

COMMODITY: BAUXITE AND ASSOCIATED CRITICAL MINERALS

**PRELIMINARY EXPLORATION FOR BAUXITE, ALUMINOUS LATERITE AND ASSOCIATED
CRITICAL MINERALS IN SALEL BLOCK, SINDHUDURG DISTRICT, MAHARASHTRA.
STAGE: G3**

**BY
GEOLOGICAL SURVEY OF INDIA
CENTRAL REGION, STATE UNIT: MAHARASHTRA, PUNE**

**PLACE: PUNE
DATE: JUNE 2026**

Summary of the Block for G3 Level Exploration

GENERAL INFORMATION ABOUT THE BLOCK

Feature	Details
Block ID	SALEL BLOCK
Exploration Agency	Geological Survey of India, Central Region, State Unit Maharashtra, Pune
Commodity	Aluminous Laterite and associated Critical Minerals
Mineral Belt / Geological Domain	West Coast Laterite Belt
Block Area	4.45 sq. km
Completion Period	One year
Objectives	To establish the subsurface continuity and to estimate the resource of bauxite and associated critical minerals
Projected Outcome	Preliminary exploration data for resource appraisal and further advancement of the block.
Personnel	Two geoscientists
Expected Field Days	Officer-1: 100days; Officer-2: 100 days; Supervisory Officer: 7 days
Toposheet / Degree Sheet	47H/12
District / State	Sindhudurg / Maharashtra

1. Location

BLOCK

Cardinal Points	Latitude	Longitude
A	16°04'25.14"N	73°33'7.39" E
B	16°04'25.14"N	73°34'33.33"E
C	16°03'28.72"N	73°34'33.72"E
D	16°03'28.78"N	73°33'7.64"E
Tehsil/Taluk	Malvan	
District	Sindhudurg	
State	Maharashtra	

2. Area

Block Area	4.45 sq. km.
Forest Area	NIL as per PMGS
Government Land Area	Data not available
Private Land Area	Data not available

3. Accessibility

Nearest town	Kunkavale and Kudal are about 3 km and 5 km northeast of Salel Block
District headquarters	Sindhudurg, about 20 km northeast of Salel Block
Nearest Rail head	Kudal and Sindhudurg, both roughly 15 km away from Salel Block
Nearest Airport	Chipi Airport Road, Parule, 15 km from Salel Block

4. Hydrography: The proposed block is not drained by any major river. Outside the proposed block in the south, westerly flowing Karli River joins Arabian Sea. Small seasonal low order streams are generated in the proposed block.

5. Climate: Humid tropical coastal climate

6. Topography: undulatory laterite plateau.

7. Availability of baseline geoscience data

Geological map	Large-scale geological mapping and earlier G4 investigations by GSI in and around the block
Geochemical data	NGCM data available
Geophysical data	Not available

8. Justification for taking up G3 level exploration

During FS 2024–25, Vhatkar and Chakraborty carried out a CMAP item targeting critical minerals in the Chauke block, covering approximately 20 sq km area. The study aimed to examine lateritic profile development and underlying lithologies for their geochemical potential. Five orientation survey sites were selected to capture complete laterite weathering profiles, from unaltered protolith through saprolite to clay-rich horizons. Twenty-eight groove samples were collected for geochemical characterization and lithological correlation.

The mapped lithology's primarily include basalt, sandstone, and laterite, which occurs as a capping horizon. Based on texture and occurrence, laterites were classified into ferruginous and aluminous varieties and bauxite, with pisolitic textures observed at several locations. The laterite profile thickness ranges from 16 to 20 meters. I

In Chauke block a total of 60 BRS, 15 PTS, and 5 boreholes were drilled with total 103.45 meterage. Geochemical analysis revealed that Al_2O_3 concentrations range from 14.89% to 48.56% in BRS samples, 28.44%

to 54.42% in PTS samples, and 14.9% to 54.11% in groove samples. Notably, 10 BRS, 4 PTS, and 10 groove samples exhibited $\text{Al}_2\text{O}_3 > 30\%$ with corresponding $\text{SiO}_2 < 7\%$, indicative of high-grade zones. Trace element analysis showed Cr ranging from 21 to 1778 ppm, Ga from 5 to 84 ppm, Ni between 12 and 161 ppm, and V from 34 to 1804 ppm.

