ANNEXURE-VI

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MINING PLAN

Submitted under
Rule 16(1) of Minerals (other than Atomic and Hydrocarbons Energy Minerals) Concession Rules 2016 and
PROGRESSIVE MINE CLOSURE PLAN
under Rule 23 of MCDR 2017
for Approval
For

Pottangi Bauxite Mine

Pottangi village, Pottangi tehsil, Koraput dist, Odisha
Of

नालको NALCO

A Navratna Company

NATIONAL ALUMINIUM COMPANY LIMITED

NALCO Bhawan, P/1, Nayapalli, Bhubaneswar-751013, India
Phone: 0674-2301988, 2301999 Fax : 0674-2300521/2300580
Email: sanjay.patel@nalcoindia.co.in

Area of Mining Lease: 697.979 ha
Type of land: Jungle Block Forest

Lease period:
50 years (as per MMDR Amendment Act 2015)
Govt, Open cast, Category-A (Fully Mechanized), Captive

VOLUME-I

TEXT & ANNEXURES

Prepared by

SRIPAD PUJAR
Qualified Person
9448366964

B.V.R. ACHAR
Qualified Person
9448469407

SUJIT Kr MOHANTY
Qualified Person
9765565528

July-2018

गौतम दास/Goutam Das
उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
परियोजना-खाना/Project-Mines Division
नेशनल एल्यूमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd
भुवनेश्वर/ Bhubaneswar-751013

Divisional Forest Officer
Koraput Forest Division

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उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
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National Aluminium Company Ltd.
भुवनेश्वर/ Bhubaneswar-751013

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उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
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National Aluminium Company Ltd
भुवनेश्वर/ Bhubaneswar-751013

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Koraput Forest Division

Table – 28: Pre-Feasibility Mineral Resources (221)- Central Block

Sections	Area sqm	Influ m	Vol cum	TF t/cum	Quantity tonnes
CA-CA'	62	100	6200	1.93	11966
CB-CB'	135	100	13500	1.93	26055
CG-CG'	74	100	7400	1.93	14282
CH-CH'	158	100	15800	1.93	30494
CI-CI'	278	100	27800	1.93	53654
CJ-CJ'	184	100	18400	1.93	35512
CK-CK'	379	100	37900	1.93	73147
CR-CR'	102	100	10200	1.93	19686
CU-CU'	50	100	5000	1.93	9650
CV-CV'	73	100	7300	1.93	14089
CW-CW'	110	100	11000	1.93	21230
TOTAL					309,765

I) **Mineral Reserves / Resources:**

Mineral Resources: (Mineral resources may be estimated purely based on level of exploration, with reference to the threshold value of minerals declared by IBM).

Table-29: Reserves/resources estimated as on 01.07.2018

Level of Exploration	Resources of Bauxite in million tonnes	Grade
G1 - Detailed exploration	38.890	45.59% Al_2O_3 1.99% SiO_2
G2 - General Exploration	2.045	45.24% Al_2O_3 2.61% SiO_2
G3 – Prospecting	--	
G4- Reconnaissance	--	

Reserves and resources are arrived after applying results of feasibility and economic evaluation of the deposit based on the various factors such as:

a) Open cast mining method, 100% recovery factor for Bauxite as the average grade of bauxite in the ore zone is about 45.6% Al_2O_3 which is way more than threshold value and total excavation of ore zone will be used as ROM.

b) Cutoff grade of +30% Al_2O_3 and Total Silica 7% max, ultimate pit depth

c) Mineral blocked in Safety zone of 7.5m width along the lease boundary

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गौतम दास/Goutam Das
उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
परियोजना-खान/Project-Mines Division
नेशनल एल्यूमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd
भुवनेश्वर/ Bhubaneswar-751013

Divisional Forest Officer
Koraput Forest Division

MINING PLAN

and

PROGRESSIVE MINE CLOSURE PLAN

For

Pottangi Bauxite Mine

Pottangi village, Pottangi tehsil, Koraput dist, Odisha

SUMMARY OF PROPOSALS AT A GLANCE

Proposal	Years					Remarks
	I	II	III	IV	V	
	Exploration					
No. of Boreholes (Core) &meterage	9 nos. 450mtrs	10nos. 500mtrs	67nos. 3350mtrs	74nos. 3700mtrs	116nos. 5800mtrs	All vertical holes
	Excavation					
Top Soil (cum)	76,800	90,890	43,070	24,900	31,900	Mining proposed in south block
Waste (cum)	88,700	127,920	117,420	144,510	192,500	
ROM (Tonnes)	2,839,995	3,150,532	3,500,055	3,500,055	3,500,055	
	Area Utilisation					
Area under Mining (Ha)	16.12 ha	26.70 ha	34.40 ha	21.64 ha	25.0 ha	In south block
Waste dumping(Ha)	2.44	2.41	2.02	18.54	2.79	Temporary stacking for first 3 yrs. Backfilling in 4th & 5th year (waste overlaid with toposoil)
Area under Top Soil stack (Ha)	1.40	1.37	2.11			
	Stacking					
Top Soil (tons)	115,200	136,335	64,605	37,350	47,850	Temporary stacking for first 3 yrs. Backfilling in 4th & 5th year
Waste (tons)	159,660	230,256	211,356	260,118	346,500	
	Environmental Protective Measures					
	Plantation over waste dump (Back filled area)					
Numbers	-	-	-	14050	32300	Plantation of saplings at 2m x2m interval
Area (Ha)	-	-	-	5.62	12.92	
	Construction of:					
Check dams(nos.)	4	3	-	-	-	All the structures will be constructed in first year itself.
RetainingWall(m)	799m (2nos.)	-	-	-	-	
Garland drain(m)	3277m (3 nos.)	-	-	-	-	
Plantation	5.76 (14400 nos.)	9.07 (14400 nos.)	8.57 (14400 nos.)	-	-	Green belt area will be planted

गौतम दास/Goutam Das 16.7.18
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नेशनल एल्युमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd
भुवनेश्वर/Bhubaneswar-751013

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INTRODUCTORY NOTE:

National Aluminium Company Limited (NALCO) is a Navaratna Public Sector Undertaking under Ministry of Mines, Govt of India, with its registered office at Bhubaneswar, Odisha. It has multi-location operations as follows:

- Mines and Alumina Refinery, Damanjodi, Odisha
- Aluminium Smelter & Captive Power Plant, Angul, Odisha
- Port Handling Facilities, Visakhapatnam, Andhra Pradesh (for alumina export and caustic soda import)

The Mines and Alumina Refinery is one of the largest integrated Bauxite-Alumina-Aluminium-Power Complex in the Country. The Company has a 2.275 MTPA Alumina Refinery along with a 6.825 MTPA Bauxite Mine (Panchpatmalli) located near Damanjodi in Koraput dist. of Odisha.

NALCO has today emerged as the largest manufacturer and exporter of Alumina and Aluminium in the country. NALCO for its superior technology, skilled & dedicated manpower is in profit track since commencement of its commercial operation since 1986-87. Because of growth potentiality and substantial sustained contribution to National Exchequer, NALCO has been conferred with 'Navaratna' status since May 2008.

अनुमोदित
APPROVED
27/07/18
क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIAN BUREAU OF MINES
भुवनेश्वर/BHUBANESWAR

NALCO is registered as the first Indian Company ... Exchange. The company has also received ISO 9001, ISO 14001, OHSAS 18001 and SA 8001 certification for all its units viz. Mine, Alumina Refinery, Aluminium Smelter and Power Plant. The Company has various prestigious awards for excellence in Production, Safety and Environment Management.

NALCO is expanding its Alumina refinery capacity by proposing 5th stream of the alumina refinery at Damanjodi for additional production of one million tons per annum (MTPA) of alumina.

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परियोजना-खान/Project-Mines Divi...
नेशनल एल्यूमिनियम कंपनी लि
National Aluminium Company
भुवनेश्वर/ Bhubaneswar-751...

Divisional Forest Officer
Koraput Forest Division

To cater the raw material requirement of this project, the Pottangi bauxite deposit near Pottangi village of Koraput district, Odisha has been identified by NALCO for mining lease.

Pottangi Bauxite deposit in Koraput district, Odisha, was discovered by the Geological Survey of India (GSI) in Nov-1971. Exploration of the deposit was conducted by GSI between the years 1972 and 1976. Altogether 69 core boreholes with a meterage of 1929.39m were drilled. Later during 1976-78, the South and Central blocks of Pottangi was explored by MECL in two phases by drilling 195 core boreholes with a total meterage of 5888.50m. These exploration data were used to estimate the reserves of bauxite. The details are given in Part A, Sec -1, Geology & Exploration.

NALCO has applied for grant of a Mining Lease over an area of 1738.04 ha for Bauxite mining in village Pottangi of Koraput district. Govt of Odisha has granted the lease in favour of NALCO and issued a letter of Terms and Conditions vide letter no.5734/SM dated 12.07.2016 (Annexure-2). However, NALCO requested the Govt for reduction of the lease area to 697.979ha and accordingly, Govt of Odisha has issued fresh LOI for the reduced area in supersession of its easlier letter. A copy of fresh LOI issued on 14.05.2018 for the area of 697.979 ha is enclosed as Annexure-1.

As per the condition no. 42 of the above said letter, the lease will be granted for a period of 50 years subject to submission of duly approved Mining Plan within a period of six months from the issue of this letter.

Hence, this Mining Plan has been prepared for 697.979 ha area and submitted under Rule 16(1) of Minerals (other than Atomic and Hydrocarbons Energy Minerals) Concession Rules 2016 along with Progressive Mine Closure Plan under Rule 23 of MCDR 2017 for approval.

गौतम दास/Goutam Das
उप महाप्रबंधक (विद्युत)/...Elect.)
परियोजना-खाना/Project-Mines Division
नेशनल एल्यूमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd.
भुवनेश्वर/ Bhubaneswar-751013

Status of statutory clearances obtained / to be obtained are tabulated below:

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Table-1

Sl.No.	LEASE STATUS
1.	Govt of Odisha has granted the lease in favour of NALCO for a period of 50 years and issued a fresh letter of Terms and Conditions governing the grant of mining lease vide letter no. 3794/SM dated 14.05.2018. (Annexure-1).
	MINING PLAN
2.	The Mining Plan of Pottangi Bauxite Mine has been prepred for 697.979 ha area and submitted under Rule 16 (1) of Minerals (other than Atomic and Hydrocarbons Energy Minerals) Concession Rules 2016 along with Progressive Mine Closure Plan under Rule 23 of MCDR 2017 for approval.
	FOREST DIVERSION PROPOSAL
3.	Forest diversion clearance will be obtained by NALCO for the retained area (697.979 ha) from MOEF & CC, Govt. of India
	ENVIORNMENT CLEARANCE
4.	Environment clearance will be obtained by NALCO for the retained area (697.979 ha) from MOEF & CC, Govt. of India to produce 3.50 MTPA of Bauxite
	CTE / CTO from State PCB
5.	CTE and CTO will be obtained by NALCO for the retained area (697.979 ha) from State PCB to produce 3.50 MTPA of Bauxite

The details of other mining leases (Panchpatmalli Bauxite Mine) held by NALCO for Bauxite mining in Koraput district, Odisha are as follows:

Table-2

Mining Lease	Date of Registration	Status	Annual Production	Lease No.	Lease Period	ML area (Ha)
Central & North Block	17.11.1982 (in favour of BALCO)	Working	6.825 MT	3889	30 Years and further extended till 16.11.2032	1315.264
	18.03.1983 (Transferred to NALCO)			1128		
South Block	20.07.1979 (in favour of BALCO)	Under use for road and conveyer corridor	3.15 MT	2136	30 Years and further extended till 31.03.2020	528.262
	03.07.1982 (Transferred to NALCO)			2228		

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उप महाप्रबंधक (विद्युत)/D.G.M. (Elect
परियोजना-खान/Project-Mines Divisio
नेशनल एल्यूमिनियम कम्पनी लिमि
National Aluminium Co. Ltd.
भुवनेश्वर/ Bhubaneswar-75

QP: Srinad Pujar, BVR Achar & Sujit Kumar Mohanty

Divisional Forest Officer
Koraput Forest Division

1.0 GENERAL

a) Table -3:

Name of lessee	M/s National Aluminium Company Limited (NALCO) *POA:* Sri Sanjay Krishna Patel General Manager (Tech). NALCO
Mine code and	Not yet allotted
Rule 45 registration no.	070RI09001
Address	NALCO Bhawan, P/1, Nayapalli, Bhubaneswar-751013, India Phone: 0674-2301988, 2301999 Fax : 0674-2300521/2300580
District	Khordha (Khurda)
State	Odisha
Pin code	751013
Phone	0674-2300633
Fax	0674-2301200
Mobile	094370 29513
E-mail id	sanjay.patel@nalcoindia.co.in

b) **Status of applicant/lessee:**

Listed Public Limited Company *(A Govt of India Enterprise, under Ministry of Mines)*

(Copy of Registration of Company is given in Annexure-3, Annexure-4 shows List of Directors. Annexure-5 shows Specific Power of Attorney letter and Annexure-6 shows photo ID of POA holder)

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उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
नेशनल एल्यूमिनियम कम्पनी लि॰
National Aluminium
भुवनेश्वर/ Bhubaneswar

c) **Mineral(s) which is/are included in the prospecting license (for fresh grant):**

Not applicable

d) **Mineral(s) which is included in the letter of Intent / lease deed:**

Bauxite

e) **Mineral(s) which the lessee intends to mine:**

Bauxite

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f) **Name of Qualified Persons preparing Mining Plan under rule 15 of MCR, 2016:**

Table -4:

Name	Sripad Pujar	BVR Achar	Sujit Kumar Mohanty
Qualification	M.Sc. (Mineral Exploration)	M.Sc. (Mineral Exploration)	M.Sc. (Geology)
Address	Plot no.32 Annapurna Badavane, Hosapete – 583 201 Ballari Dist. Karnataka		Shrushti Minerals and Consultants Pvt. Ltd., F-3, B-32, Milroc Ribandar Retreat, Ribandar, Tiswadi, Goa-403006
Phone	08394-226563		
Fax	08394-224012		
Mobile	9448366964	9448469407	9765565528
E-mail id	cgllhpt@gmail.com		shrushti.minerals@yahoo.com

(Annexure-7 shows copies of QP certificates as per Rule 15 of MCR 2016)

16-7-18

16/7/18

16/01/18

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National Aluminium Company Limited
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Divisional Forest Officer
Koraput Forest Division

2.0 LOCATION AND ACCESSIBILITY

a) Lease Details (existing mine)

Table -5:

Name of the mine	Pottangi Bauxite Mine
Lat/long of any boundary point	BP no: P -1 Latitude - 18° 34' 31.13" Longitude - 82° 57' 30.197" There are 92 corner pillars and lat/long values of these pillars are given in the sketch enclosed as plate I c also listed in table -8
Date of grant of lease	Terms letter, dated -14.05.2018 *(Annexure-1)*
Period/Expiry Date	50 yrs as per MMDR (Amendment) Act-2015
Postal Address	Pottangi Bauxite Mines, NALCO, M & R Complex, PO : Damanjodi
District	Koraput
State	Odisha
Pin code	763008
Phone	0674-2300633
Fax	0674-2301200
Mobile	094370 29513
E-mail id	sanjay.patel@nalcoindia.co.in

b) Details of applied / lease area with location map (fresh area / mine):

Table –6: Fresh Area

Forest	Non-forest
Jungle Block- Area-697.979 ha	--

Table -7:

Total lease area /applied area	697.979 ha
District & State	Koraput, Odisha
Tehsil / Taluka	Pottangi
Village	Pottangi
Whether the area falls under Coastal Regulation Zone (CRZ)? If yes, details thereof	No
Existence of public road/railway line, if any nearby and approximate distance	One National Highway (NH-43) is passing at south of the lease area at around 4.6km away. No Railway line is passing nearby the lease area.
Toposheet No. with latitude & longitude of all corner boundary point/pillar	Topo sheet no –E44K14 Lat / Long values are given in table below

A general location map is attached as Plate- I a.

Table – 8: Latitude and longitudes of the corner pillars of the lease a

POINT ID	LATITUDE	LONGITUDE	POINT ID	LATITUDE	LONGITUDE
P1	18°34'31.130"	82°57'30.197"	P47	18°35'46.818"	82°58'33.408"
P2	18°34'32.948"	82°57'35.337"	P48	18°35'45.963"	82°58'18.916"
P3	18°34'35.522"	82°57'36.358"	P49	18°35'48.125"	82°58'14.105"
P4	18°34'41.460"	82°57'39.144"	P50	18°35'51.912"	82°58'8.041"
P5	18°34'48.783"	82°57'47.871"	P51	18°36'3.488"	82°58'8.306"
P6	18°34'47.166"	82°57'57.508"	P52	18°36'5.650"	82°58'9.997"
P7	18°34'43.765"	82°58'05.828"	P53	18°36'9.125"	82°58'13.389"
P8	18°34'54.493"	82°58'36.176"	P54	18°36'9.849"	82°58'11.130"
P9	18°35'2.076"	82°58'24.249"	P55	18°36'7.305"	82°58'6.553"
P10	18°35'10.069"	82°58'24.233"	P56	18°36'6.222"	82°58'1.322"
P11	18°35'16.687"	82°58'19.259"	P57	18°36'1.260"	82°57'55.632"
P12	18°35'23.132"	82°58'9.107"	P58	18°36'4.290"	82°57'25.196"
P13	18°35'31.202"	82°58'13.909"	P59	18°36'17.479"	82°57'20.567"
P14	18°35'37.459"	82°58'19.495'	P60	18°36'25.925"	82°57'14.712"
P15	18°35'39.743"	82°58'19.580"	P61	18°36'31.139"	82°57'23.797"
P16	18°35'43.264"	82°58'43.113"	P62	18°36'34.674"	82°57'29.280"
P17	18°35'34.585"	82°58'46.861"	P63	18°36'46.641"	82°57'35.650"
P18	18°35'26.698"	82°58'46.638"	P64	18°36'56.768"	82°57'43.700"
P19	18°35'17.260"	82°58'41.141"	P65	18°37'6.481"	82°57'41.097"
P20	18°35'4.602"	82°58'40.993"	P66	18°37'0.184"	82°57'32.452"
P21	18°35'4.752"	82°58'46.071"	P67	18°36'46.880"	82°57'27.201"
P22	18°35'13.251"	82°58'48.565"	P68	18°36'40.171"	82°57'17.921"
P23	18°35'29.614"	82°59'1.031"	P69	18°36'35.025"	82°57'8.371"
P24	18°35'33.820"	82°59'27.088"	P70	18°36'34.687"	82°56'58.995"
P25	18°35'51.585"	82°59'17.194"	P71	18°36'32.185"	82°56'53.990"
P26	18°36'3.803"	82°59'14.697"	P72	18°36'22.684"	82°56'53.171"
P27	18°36'9.290"	82°59'21.004"	P73	18°36'14.451"	82°56'46.000"
P28	18°36'1.187"	82°59'30.256"	P74	18°36'8.023"	82°56'31.675"
P29	18°35'57.913"	82°59'37.042"	P75	18°36'3.559"	82°56'25.338"
P30	18°36'10.671"	82°59'39.561"	P76	18°35'57.326"	82°56'30.086"
P31	18°36'15.928"	82°59'31.475"	P77	18°36'1.796"	82°56'37.872"
P32	18°36'39.935"	82°59'43.475"	P78	18°36'7.103"	82°56'46.780"
P33	18°36'47.529"	82°59'46.823"	P79	18°36'10.115"	82°57'0.493"
P34	18°37'3.478"	82°59'49.967"	P80	18°36'3.565"	82°57'7.864"
P35	18°37'2.935"	82°59'49.457"	P81	18°35'56.752"	82°57'22.308"
P36	18°37'0.530"	82°59'47.340"	P82	18°35'49.221"	82°57'56.310"
P37	18°36'53.475"	82°59'45.544"	P83	18°35'33.929"	82°57'46.664"
P38	18°36'53.475"	82°59'33.358"	P84	18°35'33.485"	82°57'34.619"
P39	18°36'46.481"	82°59'33.358"	P85	18°35'37.470"	82°57'30.461"
P40	18°36'35.363"	82°59'27.474"	P86	18°35'27.984"	82°57'8.888"
P41	18°36'30.577"	82°59'24.854"	P87	18°35'23.381"	82°57'8.053"
P42	18°36'20.411"	82°59'19.830"	P88	18°35'21.546"	82°57'32.902"
P43	18°36'13.821"	82°59'11.632"	P89	18°35'10.228"	82°57'32.627"
P44	18°36'6.546"	82°59'9.934"	P90	18°35'5.719"	82°57'22.905"
P45	18°36'1.793"	82°58'59.295"	P91	18°34'43.864"	82°57'21.499"
P46	18°35'57.111"	82°58'55.372"	P92	18°34'36.347"	82°57'26.829"

c) Attach a general location map showing area and access routes. It is preferred that the area be marked on a Survey of India topographical map or a cadastral map or forest map as the case may be. However, if none of these are available, the area may be shown on an administrative map.

A general location map is attached as Plate- I a on administrative map and area precise map showing area and access routes are marked on a Survey of India toposheet of 1:50,000 scale as Plate Ib. Authenticated DGPS map of the lease area is enclosed as Plate -Ic.

