

**PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR  
MANGANESE AND ASSOCIATED MINERALS IN KATORI-  
JHIRIYA BLOCK (140.22 SQ.KM)  
DISTRICT- BALAGHAT, MADHYAPRADESH**

**COMMODITY: MANGANESE**

**BY  
MINERAL EXPLORATION & CONSULTANCY LIMITED  
DR. BABASAHAB AMBEDKAR BHAWAN  
SEMINARY HILLS**

**PLACE: NAGPUR**

**DATE: 17.11.2022**

**Summary of the Block for Reconnaissance Survey (G4 Stage)**  
**GENERAL INFORMATION ABOUT THE BLOCK**

<b>Features</b>	<b>Details</b>
Block ID	Katori-Jhiriya
Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
Commodity	Manganese and Associated Minerals
Mineral Belt	Mineralisation of Manganese occurring around the area is associated with Quartz-Muscovite Schist, Muscovite-Biotite Schist, Quartzo feldspathic Gneiss and Sericite Schist etc. in the Mansar formation of Sausar Group. The rocks belongs to the Meso-Proterozoic age.
Completion period with entire Time schedule to complete the project	Time Line for Exploration work with Drilling is 18 months.
Objectives	<p>The block area falls in the vicinity of prominent old quarries and pits and a lease hold area in the west of the block.</p> <p>The presence of supporting lithology for Manganese mineralization viz. Quartz-Muscovite Schist, Muscovite-Biotite Schist, Quartzo feldspathic Gneiss and Sericite Schist etc. encourages to take up the G4 Exploration in the area.</p> <p>Based on the evaluation of previous work, the present exploration program has been formulated to fulfill the following objectives.</p> <p>i) To carry out remote sensing study, geological &amp; structural mapping on 1:12,500 scale for demarcation of Manganese mineralization and host rock for Manganese with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones.</p> <p>ii) To collect surface Bedrock samples &amp; analyze for Manganese for further course of Exploration program.</p> <p>iii) In case, surface samples give positive results, 5 Nos. scout boreholes shall be drilled which in turn will decide the future course of Exploration program at G-3/G-2 category of UNFC.</p>

		iv) To estimate reconnaissance resources (334) along with accessory elements as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level.
	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	Work will be carried out by the proposed agency (MECL).
	Number of Geoscientists	Nos. of Geoscientists: 2 (1Field + 1HQ)
	Expected Field days( Geology, Surveyor)	Geologist Party days:180 field + 60 HQ Survey Party days : Nil

<b>1.</b>	<b>Location</b>																												
	Longitude-Latitude	<table border="1"> <thead> <tr> <th>Points</th> <th>LONGITUDE</th> <th>LATITUDE</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>79° 58' 10.9344" E</td> <td>21° 45' 00.0000" N</td> </tr> <tr> <td>B</td> <td>80° 00' 00.0000" E</td> <td>21° 43' 42.1519" N</td> </tr> <tr> <td>C</td> <td>80° 00' 00.0000" E</td> <td>21° 42' 40.1234" N</td> </tr> <tr> <td>D</td> <td>79° 53' 44.7663" E</td> <td>21° 31' 49.7207" N</td> </tr> <tr> <td>E</td> <td>79° 48' 37.4641" E</td> <td>21° 34' 40.1505" N</td> </tr> <tr> <td>F</td> <td>79° 50' 12.1470" E</td> <td>21° 36' 22.4909" N</td> </tr> <tr> <td>G</td> <td>79° 55' 21.9037" E</td> <td>21° 36' 35.0974" N</td> </tr> <tr> <td>H</td> <td>79° 55' 25.8017" E</td> <td>21° 42' 01.5219" N</td> </tr> </tbody> </table>	Points	LONGITUDE	LATITUDE	A	79° 58' 10.9344" E	21° 45' 00.0000" N	B	80° 00' 00.0000" E	21° 43' 42.1519" N	C	80° 00' 00.0000" E	21° 42' 40.1234" N	D	79° 53' 44.7663" E	21° 31' 49.7207" N	E	79° 48' 37.4641" E	21° 34' 40.1505" N	F	79° 50' 12.1470" E	21° 36' 22.4909" N	G	79° 55' 21.9037" E	21° 36' 35.0974" N	H	79° 55' 25.8017" E	21° 42' 01.5219" N
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	Villages	Basi, Bakera, Lalpur, Bhajiyadand, Katori, Jhiriya, Saleteka, Chorpindkepar, Fulchur, Shivpur etc.																											
	Tehsil/Taluk	Khairlanji																											
	District	Balaghat																											
	State	Madhya Pradesh																											
<b>2.</b>	<b>Area (hectares/ square kilometres)</b>																												
	Block Area	140.22 sq.km																											
	Forest Area	Part of Chikhla and Phulchur Reserve Forest falls in the Block area																											
	Government Land Area	Data not available																											
	Charagaha	Data not available																											
	Private Land Area	Part of the area is private cultivated land																											
	Study of DSS	Area Not Inviolate																											

<b>3.</b>	<b>Accessibility</b>	
	Nearest Rail Head	Balaghat (20 Km) in NE Direction
	Road	Block lies in the west of Bhandara-Balaghat State Highway that runs parallel and very close to the eastern boundary of the block.
	Airport	Nagpur (100 km)
<b>4.</b>	<b>Hydrography</b>	
	Local Surface Drainage Pattern (Channels)	The drainage pattern in the block is dendritic. General flow direction of the area is towards south where tributaries go in the Wainganga River. River Chandan flows north to south lies beyond the eastern boundary of the block.
	Rivers/ Streams	River Wainganga in South, River Chandan in East.
<b>5.</b>	<b>Climate</b>	
	Mean Annual Rainfall	Average annual rainfall is 1294 mm The climate of the area is mainly tropical with clearly defined dry and rainy seasons. The humidity is generally low except during the monsoons.
	Temperatures (December) (Minimum)	Minimum temperatures 08 °C
	Temperatures (May-June) (Maximum)	Maximum temperatures up to 45 °C
<b>6.</b>	<b>Topography</b>	
	ToposheetNumber	55 O/14
	Morphology of the Area	The topography is undulating in the western part of the block. Rest of the area is moderate to flat with occasional undulation indicating an overall slope towards south.
<b>7.</b>	<b>Availability of baseline geoscience data</b>	
	Geological Map (1:50K/25K)	District Resource Map of Balaghat (1:1,00,000 scale)
	Geochemical Map	-
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	
<b>8.</b>	<b>Justification for taking up Reconnaissance Survey/ Regional Exploration</b>	<p>i) The Govt. of India enacted the MMDR Amendment Act-2015 duly introducing the system of auction for allocation of Mineral Concessions. Manganese has been categorized in the Fourth Schedule which needs prospecting and exploration by the State Govt. before auctioning of blocks.</p> <p>ii) The area contains the continuation of Balaghat-Ukwa manganese ore belt. The rocks of the area majorly belong to the Precambrian Sausar Group in which Manganese mineralisation is present in the region.</p>

		<p>ii) MECL conducted field visit in this block, during geological traverses identified manganese occurrences around Fulchur - Katori villages and collected five number of samples in the proposed block. The five samples are analysed through handle XRF and samples are showing 10 to 26 % mn value.</p> <p>iii) Based on the evaluation of previous work and the manganese sample given value from 10 to 26% mn identified during the filed visit and also the recommendation from GSI in the adjacent areas of Miragpur and Pindkapur, the present Reconnaissance Survey exploration program at G-4 level has been prepared. The Remote sensing combined with geological mapping, surface sampling and pitting/trenching will be helpful in assessing the disposition of the mineralized zones, structural features like shears and faults if any.</p> <p>iii) The Exploration will be helpful in estimation of reconnaissance resources of Manganese and associated minerals in the block area. Geochemical sampling of BRS/SS/CS/ Pitting/trenching and the drilling of scout boreholes will be helpful in assessing the disposition.</p> <p>iv) The Reconnaissance Survey (G4) will eventually help in planning of detailed exploration program (incase upgraded to G-3/G-2 level) which in turn will facilitate the state Government for action of block.</p>
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# **PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR MANGANESE AND ASSOCIATED MINERALS IN KATORI- JHIRIYA BLOCK (140.22 SQ.KM) DISTRICT- BALAGHAT, MADHYAPRADESH**

## **1.0.0 INTRODUCTION**

### **1.1.0 Preamble**

1.1.1 Manganese being important constituent in steel manufacture has played a vital role in the industrial growth of a nation. Manganese is one of the most common elements in the Earth's crust and is widely distributed across the planet's surface. It is very hard, brittle, gray-white transition metal that is found in variety of minerals, but never as free element in nature; is it often found in minerals in combination with iron. Manganese ore is the basic source to provide manganese as indispensable input in making of iron and all types of steels. So far there is no technology which can substitute manganese in steel making. Manganese combines the twin benefits of relatively low price with outstanding technical usage.

