### **Code of Practice in Case of Fire at Mines**

##### **Objective:**

To deal with fire efficiently and quickly at different locations of mine

##### **Source of Fire:**

- i) Electrical Sub Station.
- ii) Oil & Lubricant Room.
- iii) Mine machineries.

##### **Line of Action:**

- i) Sufficient fire extinguishers will be installed at selected locations on site. Besides, numbers of water hydrants with sufficient length of hosepipes will be made available at the surface for fire protection.



- ii) Any person notices any sign of fire shall immediately take steps to give warning by blowing the siren continuously and take steps to extinguish the fire by using appliances available near the site.
- iii) **Duties of mine Official:** - The Mine officials receiving the warning will forthwith inform at following places.
  - a) Fire fighting station
  - b) Security main gate
  - c) Mines Manager
  - d) Mines Agent / Owner

After intimation he should reach the spot, remove Men & Machinery and take steps to tackle the fire in accordance with the fire fighting instructions. Inform the security office to get an Ambulance if required.

- a) **Duties of Fire Fighting Team:** - On receiving warning, the team shall reach the site of fire and depending on its nature, class and extent shall take steps to extinguish it and rescue persons who may be caught in fire.
- b) **Duties of Mines Manager:** -
  - (i) On receipt of information about fire, the Manager will forthwith rush to the spot and assess the situation. He will oversee the overall rescue

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operation and make necessary arrangement for medical aid to the affected persons, if any.

- (ii) Inform the management and statutory bodies.

#### **6.4.4.2 Code of Practice in case of Explosion & Accidents**

##### **Objective**

To deal with accidents efficiently and quickly.

##### **Line of Action**

Any person, who notices any explosion or accident, should immediately take steps to give warning by suitable mean and at the same time take necessary action for withdrawal of men from the site. He shall also inform the mine's Manager and other officials without any delay.

##### **Duties of Mine's Manager**

- (a) On receipt of information about explosion or accident, the manager shall forthwith rush to the spot and the situation. He shall make the arrangements for withdrawal of affected persons, if any.
- (b) Inform the hospital for Ambulance for affected persons, if any.
- (c) Provide First aid to affected persons.
- (d) Inform the senior officials and statutory bodies.

#### **6.4.4.3 Action in Emergency**

If any emergency like fire arises in the mine one should immediately inform to Security Supervisor. Security will inform key personnel and act as detailed above and consequently inform to CCR for broad announcement by Public Address System and to blow the Alarm if CCR is not affected itself. The emergency alarm will be wailing sound for two minutes on hearing telephone or alarm; the key personnel will act as per responsibilities. The procedure for all emergency situations as mentioned above would be same.

#### **6.4.4.4 Site Restoration**

The incident controller will check the areas thoroughly for possible hazards such as toxic fume or live wires after emergency and will inform site controller accordingly.

The key personnel will meet to evaluate their individuals and overall performance in responding to situation after the emergency is over. The review shall determine.

- Effectiveness of emergency response plan.
- Mine crew performance.
- Any need for updating or revision of the emergency response plan.
- Suitable arrangement for restart of the work.
- Evaluation and control of efficient arising out of mitigating measures like foam discharge & overflow of oil in water.
- Rehabilitate evacuated area.
- Adopt measures to prevent similar recurrence.

#### **6.4.4.5 Precautions**

To avoid all these disasters at working place and to minimize their effects following precautions shall be taken and arrangement shall be made at the working place.

- (i) Periodical maintenance of mine machineries.
- (ii) The persons shall be trained properly to handle the situation.
- (iii) Detailed warning system, implementation procedure, emergency control centre, shall be maintained at the mine with names of trained persons.

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- (iv) Details and availability of heavy machinery, fire-fighting equipment shall be available at the site.
- (v) Proper arrangements shall be made for treatment of injured person, if any.
- (vi) All the safety equipment shall be available at the mine.

#### **6.4.4.6 Post Disaster Analysis and Evaluation**

When the emergency is over, the team will carry out a detailed analysis of cause of accident/occurrence, evaluate the influence of various factors and find out the procedures to minimize them in future. At the same time adequacy of disaster management plan shall be evaluated and shortcomings shall be rectified to improve the plan.

#### **6.4.5 Off-Site Emergency Planning**

##### **6.4.5.1 Introduction**

The off-site emergency plan is an integral part of any hazard control system. It would be based on those accidents identified by the works management, which could affect people and the environment outside the works. Thus, the off-site plan follows logically from the analysis that took place to provide the basis for the on-site plan and the two plans should therefore complement each other. The key feature of a good off-site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan. The roles of the various parties that may be involved in the implementation of an off-site plan are described below. The responsibility for the off-site plan will be likely to rest either with the works management or with the local authority.

Either way, the plan must identify an emergency coordinating officer who would take overall command of the off-site activities. As with the on-site plan, an emergency control center will be required within which the emergency coordinating officer can operate. An early decision will be required in many cases on the advice to be given to people living “within range” of the accident – in particular whether they should be evacuated or told to go indoors. Consideration of evacuation may include the following factors:

- a. In the case of a major fire but without explosion risk (e.g. an oil storage tank), only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically.
- b. But if the fire is escalating it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people would be advised to stay indoors and shield themselves from the fire.

#### **6.4.5.2 Aspects To Be Included In An Off-Site Emergency Plan**

Some of the aspects to be included in off-site emergency plan are as follows:

##### **a) Organization**

Details of command structure, warning systems, implementation procedures, emergency control centers Name and appointments of incident controller, site main controller, their deputies and other key personnel.

**b) Communications**

Identification of personnel involved, communication center, call signs, network, list of telephone numbers.

**c) Special Emergency Equipment**

Details of availability and location of heavy lifting gear, bulldozers, specified fire-fighting equipment, fireboats.

**d) Voluntary Organizations**

Details of organizers, telephone numbers, resources, etc

**e) Meteorological information**

Arrangements for obtaining details of weather conditions prevailing at the time and weather forecasts will be made.

**f) Humanitarian Arrangements**

Transport, evacuation centers, emergency feeding, treatment of injured, first aid, ambulances, temporary mortuaries.

**g) Public Information**

Arrangements for: -

(i) Dealing with the media-press office

(ii) Informing relatives, etc.

**h) Assessment**

Arrangements for: -

(i) Collecting information on the causes of the emergency

(ii) Reviewing the efficiency and effectiveness of all aspects of the emergency plan.

#### **6.4.5.3 Role Of The Emergency Coordinating Officer**

The various emergency services will be coordinated by an Emergency Coordinating Officer (ECO) who is likely to be a senior police officer but, depending on the circumstances, could be a senior fire officer. The ECO will liaise closely with the site main controller. Again depending on local arrangements, for very severe incidents with major or prolonged off-site consequences, the external control may pass to a senior local authority administrator or even an administrator appointed by the Central or State Government.

#### **6.4.5.4 Roles Of Major Hazard Works Managements**

Where the local authority has the organization to formulate the plan, the role of works managements in off-site emergency planning will be to establish liaison with those preparing the plans and to provide information appropriate to such plans. This will include a description of possible on-site accidents with potential for off-site harm, together with their consequences and an indication of the relative likelihood of the accidents.

Advice should be provided by works managements to all the outside organizations which may become involved in handling the emergency off-site and which will need previously to have familiarized themselves with some of the technical aspects of the works activities, e.g. emergency services, medical departments, etc.

#### **6.4.5.5 Role Of The Local Authority**

In some places the duty to prepare the off-site plan lies with the local authorities. They may have appointed an emergency planning officer (EPO) to carryout all this duty as part of the EPO's roles in preparing for a whole range of different emergencies within the local authority area. The EPO will need to liaise with the works to obtain the information to provide the basis for the plan.

Rehearsals for off-site plans are important for the same reasons as on-site plans and will need to be organized by the EPO.

#### **6.4.5.6 Role Of The Police**

The police normally assume the overall control of an emergency, with a senior officer designated as emergency coordinating officer.

Formal duties of the police during an emergency include protecting life and property and controlling traffic movements.

The functions include controlling bystanders, evacuating the public, identifying the dead and dealing with casualties and informing relatives of dead or injured.

#### **6.4.5.7 Role Of The Fire Authorities**

The control of a fire is normally the responsibility of the senior fire brigade officer who would take over the handling of the fire from the site incident controller on arrival at the site. The senior fire brigade officer may also have a similar



responsibility for other events. Fire authorities having major hazard works in their area should have familiarized themselves with the location on site of all stores of flammable materials, water and foam supply points and fire-fighting equipments.

#### **6.4.5.8 Role Of The Health Authorities**

Health authorities, including doctors, surgeons, hospitals, ambulances and so on, have a vital part to play following a major accident and they should form an integral part of any emergency plan.

For major fires, injuries will be the result of the effects of thermal radiation to a varying degree and the knowledge and experience to handle this in all, but extreme, cases may be generally available in most hospitals.

#### **6.4.5.9 Roles Of The Government Safety Authority**

The Inspectors of Director General of Mines Safety are likely to want to satisfy themselves that the organization responsible for including the off-site plan has made adequate arrangements for handling emergencies of all types including major emergencies.

In the event of an accident, local arrangements regarding the role of the factory inspector will apply. In the aftermath, factory inspectors may wish to ensure that the affected areas are rehabilitated safely.



## **CHAPTER-VII**

### **PROJECT BENEFITS**

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#### **7.0 INTRODUCTION**

Grasim Industries Limited is very much conscious of its obligations to society at large. The company has contributed substantially to the exchequer. In addition, the company has provided opportunities for all around socio-economic development.

#### **7.1 PROMOTION OF SOCIAL & ECONOMIC STATUS**

Grasim Industries Limited has promoted rural development programme in the various fields like education, health & family welfare, agriculture etc, like;

- Health awareness programmes and surgical camps (eye camps, cleft lips correction camps, dental camps, pulse polio camps, etc.)
- It is running 18 hospitals.
- Presently running 45 schools.
- Increasing awareness for protection and conservation of environment.
- Promotion of Educational Programmes
- Promoted Community Programmes
- Grasim Cement has laid black top roads on the following stretches as part of community and infrastructure development, regular maintenance of these roads are being undertaken by Grasim Cement.
  - Rawan to Hathbandh - 27 km.
  - Rawan to Hirmi - 11.5 km.
  - Rawan to Chuchurungpur - 2.9 km.
  - Pakidi to Balodabazar - 20 km.
  - Rawan by pass road is under construction

- Grasim Cement has extended help to the farmers under the project Swarojgar, and Griha Udyog. Grasim Cement has rendered its support to the farmers in providing the training on agriculture, depending of ponds, servicing of hand pumps & bore wells, veterinary training and cattle health camps.
- Under the health and family welfare programme, Grasim Cement has conducted, medical health, family planning and aids awareness camps apart from training on first aid, health and hygiene and camp for eradication of leprosy.
- Following social welfare activities were undertaken by GIL management from 01.04.07 to 31.03.08;

**TABLE – 7.1**

**SOCIO ECONOMIC ACTIVITIES**

<b>S.No.</b>	<b>Activities</b>	<b>Beneficiary</b>
1.	Coaching for admission in Navodaya School-NTMM	150
2.	Distribution of Scholarship to students	133
3.	Block Level Sports Tournaments	643
4.	Computers to 4 High schools	1900
5.	Balbhoj to primary school students	250
6.	Distribution of utensils to primary school students	1030
	<b>Total</b>	<b>4160</b>

Source: Project Report

## **7.2 CORPORATE SOCIAL RESPONSIBILITIES**

Rural developmental activities done from the year 2008 – 2009 and proposal for the year 2010.

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP</b> <b>Report</b>
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**TABLE – 7.2**

<b>S. No.</b>	<b>Parameters</b>	<b>Parameters of work done</b>	<b>Expenditure 2008-09 (Rs.)</b>	<b>Till Date 01.04.09 (Rs.)</b>	<b>Expenditure Proposed- 2009-10 (Rs.)</b>
1.	Housing	<ul style="list-style-type: none"> <li>➤ Repairing of and community buildings</li> <li>➤ Repairing of Roads</li> <li>➤ Indira Awas/ Gobar Gas Plant</li> </ul>	72000	1264250	800000
2.	Water Supply	<ul style="list-style-type: none"> <li>➤ Mines water in villages</li> <li>➤ Repairing of Bore-wells and pumps/ water supply</li> <li>➤ Water Harvesting (Deepening of pond and construction of stairs near pond)</li> </ul>	84000	1139000	300000 430000
3.	Health, Safety & Medical Facilities	<ul style="list-style-type: none"> <li>➤ Family Planning Camps</li> <li>➤ Medical facilities to villagers</li> <li>➤ Cataract Operations,</li> </ul>	169000	1650222	675000
4.	Education & Training	<ul style="list-style-type: none"> <li>➤ Distribution of Tatpattis to local schools, Scholarship to village students, Asist. In construction of school buildings/ boundary/ shed, Coaching for Navodaya school, Silai &amp; Tailoring Training, Agriculture training to farmers &amp; Distribution of uniform to student.</li> </ul>	237000	2975950	750000
5.	Employment /Training to local inhabitants	<ul style="list-style-type: none"> <li>➤ Self Employment camp, Training for repairing of Motor Cycle/Two wheeler, Training for repairing of Electronic items and TV/Mahila Bal Vikas camp</li> </ul>	19000	205500	90000
6.	Recreation & Sports	<ul style="list-style-type: none"> <li>➤ Inter-School Sports meet, Distribution of Musical items to Mahila Mandals, Inetr-village sports, Religious</li> </ul>	57000	344200	110000

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		function in village			
7.	Others	➤ Cattle camp & feed training, Distribution of Tricycles/sewing machine etc	27000	558900	40000

Source: Prefeasibility Report

### 7.3 Action plan for identification of unskilled local youth for employment in various forms by imparting training:

**TABLE – 7.3**  
**TRAINING PROGRAMME**

	1st Year			2nd Year			Total amount (Rs. In Lacs)
TRAINING PROGRAMMES	No. of Villages	Qty	Amt	No. of Villages	Qty	Amt	
1. Short term courses for skill up gradation.							
2. Vocational training (Dairy, Poultry, bee keeping)							
3. Providing training to unemployed education youth in spoken English language and personality development to enable them to appear for interviews.							

### 7.4 CONCLUSION

Expansion of limestone production capacity will result in increase of revenue for Grasim Cement to promote more rural development programme in the expansion phase of the cement plant.

Project activity and the management has supported the local administration and provided other form of assistance for the development of public amenities in this region.

Grasim Industries Limited has generated fair amount of direct and indirect employment in the study area. The local economy has received boost due to employee spending and services generated. The overall effect has

improved buying power of employees and thus a higher standard of living viz. better education, improved health and sanitation facilities housing and acquisition of consumer durable. This is envisaged as a major positive benefit.



## CHAPTER-VIII

# ENVIRONMENTAL MANAGEMENT PLAN

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### 8.1 INTRODUCTION

The environmental management plan consists of the set of mitigation, management, monitoring and institutional measures to be taken during implementation and operation of the project, to eliminate adverse environmental impacts or reduce them to acceptable levels. The present environmental management plan addresses, the components of environment, which are likely to be affected by the different operations in a limestone mine.

**The aims of EMP are:**

- Overall conservation of environment.
- Minimization of waste generation and pollution.
- Judicious use of natural resources and water.
- Safety, welfare and good health of the work force and populace.
- Ensure effective operation of all control measures.
- Vigilance against probable disasters and accidents.
- Monitoring of cumulative and long time impacts.
- Ensure effective operation of all control measures.

### 8.2 POLLUTION CONTROL MEASURES

#### 8.2.1 Air Pollution Control

In limestone mine, air pollution will be caused mainly due to dust generation from mining activities like drilling, blasting, loading, haulage & crushing etc. However, proper precautions will help in minimizing the air pollution, as follows.

### **8.2.1.1 Control of Fugitive Emission**

#### **A. Dust Pollution**

The main pollutant in air is Particulate Matter (PM<sub>10</sub>), which is generated due to various mining activities. However, to reduce the impact of dust pollution the following steps are being taken during various mining activities.

##### **a) During drilling operations**

- ◆ DM 30 & ICM 260 drills used for blast hole drilling has an inbuilt vaposal system to suppress the dust generated at the source itself.
- ◆ Sharp drill bits are being used for drilling.
- ◆ The drill machines are being kept leakage free and equipped with wet drilling arrangements.
- ◆ Drill operators are equipped with Personal Protective Equipment.

##### **b) During blasting operation**

- ◆ Blasting is being done in controlled manner with use of electric delay detonator to minimize dust to get air borne and also limit the fly rocks within 50-60 m.
- ◆ Competent persons carry out blasting and all the precautions laid down under MMR - 1961 circulars and directions of DGMS issued from time to time will be followed.

##### **c) During loading operation**

- ◆ Transportation vehicles will never be overloaded.
- ◆ Skilled operators will only operate the machines.

##### **d) During Transport operation**

- ◆ All the haulage roads in the area are kept wide, leveled, compacted and properly maintained and water is sprayed regularly during the shift operation to prevent generation of fugitive dust due to movement of dumpers, and other vehicles.



**e) During Crushing**

Water is being sprayed in the form of a fine jet to suppress the dust generated while unloading of dumpers at crusher hopper. Bag filters are also installed in the crushing circuit to suppress the dust generated while crushing and during transportation of limestone from one conveyor to other. Apart from this, curtains are also provided to cover the dump hopper so as to it can minimize the dust exposure away from the hopper.

Dust suppression on haul roads is done by the means of two no. of water tanker of 12 KL and 8 KL capacity. Proposal for lying of Permanent water sprinkling system on the main haul roads to crusher dump hopper is under consideration.

**e) Plantation work carried out**

In order to reduce spread of air pollution in the surroundings, green belt has been developed around the mines office, mine approach road, along mine boundary, etc. to control dust pollution.

**f) Monitoring of air pollution**

Periodic air quality survey will be carried out to monitor the quality and for timely corrective actions.