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QP- Sripad Pujar, B.V.R. Achari & Sunil Kumar Mohanty

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3.0 DETAILS OF APPROVED MINING PLAN / SCHEME OF MINING :

3.1) Date and reference of earlier approved MP/SOM-if any

Not applicable as this is first Mining Plan after lease grant letter to NALCO.

3.2) Details of last modifications if any (for the previous approved period) of approved MP/SOM, indicating date of approval, reason for modification:

Not applicable as this is first Mining Plan after lease grant letter to NALCO.

3.3) Give Review of earlier approved proposal (if any) in respect of excavation exploration, reclamation etc.

Not applicable as this is first Mining Plan after lease grant letter to NALCO.

3.4) Give Status of compliance of violations pointed out by IBM

Not applicable as this is first Mining Plan after lease grant letter to NALCO.

3.5) Indicate and give details of any suspension/closure/prohibitory order issued by any Government agency under any rule or Court of law :

Not applicable as this is first Mining Plan after lease grant letter to NALCO.

3.6) In case the MP/SOM is submitted under rule 17(3) of the MCR' 2016 for approval of modification, specify reason and justification for modification under these rules.

Not applicable.

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PART – A

1.0 GEOLOGY AND EXPLORATION:

a) Briefly describe the topography, drainage pattern, vegetation, climate, rainfall data of the area applied/mining lease area.

The deposit occupies the flat top of the hill, named as 'Sirimanda Parbat'. The area around Pottangi forms a series of hills ranging in height from 1000 m to 1400 m above M.S.L. The deposit is nearly flat with prominent slopes on the north and east. The slopes are gentle to moderate, rarely steep. When the slopes are gentle to moderate, they are congenial for formation of thick bauxite profile. The slope gradient varies from 1:6 to 1:12. The peak portions of the deposit are occupied by khondalites forming the ridges.

Peripheral escarpments are conspicuously developed on the eastern and northern fringes of North block and the northern and southern peripheries of the Central block. The South block, however, shows relatively less pronounced escarpments, except on its southern fringe. Caves, at places, are developed in steep peripheral escarpments.

The drainage pattern, as indicated by the numerous streams and nalas, is of dendritic type. A few perennial springs sprout from the hill slopes and drain into the nearby streams. Two such perennial streams originate from the western slopes of Sirimanda Parbat and flow to the west. Pottangi bauxite capping (Sirimanda Parbat) is devoid of much vegetation.

The area enjoys a tropical climate. Lying at an altitude of over 1000 m. above M.S.L., Pottangi area has a pleasant climate during summer. The temperature in May rarely exceeds 40°C. The winter-month are pretty cold and in December-January, the temperature often drops down to 5° C. Frost is observed, at time in the early hours of the day in winter months. Monsoon sets in early June and continues till the middle of October. It is severe from July to august and the average annual precipitation is about 1200mm. The mean minimum humidity is in January) and mean maximum 90% is in August-September.

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b) Brief descriptions of Regional Geology with reference to location of lease/applied area

The rock formations in this region represent the Eastern Ghats belt of Peninsular Archaeans and comprise mainly khondalite and charnockite groups of rocks. The flattops of the khondalite hills are often mantled by fairly thick blankets of laterite/bauxite, presumably of Tertiary age. Such flat-top are noticed on Sirimanda Parbat. The valleys are generally covered by soil and alluvium of Sub-Recent to Recent age.

The generalized geological sequence of the rock formations in the area is given below:

Recent	Soil and Alluvium
Tertiary Quaternary	Laterite and bauxite
Archaean - Eastern Ghats Super Group.	Pegmatites and Quartz veins
	Charnockitic gneisses (acid to intermediate-charnockite) and pyroxene granulites, (basic charnockites).
	Khondalites and leptynites

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Khondalites are highly weathered and mostly spotted, red and white grading to grey and brown at places. The rocks are gneissose with foliation marked by alternating layers: of elongated sillimanite needles and quartzo-felspathic minerals. Petrographically, the rock consists of xenomorphic quartz grains often showing undulose extinction, garnets locally occurring as porphyroblasts sillimanite occurring as Sub-hedral grains and needles, occasionally bent and showing traverses fractures. The texture is crudely gneissic to occasional granulitic. General strike of foliation of the khondalite as well as charnockite groups of rocks is NE-SW, with local variations ranging from NNE-SSW to ENE-WSW. The dip varies from 30° to 75° towards south-east and east-south-east.

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The khondalite shows two major sets of joint one vertical dip-joint and the other low-dipping strike-joint. a few minor folds have been noticed within the khondalite, the axes of which plunge towards, south-west with low angles of 10° to 20°. Typical garnetiferous leptynites are finely banded and gneissose with development of thin bands of quartz in a predominantly garnetiferous quartzo-felspathic rock. Their foliation is in conformity with that the khondalites. They occur as bands, impersistent and, lenticular. The rocks are light coloured, medium to fine grained, composed essentially of quartz, microperthite and garnet.

The charnockite group of rocks occurs mostly as charnockite gneisses, comprising the acid to intermediate typos. These are characterised by the presence of augen shaped porphyroblasts of feldspars and display a crude foliation marked by alternate layers of garnet, quartzo felspathic minerals, and pyroxene (hypersthene & rarely diopside). The feldspar includes mostly orthoclase and perthite. Apatite is rarely found, as an a accessory mineral. The texture is crudely gneissic to locally granulitic. Basic charnockites not so abundant as charnockite gneisses, are represented by dark-coloured lenticular bands of pyroxene granulites, with typically granulitic texture. These rocks consist essentially of hypersthene, diopside, plagioclase (Oligoclase-andesine), microperthite, orthoclase and minor amounts of quartz. Hornblende and biotite are present as accessories. Veins of pegmatite and quartz are occasionally observed traversing, the khondalites and charnockites.

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The laterite/bauxite, capping the khondalitic rocks occurs as blankets of varying extent and thickness. Their aerial extents vary from 0.5sqkm to 3sqkm and thickness of laterite/bauxite profile ranges between 5 and 20 m as exposed in scarp sections. Bauxite is composed dominantly of gibbsite, finely disseminated in a reddish ferruginous groundmass. Thin soil mantle covers the laterite/bauxite at places and is silty to clayey in nature. Alluvium is seen in the valley areas.

(Source: Report on Exploration of Pottangi Bauxite Deposit, Orissa Circle, GSI,1977)

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c) Detailed description of geology of the lease area such as shape and size of the mineral/ore deposit, disposition various litho-units indicating structural features if any etc. (Applicable for Mining Plan for grant & renewal and not for Scheme of Mining/Modifications in the approved Mining Plan/Scheme of Mining).

The rock types exposed on the Pottangi deposit include laterite, bauxite and khondalite with occasional patches of soil. The major part of the capping is occupied by sheeted out crops of bauxite/laterite. At places, bauxites display a crude relict foliation conformable with that of khondalites. Khondalite crops out as linear ridges at the higher elevations. These follow a general strike trend of NE-SW with moderate to occasional steep dips to South. Also, bands of weathered khondalites are observed at places, within the bauxite on the surface of the capping. The mining area has been divided into 5 blocks for the convenience, namely;

1. South block
2. Central block
3. North block
4. Extension East block
5. Extension West block

South block

The major part of South block is capped by exposures of bauxite with a few patches of laterite in the north-western fringes and in the central part of the block. Thin soil cover is seen in the western part. Khondalites are exposed on the western extremity, north-eastern part and on the southern limit of the block. The maximum exploration activity has been carried out here in this block, like boreholes, trial pits and elongated trench in T shape (refer geological plan).

Central block

In the Central block, frequent occurrences of khondalite bands are observed in the eastern part. On the western part, these form escarpments. In the central part, several soil patches are noted. The rest of the area of the block is covered by exposures of bauxite/laterite.

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North block

The North block exposes khondalites on its western part. The rest of the block is covered by exposures of bauxite with a few patches of laterite. Escarpments, with development of caves, are observed on the eastern periphery.

Extension West block

This block is extended from north block. Majority of the bauxite is present on the top flat area as blankets with a few patches of laterite and soil cover in southern portion. Rest of the area is having occurrences of khondalite bands.

Extension East block

This block is also extended from north block. This block marks the highest elevation (1480 mRL) on the entire Pottangi Bauxite Deposit. Majority of the bauxite is present in three distinct exposures on flat tops. Remaining area is covered with khondalites.

Bauxite Deposit:

(a) Mode of occurrences: Bauxite occurs in the form of thick and extensive blanket capping resting over the khondalite bed-rock. Bauxites are exposed as sheeted outcrops along with occasional exposures of laterite, khondalite and soil. At places, bauxite is mantled by a thin veneer of ferruginous and siliceous duricrust (laterite). Gibbsite forms the chief aluminium bearing mineral in bauxite and occurs in the form of tiny sachharoidal disseminations in a reddish ferruginous groundmass. Bauxites, composed of disseminations of gibbsite, show a characteristically spongy texture, whereas the fine grained cryptocrystalline aggregates of gibbsite constitute the massive bauxite.

(b) Laterite-bauxite-profile: Based on the sub-surface data, the complete profile of Pottangi Bauxite Deposit is enumerated below:

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Table-9: Geological Profile

Litho unit	*Description*
Soil	Greyish brown, brown and dark grey in colour; occasionally silty and clayey.
Laterite	Dark red and chocolate brown in colour. Hard and compact; cavernous with cavities mostly filled by limonite, goethite and occasional clayey material. Locally, nodular to pisolitic types are also observed. Hematite and goethite bands are frequently present Gibbsite is in low amount.
Bauxite	Brick red and yellowish brown in colour. Cavernous and porous Hematite goethite and clay minerals occur as bands and streaks. Gibbsite is in low to moderate amount (Al_2O_3 is between 40 and 45%). Pale/red, brown, flesh pink & occasionally creamy(white in colour. Porous to spongy in texture. Gibbsite is in moderate to high concentrations. Intercalation of Iron oxides and clay min are in lesser amount. (Al_2O_3 content is >45%).
Lithomarge	Purplish white, pale buff, yellow to pink coloured and fine grained plastic in nature. Kaolinite is the predominating clay mineral. Gibbsite and iron oxides are in low concentrations. Locally, contain fragments of altered khondalite.
Weathered Khondalite	Pale brown to pale pink and occasionally purple while in colour, medium-grained. Alteration of garnet to iron oxides is observed. Felspar is mostly kaolinised / gibbsitised. Quartz is in predominating amount. Lenticles of partially leached khondalite is occasionally encountered within the bauxite zone.

(Source: Report on Exploration of Pottangi Bauxite Deposit, Orissa Circle, GSI,1977)

The litho-units are described below:

Soil: The soil, mostly associated with laterite and rarely with bauxite, occurs in areas of shallow depressions or on flat grounds. At places, it is mixed with reddish brown "morrum". The thickness of soil cover varies from a few centimeters to a maximum of one metre.

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Laterite: This is exposed on the surface of the capping as patchy outcrops. In the sub-surface, it is recorded mostly in the upper zones of the profile, and sometimes as discontinuous lenses within and also very rarely at the base, of bauxite zones. Bauxite consists of irregular cavities of varying dimensions and shape. The cavities range in size from a few mm to a maximum of 5 cm. The cavities are mostly lined with hematite, goethite and limonite. The nodular variety is maroon in colour, the nodules varying in size from 5 mm to 4 cm. The nodules have dark red ferruginous cores and brownish goethite crusts. Gibbsite, sometimes, forms the core of such nodules which are cemented together in a fine ferruginous (Limonitic) matrix.

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Bauxite: This lithounit is divisible into two broad types: Low grade bauxite (30 to 45%Al_2O_3 & - 5% SiO_2) and high grade bauxite (+45% Al_2O_3 & -5% SiO_2)

Low Grade Bauxite: The low grade bauxite occurs below the laterite zone and is also widely exposed on the surface in the form of sheeted outcrops occupying the maximum surface area of the capping. This bauxite type is generally brick-red to yellowish brown in colour, porous and cavernous textured the cavities being lined by gibbsite- limonite, and locally kaolinite. Limonitisation of garnets is observed. The cavities are at times seen aligned simulating crude foliation. Joints are also common. Gibbsite occurs in moderate concentration with sub-ordinate amounts of iron oxides.

As recorded in the bore holes, this low-grade bauxite zone has a maximum thickness of 11m in South Block, 10m in Central Block and 7.40m in North block. Alumina content in this zone ranges between 40 to 45%, with low silica (less than 5%) and titania (less than 3%). Iron oxide varies from 23 to 38%.

High grade Bauxite: This type of bauxite is pale red, brown, flesh pink and rarely creamy in colour, porous to spongy in texture. It occurs in two distinct form namely (i) spongy to massive variety composed of tiny, sacchroidal, greyish white crystals of gibbsite randomly distributed- in a brown ferruginous ground mass and (ii) the banded variety, sporadic in occurrence, consisting of tiny crystals of gibbsite concentrate. in a distinctly linear pattern preserving the relict foliation planes of the khondalites from which it is derived. Ferruginous intercalations are occasionally observed in the bauxite zone. These light coloured, spongy textured, bauxite is of better grade and are mostly recorded in middle and basal parts of the bauxite zone. In general, within the bauxite horizon there is an improvement in the quality of bauxite towards depth.

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Gibbsite occurring as crystalline and crypto-crystalline aggregates forms the predominant aluminium bearing mineral in this ore. Iron minerals, i.e. hematite, goethite and limonite are noted in subordinate amounts with kaolinite in traces. This high grade bauxite has a thickness of about 17-21 m in South and North blocks. In the Central block, a maximum thickness of 18 m is observed.

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The alumina content in this type of bauxite varies from 45 to 55% with relatively low content of iron oxides (10-20%), silica is low (0.8 to 3%) and titania is uniformly low (1.5 to 3%). The LoI of bauxite ranges between 25 to 33 percent. Lenticular partings of weathered khondalite within the bauxite zone have been encountered in a few bore holes (PB-5 and 11 in South block: PCB-11 in Central Block and PNB-S in North Block).

Lithomarge: This unit is mostly encountered at the base of the laterite bauxite profile and commonly intervenes between bauxite and the khondalitic bed rock. This lithounit is impersistent in its mode of occurrence and has been intersected only in a few bore holes, Lithomarge clays are rarely intersected within the bauxite zone (PB-II, South Block). In colour, lithomarge is variegated with shades of red-brown, yellow-brown, purple, buff, pink and white. It is fine grained and plastic, composed mostly of kaolinite with occasional gibbsite concentrations. In a few places, distinct relict layering of the bed rock are preserved in the lithomarge. Fragments and lenticles of weathered khondalite also occur embedded in this zone. Its contact with the bauxite above and the bed rock below is gradational. Sub-surface data reveal that lithomarge is recorded at a minimum depth of 8.35 m (PEB-30 in Central Block) and a maximum depth of 48.25 m (PNB-7 in the North Block). The thickness of this zone varies widely and bore hole PCB-13 (Central block) recorded a maximum thickness of 25 m.

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Khondalite: This lithounit spread over 343.209 ha covering valleys forms the base of the laterite-bauxite profile, sometimes intervened by lithomargic zone. The contact between the bed rock, and bauxite profile is mostly uneven, the former sometimes appearing as projections or ridges into the overlying bauxite. The basement rock consists of quartz, garnet, and feldspar with sillimanite in minor amount, rutile and graphite in accessory amounts. Khondalite intersected in the bore holes is mostly weathered, with the feldspars and sillimanite showing alteration to gibbsite and kaolinite, garnets to gibbsite and iron minerals viz. hematite and goethite. The weathered rock is shades of brown, pale pink and purple in colour and is medium-grained.

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Weathered khondalite was intersected at shallow depths of 8 m in PB-16 of South block and maximum depths of 40.40 m in PNR-13 of North block. As the drill hole (upto a maximum depth of 54 m. in PNB-7, North block) did not encounter any compact fresh khondalite, the zone of alternation appears to be considerably thick. Occurrences of partially altered khondalitic rocks within the bauxite profile are not uncommon.

d) Prospecting/Exploration:

Table – 10:

Name of prospecting /exploration agency And Address	**M/s GSI** HO: 27, J.L. Nehru Road, Kolkata-700016, West Bengal **M/s MECL** HO: Dr. Babasaheb Ambedkar Bhawan. Highland Drive Road, Seminary Hills, NAGPUR

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e) Details of prospecting/exploration already carried out:

The Pottangi bauxite deposit has been initially explored by Geological Survey of India (GSI). Subsequently MECL carried out exploration in two phases viz. Phase-I and Phase-II. The salient information on the deposit characteristics, quantum of exploration carried out as well as reserves and grades of bauxite as estimated and presented in the Phase-II exploration report by MECL have been reviewed and discussed below:

Exploration by GSI : GSI have carried out exploration activity of the Pottangi deposit with the aid of broad spaced drilling (69 core boreholes with a total meterage of 1929.39m) and estimated the bauxite resources of about 50 million tons considering Al_2O_3 and SiO2 cut-offs at +40% and -5% respectively for all the four blocks. [South (0.6 sqkm), Central (1.0sqkm) North (0.4 sqkm) and Extension (1.0 sqkm)].

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Exploration by MECL: Phase-I exploration has been carried out by MECL in the south and central blocks during January 1976 to June 1977. The exploration work comprises dry drilling of 181 boreholes on grids of 100 m x 50 m, 100 m x 100 m and 200 m x 200 m at different areas. The total drilled meterage is 5,161.65 m with borehole depths varying from 6 m to 50 m. A few deep pits at 100 m interval were sunk with depths ranging from 20.20 m to 35.60 m and a few adits (2 Nos. in east-west direction and 1 No. in south to north direction) were driven as a check on the interpretations of the bauxite horizon made through borehole data. A 'T' shaped shallow trench (100 m x 200 m) was also dug to know the physical continuity of the bauxite horizon.

Table-11: Exploration Summary of MECL Phase-I

Nature of exploration	Particulars
Pitting (spacing) No & quantum	351.90m in 12 Pits 100 m interval. Depth range: 20.20-35.60 m in pits
Trenching (spacing) No & quantum	1596.60 Cum T-shaped trenching (100m x 200)
Surface drilling (by type of drilling (spacing) Nos. & quantum	5161.65 m in 181 vertical & Inclined BHs. Dry drilling by NX/BX shoe bit size BHs. Spacing 50, 100, 200m. Depth range: 6 m to 50 m.
Aditing:	817 m South block 2 Nos. Adits East-West direction 1 South to North Adit in 50 to 1 in 100 gradient.

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Table – 12: Reserves estimation by MECL

Category (Grid)	Reserves(MT)	Al_2O_3 %	SiO_2%	Remarks
A- (100m x 50m)	15.43	45.97	2.01	In South and Central blocks only
B- (100m x 100m)	22.89	45.12	1.98	
C- (200m x 200m)	2.56	44.31	2.59	
Total	**40.88**			

The Phase-II exploration programme was conducted by MECL in some areas covering all blocks during 1977-78. This was done mainly to resolve some confusions on the comparison of analytical data of boreholes and adjoining pit samples of Phase-I exploration, to firm up the ore body geometry and reserves, and to generate some exploratory data for the characterisation of bauxite in the North and Extension blocks.

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The exploration work comprises drilling of 14 boreholes and sinking of 12 pits (7 shallow pits and 5 deep pits) in the south and central blocks. Re-sampling in some existing pits of Phase-I exploration was also taken up. Besides, 19 vertical boreholes were drilled in the North and Extension blocks. The borehole and pit samples, numbers totalling to 1479, were subjected to analytical work. The total drilling and pitting meterage during this stage of exploration amounted to about 1343.05 m and 818.80 m respectively. The results of the Phase-II Exploration work reveal no significant change in the inference regarding the geometry, reserves and grade of the deposit as determined in earlier exploration work.

Table – 13: Lease area explored as per UNFC norms

Total lease area : 697.979 ha						Remarks comments including reasons for not carrying out the exploration as per UNFC norms
Item of information	Lease area explored as per UNFC norms -145.37 ha as on dt.					
	Total lease area =A+B+C+D+E = 697.979 ha					
	G1 level	G2 level	G3 level	Explored and found non-mineralised with level of exploration (Remarks)	Unexplored lease area	
	A	B	C	D	E	F
Area as per level of exploration	138.84ha	6.53 ha	--	--	552.609 ha	*Although unexplored area is 552.609 ha, out of this 209.40 ha area is proposed for further exploration as this is mineralized and remaining 343.209 ha area is non-mineralised containing Khondalites and deep valleys.*
No. of BH drilled*	251	2	--	--	--	
No. of BH considered for resource	--	--	--	--	--	
Meterage drilled	7770.29m	47.60m	--	--	--	
Grid interval	100m x 50m	200m x 100m	--	--	--	
Scale of mapping	1:4000	1:4000	--	--	--	
Reserve estimated after above exploration as on dtd 01.07.2018 :						40.625 MT
Remaining Resource estimated after above exploration as on dtd 01.07.2018:						0.31 MT
Total Reserve / Resource estimated after above exploration as on dtd 01.07.2018:						40.935 MT

**Note: Although a total of 264 bore holes were drilled in the lease area, data of 11 nos. bore holes data are not available and only 253 nos. data are available. Hence, only these 253 nos. boreholes are considered for reserves estimation.*

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i) **Number of pits and trenches indicating dimensions, spacing etc along and across the strike/foliation with reference to geological plan.**

Table – 14: Summary of Exploration

Type	GSI	MECL
Pitting	19 nos. 368cum	24 nos. 1170.7cum -100m spacing
Trenching	-	1596.60 cum (100x200m)
Aditing	-	817.20m
Drilling	69 holes-1929.39m	195 holes with 5888.5m

ii) **Number of boreholes indicating type (Core/RC/DTH), dia, spacing, inclination, Collar level, depth etc with standard borehole logs duly marking on geological plan/sections.**

M/s GSI has drilled 69 core boreholes with a meterage of 1929.39m during 1972-77. M/s MECL has drilled 169 nos. of vertical core drill holes (4542.65m) and 12 nos. of inclined core drill holes (619m) in phase I and in phase II, MECL has drilled 5 nos. of vertical core drill holes (195.75m) and 9 nos. of inclined core drill holes (531.10m) during 1976-78 (MECL-Total 195 holes with 5888.5m). These Bore holes are marked in Geological Plan. Chemical Analysis report enclosed as Annexure-9. Details of each drilled holes are given in Annexure-13.