Proposed Salel-G3 Block has been upgraded from the Chauke Block. A total of 36 samples (BRS-15, PTS-2, CS-13 & groove- 6) were collected from the proposed Salel Block. The notable geochemical variability in the block is tabulated below.

Table. No.1: Geochemical analytical results of Salel block.

Sample type	No. of sample	commodity	Range
BRS	15	Al_2O_3 , Co, Cr, Ga, Ni & V	14.89% to 48.80%, 12 to 140 ppm, 92 to 783 ppm, 5 to 69 ppm, 13 to 149 ppm & 376 to 1070 ppm.
PTS	2	Al_2O_3 , Co, Cr, Ga, Ni & V	28.44% and 35.23%, 38 to 48 ppm, 189 and 384 ppm, 35 to 50 ppm, 71 to 74 ppm & 151 to 703 ppm.
CS from 1 BH	13	Al_2O_3 , Cr, Ga & V	15.03% to 33.80%, 43 to 920 ppm, 05 to 52 ppm & 185 to 1105 ppm.
Groove from 1 profile	6	Al_2O_3 , Co, Cr, Ga, Ni & V	14.90% to 29.76%, 42 to 69 ppm, 21 and 256 ppm, 5 to 52 ppm, 68 to 109 ppm & 367 to 793 ppm.

The results indicate the potentiality for aluminous laterite and bauxite along with critical mineral within the Salel-G3 block.

PRELIMINARY EXPLORATION FOR BAUXITE, ALUMINOUS LATERITE AND ASSOCIATED CRITICAL MINERALS IN SALEL BLOCK, SINDHUDURG DISTRICT, MAHARASHTRA

1.1.0 INTRODUCTION

The Salel block covering an area of 4.45 sq km located in the southwestern part of Survey of India toposheet No. 47 H/12. The proposed area exposes Sandstone, Deccan basalts, laterite and bauxite. The objective of this item is to assess the potentiality of bauxite, aluminous laterite and associated critical minerals in the area. The investigation will comprise DM on 1:4000 scale along with drilling on 400*400 m grid pattern with a proposed 24 vertical boreholes up to 15 to 20m depth for assessment of bauxite and associated critical mineral resource in Salel block. The number of boreholes is tentative and may be change after detailed mapping based on feasibility of the area.

2.1.0 BACKGROUND INFORMATION

The Salel Block (FS: 2026-27), bounded by latitudes $16^\circ 03' 28.72''$ to $16^\circ 04' 25.14''\text{N}$ and longitudes $73^\circ 33' 7.39''$ to $73^\circ 34' 33.72''\text{E}$,

During FS 2024–25, Vhatkar and Chakraborty undertook a CMAP item targeting critical minerals in the Chauke block, covering approximately 20 sq km area. The study aimed to examine lateritic profile development and underlying lithologies for their geochemical potential. The mapped lithology's primarily include basalt, sandstone, and laterite, which occurs as a capping horizon. Based on texture and occurrence, laterites were classified into ferruginous and aluminous varieties and bauxite, with pisolitic textures observed at several locations. The laterite profile thickness ranges from 16 to 20 meters.

Geochemical analysis revealed that Al_2O_3 concentrations range from 14.89% to 48.56% in BRS samples,

28.44% to 54.42% in PTS samples, and 14.9% to 54.11% in groove samples. Notably, 10 BRS, 4 PTS, and 10 groove samples exhibited $\text{Al}_2\text{O}_3 > 30\%$ with corresponding $\text{SiO}_2 < 7\%$, indicative of high-grade zones. Trace element analysis showed Cr ranging from 21 to 1778 ppm, Ga from 5 to 84 ppm, Ni between 12 and 161 ppm, and V from 34 to 1804 ppm, underscoring the block's potential for critical mineral exploration alongside aluminous laterite and bauxite resources.

A total of 36 samples (BRS-15, PTS-2, CS-13 & groove- 6) were collected from the proposed Salel-G3 Block (Table No.1). Based on encouraging outcome of Chauke block (CMAP, FS: 2024-25), the Salel G3 block has been proposed as a seamless upgradation to assess the potentiality of Bauxite, Aluminous Laterite and associated Critical Minerals.