1.1.2 Manganese ores of major commercial importance are: (i) Pyrolusite ( $MnO_2$ , Mn about 63.2%); (ii) Psilomelane (Manganese oxide, containing water and varying amounts of oxides of Ba, K and Na as impurities; Mn commonly 45-60%); (iii) Manganite ( $Mn_2O_3 \cdot H_2O$ , Mn about 62.4%); and (iv) Braunitzite ( $3Mn_2O_3, MnSiO_8$ , Mn about 62% and  $SiO_2$  about 10%)(Indian Minerals Yearbook, 2017 of IBM).

1.1.3 The increasing demand of manganese in the country in recent years can be eased with the exploration of new manganese deposits of economic importance.

1.1.4 Indian manganese ore deposits occur mainly as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaean) of Madhya Pradesh (Balaghat, Chhindwara and Jabua districts), Maharashtra (Bhandara and Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundargarh district) and with Kodurite Series (Archaean) of Odisha (Ganjam, Rayagada, Kalahandi, Balangir and Koraput districts) and Andhra Pradesh (Srikakulam and Visakhapatnam districts).

- 1.1.5 The total reserves/resources of manganese ore in the country as on 1.04.2015 have been placed at 495.87 million tonnes as per NMI database, based on UNFC system (Mineral Year Book-2019). Out of these, 93.47 million tonnes are categorised as reserves and the balance 402.40 million tonnes are in the remaining resource category. Grade-wise, Ferromanganese grade accounts for 7%, Medium grade 11%, BF grade 28% and the remaining 54% are of Mixed, Low, Others, Unclassified, and Not-known grades including 0.17 million tonnes of battery/chemical grade. The overall grade of the manganese ore reserve in the country is in the range of 30-35% Mn (IBM Mineral Year Book 2019).
- 1.1.6 The total state-wise distribution of the manganese resources in the country indicates that Odisha tops with 44% share followed by Karnataka 22%, Madhya Pradesh 12%, Maharashtra & Goa 7% each, Andhra Pradesh 4% and Jharkhand 2% each. Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining about 2% resources.
- 1.1.7 The Govt. of India enacted the MMDR Amendment Act, 2015 duly introducing the system of auction for allocation of Mineral Concessions. Manganese has been categorized in the Fourth Schedule which needs prospecting and exploration by the State Govt. before auctioning of blocks.
- 1.1.8 MECL in association with DMG, Madhya Pradesh has looked up for the area for investigation of manganese and associated minerals around the explored Manganese blocks in Balaghat district of Madhya Pradesh.
- 1.1.9 Subsequently, after receipt of consent from DMG, Madhya Pradesh to take up exploration work, MECL has prepared an exploration proposal for reconnaissance survey (G-4) for manganese and associated minerals in Katori-Jhiriya Block in Balaghat District of Madhya Pradesh and submitted to NMET for taking up for discussion in the upcoming TCC.

### **1.2.0 Background**

- 1.2.1 The Proposed block area lies in the east of around Miragpur and Pindkapur area. Miragpur area has witnessed extensive mining activity ever since the beginning of the century. The mining operation was first initiated by the Central India Mining

Company, which hold under lease most of the area around Miragpur and Mohgaonghat, Neempahadi and a few others towards south . In the west and in the north of the proposed Exploration block still Mining activities are going in the Leasehold areas.

- 1.2.2 The proposed area is a free hold area after release of 10A2B Blocks. Presence of Manganese bearing Mansar formation rocks in the area indicates the need of the evaluation of the area systematically through the G4 level of exploration. Hence, considering the previous study and vicinity of adjoining manganese bearing area, MECL propose to carry out the exploration for manganese and associated minerals in the block.

### **1.3.0 Location and Accessibility**

- 1.3.1 The block is located in Khairlanji Tehsil , Balaghat District, Madhya Pradesh. Block lies in the west of Bhandara-Balaghat State Highway that runs parallel and very close to the eastern boundary of the block. The nearest railhead is Balaghat (20 Km) in NE Direction. The nearest airport Nagpur, is 100 Km away from the block in SW direction. The area falls in Survey of India Toposheet No. 55O/14.

### **1.4.0 Physiography & Drainage**

- 1.4.1 The topography is undulating in the western part of the block. In general, rest of the area is moderate to flat with occasional undulation indicating an overall slope towards south.
- 1.4.2 The drainage pattern in the block is dendritic. General flow direction of the area is towards south where tributaries go in the Wainganga River. River Chandan flows north to south lies beyond the eastern boundary of the block.

### **1.5.0 Climate**

- 1.5.1 The average annual rainfall is 1294 mm. The climate of the area is mainly tropical with clearly defined dry and rainy seasons. The humidity is generally low except during the

monsoons. The area comes within the semi arid zone with temperature ranging from 08 C (Dec-Feb) to 45 C (Apr-Jun).

**1.6.0 Flora Fauna :** The Block falls in the part of Part of Chikhla and Phulchur Reserve Forest. The general Flora are Azadirachta Indica, Bamboo Sps, Anogeissus latifolia. etc, shrubs in the area are Cassia fistula., Lantana camara, etc., herbs found are Acacia nilotica, Azolla pinnata, Cassia tora etc. mammals in the area are Chinkara, Chital, Nilgai, Common Langur etc., and Birds in the area are White-throated Kingfisher, Indian Skimmer, Vanellus indicus, Amauornis phoenicurus etc

### **1.7.0 Regional Geology**

1.7.1 Geology of Sausar Group of rocks, extending from Chhindwara district of Madhya Pradesh, in the west, to Balaghat district, in the east, and possibly continuing beyond, is interesting for encompassing majority of the manganese deposits of the world. Sir Fermor through a series of publications between 1904 and 1909, brought out a detailed account of his 'Sausar Series' (phyllite, schists, gneisses, crystalline limestone/marble and calc-silicates/granulites and associated manganese ore deposits) of Central India. The stratigraphic succession suggested by Fermor (op.cit) and improved upon by West (1936, in [2]) and later by Naryanaswami et al. [3] is largely accepted for the gneiss and schist belt of Sausar group of Central India.

The rocks of the Sausar Series are intensely folded in isoclinal and recumbent folds along E-W axes which generally plunge eastward or westward at low to moderate angles. The folds are generally overturned northward with their axial planes dipping steeply southward at 60°-80° along the southern part of the belt, and flattening to moderate southward dips of 30°-50° along the central parts where the isoclinal folds are recumbent. In parts of Balaghat District at the north-eastern end of the belt, the recumbent folds are very flat and are overturned to the south with low northward dips of 10°-30°. Along the northern margin of the map area, the recumbent folds are found to be thrust over older rocks in the form of thrust sheets and nappes. The belt is traversed by some major steeply dipping thrust faults trending parallel to the strike, and by minor, transverse faults, The isoclinal folds of the southern belt and the recumbent folds and thrust sheets of the northern belt have an en echelon disposition as the folds themselves show successive northward shifts when followed to the east

and north-east. A similar reverse pattern of northward shifts is also apparent in Chindwara District towards the west. The structure of the belt is further complicated by the refolding or cross-folding of the earlier fold axes of the isoclinal and recumbent folds and thrust sheets. The axes of these cross-folds plunge at low to moderate angles to the west and southwest, Granite plutons and ortho-gneisses are generally found emplaced along the axes of these late cross-folds.