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iii) **Details of samples analysis indicating type of sample (surface/sub-surface from pits / trenches/borehole etc)**

Table – 15:

Sample Details	GSI	MECL:Ph-I	MECL:Ph-II
1) Surface	174	No data	-
2) Pits	91		887
3) Drill cores	1634		541
4) Check samples	45		25
5) Total	1944	6337	1453

Recently some more samples have been collected and analyzed. The details of which are given below:

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Table – 16:

No.	Al_2O_3%	SiO_2%	Fe_2O_3%	Remarks
PS-1	52.76	1.01	19.49	Surface sample near borehole P-73 of South Block
PS-2	38.47	1.10	36.74	Surface sample near borehole PB-11 of South Block
PS-3	45.07	1.76	28.43	Pit sample of Pit PP-13 of South Block
PS-4	43.62	2.23	24.92	Surface sample near borehole P-12 of South Block
PS-5	51.64	2.50	17.57	Trench sample near borehole P-58 of South Block
PS-6	37.79	2.80	20.76	Trench sample near borehole PB-15 of South Block
PS-7	53.70	2.01	10.62	Pit sample of Pit PP-14 of South Block
PS-8	60.44	1.12	14.25	Surface sample near borehole PC-40 of Central Block
PS-9	47.28	1.71	23.97	Pit sample of Pit PBP-7 of Central Block
PS-10	50.62	2.87	14.06	Pit sample of Pit PBP-2 of Central Block
PS-11	49.32	1.65	19.16	Trench sample near borehole P-8 of South Block
PS-12	39.12	2.49	27.01	Surface sample near borehole PCB-26 of Central Block
PS-13	46.11	2.22	22.98	Surface sample near borehole PC-59 of Central Block
PS-14	48.01	2.18	21.22	Surface sample near borehole PE-1 of Western Extn block
PS-15	54.77	1.80	11.90	Surface sample of Eastern Extension Block

iv) Expenditure incurred in various prospecting operations:

Cost of exploration: Rs. 95.80 lakhs (MECL)

f) The surface plan of the lease area may be prepared on a scale of 1: 1000 or 1: 2000 with contour interval of maximum of 10 m depending upon the topography and size of the area duly marked by grid lines showing all features indicated under MCDR 2017.

Enclosed as Plate no-IIa

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g) For preparation of geological plan, surface plan prepared on a scale of 1: 1000 or 1: 2000 scale specified under para 1.0 (f) of Part A of the format may be taken as the base plan. The details ofexploration already carried out along with supporting data for existence of mineral, locations proposed exploration, various lithounits along with structural features, mineralized / ore zone with grade variation if any may be marked on the geological plan along with other features indicated under MCDR 2017.

Enclosed as Plate no-II b

h) Geological sections may be prepared on natural scale of geological plan at suitable interval across the lease area from boundary to boundary.

Enclosed as Plate no-II c

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i) **Broadly indicate the future programme of exploration with due justification (duly marking on Geological plan year wise location in different colours) taking into consideration the future tentative excavation programme planned in next five years as in table below:**

Table-17

Year	No. of boreholes (Core/RC/DTH)	Grid interval	Total meterage	No. of Pits, dimensions and volume	No. of Trenches, Dimensions/volume
First	9 - Core	100x100m	450	-	-
Second	10- Core	100x100m	500	-	-
Third	67- Core	100x100m	3350	-	-
Fourth	74- Core	100x100m	3700	-	-
Fifth	116- Core	100x100m	5800	-	-
Total	**276- Core**		**13800**		

Total mineralized area in the lease is 354.77 ha, out of this 145.37 ha area was explored earlier by GSI and MECL under G1 & G2 category. Remaining unexplored area is 552.609 ha, out of this 209.40 ha area only is proposed for further exploration as this is part of mineralized area and remaining 343.209 ha area is non-mineralised containing Khondalites and deep valleys, which is not proposed for exploration.

As per Rule 12(3) of MCDR 2017, the future exploration program has been proposed for this plan period to carry out detailed exploration (G1 level) by vertical core drill holes over the entire potentially minerlaised area (209.40ha) of mining lease including all blocks along with Topographical Survey and Geological mapping in 1:2000 scale. After exploration by drilling, check analysis of at least 10% of samples will be analyzed from third party NABL accredited /or department of Science & Technology (DST) / BIS recognized laboratories or government laboratories for assessing the acceptable levels of accuracy according to MEMC Rules 2015.

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Proposed boreholes are marked in Geological Plans. The depth of proposed boreholes shall be around 50m or till the end of mineralization/discontinuance of ore body. The details are given below:

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Table-18: PROPOSED BOREHOLES IN SOUTH BLOCK-1st Year

PBH No.	Section	Location (UTM-WGS 84)		Depth (mtr)	RL (mtr)	Inclination
		Northing	Easting			
SPBH-1	SB-SB'	2056009	706687	50	1334	Vertical
SPBH-2	SC-SC'	2055894	706753	50	1356	Vertical
SPBH-3	SD-SD'	2055879	706850	50	1349	Vertical
SPBH-4	SD-SD'	2056321	707033	50	1311	Vertical
SPBH-5	SE-SE'	2056160	707074	50	1317	Vertical
SPBH-6	SE-SE'	2056282	707125	50	1309	Vertical
SPBH-7	SF-SF'	2056051	707137	50	1309	Vertical
SPBH-8	SF-SF'	2056102	707159	50	1298	Vertical
SPBH-9	SG-SG'	2055599	707058	50	1352	Vertical
Total				450		

Table-19: PROPOSED BOREHOLES IN SOUTH BLOCK-2nd Year

PBH No.	Section	Location (UTM-WGS 84)		Depth (mtr)	RL (mtr)	Inclination
		Northing	Easting			
SPBH-10	SH-SH'	2055612	707172	50	1340	Vertical
SPBH-11	SH-SH'	2055878	707282	50	1297	Vertical
SPBH-12	SI-SI'	2055898	707399	50	1293	Vertical
SPBH-13	SJ-SJ'	2055578	707374	50	1313	Vertical
SPBH-14	SK-SK'	2055649	707512	50	1298	Vertical
SPBH-15	SK-SK'	2055848	707595	50	1272	Vertical
SPBH-16	SL-SL'	2055707	707645	50	1270	Vertical
SPBH-17	SM-SM'	2055476	707657	50	1271	Vertical
SPBH-18	SN-SN'	2055447	707753	50	1271	Vertical
SPBH-19	SO-SO'	2055537	707898	50	1242	Vertical
Total				500		

Table-20: PROPOSED BOREHOLES IN CENTRAL BLOCK-3nd Year

PBH No.	Section	Location (UTM-WGS 84)		Depth (mtr)	RL (mtr)	Inclination
		Northing	Easting			
CPBH-1	CB-CB'	2056669	706250	50	1360	Vertical
CPBH-2	CC-CC'	2056684	706351	50	1357	Vertical
CPBH-3	CD-CD'	2056697	706450	50	1355	Vertical
CPBH-4	CD-CD'	2056803	706432	50	1376	Vertical
CPBH-5	CE-CE'	2056710	706552	50	1351	Vertical
CPBH-6	CF-CF'	2056632	706668	50	1331	Vertical
CPBH-7	CF-CF'	2056734	706651	50	1347	Vertical
CPBH-8	CF-CF'	2056846	706630	50	1360	Vertical
CPBH-9	CF-CF'	2056929	706617	50	1352	Vertical
CPBH-10	CG-CG'	2056546	706787	50	1320	Vertical
CPBH-11	CG-CG'	2056781	706746	50	1348	Vertical
CPBH-12	CH-CH'	706922	706922	50	1306	Vertical
CPBH-13	CH-CH'	2056768	706851	50	1335	Vertical
CPBH-14	CI-CI'	2056379	707023	50	1308	Vertical
CPBH-15	CI-CI'	2056787	706952	50	1332	Vertical
CPBH-16	CJ-CJ'	2056324	707134	50	1308	Vertical
CPBH-17	CJ-CJ'	2056598	707086	50	1316	Vertical
CPBH-18	CK-CK'	2056810	707151	50	1331	Vertical
CPBH-19	CL-CL'	2056648	707277	50	1322	Vertical
CPBH-20	CM-CM'	2056717	707372	50	1335	Vertical
CPBH-21	CN-CN'	2056856	707453	50	1361	Vertical
CPBH-22	CO-CO'	2056817	707648	50	1338	Vertical
CPBH-23	CP-CP'	2056616	707524	50	1324	Vertical
CPBH-24	CQ-CQ'	2056515	707552	50	1324	Vertical
CPBH-25	CQ-CQ'	2056566	707630	50	1324	Vertical
CPBH-26	CR-CR'	2056470	707667	50	1308	Vertical
CPBH-27	CS-CS'	2056314	707611	50	1295	Vertical
CPBH-28	CT-CT'	2056278	707739	50	1296	Vertical
CPBH-29	CU-CU'	2056199	707800	50	1292	Vertical
CPBH-30	CV-CV'	2056176	707947	50	1286	Vertical
CPBH-31	CW-CW'	2056146	708083	50	1276	Vertical
CPBH-32	CX-CX'	2056101	708178	50	1258	Vertical
Total				1600		

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Table-21: PROPOSED BOREHOLES IN NORTH BLOCK-3nd Year

PBH No.	Section	Location (UTM-WGS 84)		Depth (mtr)	RL (mtr)	Inclination
		Northing	Easting			
NPBH-1	NA-NA'	2057051	707320	50	1374	Vertical
NPBH-2	NA-NA'	2056975	707472	50	1384	Vertical
NPBH-3	NA-NA'	2056929	707560	50	1365	Vertical
NPBH-4	NA-NA'	2056882	707651	50	1348	Vertical
NPBH-5	NA-NA'	2056838	707738	50	1336	Vertical
NPBH-6	NB-NB'	2057247	707376	50	1398	Vertical
NPBH-7	NB-NB'	2057147	707573	50	1395	Vertical
NPBH-8	NB-NB'	2057100	707663	50	1373	Vertical
NPBH-9	NB-NB'	2057055	707753	50	1363	Vertical
NPBH-10	NB-NB'	2057010	707846	50	1357	Vertical
NPBH-11	NB-NB'	2056963	707933	50	1347	Vertical
NPBH-12	NC-NC'	2057314	707685	50	1392	Vertical
NPBH-13	NC-NC'	2057268	707774	50	1377	Vertical
NPBH-14	NC-NC'	2057223	707864	50	1364	Vertical
NPBH-15	NC-NC'	2057177	707953	50	1352	Vertical
NPBH-16	NC-NC'	2057132	708042	50	1334	Vertical
NPBH-17	NA-NA'	2057051	707320	50	1374	Vertical
NPBH-18	NA-NA'	2056975	707472	50	1384	Vertical
NPBH-19	NA-NA'	2056929	707560	50	1365	Vertical
NPBH-20	NA-NA'	2056882	707651	50	1348	Vertical
NPBH-21	NA-NA'	2056838	707738	50	1336	Vertical
NPBH-22	NB-NB'	2057247	707376	50	1398	Vertical
NPBH-23	NB-NB'	2057147	707573	50	1395	Vertical
NPBH-24	NB-NB'	2057100	707663	50	1373	Vertical
NPBH-25	NB-NB'	2057055	707753	50	1363	Vertical
NPBH-26	NB-NB'	2057010	707846	50	1357	Vertical
NPBH-27	NB-NB'	2056963	707933	50	1347	Vertical
NPBH-28	NC-NC'	2057314	707685	50	1392	Vertical
NPBH-29	NC-NC'	2057268	707774	50	1377	Vertical
NPBH-30	NC-NC'	2057223	707864	50	1364	Vertical
NPBH-31	NC-NC'	2057177	707953	50	1352	Vertical
NPBH-32	NC-NC'	2057132	708042	50	1334	Vertical
NPBH-33	NC-NC'	2057223	707864	50	1364	Vertical
NPBH-34	NC-NC'	2057177	707953	50	1352	Vertical
NPBH-35	NC-NC'	2057132	708042	50	1334	Vertical
NPBH-1	NA-NA'	2057051	707320	50	1374	Vertical
Total				1750		

Table-21: PROPOSED BOREHOLES IN EAST Extn BLOCK-4th Year

PBH No.	Section	Location (UTM-WGS 84)		Depth (mtr)	RL (mtr)	Inclination
		Northing	Easting			
EPBH-1	EA-EA'	2056331	708858	50	1245	Vertical
EPBH-2	EA-EA' & EB-EB'	2056352	708926	50	1245	Vertical
EPBH-3	EA-EA' & EB-EB'	2056450	708901	50	1254	Vertical
EPBH-4	EA-EA' & EB-EB'	2056470	708964	50	1254	Vertical
EPBH-5	EB-EB'	2056566	708927	50	1255	Vertical
EPBH-6	EB-EB'	2056583	708986	50	1255	Vertical
EPBH-7	EB-EB' & EC-EC'	2056693	708996	50	1258	Vertical
EPBH-8	EC-EC'	2056808	709027	50	1266	Vertical
EPBH-9	EC-EC' & ED-ED'	2056903	708998	50	1296	Vertical
EPBH-10	EC-EC' & ED-ED'	2056936	709097	50	1296	Vertical
EPBH-11	ED-ED'	2057014	709013	50	1307	Vertical
EPBH-12	ED-ED'	2057045	709108	50	1314	Vertical
EPBH-13	ED-ED' & EE-EE'	2057125	709030	50	1305	Vertical
EPBH-14	ED-ED' & EE-EE'	2057157	709125	50	1317	Vertical
EPBH-15	ED-ED' & EE-EE'	2057188	709221	50	1307	Vertical
EPBH-16	EE-EE'	2057233	709040	50	1311	Vertical
EPBH-17	EE-EE'	2057265	709134	50	1321	Vertical
EPBH-18	EE-EE'	2057289	709213	50	1318	Vertical
EPBH-19	EF-EF'	2057300	708921	50	1318	Vertical
EPBH-20	EF-EF'	2057331	709015	50	1329	Vertical
EPBH-21	EF-EF'	2057362	709112	50	1332	Vertical

EPBH-22	EF-EF'	2057393	709206	50	1323	Vertical
EPBH-23	EF-EF'	2057360	708785	50	1323	Vertical
EPBH-24	EF-EF'	2057391	708881	50	1334	Vertical
EPBH-25	EF-EF'	2057425	708976	50	1340	Vertical
EPBH-26	EF-EF'	2057455	709073	50	1341	Vertical
EPBH-27	EF-EF'	2057478	709142	50	1332	Vertical
EPBH-28	EH-EH' & EI-EI'	2058163	709638	50	1402	Vertical
EPBH-29	EH-EH'	2058054	709615	50	1392	Vertical
EPBH-30	EG-EG' & EH-EH'	2057945	709599	50	1384	Vertical
EPBH-31	EF-EF' & EG-EG'	2057819	709540	50	1366	Vertical
EPBH-32	EF-EF' & EG-EG'	2057715	709614	50	1370	Vertical
EPBH-33	EF-EF' & EG-EG'	2057715	709549	50	1360	Vertical
EPBH-34	EF-EF' & EG-EG'	2057740	709620	50	1364	Vertical
EPBH-35	EF-EF'	2057616	709564	50	1350	Vertical
EPBH-36	EF-EF'	2057637	709631	50	1353	Vertical
EPBH-37	EE-EE' & EF-EF'	2057519	709588	50	1345	Vertical
EPBH-38	EE-EE' & EF-EF'	2057541	709655	50	1345	Vertical
EPBH-39	EE-EE'	2057419	709606	50	1335	Vertical
EPBH-40	EE-EE'	2057439	709664	50	1335	Vertical
EPBH-41	ED-ED' & EE-EE'	2057323	709634	50	1333	Vertical
EPBH-42	ED-ED' & EE-EE'	2057340	709687	50	1333	Vertical
EPBH-43	ED-ED'	2057222	709645	50	1325	Vertical
EPBH-44	ED-ED'	2057253	709740	50	1321	Vertical
EPBH-45	EC-EC' & ED-ED'	2057113	709632	50	1315	Vertical
EPBH-46	EC-EC' & ED-ED'	2057144	709727	50	1318	Vertical
EPBH-47	EC-EC' & ED-ED'	2057175	709822	50	1305	Vertical
EPBH-48	EC-EC'	2057008	709635	50	1307	Vertical
EPBH-49	EC-EC'	2057039	709730	50	1307	Vertical
EPBH-50	EC-EC'	2057070	709825	50	1297	Vertical
EPBH-51	EB-EB' & EC-EC'	2056867	709525	50	1284	Vertical
EPBH-52	EB-EB' & EC-EC'	2056897	709619	50	1296	Vertical
EPBH-53	EB-EB' & EC-EC'	2056929	709715	50	1296	Vertical
EPBH-54	EB-EB' & EC-EC'	2056961	709810	50	1288	Vertical
EPBH-55	EB-EB' & EC-EC'	2056992	709905	50	1278	Vertical
EPBH-56	EB-EB'	2056752	709497	50	1271	Vertical
EPBH-57	EB-EB'	2056770	709552	50	1280	Vertical
EPBH-58	EI-EI' & EJ-EJ'	2058493	709988	50	1440	Vertical
EPBH-59	EI-EI' & EJ-EJ'	2058510	710040	50	1438	Vertical
EPBH-60	EI-EI'	2058373	709944	50	1440	Vertical
EPBH-61	EI-EI'	2058396	710014	50	1440	Vertical
EPBH-62	EH-EH' & EI-EI'	2058296	710030	50	1428	Vertical
EPBH-63	EH-EH' & EI-EI'	2058186	710012	50	1426	Vertical
EPBH-64	EH-EH'	2058186	710012	50	1405	Vertical
EPBH-65	EH-EH'	2058205	710069	50	1402	Vertical
EPBH-66	EG-EG' & EH-EH'	2058095	710058	50	1383	Vertical
EPBH-67	EG-EG' & EH-EH'	2058126	710153	50	1382	Vertical
EPBH-68	EG-EG'	2058005	710105	50	1370	Vertical
EPBH-69	EG-EG'	2058033	710190	50	1368	Vertical
EPBH-70	EG-EG'	2058059	710268	50	1351	Vertical
EPBH-71	EF-EF' & EG-EG'	2057957	710278	50	1336	Vertical
EPBH-72	EF-EF' & EG-EG'	2057988	710373	50	1324	Vertical
EPBH-73	EJ-EJ'	2058907	710286	50	1480	Vertical
EPBH-74	EI-EI' & EJ-EJ'	2058798	710269	50	1476	Vertical
Total				3700		

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Table-22: PROPOSED BOREHOLES IN WEST Extn BLOCK-5th Year

PBH No.	Section	Location (WGS-84) in UTM		Depth (mtr)	RL (mtr)	Inclination
		Northing	Easting			
WPBH-1	WA-WA'	2057822	705034	50	1251	Vertical
WPBH-2	WA-WA'	2057776	704946	50	1250	Vertical
WPBH-3	WA-WA'	2057905	704980	50	1251	Vertical
WPBH-4	WA-WA'	2057820	705034	50	1250	Vertical
WPBH-5	WA-WA' &WB-WB'	2057941	705073	50	1251	Vertical
WPBH-6	WA-WA' &WB-WB'	2057860	705126	50	1251	Vertical
WPBH-7	WB-WB'	2057963	705181	50	1251	Vertical
WPBH-8	WB-WB'	2057901	705220	50	1251	Vertical