Action Plan for the control of fugitive dust emission is as given below:

**TABLE: 8.2.1.1**

**ACTION PLAN FOR FUGITIVE DUST EMISSION**

<b>S. No.</b>	<b>Source of generation of fugitive emissions</b>	<b>Action Plan Proposed</b>
<b>1.</b>	<b>Drill Operations</b>	<ul style="list-style-type: none"> <li>DM 30 &amp; ICM 260 drills used for blast hole drilling has an inbuilt vaposal system to suppress the dust generated at the source itself.</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Drill speeds is being regulated as per manufacturer's guidelines.</li> </ul>
<b>2.</b>	<b>Blasting</b>	<ul style="list-style-type: none"> <li>▪ Use of suitable explosives and overcharging of blast holes is avoided.</li> <li>▪ Heavy duty (under high pressure) water spraying is done on the blasted muck pile (before loading by excavator) to suppress the dust.</li> <li>▪ Rock breaker is used for breaking over size boulders in order to reduce dust and noise generation, which otherwise would be generated due to secondary blasting.</li> </ul>
<b>3.</b>	<b>Loading / Unloading / Transportation</b>	<ul style="list-style-type: none"> <li>▪ Water spraying is being done on haul roads and during unloading to suppress the dust effectively.</li> <li>▪ Dust suppression on haul roads is done by the means of two no. of water tanker of 12 KL and 8 KL capacity. Proposal for lying of Permanent water sprinkling system on the main haul roads to crusher dump hopper is under consideration.</li> <li>▪ Overloading of transport equipment is prevented in order to stop spillage.</li> <li>▪ Development of green belt/plantation on the sides of approach roads, around office complex, and workshop area which arrests dust.</li> </ul>

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<b>4.</b>	<b>Crusher</b>	<p>Water is being sprayed in the form of a fine jet to suppress the dust generated while unloading of dumpers at crusher hopper. Bag filters are also installed in the crushing circuit to suppress the dust generated while crushing and during transportation of limestone from one conveyor to other. Apart from this, curtains are also provided to cover the dump hopper so as to it can minimize the dust exposure away from the hopper.</p> <ul style="list-style-type: none"> <li>▪ Operators and attendants are being provided with dust mask.</li> </ul>
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*Source: Scheme of Mining & progressive mine closure plan*

## **B. Prevention and control of Gaseous Pollution**

In mining activities, the only source of gaseous emissions is from blasting and the engines of other vehicles and equipments. Blasting of explosives results in increase of nitrogen oxides, which get diluted by the wind. Blasting with optimization of use of explosive energy will help in reducing the above emissions. The emissions from the diesel engines of the machinery could be visible as smoke or invisible gases such as Sulphur dioxide, Oxides of Nitrogen and unburnt Hydrocarbons due to incomplete combustion of the fuel. The reasons may be quality of fuel, improper operation of the engine, etc.

Proper maintenance of machines improves combustion process and brings the reduction in pollution. The effect of these gases will be limited to the surrounding of the equipment in operation only and will not affect the nearby community. The persons working in near vicinity of machines are provided with PPE's.

## **8.2.2 Noise Mitigation & Vibration Control**

### **8.2.2.1 Noise Abatement and Control**

- All the latest machines has been purchased and due care is being taken off, for generation of noise by the equipment.
- Use of in built eco friendly system in HEMM in mining like vaporized water injection in drilling machine & sound/ dust proof AC cabins. This helps in reducing noise as well as dust generation during drilling.
- Controlled blasting method is being practiced
- Drilling and blasting operations are being carried out under the supervision of qualified persons.
- Blasting is done by NON-Electric detonators (NONEL).

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- Max. charge per delay is kept to the minimum to reduce the hazards of ground vibrations.
- Rock breaker is used for breaking ore size boulders generated during blasting, this eliminates secondary blasting.
- Ground vibration is being monitored by NOMIS Seismograph on regular basis for each blast.
- Plantation of dense belt of trees has been planned under green belt development programme, which acts as an acoustic barrier, so that public at large will be not affected.
- Dense plantation has been carried out around the crusher, on the sides of approach roads, on both sides of belt conveyor system, around office complex and workshop area and on the sides of working pit. This would help in arresting noise at source due to mining activities in the area.
- In order to reduce the effect of noise pollution, earmuffs are being provided to all operators and employees working at mining site as a safety measure.
- Periodical monitoring of noise level of mining machines and at some locations in the surrounding area of mine working are carried out with the help of sound level meter. The results obtained are submitted to MOEF, SPCB & IBM as per statutory requirement.

#### **8.2.2.2 Protective measures for ground vibrations / fly rocks caused by blasting**

Numbers of innovations and studies would be carried out at our mine for minimizing adverse impact of blasting. Following measures will be adopted at mine to reduce ground vibration, fly rocks, dust generation, noise generation, etc.

- By optimization of drilling – blasting parameters i.e. burden, spacing, depth of hole, etc.

- By using Control Blasting
- By avoiding secondary blasting with the help of rock breaker.

### **8.2.3 WATER MANAGEMENT**

#### **8.2.3.1 Water conservation measures proposed in the core zone:**

Adequate control measures will be adopted to check not only the wash-off from soil erosion but also uncontrolled flow of mine water. The measures to be adopted are:

- Garland drain & 4 Nos. settling tank have been constructed around working pit, OB soil dump and the dump is also scientifically vegetated to avoid soil erosion and water so collected is used for plantation.
- Retaining walls having water holes will be provided along the toe of the dumps to avoid the soil wash out & around the active pit to prevent fall of human/animal in to the working pit.
- In future top soil stacking will be done by retreating method of dumping to facilitate early reclamation of the above. The terraces will be provided an inward slope of 2% to facilitate drainage of the rain water. Pits of 0.5 x 0.5 x 0.5m will be made at an interval of 3m. The prepared pits will be filled with soil and cow dung mixed in the ratio of 3:1 along with small quantities of BHC. Saplings of Accacia Siamea and Acacia Auriculiformis will be planted.
- Selection of waste dumps site has been done by keeping distance from watercourses in the area
- Periodical testing of mine water is being carried out to check its quality.
- Sump with capacity of 7 lac m<sup>3</sup> has been designed taking into account of Peak sudden rainfall and maximum discharge in the area and adequate retention period to allow proper settling of silt material

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- Ground water level is being monitored by piezometers in the project area
- Roof water harvesting is done at hospital, school building, shopping complex, CCR building, Mine office and Rawan Panchayat Bhawan.
- Oil/water separator has been provided in the workshop and is used for green belt development after proper treatment.

The ground water table in the mine area is not likely to be affected, as no toxic chemicals are present in the rejects stacked. The domestic sewage from the canteen and toilets would be routed to septic tanks followed by soak pits.

#### **8.2.3.2 Waste Water Management**

The domestic sewage from the canteen and toilets is routed to septic tanks followed by soak pits. Waste water generated from workshop is properly collected, treated so as to conform to the standards prescribed under GSR 422(E) dt 29.5.93 & 31.12.93 or as amended from time to time. Oil & grease trap are installed before discharge of workshop effluents.

#### **8.2.4 Solid Waste Management & Land Reclamation**

The lease area is underlain by the OB cover and intercalation of the same along with shale which is found in the limestone of the lower benches due to which the quality of the limestone gets deteriorated. To overcome this, the OB cover is removed before feeding it to crusher and it is passed through the screening system to remove the deleterious material such as shale and clay from the limestone as screen reject. The OB soil and crusher screen rejects are stacked systematically as multilevel dumps at their respective places. The OB dumps are formed with retreating method of dumping thereby facilitating its early reclamation.

#### 8.2.4.1 TOP SOIL MANAGEMENT

In order to prevent and control soil erosion following measures are taken:

- A total quantity of 2, 87,250 m<sup>3</sup> of overburden soil has been generated. Total 9,000 m<sup>3</sup> has been stacked systematically as multi level dumps.
- One of the dump has been completely afforested. The dumps are provided with drain and settling tank. Apart from the above 2, 78,250 m<sup>3</sup> quantity has been used in green belt area for better growth of the vegetation over there.
- Stone pitching has been done all around the dump to prevent denudation of soil and to provide stability to the dump.
- Toe drains with suitable baffles are provided all along the toe of dumps to arrest the soil from dump slope being carried by rain water and causing siltation downstream.
- All loose material slopes are provided with plantation by making contour trenches to check soil erosion due to wind as also rains. Native trees and shrubs are preferred for the same.
- Coconut fiber as geotextile matting will be provided to stabilize and provide strength to loose soil. This will hold moisture from evaporation and help in seed germination and growth of vegetation. Later on it will also act as manure and enhance soil fertility and permeability.
- The coco – filters will be installed at the foot of dumps to arrest and prevent silt deposition and provide clean water reducing total suspended solid level. De-silting will be done at regular intervals.
- Top soil generation for the next five years 2009 -2014, is given below :



**TABLE- 8.2.4.1**  
**QUANTITY OF TOP SOIL TO BE GENERATED**  
**DURING THE YEAR 2009-2010**

S. No.	Year	Quantity of top soil to be generated (m <sup>3</sup> )
1.	2009-2010	100000
2.	2010-2011	100000
3.	2011-2012	100000
4.	2012-2013	100000
5.	2013-2014	100000

*Source: Scheme of Mining & progressive mine closure plan*

- Top soil stacking will be done by retreating method of dumping to facilitate early reclamation of the above. The terraces will be provided an inward slope of 2% to facilitate drainage of the rain water. Pits of 0.5 x 0.5 x 0.5m will be made at an interval of 3m. The prepared pits will be filled with soil and cow dung mixed in the ratio of 3:1 along with small quantities of BHC. Saplings of *Accacia Siamea* and *Acacia Auriculiformis* will be planted.

#### **8.2.4.1.1 WASTE AND SCREEN REJECTS**

Yearwise generation of waste, screen rejects & top soil for will be as given in the table below:

**TABLE- 8.2.4.1.1**  
**YEARWISE GENERATION OF WASTE**

Year	Overburden	Screen reject	Top Soil
First Year	1000000 T	400000 T	100000 m <sup>3</sup>
Second year	1200000 T	400000 T	100000 m <sup>3</sup>
Third Year	1500000 T	400000 T	100000 m <sup>3</sup>
Fourth Year	1800000 T	800000 T	100000 m <sup>3</sup>
Fifth Year	2000000 T	550000 T	100000 m <sup>3</sup>
<b>Total</b>	<b>75,00,000 T</b>	<b>25,50,000 T</b>	<b>500000 m<sup>3</sup></b>

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

The top soil so generated will be used for Green Belt development / Plantation purpose.

The waste material such as OB and Screen reject will be transported by dumpers to their respective dumps where they will be unloaded. Maximum height of the terraces will be kept at 6/8 m for screen reject and overburden soil dumps.

The existing dumps are located over the area which is non mineable as it contains shaly limestone at very depth of O.B. at places.

The cumulative year wise areas covered under the above dumps are given in table below:

**TABLE NO. 8.2.4.1.1 (A)**

**YEARWISE AREA TO BE COVERED UNDER DUMPS**

Year	Overburden dump area increment in ha	Screen reject dump are increment in ha
2009-10	4.80	5.7
2010-11	1.20	0
2011-12	0	0
2012-13	0	0
2013-14 (till end of lease period)	0	0
<b>Total</b>	<b>6.00</b>	<b>5.7</b>

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

#### **8.2.4.2 Land Reclamation**

The activity will affect the present landscape of the ML area. The original topography of the ML area will be affected mainly due to the actual mining operation.

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At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir.

Out of total lease area i.e. 722.834 ha, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.

**Table: 8.2.4.2**  
**POST-MINING (CONCEPTUAL) LAND USE OF CORE ZONE WITH ENVIRONMENT MANAGEMENT**

S. No.	Description	Landuse				
		Plantation	Public Use	Water Body	Undisturbed	Total
1.	Top Soil Dump	Nil	-	-	-	Nil
2.	Waste Dump	40.32	-	-	-	40.32
3.	Excavation (Voids)	-	-	307.954	-	307.954
	Reclaimed (Backfilled)	251.00	-	-	-	251.00
4.	Road	-	10.00	-	-	10.00
5.	Built up area	-	1.72	-	-	1.72
6.	Town Ship Area	-	-	-	-	-
7.	Afforestation (Green Belt /Avenue Plantation)	111.840	-	-	-	111.840
8.	Mineral storage	-	-	-	-	-
9.	Undisturbed Area	-	-	-	-	-
	<b>Total</b>	<b>403.16</b>	<b>11.72</b>	<b>307.954</b>	<b>-</b>	<b>722.834</b>

*Source: Modified Scheme of Mining & Progressive Mine Closure Plan*

#### **8.2.4.3 Phase wise reclamation and rehabilitation schedule of the mine**

Phase wise reclamation and rehabilitation schedule of the mine as given in EMP and approved by MoEF is as under :

**Stage(1):** At the end of first 5 years i.e. March 1999 the eastern flange of the first bench slope to be shrubbed for a total planned area of 0.38 hectares. The aforesaid job has been started and initial reclamation of the slope has already been done by doob grass. Plantation on the bench slope has been started and saplings of yellow oleander, bougain bellia, shoe flower, su-babool and Karanja have already been planted.

**State (2):** At the end of first 15 years i.e. 2014, the first bench berm and slope and berm of 2nd & 3rd benches along the eastern and southern flange will be shrubbed. Total berm and slope area to be shrubbed is 14.01 hectares involving a total plantation of 6075 nos. saplings.

**Stage (3):** At the end of 25th year i.e. 2024 the first bench slope and berm along with its balance eastern flange, northern flange and southern flange and berm of 2nd & 3rd bench along their balance eastern & southern flange will be shrubbed & planted.

**Stage (4):** The reclamation measures at this stage will involve the following.

The berm of 2nd & 3rd bench and slope & berm of 1st bench will be shrubbed and carpeted. The lower benches will be developed as water storage used partly for irrigation purpose and partly for pisciculture as incorporated in the progressive mine closure plan.

## **8.2.5 GREENBELT DEVELOPMENT & PLANTATION PROGRAMME**

### **8.2.5.1 Existing Green Belt/Plantation**

Till now, about 94.67 area has been covered by plantation by planting around 2,35,550 no of saplings.

A large number of ornamental plants have also been planted to provide visual aesthetics.

Continuous efforts to promote green belt in & around the mine lease area by horticulturist have been done.

A green belt of tree plantation around the mine site (also along the lease boundary in downwind direction) has helped to arrest the particulate matter in the area and hence attenuate the pollution to a great extent as it work as a wind break.

Details of the plantation done by GIL during the last few years is as mentioned in the table below:

**TABLE- 8.2.5.1 (A)**

**PLANTATION DETAILS AROUND THE ML AREA**

Details	YEARS									TOTAL
	UP TO 2000-01	2001-02	2002-2003	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	
<b>No of plant</b>	156353	15000	42980	43146	40059	51276	37050	25020	15000	425884
<b>Area (in Ha.)</b>	40.59	6.00	19.54	19.61	7.43	0.00	0.00	1.50	0.00	94.67

The following plant species has been planted according to CPCB guidelines:

**TABLE: 8.2.5.1 (B)**

**Plants Species Planted In Grasim Cement - Raipur**

S. No.	Name Of The Plants
<b>Forestry Plant</b>	
1.	Teak
2.	Sisoo
3.	Karanga
4.	Peltaform
5.	Casia siamia
6.	Kadamba
7.	Nilgiri
8.	Gliricidia

<b>9.</b>	Bahunia
<b>10.</b>	<i>Accasia auriculiformis</i>
<b>11.</b>	Kaner
<b>12.</b>	Subabool
<b>13.</b>	Amaltas
<b>14.</b>	Ashok
<b>15.</b>	Bamboo
<b>16.</b>	Casurina
<b>17.</b>	Champa
<b>18.</b>	Gulmohar
<b>19.</b>	Neem
<b>20.</b>	Rain tree
<b>21.</b>	Alasthomia
<b>22.</b>	Sirasa
<b>Fruits</b>	
<b>23.</b>	Mango
<b>24.</b>	Guava
<b>25.</b>	Lemon
<b>26.</b>	Musambi
<b>27.</b>	Awala
<b>28.</b>	Bel
<b>29.</b>	Anar
<b>30.</b>	Ber
<b>C-bio diesel plants</b>	
<b>31.</b>	<i>Jetropha curcus</i>

### 8.2.5.2 Proposed Green Belt/Plantation Programme

At the end of life of mine, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.

The following species to be planted in the Green belt *Ziziphus mauritiana* (Bar), *Acacia arabica* (Babul), *Ficus bengalensis* (Bargad), *Dalbergia sissoo* (Shisham), *Embllica officialis* (Amla), *Ficus religiosa* (Pipal), *Tamarindus indica* (Imli), *Azadirachta indica* (Neem) etc. Plantation shall be carried out as per CPCB guidelines.

**TABLE: 8.2.5.2**

#### Ecology: Stage wise Cumulative Plantation

#### REQUIREMENTS FOR PLANTS FOR AFFORESTATION AND RECLAMATION

Year	Un-worked Area Green Belt		Outside Dumps		Inside Dumps (Backfilled)		Top Soil Dumps		Total	
	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees	Area (Ha.)	Trees
Existing	91.99	229975	1.45	2500	1.23	3075	-	-	94.67	235550
I	1.00	2500	-	-	-	-	-	-	1.00	2500
II	1.00	2500	-	-	-	-	-	-	1.00	2500
III	1.00	2500	-	-	-	-	-	-	1.00	2500
IV	1.00	2500	-	-	-	-	-	-	1.00	2500
V	1.00	2500	-	-	-	-	-	-	1.00	2500
VI th year onward	14.85	37125	38.87	77740	249.77	624425	-	-	303.49	739290
Total	111.84	279600	40.32	80240	251	627500	-	-	403.16	987340

Source Modified Scheme of Mining and Progressive Mine Closure Plan

## **8.2.6 Occupational Health and Safety Measures**

Occupational health and safety (OHS) is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. The goal of all occupational health and safety programs is to foster a safe work environment.

