Proposal for Thakurani Iron Ore Block over an area of 1.399 Sq.Km in Keonjhar District, Odisha for Preliminary Exploration (G3 Stage) under NMET

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

By

Odisha Mineral Exploration Corporation Limited

Place : Bhubaneswar
Date :

SUMMARY OF THE BLOCK FOR PRELIMINARY EXPLORATION (G3 STAGE)

	Features	**Details**
	Block ID	Thakurani Iron Ore Block (1.399 Sq.Km)
	Exploration Agency	Odisha Mineral Exploration Corporation Limited (OMECL), Bhubaneswar, Odisha
	Previous Exploration Agency	Large Scale Mapping was conducted by GSI
	G4 stage Geological Report	Taken over lease of D.R. Patnaik (1.21 Sq.Km)
	Commodity	Iron & Manganese Ore
	Mineral Belt	Bonai-Kendujhar belt of Sundargarh & Keonjhar Districts, Odisha
	Completion Period with entire Time schedule to complete the project	12 months
	Objectives	Objectives of the Preliminary exploration (G3) over an area of 1.399 Sq.Km are as follows: 1. Geological mapping in 1:2000 scale and demarcate the rock types of Iron and Manganese bearing formations with the structural features i.e. strike, dip, lineation/foliation etc. 2. Core drilling of 1600 m with 16 nos. of borehole (100m each) to decipher the subsurficial occurrences and its vertical depth. 3. Chemical Analysis of core samples and surface samples 4. Existence of Iron & Manganese ore body and estimation of tonnage, grade and mineral content in G3 level as per UNFC guideline.
	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, Report writing will be carried out by OMECL.
	Name/ Number of Geoscientists	OMECL Geologists
	Expected Field days (Geology) Geological Party Days	150 days
1.	**Location**	
	Latitude	22°07'41.52040"N to 22°09'04.26533"N
	Longitude	85°25'25.01650"E to 85°26'26.62891"E
	Villages	Karakhendra, Karakolha
	Tehsil/ Taluk	Champua Taluk
	District	Keonjhar
	State	Odisha
2.	**Area (hectares/ square kilometres)**	
	Block Area	1.399 Sq.Km
	Forest Area	1.399 Sq.Km
	Government Land Area	N/A
	Private Land Area	N/A
3.	**Accessibility**	
	Nearest Rail Head	Nearest Rail Head is Barbil
	Road	Easily accessible by using SH 10B via NH 520, 20 & 16.

	Airport	Biju Patnaik International Airport, Bhubaneswar and Birsa Munda Airport, Ranchi
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels) Rivers/ Streams	There is no river of perennial stream in the lease area. 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	During rainy season, the mean annual rainfall is upto 1378 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 12 - 15^{o}C. The warmest month is May with an average temperature of 40^{o}C.
6.	**Topography**	
	Toposheet Number	Topo-sheet No. F45H8 (73 F/8) The Block area has been shown on the SOI Toposheet No. F45H8 (Annexure – A)
	Morphology of the Area	The area is located along the western slope of Thakurani hill. The area represents an undulating topography having the highest altitude of 600m above mean sea level. The block area is devoid of any agricultural or private land.
7	**Availability of baseline geoscience data**	
	Geological Map (1:50K/ 25K)	The proposed block is shown in Google Earth Image (Annexure – B). The block is also shown in Regional Geological Map (1:50000) of GSI (Annexure-C).
	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. 7879 – IV (Misc)SM-136/2018, dtd. 27.09.2021, has allotted Thakurani Iron Ore Block to OMECL for exploration as per **UNFC** classification. The block is a taken over lease of D.R. Patnaik mining lease. And also, the block is adjacent to the Belkundi Fe & Mn Mines of OMDC Ltd. to the west and Thakurani Fe & Mn Mines of BPME Ltd to the south. In view of this, OMECL 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 represents an undulating topography having an altitude ranging from 600m to 480 m above M.S.L. The block is devoid of any perennial nala whereas certain dry channels are observed that carry surface runoffs during raining season. The area is located along the western slope of Thakurani hill. The drainage pattern is dendritic, flow down the slope. The area do not have any agricultural land or private land. Entire area is Forest Land.

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. 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 Sundargarh 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 towards NNE. The study area is a part of volcaniclastic-terrigenous sedimentary formations with deposits of huge Iron & Manganese deposits (Annexure – D). The Singhbhum granite and Iron ore group are overlain by metasedimentary and metavolcanics of the Singhbhum, Dhanjori and Kolhan groups. The IOG rocksin 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 principal Iron Ore formations observed regionally are Hard Laminated Ore, Soft laminated Iron ore, Lateritic Iron Ore, Hard Massive Ore, Iron ore floats and Banded Hematite Jasper (BHJ)/ Banded Hematite Quartzite (BHQ).

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 / bandings 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 manganese-ore bodies in the Bonai-Kendujhar belt (Jamda-Koira valley) are confined to Shale Formation of Precambrian Iron Ore Group. Based on mode of occurrence, these ore bodies can be classified into three types: Stratiform, Stratabound (replacement) and Reworked. In the stratiform (in situ) type of deposits, the manganese ores occur as thin bands/laminae conformable with the country rock. Manganese ore may alternate with shale layers or may display rhythmic layering with chert. They are often co-folded with shale.

