REGD PARCEL
Phone 0674-2352483
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Plot No. 149, Pokhariput
BHUBANESWAR 751020

भारत सरकार GOVERNMENT OF INDIA
खान मंत्रालय MINISTRY OF MINES
भारतीय खान ब्यूरो INDIAN BUREAU OF MINES
क्षेत्रीय खान नियंत्रक के कार्यालय
OFFICE OF THE REGIONAL CONTROLLER OF MINES

No. MSM/FM/28-ORI-BHU/2017-18 / 2154

Date: 24.11.2017

To

Shri Padma Lochan Mohanty, Managing Director,
M/s MGM Minerals Ltd,
5A Forest Park, Bhubaneswar-[illegible]

Sub: Approval of Modification of Review of Mining Plan of Patabeda Iron Ore Mine along with Progressive Mine Closure Plan (PMCP) over an area of 28.397 ha in Sundergarh district of Odisha State, submitted by M/s MGM Minerals Ltd under Rule 17(3) of Mineral Concession Rules, 2016.

Ref: - i) Your letter No. Nil dated [illegible].10.2017
ii) This office letter of even no dated 17.10.2017
iii) This office letter of even no dated 17.10.2017 addressed to the Director of Mines, Govt. of Odisha, copy endorsed to you.
iv) This office letter of even no dated 06.11.2017.
v) Your Qualified Person letter No [illegible]-06/2017-18 dated [illegible].11.2017.

Sir,

In exercise of the power delegated to me vide Gazette Notification No. S.O. 1857(E) dated 18.05.2016, I hereby approve the modification of Review of Mining Plan including Progressive Mine Closure Plan of Patabeda Iron Ore Mine over an area of 28.397 ha of M/s MGM Minerals Ltd in Sundargarh district of Odisha State submitted under Rule 17(3) of Mineral Concession Rules, 2016. This approval is subject to the following conditions:

I. The modification of review of Mining Plan is approved without prejudice to any other law applicable to the mine area from time to time whether made by the Central Government, State Government or any other authority and without prejudice to any order or direction from any court of competent jurisdiction.
II. The proposals shown on the plates and/or given in the document is based on the lease map /sketch submitted by the applicant/lessee and is applicable from the date of approval.
III. It is clarified that the approval of aforesaid modification of review of Mining Plan does not in any way imply the approval of the Government in terms of any other provision of Mines & Minerals (Development & Regulation) Act, 1957, or the Mineral Concession Rules, 2016 and any other laws including Forest (Conservation) Act, 1980, Environment (Protection) Act, 1986 or the rules made there under, Mines Act, 1952 and Rule & Regulations made there under.
IV. Indian Bureau of Mines has not undertaken verification of the mining lease boundary on the ground and does not undertake any responsibility regarding correctness of the boundaries of the leasehold shown on the ground with reference to lease map & other plans furnished by the applicant/lessee.

V. At any stage, if it is observed that the information furnished, data incorporated in the document are incorrect or misrepresented, then the approval of the document shall be revoked with immediate effect.

VI. If this approval conflicts with any other law or court order/ Direction under any statute, it shall be revoked immediately.

VII. Validity of this document shall expire on 17.03.2021.

VIII. Next Financial Assurance shall be due for submission on or before 31.03.2021.

Thanking you,

Yours faithfully,

Encl: - One copy of modified order of review of Mining Plan

(HARKESH MEENA)
क्षेत्रीय खान नियंत्रक / Regional Controller of Mines

Copy for kind information to:-

1. The Director of Mines, Directorate of Mines, Government of Odisha, Heads of the Department Building, Bhubaneswar - 751001, Odisha along with one copy of modification of review of Mining Plan by REGISTERED PARCEL.
2. Shri Pradeepta Mohapatra, Authorised Person, Barabari, Dist- Keonjhar, Odisha- 758034.

(HARKESH MEENA)
क्षेत्रीय खान नियंत्रक / Regional Controller of Mines

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Qualified person

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INTRODUCTORY NOTES

Patabeda iron ore mine in village Patabeda under Bonai Sub-division of Sundargarh district over an area of 28.397Ha was executed in favor of MGM Minerals Limited, Bhubaneswar on 08.03.2006 for 20 years. The validity of lease was up to 07.03.2026. **(Annexure - 1)**. However, as per MMDR (Amendment) Act 2015, the validity of the lease period is deemed to be extended for a period of fifty years i.e. 07.03.2056. The lessee will approach to the State Government for extension of the Mining Lease on 07.03.2025 i.e. one year before expiry of the original lease deed. In this regard an undertaking from the lessee is enclosed.

Status of Statutory Clearances

Statutory clearances like Forest clearance, Environment Clearance, Approved Mining Plan, Consent to Operate, permission for HEMM operation and deep hole drilling and blasting has been obtained by the lessee. The details of the statutory clearances are furnished below:

(i) Status of Forest Clearance from MoEF, Govt. of India

The total mining lease area is 28.397 Ha. Out of which 27.086 Ha is DLC area and balance 1.311 Ha is non forest land. Forest clearance has been obtained over 23.581 Ha vide letter no. 8(21)28/2003-FCE dated 30.12.2005 **(Annexure – 2)**.

Note: At the time of obtaining forest clearance, safety zone of 20m width was left from L to M and B to H along ML boundary. From L to M is a mineralized zone where as from B to H it is non-mineralized zone. However, right now the lessee wants to keep safety zone of 7.5m along pillar no L to M and along pillar No B to H. Therefore, it has been planned to include the 12.5m wide area under mining leaving only safety zone of 7.5m from the ML boundary (L to M and B to H). Accordingly, safety zone in all relevant plans have been modified.

(ii) Surface Right area

The surface right has been obtained excluding the private tenanted land vide letter No 384/ (mining) dated 29.03.2006. The copy of the letter regarding grant of surface Right area is enclosed vide Annexure – 3

अनुमोदित
APPROVED

क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIN BUREAU OF MINES
भुवनेश्वर / BHUBANESWAR

Pradeept Mohapatra
Qualified Person

(iii) Status of Environmental Clearance from SEIAA, Odisha

State Environment Impact Assessment Authority (SEIAA) considered the letter no. MGMM/Co/2008-09/02-417 dated 09.02.2009 and application no. MGGM/Co/2009-10/11-254 dated 30.11.2009 along with TOR for environmental clearance on the project and issued environmental clearance for enhancement of production of iron ore from 0.16 million tons to 0.8 million tons per annum vide SEIAA letter no. 33 dated 11.12.2009 **(Annexure – 4)**

(iv) Status of Consent to operate the project from Sate Pollution Control Board

Consent for discharge of sewage and trade effluent under section 25/26 of Water (PCP) Act 1974 and for existing / new operation of the plant under section 21 of Air (PCP) Act, 1981 was obtained for the production of 0.8 MTPA Iron ore vide letter No. 25103/Ind-II-NOC-5068, dated 17/11/2008, which is valid up to 07.03.2026 **(Annexure – 5)**

(v) Status of Mining Plan approval

The last Scheme of Mining was approved vide Letter No - MS/FM/34-ORI/BHU/2015-16/3919, dated 28.03.2016 which is valid up to 31.03.2021. **(Annexure – 6).** However, the lessee is now seeking modification in the approved Scheme of Mining under Rule 17(3) of MCR 2016. The details of reason of modification of approved Scheme of Mining are furnished in 3.6 Paragraphs.

(vi) Permission for Use of HEMM and deep hole drilling and blasting

Permission for use of HEMM and deep hole drilling and blasting has been obtained from DGMS by the lessee under Rule 102(6b) of MMR 1961.(copy of the letter is enclosed as **Annexure-7)**

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1.0 GENERAL

a)	Name of lessee/ registration No under Rule 45	:	MGM Minerals Limited, Patabeda Iron Ore Mines Registration No – IBM/290/2011. Mine code – 30ORI13051
	Address of the Lessee (Residential & correspondence)	:	MGM Minerals Ltd., 5A Forest Park, Bhubaneswar - 751009
	Phone / Fax / Mobile No / E Mail ID		Phone - (0674) 2596400 / 2596410. Fax - (0674) 2596390. E Mail ID - mgmbbsr@gmail.com
b)	Status of the Lessee	:	It is a Limited Company. The latest list of board of director is attached as **Annexure -8a.** A latest resolution w.r.t nominated owner is furnished as **Annexure-8 (b)**
	Name of the authorized signatory	:	Shri P. L. Mohanty Managing Director. Photo identity is at **Annexure – 8(c)**
c)	Minerals which are included in the Prospecting license	:	Not applicable
d)	Minerals which are included in the lease deed	:	Iron Ore
e)	Minerals which the lessee intends to mine	:	Iron Ore.
f)	Name and Address, Registration No. of the Recognized Person Together With Validity of Date/Person Employed Under Rule 42(1)(b) Who Has Prepared Mining Plan	:	As per Rule 15 of MCR 2016, the Qualified Person who have prepared the Mining Plan is furnished below:

Name	**Pradeept Mohapatra**
Address	At ; Umchabali, Po - Bamebari, Joda Keonjhar, Odisha Pin-758034 Email : pmohapatra_07@yahoo.com Mob: 9438149715
Registration Number	Not Applicable
Date of Registration	Not Applicable
Valid up to	Not Applicable

Self certified copies of working experience along with certificates in support of educational qualifications required as per the Rule 15 of MCR 2016 is attached as **Annexure 9.**

Pradeept Mohapatra
Qualified Person

2.0 LOCATION AND ACCESSIBILITY

(a) Lease details

i)	Name of mine	:	Patabeda Iron Ore Mines (28.397 Ha)
ii)	UTM Co-ordinate of any boundary point	:	Pillar No. A. E332280.855-N2426587.805
iii)	Date of Grant of lease/ Period	:	Mining lease over an area of 28.397 Ha was granted for 20 years w. e. from 08.03.2006.
iv)	Expiry date	:	Date of expiry is 07.03.2026. However, as per Mines & Minerals (Development and Regulation) Amendment Act 2015, the mining lease is deemed to be granted / extended till 07.03.2056.
v)	Name of lease holder	:	MGM Minerals Limited
vi)	Postal Address	:	MGM Minerals Limited, 5A Forest Park, Bhubaneswar – 751009 (Odisha)
vii)	Telephone/ fax/ Mobile No.	:	(0674) 2596350/2596380
viii)	Email id	:	mgmm28397@gmail.com

(b) Details of lease area with location map

Forest		Non-forest	Total
DLC Forest Land	27.086 Ha	1.311 Ha	28.397 Ha

The other details of the lease area are as below:

Total Lease area applied for renewal	:	Not applicable
District & State	:	Sundergarh, Odisha
Taluka	:	Bonai
Villages	:	Patabeda
Whether the area falls under Coastal Regulation Zone (CRZ)? If yes, details thereof.	:	Area does not fall under Coastal Regulation Zone
Existence of public road/ railway line, if any nearby and approximate distance	:	Patabeda mining lease area over 28.397 Ha is located in the village Patabeda of Bonai sub division of Sundargarh District, Odisha. The area can be approached from Barbil and Joda town through Koira. Area is approachable from Koira covering a distance of 20 Kms. The area is also connected by un metalled and all weather road to Express Highway No.2 to Jurudi railway station at a distance of 10 Kms. Paradeep is the nearest port situated at a distance of 350km.
Topo sheet No. with UTM Co-ordinate of the lease area	:	Topo sheet bearing No 73G/5 on a scale of 1:50,000. UTM Co-ordinate E332303.418 – N2426390.337 / E331623.726-N2427161.753

Pradeepi Mohapatra
Qualified Person

c) Attach a general location plan showing area and access routes, preferably on a Survey of India topographical map or a cadastral map or forest map as the case may be.

Lease area is marked in a survey of India topographical map in the scale 1:50000 showing all features within 5 Km from the lease boundaries (**Plate No - 1**). Authenticated lease map on a revenue map in the scale of 1 : 3960 (16" = 1 mile) is at **Plate No - 2.**

(d) Detail of boundary Description & Land Schedule

Detail of boundary Description & Land Schedule are mentioned in the lease deed. DGPS survey as per Circular No 2/2010 and its addendum of IBM was conducted once where some errors were encountered. So the same is being conducted for the 2nd time by ORSAC.

3.0 DETAILS OF APPROVED MINING PLAN / SCHEME OF MINING (if any)

3.1 Date and reference of earlier approved mining plan / scheme

The details of last approval of mining plan & scheme of mining by IBM are as under.

Sl. No.	Status of approval	Period	Rule	Letter no. & date of approval.	Annex No
1.	Mining Plan	Dev. & Production for 2006-07 to 2010-11	24 A of MCR 1960	BBS/SG/FE/MP-131 dated 08.11.2002	6
2.	Modification to approved mining plan	Dev. & Production for 2007-08 to 2010-11	10 of MCDR 1988	MPM/OTF-MECH/11 –ORI / BHU / 2007-08 dated 26.10.2007.	
3	Scheme of mining	Dev. & Production for 2011-12 to 2015-16	12 of MCDR 1988	314 (3)/2010/ MCCM (CZ)/ MS/48 dated 01.04.2011	
4.	Modification to approved Scheme of mining	Dev. & Production for 2013-14 to 2015-16	10 of MCDR 1988	MSM/FM/07 -ORI/BHU / 2013-14 dated 04.06.2014	
5	Scheme of mining	Dev. & Production for 2016-17 to 2020 - 21	12 of MCDR 1988	MS/FM/34-ORI/BHU/2015-16/ 3919, dated 28.03.2016 which is valid up to 31.03.2021.	

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

Earlier, the Scheme of mining was approved for the period of 2011-12 to 2015-16 (serial 3 of above table). After completion of 2 years of the scheme period there was a modification for balance 3 years of the scheme period (serial 4 of above table).

Reason for modification (Refer last approved scheme of mining vide IBM letter No 314 (3)/2010/ MCCM (CZ)/ MS/48 dated 01.04.2011.

Violations intimated by Ibrahim Sharief Asst. Controller of Mines IBM Bhubaneswar vide No ORI/IRON/SNG/MCDR-23/BBS dated 16.11.2012 under Rules 13 (1) and 47 of MCDR'1988 was complied by the lessee vide letter No MGMM/CO/2012-13/09-313 dated 15.12.2012 (**Annexure - 10**). As per need, modification to the approved scheme of mining was done to continue mining in a

Pradeept Mohapatra
Qualified Person

more scientific manner with due regards to environment and mineral conservation, which was approved vide letter No MSM/FM/07 -ORI/BHU / 2013-14 dated 04.06.2014 (Annexure – 11).

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

The review of approved proposal for the completed years of 2016-17 & 2017 – 18 (upto10.09.207) are mentioned below.

(i) Exploration (as per scheme of mining approved on 28.03.2016).

(a) Proposal

Bore hole Number	Co-ordinate	Depth Proposed	Year to be completed
PBH-1	N 2427070.80 – E 331804.11	End of Ore Zone	2016-17
PBH-2	N 2426984.95 – E 331887.28	End of Ore Zone	
PBH-3	N 2426911.00 – E 331743.00	End of Ore Zone	
PBH-4	N 2426835.94 – E 331834.00	End of Ore Zone	
PBH-5	N 2426747.94 – E 331702.00	End of Ore Zone	
PBH-6	N 2426647.00 – E 331750.00	End of Ore Zone	
PBH-7	N 2426852.91 – E 331974.70	End of Ore Zone	
PBH-8	N 2426783.01 – E 331983.31	End of Ore Zone	2017-18
PBH-9	N 2426774.39 – E 331913.13	End of Ore Zone	
PBH-10	N 2426703.97 – E 331921.01	End of Ore Zone	
PBH-11	N 2426565.29 – E 331868.80	End of Ore Zone	

(b) Achievement

During 2016-17, a total of 7 bore holes have been drilled with a total meterage of 454.90m. **(Form – "J" at Annexure – 12 and Form –"K" with bore hole logs are at Annexure - 13).** Details of location, collar and depth of hole of 7 bore holes are furnished below:

Bore hole Number	Co-ordinate		Depth in Meter
	Easting	Northing	
CBH-29	331743	2426911	47.9
CBH-30	331834	2426836	37
CBH-31	331702	2426748	20
CBH-32	331750	2426647	51
CBH-33	331887	2426985	65
CBH-34	331800	2427081	130
CBH-35	331980	2426853	140

(ii) Mine development and ore production (as per scheme of mining approved on 28.03.2016)

(a) Proposal for mine development (OB & IB), ore (Ore >58% Fe) and Mineral Reject (MR 45 to 58% Fe) production approved in the last approved scheme period of 2011-12 to 2015-16 and achievement is as follows.

- **ROM Production**

Year	Proposed (MT)	Achievement (MT)	Percentage of Achievement	Reason of deviation if any
2016-17	662338	293778	44%	Due to temporary break down of Machineries and low dispatch the production could not be achieved
2017-18 (up to 10.09.2017)	736449	259221	35%	During balance period of 6 months the remaining ROM production will be achieved

Pradeept Mohapatra
Qualified Person

- **Saleable ore**

Year	Proposed (MT)	Achievement (MT)	Percentage of Achievement	Reason of deviation if any
2016-17	553758	313570.00	56.66	Due to temporary break down of Machineries and low dispatch the production could not be achieved
2017-18 (up to 10.09.2017)	615719	125864.02	20.44	During balance period of 6 months the remaining saleable ore production will be achieved.

- **mineral reject**

Year	Proposed (MT)	Achievement (MT)	Percentage of Achievement	Reason of deviation if any
2016-17	108680	37880.00	34.86	Due to temporary break down of Machineries and low dispatch the production could not be achieved
2017-18 up to 10.09.2017)	120730	51808.85	42.91	During balance period of 6 months the remaining subgrade ore production will be achieved.

- **Generation of waste**

Year	Proposed (MT)	Achievement (MT)	Percentage of Achievement	Reason of deviation if any
2016-17	30516	6472.00	21.20	As the ROM production could not be achieved, proportionately waste generation was low.
2017-18 up to 10.09.2017)	81026	18811.50	23.21	During balance period of 6 months the remaining subgrade ore production will be achieved.

(iii) Reclamation

None of the area was proposed for reclamation in the last scheme period of 5 years (2016-17 to 2020-21) Hence, reclamation was not necessary during the period.

3.4 Status of compliance of violations pointed out by IBM

IBM has not pointed out any violation during 2016-17 to till date.

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

No suspension/ closure/ prohibitory order issued by any Government agency under any rule or Court of law have been issued during the scheme period of 2016-17 to till date.

3.6 In case the MP/SOM is submitted under rules 9 and 10 of MCDR'88 or under rule 22(6) of the MCR, 1960 for approval of modification, specify reason and justification for modification under these rules:

However, the lessee is now seeking modification in the approved Scheme of Mining which was approved on 28.03.2016. The modification is required for the following reason:

Pradeept Mohapatra
Qualified Person

(a) Business Environment:

At present the production capacity of the mine is 0.8MTPA For which the lessee has obtained Environment Clearance. However, the lessee wants to enhance the production from 0.8MTPA to 1.5MTPA because of the following reason:

The average grade of iron ore in this mine is tentatively 62%Fe with a recovery of sized ore is about 60%. Hence, at present there is a demand of high grade sized ore. Further, as per the MMDR (Amendment Act) 2015, most of the leases are going to be expired on 31.03.2020, and the said leases will be put for Auction. Hence, there will be scarcity of material for domestic consumers after 31.03.2020. Hence, to fulfill the demand supply gap to the domestic steel sector the enhancement can help a lot to continue the production of steel.

(b) Conservation of Mineral

(i) At the time of obtaining forest clearance, safety zone of 20m width was left from Pillar No L to M and B to H. As per the geological mapping, from pillar no L to M the exposed litho unit shows that the area is a mineralised zone. The lessee is now interested to include the safety zone area leaving only 7.5m distance within the said pillars(Pillar No L to M).

(ii) In the approved Scheme of Mining, the production planning has been proposed only in high grade ore zone As a result of which there will be huge stack of low grade/sub grade ore within the lease area. Hence, to make the mineral rejects saleable proper blending arrangement will be made from 2017-18 onwards.

Pradeepta Mohapatra
Qualified Person

PART – A

CHAPTER-I

1.0 GEOLOGY AND EXPLORATION

(a) Briefly describe the topography, drainage pattern, vegetation, climate, Rain fall data of the mining lease area:

(i) Topography of the area

The area is featured in Topo sheet No 73 G/5 on a scale of 1:50,000. UTM Co-ordinate of the lease area E332303.418 – N2426390.337 / E331623.726-N2427161.753. Physiographical approach of the lease area comprises gently sloping topography with a prominent hill mound having around 725 m RL in the northern part and 600 m. RL in the western portion of the lease area. Gradient of the area varies from 1:2 to 1:24

(ii) Drainage Pattern of the area

Kakarpani is the nearest stream of the vicinity and is situated at a distance of about 1.5 km east of the lease area. This water course meets with Suna Nadi / Kundru nala at a distance of about 3.0 km from the lease area to the northwest. Another perennial nala is Baitarani River which is at a distance of 8.5 km east of the area. Since mine workings are much above the ground water level, it does not contribute any water to the existing surface drainage and there is no depletion of ground water. The present mine workings are at a higher level no water accumulation is there, needing pumping of water. Minimum seasonal fluctuation in the ground water level in general varies from 2 to 4m.

(iii) Vegetation of the area

The prevailing vegetative cover over the area is mainly of tropical dry deciduous forest [5 B/C-1 (c)] as per Champion and Seth (1968) Ref: "Classification of forest type of India". The forest community in core zone is dominated by Shorea robusta, Terminila belerica, Terminalia tomentosa, Adina cordifolia, Anogeissus latifolia, Madhuca latifolia, Lagerstroemia flosreginae and Holarrhena antidysenterica. It has been observed that the relative frequency of Shorea robusta is maximum at 15% while that of Bambusa arundinacea is minimum at 1%.

(iv) Climate

Climatic condition of the area has been derived from last 10 years data available from IMD Sundergarh. Climate of the region is tropical wet and dry. The south-west monsoon normally sets in the study area by first week of July.

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Qualified Person

Yearly average Temperature, Relative Humidity and rain fall data and predominant wind directions (IMD Sundargarh)

Average monthly Max & Min Temperature during last 10 years (2005 to 2014)

Month	Temp (°C)	
	Max	Min
January	29.4	9.4
February	33.3	12.6
March	37.3	18.2
April	41.0	22.3
May	41.7	25.0
June	39.1	25.5
July	33.1	23.9
August	28.6	21.0
September	33.2	23.0
October	34.4	19.7
November	31.4	15.3
December	29.6	10.8
Average	**34.34**	**18.89**

Average monthly Relative Humidity during last 10 years (2005 to 2014)

Month	Av. Rainfall (mm)
January	68.3
February	66.4
March	55.9
April	40.0
May	51.6
June	73.4
July	84.2
August	79.0
September	83.8
October	76.2
November	71.2
December	76.1
Average	**68.84**

Average Yearly Rainfall during last 10 years (2005 to 2014)

Year	Av. Rainfall (mm)
2005	1427.0
2006	1616.1
2007	2204.0
2008	1948.9
2009	1383.1
2010	1211.0
2011	1942.3
2012	2088.8
2013	1853.6
2014	1791.1
Average	**1746.59**

Pradeept Mohapatra
Qualified Person

Average month-wise Predominant wind directions are as below.