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WPBH-9	WB-WB' & WC-WC	2057975	705293	50	1251	Vertical
WPBH-10	WC-WC'	2058006	705391	50	1251	Vertical
WPBH-11	WC-WC' &WD-WD'	2058043	705487	50	1251	Vertical
WPBH-12	WD-WD'	2058080	705580	50	1251	Vertical
WPBH-13	WD-WD' & WE-WE'	2058094	705692	50	1251	Vertical
WPBH-14	WD-WD' & WE-WE'	2058178	705638	50	1246	Vertical
WPBH-15	WE-WE'	2058239	705701	50	1232	Vertical
WPBH-16	WE-WE'	2058141	705723	50	1249	Vertical
WPBH-17	WE-WE' &WF-WF'	2058304	705788	50	1220	Vertical
WPBH-18	WE-WE' &WF-WF'	2058207	705812	50	1242	Vertical
WPBH-19	WE-WE' &WF-WF'	2058108	705835	50	1251	Vertical
WPBH-20	WF-WF'	2058298	705893	50	1223	Vertical
WPBH-21	WF-WF'	2058200	705916	50	1241	Vertical
WPBH-22	WF-WF'	2058102	705940	50	1251	Vertical
WPBH-23	WF-WF'	2058006	705961	50	1242	Vertical
WPBH-24	WF-WF'	2057917	705980	50	1231	Vertical
WPBH-25	WF-WF'	2057855	705996	50	1227	Vertical
WPBH-26	WF-WF' & WG-WG'	2058315	705991	50	1228	Vertical
WPBH-27	WF-WF' & WG-WG'	2058218	706014	50	1247	Vertical
WPBH-28	WF-WF' & WG-WG'	2058121	706037	50	1251	Vertical
WPBH-29	WF-WF' & WG-WG'	2058022	706061	50	1249	Vertical
WPBH-30	WF-WF' & WG-WG'	2057923	706082	50	1245	Vertical
WPBH-31	WG-WG'	2058319	706092	50	1232	Vertical
WPBH-32	WG-WG'	2058221	706116	50	1249	Vertical
WPBH-33	WG-WG'	2058124	706139	50	1256	Vertical
WPBH-34	WG-WG'	2058026	706163	50	1261	Vertical
WPBH-35	WG-WG'	2057928	706185	50	1262	Vertical
WPBH-36	WG-WG' & WH-WH'	2058305	706198	50	1248	Vertical
WPBH-37	WG-WG' & WH-WH'	2058208	706222	50	1238	Vertical
WPBH-38	WG-WG' & WH-WH'	2058109	706244	50	1266	Vertical
WPBH-39	WG-WG' & WH-WH'	2058013	706269	50	1278	Vertical
WPBH-40	WH-WH'	2058180	706329	50	1259	Vertical
WPBH-41	WH-WH'	2058083	706351	50	1276	Vertical
WPBH-42	WH-WH'	2057986	706376	50	1289	Vertical
WPBH-43	WE-WE' & WF-WF'	2058685	705686	50	1243	Vertical
WPBH-44	WE-WE' & WF-WF'	2058599	705719	50	1243	Vertical
WPBH-45	WF-WF'	2058702	705798	50	1240	Vertical
WPBH-46	WF-WF'	2058637	705813	50	1234	Vertical
WPBH-47	WF-WF' & WG-WG'	2058696	705902	50	1248	Vertical
WPBH-48	WF-WF' & WG-WG'	2058618	705910	50	1234	Vertical
WPBH-49	WG-WG'	2058709	706001	50	1246	Vertical
WPBH-50	WG-WG'	2058654	706014	50	1237	Vertical
WPBH-51	WG-WG' & WH-WH'	2058742	706099	50	1248	Vertical
WPBH-52	WG-WG' & WH-WH'	2058656	706121	50	1246	Vertical
WPBH-53	WH-WH'	2058787	706188	50	1248	Vertical
WPBH-54	WH-WH'	2058700	706207	50	1243	Vertical
WPBH-55	WH-WH' & WI-WI'	2058835	706273	50	1258	Vertical
WPBH-56	WH-WH' & WI-WI'	2058750	706309	50	1256	Vertical
WPBH-57	WI-WI'	2058878	706348	50	1254	Vertical
WPBH-58	WI-WI'	2058785	706388	50	1250	Vertical
WPBH-59	WI-WI' & WJ-WJ'	2058932	706427	50	1276	Vertical
WPBH-60	WI-WI' & WJ-WJ'	2058877	706460	50	1268	Vertical
WPBH-61	WJ-WJ'	2059002	706524	50	1273	Vertical
WPBH-62	WJ-WJ' & WK-WK'	2059089	706584	50	1284	Vertical
WPBH-63	WK-WK'	2059158	706647	50	1285	Vertical
WPBH-64	WK-WK' & WL-WL'	2059240	706708	50	1288	Vertical
WPBH-65	WL-WL'	2059330	706753	50	1306	Vertical
WPBH-66	WL-WL' & WM-WM'	2059441	706764	50	1318	Vertical
WPBH-67	WL-WL' & WM-WM'	2059403	706825	50	1318	Vertical
WPBH-68	WM-WM'	2059523	706803	50	1316	Vertical
WPBH-69	WM-WM'	2059478	706880	50	1315	Vertical
WPBH-70	WM-WM' &WN-WN'	2059613	706848	50	1312	Vertical
WPBH-71	WM-WM' &WN-WN'	2059552	706925	50	1310	Vertical
WPBH-72	WN-WN'	2059685	706922	50	1332	Vertical
WPBH-73	WO-WO'	2057716	706415	50	1311	Vertical
WPBH-74	WO-WO'	2057798	706474	50	1321	Vertical
WPBH-75	WO-WO' &WP-WP'	2057662	706500	50	1310	Vertical
WPBH-76	WO-WO' &WP-WP'	2057748	706561	50	1322	Vertical

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नेशनल एल्युमिनियम कंपनी लिमिटेड
National Aluminium Company Ltd.
भुवनेश्वर/Bhubaneswar-751013

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WPBH-77	WP-WP'	2057596	706592	50	1314	Vertical
WPBH-78	WP-WP'	2057685	706640	50	1322	Vertical
WPBH-79	WP-WP'	2057774	706687	50	1320	Vertical
WPBH-80	WP-WP'&WQ-WQ'	2057579	706703	50	1310	Vertical
WPBH-81	WP-WP'&WQ-WQ'	2057652	706744	50	1318	Vertical
WPBH-82	WP-WP'&WQ-WQ'	2057740	706791	50	1318	Vertical
WPBH-83	WQ-WQ'	2057567	706806	50	1316	Vertical
WPBH-84	WQ-WQ'	2057646	706845	50	1322	Vertical
WPBH-85	WQ-WQ'	2057731	706889	50	1321	Vertical
WPBH-86	WQ-WQ' & WR-WR'	2057557	706910	50	1317	Vertical
WPBH-87	WQ-WQ' & WR-WR'	2057645	706956	50	1324	Vertical
WPBH-88	WQ-WQ' & WR-WR'	2057736	707003	50	1322	Vertical
WPBH-89	WR-WR'	2057525	707007	50	1320	Vertical
WPBH-90	WR-WR'	2057615	707054	50	1330	Vertical
WPBH-91	WR-WR'	2057705	707100	50	1334	Vertical
WPBH-92	WR-WR'& WS-WS'	2057500	707094	50	1323	Vertical
WPBH-93	WR-WR'& WS-WS'	2057590	707122	50	1330	Vertical
WPBH-94	WR-WR'& WS-WS'	2057660	707126	50	1328	Vertical
WPBH-95	WS-WS'	2057487	707178	50	1332	Vertical
WPBH-96	WS-WS'	2057587	707175	50	1334	Vertical
WPBH-97	WS-WS'	2057686	707174	50	1330	Vertical
WPBH-98	WS-WS' & WT-WT'	2057460	707294	50	1348	Vertical
WPBH-99	WS-WS' & WT-WT'	2057569	707251	50	1340	Vertical
WPBH-100	WT-WT'	2057446	707405	50	1370	Vertical
WPBH-101	WT-WT'	2057528	707356	50	1354	Vertical
WPBH-102	WT-WT'	2057616	707301	50	1343	Vertical
WPBH-103	WT-WT'	2057701	707248	50	1333	Vertical
WPBH-104	WT-WT' & WU-WU'	2057501	707489	50	1372	Vertical
WPBH-105	WT-WT' & WU-WU'	2057587	707437	50	1356	Vertical
WPBH-106	WT-WT' & WU-WU'	2057672	707384	50	1344	Vertical
WPBH-107	WU-WU'	2057566	707566	50	1365	Vertical
WPBH-108	WU-WU'	2057652	707514	50	1352	Vertical
WPBH-109	WU-WU'	2057737	707461	50	1342	Vertical
WPBH-110	WU-WU' & WV-WV'	2057602	707661	50	1356	Vertical
WPBH-111	WU-WU' & WV-WV'	2057687	707609	50	1348	Vertical
WPBH-112	WU-WU' & WV-WV'	2057772	707557	50	1343	Vertical
WPBH-113	WV-WV'	2057733	707699	50	1347	Vertical
WPBH-114	WV-WV'	2057819	707646	50	1343	Vertical
WPBH-115	WV-WV' & WW-WW'	2057857	707739	50	1339	Vertical
WPBH-116	WW-WW'	2057929	707813	50	1333	Vertical
TOTAL				5800		

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National Aluminium Company Ltd
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j) Reserves and Resources as per UNFC with respect to the threshold value notified by IBM may be furnished in a tabular form as given below: (Area explored under different level of exploration may be marked on the geological plan and UNFC code for area considered for different categories of reserve / resources estimation may also be marked on geological cross sections). Submit a feasibility/pre-feasibility study report along with financial analysis for economic viability of the deposit as specified under the UNFC field guidelines may be incorporated.

As detailed exploration has been carried out by GSI and MECL, the details of estimation of reserves / resources given in GSI/MECL report is discussed in previous section. However, fresh Reserves / Resources have been estimated by geological cross section method using the same exploration data by considering the IBM threshold value of 30% Al_2O_3 and Total Silica - 7% max.

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A pre-feasibility study report along with financial analysis for economic viability of the deposit as per part V of MEMC Rules 2015 is enclosed as Annexure-10. Area explored under different level of exploration marked on the geological plan and UNFC code for area considered for different categories of reserve / resources estimation marked on geological cross sections.

Table – 23: Summary of block wise Reserves / Resources in million tonnes

Category (UNFC)	South block	Central Block	Total
Probable Mineral Reserves (121)	*21.314*	*17.266*	38.580
(122)	*0.598*	*1.447*	2.045
Probable Mineral Reserves-Total	21.92	18.713	40.625
Pre-Feasibility MineralResource(221&222)	-	0.31	0.31
Total Reserves + Resources	**21.92**	**19.023**	**40.935**

k) Furnish detailed calculation of reserves/resources section wise (When the mine is fully mechanized and deposit is of complex nature with variation of size, shape of mineralized zones, grade due to intrusion within ore zone etc, an attempt may be made to estimate reserves/resources by slice plan method). In case of deposits where underground mining is proposed, reserve/resources may be estimated by level plan method, as applicable, as per the proposed mining parameters.

253 boreholes drilled earlier by GSI/MECL have been used in restimation of reserves/resources. These are listed in Annexure-13. Section wise detailed calculation of reserves/resources for each block are tabulated below:

Table – 24: Probable Mineral Reserves (121)-South Block

	BAUXITE					WASTE (Topsoil)				
Sec-tions	Area sqm	Influ m	Vol cum	TF t/cum	Quantity tonnes	Area sqm	Influ m	Vol cum	TF t/cum	Quantity Tonnes
A-A'	1218	100	121800	1.93	235074	63	130	8190	1.5	12285
B-B'	8003	100	800300	1.93	1544579	185	100	18500	1.5	27750
C-C'	7894	100	789400	1.93	1523542	299	100	29900	1.5	44850
D-D'	13129	100	1312900	1.93	2533897	315	100	31500	1.5	47250
E-E'	13254	100	1325400	1.93	2558022	400	100	40000	1.5	60000
F-F'	13852	100	1385200	1.93	2673436	325	100	32500	1.5	48750
G-G'	8103	100	810300	1.93	1563879	218	100	21800	1.5	32700
H-H'	6113	100	611300	1.93	1179809	174	100	17400	1.5	26100
I-I'	7897	100	789700	1.93	1524121	202	100	20200	1.5	30300
J-J'	7564	100	756400	1.93	1459852	161	100	16100	1.5	24150
K-K'	7943	100	794300	1.93	1532999	200	100	20000	1.5	30000
L-L'	5293	100	529300	1.93	1021549	158	100	15800	1.5	23700
M-M'	3729	100	372900	1.93	719697	132	100	13200	1.5	19800
N-N'	5495	100	549500	1.93	1060535	119	100	11900	1.5	17850
O-O'	950	100	95000	1.93	183350	64	115	7360	1.5	11040
Total					21314341					456525

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भुवनेश्वर/ Bhubaneswar

Table – 25: Probable Mineral Reserves (122)-South Block

Sections	Area sqm	Influ m	Vol cum	TF t/cum	Quantity tonnes
D-D'	421	100	42100	1.93	81253
E-E'	683	100	68300	1.93	131819
F-F'	1540	100	154000	1.93	297220
H-H'	211	100	21100	1.93	40723
K-K'	245	100	24500	1.93	47285
Total					**598,300**

Table – 26: Probable Mineral Reserves (121)- Central Block

Sec-tions	BAUXITE					WASTE (Topsoil)				
	Area Sqm	Influ m	Vol cum	TF t/cum	Quantity Tonnes	Area Sqm	Influ m	Vol cum	TF t/cum	Quantity tonnes
CA-CA'	358	100	35800	1.93	69094	30	130	3900	1.5	5850
CB-CB'	1433	100	143300	1.93	276569	118	100	11800	1.5	17700
CC-CC'	3128	100	312800	1.93	603704	210	100	21000	1.5	31500
CD-CD'	2455	100	245500	1.93	473815	484	100	48400	1.5	72600
CE-CE'	4945	100	494500	1.93	954385	121	100	12100	1.5	18150
CF-CF'	3293	100	329300	1.93	635549	210	100	21000	1.5	31500
CG-CG'	5735	100	573500	1.93	1106855	251	100	25100	1.5	37650
CH-CH'	9394	100	939400	1.93	1813042	311	100	31100	1.5	46650
CI-CI'	7790	100	779000	1.93	1503470	285	100	28500	1.5	42750
CJ-CJ'	3538	100	353800	1.93	682834	165	100	16500	1.5	24750
CK-CK'	3544	100	354400	1.93	683992	157	100	15700	1.5	23550
CL-CL'	7159	100	715900	1.93	1381687	90	135	12150	1.5	18225
CM-CM'	3351	100	335100	1.93	646743	145	100	14500	1.5	21750
CN-CN'	761	100	76100	1.93	146873	143	100	14300	1.5	21450
CO-CO'	2478	100	247800	1.93	478254	199	100	19900	1.5	29850
CP-CP'	5896	100	589600	1.93	1137928	215	100	21500	1.5	32250
CQ-CQ'	2465	100	246500	1.93	475745	217	100	21700	1.5	32550
CR-CR'	5546	100	554600	1.93	1070378	199	100	19900	1.5	29850
CS-CS'	5388	100	538800	1.93	1039884	181	100	18100	1.5	27150
CT-CT'	3662	100	366200	1.93	706766	305	100	30500	1.5	45750
CU-CU'	3440	100	344000	1.93	663920	251	100	25100	1.5	37650
CV-CV'	1812	100	181200	1.93	349716	164	100	16400	1.5	24600
CW-CW'	1672	100	167200	1.93	322696	112	100	11200	1.5	16800
CX-CX'	218	100	21800	1.93	42074	77	135	10395	1.5	15593
TOTAL					**17265973**					**443925**

Table – 27: Probable Mineral Reserves (122)-Central Block

Sections	Area sqm	Influ m	Vol cum	TF t/cum	Quantity tonnes
CG-CG'	1366	100	136600	1.93	263638
CH-CH'	1253	100	125300	1.93	241829
CI-CI'	391	100	39100	1.93	75463
CJ-CJ'	189	100	18900	1.93	36477
CL-CL'	582	100	58200	1.93	112326
CM-CM'	1375	100	137500	1.93	265375
CO-CO'	964	100	96400	1.93	186052
CU-CU'	333	100	33300	1.93	64269
CV-CV'	605	100	60500	1.93	116765
CW-CW'	289	100	28900	1.93	55777
CX-CX'	152	100	15200	1.93	29336
TOTAL					**1,447,307**

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Divisional Forest Officer
Koraput Forest Division

Table –30: Resources and Reserves

Category	UNFC	Bauxite million tons	
A. Total Mineral Reserve			
Proved Mineral Reserves	111	-	
Probable Mineral Reserves	121	38.580	45.59% Al_2O_3 & 1.42% SiO_2
	122	2.045	45.78% Al_2O_3 & 2.78% SiO_2
	Total	40.625	
B. Total Remaining Resources			
Feasibility Mineral Resource	211	-	-
Prefeasibility Mineral Resource	221	0.310	41.70% Al_2O_3 & 1.51% SiO_2
Measured Mineral Resource	331	-	-
Indicated Mineral Resource	332	-	-
Inferred Mineral Resource	333	--	-
Reconnaissance Mineral Resources	334	-	-
Total Reserves + Resources		**40.935**	-

Note: It is not possible to quantify grade wise reserves, as normally there is considerable variation in size and grade distribution within the ore zone, which results variable recovery factor and bulk density. Thus, tonnages arrived are tentative.

Justification in support of UNFC Codification

Under United Nations Framework Classification (UNFC), the reserves/ resources have been categorized by attributing 3-digit codes of (E) economic axis, (F) feasibility axis and (G) geological axis.

Probable Mineral Reserves (121) are estimated using data of 100m x 50m and 100m x 100m grids in South and Central blocks. Although the area is explored in detail, it is coming under feasibility axis F2 as the lease is yet to be executed after getting Forest and Environmental clearances.

Reserves blocked in the safety zone are estimated as Pre-Feasibility Mineral Resources (221).

The Probable Mineral Reserves has been coded under 121&122 as per the status of geological, economic and feasibility axis as follows :

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Table-31

Economic Axis (E1 : Economic)	Feasibility Axis (F2 : PreFeasibility study)	Geological Axis (G1 : Detailed Exploration)
1. Detailed Exploration : 100m x 50m and 100m x 100m grids in South and Central blocks. **2. Mining Report :** Mining plan prepared and being submitted for approval by IBM. **3. End use grades of reserves:** Minable reserve as on date is 41.88 Mill.Tones with average grade of 45.59% Al_2O_3 and 1.99% SiO_2 **4. Specific knowledge of forest/non-forest and other land use data.** Total lease area is in forest and Forest clearance will be obtained.	**1. Geology:** Geological report is prepared in detail with adequate exploration data. **2. Mining :** Mining plan prepared and being submitted for approval by IBM. **3. Environmental :** Monitoring of environmental domains is being carried out, EIA/EMP being prepared. **4. Processing :** No processing study required as ROM will be fed to plant to crush the ROM to -150mm material. **5. Infrastructure and services, construction activities:** The mine will establish required infrastructural facilities including transportation before mine operation. **6. Costing:** The estimated cost of production is about Rs.300/- per ton. **7 & 8. Marketing and Economic Viability:** As all ore will be consumed by NALCO Refinery, no issue of marketing and economic viability. **9. Other Factors:** Lease is yet to executed and Forest Clearance and Environmental Clarances still under process. **10. Economic Evaluation:** The estimated cost of production is about Rs.300/- per ton. However, as all ore will be consumed by NALCO Refinery, no issue of economic viability	**1.Geological survey:** (i) Mapping-Surface and Geological maps prepared in 1:4000 scale. (ii)Preparation of detailed topo graphical (surface), geological map including all surface geological features, extent of deposit, structure, location of boreholes, sections and borehole data. (iii)Topogrid/triangulation stations identified and these are linked in Surface Plan. **2.Geochemical survey:** Not necessary as detailed exploration is carried out. **3.Geophysical survey:** Not necessary as detailed exploration is carried out. **4.Technological:** (i)Pitting – 19 nos. 368cum by GSI, 24 nos. 1170.7cum -100m spacing by MECL (ii)Trenching – 1596.60cum (100x200m) by MECL. (iii)Drilling- GSI conducted exploration in 1972-76 with 69 core boreholes with a meterage of 1929.39m. Later during 1976-78, the South and Central blocks were explored by MECL in two phases by drilling 195 core boreholes with a total meterage of 5888.50m. Drilling was in 100m x 50m and 100m x 100m grids in South and Central blocks. Reserves/resources are estimated by considering the depth of mineralization upto the depth encountered in BH and lateral extension is limited to 50% of section line spacing based on geological considerations. (iv)Exploratory mining - Not carried out. (v)Sampling - Drill sampling was done and analyzed. **5.Petrographic and mineragraphic study:** Not necessary as detailed exploration is carried out. **6)Geostatistical analysis** Not necessary as detailed estimation by section method is carried out.