### **8.2.6.1 Occupational health hazards at mine site:**

Mining activity experiences risk of a number of hazards. Some examples of such hazards are as under:

- Exposure to dust
- Exposure to High temperatures;
- Noise exposure;
- Physical Hazards;
- Vehicular movements and blasting related issues.

These mainly impact on those working within the mine although health hazards can also impact on local communities.

### **8.2.6.1 Implementation of Occupational health and safety measures:**

Occupational Health & Safety measures result in improving the conditions under which workers are employed and work. It improves not only their physical efficiency, but also provides protection to their life and limb. GIL considers the following safety measures:

- Safety clauses in contract order
- To depute dedicated safety team
- Inspection and maintenance of equipments and accessories
- Pre placement and periodic health check up
- Removal of unsafe conditions and prevention of unsafe acts



- Detailed analysis of each and every incident
- To provide standard PPEs and ensure its uses
- Periodic inspection by internal and external safety experts
- Celebrations of various safety events for awareness
- An effective and clearly audible means of giving warning, in case of fire, to every person shall be provided in the factory. A free passage-way giving access to each means of escape in case of fire shall be maintained for the use of all workers in the factory.
- Medical facilities & first aid boxes will be established in the mine premises.
- Pits, Sumps, openings in floor etc. which may be a source of danger, shall be either securely covered or securely fenced. Securely fencing a pit means covering or fencing it in such away that it ceases to be a source of danger.

**Besides, following points will be taken care of during mine operation for assuring safety of workers:**

- Health Awareness Programmes and Surgical Camps (Eye Camps, Cleft Lips Correction Camps, Dental Camps, Pulse Polio Camps, Etc.)
- Periodical medical examination is being conducted for the existing mine as per DGMS in Form –O in addition to the initial medical exam which was carried out at the time of joining. The same practice will be continued for enhanced production capacity.
- The mine workers will be provided all necessary PPE, especially dust masks for their safe guard from dust, Ear Plugs/Ear Muffs for noise and measures for other hazards. The fresh employees when taken will be thoroughly medically examined under initial medical examination and thereafter during continuation of employment; the periodic medical examination will be conducted. The examination includes apart from the general observation, the Chest X-ray, Lung function Test, Spirometry, Auditory will be conducted and the record

of the same will be maintained and submitted to the concerned authorities.

- Under initial vocational training, the workers are given training related to all safety and health aspects pertaining to their vocation and thereafter every quarter, special training courses/ Awareness programme for Malaria eradication, HIV and health effects on exposure to mineral dust will be organized for employed person as well as for nearby villagers.
- The Occupational Health Surveillance Programme: A team of qualified doctors and nurses visit periodically for health check up of all the workers, team and its records is maintained properly.
- GIL management has decided to invest Rs 6,75,000 during the year 2009-10 towards health and safety measures.

### **8.3 CONCLUSION**

As discussed, it is safe to say that the project is not likely to cause any significant impact on the ecology of the area, as adequate preventive measures will be adopted to contain the various pollutants within permissible limits. Green belt development around the area would also be taken up as an effective pollution mitigative technique, as well as to control the pollutants released from the premises of GIL.



## CHAPTER-IX

# SUMMARY AND CONCLUSION

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### 9.1 Introduction

This is a proposal for Expansion of Rawan Jaipan Limestone Mine (ML area: 722.834 ha) from 2.8 MTPA to 7.5 MTPA capacity at Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chhattisgarh) Grasim Industries Limited.

This mining project falls under Category A (1a) (3) as per New EIA Notification 2006.

### 9.2 Justification for the project

The following points show the justification for the implementation of the proposed enhancement of Limestone Mining Project:

- The total land required for the mining project is 722.834 hectares, out of which, 403.16 ha area has been proposed for the plantation / greenbelt. Tolerant species should be selected for the Green belt development. The planting should be in appropriate alternate rows around the project site to prevent lateral pollution dispersion.
- There will not be any kind of major pollution due to the mining activity, as proper pollution control measures are/will be implemented with environment friendly technology. There will be “**Zero Water Discharge**”, as the domestic wastewater generated from the mine office will be disposed off in septic tanks via soak pits.
- No forest land is involved.
- No R & R plan is involved.
- No court case/ litigation is pending against this project.
- No National Park, Biosphere Reserve, Wild Life Sanctuary, Reserve Forest, Protected Forest within the study area.

- There is not any kind of major pollution due to the mining activity, as the mining is being done with environment friendly technology
- In view of the above, the proposal for expansion of limestone mine project is considered justified.

## **9.3 ENVIRONMENTAL MANAGEMENT PLAN**

### **9.3.1 Air Pollution Control**

- Efficient in-built wet drilling system has been provided in the drills and operated in day hours only.
- Operators use dust masks.
- Dust generated during blasting is instantaneous in nature and is immediately dissipated.
- Operators utilizes closed AC cabin and dust mask also provided to be used when needed.
- Haulage road are adequately sprayed with water by either water tanker or water sprinkler.
- Both side of the road have been planted to arrest airborne dust.

### **9.3.2 Water Pollution Control**

- Garland drain & 4 Nos. settling tank have been constructed around working pit, OB soil dump and the dump is also scientifically vegetated to avoid soil erosion and water so collected is used for plantation.
- Selection of waste dumps site has been done by keeping distance from watercourses in the area
- Periodical testing of mine water is being carried out to check its quality.
- Sump with capacity of 7 lac m<sup>3</sup> has been designed taking into account of Peak sudden rainfall and maximum discharge in the

<b>Expansion of Captive Rawan-Jaipan Limestone Mine (ML Area : 722.834 ha)</b> <b>Limestone Production Capacity from 2.8 MTPA to 7.5 MTPA</b> At Village: Rawan, Tehsil: Simga, Distt.: Raipur (Chattisgarh)	<b>Draft EIA/EMP Report</b>
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area and adequate retention period to allow proper settling of silt material

- Ground water level is being monitored by piezometers in the project area
- Roof water harvesting is done at hospital, school building, shopping complex, CCR building, Mine office and Rawan Panchayat Bhawan.
- Oil/water separator has been provided in the workshop and is used for green belt development after proper treatment.

### **9.3.3 Noise Pollution Control**

- Controlled blasting method is being practiced
- Drilling and blasting operations are being carried out under the supervision of qualified persons.
- Blasting is done by NON-Electric detonators (NONEL).
- Max. charge per delay is kept to the minimum to reduce the hazards of ground vibrations.
- Rock breaker is used for breaking ore size boulders generated during blasting, this eliminates secondary blasting.
- Ground vibration is being monitored by NOMIS Seismograph on regular basis for each blast.

### **9.3.4 Land Reclamation**

The activity will affect the present landscape of the ML area. The original topography of the ML area will be affected mainly due to the actual mining operation.

At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir.

Out of total lease area i.e. 722.834 ha, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.

### 9.3.5 Green Belt Development/Plantation

At the end of life of mine, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.

The following species to be planted in the Green belt *Ziziphus mauritiana* (Bar), *Acacia arabica* (Babul), *Ficus bengalensis* (Bargad), *Dalbergia sissoo* (Shisham), *Emblica officialis* (Amla), *Ficus religiosa* (Pipal), *Tamarindus indica* (Imli), *Azadirachta indica* (Neem) etc. Plantation shall be carried out as per CPCB guidelines.

Plantation will be done along the periphery of the lease area. The trees will be planted at suitable grid spacing to encourage proper growth. This will help in reducing the concentration of pollutants and will also be effective in attenuating noise levels.

Following be considered while selecting plant species for green belt development and tree plantation:

- Broad leaved and fast growing trees to trap maximum dust.
- To be perennial and evergreen.
- To give thick canopy cover.

## 9.4 CONCLUSION

The project will prove beneficial to the people as the company already made the infrastructural facilities for the villagers like Educational facilities, Medical facilities, Transportation facilities etc. which will improve the socio-economic environment of the area.



## CHAPTER-X

### DISCLOSURE OF CONSULTANTS ENGAGED

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#### 10.1 DISCLOSURE OF CONSULTANTS ENGAGED

J.M. EnviroNet Pvt. Ltd. (JMEPL) was established in the year 1993. 'JM' in the name of the Company is derived from the name of 'Lord Shiva' - the Temple of 'Jharkhand Mahadev' (JM). The Temple is located at Queens Road, Vaishali Nagar, Jaipur.

The Registered office of JMEPL is at 7-CH-10, Jawahar Nagar, Jaipur. Its Delhi-NCR Corporate office is at SCO-16, Sector 10A, Gurgaon (Haryana).

J.M. EnviroNet Pvt. Ltd. is accredited with ISO-9001: 2008 for EIA Division. EIA Division is also approved by National Accreditation Board for Education & Training (NABET) formerly NRBPT (Quality Council of India) with Registration No. EIA 81 004. The Company has its own Environmental Laboratory at Gurgaon (Haryana) approved under EPA (Environment Protection Act) From the Ministry of Environment & Forests, Govt. of India, New Delhi vide notification No.865E dated 11.04.2008 published in the Gazette of India dated 11.04.2008 & approved by the National Accreditation Board for Testing and Calibration Laboratories, Govt. of India (NABL) (Registration No.NABL-T-1327), as also ISO-17025: 2005.

The Company's work is spread over 20 States viz.:- Andhra Pradesh, Kerala, Gujarat, Maharashtra, Orissa, Tamil Nadu, Goa, Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Assam, West Bengal. Karnataka Jharkhand, Bihar & Uttarakhand.

JMEPL is offering Environmental Consultancy Services in various sectors viz Industrial Projects / Chemical Industries / Cement Plants / Thermal

Power Plants / Mining Projects / Coal Washery Project/ Real Estate Projects / Distilleries / Steel Plants etc.

In the Mining sector, JMEPL is covering mines of minerals viz. Limestone, Bauxite, Chromite, Coal, Zinc, Copper, Gypsum, Soapstone, Iron & Manganese ore, Clay, Silica Sand, Feldspar, Quartz etc.

Besides this, its MoEF and NABL approved Environmental Laboratory at Gurgaon is also providing Analytical Laboratory Services of various elements and environmental parameters.

Annual monitoring as per MoEF / CPCB / SPCB guidelines, Risk Assessment and Disaster Management Plan, consultancy for Rain Water Harvesting Plan, detailed Hydro-geological Study for major mining projects, preparation of Environmental Statement Reports (Environmental Clearance Compliance Conditions), etc. are amongst the various other consultancy services offered by the Company.

JMEPL has a highly qualified team of Subject Experts. As Faculty Heads of the EIA Division we have Ex-chairman State Pollution Board, Retd. General Managers of the Reputed Cement Companies, Ex-Head EIA Division of big Business Group, STP & ETP designing experts, Retd. Mining and Geology Experts with vast experience in their respective fields. JMEPL has already conducted EIA studies and prepared EIA / EMP reports for more than 500 projects under various sectors.





## **EXECUTIVE SUMMARY**

### **1.0 PROJECT DESCRIPTION**

#### **1.1 INTRODUCTION**

The applicant M/s. Grasim Industries Limited is a flagship company of Aditya Birla Group having business interest in Cement manufacturing, Viscose Staple Fibre, Sponge Iron, Textiles, Software Services etc. Cement manufacturing is core business of the Group and contributes to about 50% of the Groups turnover and is well experienced in cement manufacture with six large capacity cement plants already running successfully in various parts of the country.

M/s Grasim Cement has an existing Cement Plant Complex comprising of Cement Plant (3.3MTPA), Captive Thermal Power Plant (30 MW) & Limestone Mine (ML area: 722.834 ha & limestone production capacity: 2.8 MTPA) in village Rawan, Tehsil Simga, District Raipur (C.G.).

Environmental Clearance for existing limestone production capacity (i.e. 2.8 MTPA) has been accorded by MoEF, New Delhi vide Letter No. J-11015/70/2003-IA-II (M); dated 15th April, 2005.

Grasim management is proposing for a Brown Field Integrated Cement Project.

In order to fulfill the additional limestone requirement for enhanced Clinker production capacity, GIL has proposed to increase limestone production capacity of Rawan-Jhipan limestone mine from 2.8 MTPA to 7.5 MTPA i.e. 4.7 MTPA.

This mining project falls under Category A (1a) (3) as per New EIA Notification, 2006.

## 1.2 DETAILS OF THE PROJECT

S. No.	Particulars	Details
<b>LOCATION</b>		
1.	A. Village	Rawan
	B. Tehsil	Simga
	C. District	Raipur
	D. State	Chhattisgarh
2.	Latitude	21 °33' to 21 °35' N
3.	Longitude	81 °58' to 82 °00" E
4.	Toposheet No.	64 G/14, 64 K/2
5.	General ground level	276 mRL
6.	Land use of the Lease area (in hectares)	
	Govt. Waste Land (in hectares)	159.517 ha
	Agriculture Land (Private Land) (in hectares)	563.317 ha
	<b>Total Lease Area (in hectares)</b>	<b>722.834 ha</b>
<b>DETAILS OF THE STUDY AREA</b>		
7.	Nearest National Highway	NH-6 (70 km)
8.	Nearest Railway Station	Bhatapara – 17 km (South-East)
9.	Nearest Town	Raipur– 85 km
10.	Ecological Sensitive Areas	None within 10 km radius
11.	Nearest Water Body	Mahanadi Canal
12.	Source of Water	Mine Sump Water / Bore Well
Requirements of the Project		
<b>CLIMATOLOGY (WINTER SEASON: DECEMBER 2009 TO FEBRUARY 2010)</b>		
13.	A. Temperature	11.4 °C - 30.2 °C
	B. Relative Humidity At 8:30 hrs. At 17:30 hrs.	37% to 95% 28% to 81%
14.	Dominant Wind Direction	From NE
<b>REQUIREMENT FOR THE PROJECT</b>		
15.	Water Requirement	Total water requirement after enhancement of production capacity will be 350 KLD. <b>Source:</b> Water will be sourced from stored water in the mining pit & for drinking

		purpose existing bore well will be used (CGWA permission has been obtained).
16.	Manpower Requirement	Existing Man power is 96 persons. No additional Man power will be required for the project.
17.	Project Cost	
18.	Total Cost of the Project	Rs 40 Crores
19.	EMP Cost <ul style="list-style-type: none"> <li>Capital Cost</li> <li>Recurring Cost</li> </ul>	Rs 60 Lacs Rs 10 Lacs

*Source: Scheme of Mining & Progressive Mine Closure Plan*

## **2.0 MINING DETAILS**

<b>S. No.</b>	<b>Details</b>	<b>Explanation</b>
1.	ML area	722.834 ha
2.	Mineable Reserve	162.02 Million Tonnes (as on 01.04.09)
3.	Method of mining	Mechanized opencast
4.	Life of the Mine	About 22 years (@7.5 MTPA limestone production.)
5.	Extent of mechanization	Excavator, Roak Breaker, Loader, Dumper, Drill Rig, Dozer, Water Tanker, Diesel Tanker, Explosive Van etc.
6.	Bench Height and Width	Bench Height – 8.0 m; Bench Width –30 m
7.	Environment Clearance from MoEF for expansion from 1.6 MTPA to 2.8 MTPA production of limestone.	Letter no J-11015/70/2003-IA-II (M) dated 15.04.05
8.	Modified Scheme of Mining for the period (2009-2014) for the enhanced limestone production capacity of 7.5 MTPA.	IBM vide letter no 314 (3)/2009-MCCM (CZ)/MP/MS/PMCP-16 dated 4.12.09

*Source: Scheme of Mining & Progressive Mine Closure Plan*

## **2.1 PROPOSED METHOD OF MINING**

Mining will be carried out by mechanized opencast method to produce limestone @ 7.5 Million Tonnes per annum by deploying heavy earth moving machinery and deep hole drilling & blasting. Drilling is/will be carried out by DM-30 and ICM –260 drill machines. Blasting is/will be carried out with slurry explosives, Site Mixed Emulsion (SME) and Ammonium Nitrate Fuel Oil (ANFO). NONEL system is/will be extensively used in blasting.

## **2.2 UTILITY & REQUIREMENT FOR THE MINING PROJECT**

### **2.2.1 Extent of Mechanization**

**Table: 2.2.1**

<b>S.No.</b>	<b>Machine</b>	<b>No.</b>
1.	Excavator	5
2.	Rock Breaker	1
3.	Loader	1
4.	Dumper	12
5.	Drill Rig	1
6.	Drill Rig	1
7.	Dozer	2
8.	Dozer	2
9.	Water Tanker	2
10.	Diesel Tanker	1
11.	Explosive Van	1
12.	Tyre handler	1
13.	Vibromax	1
14.	Dewatering Pump	5

*Source: Scheme of mining & Progressive Mine Closure Plan*

## **2.2.2 Water Requirement**

Total water requirement for the proposed project will be 350 KLPD.

**TABLE – 2.2.2**

<b>S. No.</b>	<b>Purpose</b>	<b>Existing Requirement (KLD)</b>	<b>Additional Requirement for proposed expansion (KLD)</b>	<b>Total Requirement (KLD)</b>
<b>1.</b>	Dust Suppression & Mining Activity	130	50	180
<b>2.</b>	Workshop	10	15	25
<b>3.</b>	Drinking	4	2	6
<b>4.</b>	Green Belt Development	94	45	139
	<b>Total</b>	<b>238</b>	<b>112</b>	<b>350</b>

*Source: Scheme of Mining & Progressive Mine Closure Plan*

**Note:** Water will be sourced from stored water in the mining pit & for drinking purpose existing bore well will be used (CGWA permission has been obtained).

## **3.0 DESCRIPTION OF ENVIRONMENT**

Baseline study of the study area (i.e. 10 km radius from the project boundary) has been conducted during Winter Season (December 2009 to February 2010). Monitoring for ambient air quality (as per CPCB standards), ambient noise levels, water quality, soil quality was conducted at respective sampling locations. The study for land use pattern using satellite imagery, study for demography & flora & fauna has also been conducted.