Sl No	Month	Direction	Prominent wind direction
1	January	North-East > South -West	
2	February	South South-West > North North-East	
3	March	South South-West > North-East	
4	April	South > North	
5	May	South South-West > North North-East	
6	June	South South-West > North North-East	Predominant Wind Direction is South South-West to North North-East
7	July	South-West South > North-East North	
8	August	South-West South > East North	
9	September	South-West South > North East	
10	October	North North-East > South	
11	November	North North-East > North North-West	
12	December	North North-East > North North-West	

(v) Regional geology

The Patabeda deposit under discussion forms a part of the Singbhum – Keonjhar- Bonai group of iron ore is located in the western flank of the eastern limb of the horse shoe shaped Bonai synclinorium which was recognized by Jones H. C. in 1934. The pre Cambrian schistose rock in which the whole clan of the deposits are nested and which includes schist, tuffs, phyllite, basic rock, BHQ/BHJ have been classified as Iron Ore Series (IOS). The iron bearing formation of the Bonai range are correlated with similar iron bearing formation e.g. Bailadila iron ore series in Madhya Pradesh and Bellary Hospet group of iron ore deposits of Karnataka. The regional stratigraphic successions of the pre Cambrian rocks have undergone revision by various geologists like J. A. Dunn, S. N Sarkar, A. K. Saha etc. The latest revised one is by S. N Sarkar and A. K. Saha (1977), along with hitherto and widely accepted sequence given by Dunn (1941) is as below.

Regional Stratigraphic Succession

South of copper belt thrust zone in Singhbhum, North Mayurbhanj and North Keonjhar

End of Singhbhum orogenic cycle (c. 850 M.Y.)

Newer Dolerite
Mayurbhanj Granite
Gabbro-Anorthosite
Ultramafic intrusion
Unconformity
Dhanjori Group Jagannathpur Lavas, Dhanjori Simlipal Lavas
Unconformity
Chaibasa formation
Unconformity
Singhbhum Granite
Iron ore orogeny
Iron ore group
Unconformity
Older metamorphic gneiss
O. M. group
Older metamorphic group

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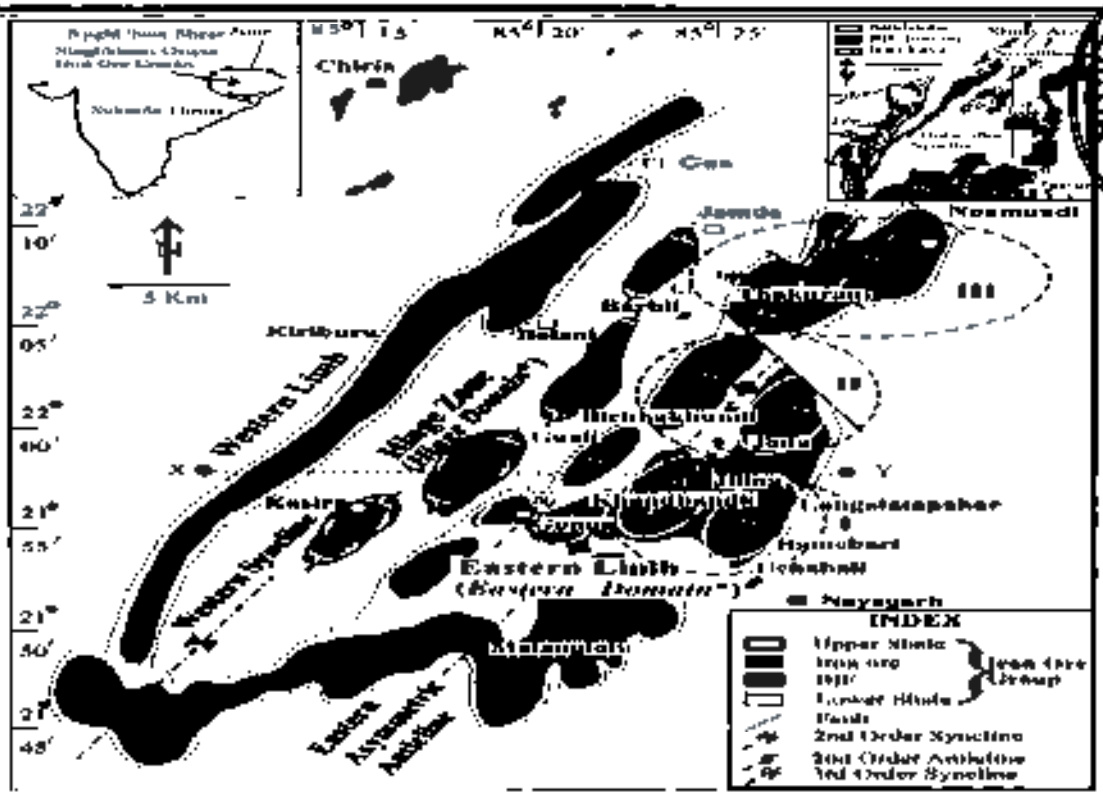

(c) Detailed description of geology of the lease area such as shape and size of the mineral/ore deposit, disposition of various litho-units indicating structural features if any etc.

The Patabeda iron ore mine discerns a fairly wide range of rock types of the iron ore group. The different lithological units present can be broadly categorized into three major groups, namely -

(a) Laterite

(b) Iron Ore formations (BIF), strati form deposit such as BHJ/BHQ.

(b) Argillaceous formations such as shale.

Local Geology

During the field studies, it was found that the local structural elements are compatible with the general regional trend of the eastern limb of the synclinorium. The main rock types found in these mines are Laterite, Hematite (Massive, Hard Laminated, Soft laminated), BHJ/BHQ. In the ML area, iron ore found as mainly hard massive laminated and soft laminated variety. The strike of the ore body/host rock is along NE – SW and the dip is due NW varying from 35^0 to 45^0. The attitude of rock mass/litho units nearly confirm the regional trend

Lithological successions

The lithological succession established as observed within the leasehold area are compatible with other locations on the eastern limb of the synclinorium. The general lithological succession is as follows:

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Laterite
Float iron ore
Lateritic iron ore/Canga ore
Banded iron formation
Shale
BHJ/BHQ

The important ore types are hematite with minor portion of Goethite and limonite. The iron ore is occurring in the form of hard lumpy and laminated varieties

Control of mineralization

The possible parameters of control of mineralization may be attributed to

(a) Regional and local tectonics, (b) Leaching and metasomatic replacement of BHJ and there by leading to iron ore formations, as evidenced by the presence of un-leached portion of the ore and BHJ in the ore body.

Effects of Weathering

The weathering has led to the formation or Laterite, which is highly erratic in nature, hence irregular/discontinuous pockets of Laterite is a common feature in the iron ore deposits.

Shape and size of the mineral/ore deposit:

The shape and size of the ore deposit has been arrived by considering the data/information of existing quarry and drilled bore holes. The lessee has undertaken drilling of 65 DTH/ bore holes within the lease area for a meterage of 10675.45m.

These boreholes along with existing quarry gives valuable information about the ore body configuration i.e. shape & size of the mineral deposit. Based on the results of bore holes it can be observed that maximum depth of iron ore occurrence is 130m (28CBH-34 2016-17) and the minimum depth of the bore hole in which iron ore body is encountering is 7.2m (28CBH-38). The average thickness of the ore body has been assumed as 45m Considering the information of geology and bore holes data, the shape and size of these mineral deposits are 462m x 380m x 45m.

Disposition of various litho-units indicating structural features:

The main rock types such as Laterite, Hematite, shale, BHJ found in Patabeda Iron Ore Mine of M/s MGM Minerals are of iron ore series of Singhbhum. The disposition of various litho units are explained below:

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Laterite

The Laterite is reddish, brown, porous, concretionary material. As per the bore hole data, laterite occurs below the soil cover within the lease area. The thickness of laterite varies from 1m to 10m approximately. It occurs in the northern and south eastern part of the ML area.

(i) Float iron ore

In the south western part of the ML area, float iron ore occurs with an average thickness of 15m. The recovery of iron ore above 45% will be around 50%.

(ii) Lateritic iron ore/ Canga ore

A well-consolidated rock consisting essentially of fragments of iron formation, cemented with limonite occurs in the southern part of the ML area.

(iii) Iron Ore (Hard Laminated ore, and soft laminated iron ore)

As per the geology of the area, exposure of Hard Laminated Iron ore, occurs in the central and south central part of the ML area. The Massive ore body is dipping due North West with varying angle. As per the bore hole data soft laminated iron ore occurs below the Hard Laminated iron ore.

(iv) Shale

Ferruginous shale is occurring in the eastern part of the ML area. The strike of the shale is due NW-SE dipping due NE.

(v) Banded Hematite Jasper (BHJ)

As per the exploration data, BHJ found to be occurring below the iron ore zone. Further, BHJ has also exposed in the southern part of the ML area.

(d) Name of prospecting /exploration agency

Geology Division of the sister concern company M/s M. G. Mohanty was engaged along with the geologist of MGM Minerals Limited. Address – Geology Division, M/s M. G. Mohanty, Patabeda Iron Mines, At -Patabeda, Post – Malda, Mobile - 9937830968; Email id: mgmmines@gmail.com.

(e) Details of prospecting/exploration already carried out

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

Total 17 trial pit and one trench were put during PL stage. The length and width of each pit were 3m and 3m respectively. The minimum and maximum depth was 0.7m (pit-1) and 4.20 (pit-8). The dimension of trench was 80m x 2m x 1m. Based on the prospecting existing quarry have been formed which covers around 11.487Ha area

(ii) Number of boreholes indicating type (Core/RC/DTH), diameter, spacing, inclination, Collar level, depth etc. with standard borehole logs duly marking on geological plan/sections. (Bore hole logs are at **Annexure – 13)**

Total 65 DTH/bore holes have been drilled till date within the lease area. The number, type, diameter, spacing etc. of holes are furnished below:

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Year	No of boreholes	Type of hole	Core Size	Spacing (m)	Inclination
2006-07 to 2010-11	31	Non-core	–	200 / 100	Vertical
	02	Core	NQ & BQ	200 / 100	Vertical
2011-12 to 2017-18	32	Core	NQ & BQ	100/100	Vertical

The year wise DTH/boreholes drilled within the lease area with meterage are furnished below:

YEAR	Type of holes		Total Holes	Spacing	Meterage (m)		Total Meterage (m)
	DTH	Core type			DTH	Core type	
2006 - 07	19	02	21	50-100	243.00	126	369
2007 - 08	02	00	02	50-100	43.00	–	43
2008 - 09	03	00	03	50-100	124.00	–	124
2009 - 10	05	00	05	50-100	226.00	--	226
2010 - 11	02	00	02	50-100	77.00	--	77
2011 - 12	-	-	-	-	-	–	0
2012 - 13	-	14	14	50-100		614.72	614.72
2013 - 14	-	-	-	-	–	–	0
2014 - 15	-	04	04	50-100		123.70	123.7
2015 - 16	-	07	07	50-100		457.50	457.5
2016 - 17	-	07	07	50-100		454.90	454.9
Total	**31**	**34**	**65**		**713.00**	**1776.82**	**2489.82**

During the first few years from 2006-07 to 2010-11 a total of 31 numbers of DTH holes were completed totaling to 839 m drill length. During the year 2006-07, total 19 DTH holes and 12 DTH were completed during 2007-08 to 2010-11. Holes intercepted all types and grade of non-ore, ore and mineral reject. Formation wise drill dusts, as far as visualized / practicable were collected at site and combined samples prepared and analyzed for Fe and other ingredients. Basing on this mining continued in the area till core drilling was introduced from 2012-13.

Core type bore hole started during the year 2006-07. During this year 02 core type bore hole were completed. Subsequently, from 2012-13 onwards the lessee has completed 32 core type bore holes. Cumulatively, till date 34 core type bore holes have been completed by the lessee to re-assess the reserve/resources. The details of 34 core drilling are furnished below:

Sl. No	Hole ID	Latitude	Longitude	Collar RL(m)	Closing RL(m)	Depth (m)	Grid Interval	Level of exploration
1	CBH-1	2426735.45	331829.86	708	632	76	100 x 100	G1
2	CBH-3	2426730.91	331739.01	693	664.5	28.5	100 x 100	G1
3	28CBH23/2012-13	2426531.34	331882.00	705	675	30	100 x 100	G1
4	28CBH24/2012-13	2426767.00	331857.00	699	653	46	100 x 100	G1
5	28CBH25/2012-13	2426797.00	331826.00	693	669	24	100 x 100	G1
6	28CBH26/2012-13	2426741.00	331776.00	693	655	38	100 x 100	G1
7	28CBH27/2012-13	2426721.00	331845.00	699	657	42	100 x 100	G1
8	28CBH28/2012-13	2426717.00	331742.00	693	644	49	100 x 100	G1
9	28CBH29/2012-13	2426867.00	331889.00	630	543	87	100 x 200	G2
10	28CBH30/2012-13	2426730.00	331723.00	689	638	51	100 x 100	G1
11	28CBH31/2012-13	2426805.00	331776.00	687	659	28	100 x 100	G1
12	28CBH32/2012-13	2426826.00	331841.00	687	662	26	100 x 100	G1
13	28CBH33/2013-14	2426710.00	331710.00	681	638	43	100 x 200	G2
14	28CBH34/2013-14	2426803.00	331735.00	681	641	40	100 x 200	G2

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15	28CBH35/2013-14	2426843.00	331810.00	681	625	56	100 x 100	
16	28CBH36/2013-14	2426873.00	331791.00	675	622	53	100 x 100	
17	28CBH37/2014-15	2426583.00	331735.00	652	627	25	100 x 100	
18	28CBH38/2014-15	2426748.00	331902.00	699	692	7.2	100 x 100	G1
19	28CBH39/2014-15	2427005.00	331787.00	625	551	74	100 x 200	G2
20	28CBH40/2014-15	2426644.00	331969.00	703	686	18	100 x 100	G1
21	28CBH41/2015-16	2426973.00	331715.00	649	578	71	100 x 200	G2
22	28CBH42/2015-16	2426809.00	331928.00	693	677	17	100 x 100	G1
23	28CBH43/2015-16	2426868.00	331837.00	675	617	58	100 x 100	G1
24	28CBH44/2015-16	2426878.00	331731.00	669	629	40	100 x 200	G2
25	28CBH45/2015-16	2426934.00	331829.00	650	544	106	100 x 100	G1
26	28CBH46/2015-16	2426935.00	331868.00	651	560	91	100 x 100	G1
27	28CBH47/2015-16	2426909.26	331675.34	649	574	75	100 x 100	G1
28	28CBH29/2016-17	2426911.00	331743.00	655	607	48	100 x 100	G1
29	28CBH30/2016-17	2426835.94	331834.00	678	641	37	100 x 100	G1
30	28CBH31/2016-17	2426852.91	331974.70	672	652	20	100 x 200	G2
31	28CBH32/2016-17	2426747.94	331702.00	673	622	51	100 x 100	G1
32	28CBH33/2016-17	2426984.95	331887.28	627	523	104	100 x 100	G1
33	28CBH34/2016-17	2427061.00	331800.11	618	488	130	100 x 100	G1
34	28CBH35/2016-17	2426647.00	331750.00	675	610	65	100 x 100	G1

The details of 31 DTHs are furnished below:

Sl No.	DTH No	Year of completion	Latitude	Longitude	Collar RL(m)	Closing RL(m)	Depth (m)	Grid interval	Level of exploration
1	DTH-02		331829	2426735	664	651	13	Unexplored Area	
2	DTH-04		332005	2426832	680.5	670.5	10	100x 100	G1
3	DTH-06		331877	2426631	700	685	15		G1
4	DTH-07		331978	2426835	702	686	16	Unexplored Area	
5	DTH-08		331983	2426735	692	682	10		
6	DTH-09		331972	2426833	681	668	13	100x 100	G1
7	DTH-10		331873	2426836	688	642	46	100x 100	G1
8	DTH-11		331777	2426834	688	642	46	100x 100	G1
11	DTH-12		331923	2426834	686	667	19	100x 100	G1
12	DTH-13	2006	331716	2427035	626	613	13	100X 200	G2
13	DTH-14		331669	2426728	670	643	27	100x 200	G2
14	DTH-15		331744	2426629	670	641	29	100x 100	G1
15	DTH-16		331670	2426829	668	643	25	100x 200	G2
16	DTH-17		331670	2426933	648	643	5	100x 200	G2
17	DTH-18		331774	2426934	658	643	15	100x 100	G1
18	DTH-19		331692	2426834	656	643	13	100x 200	G2
19	DTH-20		331882	2426936	653	637	16	100x 100	G1
20	DTH-21		331695	2427141	604	588	16	100x 200	G2
21	DTH-22		3319456	2426531	715	699	16	Unexplored Area	
22	DTH-23	2007	331776	2426737	700	682	18	100x 100	G1
23	DTH-24		331686	2426737	660	635	25	100x 100	G1
24	DTH-27	2008	331861	2426837	686	647	39	100x 100	G1
25	DTH-28		331736	2426837	683	618	65	100x 100	G1
26	DTH-1		331976	2426507	714	649	65	Unexplored Area	
27	DTH-2	2009	331951	2426532	710	645	65		
28	DTH-4		331918	2426997	642	566	76	100x 100	G1
29	DTH-21		331676	2426637	665	633	32	100x 100	G1
30	DTH-26	2010	331686	2426930	655	634	21	100X 200	G2
31	DTH-18	2010	331676	2426837	675	655	20	100x 200	G2
32	DTH-20	2010	331684	2426939	679	659	20	100x 100	G1
33	DTH-25	2011	331766	2426837	647	591	56	100x 100	G1

Formation and run wise samples have been analyzed and borehole log sheet finalized. The details of 34 Core bore holes are furnished as Annexure – 13.

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Outcome of the Exploration/Synthesis of exploration data:

A total of 65DTH/ bore holes have been drilled within the lease area. Out of the total bore holes 34 Bore holes have been taken into consideration for resource/reserve estimation. Remaining DTH holes are excluded for estimation of resource. As earlier explained, till date 2489.82m has been drilled within the lease area. Total 3 bore holes are found negative and 56 nos are positive. Total 6 DTHs have been drilled unsystematically (not in a proper grid pattern) in the eastern part. Hence, these DTHs are not considered under any level of exploration. With these bore holes 12.80Ha area are explored under G1 category and 4.50Ha area have been explored under G2 category.

(iii) Details of samples analysis indicating type of sample (surface/sub-surface from pits/trenches/borehole etc.) Complete chemical analysis for entire strata for all radicals may be undertaken for selected samples from a NABL accredited Laboratory or Government laboratory or equivalent. Entire mineralized area may be analyzed meter wise with 10% of check samples. (At least for 10% of total samples may be analyzed in accordance to BIS and reports from NABL accredited/other government laboratory).

As explained above 34 core type hole have been completed till date. Analysis of cores has been completed by engaging NABL Accredited lab namely, M/s Mitra S.K. Lab, Barbil and M/s R.V. Briggs. Parameters like Fe, Al_2O_3, Sio_2 and Lol have been analyzed. The analysis report is enclosed as Annexure –14. Accordingly, bore hole wise composite run wise assay value of core sample were marked in the cross section to demarcate the grade-wise patches of the ore bodies in that section.

Expenditure incurred in various prospecting operation.

Name of the Exploration Agency	No of Bore Holes	Expenditure Incurred Rs. In Cr
MGM Group (by own drill rig)	34 Core type and 31 DTH	50, 46,168.00

All the core bore holes have been drilled by in-house facilities. Average cost per meter in in core prospecting work was Rs. 2640m per meter. Accordingly, the total expenses for 34 core type bore holes for 1776.82m drilling is Rs 50, 46,168.00.

(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 Rule 28(1)(a) of MCDR 2017

Based on the topographical survey of the area, surface plan of the lease area has been prepared on 1:1000 scales with contour interval of 5 m and grid lines at 100 m interval. All surface features as indicated under rule 32 of MCDR, 2017 have been marked in the Surface plan.

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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 of exploration already carried out along with supporting data for existence of mineral, locations proposed exploration, various litho-units 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 Rule 32 (a),(b) of MCDR 2017.

A detail geological mapping has been undertaken within the lease area. During geological mapping all the litho units and structural information were collected. The lessee has undertaken 65 DTH/bore holes within the lease area. The existing quarries and bore holes within the lease area, have given valuable information about the ore body extension and litho units. These information have been plotted over the geological plan as per their occurrence. The geological map has been prepared on a scale of 1:1000 by incorporating the data/information collected during geological mapping and from boreholes. Based on the mapping, the status of resources estimated under different level (G1 and G2) is furnished in the following table:

Item of information	Lease area explored as per UNFC norms (in Ha) as on date. 10.09. 2017 Total Lease area = A+B+C+D+E					Remarks/Comments including reasons for not carrying out the exploration as per UNFC norms.
	G1 Level (mineralized)	G2 Level (mineralized)	G3 Level (mineralized)	Explored and found non-mineralized with level of exploration (Remarks)	Unexplored lease area	
	A	B	C	D	E	
Area as per level of exploration	12.80	2.00	--	2.50	11.097	Total 6 DTH have been drilled unsystematically/ erratically within unexplored zone. However, these DTHs have not been considered under any exploration level.
No. of BH Drilled						
No. of BH considered for Resource Estimation.	49	7	--	3		
Meterage Drilled						
Grid Interval	50 x 100	100 x 200	--	100 x 200	--	
Scale of Mapping	1:1000	1:1000	--	1:1000	1:1000	There is a proposal of 24 bore holes to explore the entire area under G1 level. This will be completed by 2017-18 to 2019-20

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

Total 8 numbers of geological longitudinal sections of the acquired area within the mining lease have been prepared on 1:1000 scales at every 50 m interval in NW – SE.

(i) Future programme of exploration with due justification (marking on Geological plan year wise location in different color) taking into consideration the future tentative excavation programme planned in next five years as tabulated below

A total of 24 bore holes have been proposed within remaining unexplored area at 50m x 100m grid interval. As a result of which entire area will be covered under exploration at G1 level. The proposal has been envisaged during the financial year 2017-18 to 2019-20. It is proposed to drill up to an

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average depth of 50m or up to the bottom of mineralization in each bore hole. Total meterage of drilling during ensuing plan period will be 990m (approx.). This meterage may vary depending on the results of bore hole. The details of proposed exploration programme during this plan period are given below. Location of these boreholes is shown in Geological Plan and sections.

Year	Bore Hole Id	Bore Hole Collar RL	Easting	Northing	Estimated closing Depth (m)	No of Bore hole	Type of Bore hole	Details of Analysis
2017-18	PBH-08	628	331983.31	2426783.08	50.0	14	Core/RC	The analysis will be done at every one meter interval. Further, if there is any change in lithology within the sampled interval of 1m then based on lithology additional sampling will be carried out.
	PBH-09	691	331913.13	2426774.46	40.0			
	PBH-10	702	331921.01	2426703.97	40.0			
	PBH-11	688	331888.60	2426555.29	60.0			
	PBH-12	677	332062.00	2426721.00	40.0			
	PBH-13	707	331930.37	2426634.09	40.0			
	PBH-14	700	332000.55	2426642.71	40.0			
	PBH-15	712	331938.96	2426583.91	65.0			
	PBH-16	715	332009.17	2426572.53	40.0			
	PBH-17	678	332070.00	2426651.00	40.0			
	PBH-18	691	332079.35	2426591.14	40.0			
	PBH-19	666	332149.53	2426589.76	40.0			
	PBH-20	662	332158.15	2426519.58	40.0			
	PBH-21	651	332228.33	2426528.19	40.0			
2018-19	PBH-22	620	331680.00	2426520.00	30.0	10	Core/RC	--do--
	PBH-23	625	331670.00	2426590.75	35.0			
	PBH-24	645	331770.00	2426511.95	45.0			
	PBH-25	654	331700.00	2426630.77	40.0			
	PBH-26	668	331830.00	2426528.32	55.0			
	PBH-27	663	331665.10	2426785.60	30.0			
	PBH-28	685	331807.91	2426673.05	40.0			
	PBH-29	715	331660.00	2426916.94	30.0			
	PBH-30	630	331700.00	2427012.74	30.0			
	PBH-31	615	331649.93	2427115.86	40.0			
	Total				990.0			

(j) Reserves and Resources as per UNFC with respect to threshold value notified by IBM (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). Feasibility study report along with financial analysis for economic viability of the deposit as specified under the UNFC field guide lines is incorporated.