3.1.0 LOCATION AND ACCESSIBILITY

The mapped area is situated in Malvan Tehsil, Sindhudurg District of Maharashtra. It is located 20 Km towards South-West from District headquarters Oros. 456 KM from State capital Mumbai. The area is well connected by SH-4 which joins Mumbai-Goa Highway i. e. NH-66 (erstwhile NH-17) at Kudal. The nearest railway station is about 19.5 km located at Kudal. The nearest port is situated at the Redi Port in Vengurla tehsil of Sindhudurg district. The Redi Port currently handles 2.4 million tons of cargo annually. The nearest domestic airport is located at Chipi, Sindhudurg which is about 15 kms from the study area and the nearest international airport is located at Gao in Dabolim which is about 105 km south of the area.

4.1.0 PHYSIOGRAPHY, DRAINAGE AND CLIMATE

The study area forms a small part of the Konkan plain that is located due west of the Western Ghat escarpment and due east of the Arabian Sea. The overall topography of the area can be termed as plateau which exhibits highly dissected topography with flat topped hills and the hill spurs separated from one another by valleys. The highest elevation is 210 m above MSL near Chauke village whereas the lowest elevation is 36 m above MSL near Dhamapur village. The area is devoid of any river, but numerous nallas dissects the entire area.

The climate of the study area is typical blend of Konkan coastal and inland climate of Maharashtra which is almost hot and humid in summers and mild in winter. The temperature has a relatively narrow range between 20 °C to 40 °C. Weather from October to May is humid. Maximum temperatures rarely exceed 40 °C and typically range between 33 to 35 °C. The area receives abundant rainfall from June to September due to its proximity to the Western Ghats and Arabian Sea. Annual rainfall in the area varies between 300-350cm.

5.1.0 PREVIOUS WORK

Joshi et al. (2004) identified regolith profiles across three physiographic levels in the Konkan region- high hills (~1000 m), plateau (60–120 m), and coastal plains (up to 15 m) with variable degrees of bauxite enrichment at each level. High-grade bauxite occurrences, primarily of the blanket type, are reported in Satara, Sangli, and Kolhapur districts with active mining in areas like Radhanagri, Gargoti, and Udgiri. In contrast, low-level lensoidal or pockety bauxite deposits are found in Sindhudurg, Ratnagiri, and Raigad districts, though largely underexplored.

Initial exploratory work was carried out by the Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), in collaboration with the Geological Survey of India (GSI), through random sampling of high- and low-level laterites, indicating favorable Al_2O_3 concentrations (JNARDDC, 1999). Subsequent investigations ranging from G4 to G2 stages were carried out by GSI across toposheets 47H/6, 47H/7, and 47H/10 (Bhatia & Katti, 2008; Bhatia & Eshwara, 2010; Kishore, 2009; Bhatia, 2010; Saha & Eshwara, 2005; Fulzele et al., 2012; Bhatia et al., 2012), establishing bauxite resources in areas such as Ghodepawadi, Hamdara, Nanar, Kumbhawade, Kalambewadi, and Katta-Kalvi.

During 2015–17, GSI conducted mineral prognostication in degree sheet 47H, the Kunkeshwar block (16°15'00"–16°21'0.5"N; 73°23'23"–73°30'00"E) was investigated in FS 2020–21, where analytical results revealed Al_2O_3 values ranging from 9.59% to 57.73% in BRS samples and 18.58% to 57.96% in PTS samples. This led to the delineation of approximately 2 sq km of bauxite and 65 sq km of aluminous laterite potential zones (Bhaise & Rahman, 2020). In FS 2021–22, a G4 stage investigation in the Math Budruk block (16°15'00"–16°20'00"N; 73°30'00"–73°36'10"E) revealed Al_2O_3 content ranging from 17.91% to 56.57% in BRS and 19.67%

to 59.23% in PTS samples, leading to the identification of 10.36 sq km of bauxite and 34.68 sq km of aluminous laterite (Vhatkar & Rahman, 2022).

A collaborative G3 investigation was also carried out in the Kudopi area (toposheets 47H/11 and 47H/12) by GSI and DGM, Maharashtra. Core samples exhibited Al_2O_3 values ranging from 19.93% to 55.67%, with a resource estimate of 3.92 million tonnes (MT) of bauxite (average grade 45.47% Al_2O_3) and 40.47 MT of aluminous laterite (average 28.80% Al_2O_3) (Bhaise et al., 2022).

