Ecology Conservation & Management Strategies

Durgmanwadi Bauxite Mines

Sponsored by

M/s HINDALCO INDUSTRIES LIMITED

April 2006

Prepared by

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1. Preamble

1.1 Introduction

HINDALCO Industries Limited a flagship Company of the Aditya Birla Group formerly known as Indian Aluminium Company Limited (INDAL) has its alumina refinery located at Belgaum in Karnataka State operating since 1970. Captive Bauxite Mines in adjacent Kolhapur District in Maharashtra State support the manufacturing plant at Belgaum since its inception. Government of Maharashtra granted five mining leases in the Kolhapur District in the year 1968. the Durgamanwadi Bauxite Mines is one of the five mining leases that started operation from 1992.

The company obtained the NOC and Consent to Establish from the Maharashtra Pollution Control Board in the year 1991 and 1993 respectively for a capacity of 0.864 mtpa. Application for Environmental Clearance was made in 1993 to the Environmental Department, Government of Maharashtra.

The company has received the Environmental Clearance from the Environment Department of Government of Maharashtra in the year 1996. The Consent to Operate is renewed from time to time and the current Consent to Operate is valid till December 2006. The company has been carrying out its operations within the prescribed production capacity and pollution control norms since inception.

1.2 Durgamanwadi Bauxite Mine

HINDALCO Industries Limited is operating Durgamanwadi Bauxite Mine in Padsali & Durgamanwadi Village, Radhanagari Taluka, Kolhapur District, Maharashtra over an area of 204.56 Ha.

Durgamanwadi Bauxite Mining Lease was granted to HINDALCO Industries Limited (previously named as INDAL) in 1968 for 30 years. Although the mining lease was granted in the year 1968, the mining operations commenced at this mine in 1992.

1.3 Purpose of the Report

In order to achieve sustainable development both in mining and ecology conservation in the area, M/s HINDALCO Industries Limited decided to carryout environmental protection plan & conservation strategies for the local species of flora & fauna.

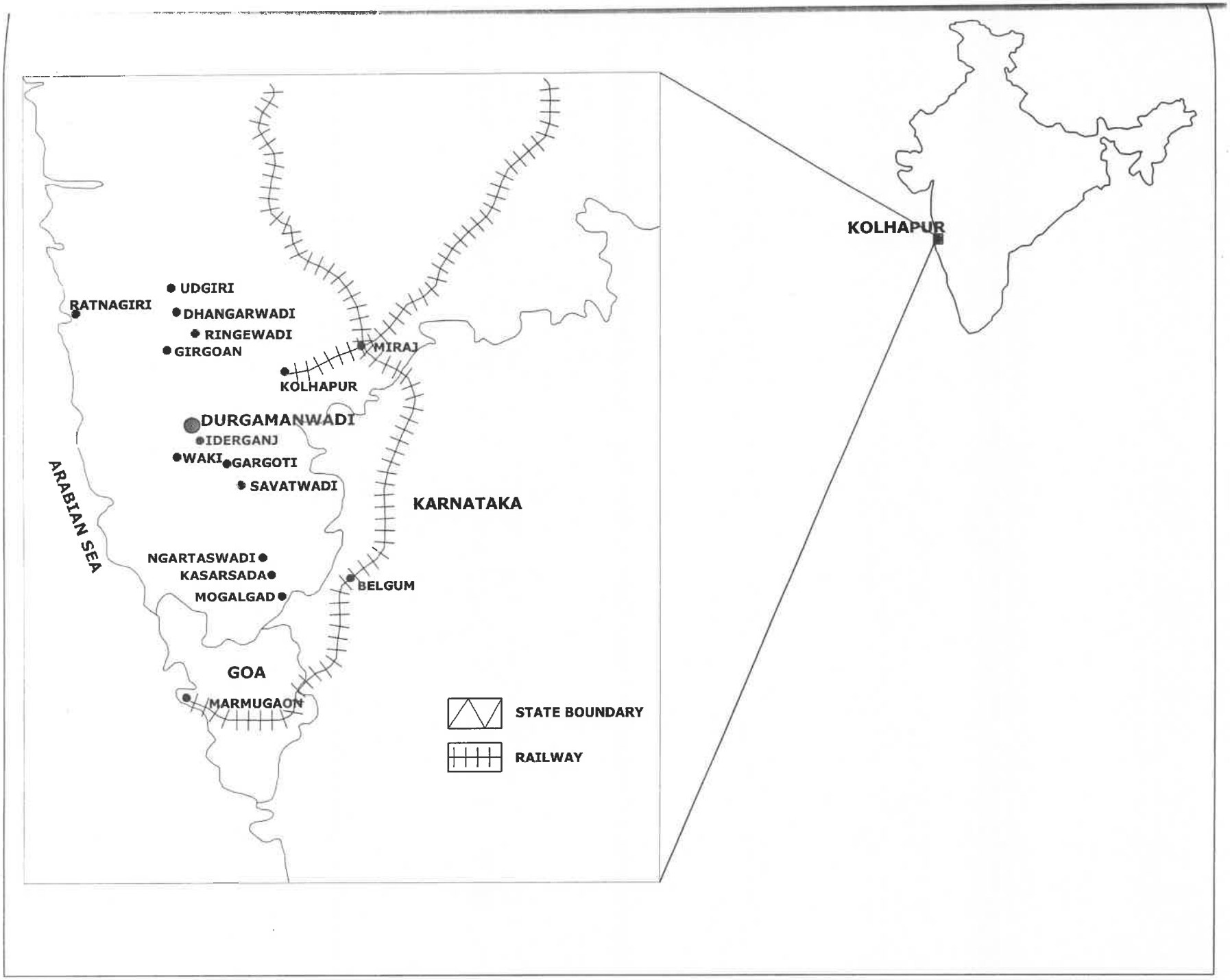
1.4 Scope of the Study

The scope of the study involves identification of all the environmental aspects that has the potential impact on the ecological environment and delineating proper environmental measures to minimize the impacts and development of ecology conservation strategies for the area.

1.5 Location of the Project

The Durgamanwadi Bauxite Mine is situated in Padsali & Durgamanwadi Village of Radhanagari Taluka, Kolhapur District, Maharashtra.

Mine Lease	Village	Taluka	District & State	Area (Ha)
Durgamanwadi Bauxite Mine	Padsali & Durgamanwadi	Radhanagari	Kolhapur, Maharashtra	204.56
Total Lease Area [private stony waste land 141.14 Ha + Forest Land 63.42 Ha]				**204.56**


KOLHAPUR
UDGIRI
RATNAGIRI
DHANGARWADI
RINGEWADI
GIRGOAN
MIRAJ
KOLHAPUR
DURGAMANWADI
IDERGANJ
WAKI
GARGOTI
SAVATWADI
KARNATAKA
ARABIAN SEA
NGARTASWADI
KASARSADA
MOGALGAD
BELGUM
GOA
MARMUGAON
STATE BOUNDARY
RAILWAY

The location of the lease area falls under the following geographical latitudes and longitudes:

Latitude	:	N 16° 26′ - N 16° 28′
Longitude	:	E 73° 56′ - E 73° 58′

Durgamanwadi Bauxite Mine is situated in the northwestern side of the Radhanagari Village. The entire area is plateau type and has been divided into three blocks i.e. Eastern, Western and Central Blocks.

