PROPOSAL FOR PRELIMINARY EXPLORATION (G-3) FOR COPPER AND ASSOCIATED MINERALS IN SINGHANA-BODHAN BLOCK (3.36 Sq. Km.), NORTH KHETRI COPPER BELT, DISTRICT: JHUNJHUNU, RAJASTHAN

UNDER NMET PROGRAM.

COMMODITY: COPPER AND ASSOCIATED MINERALS

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED
DR. BABASAHAB AMBEDKAR BHAWAN
SEMINARY HILLS

PLACE: NAGPUR **DATE: 14th FEBRUARY, 2025**

Summary of the Block for Preliminary Exploration (G-3)

GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Singhana Bhodan Block (3.36 sq. km.)
	Exploration Agency	Mineral Exploration & Consultancy Limited (MECL)
	Commodity	Copper & Associated Minerals
	Mineral Belt	North Khetri Copper Belt of Rajasthan
	Budget &Time Schedule to complete the project	910.37 lakhs: 15 Months
	Objectives	The present exploration program at G3 stage has been formulated to fulfil the following objectives: **Phase-I:** i. To carry out detailed Geological mapping on 1:2000 scale & Topographical contour survey over the entire 3.36 sq.km. ii. To carry out ground geophysical surveys (TDEM, Deep I.P. & Gravity, Magnetic) to delineate sub surface configuration and to identify potential anomalous zones for possible mineralization. **Phase-II** (Based on the positive outcome of Phase-I work & review with TCC) iii. To carry out exploratory drilling to prove the strike and depth persistence of ore zones up to 200m vertical depth (120mRL) from surface at 200m spacing interval in the identified potential anomalous area. iv. To drill one deeper level borehole up to 450m vertical depth (-80mRL) from surface to check the depth persistence of ore zones on selected one section line. v. To estimate ore resources under inferred category (G3) as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules 2015.

<table>
<tr><td></td><td>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</td><td>Work will be carried out by MECL.</td></tr>
<tr><td></td><td>Name/Number of Geoscientists</td><td>Two nos. Geoscientist of Geology/Geophysicist (Field + HQ)</td></tr>
<tr><td></td><td>Expected Field days (Geology, surveyor)</td><td>Geologist Party days:210 days</td></tr>
<tr><td></td><td></td><td>Surveyor Party days: 30 days</td></tr>
<tr><td>1.</td><td>Location</td><td>The Singhana- Bhodan Block area falls in Survey of India Toposheet No. 44P/16 and covers total area of 3.30 sq.km. The block area falls in and around the villages Singhana, Bhodan Tehsil-Khetri, Dist- Jhunjhunu, Rajasthan.</td></tr>
<tr><td></td><td>Latitude and Longitude</td><td><u>Corner cardinal points of Singhana- Bhodan G3 Block (3.36 sq.km)</u>

<table><tr><th>Corner Cardinal point</th><th>Latitude</th><th>Longitude</th></tr><tr><td>A</td><td>28° 07' 12.6566" N</td><td>75° 50' 46.0259" E</td></tr><tr><td>B</td><td>28° 07' 29.1389" N</td><td>75° 51' 41.5232" E</td></tr><tr><td>C</td><td>28° 06' 53.9309" N</td><td>75° 52' 07.0818" E</td></tr><tr><td>D</td><td>28° 06' 54.0239" N</td><td>75° 52' 31.2173" E</td></tr><tr><td>E</td><td>28° 06' 41.7310" N</td><td>75° 52' 34.9908" E</td></tr><tr><td>F</td><td>28° 06' 18.7298" N</td><td>75° 51' 19.3296" E</td></tr></table></td></tr>
<tr><td></td><td>Villages</td><td>Singhana, Bhodan</td></tr>
<tr><td></td><td>Tehsil/Taluk</td><td>Khetri</td></tr>
<tr><td></td><td>District</td><td>Jhunjhunu</td></tr>
<tr><td></td><td>State</td><td>Rajasthan</td></tr>
<tr><td>2.</td><td>Area (hectares/ sq. km)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>3.36 sq.km</td></tr>
<tr><td></td><td>Forest Area</td><td>Data not available</td></tr>
<tr><td></td><td>Government Land Area (Bilanam)</td><td>Data not available</td></tr>
<tr><td></td><td>Charagaha</td><td>Data not available</td></tr>
<tr><td></td><td>Private Land Area</td><td>Data not available</td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>The nearest railhead is Narnaul which is 25 km east of the area on Rewari - Phulera meter gauge section of Western Railway</td></tr>
<tr><td></td><td>Road</td><td>Well connected by road to Jaipur (165km) & Delhi (180km)</td></tr>
<tr><td></td><td>Airport</td><td>Indira Gandhi International Airport, New Delhi (170km)</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
</table>

	Local Surface Drainage Pattern (Channels)	The area is drained by the north- easterly flowing Sukh River which at present drains the waste water of Khetri Copper smelter.
	Rivers/ Streams	Sukhi River
5.	**Climate**	
	Mean Annual Rainfall	Average annual rainfall is about 466 mm.
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	The average temperature during the summer is 40°C, which reaches upto 48°C sometimes during May-June. While the average winter temperature is 14°C, which at times goes down to 2°C during December-January
6.	**Topography**	
	Toposheet Number	44P/16
	Morphology of the Area	The area covered by alluvium and exhibits generally plain topography with an altitude of around 330 to 350 meters above mean sea level. The area is drained by the north-easterly flowing Sukh nadi, which at present drains the waste water of Khetri copper smelter.
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/25K)	Available
	Geochemical Map	Not applicable.
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Available
8.	**Justification for taking up Preliminary Exploration**	i. Proposed Singhana-Bhodan Block forms the part of prominent Singhana-Muradpur-Pacheri segment of North Khetri Copper Belt and lies between the gap areas of previously explored Singhana Extension Block-II and Muradpur Block. ii. The previous exploration carried out by GSI & MECL (2002 & 2013-14) in Singhana Extension Block-II & Muradpur Central Block established presence of prominent two copper lodes (Lode-I & II) of varying thickness between 120mRL to -240mRL. iii. In Singhana Extension-II Block, Lode-I hosted by biotite-amphibole quartzites intersected in two boreholes i.e. SME-7 (3.65m x 1.22% Cu) and SME-9 (4.85m x 0.83% Cu). The promising lode-II hosted by amphibole rich rock has been intersected in borehole SME-7 (12.75m x 0.90% Cu). The average gold content of lode-I is 0.3 to 0.4 g/t while in lode-II the average gold content is 0.5 g/t. A total of

		iv. 2.83 m.t. of ore resource with 0.82% Cu have been estimated in Singhana Extension Block-II over a strike length of 1.0km and up to vertical depth of 470m (-180mRL). v. In Muradpur Central block, the most persistent lodes HWI, HWII of Lode-I & FWI – FWII of Lode-II have exhibited the pinch and swell structure and are disposed in en-echelon pattern. Total 5.42 m.t. copper ore resource with an average grade of 0.47% Cu at 0.2% Cu cut-off & 2.30 m.t. copper ore resource with an average grade of 0.70% Cu at 0.5% Cu cut-off estimated over a strike length of 600m & 500m respectively up to vertical depth of 265m. vi. Since the proposed Singhana Bhodan Block lies in between the gap areas of Singhana Extension -II Block and Muradpur block forms the basis for present exploration to prove the prove the strike and depth continuity of these prominent copper bearing lodes at 200m vertical depth and 450m vertical depth from surface. vii. Moreover, DMG Rajasthan has requested MECL to quantify the copper ore resources and associated minerals in Singhana Bhodan Block under NMET funding. In light of the above, MECL formulated preliminary exploration (G3) proposal to establish copper and associated mineral resource in the area. viii. The present exploration at G3 stage would be helpful to estimate the copper and associated minerals resource at inferred category (333) of UNFC. This will enable the Govt. to upgrade and amalgamate the block with the adjoining/adjacenet potential blocks to make a sizable block for auction.

PROPOSAL FOR PRELIMINARY EXPLORATION (G3) FOR COPPER AND ASSOCIATED MINERALS IN SINGHANA-BHODAN BLOCK, NORTH KHETRI COPPER BELT, DISTRICT - JHUNJHUNU, RAJASTHAN

1.0 INTRODUCTION

1.1.1 Copper with its unique physical, mechanical and electrical properties, has played a vital role in the industrial growth of a nation. Copper is a soft, malleable and ductile metal with very high thermal and electrical conductivity. Copper is one of the few metals that occurs in nature in directly usable metallic form (native metals) and is an important non-ferrous base metal having wide industrial applications, ranging from defence, space programme, railways, power cables, mint, telecommunication cables etc. India is not self-sufficient in the production of copper ore and imports copper concentrates for its smelters in addition to domestic production of ore and concentrates. Copper demand in India is expected to grow at 6 to 7% due to increased thrust of Government of India towards "Make in India" and "Smart City" programmes and increased investments in railways, power, defence and infrastructure sectors would drive the demand for copper in the country.

1.1.2 In India, around 75% of demand is met through imports. The increasing demand of copper metal in the country could be eased with the exploration of new copper deposits of economic importance. During, preceding decades no large-scale metal deposit has been discovered in India. However, the possibility of working of small mineral bodies in proximity to each other, though technological advances and increased operational efficiency cannot be ruled out. Therefore, it is necessary and imperative to locate and explore such small copper deposits in cluster.

1.1.3 As per IMYB-2022 of IBM, the total reserves/resources of copper ore as on 1.4.2020 UNFC system are estimated at 1.66 billion tonnes. Of these, 163.89 million tonnes (9.87%) fall under ‘Reserves category’ while the balance 1.50 billion tonnes (90.13%) are placed under ‘Remaining Resources’ category. Gradewise there are no reserves with 1.85% or more copper grade. However, 163.89 million tonnes reserves fall under 1% to below 1.85% Cu grade. Of the total ore resources 8.28 million tonnes (0.49%) comprise ore containing 1.85% Cu or more and 587 million tonnes (35.33%) resources fall under 1% to below 1.85% Cu grade. The total metal content out of the total copper resources is 12.20 million tonnes of which 2.16 million tonnes constitute reserves. Rajasthan state hold largest copper ore reserves/resources of 868 million tonnes constituting 52.25% of total estimated copper ore reserves/resources of India.

1.1.4 In view of the current scenario there is an urgent need to convert the available resources into reserves and locate new mineral deposits to meet the demand of the country.

2.0.0 BACKGROUND INFORMATION

2.1.1 The prominent Khetri Copper Belt (KCB) extends over a distance of 100km from Raghunathgarh in Sikar district in south east to Pacheri in Junjhunu District in the North east of Rajasthan and hosting numerous small to large copper deposits. KCB appears to extend further northeast below the soil cover. A 12km long strike length (NE-NW) Singhana-Muradpur-Pacheri segment of North Khetri Copper Belt (NKCB) is just adjoining and north eastern extension of Khetri Mines-Banwas area which was previously explored by GSI & MECL. Subsequently, MECL established total 20.09 m.t. with 1.50% Cu in Singhana area comprising of three sub-blocks namely Singhana Block, Singhana Extension Block & Singhana Extension Block-II over 3.0 km strike length. Moreover, MECL carried out exploration in Muradpur Central Block and established 5.42 mt. of 0.47% Cu. The previous investigations revealed that significant mineralized zones for copper intersected in the boreholes from 100m to up to 500m vertical depth from surface in Singhana Extension Block-II and Muradpur area.

2.1.2 The proposed Singhana-Bhodan Block (G3) is just adjoining block and lies in between the gap areas of Singhana Extention Block-II and Muradpur Block in Singhana-Muradpur-Pacheri segment of North Khetri Copper Belt.

2.1.3 Copper mineralization in the area is mostly hosted by amphibole-biotite quartzite, amphibole quartzite and amphibole magnetite/amphibole rich rock and mineralization distributed over a vertical depth of around 150m to 500m from surface. Based on the potentiality of the prospect, DMG, Govt. of Rajasthan given consent to MECL for carrying out preliminary Exploration (G3) in Singhana-Bhodan Block, Jhunjhunu District under NMET funding vide letter No. MECL/EXPL/File/DMG-RAJ. /2024-25/655 Dated: 21.09.2024.

