# PROPOSAL FOR PRELIMINARY EXPLORATION (G-3) FOR POTASH IN DHANKOWALI DHANI (NORTH) BLOCK, SATIPURA SUB BASIN, NORTHWESTERN PART OF RAJASTHAN (9.63 SQ.KM AREA)

DISTRICT- HANUMANGARH, RAJASTHAN

COMMODITY: POTASH

## BY MINERAL EXPLORATION CORPORATION LIMITED DR. BABASAHAB AMBEDKAR BHAWAN SEMINARY HILLS

PLACE: NAGPUR

DATE: 15th SEPTEMBER 2023



## SUMMARY OF THE BLOCK FOR PRELIMINARY EXPLORATION (G-3) GENERAL INFORMATION ABOUT THE BLOCK

П	Features	Details						
	Block ID	Dhankowali Dhani (North) Block						
T	Exploration Agency	Mineral Exploration & Consultancy Limited (MECL)						
1	Commodity	Potash						
1	Mineral Belt	Satipura Sub Basin, Nagaur Ganganagar Basin Northwestern Part of Rajasthan						
11111	Completion period with entire Time schedule to complete the project	18 Months						
	Objectives	The Preliminary Exploration (G-3) is proposed with the following Objectives:  i) To confirm the continuity and potentiality of potash bearing zones in the proposed area.  ii) To generate data for initial assessment of mineralogy of the potash zones and the K contents.  iii) To estimate resources of Potash zones especially with Polyhalite, sylvite & sylvinite zones as per UNFC system in 333 Category.						
	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 earried out by the proposed agency.						
	Name Number of Geoscientists	Two no Geoscientist (2 Field + 1 HQ)						
	Expected Field days (Geology,	Geologist Party days on Field: 360 days						
- 13	Geophysics, Surveyor)	Geologist Party days on HQ: 60 days						



1.	Location	The area is about is a ma diamono Jaisalme area but	is well com 7-8km from for railway f-railway-cro r) and 15 (P	the Hanum station on ssing The athankot- Sa block boun	ilway as well a angarh junction Jodhpur - Ba National High unakhaijali in G dary. The entir	momangarh dist s road networks n Hamumangarh thinda line. Th mway nos. 11 Gujarat) pass th e area is well o	The site i junction nere is a (Rewari- rough the			
	Latitude- Longitude	Cardin al	Coordinate Deci	in Degree inal	Coordinate	Coordinate in UTM 43N (WGS-84)				
		point	Latitude	Longitud e	Easting (m)	Northing (m)	km)			
		A	29.66120	74.16440	419138.000	3281540.00				
		В	29.66130	74.18920	421538.000	3281540.00				
		С	29.65620	74.18930	421538.000	3280970.00				
		D	29.64990	74.20000	422575.000	3280260.00	9.63			
		E	29.63370	74.20020	422580.000	3278460.00				
		F	29.63340	74.16470	419138.000	3278460:00				
	Tehsil/Taluk District State	Hanumar Rajasthar	-							
2.			-							
	square kilometres)	0.00								
	Block Area	9.63 sq.k								
	Forest Area	Non-Fore								
	Government Land Area (Bilanam)	Data not								
	Charagaha	Data not								
2	Private Land Area Accessibility	Data not	avanaoic							
٥.	Nearest Rail Head	Hamimor	garh Innetio	n is the near	est railway stat	ion				
	Road	12 200 2 200 11 2 2 2 2			of NH 11and					
	Airport	Bikaner	** : : T :: \$40 : \$45 \$46 \$5			F-18-8-1-1-1-1				
4.	Hydrography									
	Local Surface Drainage Pattern (Channels)					a. Orie canal i (North) Block.	s passing			
	Rivers Streams	There is a	iot a single p	erennial stre	am in the area					
5.	Production of the Contract of									
	Mean Annual Rainfall	Average	annual rainfa	ill is 10 cm t	o 30 cm					



	Temperatures (December) (Minimum) Temperatures (June)	Minimum temperatures 0°C (Dec-Feb),  Maximum temperatures up to 50°C (March-June)
	(Maximum)	
6.	Topography	
. 62+.	Toposheet Number	42K/2
	Morphology of the	The area is almost flat terrain and covered with thick aeolian sand or
	Area	alluvial sediments. The average height of the area is 180m above MSL.
7.	Availability of baseline geoscience data	
	Geological Map (1:50K/25K)	Geological Map of Nagaur Ganganar Basin
	Geochemical Map	Not available.
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	== <u> </u>
8.	Justification for taking up Reconnaissance Survey/ Regional Exploration	<ol> <li>In the Satipura Sub Basin, GSI has established 202.30 mt. probable and 1429.95 mt. possible resources with an average grade of 4.86% K in 245.61 sq. km. area. Further GSI have explored Satipura Block (FSP:2016-2018), Jhandewali North (FSP:2019-20) and South block (FSP:2019-20), Jorkiyan South Block (FSP: 2020-2021), Khunja (NW) Block (FSP: 2020-21), Makkasar block (FSP: 2021-2022), Bawriyanwali Dhani Block (FSP: 2022-2023), Makkasar North Block (FSP: 2022-2023) and upgraded the resources upto G-3 level. In the present field season, i.e., FS 2023-2024, GSI shall further explore Jorkiyan North Block and Chistiyan Block.</li> <li>The distribution of potash bearing zones are continuous in North</li> </ol>
		East and South West direction which can be observed from the explored GSI blocks. As a result, the Dhankowali Dhani North Block is the potential area for further establishment of potash resource.
		Out of a total sub-basin area of 2,470.51 sq. km, within the Nagaur-Ganganagar basin, only 6.63% of the total area i.e., 164 sq. km area has been explored till date. The remaining unexplored area within the eight sub-basins aggregates to ~2,300 sq. km. This is ~93% of the total sub-basin area. It may be noted that this area was demarcated by GSI based on 2% K isochore boundary (1974-1991).  4 Polyhalite potash mineral is not water soluble, and with the



present technology can only be mined by conventional underground Mining method. Whereas the mineable soluble Potash i.e., Sylvite Sylvinite zones are also found. The current exploration practice does not involve separate delineation of these bands. Thus, these bands have to be separately delineated into specific Sylvine Sylvinite zones. The availability of such data is for planning a solution mining operation as these bands have to be separately delineated during exploration to establish their continuity and disposition for planning any mining activity.



#### PROPOSAL FOR PRELIMINARY EXPLORATION (G-3) FOR POTASH IN DHANKOWALI DHANI (NORTH) BLOCK (9.63 Sq Km), SATIPURA SUB-BASIN, NORTHWESTERN PART OF RAJASTHAN DISTRICT- HANUMANGARH, RAJASTHAN

#### 1.0.0 Preamble

#### 1.1.0 Background

- 1.1.1 Potassium, Nitrogen and Phosphorous (K, N & P) are the key chemical contents used in the Fertilizer Industry. Major production of potash in the world is obtained from Sylvite (KCl) and Polyhalite [K<sub>2</sub>Ca<sub>2</sub>Mg(SO<sub>4</sub>)<sub>4</sub> 2H<sub>2</sub>O] associated with Halite (NaCl) bearing evaporite sequences. India produces only meager quantity of potash as byproducts during the manufacture of common salt from seawater and the entire requirement of potash is met through imports. Sinha et al (1973) of CGWB, while exploring for Ground Water, reported halite from Lakhasar at a depth of 541m and correlated it with the Kohat salt sequence of Pakistan. Presence of halite at a depth of 469m was further reported by CGWB from Satipura in Shri Ganganagar district.
- 1.1.2 In February 2009, a meeting was held in New Delhi under the Chairmanship of Secretary (Mines). In which, it was discussed that potash exploration in Northwestern part of Rajasthan should be taken up by MECL.
- 1.1.3 Pursuant to post 2015 MMRD Amendment Act, GSI initiated detailed Exploration in Satipura Sub Basin and MECL initiated Exploration in Lakhasar, Bharusari and Jaitpura Sub Basins.
- 1.1.4 CMD, MECL shared a brief presentation outlining the global scenario of salt deposits during the review of status of exploration in the 20th meeting of Technical cum Cost Committee (TCC) of National Mineral Exploration Trust (NMET) held at GSI, Central Region, Nagpur on 4th & 5th April, 2019. He informed that the salt formation is the source of multiple products namely sodium, potassium, magnesium, lithium, chlorine, bromine, iodine and several other elements in various compositions and percentages. All these elements compounds can be used in several sectors across the value chain such as fertilizer, chemical, petrochemical and other allied industries. It was deliberated that the auction of the land containing the bedded salt formations such as potash blocks for composite license may not be an appropriate and feasible option with the present level of exploration results and most importantly when the huge potential of the several products that can be extracted simultaneously from the bedded salt deposit instead of only potash. Further, the geological reports should also identify the other possible resource potential and the same needs to be assessed for techno economic feasibility of extraction/mining.
- 1.1.5 Out of a total sub-basin area of 2,470.51 sq. km, within the Nagaur-Ganganagar basin, only 6.63% of the total area i.e., 164 sq. km area has been explored till date. The remaining unexplored area within the eight sub-basins aggregates to ~2.300 sq. km.