The concentration for all the 10 AAQM stations for PM<sub>10</sub> ranges between 31.87 to 82.76 µg/m<sup>3</sup>, PM<sub>2.5</sub> ranges between 18.40 to 38.10 µg/m<sup>3</sup>, SO<sub>2</sub> ranges between 5.5 to 16.30 µg/m<sup>3</sup> and NO<sub>2</sub> ranges between 8.40 to 21.00 µg/m<sup>3</sup>.

The ground water analysis for all the 10 sampling stations shows that pH varies from 7.32 to 7.81, total hardness varies from 222.6 mg/l to 299.7 mg/l & total dissolved solids varies from 446 mg/l / to 498 mg/l.

The analysis results for soil shows that soil is neutral in nature as pH value ranges from 7.57 to 7.82 & is loamy clay in texture. The concentration of Nitrogen, Phosphorus & Potassium has been found to be in good amount in the soil samples.

### **3.1 SOCIO-ECONOMIC ENVIRONMENT**

The population as per 2001 Census records is 36565 (for 10 km radius buffer zone). Scheduled Caste fraction of the population of the study area (10 km) is 15.80% and Scheduled Tribe 6.98%. Percentage of literacy is 57.23% and that of workers those actually engaged in occupation is 40.78% including, 30.43% of Main workers & 10.35% of marginal workers. Rest 59.22% of the total population, are considered as non-workers.

## **4.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

The key project activities generating emissions in a Limestone mining are drilling, blasting, loading, haulage and other transport activities etc.

- **Impact on Soil and Land Use Pattern**

Topsoil generated from the mine will be stacked separately & will be used for plantation purpose within the lease area. At the conceptual stage, there will be no top soil sump.

Opencast mining activities may alter the landscape of the lease area and shall not have any effect on the surface features of the surrounding areas. At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir. Out of total lease area i.e. 722.834 ha, 403.16 ha area will be covered under

green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha bacfilled area.

- **Impact of mining on ground water table**

Mining in the area will be done well above the water table therefore impact on water regime is not anticipated. The general ground level in the area is 276 mRL. The ground water table is 236 m RL (40 m bgl) while the workings in the area is proposed upto the ultimate depth of 240 mRL (36 m bgl). There will be no discharge of mine water. Mineral as well as overburden is non – toxic in nature.

- **Impact on Air Quality**

The generation of dust will be anticipated from various mining activities i.e. dozing, drilling, blasting, loading, haulage and other transport activities related to mining. These will increase particulate matter in the area if no mitigative measures are taken. Gaseous emission will be generated from HEMM and their transportation vehicles. By proper mitigation measures viz regular water sprinkling on haul raods & loading points, better maintenance and efficient operation of ecquipments & vehicles and green belt development will keep pollution under control.

- **Impact of Noise Levels & Ground Vibration**

Major noise generating sources of the mining activity are the drilling and blasting and trucks movement used for transportation of limestone. The instant noise level from blasting is high for some instance but it is within the prescribed limits due to application of improved technology and is confined to working zones.

The proposed plantation will also check propagation of noise in the surrounding areas.

## **5.0 ENVIRONMENTAL MONITORING PROGRAMME**

**Table: 5.0**

<b>S. No.</b>	<b>DESCRIPTION</b>	<b>FREQUENCY OF MONITORING</b>
1.	Meteorological Data	Daily
2.	Ambient Air Quality at project site	Twice a week
3.	Water Quality	Quarterly
4.	Noise Level Monitoring	Quarterly
5.	Soil Quality	Quarterly
6.	Health Check-up	As per the Factory Act.

## **6.0 ADDITIONAL STUDIES**

The Additional Studies conducted as per the additional Terms of References vide MoEF letter no.- J-11015/17/2009 - IA. II (M) dated 26<sup>th</sup> Oct, 2009 are Biological Study, Hydro-geological Study & Rain water Harvesting Plan, Disaster Management Plan.

## **7.0 PROJECT BENEFITS**

The proposed project activity will help in combating the growing demand of cement in the market & hence will help in the economic growth of the country. GIL has already been actively involved in the CSR activities in the nearby villages of the project site. Infrastructure development in the nearby villages, creating educational facilities, empowering women through self help groups, gainful employment for rural, health awareness programmes & surgical camps, supplementing resettlement efforts in areas affected by natural calamities, assisting social forestry programmes in the area, are some of the highlights of the CSR activities which are operating presently & will continue for the life of the mine.



## **8.0 8.0 ENVIRONMENT MANAGEMENT PLAN**

### **8.1 MANAGEMENT OF LAND USE PATTERN**

The activity will affect the present landscape of the ML area. The original topography of the ML area will be affected mainly due to the actual mining operation.

At the end of life of mine, 558.954 ha will be excavated, out of which, 251.00 ha will be backfilled & reclaimed by plantation, rest 307.954 ha will be developed as water reservoir.

Out of total lease area i.e. 722.834 ha, 403.16 ha area will be covered under green belt/plantation, including 111.84 ha unworked area, 40.32 external dumps, 251.00 ha backfilled area.

### **8.2 AIR MANAGEMENT**

- Efficient in-built wet drilling system has been provided in the drills and operated in day hours only.
- Operators utilizes closed AC cabin and dust mask also provided to be used when needed.
- Dust generated during blasting is instantaneous in nature and is immediately dissipated.
- Controlled blasting is being done.
- Rock breaker is being used to avoid secondary blasting.
- Haulage road are adequately sprayed with water by either water tanker or water sprinkler. Both side of the road have been planted to arrest airborne dust. Operators are provided with dust masks.
- Development of Green belt/plantation along the haul roads, mine office to arrest dust.

### **8.3 WATER MANAGEMENT**

Adequate control measures are being adopted to check not only the wash-off from soil erosion but also uncontrolled flow of mine water. The measures to be adopted are:

- Garland drain & 4 Nos. settling tank have been constructed around working pit, OB soil dump and the dump is also scientifically vegetated to avoid soil erosion and water so collected is used for plantation.
- Selection of waste dumps site has been done by keeping distance from watercourses in the area
- Periodical testing of mine water is being carried out to check its quality.
- Sump with capacity of 7 lac m<sup>3</sup> has been designed taking into account of Peak sudden rainfall and maximum discharge in the area and adequate retention period to allow proper settling of silt material
- Ground water level is being monitored by piezometers in the project area
- Roof water harvesting is done at hospital, school building, shopping complex, CCR building, Mine office and Rawan Panchayat Bhawan.
- Oil/water separator has been provided in the workshop and waste water generated from workshop is used for green belt development after proper treatment.

### **8.4 SOLID WASTE MANAGEMENT**

- Total OB/waste generated up to the end of life of mine will be used for backfilling.
- About 40.32 ha area will be covered by waste dumps.
- Presently, around 2,87,250 m<sup>3</sup> topsoil soil has been generated. 9000 m<sup>3</sup> has been systematically stacked covering 2.66 ha.
-

## **8.5 NOISE MANAGEMENT**

All precautions are being taken to keep noise levels within the prescribed standards:

- Drilling machines are having closed AC cabins, operators have been provided with earplugs/earmuffs for use during drilling operation.
- Noise generated due to blasting is impulse type which is controlled by putting adequate stemming column.
- Rock breakers are used for reduction of oversize boulders thereby avoiding secondary blasting, which generates irritating noise.
- Persons working in high noise zone are equipped with earplugs/earmuffs.
- Regular measurement of noise level is proposed near drilling equipment and other heavy earth moving machinery & steps will be taken to improve maintenance of all equipments so that noise level remain within permissible limits.
- Plantation of trees on internal roads and barriers.

## **8.6 SOCIO-ECONOMIC ENVIRONMENT**

Better education facilities, proper health care, road infrastructure and drinking water facilities are basic social amenities for better living standard of any human being. Grasim Industries Limited (GIL) will initiate the above amenities either by providing or by improving the facilities in the area, which will help in uplifting the living standards of local communities. The following activities are proposed for socio-economic benefits:

**TABLE – 8.6**  
**DETAILS OF CSR ACTIVITIES**

S. No.	CSR Activities proposed for the Enhancement Project	Amount (Rs.Lacs) for Year 2009-2010
1.	Housing	8,00,000
2.	Water Supply	7,30,000
3.	Health, Safety & Medical Facilities	6,75,000
4.	Education & Training	7,50,000
5.	Employment /Training to local inhabitants	90,000
6.	Recreation & Sports	1,10,000
7.	Others	40,000
	Total	31,95,000

## **8.7 TERRESTRIAL ECOLOGY**

There is no wildlife life sanctuary or national park or biospheres reserve exists within the study area.

## **8.8 GREENBELT DEVELOPMENT AND PLANTATION PROGRAMME**

Out of total ML area of 722.834 ha, 403.16 hectare area will be covered under plantation & green belt development.

The following species to be planted in the Green belt *Ziziphus mauritiana* (Bar), *Acacia arabica* (Babul), *Ficus bengalensis* (Bargad), *Dalbergia sissoo* (Shisham), *Embllica officialis* (Amla), *Ficus religiosa* (Pipal), *Tamarindus indica* (Imli), *Azadirachta indica* (Neem) etc. Plantation shall be carried out as per CPCB guidelines.

## **9.0 CONCLUSION**

As discussed, it is safe to say that the project is not likely to cause any significant impact on the ecology of the area, as adequate preventive measures will be adopted to contain the various pollutants within permissible limits. Green belt development around the area would also be taken up as an effective pollution mitigative technique, as well as to control the pollutants released from the premises of GIL.



**ANNEXURE 2**
**AMBIENT AIR QUALITY**
**LOCATION: SA1 RAWAN JHIPAN MINE SITE**

 (Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
05.12.2009	10.3	13.2	12.9	14.6	11.9	15.0	67.77	29.63
06.12.2009	10.0	12.5	11.8	15.4	12.0	14.9	64.52	34.63
11.12.2009	11.5	12.8	13.1	16.1	12.1	15.1	69.12	31.45
12.12.2009	9.9	13.4	11.5	14.7	12.5	16.4	71.39	33.54
19.12.2009	9.3	11.9	12.5	12.9	13.3	13.4	78.63	29.65
20.12.2009	10.6	12.0	11.8	13.6	10.9	12.4	72.12	24.32
24.12.2009	11.4	11.3	13.1	12.9	12.5	14.9	69.63	30.25
25.12.2009	9.8	15.0	10.9	18.3	11.9	17.2	61.72	38.10
02.01.2010	11.0	12.4	12.0	15.9	11.3	16.4	67.45	31.54
03.01.2010	11.5	13.0	13.3	16.8	10.5	15.4	71.63	29.65
09.01.2010	10.8	12.1	11.7	15.6	12.5	14.6	76.32	24.63
10.01.2010	10.2	11.5	13.4	13.4	12.1	12.4	79.63	22.06
16.01.2010	9.5	12.8	10.5	14.7	11.4	13.1	82.76	21.30
17.01.2010	9.3	13.5	9.9	16.4	10.6	15.4	80.14	26.87
26.01.2010	10.9	11.6	11.7	13.4	10.4	12.5	75.65	29.64
27.01.2010	11.3	14.9	13.0	17.1	12.0	16.1	70.65	30.51
04.02.2010	9.8	12.8	12.3	15.8	10.4	14.3	69.35	26.35
05.02.2010	10.6	13.4	11.6	16.3	12.4	17.5	79.25	23.49
12.02.2010	11.2	11.9	12.8	16.4	11.3	18.3	82.76	28.97
13.02.2010	10.5	12.4	11.7	15.1	10.3	16.1	72.45	30.64
21.02.2010	9.4	13.7	10.7	16.2	9.4	15.4	62.46	21.30
22.02.2010	11.5	11.5	12.5	12.8	11.0	11.6	68.45	28.15
25.02.2010	10.7	14.5	13.0	17.3	12.3	15.0	70.23	30.58
26.02.2010	11.0	11.8	12.0	12.1	11.4	11.5	77.38	31.45

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	13.4	18.3	82.76	38.10
<b>Min.</b>	9.3	11.3	61.72	21.30
<b>95%tile</b>	13.1	17.245	82.36	34.46

# **AMBIENT AIR QUALITY**

**LOCATION: SA2 PLANT SITE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
01.12.2009	13.2	16.9	14.6	18.9	15.3	17.6	68.64	30.25
02.12.2009	12.6	15.4	13.0	17.9	12.3	21.0	64.31	31.52
09.12.2009	13.6	14.6	14.6	16.4	13.6	17.6	59.31	33.00
10.12.2009	12.6	16.4	13.6	20.6	14.6	19.4	57.63	29.65
15.12.2009	13.6	15.6	15.6	18.4	14.2	16.5	56.45	26.31
16.12.2009	11.2	14.3	12.5	17.5	13.6	20.6	55.46	24.32
22.12.2009	12.5	16.1	13.6	19.6	11.5	16.9	52.86	22.54
23.12.2009	13.6	15.8	15.8	20.6	14.6	19.6	53.21	21.10
04.01.2010	11.6	14.4	14.6	19.4	11.2	17.4	59.34	22.36
05.01.2010	12.4	15.6	15.7	18.4	16.3	15.3	61.46	24.54
11.01.2010	11.4	16.8	13.6	17.9	12.6	15.9	63.49	26.31
12.01.2010	12.6	14.9	14.6	19.3	13.4	21.0	65.64	28.65
18.01.2010	11.5	15.1	12.6	16.4	11.6	15.6	67.69	30.65
19.01.2010	13.0	16.9	14.8	17.5	12.8	16.3	70.86	32.45
24.01.2010	11.8	15.7	13.9	16.9	11.4	14.3	68.63	33.50
25.01.2010	11.7	16.8	12.7	18.4	14.9	16.4	65.36	31.20
02.02.2010	12.9	14.7	13.7	15.6	15.6	14.3	67.65	29.65
03.02.2010	11.6	15.7	14.8	16.4	13.8	19.6	62.36	27.65
10.02.2010	11.4	16.8	13.5	18.9	12.6	16.2	60.54	26.54
11.02.2010	12.3	15.4	14.6	17.6	15.9	15.1	64.39	25.64
17.02.2010	13.6	16.5	16.3	21.0	14.7	19.3	67.63	24.69
18.02.2010	12.5	14.9	15.9	18.6	13.5	20.1	61.36	23.10
23.02.2010	11.6	15.7	12.5	19.6	11.6	17.4	59.36	26.54
24.02.2010	12.9	16.0	16.3	20.6	11.4	18.6	64.36	28.69

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	16.30	21.00	70.86	33.50
<b>Min.</b>	11.20	14.30	52.86	21.10
<b>95%tile</b>	15.9	20.6	68.63	32.91

# **AMBIENT AIR QUALITY**

**LOCATION: SA3 GUEST HOUSE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
02.12.2009	9.8	10.9	11.2	12.6	10.1	11.3	59.32	22.36
03.12.2009	8.4	9.9	10.5	11.6	9.6	10.6	56.48	24.51
09.12.2009	7.6	8.9	9.6	9.8	10.6	11.3	54.32	26.54
10.12.2009	9.4	10.6	11.5	12.3	9.4	14.5	52.98	28.96
16.12.2009	8.2	8.4	9.4	11.5	8.6	10.5	50.63	23.65
17.12.2009	7.7	9.6	9.9	12.6	10.6	11.6	48.69	25.64
26.12.2009	6.7	8.6	7.9	9.2	9.4	10.6	46.94	27.94
27.12.2009	7.9	11.2	8.8	13.0	7.6	12.3	45.12	29.65
05.01.2010	8.1	10.2	10.6	14.2	11.3	11.3	48.96	28.63
06.01.2010	9.6	9.2	11.1	12.6	10.6	10.3	50.63	27.64
11.01.2010	7.6	11.7	9.2	14.5	8.6	13.6	53.10	30.50
12.01.2010	9.4	9.7	11.0	11.6	10.4	12.6	56.98	29.63
19.01.2010	6.9	10.7	8.6	12.9	9.7	14.5	58.64	28.64
20.01.2010	7.2	8.8	9.7	9.9	10.5	10.6	60.34	26.31
24.01.2010	8.6	9.9	10.9	12.4	9.6	11.3	64.80	24.36
25.01.2010	9.4	10.1	11.5	11.3	10.6	9.6	62.31	22.36
05.02.2010	6.8	11.2	9.4	12.6	8.3	10.2	60.31	20.50
06.02.2010	7.6	8.6	10.6	9.8	9.6	8.4	58.64	22.36
11.02.2010	8.8	9.4	9.4	10.6	7.6	11.6	56.49	24.63
12.02.2010	9.4	10.9	11.3	12.6	10.8	10.7	54.87	26.31
19.02.2010	7.7	11.8	9.5	13.8	10.9	14.5	52.64	28.94
20.02.2010	8.7	10.5	10.6	11.7	11.5	12.4	48.69	30.50
24.02.2010	9.4	9.7	10.2	10.9	8.7	9.5	46.78	28.64
25.02.2010	6.9	8.6	7.9	9.9	6.7	8.4	45.31	26.94

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	11.5	14.5	64.80	30.50
<b>Min.</b>	6.7	8.4	45.12	20.50
<b>95%tile</b>	11.3	14.3	62.01	30.37