2.1.4 In light of the above, MECL formulated scheme of exploration proposal at G3 stage for Copper and associated minerals in Singhana-Bhodan Block area over 3.36 sq.km extent by way of detailed geological mapping, ground geophysical survey and followed by exploratory drilling to establish the strike and depth continuity of ore body up to 200m vertical depth from surface over a strike length of 1.6km.

3.0 LOCATION AND ACCESSIBILITY

2.1.0 The proposed Singhana Bhodan block covers an area of 3.26 sq. Km. and falling north eastern continuity of Khetri mines-Banwas and Singhana area of North Khetri Copper Belt, Jhunjhunu District of Rajasthan. The block area falls in Survey of India Topo-sheet No. 44P/16 and the Co-ordinates of the corner points of the block area are given in Table No. 2.1. Location of the proposed Block is shown in **Plate No.I.**

Table: 2.1
Co-ordinates of corner points of proposed Singhana-Bhodan Block (G-3) for Copper and associated minerals, District: Jhunjhunu, State: Rajasthan

Corner Cardinal point	Latitude	Longitude
A	28° 07' 12.6566" N	75° 50' 46.0259" E
B	28° 07' 29.1389" N	75° 51' 41.5232" E
C	28° 06' 53.9309" N	75° 52' 07.0818" E
D	28° 06' 54.0239" N	75° 52' 31.2173" E
E	28° 06' 41.7310" N	75° 52' 34.9908" E
F	28° 06' 18.7298" N	75° 51' 19.3296" E

2.1.1 Singhana-Bhodan block is located about 1.5km East of Singhana Town and about 1.5km West of Muradpur village. Singhana (1.5km) is the nearest town and is well connected by all weather metal roads to major cities. The block area is located around 6 kilometers NNE of Khetri Copper Complex (KCC) of M/s Hindustan Copper Ltd (HCL). Khetri Nagar, the copper town of HCL and Singhana has basic infrastructure facilities.

2.1.2 The proposed block area is well connected by all weather road to State Capital Jaipur (about 165 km) and National Capital New Delhi (180 Km) via NH52 and NH11 respectively. The nearest railhead is Narnaul which is 25 km east of the area on Rewari - Phulera meter gauge section of Western Railway. Indira Gandhi International (IGI) Airport, New Delhi, is the nearest airport at a distance of about 170 km away from the block.

3.0 PHYSIOGRAPHY AND DRAINAGE

3.1.0 The major part of the area is covered by alluvium and soil. The area exhibits general plain topography. The flat area is covered by stabilized sand dunes at places and is generally 330 m to 350m above mean sea level. The north easterly flowing Sukh Nadi occupies the eastern part of the block and represents the drainage of the area. The general slope of ground is northeasterly. All the nalas in the area are seasonal, flow in the monsoon and remain dry during the summer.

4.0 CLIMATE & RAINFALL

4.1.0 The area experiences semiarid climate and water table is 20m to 50m below the ground. The average annual rainfall of Buhana TehsIl is about 466mm mainly during June to August (2001 to 2021, source: Government of Rajasthan, Water Resources). Owing to limited rainfall, the flora of the area is not rich and varied.

4.1.1 The area falls under semi-arid climate zone. It is characterised by very hot summers and very cold winters with poor rainfall during south-west monsoon period. The average temperature during the summer is 40°C, which reaches upto 48°C sometimes during May-June. While the average winter temperature is 14°C, which at times goes down to 2°C during December-January.

5.0 REGIONAL GEOLOGY AND STRUCTURE

5.1.1 The Delhi Fold Belt of middle to upper Proterozoic age extends over 700 km. in the state of Rajasthan and parts of Gujarat. This fold belt constitutes an important setting for the major base metal deposits of India. The Khetri Copper Belt, which is a part of the North Delhi Fold Belt, extends over a strike length of 100 km. from Raghunathgarh, Distt. Sikar in the south to Pacheri, Distt. Jhunjhunu in the north east in the State of Rajasthan. The belt appears to extend further northwards below the soil cover.

5.1.2 The Khetri Copper Belt (KCB) is divided by the Kantli river into two main segments; viz. the North Khatri Copper Belt (NKCB) and the South Khetri Copper Belt (SKCB). The North Khetri Copper Belt which hosts the major copper ore producing mines has witnessed intense mining activity for over hundreds of years. In the South Khetri Copper belt mineralisation is controlled by a strike fault extending for over 25 km. from Satkui to Raghunathgarh. Numerous old workings can be traced all over the Khetri Copper Belt.

5.1.3 The rock types present in the KCB belong to the Delhi Super Group and have been sub divided into the older Alwar Group with mainly arenaceous members and the younger Ajabgarh group with predominantly argillaceous composition. These two groups have a gradational contact. The KCB comprises metamorphosed arenaceous, argillaceous and calcareous sedimentary rocks associated with mafic volcanic rocks belonging to Alwar and Ajabgarh Group (Heron 1953; Das Gupta 1968; Sarkar and Dasgupta 1980a, b; Roy and Jakhar 2002) of the Delhi Supergroup. The copper deposit of KCB are hosted in the Proterozoic sequence of rocks belong to Ajabgarh Group of Delhi Supergroup situated in foot hill zone of Aravalli Mountain Range.

5.1.4 The arenaceous and argillaceous metasediments of Alwar and Ajabgarh Groups belonging to Delhi Supergroup constitute the regional geological sequence of the area. The area is mostly covered with alluvium and the major rock types exposed in the area are quartzite (feldspathic quartzite and quartzite with phyllite and schist), phyllite / carbon phyllite with or without andalusite, schists (andalusite-biotite-sericite-garnet-chlorite schist), calc-gneiss, biotite granite etc. The basement of the meta-sedimentary units in the NKCB is represented by the ~1.82 Ga calc alkaline granitic rocks and 1.70 Ga albitized A-type granites (Text Figure-4; Kaur et al. 2007, 2009, 2011). The regional geological map of Khetri Copper Belt & North Khetri Copper Belt with proposed Singhana-Bhodan Block location is shown as Text Figure-1 and Text Figure-2 respectively.

5.1.5 The Stratigraphic succession of the Khetri belt, after Heron (1923) and Dasgupta (1968) are given in following Table-5.1.

Table: 5.1
Geological Succession of the Khetri belt (Heron, 1923 and Dasgupta, 1968)

Age	Formation	Rock types
Recent and Sub-recent		Alluvium and blown sand
Delhi Super Group (Proterozoic)	Post Delhi Intrusive	Quartz Veins, Chert-Aplite Veins. Thin amphibolite dykes, pegmatites granite aplitic-granite, amphibolites (metamorphosed) Upper arenaceous unit: Biotite Schist, felspathised biotite gneiss and amphibole-biotite gneiss.
	Ajabgarh Group	**Upper pelitic unit:** Phyllite, impure marble, calc-gneiss, amphibolites, amphibole quartzite, silicified phyllite, cherty carbonate rock. **Middle arenaceous unit:** Massive, thick bedded quartzite with rare intercalations of phyllite. **Lower pelitic unit:** Phyllite, sericite schist, biotite-chiastolite schist, felspathic biotite schist, silicified schist, marble, carbonaceous phyllite, graphitic schist, quartzite, antholpyllite – cummingtonite rock and amphibolites.
	Alwar Group	Arkosic quartzite, amphibole quartzite, amphibole-quartz gneiss, actinolite marble, amphibole-biotite quartzite, phyllite and mica schist.

5.1.6 The present study area belong to Alwar and the Ajabgarh Groups of the Delhi Supergroup. The Alwar Group and the Ajabgarh Group show the gradational contact. The Alwar Group is represented by arkosic quartzite, amphibole quartzite, and amphibole biotite quartzite and the Ajabgarh Group is represented by garnetiferous biotite schist, garnetiferous amphibolite and anthophyllite cummingtonite rock.

5.1.7 The general strike of the rock formation varies between NE-SW to NNE-SSW, with several local variations due to the presence of folds belonging to different generations. The dips generally vary from 50° to sub vertical towards northwest. Khetri Copper Belt (KCB) has witnessed at least three stages of deformation, as evidenced by the folds belonging to different generations, namely, F1, F2 and F3. Whereas folds F1 and F2 are tight, coaxial, trending NE-SW in general and plunging gently in either of the directions, F3 folds are relatively open and steeply plunging folds, with their axes plunging either towards NW or SE. The folds have exercised a major control over the mineralization apart from the lithological control in the North Khetri Copper Belt. In the South Khatri Copper Belt, mineralization is controlled by a strike fault extending for over 25 km from Satkui to Raghunathgarh Both transverse and longitudinal shears are common. Numerous joint sets are also present.

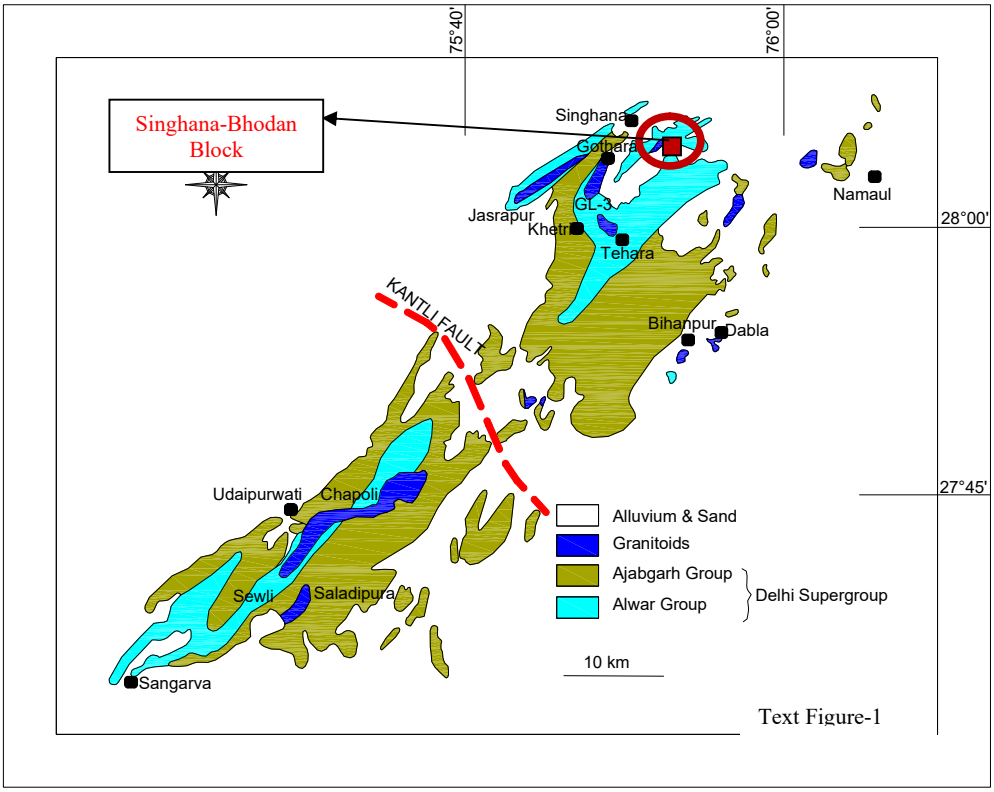
5.1.8 Numerous workers have reported widespread post-metamorphic hydrothermal alterations (Roychowdhury and Dasgupta 1965; Kaur et al. 2012; Knight et al. 2002). Roy Chowdhury and

Das Gupta (1965) reported Fe–Mg metasomatism, chloritization, biotitization, sericitization and silicification.

5.1.9 The bulk of the mineralization is confined to the Garnetiferous-chlorite-biotite-quartzite/schist, biotite quartzite and amphibole-quartzite in the northern part of the belt. However, amphibole rich rock forms the major host rock for mineralization in Banwas, Singhana and Kalapahar areas. In the South Khetri Copper Belt grey banded phyllitic quartzite is the major host rock for mineralization.