Reconnaissance survey by Vhatkar and Suryavanshi (2023) in the Devgarh Block during FS 2022–23, reported Al_2O_3 values between 21.95% and 59.17%, averaging 35.63%, and delineated 24.25 sq km of bauxite potential.

G4 stage work continued in the Baparde and Padel blocks during FS 2022–23. In Baparde, Gautam (2023) delineated 18 sq km for bauxite and 27 sq km for aluminous laterite within a 50 sq km study area. In the Padel block, Rahman (2023) identified 13.39 sq km and 17.69 sq km for bauxite and aluminous laterite, respectively. Most recently, G4 investigations were initiated in FS 2023–24 in the Achra and Phanasgaon blocks. Tare and Panda (2024) identified 5 sq km of bauxite and 21 sq km of aluminous laterite in Achra block, with promising sites at Munage, Vayangani, Tonadavali, and Maldi. In the Phanasgaon block, Gautam and Bhagat (2024) delineated 6 sq km of bauxite and 60 sq km of aluminous laterite potential in areas around Pendhri, Goval, Somlewadi, and Patgoan.

Vhatkar and Chakraborty undertook a CMAP item during FS 2024–25, targeting critical minerals in the Chauke block, covering approximately 20 sq km area.

The mapped lithology's primarily include basalt, sandstone, and laterite, which occurs as a capping horizon. Based on texture and occurrence, laterites were classified into ferruginous and aluminous varieties and bauxite, with pisolitic textures observed at several locations. The laterite profile thickness ranges from 16 to 20 meters. A total of 60 BRS, 15 PTS, and 5 boreholes with 103.45 meterage were drilled. Twenty-eight groove samples were collected for geochemical characterization and lithological correlation. Based on the outcome of Chauke Block, the Salel G3 block has been proposed as a seamless upgradation to assess the potentiality of Bauxite, Aluminous Laterite and associated Critical Minerals.

6.1.0 GEOLOGY OF THE AREA

During FS 2024-25, Chauke Block, in parts of Sindhudurg District in western Maharashtra, an area of 20 sq km was mapped on 1:25,000 scale by Vhatkar and Chakraborty. The LSM area exposes sandstones of Badami Group of Kaladgi Supergroup, basalts of Deccan Trap, laterite and/or aluminous laterite and bauxite within laterite cappings. More than 90% of the area is covered by laterite cappings. Most of the laterites have developed over the Deccan lavas. The stratigraphy of the mapped area has been summarized in Table No.2 below. Table No.2 Stratigraphy of LSM area in parts of Toposheet No. 47H/12 Sindhudurg District, Maharashtra (Vhatkar and Chakraborty, 2025)

Lithology	Formation/Group	Supergroup	Age
Alluvium	-	-	Cenozoic
Laterite/aluminous laterite & bauxite	-	-	Upper Cretaceous to Paleocene
Basalt	Purandargarh	Deccan Trap	
Sandstone, shale	Badami Group	Kaladgi Supergroup	Neoproterozoic

7.1.0 OBJECTIVES OF THE PROPOSED EXPLORATION PROGRAMME

The present exploration programme has been formulated with the objective:

- To establish the subsurface continuity and to estimate the resource of bauxite and associated critical

minerals

8.1.0 PROPOSED SCHEME OF EXPLORATION

The proposed G3 exploration programme comprises geological mapping (1:4000), drilling target of 430m with tentative 28 boreholes, borehole logging, sample collection and processing, and laboratory studies.

Borehole logging, core sampling, and laboratory analyses will support interpretation and preliminary resource appraisal. Selected samples will be analyzed for Major oxides- Al_2O_3 , SiO_2 , Fe_2O_3 , TiO_2 , K_2O , CaO , MgO , Na_2O , P_2O_5 & MnO ; Trace elements - V, Ga, Sc, Y & Zr.