# **AMBIENT AIR QUALITY**

**LOCATION: SA4 PARASWANI VILLAGE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
05.12.2009	9.8	11.9	11.0	13.0	10.2	12.0	45.36	21.36
06.12.2009	8.1	10.7	10.2	12.0	11.8	11.5	47.65	22.63
11.12.2009	7.6	11.0	9.2	12.9	10.5	11.0	49.65	24.28
12.12.2009	9.2	12.2	10.6	13.0	9.2	12.1	50.13	23.45
19.12.2009	8.4	10.5	9.8	11.2	7.6	10.2	48.36	24.28
20.12.2009	7.3	11.5	8.9	12.3	10.1	10.9	45.63	22.25
24.12.2009	6.6	12.1	7.8	13.3	9.6	12.5	43.12	21.54
25.12.2009	8.9	11.0	10.5	12.9	8.5	11.4	41.36	20.31
02.01.2010	7.2	10.2	9.2	11.8	7.2	13.3	45.63	19.65
03.01.2010	9.1	10.9	11.1	11.5	9.6	12.9	48.36	18.65
09.01.2010	8.4	11.5	11.8	12.6	10.6	11.0	50.13	20.36
10.01.2010	6.9	10.5	7.2	11.7	9.6	10.2	48.69	19.98
16.01.2010	7.8	11.6	9.4	13.3	8.1	12.5	42.32	20.13
17.01.2010	8.3	10.5	10.5	13.0	9.4	12.3	39.36	22.54
26.01.2010	9.6	10.8	11.3	13.3	10.5	11.0	32.08	23.65
27.01.2010	7.5	11.7	9.8	12.9	11.2	13.3	33.65	24.27
04.02.2010	6.8	10.6	7.9	11.5	6.9	12.9	35.36	22.15
05.02.2010	7.9	11.4	11.2	12.6	10.5	13.1	37.98	18.49
12.02.2010	8.7	12.3	10.9	13.1	11.8	12.1	39.47	19.65
13.02.2010	7.8	10.9	9.7	11.2	11.3	13.2	41.25	20.36
21.02.2010	9.8	11.5	11.8	12.0	9.2	13.3	43.21	21.54
22.02.2010	8.9	10.2	10.5	11.1	8.6	10.2	45.63	22.54
25.02.2010	6.9	12.0	7.9	13.0	6.6	12.0	47.12	23.01
26.02.2010	9.6	10.8	11.2	11.5	8.6	10.6	49.16	24.00

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	11.8	13.3	50.13	24.28
<b>Min.</b>	6.6	10.2	32.08	18.49
<b>95%tile</b>	11.5	13.3	50.05	24.27



# **AMBIENT AIR QUALITY**

**LOCATION: SA5 RAWELI VILLAGE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
04.12.2009	9.1	10.5	11.6	11.5	9.6	10.2	46.39	20.31
05.12.2009	8.4	9.4	10.8	12.6	8.1	13.5	44.32	21.65
12.12.2009	6.9	8.6	7.2	11.7	9.4	12.3	42.54	22.36
13.12.2009	7.8	11.0	9.4	12.3	10.5	11.0	40.31	24.61
21.12.2009	6.5	12.2	8.5	13.0	11.2	11.3	39.64	25.10
22.12.2009	9.6	10.5	11.3	12.0	9.9	13.9	38.64	23.65
25.12.2009	7.5	11.5	9.8	13.9	10.5	14.1	31.87	21.36
26.12.2009	6.8	12.1	7.9	14.3	11.6	12.1	33.64	20.36
02.01.2010	7.9	9.4	11.2	12.6	10.3	13.2	35.16	19.65
03.01.2010	5.9	11.6	6.8	13.1	5.9	14.3	37.94	18.40
09.01.2010	6.1	8.9	9.7	11.2	8.6	10.2	39.54	19.64
10.01.2010	9.8	10.8	11.4	12.0	10.6	10.0	41.23	20.31
16.01.2010	8.9	9.3	10.5	11.1	11.2	12.0	43.63	22.31
17.01.2010	6.9	10.6	7.9	13.0	11.6	11.5	45.36	18.40
26.01.2010	5.9	11.4	8.6	14.3	10.5	12.0	49.64	20.31
27.01.2010	7.5	8.9	11.0	11.0	9.2	12.1	52.67	22.36
05.02.2010	6.8	10.6	10.2	12.9	8.6	10.2	50.23	21.36
06.02.2010	7.9	11.4	9.2	13.9	10.1	11.9	48.65	23.47
11.02.2010	5.9	12.3	8.2	14.0	9.6	12.5	46.48	24.58
12.02.2010	7.8	10.9	9.8	11.2	8.5	10.4	44.65	25.10
19.02.2010	9.8	9.5	10.9	12.3	7.2	13.3	42.65	23.65
20.02.2010	8.9	10.2	11.6	13.3	9.6	12.9	40.36	21.98
24.02.2010	6.9	8.6	7.5	12.9	10.6	11.0	39.65	22.54
25.02.2010	7.8	10.8	9.2	11.8	11.4	12.3	41.32	24.17

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	11.6	14.3	52.67	25.10
<b>Min.</b>	5.9	8.6	31.87	18.40
<b>95%tile</b>	11.4	14.0	50.1	25.0

# **AMBIENT AIR QUALITY**

**LOCATION: SA6 CHHACHHAN PAHRI**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24	24
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	HOURS PM <sub>10</sub>	HOURS PM <sub>2.5</sub>
01.12.2009	9.8	11.2	10.2	12.3	11.0	11.3	56.32	20.13
02.12.2009	8.9	10.6	9.8	11.9	10.3	10.3	54.69	23.16
09.12.2009	9.2	9.9	10.9	10.3	9.6	12.6	52.46	25.64
10.12.2009	10.2	10.2	11.2	11.5	10.3	13.0	50.64	22.64
15.12.2009	9.4	11.6	10.6	13.5	11.7	12.3	55.65	26.31
16.12.2009	8.8	10.0	9.8	11.3	8.8	10.1	60.77	24.68
22.12.2009	9.7	11.1	10.2	12.5	11.2	10.6	58.64	26.48
23.12.2009	10.1	10.6	11.9	13.2	10.6	11.6	56.48	28.12
04.01.2010	9.3	11.6	10.3	12.4	11.2	11.3	54.12	27.16
05.01.2010	10.3	9.9	11.2	10.6	10.5	9.9	52.14	26.13
11.01.2010	8.9	10.2	9.2	11.5	11.3	10.6	50.64	25.61
12.01.2010	9.8	11.2	10.5	13.6	9.4	11.0	48.19	24.89
18.01.2010	10.6	12.0	11.5	13.4	10.2	12.1	42.18	22.46
19.01.2010	9.6	11.9	10.6	12.9	9.6	11.0	37.12	21.64
24.01.2010	10.5	12.5	11.0	14.7	9.8	13.2	39.12	23.16
25.01.2010	8.8	9.9	9.0	10.9	10.9	11.3	41.58	19.25
02.02.2010	9.4	10.9	10.1	11.6	11.9	12.9	43.65	20.13
03.02.2010	8.9	11.2	9.9	12.9	10.6	10.2	45.87	22.54
10.02.2010	9.0	12.0	10.3	13.6	9.6	10.6	47.98	21.65
11.02.2010	9.9	11.5	11.0	13.5	10.3	11.2	49.16	23.15
17.02.2010	10.3	10.4	11.9	11.8	10.2	9.9	51.97	24.62
18.02.2010	9.4	9.9	10.6	10.6	9.3	12.3	53.46	26.13
23.02.2010	10.0	10.7	11.0	12.6	9.4	10.6	55.61	24.18
24.02.2010	9.1	11.8	10.5	14.7	11.0	11.6	57.94	26.13
	<b>SO<sub>2</sub></b>		<b>NO<sub>2</sub></b>		<b>PM<sub>10</sub></b>		<b>PM<sub>2.5</sub></b>	
<b>Max.</b>	11.9		14.7		60.77		28.12	
<b>Min.</b>	8.8		9.9		37.12		19.25	
<b>95%tile</b>	11.5		13.5		58.53		27.05	

# **AMBIENT AIR QUALITY**

**LOCATION: SA7 RAWAN VILLAGE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
05.12.2009	9.9	11.5	10.9	12.5	9.6	11.5	55.62	30.00
06.12.2009	10.0	10.5	11.0	11.5	12.8	10.9	57.54	29.05
11.12.2009	8.9	12.1	9.9	13.2	11.5	11.1	59.46	27.61
12.12.2009	9.8	11.6	10.8	12.7	9.6	11.7	60.31	25.61
19.12.2009	8.7	10.9	9.7	11.9	10.9	10.9	58.64	23.16
20.12.2009	9.9	12.2	10.7	14.8	11.8	13.8	56.45	21.65
24.12.2009	8.8	10.8	9.8	11.9	12.4	12.9	58.64	22.65
25.12.2009	8.0	11.9	9.0	12.8	11.6	13.9	61.32	24.64
02.01.2010	9.1	12.6	10.1	13.5	12.6	14.5	59.61	26.31
03.01.2010	8.1	11.4	9.1	12.4	10.8	13.6	57.61	24.61
09.01.2010	10.1	10.3	11.1	11.3	9.6	10.3	55.36	22.36
10.01.2010	9.3	10.9	10.3	11.6	8.6	12.6	53.95	20.00
16.01.2010	8.3	11.6	9.9	12.3	10.9	13.3	51.36	23.05
17.01.2010	9.4	10.4	12.9	11.2	11.9	12.3	47.64	25.61
26.01.2010	8.6	11.0	10.6	13.0	12.0	14.0	43.61	27.61
27.01.2010	10.2	10.6	11.5	11.3	10.9	10.3	40.36	26.54
04.02.2010	8.6	10.9	12.0	12.0	11.0	13.2	42.61	28.61
05.02.2010	9.5	12.2	10.6	13.3	9.6	14.8	44.62	29.65
12.02.2010	8.4	11.1	9.8	12.6	8.8	13.6	46.32	30.00
13.02.2010	10.6	12.3	12.9	14.8	11.9	13.4	48.65	28.61
21.02.2010	8.0	10.5	9.0	12.3	10.0	11.2	50.98	26.31
22.02.2010	9.0	11.6	10.3	13.6	11.3	12.5	52.63	24.95
25.02.2010	10.0	12.2	11.6	13.3	12.6	12.4	54.21	22.65
26.02.2010	9.7	10.3	12.5	11.3	11.5	10.3	53.62	20.00

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	12.9	14.8	61.32	30.00
<b>Min.</b>	8.00	10.3	40.36	20.00
<b>95%tile</b>	12.6	14.2	60.20	29.94

# **AMBIENT AIR QUALITY**

**LOCATION: SA8 AMERI VILLAGE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
04.12.2009	7.1	9.7	8.4	11.2	6.9	8.6	43.52	23.61
05.12.2009	6.3	10.1	9.9	12.4	7.2	9.6	37.16	22.46
12.12.2009	6.9	8.6	7.1	11.7	8.5	9.8	47.31	19.92
13.12.2009	5.7	9.3	7.5	10.9	5.8	10.2	33.93	24.61
21.12.2009	7.2	9.1	9.6	10.3	8.3	9.3	48.32	23.13
22.12.2009	6.1	10.2	10.2	12.3	8.9	9.2	41.32	20.61
25.12.2009	7.6	9.8	9.1	11.8	5.8	8.6	46.21	22.18
26.12.2009	5.8	9.6	7.3	10.5	6.9	9.1	35.19	25.00
02.01.2010	8.6	8.8	9.9	10.1	8.1	11.6	43.38	23.56
03.01.2010	6.3	9.3	9.8	11.8	8.4	8.9	41.73	20.39
09.01.2010	5.9	9.0	7.5	10.3	6.9	8.7	36.39	21.23
10.01.2010	5.5	8.9	7.1	12.6	6.1	9.8	34.16	24.13
16.01.2010	7.1	9.2	9.4	10.7	6.3	8.9	40.76	21.37
17.01.2010	6.8	8.5	8.5	10.8	8.7	11.5	36.51	24.19
26.01.2010	6.0	10.1	8.9	12.5	8.2	9.2	40.29	18.81
27.01.2010	7.2	9.8	9.5	11.2	8.7	9.1	35.21	21.38
05.02.2010	6.8	9.2	10.3	11.9	7.6	9.4	32.09	24.53
06.02.2010	7.3	8.7	9.1	10.6	5.9	11.3	41.27	20.18
11.02.2010	6.9	9.1	8.6	10.9	6.2	10.1	43.91	22.39
12.02.2010	6.1	9.0	9.8	10.4	9.2	8.7	36.73	18.86
19.02.2010	7.4	8.6	9.3	11.3	7.5	9.9	35.46	22.19
20.02.2010	6.2	9.7	8.4	12.3	8.3	9.0	43.91	24.91
24.02.2010	5.6	8.7	9.7	11.6	5.5	8.8	47.85	19.31
25.02.2010	7.3	9.4	10.1	10.7	6.0	9.1	38.21	18.99

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	10.3	12.6	48.32	25.00
<b>Min.</b>	5.50	8.5	32.09	18.81
<b>95%tile</b>	9.9	12.3	47.77	24.87

# **AMBIENT AIR QUALITY**

**LOCATION: SA9 NEAR KASAHIDIH VILLAGE**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
02.12.2009	7.6	10.3	9.1	11.2	8.6	8.8	35.67	21.96
03.12.2009	9.2	9.7	10.6	10.9	9.8	10.1	40.28	26.01
09.12.2009	7.9	10.1	11.2	12.3	9.1	11.6	49.68	21.28
10.12.2009	8.4	9.4	9.9	11.9	8.4	9.1	51.97	26.03
16.12.2009	8.1	9.6	10.2	11.1	7.8	10.5	37.12	19.62
17.12.2009	7.8	9.1	12.1	10.7	10.4	9.6	42.98	23.96
26.12.2009	9.3	9.8	10.7	11.5	9.7	10.1	49.52	21.39
27.12.2009	8.4	11.0	9.8	12.6	9.0	11.4	47.36	24.12
05.01.2010	7.2	8.9	11.6	10.4	10.8	9.4	50.49	20.31
06.01.2010	8.5	10.3	9.2	11.9	8.6	10.2	33.12	25.68
11.01.2010	9.1	9.5	10.3	10.8	9.7	9.6	46.25	26.40
12.01.2010	7.9	9.7	9.4	11.2	8.3	9.3	41.38	19.62
19.01.2010	9.4	10.3	10.1	11.6	9.5	10.2	52.87	20.86
20.01.2010	8.5	9.0	11.8	12.7	10.7	8.9	48.73	26.15
24.01.2010	8.9	9.8	10.8	11.8	7.5	10.4	40.29	20.83
25.01.2010	7.5	10.2	9.6	11.6	8.9	11.3	36.84	22.37
04.02.2010	8.3	8.9	10.7	10.3	10.1	9.6	48.27	18.50
05.02.2010	7.4	9.6	12.2	10.9	10.5	9.8	44.29	24.91
12.02.2010	9.6	10.1	11.6	11.3	7.4	9.2	40.26	26.21
13.02.2010	8.8	9.8	10.4	12.5	9.9	11.7	39.52	23.20
21.02.2010	9.3	8.7	11.9	11.7	9.8	11.3	50.26	19.73
22.02.2010	8.7	9.1	10.3	11.1	7.9	10.6	41.93	20.79
25.02.2010	9.1	9.3	10.5	11.4	9.5	10.3	43.21	25.32
26.02.2010	8.2	10.7	11.9	12.2	8.8	9.0	51.28	20.31

	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	12.2	12.7	52.87	26.40
<b>Min.</b>	7.2	8.7	33.12	18.50
<b>95%tile</b>	11.85	12.25	51.87	26.20

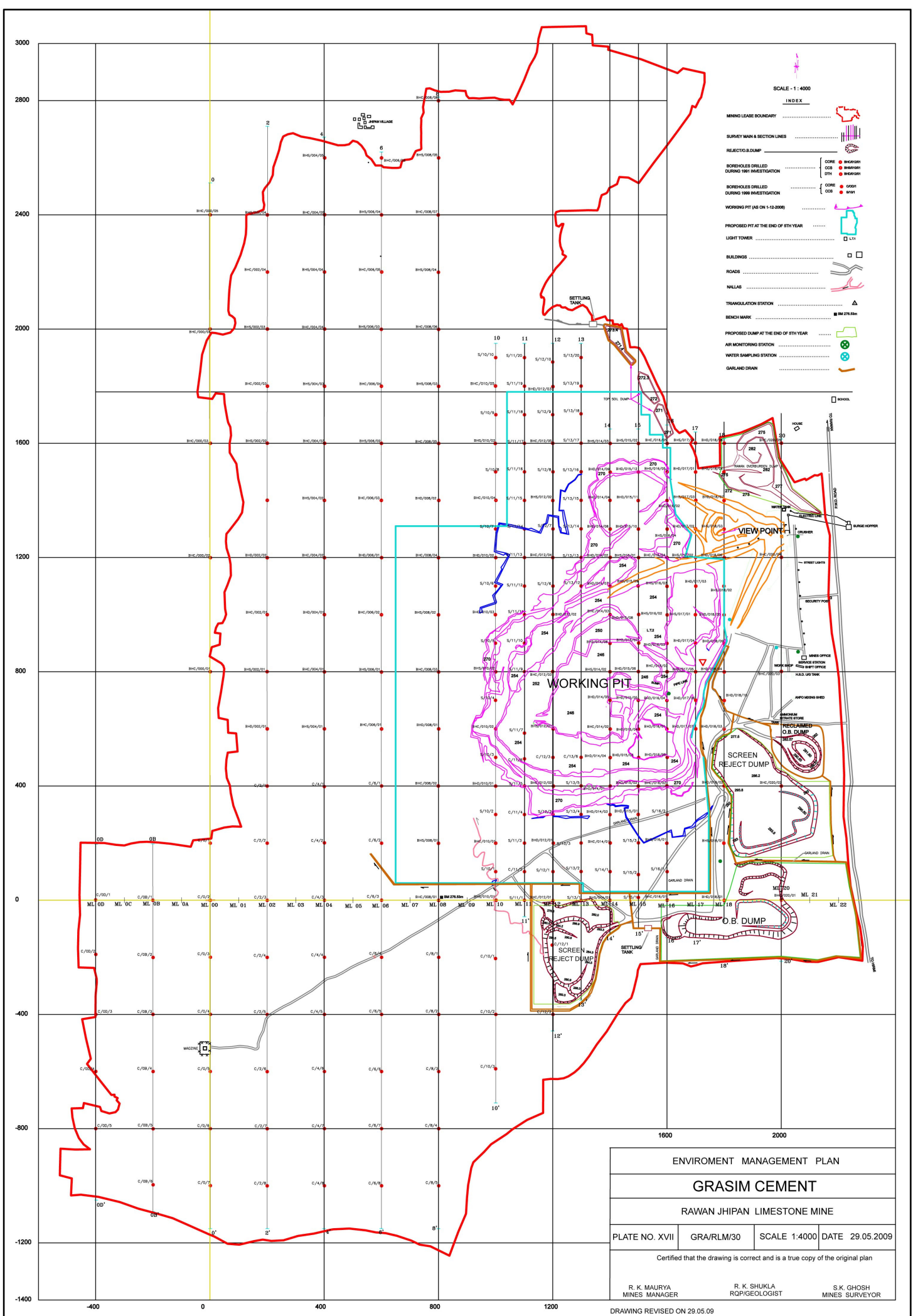
# **AMBIENT AIR QUALITY**

**LOCATION: SA10 Rengadih Village**

(Unit  $\mu\text{g}/\text{m}^3$ )