The manganese ore belonging to stratabound (remobilized type occur as linear bodies, bound within shale or like a tabular ore body below thick cherty horizon. They are formed due to the remobilization of Mn and other traces from the existing stratiform ore bodies and other Mn-rich rocks and its re-precipitation along structurally weak planes like shear zones/ fault planes or along fractures.

Some manganese ore bodies are formed during a later stage and are termed as reworked deposits. The reworked type of manganese ore bodies are detrital in nature, occur deep below the surface and have limited depth persistency. These are highly ferrous and aluminous, low to sub-grade manganese-rich pebbles found within the lateritic crust of manganese quarries and often extend up to a depth of 10 m from the surface. These are concretionary in nature, and oolitic, spheralitic to nodular in shape. Bog manganese ore (wad) often occurring associated with manganese ore is considered to be a reworked type. In this case groundwater plays a significant role in its formation and deposition due to supergene enrichment. It is black to brownish black in colour and shows dull to earthy lusture. It is very soft, powdery, fine grained (avg. 20µm), soils the hand with black/brownish black reddish-brown streak. The hardness of wad on the mineralogical Moh's scale is 1 3, specific gravity ranging between 2.80 and 3.90 g/cc.

The part of the block is a taken over lease of D.R. Patnaik mining lease. And also, the block is adjacent to the Belkundi Fe & Mn Mines of OMDC Ltd. to the west and Thakurani Fe & Mn Mines of BPME Ltd to the south.

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

The block area over an area of 1.399 Sq.Km in Thakurani Pahar of Champua sub-division in Keonjhar district, is covered by Survey of India Toposheet No. 73 F/8. This area represents a part of western slope of Thakurani range of Bonai – Keonjhar Iron Ore Group. It exposes different lithounits of Iron Ore Group. The main lithoassemblages encountered in the area are different types of shales locating float iron ore deposit and manganese occurrences. Prominent Manganese deposits are however located in the northern part of the area although occurrences have also been noticed in the southern part confined to the shale horizon. The shale exibit NNE – SSW trending bedding planes dipping at an average angle of 20° due both north and south. The shales are mostly pink to variegated with presence of white shale. Lateritization has been observed above the shale horizon. During the field traverses made, outcrops of Iron and Manganese are encountered. Also there are existence of float ores of Iron occurrences in northern part of the block. The near by mining leases undergo mining activities for iron and manganese. Hence, possibilities of Manganese and Iron 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 subsurficial existence of Iron and Manganese Ore & potentiality of the block.

1.5. Observation and Recommendations of previous work.

The block is proposed for Preliminary Exploration (G3 stage of exploration) as per UNFC for Resource.

2. Previous Work

2.1. Previous Exploration in adjoining area

The adjacent mining leases, the Belkundi Fe & Mn Mines of OMDC Ltd. to the west and Thakurani Fe & Mn Mines of BPME Ltd to the south, have been explored and undergo mining activity.

2.2. Previous exploration in the proposed Block

The part area (1.21 Sq.Km) is a taken over lease of D.R. Patnaik mining lease. The area has been covered up under Large scale geological mapping by Geological Survey of India. Afterwards, exploration has been carried out by the lessee . About 12 nos. of trial pits have been executed where occurrences of manganese are located. Drilling activity has not been carried out in the proposed area. Based on old workings and trial pits, mining was proposed to be carried out within an area of 0.15 Sq.Km. The samples from the trial pits have a range from 25 to 32 Mn%. The Mineable reserve estimated as on dt. 01.04.1999 is 167700 Metric Tonne (MT) and after production reserve depleted to 167271.40 MT during the period 1999 – 2004. The Mining lease got expired during the year 2007.

3. Block description

THAKURANI IRON ORE BLOCK PILLAR CO-ORDINATES					
Sl. No.	**Pillar ID**	**Easting**	**Northing**	**Longitude**	**Latitude**
1	1	337441.290	2447859.390	85°25'25.89407"	22°07'41.52040"
2	2	337440.204	2447973.689	85°25'25.81483"	22°07'45.23609"
3	3	337433.743	2448007.848	85°25'25.57701"	22°07'46.34446"
4	4	337418.874	2448122.988	85°25'25.01650"	22°07'50.08286"
5	5	337431.530	2448240.326	85°25'25.41569"	22°07'53.90195"
6	6	337574.305	2448436.771	85°25'30.32693"	22°08'00.33679"
7	7	337688.268	2448516.107	85°25'34.27515"	22°08'02.95448"
8	8	337779.163	2448560.506	85°25'37.43100"	22°08'04.42855"
9	9	337880.929	2448737.221	85°25'40.91851"	22°08'10.20806"
10	10	337999.500	2448950.307	85°25'44.97944"	22°08'17.17567"
11	11	338071.905	2449080.248	85°25'47.45933"	22°08'21.42458"
12	12	338144.786	2449209.206	85°25'49.95626"	22°08'25.64172"
13	13	338228.671	2449360.109	85°25'52.82933"	22°08'30.57596"
14	14	338346.700	2449561.897	85°25'56.87569"	22°08'37.17603"
15	15	338536.337	2449781.345	85°26'03.41491"	22°08'44.37419"
16	16	338573.518	2449824.119	85°26'04.69711"	22°08'45.77731"
17	17	338597.553	2449881.398	85°26'05.51533"	22°08'47.64759"
18	18	338601.557	2449981.476	85°26'05.61910"	22°08'50.90262"
19	19	338596.440	2450087.423	85°26'05.40241"	22°08'54.34543"
20	20	338599.615	2450311.151	85°26'05.43281"	22°09'01.62028"
21	21	338599.080	2450337.650	85°26'05.40460"	22°09'02.48160"
22	22	338596.670	2450392.476	85°26'05.30077"	22°09'04.26330"
23	23	338599.432	2450392.510	85°26'05.39716"	22°09'04.26533"
24	24	338767.566	2450387.355	85°26'11.26699"	22°09'04.15401"
25	25	338885.691	2450389.271	85°26'15.38896"	22°09'04.25580"
26	26	338949.993	2450362.901	85°26'17.64262"	22°09'03.41996"
27	27	339045.825	2450285.501	85°26'21.01498"	22°09'00.93558"
28	28	339141.794	2450209.658	85°26'24.39151"	22°08'58.50185"
29	29	339204.645	2450087.204	85°26'26.62891"	22°08'54.54164"
30	30	338293.949	2448580.700	85°25'55.38800"	22°08'05.25800"
31	31	337995.755	2447852.874	85°25'45.24441"	22°07'41.49508"
32	32	337866.385	2447854.394	85°25'40.72953"	22°07'41.50104"
33	33	337813.550	2447855.014	85°25'38.88561"	22°07'41.50345"
34	34	337686.722	2447856.503	85°25'34.45942"	22°07'41.50920"
35	35	337568.709	2447857.889	85°25'30.34088"	22°07'41.51452"
36	36	337510.761	2447858.569	85°25'28.31852"	22°07'41.51713"