- 1.7.2 The area is the South-western continuation of the Balaghat-Ukwa manganese ore belt occurring within the intensely folded and metamorphosed rocks of the Pre-Cambrian Sausar Group. The geological formations of the area consist mainly of 1. Pink and Grey Gneisses and Migmatites with enclaves of high grade metamorphites and gneiss represented by Archaean aged Amgaon Gneissic complex/Tirodi Gneissic Complex and 2. Quartz-Muscovite Schist, Muscovite-Biotite Schist, Quartzo feldspathic Gneiss and Sericite Schist etc. belonging to the Mansar formation of Sausar Group of Meso-Proterozoic age.

### **1.8.0 Regional Structure**

- 1.8.1 The Sausar rocks are known to have undergone three phases of deformation. Tight, isoclinal to recumbent folding along NE-SW to ENE-WSW axial trend marks the first phase of folding and produces S1 schistosity. The second phase of isoclinal folding is essentially co-axial but non co-planner to F1 folds and produced shallow dipping (300) S2 axial plane cleavages [9]. NW-SE to WNW-ESE trending open warps with steep plunges (700) represent last phase of folding.
- 1.8.2 The structure of the belt may be described under the following four divisions:
1. Southern belt of overturned, isoclinal folds.
  2. Northern belt of recumbent folds and thrust blocks or nappes.
  3. Central belt of gneissic formations of the nature of crystalline axis with narrow and linear outcrops of infolded schists.
  4. Regions of refolding or cross-folding and associated granite plutons.

(1) Southern belt of isoclinal folding.--This belt, characterized by steeply dipping, overturned, isoclinal folds extends along the southern portion of the manganese ore

belt from Kelod-Salai-Parseoni in north-western Nagpur District, through Mansar-Goguldoho in northern and north-eastern Nagpur District\_ and Dongari Buzurg-Chikhla-Bhajiadand-Waraseoni region in northern Bhandara and Balaghat Districts to Bharweli-Ukwa region in eastern Balaghat District. The axes of these folds trend WNW-ESE to east-west in Nagpur District, and gradually veer to ENE and NE in Bhandara and Balaghat Districts. They plunge at low angles of 20°-30 ° eastward, though westerly plunges are also noticeable at intervals due to the cross folding.

**2) Northern belt of recumbent folds, thrust blocks and nappes.** This belt extends from Sapghota-Ambajhiri in north-western Nagpur through Deolapar region (W. D. West, 1936) in northern Nagpur District to the Sonawani and the Dhansua R.F. in northern and north-eastern Balaghat District. The belt is characterized by at least four thrust blocks or nappes which have not yet been connected together along their strike. These are (1) Sapghota thrust block, (2) Ambajhiri thrust block, (3) Deolapar nappe and (4) Sonawani thrust block. They consist of younger rocks of the Sausars (Chorbaoli to Bichua stages) which have been thrust over the Tirodi biotite-gneiss, and form steep to moderate dipping overturned, isoclinal folds and flat-dipping recumbent folds whose axes are conformable to the regional fold axes. In the Sapghota-Ambajhiri and Deolapar thrusts, the thrust plates reveal steep to moderate southerly dips along their southern margins and low to flat dips along their northern margins. The Sonawani thrust block shows low to moderate dips to the north, but the northern limit of the thrust has not yet been mapped. The folds within the thrust blocks or nappes are generally doubly plunging synclinal structure which are themselves folded, recumbent folds; the succession of rocks in the case of Ambajhiri and Deolapar nappes is reversed, but is normal in the case of Sonawani and adjacent thrust blocks.

**3) Central belt of gneissic formations with narrow infolded schist:** This belt consisting of extensive stretches of Tirodi biotite-gneiss and is characterized by numerous narrow, linear, infolded runs of schists occupies the region between the two structural divisions described above and appears to represent the central crystalline axis of the tectonic framework. An extensive area of this belt is exposed in Balaghat District between the Bawanthari River in the south-west, Tangla and Karwahi RF on

the west and Kurai and Sonawani RF in the north and extends through the alluvial plains of Katangi, Waraseoni and Balaghat up to the Dhansua RF and other hill tracks in north-eastern Balaghat District. The individual outcrops are mostly less than 200 ft. in width and some are four to five miles in length, and occur within the biotite gneiss with a general ENE-WSW to NE-SW regional trend. They are considered to be remnants of steep to flat dipping infolded, recumbent, refolded folds, consisting chiefly of Mansar muscovite schist and the associated manganese ore horizon and Sitasongi quartz-muscovite-schist. The Tirodi-Sukli-Garra area is underlain by the largest number of these infolded runs of Mansar schists and manganese ore bodies in an apparently inverted sequence. There are three other detached areas that form part of this belt: (1) An east-west area in the Warpani R.F. in north-western Nagpur District, (2) An east-west area extending westward from Mangarli to west of Paunia in Northern Nagpur District, and (3) A small area extending westward from Aoleghat in north-eastern Nagpur District. The area to the east of Mangarli is characterized by numerous infolded Mansar schist outcrops.

4) **Regions of Cross-folding and refolding:** Evidences are found throughout the manganese ore belt for a late stage deformation which has affected the earlier folds to varying degrees. These later folds which may be described as cross-folds are classified into the following groups:

(1) These cross-folds have their axes at about  $45^\circ$  to the axes of earlier folds, and plunge at moderate angles in the opposite direction. They are found in force in the central part of the belt from Ramtek in Nagpur District to Pusada in northern Bhandara and Tirodi area in Balaghat District. The most characteristic one in this region is the Alesur-Susurgeh-Pusada crossfold which plunges at  $30^\circ$ - $50^\circ$  south-west, whereas the earlier isoclinal folds plunge at  $250$ - $30^\circ$  east.

(2) Those which are parallel to the earlier ones, but their axes plunge in the opposite direction generally at  $20^\circ$ - $30^\circ$  west or south-west. Examples of this type are found in the Goguldoh--Junewani-Suwardhara-Paraseoni region of northern Nagpur District, and along the Chandpur quartzite range in northern Bhandara District.

(3) Those having their axial planes parallel to the main folds and whose axes plunge at 10°-20 ° west or WSW. These are common in the thrust blocks in the Ambajhiri, Deolapar and Sonawani areas.

(4) Those whose axes plunge in the direction opposite to that of earlier folds at intervals along their strike. This type is commonly seen in the southern belt of isoclinal folding, e.g., in the Bharweli-Ukwa syncline in eastern Balaghat District, in the Chil h'a-Mangarli region in northern Bhandam District and in the Goguldoho-Junewani-Suwardhara in northern Nagpur District. Cross-folding is seen to be intensely developed in the central belt of gneissic formation extending from Ramtek to Pusada and Tirodi where the first type is common. A number of granite plutons is also seen along this axis indicating the severity of deformation. The intensity of crossfolding fades out on either side of this central axis, where other types of cross-folds are developed, and no granite plutons are seen.

1.8.3 Regional stratigraphic succession of the litho-units after District Resource map of GSI is illustrated in the Table I.A. Regional geological map with the proposed Block is given in PLATE-II.

