Geoscientific and Technical Data Dossier
SCBM 2025

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1. Executive Summary

ISM (IIT) Dhanbad was awarded the work to carry out the evaluation of three (03) CBM blocks offered under Special CBM Bid Round - 2025 by Directorate General of Hydrocarbons (DGH).

The scoping evaluation presented in this report is based on the available data provided by DGH that was obtained from the data repository of DGH. This evaluation also includes study of available data from adjoining coal mining areas that supplements the study by integration of well control points away from CBM block boundaries. The study was carried out with a field scale Geocellular model using **'PETREL' and MATLAB**. The required resources like PETREL were provided by DGH for carrying out this study, whereas data analysis and computational workflow have been accomplished in the in-house MATLAB tool developed by IIT(ISM) Dhanbad.

The scope of this study is limited to static modelling that serves the purpose for resource-based evaluation of CBM blocks. The available data on gas content and isotherms have been used to characterize the coal reservoirs.

The geological model and Gas Initially In-Place (GIIP) estimation of the CBM blocks have indicated a resource density of 0.15 BCM/km^2 and 0.14 BCM/km^2 in the CBM block SR-ONHP(CBM)-2025/1 and SR-ONHP(CBM)-2025/2, respectively. Though resource density is one of the major indicators of CBM potential, it is not the only parameter that defines the CBM prospectivity. From a development perspective, CBM recovery factor and surface constraints play a vital role in CBM development. This study is limited to static modelling; thus, a production profile-based recovery factor estimation is beyond the scope of this study.

2. Introduction

With the objective to augment domestic production of Petroleum, the Government of India ("Government") has announced the Special CBM Round – 2025 with the offer of three (03) CBM Blocks, under the Hydrocarbon Exploration and Licensing Policy ("HELP") through International Competitive Bidding ("ICB") for Petroleum Operations. Table 1 lists the block details:

Table 1: Details of Special CBM Round 2025 Blocks

S. No.	Block Name	State	Basin	Area	Coal Field
1	SR-ONHP(CBM)-2025/1	West Bengal	South Rewa	230	Raniganj
2	SR-ONHP(CBM)-2025/2	West Bengal		100	Raniganj
3	CB-ONHP(CBM)-2025/1	Gujarat	Cambay	189	-

The coal blocks of West Bengal listed above come under Basin III category, whereas the CBM block of Gujarat comes under Basin 1 category. The coal seams of CBM block SR-ONHP(CBM)-2025/1 are of Permian age with Barakar coal seam as the target formation for development. The coal seams of CBM block SR-ONHP(CBM)-2025/2 are of late Permian age with Raniganj coal seam as the target formation for development. The coal seams of CBM block CB-ONHP(CBM)-2025/1 belong to Early to Middle Eocene age with Kadi, Kalol, and Sobhasan lignite coal seams as the target formation. **Figure 1** shows the location of the blocks SR-ONHP(CBM)-2025/1 and SR-ONHP(CBM)-2025/2. **Figure 2** shows the location of the block CB-ONHP(CBM)-2025/1.

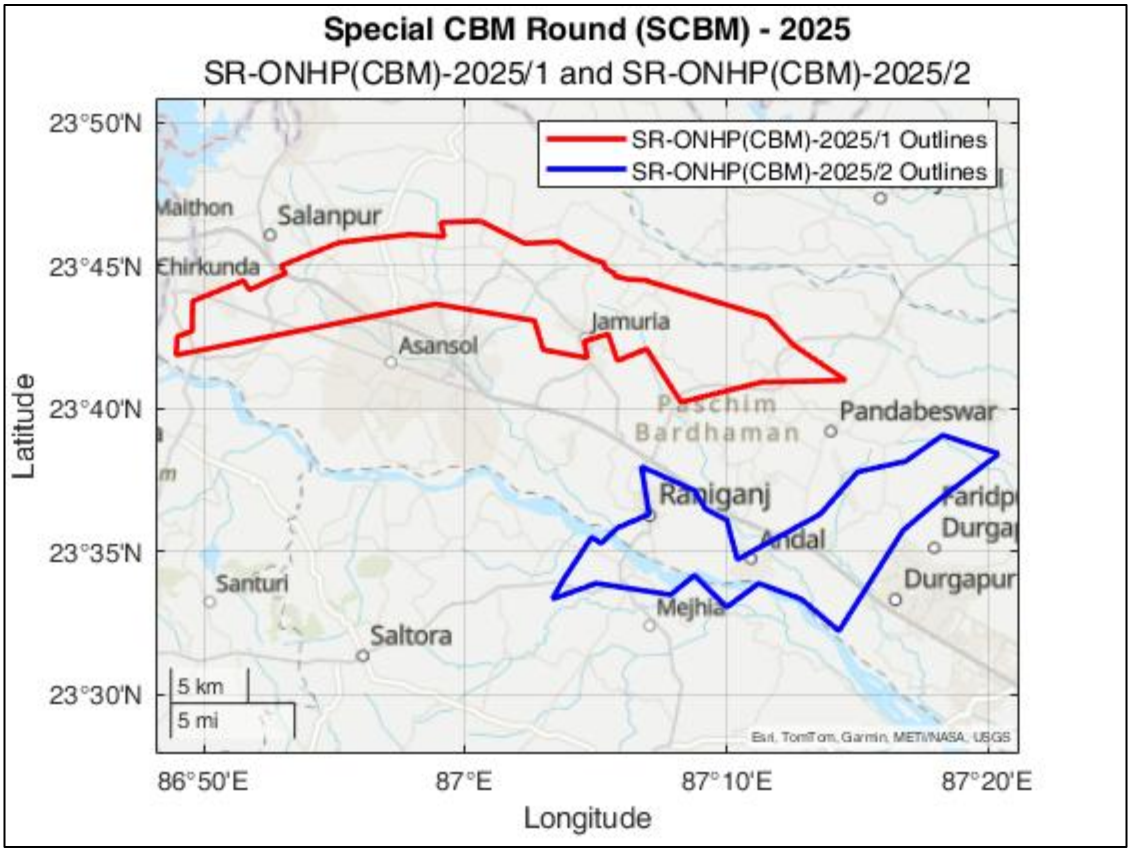


Figure 1: Location of Special CBM Round 2025 CBM blocks - SR-ONHP(CBM)-2025/1 and SR-ONHP(CBM)-2025/2