4. Planned Methodology

4.1. In accordance to the objectives set for preliminary exploration (G3 level of exploration) in Thakurani Iron Ore Block, near village Karakhendra & Karakolha, Keonjhar district, Odisha, geological mapping, 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 and Mineral (Auction) Second 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 (1.399 Sq.Km) and all the surface features will be marked in the 1:2000 scale plans. The block boundary will be surveyed by DGPS / total station in WGS-84 Datum for demarcation of Block boundary points to enable the block auctionable. The reduced level and coordinate of the scout borehole would be determined.

4.3. Geological Mapping

Geological mapping on 1:2000 scale in the area (1.399 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 1:2000 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, **16 nos. of boreholes** of **1600 mtrs (100m each)** depth of core drilling is being proposed over the area 1.399 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 borehole cores would be logged systematically viz. details of litho-units, 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 -200 mesh size and the same would be divided into four parts through coning and quartering. One part of 100 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 Manganese ore and its physical character. The primary core samples will be analyzed for nine radicals i.e., Fe%, Mn%, SiO_2%, Fe_2O_3%, P%, Al_2O_3%, S%, Insolubles & 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 960 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 mineralized zones of primary drill samples from the borehole. As proposed, 16 nos. of composite samples would be generated and will be analyzed for complete chemical analysis.

c) 20 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 & Mineragraphic Studies

Thin and polished section studies of the out-crop samples and the core samples will be studied for detailed petrographic and mineragraphic characteristics. These samples will be drawn from ore zones and associated rocks. A provision of 15 nos. specimens for petrographic and 25 nos. specimens for mineragraphic studies has been kept for the proposed area.

4.8. Bulk Density Determination

In addition, bulk density determination of 10 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 1.399 Sq.Km in Keonjhar district is as below.

Quantum of Work for Thakurani Iron Ore Block (1.399 sq.km)			
Sl No.	**Item of work**	**Unit**	**Quantity**
A	**Detailed Geological Mapping**		
1	In 1:2000 Scale	Sq.Km	1.399
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	52
2	Topographic Survey and surface contouring	Sq.Km	1.399
C	**Drilling**		
1	Core drilling	m	1600
2	Borehole Pillaring (12"x12"x30")	Nos.	16
D	**Chemical Analysis**		
i)	***Primary Samples*** (Surface Samples + Core Samples + Check Samples)		
1	Samples preparation	Nos.	1086
2	Chemical analysis for nine radicals (Fe%, Mn%, SiO2%, Fe2O3%, Al2O3%, P%, S%, Insolubles & LOI)	Nos.	1086
ii)	***Composite samples***		
1	Sample preparation	Nos.	16
2	Chemical analysis for nine radicals (Fe%, Mn%, SiO2%, Fe2O3%, Al2O3%, P%, S%, Insolubles & LOI)	Nos.	16
E	**Physical Analysis**		
1	Preparation of standard thin section of rock	Nos.	15
2	Complete Petrographic Studies	Nos.	15
3	Preparation of polished thin section of rock/ wafer	Nos.	25
4	Complete Minerographic Studies	Nos.	25
F	**XRD analysis**	Nos.	20
G	**Analysis of rock sample for determination of a package by 34 elements by ICPMS**	Nos.	20
H	**Bulk Density Determination**	Nos.	10
I	**Report Preparation (as per MEMC Amendment Rule 2021/UNFC)**	Nos.	1