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM <sub>10</sub>	24 HOURS PM <sub>2.5</sub>
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>		
05.12.2009	9.1	10.2	10.8	13.0	9.3	12.1	48.65	20.96
06.12.2009	10.2	12.6	11.2	11.6	8.9	10.4	42.96	26.75
11.12.2009	8.3	11.6	9.4	12.9	10.1	10.1	54.87	20.30
12.12.2009	8.9	9.6	10.2	10.4	9.6	8.9	50.29	25.63
19.12.2009	9.3	10.1	11.0	12.1	8.9	11.3	39.52	18.19
20.12.2009	8.7	9.8	10.3	11.5	11.4	10.2	49.27	25.65
24.12.2009	9.5	10.9	11.1	12.7	10.2	10.6	54.62	21.38
25.12.2009	10.1	10.8	11.3	11.8	11.5	12.1	60.42	24.96
02.01.2010	9.2	10.5	10.6	13.0	9.4	10.0	59.32	19.00
03.01.2010	10.3	11.1	11.5	12.5	11.3	8.9	41.28	21.62
09.01.2010	8.9	9.6	10.2	11.0	9.1	10.2	52.46	26.87
10.01.2010	9.6	8.9	11.5	12.7	10.2	11.4	49.68	28.02
16.01.2010	8.7	10.2	9.8	11.7	8.6	9.8	47.26	19.98
17.01.2010	9.1	9.7	10.9	10.9	9.5	11.6	38.26	22.38
26.01.2010	10.7	11.4	11.5	12.8	11.2	9.6	41.28	23.85
27.01.2010	8.4	9.9	9.8	13.0	8.7	12.1	51.36	28.29
04.02.2010	9.5	10.1	11.2	11.8	9.4	10.4	55.63	21.34
05.02.2010	8.6	11.6	10.5	12.1	8.9	11.7	45.85	27.52
12.02.2010	9.3	9.8	11.0	11.6	10.2	9.4	40.58	21.50
13.02.2010	10.4	11.0	11.1	12.8	11.0	11.5	37.42	19.36
21.02.2010	9.6	9.7	10.9	12.1	10.1	10.6	58.32	24.59
22.02.2010	8.7	8.9	9.8	11.9	9.2	11.2	36.53	17.41
25.02.2010	8.5	9.5	10.4	13.1	8.7	10.3	43.75	24.61
26.02.2010	9.1	10.3	11.5	12.9	10.3	9.5	44.26	19.90

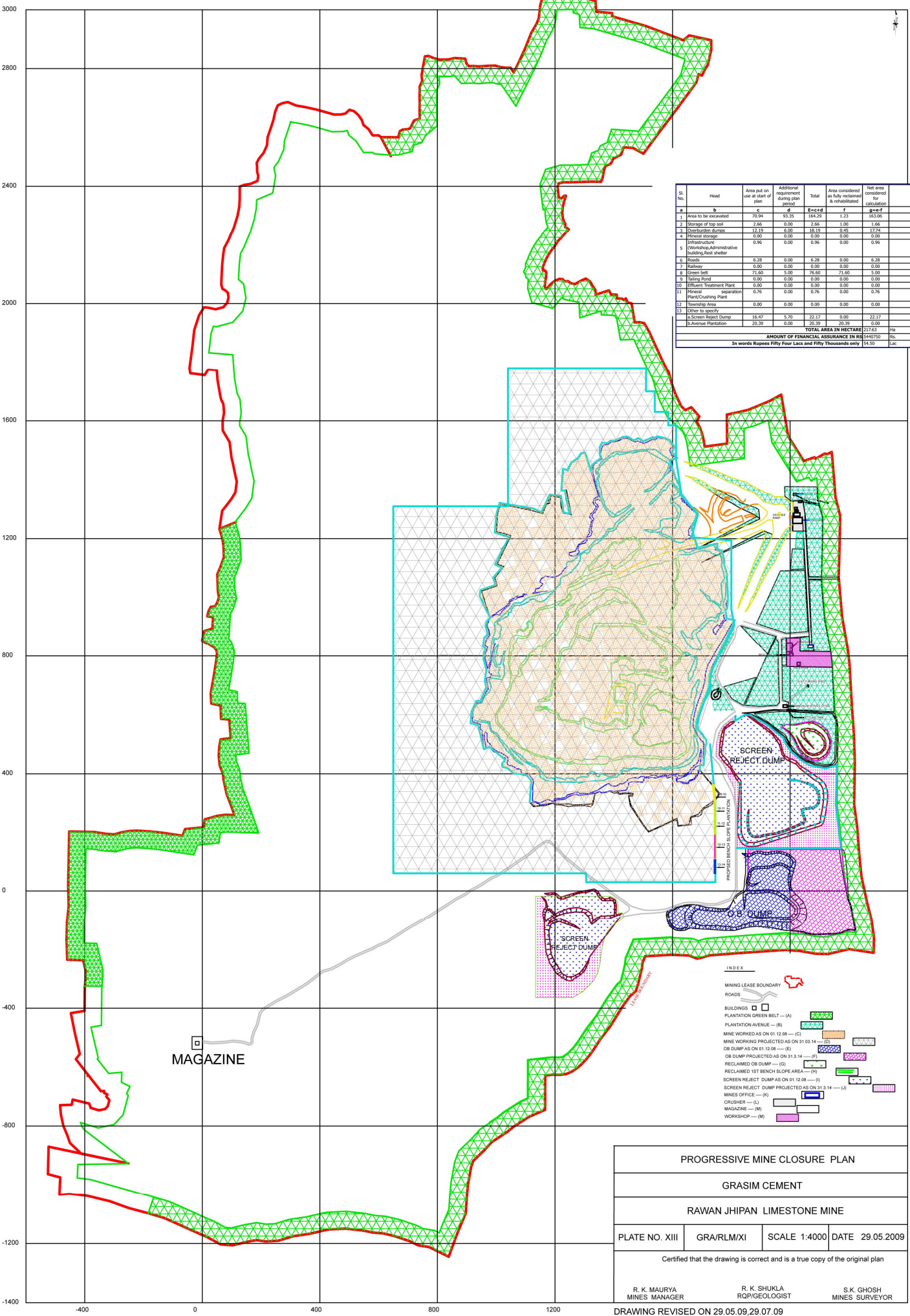
	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Max.</b>	11.5	13.1	60.42	28.29
<b>Min.</b>	8.3	8.9	36.53	17.41
<b>95%tile</b>	11.5	12.9	59.17	27.94



ENVIROMENT MANAGEMENT PLAN			
GRASIM CEMENT			
RAWAN JHIPAN LIMESTONE MINE			
PLATE NO. XVII	GRA/RLM/30	SCALE 1:4000	DATE 29.05.2009
Certified that the drawing is correct and is a true copy of the original plan			
R. K. MAURYA MINES MANAGER		R. K. SHUKLA RQP/GEOLOGIST	
		S.K. GHOSH MINES SURVEYOR	

DRAWING REVISED ON 29.05.09





S. No.	Head	Area put on use at start of plan	Additional requirement during plan period	Total	Area considered as fully reclaimed & rehabilitated	Net area considered for calculation
a	b	c	d	e=c+d	f	g=e-f
1	Area to be excavated	70.94	93.35	164.29	1.23	163.06
2	Storage of top soil	2.66	0.00	2.66	1.00	1.66
3	Overburden dumps	19.19	0.00	19.19	0.45	17.74
4	Mineral storage	0.00	0.00	0.00	0.00	0.00
5	Infrastructure (Workshop, Administrative building, Rest shelter)	0.96	0.00	0.96	0.00	0.96
6	Roads	6.28	0.00	6.28	0.00	6.28
7	Railway	0.00	0.00	0.00	0.00	0.00
8	Screen belt	71.40	0.00	71.40	11.50	5.90
9	Filling Pond	0.00	0.00	0.00	0.00	0.00
10	Effluent Treatment Plant	0.00	0.00	0.00	0.00	0.00
11	Mineral separation Plant/Crushing Plant	0.76	0.00	0.76	0.00	0.76
12	Township Area	0.00	0.00	0.00	0.00	0.00
13	Other to specify	0.00	0.00	0.00	0.00	0.00
14	a.Screen Reject Dump	16.47	5.70	22.17	0.00	22.17
15	b.Avenue Plantation	20.39	0.00	20.39	20.39	0.00
TOTAL AREA IN HECTARE						217.63
AMOUNT OF FINANCIAL ASSURANCE IN RS (IN Lakhs)						244750
In words Rupees Fifty Four Lacs and Fifty Thousands only						54.50

INDEX

- MINING LEASE BOUNDARY
- ROADS
- BUILDINGS
- PLANTATION GREEN BELT — (A)
- PLANTATION AVENUE — (B)
- WINE WORKED AS ON 01.12.88 — (C)
- WINE WORKING PROJECTED AS ON 31.03.14 — (D)
- OB DUMPS AS ON 01.12.88 — (E)
- OB DUMP PROJECTED AS ON 31.3.14 — (F)
- RECLAIMED OB DUMP — (G)
- RECLAIMED 1ST BENCH SLOPE AREA — (H)
- SCREEN REJECT DUMPS AS ON 01.12.88 — (I)
- SCREEN REJECT DUMP PROJECTED AS ON 31.3.14 — (J)
- MINES OFFICE — (K)
- CRUSHER — (L)
- MAGAZINE — (M)
- WORKSHOP — (N)

PROGRESSIVE MINE CLOSURE PLAN

GRASIM CEMENT

RAWAN JHIPAN LIMESTONE MINE

PLATE NO. XIII    GRA/RLM/XI    SCALE 1:4000    DATE 29.05.2009

Certified that the drawing is correct and is a true copy of the original plan

R. K. MAURYA    R. K. SHUKLA    S. K. GHOSH  
MINES MANAGER    RQP/GEOLOGIST    MINES SURVEYOR

DRAWING REVISED ON 29.05.09, 29.07.09



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



MINES OFFICE ROAD

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**DEMARKATION OF MINES LEASE BY FENSING AND  
DEVELOPMENT OF GREENBELT**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**ANOTHER VIEW OF DEMARKATION OF MINES LEASE  
BY FENSING AND DEVELOPMENT OF GREENBELT**

RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**PLANTATION AND DEVELOPMENT GREEN BELT ALL  
ALONG THE LEASE BOUNDARY**



RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**PANOROMIC VIEW OF FULLY DEVELOPED GREEN BELT**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**VIEW OF MINES MAIN HAULAGE ROAD AND PLANTATION**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**AFFORESTATION AT CRUSHER RAMP**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**VIEW OF BENCH SLOPE RECLAMATION**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**LIMESTONE BENCHES AT SOUTH DIRECTION**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**LIMESTONE BENCHES AT SOUTH WEST DIRECTION**

**RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR**



**LIMESTONE BENCH AT NORTH**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**LIMESTONE BENCH AT WEST**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**MINES TO BE ADVANCED AT NORTH DIRECTION**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**OVER VIEW**



**CLOSE VIEW**

**PIT ADVANCEMENT AT SOUTH DIRECTION**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**PIT ADVANCEMENT AT NW AND WEST DIRECTION**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



USE OF ROCK BREAKER



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**VIEW OF RECLAIMED OVERBURDEN DUMP**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**VIEW OF DUMP AND GARLAIN DRAIN ALONG THE DUMP**



RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**SETTLING TANK ALONGWITH GARLAIN DRAIN**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**OIL SEPARATOR AFTER WASHING RAMP**

## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**COVERED CROSS COUNTRY CONVEYOR BELT**



## RAWAN – JHIPAN LIMESTONE MINE,GRASIM CEMENT RAIPUR



**DEVELOPMENT OF NEW VIEW POINT**





# GRASIM CEMENT

(A UNIT OF GRASIM INDUSTRIES LTD.)  
P.O. GRASIM VIHAR, RAWAN  
DISTT. - RAIPUR (CG) PIN - 493196



## MODIFICATIONS OF THE APPROVED SCHEME OF MINING AND PROGRESSIVE MINE CLOSURE PLAN

OF  
**RAWAN - JHIPAN LIMESTONE MINE**  
(Tahsil - Simga, Distt. Raipur, CG)

FOR

MINING LEASE AREA : 722.834 Hectares  
CATEGORY OF MINE : "A Fully Mechanized"  
TYPE OF AREA : Non Forest

(IN TWO VOLUMES)

(For the Period from 01.04.2009 to 3.12.2013)

### VOLUME - I (TEXT)

Submitted for approval from  
INDIAN BUREAU OF MINES - NAGPUR

Under Rule 10 & 23D (1) of MCDR - 1988

पत्र संख्या 314 (3)/..... 2009 - एमसीसीएम (मध्य)/एमपी/  
एमएस/पीएमसीपी. - 16 दिनांक 4.12.09

द्वारा अनुमोदित किया गया।

Approved vide letter No. 314(3)/..... Prepared by -

MCCM(CZ)/MP/MS/PMCP - 16 dated 4.12.09

**RAVI KANT SHUKLA**

RQP NO. RQP/NGP/289/2003/A

**MINE PLANNING CELL**

GRASIM CEMENT, GRASIM VIHAR, RAWAN  
DISTT. - RAIPUR (CG) PIN - 493196

अनुमोदित  
**APPROVED**

*Chin*  
4/12/09

खान नियंत्रक (मध्यखंड)  
Controller of Mines (Central Zone)  
भारतीय खान ब्यूरो  
Indian Bureau of Mines

## **Action Plan for Monitoring as per revised NAAQS dated 16.11.2009**

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### **1.0 INTRODUCTION**

Post Project Monitoring is an essential part to check the impact of any project activity. Hence proper ambient air quality monitoring as per the revised National Ambient Air Quality Standards (NAAQS), dated 16.11.2009 prescribed by CPCB will be carried out on a regular basis to ascertain the following:

- ❖ State of Pollution within the project site and in its vicinity.
- ❖ Generate data for predictive or corrective purpose in respect of pollution.
- ❖ Examine the efficiency of air pollution control system adopted at the site.
- ❖ To assess environmental impacts.

Monitoring will be carried out at the site as per the norms of CPCB.

Environmental Monitoring Programme will be conducted for various environmental components as per conditions stipulated in Environmental Clearance Letter issued by MOEF & Consent to Operate issued by SPCB. Six monthly compliance reports will be submitted on regular basis, to MoEF, New Delhi on 1<sup>st</sup> of June & 1<sup>st</sup> of December. Quarterly compliance Report for conditions stipulated in Consent to Operate will be submitted to SPCB on regular basis.

### **1.1 Formation of EMC (Environmental Management Cell)**

In order to maintain the environmental quality within the standards, regular monitoring of various environmental components is necessary. The company has a full-fledged environmental management cell (EMC) reporting directly to Plant Manager for environmental monitoring and control. The EMC team takes care of pollution monitoring aspects and implementation of control measures.



A group of qualified and efficient engineers with technicians is deputed for maintenance, up keeping and monitoring the pollution control equipment, to keep them in working at the best of their efficiencies.

### **1.1.1 Responsibilities of EMC**

The responsibilities of the EMC include the following:

- i. Ambient air quality monitoring in core as well as in buffer zone.
- ii. Statistical interpretation of monitoring results & up-gradation in air pollution control measures accordingly.
- iii. Submission of monitoring results to the regulatory authorities on regular basis.
- iv. Specification and regulation of maintenance schedules for pollution control equipment.
- v. Developing the green belt.
- vii. Proper implementation of the Environmental Management Plan.
- viii. Organizing meetings of the Environmental Management Committee and reporting to the committee.

## **1.2 MEASUREMENT METHODOLOGIES**

### **1.2.1 INSTRUMENT TO BE USED**

The following instruments will be used for data collection work in the monitoring schedule:

1. Respirable dust collector with attachment for gaseous pollutants, Envirotech APM 460.
2. Fine Vollume Sampler APM 550
3. Automatic Weather Station
4. GPS

In addition to the above instruments, the data on land use to be collected by the field team by meeting with a large number of local inhabitants in the study area and different government departments / agencies.

### **1.2.2 MONITORING PROGRAMME**

Post project monitoring will be carried out as per revised National Ambient Air Quality Standards (NAAQS). The project site is considered as core zone and the area lying within 10 km radius from the mine site is considered to be the buffer zone where some impacts may be observed on physical and biological environment. In the Buffer zone slight impact may be observed and that too is occasional.