**Table I.A**  
**Regional Stratigraphic sequence of Litho units (After District Resource map of GSI)**

Age	Group	Formation	Litho-units
Cretaceous-Palaeogene	Amarkantak Group	Unclassified	Basalt Flows
		Intrusive	Pink Granite and Leuco Granite
PALAEO PROTEROZOIC	Sausar Group	Charbaoli Formation	Quartzite and Quartz Muscovite Schist
		Mansar Formation	Quartz Muscovite Schist, Muscovite Biotite, Quartzo Feldspathic Gneiss, Phyllite & Sericite Schist With Manganese Ore
		Lohangi Formation	Crystalline Limestone,

			Calc gneiss & Black Magniferous marble with some Manganese Ore
		Sitsaongi Formation	Quartz Muscovite Schist, Quartz Grit Conglomerate, Siltstone and Pebble Bed
ARCHAEAN to PALAEO PROTEROZOIC	Amgaon Gneissic Complex / Tirodi Gneissic Complex		Pink and Grey Gneisses and Migmatite, Grey Stromatic Gneiss with enclaves of high grade Metamorphites and Gneiss
			Ortho-gneiss
			Granulite

### 1.9.0 Geology of the Block

1.9.1 The area mostly exposes lithounits belonging to Palaeo-Proterozoic aged Manasar Formation rocks comprising Quartz Muscovite Schist, Muscovite Biotite, Quartzo Feldspathic Gneiss, Phyllite & Sericite Schist With Manganese Ore.. The tentative stratigraphic sequence of litho units exposed in the Block area (After GSI) and after District Resource map of GSI is given in Table I.B.

**Table I.B**  
**Stratigraphic sequence of the Katori-Jhiriya Block area**  
(After GSI)

Age	Group	Formation	Litho-units
Cretaceous-Palaeogene	Amarkantak Group	Unclassified	Basalt Flows
	Intrusive		Pink Granite and Leuco Granite
PALAEO PROTEROZOIC	Sausar Group	Charbaoli Formation	Quartzite and Quartz Muscovite Schist
		Mansar Formation	Quartz Muscovite Schist, Muscovite Biotite, Quartzo Feldspathic Gneiss, Phyllite & Sericite Schist With Manganese

			Ore
		Lohangi Formation	Crystalline Limestone, Calc gneiss & Black Magniferous marble with some Manganese Ore
		Sitsaongi Formation	Quartz Muscovite Schist, Quartz Grit Conglomerate, Siltstone and Pebble Bed
ARCHAEAN to PALAEO PROTEROZOIC	Amgaon Gneissic Complex / Tirodi Gneissic Complex		Pink and Grey Gneisses and Migmatite etc

### 1.10.0 Mineral Potentiality based on geology and ground geochemistry etc.

- 1.10.1 Manganese mineralization associated with the Sausar Group is known to occur at three horizons, bottom middle and top of the Mansar Formation, and form major deposits like Ukwa, Bharweli, Ramrama, Tirodi and Sukli-Sitapathore, within the state of Madhya Pradesh. These deposits are considered as metamorphosed syngenetic type based on their association and co-folding with the quartz muscovite schists of Mansar Formation. High temperature manganese oxides like hausmanite, vredenburgite, jacobsite and braunite constitute the major part of these deposits.
- 1.10.2 Quartz-muscovite/sericite schists, with or without manganese mineralization, occurs at many places associated with well cleaved quartzose core. All such occurrences are invariably aligned along one or the other high strain zones, characteristically having a layered arrangement of minerals. The manganese deposits, likewise, also have a quartzose core alternating with layers of manganese ores. Peripheral zones of such quartz-manganese core are occupied by feldspathic muscovite/ sericite schists in biotite gneiss/metacarbonate host, and by feldspathic sericite-phyllite in phyllite hosts, respectively. Occurrence of the ore bodies in high strain zones is evidenced by stretching and preferred orientation of quartz and opaques along  $\sigma$  and  $C$  planes of mylonites.
- 1.10.3 The manganese mineralisation in the study area is expected to be associated with the muscovite schist of Mansar formation. However, the mn values recorded from the collected samples showing generally <10% (hand held XRF analysis) which indicates

good potentiality of manganese in this area. The hand held XRF analysis data has given the Mn values ranges from 10% to 26%.

## **2.0.0 Previous Work**

- 2.1.0 Prior to 1883, manganese ore was reported in Nagpur district by Col. Bloomfield (Bull.Geol.Surv.Ind.Ser.A.No.22, pt. 1,1960, pp 5). Jenkins, however, was first to discover manganese ore in Nagpur district in 1833 (Jenkins, Sci.Vol.1, pp.226-227). P.N. Dutta of GSI. in the course of systematic geological mapping discovered major manganese deposits of the adjacent Bhandara district.
- 2.2.0 A detailed description of the known manganese deposits of this area is given by L.L. Fermer (1909) in his exhaustive memoir on The Manganese ore Deposits of India (Mem.G.S.I.Vol. 37,1909). R.C. Burton in 1912 examined some of the manganese deposits in the northern portion. W.D.West (1940) made a rapid survey of the important mines for appraisal of the manganese ore reserves available in the mines.
- 2.3.0 N.A.Vemban and coworkers carried out detailed large scale mapping and investigation of manganese ore deposits of Tirodi area of Waraseoni Tahsil of Balaghat district, during 1951-54 under the supervision of John A.Strackzek.
- 2.4.0 The southwestern part of the Balaghat district saw intensive mining activity in the beginning of the present century. Mining was first initiated by a British firm, - Central India Mining Company, which held the lease for most of the area. Exploitation was done mainly by open cast method, and was restricted between Miragpur and Gosai pahadi hillock. The Miragpur area lies to the west of the present exploration block.
- 2.5.0 A short field visit has been carried out for due diligence study of the proposed area. The Katori- Jhiriya block is located near Balaghat Town and 40km. south of it, falls in the Survey of India Toposheet No. 55O/14. The proposed area is characterized by detritic drainage pattern with dense forest of Mansar formation. Total five nos. of samples have been collected and undergone hand held XRF analysis. All five samples showing good percentage of Mn. The samples generally show <10% Mn. The analytical results mentioned below:

Sample ID	Latitude	Longitude	Hand held XRF Result in %					
			Mn%	Ca%	Si%	P%	Fe%	Al%
BR-2	21°34'44.7"	79°51'46.1"	26.8	7.07	6.5	3.4	1.6	1.1
BR-3	21°34'43.5"	79°51'43.5"	19.6	4	14.5	2	4.9	1.6
BR-4	21°34'41.6"	79°51'40.0"	12.4	0.3	20.7	0.1	5.4	2.2
BR-5	21°34'39.0"	79°51'42.2"	18.7	0.47	12.7	--	5.5	7.96
BR-6	21°34'40.6"	79°51'46.6"	26	1.05	15.35	--	5.02	0.61



A. Photograph showing Mn outcrop trending NE-SE direction near Fulchur village (BR-5 Sample)



B. Photograph showing Mn outcrop trending NE-SE direction near Fulchur village (BR-2 Sample)



C. Photograph showing Mn ore sample (BR-2 Sample)

### 3.0.0 Block description

3.1.0 The proposed G-4 block for Manganese and associated minerals falls in Survey of India Toposheet No. 55O/14 and covers an area of 140.22 sq. km in and around villages Basi, Bakera, Lalpur, Bhajiyadand, Katori, Jhiriya, Saleteka, Chorpindkepar, Fulchur, Shivpur etc. of Balaghat District, State Madhya Pradesh. The block location is given in **PLATE-I**. The Co-ordinates of the corner points of the block area both geodetic and UTM are given in **Table No.-III.A**.

Sl. No.	Corner	DDMMSS (WGS84)		UTM 44N	
	Points	LONGITUDE	LATITUDE	Easting(X)	Northing(Y)
1	A	79° 58' 10.9344" E	21° 45' 00.0000" N	393462.392	2405510.859
2	B	80° 00' 00.0000" E	21° 43' 42.1519" N	396579.906	2403096.572
3	C	80° 00' 00.0000" E	21° 42' 40.1234" N	396567.586	2401189.288
4	D	79° 53' 44.7663" E	21° 31' 49.7207" N	385643.697	2381263.382
5	E	79° 48' 37.4641" E	21° 34' 40.1505" N	376842.555	2386568.94
6	F	79° 50' 12.1470" E	21° 36' 22.4909" N	379589.243	2389695.263
7	G	79° 55' 21.9037" E	21° 36' 35.0974" N	388498.972	2390018.76
8	H	79° 55' 25.8017" E	21° 42' 01.5219" N	388680.634	2400055.144

### 4.0.0 Planned Methodology

In accordance to the objective set for reconnaissance survey (G-4) of the block, the exploration programme is proposed. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rule-2015. Accordingly, the following scheme of exploration is formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs.