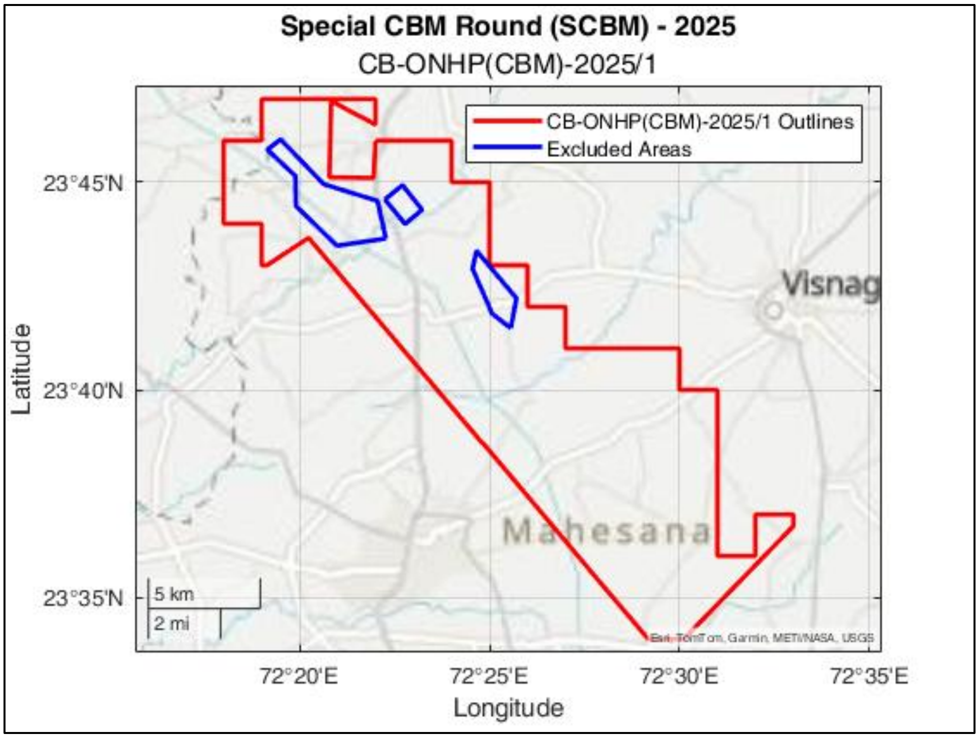


Figure 2: Location of Special CBM Round 2025 CBM block - CB-ONHP(CBM)-2025/1

This study intends to evaluate each CBM block based on the data available and rank them in terms of development prospects.

3. Reservoir Characterization of the Special CBM Round Blocks

A comprehensive study of the data available from existing wells was done. As the CBM blocks have very limited data within the block, the data from neighboring coal mining areas was used to characterize the CBM reservoirs.

3.1. SR-ONHP(CBM)-2025/1

The Raniganj CBM Block SR-ONHP-CBM-2025/1 spreads over an area of 200 sq. km. The block was previously awarded to ONGC-CIL Consortium (ONGC- 74%, CIL-26%) on Nomination basis by Government of India in January 2002. As a part of the exploration campaign, the consortium drilled seven (07) core holes in Barakar formation of the said block. The available data from the existing core holes was rigorously analysed to characterize the coal seams of this block. Figure 3 shows the location of existing core holes within the block.

