Proposal for Khandadhar Sub Block - E over an area of 8.797 Sq. Km in Sundargarh District, Odisha for Preliminary Exploration (G3 - Stage) under NMET

(Basemetals/ Ferrous/ Non-Ferrous/ Industrial/ Strategic & Critical/ Precious metals etc.)

By

Odisha Mining Corporation Limited
A Gold Category State PSU

Place : Bhubaneswar
Date : 22.09.2023

SUMMARY OF THE BLOCK FOR PRELIMINARY EXPLORATION (G3 STAGE)

Features	**Details**
Block ID	Khandadhar Sub Block - E (8.797 Sq. Km)
Exploration Agency	Odisha Mining Corporation Limited (OMC Ltd.), Bhubaneswar, Odisha
Previous Exploration Agency	Reconnaissance survey (G4) was conducted by OMC Ltd. (Erstwhile OMECL)
Commodity	Iron Ore
Mineral Belt	Bonai - Keonjhar belt of Sundargarh & Keonjhar Districts, Odisha
Completion Period with entire Time schedule to complete the project	15 months
Objectives	Objectives of the Preliminary Exploration (G3) over an area of 8.797 Sq. Km are as follows: 1. Geological mapping in 1:5000 scale and demarcating the rock types of Iron bearing formations with the structural features i.e. strike, dip, lineation/foliation, etc. 2. Core drilling of 6020 m with 86 nos. of borehole (70m each) to decipher the sub-surficial occurrences and their vertical depth. 3. Chemical Analysis of core samples and surface samples 4. Existence of Iron ore body and estimation of tonnage, grade and mineral content in G3 level as per UNFC guidelines & Minerals (Evidence of Mineral Contents) Amendment Rules, 2021.
Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	The Core drilling work, Survey, Sampling and Laboratory work will be carried out through out-source agency. Geological Mapping, Logging, and Report preparation will be carried out by OMC Ltd.
Name/ Number of Geoscientists	OMC Ltd. Geologists
Expected Field days (Geology) Geological Party Days	11 months (330 days)

1.	**Location**	
	Latitude	21°46'53.89899"N to 21°48'27.24200"N
	Longitude	85°10'13.38300"E to 85°12'17.95902"E
	Villages	Batagaon, Lashi, Kensara, Bhutula & Raisuan
	Tehsil/ Taluka	Lahunipada
	District	Sundargarh
	State	Odisha
2.	**Area (hectares/ square kilometres)**	
	Block Area	8.797 Sq.Km/ 879.731Ha
	Forest Area	879.502 Ha
	Non – Forest Area	0.229 Ha
3.	**Accessibility**	
	Nearest Rail Head	Barsuan railway station
	Road	Connected to NH 520 at Lahunipada through a state highway
	Airport	Rourkela & Jharsuguda Domestic Airport and Biju Patnaik International Airport, Bhubaneswar
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels) Rivers/ Streams	The regional drainage pattern of the area is dendritic in nature. However, during rainy season water flows along the slope.
5.	**Climate**	
	Mean Annual Rainfall	1200 to 1700 mm, average 1400 mm
	Temperatures (Minimum & Maximum)	The area experiences a humid tropical climate. The month of January is considered as the coldest month in that region when the mercury drops down to 5°C. The warmest month is May with an average temperature of 45°C.
6.	**Topography**	
	Toposheet Number	Toposheet No. F45N1 (73G/1) The block area has been shown on part of the SOI Toposheet No. F45N1 (Annexure – A)
	Morphology of the Area	The area is located along the eastern limb of the horseshoe synclinorium (B – K Belt). The area represents highly rugged topography with dissected hills and “V” shaped valleys. Elevation ranges from 540 to 980 m above mean sea level.
7	**Availability of baseline geoscience data**	

	Geological Map (1:50K/ 25K)	The proposed block is shown in google earth image (Annexure – B). The proposed block is shown in regional map of horseshoe synclinorium belt (Annexure – C) The block is also shown in the geological map (1:12,500) of OMC Ltd. (Erstwhile OMECL) (Annexure-D).
	Geochemical Map	Not Available
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Not Available
8.	**Justification for taking up Preliminary Exploration**	Department of Steel & Mines, Government of Odisha, vide their notification No. 4505/SM, dtd. 05.06.2018, has allotted Khandadhar Sub Block - E to OMC (Erstwhile OMECL) for exploration as per **UNFC** classification. The Khandadhar block (40.46 Sq. Km) which includes the area of Khandadhar Sub Block – E (8.797 Sq. Km) has been explored by OMC in G4 stage in 2022-23. 127.89 MT of iron ore has been estimated in G4 level. 44.40 m has been intercepted by iron ore in two boreholes with a total meterage of 61.50 m drilled in Sub Block – E during G4 exploration. The adjacent blocks Jhumka Pathriposhi (East) (Auctioned block of M/s. Rungta) has an iron ore potential of 140.475 MT, Jhumka Pathriposhi (West) (Explored block of GSI) has an iron ore potential 70.10 MT. In view of this, OMC has proposed the said block for Preliminary Exploration (G3 stage). This will help in planning of further upgrading the level of exploration in order to make the block auctionable.

DETAILED DESCRIPTION

1. Block Summary

1.1. Physiography

The area is located along the eastern limb of the horseshoe synclinorium (B – K Belt). The area represents highly rugged topography with dissected hills and "V" shaped valleys. Elevation ranges from 540 to 980 m above mean sea level. Many small to medium size perennial nalas and streams are present in the region. The drainage pattern is dendritic, flowing down the slope.

1.2. Background Geology (Regional Geology, Geology of the Block)

The Iron Ore Supergroup (IOSG) has three stratigraphic horizons of BIFs (BIF-I, BIF-II, BIF- III) in the space and time, which are structurally, stratigraphically, mineralogically, petrologically, metamorphically and Ore deposit wise different from each other (Acharya,2005). BIF-III, the Horse shoe basin is the youngest of all. It has the best grade and huge sized ore bodies.

Thick piles of volcano-sedimentary rocks geographically bounded by two major granite batholiths, the Bonai granite and Keonjhar granite in the west and east respectively, together known as BK belt. The BK belt is U-shaped, well known as Horse shoe synclinorium. The Bonai-Keonjhar belt (BK belt) consists of two limbs, eastern and western limbs. The Iron formations of eastern limb are mostly restricted to Noamundi, Thakurani, Joda, Jaribahal, Malangtoli, Jilling, Jajang and Gurubeda area. The Iron deposit of western belt covers Kiriburu, Bolani, Kalta Barsuan and the Khandadhar area.

The synclinorium has a general trend of NNE-SSE direction with low plunging amount towardsNNE. The study area is a part of volcaniclastic-terrigenous sedimentary formations with deposits of huge Iron deposits (Annexure – C). The Singhbhum granite and Iron ore group are overlain by metasedimentary and metavolcanics of the Singhbhum, Dhanjori and Kolhan groups. The IOG rocks in BK belt consists of shales as well as tuffaceous shales, BIFs, Volcanics, cherts. The stratigraphy sequence is as follows:

Kolhan Group	Sandstone, Conglomerate Breccia
Unconformity	
Koira Group	Younger (Upper) Shales
Youngest Iron Ore group (BIF III)	Banded Iron Formations
	Older (Lower) Shales
Volcanic Dhanjori Formation	Tuffaceous shale
	Lower basic lava
Basal sandstone, Gritty sandstone, Quartzite	
Unconformity	
Singhbhum Granite with enclaves of metasedimentary and metabasic rocks.	

The lithounits encountered during mapping of the Khandadhar Sub Block – E in G4 level (1:12,500) are iron ore, BHJ, shale, laterite, floats and banded chert. The main iron ore types classified in the area are hard laminated ore, soft laminated ore, hard massive ore, lateritic iron ore and conga ore.

Laminated ore exhibits well developed layering due to alternate iron rich and silica rich bands. This type can be grouped into soft laminated ore (SLO) and hard laminated ore (HLO) depending on its compactness and thickness of silica layer. The HLO exhibits large-scale open folds while tight folds are generally seen in SLO. Massive ore is usually fine grained, dense and compact. It is seen in the topographic highs and show gradational relation with the underlying laminated ore.

BHJ is red / buff in colour and show distinct banding. Often the bands are gradational. The jasper and hematite are similar in thickness. This litho-unit consists of alternating thin laminae / bands of silica (in various forms) and iron minerals. Because of its hardness and relative resistance to erosion, it forms high ridges and attain a maximum thickness.