The Mining lease was granted initially on 16.04.1968 for 30 years.

Ownership	**Area (Ha)**
Government Revenue Land	63.42
Private Land	141.14
Forest Area	81.14
Total Lease Area	**285.70**

The company while applying for renewal of the lease in 1997, reduced the forest area and applied for 235.60 Ha.

The Government of Maharashtra has renewed the ML for 204.56 Ha (141.14 Ha Private Land + 63.42 Ha Govt. Revenue Land) on 09.08.2000 for a period of 20 years.

The 63.42 Ha Government Revenue Land granted by the Government of Maharashtra has now been claimed by the forest department as forestland. Out of this 63.42 Ha forestland the company has applied for diversion of 29.10 Ha. of mineralized forest land for non forest purpose to the concerned authority under Forest (Conservation) Act 1980. The clearance is awaited. The mining operations are being carried out in non-forest land.

1.6 Climate

Temperature

The study area experiences a maximum temperature around 37º-38ºC during summer, while the minimum temperature is around 15º-18º C during winter

Rainfall

The rain predominantly occurs between June - October and the area receives an average annual rainfall of 3000 mm.

Relative Humidity

The relative humidity in the study area varies between 32 – 54 %.

1.7 Geology

Durgmanwadi Bauxite Deposit is situated in the northwestern side of the Radhanagari town and falls under Survey of India Toposheet No 47 H/15.

Topographically, the area is plateau type surrounded by low lying area with slopes towards north and south. The plateau has been divided into three blocks:

- Eastern
- Western
- Central

The area is characterized by a subtropical climate. The rainy season is restricted to 4 months (June-September). The plateau top is mostly devoid of any vegetation.

The general geology of Durgmanwadi corresponds to the Deccan Traps of Upper Cretaceous to Lower Eocene age. The Bauxite, Laterite zone

spreads over the plateau covering it as blanket. On the basis of rock types exposed in and around the area and data obtained from boreholes, the following geological sequence has been established for the area:

Soil
Laterite
Bauxite
Lithomerge Clay
Basalt (Deccan Trap)

Details of the Area:	
District & State	Kolhapur, Maharashtra
Taluk	Radhanagari Taluka
Village	Padsali & Durgamanwadi Village
Nature of the Area	Private Land & Forest Land
Latitude	N 16° 26′ - N 16° 28′
Longitude	E 73° 56′ - E 73° 58′
General Climatic Conditions	
Maximum Temperature	37° to 38° C (Summer)
Minimum Temperature	15° to 18° C (Winter)
Annual Rainfall	Average: 3000 mm
Wind Pattern during study period	W & WNW
Accessibility	
Road Connectivity	The lease area is about 55 km from Kolhapur City. Kolhapur-Ponda-Devgad SH (8 Km)
Rail Connectivity	Kolhapur (55.0 km)
Airport	Kolhapur (55.0 km)
Historical / Important Places	
Archaeologically Important Site	-
Historically Important Site	-
Sensitive Places	-
Sanctuaries / National Parks	Extended Radhanagari Wild Life Sanctuary adjacent to lease area

1.8 Biological Environment

Flora

The Plateau is a barren wasteland devoid of any major trees. The core zone mainly consists of species such as Jamun, Anjan, Gela, Waras, Kumbhi, Nana, Karambu ect and shrubs like Braken fern, karavi. The climbers includes Ghotvel and Alea.

Fauna

In the Core zone there are no Schedule - I animals. The plateau top is not a resting ground for wild animals. The plateau top does not form a part of the migratory route for wild animals. During the last 14 years period no wild animals were seen on the plateau top.

Authenticated List of Flora & Fauna in Core & Buffer Zones

Natural Vegetation / forest type (Core Zone)

Sr. No.	Local Name	Botanical Name
Trees		
1.	Jamun	Tugenia jambolana
2.	Anjan	Memecylon umbellatum
3.	Gela	Randia dumetorum
4.	Waras	Heterophragma quadriloculare
5.	Kumbhi	Careya arborea
6.	Nana	Lagerstroemia lanceolata
7.	Karambu	Olea dioica
8.	Umber	Ficus glomerata
9.	Khair	Acacia catechu
10.	Ritha	Sapindus emarginatus
11.	Rametha	Lasiosiphon ericephalus
12.	Ain	Terminalia tomentosa
13.	Amba	Magnifera indica
14.	Awala	Emblica officinalis
15.	Bahawa	Cassia fistula
16.	Totran	Zizyphus Rugosa
Shrubs		
1.Herbs	Braken fern	Pteris acquirina
2.	Karavi	Strobilanthus callous
Climbers		
1.	Ghotvel	Smilax macrophylla
2.	Alea	Dalbergia volubilis

List of Flora (Buffer Zone)

Sr. No.	Local Name	Botanical Name
Trees		
1.	Jambhul	Eugenia jambolana
2.	Anjan	Memeculon umbellatum
3.	Karambhu	Olea dioica
4.	Pandhari	Murraya exotica
5.	Asani	Bridelia retusa
6.	Hadak	Choroxylon swietenia
7.	Gela	Randia dumetorum
8.	Phansi	Carallia brachiata
9.	Surangi	Orchrocarpus longifolus
10.	Lokhandi	Ixora parviflora
11.	Waras	Heterophragma quadriloculare
12.	Bibi	Holigavna arnottina
13.	Kumbhi	Careya arborea
14.	Nana	Lagerstroemia lanceolata
15.	Ain	Terminalia tomentosa
16.	Kinjal	Terminalia paniculata
17.	Amba	Magnifera indica
18.	Sag	Tectona grandis
19.	Sawar	Bombax malabaricum
20	Tamalpatra	Cinnamomum tamala
Shrubs		
21.	Adulsa	Adhatoda vesica
22.	Brackenfern	Pteris acquilina
23.	Ghagri	Crotolaria retusa
24.	Karwand	Carissa karandas
25.	Karavi	Strobilanthus callosus
26.	Rametha	Lassiosihphon eriocephalus