- This is ~93% of the total sub-basin area. It may be noted that this area was demarcated by GSI based on 2% K isochore boundary (1974-1991).
- 1.1.6 In the meantime, DMG, Rajasthan, RSMML, Rajasthan and MECL jointly took an initiative (where MECL acted as the Program Manager) to undertake a comprehensive feasibility study through engagement of an international consultant for soulution mining of potash and feasibility of construction of pilot plant in Bikaner district. The main objective of the study was to assess the various requirement of setting up a Pilot Plant for extraction of Potash and to identify the possible methods to de-risk the potential deposits before a sizable investment is made. This study is the pioneering study in the country as mining of potash has not been attempted in any part of the country.
- 1.1.7 An apex level delegation led by Honorable Minister, Mine and Geology, Govt. of Rajasthan undertook a visit to select solution mining project and potash harvesting facility /manufacturing plant between 12<sup>th</sup> Sept 2022 and 17<sup>th</sup> Sept 2022. Several detailed discussions were taken place on the visit made to the solution mining sites and the findings of the report including the benchmarking of the Rajasthan deposit, resources, selection of block, methodology of solution mining, way forward and action plan etc. The final report had been submitted along with the way forward for Potash mining in the state of Rajasthan in November, 2022.
- 1.1.8 Moreover Hon'ble Minister, Mine and Geology, Govt. of Rajasthan has also shown his interest to develop potash mining in the state of Rajasthan and also requested to estimate the mineral wise resource in the deposits vide D.O letter No. P.19(12)/Mine/Group-2/2023 dated 13/01/2023. Ministry of Mines, Government of India has also showed further interest to carry out exploration of potash minerals in the state of Rajasthan.
- 1.1.9 An apex level meeting chaired by Honorable Secretary, Ministry of Mines and Secretary, Ministry of Fertilizer, Govt. of India undertook a visit to possibility solution mining on 24th February 2023. Secretary (Fertilizers) informed that, in Nagaur-Ganganagar Basin, the Polyhalite is associated with NaCl. After treatment of NaCl, the Polyhalite may contain Potassium up to 16%. Secretary (Fertilizers) opined that minerals such as Potash on which we are 100% import-dependent have strategic importance. Secretary, MoM opined that there is a need for further assessment of the deposit through drilling to upgrade the blocks to the G2 stage. This will facilitate a decision on the feasibility of mining.
- 1.1.10 Further a review meeting on Potash exploration in Nagaur-Ganganagar basin, Rajasthan was held on 21<sup>st</sup> June, 2023 which was chaired by Secretary, MoM, GoI along with Addl. Secretary, MoM, GoI and Director, MoM. GoI. After the detail discussion regarding the potash exploration, it was directed to work out the respective proportions of Sylvite and polyhalite in the deposits which will be facilitate to take decision on establishment of pilot plant for extraction of potash minerals.
- 1.1.11 In this scenario, MECL further wish to take up the exploration work in the western continuation of exploration blocks of GSI in Satipura sub-Basin in Hanumangarh District, Rajasthan to expedite the vision of the ministry.



#### 1.2.0 Location and Accessibility

- 1.1.1 The area is in the northwest part of the main Hanumangarh district town. The area is well connected by railway as well as road networks. The site is about 7-8km from the Hanumangarh junction. Hanumangarh junction is a major railway station on Jodhpur Bathinda line. There is a diamond-railway-crossing. The National Highway nos. 11 (Rewari- Jaisalmer) and 15 (Pathankot- Samakhaijali in Gujarat) pass through the area but outside the block boundary. The entire area is well connected with the road (metalled and jeepable track)
- 1.1.2 The proposed Dhankowali Dhani (North) Block having an area of 9.63 sq. km falling in survey of India Toposheet No 44K/02. The coordinates of the cardinal points of proposed block boundary are furnished below.

Coordinates of cardinal points of Block Boundary of Dhankowali-Dhani North Block, District: Hanumangarh, Rajasthan

Cardinal point	Dec	e in Degree imal S-84)	and the second of the second of the second	in UTM 43N (S-84)	Area (in
e.	Latitude	Longitude	Easting (m)	Northing (m)	km)
A	29.66120	74.16440	419138.00000	3281540,00000	
В	29.66130	74.18920	421538,00000	3281540.00000	
C	29,65620	74.18930	421538.00000	3280970,00000	9.63
D	29.64990	74.20000	422575.00000	3280260.00000	9:03
E	29.63370	74.20020	422580,00000	3278460.00000	
F	29.63340	74.16470	419138,00000	3278460.00000	

#### 1.3.0 Physiography & Climate

- 1.3.1 The entire area of Nagaur-Ganganagar basin is covered by thick aeolian sand or alluvial sediments except the southern part where scanty outcrops could be seen. The present study area is entirely covered by thick aeolian or alluvial sediments.
- 1.3.2 There is not a single perennial stream in the area. One canal is passing through the south of proposed Dhnkowali Dhani (North) Block.
- 1.3.3 The area experiences extreme climate with temperature varying from near to freezing point up to 1° C to 2° C during winter months to as high as 48° C during summer months. Dust storms are quite common in the summer months from March to July. Rainfall is scanty and averages from less than 10 cm to 30 cm annually and is mainly received during the month of July-August.



#### 1.4.0 Previous work

- 1.4.1 The presence of evaporite minerals like gypsum, anhydrite and halite were known from Nagaur and Bikaner areas since 1930's. Halite in Bikaner is reported by P.K. Ghosh 1952, Gypsum in Nagaur by Roy Chowdhury et al 1965 and anhydrite inter section in boreholes drilled by Central Ground Water Board (CGWB) and Oil & Natural Gas Corporation (ONGC). George I. Smith (1968) of the USGS evaluated the data of GSI and identified that Nagaur basin is one of the area geologically most favourable for occurrence of potash bearing marine evaporite deposit.
- 1.4.2 R.S. Jain and Premchandra (1973), based on the data from ONGC & CGWB, identified several negative Bouguer Gravity anomalies and related these to the presence of a thick evaporite sequence in the Nagaur basin. A total of 12 gravity low sites, mostly in the southern part of the basin were recommended for drilling.
- 1.4.3 Based on the above studies, GSI has launched exploration programme for potash in 1974. GSI has carried out potash exploration in an area of 28,500 Sq.Km. out of the total area of 50,000 sq.km. of Nagaur-Ganganagar basin. GSI has drilled a total of 58,733.95m of drilling in 68 closed & 2 abandoned boreholes. All the boreholes were drilled vertical, assuming that the host rock (halite) is disposed horizontally to sub horizontally with 3° - 5° rolling dips towards NW.
- 1.4.4 Based on the exploration results, eight depo-centres for potash mineralisation containing over 2% K were identified, namely Lakhasar, Bikaner, Gharsisar, Hanseran, Arjunsar, Jaitpur, Bharusari and Satipura GSI has carried out detailed exploration in three sub basins i.e. Satipura, Bharusari and Lakhasar for computing the resources of Potash minerals and halite
- 1.4.5 GSI has computed Potash and Halite resources in three sub basins i.e. Satipura (10 boreholes), Bharusari (6 boreholes) and Lakhasar (4 boreholes), based on the intersection of potash mineralization at 3% K cut-off and 1.50 m minimum stoping width by Isochore Isograde method. GSI estimated a total of 2476.58 mt. (409.19 mt probable and 2072.39 mt possible) potash resources with 4.70 % K and 23.54% Na in Satipura, Bharusari and Lakhasar basins and geological resources of more than 6



trillion tonnes of halite with above 90% NaCl in Nagaur-Ganganagar basin. The resources computed in three basins are given in Table below

Sub-Basin wise Potash Resource with average Grade Estimated by GSI

Area	Ore Resour	Grade				
(Sq. Kms)	Probable	Possible	Total	K%	Na %	
245.61	202.30	1429.95	1632.25	4.80	25.08	
71.00	88,16	300.15	388.31	4.68	17.17	
29.50	113,73	342.29	456.02	4.39	23.51	
346.11	404.19	2072.39	2476.58	4.70	23.54	
	(Sq. Kms) 245.61 71.00 29.50	(Sq. Kms) Probable 245.61 202.30 71.00 88.16 29.50 113.73	(Sq. Kms)         Probable         Possible           245.61         202.30         1429.95           71.00         88.16         300.15           29.50         113.73         342.29	(Sq. Kms)         Probable         Possible         Total           245.61         202.30         1429.95         1632.25           71.00         88.16         300.15         388.31           29.50         113.73         342.29         456.02	(Sq. Kms)         Probable         Possible         Total         K%           245.61         202.30         1429.95         1632.25         4.80           71.00         88.16         300.15         388.31         4.68           29.50         113.73         342.29         456.02         4.39	