The Laterite is mostly found above the iron ore and shale horizon. Usually, the top and the slopes of hillocks often with Iron ore/BHJ exposures are covered by laterite mantle. The laterite is hard and massive unconsolidated laterite soil, commonly known as “Morrum” are found in abundant in these areas.

The iron ore outcrop covers an area of around 0.80 Sq. Km approximately having a general trend of NNE to NE with 20° – 30° due NW.

1.3. Mineral potentiality based on geology, geophysics, ground geochemistry etc.

The said block over an area of 8.797 Sq. Km of Lahunipada tahasil in Sundargarh district, is covered by Survey of India, Toposheet No. F45N1 (73G/1). The block area is exposed with weakly metamorphosed volcano-sedimentary sequence. It exposes different lithounits of Iron Ore Group. The main litho assemblages encountered in the area are iron ore, BHJ, shale, laterite, floats and banded chert. The area is generally confined to the eastern limb of the NNE plunging synclinorium of the BK Belt. The general trend is NE-SW with gently dips (20° – 30°) due NW. Varieties of iron ore deposits in the area include friable ore & conga/recemented type ore, lateritic iron ore, hard laminated ore, hard massive ore and soft laminated ore. The shales are mostly ferruginous (red) to variegated with presence of white shale. Lateritization has been observed above the iron ore as well as shale horizon. Around 44.40 m has been intercepted by iron ore in two boreholes with a total meterage of 61.50 m drilled in Sub Block – E during G4 exploration by OMC (Erstwhile OMECL).

The adjacent already explored blocks Jhumka Pathriposhi (East) (Auctioned block of M/s. Rungta) has an iron ore potential of 140.475 MT, Jhumka Pathriposhi (West) (Explored block of GSI) has an iron ore potential 70.10 MT. Hence, possibilities of substantial Iron ore deposits can be anticipated with respect to detail exploration.

1.4. Scope for proposed exploration.

In view of above, there is scope for preliminary exploration (G3 level of exploration) in the block to prove the sub-surficial existence of Iron ore & potentiality of the block.

1.5. Observation and Recommendations of previous work.

The Khandadhar block (40.46 Sq. Km) which includes the area of Khandadhar Sub Block – E (8.797 Sq. Km) has been explored by OMC in G4 stage in 2022-23. It was recommended that, as the block has substantial iron ore potential, it may be upgraded to at least G2 (General Exploration) level of exploration to make it auctionable. G2 level exploration will increase the confidence level in quality and quantity of the resource potential in the block.

2. Previous Work

2.1. Previous Exploration in adjoining area

The adjacent already explored blocks - (i) Jhumka Pathriposhi (East) (Auctioned block of M/s. Rungta) has an iron ore potential of 140.475 MT and was explored by MECL & GSI at G2 level and (ii) Jhumka Pathriposhi (West) has an iron ore potential 70.10 MT and was explored by GSI at G2 level.

2.2. Previous exploration in the proposed Block

The Khandadhar Block as a whole comprising of six sub-blocks (Khandadhar Sub Block – A, B, C, D, E & G) over an area of 40.46 Sq. Km has been explored in G4 stage under the funding of National Mineral Exploration trust (NMET) in 2022 – 23 (Annexure – D). A total of 08 nos. of vertical boreholes with a total meterage of 510.50 m have been drilled to estimate the resource potential in the G4-Stage of exploration. Out of 08 boreholes, 02 boreholes have been drilled in Sub Block – E. Around 44.40 m has been intercepted by iron ore in these 02 boreholes with a total meterage of 61.50 m drilled in Sub Block - E. The total resource potential estimated in Khandadhar Block (40.46 sq.km) is of 127.89 MT for iron ore with an average Fe content of 59.47%. For bauxite, the resource potential estimated is 8.57 MT with an average Al_2O_3 content of 49.99% and average SiO_2 content of 4.82%. Against the manganese ore, the resource potential estimated is 3.58 MT with an average Mn content of 22.74%. Only iron ore has been intercepted during the G4 exploration in Sub Block – E.

3. Block description

Block Boundary Co-ordinates of Khandadhar Sub Block-E, Sundargarh Dist., Odisha			
Sl. No.	**Pillar ID**	**Longitude**	**Latitude**
1	E-1	85°12'17.95902"	21°46'57.03500"
2	E-2	85°11'59.03501"	21°46'56.86502"
3	E-3	85°10'13.59203"	21°46'53.89899"
4	E-4	85°10'13.38300"	21°48'06.35801"
5	E-5	85°10'18.08700"	21°48'25.78900"
6	E-6	85°12'16.97304"	21°48'27.24200"
7	E-7	85°12'17.11393"	21°48'14.36152"
8	E-8	85°11'30.22533"	21°47'41.12137"
9	E-9	85°11'38.07748"	21°47'30.76819"
10	E-10	85°11'41.85653"	21°47'29.79116"
11	E-11	85°11'43.92056"	21°47'30.12715"
12	E-12	85°11'44.56360"	21°47'34.58315"

13	E-13	85°11'47.68964"	21°47'34.42113"
14	E-14	85°11'48.34166"	21°47'35.49312"
15	E-15	85°11'49.37967"	21°47'35.42012"
16	E-16	85°11'51.98272"	21°47'36.31310"
17	E-17	85°12'01.69286"	21°47'36.64504"
18	E-18	85°12'03.53489"	21°47'37.39803"
19	E-19	85°12'05.75290"	21°47'35.15601"
20	E-20	85°12'07.22393"	21°47'36.26400"
21	E-21	85°12'09.71837"	21°47'33.62610"
22	E-22	85°12'14.09951"	21°47'33.15759"
23	E-23	85°12'16.04504"	21°47'34.07094"
24	E-24	85°12'15.32238"	21°47'35.37988"
25	E-25	85°12'16.72828"	21°47'35.51620"
26	E-26	85°12'17.55144"	21°47'34.42631"
27	E-27	85°11'26.44799"	21°47'23.55000"
28	E-28	85°11'24.00900"	21°47'29.99203"
29	E-29	85°11'09.77302"	21°47'22.75699"
30	E-30	85°11'09.35702"	21°47'15.86900"
31	E-31	85°11'31.90198"	21°47'17.62203"

4. Planned Methodology

4.1. In accordance to the objectives set for preliminary exploration (G3 level of exploration) in Khandadhar Sub Block - E, Sundargarh district, Odisha, geological mapping in 1:5000 scale, core drilling, core sampling, chemical studies, petrological and mineralogical studies are proposed in the block. The exploration will be carried out as per Minerals (Evidence of Mineral contents) Amendment Rules-2021 Accordingly, the details of different activities to be carried out are presented in subsequent paragraphs.

4.2. Topographic Surveying

Topography survey will be carried in the area (8.797 Sq. Km) and all the surface features will be marked in the 1:5000 scale plans. The block boundary will be surveyed by DGPS / total station in WGS-84 Datum and demarcation of the boundary pillars to enable the block auctionable. The reduced level and coordinate of the boreholes would be surveyed by DGPS/ total station.

4.3. Geological Mapping

Geological mapping on 1:5000 scale in the area (8.797 Sq. Km) will be carried out by taking geological traverses. The contacts of different formations, surficial lithology, structural features, etc. will be noted in detail. The geological map on 1:5000 scale will be generated based on the details gathered during the field visit.

4.4. Core Drilling

Based on the outcome of the geological mapping, **86 nos. of boreholes** of **6020 mtrs (70m each)** depth of core drilling is being proposed over the area 8.797 Sq. Km to intersect the mineralized zone. The map showing the borehole proposal is attached as Annexure – E. This will

upgrade the block to G3 level.

4.5. Core Logging

The drill cores would be logged systematically viz. details of lithounits, colour, structural feature, texture, mineralization, beside the recovery, rock quality designation and Iron & Manganese ore type would be recorded.

4.6. Core Sampling

The drill core will be split into two equal halves and one part would be preserved in the core box. The other half will be powdered to -100/-200 mesh size and the same would be divided into four parts (50gm each) through coning and quartering. One part of 50 gm sample will be sent to chemical laboratory for analysis, second part to be preserved in the camp as duplicate sample, third part to be utilized for preparing composite sample for individual ore band and the fourth part would kept as either check sample or sample to be used for any other specific purpose.