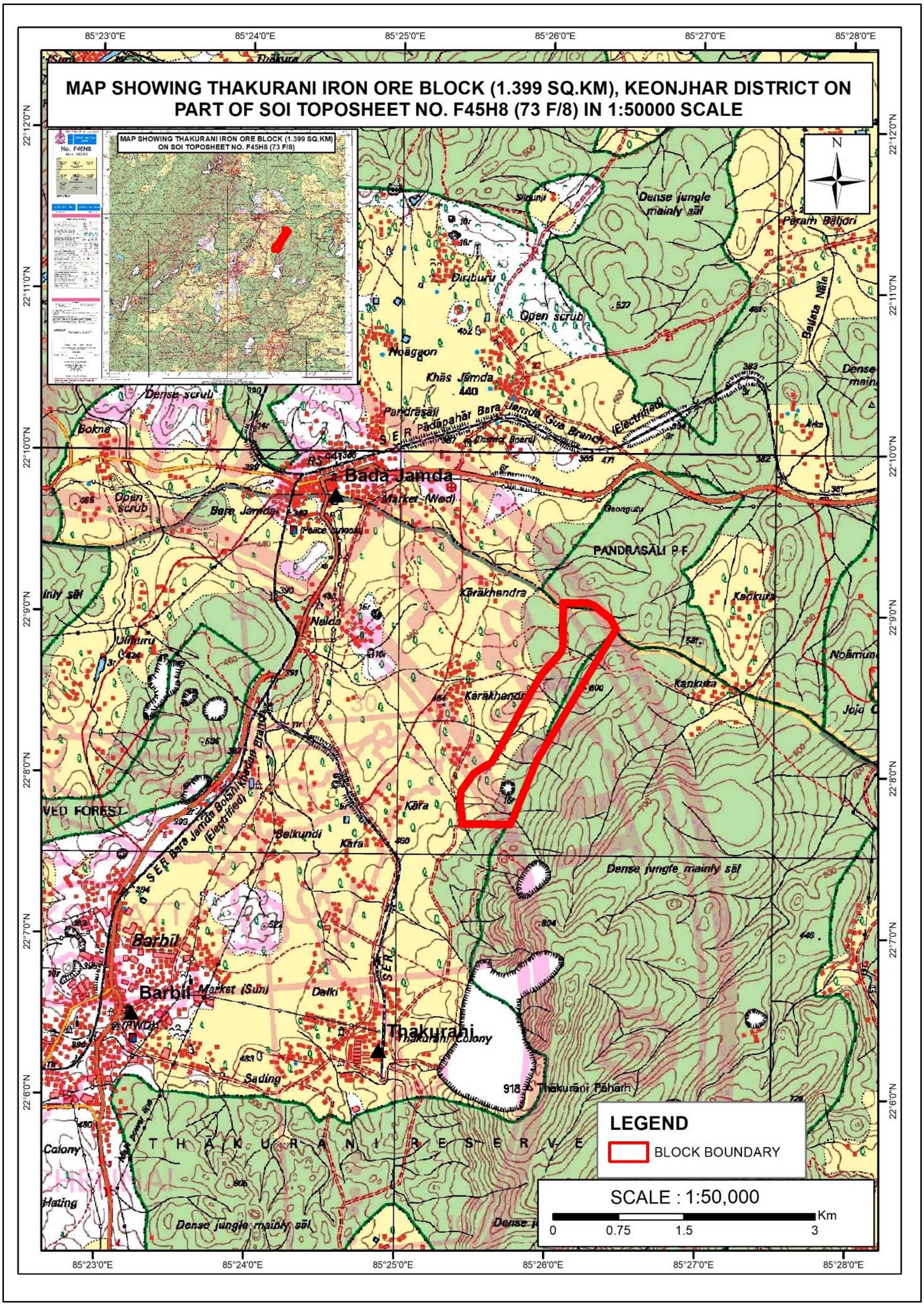
Estimated Cost for Preliminary Exploration (G3 level of exploration) for Iron & Manganese Ore in Thakurani Iron Ore Block, Keonjhar district, Odisha [Block Area: 1.399 sq.km, Nos. of Borehole: 16 Nos., Borehole Depth Range: 100 mtr, Time Schedule: 12 Months]							
Sl No.	**Item of work**	**Unit**	**Rate 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	150	16,50,000.00	
	Charges for one Geologist per day at HQ	Per day	1.3	9,000	60	5,40,000.00	
	Labour (2 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	300	1,65,900.00	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	60	4,98,000.00	
	Labour (2 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.
	Charges for One Sampler per day	Per day	1.5.2	5,100	60	3,06,000.00	
	Labour (4 Nos.) per party (Rs. 553/day/labour)	Per day	5.7	553	240	1,32,720.00	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	52	9,98,400.00	36 Boundary Pillar + 16 Boreholes
					Sub - Total - A	**43,57,380.00**	
B	**Drilling Work (Out Source)**						

	Drilling - Hard rock	Per m	2.2.1.4a	11,500	1600	1,84,00,000.00	Reimbursement of Oursource component will be made as per Para 3 of NMET-SOC
	Land/Crop compensation	Per Borehole	5.6	20,000	16	3,20,000.00	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	800	12,72,000.00	
					Sub- Total - B	**1,99,92,000.00**	
C	**Laboratory Studies (Out Source)**						
i	**Chemical Analysis**						
	Primary Samples (Surface Samples + Core Samples + Check Samples)						
	Chemical analysis for nine radicals (Fe%, Mn%, SiO2%, Fe2O3%, Al2O3%, P%, S%, Insolubles & LOI)	per Nos.	4.1.15a & b	5,042	1086	54,75,612.00	30 nos. Surface samples, 960 nos. Core samples (60%), 96 nos. check samples)
	Composite samples						
	Chemical analysis for nine radicals (Fe%, Mn%, SiO2%, Fe2O3%, Al2O3%, P%, S%, Insolubles & LOI)	per Nos.	4.1.15a & b	5,042	16	80,672.00	
ii	**Physical Analysis**						
	Preparation of standard thin section of rock	per Nos.	4.3.1	2,353	15	35,295.00	
	Complete Petrographic Studies	per Nos.	4.3.4	4,232	15	63,480.00	
	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	20	80,000.00	
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	10	35,400.00	
					Sub - Total - C	**60,69,604.00**	
D					**Sub - Total - D (A+B+C)**	**3,04,18,984.00**	