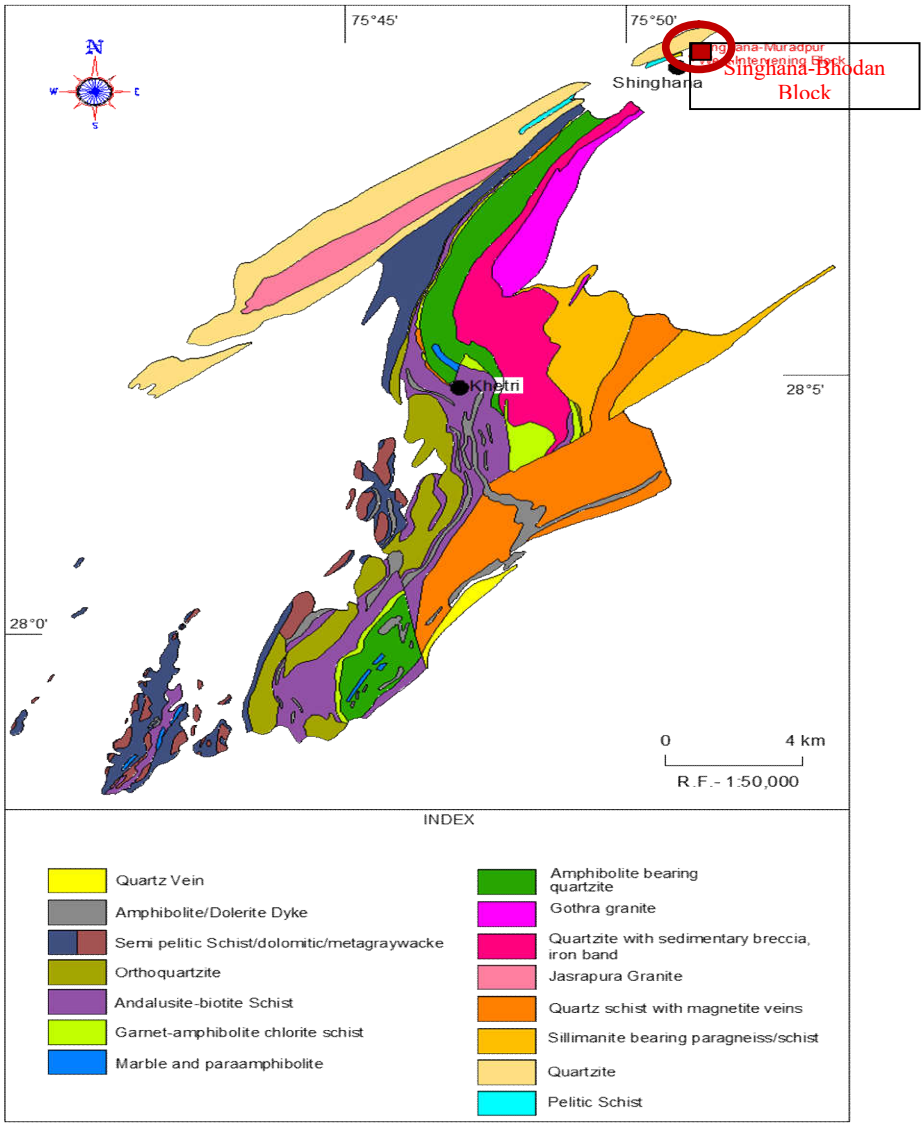
5.1.10 Regional Geological map with location of proposed Singhan-Bhodan Block is shown as **Plate No.II.**

Regional Geological Map of Khetri Copper Belt with proposed Singhan-Bhodan Block location (After Heron, 1923; Ray, 1990; GSI, 1997; and Kaur et al. 2007)



Text Figure-1

Regional Geological Map of North Khetri Copper Belt with proposed Singha-Bhodan Block location



Text Figure-2

6.0 GEOLOGY OF THE BLOCK

6.1.0 The proposed Singhana Bhodan block lies northeastern extension of Khetri Mines-Banwas area and forms part of Singhana-Muradpur-Pacheri Segment of Northern Khetri Copper Belt (NKCB). The block area is completely covered by alluvium and sand dunes at places. The area is covered with 20-40m thick soil which is under extensive cultivation. The outcrops are not observed in the

block, so the geology is inferred by interrelate the geology of adjoining areas, and borehole data. The major lithology intersected in the adjoining block area are quartzite (feldspathic quartzite, amphibole quartzite and andalusite quartzite), pellite / schist (biotite schist, quartz biotite schist) and amphibolite belonging to Alwar and Ajabgarh Group of Delhi Supergroup represent major lithounits of the area. Albitization is very common in the area. The geological succession of the block is established mainly based on subsurface data and data available around the area. The Geological map of the block area is given in **Plate No. III.**The Generalized Stratigraphic Succession of the Sinhgana-Bhodan Block area is given in Table-6.2 below.

Table 6.2: Generalized Stratigraphic Succession of the Block area (after GSI)

Post Delhi		Younger Intrusive Massive quartzites
	Unconformity	
Delhi Supergroup	**Ajabgarh Group**	Andalusite-biotite-quartz schist/phyllite. Biotite quartzite/schist.
	Gradational contact	
	Alwar Group	Amphibolite/Amphibole rich rock with magnetite bands. Amphibole-biotite quartzites. Felspathic quartzites

6.1.2 The block area is entirely covered with alluvium. The primary sedimentary structures are highly obliterated and are hardly preserved in the area. The secondary structure is foliation, which is preserved in the lithounits in the boreholes. The general trend of foliation (S1) have been taken from adjoining area, which is NNE-SSW to NE-SW with southerly dip and dip angle of about70°to80°. The Geological map of the block area is given in **Plate No. III.**

6.1.3 **Mineralization:**

The copper mineralisation as observed in the Singhana, Muradpur, Banwas and Madan – Kudan areas is confined to amphibole-biotite quartzite, amphibole magnetite rock and gt. biotite schist. As the proposed Singhana-Bhodan block is northeastern extension to Banwas, Sighana area has similar geological set up with established trend of mineralisation in the adjoining/adjacent areas like Singhana Extension-II Block and Muradpur block. Amphibole biotite quartzites, Amphibole magnetite rocks and schist are grey to greenish grey in colour and contains quartz, feldspar, amphibole, biotite, chlorite, magnetite and calcite. The area is entirely covered with thick alluvium cover of about 20-40m and as such there is no manifestation of mineralization on the surface. However, the gossans were observed in cutting of wells dug in a series in the area extending from Singhana to Pacheri. The gossans are yellow, brown and brick red in colour with poorly developed box works of cubic to rectangular shape. The zone of oxidation typically varies 35m to 45m depth from surface.

The copper mineralisation occurs in the form of sulphide minerals stringers, veins, veinlets, blebs and disseminations. Mineralised zones exhibits pinch and swell nature. The sulphide mineralization in the order of decreasing abundance is pyrrhotite, chalcopyrite and pyrite and arsenopyrite. Magnetite and ilmenite are either absent or occur in traces. The oxide phase reported from the area is magnetite, ilmenite (?) and hematite. Magnetite and ilmenite are persistently occur in the hanging wall lode in Muradpur area. The magnetite mineralization occurs within the form of magnetite dissemination. The ore minerals exhibit metamorphic fabric and effects of deformations since the mineralised veins and stringers are emplaced along foliation and are folded along with it. Analysis of core samples by earlier workers (Basu et al, 1981) indicated presence of nickel, cobalt, silver, gold, zinc, lead, molybdenum and arsenic in traces.

The wall rock alteration observed in the adjoining areas marked by extensive albitisation with chloritosation, biotitisation, sericitisation and sulphidation at places. The replacement of feldspar by albite represents the extensive albitisation in the area. The alteration of amphibole to chlorite shows the chloritisation and biotitisation of the rock types. Sericitisation can be identified by the replacement of feldspar to sericites. Sulphidation is identified by presence of sulphide minerals as, pyrite, chalcopyrite, pyrrhotite, sphalerite galena etc.

7.0 PREVIOUS WORK

7.1.1 The NE-SW trending Khetri Copper Belt (KCB) extends over a strike length of 100 km from Raghunathgarh, Sikar district in the south to Pacheri, Jhunjhunu district in the north-eastern part of Rajasthan. The KCB hosts the extensive copper mineralisation, where mining has been continued from ancient to present time and mining work has been done in Khetri, Kolihan, Akwali, Satkui, Ponk, Dhanota blocks. The extensive exploration work also has been carried out in the area by different agencies and mining work done by Hindustan Copper Limited (HCL). The KCB has been studied by a number of workers considering its academic as well as economic aspects.

7.1.2 Geological mapping of the area was first carried out by Heron (1917). This was followed by by Das Gupta (1968). The pioneer geological mapping of Khetri belt was carried out by Heron (1917), who identified the rocks of the Alwar and Ajabgarh Groups of the Delhi Supergroup in and around Khetri belt. The work of Heron was followed by Dasgupta (1968) and Basu and Chaurasia (1978). They have carried out geological mapping with the help of aerial photos on 1: 31,680 scale.

7.1.3 Sharma et.al. (1977), Madhusudan et.al. (1982) and Singh et.al. (1992) have cerried out geophysical investigation in Banawas-Muradpur-Singhana-Pacheri area. On the basis of that further investigation for copper in the area has been carried out.

7.1.4 **Exploration by GSI in Singhana-Muradpur-Pacheri Segment:**

Geological Survey of India (GSI) explored the 12 km long Singhana – Muradpur – Pacheri segment from F.S.1975-76 to 1980-1981 by drilling 18,471.25m in 51 boreholes (DHS-1 to 34, DHM-1 to 14 and DHP-1 to 3). Out of which, a total of 12,256.75 meters of drilling in 34 boreholes was carried out in Singhana area. The block was sub-divided further as (i) Singhana West Sub Block, (ii) Singhana Central Sub Block and (iii) Singhana East Sub Block. The Singhana Central Sub Block having a strike length of 2.35 km and explored by drilling 28 boreholes (DHS-1 to 5, 8 to 18, 21 to 25, 27 to 30 and 32 to 34) involving 10,092.20m of drilling. Out of which 7 boreholes (DHS-6,15,16,21,25,32 &34) have been planned for second level intersection. The total reserves/resources estimated for the hanging wall lode (Probable + Possible) is 3.06 million tonnes with 0.83% copper grade and 0.49 million tonnes with 1.11% Cu for the footwall lode at 0.5% copper cut-off over a strikelength of 1.55 km.

Exploration during mid-seventies (1976-81), drilling of 3379.75m in 9 boreholes over a strike length of 900m and estimated resources of 1.11 million tonnes with 0.71 % Cu over a strike length of 500 m in the Muradpur Central Subblock at shallow level. Geophysical (Magnetic, SP, IP and EM) anomalies along the contact between biotite- amphibole-quartzite/schist, the host rock for copper mineralisation and the overlying phyllite suggests same favourable geological milieu as in the Singhana and Banwas blocks. Discovery of rich copper mineralisation in Banwas at deeper level led to exploration in the Muradpur block by GSI during F.S. 1999-2000. To check further western continuity, GSI (2005-06) carried out exploration (1022.05m in 4Bhs) in Muradpur West block. MBH-2 intersected 2.00m zone with 0.76% Cu. Subsequently, MECL carried out detailed investigation in Muradpur Central Block during 2012-13.