#### 4.1.0 Remote Sensing Study

4.1.1. Remote sensing study shall be carried out in the entire 140.22 sq km area to identify the lineaments, lithological contacts, other structural features and the mineral potential zones through mineral targeting process. A detailed report will be provided

in the end of the study which will be helpful for the current and future exploration work

#### **4.2.0 Geological Mapping**

4.2.1. Geological mapping will be done in the entire 140.22 sq km area on 1:12,500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the ore bodies available along with their surface disposition will be marked on map.

#### **4.3.0 Surveying:**

4.4.0 The prospect area would be tied up with the triangulation network and the surface features will be picked up and marked on a map on 1:12,500 scale. The reduced levels and co-ordinates of boreholes, pits and trenches would be determined. Geological traverses, geological features and location of surface samples will be marked with hand held GPS. During exploratory drilling of scout borehole, fixation and determination of reduced level and co-ordinates of the boreholes will be undertaken by DGPS/ Total station.

#### **4.5.0 Geological Mapping**

4.5.1. Large scale geological mapping on 1:12,500 scale will be carried out in the entire block by taking geological traverses. The contacts of different formations, identification of different lithological units, structural features, etc., will be carried out in detail. The geophysical survey data could help in updating of map. The geological map on 1:12,500 scale will be generated based on the detail geological mapping of the block and interpretation of exploration data.

#### **4.6.0 Geochemical Sampling**

4.6.1. **Surface sampling (Bed Rock/Channel Sample):** During the course of Geochemical Sampling the bed rock / channel samples shall be collected from the outcrops along with soil and stream sediment samples. A total of 200 no of primary, 10 no of internal check and 20 no of external check samples will be analyzed for manganese mineralization i.e. Mn, SiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub> Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub> and Acid Insolubles.

#### **4.7.0 Surveying**

4.7.1. Geological traverses, geological features and location of surface samples will be marked with hand held GPS. During exploratory drilling of scout borehole, fixation and determination of reduced level and co-ordinates of the boreholes only will be

undertaken by DGPS/ Total station. The anomalous zone demarcated on the basis of Geological mapping and Geo-chemical sampling where drilling will be carried out can be surveyed on topographic plan in 1:5000 and contour map will be prepared at 2m contour interval.

#### 4.8.0 Geophysical Survey

4.8.1. Physical properties of Manganese ore and expected host rocks are given in table below.

Ore/ rock	Chemical composition	Mn content	Density (g/cc)	Magnetic Susceptibility. 0-CGS
Pyrolusite	MnO <sub>2</sub>	63%	4.70-5.00	Paramagnetic
Psilomelane	MnOMn <sub>2</sub> OH <sub>2</sub> O		3.70-4.70	
Braunite	Mn <sub>2</sub> O <sub>3</sub> Mn <sub>6</sub> O <sub>2</sub>	64.3%	4.75-4.82	
Rhodonite	MnSiO <sub>3</sub>	41.8%	3.40-3.6	Paramagnetic
Rhodochrosite	MnCO <sub>3</sub>	47.8%	3.40-3.60	100
Jacobsite	MnFe <sub>2</sub> O <sub>4</sub>		4.95	200-300
Quartz	SiO <sub>2</sub>		2.6-2.8	.00063
Mica	K(Mg,Fe) <sub>3</sub> AlSi <sub>3</sub> O <sub>10</sub> (F,OH) <sub>2</sub> / KAl <sub>2</sub> (F,OH) <sub>2</sub>		2.15	

4.8.2. In addition to above the resistivity contrast between Manganese ore and host rocks is also remarkable, based on the above physical properties of the manganese ores and its host rocks in typical geological settings.

4.8.3. On the basis of above properties, Integrated Geophysical Surveys i.e., Self Potential (S.P) and Magnetic have been planned to carry out in the potential area marked by geological mapping. A total of 20.00 L.km of Self Potential (S.P) and Magnetic Surveys will be covered in the block. The Approximate time period to conduct the survey will be around 3 months.

#### 4.9.0 Exploratory Mining (Trenching/Pitting)

4.9.1. Shallow trenching/pitting (Excavation) shall be carried out in the potential zones identified based on the results of geological mapping and geochemical sampling. A provision of shallow trenching/pitting of 200 cubic meter has been planned. Trenching work will be carried out by cutting trenches of 1m width and 2 m depth directly on the fresh outcrop/rock exposures across the Mn ore bearing formation. Locations of pits/trenches on ground will be decided by field geologist based on field observations. Trench walls will be geologically mapped.

4.9.2. A total of 100 no of primary, 5 no of internal check and 10 no of external check trench samples will be analyzed for manganese mineralization i.e. Mn, SiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub>, Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub> and Acid Insolubles.

#### **4.10.0 Core Drilling:**

4.10.1. Based on Geological mapping with Remote sensing studies, Geochemical studies and Shallow trenching/pitting (Excavation), the extension of the mineralized zones (ore bodies) will be marked. To find out the potentiality of mineralized zones in strike & dip, 8 Nos scout boreholes involving 500m of drilling will be carried out for upper level of intersection of mineralized zones.

#### **4.11.0 Drill Core Logging:**

4.11.1. The borehole cores would be logged systematically. Details of the litho units, colour, structural feature, texture, mineralization, % recovery of core, rock quality designation (RQD) etc. would be recorded.

#### **4.12.0 Drill Core Sampling:**

4.12.1. The mineralized (manganese) part of drill core will be sampled as Primary sample. The length of each sample will be kept 1.00 m within the ore zone depending upon the thickness of particular type of manganese ore and its physical character. The primary core samples for manganese mineralisation will be analysed for 6 radicals i.e. Mn, SiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub>, Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub> and Acid insolubles. The cores of rocks 3 m immediate on footwall and 3 m immediate on hanging wall of mineralized zones would be sampled at 1.0 m interval, as far as possible, depending upon the intensity of mineralization, change in lithology and core recovery etc.

4.12.2. A total of 138 no of core samples (120 no Primary & 18 no Check samples) shall be generated from the mineralized zones to be intersected in the boreholes. Samples will be analysed for manganese mineralization (Mn, SiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub> Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub> and Acid Insolubles)

4.12.3. Internal check samples (5% of Primary samples) will be analyzed in Chemical Laboratory of MECL and 10% of Primary samples will be sent as External Check Samples to NABL External Labs for analysis of manganese mineralization (Mn, SiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub> Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub> and Acid Insolubles).

4.12.4. Total 15 Nos of composite samples will be analysed for Mn, SiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub> Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub> and Acid Insolubles.

#### **4.13.0 Whole Rock Analysis:**

4.13.1. Whole Rock analysis for SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, MnO, CaO, Na<sub>2</sub>O, K<sub>2</sub>O+H<sub>2</sub>O, MgO, P<sub>2</sub>O<sub>5</sub>, CO<sub>2</sub>, & S radicals will be carried out on 10 Nos samples to check the rock types, their variation in chemical composition.

#### **4.14.0 Petrological & Mineralogical Studies:**

4.14.1. During the course of Geological mapping and core logging 20 samples from various litho units from surface, Pit/Trenh/Channels and lithounits intersected in boreholes will be studied for petrography and 15 samples from mineralized zones will be studied for the ore mineral assemblages and their distribution, alteration, enrichment etc in polished sections.

#### **4.15.0 Justification :**

The Govt. of India enacted the MMDR Amendment Act-2015 duly introducing the system of auction for allocation of Mineral Concessions. Manganese has been categorized in the Fourth Schedule which needs prospecting and exploration by the State Govt. before auctioning of blocks. The area contains the continuation of Balaghat-Ukwa manganese ore belt. The rocks of the area majorly belong to the Precambrian Sausar Group in which Manganese mineralization is present in the region. Based on the evaluation of previous work and the manganese occurrences with value (more than 10% mn with hand held XRF) identified during the filed visit and also the recommendation from GSI in the adjacent areas of Miragpur and Pindkapur, the proposed block is very much potential for manganese. Hence Reconnaissance Survey exploration program at G-4 level has been prepared in order to find out surface and depth continuity of manganese ore

body. The Remote sensing combined with geological mapping, surface sampling and pitting/trenching will be helpful in assessing the disposition of the mineralized zones, structural features like shears and faults if any.