The length of each sample will be kept 0.50 m-1.0m depending upon the width of particular types of ore and its physical character. The primary core samples will be analyzed for five radicals i.e., Fe%, Al_2O_3%, SiO_2%, P%, & S% and LOI.

The mineralized zone including the cores of immediate footwall and hanging wall rocks (5 mtr. length each) would be sampled at 1.0 m interval, as far as possible depending upon the intensity of mineralization, change in litho logs and core recovery etc. It is envisaged that:

a) Around 4214 nos. of primary samples would be generated from the bore hole and 30 nos. of surface samples. Around 10% of primary samples will be checked and will be called as check samples.

b) Composite samples would be prepared from different mineralized zones of primary drill samples from the borehole. As proposed, 200 nos. of composite samples would be generated and will be analyzed for complete chemical analysis.

c) 50 nos. of samples would be analyzed by X-ray diffraction (XRD) to ascertain the presence of any uncommon minerals.

d) 20 nos. of samples would be analyzed for trace elements and REE by ICPMS.

4.7. Petrographic & Mineralographic Studies

Thin and polished section studies of the out-crop samples and the core samples will be studied for detailed petrographic and mineralographic characteristics. These samples will be drawn from ore zones and associated rocks. A provision of 25 nos. specimens for petrographic and 25 nos. specimens for mineralographic studies has been kept for the proposed area.

4.8. Bulk Density Determination

In addition, bulk density determination of 30 nos. of samples will be carried out for the proposed block.

5. Nature Quantum and Target

The proposed quantum of work for the Block for G3 stage of exploration over an area of 8.797 Sq. Km in Sundargarh district is as below.

Quantum of Work for Khandadhar Sub Block - E (8.797 sq.km)			
Sl No.	**Item of work**	**Unit**	**Quantity**
A	**Detailed Geological Mapping**		
1	In 1:5000 Scale	Sq. Km	8.797
B	**Survey Work**		
1	Demarcation of lease boundary, Fixation of Borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS	Per point of observation	31
2	Topographic Survey and surface contouring	Sq. Km	8.797
C	**Drilling**		
1	Core drilling	m	6020
2	Borehole Pillaring (12"x12"x30")	Nos.	86
D	**Chemical Analysis**		
i)	***Primary Samples*** (Surface Samples + Core Samples + Check Samples)		
1	Samples preparation	Nos.	4664
2	Chemical analysis for seven radicals (Fe%, Al_2O_3%, SiO_2%, P%, S%, Insolubles & LOI)	Nos.	4664
ii)	***Composite samples***		
1	Sample preparation	Nos.	200
2	Chemical analysis for seven radicals (Fe%, SiO_2%, Al_2O_3%, P%, S%, Insolubles & LOI)	Nos.	200
E	**Physical Analysis**		
1	Preparation of standard thin section of rock	Nos.	25
2	Complete Petrographic Studies	Nos.	25
3	Preparation of polished thin section of rock/ wafer	Nos.	25
4	Complete Mineralographic Studies	Nos.	25
F	**XRD analysis**	Nos.	50
G	**Analysis of rock sample for determination of a package by 34 elements by ICPMS**	Nos.	20
H	**Bulk Density Determination**	Nos.	30
I	**Report Preparation (as per MEMC Amendment Rule 2021/UNFC)**	Nos.	1

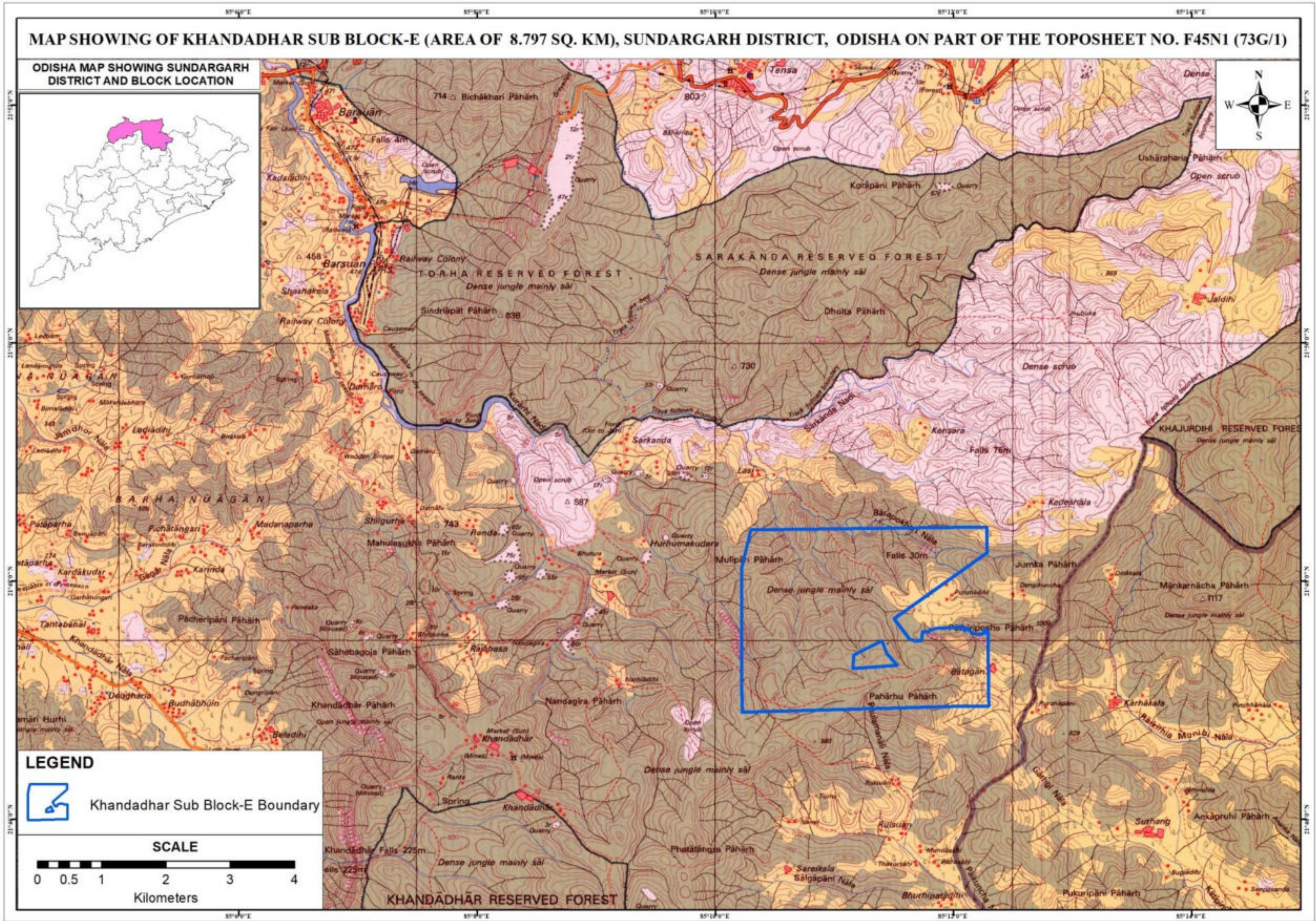
Estimated Cost for Preliminary Exploration (G3 level of exploration) for Iron Ore in Khandadhar Sub Block - E, Sundargarh district, Odisha [Block Area: 8.797 sq.km, Nos. of Borehole: 86 Nos., Borehole Depth Range: 70 mtr, Time Schedule: 15 Months]							
Sl No.	**Item of work**	**Unit**	**Rate as per NMET SOC 2020-21**		**Estimated cost of proposal**		**Remarks**
			SOC item Sl. No.	**Rate as per SOC in Rs.**	**Quantum of Work**	**Total Amount (in Rs.)**	
A	**Geological Work**						
	Charges for one Geologist per day at Field	Per day	1.3	11,000	330	36,30,000.00	
	Charges for one Geologist per day at HQ	Per day	1.3	9,000	120	10,80,000.00	
	Labour (2 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	660	3,64,980.00	Amount will be reimbursed as per the notified rates by the Central Labour Commission rates or respective State Govt. whichever is higher.
	Charges for one Surveyor per day (Topography Survey)	Per day	1.6.1a	8,300	120	9,96,000.00	
	Labour (2 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	480	2,65,440.00	Amount will be reimbursed as per the notified rates by the Central Labour Commission rates or respective State Govt. whichever is higher.
	Charges for One Sampler per day	Per day	1.5.2	5,100	30	1,53,000.00	
	Labour (4 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	120	66,360.00	Amount will be reimbursed as per the notified rates by the Central Labour Commission rates or respective State Govt. whichever is higher.
	Demarcation of lease boundary, Fixation of Borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS	Per point of observation	1.6.2	19,200	31	5,95,200.00	31 Boundary Pillar
					Sub - Total - A	**71,50,980.00**	