Climbers		
27.	Alea	Dalbergia volubilis
28.	Ghotvel	Smilax macrophylla
29.	Cane	Calamus sp
Grasses		
30.	Bongarat	Anthistiria ciliata
31.	Bhalekusal	Andropogon triticeus
32.	Gondal	Andropogon triticeus
33.	Sheda	Ischaemum laxum
34.	Chivarkathi	Oxytenanthera stocksii
Medicinal		
35.	Arjun	Terminalia arjuna
36.	Apta	Beuhinia racemosa
37.	Behada	Terminilia bellerica
38.	Charoli	Buchanania lanzan
39.	Kadhinimb	Murraya koenigii
40.	Khair	Acacia catechu
41.	Kokam	Garcinia indica
42.	Nandruk	Ficus microcarpa
43.	Palas	Butea monosperma
44.	Jaiphal	Myristica malabarica
45.	Ritha	Sapindus emarginatus
46.	Umbar	Ficus glomerata
47.	Aghada	Achyanthus aspera
48.	Muradsheng	Helicteres isora
49.	Shikekai	Acacia concinna
50.	Sarpagandha	Rauvolfia serpentina
51.	Bhuikowala	Ipomea digitata
52.	Trifal	Xanthoxylum retusa

List of Fauna (Core Zone)

Sr.No	Common Name	Scientific Name	Included in Schedule of Wildlife Act
I	**Mammals**		
1.	Short nosed Fruit bat	Cynopterus sphnix	V
2.	Stripped squirrel	Funambulaus palmarum	-
3.	Indian Grey Mongoose	Hepestes edwardsi	IV
4.	Blank napped Hare	Lepus nigricolis	IV
5.	Soft Furred Field rat	Millardia mekltada	V
6.	Little Indian Field mouse	Mus booduga	V
7.	Common Langur	Presbytis entellus	II
8.	Wild Boar	Sus scrofa	III
9.	Indian Porcupine	Hytrix indica	IV
10.	Jungle cat	Felis chaus	IV
II	**Reptiles**		
11.	Common Garden Lizard	Calotes versicolor	--
12.	Monitor Lizard	Varanus bengalensis	II
13.	Scorpion	Taurus domesticus	--
14.	Common Rat snake	Ptyas mucosus	II
15.	Saw scaled viper	Echis carinatus	IV
16.	Common green whip snake	Ahoetulla nasatus	IV
17.	Indian Cobra	Naja naja	II
III	**Birds**		
18.	Pariha Kite	Milvus migrans	IV
19.	Crested hawk eagle	Spizaetus Chirrhatus	--
20.	Spotted Owlet	Athene brama	IV
21.	Common Indian Nightar	Caprimulgus asiaticus	IV
22.	Jungle Crow	Corvus macrorhynchos	IV
23.	Indian pitta	Pitta brachyura	IV
24.	Spotted Dove	Streptopelia chinensis	IV
25.	Common Kingfisher	Alcedo athis	IV
26.	Lesser Golden Baked Woodpecker	Dinopium bengalensis	IV
27.	Tailor Bird	Orthotomus sutorius	IV
28.	Grey Jungle peafowl	Gallus sonneratti	IV
29.	Black Bird	Turdus menula	--
30.	Jungle bush quail	Perdicula asiatica	IV
31.	Black Drongo	Dicrurus macrocerus	IV
32.	Lesser Whistling teal	Dendrocygna javanica	IV

List of Fauna (Buffer Zone)

Sr. No	Common Name	Scientific Name	Included in Schedule of Wildlife Act
Mammals			
1.	Sloth bears	Melursus ursinus, Shaw	I
2.	Jackal	Canis aureus, Linnaeus	IV
3.	Hyena	Hyaena hyaena, Linneaus	III
4.	Wild Cat	Relis sylvestris	II
5.	Wild Dog	Cuon alpinus,	II
6.	Indian Bison	Bos gaurus, H.Smith	II
7.	Sambar	Cervus unicolor, Kerr	III
8.	Chital or Spotted Deer	Axis axis, Erxleben	III
9.	Mouse deer	Tragulus meminna, Erxleben	II
10.	Languor	Presbytis entellus, Geoffroy	II
11.	Fox	Vulpes bengalensis, Shaw	II
12.	Indian Hare	Lepus nigricollis, F.Cuvier	IV
13.	Common Flying squirrel	Petaurista petaurista, Pallas	II
14.	Porcupine	Atherurus macrourus, Lannaeus	IV
15.	Wild Boar	Sus scrofa, Linn	III
16.	Indian ratel	Mallivora capensis, Schreber	III
17.	Palm civet/Toddy civet	Parodoxurus hermaphorditus	IV
18.	Leopard/Panther	Panthera pardus	I
19.	Palm squirrel	Funambulus pennati	IV
20.	Large Indian Mongoose	Herpestes edwardsi	IV

Sr. No	Common Name	Scientific Name	Included in Schedule of Wildlife Act
Birds			
21.	Common Indian Nighjar	Caprimulgus asiaticus	IV
22.	Indian peafowl	Pavo cristatus	I
23.	Gray partridge	Perdix perdix	IV
24.	Tailor Bird	Orthotomus sutorius	IV
25.	Common quail	Coturnix coturnix	IV
26.	Lesser Whistling teal	Dendrocygna javanica	IV
27.	Common teal	Anas creca	IV
28.	Green Imperial pigeon	Ducula aenea	IV
29.	Indian Myna	Acridotherus tristris	IV
30.	White breasted Kingfisher	Halcyon smyrensis	IV
31.	Black Drongo	Dicrurus macrocerus	IV
32.	Indian Roller	Coracias benghalensis	IV
33.	Golden Oriole	Oriolus oriolus	IV
34.	Purple sunbird	Nectrarinia Zeylanica	IV
35.	Common Pariah Kite	Milvus migrans	IV
36.	Green Bear Eater	Merops orientalis	IV
37.	Baya, Weaver Bird	Ploceus phillippinus	IV
38.	Spotted dove	Streptopelia senegalensis	IV
39.	Red wattled lapwing	Vanellus indicus	IV
40.	Red vented bulbul	Pycnonotus cafer	IV
41.	Indian Hoopoe	Hoopoe hoopoe	IV
42.	Cuckoo	Cuculus canorus	IV
43.	Crow pheasant	Centropus sinensis	IV
44.	Pond Heron	Ardeola grayii	IV
45.	Cattle egret	Bubulcus ibis	IV
46.	Coppsersmith	Megalaima haemacephala	IV
47.	Indian Gray Hornbill	Ocyceros birostris	IV
48.	Indian Robin	Saxicoloides fulicata	IV
Reptiles			
49.	Indian cobra	Naja naja	II
50.	Scorpion	Taurus domesticus	--
51.	Garden Lizard	Calotes calotes	IV
52.	Monitor Lizard	Varanus bengalensis	II
53.	Rat Snake	Ptyas mucosus	II
54.	Keel back	Oliveceous keelback	II
55.	Russel's Viper	Vipera russelli	II

2. Radhanagari Sanctuary & Threats to Animals

2.1 Introduction

Radhanagari wildlife sanctuary is located in between the areas of the major reservoirs viz. "Shahu Sagar"and "Laxmi sagar" in Kolhapur district. The entire protected area is undulating with steep escarpments. The soil is reddish and lateritic. High percentage of bauxite ore is found in Plateaus or "Sadas".

Radhanagari Sanctuary is located at a distance of about 4 – 5 km from the mining area however, the extended sanctuary area is very much adjacent to the mine lease area.