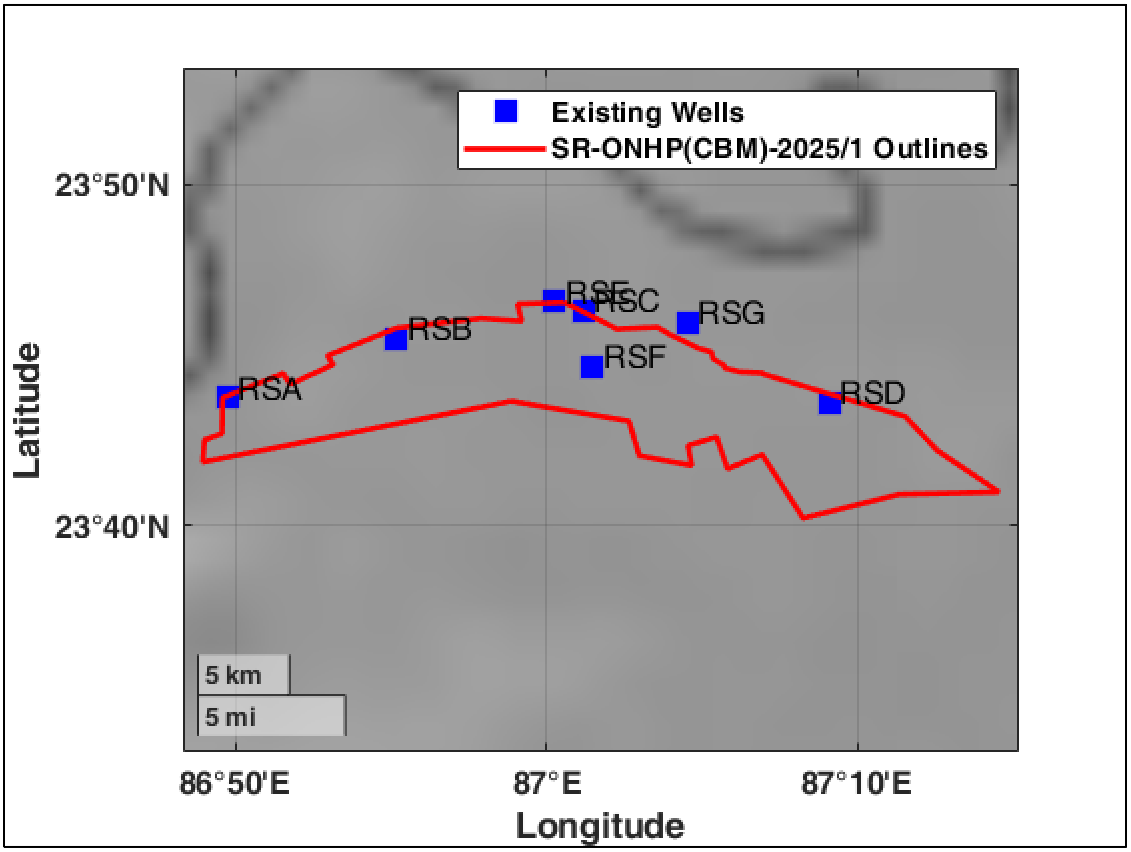


Figure 3: CBM block SR-ONHP(CBM)-2025/1 and Existing well locations

The data from core wells existing in the block comprised of desorption data, well logs and lithological data, A rigorous analysis of the available data was done to establish a regional trends on structural tops and bottoms, coal continuity, and gas content variations in the block SR-ONHP(CBM)-2025/1.

3.1.1. Measured Gas Content and Isotherms

Table 2 lists the gas content data (on as-received and dry-ash free basis) available in the Raniganj CBM block SR-ONHP(CBM)-2025/1. There is no data available on adsorption isotherm in the study area (SR-ONHP(CBM)-2025/1).

Table 2: Measured Gas Content Data in SR-ONHP-CBM-2025/1

Well	Sample Depth (m)		Barakar Coal Seam	Measured As-received Gas Content (m3/t)	Measured DAF Gas Content (m3/t)	Ash Content (%)	Moisture Content (%)
	From	To					
RSA	368.55	370.10	VIII	2.00	2.30	0.49%	13.43%
	553.13	553.56	VII	5.36	6.87	0.50%	21.40%

	555.50	556.30	VII	8.93	10.33	0.66%	12.90%
	598.64	599.41	VI	6.17	7.36	0.33%	15.85%
	646.80	647.75	V	7.73	10.09	0.48%	22.90%
	657.50	658.02	IV	8.91	10.32	0.40%	13.30%
	661.35	661.75	IV	7.23	8.30	0.50%	12.46%
	663.69	664.38	IV	6.16	7.60	0.54%	18.38%
	723.18	723.68	III	2.08	2.67	0.45%	21.77%
	738.15	738.63	III	1.07	1.35	0.42%	20.17%
	757.30	758.40	II	1.11	1.40	0.52%	20.45%
RSB	493.15	493.65	V	0.78	0.88	1.04%	10.52%
	493.65	494.61	V	0.67	0.86	2.33%	19.35%
	571.72	573.41	III	1.14	1.79	0.74%	35.60%
	609.55	610.35	III	1.40	2.59	1.88%	44.09%
	642.75	643.25	II	0.66	1.03	0.12%	35.52%
	649.35	650.10	II	0.79	1.14	0.14%	30.27%
	656.55	657.17	II	0.90	1.13	0.08%	20.12%
	665.95	667.35	II	1.07	1.37	0.50%	21.50%
	676.35	678.20	II	0.76	1.04	0.85%	26.13%
RSC	838.65	839.70	VI	10.26	14.79	4.45%	26.19%
	841.70	842.60	VI	3.90	5.57	3.04%	26.95%
	845.50	846.45	VI	11.83	17.47	6.28%	26.00%
	846.80	848.70	VI	4.77	6.90	2.04%	28.83%
	940.19	941.09	V	6.09	9.30	2.16%	32.38%
	947.30	947.90	V	1.93	2.67	0.51%	27.22%
	948.20	948.55	V	1.93	2.67	0.51%	27.22%
	948.80	949.36	V	4.06	5.42	0.00%	25.16%
	951.47	951.85	V	4.06	5.42	0.00%	25.16%
	977.57	978.30	III+IV	9.11	12.42	0.00%	26.66%
	978.65	979.30	III+IV	9.11	12.42	0.00%	26.66%
	979.78	979.94	III+IV	10.51	13.21	0.00%	20.44%
	980.03	980.34	III+IV	10.51	13.21	0.00%	20.44%
	980.63	980.85	III+IV	10.51	13.21	0.00%	20.44%
	982.58	982.76	III+IV	6.41	8.28	0.00%	22.57%
	983.11	983.51	III+IV	6.41	8.28	0.00%	22.57%
	984.09	984.55	III+IV	6.41	8.28	0.00%	22.57%
	985.90	986.87	III+IV	9.05	12.17	0.00%	25.63%
	988.45	989.45	III+IV	8.02	12.49	0.00%	35.80%
	996.30	997.30	III+IV	10.73	12.88	0.00%	16.72%
	1000.60	1000.78	III+IV	6.80	10.32	0.00%	34.14%
	1001.28	1001.63	III+IV	6.80	10.32	0.00%	34.14%
	1002.70	1003.10	III+IV	6.80	10.32	0.00%	34.14%