- 1.4.6 Geophysical surveys comprise seismic refraction and reflection, deep resistivity soundings, gravity, and magnetic surveys were conducted during 1973-1993 in three phases to aid potash investigation (B.C. Saikia et al. 1973). Geophysical logging including gamma ray, neutron, gamma-gamma ray, SP, and resistivity techniques was conducted in a few boreholes. In the second phase (1979-83) geophysical studies were made in Lakhasar-Kalu Bikaner-Sujasar-Bidasar and Pallu-Hanumangarh-Ganganagar-Suratgarh-Bharusari areas (Babu Lal et al., 1984). Seismic surveys have delineated depth to the halite, whereas deep resistivity sounding has delineated depth to the Jodhpur sandstone (Marwar Supergroup) i.e base to the halite occurrences. Limited gravity surveys have delineated 'lows' around Lalgarh, Jasalsar, Jhajheu, and Gussainsar, and south of Sudsar. Regional magnetic survey delineated magnetic lows at Jandewali, Satipura, Makkasar, Baropal, and Bharusari which are favourable for potash (Babu Lal et al., 1984).
- 1.4.7 Babu Lal et al., 1984 stated that an acute positive magnetic anomaly trending NE-SW between Kamhawala and Suratgarh and subsequently swinging to NNW-SSE towards. Pallu is flanked on either side by magnetic low zones. The magnetic low zone extending from Sahuwala in the East to Satipura in the West, swinging towards. Baropal (SW) and then towards Bharusari and Khoda (in the South), has been interpreted as a closed basinal feature with its deeper portions located east of Hanumangarh, around Pilibanga, Baropal, and Bharusari. The area between the large positive magnetic values with a narrow band of negative values between Satipura and Makkasar provides the structural barrier suitable for deposition and preservation of



higher-order evaporites. Similarly, areas around Bharusari and east of Hanumangarh with magnetic low anomaly zones are considered suitable for highorder evaporite deposits. In these connections, it is important to note that boreholes drilled at Satipura (P-21), Makkasar (P-32), Khunja (P-35), Naibasti (P-54), Dabli Rathan (P-57), Khunja proper (P-63), Bharusari (P-51), Karala-ki-Dhani (P-56), Sumerkhan ki Dhani (P- 62), Bharusari west (P-64) and Khadesari north (P-67) have shown positive indications of sylvite mineralization. Borehole no P-29 (Jandawali) and P-60 (Bawriyanwali Dhani) located at the fringe of positive magnetic anomaly have also shown the presence of sylvite mineralization.

- 1.4.8 Mahato et al. (2016-18) carried out preliminary exploration for potash in Satipura sub-basin of Nagaur-Ganganagar evaporite basin, Ganganagar district, Rajasthan (G-3) stage in between P-35 (Khunja) and P-29 (Jandawali), with a spacing of 800 m or close during GSI field season program 2016-18. From the chemical analytical data, it is confirmed that there are two prominent mineralized zones. Zone -I belong to the H2 cycle and Zone -II belongs to the H1 cycle. Zone -I is co-rrelatable in all the eight boreholes whereas zone -II is correlatable with only between boreholes RJNGS -1B to RJNGS-3 and pinches out in the westward direction. From the calculation of mineralized zone from 10 boreholes concerning their thickness, resource of 133.07466 million at 2% cut off with an average grade of 3.34 K%, 67.516288 million tonnes at with an average grade of 4.82 44,600208 million tonnes has been estimated with 4% cut off value at an average grade of 6.31 K%, and 3284MT halite averaging 35.75% Na (natural cut-off) and with over 80%NaCl have been estimated for a minimum stoping width of 1.0 m. for the entire Satipura block.
- 1.4.9 Considering the previous explored data, Preliminary exploration for potash in Jandawali North Block having an area of 6.45 sq km in Satipura sub-basin of NagaurGanganagar evaporite basin, Hanumangarh district, Rajasthan has been carried out in G-3 stage exploration with 6970 m drilling in nine nos of boreholes having spacing of 800m during FS 2019-21. The total inferred resource (333) of potash is 139.62 million tonne at 2% cut off with an average grade of 2.44 K%, 21.17 million tonne at 5% cut off with an average grade of 5.63% and 8.24 million tonne at 8% cut off with an average grade of 9.98 K%, are estimated in the area of investigation. The



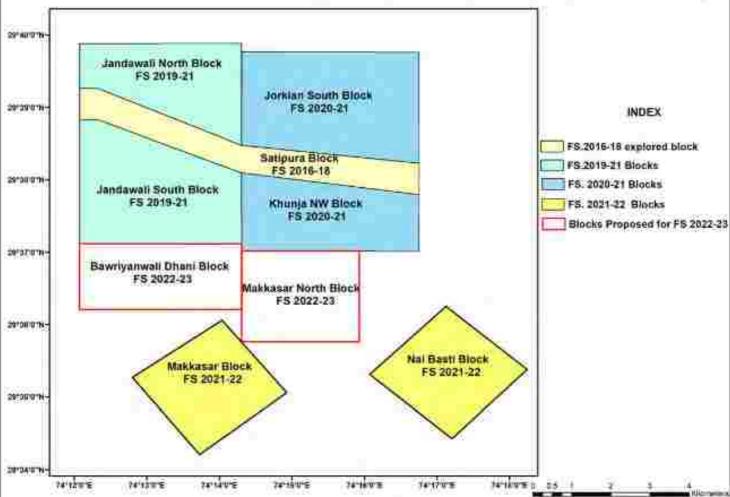
- total inferred resource of halite is 2299.41 million tonne at 31.47% cut off grade with an average grade of 34.54% Na with over 86% NaCl.
- 1.4.10 Simultaneously, an area of 9.2 sq km has been explored under G3 Stage investigation to check southern continuity of potash mineralisation of Satipura block during the FS 2019-2021 with 10090.00 m drilling in 13 nos of boreholes. The inferred resource of 153.945 million tonnes at 2% cut off with average grade of 2.359 K%, 31.344 million tonnes at 5% cut-off with average grade of 5.640 K% and 9.514 million tonnes at 8% cut off with average grade of 10.042 K%, are estimated in the area of investigation. The total inferred resource of halite is 4632.00MT averaging 32.52% Na (natural cut-off) and with over 80% NaCl, have been estimated.
- 1.4.11 During FS 2020-21& 2021-22, exploration for potash in Jorkian South block, Satipura sub-basin of Nagaur-Ganganagar Evaporite Basin in Hanumangarh district, Rajasthan had been taken up in an area of 10.30 sq. km. Total fourteen boreholes drilled with the cumulative drilling meterage of 10,851.00m towards north of earlier drilled boreholes P-35, RJNGS-01 to RJNGS-4. The inferred resource of 151.161 million tonnes at 2% cut off with average grade of 3.26 K% (or 3.92 K2O%), 33.050 million tonnes at 8% cut-off with average grade of 8.25 K% (or 9.94 K2O%) and 17.773 million tonnes at 8% cut off with average grade of 13.05 K% (or 15.72 K2O%) are estimated in the area of investigation. The total inferred resource of halite is 3165.296 million tonnes at 31.47 Na% (or 80% NaCI) cut-off with average grade of 34.68 Na%, have been estimated.
- 1.4.11 In the same field season, an area of 6.80 sq km of Khunja Block in Satipura Sub Basin had been explored with total of 6952 m drilled in 09 vertical boreholes in grid pattern of 800m spacing. The total inferred resource of 110.62 million tonnes of potash at 2% cut off with an average grade of 3.58 K% (4.30 KtO %), 23.11 million tonnes at 5% cut off with an average grade of 8.27 K% (9.92 KtO%) and 12.39 million tonnes at 8% cut off with an average grade of 11.65 K% (13.98 KtO %), are estimated in the area of investigation. The total inferred resource of halite is 2159.63 million tonnes at 31.47% cut-off grade with an average grade of 35.71% Na with over 80% NaC1.



- 1.4.12 Moreover, Makkasar Block, Makkasar North block, Nai Basti Block and Bawriyanwali Dhani block has been taken up to for exploration in G-3 stage in the last two field seasons.
- 1.4.13 Chistiyan Block and Jorkian north block shall be taken up for exploration by GSI under FSP 2023-24.
- 1.4.13 The schematic diagram of all the GSI blocks explored since 2016 is given below. The present proposed block is adjacently located west of Jandawwali North Block, Satipura Block and Jhandawali South block.