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भुवनेश्वर/Bhubaneswar-751013

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Koraput Forest Division

Prefeasibility Mineral Resources (present in 7.5m buffer zone which is not minable) has been coded under 221 as per the status of geological, economic and feasibility axis as follows :

Table-32

Economic Axis (E2 : Potentailly Economic)	Feasibility Axis (F2 : PreFeasibility study)	Geological Axis (G1 : Detailed Exploration)
1.General and detailed exploration 100m x 50m and 100m x 100m grids in South and Central blocks. **2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade).** Average grade is above the threshold values **3. General knowledge of forest/nonforest and other land use data.** Lease is yet to executed and Forest Clearance and Environmental Clarances still under process. The area of this deposit fall in 7.5m buffer zone which is not minable.	**1. Geology:** Geological report is prepared in detail with adequate exploration data. **2. Mining :** Mining plan prepared and being submitted for approval by IBM. **3. Environmental :** Monitoring of environmental domains is being carried out, EIA/EMP being prepared and environmental clearance will be obtained. **4. Processing :** No processing study required as ROM will be fed to plant to crush the ROM to -150mm material. **5. Infrastructure and services, construction activities:** The mine will establish required infrastructural facilities including transportation before mine operation. **6. Costing:** The estimated cost of production is about Rs.300/- per ton. **7 & 8. Marketing and Economic Viability:** As all ore will be consumed by NALCO Refinery, no issue of marketing and economic viability. **9. Other Factors:** Lease is yet to executed and Forest Clearance and Environmental Clarances still under process. **10. Economic Evaluation:** The estimated cost of production is about Rs.300/- per ton. However, as all ore will be consumed by NALCO Refinery, no issue of economic viability	**1.Geological survey:** (i) Mapping-Surface and Geological maps prepared in 1:4000 scale. (ii)Preparation of detailed topo graphical (surface), geological map including all surface geological features, extent of deposit, structure, location of boreholes, sections and borehole data. (iii)Topogrid/triangulation stations identified and these are linked in Surface Plan. **2.Geochemical survey:** Not necessary as detailed exploration is carried out. **3.Geophysical survey:** Not necessary as detailed exploration is carried out. **4.Technological:** Drilling- GSI conducted exploration in 1972-76 with 69 core boreholes with a meterage of 1929.39m. Later during 1976-78, the South and Central blocks were explored by MECL in two phases by drilling 195 core boreholes with a total meterage of 5888.50m. Drilling was in 100m x 50m and 100m x 100m grids in South and Central blocks. Reserves/resources are estimated by considering the depth of mineralization upto the depth encountered in BH and lateral extension is limited to 50% of section line spacing based on geological considerations. (iv)Exploratory mining - Not carried out. (v)Sampling - Drill sampling was done and analyzed. **5.Petrographic and mineragraphic study:** Not necessary as detailed exploration is carried out. **6)Geostatistical analysis** Not necessary as detailed estimation by section method is carried out.

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2.0 MINING:

A. OPEN CAST MINING:

NALCO is expanding its refinery capacity by proposing 5th stream of the alumina refinery at Damanjodi for additional production of 1.0 MTPA of alumina. To cater the raw material requirement of this project, the annual requirement of bauxite for production of one million tons of alumina works out to about 3.50 million tons/annum. Mining activity in this lease is proposed to be in line with this scale of operation.

a) Briefly describe the existing as well as proposed method for excavation with all design parameters indicating on plans /sections.

This is a new mining area and it is proposed to operate after execution of mining lease. Considering the major factors like topography, estimated reserve & grade, thickness and nature of ore/overburden, fully mechanized opencast of mining (trench method) is proposed with the deployment of heavy earth moving machineries (HEMM) like ripper dozer, blast hole drill, front-end loader, back-hoe, dumper, semi mobile crusher with conveyor, double roll toothed crusher etc.

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Lessee is proposing to produce a maximum quantity of 3.50 million tonnes of Bauxite from one end of the mining lease, that is from south block itself as this block is sufficiently explored and it contains good amount of mineral reserves under minable category (40.625MT) which is sufficient for this plan period.

Before commencement of mining operation, a suitable access road of 10m width to the Pottangi mine will be developed for regular transportation of employees from the township at Damanjodi, maintenance of overland conveyor installation and also to maintain a regular surface linkage between the mine and the alumina refinery. There are two approach roads to this lease area. One approach road at Eastern side is from Turria village and another approach road at Western side is from Marla village. The present approach road of 6.1kms

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made during the exploration programme of GSI/MECL is of 3meters width and is completely damaged. The same existing approach road will be related with 10 meters width and will be extended about additional 16.15 km to connect all the five blocks for Excavation/Exploration purpose. Conceptual plan plate no. V shows the approach/haulage road.

Following considerations are made for mine planning:

- Eight months of dry season and four months of rainy/monsoon season per year.
- Three hundred fifty effective working days per year
- Two operating shifts per day, each of 8 hours duration.
- Effective working hours at 12 per day during dry season and 8 per day during monsoon.

b) **Indicate year-wise tentative Excavation in Cubic Meters indicating development, ROM, pit wise as in table below.**

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I. Insitu tentative Excavation

Table-33: Year wise working details –in Cum

Year	Pit No.	Total tentative Excavation	Top Soil	OB/SB /IB	ROM		Mineral rejects	ROM/ Waste Ratio
					Bauxite	Mineral Reject		
1	2	3	4	5	6	7	8	9
First	One	15,83,000	76,800	88,700	1,417,500	-	-	1: 0.11
Second		18,51,210	90,890	127,920	1,632,400	-	-	1: 0.13
Third		19,73,990	43,070	117,420	1,813,500	-	-	1: 0.09
Fourth		19,82,910	24,900	144,510	1,813,500	-	-	1: 0.09
Fifth		20,37,900	31,900	192,500	1,813,500	-	-	1: 0.12

Tentative tonnage of the ore arrived by computing approximate bulk density and recovery factor as these data are variable and may be established on time series.

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The recovery of Bauxite has been considered as 100 % as the average grade of bauxite in the ore zone is about 45.6% Al_2O_3 which is way more than threshold value and total excavation of ore zone will be used as ROM.

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Bulk density details are given below.

Bulk density of Pottangi bauxite has been taken as calculated in *GSI report* as a test case based on the data collected from test pits (PSP-8, PNP-2). Volume and weight of material excavated from each pit were measured and weighed for a depth interval of one metre.

Table-34: Results of BD tests by GSI

Particulars	PSP-8	PNP-2
1. Volume of the material for a depth Excavation of 1 m to 2 m (cu. m.)	3.78	3.65
2. Weight of the material (in tonnes)	7.18	7.12
3. Tonnes of orc/cum (Bulk density)	1.90	1.95

The bulk density thus is between 1.90 and 1.95. Hence, average of these two, that is 1.93 ton/cum is considered.

Table-35:

	Bauxite	Waste (Siliceous Bauxite)	Toposil
Bulk Density	1.93 ton/cum	1.8 ton/cum	1.5 ton/cum

Thus, the tonnage arrived are as below:

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Table-36: Year wise working details –in tonnes

Year	Pit No.	Total tentative Excavation	Top Soil	OB/SB /IB	ROM		Mineral rejects	ROM: Waste Ratio
					Bauxite	Mineral Reject		
1	2	3	4	5	6	7	8	9
First	One	31,14,855	1,15,200	1,59,660	28,39,995	-	-	1: 0.10
Second		35,17,123	1,36,335	2,30,256	31,50,532	-	-	1: 0.12
Third		37,76,016	64,605	2,11,356	35,00,055	-	-	1: 0.08
Fourth		37,97,523	37,350	2,60,118	35,00,055	-	-	1: 0.08
Fifth		38,94,405	47,850	3,46,500	35,00,055	-	-	1: 0.11

Annexure- 11 shows details of calculation.

II. Dump re-handling: (for the purpose of recovery of mineral):

No proposals of dump re-handling as this is first Mining Plan.

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c) **Enclose Individual year wise development plans and sections showing pit layouts, dumps, stacks of mineral reject, if any, etcin case of 'A' category mines.Composite development plans showing pit layouts, dumps, stacks of mineral reject, if any, etc. and year wise sections in case of 'B' category mines.**

Year wise Production and Development plans and sections are enclosed in 1:2000 scale. (Plate III a & b)

d) **Describe briefly giving salient features of the proposed method of working indicating Category of mine.**

Fully mechanized method of mining (A category) with two shift basis working will be adopted. Mining machineries like ripper dozer, blast hole drill, front-end loader, back-hoe, dumper, Semi mobile crusher with fixed long distance conveyor, double roll tooth crusher and cable belt conveyor will be deployed.

Before commencement of bauxite mining operation in South block, it is proposed to remove the topsoil to gain easy access to the bauxite benches in the respective areas. The overburden consists of top soil of about 0.5m depth which is proposed to be removed separately by scraping with dozer and the heaps so formed will be lifted by loader-dumper combination. This material initially for three years shall be stacked separately temporarily on the ground earmarked for top soil. Thereafter, this will be used for backfilling of the mined-out areas for growing trees and vegetation.

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The bauxite is proposed to be excavated by Trench mining method comprising of a number of parallel trenches with staggered faces. Mining in each trench will take place in distinct slices of 8m each. Top bauxite will be loosened either by ripper dozer or drilling-blasting depending upon physical characteristics of the material. Loosened bauxite will be loaded by hydraulic shovel/loaders on to the dumpers for transportation to the proposed crusher.

It is proposed to start the trench from western part at the South block and extending them towards east. The bauxite deposit shows variable thickness, in South block it generally varies between 6 m to 37 m. Considering the above, it

is planned to mine with 8m bench height with width of the benches varying from 15-200mtrs for the purpose of safety of working and ease of movement of machinery. The individual bench faces will be kept nearly vertical whereas the overall quarry slope angle will be maintained at 45^0 with the horizontal to keeping the overall pit design stable. Ripper will be deployed for bauxite production, where bench height is low. Drilling and blasting technique will be adopted in benches where the strata are too hard for economically loosening by ripping. The bottom of the bauxite shall be excavated using hydraulic Back-hoe shovels. The mined out Bauxite will be transported through dumpers to crusher unit for crushing to -150mm size and this crushed ore will be sent by conveyor method of transportation to NALCO's Alumina Refinery located Damanjodi.

Drilling & Blasting:

Loosening & breaking the In-situ strata/rock by blasting is a normal practice followed in mining activity. At this mine, ripping, blasting and hydraulic rock breaking (instead of secondary blasting) are adopted to loosen/break the rock mass depending upon the rock properties, size requirement and productivity.

Due to the presence of villages nearby the proposed mine, a blast vibration study by a reputed institute like CMRI, Dhanbad to know the impact of blasting due to vibration or fly rock on human life is proposed to be taken up by lessee after the start of mine operation. The data from this study will be used to estimate optimium charge per delay and most suitable drilling /blasting design along with initiation and firing pattern so as to minimise the effects of blasting on nearby settlements.

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Broad blasting parameters

It is proposed to blast 8m high benches in Bauxite. Controlled blasting parameters as suggested by proposed vibration studies will be practiced to achieve optimum results in terms of fragmentation, economy and least possible effect on the surrounding environment.

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Table-37: Blasting parameters

Hole Diameter	150mm	Explosive charge/hole	160 Kg
Bench height	8m	Maximum charge/delay	80 K
Hole depth	8.8m	Holes in a round	5
Burden	4m	Blasting pattern	St
Spacing	5m	Hole Initiation System	NONEL
Charging	20 Kg/m	Surface Initiation System	-do-
Yield/m	40 t	Frequency of blasting	Daily

Type of explosives to be used

Charging: Blasting will be done with the help of 70% Ammonium Nitrate Fuel Oil (ANFO) mixture and 30% high explosives. Top part of the hole over 2m will be used/subjected for stemming by the drill cuttings and remaining hole length will be charged by the ANFO & high explosives as base charge. During rainy season and in wet ground, large dia cartridge (120mm dia) of slurry/emulsion explosive will be used.

Stemming: Stemming is a process of filling of inert materials to pack the explosive in the blast hole. Proper and compact stemming withholds the gas after blasting. More stemming (than optimum) allows less explosives into the hole, decreases blasting efficiency and increases ground vibration while less stemming causes air blast and noise. Keeping in view the above facts, optimum top stemming column in the blast hole will be 3.75m which is 25 times of blast hole diameter to obtain sufficient burial depth of explosive charge to prevent premature venting of explosive gas energy and to reduce the noise level. This length of steaming also prevents fly rock occurrence & movements.

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Initiation: In order to mitigate blast induced noise, only non-electric initiating system (NONEL) will be used for in-hole as well as hole to hole initiation. To reduce noise /air overpressure as well as ground vibration, deck charging has been recommended for 8m to 10m deep holes. Using deck charge, the maximum explosive charge/delay will be reduced. This results better fragmentation of rock which is also observed in various experimental blasts. However, large diameter explosive of slurry / emulsion shall be used in rainy season.

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Powder factor: As per the experience of mining in the Panchpatmali Mine, powder factor (PF) for Bauxite is estimated as below:

Quantity broken/hole= Burden x Spacing x Depth x Avg. Bulk Density

= 4 m x 5 m x 8m x 2.0 tons / m3
= 320 tons/hole

Explosive charge/hole = 160kg
PF = Charge per hole(kgs of explosives) /Qty broken per hole (tonnes)
PF = 160 / 320 = **0.5 kg/ton**

Storage of Explosives: It is proposed to build a magazine of 25 ton capacity for storing conventional slurry/emulsion explosives and other blasting accessories at Extension east block. However, considering the security hazards in the surrounding area, possibility of carrying out contractual blasting will also be explored before actual execution stage.

Sizing: Run-off mine (ROM) Bauxite (-800mm size) obtained from the ripping, blasting and excavation by the backhoe will be transported by high capacity dumpers (50t or higher) to the hopper of 900tph crusher where Bauxite is crushed in to -150mm size.

Transportation: ROM Bauxite from the face to the primary crusher will be transported by high capacity dumpers (50t or higher) while crushed Bauxite is transported to the refinery plant at Damanjodi by the proposed belt conveyor.

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Machinery:

Excavation and loading: Top Bauxite (first slice from top) will be excavated & loaded in the 50t / 55t capacity dumper by 8.7m^3 capacity wheel loader and Bauxite of bottom bench (remaining slices) will be excavated by 6.5m^3 capacity back hoe shovel & loaded in the 50t / 55 t dumper. the detailed calculation is as follows:

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Table: 38

Item	Top Bauxite	Bottom Bauxite
Bucket Capacity	= 8.7 m^3	= 6.5 m^3
Bucket fill factor	= 0.75	= 0.75
Swell factor	= 0.75	= 0.75
Availability of loader	= 85%	= 85%
Utilization of available loader	= 75%	= 60%
Shovel cycle time	= 45 sec	= 50 sec
Swing factor	= 1	= 1
Volume required to be handled/ annum	= 20,50,000 m^3	= 13,62,500 m^3
Output / wheel loader	= 8.7 x 0.75 x 0.75 x 85% x 75% x 3600 x 8 x 2 x 365 / (45 x 1) =14,57,555 m^3	= 6.5 x 0.75 x 0.75 x 85% x 60% x 3600 x 8 x 2 x 365 / (50 x 1) =7,84,063 m^3
Required wheel loaders / shovels	= 20,50,000 / 14,57,555 = 1.41, say 2 nos.	=3,62,500/7,84,063 = 1.73 say 2 nos.

Haulage of Ore and Overburden: Bauxite is mined and transported to crusher for crushing and transportation to Nalco's Alumina Refinery located at foot hill at Damanjodi. Excavator and dumper calculation are made as follows:

Table:39

Parameters	Top Bauxite	Bottom Bauxite
Bucket capacity	= 8.7 m^3	= 6.5 m^3
Bucket fill factor	= 0.9	= 0.9
Swell factor	= 0.85	= 0.75
Tonnage factor	= 2 t/m^3	= 2 t/m^3
Tonnes per pass	= 8.7 x 0.9 x 0.85 x 2 = 13.31 t	= 6.5 x 0.9 x 0.85 x 2 = 9.945 t
No. of passes	Tonnage rating of dumper / tones per pass = 50 / 13.31 = 3.75, say 4 passes	Tonnage rating of dumper / tones per pass = 50 / 9.945 = 5.02, say 5 passes
Loading time	= 4 x 45 = 180 sec.	= 5 x 36 = 180 sec.
Lead	5 km	5 km
Load travel time	(3600 x 5) / 25 = 720 sec.	(3600 x 5) / 25 = 720 sec.
Dumping time	60 sec.	60 sec.
Empty travel time	(3600 x 5) / 25 = 720 sec.	(3600 x 5) / 25 = 720 sec.
Spotting time	60 sec.	60 sec.
Dumper cycle time	= 180+ 720+ 60 + 720 + 60 = 1740 sec	= 180 + 720 + 60 + 720 + 60 = 1740 sec
Number of rear dump trucks required /loader	=Cycle time/(loading + spotting time) =1740/(180+60) = 1740 / 240 = 7.25 say 8 Nos.	=Cycle time/(loading + spotting time) = 1740/(250+60) = 1740 / 310 = 5.61, say 6Nos.
Number of excavators	= 2	= 2
Number dumpers required in all total	= 2 x 8 = 16 Nos.	= 2 x 6 = 12 Nos.

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Blast Hole Drilling: There is a proposal to loosen 80% aluminous laterite and 30% Bauxite through drilling & blasting. Justification details are as follows.

Table-40

Parameters	Overburden	Bauxite
Burden	4 m	4m
Spacing	5 m	5m
Bench height	2.0 m	8m
Sub-grade drilling (10% of bench height)	0.2 m	0.8m
Depth of the hole	2 + 0.2 = 2.2 m	8+ 0.8 = 8.8m
Drill hole diameter	150 mm	150 mm
Drilling speed	18m / hr.	18m/hr
Working hours in a shift	8	8
Number of shifts per day	2	2
Annual working days	365	365
Drill availability	70%	70%
Utilization of available drill	40%	40%
Meters to be drilled/ drill / annum	= 18 x 8 x 2 x 365 x 70% x 40% = 29,433m	= 18 x 8 x 2 x 365 x 70% x 40% = 29,433m
Output / hole	= 4 x 5 x 2 x 2 = 80 t	= 4 x 5 x 8 x 2 = 320 t
Quantity to be loosened through blasting	= 0.1 x 80% = 0.08 Mill.Tones	= 0.6 x 30% = 0.18 Mill.Tones
Annual requirement of holes	= (0.08 x 10^6)/ 80 = 1000 Nos.	= (0.18x10^6)/ 320 = 5625Nos.
Meterage of drilling required	= 1000 x 2.2 = 2200 m	= 562.5 x 8.8 = 4950 m
No. of drills required to be in operation	= 2200 / 29,433 = 0.07, say 1 No.	= 4950/29,433 = 0.16, say 1 No.

One drilling machine is sufficient, one will be standby.