B	**Drilling Work (Out Source)**						
	Drilling - Hard rock	Per m	2.2.1. 4a	11,500	6020	6,92,30,000.00	Reimbursement of Outsource component will be made as per Para 3 of NMET-SOC
	Land/Crop compensation	Per Borehole	5.6	20,000	0	0.00	As per actuals as certified by local authorities subject to a maximum of 20,000 per bore hole
	Drill core preservation	per m	5.3	1,590	3010	47,85,900.00	
					Sub- Total - B	**7,40,15,900.00**	
C	**Laboratory Studies (Out Source)**						
i	**Chemical Analysis**						
	Primary Samples (Surface Samples + Core Samples + Check Samples)						
	Chemical analysis for seven radicals (Fe%, Al_2O_3%, SiO_2%, P%, S%, Insolubles & LOI)	per Nos.	4.1.15 a & b	4,200	4664	1,95,88,800.00	30 nos. Surface samples, 4214 nos. Core samples (70%), 420 nos. check samples)
	Composite samples						
	Chemical analysis for seven radicals (Fe%, SiO_2%, Al_2O_3%, P%, S%, Insolubles & LOI)	per Nos.	4.1.15 a & b	4,200	200	8,40,000.00	
ii	**Physical Analysis**						
	Preparation of standard thin section of rock	per Nos.	4.3.1	2,353	25	58,825.00	
	Complete Petrographic Studies	per Nos.	4.3.4	4,232	25	1,05,800.00	
	Preparation of polished thin section of rock/ wafer	per Nos.	4.3.2	1,549	25	38,725.00	
	Complete Minerographic Studies	per Nos.	4.3.4	4,232	25	1,05,800.00	
iii	**XRD analysis**	per Nos.	4.5.1	4,000	50	2,00,000.00	
iv	**Analysis of rock sample for determination of a package by 34 elements by ICPMS**	per Nos.	4.1.14	7,731	20	1,54,620.00	(20 Trace elements + 14 REE)

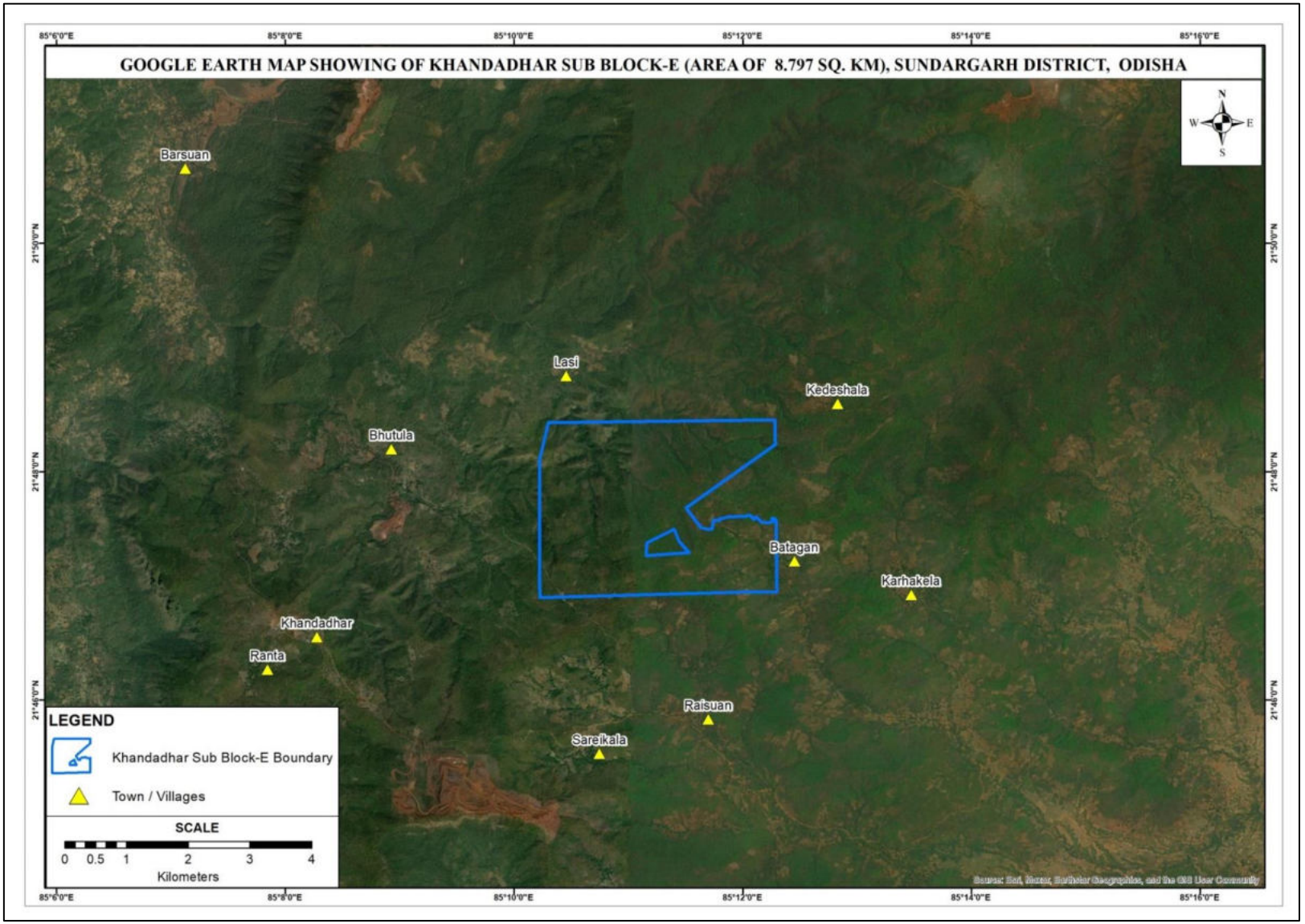
v	**Bulk Density Determination**	per Nos.	4.10	3,540	30	1,06,200.00	
					Sub - Total - C	**2,11,98,770.00**	
D					**Sub - Total - D (A+B+C)**	**10,23,65,650.00**	
E	Preparation of Exploration Proposal	One Number (5 Hard copies) along with soft copy	5.1	2% of approved project cost or 3.8 lakh whichever is lower		3,80,000.00	
F	Geological Report Preparation	Cost per 5 Hard copies of report along with soft copy	5.2	**Project exceeding ₹300 lakh:** Minimum of ₹9 Lakh or 3% of the work which ever is more subject to maximum of ₹20 Lakh and ₹10,000/ each additional copy.		20,00,000.00	
G	Tendering Process Cost	One time, in case of outsourced component	2.3	2% of the approved project cost or 5 Lakh whichever is lower will be paid one time to EA		5,00,000.00	
H	Operational Charges		6.0 iii	In case of total outsourced cost more than ₹ 1 Crore		15,00,000.00	Reimbursement of cost in case of outsource components of Project Work
I	Peer Review		As per EC decision			30,000.00	
J					Total Estimated cost without GST (18%) (D+E+F+G+H+I)	10,67,75,650.00	
K					GST (18%)	1,92,19,617.00	
L					**Grand Total (J+K)**	**12,59,95,267.00**	

Time Schedule for Preliminary Exploration of Khandadhar Sub Block - E (8.797 sq. km) in Sundargarh district																		
Sl. No.	**Activities**	**Unit**	**Months**															**Quantity**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**9**	**10**	**11**	**12**	**13**	**14**	**15**	
1	Geological Mapping	Sq.Km																8.797
2	Geologist party days	day																330
3	Survey party days	day																120
4	Surface Drilling	m																6020
5	Sampling party days/ core sampling	day																30
6	Laboratory Studies	Nos.																5064
7	Geologist party days (HQ)	day																120
8	Geological Report Writing and Peer review	day																120
Note 1: Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearance																		
2. Timeloss on account of monsoon/ agriculture activity/ forest clearance/ local law & order problem/ lockdown etc. will be additional to above timeline.																		