#### Exploration Blocks in Satipura Sub Basin, Hanumangarh, Rajasthan







#### 2.0.0 Regional Geology

2.1.0 The Nagaur-Ganganagar Evaporite Basin is an intracratonic basin in which marine sediments of Marwar Supergroup were deposited on the basement rocks of the Malani Igneous Suite and or Delhi metamorphites. This basin is considered the southernmost continuation of this large Eocambrian basin of which Salt Range of Pakistan forms the northern part (Jones, 1970). The Halogenic deposits in Iran, Oman and Pakistan are considered to form a single basin (Zharkov, 1984) situated on the south-western Asiatic continent at the time of its formation, but moved to its present geographic location due to plate tectonic movements. This large evaporate basin extends approximately 700 km from north to south and 350 km from east to west, notwithstanding a void area corresponding with the Delhi-Lahore uplift. The northern part of this evaporite basin, close to the northern edge of the Indian plate, has been thrusted southwards (Salt Range and Potwar Plateau). The thrust is still active (Baker, 1987; Jaillard 1992), and has brought the Eocambrian salt to surface (Jaillard, op. cit.). Several salt mines, including those of Khewra and Warcha, are located in the Salt Range of Pakistan. Nagaur Ganganagar basin, covering over 1,00,000 sq km and in parts of Ganganagar, Hanumangarh, Churu, Bikaner, Nagaur, Jodhpur, Jaisalmer and Pali districts of Rajasthan, Sirsa district of Harvana and Faridkot and Bhatinda districts of Punjab. It is bounded by Delhi-Lahore subsurface ridge to the north and northeast, Aravalli range in the east, Jodhpur-Pokaran-Chhotan (Malani) ridge in the south and Devikot- Nachana (subsurface) high in the southwest. Birmania basin about 120 km to the southwest, probably forms the extension of the main evaporate basin in the southwest. The halite-bearing evaporate sequence within the basin appears to extend up to Sardarshahr- Bidasar Fault in the east, up to Balesar in the south and up to Devikot- Nachana subsurface high in the southwest, inferred from Oil India boreholes located at Baghewala and Tabriwala. The salt deposits in the south and southeast in Nagaur area show gradual litho-facies variation to a thick sulphate predominating facies where thick gypsum/anhydrite beds are developed within the sequence. The absence of un-metamorphosed sediments older than those of the Marwar Supergroup in its contact with Precambrian rocks suggests that the basin floor comprises metamorphites belonging to the Delhi Supergroup and gneisses, granites and rhyolites of the Malani Igneous Suite (Dasgupta et at, 1988). In the southern part of the basin, rocks of the Marwar Supergroup and their time equivalents, the Randha and the Birmartia Formations, overlie the Malani Igneous



Suite (at Jodhpur, Balesar, Kul and Pokaran) and the Delhi Supergroup of rock (at Khatu, Bidasar, Ratangarh, etc.). The above conclusion is also supported by the strong and steep deepening of the Precambrian basement along the Pakistan border (Tectonic Map of India, Ray, 1977). This is believed to be the western edge of the Indian plate, the north-western movement of which induces the Quetta festoon. The eastern margin of the basin (in Indian part) is tectonically disturbed in most of the places. The Sardarshahr-Bidasar Fault located on the eastern margin is a well-marked dividing plane between the Marwar Supergroup and the Delhi Supergroup. This fault strikes almost NNE-SSW with steep westerly dip and an estimated down-throw of over 740 m for the western block. The fault passes through Khatu, Ladnun, Rajaldesar and Sardarshahar. This fault was either contemporaneous to the deposition of sediments of the Marwar Supergroup or pre-dated it. The fault became intermittently active and is envisaged to have been active till recent time (Alimad and Ahmad, 1980). Geophysical data suggest that the fault extends towards north through Haryana into Punjab (Babu Lal, et al., 1984) and further north-westwards into Pakistan.

2.1.1 Regional Straticgraphic Setup: The entire area of the Nagaur-Ganganagar basin is covered by thick aeolian sand or alluvium sediments except in the southern part where scanty out crops are observed. The Nagaur-Ganganagar basin is an intra-cratonic basin in which marine sediments of the Marwar Supergroup were deposited on the basement rocks of the Malani Igneous suite and/or Delhi metamorphites. A generalized stratigraphic sequence built up is as follows:

Litho-Stratigraphic Succession of Nagaur-Ganganagar Basin (After Kumar et. al. 1993 GSI)

	france transmit on mi was	THE PERSON NAMED IN	
Age	Supergroup	Group	Thickness (m)
Recent to Sub recent (Quaternary)			0 = 373
	Unconformity	1910-1211-121-121	
Lower Eocene (Tertiary)	.50.55		38 – 120
±	Unconformity	***************************************	
Upper Proterozoic to Lower Cambrian	Marwar	Nagaur, Bilara HEG, Jodhpur	50 - 290 100 - 300 240 - 423
=	Unconformity	1711-1711-17	
Precambrian	Malantigneous Suite Delhi Supergroup	Ajabgarh	Basement rocks



2.1.2 The Hanseran Evaporite Group (HEG) appears to be homotaxially time equivalent and Facies Variant of the Bilara Group and comprises cyclic deposits of halite (most dominant constituents) alternating with anhydrite, clay, dolomite & magnesite.

#### 2.2.0 Description of Lithounits

#### 2.2.1 Basement Rocks (Malani Igneous suite rocks/Delhi Metamorphites)

The basement rocks of Delhi Supergroup (Ajabgarh Group) are exposed towards East, North and North-Eastern margin and the rocks of Malani Igneous Suites are exposed towards south & south-west margin of Nagaur-Ganganagar basin. Metasediments of the Delhi Supergroup are represented by massive quartzite, quartz-sericite schist, phyllite, slate and amphibolite intruded by post-Delhi quartz veins. Rocks of the Malani Igneous Suite represented by rhyolite, tuffs and rhyolite porphyry intruded by Jalore and Siwana granites.

#### 2.2.2 Marwar Super Group

The Marwar Supergroup is best developed in the Nagaur- Ganganagar basin which extends from near Jodhpur in the south to Pokaran in the southwest while in the northeast it follows the Aravlli trend in to Haryana and Punjab. In the north it extends up to salt range in Pakistan. It comprises essentially an unfossiliferous marine sedimentary sequence that has been divided into following three groups.

- (i) Nagaur Group.
- (ii) The Bilara Group and the Hanseran Evaporite Group (HEG) which are homotaxially time equivalent and facies variant.
- (iii) Jodhpur Group.
- I) Jodhpur Group: The rocks of Jodhpur Group unconformably overlie the basement rocks (Malani Igneous Suite and Delhi Metamorphites) and have gradational contact with the overlying Bilara Group or Hanseran Evaporite Group. The Jodhpur Group mainly comprises reddish to buff and grey coloured, medium to coarse grained, often calcareous, glauconitic & micaceous sandstone, with occasional interbands of shale & siltstones.
- II) Bilara Group: The Jodhpur Group of rocks is unconformably overlain by Bilara Group, which comprises three calcareous dominant rock formation i) Pondlo Dolomite, ii) Gotan Limestone and iii) Dhanapa Dolomite. Outcrops of the Bilara Group are scanty. The Bilara limestone emits fetid odour when freshly chipped. It also yields small quantity of oil and inflammable gas on distillation (Heron, 1932).
- III) Hanseran Evaporite Group (HEG): The Hanseran Evaporite Group (HEG) is sandwiched between the underlying Jodhpur Group and the overlying Nagaur Group of rocks. HEG comprises cyclic deposits of halite (NaCl) with anhydrate, clay, dolonite and magnesite. Halite is the most dominant constituent of the Group with minor polyhalite ([K2MgCa2(SO4)4.2H2O], occasional sylvite (KCl), rare languagement [K2 SO4, 2MgSO4] and traces of carnallite (KCl, MgCl2.2H2O). Thickness of HEG ranges from 103.20m to 652.15m. So far seven halite cycles; numbered as H1, H2-to- H7 from bottom to top, have been



identified. These halite cycles are separated from one another by clays and or anhydrite and or dolomite. It has been divided into eight formations and 17 units on the basis of lithological characters and order of superposition as shown in Table below.

### STRATIGRAPHIC SEQUENCE OF THE HANSERAN EVAPORITE GROUP (H.E.G) (After GSI)

Age	Super Group	Group	Formation	Unit	Rock Types
		Uncont	formity		-
		Nagaur	3	10.55	22
		22.1122.71	-Gradational Co	ntact	
			Lakhusar	E 16	Clay, Claystone, Anhydrite
			*********	E 15	Halite (H1) ± Polyhalite
			Sataiyan	E 14	Clay, anhydrite, dolomite
둂			77. S.D.	E 13	Halite (He) ± Polyhalite
- E			Harsinghpura	E 12	Clay, anhydrite, dolomite
景				E 11	Halite (H <sub>3</sub> ) ± Polyhalite
Awar C	Marwar Super Group	HANSERAN	Kupli	E 10	Dolomite, Dolomitic Anhydrite + clay
<u> </u>		≃′	Malkisar	E 9	Halite (H4) ± Polyhalite
28	<u>.</u>	20 EE		E.8	Dolomite + Anhydrite + clay
ã	Ë	z		E 7	Halite (H3) + Polyhalite
2	8	<	Chattargarh		Dolomite + Anhydrite + clay
Upper Proterozoic to Lower Cambrian	Mar H		Kalu	E 5	Halite+Polyhalite(H <sub>2</sub> )±sylvite+ Langbeinite
Ē.				E 4	Anhydrite + Dolomite+ clay
5				E-3	Halite (H1) + Polyhalite+ sylvite
1000			********	E2	Anhydrite + dolomite
			Lakhasar	E 1	Clay with Anhydrite
				E 0	Clay+marl+calcilutite gyp+LS
			-Gradational Co	ntact-	and the second
		Jodhpur		1 :=	1 3

IV) Nagaur Group: The Nagaur Group is the youngest member of the Marwar Supergroup and has a gradational contact with the underlying HEG, in the northern parts of the basin. In the southern part of the basin the Group overlies the Bilara Group with gradational contact at most of the places. The Nagaur sandstone, comprising a sequence of brick red to red claystone, siltstone and sandstone often with blotches and bands of green clay varies in thickness from 50m to 290m.