J-(i) Parameters considered during estimation of the reserve/resource in the earlier Approved Scheme of mining:

In the last approved scheme the reserves have been estimated in cross sectional method considering the following Mining Block – 1 (in situ) and 2 (float)

Mining Block – 1 (in situ) is bounded by following UTM Co-ordinates

Approximate area covered	Longitude (X – Axis) Northing	Latitude (Y-Axis) Easting
112150 sq. m. / 11.215 Ha	331630	2427005
	331950	2426975
	332170	2426850
	331640	2426645

Mining Block – 2 (float) is bounded by following UTM Co-ordinates

	331640	2426645

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Mining Block – 2 (float) is bounded by following UTM Co-ordinates

29100 sq. m./2.91 Ha	331640	[illegible]
	331800	[illegible]
	331800	[illegible]
	331645	[illegible]

J-(ii) Mining Block – 1 (In situ Zone) (Calculation)

- Volume of material mined out from the ore zone is the ROM.
- ROM (cum) x 0.75 (recovery factor for >58% Fe ore x 3.4 as Bulk Density
  = Quantity of >58% Fe ore in tons
- ROM (cum) x 0.20 (recovery factor for 45% to 58% Fe ore x 2.5 as Bulk Density
  = Quantity of 45% to 58% Fe ore in tons
- ROM (cum) x 0.05 (recovery factor for <45% Fe ore x 2.0 as Bulk Density
  = Quantity of <45% Fe ore in tons (Inter burden waste)

J- (iii) Mining Block – 2 (Float ore Zone) (Calculation)

- ROM (cum) x 0.40 (recovery factor for >58% Fe ore x 3.4 as Bulk Density = Quantity of >58% Fe ore in tons
- ROM (cum) x 0.10 (recovery factor for 45% to 58% Fe ore x 2.5 as Bulk Density = Quantity of 45% to 58% Fe ore in tons
- ROM (cum) x 0.50 (recovery factor for <45% Fe ore x 2.0 as Bulk Density = Quantity of <45% Fe ore in tons (Inter burden waste)

Category wise reserve/resource estimated in the earlier Scheme of mining with grade (As on 01.04.2016):

The category wise reserve and resources estimated in the approved Scheme of Mining is given below:

Reserves	Total Million tons
Mineable Proved Reserves (111)	9.99
Mineable Probable Reserves (122)	0.036
Total	**10.026**

Depletion of ore reserves during 2016-2017 to 2017-18 (up to 10.09.2017)

Year	Production of ROM
2016-17	293778
2017-18 (up to 10.09.2017)	259221
Total	**552999**

Balance ore reserves as on 10.09.2017

Reserves	Total Million tons
Mineable Proved Reserves (111)	9.437
Mineable Probable Reserves (122)	0.036
Total	**9.473**

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(k) Detailed re-estimation of section and Level-wise Geological Resources (Measured, Indicated) & Mineable Reserves (Proved & Probable) as on 10.09.2017.

Resource/Reserve assessment has been made by cross sectional area method. Cross sectional area measured in sections are multiplied with the respective length of influence of each section giving the volume. As the volume so calculated is combination of saleable ore, Mineral rejects and intercalated waste, a recovery factor has been applied to get the volume of each saleable ore, Mineral rejects and waste. The volume (cum) so calculated for saleable ore and mineral rejects is then converted into tonnage under different category. The cross sectional area method is defined as follows:

Where, G = C * LI * = Volume of ore (V) X Incidence factor(R) X TCF
G = Geological reserve in metric tones
C = Cross sectional area in Square meters
LI = Length of Influence in meters
TCF = Tonnage conversion factor

Updated reserves established category-wise (with basis of parameters)

Reason for Escalation of Resource/reserve:

During the financial year 2016-17, the lessee has drilled 7 core type bore holes to convert the resources into reserve. Accordingly, the resource is going to change from the earlier approved Scheme of Mining.

(K.1)Parameters considered for estimation of resources / reserves by cross sectional method. Resource and Reserves within lease are arrived after applying results feasibility study and economic evaluation of deposits based on various factors such as

The reserve of the mines has been re-estimated by taking various parameters in to account. The total mining lease was resurveyed & geological mapping was carried out for the same. Based on the geological mapping, drilled bore hole and recent updated surface plan the reserve/resource have been updated. Parameters like Mining method, recovery factors, mining losses, Cutoff grade, Ultimate pit depth proposed, mineral/Ore blocked due to benches, barriers and pillars etc. heve been taken into consideration for the estimation of resources. However, parameters considered for the estimation of resource/reserve are furnished below:

Sl. No.	Parameters	Assumptions
1	No of Sections	8nos
2	Length of Influence	100m
3	No of bore holes considered	34nos core type bore hole
4	ROM ore (+45%Fe)	95% w.r.t total excavation
5	Generation of Waste materials	05% w.r.t total excavation
6	Threshold value	+45%Fe

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7	Sub grade considered		+45%Fe to -58%Fe
8	Cut-off grade		58% Fe
9	Tonnage factor saleable ore		3.4 t/m^3
10	Tonnage factor mineral rejects		2.5 t/m^3
11	Tonnage factor waste		2.0 t/m^3
12	Saleable ore	Recovery factor	75% w.r.t total excavation
		Grade	+58% Fe
13	Mineral rejects	Recovery factor	20% w r.t total excavation
		Grade	+45% -58% Fe
14	Inter burden	Recovery factor	05% w.r.t total excavation
		Grade	- 45% Fe
15	Float ore		
	Recovery factor		50% of total excavation

The bulk density study has been undertaken by M/s Earth and Environment Lab an NABL Accredited Lab. The copy of the certificate is enclosed as **Annexure- 14A**

Type of resources

Measured resources

Resource under Measured Mineral Resources (331) has been estimated based on the available information from the bore hole data, existing quarries and geological mapping. The entire core type exploratory drill holes with grid spacing of 50m X 100m and existing quarries have been considered as G1 category and categorized under 331 as per UNFC code.

Indicated Resource (332):

The indicated resource has been taken another 50m from the proved limit considering the lateral extension of ore body at depth matching with the measured limit.

GIST OF GEOLOGICAL RESOURCES (As on 10.09.2017)

Category	Resource +58% Fe (MT)			Resource (45 to 58% Fe) MT			ROM (+45%Fe)
	In situ	Float	Total	In situ	Float	Total	
Measured(331)	8548110	303832.5	8851943	1676100	58200	1734300	10586243
Indicated (332)	970657.5	--	970657.5	190325	--	190325	1160983
Total	**9518768**	**303832.5**	**9822600**	**1866425**	**58200**	**1924625**	**11747225**

Section wise measured resource (331)

In situ zone

Section	Cross Section Area (Sq. m)	Length of influence (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tons)	Volume of 45% to -58% Fe (Cum)	Quantity of 45% to -58% Fe (Tons)	Volume of -45% Fe (Cu.m)	Quantity of -45% Fe Ore (Tons)	ROM (Tonnes)
	A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.6	H=Cx5%	I=Hx2	J=E+G
AA'	2070	50	103500	77625	263925	20700	51750	5175	10350	315675
BB'	4480	50	224000	168000	571200	44800	112000	11200	22400	683200
CC'	6220	50	311000	233250	793050	62200	155500	15550	31100	948550
DD'	6980	50	348000	261000	887400	69600	174000	17400	34800	1061400
EE'	6890	50	344500	258375	878475	68900	172250	17225	34450	1050725
FF'	13510	50	675500	506625	1722525	135100	337750	33775	67550	2060275
GG'	10460	50	523000	392250	1333650	104600	261500	26150	52300	1595150
HH'	12530	50	626500	469875	1597575	125300	313250	31325	62650	1910825
II'	4360	45	196200	147150	500310	39240	98100	9810	19620	598410
Total			3352290	2514160	8548110	670440	1676100	167610	335220	10224210
Total in Million Tones			3.35	2.51	8.55	0.67	1.68	0.17	0.34	10.22

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Float and conga ore zone

Section	Cross Section Area (Sq.m)	LOI (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tonnes)	Volume of 45% to -58% Fe (Cu.m)	Quantity of 45% to -58% Fe (Tons)	Volume of -45% Fe (Cu.m)	Quantity of -45% Fe (Tons)	ROM (Tons)
	A	B	C=(AxB)	D=Cx40%	E=Dx3.4	F=Cx10%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
AA'	462	50	23100	9240	31416	2310	5775	11550	23100	37191
BB'	720	50	36000	14400	48960	3600	9000	1800	3600	57960
CC'	250	50	12500	5000	17000	1250	3125	625	1250	20125
DD'	218	50	10900	4360	14824	1090	2725	545	1090	17549
EE'	76	50	3800	2850	9690	760	1900	190	380	11590
FF'	267	50	13350	10012.5	34042.5	2670	6675	667.5	1335	40717.5
GG'	497	50	24850	18637.5	63367.5	4970	12425	1242.5	2485	75792.5
HH'	663	50	33150	24862.5	84532.5	6630	16575	1657.5	3315	101107.5
II'	0	45	0	0	0	0	0	0	0	0
Total			157650	89362.5	303832.5	23288	58200	18277.5	36555	362032.5
Total in Million Tones			0.16	0.09	0.30	0.02	0.06	0.02	0.04	0.36

Section wise Indicated resource (332)

Sections	Cross Section Area (Sq.m)	Length of Influence (m)	Volume (Cu.m)	Volume of +58% Fe Ore (Cu.m)	Quantity of +58% Fe Ore (Tonnes)	Volume of 45% to -58% Fe Ore (Cu.m)	Quantity of 45% to -58% Fe Ore(Tonnes)	Volume of -45% Fe Ore (Cu.m)	Quantity of -45% Fe Ore (Tonnes)	ROM (Tonnes)
	A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
AA'	1590	50	79500	59625	202725	15900	39750	3975	7950	242475
BB'	940	50	47000	35250	119850	9400	23500	2350	4700	143350
CC'	1280	50	64000	48000	163200	12800	32000	3200	6400	195200
DD'	310	50	15500	11625	39525	3100	7750	775	1550	47275
EE'	660	50	33000	24750	84150	6600	16500	1650	3300	100650
FF'	1870	50	93600	70125	238425	18700	46750	4675	9300	285175
GG'	0	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH'	0	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
II'	1070	45	48150	36112.5	122782.5	9630	24075	2407.5	4815	146857.5
Total			380650	285487.5	970657.5	76130	190325	19032.5	38065	1160983
Total in Million Tones			0.38	0.29	0.97	0.08	0.19	0.02	0.04	1.16

MINEABLE RESERVE

Mineral/ ore blocked dues to benches:

During mining operation certain resources have been blocked under UPL, lease boundary safety zone, within bench slope. The iron ore in these blocked areas are non-mineable. Although feasibility study has been carried out and the quantity has been established, because of the above mentioned blockages the quantity falls under F-1 category. By considering these blockages, due to above mention various factors, the mineable resource has been estimated. The blockage iron ore within Measured, and indicated resources has been categorized under 211 and 222. Considering the blockage of iron ore under different categories the mineable and non- mineable reserve has been estimated. The detail mineable reserves are given below:

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Summary of mineable reserves of Iron ore (As on 10.09.2017)

Category	Resource +58% Fe (MT)			Resource (45 to 58% Fe) MT			ROM (+45% Fe) MT
	In situ	Float	Total	In situ	Float	Total	
Proved (111)	8381850	298596.5	8680447	1643500	57237.5	1700738	10381184
Probable (122)	609450	--	609450	119500	--	119500	728950
Total	8991300	298596.5	9289897	1763000	57237.5	1820238	11110134

Section wise proved Mineral reserve (111)

In situ Ore zone

Sections	Cross Section Area (Sq. m)	Length of Influence (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tons)	Volume of 45% to - 58% Fe (Cu.m)	Quantity of 45% to -58% Fe (Tons)	Volume of -45% Fe (Cu.m)	Quantity of -45% Fe (Tonnes)	ROM (Tonnes)
	A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
AA'	2070	50	103500	77625	263925	20700	51750	5175	10350	315675
BB'	4480	50	224000	168000	571200	44800	112000	11200	22400	683200
CC'	6220	50	311000	233250	793050	62200	155500	15550	31100	948550
DD'	6920	50	346000	259500	882300	69200	173000	17300	34600	1055300
EE'	6890	50	344500	258375	878475	68900	172250	17225	34450	1050725
FF'	18510	50	675500	506625	1722625	135100	337750	33775	67550	2060275
GG'	10420	50	521000	390750	1328550	104200	260500	26050	52100	1589050
HH'	12098	50	604900	453675	1542495	120980	302450	30245	60490	1844945
II'	3480	45	156600	117450	399330	31320	78300	7830	15660	477630
Total			3287000	2465250	8381850	657400	1643500	164350	328700	10025350
Total in Million Tones			3.29	2.47	8.38	0.66	1.64	0.16	0.33	10.03

Float and conga ore zone

Section	Cross Section Area (Sq.m)	Length of Influence (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tons)	Volume of 45% to - 58% Fe (Cu.m)	Quantity of 45% to -58% Fe (Tons)	Volume of -45% Fe (Cu.m)	Quantity of -45% Fe (Tonnes)	ROM (Tons)
	A	B	C=(AxB)	D=Cx60%	E=Dx3.4	F=Cx10%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
AA'	422	50	21100	8440	28696	2110	5275	10550	21100	33971
BB'	683	50	34150	13660	46444	3415	8537.5	1707.5	3415	54981.5
CC'	250	50	12500	5000	17000	1250	3125	625	1250	20125
DD'	218	50	10900	4360	14824	1090	2725	545	1090	17549
EE'	76	50	3800	2850	9690	760	1900	190	380	11590
FF'	267	50	13350	10012.5	34042.5	2670	6675	667.5	1335	40717.5
GG'	497	50	24850	18637.5	63357.5	4970	12425	1242.5	2485	75782.5
HH'	663	50	33150	24862.5	84532.5	6630	16575	1657.5	3315	101107
II'	0	45	0	0	0	0	0	0	0	0
Total			183600	87822.5	298596.5	22995	57237.5	17188	34370	355834
Total in Million Tones			0.18	0.09	0.30	0.02	0.06	0.02	0.03	0.36

Section wise probable Mineral reserve (122)

Sections	Cross Section Area (Sq.m)	Length of Influence (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tons)	Volume of 45% to -58% Fe (Cu.m)	Quantity of 45% to -58% Fe (Tons)	Volume of -45% Fe (Cu.m)	Quantity of -45% Fe (Tons)	ROM (Tons)
	A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
C-C'	1328	50	66400	49800	169320	13280	33200	3320	6640	202520
D-D'	274	50	13700	10275	34935	2740	6850	685	1370	41785
E-E'	780	50	39000	29250	99450	7800	19500	1950	3900	118950
F-F'	260	50	13000	9750	33150	2600	6500	650	1300	39650
G-G'	520	50	26000	19500	66300	5200	13000	1300	2600	79300
H-H'	790	50	39500	29625	100725	7900	19750	1975	3950	120475
I-I'	0	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J-J'	0	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K-K'	920	45	41400	31050	105570	8280	20700	2070	4140	126270
Total			239000	179250	609450	47800	119500	11950	23900	728950
Total in Million Tones			0.24	0.18	0.61	0.05	0.12	0.01	0.02	0.73

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Summary of Feasibility Resources and pre- feasibility resource

Category	+58% Fe (MT)	(45 to 58%Fe) (MT)	ROM (+45%Fe) (MT)
In situ ore zone			
Feasibility resources (211)	166260.00	32600.00	198860
Pre-Feasibility Resources (222)	361207.50	70825.00	432032.50
Sub-total	527467.50	103425.00	630892.50
Float ore zone			
Feasibility resources (211)	5236.00	962.50	6198.50
Total ore to be blocked (in situ and float ore zone)	532703.5	104387.5	637091.00

Section wise Feasibility resources (211)

Sections	Cross Section Area (Sq.m)	Length of influence (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tonnes)	Volume of 45% to -58% Fe (Cu.m)	Quantity of 45% to -58% Fe (Tons)	Volume of -45% Fe (Cu.m)	Quantity of -45% Fe (Tons)	ROM (Tonnes)
	A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
C-C'	0	50	0	0	0	0	0	0	0	0
D-D'	0	50	0	0	0	0	0	0	0	0
E-E'	0	50	0	0	0	0	0	0	0	0
F-F'	40	50	2000	1500	5100	400	1000	100	200	6100
G-G'	0	50	0	0	0	0	0	0	0	0
H-H'	0	50	0	0	0	0	0	0	0	0
I-I'	40	50	2000	1500	5100	400	1000	100	200	6100
J-J'	432	50	21600	16200	55080	4320	10800	1080	2160	65880
K-K'	880	45	39600	29700	100980	7920	19800	1980	3960	120780
Total			65200	48900	166260	13040	32600	3260	6520	198860
Total in Million Tones			0.07	0.05	0.17	0.01	0.03	0.00	0.01	0.20

Float and conga ore zone

Section	Cross Section Area (Sq.m)	Length of influence (m)	Volume (Cu.m)	Volume of +58% Fe Ore (Cu.m)	Quantity of +58% Fe Ore (Tonnes)	Volume of 45% to -58% Fe Ore (Cu.m)	Quantity of 45% to -58% Fe Ore (Tonnes)	Volume of -45% Fe Ore (Cu.m)	Quantity of -45% Fe Ore (Tonnes)	ROM (Tons)
	A	B	C=(AxB)	D=Cx48%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
AA'	40	50	2000	800	2720	200	500	1000	2000	3220
BB'	37	50	1850	740	2516	185	462.5	92.5	185	2978.5
Total			3850	1540	5236	385	962.5	1092.5	2185	6198.5
Total in Million Tones			0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01

Section wise Pre-Feasibility Resources (222)

Sections	Cross Section Area (Sq.m)	Length of influence (m)	Volume (Cu.m)	Volume of +58% Fe Ore (Cu.m)	Quantity of +58% Fe Ore (Tonnes)	Volume of 45% to -58% Fe Ore (Cu.m)	Quantity of 45% to -58% Fe Ore(Tonnes)	Volume of -45% Fe Ore (Cu.m)	Quantity of -45% Fe Ore (Tonnes)	ROM (Tonnes)
	A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
C-C'	262	50	13100	9825	33405	2620	6550	655	1310	39955
D-D'	666	50	33300	24975	84915	6660	16650	1665	3330	101565
E-E'	500	50	25000	18750	63750	5000	12500	1250	2500	76250
F-F'	50	50	2500	1875	6375	500	1250	125	250	7625
G-G'	140	50	7000	5250	17850	1400	3500	350	700	21350
H-H'	1080	50	54000	40500	137700	10800	27000	2700	5400	164700
I-I'	0	50	0	0	0	0	0	0	0	0
J-J'	0	50	0	0	0	0	0	0	0	0
K-K'	150	45	6750	5062.5	17212.5	1350	3375	337.5	675	20587.5
Total			141850	106387.5	361207.5	28330	70825	7092.5	14185	432032.5
Total in Million Tones			0.14	0.11	0.36	0.03	0.07	0.01	0.01	0.43

A Feasibility study report along with financial analysis for economic viability of the deposit as specified under the UNFC field guidelines has been incorporated as Annexure - 15 .

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(I) Mineral Reserves and Resources

Mineral Resources have been estimated by sectional area method based on level of exploration with reference to the threshold value of minerals declared by IBM i.e. 45% Fe and it is reflected as below.

Level of Exploration	Resources in Million tone	Grade
G1 - Detail Exploration	10.586	+45%Fe
G2 - General Exploration	1.161	
G3 - Prospecting	--	
G4 - Reconnaissance	--	
Total	**11.747**	

Resources and Reserves within the lease have been arrived after applying results feasibility/pre-feasibility study and economic evaluation of deposit based on various factors such as:

Mining Method

The mine will be operated by Fully Mechanized Method. The quarry bench height & width will be maintained 10m &15m respectively for the production of iron ore. But at the ultimate stage the bench height and width will be kept at 10m each. Mining equipment like DTH drill of 105mm dia, Volvo (30t), hydraulic excavators of 0.9 - 4.3 cum capacity etc. will be used during ensuing scheme period to achieve the targeted production. Processes of excavation and loading of overburden/waste will be done by deploying hydraulic excavators and dumpers.

Geo-mining Character/Recovery factor/ Tonnage Factor:

Geo-Mining Parameters	Quantitative Description
In situ ore	
Saleable ore incidence	75% of total excavation (+58% Fe)
Mineral rejects generation	20% of total excavation (45-58% Fe)
Waste	05% of total excavation (- 45% Fe)
For float/conga ore	
Saleable ore incidence	40%
Mineral rejects generation	10%
Waste	50% waste
Bulk density	3.4 t/m^3 for Saleable ore, 2.5t/m3 sub grade and 2.0 for waste.
Bench height	10m
Bench width	15m
Cut-off Grade	55% Fe
Threshold Value	45% Fe
Mineral rejects	+45% Fe-55% Fe

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Reserve & Grade as per United Nations Framework Classification: **(As on 10.08.2017)**

	Category	Code	Quantity (MT)	Grade	
				+58%Fe	45-58%Fe
A. Reserve	Proved	(111)	10381184.00	8680447	1700738
	Probable	(121)	--	--	--
		(122)	728950.00	609450	119500
	Total reserve		**11110134.00**	**9289896**	**1820238**
B. Remaining Resources	Feasibility Mineral Resources	(211)	205058.50	171496	33562.5
	Pre-feasibility Mineral	(221)	--	--	--
	Resources	(222)	432032.50	361207.5	70825.00
	Measured Mineral Resources	(331)	--	--	--
	Indicated Mineral Resources	(332)	--	--	--
	Inferred Mineral Resources	(333)	--	--	--
	Reconnaissance Mineral Resources	(334)	--	--	--
	Total Remaining Resource		**637091.00**	**532703.5**	**104387.5**
	Total Reserve + Resource		**11747227.00**	**9822601**	**1924626**

Note: It may not be 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.

Reporting of Mineral Resources As per the format prescribed in Part IV- A of Minerals (Evidence of Mineral Content) Rule 2015

Sl. No.	Contents	Explanation
1	Title & Ownership	Geology Division of M/s M. G. Mohanty was engaged along with the geologist of MGM Minerals Limited. Address – Geology Division, M/s. M. G. Mohanty, Patabeda Iron Mines, At -Patabeda, Post – Malda, Mobile - 9937830968; Email id: mgmmines@gmail.com.
2	Details of the area	**Name of the Mine :** Patabeda Iron Ore Mines (28.397 Ha) **Name of the lessee :** M/s MGM Mineral Ltd Village: Patabeda, District : Sundargarh **Date of Grant of lease/ Period:** Mining lease over an area of 28.397 Ha was granted for 20 years w. e. from 08.03.2006. **Expiry date: 07.03.2026.** However, as per Mines & Minerals (Development and Regulation) Amendment Act 2015, the mining lease is deemed to be granted / extended till 07.03.2056.

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3	Infrastructure & Environment	**Local Infrastructure:** The area can be approached from Barbil and Joda town through Koira. Area is approachable from Koira covering a distance of 20 Kms. The area is also connected by un metalled and all weather roads to Express Highway No.2 to Jurudi railway station at a distance of 10 Kms. **Host population:** The major surrounding villages are Patabeda, Gonua, Mandajoda etc. The population of villages are Patabeda : 351 Gonua : 151 Mandajoda : 254 **Historical sites:** Nil **Forests** sanctuaries, national park : Nil within 10 km radius Environmental settings of the area. Detail environment setting has been explained in Ch – VIII.
4	Previous Exploration	Explained in page no 15 of Chapter-I
5	Geology	Explained in Chapter-I
6	Aerial/ground geophysical/ geochemical data	Not done, However, detail exploration has been carried out by DTH/Core drilling.
7	Technological investigation	Details have been explained in page No-14 -17.
8	Location of data Points.	The lease area has been surveyed by using Total Station and DGPS on a scale of 1:1000 scale. During the survey the location of DTH/bore hole points were marked based on the topography and accessibility of drill machine.
9	Sampling Technique	Earlier during prospecting, iron ore from trial pit were collected and analyzed. Further, after drilling cut samples of cores and chips of DTH were taken and analyzed to know the quality of ore in terms of Fe.