2.2 Threats

Due to excellent habitat with good water sources and conducive climatic conditions, the wild life in the area is quite rich in diversity and low in status as they face number of threats due to various anthropologic and other biotic and abiotic causes.

Forest Fire

Forest fire in late winter and in summer is of great threat to the wild life. This, not only destroys ground vegetation, but as well as many small & ground dwelling animals and birds, their young ones and eggs also gets burnt and destroyed. Such fire is caused by negligence and aberrant behavior of the people who carelessly throw the lighted bidis /cigarettes, matchsticks in the forest/sanctuary area. This causes shortage of ground vegetation on which most of the herbivorous animals are dependent for their sustenance.

4

BASE MAP OF THE STUDY AREA

LEGEND

- MINE LEASE
- ULTIMATE PIT LIMIT
- MINERALIZED ZONE
- NALLAH
- RIVER
- RESERVIORS
- RESERVED FOREST
- AGRICULTURAL LAND
- ORIGINAL WILD LIFE SANCTUARY
- SETTLEMENTS
- 10KM RADIUS

0 1 2 3 4 5KM

PROJECT : DURGAMANWADI BAUXITE MINES

CLIENT : M/s HINDALCO INDUSTRIES LTD.,

TITLE : BASE MAP OF THE STUDY AREA

PREPARED BY

M/s BHAGAVATHI ANA LABS LTD.,

HYDERABAD

Noise, Lighting & Atmospheric Pollution

The mining activities cause disturbances to the wild life in the area by way of noise & atmospheric pollution. Movement of heavy vehicles and earthmoving machines for extensive mining activity disturbs the natural habitat of the biotic life. This creates problem for the wild life particularly during the night-time.

Water Scarcity

Even though the area has heavy rainfall, the streams get dried up during summers leading to water scarcity in the area. This poses a problem to the sustenance of small & dwelling animals in the area.

Roads

Most of the pervasive threats to biological diversity involve roads (World Bank 1997). Review of the published literature reveals that the impacts of roads on wildlife can be broadly grouped into the following six categories.

- Habitat Fragmentation & Modification
- Restriction of Animal Movements
- Injury & Mortality of Wildlife Species
- Soil Erosion & Hydrological Alterations
- Environmental Contamination
- Human Colonization-induced Disturbances

1. Opening of a road through a forest area may induce micro-climatic changes, thereby bringing about modification in the ecosystem. Animals move to forage, find mates, seek shelter, reach breeding sites and participate in social interactions. These movements occur

on a variety of spatial scales ranging from less than a meter to hundreds of kilometers.

2. Three components of a road that can act as barriers to the movements of terrestrial animals are

   - Bare Road Surfaces
   - Altered Roadside Habitats (deep ditches & fences)
   - The broad band emissions and disturbances (noise, dust, headlight illumination and airborne pollutants in the soil

3. A significant number of animals are injured or killed by the passing vehicles.

4. Runoffs from the mining areas especially during monsoons may cause significant problems to both animal & plant life.

3. Management Plans

The Environment Management Plan submitted to the Ministry of Environment & Forests (MoEF), lays down number of safety measures to maintain proper environment despite the mining and other ancillary activities. Their implementation will accordingly benefit the wild life living in the area. They shall be monitored and controlled by the appropriate authority like the State Pollution Control Board, Ministry of Environment & Forests, Indian Bureau of Mines, Department of Mining and Geology and Forest Department of the State.

3.1 Habitat Improvement

Maintaining the quality of present habitat and wherever it is degraded to improve the same is the top most priority for conservation and management of wildlife in order to maintain and improve their status. Habitat should not only mean the habitat of flagship species, it should also mean the habitat of smaller lesser known and lesser seen wildlife including vegetation which are part of the food circle. Hence, all the elements of a good habitat had to be maintained in the area. The following steps needed to be taken for habitat conservation and restoration wherever necessary.

3.2 Prevention of Forest Fire

Forest fire, which is an annual feature, is detrimental to any habitat, need to be arrested. For this purpose suitable fire lines have to be cleared along permanent lines like footpath, nallahs, extraction paths, ridges and boundary of active mines etc. to a width of 15 mts and to a width of 30 mts on the boundary line of Reserve Forest should be properly demarcated before the fire line is cleared. Before the fire season

commences, every year 4 fire watchers have to be maintained at vantage points or watch towers for having full view of the entire area to alert the work force to immediately spring into action to extinguish the fire. For this purpose they should be equipped with necessary gadgets like rakes, billhooks, brooms, buckets etc, for bringing fire under control without loss of time.

They can either extinguish the fire or start counter fire from a fire line to stop spread of fire. As an annual feature, a controlled burning of the fire line is to be taken up under proper supervision in the month of December or January to clear the line of any inflammable material.

In order to keep the fire fighting squad in readiness, it is necessary to organize a drill with the forest staff and the mine-workers so that they can go into action immediately wherever fire occurs. A group of 10 regular mining workers in each shift can be earmarked to help the forest staff to extinguish the fire, whenever they are reported, as it become difficult to control by the forest staff only. They should be so picked up that their short absence should not affect vital mining work.

3.3 Water

The core zone mainly consists of flat stony wasteland. There is no perennial source of water on the plateau. On the slopes of the plateau large number of seasonal nallahs are originating which dries up during peak summers. The animal life within the buffer area suffers with acute water scarcity during the peak summer seasons. This can be properly handled by harvesting the rainwater during monsoon and their proper utilization during the needy periods. Water holes of suitable sizes should be developed in vallies for making water available for different animals in the area. Mined out areas can also be used as water sources for the animals with suitable treatment to prevent seepage.

3.4 Roads

Roads shall be properly used. The management has decided to ply the vehicles away from the sanctuary thereby minimizing the adverse impacts envisaged by transportation vehicles.

- Vehicles will be maintained regularly to avoid noise
- Greenbelt to be maintained to attenuate the noise levels
- Avoiding vehicular traffic during nights
- The management decided to avoid the bauxite mining activities during the breeding season of most of the animals (i.e monsoon season)

3.5 Fencing the Mine Pits

The safety zone area shall be maintained. The mine will be properly fenced by appropriate methods to prevent accidental fall of any animal. For this purpose rubble wall fencing shall be quite useful and cost effective.