	1013.56	1013.86	II	3.41	5.09	0.00%	33.07%
	1015.06	1015.76	II	3.41	5.09	0.00%	33.07%
	1017.81	1018.13	II	3.10	4.15	0.00%	25.33%
	1018.17	1018.80	II	3.10	4.15	0.00%	25.33%
	1030.35	1031.20	II	5.90	8.65	0.00%	31.80%
	1035.70	1037.00	II	4.40	5.68	0.00%	22.51%
RSD	496.75	496.80	II	1.34	1.70	0.60%	20.62%
	497.70	498.07	II	1.34	1.70	0.60%	20.62%
	498.47	498.85	II	1.34	1.70	0.60%	20.62%
	502.30	503.60	II	0.79	1.00	0.73%	20.78%
	506.70	507.10	II	0.62	0.83	0.73%	23.75%
	507.70	508.05	II	0.62	0.83	0.73%	23.75%
	510.00	510.55	II	0.71	0.99	2.23%	27.92%
	511.15	511.50	II	0.71	0.99	2.23%	27.92%
RSE	991.20	992.20	VI(M)	6.11	8.60	0.36%	28.60%
	992.75	993.75	VI(M)	7.13	9.56	0.29%	25.15%
	1109.67	1110.82	V(T)	5.18	8.32	0.96%	36.80%
	1111.15	1114.06	V(M)	6.37	9.10	0.99%	29.03%
	1114.94	1115.77	V(M)	5.99	7.85	0.86%	22.86%
	1136.25	1138.26	III+IV	5.40	7.09	0.67%	23.19%
	1139.68	1141.47	III+IV	6.80	9.57	0.67%	28.28%
	1141.90	1144.52	III+IV	7.45	11.28	0.74%	33.22%
	1151.49	1152.62	III+IV	5.10	6.65	0.67%	22.27%
	1161.84	1162.82	III+IV	5.46	7.13	0.66%	22.78%
	1172.96	1174.03	II(T)	4.00	6.62	0.77%	38.81%
	1181.40	1183.22	II(T)	6.37	9.30	0.56%	31.00%
	1187.78	1188.94	II(T)	2.64	4.09	0.49%	35.00%
	1194.50	1195.60	II(B)	1.80	2.53	0.68%	28.21%
	1208.75	1209.60	I	3.60	4.65	0.78%	21.78%
RSF	1327.20	1328.25	VI	4.50	5.52	1.23%	17.30%
	1328.70	1329.80	VI	5.01	6.54	2.30%	21.15%
	1333.35	1334.25	VI	2.15	3.58	1.95%	38.11%
	1334.55	1337.60	VI	0.74	1.43	1.00%	47.12%
RSG	568.00	569.25	VI(B)			0.18%	18.67%
	569.85	571.05	VI(B)			0.16%	14.30%
	571.45	572.45	VI(B)			0.19%	17.10%
	659.95	660.85	II(T)	0.70	0.88	0.11%	20.66%
	651.70	651.90	II(T)	0.35	0.50	0.22%	21.17%
	655.93	656.81	II(T)	0.57	0.84	0.15%	31.93%
	665.95	666.95	II(B)	0.81	1.09	0.08%	25.52%
	668.09	669.19	II(B)	0.35	0.55	0.46%	35.61%

	670.15	671.23	II(B)	1.20	1.56	0.18%	23.07%

The measured gas content data was analyzed in the area SR-ONHP(CBM)-2025/1 and was found to have poor correlation with depth. The as-received and DAF gas content data, when plotted with depth, show a general trend of increasing gas content with depth; however, the correlation is sparsely weak and thus no reasonable depth trend can be established on gas content (Figure 4 and Figure 5)