#### 4.16.0 Nature Quantum and Target

4.16.1. Details of the particular, Quantum and the targets are tabulated in **Table No.-IV.A.**

**Table No-IV.A**  
**Envisaged Quantum of proposed work in Katori-Jhiriya G4 Block**

Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Geological Mapping (on 1:12,500 Scale)	Sq. Km.	140.22
2	Geophysical Work		
	i) Self Potential (S.P) and Magnetic Survey	Line Km	20.00
3	Trenching (1m x 2m x75m)	Cu. m	150
4	Core Drilling (8 Scout Boreholes)	m.	500.00
5	Sample Preparation & Chemical Analysis		
A.	Primary samples for Manganese (Bedrock/Channel Samples)		
	i) Primary samples for 6 radicals i.e. Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles	Nos.	200
	ii) Internal Check samples (5% of Primary samples) for 6 radicals	Nos.	10
	iii) External Check sample (10% of Primary samples) for 6 radicals	Nos.	20
B.	Primary samples for Manganese (Trench/Channel Samples)		
	i) Primary samples for 6 radicals i.e. Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles	Nos.	100
	ii) Internal Check samples (5% of Primary samples) for 6 radicals	Nos.	5
	iii) External Check sample (10% of Primary samples) for 6 radicals	Nos.	10
C.	Primary samples for Manganese (Core)		
	i) Primary samples for 6 radicals i.e. Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles	Nos.	120
	ii) Internal Check samples (5% of Primary samples) for 6 radicals	Nos.	6
	iii) External Check sample (10% of Primary samples) for 6 radicals	Nos.	12
D.	Composite Samples for Manganese (Core) for 6 radicals i.e. Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles	Nos.	15
6	Whole Rock Analysis		

Sl. No.	Item of Work	Unit	Proposed Quantum of work
	For SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , TiO <sub>2</sub> , MnO, CaO, Na <sub>2</sub> O, K <sub>2</sub> O+H <sub>2</sub> O, MgO, P <sub>2</sub> O <sub>5</sub> , CO <sub>2</sub> , & S.	Nos	15
7	Petrographic Studies	Nos	20
8	Mineragraphic Studies	Nos	15
9	Report Preparation (Digital format)	Nos.	1

### 5.0.0 Manpower Deployment

5.1.0 Manpower deployment List will be provided later.

### 6.0.0 Break-up of Expenditure

6.1.0 Tentative Cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020. The total estimated cost is Rs. **189.51 Lakh**. The summary of tentative cost estimates for Reconnaissance Survey (G-4 Level) is given in **Table No.-VI.A** and details of tentative cost estimates is given in **Table No.-VI.B**. Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) is given in **Table No. VI-C**.

**Table No-VI.A**

**Summary of Tentative Cost Estimates for Reconnaissance Survey (G-4 Level)  
Exploration**

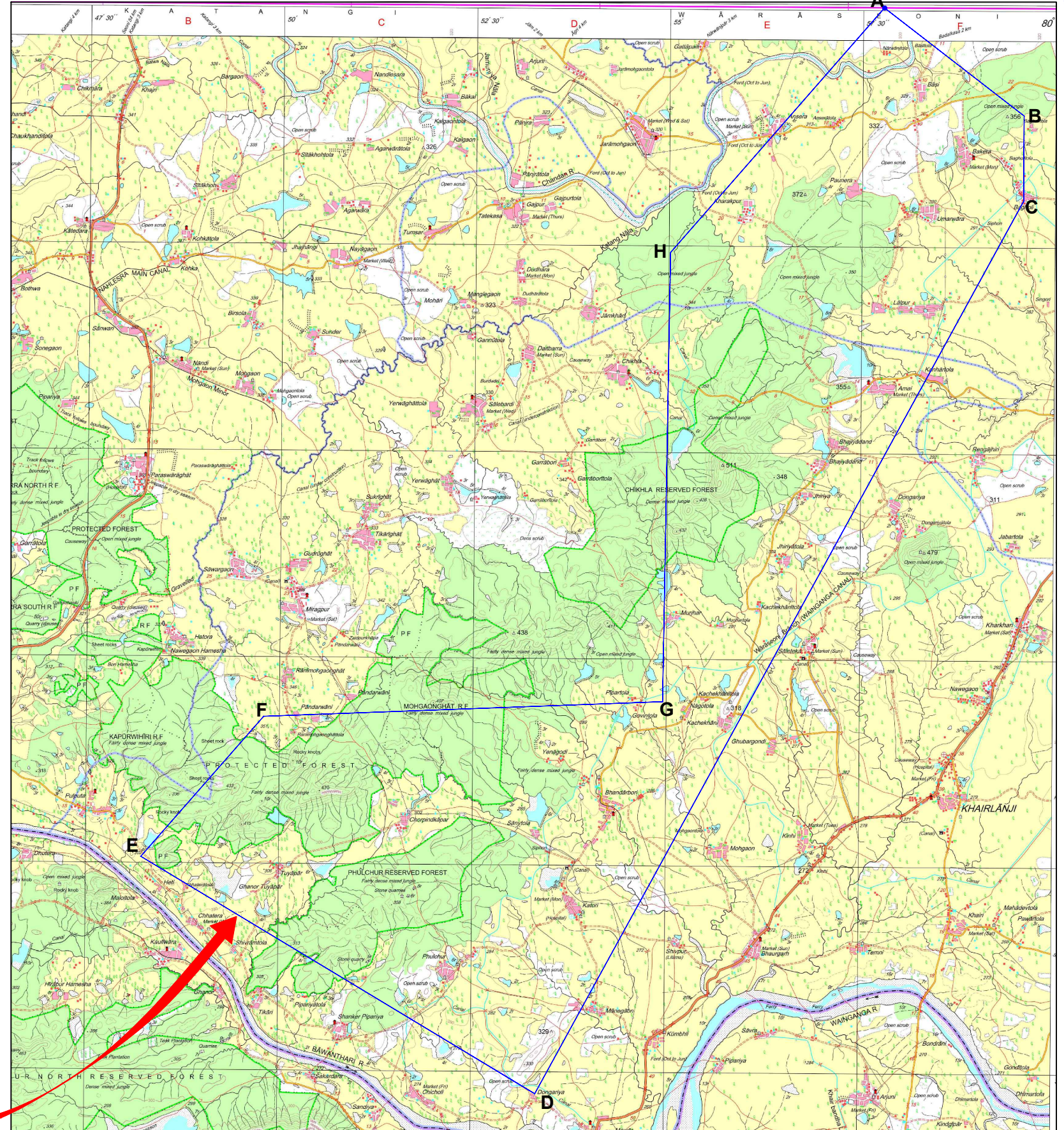
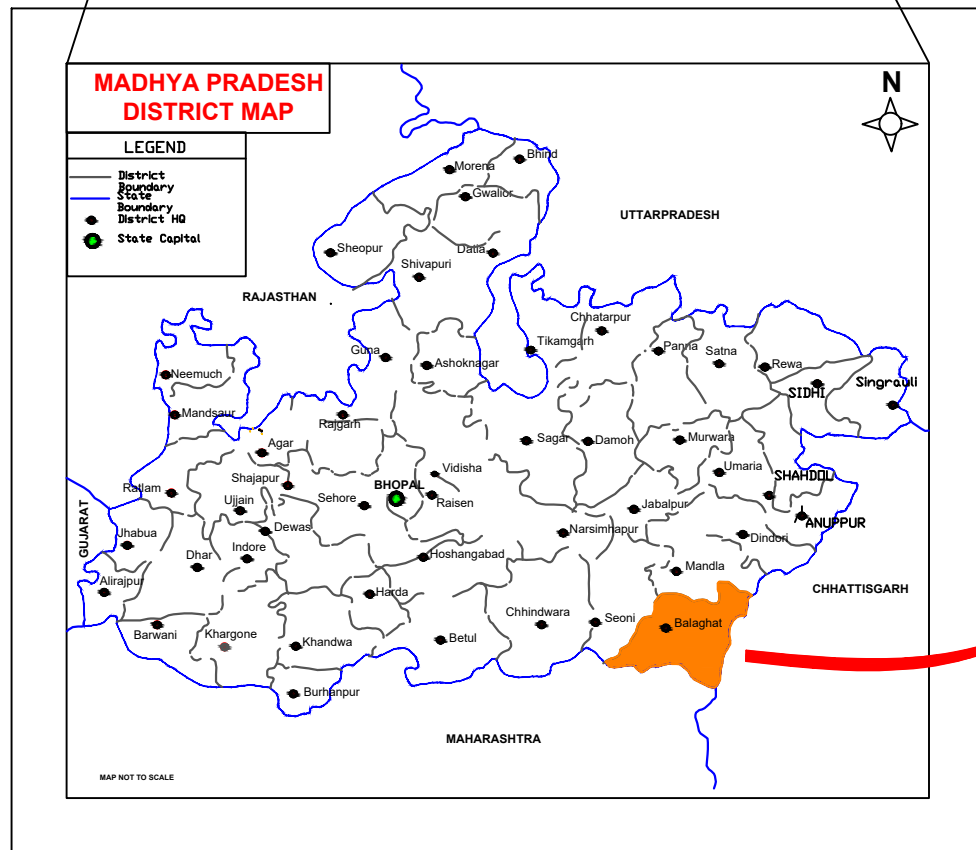
Sl. No.	Item	Total
1	Geological Work	<b>31,92,440</b>
2	Pitting & Trenching	<b>6,60,000</b>
3	Geophysical Work	<b>21,04,207</b>
4	Drilling	<b>72,75,750</b>
5	Laboratory Studies	<b>17,53,753</b>
	<b>Sub total</b>	<b>1,49,86,150</b>
6	Report	<b>7,49,308</b>
7	Peer Review	<b>10,000</b>
8	Proposal Prepration	<b>3,14,709.15</b>
	<b>Total</b>	<b>1,60,60,167</b>
9	GST (18%)	<b>28,90,830.00</b>
	<b>Total cost including 18% GST</b>	<b>1,89,50,997</b>
	<b>SAY, in Lakhs</b>	<b>189.51</b>