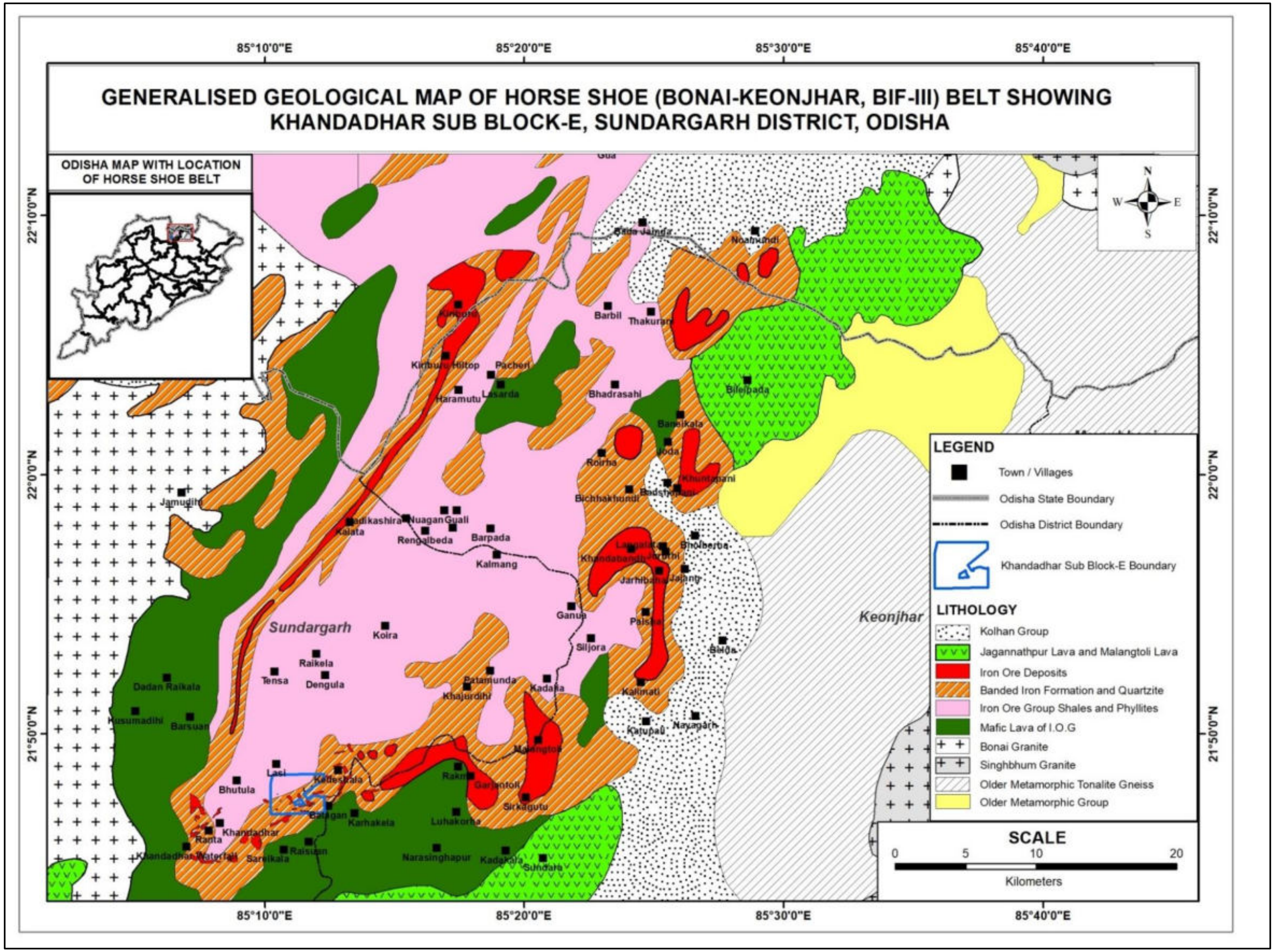
ANNEXURE – A


MAP SHOWING OF KHANDADHAR SUB BLOCK-E (AREA OF 8.797 SQ. KM), SUNDARGARH DISTRICT, ODISHA ON PART OF THE TOPOSHEET NO. F45N1 (73G/1)
ODISHA MAP SHOWING SUNDARGARH DISTRICT AND BLOCK LOCATION
N
W
E
S
TORHA RESERVED FOREST
SARAKANDA RESERVED FOREST
KHAJURDIHI RESERVED FOREST
KHANDADHAR RESERVED FOREST
BARHA NUAGAN
Dense jungle mainly sal
Barsuan
Tensa
Sarkanda
Khandadhar
Falls 30m
Pahärhu Pähärh
LEGEND
Khandadhar Sub Block-E Boundary
SCALE
0 0.5 1 2 3 4
Kilometers

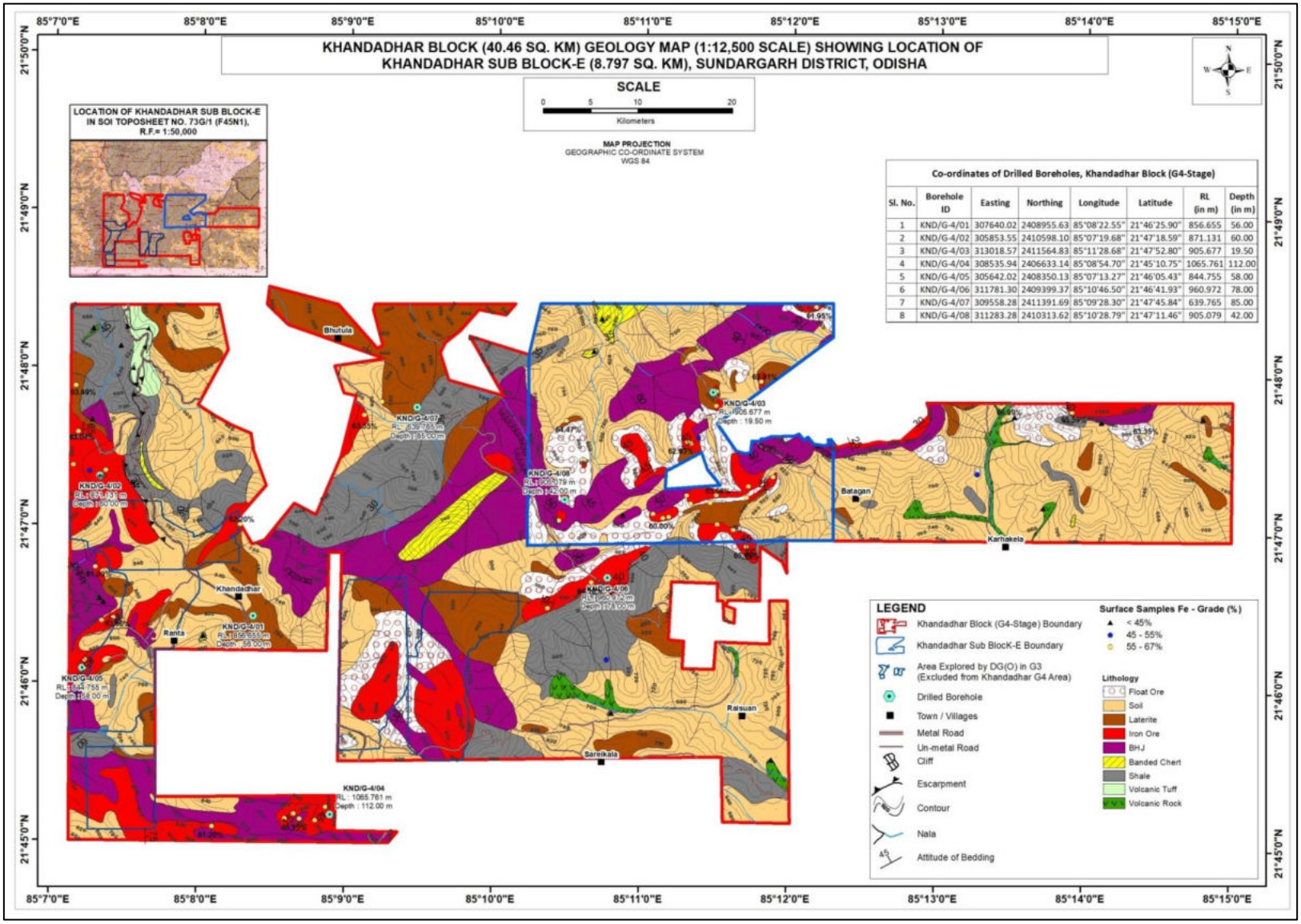
ANNEXURE – B


GOOGLE EARTH MAP SHOWING OF KHANDADHAR SUB BLOCK-E (AREA OF 8.797 SQ. KM), SUNDARGARH DISTRICT, ODISHA
85°6'0"E
85°8'0"E
85°10'0"E
85°12'0"E
85°14'0"E
85°16'0"E
21°50'0"N
21°48'0"N
21°46'0"N
N
W
E
S
Barsuan
Lasi
Kedeshala
Bhutula
Batagan
Karhakela
Khandadhar
Ranta
Raisuan
Sareikala
LEGEND
Khandadhar Sub Block-E Boundary
Town / Villages
SCALE
0 0.5 1 2 3 4
Kilometers