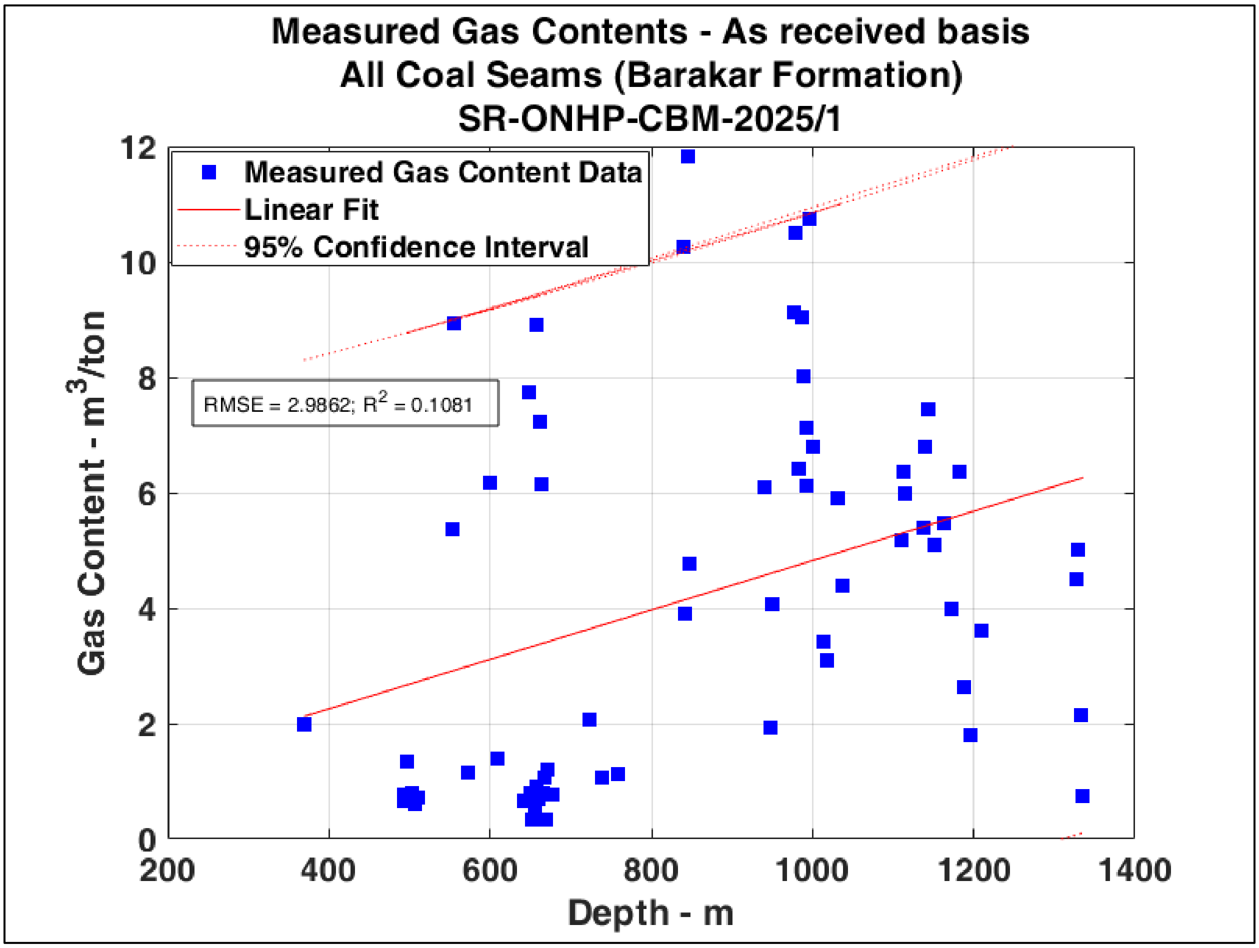


Figure 4: Measured Gas Content (As-received basis) in SR-ONHP(CBM)-2025/1

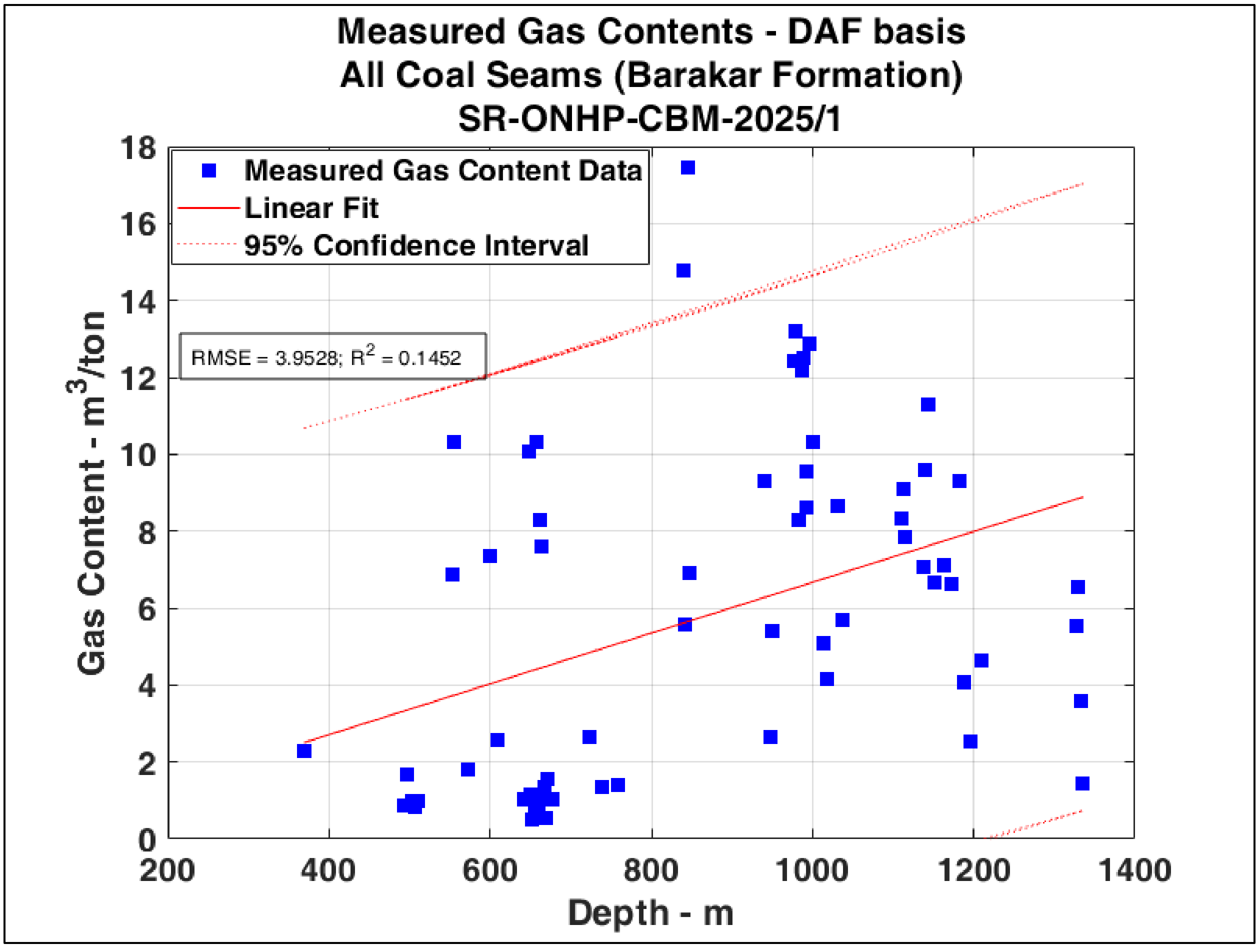


Figure 5: Measured Gas Content (DAF basis) in SR-ONHP(CBM)-2025/1

3.1.2. Ash Content

It is generally observed that the ash content, in a coal, correlates very well with bulk density. The procedure of ash content modelling is to establish a correlation between ash and density and then use the correlation to calculate the ash content from density logs. The determination of density cut-off for estimation of net pay is also derived from the ash-density plot. In typical CBM reservoir modelling, the density value obtained at 50 % ash content or higher is normally taken as the density cut-off value. The methodology to determine density cut-off determination is explained in the **Figure 6.**