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10	Drilling Technique & drill sampling employed	Total 34 core type Bore holes and 31 DTH have been drilled t[illegible]. However, 34 core type bore holes have been taken into consideration for resource estimation. The core diameter was 47mm dia (NQ). The details of location of Bore holes collar R.L, inclination etc. have been furnished in page no-15-16. Litho wise Logging of core samples was done during the drilling. The core samples have been properly recorded and the core recovery was around 80 -90%Fe.
11	Sub-sampling techniques and sample preparation	Each core sample was split into two halves. One half was preserved while the other half was first sun dried to remove moisture if any. The dried samples were weighed using a spring balance in order to check loss of sample in course of processing. Then the sample was crushed manually using stainless steel mortar and pestle to fine powder of –200 mesh sizes. The powdered sample was reduced to about 100gm by coning and quartering before sending for chemical analysis.
12	Quality of assay data and laboratory tests	The samples were analysed at NABL accredited Lab i.e. R.V.Briggs. Meter wise analysis of iron ore was carried out by the Lab. From the chemical analysis results of core samples received for various boreholes, the grade of iron ore was computed borehole wise with threshold value of 45% Fe. Weighted averaging technique was used to obtain the average grade. The average grade of Fe at 45%Fe threshold value is 62%Fe.
13	Quality of assay data and laboratory tests	The tonnages are estimated on a dry basis or with natural moisture.
14	Bulk Density	Bulk density study has been conducted by NABL accredited Lab namely M/s Earth and Environment Lab, Bhubaneswar. Accordingly, The Bulk Density of iron ore (+58%Fe) is considered as 3.4MT/cum and Mineral rejects 45-58%Fe is considered as 2.5MT/cum.
15	Resource estimation techniques	Details of resource estimation is explained in Chapter-I (Geology and Reserve)
16	Further work	Part of the area has been explored in G1 level. The remaining un explored and G2 level area needs to be explored. Accordingly a total of 24 Nos of Bore holes have been proposed to be done within a period of two years.
17	Annexures/enclosures to the report	Ref Annexure – 13 and 14
18	Any other information	It is observed that some of the bore holes terminated in the ore zone. Hence, bore holes have been proposed again in the same location.

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CHAPTER-II

2.0 MINING

2.1 Opencast Mining

(a) Existing as well as proposed method of excavation with all design parameters indicating on plans / sections

◆ Existing method of mining:

The mine under reference belongs to category - A (Fully Mechanized) mine, now is operated on single shift basis. The same Fully Mechanized Method of Mining will be adopted during the ensuing plan period. The details of salient description of existing method of mining are furnished below:

❖ Salient description of Present Mining Methods: (As per Approved Scheme of Mining)

Sl No	Salient features	Description
1)	Method of Mining	Fully Mechanized (FM)
2)	Existing production	0.80 MT
3)	Type of ore	Hard Laminated ore, Soft Laminated ore
4)	Means of raising	Drilling, Blasting, excavation, screening, crushing, loading etc.
5)	Bench height and width	Height-6m Width – More than the height
6)	Stripping ratio (t/m3) (Ore: OB)	1:0.022
7)	Over all slope	37.5^0
8)	Transportation ore to the stacking yard	Through dumper & tippers
9)	Nature of overburden/ inter burden	Generally consists of BHJ, shale, and Laterites.
10)	Blasting proposal	Deep hole blasting is carried on to dislodge the boulders.

❖ Details of the Existing Quarry

Mining was commenced in the lease area since 2006. From the date of commencement one quarry has been developed in the lease area. The details of the existing quarries particularly with respect to their length, breadth area utilized, status of working etc. have been indicated as follows:

Name of the quarry	Dimension		Area (m2)	Top RL (m)	Bottom RL(m)	No of benches	Status
	Length (m)	Width (m)					
Existing Quarry	358	320	11.487	707	633	13	Active

❖ Details of the Existing Dump

There exist three dumps in the northern part of the lease area. The waste dump mainly constitutes materials like BHJ, shale and laterite. Tentatively, the present dimension of the dump is mentioned below:

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Dump	Co-ordinate	Length(m)	Width(m)	Area (Ha)	No of Terraces	Top RL	Bottom RL
South Dump – 1	N2426503- N2426636 E331844-331938	130	80	1.055	1	711	697
South Dump – 2	N2426500-N2426565 E331740-331860	100	65	0.511	1	662	647
North Dump – 3	N2427170 - N2427016 E331652 - 331752	135	95	1.461	2	631	611
East Dump - 4	N2426626 - N2426746 E332080-332192	150	36	0.542	1	674	674

❖ **Details of the Existing Mineral rejects**

Sl. No	Name of the stack	Location	Area in Ha	Average Grade	Quantity Cum	Top RL(m)	Bottom RL(m)
1	Mineral reject dump -1	E331740-331840 N2426980-2427040	0.25	51.45	32686.86	620.58	628.4
2	Mineral reject dump-2	N2427030-2427100 E331710-331790	0.30	51.05	18439.85	616.57	630.8
	Total				51126.71		

Selection of quarry area for development

There is one quarry existing within the lease area. The same pit has been selected for the development. Earlier, the proposal was envisaged only in hard massive zone from west to east. In this modification of approved Mining Plan, the development has been envisaged from north to south and west to east. In the northern part, iron ore of low grade is found to occur where as in the western part high grade hard massive ore is occurring. As a result of simultaneous development, the low grade ore can be blended with high grade ore to make the low grade ore saleable.

Proposed Method of Mining:

The Patabeda iron ore mine 'A' category mine. Taking into consideration the topography of the deposit, estimated reserve and grade, disposition of ore body, nature of intercalated waste, incidence of iron ore, and production requirement, the deposits will be mined by fully mechanized method with the deployment of earth moving machines like blast hole drill, hydraulic shovel, dumpers, dozers etc. on three shift basis.

Capacity of the Mine:

The present capacity of the mine is 0.8MTPA as per Environment Clearance obtained from MoEF, GOI. However, considering the present market condition, available resource, the capacity of the mine is proposed to be enhanced up to 1.50 Million tons per Annum.

Bench Parameter

The present bench height has been kept at 6m. Once the production capacity is enhanced up to 1.50MTPA, the bench height is proposed to be changed from 6m to 10m. The minimum bench width in the working benches shall be maintained at more than 10m while in the ultimate stage, the bench width shall be reduced to 10m, thus having a final pit slope of 45^0.

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Haul Road alignment:

The layout of roads for haulage of ore/ waste and access to different installation in the mine will be developed complying with the statutory regulations stipulated in the Metalliferrous Mines Regulations,1961. Overburden will be sent to the dumping yard. Sites located in the lease area. Fifteen (15m) wide haul road will be developed in the lease area as per need at a gradient up to 1:16. However, in the ramp the gradient will be maintained at 1:12. Regular maintenance of haul road will be done to protect the road from damage and vehicles from wear & tear.

Site Services:

As far as day to day mine operation is concerned, the infrastructure such as site office, weigh bridge, rest shed, First-aid center, blasting shed security house, magazine, guard house etc. are already made available in the lease area.

Drilling and Blasting

Drilling is proposed to be done using 105mm diameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using Nitrate Mixture such as power gel explosive. Controlled blasting along with shock tube initiation system / NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Excavation, Loading and transportation

The blasted material will be excavated by shovels of 2.1cum - 4.3 cum capacity and loaded onto 30T dumpers for transportation of the ROM, Mineral rejects and waste. Loading will be done mechanically. The ROM ore from different mining faces will be transported by dumpers of 30t in a pre-determined proportion (for blending different qualities of ore), and delivered to the processing plant.

Mining of the Deposit

Mining of the deposit will be carried out by conventional cyclic operations namely drilling and blasting of ore zone, excavation, loading and haulage of run of mine ore. Drilling and blasting operation will be carried out at hard / laminated iron ore zone for loosening. These loosened iron ore then excavated and loaded to the dumper for processing. The processed ore shall be sent to the different destinations by and means as explained above.

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Mineral processing

ROM to be excavated from the mine will be sent to the Mobile screening plant to segregate the ore to different size. Sizing of the ore into proper size as per the buyer's specification is being done in the crusher and screen unit capacity installed within the lease area. The ROM ore of 0 – 300 mm size will be transported by dumpers to the mineral stack yard from where it is fed to screen plant by means of a hydraulic excavator. The oversized ore (+300 mm) is broken to smaller size by rock breakers. The detail material balance has been explained ing ch-6

(b) Summary of year-wise tentative Excavation in cum

I. Tentative Excavation

Year	Tentative Excavation of ROM + OB/SB/ IB (cum)	Top Soil (cum)	OB/SB/ IB (cum)	ROM (cum)		Total RoM cum	Waste/ ROM Ratio cum/cum
				Ore* +58% Fe	MR 45-58% Fe		
2017-18	177500	--	8875	133125	35500	168625	1:0.052
2018-19	520860	--	53650	368850	98360	467210	1:0.115
2019-20	557815	--	90605	368850	98360	467210	1:0.194
2020-21	594905	--	127695	368850	98360	467210	1:0.272
Total	**1851080**		**280825**	**1239675**	**330580**	**1570255**	

Note: Tentative tonnage of the ore may be arrived by computing approximate bulk density and recovery factor as these data are variable and may be established on time series. At present in this document, the tonnage factor and recovery factor has been considered as per exploration input from the drilled bore-hole data and time series data as below:

Ore Recovery Factor :

Saleable ore incidence	75% of total excavation (+58% Fe)
Mineral rejects generation	20% of total excavation (45-58% Fe)
Intercalated waste	05% of total excavation (-45% Fe)

Tonnage Factor : Saleable ore = 3.4 t/ cum
Mineral rejects = 2.5 t/ cum
Waste = 2.0 t/cum

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भुवनेश्वर / BHUBANESWAR

Thus, tentative tonnage proposed to be produced per year is arrived as below

In situ Tentative Excavation (MT)

Year	Tentative Excavation of ROM + OB/SB/ IB (MT)	Top Soil (MT)	OB/SB/ IB (MT)	ROM (MT)			ROM MT/ Waste MT Ratio
				Ore*	MR	Total ROM MT	
2017-18	559125	--	17750	452625	88750	541375	1:0.033
2018-19	1607290	--	107300	1254090	245900	1499990	1:0.071
2019-20	1681200	--	181210	1254090	245900	1499990	1:0.170
2020-21	1755380	--	255390	1254090	245900	1499990	1:0.109
Total	5602995		**561650**	**4214895**	**826450**	**5041345**	

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

Dump identification / No	Year-wise handling (cum)	Estimated recovery of salable material (cum)	Reject (cum)

No Proposal during the scheme period 2017-18 to 2020-21

(c) Individual year wise development plans and sections showing pit layouts, dumps, stacks of mineral reject, if any, etc. ('A' category mines).

Individual year wise development plans and sections showing pit layouts, dumps, stacks of mineral reject have been prepared in 1 : 1000 Scale.

(d) Brief description on salient features of the proposed method of working indicating category of mine

During ensuing scheme period, the existing pits have been selected for development. It has been planned to enhance the production capacity from 0.8MTPA to 1.5MT of ROM per Annum. Development of existing pit will be done by moving the existing benches laterally in the southern and eastern direction. During the year 2017-18 the bench height will be kept at 6m whereas from 2018-19 onwards the bench height has been proposed to be kept at 10m. The layout of roads for haulage of ore/ waste and access to different installation in the mine will be developed complying with the statutory regulations stipulated in the Metalliferrous Mines Regulations, 1961. Overburden will be sent to the dumping yard. Sites located in the lease area. Fifteen meter wide haul road will be developed in the lease area as per need at a gradient up to 1:16. The mine will be operated in a three shift basis. Process of excavation and loading of overburden/waste will be done by deploying hydraulic excavators and dumpers. Excavators of 0.9m^3 to 4.3m^3 capacities will be deployed for excavation & loading of ROM ore and dumpers of 10t to 30t capacity shall be deployed for transportation of ore and OB. Hard iron ore will be loosened through drilling & blasting. For the purpose, DTH drill of 105mm dia will be used during ensuing scheme period to achieve the targeted production. For maintenance of OB dumps, loader/ dozers will be deployed. Loading & un-loading of sorted & sized ore is loaded by mechanized method. In addition to existing transportation road it is proposed to transport the material in the proposed road passing in the north of pillar No - P which is ultimately connected to Jururi – Koira.

In this mines of MGM Minerals Limited open cast fully mechanized (category 'A') system of mining is

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In practice since long to mine the iron ore deposit adopting a system of bench formation with deep hole blasting keeping in mind the quality, cost, safety and conservation of mineral. No change in present method of mining has been envisaged during the proposed scheme period. Deployment of machinery for development and production from the quarry are calculated as below.

Details of Mine development

Mine Development in 2017-18

During this year lessee has already obtain a production of 0.259MT (till 10.09.2017). Hence, remaining 0.541 MT will be produced during the period (11.09.2017-31.03.2018). However, proposed planning will be adopted/implemented by the lessee w.e.f 13.12.2017. The details of the production/development during 2017-18 (11.09.2017-18) will be as follows:

Sl. no	Description	Quarry
1	Co-ordinate	2426630-2426920N/331650-331990E
2	Sections considered	DD',EE ' FF', GG',HH' and II'
3	RL of quarry floor at the end of the year	648 (existing 620)
4	Bench levels to be worked (m)	648,654,660,666,672 (m)
5	No benches to be worked	5 numbers
6	Height of bench	6 (m)
7	Width of the benches(m)	12 (m) or more than height
8	Average cross sectional area(m^2)	3810
9	Average thickness of excavation(m)	46
10	Average advancement of benches(m)	648-30M 654-30M 660-35M 666-35M 672-35M
11	Direction of advancement	Due East and south
12	Individual slope of the bench	75°- 80°
13	Overall slope of the quarry	About 20°-28°

Section and RL wise calculation for the mined development during 2017-18

Sections	RL (m)	Cross Section Area (Sq.m)	LOI (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe (Tons)	Volume of 45% to -58% Fe (Cu.m)	Quantity of 45% to -58% Fe (Tons)	Volume of Waste -45% Fe (Cu.m)	Quantity of Waste -45% Fe (Tons)	ROM (Tons)
		A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
D-D'	678	140	30	4200	3150	10710	840	2100	210	420	12810
	672	140	30	4200	3150	10710	840	2100	210	420	12810
	660	70	40	2800	2100	7140	560	1400	140	280	8540
E-E'	672	100	50	5000	3750	12750	1000	2500	250	500	15250
	666	170	50	8500	6375	21675	1700	4250	425	850	25925
	660	280	50	14000	10500	35700	2800	7000	700	1400	42700
F-F'	672	110	50	5500	4125	14025	1100	2750	275	550	16775
	666	170	50	8500	6375	21675	1700	4250	425	850	25925
	660	260	50	13000	9750	33150	2600	6500	650	1300	39650
	654	330	50	16500	12375	42075	3300	8250	825	1650	50325
G-G'	672	90	50	4500	3375	11475	900	2250	225	450	13725
	666	120	50	6000	4500	15300	1200	3000	300	600	18300
	660	210	50	10500	7875	26775	2100	5250	525	1050	32025
	654	290	40	9200	6900	23460	1840	4600	460	920	28060
	648	220	30	6600	4950	16830	1320	3300	330	660	20130
H-H'	672	80	50	4000	3000	10200	800	2000	200	400	12200

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	666	140	50	7000	5250	17650	1400	3500	350	700	21350
	660	180	50	9000	6750	22950	1800	4500	450	900	27450
	654	135	50	6750	5062.5	17212.5	1350	3375	337.5	675	20587.5
	648	115	50	5750	4312.5	14662.5	1150	2875	287.5	575	17537.5
I-I'	672	80	50	4000	3000	10200	800	2000	200	400	12200
	666	110	50	5500	4125	14025	1100	2750	275	550	16775
	660	100	50	5000	3750	12750	1000	2500	250	500	15250
	654	90	50	4500	3375	11475	900	2250	225	450	13725
	648	140	50	7000	5250	17850	1400	3500	350	700	21350
Total		3819		177500	133125	452625	35500	88750	8875	17750	541375
Total in Million Tones				0.18	0.13	0.45	0.04	0.09	0.01	0.02	0.54

Mine Development in 2018-19

It has been planned to enhance the production of ROM from 0.8MTPA to 1.5MTPA during this year. This level of production will be achieved once the EC is obtained. The details of development will be as follows:

Sl. No	Description	Quarry
1	Co-ordinate	2426000-2426990N/331640-331990E
2	Section considered for development	DD',EE',FF', GG',HH',II' and JJ'
3	RL of quarry floor at the end of the year	630(existing 620)
4	Bench levels to be worked (m)	640,650,660,666,670,680
5	No benches to be worked	6 numbers
6	Height of bench	10(m)
7	Width of the benches(m)	15(m)
8	Average cross sectional area(m^2)	9836
9	Average thickness of excavation (m)	50
10	Average advancement of benches (m)	630-60m 640,-50m 650,-40m 660,-20m 666,-20m 670,-20m 680-10m
11	Direction of advancement	Due East and south
12	Individual slope of the bench	75°-80°
13	Overall slope of the quarry	About 20°-28°

Section and RL wise calculation for the mined development during 2018-19

Sections	RL (m)	Cross Section Area (Sq.m)	Length of influence (m)	Volume (Cu.m)	Volume of +58% Fe (Cu.m)	Quantity of +58% Fe Ore (Tons)	Volume of 48% to 58% Fe (Cu.m)	Quantity of 48% to 58% Fe (Tons)	Volume of Waste +48% Fe (Cu.m)	Quantity of Waste +48% Fe (Tons)	ROM (Tons)
		A	B	C=(A x B)	D=C x 75%	E=D x 3.4	F=C x 20%	G=F x 2.5	H=C x 5%	I=H x 2	J=(E+G
D-D'	670	80	50	4000	3000	10200	800	2000	200	400	12200
	660	430	50	21500	16125	54825	4300	10750	1075	2150	65575
	650	760	50	38000	28500	96900	7600	19000	1900	3800	115900
	666	100	50	5000	3750	12750	1000	2500	250	500	15250
E-E'	680	110	50	5500	4125	14025	1100	2750	275	550	16775
	660	830	50	41500	31125	105825	8300	20750	2075	4150	126575
	670	60	50	3000	2250	7650	600	1500	150	300	9150
F-F'	680	30	50	1500	1125	3825	300	750	75	150	4575
	650	470	50	23500	17625	59925	4700	11750	1175	2350	71675
	670	180	50	9000	6750	22950	1800	4500	450	900	27450
	666	110	50	5500	4125	14025	1100	2750	275	550	16775
G-G'	680	360	50	18000	13500	45900	3600	9000	900	1800	54900
	660	520	50	26000	19500	66300	5200	13000	1300	2600	79300
	640	1140	50	57000	42750	145350	11400	28500	2850	5700	173850
H-H'	670	120	50	6000	4500	15300	1200	3000	300	600	18300
	666	20	50	1000	750	2550	200	500	50	100	3050
	680	80	50	4000	3000	10200	800	2000	200	400	12200
	650	340	50	17000	12750	43350	3400	8500	850	1700	51850
	640	660	50	33000	24750	84150	6600	16500	1650	3300	100650

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	630	620	50	41000	30250	10650	8200	20500	2050	4100	35075
	670	50	50	2500	1875	6375	800	1250	125	250	7625
E-E'	650	100	50	5000	3750	12750	1000	2500	250	500	15250
	640	850	50	31800	23825	80325	6300	15750	1575	3150	96075
	630	840	50	47000	35250	118850	9400	23500	2350	4700	143950
F-F'	640	210	50	10500	7875	26775	2100	5250	525	1050	32025
	630	486	50	24300	18225	61965	4860	12150	1215	2430	74115
Total		8836		491800	368850	1254060	98360	246900	24690	49180	1499990
Total in Million Tones				0.491	0.3689	1.254	0.983	0.246	0.024	0.491	1.4999

Side burden Generation during 2018-19

Section Considered	R.L	Cross Sectional area (m2)	Length of influence (m)	Volume (Cu.m)	Quantity (MT)
a	b	c	d	e=c x d	f= e x 2
Section F-F'	650 MRL	160	50	8000	16000
	640 MRL	420	50	21000	42000
Total				29000	58000

Mine Development In 2019-20

It has been planned to continue the enhanced production of 1.5MTPA in this year. The details of development will be as follows:

Sl. no	Description	Quarry
1	Co-ordinate	2426000-2427050N/331640-331960E
2	Sections considered	DD',EE ' FF', GG',HH',II' and JJ'
3	RL of quarry floor at the end of the year	620(existing 620)
4	Bench levels to be worked (m)	620,630,640,650,670,680,690(m)
5	No benches to be worked	7 numbers
6	Height of bench	10(m)
7	Width of the benches(m)	15 (m)
8	Average cross sectional area (m^2)	9836
9	Average thickness of excavation (m)	50
10	Average advancement of benches (m)	620-90m 630-80m 640-20m 650-20m 660-20m 670-20m 680-35m 690-20m
11	Direction of advancement	Due East and south
12	Individual slope of the bench	75°-80°
13	Overall slope of the quarry	About 20°-25°

Section and RL wise calculation for the mined development during 2019-20

Section	RL (m)	Cross Section Area (Sq.m)	LOI (m)	Volume (Cu.m)	Volume of +65% Fe (Cu.m)	Quantity of +65% Fe (Tons)	Volume of 45% to -65% Fe (Cu.m)	Quantity of 45% to -65% Fe (Tons)	Volume of Waste -45% Fe (Cu.m)	Quantity of Waste - 45% Fe (Tons)	ROM (Tons)
		A	B	C=(AxB)	D=Cx75%	E=Dx3.4	F=Cx20%	G=Fx2.5	H=Cx5%	I=Hx2	J=E+G
D-D'	670	82	50	4100	3075	10455	820	2050	205	410	12505
	660	140	50	7000	5250	17850	1400	3500	350	700	21350
	650	210	50	10500	7875	26775	2100	5250	525	1050	32025
	690	380	50	19000	14250	48450	3800	9500	950	1900	57950
	680	400	50	20000	15000	51000	4000	10000	1000	2000	61000
E-E'	670	170	50	8500	6375	21675	1700	4250	425	850	25925
	660	120	50	6000	4500	15300	1200	3000	300	600	18300
	650	210	50	10500	7875	26775	2100	5250	525	1050	32025
	690	70	50	3500	2625	8925	700	1750	175	350	10675
	680	180	50	9000	6750	22950	1800	4500	450	900	27450
F-F'	670	230	50	11500	8625	29325	2300	5750	575	1150	35075
	660	100	50	5000	3750	12750	1000	2500	250	500	15250

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	650	60	50	3000	2250	7650	600	1500	150	300	3750
	640	50	50	2500	1875	6375	500	1250	125	250	3125
	690	250	50	12500	9375	31875	2500	6250	625	1250	15625
	680	530	50	26500	19875	67575	5300	13250	1325	2650	33125
	670	160	50	8000	6000	20400	1600	4000	400	800	10000
G-G'	660	110	50	5500	4125	14025	1100	2750	275	550	13775
	650	170	50	8500	6375	21675	1700	4250	425	850	26625
	640	170	50	8500	6375	21675	1700	4250	425	850	25625
	630	810	50	40500	30375	103275	8100	20250	2025	4050	123525
	690	180	50	9000	6750	22950	1800	4500	450	900	27450
	680	530	50	26500	19875	67575	5300	13250	1325	2650	80825
	670	250	50	12500	9375	31875	2500	6250	625	1250	38125
H-H'	660	120	50	6000	4500	15300	1200	3000	300	600	18300
	650	170	50	8500	6375	21675	1700	4250	425	850	25925
	640	170	50	8500	6375	21675	1700	4250	425	850	25925
	630	650	50	32500	24375	82875	6500	16250	1625	3250	99125
	620	1080	50	54000	40500	137700	10800	27000	2700	5400	164700
I-I'	620	1040	50	52000	39000	132600	10400	26000	2600	5200	158600
J-J'	620	950	50	47500	35625	121125	9500	23750	2375	4750	144875
K-K'	620	94	50	4700	3525	11985	940	2350	235	470	14335
Total		9836		491800	368850	1254090	98360	245900	24590	49180	1499980
Total in Million Tones				0.491	0.368	1.254	0.098	0.245	0.024	0.491	1.4999