#### Tertiary Sediments

The Nagaur Group rocks are overlain by the Tertiary sediments in parts of Southern & Western sector of Nagaur-Ganganagar basin. The contact is unconformable with the Nagaur Group of rocks. Tertiary sedimentation appears to have taken place along the sea arms extending from SW (Jaisalmer basin) through Pokaran to north of



Ganganagar and limiting its eastern extent by the subsurface Dulmera High passing through Kanchian-Suratgarh-Harsinghpura-Lunkaransar-Dulmera and Lakhusar. The Sub surface stratigraphy inferred by Ghosh and Srivastava (1971) is given below:

Stratigraphic sequence of Tertiary in Nagaur-Ganganagar basin

	Recent & Sub recent							
(Amin)	Unconf	formity						
	Jogira Fullers Earth (Eocene)	Shale, marl, fuller's earth, limestone, Forminiferal limestone & siltstones.	116-121m					
Teriatry	Marl Sandstone (Paleocene)	200+210m						
	Palana Shales (Palaeocene)	Variegated shales and clays, associated with carbonaceous c base-not shale; shaly lignite, silt & sandstone.	157m					
*********	1	Inconformity						
		Nagaur Group	111					

#### Quaternary Sediments

Quaternary Sediments comprising aeolian sand (forming dunes) alluvial sand, clay, kankar, grit, gravel, calcareous sandstone, caliche, gypsite and reworked limestone fragments lie unconformably either over the Nagaur Group of rocks or over the Tertiary sediments varying in thickness from 0.00 to 373.00m in Nagaur-Ganganagar basin.

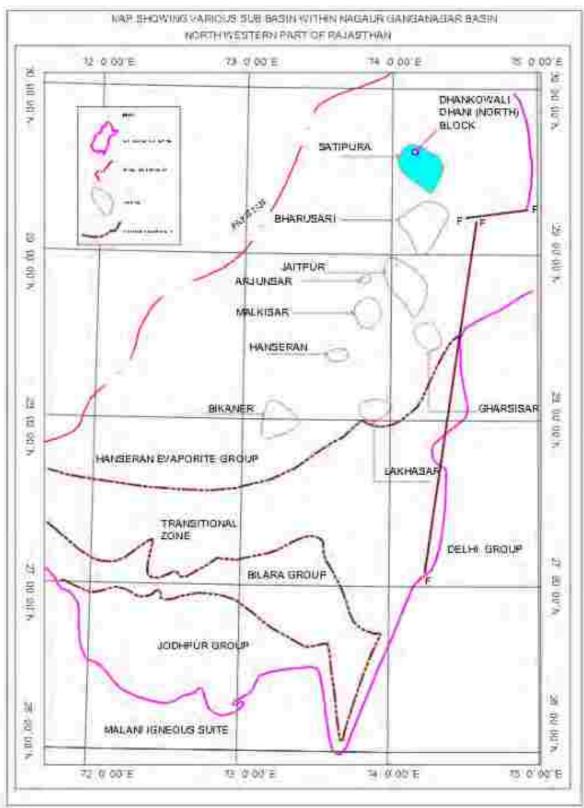
#### 3.0.0 Structure

- 3.1.1 The Nagaur-Ganganagar basin, covering an area of 50,000 sq km is bounded by the Aravalli Range in the east, Lahore-Delhi sub-surface ridge in the north and north-east, Devikot-Nachana sub-surface high in the west and Jodhpur-Pokharan-Chotan-Malani ridge in the south. The basin appears to extend up to Sardarsahar-Bidasar fault in the east. The Sardarsahar fault trend N-S with steep dip towards west and downthrown also towards. West and marks the Eastern limit of HEG. The basin appears to merge with the Indus basin in the Northwest. Jones (1970) considers the Nagaur-Ganganagar basin as south-eastern extension of the saline series of salt range of Pakistan (the exposed portion of Nagaur-Ganganagar basin in Pakistan constitutes the Salt Range.)
- 3.1.2 A number of vertical to sub-vertical faults (FIII to FVII) trending N-S, NE-SW and E-W with downthrow towards W, NW and S respectively has been inferred on the basis of drill data. Evaporite horizons in western part occur at relatively greater depths than in the east as a result of these step faults providing favourable condition for evaporite deposition resulting in increase in thickness of H.E.G. as well as halite together with number of halite cycles in the western and north-western parts of the

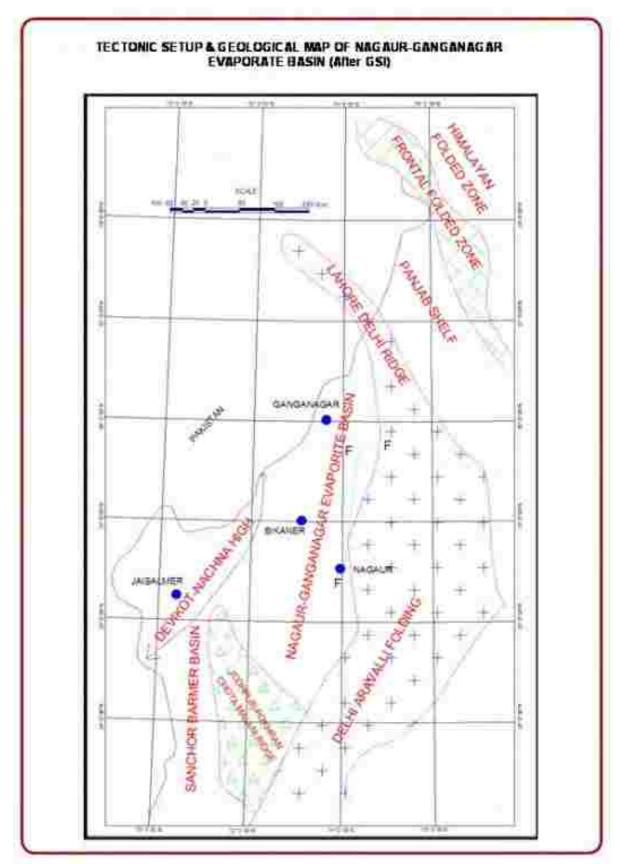


- basin. One E-W trending transverse faults (FVIII) between Lakhasar and Kalu with a down throw of 217m towards south has been inferred.
- 3.1.3 Structures observed in drill cores include bedding, lamination, flow structures, nodular anhydrite, stylolite sutures, breccia and algal structures. Bedding is horizontal to sub horizontal with 3° to 5° rolling dips towards NW. Flow structures have an oblique relationship with the bedding lamination due to salt flowage. Locally the halite beds show steep dip due to salt flowage. Presence of nodular anhydrite could indicate their formation in marginal sea environment under arid climate. Stylolite sutures are observed in anhydrite cores indicating solution activity under high pressure. Algal structures in the form of non-phosphatic stromatolites of Collonella Group have been recorded in the cores of dolomite and dolomitic anhydrite in various boreholes.











#### 4.0.0 Mineralisation

4.1.0 The Hanseran Evaporite Group (HEG) comprises cyclic deposits of halite (most dominant constituent) alternating with anhydrite, clay-dolomite and magnesite. The most dominant constituent of Group is halite (NaCl) with minor polyhalite [K<sub>2</sub> Mg Ca<sub>2</sub> (SO<sub>4</sub>) + 2H<sub>2</sub>O], sylvinite (KCl, NaCl), sylvite (KCl), langbeinite (K<sub>2</sub> SO<sub>4</sub> 2 Mg SO<sub>4</sub>) and carnallite (KCl, Mg Cl<sub>2</sub> 6H<sub>2</sub>O), in order of their abundance. A maximum of seven halite cycles, numbered as H1, H2-- H7 from bottom to top have been identified. The halite cycles are separated from one another by intervening zones comprising anhydrite, clay, dolomite and occasionally glauconite.

It has been observed from previous exploration data of adjacent blocks, potash mineralisation is only hosted by the halite of H1 and H2 cycle within which potash mineralisation in H2 cycle is more prominent and the cumulative thickness of potash zones in H2 cycle is varying from 0.92 m (RJNGJN-05, eastern side of Jhandewali North Block) to 24.82 m (RJNGJN-02, Western side of Jhandewali North Block nearer to the proposed block).