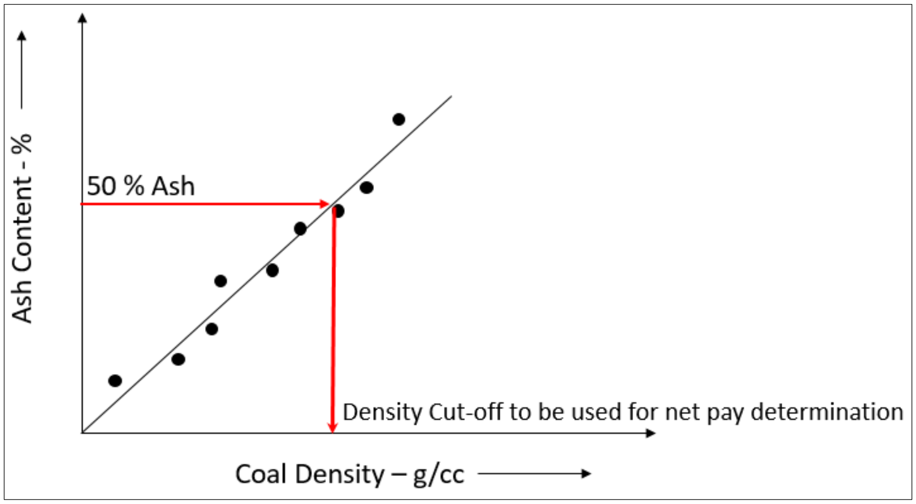


Figure 6: Methodology of density cut-off determination

In the available reports from Raniganj CBM Block SR-ONHP(CBM)-2025/1, there is no availability of bulk density data of core samples. Therefore, a correlation between ash content and bulk density couldn't be established. However, in this study, a density cut-off of 2.0 g/cc has been used in the determination of net pay thickness. It is consistent with current coal gas reservoir engineering practice and with observation from successful CBM projects across the world that higher density shaly coals also hold substantial volumes of gas.

3.1.3. Moisture Content

In a coalbed methane reservoir, the water content of coal decreases steadily with rank. Consequently, it is commonly observed that moisture content of coal decreases with depth as the rank of coal increases with depth. In Raniganj CBM Block SR-ONHP(CBM)-2025/1, the analysis of moisture content data shows a sparse distribution of moisture content. **Figure 7** shows the variation of moisture content with depth.

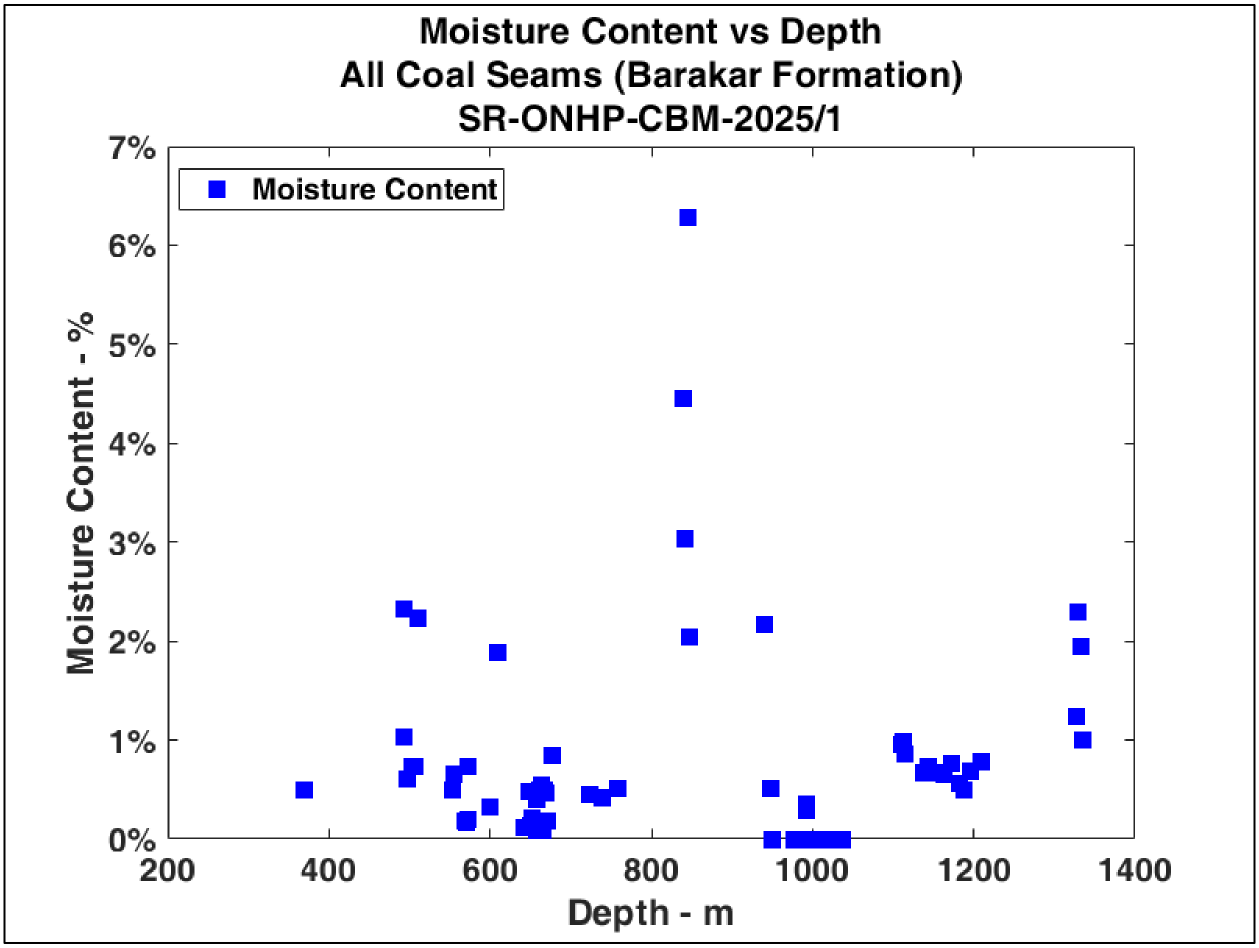


Figure 7: Moisture Content vs Depth – SR-ONHP(CBM)-2025/1

3.2. SR-ONHP(CBM)-2025/2

The Raniganj CBM Block SR-ONHP-CBM-2025/2 spreads over an area of 130 sq. km. The block was previously awarded to ONGC-CIL Consortium (ONGC- 74%, CIL-26%) on nomination basis by Government of India in January 2002. As a part of the exploration campaign, the consortium drilled nine (09) core holes and three (03) pilot wells in the Raniganj formation of the said block. The available data from the existing core holes was rigorously analysed to characterize the coal seams of this block. Figure 8 shows the location of existing core holes within the block.