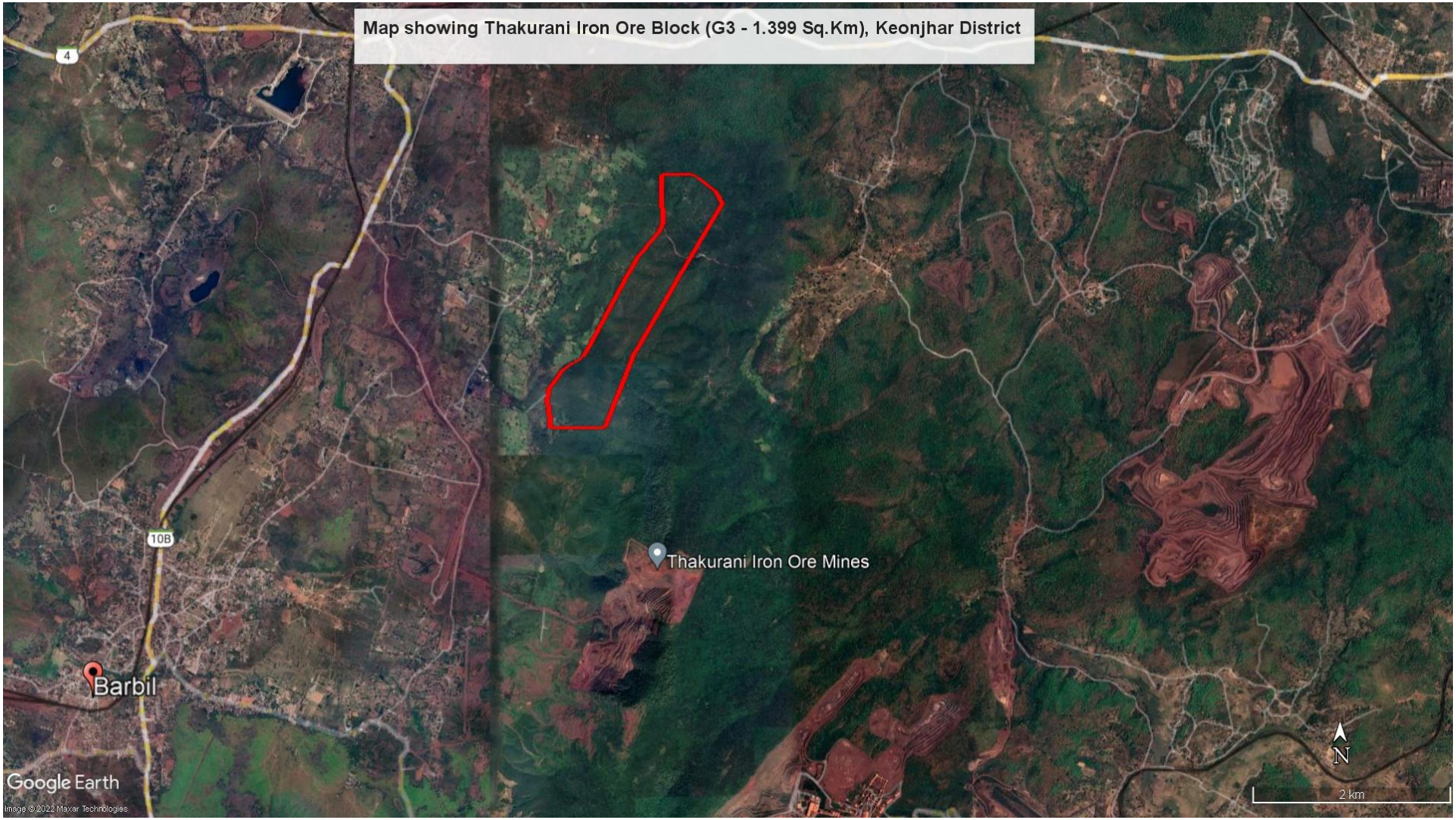
E	Preparation of Exploration Proposal	One Number (5 Hard copies) along with soft copy	5.1	2% of approved project cost or 3.8 lakh whichever is lower		3,80,000.00	
F	Geological Report Preparation	Cost per 5 Hard copies of report along with soft copy	5.2	**Project between ₹150 lakh to ₹300 lakh:** Minimum of ₹7.5 Lakh or 3% of the work which ever is more and ₹3000/ each additional copy. **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.		9,12,569.52	
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			10,000.00	
J	Total Estimated cost without GST (18%) (D+E+F+G+H+I)					3,37,21,553.52	
K	GST (18%)					60,69,879.63	
L	**Grand Total (J+K)**					**3,97,91,433.15**	

Time Schedule for Preliminary Exploration of Thakurani Iron Ore Block (1.399 Sq.Km) in Keonjhar district														
Sl. No.	**Activities**	**Unit**	**Months**											**Quantity**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	
1	Geological Mapping	Sq.Km													1.399
2	Geologist party days	day													150
3	Survey party days	day													60
4	Surface Drilling	m													1600
5	Sampling party days/ core sampling	day													60
6	Laboratory Studies	Nos.													1232
7	Geologist party days (HQ)	day													60
8	Geological Report Writing and Peer review	day													60
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.															