3.6 Stage wise Land Use Pattern & Reclamation (Ha.)

S.NO.	LANDUSE CATEGORY		PRESENT	5TH YEAR	10TH YEAR	12TH YEAR	TOTAL
1	Top soil dump		-	-	-	-	-
2	Waste dumps (external)		-	-	-	-	-
3	Excavation (voids only)		37.84	42.26	47.89	48.70	48.70
4	Road		3.00	3.00	3.00	3.00	3.00
5	Built up area		0.67	0.67	0.67	0.67	0.67
6	Afforestation	Backfilled Area	(10.18)	(16.00)	(22.00)	(28.50)	(28.50)
		Vacant Area	(70.00)	(80.00)	(90.00)	(90.00)	(90.00)
7	Reclamation (backfilled)		15.18	21.56	26.50	31.50	31.50
8	Undisturbed area	Vacant land	147.87	137.07	126.50	120.69	120.69
	Total		**204.56**	**204.56**	**204.56**	**204.56**	**204.56**

3.7 Conceptual Land Use Pattern - Environmental Management

S.No	Land use	Plantation	Water Body	Public Use	Un Disturbed	Total
1	Top soil dump	-	-	-	-	-
2	Waste dumps (external)	-	-	-	-	-
3	Excavation (voids only)	31.50	48.70	-	-	80.2
4	Road	-	-	3.00	-	3.00
5	Built up area	-	-	0.67	-	0.67
6	Afforestation	90.00	-	-	-	90.00
7	Undisturbed area	-	-	-	30.69	30.69
	Total	121.50	48.70	3.67	30.69	204.56

ECOLOGY: STAGE WISE CUMULATIVE PLANTATION

Requirement of Plants for Afforestation / Reclamation

Year	Un-worked Green belt		Out side Dumps		Inside Dumps		Top soil Dumps		Total	
	Area (ha)	Trees	Area (ha)	Trees	Area (ha)	Trees	Area (ha)	Trees	Area (ha)	Trees
Up to 2005-06	70.00	175000	-	-	10.18	25450	-	-	80.18	200450
2006-07	2.00	5000	-	-	1.82	4550	-	-	3.82	9770
2007-08	2.00	5000	-	-	1.00	2500	-	-	3.00	7500
2008-09	2.00	5000	-	-	1.00	2500	-	-	3.00	7500
2009-10	2.00	5000	-	-	1.00	2500	-	-	3.00	7500
2010-11	2.00	5000	-	-	1.00	2500	-	-	3.00	7500
2011-12	2.00	5000	-	-	1.20	3000	-	-	3.20	8000
2012-13	2.00	5000	-	-	1.20	3000	-	-	3.20	8000
2013-14	2.00	5000	-	-	1.20	3000	-	-	3.20	8000
2014-15	2.00	5000	-	-	1.20	3000	-	-	3.20	8000
2015-16	2.00	5000	-	-	1.20	3000	-	-	3.20	8000
2016-17	-	-	-	-	3.50	8750	-	-	3.50	8750
2017-18	-	-	-	-	3.00	7500	-	-	3.00	7500
Post Mining	-	-	-	-	3.00	7500	-	-	3.00	7500
Total	**90.00**	**225000**	**-**	**-**	**31.50**	**78750**	**-**	**-**	**121.50**	**303750**

4. Minimizing Impacts of Active Mining

Salient Features of Mining & Environmental Protection at Durgmanwadi Bauxite Mines

- ***Mining Activities are limited to daytime only***
- ***There are no blasting operations***
- ***Mining activity at-a-time is limited to a small area (approximately 5 Ha. Only)***
- ***Mobile crusher with in-built dust suppression system is used for effective dust suppression***
- ***Simultaneous backfilling and rehabilitation works are carried out***
- ***Atomized Dust Suppression System is adopted for effective dust suppression at haul roads***
- ***Plantation is carried out with the help of experts from various institutions like Dapoli Agricultural University, Maharashtra & Karnataka State Forest Departments and Bharatiya Agro Industries Foundation (BAIF) etc***
- ***Environmental Education & Awareness Campaigns are conducted on a periodic basis etc***

4.1 Blasting

As the blasting operations cause lot of disturbance to the animals, the management has adopted eco-friendly operations. For breaking of overburden and bauxite, drilling and blasting are not carried out in mines. For breaking of rock, high capacity riper dozers have been deployed. This has reduced the problem of noise and ground vibration due to blasting.

Hence, the impact on habitat disturbance of the animals is minimized.

4.2 Lighting

Lighting creates lot of problem and stress for animals. This should be kept at the minimum within the forest/sanctuary area and wherever possible should be avoided. In order to comply with this requirement M/s HINDALCO Industries Limited at Durgmanwadi Bauxite Mines has confined its mining operations to day time only and no work is carried out during the night-times

4.3 Noise (vehicles, Earthmovers and Machines)

All vehicles and machineries are regularly checked and maintained for ensuring minimum possible noise level.

4.4 Dust pollution

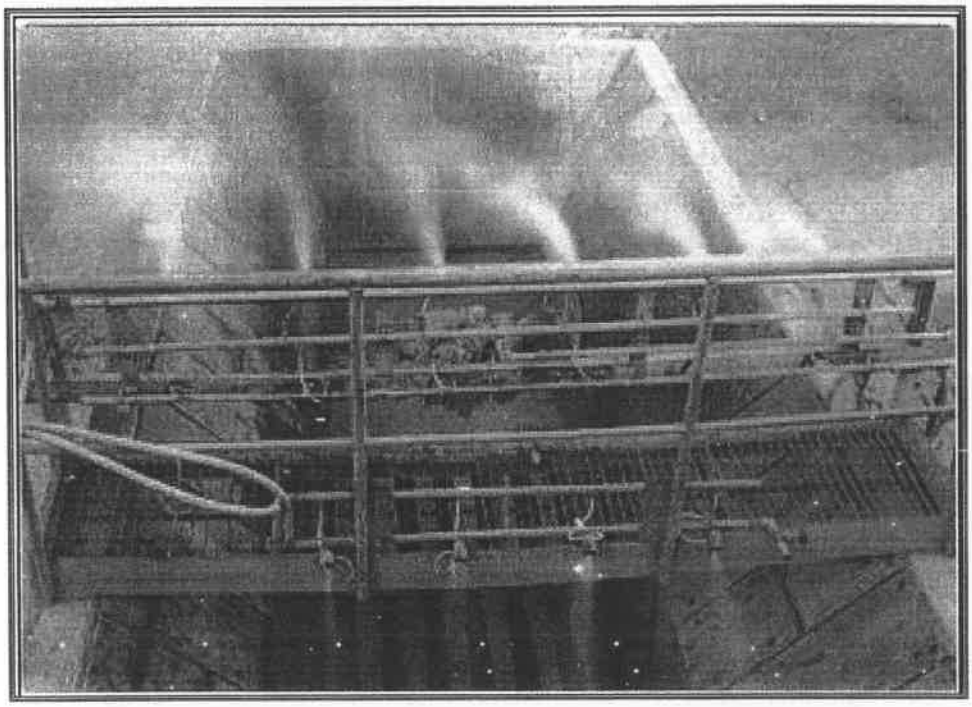
While all the provisions of Mining plan (approved by IBM), Environment Management Plan and Reclamation plan are rigidly followed, the dust levels have been kept under the permissible limits by spraying water and other dust suppression measures are monitored regularly.