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Table- 41: List of proposed machinery / equipment

Sl. No.	Class of machinery	Description	Size/ Capacity	H.P / Unit	Motive Power	No. of units
1	Ripper Dozer	Dozer	450 TPH	510	Non-Electric	8
2	Wheel Dozer	Dozer	350 YPH	485	-do-	2
3	Blast Hole Drill	Blast Hole Drill	150 mm Ø	276	Electric	6
4	Rock Breaker	Rock Breaker	5 T	120	Non-Electric	2
5	Hydraulic Excavators	Shovel	6.5 M^3	650	Non-Electric	4
6	Wheel Loader	Loader	8.7 M^3	641	-do-	10
7	Dumpers	Rigid Dumper	50 T	641	-do-	05

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		Rigid Dumper	55 T	641	-do-	25
8	Water Sprinkler	Sprinkler	28 KL	380	-do-	2
		Sprinkler	28 KL	380	-do-	
9	Motor Grader	Motor Grader	5.0 M^3	280	-do-	
		Motor Grader	4.5 M^3	240	-do-	
10	Hydraulic Crane	Crane	12 T	49	-do-	1
11	ANFO Van	Van	5 T	240	-do-	2
12	Explosive Van	Explosive Van	10 T	100	-do-	4
13	Diesel Bowser	Diesel Bowser	9 KL	120	-do-	3
14	Vacuum suction drill	Exploration Drill	25 mm	60	-do-	2
15	Light Mast	Truck mounted	---	---	---	14
16	Crusher	Fixed / mobile	900tph			1

e) **Describe briefly the layout of mine workings, pit road layout, the layout of faces and sites for disposal of overburden/waste along with ground preparation prior to disposal of waste, reject etc. A reference to the plans and sections may be given. UPL or ultimate size of the pit is to be shown for identification of the suitable dumping site.**

The general layout of mine showing the proposed mining areas, overburden /waste and top soil dumps, crushing plant, Statutory buildings, explosive magazine, haul roads and approach roads is presented in Production Plans (Plates -IIIb). Details of extent, co-ordinates and levels of working etc., are given below. (Cross sectional area is given in Production calculation table, Annexure-12):

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Table- 42: Year wise working details

Year	Working Area (Ha)	Top RL	Bottom RL	Northing	Easting
First	16.12	1362	1333	2056077	707149
				2055524	706600
Second	26.70	1341	1317	2056262	706470
				2055524	707269
Third	34.40	1326	1304	2056337	707360
				2055524	706449
Fourth	40.18*	1317	1301	2056355	707400
				2055524	706658
Fifth	46.33 **	1316	1284	2056355	707544
				2055524	706752

*Out of total 40.18 ha area, the backfilling area is 18.54 & plantation on backfilled area is 5.62 ha
**Out of total 46.33 ha area, the backfilling area is 21.33 & plantation on backfilled area is 18.54 ha

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Table- 43: Year wise working proposals

Perticulars		First	Second	Third	Fourth	Fifth
Bench geometry	Height (in m)	5 to 8	3 to 8	4 to 9	3 to 8	3 to 8
	Width (in m)	20 to 130	20 to 230	16 to 235	15 to 200	15 to 220
	Individual bench slope	70-80^0	70-80^0	70-80^0	70-80^0	70-80^0
Road design	Gradient of haul road	1 in 16-20	1 in 16-20	1 in 16-20	1 in 16-20	1 in 16-20
	Ramp gradient	1 in 10-12	1 in 10-12	1 in 10-12	1 in 10-12	1 in 10-12
	Berm height	1 to 1.5m	1 to 1.5m	1 to 1.5m	1 to 1.5m	1 to 1.5m
Mine development	Location of Development	South block	South block	South block	South block	South block
	Sections consider for Development	SB – SB' to SG-SG'	SA – SA' To SH-SH'	SA – SA' to SI-SI'	SC –SC' to SI-SI'	SD-SD' to SK-SK'
	No. of benches	4	4	4	3	4
	Benches consider for Development with RL	1-1362 to 1357 2-1357 to 1349 3-1349 to 1341 4-1341 to 1333	1-1341 to 1338 2-1338 to 1333 3-1333 to 1325 4-1325 to 1317	1-1326 to 1317 2-1317 to 1313 3-1313 to 1309 4-1309 to 1304	1-1317 to 1309 2-1309 to 1304 3-1304 to 1301	1-1316 to 1309 2-1309 to 1301 3-1301 to 1293 4-1293 to 1284
	Length of proposed benches (in m)	125 to 885	195 to 1035	205 to 800	310 to 1150	405 to 1500
	Direction of advancement	NE to SW	NE to SW	NE to SW	NE to SW	NE to SW
	Dimension of mine at the end of the year including existing benches	16.12 ha (610x264m)	26.70 ha (700x381m)	34.40 ha (850x405m)	21.64 ha (822x263m)	25.0 ha (950x263m)
	Overall mine slope angle	45^0	45^0	45^0	45^0	45^0
	Production of saleable ore (in MT)	2.84	3.15	3.50	3.50	3.50
	Generation of mineral rejects	-	-	-	-	-
	Production of ROM (ore + mineral reject) - in MT	2.84	3.15	3.50	3.50	3.50
	Total generation of waste (in MT)	0.275	0.367	0.276	0.297	0.394

The waste will be dumped temporarily for the first three years of this plan period in the central block adjacent to south block. These sites will be temporary but protection measures like toewalls and garland drains around dumps will be carried out to prevent erosion and wash off. No necessity of proving these areas for barreness as dumps are temporary. During fourth and fifth year, this waste will be backfilled in mined out areas. The details are;

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Table- 44: Year wise Waste handling

TEMPORARY WASTE DUMPING						
YEAR	EXTENT (Ha)	No. of Terraces	TOP RL (m)	BOTTOM RL (m)	NORTHING	EASTING
1	2.44	2 terraces of 8 m	1325	1310	2056345	706893
					2056634	707007
2	2.41	2 terraces of 8 m	1333	1317	2056370	706893
					2056651	707007
3	2.02	1 terrace of 8 m	1333	1325	2056400	706893
					2056609	707007

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TEMPORARY TOPSOIL DUMPING						
YEAR	EXTENT (Ha)	No. of Terraces	TOP RL (m)	BOTTOM RL (m)	NORTHING	EASTING
1	1.40	1 terrace of 8 m	1318	1310	2056334	706827
					2056533	706915
2	1.37	1 terrace of 8 m	1325	1318	2056400	706827
					2056607	706915
3	2.11	2 terraces of 8 m	1328	1318	2056369	706827
					2056651	706915

f) **Conceptual Mine planning upto the end of lease period taking into consideration the present available reserves and resources describing the excavation, recovery of ROM, Disposal of waste, backfilling of voids, reclamation and rehabilitation showing on a plan with few relevant sections.**

The mineable (probable) reserves estimated are 40.625 million tons and with the proposed production of 3.50 million TPA, the life of mine will be about 13 years. However, after completion proposed exploration, the reserves will increase and based on this, Conceptual mine planning will be revised considering new data on the life of the mine.

Excavation: In the lease about 354.777 ha area is mineralized. Considering the current exploration data and geology, pit layout is designed in south block only in this plan period. The ROM will be stacked in the 10.23 ha area earmarked for Crushing and transported to Refinery by any other mode till the establishment of ROM handling system (crusher, conveyor etc).

The mining will be carried out in other blocks also in the conceptual stage. The final pit limit is designed based on the ultimate pit slope and ultimate pit limit.

Table-45: UPL Parameters

Area (ha)	Pit Dimension in mtrs			
	Length	Width	Depth	Slope
354.777	12921	274.49	30	45°

The ultimate pit limit is demarcated on the Geological Plan and Cross Sections and enclosed as Plates IIC. Location of proposed workings are shown in the year wise layout plans, plate III/a to III/e.

Recovery of ROM: The recovery of ore from the reef ore zone is considered as 100% for production planning.

Disposal of Dumps: The waste mainly consisting of siliceous bauxite at the floor of the deposit (lithomarge) and topsoil with occasional laterite patches (having Al_2O_3 less than 20%) over the deposit. These will be dumped temporarily for the first three years of this plan period.

There is no sub grade generation during mining plan period as all the +30% Al_2O_3 and -7% SiO_2 material produced will be sent to Alumina plant of NALCO.

Backfilling of voids: Concurrent backfilling is not feasible as exhaustion of ore will happen after third year. Hence, waste generated will be dumped temporarily for first three years in the portion of the central block adjacent to south block and used for backfilling of mined out pits in fourth and fifth year. The area chosen for backfilling will be ensured that no ore is left unmined before backfilling is carried out.

Table-46: Backfilling Details

Year	Extent (Ha)	Northing	Easting
4	18.54	2056316	707036
		2055542	706862
5	2.79	2055693	707249
		2055525	706979

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The backfilling will be done in original litho sequence with waste at the bottom and topsoil on top as spreading over to facilitate plantation.

Reclamation and Rehabilitation:

For protection of the mining area and to prevent further degradation of land and stabilization of dumps, the measures and afforestation that are proposed are given below:

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Table-47: Proposed Protective Measures

Year	Items	Dimension*	Location
FIRST	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 91
		25 m x (1-3m) x 2m	South block southern valley
		25 m x (1-3m) x 2m	Near BP 8
		25 m x (1-3m) x 2m	Near BP 88- Western valley
	Retaining Wall	389m x (2m-1m) x 1m	Western side of Proposed Dump
	Retaining Wall	410m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	2470m x (2m-1m) x 1m	Around the proposed working Pit-South block
	Garland Drain	394m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	413m x (2m-1m) x 1m	Eastern side of proposed Dump
SECOND	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 81- outside lease area
		25 m x (1-3m) x 2m	Western side of Proposed conveyor belt-western valley
		25 m x (1-3m) x 2m	Eastern valley of West Extension Block

**Dimension parameters- Length x (bottom width -top width) x height*

Table-48: Proposed Plantation details

Year	Area in Ha	No. of Plants	Location
First	5.76	14,400	South & Central block safety zone
Second	9.07	22,675	North & west extn safety zone
Third	8.57	21,425	East extn safety zone
Fourth	5.62	14050	Part backfilled area
Fifth	12.92	32,300	Part backfilled area

Table-49: Land Use Pattern

Type of land use	Existing (ha)	This Plan period(ha)	Conceptual (ha)
Mining & Backfilling	0.113*	46.113#	354.777
Waste /Soil Dump	-	5.23	-
Statutory buildings/Infrastructre	-	33.859	28.326
Power Corridor	-	12.40	12.40
Primary Crusher/Conveyor belt (including temporary mineral stocks)	-	10.23	10.23
Roads	1.840	16.150	8.139
Safety zone/Greenbelt	23.400	23.400	284.107
Area untouched	672.626	550.597	--
Total	**697.979**	**697.979**	**697.979**

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Note:

**This area includes pits/trenches made by GSI/MECL*

 # This area includes 21.33 ha of backfilling area and further this area involve about 18.44 ha plantation.

B. UNDERGROUND MINING:

Not applicable

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3.0 MINE DRAINAGE

a) Minimum and maximum depth of water table based on observations from nearby wells and water bodies.

The ground water level in the area is observed to be ata depth of 140 m to 150 m. The deposit is planned to be worked up to a depth above the average surface level. Therefore, such depth of working would not affect the ground water table. Minimum RL of water table of the area is 1226 mRL and maximum is 1216 mRL as it is observed from nearby wells and water bodies.

b) Indicate maximum and minimum depth of working

Mining will be done up to a maximum of 40m below ground/plateau level. Therefore, there is no possibility of ground water puncture during the plan period of 5 years as well as life of the mine.

Table-50: Working levels

Block Name	At the end of plan period (mRL)		At the end of Conceptual period (mRL)	
	Top	Bottom	Top	Bottom
South block	1362	1284	1301	1240
Central Block	--	--	1385	1245
North Block	--	--	1415	1305
East Extn Block	--	---	1480	1228
West Extn Block	--	--	1330	1200

c) Quantity and quality of water likely to be encountered, the pumping arrangements and places where the mine water is finally proposed to be discharged

Likely make-off of water in the quarry floor will be the sum of direct precipitated water and surface run-off water which will be seeped into the porous strata. Surface run off water around the mine will be diverted in to the natural drainage course through the garland drain located sufficiently ahead of the laterite face.

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d) **Describe regional and local drainage pattern. Also indicate annual rain fall, catchments area, and likely quantity of rain water to flow through the lease area, arrangement for arresting solid wash off etc.**

The drainage pattern, as indicated by the numerous streams and nalas, is of dendritic type. A few perennial springs sprout from the hill slopes and drain into the nearby streams. Two such perennial streams originate from the western slopes of Sirimanda Parbat and flow towards west. One stream flows close to Malkarbanda and the other flows close to Sipayiputtu and both these streams drain into the Pottangi nala. About 4-5 km north of Sirimanda Parbat is the Kundili nala which also has a north-west flow. The Pottangi nala meets the Kundili nala just before the latter joins the Kolab River. Average rainfall in the Koraput district is 1400mm while the highest annual rainfall is 1800mm.

As the topography of the mining area is comprising of valleys and hillocks, erosion of mining and dump areas may result in contamination of water bodies due to discharge of mine water/effluent and sedimentation of the seasonal nallahs flowing nearby. To prevent these, lessee proposes to construct the following measures and the details are given below:

Table-51: Proposed Protective Measures

Year	Items	Dimension*	Location
FIRST	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 91
		25 m x (1-3m) x 2m	South block southern valley
		25 m x (1-3m) x 2m	Near BP 8
		25 m x (1-3m) x 2m	Near BP 88- Western valley
	Retaining Wall	389m x (2m-1m) x 1m	Western side of Proposed Dump
	Retaining Wall	410m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	2470m x (2m-1m) x 1m	Around the proposed working Pit-South block
	Garland Drain	394m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	413m x (2m-1m) x 1m	Eastern side of proposed Dump
SECOND	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 81- outside lease area
		25 m x (1-3m) x 2m	Western side of Proposed conveyor belt-western valley
		25 m x (1-3m) x 2m	Eastern valley of West Extension Block

**Dimension parameters- Length x (bottom width -top width) x height*

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4.0 STACKING OF MINERAL REJECT /SUB GRADE MATERIAL AND DISPOSAL OF WASTE

a) Indicate briefly the nature and quantity of top soil, overburden / waste and Mineral Reject to be disposed off:

The waste mainly consisting of siliceous bauxite at the floor of the deposit and topsoil with an average thickness of 0.5m along with occasional laterite patches (having Al_2O_3 less than 20%) over the deposit.

Table -52: Year wise quantity in tonnes of Waste and others

Year	Topsoil (tons)		Waste (tons)		Mineral rejects		
	Reuse / Spreading	Storage	Backfilling	Storage	Blending	Storage	Beneficiation
First	-	115,200	-	159,660	-	-	-
Second	-	136,335	-	230,256	-	-	-
Third	-	64,605	-	211,356	-	-	-
Fourth	37,350	-	260,118	-	-	-	-
Fifth	47,850	-	346,500	-	-	-	-

b) The proposed dumping ground within the lease area be proved for presence or absence of mineral and be outside the UPL unless simultaneous backfilling is proposed or purely temporary dumping for a short period is proposed in mineralized area with technical constraints & justification.

The waste will be dumped temporarily for the first three years of this plan period in the central block adjacent to south block. These sites will be temporary but protection measures like toewalls and garland drains around dumps will be carried out-before the start of dumping-to prevent erosion and wash off. No necessity of proving these areas for barreness as dumps are temporary. During fourth and fifth year, this waste will be backfilled in worked out areas. The area choosen for backfilling will be drilled for proving absence of any ore and this will be informed to IBM and permission will be sought for carrying out backfilling.

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c) **Attach a note indicating the manner of disposal of waste, configuration and sequence of year wise build up of dumps along with the proposals for protective measures.**

Temporary dumping of waste is planned in the central block adjacent to south block in first three years. In fourth and fifth year the waste will be backfilled in the worked out pits. Other details are described below.

Table- 53:

TEMPORARY WASTE DUMPING

Year	Total waste to be dumped (m^3)	Dump no.	Location		Avg. height of dump(m)	Area to be dumped (m^2)	RL upto which dumping to be done	No. of terrace	Terrace height (m)	Slope of the terrace
			Northing	Easting						
1	88,700	TD	2056634	707007	16	24400	1325	2	8	26°
2	127,920		2056651	707007	16	24100	1333	2	8	26°
3	117,420		2056609	707007	8	20200	1333	1	8	26°

TEMPORARY TOPSOIL DUMPING

Year	Total Topsoil to be dumped (m^3)	Dump no.	Location		Avg. height of dump(m)	Area to be dumped (m^2)	RL upto which dumping to be done	No. of terrace	Terrace height (m)	Slope of the terrace
			Northing	Easting						
1	76,800	TS	2056533	706915	8	14000	1310	1	8	26°
2	90,890		2056607	706915	8	13700	1318	1	8	26°
3	43,070		2056651	706915	16	21100	1318	2	8	26°

BACKFILLING (WASTE)					BACKFILLING (TOP SOIL)			
Year	Section	Top RL	Bottom RL	Quantity Tons	Section	Top RL	Bottom RL	Quantity Tons
4	A-A'	1309	1307	46800	A-A'	1311	1309	32175
	B-B'	1299	1306	162000	B-B'	1309	1306	72450
	C-C'	1302	1300	108000	C-C'	1303	1302	56100
	D-D'	1337	1330	252000	D-D'	1338	1337	99000
	E-E'	1328	1318	248400	E-E'	1329	1328	60000
	F-F'	1336	1332	45000	F-F'	1337	1336	33600
	SUB TOTAL			862200	*SUB TOTAL*			353325
5	G-G'	1344	1337	176400	G-G'	1345	1344	28500
	H-H'	1335	1325	171000	H-H'	1337	1335	19200
	SUB TOTAL			347400	*SUB TOTAL*			47700

Waste dumping will be in stages of 8m over an area of 2.44 ha in first year from 1310mRL to 1325mRL with a designed capacity of 1.60 lakh tons, in second year dumping will be over an area of 2.41 ha from 1317mRL to 1333mRL with a designed capacity of 2.46 lakh tons and in third year it will be over an area of 2.02 ha from 1325mRL to 1333mRL with a designed capacity of 2.12 lakh tons. All dumping will be with reverse slope. General slope of the dump will be less than 35°.

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Topsoil dumping will be also be in stages of 8m over an area of 1.40 ha in first year from 1310mRL to 1318mRL with a designed capacity of 1.38 lakh tons, in second year dumping will be over an area of 1.37 ha from 1318mRL to 1325mRL with a designed capacity of 1.35 lakh tons and in third year it will be over an area of 2.11 ha from 1318mRL to 1328mRL with a designed capacity of 6.41 lakh tons. All dumping will be with reverse slope.

The area identified for dumping is shown in Prduction and development plans.

To prevent erosion of dump areas that may result in contamination of water bodies due to discharge of mine water/effluent and sedimentation of the seasonal nallahs flowing nearby, lessee proposes to construct the following measures in the dumping area in the first year itself and the details are given below:

Table-54: Proposed Protective Measures

Year	Items	Dimension*	Location
FIRST	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 91
		25 m x (1-3m) x 2m	South block southern valley
		25 m x (1-3m) x 2m	Near BP 8
		25 m x (1-3m) x 2m	Near BP 88- Western valley
	Retaining Wall	389m x (2m-1m) x 1m	Western side of Proposed Dump
	Retaining Wall	410m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	2470m x (2m-1m) x 1m	Around the proposed working Pit-South block
	Garland Drain	394m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	413m x (2m-1m) x 1m	Eastern side of proposed Dump
SECOND	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 81- outside lease area
		25 m x (1-3m) x 2m	Western side of Proposed conveyor belt-western valley
		25 m x (1-3m) x 2m	Eastern valley of West Extension Block

Dimension parameters- Length x (bottom width -top width) x height

The location of these structures are marked in Reclamation Plan.

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5.0 USE OF MINERAL AND MINERAL REJECT

a) **Describe briefly the requirement of end-use industry specifically in terms of physical and chemical composition.**

The Pottangi Bauxite Mine will be the captive mine for NALCO. All production of Bauxite will be consumed in the refinery plant of the Lessee (NALCO) located at Damanjodi. The requirement of plant feed (Bauxite) grade as follows:

Table- 55:

Particulars	Grade
Alumina – Al_2O_3	42.5±2.0 %
Total Silica – SiO_2	3.84 ± 0.5%

Different grades of Bauxite from different faces will be blended into the primary crusher at mine and dispatched to the Alumina Refinery Plant through the Conveyor system. Although ROM Bauxite grade over month to month basis will be maintained to the specification of required quality on monthly weighted average basis, occasional higher SiO_2 content upto 7% Silica as encountered during mining within the ore zone will also be mined out and sent to the refinery plant after blending with low Silica Bauxite.

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b) **Give brief requirement of intermediate industries involved in up gradation of mineral before its end use:**

Not applicable

c) **Give detail requirement for other industries, captive consumption, export, associated industrial use etc.**

Not applicable as total mined out bauxite ore will be utilised by the lessee for captive consumption in its existing refinery plant located at Damanjodi.

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d) **Indicate precise physical and chemical specification stipulated by buyers**

Same as in section a above.

e) **Give details of processes adopted to up -grade the ROM to suit the user requirement**

Different grades of Bauxite from different faces will be blended into the crusher plant at mine and dispatched to the Alumina Refinery Plant through the proposed conveyor system.

No sub-grade material will be generated at the mine.

f) **Changes in the Specification, if any imposed by the user industries and/ or specifications required in the case of new user industries, if any to be given.**

No change in specification.

g) **Efforts made for utilisation of the sub-grade mineral including fines.**

Sub-grade materials will not be generated at the mine. As all ROM will be of grade suitable for Alumina Refinery it will be crushed to -150mm in the crusher plant at mine and dispatched to the Alumina Refinery Plant through the proposed conveyor system.

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6.0 PROCESSING OF ROM AND MINERAL REJECT

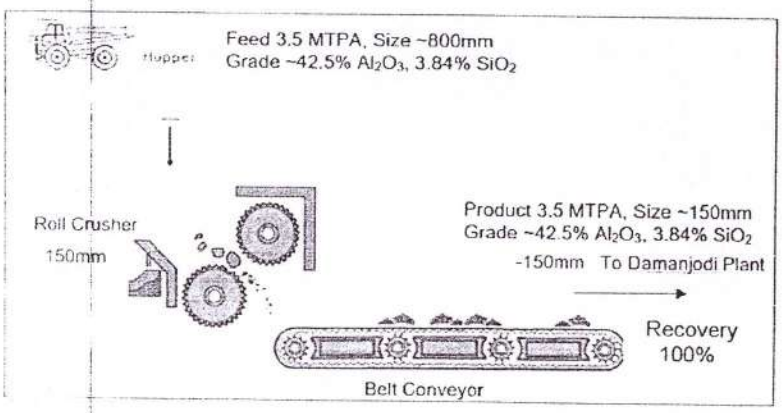
a) If processing / beneficiation of the ROM or Mineral Reject is planned to be conducted, briefly describe nature of processing / beneficiation. This may indicate size and grade of feed material and concentrate (finished marketable product), recovery etc.

Run-off mine Bauxite of ~800mm size will be crushed in crusher unit 900tph capacity in to -150mm size. The crushing unit will be located on the pit top. The crusher will be toothed Double Roll Crusher to be established to (a) vary set size depending upon the size requirements, (b) generate minimum fines than the other type of crushers and (c) prevent the jamming because of gripping of Bauxite by the teeth.

b) Give a material balance chart with a flow sheet or schematic diagram of the processing procedure indicating feed, product, recovery, and its grade at each stage of processing.

The ROM bauxite will be transported and crushed in the proposed facilities of Crusher /Screening Plant. The sized bauxite will be dispatched to the refinery of NALCO at Damanjodi through a conveyor. The tentative size range at different stages of processing like feed and product along with the flow diagram is given below:

Material Balance Chart



However, other plant parameters like material balance, recovery at each stage will be reviewed in next plan.

c) **Explain the disposal method for tailings or reject from the processing plant.**

Not applicable

d) **Quantity and quality of tailings /reject proposed to be disposed, size and capacity of tailing pond, toxic effect of such tailings, if any, with process adopted to neutralize any such effect before their disposal and dealing of excess water from the tailings dam.**

Not applicable

e) **Specify quantity and type of chemicals if any to be used in the processing plant.**

Not applicable

f) **Specify quantity and type of chemicals to be stored on site / plant.**

Not applicable

g) **Indicate quantity (cum per day) of water required for mining and processing and sources of supply of water, disposal of water and extent of recycling.**

No wet processing is proposed only size bifurcation by simple crushing and screening. Water requirement is only for dust suppression in plant and mining area, where about 100 cum/day of water will be used which will besourced from the wells located outside lease area.