Moreover as per the discussion with on-site Geologist of GSI in the Satipura subbasin during the site visit on 11/07/2023, the sylvite occurs in H2 cycle with depth varying from 614 to 655m and thickness from 0.40 to 2.50m. The depth and thickness increase towards the centre of the Satipura Sub-basin. The physical identification of sylvite as discussed is sharp spooked out surface with bitter taste.

#### 5.0.0 Proposed Exploration by MECL

#### 5.1.0 Strategy

5.1.1 In the Satipura Sub Basin, GSI has established 202.30 mt. probable and 1429.95 mt. possible resources with an average grade of 4.80% K in 245.61 sq. km. area. Further GSI have explored Satipura Block (FSP:2016-2018), Jhandewali North (FSP:2019-20) and South block (FSP:2019-20), Jorkiyan South Block (FSP: 2020-2021), Khunja (NW) Block (FSP: 2020-21), Makkasar block (FSP: 2021-2022), Nai Basti Block (FSP: 2021-2022), Bawriyanwali Dhani Block (FSP: 2022-2023), Makkasar North Block (FSP: 2022-2023) and upgraded the resources upto G-3 level. In the present field season, i.e., FS 2023-2024, GSI shall further explore Jorkiyan North Block and Chistiyan Block. On basis of encouraging result of these blocks, continuity of Potash mineralisation and present demand of fertilizer minerals in the country, MECL further prepared a preliminary exploration proposal in the Dhankowali Dhani (North) block which is located in the western side of GSI Blocks to establish the continuity and resource of potash mineralisation in the area.



#### 5.2.0 Objectives

#### The Preliminary Exploration (G-3) is proposed with the following Objectives:

- To confirm the continuity and potentiality of potash bearing zones in the proposed area.
- To generate data for initial assessment of mineralogy of the potash zones and the K contents.
- To estimate resources of Potash zones as per UNFC system in 333
   Category.

#### 5.3.0 Methodology of Exploration

- 5.3.1 Survey: Co-ordinates of the cardinal points of all the boreholes will only be determined by DGPS survey. Hence a total of 16 nos of boreholes to be surveyed by DGPS. The cardinal points of the block boundary shall be surveyed by total station to ascertain coordinates and RL.
- 5.3.2 Geological Mapping: Large scale geological mapping on 1: 10,000 scale will be carried out in the entire block by taking geological traverses and all the geological structural features will be recorded if any. This map will be the Base map for future work.
- 5.3.3 Drilling: A total of 16 no. of boreholes are proposed in the unexplored area of the Satipura sub basin in 800m X 800m grid which is suggested exploration scheme as per the MEMC 2015 (Amended upto 2021). A total of 12800 m of drilling in 16 Nos of vertical boreholes have been proposed in the block. The location of proposed boreholes is given as Plate No- II with proposed depth.
  The location of these boreholes may change slightly subject to approachability owing

The location of these boreholes may change slightly subject to approachability owing to terrain conditions. All the formations i.e. Quaternary / Tertiary sediments, Nagaur Group, Hanseran Evaporite Group and Jodhpur Group will be drilled by coring

#### 5.3.4 Geophysical Studies.

As per the existing exploration practice Dual Density, Neutron, Resistivity, spectral Gamma and Caliper logging to be carried out in all the boreholes. Based on the geophysical interpretation, sampling of potash bearing zones shall be taken up.

#### 5.3.5 Drill core Logging and Sampling

Detailed core logging will be carried out for all the boreholes and various details i.e., litho units formations, intercalations and parting, core recovery, colour, structures and textures etc will be recorded. In the Hanseran Evaporite Group, special attention is required to identify Polyhalite and other Potash bearing minerals.



#### 5.3.6 Sampling:

The primary samples will be drawn at the length of 0.50 m in the potash bearing zones depending upon the variation in the potash characteristics as well as 1.00m length interval in the non potash bearing Halite zones. As it has been observed that the potash mineralisation is only developed in H1 and H2 halite cycles, it is adviced to draw samples from the H1 and H2 halite cycles only. However, if the potash mineralisation is observed visually in any other Halite cycle, samples shall be prepared for those zones also. Non halite areas shall not be sampled. Standard procedure will be adopted for preparation of samples.

This will generate about 2400 no of Primary samples for 11 radicals. Thus 240 no (10% of primary samples) external check samples will also be generated.

#### 5.3.7 Laboratory Studies Chemical Analysis:

a) All the Primary, Internal & External Check samples [2760 no; = 2400 Primary & 120 Internal Check (5%), 240 External Check (10%) of Primary samples will be analyzed for 11 radicals i.e. K, Na, Mg, Cl, Br, I, Li, F, B, CaSO, & Water insolubles.

X.R.D. Studies: X-ray Diffraction studies will be carried out on the primary samples of potash zones which will be about about 1000 nos to identify the different mineral phases occurring in the mineralized zones.

Specific gravity determination: Specific Gravity will be determined on 20 nos. drill core specimen of halite.

5.3.8 Exploration Report: Data generated from proposed exploration along with integration of earlier data of GSI & MECL will be utilized in Report preparation.

#### 5.3.9 Quantum of work:

The quantum of work proposed in the present exploration scheme is given in Table below:



### Quantum of work proposed for Potash Exploration in Dhankowali Dhani (North) Block, Satipura Sub Basin, District-Hanumangarh, Rajasthan.

Sl. No.	Item of work	Unit	Quantum
1.	Geological Mapping on 1:10,000 scale	Sq. Km.	9.63
2	DGPS survey of 16 Nos of BHs & 1 Nos of Base Station	Nos	17
3.	Drilling: i) 16 boreholes	m.	12800 m (16 BHs)
4.	Geophysical Studies		
	i) Borehole Geophysical Logging Dual Density, Resistivity, Spectral Gamma, Neutron, Caliper	m.	12800 m (16BHs)
5.	Laboratory Studies		
	A. Primary + Check Samples		
	i. Primary samples for 11 radicals i.e. K. Na, Mg, Cl, Br, I, Li, F, B, CaSO <sub>4</sub> & Water insolubles	Nos.	2400
	ii, Internal check samples (5% of Primary samples) for 11 radicals i.e. K, Na, Mg, Cl, Br, I, Li, F, B, CaSO <sub>4</sub> & Water insolubles from MECL Lab.		120
	iii. External check samples (10% of Primary samples) for 11 radicals i.e. K, Na, Mg, Cl, Br, I, Li, F, B, CaSO <sub>4</sub> & Water insolubles from External NABL Lab.	Nos	240
	iv. X-Ray Diffraction Studies	Nos.	1000
б.	Specific Gravity Determination	Nos.	20
7-	Report Preparation (Digital Format)	Nos.	(1)

#### 6.0.0 Manpower Deployment

6.0.1 Manpower deployment List may be provided later.

#### 7.0.0 Time Schedule and Cost Estimates:

- 7.1.0 Time Schedule: The proposed exploration programme like drilling, Geology, Laboratory work including Camp setting & winding and Laboratory studies will be completed in 16 months time. Report writing will take additional 3 months including 1 months overlap with laboratory studies. Thus, the total time proposed for completion of work is 18 months. The bar chart showing Action Plan/time schedule is given in Table-7.1.
- 7.2.0 Cost Estimate: Cost has been estimated based on rates of SOC of NMET dated 01.04.2020. The total estimated cost is Rs 2471.73 Lakhs. The details of cost estimates are given in Table 7.2 and summary is given below.



#### Summary of Cost Estimates

SI No.	Item	Estimated Cost INR (₹)			
1	Exploratory Drilling	1674,84,100			
2	Geology & Survey	33,04,880			
3	Geophysical Logging	36,04,400			
4	Laboratory Studies	265,45,420			
	Sub total	2069,38,800			
6	Report	20,00,000			
7	Peer Review	30,000			
8	Proposal Prepration	5,00,000			
	Total	2094,68,800			
9	GST (18%)	377,04,384			
Te	tal cost including 18% GST	2471,73,184			
	SAY, in Lakhs	2,471.73			

#### 8.0.0 Justification:

- 8.1.1 In the Satipura Sub Basin, GSI has established 202.30 mt. probable and 1429.95 mt. possible resources with an average grade of 4.80% K in 245.61 sq. km. area. Further GSI have explored Satipura Block (FSP:2016-2018), Jhandewali North (FSP:2019-20) and South block (FSP:2019-20), Jorkiyan South Block (FSP: 2020-2021), Khunja (NW) Block (FSP: 2020-21), Makkasar block (FSP: 2021-2022), Nai Basti Block (FSP: 2021-2022), Bawriyanwali Dhani Block (FSP: 2022-2023), Makkasar North Block (FSP: 2022-2023) and upgraded the resources upto G-3 level. In the present field season, i.e., FS 2023-2024, GSI shall further explore Jorkiyan North Block and Chistivan Block.
- 8.1.2 The distribution of potash bearing zones are continuous in North East and South West direction which can be observed from the explored GSI blocks. As a result, the Dhankowali Dhani North Block is the potential area for further establishment of potash resource.
- 8.1.4 Out of a total sub-basin area of 2,470.51 sq. km, within the Nagaur-Ganganagar basin, only 6.63% of the total area i.e., 164 sq. km area has been explored till date. The remaining unexplored area within the eight sub-basins aggregates to ~2,300 sq. km. This is ~93% of the total sub-basin area. It may be noted that this area was demarcated by GSI based on 2% K isochore boundary (1974-1991).
- 8.1.5 Polyhalite potash mineral is not water soluble, and with the present technology can only be mined by conventional underground Mining method. Whereas the mineable soluble Potash i.e., Sylvite Sylvinite zones are also found. The current exploration practice does not involve separate delineation of these bands. Thus, these bands have to be separately delineated into specific Sylvine Sylvinite zones. The availability of such data is for planning a solution mining operation as these bands have to be separately delineated during exploration to establish their continuity and disposition for planning any mining activity.