Mitigation Measures

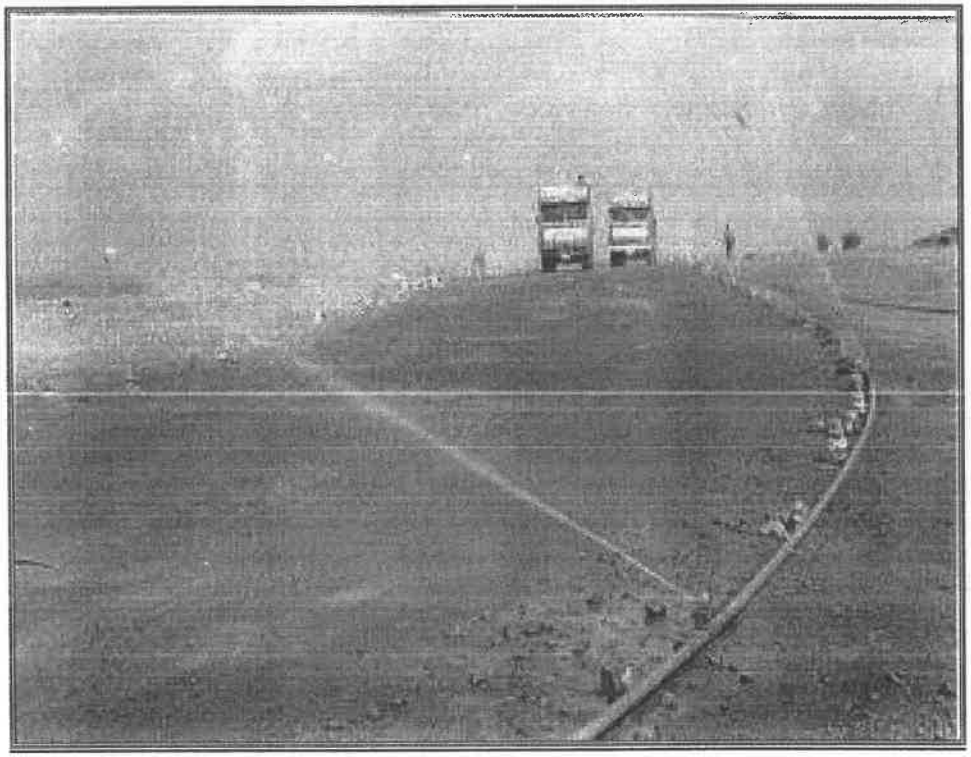
- In order to minimize the dust emanating from the various sources water is sprinkled regularly at the mine pits and also on the haulage roads in order to suppress the dust
- Transport vehicles are maintained regularly in order to minimize the emissions from them
- Plantation is carried out which acts as pollution sink

Dust Control At Source : Wetting (after Ripping)

Dust Suppression at Crushing



Atomized Dust Suppression on Haul Roads



4.5 Water Pollution

Canteen wastewater to a tune of 3.5-m3/ day is generated which is allowed to flow through the vermin-filter. The vermin-filter is based on the principle that the earthworms and bacteria aerobically process the organic matter and convert into humus rich bio-fertilizer. Water flowing from this filter is periodically tested. This water is used in the nursery.

The chemical analysis of bauxite and waste rock do not show any toxic substances, which can pollute the water. During rainy season, rainwater from the pit is collected through the garland drains into the settling tank and then flows through series of check dams. Water flowing through the check dam further undergoes self-purification before confluencing any river. Thus, the natural streams are kept free from any suspended particulate matter entering their course.

4.6 Reclamation

The rehabilitation of mined land can largely be considered as ecosystem reconstruction and re-establishment of the land 's ability to capture and retain fundamental resources. In rehabilitation planning, it is imperative that goals, objectives and success criteria are clearly established so that the task can be undertaken in a systematic way, while realizing that these may require some modification later. Biodiversity gains are a realistic objective within rehabilitation planning models.

Mining works is undertaken in a workmanship manner without exposing large area to mining operation at a time and keeping the approach routes limited to essential requirement. Reclamation of mined out areas is taken up immediately as soon as the mining is completed in the area.

4.7 Improvement of Water Availability for Animals

Sometimes due to want of water for drinking and bath, animals stray out and there will be a confrontation with the people. Suitable water bodies (game tanks) shall be developed in the area by seeking guidance from local forest officials. This will also partly prevent transmission of communicable diseases from other animals.

4.8 Awareness Programme

Awareness programme shall be conducted on continues basis to protect the flora and fauna in the region. The mine workers and as well as the nearby villagers shall be made aware of the conservation and protection of trees and animals. All ways & means have been taken to preserve, conserve and protect the flora and fauna of the region.

The protective measures undertaken by Durgmanwadi Bauxite Mines have been illustrated in detail.

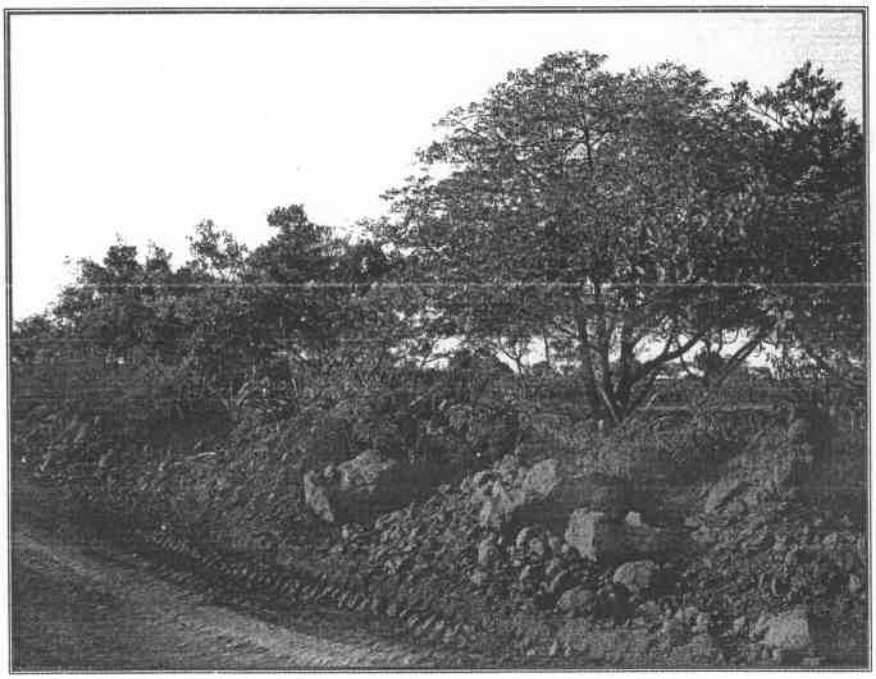
Protective Measure Undertaken by M/s HINDALCO Industries Limited at Durgmanwadi Bauxite Mines

Air Quality Management

Mitigative measures suggested for air pollution control are based on the baseline ambient air quality monitoring data. From the point of view of maintenance of an acceptable ambient air quality in the region, it is desirable that air quality should be monitored on a regular basis to check it vis-à-vis the standards prescribed by CPCB and in cases of non-compliance, appropriate mitigative measures shall be adopted.