Side burden Generation during 2019-20

Section Considered	R.L	Cross Sectional area (m2)	Length of influence (m)	Volume (Cu.m)	Quantity (MT)
a	b	c	d	e=c x d	f= e x 2
Section F-F'	650 MRL	100	50	5000	10000
	640 MRL	80	50	4000	8000
Section G-G'	630 MRL	300	50	15000	30000
	620 MRL	580	50	29000	58000
Section H-H'	620 MRL	260	50	13000	26000
Total				66000	132000

Mine Development in 2020-21

It has been planned to continue the enhanced production of 1.5MTPA in this year. The details of development will be as follows:

Sl. no	Description	Quarry
1	Co-ordinate	2426020-2429010N/331630-332000E
2	Sections considered	DD',EE ' FF', GG',HH',II',JJ' and KK'
3	RL of quarry floor at the end of the year	620(existing 620)
4	Bench levels to be worked (m)	620,630,640,650,670 (m)
5	No benches to be worked	5 numbers
6	Height of bench	10(m)
7	Width of the benches(m)	15 (m)
8	Average cross sectional area (m^2)	9836
9	Average thickness of excavation (m)	47
10	Average advancement of benches (m)	620-30m 630,-30m 640-20m 650,-70m 560-60m 670-40m
11	Direction of advancement	Due East and south
12	Individual slope of the bench	75°-80°
13	Overall slope of the quarry	About 20°-25°

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Section and RL wise calculation for the mined development during 2020-21

Sections	RL (m)	Cross Section Area (Sqm) A	Length of Influence (m) B	Volume (Cu.m) C=(A+B)	Volume of +58% Fe Ore (Cu.m) D=Cx75%	Quantity of +58% Fe Ore (Tons) E=Dx3.4	Volume of 45% to -58% Fe Ore (Cu.m) F=Cx20%	Quantity of 45% to -58% Fe Ore (Tons) G=Fx2.5	Volume of Waste -45% Fe (Cu.m) H=Cx5%	Quantity of Wse to -45% Fe (Tons) I=Hx2	ROM (Tons) J=E+G
D-D'	670	80	40	1600	1200	4080	320	800	80	160	4880
	660	240	40	9600	7200	24480	1920	4800	480	960	29280
	650	330	50	16500	12375	42075	3300	8250	825	1650	50325
	640	560	50	28000	21000	71400	5600	14000	1400	2800	85400
E-E'	670	160	40	6400	4800	16320	1280	3200	320	640	19520
	660	370	40	14800	11100	37740	2960	7400	740	1480	45140
	650	670	50	33500	25125	85425	6700	16750	1675	3350	102175
	640	880	50	44000	33000	112200	8800	22000	2200	4400	134200
F-F'	670	320	50	16000	12000	40800	3200	8000	800	1600	48800
	660	800	50	30000	22500	76500	6000	15000	1500	3000	91500
	650	110	50	5500	4125	14025	1100	2750	275	550	16775
G-G'	670	360	50	18000	13500	45900	3600	9000	900	1800	54900
	660	290	50	14500	10875	36975	2900	7250	725	1450	44225
	650	110	50	5500	4125	14025	1100	2750	275	550	16775
H-H'	670	270	50	13500	10125	34425	2700	6750	675	1350	41175
	660	540	50	27000	20250	68850	5400	13500	1350	2700	82350
	650	570	50	28500	21375	72675	5700	14250	1425	2850	86925
	640	250	50	12500	9375	31875	2500	6250	625	1250	38125
	630	220	50	11000	8250	28050	2200	5500	550	1100	33550
Section I-I'	670	140	50	7000	5250	17850	1400	3500	350	700	21350
	660	320	50	16000	12000	40800	3200	8000	800	1600	48800
	650	510	50	25500	19125	65025	5100	12750	1275	2550	77775
	640	590	50	29500	22125	75225	5900	14750	1475	2950	89975
	630	590	50	29500	22125	75225	5900	14750	1475	2950	89975
J-J'	650	220	50	11000	8250	28050	2200	5500	550	1100	33550
	640	370	50	18500	13875	47175	3700	9250	925	1850	56425
	630	366	50	18400	13800	46920	3680	9200	920	1840	56120
Total		8636		431800	323850	1100820	86360	215900	21580	43160	1316720
Total in Million Tones				0.431	0.323	1.100	0.086	0.215	0.021	0.043	1.316

Side burden Generation during 2020-21

Section Considered	R.L	Cross Sectional area (m2)	Length of Influence (m)	Volume (Cu.m)	Quantity (MT)
a	b	c	d	e=c x d	f= e x 2
F-F'	660 MRL	410	50	20500	41000
G-G'	660 MRL	300	50	15000	30000
	650 MRL	530	50	26500	53000
I-I'	670 MRL	330	50	16500	33000
	660 MRL	290	50	14500	29000
	650 MRL	150	50	7500	15000
	630 MRL	50	50	2500	5000
Total				103000	206000

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.

Lay out of mine working

Development of existing pit will be done by moving the existing benches laterally in the southern and eastern side. At the end of plan period the dimension of the proposed quarries will be as follows

Name of the quarry	Dimension(m x m)	Top RL	Bottom RL
Proposed quarry	350m x 320m	704	620

PIT ROAD LAYOUT

The existing benches of the proposed quarry will be utilized for haul road. The bench width has been kept at 16 m. However, the after putting the berms of 1.5m width and 1.0m height of the haul road will be kept at 13 m with gradient of 1:16. In case of ramp the gradient will be maintained at 1:12.

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LAYOUT OF FACES

Name of the quarry	Description	2017-18	2018-19	2019-20	2020-21
Proposed quarry	Face RL	648 to 672	630 to 680	620 to 690	620 to 690
	Length of face	520m	560m	580m	650m
	Direction of advancement	Due East and south	Due East and south	Due East and south	Due East and south
	Length of Advancement	65m	90m	130	150

Site for disposal of waste along with ground preparation

It has been planned to dispose of the waste over the existing dump. The dump No - 3 existing in the northern part has been selected for the disposal of waste. A retaining wall already exists all along the dump. However, the length will be increased and existing retaining wall will be maintained every year. The dumping will be carried out in a re-treating fashion.

Site for disposal of mineral rejects along with ground preparation

Part of the mineral rejects will be blended with high grade iron ore and despatched as per consumers requirement. The remaining Mineral rejects will be stored temporarily in the south eastern part of the proposed dump. About 0.50 ha has been kept for the purpose.

(ii) Extent of mechanization

(ii.1) Dozing

Presently, Back hoe cum Loader & excavator is utilized in the mines for construction, leveling and compaction of haul road and waste dump. The same shall be continued in the scheme period.

(ii.2) Drilling

Drilling of the blast holes is proposed to be done by Pneumatic DTH drill of 105mm dia holes in the in situ iron zone. Height of the bench is proposed to be kept at 6m. The specifications of the DTH drill with compressor are as follows:

Deep drilling parameters

Diameter of blast hole drill	:	105 mm
Height of the bench	:	10 m
Additional drilling required (sub grade) (A)	:	1 0 m
Length of the hole (H + A)	:	11 m
Burden (B)	:	3.0 m
Spacing (S)	:	3.5 m
Volume of earth to be broken/loosen per hole	:	B x S x H = 3.5 x 3.0 x 11 = 115.5 or 115 cum
Meterage of drilling per drill for primary blasting in ore zone		
Maximum volume of material in in situ zone including overburden year (2019-20)	:	594905 cum
Volume to be loosened through drilling & blasting (80% of the total excavation)	:	475924cum

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Number of holes to be drilled in a year (maximum)	:	47 5924 ÷ 115 = 4138 (approx.)
Number of holes to be drilled per day of 300 working days in a year	:	4138 ÷ 300 = 13.79 or say 14 numbers
Total meterage of drilling per day (length of blast hole = 11 m)	:	14 x 11 = 154 m per day
Requirement of drills		
Speed of the DTH drill	:	20 m / hr
Effective drilling hrs/one shift (8hrs shift of which effective working hrs = 6.5 hrs / shift)	:	6.5 hrs
Meterage of drilling to be effected / day	:	10 x 6.5 = 65m
Number of drills required	:	154 ÷ 65= 2.369 or say 2 number

(ii.3) Blasting

As the nature of the ore is hard, about 70% of the total excavation will be obtained through blasting within iron ore zone. The proposed mining will have 10.0m height benches in iron ore zone. Drilling will be done for blast hole by 105mm dia DTH in iron ore zone fed by compressed air. The parameters with blasting details are furnished below:

Parameters		Drilling/ Blasting details
Diameter of Holes	:	105 mm
Burden	:	3.5 m
Spacing	:	3.5 m
Depth of Hole including sub grade drilling	:	11 m
Main explosive	:	Power gel, detonator, safety fuse, Nitrate mixture
Dia. of cartridge	:	80-83 mm Nobel gel, Ammonium nitrate
Powder factor	:	6t/ Kg
Maximum production capacity	:	1761785T
Blasting @ 70% of total excavation	:	1233249T
Annual consumption of explosive	:	1233249/6 = 205541kg or 205.541T
Type of blasting	:	Primary
Blasting Pattern		Staggered pattern
Loading of explosive		Manually

Staggered pattern of drilling and row to row sequence with the help of ordinary delay detonators will be adopted for the blasting purpose. During blasting of multi-rows or more numbers of holes in a single row, provision of delay detonator and NONEL/RAYDET shall be utilized in order to control ground vibration.

(ii.4) Secondary blasting

Secondary blasting is not proposed. The big size boulders will be fragmented with the help of rock breaker

(ii.5) Type of explosive and detonator to be used

Nitrate mixture such as Power gel explosive will be used for blasting. Electric detonator and Nonel system will be used for initiation / ignition. The use of Nonel system of initiation will have the following advantages :

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- ✓ High blasting efficiency
- ✓ Minimize ground vibration
- ✓ Control fly rocks
- ✓ Better fragmentation
- ✓ Safe to handle

(ii.6) Storage and transportation of explosives

To maintain safety as well as to prevent pilferage & theft, a licensed magazine has been made available for storage of under mentioned kinds and quantities of explosives. The licensed capacity of magazine is as below.

Commercial Name	Class	Division	Quantity
Nitrate Mixtures	Class-II	-	980 Kg
Safety	Class-VI	Division-1	20000m
Detonating Fuse/Nonel	Class-VI	Division-2	1500m
Electronic Detonator	Class-VI	Division-3	10000nos.
Ordinary Detonator	Class-VI	Division-3	10000nos.

The magazine has been proposed to be dismantled from 2018-19 onwards and the blasting shall be carried out from outside agencies by agreement under Rule 22.

(ii.7) Excavations and Loading

ROM ore and waste will be excavated by 4.3 cum capacity excavators. The detailed calculations are as follows:

Specification of excavators		
Bucket capacity (C1)	:	4.3 cum
Bucket fill factor (F)	:	0.7
Time cycle pass at 90^{O} swing (T1)	:	35 sec
Swell factor (S)	:	0.7
Production efficiency factor (e)	:	0.7
Job management factor (f)	:	0.9
Time scheduling		
Working days per year (D)	:	300 days
Number of working shifts per day	:	3 shift
Working hours per shift	:	8 hrs
Effective working hours per shift (E)	:	6.5 hrs
Seconds in hour (s)	:	3600 sec

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Output/4.3 cum shovel/annum	:	[C1 x F x S x e x f x s x E x D] x [4.3 x 0.7 x 0.7 x 0.7 x 0.9 x 3600 x 6.5 x 300] ÷ 30 = 310613 cum
Number of excavators required		
Maximum excavation in in situ zones & OB	:	594905 cum
Total excavation by one 4.3 cum capacity shovel per annum	:	310613 cum
To excavate 596900 cum requirement of excavator	:	594905 ÷ 310613 = 1.915 or say 2
Excavator required as stand by	:	1 numbers of 4.3 cum capacity
Total requirement of excavator 4.3 cum capacity	:	3 number

The lessee is already having 3 no. of 2.1 cum excavator and 3 no. of 1.5 cum excavator. In addition to that, 3 nos of excavator of 4.3 cum capacity are required for excavation of ore and OB during scheme period.

Requirement of loader

Loading will be done by mechanized method. The depatchable ore, sub grade and waste material will be loaded by the loader to the dumper. The bucket capacity of the loader will be 2.5Cu.m. The detail calculation of loader will be as follows:

C	=	Nominal Bucket Capacity	=	2.5m^3
F	=	Bucket fill factor	=	0.8
S	=	Swell factor (at 25% swell)	=	0.85
t	=	Time cycle per pass	=	90sec
e	=	Overall efficiency for three working shift	=	0.80
T	=	Seconds per hour	=	3600
n	=	Number of working shifts/day	=	3
h	=	Hours per shift	=	8
W	=	Working days in a year	=	300
A	=	Availability of machine	=	0.85
U	=	Utilization Factor (%)	=	0.80
B.D	=	Bulk Density (MT/cum)	=	3.28

Rate of Production

Output/loader/hour = (C x F x S x T)/(t)
= 2.5 x 0.8 x 0.85 x 3600/90 = 68m^3 or 231.2 Tone say 223 T

Output/loader/year = 223 x h x n x w x e x A x U x B.D
= 223 x 8 x 3 x 300 x 0.85 x 0.80 x 3.28

= 3581130TPA

Number of Loaders

Item	Quantity
Volume required to be handled per annum	= 594905m^3
Rate of production per Annum (2.5cum)	= 3581130 m^3
Number of loader required (2.5cum)	=594905/3581130=0.166 say 1
Keeping one stand by Number of loader required (2.5 cum)	= 1+1(Stand by)=2 nos

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Loading Machine Details

Type	Nos	Size/Capacity	Make
ZL 50	2	2.5 Cu.m bucket	Volvo

For loading, the lessee is having 2 front end loaders of 1.7 cum capacity which will be utilized during mining operation when necessary. In addition to that 2 numbers of 2.5 cum capacity loader will be required for loading during plan period.

(II.8) Haulage & Transport equipment for ore & waste

ROM ore will be transported to the screening and crusher site for sizing and sorting while the waste materials will be transported to the earmarked dumping ground. For the purpose of transportation 10-30t dumper will be utilized during scheme period. However, for calculation purpose higher capacity 30t dumper has been taken into consideration. Average distance/ lead for the quarry to ore stack yard/ screening unit is assumed to be 1 Km. Accordingly calculation for tipper/dumper requirement is furnished.

Requirement of Tipper		
Capacity of the tipper	=	30 tons
Rate of production of 4.3 cum excavator per day	=	310613 cum ÷ 300 = 1035cum or say 3519 tons.
Number of passes required for one tipper attached to 2.1 cum excavator	=	Tipper capacity ÷ C1 x F x S x Average Tonnage factor = 30 ÷ (4.3 x 0.7 x 0 7 x 3.28) = 4.34 or 5 passes
Loading time	=	5 passes x 35 (T1) = 175 seconds or say 2.91 min or 3min.
Hauling time for crusher plant	=	Average hauls road length to be covered by the loaded tipper (1 km) ÷ Average speed of the volvo (30 km per hr.) (Loaded) = 6 min
Dumping time & Return time (empty)	=	3 min + 3 min @15 km per hr.= 6 min
Spotting & waiting time	=	4 min
Tipper cycle time (ore to crusher site) = Loading time, hauling time, unloading time, return time, spotting time and waiting time	=	3.0 + 6 + 6 + 4 = 19.0 min.
Working time per tipper per day	=	6.5 hrs.
Number of trips per tipper per day	=	(6.5 x 60) ÷ 19.0 = 21 trips
Tonnage per day per tipper	=	21 x 30 = 630 tons
Tipper requirement (for 4.3 cum excavator)	=	3519 ÷ 630 = 5.58 numbers say 6 numbers
1 (one) 4.3 cum excavators shall require	=	6 volvo
Total volvo requirement for 2 excavator	=	12 number + 2 stand by

The lessee already possesses 5 numbers of 10 ton capacity and 3 numbers of 7.5 ton capacity tippers which will serve the purpose of transportation. In addition to that 14 nos of volvo having 30 t capacity are required for the transportation.

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(ii.9) List of existing machinery/ Equipment vis-à-vis requirement

Unit operation	Machinery	Capacity	No. of units	
			Required	Existing
Excavation	DTH Drill	105mm	2	1
	Excavator	1.5 cum	--	1
	Excavator	2.1 cum	--	3
	Excavator	4.3 cum	3	--
Loading	Front end loader	1.7 cum	0	1
	Front end loader	1.5 cum	0	1
	Front end loader	2.5 cum	2	--
	Back hoe cum Loader	0 3 x 1 2 cum	0	1
Transporting	Tipper	10T (6.0 cum)	--	6
	Volvo	30t (16cum)	12	--
Mineral Sizing & Screening Plant	Crushing	350TPH	--	1
	screening	350TPH		1
	Screening	250 TPH	--	1
	Screening unit	100 TPH	1	--
Rock Drill compressor	Combined	5 cum	1	3
			1	2
	Water tanker	10t	--	1
	DG Set		--	1
Rock breaker		200 lbs	3	--

(f) Conceptual Mine planning up to 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.

- **LIFE OF THE MINE**

Total mineable reserve of iron ore under all the categories (Proved & Probable) within the area has been reworked and it is estimated that 11110134.00 MT of ROM available as on date as per present exploration data. The total production from mines during the present scheme period will be 6057809 MT. Hence reserve available for conceptual period will be 6057809 MT. The details of calculation of life of the mines are as follows:

- ✓ Total reserves under proved & probable category - 11110134 MT
- ✓ Production during balance 4 years of scheme period - 5052325 MT
- ✓ Balance reserves for conceptual period - 6057809 MT
- ✓ Production per annum - 1500000MT
- ✓ No of years production will be carried out during Conceptual period - 6057809/1500000=4.03 Years say 4 years
- ✓ Life of mine - 8 years

(4 years of scheme period + 4 years of conceptual period)

However, the life of the mines may not hold constant for all the time. By making assessment of reserves by further exploration, pit data and market demands on regular basis the life of the deposit may increase or decrease, accordingly the life of mine may vary from time to time.

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- **TIME FRAMES FOR COMPLETION OF EXPLORATION WITHIN THE LEASE HOLD AREA**

The scheme period is going to be expired on 31.03.2021. During scheme period it has been envisaged to do 24nos of bore holes. The total area will be explored under G1 category during the year 2018-19. The locations of bore holes are shown in Geological plan.

- **ULTIMATE EXTENT & SIZE OF THE PIT**

Ultimate pit design/Lay out:

Patabeda iron ore mine exposes iron ore, BHJ, Shale etc. Keeping in view the ore occurrences, safety zone, ultimate pit limit has been delineated. There will be one quarry at the end of the life of the mine. As per the present exploration status, an area of 17.556 hectares will be utilized for mining of iron ore. Maximum 14nos of benches will be formed during life of the mine. (Ref conceptual plan and section).The details of benches are with their R.L, extent and area to be covered are given below:

Name of the quarry	Extent of the quarry					Number of Benches in ore	Number of Benches in OB
	Length(m)	Width (m)	Area (m2)	Top RL	Bottom RL		
Conceptual quarry	462	380	175560	710	570	14	Nil

Final slope angle at the close of mine:

The individual bench slope would be kept nearly vertical, height and width of the benches would be kept at 10m each. The final slope angle of the pit will be 45^0 at the end of the life of the mine.

Ultimate Pit Limit Boundaries

The ultimate pit limit boundaries have been earmarked in the conceptual plan and conceptual sections.

- **ULTIMATE CAPACITY OF DUMP**

Top soil generation: Top soil generation observed to be nil. Hence, there is no proposal of stacking of top soil during plan period as well as conceptual period.

Dump proposed during scheme period

Quantity of yearly generation of waste and proposals for disposal of waste:

Two types of ore zone have been earmarked in the geological plan. One is in situ iron ore zone where inter burden percentage is about 5% other is float ore zone where the waste percentage is about 40%. During, ensuing plan period, only in situ ore zone has been proposed to be developed. Further, there will be handling of side burden (mainly shale, laterite& BHJ) during ensuing scheme period. The pit wise waste generation will be as follows:

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Generation of waste from pit and its utilisation

Year	Quantity of IB/ Waste (MT)	Side Burden & Over Burden (MT)	Total waste in MT	Total waste in cum	Road maintenance @30%	Waste to be dumped @70%
2017-18	21460	0	21460	10730	3219	7511
2018-19	49180	58000	107180	53590	16077	37513
2019-20	49180	132000	181180	90590	27177	63413
2020-21	49180	206000.00	255180	127590	38277	89313
Total	**169000**	**396000.00**	**565000**	**282500**	**84750**	**197750**

Selection of dumping site mostly depends upon the factors like topography, drainage, land use, mineral inventory, pit configuration; mine waste characteristics, its volume of generation and economy in transportation etc. Total generation of waste during ensuing plan period is 282500cum. Out of which 30% i.e. 84750cum will be utilized for road maintenance (both public and internal haul road). For public road maintenance, permission from DDM will be obtained. Remaining 70% i.e. 197750 cum will be dumped at earmarked site.

Method and Manner of disposal of waste:

During ensuing plan period, dump-3 will be extended towards NE direction over an area of 0.93Ha. During dumping near dump-3, care shall be taken to ensure that the waste is leveled, compacted and terraced. There will be three terraces in the proposed dump. The height of the dump will be average 18m. The top RL of the dump will be 635m.

Configuration and sequence of year wise buildup of dumps

Year	Total waste in cum	Road maintenance @ 30%	Waste to be dumped (cum)	Area of dumping (m2)	Average height (m)	Top RL (m)	Bottom RL (m)
2017-18	10730	3219	7511	2489	10	617	607
2018-19	53590	16077	37513	4146	10	627	617
2019-20	90590	27177	63413	2950	10	627	617
2020-21	127590	38277	89313	3748	7	635	628
Total	**282500**	**84750**	**197750**				

Dumping during conceptual period

Waste will be generated from in situ and float ore zone. As part of the waste dump-2 is coming within the Ultimate pit limit, this area will be re-handled during conceptual period. The re-handling of dump will be as follows:

Area of dump to be re-handled	Average thickness of dump (m)	Volume of waste to be re-handled (m3)
2000	10	20000

Waste to be generated from in-situ and float ore zone

About 687154m^3 of waste and 398796 cum of mineral rejects will be generated during conceptual period. The details of generation of waste during conceptual period will be as follows:

i)	Total volume of in situ ore zone	=	3526000cum
ii)	Excavation proposed in in situ zone	=	1608920cum
iii)	Balance volume of ore zone	=	1917080 cum
iv)	Waste within the in situ ore zone @ 5%	=	95854 cum

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v)	Total volume of float ore zone	=	15380 0cum
vi)	Excavation proposed in the float ore zone	=	Nil
vii)	Remaining mineable reserve within float ore zone	=	153800 cum
viii)	Waste generation @ 50%	=	153800 x 0.5 = 76900cum
ix)	Side burden	=	494400 cum
x)	Dump re-handling during conceptual period	=	20000cum
xi)	**Total waste conceptual waste (cum)**	=	95854 + 76900 + 494400 +20000
		=	**687154**
xii)	Mineral reject in in situ zone	=	1917080 x 0.20 = 383416 cum
xiii)	Mineral rejects in float ore zone	=	153800 x 0.1 = 15380 cum
xiv)	**Total Mineral rejects**	=	383416 + 15380 = 398796

Configuration of ultimate Dump:

Total waste generation during life of the mine is 687154m^3. Out of the total conceptual waste, about 30% i.e. 206146cum will be utilized for road maintenance and balance 481008 cum will be utilized for back-filling in the mined out land. The details of back-filling will be as follows:

Period of back-filling	Location	Area of back filling (m2)	Average height (m)	Volume of waste (m3)	Top RL(m) up to which back filling will be done
Conceptual period	Back-filled area-1	14000	31	434000	580 -610
	Back-filled area-2	9401	5	47008	635-640

Conceptual generation of mineral reject and its utilization:

Total generation of mineral rejects during life of the mine is 398796cum. During plan period 338720cum will be generated. Balance mineral rejects available for conceptual period is 60076 cum. The mineral rejects generated will be stored for a short period. These mineral rejects will be sold to the market by blending with high grade iron ore. However, temporary mineral rejects stack yard has been proposed during planned as well as beyond planned period.