Table: 7.1 TIME SCHEDULE/ACTION PLAN FOR PRILIMINARY EXPLORATION (G-3) FOR POTASH IN DHANKOWALI DHANI (NORTH) BLOCK, SATIPURA-SUB BASIN, NORTH WESTERN PART OF RAJASTHAN, DISTRICT- HANUMANGARH, RAJASTHAN.

												N	IONTHS							
SI. No.	Activities	Unit	1	2	3	4	5	6	7	9	10	11	12		13	14	15	16	17	18
1	Camp Setting	day																		
-2	Core Drilling (4 rigs)	m.																		
4	Geologist Party days (1 Party)	day												eγ						
5	Sampling Party days, Core Sampling	day												Revie						
6	Camp Winding	day				-								, LE						
7	Laboratory Studies	Nos																		
8	Geologist Party days (1 Party), HQ	day																		
	Report Writing & Peer review	day						ji				Ü								
NOTE	-: !!***********************************	17			7															

<sup>2</sup> Time loss on account of monsoon/agricultural activity/forest clearence/local law & order problem/ lockdown etc will be additional to above time line.

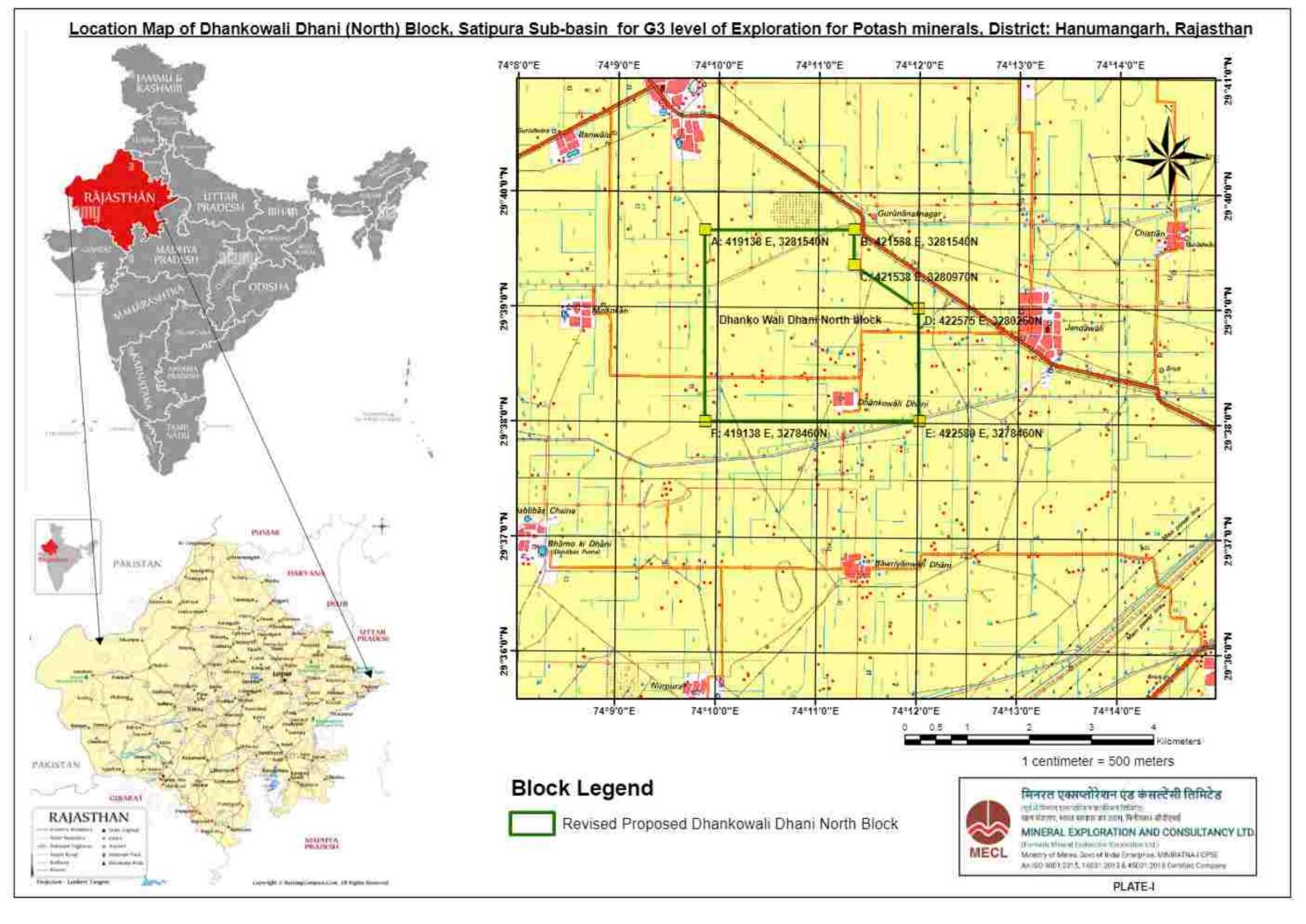
#### Table 7.2

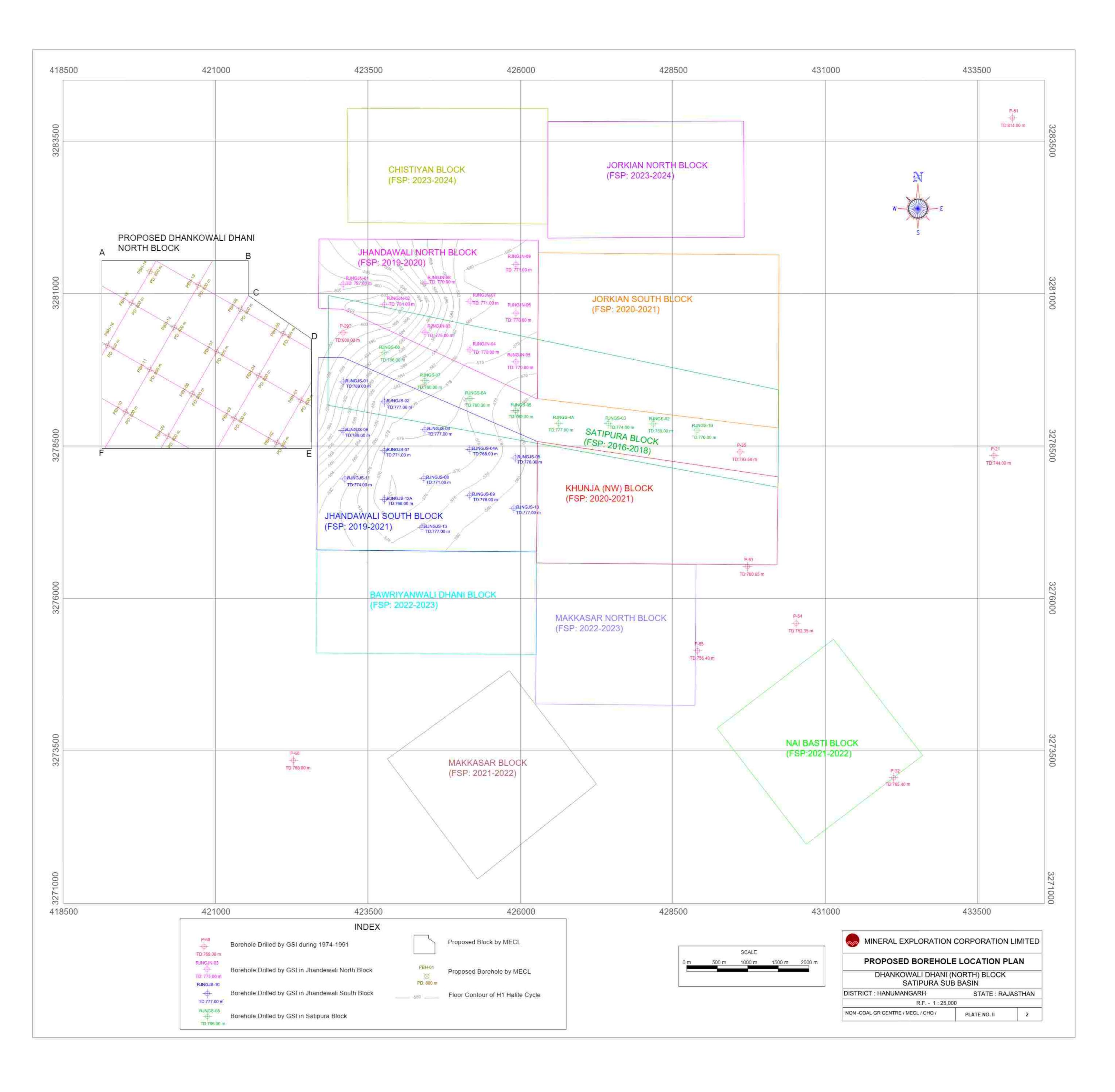
COST ESTIMATE FOR PRILIMINARY EXPLORATION (G-3) FOR POTASH IN DHANKOWALI DHANI (NORTH) BLOCK SATIFURA-SUB BASIN, NORTH WESTERN PART OF RAJASTHAN, DISTRICT-HANUMANGARH, RAJASTHAN.