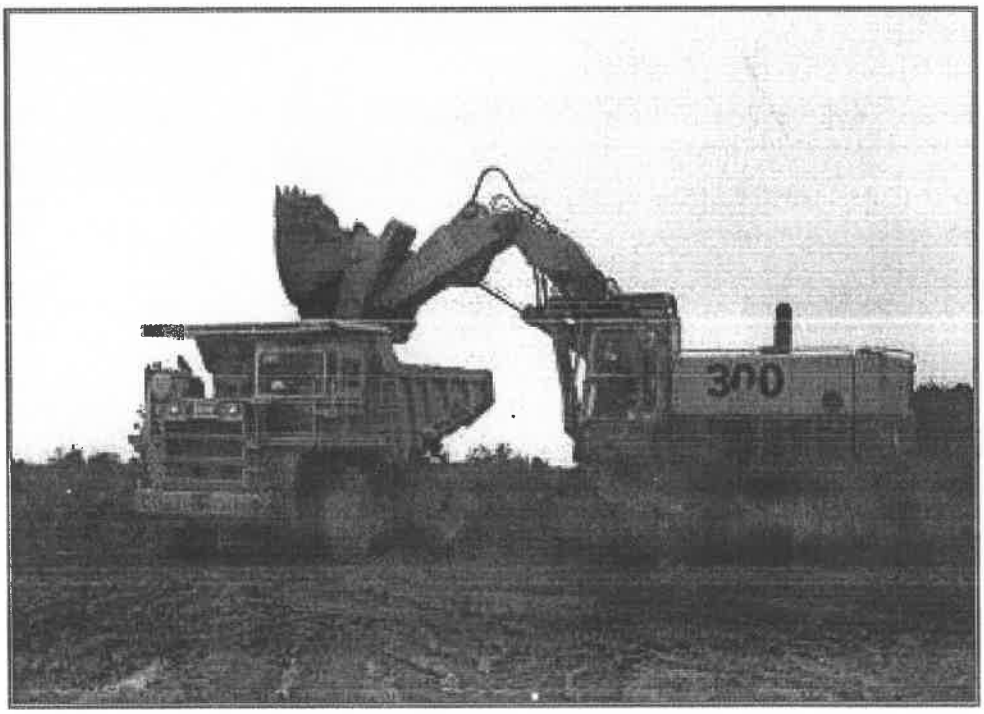
- Regular water sprinkling on the haulage roads through atomized dust suppression system for effective dust suppression
- Proper maintenance of transport vehicles
- Planned afforestation to act as pollution sink etc

Road Side Plantation

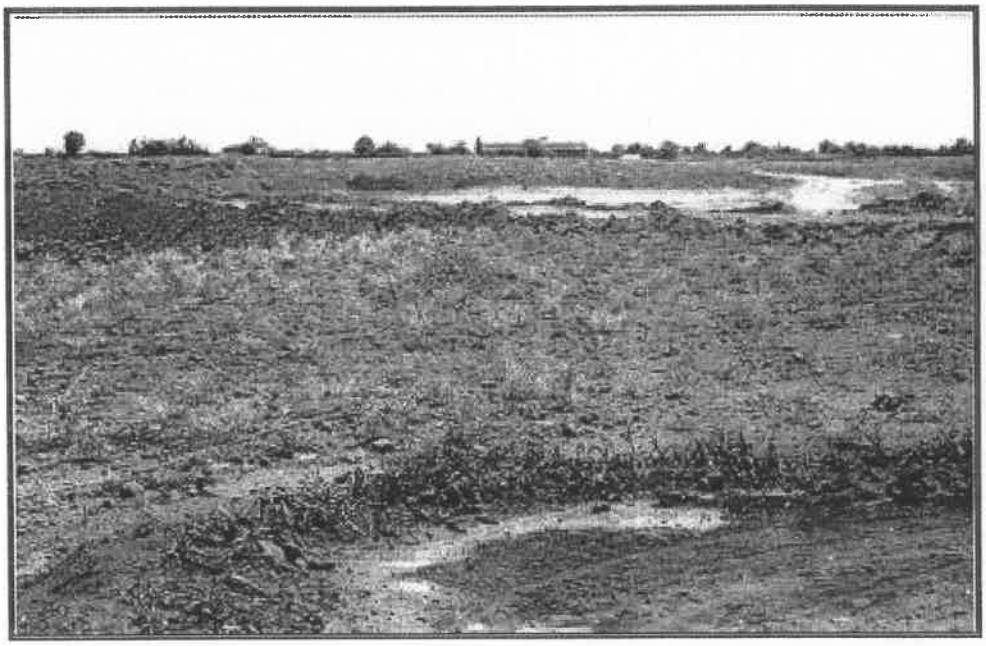


Mobile Crusher with in-built Dust Suppression System to Minimize the Dust Levels

Backfilling Operations



Simultaneous Rehabilitation of Mined Out Area



Noise Quality Management

- Selection of suitable machinery and equipment, proper mounting of equipment, providing noise insulation/padding wherever practicable and machinery fitted with properly designed silencers.
- Proper maintenance of noise generating parts of the machine.
- Thick plantation in and around the mine.
- Proper gradient of haul roads to reduce cumulative noise levels.

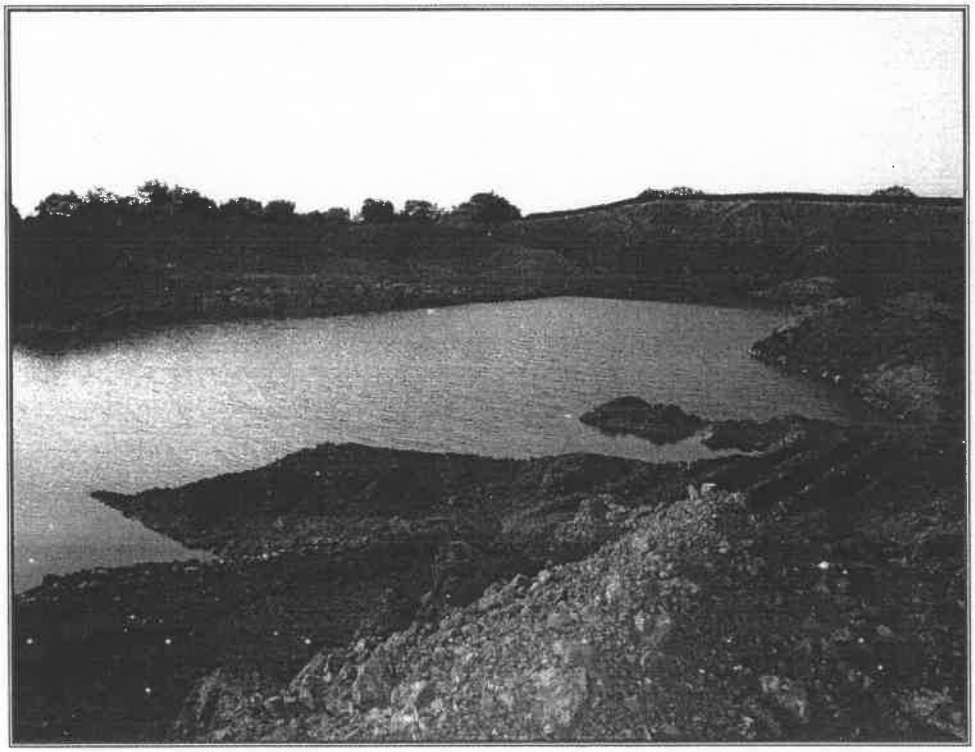
Water Management

The major cause of concern is the silt and the fine suspended particulate matter carried by the run-off water from the mining area during the monsoon. It may cause siltation of surface water sources in the buffer zone. Following measures are proposed as part of the ecology management plan to check the pollution of surface water bodies due to mining.