Estimated cost for Reconnaissance survey (G4) for Manganese ore in Katori-Jhiriya Block, District: Balaghat, Madhya Pradesh. [Block area- 140.22 sq. km; Nos. of Borehole- 8; Borehole depth range- 60m; Schedule timeline- 18 months]							
S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item -SI No.	Rates as per SoC	Qty.	Amount (Rs)	
<b>A</b>	<b>Remote Sensing Study</b>						
i	Charges for one Geologist per- HQ	day	1.2	9,000	15	1,35,000	
	<b>GEOLOGICAL WORK (1:12,500 scale)</b>						
i	Charges for one Geologist per- HQ	day	1.2	9,000	15		
i	Charges for one Geologist- Field	day	1.2	11,000	180	19,80,000	
ii	Charges for one Geologist per- HQ	day	1.2	9,000	60	5,40,000	
iii	2 labours/ party (Rs 443/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	443	360	1,59,480	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
iv	Core Sampling -1 Samplers Labour charge not included	day	1.5.2	5,100	55	2,80,500	
v	4 labours/ party (Rs 443/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	443	220	97,460	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
					<b>Sub Total- A</b>	<b>31,92,440</b>	
<b>B</b>	<b>GEOPHYSICAL SURVEY</b>						
i	SP and Magnetic Survey (8-20 L Km)	Line Km	3.3b	12,92,047	1	12,92,047	
ii	Charges for one Geophysicist per day at field	day	3.18	11,000	30	3,30,000	
iii	Charges for one Geophysicist per day at HQ	day	3.18	9,000	20	1,80,000	
iv	Surveyor Work	days	1.6.1a	8,300	30	2,49,000	
v	4 labours/ party (Rs 443/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	443	120	53,160	
					<b>Sub Total- B</b>	<b>21,04,207</b>	will be decided after review
<b>C</b>	<b>PITTING AND TRENCHING</b>						
i	Trenching (1m x 2mx 150 m)	Cu m	2.1.1	3300	200	6,60,000	
					<b>Sub Total- C</b>	<b>6,60,000</b>	
<b>D</b>	<b>DRILLING</b>						
i	Drilling upto 300m (Hard Rock) (1 rigs )	m	2.2.1.4a	11,500	500	57,50,000	
ii	Borehole deviation Survey	m	2.2.6	330	500	1,65,000	
iii	Land / Crop Compansation	per BH	5.6	20,000	8	1,60,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
iv	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	8	16,000	
v	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	320	11,520	Certification in this regard is required to be provided
vi	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	3	1,50,000	
vii	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
viii	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
ix	Approach Road Making (Flat Terrain)	Km	2.2.10a	22,020	4	88,080	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed for max. 4 km.
x	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and by DGPS	Nos	1.6.2	19,200	9	1,72,800	*8 Boreholes and 1 base station
xi	One complete borehole plus mineralised cores of all the remaining Bhs	m	5.3	1,590	165	2,62,350	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
					<b>Sub Total- D</b>	<b>72,75,750</b>	
<b>E</b>	<b>LABORATORY STUDIES</b>						
<b>1</b>	<b>Chemical Analysis</b>						
i	<b>Primary &amp; Check samples for Maganese</b>						
	a. Primary Samples for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	420	11,93,220	
	b-Internal (5%) Check samples for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	21	59,661	
	c-External(10%) Check samples from NABL Lab for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	42	1,19,322	
ii	<b>Composite samples for Maganese</b>						
	a. Composite Samples for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	15	42,615	
<b>2</b>	<b>Physical &amp; Petrological Studies</b>						
i	Preparation of thin section	Nos	4.3.1	2,353	20	47,060	
ii	Complete petrographic study report	Nos	4.3.4	4,232	20	84,640	
iii	Preparation of polished section	Nos	4.3.2	1,549	15	23,235	
iv	Complete mineragraphic study report	Nos	4.3.4	4,232	15	63,480	
v	Digital Photographs	Nos	4.3.7	280	25	7,000	
vi	Whole Rock Analysis (Major oxide and 8 additional trace elements)	Nos	4.1.15a & b	7,568	15	1,13,520	
					<b>Sub Total- E</b>	<b>17,53,753</b>	
<b>F</b>					<b>Total A to E</b>	<b>1,49,86,150</b>	
<b>G</b>	<b>Geological Report Preparation</b>		<b>5.2</b>	For the projects having cost exceeding Rs. 50 lakhs and less than Rs. 150 lakhs - A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more		<b>7,49,308</b>	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
<b>H</b>	<b>Peer review Charges</b>		<b>As per EC decision</b>			<b>10,000</b>	
<b>I</b>	<b>Preparation of Exploration Proposal (5 Hard copies with a soft copy)</b>	<b>5 Hard copies with a soft copy</b>	<b>5.1</b>	2% of the Cost or Rs. 3.8 Lakhs whichever is lower		<b>3,14,709</b>	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
<b>K</b>	<b>Total Estimated Cost without GST</b>					<b>1,60,60,167</b>	
<b>J</b>	<b>Provision for GST (18% of I)</b>					<b>28,90,830.00</b>	GST will be reimburse as per actual and as per notified prescribed rate
<b>K</b>	<b>Total Estimated Cost with GST</b>					<b>1,89,50,996.65</b>	
					<b>or Say Rs. In Lakhs</b>	<b>189.51</b>	
<b>Note:</b>							
1	If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required.						