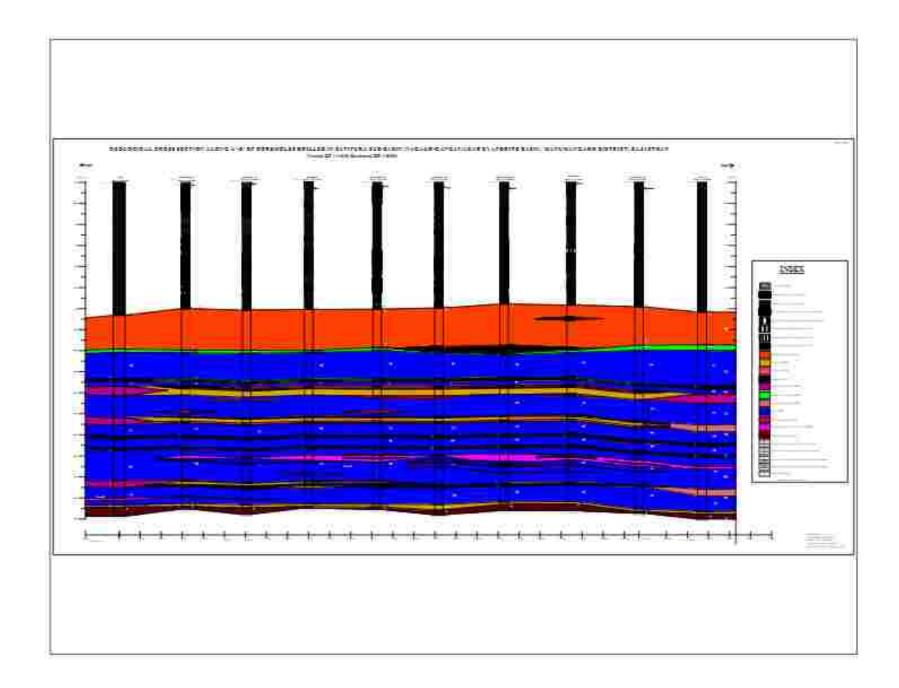
Total Area - 9.63 up km; Not of Borebole - 16; Bosebole depth range - Avg 300 m; Completion Time - 18 Months

5.N	Item of Wark	Unit	Bater as pr	r NMET 50C 2010-21	Timumd	Cost of the Proposal	Remarks
2.0	HERGENOTE:	WHE	SeC-Item -Si No.	Rates as per SeC	Qtt	Total Amount (Rs)	A.C. Salara
A	GEOLOGICAL WORK						
1	Borebole logging & sampling & report writing						
8	Ourpe (for one Geologie per day at HQ	day	113	:9,000	88	5,40,000	
(8)	Charges for Cambridge party per day at field	day	113	11,000	360	39,60,000	
760	Figure Labour 42 Anni worth poetry v	day	353	454	1726	3.35,660	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Gorn, whichever is higher
4	Charges For one Sumper persons (1, Purps)	one simple: per day	122	3,100	300	15,30,000	V
	Cabings (47mm)	dzy	92	#94	1,200	5,92,300	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Good, whichever is higher
7	Survey (on 1:10000 Scale)	neso es rocaro en		7.00			
2	Reduced Level of the hotelinies and Blancher points by GCDS	Per Point of observation	162	39,200	i?		BH-16 nos & Sase Station 1 Nes
	Sub-Total A					73,04,880	
	DRILLING						
1	Drilling up to 300m (Hard Rock) Drilling 301 to 600 m (Hard Rock)	m	22   45 22   46	11,500 22,429	4,800 4,900	551,00,000 598,16,000	Soc-Page No-2, Clause No. II. Note at Potash
	Drilling 600 to 990 m (Hard Rock)	- 14	2214:	33,235	3,200	423,20,000	Cri2lin <u>≢</u>
3	Securials deviation States by Multisher Cemera	#	226	316	8	ā	
346	Land Crop Compensation (in case the ESI fells in agricultural Lind)	per3H	356	29,000	26	3.20,000	Amount will be reimbursed as per actuals or man. Ra. 20000 per SH with certification from local authorities
\$	Construction of concrete Piller (12"x12"x30")	per borahale	2275	2,000	26	32,000	
6	Borahole plugging by coment	(#1	2235	150	92,800	19,20,000	
Ť	Transportation of Drill Rig & Truck essociated per drill	Xm )	228	35	22,900	4,32,000	
£	Monthly Accommodation Charges for drilling Camp (P.s 50000 - per Month upto 2 rigs, 50% Additional Charge for additional rigs)	точф	219	1,02,900	14	14,00,000	
	Drilling Camp Satting Oast	Nei	2.2.9s 2.2.9b	2,50,000	:4	10,00,000	
	Defiling Chang Washing up Cost  Zood Making (Fat Terran)	Nes Xm.	2210s	2.30,000 22,020	35		Road Miking will be comidered as per the requirement and Road Moking Charges will be
12	Szill Core Preservation	per m	33	1,590	2,600	41,34,000	reminused accordingly
	Sub Total B					1674,84,100	
_	BOREHOLE GEOPHYSICAL LOGGING		3,114	702	22.200	12.02.200	
÷	Dial Denisy Security	711	3.11f	102	92,800 92,800	13,95,600 9,47,200	6
3	Special George	m	3,110	164	12,500	20,39,200	
_	Eatoni (r)	201	3.11c 3.11g	39 10	12,800 12,800	4,89,250 2,43,250	
	Complicació in PICE	125	3.28	9,000	20	1,80,000	
*	Cample vices to Field Sub Total C	45	7.18	11,000	10	3,39,000 56,04,400	
	101-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1					55,000,412	
1	LABORATORY STUDIES Chemical Analysis Primary samples						
	a. Analysis of 11 meticals. i.e. N. Na, Water insolubles. Mg, Cl. Br, I. Li & CeSO4, F & S	Nes	411	1,157	2,400	195,76.800	
E)	Check sample: Internal (5%) and External(10%)						
	z. Andysia of II redicals 14, K. Na. Water mentubles, Mg. C1 Bg. I. Li & Cc504, F & B	Nei	411	1,137	360	29,36,520	
147	XXD analysis for identification of numerals (Ramino)	Nei	431	4,000	1.500	45,00,000	
	Sub-Total-1					265,33,320	
2	Physical Laboratory						
1	Specific Gravity Determination Sub Total-D	3/6	**,1_	1,665	20	32,100 26£,45,420	
	eros Strictes					SHAME	
E	Total - A to D					2069.38.800	ľ
_				For the project change		300,20,000	
6	Geological Report Preparation		·53	cost more than Re. 200 lights - A more more of Re. 8 lighter 2% of the rather of waste whichers in more wylets to a more amount of Dr. 18 lights		20,50,566	EA has to submit the final Geological Report in Hand Copies (5 Nos) and the self copy to NASE
н	Poer reviest Charges		As per EC decision			30,000	
	Preparation of Exploration Proposal (I Stard copies with a soft copy).	5 Hard copies with a soft copy	<b>*</b>			5,00,000	EA has to submit the Hard Copies and the self- copy of the final proposal along with Maps and plan as suggested by the TCC-NMET in its meeting while distring the proposal
1	Total Estimated Cost without GST					2094,68,880	I.
K	Provision for GST (18% of G)	Fig.				377,04,384	GST will be reimbursed as per actual and as per motified prescribed rate
	Total Estimated Cost with GST					1471,78,184	
	CONTROL OF THE PROPERTY OF THE			Say in Lakhs	(Rs.)	2,471.72	

Note - 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.







## GRAPHIC LITHOLOG OF BOREHOLES DRILLED IN JANDAWALI NORTH BLOCK, NAGAUR-GANGANAGAR EVAPORITE BASIN, HANUMANGARH DISTRICT, RAJASTHAN