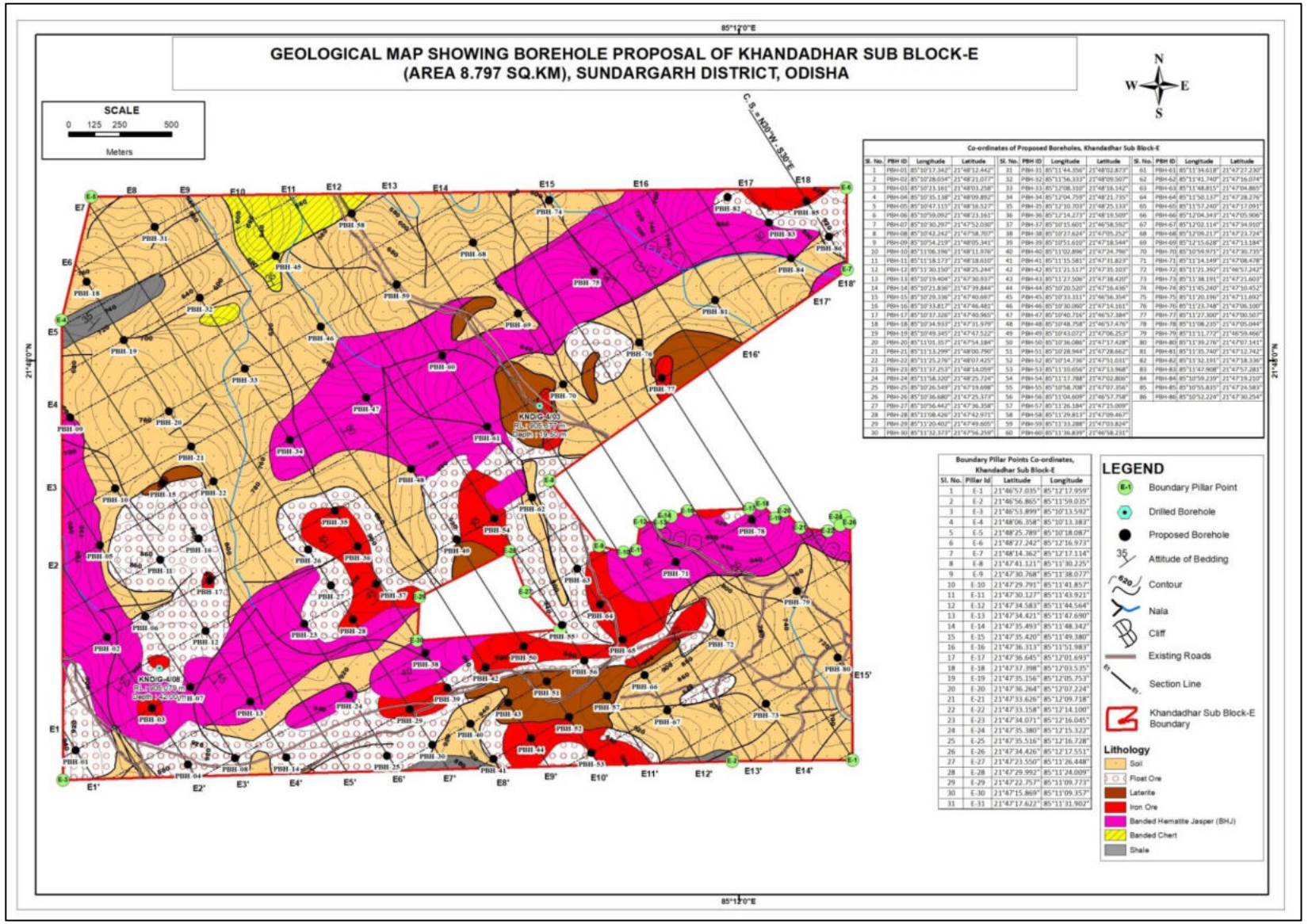
ANNEXURE – C


GENERALISED GEOLOGICAL MAP OF HORSE SHOE (BONAI-KEONJHAR, BIF-III) BELT SHOWING KHANDADHAR SUB BLOCK-E, SUNDARGARH DISTRICT, ODISHA
ODISHA MAP WITH LOCATION OF HORSE SHOE BELT
85°10'0"E
85°20'0"E
85°30'0"E
85°40'0"E
22°10'0"N
22°0'0"N
21°50'0"N
N
S
E
W
Sundargarh
Keonjhar
Barbil
Thakurani
Kiriburu Hilltop
Pacheri
Haramutu
Lasarda
Bhadrasahi
Bileipada
Roirha
Bichhakhundi
Jamudihi
Kalata
Nuagan
Guali
Rengalbeda
Barpada
Kalmang
Ganua
Koira
Siljora
Raikela
Tensa
Dengula
Dadan Raikala
Patamunda
Khajurdihi
Kadalia
Kalimati
Kusumadihi
Barsuan
Katupali
Nayagarh
Malangtoli
Lasi
Bhutula
Rakma
Sirkagutu
Karhakela
Luhakorha
Khandadhar
Ranta
Khandadhar Waterfall
Sareikala
Raisuan
Narasinghapur
Kadakala
Sundara
LEGEND
Town / Villages
Odisha State Boundary
Odisha District Boundary
Khandadhar Sub Block-E Boundary
LITHOLOGY
Kolhan Group
Jagannathpur Lava and Malangtoli Lava
Iron Ore Deposits
Banded Iron Formation and Quartzite
Iron Ore Group Shales and Phyllites
Mafic Lava of I.O.G
Bonai Granite
Singhbhum Granite
Older Metamorphic Tonalite Gneiss
Older Metamorphic Group
SCALE
0
5
10
20
Kilometers

ANNEXURE – D


KHANDADHAR BLOCK (40.46 SQ. KM) GEOLOGY MAP (1:12,500 SCALE) SHOWING LOCATION OF KHANDADHAR SUB BLOCK-E (8.797 SQ. KM), SUNDARGARH DISTRICT, ODISHA
SCALE
0 5 10 20
Kilometers
MAP PROJECTION
GEOGRAPHIC CO-ORDINATE SYSTEM
WGS 84
LOCATION OF KHANDADHAR SUB BLOCK-E IN SOI TOPOSHEET NO. 73G/1 (F45N1), R.F.= 1:50,000
Co-ordinates of Drilled Boreholes, Khandadhar Block (G4-Stage)
Sl. No. | Borehole ID | Easting | Northing | Longitude | Latitude | RL (in m) | Depth (in m)
1 | KND/G-4/01 | 307640.02 | 2408955.63 | 85°08'22.55" | 21°46'25.90" | 856.655 | 56.00
2 | KND/G-4/02 | 305853.55 | 2410598.10 | 85°07'19.68" | 21°47'18.59" | 871.131 | 60.00
3 | KND/G-4/03 | 313018.57 | 2411564.83 | 85°11'28.68" | 21°47'52.80" | 905.677 | 19.50
4 | KND/G-4/04 | 308535.94 | 2406633.14 | 85°08'54.70" | 21°45'10.75" | 1065.761 | 112.00
5 | KND/G-4/05 | 305642.02 | 2408350.13 | 85°07'13.27" | 21°46'05.43" | 844.755 | 58.00
6 | KND/G-4/06 | 311781.30 | 2409399.37 | 85°10'46.50" | 21°46'41.93" | 960.972 | 78.00
7 | KND/G-4/07 | 309558.28 | 2411391.69 | 85°09'28.30" | 21°47'45.84" | 639.765 | 85.00
8 | KND/G-4/08 | 311283.28 | 2410313.62 | 85°10'28.79" | 21°47'11.46" | 905.079 | 42.00
Bhutula
Khandadhar
Ranta
Batagan
Karhakela
Ralsuan
Sareikala
LEGEND
Khandadhar Block (G4-Stage) Boundary
Khandadhar Sub BlocK-E Boundary
Area Explored by DG(O) in G3 (Excluded from Khandadhar G4 Area)
Drilled Borehole
Town / Villages
Metal Road
Un-metal Road
Cliff
Escarpment
Contour
Nala
Attitude of Bedding
Surface Samples Fe - Grade (%)
< 45%
45 - 55%
55 - 67%
Lithology
Float Ore
Soil
Laterite
Iron Ore
BHJ
Banded Chert
Shale
Volcanic Tuff
Volcanic Rock
85°7'0"E
85°8'0"E
85°9'0"E
85°10'0"E
85°11'0"E
85°12'0"E
85°13'0"E
85°14'0"E
85°15'0"E
21°50'0"N
21°49'0"N
21°48'0"N
21°47'0"N
21°46'0"N
21°45'0"N