Estimated cost for Reconnaissance survey (G4) for Manganese ore in Katori-Jhiriya Block, District: Balaghat, Madhya Pradesh. [Block area- 140.22 sq. km; Nos. of Borehole- 8; Borehole depth range- 60m; Schedule timeline- 18 months																								
S. No.		Months/D ays	1	2	3	4	5	6		7	8	9	10	11	12		13	14	15	16	17	18		
1	Camp Setting	months							Review							Review								
2	Geological Mapping	months																						
3	Survey days	days																						
2	Geophysical Work	months																						
5	Trenching	cu.m																						
6	Drilling (1 rig)	m																						
7	Geologist days	days																						
8	Sampling days, Core Sampling	days																						
9	Camp winding	months																						
10	Laboratory Studies	months																						
11	Geologist days, HQ	days																						
12	Report Writing with Peer Review	months																						

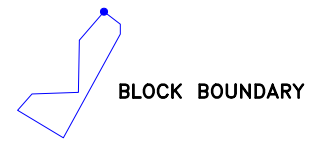
**List of Plates:**

1. Plate-I: Block Location Map of the Proposed Katori-Jhiriya block, Balaghat, State Madhya Pradesh
2. Plate-II: Regional Geological Map with Proposed Katori-Jhiriya block location (Part of GSI District Resource Map of Balaghat, Madhya Pradesh).



**Coordinates of cardinal points of Katori Jhiriya Block (140.22 Sq. Km)**

Sl. No.	Corner Points	DDMMSS (WGS84)		UTM 44N	
		LONGITUDE	LATITUDE	Easting(X)	Northing(Y)
1	A	79° 58' 10.9344" E	21° 45' 00.0000" N	393462.392	2405510.859
2	B	80° 00' 00.0000" E	21° 43' 42.1519" N	396579.906	2403096.572
3	C	80° 00' 00.0000" E	21° 42' 40.1234" N	396567.586	2401189.288
4	D	79° 53' 44.7663" E	21° 31' 49.7207" N	385643.697	2381263.382
5	E	79° 48' 37.4641" E	21° 34' 40.1505" N	376842.555	2386568.94
6	F	79° 50' 12.1470" E	21° 36' 22.4909" N	379589.243	2389695.263
7	G	79° 55' 21.9037" E	21° 36' 35.0974" N	388498.972	2390018.76
8	H	79° 55' 25.8017" E	21° 42' 01.5219" N	388680.634	2400055.144



**MINERAL EXPLORATION & CONSULTANCY LIMITED**

**LOCATION MAP**

**KATORI-JHIRIYA G4 BLOCK FOR MANGANESE (140.22SQKM)**

**DISTRICT : BALAGHAT STATE : MADHYA PRADESH**

**PART OF TOPOSHEET NO:-550/14 NOT TO SCALE**

**Prepared by : Exploration Division, MECL, Nagpur**

MECL/CHQ/EXPLORATION/NOV-2022 PLATE NO. I 1



**Estimated cost for Reconnaissance survey (G4) for Manganese ore in Katori-Jhiriya Block, District: Balaghat, Madhya Pradesh.**  
**[Block area- 140.22 sq. km; Nos. of Borehole- 8; Borehole depth range- 60m; Schedule timeline- 18 months]**

S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item -SI No.	Rates as per SoC	Qty.	Amount (Rs)	
<b>A</b>	<b>Remote Sensing Study</b>						
i	Charges for one Geologist per- HQ	day	1.2	9,000	15	1,35,000	
	<b>GEOLOGICAL WORK (1:12,500 scale)</b>						
i	Charges for one Geologist per- HQ	day	1.2	9,000	15		
i	Charges for one Geologist- Field	day	1.2	11,000	180	19,80,000	
ii	Charges for one Geologist per- HQ	day	1.2	9,000	60	5,40,000	
iii	2 labours/ party (Rs 443/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	443	360	1,59,480	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
iv	Core Sampling -1 Samplers Labour charge not included	day	1.5.2	5,100	55	2,80,500	
v	4 labours/ party (Rs 443/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	443	220	97,460	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
					<b>Sub Total- A</b>	<b>31,92,440</b>	
<b>B</b>	<b>GEOPHYSICAL SURVEY</b>						will be decided after review
i	SP and Magnetic Survey (8-20 L Km)	Line Km	3.3b	12,92,047	1	12,92,047	
ii	Charges for one Geophysicist per day at field	day	3.18	11,000	30	3,30,000	
iii	Charges for one Geophysicist per day at HQ	day	3.18	9,000	20	1,80,000	
iv	Surveyor Work	days	1.6.1a	8,300	30	2,49,000	
v	4 labours/ party (Rs 443/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	443	120	53,160	
					<b>Sub Total- B</b>	<b>21,04,207</b>	
<b>C</b>	<b>PITTING AND TRENCHING</b>						
i	Trenching (1m x 2mx 150 m)	Cu m	2.1.1	3300	200	6,60,000	
					<b>Sub Total- C</b>	<b>6,60,000</b>	
<b>D</b>	<b>DRILLING</b>						
i	Drilling upto 300m (Hard Rock) (1 rigs )	m	2.2.1.4a	11,500	500	57,50,000	
ii	Borehole deviation Survey	m	2.2.6	330	500	1,65,000	
iii	Land / Crop Compansation	per BH	5.6	20,000	8	1,60,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
iv	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	8	16,000	
v	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	320	11,520	Certification in this regard is required to be provided
vi	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	3	1,50,000	
vii	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
viii	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
ix	Approach Road Making (Flat Terrain)	Km	2.2.10a	22,020	4	88,080	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed for max. 4 km.
x	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and by DGPS	Nos	1.6.2	19,200	9	1,72,800	*8 Boreholes and 1 base station
xi	One complete borehole plus mineralised cores of all the remaining Bhs	m	5.3	1,590	165	2,62,350	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
					<b>Sub Total- D</b>	<b>72,75,750</b>	
<b>E</b>	<b>LABORATORY STUDIES</b>						
<b>1</b>	<b>Chemical Analysis</b>						
i	<b>Primary &amp; Check samples for Maganese</b>						
a.	Primary Samples for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	420	11,93,220	
b.	Internal (5%) Check samples for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	21	59,661	
c.	External(10%) Check samples from NABL Lab for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	42	1,19,322	
ii	<b>Composite samples for Maganese</b>						
a.	Composite Samples for 6 radical (Mn, SiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub> and Insolubles )	Nos	4.1.7a + 7b	2,841	15	42,615	
<b>2</b>	<b>Physical &amp; Petrological Studies</b>						
i	Preparation of thin section	Nos	4.3.1	2,353	20	47,060	
ii	Complete petrographic study report	Nos	4.3.4	4,232	20	84,640	
iii	Preparation of polished section	Nos	4.3.2	1,549	15	23,235	
iv	Complete mineragraphic study report	Nos	4.3.4	4,232	15	63,480	
v	Digital Photographs	Nos	4.3.7	280	25	7,000	
vi	Whole Rock Analysis (Major oxide and 8 additional trace elements)	Nos	4.1.15a & b	7,568	15	1,13,520	
					<b>Sub Total- E</b>	<b>17,53,753</b>	
<b>F</b>					<b>Total A to E</b>	<b>1,49,86,150</b>	
<b>G</b>	<b>Geological Report Preparation</b>		<b>5.2</b>	For the projects having cost exceeding Rs. 50 lakhs and less than Rs. 150 lakhs - A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more		<b>7,49,308</b>	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
<b>H</b>	<b>Peer review Charges</b>		<b>As per EC decision</b>			<b>10,000</b>	
<b>I</b>	<b>Preparation of Exploration Proposal (5 Hard copies with a soft copy)</b>	<b>5 Hard copies with a soft copy</b>	<b>5.1</b>	2% of the Cost or Rs. 3.8 Lakhs whichever is lower		<b>3,14,709</b>	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
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<b>J</b>	<b>Provision for GST (18% of I)</b>					<b>28,90,830.00</b>	GST will be reimburse as per actual and as per notified prescribed rate
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