Protective Measures for conceptual dump

The waste generated from the mines shall be dumped in the non-mineralized area earmarked in the plan. As the conceptual waste will be utilized for back-filling of exhausted mined out land, only plantation will be done as a protective measures. It has been planned to make plantation of 3744 Nos of saplings over the back-filled area. Further, the waste dump of planned period will be stabilized by way of plantation and proper precautionary measures will be adopted for the waste dump. The precautionary and protective measures to be adopted during waste disposal are as follows.

- The ultimate dump slope shall be maintained at 20 - 27° with individual terrace slopes not exceeding 37°.
- Each terrace will have inward slope with catch drain at the inward slope of terrace.
- Catch drain of the individual terrace shall be connected to the garland drain outside the periphery of dump. Catch drain preferably to be made up of the half concrete open pipes followed by setting

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tanks to avoid wash offs and have provision of berms at the outer side to reduce gully formation due to rain water wash offs.

- Toe wall, garland drain and settling tank will be strengthened around the dump.

LAND DEGRADATION / UTILIZATION

The detail land use pattern during plan and conceptual period are as follows:

Sl. No	Pattern of Utilization	Existing	Plan Period 4 years	At the end of plan period	At the end of conceptual period
1	Mining	12.340	1.300	13.640	17.600
2	Dumping of overburden	3.701	0.930	4.631	4.631
3	Mineral rejects stack /mineral storage	1.150	1.366	2.516*	00
4	Storing of top soil	00	00	00	00
5	Infrastructure facilities (workshop/ Site services)	1.800	0.494**	2.294**	00
6	Township/housing colony	00	00	0	00
7	Crusher/ screening plant	0.500	0.400	0.900	00
8	Construction of road	1.658	0.100	1.758	1.158
9	Magazine	0.247**	(-0.247)	0.00	00
10	Others (retaining wall, garland drain, settling pond etc.)	0.164	00	0.164	0.164
11	Safety zone and plantation area	2.494	0.00	2.494	4.844
	Sub-total	**24.054**	**4.343**	**28.397**	**28.397**
12	Unused area	4.343		0	0
	Total	**28.397**		**28.397**	**28.397**

Note:

* Out of Mineral storage area of 2.516Ha, about 0.90Ha will be converted to plantation during conceptual period.

**During plan period magazine will pull - apart and will be included in infrastructure. Out of 2.294ha infrastructure area, 1.450ha will be converted into plantation during conceptual period.

AFFORESTATION

A total of 2.943 Ha area has already been covered under plantation in safety zone, dump area etc within the lease area. Further, during ensuing plan period it has been planned to make gap filling plantation within safety zone area over 0.25Ha and 0.35Ha over the dump in the Northern side of the lease area. Hence, during plan period, a total of 0.60Ha will be covered under plantation.

Year wise Afforestation during Scheme period

YEAR	AREA OF PLANTATION (Ha)	NO OF SAPLINGS	LOCATION	NAME OF THE SPECIES
2017-18	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sesom Shrubs
	0.0875	140	South dump-2	Grass type along the slope and other available local species
Sub-total	**0.15**	**240**		

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2018-19	0.0625 0.0875	100 140	Safety zone Proposed dump	Neem, Mango, Chakunda, Sissom Shrubs Grass type along the slope and other available local species
	0.15	240		Neem, Mango, Chakunda, Sissom Shrubs
2019-20	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
Sub-total	0.15	240		
2020-21	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs etc.
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
	0.15	240		
TOTAL	0.60	960		

Further, during conceptual period, it has been envisaged that 30000nos of saplings will be planted over an area of 20.92Ha within mined out land, safety zone area, dump area and infrastructure etc. Cumulatively, at the end of the life of the mine total plantation area will be 2.943-(existing) + 0.60 (plan period) + 20.92 (conceptual period) = 24.463 hectares.

RECLAMATION / REHABILITATION

Existing

None of the mined out land has been exhausted within the lease. Therefore, reclamation of mined out land has not undertaken till date.

During Scheme period

During plan period none of the area is going to be exhausted. Hence, reclamation is not possible at any part of the quarry during plan period.

During conceptual period

At the end of conceptual period, an area of 23.938Ha will be utilized for mining and allied activities. Out of which, 17.60Ha will be utilized under mining and balance 6.338Ha will be utilized under other allied activities. Reclamation of mined out land will be done both by bench plantation and back filling plantation after the exhaust of iron ore at the end of conceptual period. The other areas like dump, mineral storage, infrastructure etc. will be reclaimed by means of plantation.

Bench plantation:

As mining operation will be carried out over the hilly terrain, most of the area will be reclaimed by means of bench plantation. About 15.30 Ha will be covered under bench plantation. At the end of conceptual period 24480 nos of saplings will be planted as a part of the reclamation programme. Details of bench plantation at the end of conceptual period will be as follows:

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Method of plantation	RL of the benches	Total numbers of benches	Area to be covered	Numbers of saplings to be planted
Bench plantation	590-710	12	15.30	24480

Back filling plantation:

There is no proposal of back filling during plan period. However, reclamation by means of back filling and plantation will be undertaken after conceptual period. An area of 2300m^2 or 2.30Ha has been proposed to be utilized back filling and plantation. However, it has been proposed to drill 14 nos of borehole within the lease hold area. Based on the exploration results the reclamation by back filling will be started. The details of reclamation will be as follows:

Period of back-filling	Location	Area of back filling (m2)	Average height (m)	Volume of waste (m3)	Top RL(m) up to which back filling will be done
Scheme period			NIL		
Conceptual period	Back-filled area-1	14000	30	420000	580 -610
	Back-filled area-2	9000	5.22	47008	635-640

Dump plantation:

The dump will be stabilized by means of plantation. As shown in the conceptual plan after proper terracing, the dump over an area of 4.63 Ha will be reclaimed by means of plantation. Plantation over the dump will be started from 2018-19 onwards.

Other areas

Other areas like mineral storage, infrastructure, road etc over 3.672 Ha will be reclaimed by means of plantation.

POST MINING LAND USE PATTERN

Life of the mine is calculated as 8 years (up to 2024-25) based on the existing reserve and production capacity. A part of the mined out area over 15.30 hectares will be reclaimed by way of plantation (because of hilly area) and 2.30 Ha hectares will be reclaimed by means of back-filling and plantation. However, the post mining land use will be as follows:

Sl. No.	Name of Mining features	Name of Post Mining Land Use	Area (ha)
1	Quarry	Reclamation (back filling & Plantation)	2.300
2	Quarry	Rehabilitation (Plantation)	15.300
3	Waste Dump	Dump Plantation	4.631
4	Infrastructure	Plantation	1.450
5	Mineral storage	Plantation	0.900
	Top soil stack yard	Plantation	00
8	Construction of road	Plantation	1.158
9	Others (Retaining wall, garland drain, settling pond etc.)		0.164
10	Unused and safety zone area	Plantation	2.494
---	Total	---	28.397

(B) Underground Mines

Not Applicable

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CHAPTER-III

3.0 MINE DRAINAGE

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

The general ground is at 580 m RL and lies towards west of the lease area. Study of nearby wells and water bodies reveals that during peak period of monsoon and summer the water level generally fluctuates. The water level remains at 574 m. RL in post monsoon and during peak monsoon comes up to about 578 m. RL. During peak summer it goes down to 570 m. RL.

3.2Maximum and minimum depth of working

At present the depth of the mining pit has attained 612 m. RL (maximum) top being at 705 m. RL in average. By end of the plan period it is proposed that the deepest level of the quarry will remain at 612 m. RL.

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

(i) The primary sources of water infiltration into the mining pit are direct rainfall and groundwater seepage. Since lowest level of working is at much higher level than the general ground water level, there is no scope for seepage of water. It is essential that the mining operation be properly dewatered to minimize the impact on the operation.

(ii) Dewatering in the Mine Area

By the open cast mining process, it was observed that during the rainy seasons and for the next few months in the post monsoon season, very negligible amount of shower is entering to the mine pit. This amount is however, hardly perceptible, even on a local scale. In the pre monsoon season there was no visible or perceptible seepage at all.

(iii) Regional and local drainage pattern indicating annual rain fall, catchments area, and likely quantity of rain water to flow through the lease area, arrangement for arresting solid wash off etc.

(a) Drainage Pattern of the area

Kakarpani is the nearest stream of the vicinity and is situated at a distance of about 1.5 km west of the lease area. This water course meets with Suna Nadi / Kundru Nala at a distance of about 3 km from the lease area to the northwest. Another perennial Nala is Baitarani River which is at a distance of 6.5 km east of the area. Since mine workings are much above the ground water level, it does not contribute any water to the existing surface drainage and there is no depletion of ground water. The present mine workings are at a higher level no water percolation is there, needing pumping of water. The makeup water during average rainy season with maximum rainfall occurring in any day has been calculated below based on mine area under excavation (there is no backfilling)

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(b) Annual rainfall, catchment area and likely water of rain water to flow through the lease area, arrangement for arresting solid wash off etc.

Physiographical approach of the lease area comprises gently sloping topography with a prominent hill mound having around 722 m. RL in the south part and 602 m. RL in the north portion of the lease area. The hillock flank maintains a gentle slope. Medium degree of steepness is noticed in the south western direction.

(ii) Rainfall

(a) The rainfall does not show any cyclic occurrences but shows erratic variations. The monsoon season spreads over the months from June to September. The annual total rainfall is given in following table (Source: IMD Sundergarh)

Year	Av. Rainfall (mm)
2005	1427.0
2006	1616.1
2007	2204.0
2008	1948.9
2009	1383.1
2010	1211.0
2011	1942.3
2012	2088.8
2013	1853.6
2014	1791.1
Average	**1746.59**

(b)The average annual rainfall is 1746.59 mm and there are on the average, 97 rainy days in a year. Rainfall peaks during July and August with the four months (June to September) recording 65% of the total rainfall.

Catchment area and likely quantity of Rainwater to flow through the lease area:

The total area is 28.397Ha. However, the catchment area is coming around 11.359Ha or 113590sqm. An average rainfall of 1746.59 mm has been taken into consideration for the calculation of run-off. The details of runoff per annum and the quantity of Rainwater to flow through the lease area are as follows:

- Run off co-efficient considered = 0.17
- Average annual rainfall = 1.74 m/yr.
- Runoff = catchment area × Runoff coefficient × Annual rainfall
  = 113590 Sq. m × 0.17× 1.74 m/ year = 33599 cu.m /yr.

Considering evaporation @ 40% = 33599 x 0.40 = 13439cum

The annual run off @ 60% = 33599 x 0.60 = 20159cum/yr.

Water accumulated in pit bottom can directly go to the setting tanks by gravity. So, accumulated water will find no time to precipitate Hence, no pumping arrangement has been proposed for de-watering from mine pit.

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Arrangement for arresting solid wash:

Surface run off from pits and OB dump site if directly discharged into the river may cause silation problem. However, the lessee has already constructed protective measures like retaining wall, garland drain and settling pond in the ML area to control erosion during monsoon season. The details of existing protective measures are given below:

Location	Dimension								
	Retaining wall			Garland drain			Settling tank (3nos)		
	Length (m)	width (m)	height (m)	Length (m)	width (m)	height (m)	Length (m)	Width (m)	Depth (m)
Dump-1	--	--	--	--	--	--	-/-	-/-	-/-
Dump-2	280	1.5	1.0	80	1.0	1.0	18	13	3
Dump-3	500	1.5	1.0	550	1.0	1.0	35	20	3
Dump-4	160	1.5	1.0	190	1.0	1.0	40	13	3

The existing south dump -2 will be stabilized by way of plantation. About 0.0875Ha of dump-2 will be covered under plantation. It has been proposed to made surface drainage system around the mine to discharge the mine water outside the lease.During the year 2017-18 to 2020-21, it has been envisaged to maintain all the existing protective measures like Retaining wall, Garland drain and settling pond. Also as per requirement the height of retaining wall will be increased at strategic location as per requirement. Additionally, 240m retaining wall, 710m garland drain will be constructed around the waste dump. Perforation (weep holes) shall be left at intervals to allow for passage of water. Adjacent to this, garland drain shall be provided to prevent any wash off or leaching of dump materials during heavy rains. Dump height will be 10m (max). Individual slopes shall not exceed 37° and the overall shape of the dump shall be 28°. Catch drains shall be provided at the inward side of the terrace. Catch drains of the terrace shall be connected to the garland drain outside the peripnery of the dump. These catch drains shall have concrete open pipes followed by settling tanks to avoid wash offs. Each terrace shall have provision of berms at the outer end to reduce gully formation due to rainwater wash offs In course of time plantation on the dead end slopes of waste dumps with local species shall be done in consultation with forest authorities. The proposal has been shown in Environmental Management Plan. The details of year wise construction of protective measures will be as follows:

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Year	Location	Dimension								
		Retaining wall			Garland drain			Settling tank (2 nos)		
		Length (m)	width (m)	height (m)	Length (m)	width (m)	height (m)	Length (m)	Width (m)	Depth (m)
2017-18	–	--	--	–	–	--	--	--	--	--
2018-19	Dump-2 & 3	60	1.0	1.5	510	1.0	1.0	13 x 12x 3m (Dump-2) 60 X 15 X 3 (Dump-3)		
2019-20	Dump-2 & safety Zone	180	1.0	1.5	200	1.0	1.0	--	--	–
2020-21	--do--	Maintenance			Maintenance			Maintenance		

Plantation for checking soil erosion

YEAR	AREA OF PLANTATION (ha)	NO OF SAPLINGS	LOCATION	NAME OF THE SPECIES
2017-18	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
	0.0875	140	South dump-2	Grass type along the slope and other available local species
Sub-total	0.15	240		
2018-19	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
	0.15	240	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
2019-20	0.0625	100	Proposed dump	Grass type along the slope and other available local species
	0.0875	140		
	0.15	240		
2020-21	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs etc.
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
	0.15	240		
TOTAL	0.60	960		

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CHAPTER-IV

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 of.

Nature of Top soil: As per the geology of the area, no top soil occurs within the lease area.

Nature of Overburden/side burden waste: Containing laterites, & shale, BHJ/BHQ etc.

Nature of Intercalated waste: Overburden (OB) occurs above the ore zone i.e. overburden capping waste, side burden (SB) is the non-ore parts wastes on both hang wall and foot wall sides of ore body removed while making the benches and inter burden (IB) are the wastes between ore bodies. These are all waste in regards to ROM ore. ROM in this area is overlain by laterite, and shale etc. The wall rock in the area is mainly laterite, BHJ and shale.

Quantity of top soil, OB/Waste and Mineral rejects

Existing Dumps

There exists four waste dumps, two in South side (South – Dump – 1 and South Dump – 2), one towards North side (North Dump – 3) and one towards East (East Dump – 4). Locations of these four Dumps are as follows.

Dump	Co-ordinate	Length (m)	Width (m)	Area (Ha)	No of Terraces	Top RL	Bottom RL
South Dump – 1	N2426503- N2426636 E331844 - 331938	130	80	1.056	2	711	680
South Dump – 2	N2426500-N2426555 E331740 - 331860	100	65	0.511	2	662	632
North Dump – 3	N2427170 - N2427016 E331652 - 331752	135	95	1.461	2	632	611
East Dump - 4	N2426626 - N2426746 E332080-332192	150	36	0.542	1	674	662

Existing sub-grade/mineral rejects dump

Sl. No	Name of the stack	Location	Area in Ha	Average Grade	Quantity Cu.m	Top RL(m)	Bottom RL(m)
1	Mineral reject dump - 1	E331740-331840 N2426980-2427040	0.25	51.46	32686.86	620.58	628.4
2	Mineral reject dump-2	N2427030-2427100 E331710-331790	0.30	51.05	18439.85	616.57	630.8
	Total				51126.71		

The generation of topsoil and mineral rejects and their usage are furnished below:

Top soil generation – Nil

Waste generation

Overburden (OB), Side burden (SB) has to be excavated and Interburden (IB) has to be segregated form Ore Zone excavation, which is calculated to be recovered during the proposed plan period as below.

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Year	Quantity of IB/ Waste (MT)	Side Burden & Over Burden (MT)	Total waste in MT	Total waste in cum	Road maintenance @30%	Waste dumped @70%
2017-18	21460	0	21460	10730	3219	7511
2018-19	49180	58000	107180	53590	16077	37513
2019-20	49180	132000	181180	90590	27177	63413
2020-21	49180	206000.00	255180	127590	38277	89313
Total	169000	396000.00	565000	282500	84750	197750

Mineral rejects generation

Year	Volume (cum) of Mineral rejects (45 to58% Fe)	Removal of Mineral rejects (cum)	Total MR (cum)
2017-18	35500	--	35500.0
2018-19	98360	25563.36	123923.4
2019-20	98360	25563.35	123923.4
2020-21	98360	--	98360.0
Total	330580	51126.71	381706.8

Usage of Waste/Mineral rejects

Year	Topsoil (Cum)		Waste (OB/SB/IB)		Mineral Rejects (Cum)	
	Reuse/ spreading	Storage	Back filling/ road maintenance	Storage	Blending	Storage
2017-18	0	0	3219	7511	31950	3550
2018-19	0	0	16077	37513	111531.1	12392.34
2019-20	0	0	27177	63413	111531.1	12392.34
2020-21	0	0	38277	89313	88524	9836
Total	0	0	84750	197750	343536.1	38170.68

(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.

Dump proposed during scheme period

Quantity of yearly generation of waste and proposals for disposal of waste:

Two types of ore zone have been earmarked in the geological plan. One is in situ iron ore zone where inter burden percentage is about 5% other is float ore zone where the waste percentage is about 40%. During, ensuing plan period, only in situ ore zone has been proposed to be developed. Further, there will be handling of side burden (mainly shale, laterite& BHJ) during ensuing plan period. A total of 282680 cum of waste will be generated during plan period. These waste disposed of outside the ultimate pit limit within barren land. Dumping site will be selected considering the factors like topography, drainage, land use, mineral inventory, pit configuration; mine waste characteristics, its volume of generation and economy in transportation etc. It can be observed that the northern part of the area near dump-3 is suitable for the proposed dumping considering the topography, barrenness, lead distance etc.

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

Generation of waste from pit and its utilisation

Year	Quantity of IB/ Waste (MT)	Side Burden & Over Burden (MT)	Total waste in MT	Total waste in cum	Road maintenance @30%	Waste to be dumped @70%
2017-18	21460	0	21460	10730	3219	7511
2018-19	49180	58000	107180	53590	16077	37513
2019-20	49180	132000	181180	90590	27177	63413
2020-21	49180	206000.00	255180	127590	38277	89313
Total	**169000**	**396000.00**	**565000**	**282500**	**84750**	**197750**

Selection of dumping site mostly depends upon the factors like topography, drainage, land use, mineral inventory, pit configuration; mine waste characteristics, its volume of generation and economy in transportation etc. Total generation of waste during ensuing plan period is 282500cum. Out of which 30% i.e. 84750cum will be utilized for road maintenance (both public and internal haul road). For public road maintenance, permission from DDM will be obtained. Remaining 70% i.e. 197750 cum will be dumped at earmarked site.

Method and Manner of disposal of waste:

During ensuing plan period, dump-3 will be extended towards NE direction over an area of 0.93Ha.

During dumping near dump-3, care shall be taken to ensure that the waste is leveled, compacted and terraced. There will be three terraces in the proposed dump. The height of the dump will be average 18m. The top RL of the dump will be 635m. The dump slope will be 37.5°.

Configuration and sequence of year wise buildup of dumps

Year	Total waste in cum	Road maintenance @ 30%	Waste to be dumped (cum)	Area of dumping (m^2)	Average height (m)	Designed capacity (cum)	Top RL (m)	Bottom RL.(m)	No of terraces
2017-18	10730	3219	7511	2489	10	24890	617	607	1st
2018-19	53590	16077	37513	4146	10	41460	627	617	2nd
2019-20	90590	27177	63413	2950	10	29500	627	617	2nd
2020-21	127590	38277	89313	3748	7	26236	635	627	3rd
Total	**282500**	**84750**	**197750**						

Proposal for protective measures

Existing Protective measures around the dump

Location	Dimension								
	Retaining wall			Garland drain			Settling tank (3nos)		
	Length (m)	width (m)	height (m)	Length (m)	width (m)	height (m)	Length (m)	Width (m)	Depth (m)
Dump-1	--	--	--	--	--	--	-/-	-/-	-/-
Dump-2	280	1.5	1.0	80	1.0	1.0	18	13	3
Dump-3	500	1.5	1.0	550	1.0	1.0	35	20	3
Dump-4	160	1.5	1.0	190	1.0	1.0	40	13	3

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Proposed protective measures

Year	Protective Measures		
	Retaining wall	Garland drain	Settling pond
2017-18	Maintenance	Maintenance	Maintenance
2018-19	60mx1mx 1.5m	510 x 1.0 x1.0	13 x 12x 3m (dump-2) 60 X 15 X 3 (Dump-3)
2019-20	180mx1mx 1.5m	200 x 1.0 x1.0	Maintenance
2020-21	Maintenance	Maintenance	Maintenance

Engineering details of retaining walls & Garland drains

(I) Retaining Walls

Retaining boulder wall (1.5 m visible height and 1.0 m width) of substantial strength shall be constructed all along the lower slope of the dumps. Perforation shall be left at around 10 m intervals to allow for passage of water.

(ii) Garland drains

Garland drains of 1.0 m deep and 1.5 m wide shall be constructed all along the lower slope of the dumps followed by the retaining wall to prevent any wash off or leaching of dump materials during heavy rains. Side walls and the base shall be pitched with locally available boulders. Joints shall be filled up with cement and sand mixture so that water cannot percolate.

(iii) Settling Tank

The garland drain shall be channelized to a settling tank. Side walls and base shall be packed with locally available boulders mixed with cement and sand.