ANNEXURE – E



Co-ordinates of Proposed Boreholes, Khandadhar Sub Block-E

Sl. No.	PBH ID	Longitude	Latitude	Sl. No.	PBH ID	Longitude	Latitude	Sl. No.	PBH ID	Longitude	Latitude
1	PBH-01	85°10'17.342"	21°48'12.442"	31	PBH-31	85°11'44.356"	21°48'02.873"	61	PBH-61	85°11'34.618"	21°47'27.230"
2	PBH-02	85°10'28.034"	21°48'21.077"	32	PBH-32	85°11'56.333"	21°48'09.507"	62	PBH-62	85°11'41.740"	21°47'16.074"
3	PBH-03	85°10'23.165"	21°48'03.258"	33	PBH-33	85°12'08.338"	21°48'16.162"	63	PBH-63	85°11'48.815"	21°47'04.885"
4	PBH-04	85°10'35.138"	21°48'09.892"	34	PBH-34	85°12'04.759"	21°48'21.735"	64	PBH-64	85°11'50.137"	21°47'28.276"
5	PBH-05	85°10'47.115"	21°48'16.527"	35	PBH-35	85°12'10.703"	21°48'25.133"	65	PBH-65	85°11'57.240"	21°47'17.091"
6	PBH-06	85°10'59.092"	21°48'23.161"	36	PBH-36	85°12'14.273"	21°48'19.509"	66	PBH-66	85°12'04.343"	21°47'05.906"
7	PBH-07	85°10'30.297"	21°47'52.030"	37	PBH-37	85°10'15.601"	21°46'58.592"	67	PBH-67	85°12'02.114"	21°47'34.910"
8	PBH-08	85°10'42.242"	21°47'58.703"	38	PBH-38	85°10'27.624"	21°47'05.252"	68	PBH-68	85°12'09.217"	21°47'23.724"
9	PBH-09	85°10'54.219"	21°48'05.341"	39	PBH-39	85°10'51.610"	21°47'18.544"	69	PBH-69	85°12'15.628"	21°47'13.184"
10	PBH-10	85°11'06.196"	21°48'11.976"	40	PBH-40	85°11'02.896"	21°47'24.796"	70	PBH-70	85°10'59.973"	21°47'30.735"
11	PBH-11	85°11'18.173"	21°48'18.610"	41	PBH-41	85°11'15.581"	21°47'31.823"	71	PBH-71	85°11'14.149"	21°47'08.478"
12	PBH-12	85°11'30.150"	21°48'25.244"	42	PBH-42	85°11'21.517"	21°47'35.103"	72	PBH-72	85°11'21.392"	21°46'57.242"
13	PBH-13	85°10'19.404"	21°47'30.931"	43	PBH-43	85°11'27.506"	21°47'38.420"	73	PBH-73	85°11'38.191"	21°47'21.603"
14	PBH-14	85°10'21.836"	21°47'39.844"	44	PBH-44	85°10'20.520"	21°47'16.436"	74	PBH-74	85°11'45.240"	21°47'10.452"
15	PBH-15	85°10'29.136"	21°47'40.697"	45	PBH-45	85°10'33.331"	21°46'36.354"	75	PBH-75	85°11'20.196"	21°47'11.692"
16	PBH-16	85°10'33.817"	21°47'46.481"	46	PBH-46	85°10'30.060"	21°47'14.161"	76	PBH-76	85°11'23.748"	21°47'06.100"
17	PBH-17	85°10'37.326"	21°47'40.965"	47	PBH-47	85°10'40.716"	21°46'57.384"	77	PBH-77	85°11'27.300"	21°47'00.503"
18	PBH-18	85°10'34.933"	21°47'31.979"	48	PBH-48	85°10'48.758"	21°46'57.476"	78	PBH-78	85°11'08.235"	21°47'05.044"
19	PBH-19	85°10'49.345"	21°47'47.522"	49	PBH-49	85°10'43.072"	21°47'06.253"	79	PBH-79	85°11'11.772"	21°46'59.866"
20	PBH-20	85°11'01.357"	21°47'54.184"	50	PBH-50	85°10'36.086"	21°47'17.428"	80	PBH-80	85°11'39.276"	21°47'07.141"
21	PBH-21	85°11'13.299"	21°48'00.790"	51	PBH-51	85°10'28.944"	21°47'28.662"	81	PBH-81	85°11'35.740"	21°47'12.742"
22	PBH-22	85°11'25.276"	21°48'07.425"	52	PBH-52	85°10'14.736"	21°47'51.031"	82	PBH-82	85°11'32.191"	21°47'18.336"
23	PBH-23	85°11'37.253"	21°48'14.059"	53	PBH-53	85°11'10.656"	21°47'13.968"	83	PBH-83	85°11'47.908"	21°47'57.281"
24	PBH-24	85°11'58.320"	21°48'25.724"	54	PBH-54	85°11'17.788"	21°47'02.808"	84	PBH-84	85°10'59.239"	21°47'19.210"
25	PBH-25	85°10'26.549"	21°47'19.698"	55	PBH-55	85°10'58.708"	21°47'07.356"	85	PBH-85	85°10'55.835"	21°47'24.583"
26	PBH-26	85°10'36.680"	21°47'25.373"	56	PBH-56	85°11'04.609"	21°46'57.758"	86	PBH-86	85°10'52.224"	21°47'30.254"
27	PBH-27	85°10'56.442"	21°47'36.358"	57	PBH-57	85°11'26.184"	21°47'15.009"				
28	PBH-28	85°11'08.426"	21°47'42.971"	58	PBH-58	85°11'29.813"	21°47'09.467"				
29	PBH-29	85°11'20.402"	21°47'49.605"	59	PBH-59	85°11'33.288"	21°47'03.824"				
30	PBH-30	85°11'32.373"	21°47'56.239"	60	PBH-60	85°11'36.839"	21°46'58.231"				

Boundary Pillar Points Co-ordinates, Khandadhar Sub Block-E

Sl. No.	Pillar Id	Latitude	Longitude
1	E-1	21°46'57.035"	85°12'17.959"
2	E-2	21°46'56.865"	85°11'59.035"
3	E-3	21°46'53.899"	85°10'13.592"
4	E-4	21°48'06.358"	85°10'13.383"
5	E-5	21°48'25.789"	85°10'18.087"
6	E-6	21°48'27.242"	85°12'16.973"
7	E-7	21°48'14.362"	85°12'17.114"
8	E-8	21°47'41.121"	85°11'30.225"
9	E-9	21°47'30.768"	85°11'38.077"
10	E-10	21°47'29.791"	85°11'41.857"
11	E-11	21°47'30.127"	85°11'43.921"
12	E-12	21°47'34.583"	85°11'44.564"
13	E-13	21°47'34.421"	85°11'47.690"
14	E-14	21°47'35.493"	85°11'48.342"
15	E-15	21°47'35.420"	85°11'49.380"
16	E-16	21°47'36.313"	85°11'51.983"
17	E-17	21°47'36.645"	85°12'01.693"
18	E-18	21°47'37.398"	85°12'03.535"
19	E-19	21°47'35.156"	85°12'05.753"
20	E-20	21°47'36.264"	85°12'07.224"
21	E-21	21°47'33.626"	85°12'09.718"
22	E-22	21°47'33.158"	85°12'14.100"
23	E-23	21°47'34.071"	85°12'16.045"
24	E-24	21°47'35.380"	85°12'15.322"
25	E-25	21°47'35.516"	85°12'16.728"
26	E-26	21°47'34.426"	85°12'17.551"
27	E-27	21°47'23.550"	85°11'26.448"
28	E-28	21°47'29.992"	85°11'24.009"
29	E-29	21°47'22.757"	85°11'09.773"
30	E-30	21°47'15.869"	85°11'09.357"
31	E-31	21°47'17.622"	85°11'31.902"