The following table is showing details of Post Project Monitoring programme:

**TABLE No.: 1.2.2**

Attributes	Sampling		Measurement Method	Test Procedure
A. Air Environment	Network	Frequency		
<b>Meteorological</b> <ul style="list-style-type: none"> <li>• Wind speed</li> <li>• Wind direction</li> <li>• Dry bulb temperature</li> <li>• Wet bulb temperature</li> <li>• Relative humidity</li> <li>• Rainfall</li> </ul>	Minimum 1 site in the project impact area	Annually by Weather Monitoring Station	Mechanical/automatic weather station	-
<b>Pollutants</b> <ul style="list-style-type: none"> <li>• PM<sub>10</sub></li> </ul>	4 to 6 locations in the project impact area (at least one station at max. GLC point, one in upwind & one in Downwind direction)	Revised National Ambient Air Quality Standards (NAAQS) vide MoEF circular, 16.11.2009	Gravimetric TOEM Beta attenuation	-
<ul style="list-style-type: none"> <li>• PM<sub>2.5</sub></li> </ul>			Gravimetric TOEM Beta attenuation	-
<ul style="list-style-type: none"> <li>• SO<sub>2</sub></li> </ul>			EPA Modified West & Geake method	Absorption in Potassium Tetra Chloromercurate followed by Colorimetric estimation using P-Rosaniline hydrochloride and Formaldehyde (IS: 5182 Part - II).
<ul style="list-style-type: none"> <li>• NO<sub>x</sub></li> </ul>			Arsenite modified Jacob & Hochheiser	Absorption in dill NaOH and then estimated colorimetrically with sulphanilamide and N (I-Nephthyle) Ethylene diamine Dihydrochloride and Hydrogen Peroxide (CPCB Method).
<ul style="list-style-type: none"> <li>• CO</li> </ul>			Non Dispersive Infra Red	-

			(NDIR) Spectroscopy	
Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	If required	If required	UV photometric Chemiluminescence Chemical Method	-
Lead (Pb) µg/m <sup>3</sup>			AAS/ICP method	sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter
Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>			Chemiluminescence Indophenol blue method	-
Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>			Gas chromatography based continuous analyzer	Adsorption and Desorption followed by GC analysis
Benzo(a) Pyrene (BaP)-Particulate Phase only, mg/m <sup>3</sup>			Solvent extraction	HPLC/GC analysis
Arsenic(As), mg/m <sup>3</sup>			AAS/ICP method	sampling on EPM 2000 or equivalent filter paper
Nickel (Ni), mg/m <sup>3</sup>			AAS/ICP method	sampling on EPM 2000 or equivalent filter paper

### 1.3 Revised NAAQ Standards dated 16.11.2009

#### NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial Residential, Rural and Other Area	Ecologically Sensitive Area(notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1.	Sulphur Dioxide (SO <sub>2</sub> ), µg/m <sup>3</sup>	Annual* 24 hours**	50 80	20 80	– Improved West and Gracke – Ultraviolet fluorescence
2.	Nitrogen Dioxide (NO <sub>2</sub> ), µg/m <sup>3</sup>	Annual* 24 hours**	40 80	30 80	– Modified Jacob & Hochheiser (Na-Arsenite) – Chemiluminescence
3.	Particulate Matter (size less than 10 µm) or PM <sub>10</sub> µg/m <sup>3</sup>	Annual* 24 hours**	60 100	60 100	– Gravimetric – TOEM – Beta attenuation
4.	Particulate Matter (size less than 2.5 µm) or PM <sub>25</sub> µg/m <sup>3</sup>	Annual* 24 hours**	40 60	40 60	– Gravimetric – TOEM – Beta attenuation
5.	Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	8 hours** 1 hour**	100 180	100 180	– UV photometric – Chemiluminescence – Chemical Method
6.	Lead (Pb) µg/m <sup>3</sup>	Annual* 24 hours**	0.50 1.0	0.50 1.0	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper – ED-XRF using Teflon filter
7.	Carbon Monoxide(CO) mg/m <sup>3</sup>	8 hours** 1 hour*	02 04	02 04	– Non Dispersive Infra Red (NDIR) spectroscopy
8.	Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>	Annual* 24 hours**	100 400	100 400	– Chemiluminescence – Indophenol blue method
9.	Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>	Annual*	05	05	– Gas chromatography based continuous analyzer – Adsorption and Desorption followed by GC analysis
10.	Benzo(a) Pyrene(BaP)- Particulate phase only, mg/m <sup>3</sup>	Annual*	01	01	– Solvent extraction followed by HPLC/GC analysis
11.	Arsenic(As), mg/m <sup>3</sup>	Annual*	06	06	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni), mg/m <sup>3</sup>	Annual*	20	20	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

\* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

- \*\* 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

#### **1.4 Locations of Monitoring Stations**

The location of the monitoring stations will be selected on the basis of prevailing micro – meteorological conditions of the area like; Wind direction & wind speed, Relative Humidity, Temperature. 4 to 6 AAQM stations will be selected (at least one station at max. GLC point, one in upwind & one in Downwind direction) to assess ambient air quality of the area. Locations for the post project monitoring shall be as under:

**TABLE NO.: 1.4**

<b>S. No.</b>	<b>Description</b>	<b>Location</b>
1.	Ambient Air Quality	Project site, at least one station at max. GLC point, one in upwind & one in Downwind direction
2.	Meteorological data	Project site

#### **1.5 DATA ANALYSIS**

Monitoring data analysis will be done as per CPCB guidelines. Once the monitoring of the ambient air is being done, statistical analysis will be done which will help in analyzing the change in the ambient air quality due to the project activity, if any. In case of any after result we will take necessary actions & follow the Air pollution control measures.



No.J-11015/70/2003-IA-II(M)  
Government of India  
Ministry of Environment & Forests

Paryavaran Bhawan,  
C.G.O.Complex, Lodi Road,  
New Delhi-110003.

Dated: 15<sup>th</sup> April 2005

To  
Shri V.K.Sethi,  
Sr. Vice President,  
Grasim Cement  
(a unit of M/s Grasim Industries Ltd.),  
UCO Building,  
4<sup>th</sup> Floor, Parliament St.,  
New Delhi.

**Sub: Expansion of Limestone Mine of Grasim Cement (a unit of M/s Grasim Industries Ltd., in village Rawan, Tehsil Shimga, District Raipur, Chhattisgarh – application for environmental clearance –reg.**

Sir,

This has reference to Government of Chhattisgarh, Directorate of Mines & Geology's letter No. Kra-3409/3100/12 dated 06.10.2004 and your letter along your application dated 31.03.2003 and subsequent letters dated 16.08.2004, 11.01.2005, and 09.03.2005 on the above-mentioned subject. The Ministry of Environment and Forests has considered the application. It has been noted that the project is for expansion of production capacity of limestone in the existing Limestone Mine. The mine has a total lease area of 722.834 ha which is a wasteland. No forestland is involved. There are no ecologically sensitive areas found within 10 km of the buffer zone. The project does not involve R&R. Of the total lease area, 391.334 ha is quarry area, 67.5 ha is for OB dumps, 2.0 ha is for infrastructure, 90 ha is for green belt and 172 ha is safety zone (undisturbed). An area of 40 ha has been already broken. Mining is by opencast -mechanised method. Drilling and blasting are involved. Expansion of rated capacity of the mine is from 1.6 million tonnes per annum (MTPA) to 2.8 MTPA of production of limestone. Mineral transportation of 9380 TPD is by conveyors to crusher located at a distance of 3.5 km in the linked cement plant. Water table level is 25-60m bgl in core zone and 30-50m bgl in buffer zone. Ultimate working depth of Mine is 40 m bgl and will intersect groundwater. CGWA approval has been obtained. Peak water requirement of 170 m3/d will be met from mine pit water. An estimated 1.26 mill. m3 of OB and 0.176 mill. m3 of other wastes has been accumulated and an additional 2.4 mill. m3 of OB and 2.6 mill. m3 of wastes will be generated (p/250/c). Backfilling is not proposed and OB will be stored in external dumps. An area of 542.834 ha of quarried area will be converted into a water reservoir. Public Hearing was held on 13.01.2004. NOC from Chhattisgarh Environment Conservation Board has been obtained on 18.05.2004. Mining Plan approved on 10.11.2003. Life of the mine at the rated capacity is 58 years. The capital cost of the project is Rs. 12.50 crores.

2. The Ministry of Environment & Forests hereby accords environmental clearance for the above-mentioned Limestone Mine of Grasim Cements (a unit of M/s Grasim Industries Ltd. for expansion in production of limestone from 1.6 MTPA to 2.8 MTPA in a total lease area of 722.834 ha under the provisions of Environmental Impact Assessment Notification, 1994 and subsequent amendments thereto subject to the compliance of the terms and conditions mentioned below:



### A. Specific Conditions

- (i) Top soil should be stacked properly with proper slope at earmarked site(s) and should not be kept active and shall be used for reclamation and development of greenbelt.
- (ii) OB and other wastes should be stacked at earmarked sites only and should not be kept active for long periods of time.  
 Plantation should be taken up for soil stabilisation along the slopes of the dump and reclaimed. Monitoring and management of rehabilitated dump sites should continue until the vegetation becomes self-sustaining. Compliance status should be submitted to the Ministry of Environment & Forests and its Regional Office located at Bhopal on yearly basis.  
 Sedimentation pits should be constructed at the corners of the garland drains around the dumps. The surface run-off should be desilted through a series of check dams and drains before final disposal.
- (iii) Catch drains and siltation ponds of appropriate site should be constructed to arrest silt and sediment flows from soil, OB and mineral dumps. The water so collected should be utilised for watering the mine area, roads, green belt development, etc. The drains should be regularly desilted and maintained properly.  
 Garland drains (size, gradient & length) and sump capacity should be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mines site. Sump capacity should also provide adequate retention period to allow proper settling of silt material.
- (iv) Crushers should be operated with high efficiency bag filters, water sprinkling system should be provided to check fugitive emissions from crushing operations, haulage roads, transfer points, etc.
- (v) Drills should be wet operated or with dust extractors and operated only during daytime.
- (vi) Controlled blasting should be practiced with the use of delay detonators and only during daytime. The mitigative measures for control of ground vibrations and to arrest the fly rocks and boulders should be implemented.
- (vii) The total area that shall be brought under plantation includes plantation on external OB dump, along ML boundary, 90 ha of green belt and safety zone within the lease by planting native plant species in consultation with the local DFO/Agriculture Department. The density of the trees should be around 2500 plants per ha.
- (viii) Partial backfilling of the mined out area shall be undertaken. The remaining quarried area (void) of 542.834 ha shall be developed as a water reservoir and used for recharge of groundwater. The higher benches of the void shall be terraced and plantation done to stabilise the slopes. Peripheral fencing shall be done along the excavated area.
- (ix) Regular monitoring of groundwater level and quality should be carried out by establishing a network of existing wells and construction of new piezometers. The monitoring for quantity should be done for a minimum four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for groundwater quality in May. Data thus collected should be submitted to the Ministry of Environment & Forests and the Central Ground Water Board, Regional Office quarterly within one month of monitoring.
- (x) The Company shall put up artificial groundwater recharge measures for augmentation of groundwater resource.



- (xi). Sewage treatment plant should be installed in the existing colony. ETP should also be provided for workshop and wastewater from mining operations.
- (xii) Digital processing of the entire lease area using remote sensing techniques should be done regularly once in 3 years for monitoring land use pattern and report submitted to MOEF and its Regional Office at Bangalore.
- (xiii) A Final Mine Closure Plan along with details of Corpus Fund should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.

#### **B. General conditions**

- (i) No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment and Forests.
- (ii) No change in the calendar plan including excavation, quantum of limestone and waste should be made.
- (iii) Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for RPM, SPM, SO<sub>2</sub>, NO<sub>x</sub>, and CO monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.
- (iv) Data on ambient air quality (RPM, SPM, SO<sub>2</sub>, NO<sub>x</sub>) should be regularly submitted to the Ministry including its Regional Office at Bhopal and the State Pollution Control Board and the Central pollution Control Board once in six months.
- (v) Fugitive dust emissions from all the sources should be controlled regularly monitored and data recorded properly. Water spraying arrangement on haul roads, wagon loading, dump trucks (loading & unloading) points should be provided and properly maintained.
- (vi) Adequate measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operations of HEMM, etc., should be provided with ear plugs/muffs.
- (vii) Industrial wastewater (workshop and wastewater from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19<sup>th</sup> May 1993 and 31<sup>st</sup> December 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents.
- (viii) Vehicular emissions should be kept under control and regularly monitored. Vehicles used for transporting the mineral should be covered with tarpaulins and optimally loaded.
- (ix) Environmental laboratory should be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board.
- (x) Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects.  
Occupational health surveillance programme of the workers should be undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed.
- (xi) A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Company.

- 4
- (xii) The funds earmarked for environmental protection measures should be kept in separate account and should not be diverted for other purpose. Year-wise expenditure should be reported to the Ministry and its Regional Office located at Bhopal.
  - (xiii) The Regional Office of this Ministry located at Bhopal shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data/ information/monitoring reports.
  - (xiv) A copy of the clearance letter will be marked to concerned Panchayat/local NGO, if any, from whom and suggestion/representation has been received while processing the proposal.
  - (xv) State Pollution Control Board should display a copy of the clearance letter at the Regional office, District Industry Centre and Collector's office/ Tehsildar's Office for 30 days.
  - (xvi) The project authorities should advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of 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 may also be seen at web site of the Ministry of Environment & Forests at <http://envfor.nic.in>.
3. The Ministry or any other competent authority may stipulate any further condition for environmental protection.
4. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986.
5. 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 Insurance Act, 1991 along with their amendments and rules.



(Dr.T.Chandini)  
Additional Director

Copy to:

1. Secretary, Department of Mineral Resources, Government of Chhattisgarh, Raipur.
2. Secretary, Department of Environment & Forests, Govt. of Chhattisgarh, Secretariat, Raipur.
3. Chief Conservator of Forests (Central), Ministry of Environment & Forests, Regional Office, E-2/240 Arcera Colony, Bhopal-462 016.
4. Secretary, Ministry of Mines, Govt. of India, Shastri Bhawan, New Delhi.
5. Chairman, Central Pollution Control Board, CBD-Cum-Office Complex, East Arjun Nagar, New Delhi-110 032.
6. Chairman, Chattisgarh Environment Conservation Board, 14/3 Park Street, Choubey Colony, Raipur.
7. Controller General of Mines, Indian Bureau of Mines, Indira Bhawan', Civil Lines, NAGPUR-440 001.
8. Member Secretary, Central Ground Water Authority, A-2, W3, Curzon Road Barracks, K.G. Marg, New Delhi-110001
9. District Collector, Raipur, Government of Chhattisgarh.
10. EI Division, Ministry of Environment & Forests, EI Division, New Delhi.
11. Monitoring File. 12. Guard File. 13. Record File.



# Central Ground Water Authority

Ministry of Water Resources

Government of India

No. 21-4(55)/NCCR/CGWA/2009-

158

Dated: 08-7-2009

To,

M/s Grasim Cement Ltd.,  
P.O. Grasim Vihar,  
Village Rawan, District Raipur-493196  
Chhattisgarh

**Sub: No Objection for withdrawal of ground water in respect of M/s Grasim Cement Ltd., for their limestone mine & cement manufacturing unit at village Rawan, Block Simga, Taluka Baloda Bazar, District Raipur, Chattisgarh -reg.**


Sir,

Kindly refer to your letter-dated 09.06.2009 on the above-cited subject. As the above mentioned site falls in 'Safe Category' area on ground water resource considerations, Central Ground Water Authority has no objection for the proposed withdrawal of **1500 m<sup>3</sup>/day** of ground water in respect of **M/s Grasim Cement Ltd., for their limestone mine & cement manufacturing unit at village Rawan, Block Simga, Taluka Baloda Bazar, District Raipur, Chattisgarh.**

However, taking into consideration the adverse effect of the ground water withdrawal that may arise on long term basis, the firm/industry is advised to implement Rain Water Harvesting and Conservation measures, Recycling and Re-use of water and Monitoring of the ground water levels in and around the area as per the hydrogeological investigation report. The data may be submitted to this office for perusal.

The NOC is valid till the area remains under 'Safe Category' on ground water resource consideration, or, for a period of five years from the date of issue of this letter, whichever is earlier.

Yours faithfully,

  
(S Bhattacharya)  
Scientist 'D'

for Member Secretary

**Copy for information to:**

- 1) The Regional Director, CGWB, NCCR, Raipur.
- 2) The TS to Chairman, CGWB, NH -IV, Faridabad.

1  
(S Bhattacharya)  
Scientist 'D'  
for Member Secretary

## CHAPTER - 1

### EXECUTIVE SUMMARY

**Project** : Groundwater Resources Evaluation  
**Promoters** : **M/S GRASIM INDUSTRIES LTD.  
VILLAGE RAWAN, DISTRICT RAIPUR,  
CHATTISGARH**  
**Possible sources** : Groundwater & Rainwater water in the  
Mine areas.

**Investigation**

**Methodology** :

- Surface Hydro geological studies for mining lease area (Core Zone)
- Surface Hydro geological studies for Buffer zone (10 Km radius).
- Estimation of ground water Recharge & Discharge factors for both core and Buffer zone.

**Coverage:** (a) 7.22884 Sq.Km. of mining lease (Core Zone)  
(b) Approx. 10 Km radius

**Findings:**

- \* The regional water level ranges between 32m. to 35m. below ground level during the pre monsoon period. Post monsoon water levels are 26m to 28m below ground level.
- \* Based on results of hydrogeological survey conducted in the area, it appears that ground water occurs in water table condition in weak zones of medium hard & hard rock. In the investigated area, thickness of top soil is very less generally not more than 3m in mining lease area.
- \* For buffer zone (10 km radius) total recharge due to rainfall & irrigation return flow at normal rainfall works out to be 71.48 mcm/annum. Total

discharge works out to be 30.77 mcm/annum & stage of development is 43%.

- \* Total gross dynamic reserves in the core zone, which includes mine area, have been estimated of the order of 0.867 mcm/annum. As ground water draft in core zone is nil it is because all the water requirement has been meet out from the rainwater collected in the sump
- \* Mining the area of core zone will have surplus exploitable ground water potential, indicates that mining activity will not affect ground water recharge and its ground water resources. No stream was encountered during the mining activity hence no diversion is required. This hardly affects surface water resources.
- \* Similarly, as no stored water will be released directly to water streams of nearby areas, possibilities of any siltation in natural streams and reduction of percolation is very less.
- \* Due to hard, crystalline and chemically resistant nature of limestone the water stored in the mining pit remains unpolluted and free from any toxic constituents. The overburden, mostly composed of very less alluvial material also does not contribute any pollutants from its waste. The waste dumps are located in such a way that there are no hindrances to flow of water bodies and streams.
- \* There is no possibility of any land subsidence due to heavy pumping or mining as the rocks are hard, compact, impervious and crystalline, which can be stand of its own. Beside that there is no heavy pumpage for ground water extraction.