(d) Stacking of Mineral Reject

Iron ore of 45 to 58% Fe contained iron ore, which has no direct market at present, is considered as mineral reject (MR). The percentage of MR generation in the area is assumed as 20% of ROM excavation inclusive of inter burden (IB) within insitu ore zone and 10% within float ore zone. Further there will be removal of mineral rejects of the existing mineral stack. The details of availability of Mineral rejects and their usages are furnished below:

Generation of mineral rejects during plan period:

Year	Volume (cum) of Mineral rejects (45 to58% Fe)	Removal of Mineral reject (cum)	Total Mineral rejects (cum)	Blending Quantity @ 90%	Mineral rejects to be Stored (cum)
2017-18	35500	--	35500.0	31950	3550
2018-19	98360	25563.36	123923.4	111531.1	12392.34
2019-20	98360	25563.35	123923.4	111531.1	12392.34
2020-21	98360	--	98360.0	88524	9836
Total	**330580**	51126.71	381706.8	**343536.1**	**38170.68**

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Selection of Site for Mineral rejects

Since the stacking of MR is for a temporary period, it is proposed to stack the minerals within the ore stack yard. The earmarked MR stack is between N2427040-2427110 - N2426900 & E331800-E331880. The height of the sub grade stack during the proposed plan period would be maximum 20 m from ground level. Since the entire produces of MR is blendable at appropriate point of time, hardly there will be any product on the MR stack yard. So, this is a temporary arrangement

Method and Manner of disposal of Mineral rejects:

It has been envisaged to stack 38170.68MT of Mineral rejects during plan period. The stacking will be undertaken in a re-treating manner. Two terraces will be created for storing the mineral rejects dump. The details of year wise stacking of Mineral Rejects will be as follows:

Year	MR to be Stored (cum)	Area of Stacking (m2)	Height(m)	Top RL(m)	Bottom RL(m)
2017-18	3550.00	2500	7	627	620
2018-19	12392.34	2300	8	635	627
2019-20	12392.34	1800	5	640	635
2020-21	9836.00	1800	5	645	640
Total	38170.68				

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CHAPTER-V

5.0 USE OF MINERAL AND MINERAL REJECT

(a) Requirement of end use industry specifically in terms of physical & chemical composition.

Ore available in the area are both salable grade containing >58% Fe and Mineral Reject with 45 to 58% Fe. Hard massive, hard laminated, soft laminated, iron ore fines, blue dust and iron containing lateralized and ferruginous laleritic ore are available in the lease, which are mined out. The entire ROM is processed though crushing & screening facilities. The 100% output is transported to ore stacking yard where those are subjected to disintegration both grade and size wise. Ore and MR are stacked at their ear marked location and IB is shifted to dump yard. As per demand of market different size and grade ore are dispatched. In case size and/or specification of ore is in demand by other industries, the lessee blend different grade ore and MR for supplying required grade of ore around >58% Fe.

(b) Requirement of intermediate industries involved in up-gradation of mineral before its end-use.

The intermediate industries involved in the up-gradation of mineral before its end use is crushing and screening unit, beneficiation plant, etc. ROM iron ore will be crushed and screened in the M.L area to cater the need of buyers in respect of size and grade. Practically, there will be no mineral rejects after blending. However, as per requirement of buyers like BRPL, ESSAR, low grade fines/screen fines will be supplied to lessen stack within the mines.

(c) Requirements for other industries, captive consumption, export, associated industrial use etc. Requirement of other industries

Sl. No.	constituents	DRI Grade	Sinter grade
1	Fe	60% Fe to 63.5% Fe	60.0 to 63.50%
2	SiO_2 + Al_2O_3	5% Max.	6% Max
3	CaO + MgO	2% Max.	-
4	P	0.07% Max.	0.07% Max.
5	S	0.03% Max.	0.03% Max
6	Size	(5 – 20) mm	(0-10)mm
7	+ 10mm	-	5.0% Max.
8	- 100 Mesh	-	25% Max.

Export:

Presently, the iron produced from the lease area is used in the domestic industries. In future if required the Iron ore will be supplied in the Export market with permission from concerned authorities.

Associated industrial use:

Iron ore produced from the lease hold are mainly used in the steel industry, Ferro manganese industry, Ferro silicon plant, etc.

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(d) Precise physical and chemical specification stipulated by buyers

Parameters	Chemical Constituent (%)	
	I	II
Fe	64-65.0	63-64.0
SiO_2	2.0	
Al_2O_3	2.0	2.0
$Al_2O_3 + SiO_2$	6.5 max	8.0 max
Al_2O_3: SiO_2	1.5 max	---
P	0.05	0.05 max
S	0.02 max	0.02 max
Cu	0.01 max	0.01 max
Moisture	5 max	5 max
Size	05-18 mm	- 5 mm
	Blue Dust	
Size	-	Below 5mm
Fe	-	63% to 65%
Al_2O_3	-	3%(max)
SiO_2	-	3.5 % (max)
$SiO_2 + Al_2O_3$	-	6.5 % (max)
P	-	0.05 %
S	-	0.02 %
C4	-	0.01 %
Pb	-	Trace
Total of other metal	-	(Except Mn, Mg, Ca) :0.1%
Moisture	-	5%(max)

(e) Processes adopted to upgrade the ROM to suit the user requirements.

For supplying to intermediate industries screening/up-gradation of minerals are done with one 175 TPH mobile screening plant. The facility is located inside the mines. Part of the sized ore after processing is dispatched to the steel plant of the lessee's sister concern MGM Minerals Ltd (Steel Division) at Dhenkanal in Odisha State and the rest of the ore including the fines ore which are supplied to indigenous user industries.

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CHAPTER-VI

6.0 PROCESSING OF ROM AND MINERAL REJECT

(a) Brief description processing / beneficiation of the ROM with nature of processing / beneficiation indicating size and grade of feed material and concentrate (finished marketable product), recovery etc.

In general, the essential impurities in iron ore are silica, alumina, sulphur and phosphorus which are in the form of Al_2O_3, SiO_2, FeS_2 or CaSO4 and $Ca_3(PO4)_2$ respectively. The Al_2O_3 / SiO_2 ratio has an important role in the economics of Fe-ore smelting.

Product Quality and Grade Control: Grade control is managed throughout the mining sequence to meet the product specifications of the customers in terms of fines content and key elements such as Fe, SiO_2 and Al_2O_3. The following practices are in place or planned to manage product quality & grade control-:

Blast hole sampling : The present practice consists of creating composite blast hole samples which are analyzed in the site laboratory to provide an estimate of the grade within the ROM; based on which the appropriate destination of the material is determined.

Grade control at screening and crushing feed locations: Based on the outcome of the blast hole results, the grade of the ROM is ascertained. At present, the grade of ROM is controlled by blending at screening and crushing feed locations. High and low grade ROM delineated by the blast hole sampling process are blended/ proposed to be blended to have a grade of about 58 - 60% Fe and are stockpiled at screening and crushing locations which are fed to the crushing and screening plants. Regular assaying of the feed and final output product is done to enable the site technical team to vary the blend accordingly to maintain the appropriate grade for each product type.

Processing of the ROM with nature of processing indicating size and grade of feed material finished marketable product, recovery etc.

Existing processing unit

Processing of ROM and mineral rejects are being done only by dry crushing & screening method. The dry processing method is being adopted for processing of ROM by the help of crushing and screening unit. At present following capacities of crushing and screening units have been established at the site.

Sl. No	Type of Machinery	Capacity of each unit	No. of units	H.P. of each unit	Electrical / Non Electrical (specify)
1	Crushing unit	350 TPH	1	500 HP	Non Electrical
2	Screening unit	350 TPH	1	500 HP	Non Electrical
		250 TPH	1	500 HP	Non Electrical

The existing processing unit will be relocated to the earmarked area. The relocation of is required to diminish the distance between excavation. The area proposed for the processing unit is a non mineralized land based on the existing exploration data.

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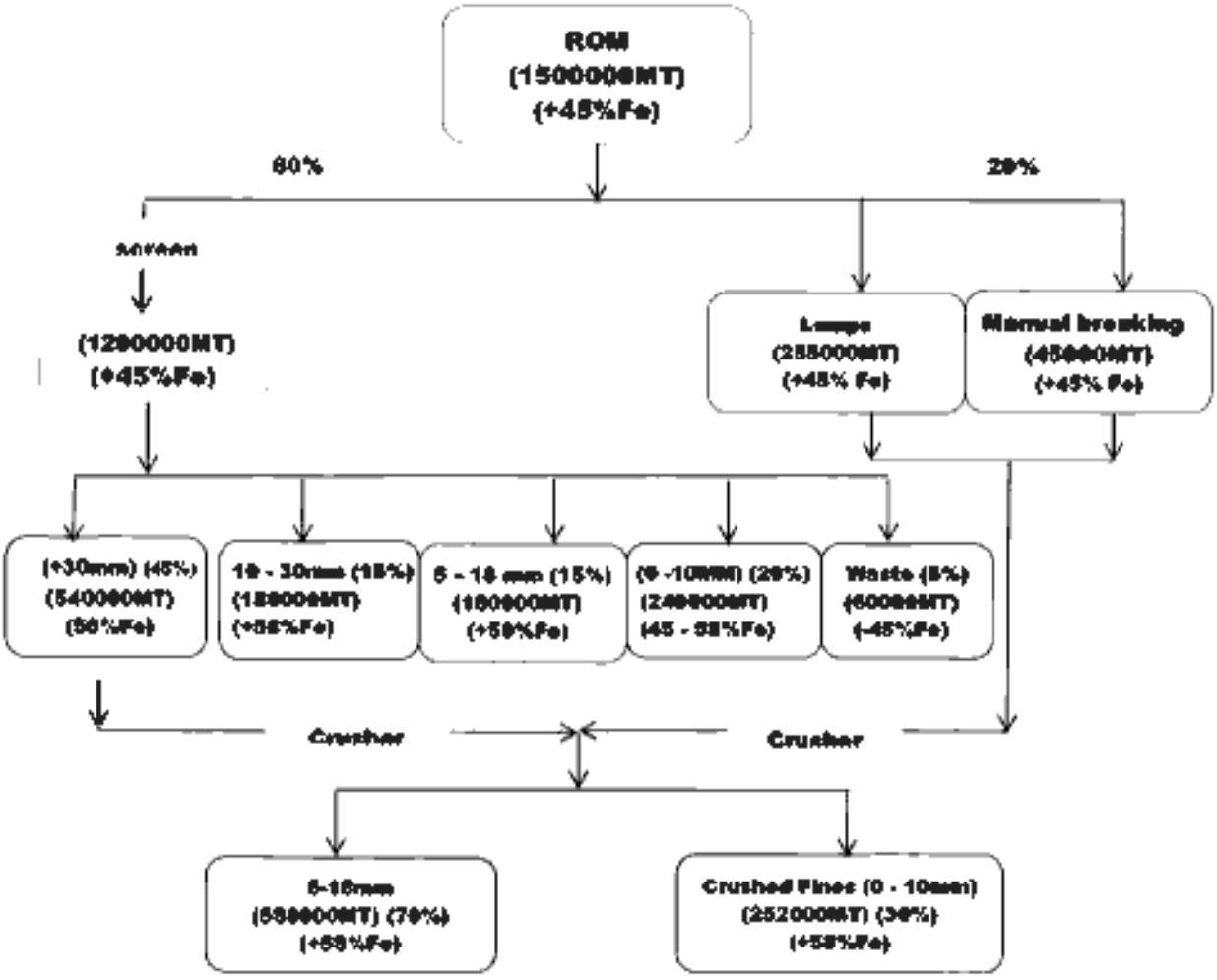
Existing process with recovery and finished product

The ROM ore is/will be subjected to screening, crushing, sizing, blending etc. before finished product is ready for dispatch. The ROM ore will be transported by dumpers to the mineral stack yard from where it is fed to screen plant by means of a hydraulic excavator. The oversized ore (+300 mm) is broken to smaller size manually and/or by rock breakers. The details of flow sheet with material balance are furnished below:



From above flow sheet it can be observed that the total saleable material (+58%Fe) is 1200000MT and 240000MT will be mineral rejects. Out of the total mineral rejects to be generated during plan period it is envisaged to blend about 90% i.e. 216000MT with high grade ore to make it saleable. Remaining 10% i.e 24000MT will be stored for future blending. Hence, total saleable material in a year will be 14, 16000.00MT.

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(b) Explain the disposal method for tailings or reject from the processing plant.

Not applicable

(c) 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

(d) Specify quantity and type of chemicals if any to be used in the processing plant

Not applicable

(e) Specify quantity and type of chemicals to be stored on site / plant

Not applicable

(f) 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. Water balance chart may be given:

The lessee has obtained permission for withdrawal of 30cum per day ground water and 130 cum /day of surface water for different uses.

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CHAPTER-VII

7.0 Other Information

(a) Site Services

The various site services such as rest shed, blasting shed, site office, potable & duly purified drinking water, canteen serving hygienic food and first-aid center etc are available within the lease area. Additional requirement, if any, shall be facilitated in as & when required.

(b) Employment Potential

- **Management and Supervisory personnel**

SL No.	Designated person	Qualification	Nos.
1	Mines Manager		1
2	Asst. Manager		2
3	Geologist		1
4	Engineer Tech.		8
5	Foreman		6
6	Mining mate		4
	Total		22

- **Skilled and Semi -skilled personnel**

1	Survey Asst.	Skilled	1
2	Operator (Drill & Exc.)	Skilled	21
3	LMV Driver	Skilled	6
4	HMV Driver	Skilled	21
5	Computer Operator	Skilled	4
6	Administrative & Tech. Staff	Skilled	35
7	Asst. Tech. Staff	Semi-Skilled	7
8	Mechanical/Screen Helper	Semi-Skilled	5
11	Helper (Truck, Equip. & GD)	Semi-Skilled	21
12	Cook	Semi-Skilled	3
13	Mazdoor	Unskilled	7
14	J.H.O	Semi-Skilled	3
15	Miner	Semi-Skilled	61
	Total		195

Details of Direct and contractual employment

Classification	Average daily employment		
	Direct	Contract	Total
a) Managerial person	12	21	33
b) Supervisory persons	10	0	10
c) Workers	92	39	131
d) Ministerial persons	0	0	0
e) Employment in plant	32	0	32
f) Others	71	0	71
Total	**217**	**60**	**277**

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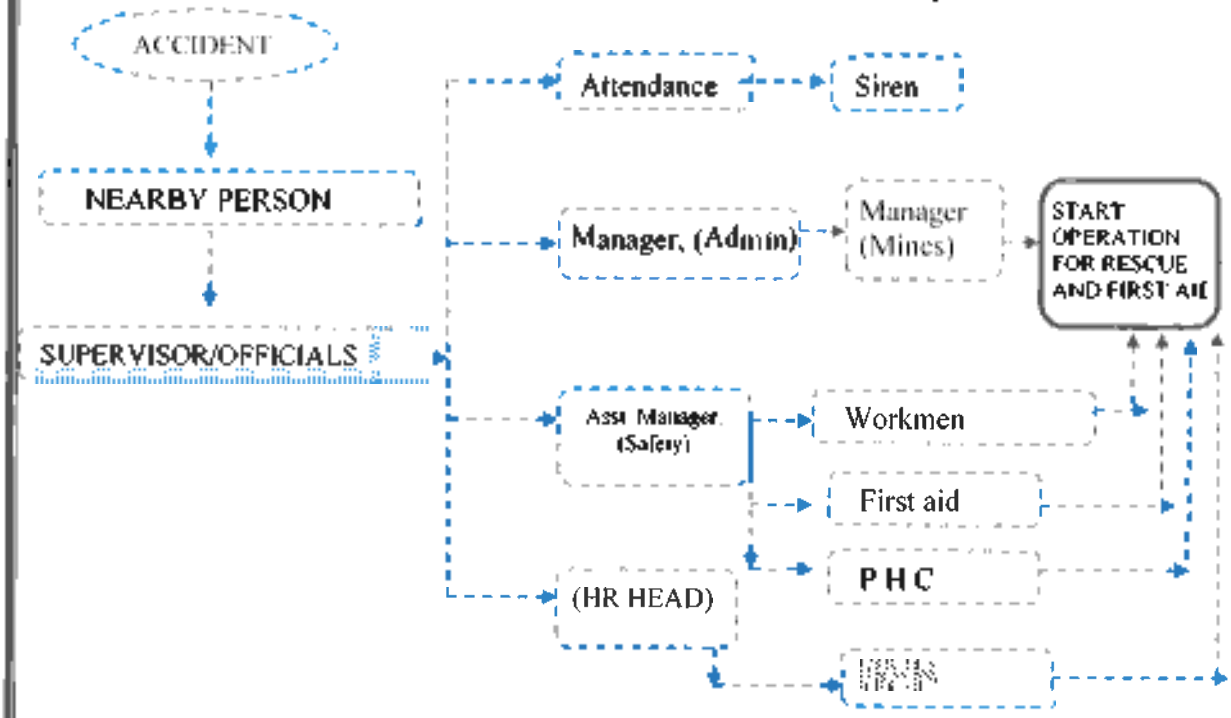
(c) Safety measures taken for miner's health

All workers are provided with safety equipment such as helmet, shoes, goggles, rope etc. It is ensured at the mines entry gate / time office that workers carry those materials with them. Drilling workers in addition to above be provided with nose mask, ear plug etc with special type of shoes. Vocational training is given to all workers in batches at regular interval to freshen their mind on their own responsibility during working in mines. Detergents are supplied with bananas and Molasses to the drilling crew. Health checkup is done to all workers once in a year. Nearby hospital facility are provided to workers and their dependents on necessity. Under emergencies they are shifted to specialized hospitals for treatment. Medicines are provided as per the prescription of the physician. A 24 hours ambulance van has been provided. Pure drinking water is provided to all workers and their dependents. For this tube wells have been sunk inside the lease area and nearby villages.

(d) Organizational chart for risk assessment

In case of any emergency the help of authorities like Fire Department, Tahasildar and other concerned officials will be taken. Emergency plan for serious accidents is given below:



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(e) Name of persons, designation with address and phone along with respective responsibilities detailed under disaster management para.

Sl.No.	Name	Designation	Mobile No.
1	Sri H.S. Pattanayak	Mines Manager	7440015201
2	Sri B.N. Mohapatra	Agent/H.R Head	5899041149
3	Sri R. S. Dubey	Dy. Manager Mines	9040636927
4	Sri B. N. Dash	Manager Adm.	7440015221
5	Sri S.K. Routray	Asst. Manager Safety	8895870605
6	Sri R.C. Mohanta	Mechanical Engineer	7440015206

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CHAPTER VIII

8.0 PROGRESSIVE MINE CLOSURE PLAN

The Patabeda Iron ore Mines is a fully mechanized Opencast mines equipped for production of Iron ore. Any development activities bring in some adverse environmental impact, which are being dealt with scientifically and sustainable pattern of mining. The salient environmental measures as presented in the Modification of approved Mining Plan are discussed herewith with the proposal for the Period 2017-18 (11.09.2017-18) to 2020-21. The relevant data generated for Air, Water, Soil & Noise etc. also enclosed as **Annexure-16.** It may be observed that no negative impacts on water and air quality is envisaged since adequate protection measures has already been undertaken which will be continued to be maintained during the tenure of lease period. There is commitment to continual improvement of environmental performance and prevention of pollution. Though the mine is fully Mechanized Opencast method operation category, which is more environment eco-friendly, hence, there will be no apprehension of adverse impact.

8.1 Environment Base line information: Attach a note on the status of baseline Information with regard to the following.

The environmental study was conducted in an area covering 10 km radius, with center as mining lease of Patabeda Iron ore Mines of M/s. MGM Minerals Limited over an area of 28.397 Ha, which is considered as the Core Zone and beyond that up to a radius of 10 Kms of the lease hold is considered as Buffer Zone. The mining related activity of the area is confined to the core zone only. The present baseline information of the core zone and buffer zone of Mines is outlined below. The detail as required under Rule 32(5) of MCDR 2017 is shown in Key Plan (Plate No.1). The environmental parameter monitoring data with respect to ambient air quality, water quality, noise monitoring, soil quality, etc. are enclosed in **Annexure- 17**

The Environmental Base line information from october-2008 to Nov-2009 (Post Monsoon 2009) were collected by the M/s Geomin Consultants pvt Ltd, an authorized NABET accredited agency. The data is confirming to the norms of SEIAA, Odisha. Based on these data, EIA & EMP has been prepared and submitted before SEIAA for grant of environment clearance for 0.8MTPA production of iron ore and accordingly, SEIAA has accorded approval for the said capacity. Further, Mitra S.K.

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Pvt Ltd has been entrusted the job for undertaking the monitoring of environment. In this regard monitoring report of last quarter has been attached as Annexure - 17. The detail discussion on the base line data are given below.

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

Sl. No	Pattern of Utilization	Existing
1	Mining	12.340
2	Dumping of overburden	3.701
3	Mineral rejects stack/mineral storage	1.150
4	Storing of top soil	00
5	Infrastructure facilities (workshop/ Site services)	1.800
6	Township/housing colony	00
7	Crusher/ screening plant	0.500
8	Construction of road	1.658
9	Magazine	0.247**
10	Others (retaining wall, gartand drain, settling pond etc.)	0.164
11	Safety zone and plantation area	2.494
	Sub-total	24.054
12	Unused area	4.343
	Total	28.397

6.1.2 Water regime, quality of air, ambient noise level, flora, climatic conditions

(i) Water regime

The area is featured in Topo sheet No 73 G/5 on a scale of 1:50,000. UTM Co-ordinate of the leased area E332303.418 – N2426390.337 / E331623.726-N2427161.753. Physiographical approach of the lease area comprises gently sloping topography with a prominent hill mound having around 725 m. RL in the northern part and 600 m. RL in the western portion of the lease area. Gradient of the area varies from 1:2 to 1:24

(a) Drainage pattern of the area

Kakarpani is the nearest stream of the vicinity and is situated at a distance of about 1.5 km west of the lease area. This water course meets with Suna nadi / Kundru nala at a distance of about 3 km from the lease area to the northwest. Another perennial nala is Baitarani River which is at a distance of 6.5 km east of the area. Since mine workings are much above the ground water level, it does not contribute any water to the existing surface drainage and there is no depletion of ground water. The present mine workings are at a higher level no water percolation is there, needing pumping of water. Minimum seasonal fluctuation in the ground water level in general varies from 2 to 4m.

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(b) The general ground is at 580 mRL and lies towards west of the lease area. Study of nearby wells and water bodies reveals that during peak period of monsoon and summer the water level generally fluctuates. The water level remains at 574 mRL in general and during peak monsoon comes up to about 578 mRL. During peak summer it goes down to 570 mRL.

(c) **Maximum and minimum depth of Workings**

At present the depth of the mining pit has attained 700 m. RL top being at 722 m. RL in average. By end of the scheme period it is proposed that the deepest level of the quarry will be about 682 m. RL.

(d) **Water quality of management**

There is no perennial nala within the lease area. Seasonal nalas carry the rain and runoff water in to Kakarpani nala which is the main perennial surface water source in the region.

(e) **Existing ground water bodies**

Bore well-constructed by the Lessee is the ground water source for drinking in the lease hold area.

(f) **Monitoring**

Check dam, garland drain and settling tank are there wherever required and few more new are to be constructed around dump at its lower contour, particularly for waste Dump - 2. Monsoon water to be let out from the settling tank of proposed lease hold area will be collected, analyzed and compared with the norms of IS: 2296 specified for surface water quality. Besides, regular monitoring of bore well water is being carried out by the lessee. Working benches will be kept free from loose overburden/waste materials. Check dam will be constructed to prevent wash off of loose sediments. Surface water samples from the Kakarpani nala and ground water samples from the tube wells of nearby villages will be analyzed for their pollutant level which will help to decide the type of treatment required. Garland drains have been proposed around the dump and quarry to guide the surface run off to the nearby settling ponds from where the water will be utilized for plantation etc. There is no possibility of acid mine drainage Regular monitoring of environmental parameters is being carried out and the results of first quarter of 2017 are at **Annexure - 17**

(ii) **Quality of Air**

In the proposed quarrying, handling of ore, movement of heavy machinery on road, drilling & blasting, exposed waste dumps, particulate matter emission are there which contribute dust to air. All unit operations where dust emission is high are kept wet by sprinkling of water as many times as required. Regular maintenance of vehicle are done. All around the safety zone and in few other places plantation has been carried out. Set of parameters developed and the resultant maximum

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GLC for PM_{10}, $PM_{2.5}$, SO_2 & NOx are within prescribed limit. Precautionary measures are being taken when the prescribed limit goes up. Regular monitoring of environmental parameters is being carried out and the results of first quarter of 2017 are at **Annexure - 17.**

(iii) Ambient noise level

Reconnaissance survey are being undertaken to identify the major noise generating sources in the area. Nine locations within the study area corresponding to the AAQ monitoring locations were identified for carrying out noise monitoring activities. From the results conducted during the study period it is clear that the noise level during day time and night time are well within the limit prescribed by CPCB for residential area. Regular monitoring of environmental parameters are being carried out and the results of first quarter of 2017 is at **Annexure - 17.**

(iv) Flora & fauna

The Floral assemblage within the core and buffer zones are more or less same, but due to broken areas within core zone, the density and distribution varies from the buffer zone. There is no elephant or tiger migratory corridor within the core and buffer zone of the project site. Impact of the proposed plant will be minimal in nature. The major flora observed in study area are Karam, Semul, Kumbhi, Sunari, Kendu, Sidha, Mohula, Barakoli, Sal, Asan, Bahada, Jamun etc. Endangered and Endemic species were not found in the study area.