Quantum of Work for Khandadhar Sub Block - E (8.797 sq.km)				
Sl No.	**Item of work**	**Unit**	**Quantity**	**Remarks**
A	**Detailed Geological Mapping**			
1	In 1:5000 Scale	Sq.Km	8.797	
B	**Survey Work**			
1	Demarcation of lease boundary, Fixation of Borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS	Per point of observation	31	31 Boundary Pillar
2	Topographic Survey and surface contouring	Sq.Km	8.797	
C	**Drilling**			
1	Core drilling	m	6020	86 Boreholes * 70 m each
2	Borehole Pillaring (12"x12"x30")	Nos.	86	
D	**Chemical Analysis**			
i)	***Primary Samples*** (Surface Samples + Core Samples + Check Samples)			
1	Samples preparation	Nos.	4664	
2	Chemical analysis for nine radicals (Fe%, Al2O3%, SiO2%, Mn%, P%, S%, Insolubles & LOI)	Nos.	4664	30 nos. Surface samples, 4214 nos. Core samples (70%), 420 nos. check
ii)	***Composite samples***			
1	Sample preparation	Nos.	200	
2	Chemical analysis for nine radicals (Fe%, Mn%, SiO2%, Fe2O3%, Al2O3%, P%, S%, Insolubles & LOI)	Nos.	200	
E	**Physical Analysis**			
1	Preparation of standard thin section of rock	Nos.	25	

2	Complete Petrographic Studies	Nos.	25	
3	Preparation of polished thin section of rock/ wafer	Nos.	25	
4	Complete Minerographic Studies	Nos.	25	
F	**XRD analysis**	Nos.	50	
G	**Analysis of rock sample for determination of a package by 34 elements by ICPMS**	Nos.	20	
H	**Bulk Density Determination**	Nos.	30	
I	**Report Preparation (as per MEMC Amendment Rule 2021/UNFC)**	Nos.	1	

Estimated Cost for Preliminary Exploration (G3 level of exploration) for Iron Ore in Khandadhar Sub Block - E, Sundargarh d [Block Area: 8.797 sq.km, Nos. of Borehole: 86 Nos., Borehole Depth Range: 70 mtr, Time Schedule: 15 Months						
Sl No.	**Item of work**	**Unit**	**Rate as per NMET SOC 2020-21**		**Estimated cost of proposal**	
			SOC item Sl. No.	**Rate as per SOC in Rs.**	**Quantum of Work**	**Total Amount (in Rs.)**
A	**Geological Work**					
	Charges for one Geologist per day at Field	Per day	1.3	11,000	330	36,30,000.00
	Charges for one Geologist per day at HQ	Per day	1.3	9,000	120	10,80,000.00
	Labour (2 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	660	3,64,980.00
	Charges for one Surveyor per day (Topography Survey)	Per day	1.6.1a	8,300	120	9,96,000.00
	Labour (2 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	480	2,65,440.00
	Charges for One Sampler per day	Per day	1.5.2	5,100	30	1,53,000.00
	Labour (4 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	120	66,360.00
	Demarcation of lease boundary, Fixation of Borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS	Per point of observation	1.6.2	19,200	31	5,95,200.00
					Sub - Total - A	**71,50,980.00**
B	**Drilling Work (Out Source)**					
	Drilling - Hard rock	Per m	2.2.1.4a	11,500	6020	6,92,30,000.00
	Land/Crop compensation	Per Borehole	5.6	20,000	0	0.00
	Drill core preservation	per m	5.3	1,590	3010	47,85,900.00

					Sub- Total - B	**7,40,15,900.00**
C	**Laboratory Studies (Out Source)**					
i	**Chemical Analysis**					
	Primary Samples (Surface Samples + Core Samples + Check Samples)					
	Chemical analysis for nine radicals (Fe%, Al2O3%, SiO2%, Mn%, P%, S%, Insolubles & LOI)	per Nos.	4.1.15a & b	4,200	4664	1,95,88,800.00
	K2O % & Na2O %					
	Composite samples					
	Chemical analysis for nine radicals (Fe%, Mn%, SiO2%, Fe2O3%, Al2O3%, P%, S%, Insolubles & LOI)	per Nos.	4.1.15a & b	4,200	200	8,40,000.00
ii	**Physical Analysis**					
	Preparation of standard thin section of rock	per Nos.	4.3.1	2,353	25	58,825.00
	Complete Petrographic Studies	per Nos.	4.3.4	4,232	25	1,05,800.00
	Preparation of polished thin section of rock/ wafer	per Nos.	4.3.2	1,549	25	38,725.00
	Complete Minerographic Studies	per Nos.	4.3.4	4,232	25	1,05,800.00
iii	**XRD analysis**	per Nos.	4.5.1	4,000	50	2,00,000.00
iv	**Analysis of rock sample for determination of a package by 34 elements by ICPMS**	per Nos.	4.1.14	7,731	20	1,54,620.00
v	**Bulk Density Determination**	per Nos.	4.10	3,540	30	1,06,200.00
					Sub - Total - C	**2,11,98,770.00**
D					**Sub - Total - D (A+B+C)**	**10,23,65,650.00**
E	Preparation of Exploration Proposal	One Number (5 Hard copies) along with soft copy	5.1	2% of approved project cost or 3.8 lakh whichever is lower		3,80,000.00
F	Geological Report Preparation	Cost per 5 Hard copies of report along with soft copy	5.2	**Project exceeding ₹300 lakh:** Minimum of ₹9 Lakh or 3% of the work which ever is more subject to maximum of ₹20 Lakh and ₹10,000/ each additional copy.		20,00,000.00

G	Tendering Process Cost	One time, in case of outsourced component	2.3	2% of the approved project cost or 5 Lakh whichever is lower will be paid one time to EA		5,00,000.00
H	Operational Charges		6.0 iii	In case of total outsourced cost more than ₹ 1 Crore		15,00,000.00
I	Peer Review		As per EC decision			30,000.00
J	Total Estimated cost without GST (18%) (D+E+F+G+H+I)					10,67,75,650.00
K	GST (18%)					1,92,19,617.00
L	**Grand Total (J+K)**					**12,59,95,267.00**

district, Odisha s]
Remarks
Amount will be reimbursed as per the notified rates by the Central Labour Commission rates or respective State Govt. whichever is higher.
Amount will be reimbursed as per the notified rates by the Central Labour Commission rates or respective State Govt. whichever is higher.
Amount will be reimbursed as per the notified rates by the Central Labour Commission rates or respective State Govt. whichever is higher.
31 Boundary Pillar
Reimbursement of Oursource component will be made as per Para 3 of NMET-SOC
As per actuals as certified by local authorities subject to a maximum of 20,000 per bore hole

30 nos. Surface samples, 4214 nos. Core samples (70%), 420 nos. check samples)
(20 Trace elements + 14 REE)

Reimbursement of cost in case of outsource components of Project Work

Time Schedule for Preliminary Exploration of Khandadhar Sub Block - E (8.797 Sq.Km) in Sundargarh district																		
Sl. No.	Activities	Unit	Months															
			1	2	3	4	5	6	7	8	Review	9	10	11	12	13	14	15
1	Geological Mapping	Sq.Km																
2	Geologist party days	day																
3	Survey party days	day																
4	Surface Drilling	m																
5	Sampling party days/ core sampling	day																
6	Laboratory Studies	Nos.																
7	Geologist party days (HQ)	day																
8	Geological Report Writing and Peer review	day																

Note 1: Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearance

2. Timeloss on account of monsoon/ agriculture activity/ forest clearance/ local law & order problem/ lockdown etc. will be additional to above timeline.

Quantity
8.797
330
120
6020
30
5064
120
120