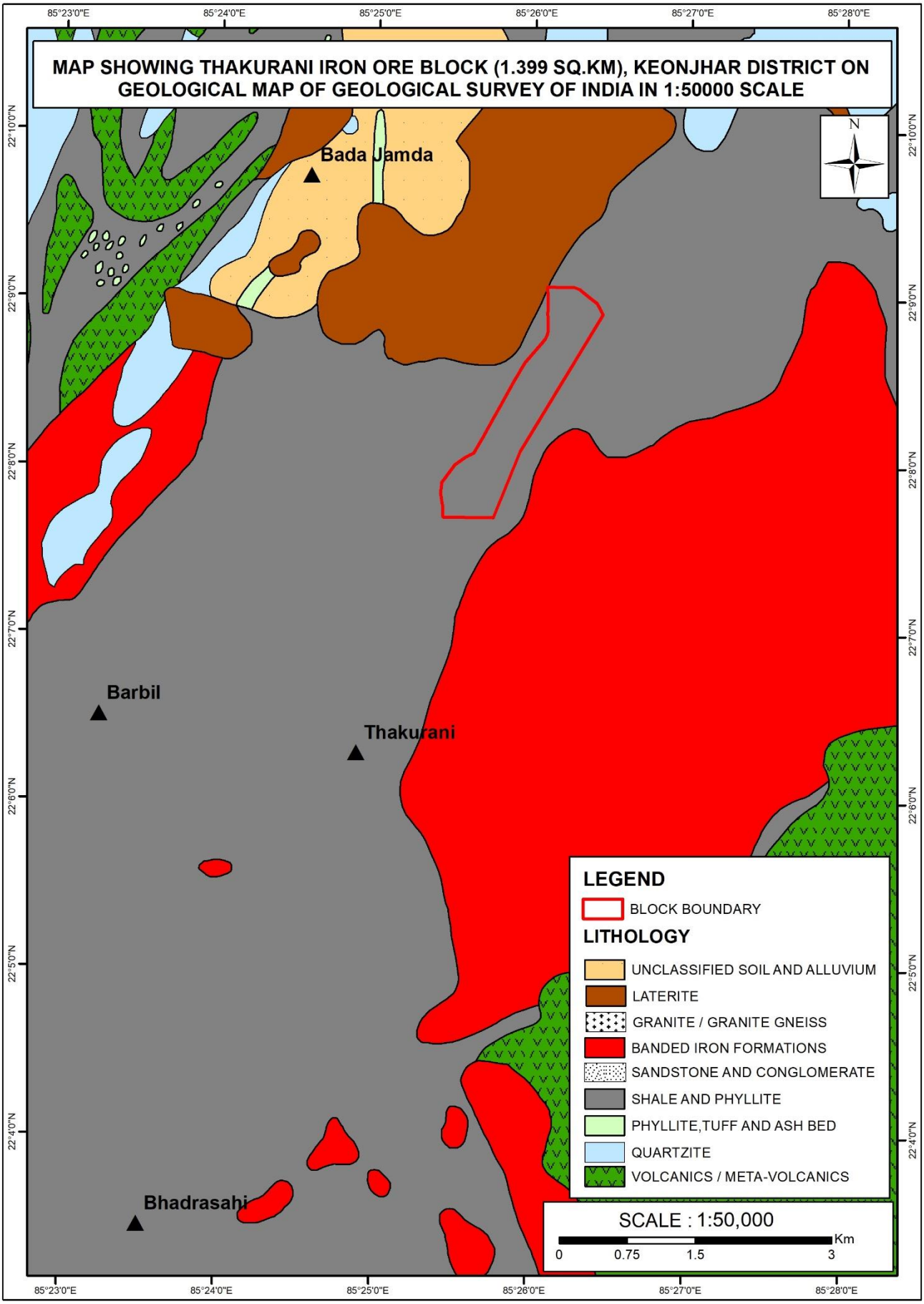
ANNEXURE – A


MAP SHOWING THAKURANI IRON ORE BLOCK (1.399 SQ.KM), KEONJHAR DISTRICT ON PART OF SOI TOPOSHEET NO. F45H8 (73 F/8) IN 1:50000 SCALE
MAP SHOWING THAKURANI IRON ORE BLOCK (1.399 SQ.KM) ON SOI TOPOSHEET NO. F45H8 (73 F/8)
85°23'0"E
85°24'0"E
85°25'0"E
85°26'0"E
85°27'0"E
85°28'0"E
22°12'0"N
22°11'0"N
22°10'0"N
22°9'0"N
22°8'0"N
22°7'0"N
22°6'0"N
N
Bada Jamda
Barbil
Thakurani
Thakurani Pāharh
PANDRASĀLI P F
THAKURANI RESERVE
Dense jungle mainly sāl
Open scrub
Dense scrub
LEGEND
BLOCK BOUNDARY
SCALE : 1:50,000
0
0.75
1.5
3
Km