7.1.5 **Exploration by MECL in Singhana-Muradpur Areas:**

MECL has carried out exploration work in various blocks of Singhana and Muradpur areas. MECL has explored 3.0 k.m. strike length of Singhana Area comprising of Singhana Block (Phase-I& II), Singhana Extension Block (Phase-I) and Singhana Extension Block-II during 1994-2002 by conducting 23,337.70m of drilling in 37 boreholes. The total ore reserve/resource established in 3.0km strike length is Singhana Area is 20.09 million tonnes with 1.50% Cu. *It is recommended that the adjoining areas may be searched with latest exploration techniques involving geophysical, geochemical and followed by drilling to reveal the presence of hidden ore bodies.*

Block wise Summary of Total estimated Reserves/Resource by MECL (3.0km strike length) in Singhana Area		
Singhana (Phase-II)	13787822	1.8
Singhana Extension (Phase-I)	3475392	0.89
Singhana Extension Block-II	2833246	0.82
Total	**20096460**	**1.50**

7.1.6 **Singhana Extension Block-II:** The previous exploration carried out in Singhana Extension Block-II by MECL (2002) has established presence of two copper lodes. Lode-I hosted by biotite-amphibole quartzites has been intersected in two boreholes i.e. SME-7 (3.65m x 1.22% Cu) and SME-9 (4.85m x 0.83% Cu). The promising lode-II hosted by amphibole rich rock has been intersected in borehole SME-7 (12.75m x 0.90% Cu). The average gold content of lode-I is 0.3 to 0.4 g/t while in lode-II the average gold content is 0.5 g/t. A total of 2.83 m.t. of ore resource with 0.82% Cu have been estimated in Singhana Extension Block-II between +290mRL and -180mRL over a vertical column of 470m from surface over a strike length of 1.0km. *It is recommended that the state of art technology involving latest geophysical, geochemical & mobile metal ion studies should be undertaken **in the adjoining areas** to reveal the presence of hidden ore bodies in the Muradpur-Pacheri Segment.*

Mineralized Zones intersected at 0.50% Cu Cut-off- Singhana Extension Block-II (MECL-2002)						
BH No.	Depth (m)		Thickness (m)	% Cu	Level of Intersection (MRL)	Lode No.
	From	To				
SME-7	470.5	474.15	3.65	1.22	-25	L-I
SME-7	475.9	477.15	1.25	0.57	-30	L-I
SME-7	540.65	553.4	12.75	0.9	-82	L-I
SME-9	468	472.85	4.85	0.83	-50	L-I
DHS-1	172	174	2	0.5	200	L-I
DHS-1	310	311.5	1.5	3.19	90	L-I
DHS-1	319	323	4	0.75	83	L-I
DHS-2	153	154	1	0.63	215	L-I
DHS-2	168	169	1	0.86	203	L-I
DHS-3	220.5	229.5	9	0.9	167	L-I
DHS-4	315.5	321	5.5	0.56	98	L-II
DHS-4	196.5	200.5	4	0.73	193	L-I
DHS-4	203.5	206.5	3	1	187	L-I
DHS-7	142.5	147	4.5	0.53	226	L-I
DHS-8	271	271.5	0.5	0.56	155	L-I
DHS-9	324.5	325	0.5	0.76	99	L-I
DHS-11	311.5	312.25	0.75	0.71	117	L-I

Mineralized Zones intersected at 0.50% Cu Cut-off- Singhana Extension Block-II (MECL-2002)						
BH No.	Depth (m)		Thickness (m)	% Cu	Level of Intersection (MRL)	Lode No.
	From	To				
DHS-11	321.25	322	0.75	0.53	110	L-I
DHS-11	328	329.5	1.5	0.63	104	L-I
DHS-12	180.5	151	0.5	0.56	195	L-I
DHS-15	251.25	252.25	1	1.32	144	L-I
DHS-15	269.75	270.75	1	1.4	130	L-I
DHS-15	274.5	277.5	3	1.13	125	L-I
DHS-25	298.5	302	3.5	0.66	188	L-I
DHS-29	152.25	152.8	0.55	0.94	227	L-I

The mineralization within the host rock is seen continuing almost up to -85mRL which is about 375m vertically from the surface.

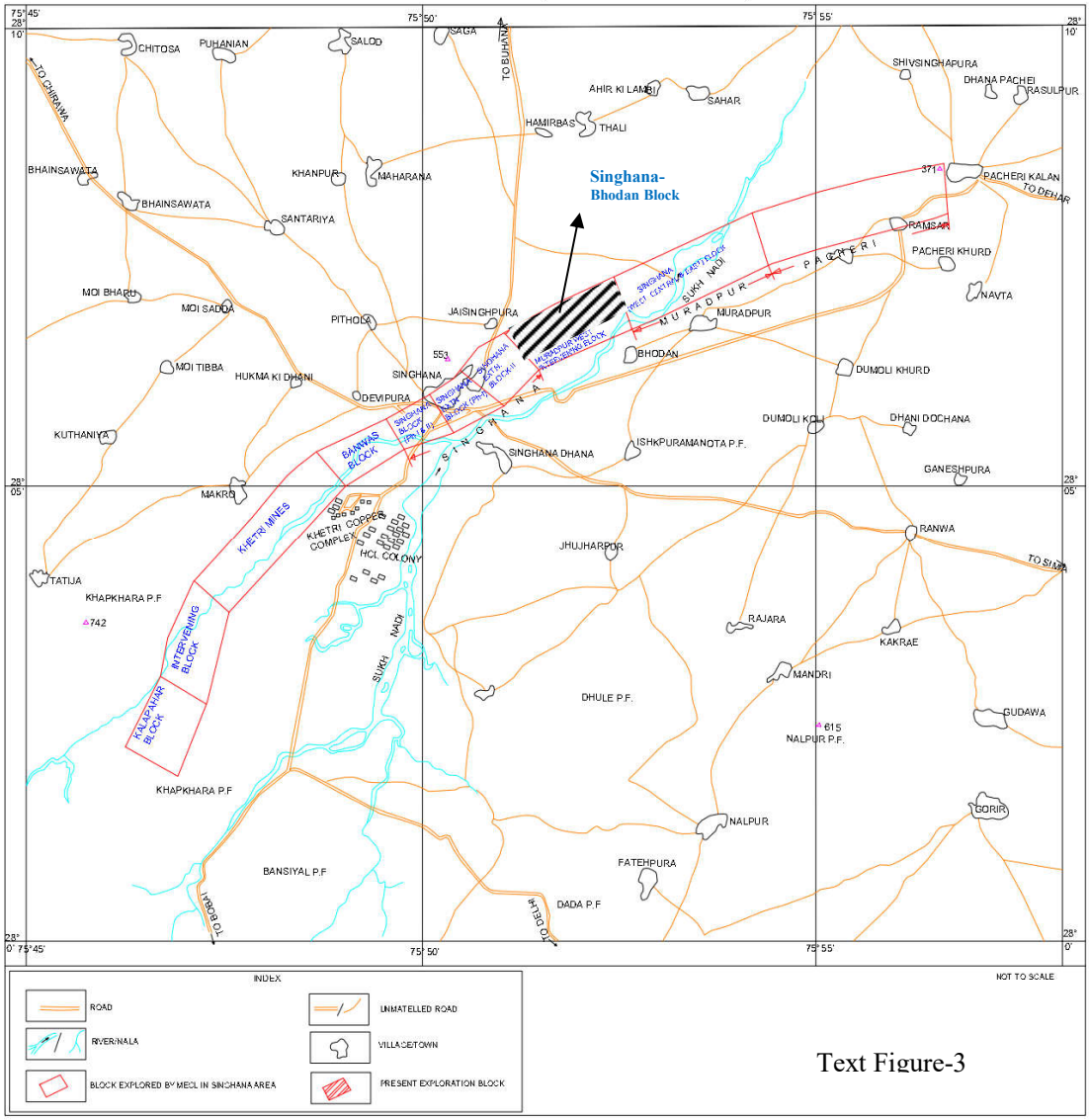
7.1.7 **Muradpur Central Block:** MECL (2012-13) carried out exploration in Muradpur Central Block by drilling 7 boreholes involving 1988 m drilling. The most persistent lodes HWI, HWII, FWI and FWII have exhibited the pinch and swell structure and are - disposed in en-echelon pattern. The ore zones delineated at 0.2% Cu and 0.5% Cu cut-off with 2.00 stopping width and 3.00m parting over the entire strike length of 600m & 500m respectively. Total 5.42 m.t. copper ore resource with an average grade of 0.47% Cu at 0.2% Cu cut-off & 2.30 m.t. copper ore resource with an average grade of 0.70% Cu at 0.5% Cu cut-off estimated by Cross section method. Total metal content of 12624 tonnes estimated up to vertical depth of 265m from the surface. It is recommended that, *since the ore body is open at depth, few boreholes may be required at `0' m level over the strike length of 500m between section lines S1-S1' and S5- S5', to decipher the shoot pattern.*

Mineralized zones at 0.2% Cu Cut-off-Muradpur Central Block				
BOREHOLE NO.	DEPTH (m)		THICKNESS (m)	ASSAY Cu%
	FROM	TO		
MKMC-1	303.48	305.70	2.00	0.25
	309.60	312.40	2.53	0.20
MKMC-2	296.20	313.70	16.63	0.31
MKMC-3	263.39	265.60	2.00	0.24
MKMC-4	134.00	136.22	2.00	0.36
MKMC-5	105.70	107.92	2.00	0.29
	143.50	186.50	38.70	0.57
MKMC-6	309.60	310.80	1.08	0.22
MKMC-7	114.90	124.80	9.41	0.33
DHM-1	162.00	164.50	2.40	0.24
	183.50	185.60	2.00	0.21
	201.00	207.00	5.76	0.38
	239.40	241.50	2.00	0.68
	417.50	421.00	3.36	0.73
DHM-2	99.00	101.50	2.40	0.24
	106.50	121.00	13.92	0.40
DHM-5	120.50	127.00	5.85	0.55
	[illegible]	174.00	3.60	0.49
	320.50	335.00	13.05	0.77
DHM-6	220.00	225.50	5.06	0.34
	228.50	235.50	6.44	0.26
	236.75	239.00	2.07	0.55
DHM-8	190.00	220.00	26.40	0.40
DHM-10	451.07	453.25	2.00	0.41

Mineralized zones at 0.5% Cu Cut-off-Muradpur Central Block				
BOREHOLE No.	DEPTH (m)		THICKNESS (m)	ASSAY Cu %
	FROM	TO		
DHM-6	236.75	239.00	2.03	0.61
MKMC-7	120.70	122.80	2.00	0.59
DHM-1	239.40	241.50	2.00	0.68
	417.50	420.00	2.38	0.65
DHM-2	112.00	121.00	8.55	0.52
DHM-8	196.75	205.00	7.26	0.50
DHM-5	120.50	125.50	4.50	0.66
	171.00	173.50	2.25	0.75
	322.00	335.00	11.70	0.82
MKMC-5	152.80	177.00	21.78	0.75

7.1.8 Location of various Blocks explored by GSI & MECL in North Khetri Copper Belt of Rajasthan with proposed Singhana Bhodan block is shown in Text Figure-3.

SCHEMATIC PLAN SHOWING LOCATION OF BLOCKS EXPLORED IN SINGHANA AREA
NORTHERN KHETRI COPPER BELT, DISTRICT-JHUNJHUNU, RAJASTHAN