(v) Climatic conditions

(a) Climatic condition of the area has been derived from last 10 years data available from IMD Sundergarh. Climate of the region is tropical wet and dry. The south-west monsoon normally sets in the study area by first week of July.

(b) Yearly average Temperature, Relative Humidity and rain fall data and wind Speed and Direction (IMD Sundergarh)

Refer Chapter – Part – A 1.0

(vi) Human settlements

There is no human settlement within the lease. Far away from the lease area there are small and big villages. Mining in the lease area never gives a negative effect to local residents; rather they are well benefitted directly and indirectly.

(vii) Public buildings, places of worship and monuments

There are no Public buildings, places of worship and monuments within or within 1 km distance from the lease area.

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(v iii) Any sanctuary located in the vicinity of the leasehold

No sanctuary is located in the vicinity of the leasehold

8.2 Impact Assessment

Description of Environmental Impact Assessment Statement on impact on Mining and beneficiation on environment.

8.2.1 Land area indicating the area likely to be degraded due to quarrying, dumping, roads, workshop, processing plant, tailing pond/dam, township etc.
The detail land use pattern during plan period and conceptual period will be as follows:

Sl. No	Pattern of Utilization	Existing	Plan Period 4 years	At the end of plan period	At the end of conceptual period
1	Mining	12.340	1.300	13.640	17.600
2	Dumping of overburden	3.701	0.930	4.631	4.631
3	Mineral rejects slack/mineral storage	1.150	1.366	2.516*	00
4	Storing of top soil	00	00	00	00
5	Infrastructure facilities (workshop/ Site services)	1.800	0.494**	2.294**	00
6	Township/housing colony	00	00	0	00
7	Crusher/ screening plant	0.500	0.400	0.900	00
8	Construction of road	1.658	0.100	1.758	1.158
9	Magazine	0.247**	(-0.247)	0.00	00
10	Others (retaining wall, garland drain, settling pond etc.)	0.164	00	0.164	0.164
11	Safety zone and plantation area	2.494	0.00	2.494	4.844
	Sub-total	**24.054**	**4.343**	**28.397**	**28.397**
12	Unused area	4.343		0	0
	Total	**28.397**		**28.397**	**28.397**

Note:

* Out of Mineral storage area of 2.516Ha, about 0.90Ha will be converted to plantation during conceptual period.

**During plan period magazine will pull - apart and will be included in infrastructure. Out of 2.294ha infrastructure area, 1.450ha will be converted into plantation during conceptual period.

(a) Air quality

Micrometeorological data was collected with respect to wind speed, wind direction, humidity, rainfall, temperature and ambient air quality monitoring was carried out at at core zone and buffer zone. During the study period, the temperature varied from 3.3 to 32°C and relative humidity varied from 14% to 98%. The average wind speed observed during the study period was 1.3 m/s & the predominant wind direction recorded was from West. The concentrations of particulate matters are well within the stipulated Standards prescribed by CPCB. Regular environmental monitoring is being conducted to assess / monitor air quality as per guide lines. Results obtained last quarter are at **Annexure – 17**

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(b) Water quality

(i) The topographical slope control can affect washouts of minerals and dumps on heavy rain.

(ii) Mitigation Measures

The solid waste is stacked over the ground with appropriate slope management and the said area is protected with retaining wall and garland drain for segregation of runoff water and contaminations thereby. Further, the stacking of wastes on dump is done in a more scientific manner maintaining the chosen height. A retaining wall on both sides of the tailing disposal area prone to the downward slope shall be constructed to arrest surface runoff from the upward catchments and channelize to the rainwater harvesting area. With this, not only the runoff impact is minimized, but also assists in harvesting the runoff for beneficiation needs. Proper drainage is developed to avoid runoff from the plant site and the tailings disposal site and its surrounding area with appropriate rainwater harvesting plan. Garland drain shall be built in the periphery of plant area. All the internal drains of the plant shall be connected to the garland drain. Other area shall also be made with perfect slope to allow free flowing of rain water to garland drain. The total surface run off shall be collected in settling tanks of adequate size as mentioned above, from where the same shall be taken to water treatment plant for recovery of clarified water which will be used in the process.

(iii) To assess the water quality, water samples were collected from core and buffer zone locations. Water samples were analyzed for physio-chemical and biological characteristics. Values of physico-chemical parameters for surface and ground water were observed below the stipulated standards. Regular environmental monitoring is being conducted to assess / monitor water quality as per guide lines. Results obtained last quarter are incorporated at Annexure - 17

(c) Noise Levels

Ambient noise monitoring is carried out in the study region at core & buffer zone locations corresponding to AAQ monitoring locations. The equivalent noise levels (Leq) at all the locations are found below the norms prescribed CPCB for day & night time. Regular environmental monitoring is being conducted to assess / monitor noise level as per guide lines and are found to be within prescribed limit. Results obtained last quarter are incorporated at Annexure – 17

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(d) Vibration levels (due to blasting)

Blasting for loosening the hard material in the mines are done in a very low scale since about 40% material are loose, soft or laminated. Nonel method is introduced to control vibration to zero level.

(d) Acid mine drainage - Not applicable

(e) Surface subsidence

Areas susceptible to natural hazard which could cause the project to present environmental problems are earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions. Irregular benches are being regularized keeping the width of bench more than height. Much deeper working without scientific study in a reputed laboratory shall be taken up. At present there is no such indication of bench failure or dump slope failure in the mines.

(f) Socio economics

The socio-economic profile of the study area is presented based on site visits; discussions with the villagers and the secondary data available from various agencies such as Hand Books of Census 2001.

Population

The total population of the study area is 33072 (as per census 2001). Demographic detail of study area is given in following paragraphs.

Sex Ratio

The sex ratio (nos. of female per thousand males) is 940.

Literacy

The literacy rate is 45.43% (overall), 29.04% (males) and 16.39% (females).

Occupational Pattern

The distribution of workers is given on the basis of Census 2001. The workers in the study area comprised of 28.58% main workers, 9.07% marginal workers and 62.34% non-workers. The main workers mainly comprise of cultivators and agricultural laborers.

Infrastructural Facilities

The study area has well developed facilities for educational and health care, drinking water, post and telegraph offices, approach roads and irrigation.

Education

Almost all the villages surveyed during study period have at least primary and middle school. The villages which have no High schools are having this facility within 5 to 10 km area. Based on the survey made in the study area, it was found that the educational facilities have been further strengthened now and a number of private schools have also come up in the study area.

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Medical and Public Health

Medical facilities available within the study area include dispensaries, hospitals, Health centers, Public health sub-centers, Maternity Homes, etc. Almost all villages are having medical facilities either at door or within 5-10 km. Based on the survey made in the study area, medical facilities have been further strengthened now and a number of private doctors are also practicing in the study area.

Drinking Water

Drinking water is available in all the villages. The main source of drinking water is through hand pump, well and Tank water. Based on the survey made in the study area, facilities have been further improved now.

Post and Telegraph

All villages have post and telegraph facilities either at door or within 5-10 km. Moreover mobile phone facility is available in almost all the villages.

Communications

Road transport is the main communication linkage in the study area. About 55% villages in the study area have access to bus service. Five major towns have access to railway stations. Transport facilities have improved significantly.

Road Network

Transport and Communication facilities are considered is an administrative necessity as well as a public convenience. However, a well-knit transportation system is a pre-requisite for the social and economic development of any district. The linking of one place with the other by road is very essential to provide good transport system. The study area has good road network. About 70% of the villages have pucca approach road and every village. Based on the survey made in the study area, facilities have further improved now.

Power and Electricity

Almost 80% villages in the study area have power supply.

Cropping Pattern

The main crop of the area is Paddy. The minor crops of the area are Wheat, Maize, Ragi, Green gram, Black gram, Horse gram, Til, Groundnut, Mustard, Potato, Jute and Sugarcane.

(g) Historical monuments

No Natural Park, wildlife sanctuary, national monument or tourist interest exist in the lease area as well as in buffer zone. Hence, there will be no negative impact on this account is there.

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8.3 Progressive reclamation Plan

8.3.1Mined-Out Land

At the end of mining in proposed plan period none of the area would have touched UPL warranting reclamation and rehabilitation. It is established that ore can economically be produced from the working pits till it touches the UPL. Question of reclamation and rehabilitation shall come at that time. However the mine is expected to continue for another about 8 years after the proposed scheme period. During mining in conceptual stage mine will be designed in such a manner that the UPL is touched in one end and progress to the other enabling planning and implementing reclamation of the quarry with available waste materials at site. Also, wastes of succeeding year mining can be put directly on preceding years working area which has come to an abandoned stage touching the UPL. However when the part of mining area touches UPL shall be explored to prove that no further ore is continuing.

Existing Fines/low grade ore/mineral rejects stack

There are two nos of low grade stacks one mineral rejects stack and another id low grade fines stack. The details are furnished below:

Sl. No	Name of the stack	Location	Area in Ha	Average Grade	Quantity Cum	Top RL(m)	Bottom RL(m)
1	Mineral reject dump -1	E331740-331840 N2426980-2427040	0.25	51.45	32686.86	620.58	628.4
2	Mineral reject dump-2	N2427030-2427100 E331710-331790	0.30	51.06	18439.85	616.57	630.8
	Total				51126.71		

Management of Existing Fines/low grade ore/mineral rejects stack

In addition to existing mineral rejects stacks, there will be generation of mineral rejects during plan period. The details of Mineral rejects to be generated and the existing mineral rejects to be removed and its usages are furnished below:

Year	Volume (cum) of Mineral rejects (45 to58% Fe)	Removal of Mineral reject (cum)	Total Mineral rejects (cum)	Blending Quantity @ 90%	Mineral rejects to be Stored (cum)
2017-18	35500	--	35500.0	31950	3550
2018-19	98360	25563.36	123923.4	111531.1	12392.34
2019-20	98360	25563.35	123923.4	111531.1	12392.34
2020-21	98360	--	98360.0	88524	9836
Total	**330580**	51126.71	381706.8	**343536.1**	**38170.68**

8.3.2 Topsoil Management - No topsoil stack is there.

Pradeept Mohapatra
Qualified Person

8.3.3 Tailings Dam Management

(i) The steps to be taken for protection and stability of tailing dam, stabilization of tailing material and its utilization, periodic de-silting measures to prevent water pollution from tailings etc, arrangement for surplus water overflow along with detail design, structural stability studies, the embankment seepage loss into the receiving environment and ground water contaminant if any may be described.

At present this is not applicable.

8.3.4 Acid mine drainage, if any and its mitigative measures. - Not applicable

8.3.5 Surface subsidence mitigation measures through backfilling of mine voids or by any other means and its monitoring mechanism.

No surface subsidence is anticipated during the scheme period. However, progressive back-filling of mine voids shall be continued as suggested in Para 8.3.1 (a) above. The information on protective measures for reclamation and rehabilitation works year-wise may be provided as per the following table.

8.3.6 Summary of Year-wise Proposal for Item No 8.3

Items	Details	2017-18	2018-19	2019-20	2020-21
Dump management	Area to be afforested (ha)	0.0875	0.0875	0.0875	0.0875
	No of saplings to be planted	140	140	140	140
	Cumulative no of plants	140	280	420	560
	Cost including watch and care during the year (Rs.)	3000	3000	3000	3000
Management of worked out benches	Area available for rehabilitation (ha)	--	--	--	--
	Afforestation done (ha)	--	--	--	--
	No of saplings to be planted in the year	--	--	--	--
	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 (L x B x D) pit wise /slope wise (ha)	--	--	--	--
	Void filled by waste / tailings (ha)	--	--	--	--
	backfilled area to be afforested	--	--	--	--
	Rehabilitation by making water reservoir	--	--	--	--
	Any other means specify)	--	--	--	--
Rehabilitation of waste land within lease(Along the safety zone by gap filling)	Area available (ha) (Along the safety zone by gap filling)	--	--	--	--
	Area to be rehabilitated	0.0625	0.0625	0.0625	0.0625
Others (specify)	Method of rehabilitation	Plantation Maintenance	Plantation 180 x1 5 x1	Plantation 13 x 12x 3m (Dump-2) 60 X 15 X 3 (Dump-3)	Plantation Maintenance
	Retaining wall (around dump)				
	Garland drain (around dump)	Maintenance	710x1x1	Maintenance	Maintenance
	Settling tank (near dump)	Maintenance		Maintenance	Maintenance
	Environment Monitoring	To be done as per MoEF & CC guide line	To be done as per MoEF & CC guide line	To be done as per MoEF & CC guide line	To be done as per MoEF & CC guide line

Pradeept Mohapatra
Qualified Person

Proposed year wise plantation program during plan period

Within the lease area

YEAR	AREA OF PLANTATION (Ha)	NO OF SAPLINGS	LOCATION	NAME OF THE SPECIES
2017-18	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
	0.0875	140	South dump-2	Grass type along the slope and other available local species
Sub-total	0.15	240		
2018-19	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
	0.15	240		Neem, Mango, Chakunda, Sissom Shrubs
2019-20	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
Sub-total	0.15	240		
2020-21	0.0625	100	Safety zone	Neem, Mango, Chakunda, Sissom Shrubs etc
	0.0875	140	Proposed dump	Grass type along the slope and other available local species
	0.15	240		
Total	0.60	960		

Outside the lease area

As per the advice of state forest department, every year the lessee is carrying out plantation outside the lease area. During plan period it has been envisaged make plantation at outside the lease area as per the proposal of State forest department.

8.4 Disaster Management and Risk Assessment

Action plan for high risk accidents like landslides, subsidence flood, fire, seismic activities, tailing dam failure etc. and emergency plan proposed for quick evacuation, ameliorative measures to be taken etc. The capability of lessee to meet such eventualities and the assistance to be required from the local authority are also described.

- As far as the nature of deposit and method of mining is concerned, there is no possibility of landslide, subsidence, inundation, fire and tailing dam failure.
- Though earthquake is felt several times in Orissa, damage to man & material has been severe till date.
- There were no floods in the past & not expected in future too, as the area is located in high altitudes.
- Kakarpani & Suna Nadi, controls the drainage system and receives the entire rain & run-off water.
- Small-scale fire may occur, which will be extinguished by fire extinguisher.
- Area under reference has no proposal of beneficiation / washing plant. Therefore, tailing dam is not necessarily required and the question of failure of tailing dam does not arise.

Pradeept Mohapatra
Qualified Person

8.5 Care and maintenance during temporary discontinuance

(i) An emergency plan for the situation of temporary discontinuance due to court order or due to statutory requirements or any other unforeseen circumstances indicating measures of care, maintenance and monitoring of status of discontinued mining operations expected to re-open in near future.

During the course of mining, there may be temporary discontinuance due to unforeseen reasons such as:

- ✓ Court order
- ✓ Natural Calamity
- ✓ Accident (Mine related).
- ✓ Slope failure.
- ✓ Failure in fulfillment of statutory requirement.
- ✓ Local issue and any other unforeseen circumstances.

Therefore, an emergency plan is necessary to re-open the mine, which will include:

- Intimation to local mine and legal administrative authorities concerned (IBM, DGMS, Directorate of Mines, Circle Mining Office & others) regarding the temporary discontinuance.
- Explanation to the local community, on the cause of temporary discontinuance and possibility of reopening of mine in future.
- Listing and proper storing of machines, materials, assets and documents.
- Care and maintenance of machinery as per machine operating manuals.
- Tightening of security to keep the machine and materials safe & secured.
- Monitoring of status of unplanned discontinued mining operation in respect of bench height, width, individual bench slope angle, over hang, under cut, misfire or any other
- Repair & maintenance parameters, whose levels either in form of higher side or lower side, is dangerous for further mine working of haul road.
- Regular monitoring of air, water, noise & others in the permitted area.

(ii) Preparation of plan & section at the time of discontinuance

- Projection of benches, in the plan and sections, which is safe for future working:
- Management of misfire, Fly rock movement, maintenance of machinery & others which are risk free and not dangerous for further working.
- Intimation to concerned authorities for reopening, once the mine is risk free.

Pradeept Mohapatra
Qualified Person

(iii) Name of persons, designation with address and phone along with respective responsibilities detailed under disaster management para.

Sl.No.	Name	Designation	Mobile No.
1	Sri H.S. Pattanayak	Mines Manager	7440015201
2	Sri B.N. Mohapatra	Agent/H.R Head	5899041149
3	Sri R. S. Dubey	Dy. Manager Mines	9040636927
4	Sri B. N. Dash	Manager Adm.	7440015221
5	Sri S.K. Routray	Asst. Manager Safety	8895870605
6	Sri R.C. Mohanta	Mechanical Engineer	7440015206

8.6 Financial Assurance

The financial assurance in shape of a Bank Guarantee from a Scheduled Bank as stated in Rule 27(1) of Mineral Conservation and Development Rules, 2017 for five years period expiring at the end of validity of the document is submitted towards financial assurance. The amount calculated for the purpose of Financial Assurance is based on the IBM Manual Appraisal 2014 as below.

Sl. No.	Head		Area (Ha) put on use at start of Proposed Scheme (A)	Additional area (Ha)required during proposed scheme period B	Total Area (Ha) at the end of proposed scheme period C= (A + B)	Area(Ha) considered as fully reclaimed & rehabilitated D	Net area (Ha) considered for calculation E =(C – D)
1	Area under mining		12.340	1.300	13 64	0.000	13.64
2	Storage for top soil		0.000	0.000	0.000	0.000	0.000
3	Waste dump site		3.701	0.930	4.631	0.000	4.631
4	Mineral storage		1.160	1.366	2.516	0.000	3.028
5	Infrastructure – WS, Admn Bldg		1.800	0.494	2.294	0.000	2.294
	Magazine		0.247	(-0.247)*	000	0.000	000
6	Roads		1.658	0.100	1.758	0.000	1.758
7	Railways		0.000	0.000	0.000	0.000	0.000
8	Tailing pond		0.000	0.000	0.000	0.000	0.000
9	Effluent Treatment Plant		0.000	0.000	0.000	0.000	0.000
10	Mineral Separation Plant		0.500	0.400	0.900	0.000	0.900
11	Township area		0.000	0.000	0 000	0.000	0.000
12		Retaining wall, garland drain, settling pond etc.	0.164	000	0.164	0.000	0.164
	Others	(safety zone area, plantation unused area etc.	2.494	0.00	2.494	0.000	2.494
	Sub - Total		24.064	4.343	28.397	0.000	28.397

अनुमोदित
APPROVED

क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIN BUREAU OF MINES
भुवनेश्वर/BHUBANESWAR

Pradeept Mohapatra
Qualified Person

As per Mineral Conservation and Development (Amendment) Rules – 2017 under Rule 27(1) the lessee will have to provide financial assurance of Rs.300000.00 per hectare for the area utilized since the area falls in A-Category mine. Financial assurance as per above calculation for 28.397 Ha @ Rs 300000/- comes to Rs. 8519100/- (Eighty Five lakhs Nineteen thousands and one hundreds only). However, the lessee has already submitted the Bank guarantee of same amount which is valid up to 31.03.2021. (The copy of the earlier bank guarantee is enclosed as **Annexure-18**).

9.0 Certificate and Undertaking

This is to certify that the Progressive Mine Closure Plan of **Patabeda Iron ore Mines** shall comply all statutory rules, regulations, orders made by the State or Central Government, Statutory organizations, court etc. Wherever any specific permission is required, the lessee will approach the concerned authorities. The lessee also undertakes to the effect that all the measures proposed in this closure plan will be implemented in a time bound manner.

10.0 Plans & Sections

This Progressive Mine Closure Plan is submitted as per the Rule 23 under MCDR 2017. Plans and sections for this plan have been referred to that of Mining Scheme, which is being submitted simultaneously for approval.

Pradeept Mohapatra
Qualified Person

CONSENT LETTER / UNDERTAKING / CERTIFICATE FROM THE LESSEE

01. The **Modification and Review of the Mining Plan** in respect of **Patabeda Iron ore Mine of M/s. MGM Minerals Limited over an area of 28.397 hectares** in Patabeda village, Sundargarh Distnct, of Odisha has been prepared under **Rule 17(3) of MCR 2016** by Qualified persons; Shri Pradeept Mohapatra, MSc (Geology) having relevant professional experiences of more than five years of working in a supervisory capacity in the field of mining after obtaining the Degree as per Rule 15 of MCR, 2016.

This is to request the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar to make any further correspondence regarding any correction of the Modification and Review of the Mining Plan with the said recognized person at his address below:

Sri Pradeept Mohapatra
At- Unchabali, Po- Barnebari,
Via- Joda, Dist-Keonjhar, Odisha
E mail: pmohapatra_07@yahoo.com
Mobile No. - +919438149715

We hereby undertake that all modifications / updating as made in the Modification and Review of the 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's Circular No.-2/2010** will be implemented and complied with when an authorized agency is approved by the State Government.

REGD. & CORPORATE OFFICE : 5A, FOREST PARK, BHUBANESWAR - 751 009, INDIA, PHONE : +91-674-2596400/410, FAX : +91-674-2596390
BRANCH OFFICE : AT/PO. : BARBIL, DISTRICT : KEONJHAR, ORISSA - 758 035, INDIA, PHONE : 91-6767-275318, FAX : +91-6767-275770
CIN-U72101OR1996PLC004413 E-mail : mgmbbsr@gmail.com

03. It is certified that the Progressive Mine Closure Plan of **Patabeda Iron Ore Mine of MGM Minerals Limited over an area of 28.397 Ha** 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 applicant will approach the concerned authorities.

    The information furnished in the Progressive Mine Closure Plan is true and correct to the best of my knowledge and records.

04. The provisions of Mines Act, Rules and Regulations made there under have been observed in the Modification and Review of the Mining Plan over an area of **28.397 Ha in** Sundargarh district of Odisha State belonging to **Patabeda Iron ore Mine** and where specific permissions are required, the Lessee will approach the DGMS. Further, standards prescribed by DGMS in respect of miners' health will be strictly implemented.

05. I do hereby undertake to complete the exploration within **Patabeda Iron Ore Mine of MGM Minerals Limited over an area of 28.397 Ha** as proposed in the Modification and Review of the Mining Plan in a time bound manner.

Sadasa Sekhar Mohanty

Place : Bhubaneswar
Date : 13.11.2017

Mining Lessee
MGM Minerals Limited

UNDERTAKING

Regarding deemed extension of the lease under section 8 of MM (D&R) Amendment Act 2015 in respect of Patabeda Iron ore Mine belonging to M/s MGM Minerals Ltd over an area of 28.397Ha in village Patabeda under Koira Tahasil of Sundergarh district, Odisha

We hereby undertake that we will approach to the State Government for extension of the Mining Lease on or before 07.03.2025 i.e. one year before expiry of the original lease deed and fulfil all the necessary requirement for execution of supplementary lease deed in favor of M/s MGM Minerals Ltd under section 8 of MM (D&R) Amendment Act 2015.

Place: Bhubaneswar
Date: 13.11.2017

For MGM Minerals Limited

Padma Lochan Mohanty

(Padma Lochan Mohanty)
Managing Director

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