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7.0 OTHERS

a. Site services & Infrastructure:

For proper functioning of the day to day operation of the mine, maintenance of machinery and servicing facilities, the following have been envisaged:

- **Office of Mines Manager** : It is normally used as a geology and survey office for short term and long term mine planning.
- **Training Centre and Library:** This building will provides space for conducting training classes, exhibition of models and a library of journals.
- **Time Office**: This building will provide facilities for attendance / time keeping of the mine employees in respect of their daily joining in the mine and leaving from the mine.
- **Pit Office**: Pit office, will be located close to mine workings, provides space for keeping closer co-ordination with various activities of mine working.
- **Central workshop and stores:** All major and capital repairs including maintenance and servicing of all mining equipment and machinery will be carried out at the mine workshop. The workshop will be provided with all essential facilities different sections. All activities of the workshop are carried out under the control of qualified Mechanical and Electrical engineers with the employment of experienced mechanics and electricians. An independent store for all essential spare parts is also maintained at the mine workshop.Machinery / equipment / vehicles washing area will be developed outside and near the garage.
- **Canteen**: This building provides dining halls along with kitchen room, stores etc.
- **First-aid Centre** : First-aid facilities equipped with sterilized dressing materials such as cotton wool, bandages, iodine and antiseptic solution etc has been provided for treatment of the workers before hospitalization, if any accident occurs in the mine.

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- **Fire Station:** Fire fighting crew will be kept alert for fighting to protect the men and materials from fire hazard.
- **Fuel Filling Station and Lubricant Store:** This station will house an underground storage attached with fuel pumps and meter. Lubricant store is a small room which stores various lubricants to top up the equipments along with fuel.
- **Explosive Magazine & Blasting Shed:** Explosives will be kept well away from the work zone in two well designed licensed buildings called magazines as per as the Indian Explosive Act.
- **Water Supply:** The water supply requirement, both for drinking and mine will be initially met by sourcing water from wells from nearby villages and later on lessee will explore to have own sources.

b. Employment potential:

Once the mine starts, it will be headed by GM (Mines) with work force as below:

Table-56:

Sl. No.	Class of personnel	Numbers
1	Highly Skilled (Management, Supervisory & Clerical)	24
2	Skilled	65
3	Semi-skilled	80
4	Un-skilled	60
Total	---	229

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नेशनल एल्यूमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd
भुवनेश्वर/ Bhubaneswar-751013

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Koraput Forest Division

Table-57: Management Personnel

Sl. No.	Administrative Post	Statutory Post	Qualification	Numbers
1	General Manager (Mines)	Agent	Degree in Mining Engineering	1
2	Asst. G M (Mining) / Sr. Manager (Mining)	Mine Manager	Degree in Mining Engineering with 1st class Mine Manager Certificate of competency	1
3	Sr. Manager / Manager(Mining)	Safety Officer	-do-	1
4	Sr. Manager / Manager(Mining)	Mining Engineer-in-charge Excvn.	-do-	1
5	Asst. Manager(Mining)	Asst. Mgr	Degree/Diploma with 1st or 2nd class mines manager's certificate of competency	12
6	Manger (HRD)	Welfare Officer	MBA (HRD) or equivalent	1
7	Manager (Survey)	Surveyor	Degree in Mining Engg. With Surveyor's certificate of competency	1
8	Manager (Geology)	Geologist	M. Sc. In Geology having more than 10 years of experience	2
9	Manager (Systems)	Computer –In-Charge	Degree in Computer Engg. Or equivalent	1
10	Manager (Mech)	Competent Mech. Engr.	Degree in Mech. Engg.	1
11	Manager (Elec)	Competent Elec. Engr.	Degree in Electrical Engg.	1
12	Asst. Manager	Time office-in-charge	MBA (Finance)/ MBA(HRD)	1
Total	---	---	---	24

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उप महाप्रबंधक (विद्युत)/D.G.M. (...
परियोजना-खान/Project-Mines Divn.
नेशनल एल्यूमिनियम कम्पनी लिमि...
National Aluminium Company ...
भुवनेश्वर/Bhubaneswar-751013

Contractual Workers: Contractual workers in the mine at different activities will be hired as per requirement.

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8.0 PROGRESSIVE MINE CLOSURE PLAN UNDER RULE 23 OF MCDR'2017

8.1 Environment Base line information:

Existing land use pattern indicating the area already degraded due to mining, roads, processing plant, workshop, township etc in a tabular form.

The total land area of the mine is 697.979 Ha and it is part of Government forest land. Existing land use pattern indicating the area already degraded due to mining, roads, safety zone green belt etc. is as follows.

Table-58: Existing land use

Type of land use	Existing (ha)
Mining	0.113
Roads	1.840
Safety zone/Green Belt	23.400
Area untouched	672.626
Total	**697.979**

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भुवनेश्वर/ Bhubaneswar-751

Water regime, quality of air, ambient noise level, flora, climatic conditions Human settlements:

Water regime:

The drainage pattern, as indicated by the numerous streams and nalas, is of dendritic type. A few perennial springs sprout from the hill slopes and drain into the nearby streams. Two such perennial streams originate from the western slopes of Sirimanda Parbat and flow to the west.

Rainwater fall in the mine will seep in to the porous strata and mined out area with zero pollution discharge. Analysis report of water over the years envisaged that parameters of water are well within the permissible limit.

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Baseline data of environmental parameters collection is being carried out by M/s Ramky Enviro Engineers Ltd., Hyderabad, for EIA studies to get Environmental Clearance from MoEFCC, New Delhi. Air, water and noise monitoring is undertaken quarterly as per CPCB norms. However, detailed analysis of all the parameters collected season wise will be submitted to IBM once the operation of mine starts.

Quality of air, ambient noise level, flora, climatic conditions, Human settlements are discussed below.

Quality of air:

Ambient air quality data has been collected in the buffer zone in the nearby villages for PM10 and PM2.5 as well as SOx and NOx and summary of the data are given below, it can be observed that the data are well within the limits.

Table-59: Ambient air Quality data ($\mu g/m^3$)

Location	PM-10			PM-2.5		
	Min	Max	98th Percentile	Min	Max	98th Percentile
Pottangi	44.5	52.3	51.8	20.1	24.1	24.0
Barhaparha	48.5	54.4	53.7	23.9	28.8	28.1
Guria	41.1	51.6	51.1	19.2	23.1	22.6
Barha marla	40.6	48.6	47.1	18.5	22.8	22.7
98 Percentile	47.1 to 53.7			22.6 to 28.1		
NAAQ Standards	100			60		

Table-60: Ambient air Quality data ($\mu g/m^3$)

Location	SO_2			Nox		
	Min	Max	98th Percentile	Min	Max	98th Percentile
Pottangi	7.9	11.2	11.1	14.1	17.6	17.2
Barhaparha	8.3	12.4	11.5	16.7	21.4	20.9
Guria	6.3	10.6	10.5	15.2	18.8	18.4
Barha marla	8.7	9.9	9.9	14.2	16.7	16.5
98 Percentile	9.9 to 11.5			16.5 to 20.9		
NAAQ Standards	80			80		

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Ambient noise level:

Sources of air/noise pollution are classified as (a) point sources from the machines like Drills, HEMMs and crushers (b) line sources like motors, Dozers, Dumpers, Conveyor (c) area source i.e. overall mining and (d) instantaneous source i.e blasting.

The ambient noise levels data has been collected in the buffer zone in the nearby villages and summary of the data are given below were found within the permissible limits of the stipulated standards.

Table – 61: Noise Levels dB(A)

Noise levels	N1	N2	N3	N4	N5	N6
	Pottangi			Barhaparha	Guria	Barha marla
	Residential	Near school	Near market	Residential		
Min	41.3	40.1	42.3	41.5	41.3	41.4
Max	56.4	54.5	57.6	54.8	56.8	55.4
Leq day	52.5	50.2	54.7	51.9	52.4	52.3
Leq night	42.3	40.7	43.5	42.1	42.1	41.6

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National Aluminium Company Ltd
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Flora

Pottangi bauxite capping (Sirimanda Parbat) is flat land with hard lateritic surface devoid of much tree growth. However Khajur (phoenix acqualis) bushes and patches of wild grass are seen. Slopes and valleys in the area support the vegetation such as termination ballerina and phonix acquallis, Mangifera indica, Artocarpus heterophyllus, Murraya Koengii, Phyllanthus embilica etc. Wild life are not seen due to scanty vegetation in the plateau of the area.

Climatic conditions:

The area enjoys a tropical climate. Lying at an altitude of over 1000 m. above M.S.L., Pottangi area has a pleasant climate during summer. The temperature in May rarely exceeds 40°C. The winter-month are pretty cold and in December-January, the temperature often drops down to 5° C. Frost is observed, at time in the early hours of the day in winter months. Monsoon sets

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in early June and continues till the middle of October. It is severe from July to august and the average annual precipitation is about 1200mm. The mean minimum humidity is (January) and mean maximum 90% (August-September).

Human settlements:

No human settlements exist within the lease area. However, within 10 km radius from mine lease area there are 14 villages and the demographic profile of the villages including number of households, population details are given below:

Table-62: Population Details

S.No	Village Name	No. of Households	Total population	Dist (in km)
1	Alasi	107	495	8.3
2	Laudi	231	1229	8.0
3	Patalaudi	19	80	10
4	Markar	56	248	8.0
5	Mariguda	89	436	8.9
6	Pangiguda	153	661	9.5
7	Bangarugudi	27	104	5.0
8	Tumbiguda	109	435	5.0
9	Olaparu	134	592	4.5
10	Bandagudi	81	347	2.0
11	Simageda	18	80	2.5
12	Pottangi	1137	4401	1.0
13	Thuria	411	1611	2.5
14	Marla	562	2072	1.5
Total		**3134**	**12791**	-

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Public buildings, places of worship and monuments

There are no public buildings, places of worship or monuments are located near the lease area.

Indicate any sanctuary is located in the vicinity of leasehold

There is no sanctuary located near the lease area.

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8.2 Impact Assessment:

i) Land area indicating the area likely to be degraded due to quarrying, dumping, roads, workshop, processing plant, tailing pond/dam, township etc.

The mining pits are present in the lease area serving as production benches. The major impacts observed include soil erosion, loss of topsoil, creation of pits and deforestation and possibility of adding silt load in the natural nallah nearby the lease area.

Table-63: Yearwise degradation of land

Details	First	Second	Third	Fourth	Fifth
Mining	15.45	26.58	34.70	34.18	34.66
Dumping	2.44	2.41	2.02	-	--
Topoil stacking	1.40	1.37	2.11		
St. Buildings	5.759	-	-	-	-

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ii) Air quality:

The semi arid climatic condition of the area coupled with mining activities on the top of the hills through open-cast, contributes to air pollution. The dust is observed to be the predominant air pollutant when the mining is in operation.

In mining area, diesel exhaust will be released from ripper dozer, shovel, dumper, drills, compressors etc. Therefore, gaseous pollutants released from the exhaust gas such as SO_2, NO_2, Pb and CO will be monitored and assessed.

Ambient Air Quality (AAQ) parameters such as SPM, PPM, SO_2, NO_x, Co, Pb, HC and dust fall will be monitored for two days in a week for 48 hours at different stations inside lease around the ML area.

iii) Water quality:

The major impact on water pollution is due to erosion of waste dump and sub-grade dump, oil and grease, contamination of water bodies due to discharge of mine water/effluent and sedimentation of the seasonal nallahs flowing nearby.

iv) Noise levels:

Noise pollution by mining activities is mainly because of excavation, handling and transportation of ore and overburden and operation of processing equipment.

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v) Vibration levels (due to blasting):

Very little drilling and blasting activities are proposed and hence no major impact from drilling / blasting. However, blast induced vibration studies by reputed scientific institution will be taken up immediately after opening of the mine to arrive at optimum charge per delay and most suitable drilling and blasting design so as to minimise the effects of blasting on settlements which are on the peripheryof the mining lease area.

vi) Water regime:

There is no seepage water and there is no water table in the vicinity as the lowest level in mining will be well above the ground level. Monsoon water gets drained through seasonal nallahs.

vii) Acid mine drainage:

Not applicable as no acidic material is present in the mining area.

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भुवनेश्वर/ 751013

viii) Surface subsidence:

Not applicable as it is opencast mining in a stable area.

vii) Socio-economics:

The mining will bring positive effect by way of generation of employment and business opportunities to local people. Apart from this lessee will undertake CSR activities focusing on measures to improve education, health, literacy of the people of surrounding villages.

viii) Historical monuments etc.

There are no public buildings, places of worship or monuments are located near the lease area.

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Mitigative measures:

. *Air:* It is proposed to deploy Water Tankers to suppress the dust by regular water spraying on all the roads used for haulage and around Crushing Plant. Plantation will be carried out as green belt all along the lease boundary which act as wind breaks.

Water: For protection of the mining area and for arresting solid wash-off the surface water management measures will be implemented.

Noise: The management plan for controlling noise pollution are providing noise insulation/padding in plants and machinery wherever practicable, limiting of speed of haulage vehicles/tippers, proper maintenance of noise generating parts of the machine, provision of earmuffs to workers as a measure to protect their ears etc.

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8.3 Progressive Reclamation Plan:

8.3.1. Mined-Out Land:

Mining in this plan period is proposed afresh and part of the mined-out pits will be backfilled by waste. The waste and topsoil dumped temporarily for first three years will be used for backfilling (waste overlid by topsoil) of mined out pits in fourth and fifth year in the portion of the central block adjacent to south block. The area choosen for backfilling will be drilled for proving absence of any ore and this will be informed to IBM and permission will be sought for carrying out backfilling.

Table-64:

BACKFILLING						AFFORESTATION	
Year	QTY -Tons	EXTENT-ha	NORTHING	EASTING	mRL	Area-ha	Saplings
4	260,118	18.54	2056316	707036	1307-	5.62	14,050 nos.
			2055542	706862	1338		
5	346,500	2.79	2055693	707249	1325-	12.92	32,300 nos
			2055525	706979	1345		

8.3.2 Topsoil Management:

The topsoil will be removed and kept aside for further use as spreading over the backfilled mined out areas (about 1.5 to 3m height) as explainec above.

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8.3.3 Tailings Dam Management:

No proposals as no tailing dam is present or proposed.

8.3.4 Acid mine drainage, if any and its mitigative measures:

Not applicable as no acidic material is present in the mining area.

8.3.5 Surface subsidence mitigation measures:

Not applicable as the proposal is for opencast mining in a stable area.

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Table-65: Summary of year wise proposal for item No. 8.3

Items	Details	Actual Position	First	Second	Third	Fourth	Fifth	Remarks
Dump Management	Area afforested (ha)	-	-	-	-	-	-	-
	No. of saplings planted	-	-	-	-	-	-	-
	Cumulative no. of plants	-	-	-	-	-	-	-
	Cost including watch and care during the year	-	-	-	-	-	-	-
Management of worked out benches	Area available for rehabilitation(ha)	--	-	-	-	-	-	-
	Afforestation done (ha)	--	-	-	-	-	-	-
	No of saplings planted	--	-	-	-	-	-	-
	Cumulative no of plants	--	-	-	-	-	-	-
	Any other method of rehabilitation (specify)	--	-	-	-	-	-	-
	Cost including watch and care during the year	--	-	-	-	-	-	-
Reclamation and Rehabilitation by backfilling	Void available for Backfilling – in ha	-	-	-	-	18.54	2.79	-
	Void filled by waste/tailings(in Ha)	-	-	-	-	18.54	2.79	-
	Afforestation on the backfilled area	--	-	-	-	5.62	12.92	-
	Rehabilitation by making water reservoir	--	-	-	-	-	-	-
	Any other means – ***Constuction of protective measures***	Year wise data given below in a seperate table						
Rehabilitation of waste land within lease	Area available (ha)	--	-	-	-	-	-	-
	Area rehabilitated	--	-	-	-	-	-	-
	Method of rehabilitation	--	-	-	-	-	-	-
Others (specify)	Greenbelt plantation-(ha)	--	5.76	9.07	8.57	-	-	-
	No. of plants		14400	22675	21425	-	-	-
	Env. monitoring	Will be carried out as per guidelines						

Year	Items	Dimension*	Location
FIRST	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 91
		25 m x (1-3m) x 2m	South block southern valley
		25 m x (1-3m) x 2m	Near BP 8
		25 m x (1-3m) x 2m	Near BP 88- Western valley
	Retaining Wall	389m x (2m-1m) x 1m	Western side of Proposed Dump
	Retaining Wall	410m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	2470m x (2m-1m) x 1m	Around the proposed working Pit-South block
	Garland Drain	394m x (2m-1m) x 1m	Western side of Proposed Dump
	Garland Drain	413m x (2m-1m) x 1m	Eastern side of proposed Dump
SECOND	Stone Masonry Check dam	25 m x (1-3m) x 2m	Near BP 81- outside lease area
		25 m x (1-3m) x 2m	Western side of Proposed conveyor belt-western valley
		25 m x (1-3m) x 2m	Eastern valley of West Extension Block

**Dimension parameters- Length x (bottom width -top width) x height*

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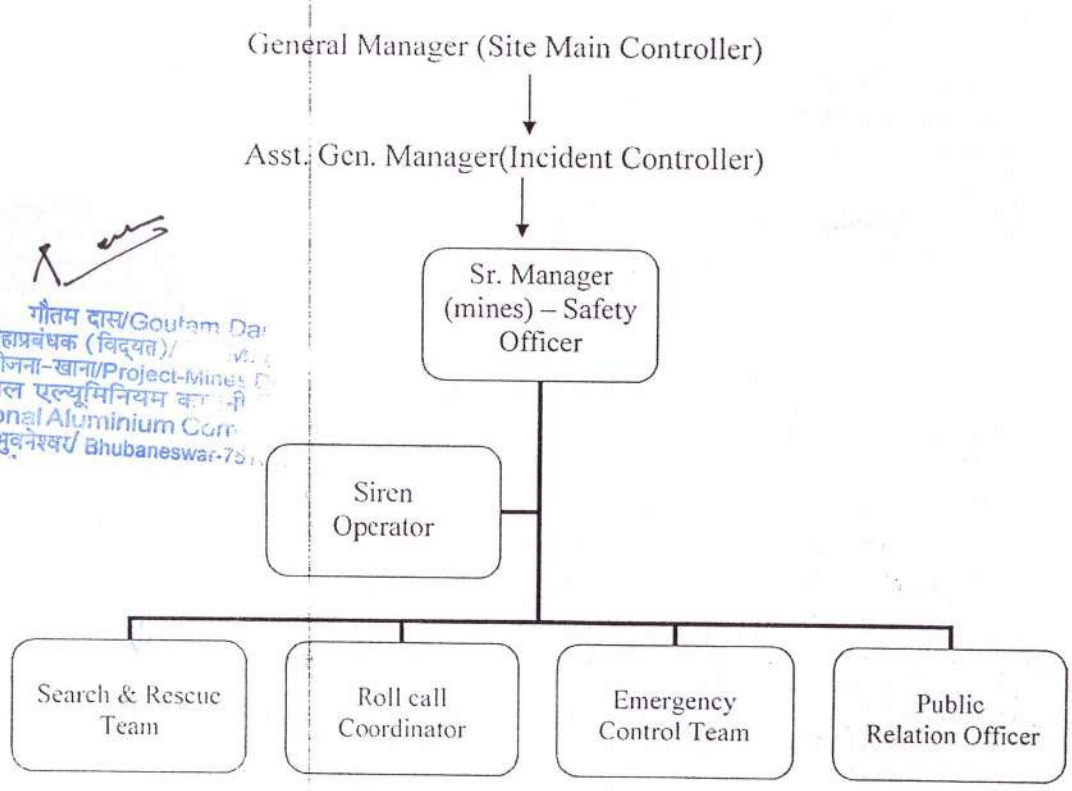
8.4 Disaster Management and Risk Assessment:

No high-risk accidents are anticipated, as the project is an open cast mining operation in a stable area free from land subsidence, earthquake etc. However, in case of any eventuality, the designated Mines Manager will be managing of the situation. He will be having communication facility and a Jeep at his disposal which will help in evacuating persons involved in any accidents. After the start of the mine, all statuory personnel like Mines Manager, Mining Enginer, Geologist will be appointed and informed to IBM.

Organisation chart for Disaster Management



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परियोजना-खान/Project-Mines
नेशनल एल्यूमिनियम कं
National Aluminium Com
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8.5 Care and maintenance during temporary discontinuance:

During such time, the area will be closed at gates and temporary staff will be arranged for care and maintenance.

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8.6 Financial Assurance:

Details of land use proposed for mining and allied activities regarding calculation of Financial Assurance as per CCOM's Circular no. 4, 2006 are given below.