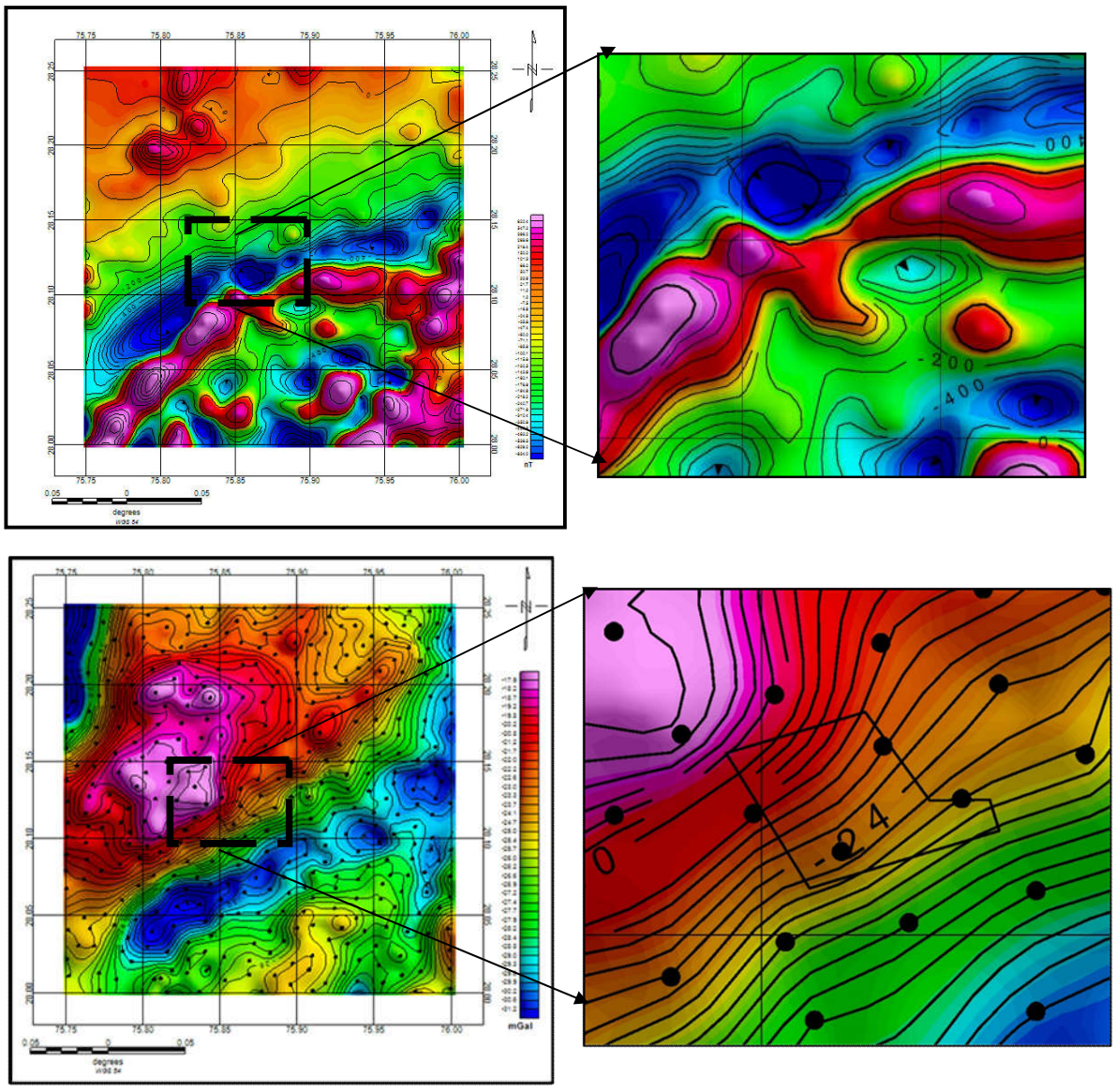


Text Figure-3

8.1.1 The proposed Singhana-Bhodan Block (G3) lies between the gap area of previously explored Singhana Extension Block-II and Muradpur Central Block in Singhana-Muradpur-Pacheri Segment of North Khetri Copper Belt (NKCB).

7.1.9 MECL carried out exploration in Singhana Muradpur West Intervening Block in 2022 and a total 4 bhs (604.0m) drilled in the area. No ore zones delineated at 0.2% Cu cut-off. It was recommended to carryout ground geophysical survey (Gravity, S.P. and I.P) to prove the deeper mineralisation with deep level boreholes.

7.1.10 Interpretation of NGPM Data: Based on the available NGPM data (GSI) total 5 Geophysical points of Gravity and Magnetic survey stations found in the proposed area, which are not adequate for reliable interpretation. However, an attempt has been made to interpret the data at regional scale. The gravity map shows moderate high anomaly upto 4 mGals with a background of -20 mGals within the proposed area, where as low to moderate magnetic anomaly was observed which is a favorable condition for possible mineralization within the proposed block. Interpreted NGPM Magnetic & Gravity maps presented below.



8.0 PRESENT WORK

8.1.1 The previous investigations in the adjoining block areas (Singhana Extension-II & Muradpur block) revealed that there is a significant copper mineralized zone intersected at 150m (180mRL) to 450m Vertical depth (-120mRL) from surface. The proposed Singhana-Bhodan Block is lies in between the gap area of these two blocks and forms the basis for present exploration to establish to strike and depth continuity in the area.

8.1.2 The present scheme of exploration at G3 stage has been formulated to prove the strike and depth continuity of mineralization through integrated ground geophysical survey followed by exploratory drilling and associated laboratory studies. The scheme of proposed exploration (G3) has been planned in two phases to meet the following objectives.

Phase-I:

vi. To carry out detailed Geological mapping on 1:2000 scale & Topographical contour survey over the entire 3.36 sq.km.
vii. To carry out ground geophysical surveys (TDEM, Deep I.P. & Gravity, Magnetic) to delineate sub surface configuration and to identify potential anomalous zones for possible mineralization.

Phase-II (Based on the positive outcome of Phase-I work & review with TCC)

viii. To carry out exploratory drilling to prove the strike and depth persistence of ore zones up to 200m vertical depth (120mRL) from surface at 200m spacing interval in the identified potential anomalous area.
ix. To drill one deeper level borehole up to 450m vertical depth (-80mRL) from surface to check the depth persistence of ore zones on selected one section line.
x. To estimate ore resources under inferred category (G3) as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules 2015.

Note: Incase, Ground geophysical survey (Phase-I) give positive indications of sub-surface mineralization exploratory drilling work shall be taken up in the area.

9.0 PLANNED METHODOLOGY

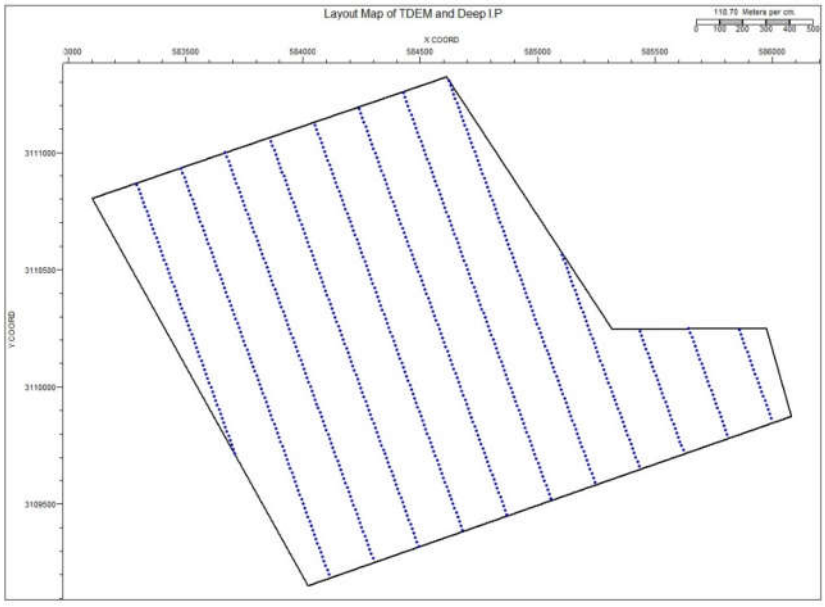
In accordance to the objective set for Singhana - Bhodan block, the following scheme of exploration has been formulated at G3 stage. The details of different activities to be carried out are presented in subsequent paragraphs

9.1.1 **Detailed Geological Mapping:**

The total study area of 3.36 Sq. km. will be mapped on 1:2000 scale with the exposures/well cutting as available along with the structural details marked on a plan. Since most of the area is under thick alluvium cover, Interpreted Geological map of the area shall be developed based on the projections drawn along dip of formation of intersected boreholes in the adjoining block areas. Geological map shall be utilised for activities like geophysical interpretation and drilling etc.

9.1.2 **Ground Geophysical Survey:**

Deeper level mineralization proved during previous exploration in the adjoining areas Singhana Extension-II Block & Muradpur Central Blocks. Based on upward continuation of gravity and magnetic anomalies of NGPM data deeper level (up to 500m or more) intersections of mineralized zones are suggested in the area. Hence, Integrated Ground geophysical survey comprising of TDEM, Deep I.P, Gravity and Magnetic survey has been planned in proposed area to delineate the sub-surface configuration of mineralised zone and to identify the possible potential anomalous zones in depth. The survey planned in a grid pattern of 20m x 200m for Deep I.P and TDEM, Gravity and magnetic survey. Traverse at 200m spacing interval planned in N 20°W -S20^{0}E direction and station interval is kept at 20m A total 20 Lkm for Deep I.P, 700 Stations for TDEM and 1200 station for Gravity and Magnetic were planned for the survey. The layout map for the proposed TDEM & Deep I.P. survey and layout map for Gravity & Magnetic survey is presented below.



Layout Map of TDEM, Deep I.P, Magnetic & Gravity Survey

9.1.3 Topographic Survey:

Topographical survey shall be carried out in the entire proposed block area (3.36 sq.km.). The study area shall be surveyed with triangulation network. The block will be tied up with survey network by triangulation station. Topographical Contouring at 2m contour interval along with available surface features shall be surveyed. The location of boreholes and their Reduced levels shall be determined. The block boundary and the borehole points will be surveyed by DGPS & Total Station in WGS-84 datum.

9.1.4 Core Drilling:

Based on the outcome of ground geophysical survey work, exploratory drilling work shall be taken up in the identified potential anomalous area. Drilling quantum has been worked out tentatively over 1.6km strike length of mineralized area. Total of 8 nos. incline boreholes (350m depth each) involving 2800 m of drilling shall be drilled to intersect the ore zones up to 200m vertical depth (120mRL) from ground level at 200m spacing interval. Additionally, One deeper level boreholes (600 depth) shall be drilled on one selected section to check the depth persistence of ore zones up to the vertical depth of 400m (-80mRL) from ground level. Altogether 3400m in 09 Boreholes planned in the area.

Table No.9.1:Details of proposed boreholes in Singhana-Bhodan Block (G3 Stage)

Block Name	Particulars	No. of proposed Bhs	Proposed Depth (m)	Total meters
Singhana-Bhodan Block	To target MZ at 200m Vertical Depth (120mRL) at 200m interval	08	350	2800
	To target MZ at 400m Vertical Depth (-80mRL) at 400m interval	01	600	600
	Sub Total	**10**		**3400**

The quantum of drilling and depth of boreholes and locations shall be finalised only after ground geophysical survey outcome and review with TCC.

9.1.5. Borehole Deviation Survey

All drilled boreholes (3400m in 9 Bhs) shall be subjected to Borehole Deviation survey by multi shot camera. Borehole depth wise deviation path shall be recorded for its azimuth an inclination.

9.1.6 Borehole Geophysical logging

Borehole geophysical survey covering components including Induced Polarization, Self Potential, Magnetic Susceptibility, Resistivity/ Induction Sonde, Dual Density etc. shall be carried out for all the 10 boreholes drilled in the block having a total meterage of 3800 m.

9.1.7 Borehole Core Logging

Detailed drill core logging will be done with consideration of lithological details, structural features, e.g. joints, veins foliations, mineralization pattern, visual estimation of mineral content and other associated minerals in percentage etc. for entire length of all the holes and determination of Rock Quality Designations (RQD) besides core recovery for entire length of core in each borehole.

9.1.8 Borehole Core Sampling:

The mineralized part of drill core will be sampled as Primary sample. The length of each sample will be kept 0.5 m within the ore zone depending upon the thickness of particular type of basemetal mineralisation and its physical characters such as intensity of mineralisation, change in lithology and core recovery etc.

The composite sample studies in Muradpur central block (MECL) revealed the presence of Nickel, Cobalt and Molybdenum in the ranges of 10 to 1000 ppm, 10 to 300 ppm and 10-100 ppm respectively. The gold assay values fall in the range of <0.1 g/t and 0.4 g/t, while the silver values are generally in traces. In Singhana-Extension Block-II, the gold values in composite samples range between 0.3 g/t and 0.5 g/t whereas silver values are generally less than 1.0 g/t Apart from copper mineralisation, considerable amount of magnetite mineralisation (Fe 4% to 15%) reported in previous exploration campaigns by GSI & MECL. Therefore, during present investigation Borehole primary core samples shall be analysed for copper and associated minerals as below.

i. A total of 400 no of primary core samples will be analysed for Cu, Pb, Zn, Ni, Co & Mo by AAS Method.
ii. A total 50 nos. of primary BH core samples of magnetite bearing rock shall be analysed for Fe, SiO_2, Al_2O_3, TiO_2, V_2O_5, Cr_2O_3, MnO, MgO, CaO, S P, & LoI
iii. Around 10% of Primary samples (40 numbers) will be sent to NABL accredited External Labs for to check for any analytical bias. Samples shall be subjected for analysis of Cu, Pb, Zn, Ni, Co & Mo by AAS Method.

Additionally, 40 nos. of composite samples shall be subjected to 34 element analysis by ICP-MS method.

9.1.9 **Composite Sampling:**

A total of 40 nos. of composite samples shall be subjected to 34 element analysis by ICP-MS method.