9.1.0 QUANTUM OF WORK

Item of Work	Unit	Proposed Quantum
Geological Survey DM (1:4000)	Sq. Km	4.45
Technological: Drilling	M	430
SMPL: Core Sampling (CS), Reactive Silica ^{\$}	Nos. Nos.	430 05
Petrographic/ Minerographic Studies: (a) PS (b) PCS (c) ORM/OM (d) XRD@	Nos. Nos. Nos. Nos.	10 10 10 10
Chemical analysis: (a) CS (b) PCS (c) REE	Nos. Nos. Nos.	430 10 10
Major oxides- Al_2O_3 , SiO_2 , Fe_2O_3 , TiO_2 , K_2O , CaO , MgO , Na_2O , P_2O_5 , MnO , LOI Trace elements - V, Ga, Sc, Y & Zr		

10.1.0 COST

Summary of the Cost estimates

Sl. No.	Item	Total Estimated Cost (Rs.)	Funding
1	Geology and Survey	0	By GSI
2	Drilling	2365000/-	NMEDT
3	Survey work	0/-	By GSI
4	Laboratory studies	0	By GSI
5	Geologist at HQ	0	By GSI
	Sub Total (1to 4)	2365000/-	
6	Exploration Report Preparation	0	By GSI
7	Proposal Preparation	0	By GSI
8	Peer review charges	0	By GSI
9	Sub Total (1to8)	2365000/-	By GSI
10	GST18%	425700/-	
	Total:	2790700/-	
	Say Rs. In Lakh	27.90/-	

COST CALCULATION

Item of Work			Unit	SoC-Item -Sl No. NMEDT	Rates as per NMET SoC 2025	Estimated Cost	
						Qty.	Total Amount (Rs)
D. Drilling - OUT SOURCED							
18.a	DRILLING	Drilling in/ Drilling in Soft rock/ Strata: HQ size borehole up to 400m Depth and NQ Size beyond 400m depth in case of NQ size drilling is done before 400m depth, the rate shall decrease by 20%	m	2.2.1.1c	5,500.00	430	₹ 23,65,000.00
18.b		Drilling in/ Drilling in Hard rock/ Strata: HQ size borehole up to 400m Depth and NQ Size beyond 400m depth in case of NQ size drilling is done before 400m depth, the rate shall decrease by 20%	m	2.2.1.1d	10,000.00	0	₹ 0.00
18.c		Drilling in/ Drilling in Very Hard rock/ Strata: HQ size borehole up to 400m Depth and NQ Size beyond 400m depth in case of NQ size drilling is done before 400m depth, the rate shall decrease by 20%	m	2.2.1.1e	12,650.00	0	₹ 0.00
18.d		Drilling for Lignite	m	2.2.1.1a	4,783.00	0	₹ 0.00
18.e		Drilling for Coal	m	2.2.1.1b	7,975.00	0	₹ 0.00
18.a		Mechanised Auger Drilling for soft strata up to 30m depth	m	2.2.2.1	4,760.00	0	₹ 0.00
18.b		Hand Auger drilling in soft strata up to 30 m depth	m	2.2.2.2	3,808.00	0	₹ 0.00
18.c		RC Drilling	m	2.2.3	8,870.00	0	₹ 0.00
18.d		Non coring drilling	m	2.2.4	4,000.00	0	₹ 0.00
19	DRILLING RELATED EXPENDITURE HEADS	Borehole Deviation Survey by Multishot survey tool (interval 6m; azimuth and inclination to be recorded)	per shot	2.2.5	330.00	0	₹ 0.00
20		Land / Crop Compensation (in case the BH falls in agricultural Land)	per BH	5.6	30,000.00	0	₹ 0.00
21		Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000.00	0	₹ 0.00
22		Borehole plugging with cement	per borehole	2.2.8	10,000.00	0	₹ 0.00

[illegible]

11.1.0 TIME SCHEDULE

The drilling component of the proposed exploration programme will be carried out as per the time schedule shown below.