Table-66:

Sl n	Head	Area put on use at start of MP (Ha)	Additional requirement during plan period (Ha)	Total Area (Ha)	Area considered as fully reclaimed & rehabilitated (Ha)	Net area considered for calculation (Ha)
1	Area under mining	0.113	46.0	46.113		46.113
2	Storage for topsoil	-	2.390	2.390	-	2.390
3	Waste dump site	-	2.840	2.840	-	2.840
4	Mineral storage	-	-	-	-	-
5	Infrastructure-Workshop, Admin. Building etc	-	33.859	33.859	-	33.859
6	Roads	1.840	14.310	16.150	-	16.150
7	Railways	-	-	-	-	-
8	Tailing pond	-	-	-	-	-
9	Effluent treatment plant	-	-	-	-	-
10	Mineral separation plant (Primary crusher with conveyor)	-	10.230	10.230	-	10.230
11	Township area	-	-	-	-	-
12	Green belt/ Safety Zone	23.400	-	23.40	-	23.400
13	***Others***					
	Power Corridor	-	12.400	12.400	-	12.400
	Unused	672.626	122.029	550.597	-	-
	Grand Total	697.979		697.979		**147.382**

The total area under utilization at the end of this plan period will be 147.382 ha. So, Financial assurance calculated for this area @Rs.3.0 lakhs *(as per Rule 27 (1) of MCDR -2017)* will be Rs.442.146 lakhs. Finacial Assurance in the form of a bank guarantee for this amount will be submitted to RCOM, IBM Bhubaneswar after the execution of lease.

अनुमोदित
APPROVED
24/07/18
क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIN BUREAU OF MINES
भुवनेश्वर/BHUBANESWAR

गौतम दास/Goutam Das
उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
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National Aluminium Company Ltd.
भुवनेश्वर/ Bhubaneswar-751013

16-7-18
SRIPAD PUJAR
QUALIFIED PERSON

B.V.R. ACHAR
QUALIFIED PERSON

16/07/18
SUJIT Kr MOHANTY
QUALIFIED PERSON

Divisional Forest Officer
Koraput Forest Division

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नालको NALCO

CONSENT LETTER/ UNDERTAKING/ CERTIFICATE

भारतीय खान ब्यूरो, भुवनेश्वर
INDIAN BUREAU OF MINES, BHUBANESWAR
GOVT. OF INDIA

01. The Mining Plan of Pottangi Bauxite Mine of M/s National Aluminium Company Ltd over an area of 697.979 ha located in Pottangi Village of Pottangi tehsil, Koraput Dist., Odisha under *Rule 16(1) of Minerals (other than Atomic and Hydrocarbons Energy Minerals) Concession Rules 2016* has been prepared by Sripad Pujar, BVR Achar & Sujit Kumar Mohanty. This is to request the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneshawar, to make any further correspondence regarding any correction of the Mining Plan with the said qualified persons at the address below:

SRIPAD PUJAR B.V.R. ACHAR SUJIT Kr MOHANTY
Chaithanya Geo Lynx, Chaithanya Bhavana,
Annapurna Badavane, HOSPET – 583 201.
Ballari Dist. Karnataka State.

We hereby undertake that all modifications / updating as made in the said Mining Plan by the said qualified persons be deemed to have been made with my knowledge and consent and shall be acceptable on me and binding in all respects.

02. It is certified that the CCOM Circular No-2/2010 will be implemented and complied with when an authorized agency is approved by the State Government.

03. It is certified that the **Progressive Mine Closure Plan** of Pottangi Bauxite Mine of M/s National Aluminium Company Ltd over an area of 697.979ha complies with all statutory rules, regulations, orders made by the Central or State Government, Statutory organization, Court etc which have been taken into consideration and wherever any specific permission is required the lessee will approach the concerned authorities.

गौतम दास/Gautam Das
उप महाप्रबंधक (विद्युत)/D.G.M.
परियोजना-खाना/Project-Mines
नेशनल एल्यूमिनियम कम्पनी लिमिटेड
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The information furnished in the Progressive Mine Closure Plan is true and correct to the best of my knowledge and records. Further, all the measures proposed in this closure plan will be implemented in a time bound manner as proposed

04. The provisions of **Mines Act, Rules and Regulations** made there under have been observed in the Mining Plan over an area of 697.979ha, in Pottangi Village of Pottangi tehsil, Koraput Dist., Odisha, belonging to M/s National Aluminium Company Ltd and where specific permissions are required, the applicant will approach the **D.G.M.S.** Further, standards prescribed by **D.G.M.S.** in respect of **miners' health** will be strictly implemented".

Date: 9.7.2018

Place: Bhubaneshwar

Sanjay Krishna Patel
General Manager (Tech), NALCO
Authorised Signatory

S. K. PATEL
Manager (Technical)
नेशनल एल्यूमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd.
Bhubaneswar-751061

नेशनल एल्यूमिनियम कम्पनी लिमिटेड
(भारत सरकार का एक उद्यम)
निगम कार्यालय
नालको भवन, पि-1, नयापल्ली, भुवनेश्वर - 751 013, भारत

National Aluminium Company Limited
(A Government of India Enterprise)
CORPORATE OFFICE
Nalco Bhawan, P/1, Nayapalli,Bhubaneswar - 751 013, India

फोन Telephone: (EPABX) (0674) 2301988, 2301999, 2300013, 2300976, 2301560, 2303233,
फैक्स Fax-(0674) 2301290, 2300580,2300740, 2300640 & 2300246, वेबसाइट Website: www.nalcoindia.com
CIN: L27203OR1981GOI000920

CERTIFICATE FROM QP

The provisions of the Mineral Conservation and Development Rules 2017 have been observed in the preparation of Mining Plan of Pottangi Bauxite Mine over an extent of 697.979ha located in Pottangi Village of Pottangi tehsil, Koraput Dist., Odisha and whenever specific permissions are required, the lessee will approach the concerned authorities of Indian Bureau of Mines.

The information furnished in the Mining Plan is true and correct to the best of our knowledge.

SRIPAD PUJAR	B.V.R. ACHAR	SUJIT Kr MOHANTY
Qualified Person	*Qualified Person*	*Qualified Person*

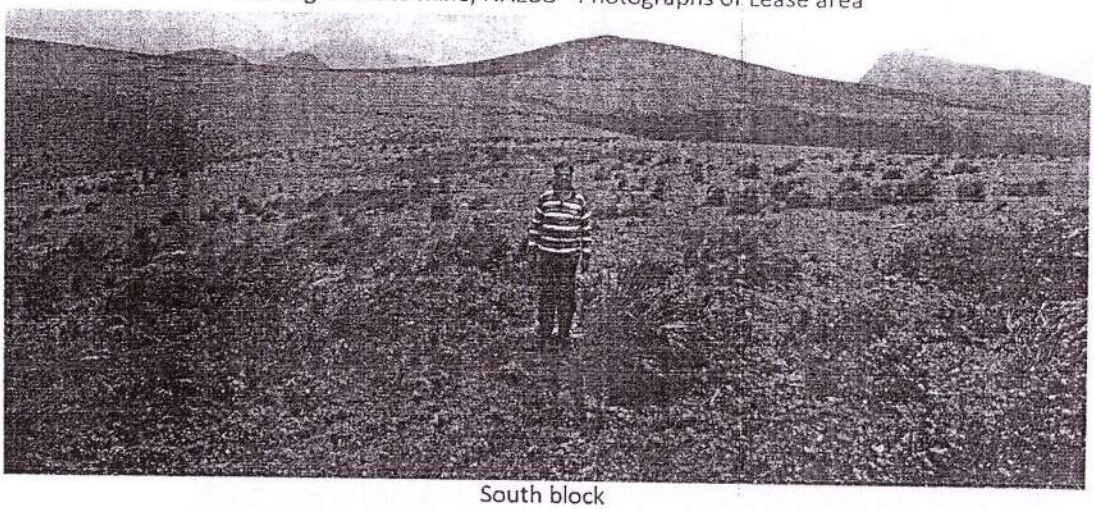
Place: Hosapete
Date: 16.07.2018

गौतम दास/Goutam Das
उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
परियोजना-खाना/Project-Mines Division
नेशनल एल्यूमिनियम कम्पनी लिमिटेड
National Aluminium Company Ltd
भुवनेश्वर/ Bhubaneswar-751013

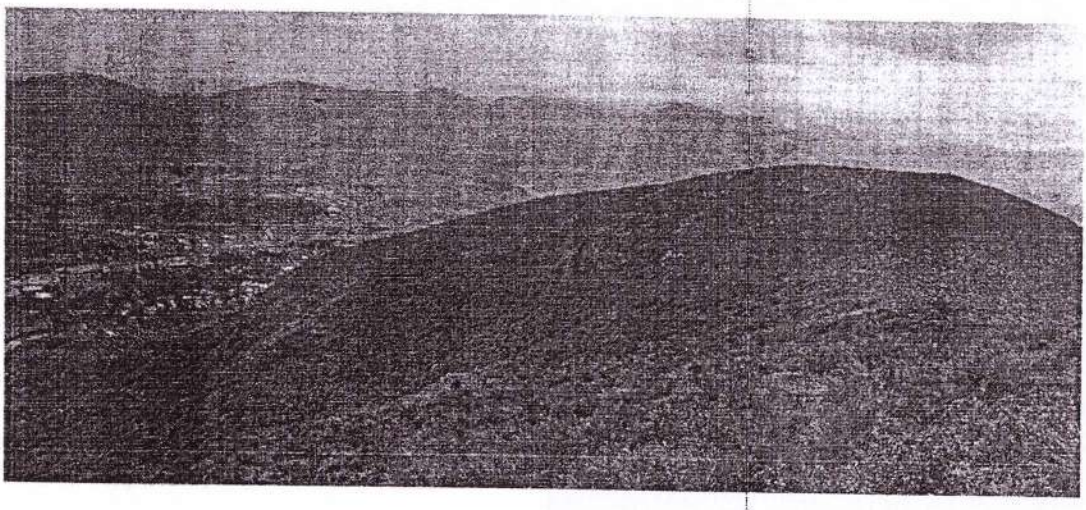
Divisional Forest Officer
Koraput Forest Division

PHOTOGRAPHS

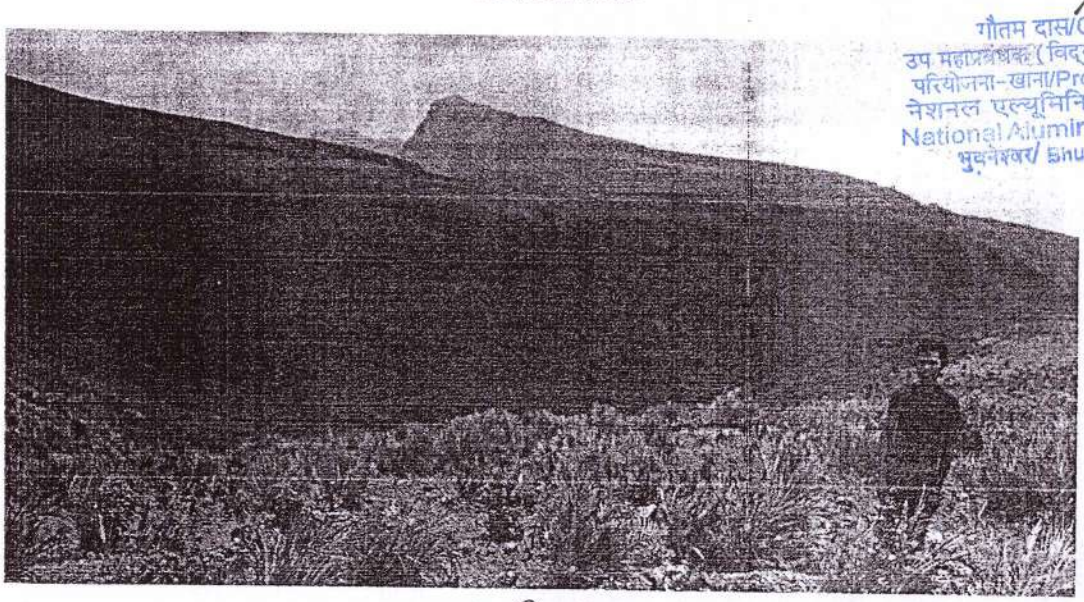
Pottangi Bauxite Mine, NALCO - Photographs of Lease area



South block



West Extn block



East Extn block

गौतम दास/Goutam Das
उप महाप्रबंधक (विद्युत)/D.G.M. (Elect.)
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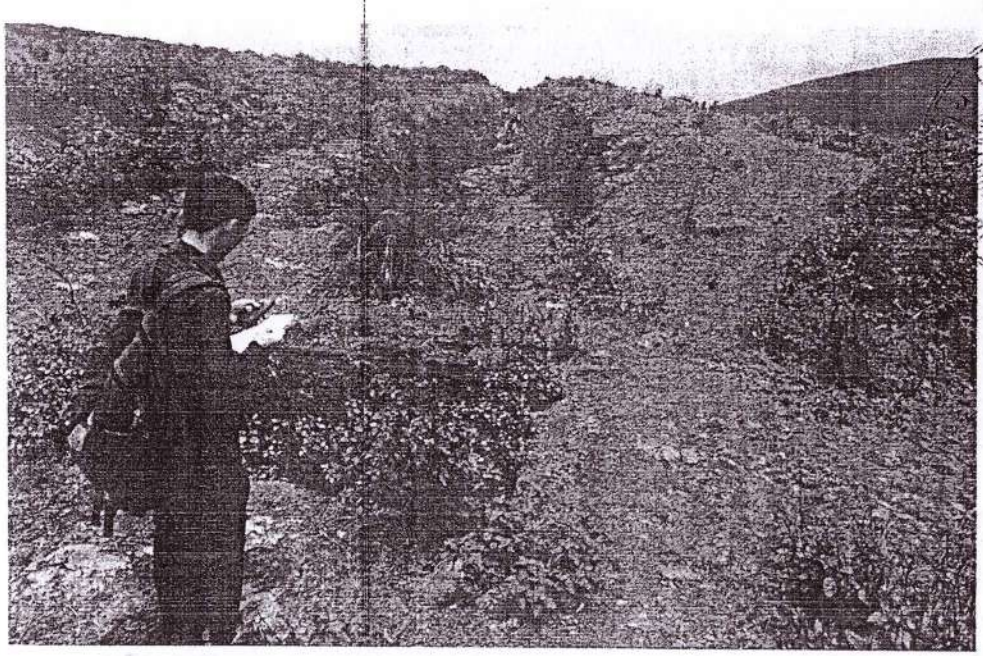
16.7.18. 16/7/18 16/07/18

Divisional Forest Officer
Koraput Forest Division

25C

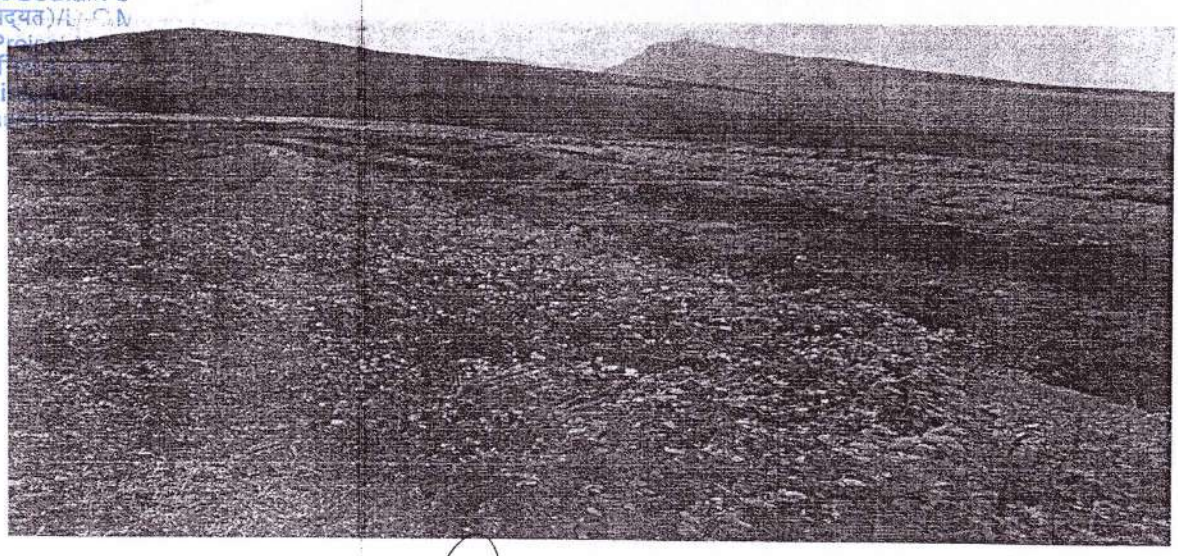


Some views of South block

showing trench and pits

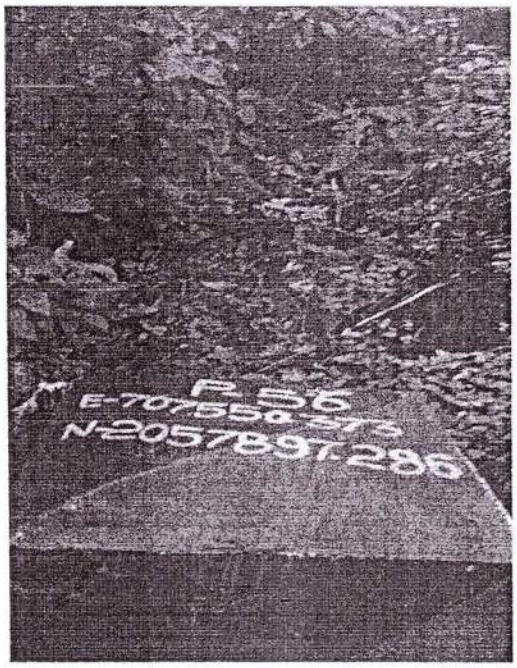
sunk by MECL

गौतम दास/Goutam D
उप महाप्रबंधक (विद्युत)/
परियोजना-खाना/P
नेशनल एल्यूमि
National Alumi
भुवनेश्वर/ Bh



Pottangi Bauxite Mine-NALCO

Photographs of few boundary pillars



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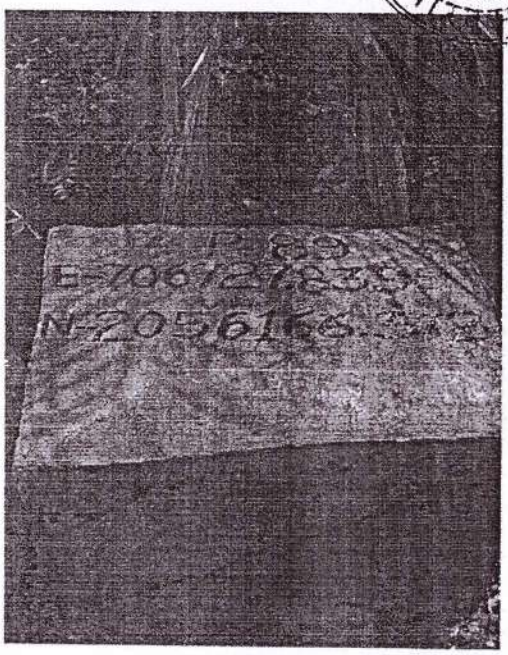
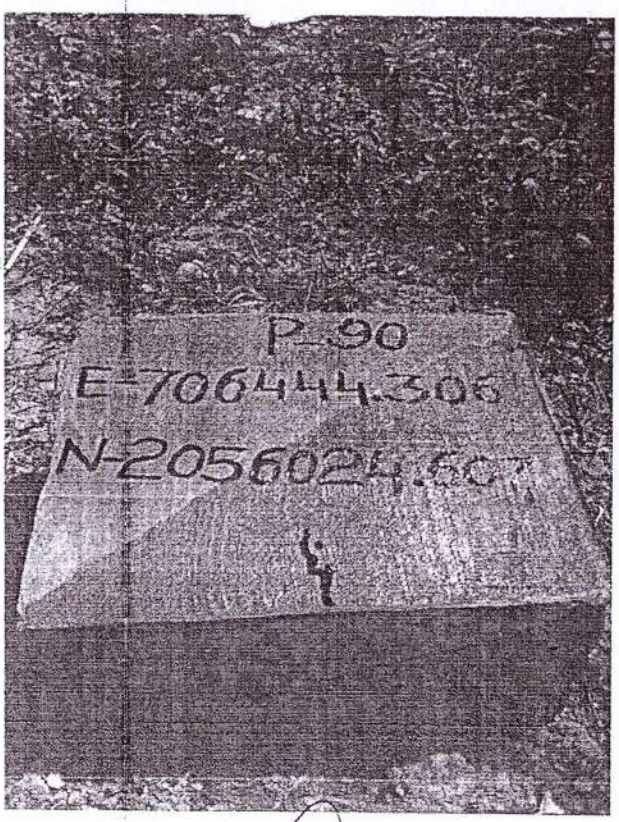
National Aluminium Company Ltd
Bhubaneswar

Divisional Forest Officer
Koraput Forest Division

258





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परियोजना-खाना/Project-Mines Divisi
नेशनल एल्युमिनियम कम्पनी लिमि
National Aluminium Company L
भुवनेश्वर/Bhubaneswar-751013