9.1.10 Petrological & Mineragraphic Studies:

Thin and Polished section studies on drill cores samples would be done for ascertaining the petrographic and mineragraphic characteristics for borehole core samples. These samples would be drawn from ore zones and host rocks. A provision of 10 specimens for petrographic and 10 nos, for mineragraphic studies has been kept. Petrographic & Mineragraphic study report includes 10 Nos. of digital photomicrographs of thin & polished sections.

9.1.11 **Specific Gravity Determination:**

To derive the tonnage factors, 10 nos of samples are proposed for specific gravity determination. The sample to be drawn from ore zones / mineralized zones.

10.0 QUANTUM OF PROPOSED WORK

10.1.1 Quantum of Work:

The proposed quantum of exploratory work (G3) in the Singhana-Bhodan Block is furnished in Table- IV.

Sl.No	Description and Nature of Work	Unit	Proposed Quantum of work
A	**GEOLOGICAL & SURVEY WORK**		
	1.Detailed Geological Mapping (1:2000 scale)	Sq. km	3.36
	2.Topographical Survey (2m contour interval)	Sq. km	3.36
B	**GROUND GEOPHYSICAL SURVEY**		
	a. Deep I.P. Survey	Line km	20
	b. Electro Magnetic Survey (TDEM)	Sounding	700
	c. Gravity & Magnetic survey	Per station	1200
C	**DRILLING**		
	1.Drilling (Hard Rock)	m	3400
	2.Borehole deviation Survey by Multishot Camera	m	3400
	3.Borehole Geophysical logging	m	3400
	4.Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and block boundary by DGPS	Per Point of observation	15 (6+9)
C	**LABORATORY STUDIES**		
1	**Chemical Analysis**		
	i. Bh Core Primary samples		
	a. For Cu, Pb, Zn, Ni, Co & Mo by AAS Method	Nos	400
	b. For Au by Fire assay method	Nos	100
	b. For Fe, SiO_2, Al_2O_3, TiO_2, V_2O_5, Cr_2O_3, MnO, MgO, CaO, S, P & LoI	Nos	50
	ii. Bh Core External Check (10%)		
	a. For Cu, Pb, Zn, Ni, Co & Mo by AAS Method	Nos	40
	iii.Composite sample analysis 34 Elements by ICP-MS	Nos.	50
D	**Petrological & Mineragraphic studies**		
	Preparation of thin & polished section	Nos	10
	Study of Thin & polished Section	Nos	10
	Digital Photographs	Nos	20
E	**Geological Report preparation**	Nos	1

10.1.2 COST ESTIMATES:

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 tentative cost estimate of **Rs. 910.07 Lakhs** is being proposed for completion of exploratory work at G3 stage. The summary of cost estimates with activity wise break-ups is furnished below Table 10.1 and details of cost estimates is given in **Table No.–10.2**.

Table: 10.1: Summary of Estimated Cost: Preliminary exploration (G3 stage) for Copper & associated Minerals in Singhana-Bhodan Block (3.36 sq.km.), North Khetri Copper Belt, District-Jhunjhunu, Rajasthan

Sl.No.	Item of work	Estimated Cost (Rs.)
1	Geological work	3,683,260
2	Ground Geophysical Survey	21,906,900
4	Drilling	44,056,300
5	Survey work	631,680
6	BH Geophysical logging	2,115,650
7	Laboratory studies	2,200,450
	Sub Total -A	**74,594,240**
8	Geological Report	2,000,000
9	Proposal Preparation	500,000
10	Peer Review Charges	30,000
	Grand Total	**77,124,240**
	GST 18%	13,882,363
	Total:	**91,006,603**
	Say Rs. in Lakhs	**910.07**

10.1.3 TIME SCHEDULE:

The proposed G3 stage exploration in Singhana-Bhodan Block envisages Phase-I & Phase-II work. Phase-I work includes detailed geological mapping, ground geophysical survey. Based on outcome of Phase-I work and review with TCC, exploratory drilling with allied activities (borehole deviation survey, borehole geophysical logging) and associate laboratory studies shall be carried out in the area. Therefore, a total of 15 months timeline has been planned for completion of the entire exploration program at G3 stage. Project progress review with TCC shall be after 6^{th} and 12^{th} month. Time schedule /action plan for preliminary exploration (G3) for Singhana Bhodan Block is given in below **Table 10.3.**

TABLE- 10.2: Estimate Cost for Preliminary exploration (G3 stage) for Copper & associated Minerals in Singhana Bhodan Block (3.36 sq.km.)
North Khetri Copper Belt, District-Jhunjhunu, Rajasthan
Borehole Depth Range:- 350m upto 500m approx. Completion Time - 15 months, Review : 6 & 12 months

S.N	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the		Remarks
			SoC-Item -Sl No.	Rates as per SoC	Qty.	Total Amount (Rs)	
A	**GEOLOGICAL WORK**						
1	Detailed Geological mapping (1:2000 scale)				3.36 sq.km.		
a	Charges for two Geologist per day at HQ	day	1.3a	9,000	60	540,000	
b	Charges for two Geologist per day at field for geological mapping on 1:2000 scale, Borehole fixation,Borehole logging & sampling works etc..	day	1.3b	11,000	210	2,310,000	
c	Labour for Geologist (2 Nos)	day	5.7	526	420	220,920	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
d	Charges for one Sampler per day (1 Party)	one sampler per day	1.5.2	5,100	85	433,500	
e	Labours for sampling work (4 Nos)	day	5.7	526	340	178,840	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
	Sub Total A					**3,683,260**	
B	**Ground Geophysical Survey**						
a	IP Survey	Line km	3.4a	69,950	20	1,399,000	
b	Electro Magnetic survey (TDEM) (profiling/sounding)	Sounding	3.7a	21,197	700	14,837,900	
c	Gravity & Magnetic Survey	per station	3.1b	4,500	1,200	5,400,000	
d	Geophysicist party days (HQ) for Data processing & Report	day	3.18	9,000	30	270,000	
	Sub Total B					**21,906,900**	
D	**DRILLING**						
a	Drilling up to 300m (Hard rock)	m	2.2.1.4a	11,500	2,700	31,050,000	Total drilling 3400m in 9 Bhs (3000m up to 300m + 700m more than 300m)
b	Drilling between 301m-600m (Hard rock)	m	2.2.1.4b	12,420	700	8,694,000	
b	Borehole deviation Survey by Multishot Camera	m	2.2.6	330	3,400	1,122,000	
c	Land / Crop Compansation (in case the BH falls in agreecultural Land)	per BH	5.6	20,000	9	180,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
d	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	9	18,000	
e	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	4,200	151,200	Nagpur to Singhana is around 1050km oneway
f	Monthly Accomodation Charges for drilling Camp (up to 4 Rigs)	month	2.2.9	50,000	6	300,000	
g	Drilling Camp Setting Cost	Nos	2.2.9a	250,000	2	500,000	
h	Drilling Camp Winding up Cost	Nos	2.2.9b	250,000	2	500,000	
i	Road Making (Flat Terrain)	Km	2.2.10a	22,020	5	110,100	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed accordingly.
j	Drill Core Preservation	per m	5.3	1,590	900	1,431,000	
	Sub Total D					**44,056,300**	
E	**Survey Work**						
a	DGPS Survey of Block Boundary cardinal points by DGPS + BH fixation & RL determination	Per Point of observation	1.6.2	19,200	15	288000	6 Boundary points+9 Bhs points
b	Charges of Surveyor (1 party) for Topographical survey 1:2000 scale (3.36 sq.km at 2m contour interval)	one surveyor per day	1.6.1a	8,300	30	249000	
c	Labours Charges for survey work;	day	5.7	526	180	94680	Amount will be reimburse as per the notified rates for unskilled labor by the Central Labour Commissioner or respective State Govt. whichever is
	Sub Total E					**631,680**	
F	Borehole Geophysical Logging	5 Bhs of 350m each	**3.12**	622.25	3,400	2,115,650	
	Sub-Total F					**2,115,650**	
G	**LABORATORY STUDIES**						
1	**Chemical Analysis**						
	Primary samples (BH core)						
	a. For Cu, Pb, Zn, Ni, Co & Mo by AAS Method	Nos	4.1.7a & b	2,841	400	1,136,400	
	b. for Au by Fire Asaay	Nos	4.1.5a	2,380	100	238,000	
	c. For Fe, SiO2, Al2O3, TiO2, V2O5, Cr2O3, MnO, MgO, CaO, S P, & LoI	Nos	4.1.15a	4,200	50	210,000	for magnetite
	External Check samples (10%) (BH Core)					-	
	a. For Cu, Pb, Zn, Ni, Co, by AAS Method	Nos	4.1.7a & b	2,506	40	100,240	
	Composite samples					-	
	a. for 34 Elements by ICP-MS	Nos	4.1.14	7,731	50	386,550	
iii)	**Petrographic & Mineragraphic samples**					-	
a	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
b	Complete petrographic study report	Nos	4.3.4	4,232	10	42,320	
c	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	
d	Complete mineragraphic study report	Nos	4.3.4	4,232	10	42,320	
e	Digital Photographs	Nos	4.3.7	280	20	5,600	
	Total - G					**2,200,450**	
	Sub Total - (A to G)					**74,594,240**	
H	**Geological Report Preparation**		**5.2**	For the projects exceeding Rs.300 Lakhs: A Minimum of Rs. 9 lakhs or 3% of the work whichever is more subject to a max. amount of 20 lakh		**2,000,000**	
I	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	**5 Hard copies with a soft copy**	**5.1/28th EC**	2% of the Cost or Rs. 5.0 Lakhs whichever is lower		**500,000**	EA has to submit the Hhard copies and soft copies of final proposal along with maps and plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
J	**Peer review Charges**		**As per EC decision**			**30,000**	
K	**Total Estimated Cost without GST**					**77,124,240**	
L	**Provision for GST (18% of H)**	**%**				**13,882,363**	GST will be reimburse as per actual and as per notified prescribed rate
M	**Total Estimated Cost with GST**					**91,006,603**	
				or Say Rs. In Lakhs		***910.07***	

Note:

1. **Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.**
2. **In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.**
3. **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 execusion of the project by NEA on its own, a Certifiate regarding non outsourcing of any component/project is required.**
4. **Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.**

Table- 10.3: Time Schedule/ Action Plan for Preliminary exploration (G3) for Copper & Associated Minerals in Singhana Bhodan Block (3.36 sq.km.), North Khetri Copper Belt, District Jhunjhunu, Rajasthan

Sl. No.	Activities	Unit	MONTHS															
			1	2	3	4	5	6		7	8	9	10	11	12		13	14	15
1	Camp Setting	Month																	
2	Geological mapping (1:2000 scale) in 3.36 sq.km.																		
3	Ground geophysical survey	Month																	
4	Geophysical survey Report	Month																	
5	Drilling (2 rigs) & associated works (3800m)	Month																	
6	Borehole Deviation survey & BH Geophysical logging (3800m)	Month							Review							Review			
7	Geologist party days in field (2 Party)	day																	
8	Sampling Party days, Core Sampling (1 party)	day																	
9	Camp Winding	Month																	
10	Laboratory Studies	Nos.																	
11	Geologist Party days in HQ (1 party)	day																	
12	Geological Report writing with Peer Review	Month																	

Note: 1. Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearances.
2. Time loss on account of monsoon/agricultural activity/forest clearance/local law & order problem may be additional to above time line.

11.0 JUSTIFICATION

Proposed Singhana-Bhodan Block forms the part of prominent Singhana-Muradpur-Pacheri segment of North Khetri Copper Belt and lies between the gap areas of previously explored Singhana Extension Block-II and Muradpur Block.

The previous exploration carried out by GSI & MECL (2002 & 2013-14) in Singhana Extension Block-II & Muradpur Central Block established presence of prominent two copper lodes (Lode-I & II) of varying thickness between 120mRL to -240mRL.

In Singhana Extension-II Block, Lode-I hosted by biotite-amphibole quartzites intersected in two boreholes i.e. SME-7 (3.65m x 1.22% Cu) and SME-9 (4.85m x 0.83% Cu). The promising lode-II hosted by amphibole rich rock has been intersected in borehole SME-7 (12.75m x 0.90% Cu). The average gold content of lode-I is 0.3 to 0.4 g/t while in lode-II the average gold content is 0.5 g/t. A total of 2.83 m.t. of ore resource with 0.82% Cu have been estimated in Singhana Extension Block-II over a strike length of 1.0km and up to vertical depth of 470m (-180mRL).