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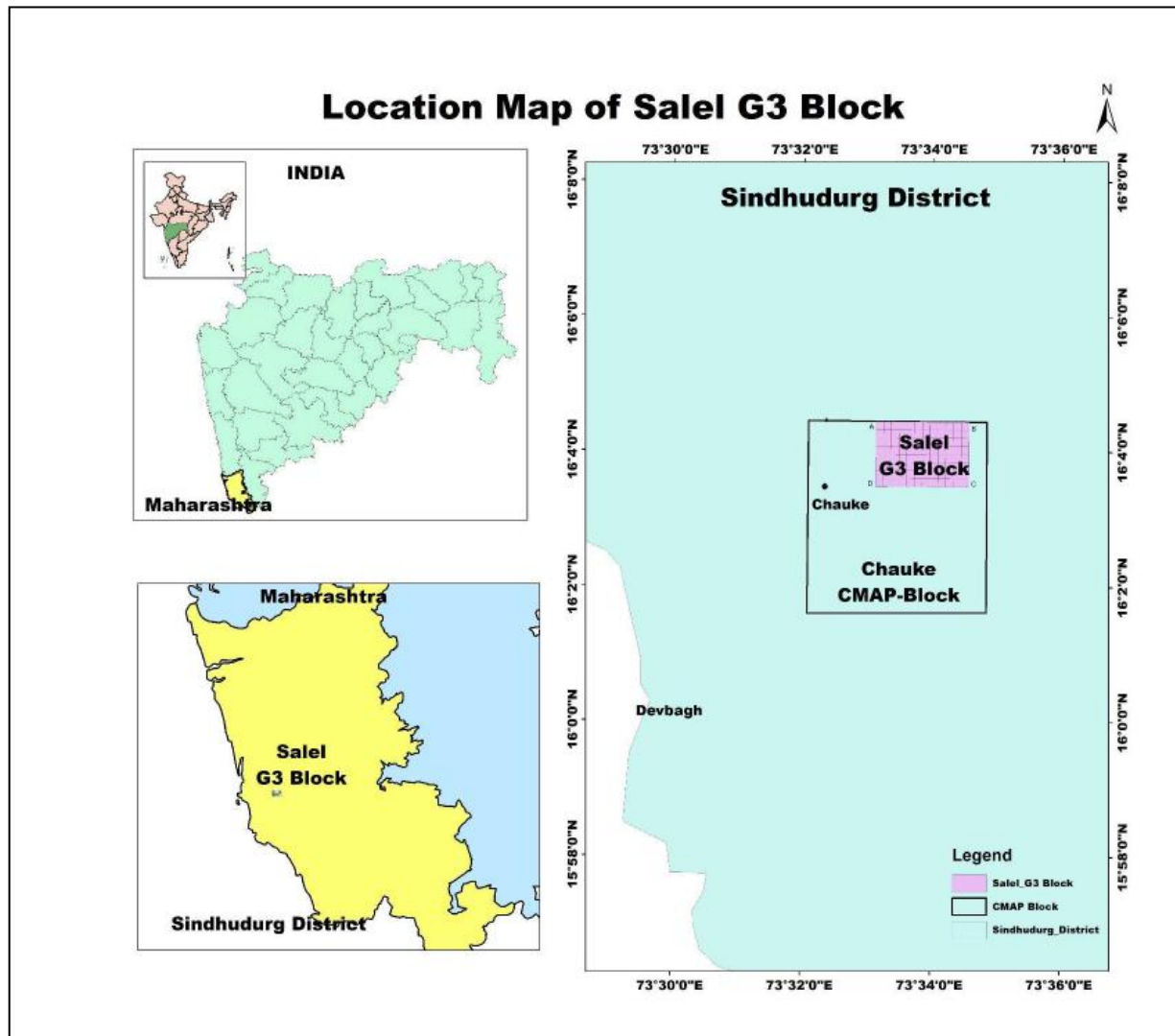