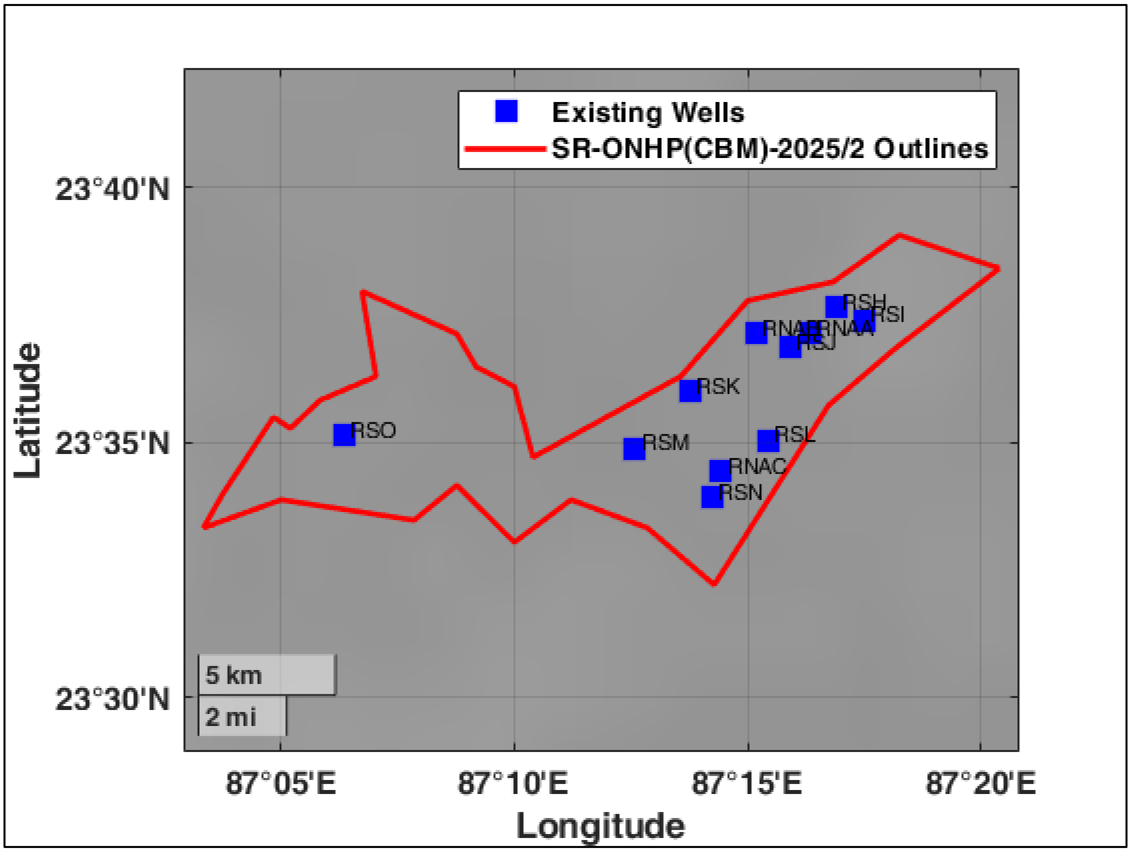


Figure 8: CBM block SR-ONHP(CBM)-2025/2 and Existing Well Location

The data from core wells existing in the block comprised of desorption and adsorption isotherm data, well logs and lithological data, A rigorous analysis of the available data was done to establish a regional trends on structural tops and bottoms, coal continuity, and gas content variations in the block SR-ONHP(CBM)-2025/1.

3.2.1. Measured Gas Content and Isotherms

Table 3 lists the measured gas content and adsorption isotherm data (on as-received basis) available in CBM block SR-ONHP-CBM-2025/2. The measured gas content was plotted with depth to confirm any depth trend. Though there exists a general depth trend with depth, the correlation is not reasonably good to establish any depth trend. **Figure 9** and **Figure 10** show the as-received and DAF gas content vs depth trend in the study area, respectively. The seam specific isotherms and measured gas contents in the area is illustrated in **Figure 11 to Figure 14.**

Table 3: Measured Gas Content and Adsorption Isotherm Data in CBM block SR-ONHP-CBM-2025/2

Gas Content Measurements

Well	Sample Depth (m)	Measured As-Received Gas Content (m3/t)	Ash + Moisture Content (%)
RSH	415.70	0.38	0.27
	419.16	0.56	0.22
	434.83	0.49	0.22
	509.25	0.36	0.25
	510.38	0.58	0.23
	528.73	0.70	0.48
	537.85	0.69	0.29
	539.05	0.54	0.20
	605.71	0.61	0.21
	609.28	0.44	0.26
	611.03	1.30	0.18
	650.71	1.27	0.22
	675.30	1.01	0.24
	742.24	2.17	0.32
	744.20	1.38	0.25
	746.23	2.22	0.26
	783.15	2.71	0.23
	784.78	4.06	0.18
	785.30	3.41	0.23
	842.01	3.21	0.24
	845.90	2.60	0.12
	848.35	2.93	0.14
	851.91	3.23	0.29
	948.44	5.63	0.30
RSI	530.50	0.84	0.22
	558.40	0.82	0.29
	584.36	0.77	0.28
	603.01	2.65	0.29
	638.25	1.26	0.23
	653.81	2.93	0.27
	666.97	4.55	0.19