- At the foot of the temporary rejection dumps, arrestors and short trenches will be provided to check soil wash off during monsoons.
- Run-off from the mining area will be passed through a series of arrestor dams with filter beds to allow settling of solid particles.
- Contour bunding and trenches are proposed during monsoon to minimize soil erosion.
- Water quality monitoring shall be carried out regularly

Apart from the above measures, M/s HINDALCO Industries Limited at Durgmanwadi Bauxite Mines is harvesting rainwater in order to meet the water requirements for various purposes during summer periods.

Rainwater Harvesting



Plantation / Afforestation Programme

Based on the ecological needs the afforestation is mainly aimed at

- Protection & Development of Natural Vegetation
- Protection of soil erosion
- Plantations of fuel wood blocks to meet the energy requirements

Intensive plantation of commercial value plants (medicinal) & fruit bearing plants will be taken up in all vacant places and on backfilled areas. For this purpose Durgmanwadi Bauxite Mines has involved institutions like Dapoli Agicultural University, Maharashtra & Karnataka State Forest Departments and Bharatiya Agro Industries Foundation (BAIF) for their expertise in the field. Apart from the block plantation,

plantation will be carried out on the feeder roadside and also existing afforestation will be strengthened by casualty replacement.

Environmental Monitoring

The mine management has undertaken the Environmental studies on continual basis as per the standards laid down by MOEF & SPCB for monitoring quality of Air, Water, Noise & Soil in coordination with the Maharashtra State Pollution Control Board and Forest Department.

Environmental Education

At Durgmanwadi Bauxite Mine it is a regular practice to provide Environmental Education to their mineworkers and to the nearby villagers in order to provide comprehensive environmental protection.

The management has also undertaken environmental awareness campaigns in the school children in order to inculcate the importance of environment protection for future well being in the younger minds.

Environmental Education

Monitoring Mechanism

The entire operation as per this plan shall be monitored by the District Forest Offices, Kolhapur Division who will be guiding M/s. HINDALCO Industries Limited and suggest & advise on proper implementation of the plan including minor course correction as and when needed. He will also be in a position to monitor the movement in the lease area and outside the leasehold area. In other lease hold areas outside the preview of this plan the Forest Department may be able to ensure that safety of wild animals with the support of the lessee and their own field staff and local people.

Budget Provided by Durgmanwadi Bauxite Mines towards Environmental Protection

Cost of Environmental Protection Measures in Rs lakhs					
S. No.		Capital cost		Annual recurring cost	
		Existing	Proposed	Existing	Proposed
1	Pollution Control Atomised Dust Suppression Syatem Garland Drains Settling Tanks Silt Check Dams Parapet Walls	 21.00 30.00 12.00 9.75 6.40	-	 3.20 0.10 0.10 0.10 0.10	 3.20 0.10 0.10 0.10 0.10
2	Pollution Monitoring Water testing kit Environmental monitoring	 2.55 6.95	-	 2.00	 2.50
3	Occupational Health	3.00	-	0.75	1.00
4	Green Belt • Mine • Township)	 - -	 - -	 2.50 -	 2.50 -
5	Reclamation / Rehabilitation of mined out area	-	-	10.00	10.00
6	Others (specify)	Nil	Nil	Nil	Nil
Total		**91.65**	**-**	**18.85**	**19.60**

Apart from this the management of Durgmanwadi Bauxite Mines has also provided budget for various Ecology Protection & Development Activities and shall be used in consultation & guidance from the State Forest Department

Purpose		Amount (Rs.)
Fire Line Cleaning / Clearing	-	50,000.00
Fire Watchers	-	1,00,000.00
Ecological Education & Awareness	-	50,000.00
Total		**2,00,000.00**

Environmental Management Action Plan (EMAP)

Environmental Impacts	Mitigation Measures (taken / to be taken)	Location	Time Frame	Implementing Organization / Supervision	Capital Cost (Rs. Lakhs)	Operational Cost (Rs. Lakhs)
Air	Roads are maintained regularly Mining Activity is limited to a relatively small area Mobile Crushers with in-built dust suppression system are used Regular water sprinkling at mining area Atomized water sprinklers are used at haulage roads Road side tree plantation is carried out	Mine Area Haulage Roads	Right from the inception Phase it is maintained	Environment Management Cell of Durgmanwadi Bauxite Mines	21.00	3.20
Noise	Conventional Method of Drilling & Blasting for mining is not adopted Eco-friendly Ripping-dozing (2 Nos of ripper-dozer) method is adopted Noise generating machinery are properly maintained Vehicle are maintained on regular basis Dense Plantation is carried out along the boundary to minimize the noise levels	Mine Area Haulage Roads	Right from the inception Phase it is maintained	Environment Management Cell of Durgmanwadi Bauxite Mines	702.00	-
Dumps	Simultaneous Backfilling & rehabilitation of mined out area is carried out in this mines.	Mine Areas	Right from the inception Phase it is maintained	Environment Management Cell of Durgmanwadi Bauxite Mines	-	10.00

Environmental Impacts	Mitigation Measures (taken / to be taken)	Location	Time Frame	Implementing Organization / Supervision	Capital Cost	Operational Cost
Water	There is no industrial wastewater generation. Canteen waste water is passed through the vermi-filters where the earthworms & bacteria aerobically process the organic matter and convert it into humus rich bio-filter and the water is used for nursery development Garland Drains, Settling Tanks & Series of Check dams have been provided to avoid any contamination to natural water course The drainage system is periodically cleared before onset of monsoon so as to ensure adequate & clear storm water flow	Canteen Area Mine Area Drainage channels	Right from the inception Phase it is maintained	Environment Management Cell of Durgmanwadi Bauxite Mines	58.15	2.90
Flora & Fauna	Afforestation is carried out along the periphery, on backfilled areas, along the haulage road etc. Mining activity is limited to day-time to avoid any noise / light related stress to fauna of the region Water pits shall be provided Bauxite Mining & Transportational activity is suspended during monsoon.	Mine Lease Area, Road Side	Right from the inception Phase it is maintained	Environment Management Cell of Durgmanwadi Bauxite Mines & Forest Officials	-	2.50