Fig1: Location map of Salel Block, Sindhudurg District, Maharashtra

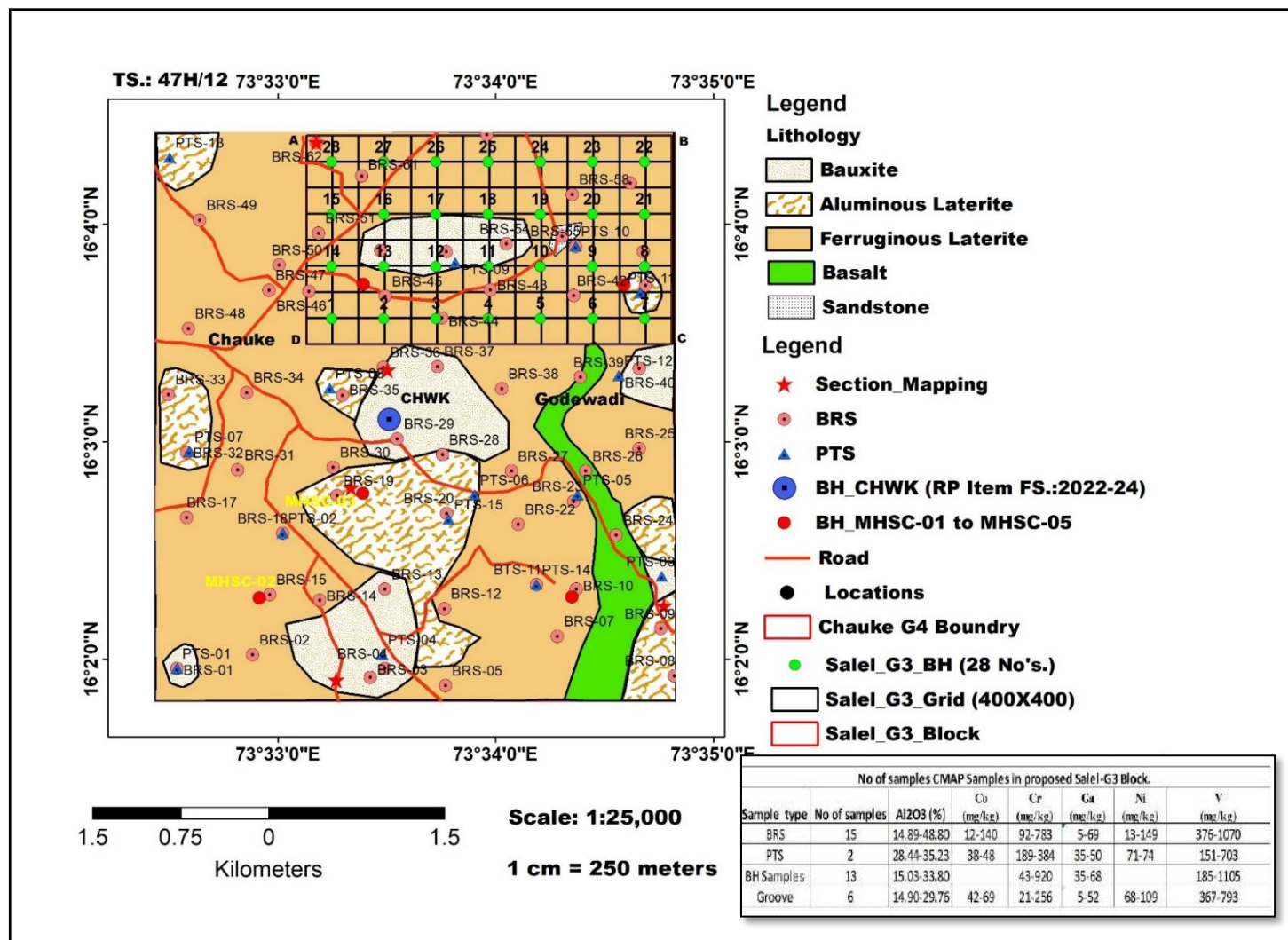


Fig.3. Proposed Salel G3 Block on LSM map of Chauke G4 Block (FS-2024-25).