In Muradpur Central block, the most persistent lodes HWI, HWII of Lode-I & FWI – FWII of Lode-II have exhibited the pinch and swell structure and are disposed in en-echelon pattern. Total 5.42 m.t. copper ore resource with an average grade of 0.47% Cu at 0.2% Cu cut-off & 2.30 m.t. copper ore resource with an average grade of 0.70% Cu at 0.5% Cu cut-off estimated over a strike length of 600m & 500m respectively up to vertical depth of 265m.

Since the proposed Singhana Bhodan Block lies in between the gap areas of Singhana Extension - II Block and Muradpur block forms the basis for present exploration to prove the prove the strike and depth continuity of these prominent copper bearing lodes at 200m vertical depth and 450m vertical depth from surface.

Moreover, DMG Rajasthan has requested MECL to quantify the copper ore resources and associated minerals in Singhana Bhodan Block under NMET funding. In light of the above, MECL formulated preliminary exploration (G3) proposal to establish copper and associated mineral resource in the area.

The present exploration at G3 stage would be helpful to estimate the copper and associated minerals resource at inferred category (333) of UNFC. This will enable the Govt. to upgrade and amalgamate the block with the adjoining/adjacenet potential blocks to make a sizable block for auction.

LIST OF PLATES

S.No	Description	Plate No.
1	Location map of Singhan Bhodan Block	I
2	Regional Geological Map with location of Singhana Bhodan Block	II
3	Geological map of Singhana Bhodan Block	III
4	Proposed Borehole location map of Singhana-Bhodan Block	IV
5	Schematic Geological cross section with proposed Borehole	V
6	Schematic Longitudinal Vertical Section with proposed Boreholes	VI

REFERENCES

1. Compendium on Khetri Belt, M. Narashiman, MECL
2. A report on the Singhana-Muradpur-Pacheri Copper investigation, Jhunjhunu Districts, Rajasthan. S.K. Basu, V.P. Sinha, S.R. Sengupta, P. K. Chaurasia (1975-81), Geological Survey of India.

3. Geological report on exploration for copper ore in Singhana Extension Block (Phase-I), Khetri Copper Belt, Dist-Jhunjhunu, Rajasthan, (2001), Mineral Exploration Corporation Limited.
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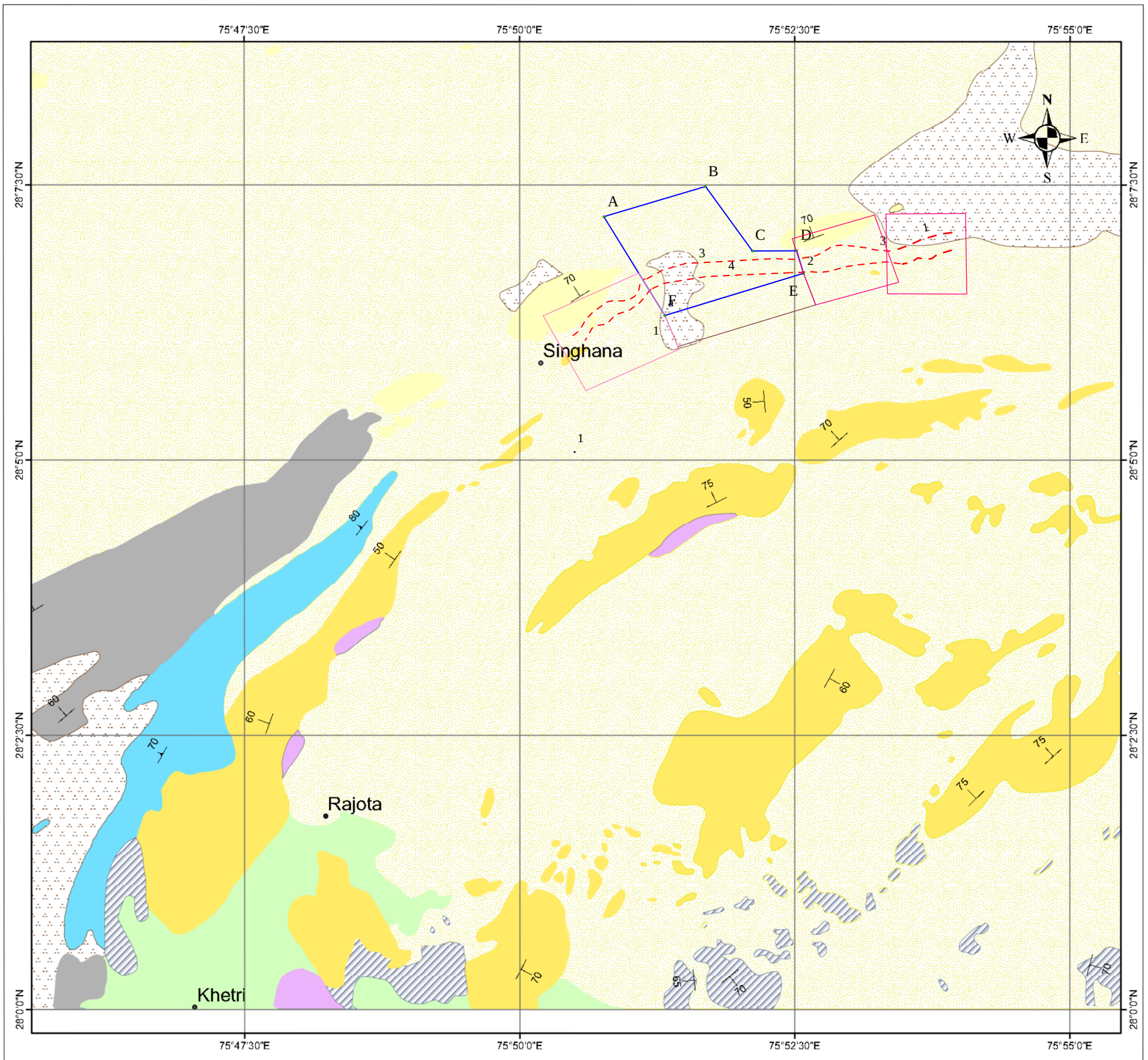
9. Report on Deep IP and Resistivity survey in Muradpur area, Jhunjhunu district and Lathiyakheri (West), Jitwas and Bethumbi Blocks, Dariba – Bethumbi Belt, Rajsamand District, Rajasthan. (2000-2001), Ramgopal, R.L.Regar and Om Prakash, Geological Survey of India.



MAP SOURCE: GSI

LEGEND

- BLOCK BOUNDARY POINTS
- BLOCK BOUNDARY

LITHOLOGY

- ANDALUSITE-BIOTITE-SERICITE-GARNET-CHLORITE SCHIST
- BIOTITE GRANITE
- CALC-GNEISS
- FINE AEOLIAN SAND AND SILT WITH OCCASSIONAL KANKAR
- FINE SAND, SILT AND CLAY
- MASSIVE QZT.LOCALLY FELDSPATHIC AND GRITTY SST
- PHYLLITE INTERBEDDED WITH QUARTZITE
- PHYLT/CARBO.PHYLLITE,ANDALUSITE-BIOT SCHIST & DOLOMITE
- QUARTZITE WITH PHYLLITE AND SCHIST

ORIENTED STRUCTURAL FEATURES

- BEDDING
- CLEAVAGE/FOLIATION/SCHISTOSITY (S1)

1 0.5 0 1 2 3 4 Kilometers

MINERAL EXPLORATION AND CONSULTANCY LIMITED

LOCATION AND REGIONAL GEOLOGICAL/ OUTCROP MAP OF NORTHERN KHETRI BELT

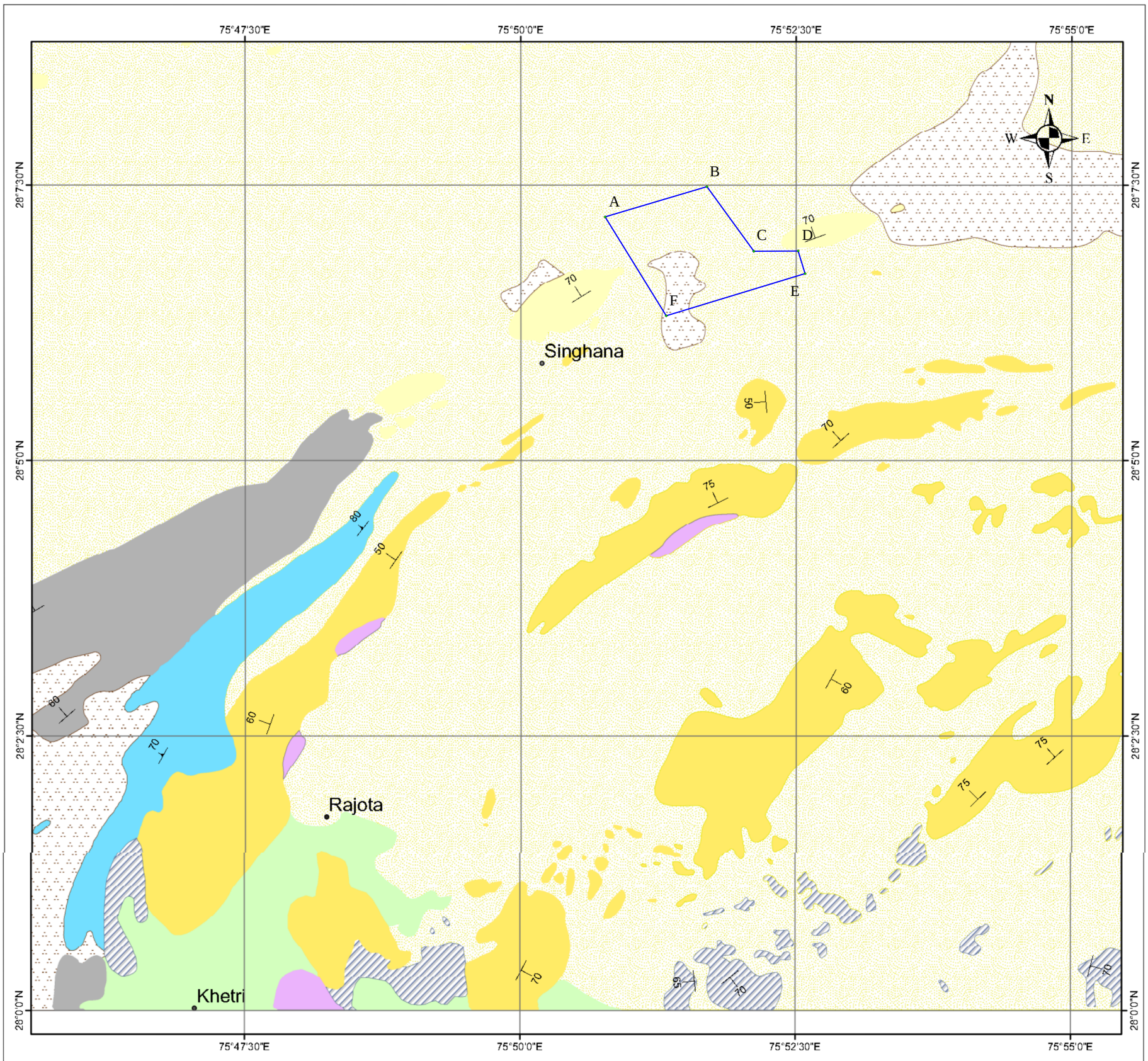
SINGHANA-MURADPUR WEST INTERVENING BLOCK

(PART OF TOPOSHEET NO. 44P/16)

DISTRICT : JHUNJHUNU STATE : RAJASTHAN

Prepared by : Exploration Division, MECL, Nagpur.	Processed at : Non-Coal Geological Report Cell MECL, Nagpur.	
R.F.: 1:50000	PLATE NO - II	2

REGIONAL GEOLOGICAL MAP WITH LOCATION OF SINGHANA-BHODAN BLOCK
NORTH KHETHRI COPPER BELT, RAJASTHAN



MAP SOURCE: GSI

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- BLOCK BOUNDARY POINTS
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- QUARTZITE WITH PHYLLITE AND SCHIST