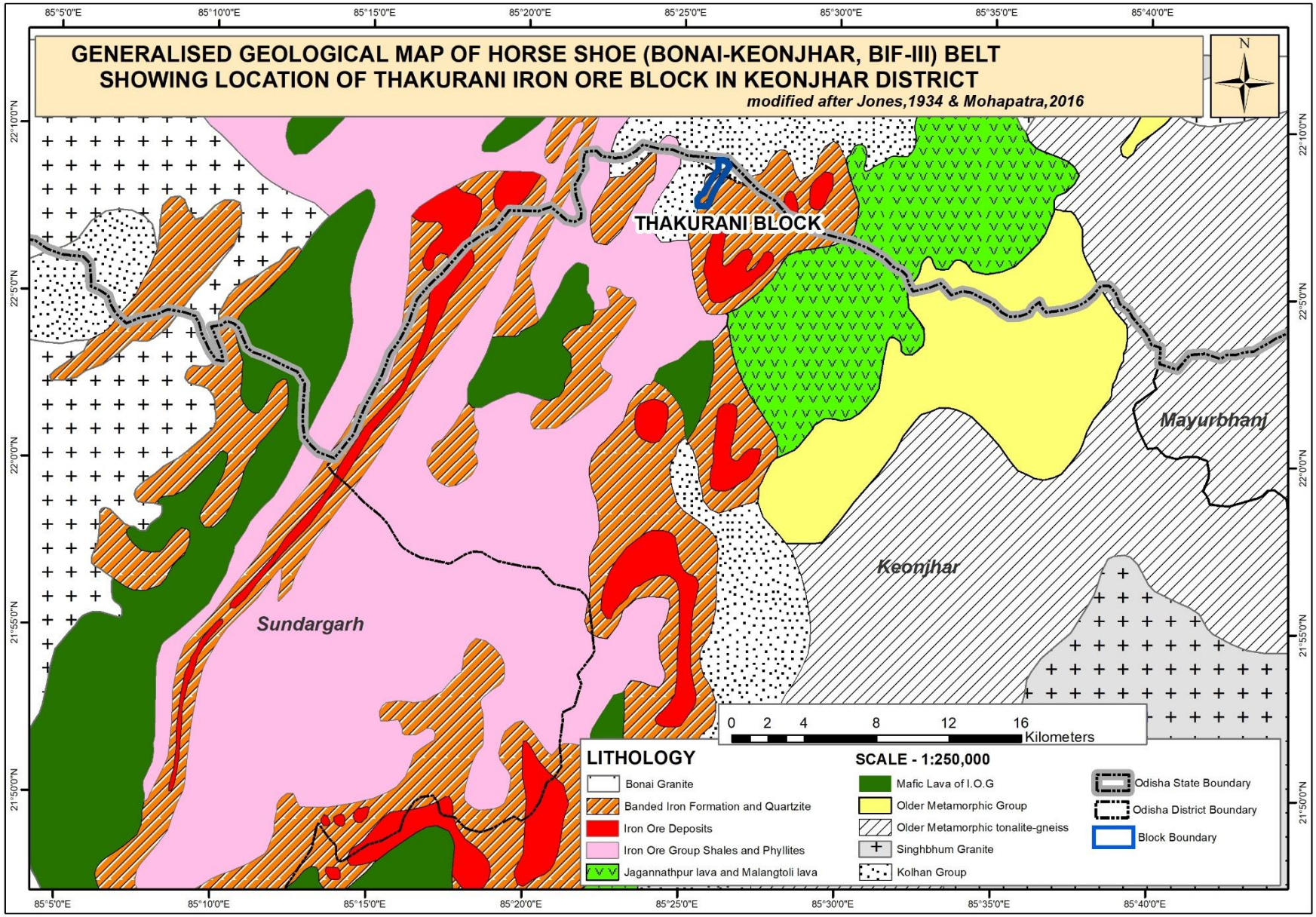
ANNEXURE – B


Map showing Thakurani Iron Ore Block (G3 - 1.399 Sq.Km), Keonjhar District
4
10B
Thakurani Iron Ore Mines
Barbil
Google Earth
Image © 2022 Maxar Technologies
N
2 km