\*\*\*\*\*

## CHAPTER – 2

### SURFACE HYDROGEOLOGICAL & HYDROLOGICAL INVESTIGATION

#### INTRODUCTION

M/S GRASIM INDUSTRIES LTD., has proposed expansion of lime stone mines (2.8 MTPA to 7.5 MTPA) at village Ravan in tehsil Simga Raipur, Chhattisgarh.

For meeting the water demands, it was decided to carry out detailed investigation for indicating feasible subsurface, which may meet water requirement on sustainable basis.

This chapter comprises of the main objectives & the investigation methodology.

#### OBJECTIVES

- Hydrological & Hydrogeological studies of the core & buffer zone for mine area..
- To assess groundwater resources of mine area.
- To assess the impact of mining on water regime.
- Water conservation measures to augment ground water storage.

#### GEOLOGY OF THE AREA

The area under discussion has been mapped by GSI as well as DGM. The regional geological set up of **Chhattisgarh super group** is as under:

	<b><i>Recent to sub recent</i></b>	-	Alluvium, laterite
	<b><i>Maniari Formation</i></b>	-	Purple shale with dolomite

	<b>Hirmi Formation</b>	-	Dolomitic limestone, & gypsum, gray dolomite
	<b>Tarenga Formation</b>	Bilha member	Purple dolomite, argillite green clay
		Daguari member	Chert and shale intercalations
		Kusmi member	Pink to purple calc. shale
<b>Raipur Group</b>	<b>Chandi Formation</b>	Nipania member	Purple green bedded limestone, purple arg. Stromatolitic dolomite
		Pendri/ Deodongar member	Purple and grey stromatolitic limestone & dolomite with flaggy limestone/shale intercalations, / ferrug. glauconitic arenite & shale
		Newari member	Pink and buff stromatolitic limestone & dolomite
	<b>Gunderdehi Formation</b>	Anda/ Dotopar member	Predominantly pink, purple and gray shale with limestone intercalations/ arenite buff to green shale member in the middle.
	<b>Charmuria Formation</b>	Bagbura member	Purple limestone (phosphetic)
		Kasdol member	Dark gray bedded limestone/ arg. Limestone with minor shale intercalations
		Ranidhar member	Cherty limestone & dolomite
		Sirpur member	Chert & clay intercalations,
<b>Chandrapur Group</b>	<b>Kansapathar Formation</b>		Glauconitic white to pinkish quartz arenite
	<b>Chaporadih Formation</b>		Purple green, gray and black shale with silt stone/ quartz arenite with shale intercalations
	<b>Lohardih Formation</b>		Ferruginous purple arkose & greywacke arenite with shale partings and conglomerate at the base

The limestone of chandi formation is underlain in the east, along Khorsi nala by shale of Dotapar member of Gunderdehi formation.

### **Local Geology**

The proposed area around Bharuwadih is a small portion of Chhattisgarh basin and comprises of limestone and shale of Chandi formation of Raipur Group. The general trends of the outcrops are in NE-SW direction. The beds are almost everywhere horizontal. On the basis of Geological mapping and drilling data, the rock shows following sequence:

Soil / Laterite

Pink, Purple stromatolitic limestone

Pink, Purple, grey shale bands

Grey limestone

Pink, purple, & grey shaly limestone / shale

### **PHYSIOGRAPHY, DRAINAGE PATTERN & RAINFALL DATA**

Topographically the area of interest forms flat landscape of Chhattisgarh. State wherein number of undulations and protuberances of different gradient are formed. The elevation of the area varies from 253m to 274m above mSL. The slope of the area is towards the southeast. Karst topography is observed in the area occupied by the sporadic outcrops of limestone.

The Mahanadi the major river system of the area of 10km radius falling within Toposheet No.64K/2. The Mahanadi traverses the area from southwestern quadrant, flows towards the northeast and crosses the area towards east of Datrengi village. The main tributaries which traverse the area of Chhattisgarh are Chitawar and Khorsi Nalas. The drainage of the area is open dendritic which is typical characteristics of flat terrain.



The area is tropical monsoon climate. Rainy season extends from June to September, the maximum rains in August; winter showers are confined to January. May is hottest part of the year when the temperature rises to 46° c (approx.) and usual range is 27° c to 48° c. January is the peak winter when the max. and min. are around 25° c and 10° c respectively. Hot dusty winds blow from mid April. Average rainfall of the area is 1200 to 1300 mm/annum

### **AQUIFER TYPES**

Investigated area has hard rock aquifer. Hard rock aquifer have either limestone or Shale as main aquifer. Ground water generally occurs in unconfining to semi confining conditions in both type of aquifers.

In general, in the investigated area limestone have moderate hydraulic conductivity It is because of the fact that these rocks are impervious in nature and do not have primary porosity. These rocks have the secondary porosity due to presence of fracture zone and weathering. The secondary porosity decreases with depth due to overlying weight of the rocks. Shales are prone to weathering, get weathered to adequate depths and develop primary porosity. Hence maximum hydraulic conductivity is observed at shallow depth generally less than 50m.

### **WATER LEVEL AND SEASONAL FLUCTUATION**

Water level in the area ranges from 32 mts. To 35mts. below ground level in pre monsoon period and 26-28 m in post monsoon period. Seasonal fluctuation is about 6 to 8 m. Fluctuation in water levels is mostly due to recharge of ground water through rainfall and ground water discharge from wells used for irrigation. This high range of water level fluctuation is only due to moderate hydraulic conductivity of limestone aquifer.

### **YIELD POTENTIAL**

There are few operating open wells, DCB & tube wells in the mining lease area operated by private cultivators. Tube wells in the area have discharge between 100 to 200 KL/day.

In the near by areas hand pumps have been constructed by the govt. to an average depth of 20 to 30m. The yield of such hand pumps is not much and is just sufficient to meet the drinking water requirement.

### **GROUND WATER MOVEMENT**

In the investigated area the movement of ground water is governed mainly by secondary fractures as metamorphics are impervious in nature and do not possess primary porosity. The ground water also follows the topography and surface water moves in South- Southwestern to northern or North-eastern direction. The hydraulic gradient is not so high and has been observed as a meter per kilometre.

### **GROUND WATER QUALITY**

Quality of ground water is generally potable and electrical conductivity is less than 2000 micromhos per cm. And total dissolved salts do not exceed 1000 mg/lit. All the constituents remain within allowable limits of drinking water standards with fluorides remaining less than 1.5 mg/lit and nitrates less than 45 mg/l. water is therefore suitable for drinking and irrigation purposes.

## CHAPTER - 3

### GROUND WATER RESOURCES EVALUATION

Ground water resources of an area can be distinguished under two categories:-

1. Dynamic ground water resources
2. Static ground water resources

#### DYNAMIC GROUND WATER RESOURCES

Dynamic ground water is that amount of water, which is found in the natural zone of fluctuation in an aquifer due to ground water recharge. Total ground water recharge ( $R_T$ ) of the area can be estimated by assessing the various components of the following equation: -

$$R_T = R_r + R_s + R_i + S_r + R_c \text{ - - - - - (I)}$$

Where,

$R_r$  = Recharge from Rainfall.

$R_s$  = Recharge from Irrigation due to surface water.

$R_i$  = Recharge from Irrigation due to ground water.

$S_r$  = Recharge through surface water bodies.

$R_c$  = Recharge to confined aquifers.

#### GROUND WATER RESOURCES IN THE CORE ZONE

The investigated area covers 7.22884 Sq.km. and proposes to acquire this land from the state govt. and from private cultivators. The main source of ground water recharge is recharge due to rainfall by direct percolation and.

#### RECHARGE DUE TO RAINFALL ( $R_{rm}$ )

##### (A) BY GROUNDWATER TABLE FLUCTUATION METHOD:

Recharge due to rainfall is computed by specific yield water table fluctuation method as below: -

$$R_r = A \times S.F \times S_y \text{ ----- (III)}$$

Where,

$R_r$  = Recharge due to rainfall in the investigated area.

$A$  = Rechargeable area = 7.22884 Km<sup>2</sup>

S.F. = Seasonal fluctuation in water level = 3m

$S_y$  = Specific yield = 4% for Limestone aquifer

For Limestone

$$= 7.22884 \times 0.04 \times 3$$

$$= 0.867 \text{ mcm/annum}$$

$R_{rm} \approx 0.867 \text{mcm/annum}$
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## **(B) BY RAINFALL INFILTRATION FACTOR METHOD:**

In areas where groundwater level monitoring is not adequate in space & time, rainfall infiltration may be adopted. The ground water estimation committee, Govt. of India (1997) has suggested norms of recharge from rainfall under various hydro geological conditions. The committee has suggested 8% for limestone aquifer has been adopted which appears to be reasonable while looking to the hydro geological and geomorphological settings. An attempt can be made to find out if it matches with the ground water recharge calculated by seasonal fluctuation method.

For alluvium

$$R_{r2m} = \text{area} \times \text{normal rainfall} \times \text{R.I. factor}$$

$$= 7.22884 \times 10^6 \times 1.3 \times 0.08$$

$$= 0.751 \text{ mcm/annum}$$

### TOTAL DYNAMIC RESERVES

Considering all above recharge components, total dynamic reserves in the investigated area will be:

$$R_{TS} = R_{rm}$$

$$R_{Tm} = 0.867 \text{ mcm/annum}$$

$$R_{Tm} = 0.867 \text{ mcm/annum}$$

### GROUND WATER DRAFT

Ground water draft in the area can be estimated by assessing the various components of the following equation:

$$D_T = D_i + D_d + D_{in} + D_w + D_{et} + D_o \text{----- (B)}$$

$D_T$  = Total ground water draft

$D_i$  = Ground water draft for irrigation in the area

$D_d$  = Ground water draft for domestic use in the area

$D_{in}$  = Ground water draft for industrial use in the area

$D_w$  = Ground water draft for irrigation & domestic use around the area in the radius of influence.

$D_{et}$  = Ground water draft by way of evapotranspiration.

$D_o$  = Ground water draft as out flow from unconfined aquifer.

### MINE AREA

From equation no. (B)

$$D_T = D_i + D_d + D_{in} + D_o + D_{et}$$

In the investigated area, there is no ground water draft all the water requirement has been met out from the rain water collected in the mine water sump. Evapotranspiration losses are negligible as water table is deep. So at present there is no other ground water draft in the investigated area.

Hence ground water draft can be computed by reducing the equation (B) to:

$$D_{Tm} = \text{Nil}$$

### **TOTAL GROUND WATER DRAFT OF AREA ( $D_T$ )**

$D_T = \text{NIL mcm/annum}$
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### **GROUND WATER RESOURCES (BUFFER ZONE)**

The area of Buffer zone (314 Sq.km. – 7.22884 sq.km = 306.771 sq.km.) lies in SIMGA block of Raipur district. This buffer zone has limestone and shale as main aquifer. Main recharging factors in this area is recharge due to rainfall and due to return flow from the applied irrigation from surface and ground water and recharge from the surface water bodies.

### **RECHARGE DUE TO RAINFALL ( $R_{RB}$ )**

#### **(A) BY GROUNDWATER TABLE FLUCTUATION METHOD:**

The groundwater recharge for the buffer zone has limestone and shale as main aquifer. There is hardly any canal irrigation and entire area of buffer zone has been irrigated by open wells / tubewells, ponds.

It has been observed in the key wells penetrating both limestone and shale aquifer that average rise in water table is 2 to 4m. at an average level it can be taken as 2.4m for both the aquifers.

Recharge due to rainfall in the buffer zone is computed by specific yield water table fluctuation method as below: -

$$\begin{aligned} R_{r1} &= A \times S.F \times S_y \\ &= 306.771 \times 2.4 \times 0.03 \\ &= 22.08 \text{ mcm/annum} \end{aligned}$$

$R_r \approx 22.08 \text{ mcm/annum}$
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**(B) BY RAINFALL INFILTRATION FACTOR METHOD:**

The ground water recharge can also roughly estimated by rainfall infiltration method. The ground water estimation committee, Govt. of India (1997) has suggested norms of recharge from rainfall under various hydro geological conditions. For areas as that of Raipur having consolidated sedimentaries and favourable hydro geological conditions of shallow water level and well-developed drainage, rainfall infiltration factor has been suggested as 4% to 8% of the normal rainfall. At an average level infiltration factor for the area can be taken as 6%.

$$\begin{aligned} R_{r2} &= \text{area} \times \text{mean annual rainfall} \times \text{R.I. factor} \\ &= 306.771 \times 1.3 \times 0.06 \\ &= 23.92 \text{ mcm/annum} \end{aligned}$$

**RECHARGE DUE TO GROUND WATER APPLIED FOR IRRIGATION ( $R_{IB}$ )**

Ground water recharge from the return flow of irrigation water is normally taken as 30% of the total water applied for irrigation as suggested by the committee. Total groundwater applied for irrigation is 8.64 mcm/annum. Ground water recharge from the above factors is as under

$$\begin{aligned} 20.88 \times 0.3 &= 6.26 \text{ mcm/annum} \\ \mathbf{R_{IB}} &= \mathbf{6.26 \text{ mcm/annum}} \end{aligned}$$

**RECHARGE DUE TO SURFACE WATER APPLIED FOR IRRIGATION ( $R_{SB}$ )**

Ground water recharge from the return flow of surface water irrigation water normally taken as 40% ( For paddy irrigation) of the total water applied for irrigation as suggested by the GWREC(1997). Total irrigated area is 185.36 Sq.km, taking 0.4m as depth of water applied for the irrigation, total groundwater applied for irrigation at 80% efficiency works out to be 9.268 mcm/annum. Ground water recharge from the above factors is as under

Surface water applied for irrigation

$$(185.36 \times 0.4) / 0.8 = 92.68 \text{ mcm/annum}$$

Recharge to ground water

$$92.68 \times 0.4 = 37.07 \text{ mcm/annum}$$

$$\mathbf{R_{SB} = 37.07 \text{ mcm/annum}}$$

**RECHARGE DUE TO SURFACE WATER BODIES ( $S_{IB}$ )**

As per the land use pattern of the buffer zone total area under surface water bodies work out to be 8.46 Sq.km. As per the GWEC ground water recharge through surface water bodies can be taken as 60% of the total spread area. hence Ground water recharge from the above factors is as under

$$8.46 \times 0.6 = 5.07 \text{ mcm/annum}$$

$$\mathbf{S_{IB} = 5.07 \text{ mcm/annum}}$$

**TOTAL RECHARGE OF BUFFER ZONE ( $R_B$ )**

$$\mathbf{R_B = R_{rB} + R_{IB} + R_{SB} + S_{IB}}$$

$$= 23.08 + 6.26 + 37.07 + 5.07$$

$$\mathbf{R_B = 71.48 \text{ mcm/annum}}$$

**GROUND WATER DRAFT OF BUFFER ZONE**

From equation no. (B)

$$D_{TB} = D_{iB} + D_{dB} + D_{inB} + D_{oB} + D_{etB}$$



In the investigated area, ground water draft will occur due to applied irrigation, due to domestic use, due to industrial use and outflow from the unconfined aquifer. Evatranspiration losses are negligible as water table is deep. Hence ground water draft can be computed by reducing the equation (B) to:

$$D_{TB} = D_{iB} + D_{dB} + D_o$$

### **DRAFT DUE TO APPLIED IRRIGATION ( $D_{iB}$ )**

The ground water draft in the buffer zone takes place mainly by dug well and tube wells used for irrigation. There are about 1450 dug wells/tube wells tapping limestone & shale aquifer. It has been stated earlier that in the limestone area ground water structures usually have a discharge of 150 cum/day, while in shale area it is 100 cum/day. Hence at an average level 120 Cum/day of discharge can be taken for both limestone and shale aquifer. The annual draft has been calculated after considering that these structures will operate only for four months a year. The annual ground water withdrawal from these wells is as under:

$$1450 \times 120 \times 120 = 20.88 \text{ mcm/annum}$$

### **DRAFT DUE TO DOMESTIC USE ( $D_{dB}$ )**

In the buffer area, the population is about 50019 according to Census figures for 2001. As population growth percentage has been @ 5.6 % per annum since 2001, the present population is estimated at 75,228 persons

Considering 100 liters ( $0.1 \text{ m}^3$ ) as domestic consumption in rural and semi urban area (as per GERC Report 1997), the total water withdrawal for domestic use will be:

$$\begin{aligned} D_{dB} &= 75228 \times 0.1 \times 365 \\ &= \mathbf{2.74 \text{ mcm/annum}} \end{aligned}$$

### **DRAFT DUE TO OUTFLOW FROM UNCONFINED AQUIFER**

As per the GWEC, 10% of the total ground water recharge can be taken as the unaccounted outflow from the unconfined aquifer. Hence

$$\begin{aligned} D_o &= 71.48 \times 0.1 \\ &= 7.15 \text{ mcm/annum} \end{aligned}$$

### TOTAL DRAFT IN THE BUFFER ZONE

$$\begin{aligned} D_{TB} &= D_{iB} + D_{dB} \\ &= 20.88 + 2.74 + 7.15 \\ \mathbf{D_{TB} &= 30.77 \text{ mcm/annum}} \end{aligned}$$

### SURPLUS DYNAMIC RESERVES OF BUFFER ZONE

Surplus ground water reserves are those reserves, which are available for utilization and are expected to recharge every year. These reserves calculations are based on the rainfall of 2010. Therefore, surplus reserves ( $R_w$ ) are computed as follows: -

$$R_{WB} = \text{Total Dynamic Reserves} - \text{Total ground water draft}$$

$$R_{WB} = R_{TB} - D_{TB}$$

$$R_{WB} = 71.48 - 30.77$$

$\mathbf{R_{WB} = 40.71 \text{ mcm/annum}}$
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Total recharge to the buffer zone is 71.48 mcm/annum. Total ground water pumpage is 30.77 mcm, indicating that the area is under safe zone and present stage of ground water development is 43% of the long term ground water recharge.

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