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- BEDDING
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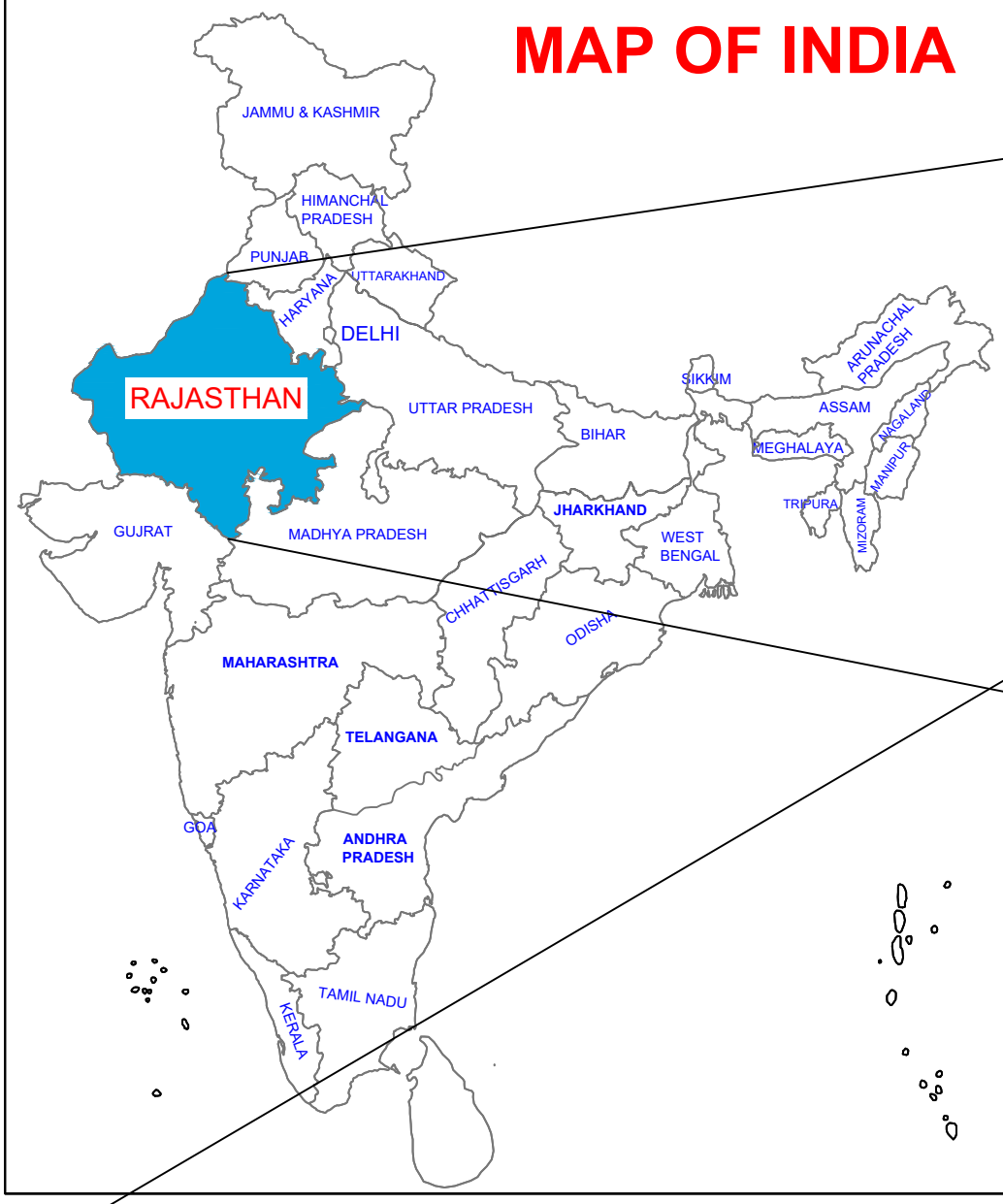
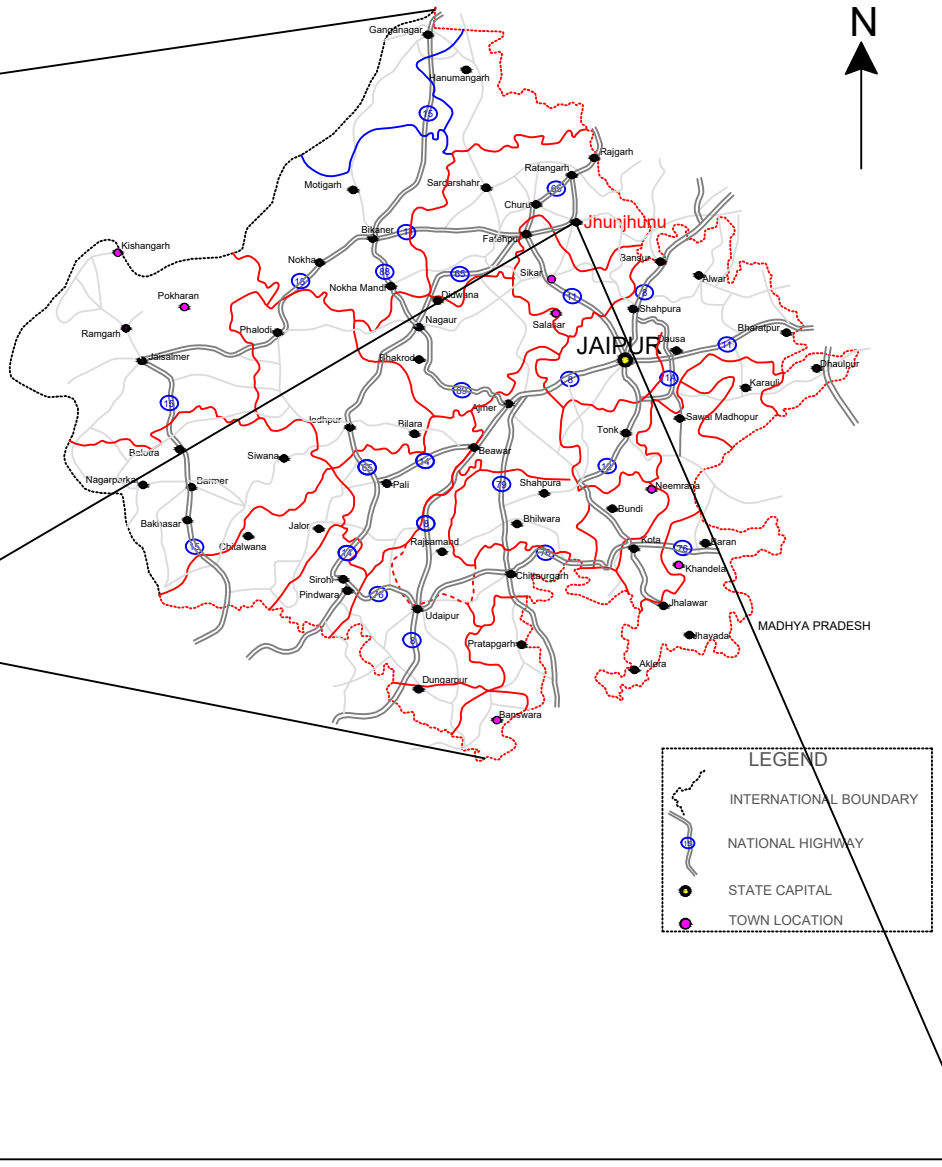
R.F.: 1:50000	PLATE NO - II	2

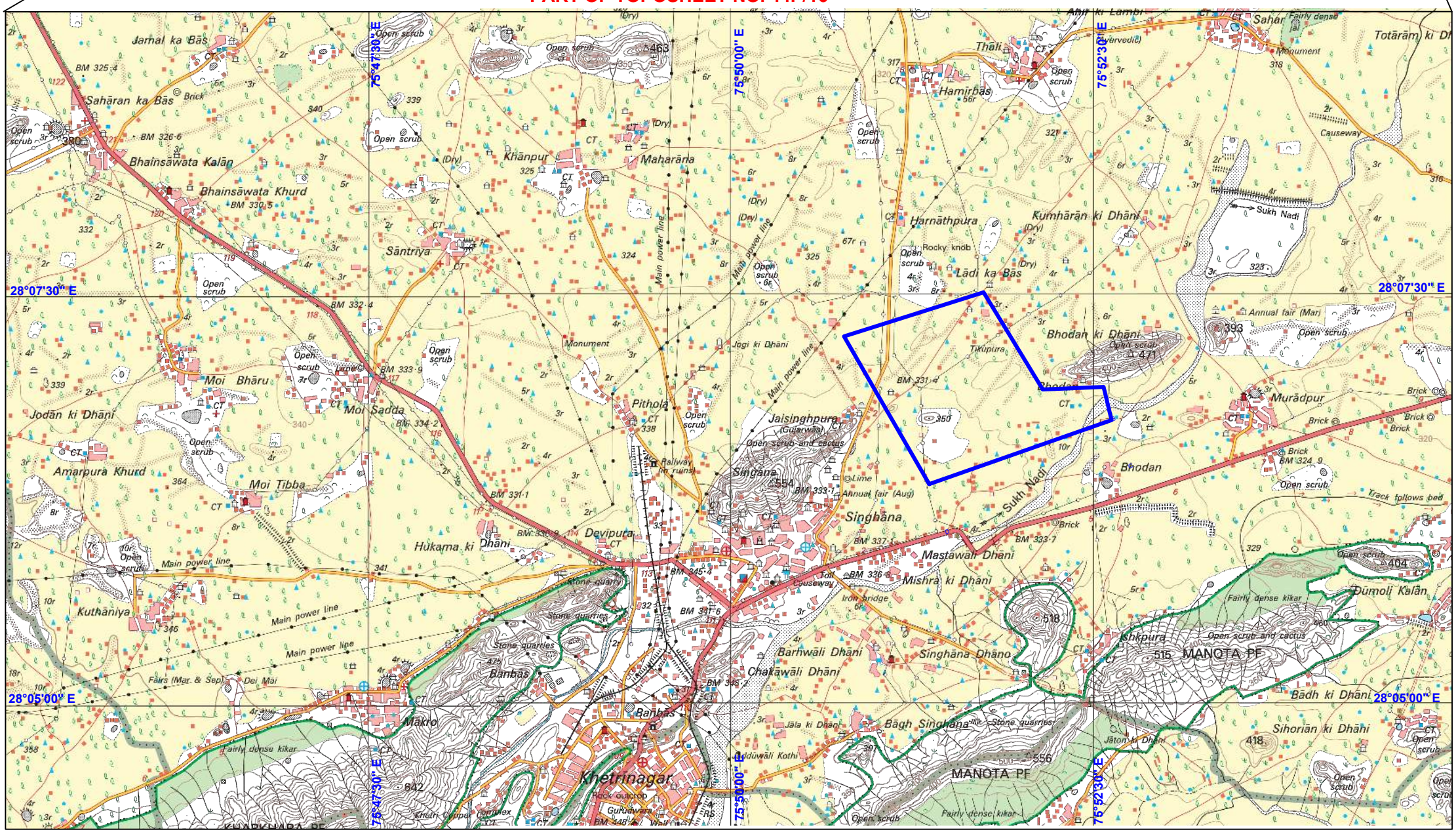
MAP OF INDIA



RAJASTHAN DISTRICT MAP

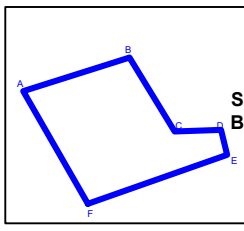


PART OF TOPOSHEET NO. 44P/16



INDEX

SINGHANA-BHODAN G3 BLOCK BOUNDARY



Scale

1.0 0.5 0.0 1.0 2.0 3.0 Km

R:F = 1:50000

MINERAL EXPLORATION AND CONSULTANCY LIMITED

LOCATION MAP

SINGHANA-BHODAN BLOCK
(NORTHERN KHETRI COPPER BELT)
(PART OF TOPOSHEET NO. 44P/16)

DISTRICT : JHUNJHUNU STATE : RAJASTHAN

Prepared by : Exploration Division, MECL, Nagpur.	Processed at : Non-Coal Geological Report Cell MECL, Nagpur.
	PLATE NO - I