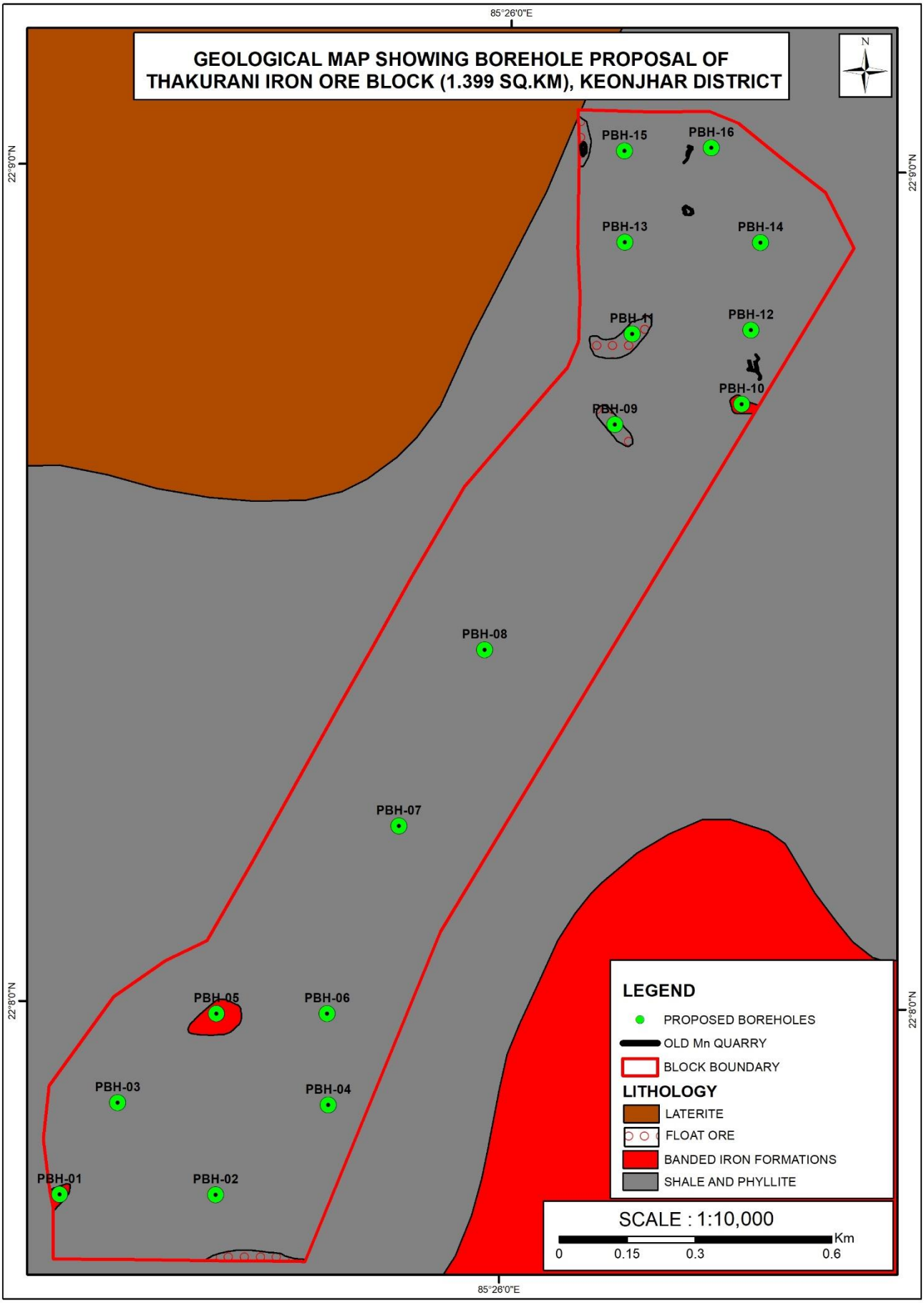
ANNEXURE – C


MAP SHOWING THAKURANI IRON ORE BLOCK (1.399 SQ.KM), KEONJHAR DISTRICT ON GEOLOGICAL MAP OF GEOLOGICAL SURVEY OF INDIA IN 1:50000 SCALE
85°23'0"E
85°24'0"E
85°25'0"E
85°26'0"E
85°27'0"E
85°28'0"E
22°10'0"N
22°9'0"N
22°8'0"N
22°7'0"N
22°6'0"N
22°5'0"N
22°4'0"N
N
Bada Jamda
Barbil
Thakurani
Bhadrasahi
LEGEND
BLOCK BOUNDARY
LITHOLOGY
UNCLASSIFIED SOIL AND ALLUVIUM
LATERITE
GRANITE / GRANITE GNEISS
BANDED IRON FORMATIONS
SANDSTONE AND CONGLOMERATE
SHALE AND PHYLLITE
PHYLLITE,TUFF AND ASH BED
QUARTZITE
VOLCANICS / META-VOLCANICS
SCALE : 1:50,000
Km
0
0.75
1.5
3

ANNEXURE – D


GENERALISED GEOLOGICAL MAP OF HORSE SHOE (BONAI-KEONJHAR, BIF-III) BELT
SHOWING LOCATION OF THAKURANI IRON ORE BLOCK IN KEONJHAR DISTRICT
modified after Jones,1934 & Mohapatra,2016
N
THAKURANI BLOCK
Sundargarh
Keonjhar
Mayurbhanj
85°5'0"E
85°10'0"E
85°15'0"E
85°20'0"E
85°25'0"E
85°30'0"E
85°35'0"E
85°40'0"E
22°10'0"N
22°5'0"N
22°0'0"N
21°55'0"N
21°50'0"N
0 2 4 8 12 16
Kilometers
LITHOLOGY
Bonai Granite
Banded Iron Formation and Quartzite
Iron Ore Deposits
Iron Ore Group Shales and Phyllites
Jagannathpur lava and Malangtoli lava
SCALE - 1:250,000
Mafic Lava of I.O.G
Older Metamorphic Group
Older Metamorphic tonalite-gneiss
Singhbhum Granite
Kolhan Group
Odisha State Boundary
Odisha District Boundary
Block Boundary

ANNEXURE – E


GEOLOGICAL MAP SHOWING BOREHOLE PROPOSAL OF
THAKURANI IRON ORE BLOCK (1.399 SQ.KM), KEONJHAR DISTRICT
N
85°26'0"E
22°9'0"N
22°8'0"N
PBH-15
PBH-16
PBH-13
PBH-14
PBH-11
PBH-12
PBH-10
PBH-09
PBH-08
PBH-07
PBH-05
PBH-06
PBH-03
PBH-04
PBH-01
PBH-02
LEGEND
PROPOSED BOREHOLES
OLD Mn QUARRY
BLOCK BOUNDARY
LITHOLOGY
LATERITE
FLOAT ORE
BANDED IRON FORMATIONS
SHALE AND PHYLLITE
SCALE : 1:10,000
Km
0
0.15
0.3
0.6