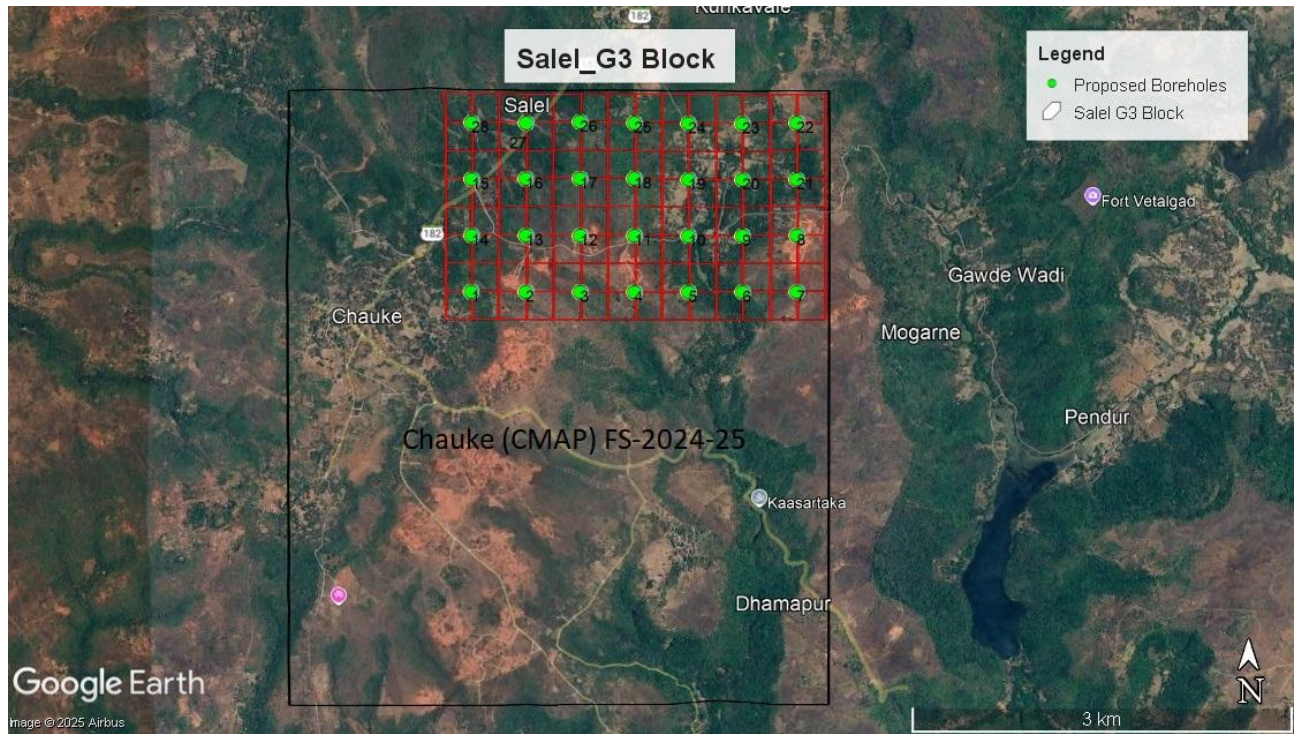


Fig.4. Accessibility map of Proposed Salel G3 Block overlaid on Google Earth Imagery

Borehole section of MHSC-04

RL-165m

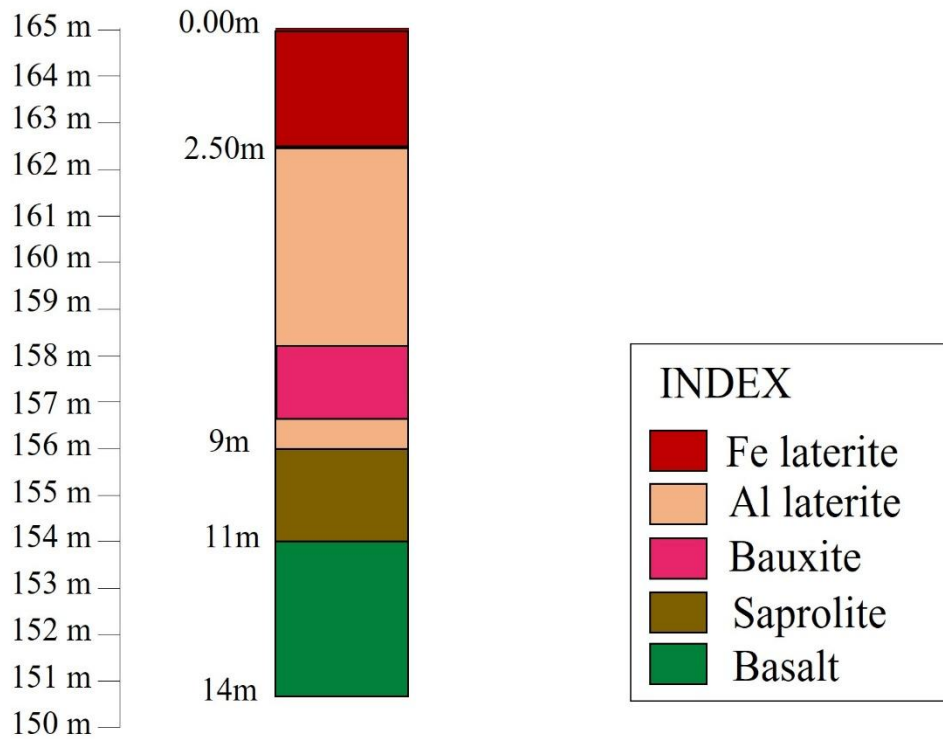


Fig 5. Borehole section of borehole MHSC-04, Salel Block, Sindhudurg District, Maharashtra.