Adsorption Isotherms Measurements

Well	Sample Depth (m)	Raniganj Coal Seam	As-Received Langmuir Volume (V_L) (m3/t)	Langmuir Pressure (P_L) (atm)	Ash Content (%)	Moisture Content (%)
RSH	742.24	VI	15.28	32.40	27.8%	4.0%
	784.78	V	13.71	40.40	15.9%	2.5%
	848.35	IV	14.52	43.20	11.1%	2.5%
RSI	995.70	IV	13.56	37.60	14.4%	1.9%
RSJ	727.20	VI	13.58	44.80	13.3%	3.9%
	836.55	IV	14.67	40.50	22.8%	3.5%
RSK	678.94	VI	14.60	37.10	17.8%	3.3%
	732.74	V	14.22	41.10	10.7%	3.1%
	781.58	IV	14.15	41.30	13.5%	2.3%
RSL	1019.00	VII(A)	13.94	36.90	13.2%	4.3%
	1252.93	V	13.65	35.50	14.2%	3.6%
RSM	551.61	VII(A)	13.66	38.90	27.8%	3.9%
	689.25	VI	12.93	43.50	16.1%	3.1%
	756.35	IV(T)	13.42	41.10	13.1%	2.5%
RSN	869.68	VII(A)	13.19	39.10	13.2%	4.9%
	1000.00	V	13.41	38.40	17.4%	5.1%
	1052.74	IV(T)	13.69	35.10	12.3%	4.2%
RSO	289.69	V	14.78	38.70	19.6%	3.8%

	682.14	3.94	0.30
	723.94	1.99	0.25
	724.75	1.99	0.22
	741.08	2.13	0.31
	743.70	2.37	0.21
	759.47	3.18	0.28
	809.00	4.25	0.23
	811.75	4.62	0.26
	833.17	4.15	0.24
	888.06	5.61	0.17
	891.25	6.43	0.20
	922.18	3.61	0.22
	923.01	2.54	0.20
	990.06	0.55	0.71
	993.96	5.09	0.16
	995.70	7.39	0.16
	998.70	6.40	0.19
	1001.00	6.34	0.21
	1056.33	3.30	0.18
RSJ	382.59	0.99	0.25
	383.65	1.01	0.61
	420.60	2.23	0.37
	422.30	2.56	0.29
	423.55	1.87	0.47
	434.53	0.96	0.42
	485.60	0.84	0.18
	487.41	0.97	0.27
	537.20	1.34	0.41
	551.58	1.54	0.22
	585.79	1.27	0.23
	596.81	3.51	0.25
	597.95	0.95	0.26
	612.63	1.83	0.32
	666.37	3.77	0.24
	670.45	3.50	0.28
	671.50	2.38	0.23
	705.25	1.94	0.23
	727.20	6.48	0.17
	728.74	4.55	0.17
	754.09	3.73	0.19
	757.30	1.73	0.20
	758.80	2.47	0.20

	825.67	4.69	0.22
	829.50	4.93	0.13
	831.50	5.40	0.13
	835.09	5.21	0.17
	836.55	6.78	0.26
	880.68	8.31	0.24
RSK	274.60	0.95	0.29
	291.73	1.15	0.24
	356.95	0.96	0.23
	358.65	1.25	0.26
	372.02	2.42	0.34
	443.62	1.46	0.18
	446.43	1.12	0.16
	450.51	1.29	0.26
	458.23	1.42	0.20
	461.09	1.39	0.25
	516.48	2.29	0.31
	519.48	2.22	0.23
	613.27	5.03	0.28
	678.94	5.09	0.21
	683.50	4.24	0.15
	686.58	4.79	0.19
	688.65	3.99	0.39
	696.35	5.64	0.22
	729.35	6.38	0.25
	732.74	7.71	0.14
	733.25	5.43	0.39
	778.60	6.98	0.22
	781.58	7.51	0.16
	784.66	6.90	0.17
RSL	700.73	2.75	0.26
	730.96	1.44	0.21
	732.21	0.98	0.20
	754.79	1.62	0.26
	821.00	3.67	0.17
	823.41	2.76	0.23
	840.42	1.90	0.24
	901.95	3.91	0.18
	903.00	2.92	0.26
	936.60	5.00	0.29
	960.69	2.41	0.23
	969.41	4.16	0.28

	1019.00	9.95	0.17
	1020.24	5.72	0.27
	1022.90	6.26	0.23
	1060.18	3.84	0.27
	1120.74	6.53	0.28
	1148.99	7.44	0.21
	1165.69	5.08	0.27
	1196.12	7.94	0.15
	1197.95	6.66	0.18
	1249.95	5.63	0.15
	1252.93	6.12	0.18
RSM	300.87	0.87	0.24
	326.20	0.49	0.28
	352.74	0.77	0.27
	397.15	0.34	0.21
	401.52	0.19	0.31
	443.70	0.25	0.30
	445.45	0.53	0.20
	489.77	1.73	0.22
	492.57	3.09	0.27
	549.02	2.23	0.21
	551.61	2.67	0.32
	606.80	2.16	0.28
	683.55	3.01	0.22
	688.45	1.46	0.17
	689.25	4.04	0.19
	725.50	4.42	0.17
	754.58	3.34	0.19
	756.35	5.16	0.16
	785.97	6.88	0.14
	816.35	8.26	0.16
	871.43	7.56	0.17
RSN	547.44	2.87	0.25
	572.98	2.59	0.22
	609.45	1.50	0.26
	639.51	2.54	0.38
	645.69	1.98	0.47
	668.80	4.35	0.21
	670.88	4.45	0.19
	682.04	2.07	0.28
	728.02	3.27	0.48
	736.25	5.14	0.28

	739.00	3.84	0.19	
	740.15	3.94	0.28	
	792.10	4.35	0.19	
	795.55	6.54	0.29	
	869.68	6.66	0.18	
	872.98	5.01	0.25	
	874.75	7.56	0.28	
	893.15	5.81	0.22	
	913.79	5.79	0.27	
	942.45	6.70	0.22	
	958.25	5.99	0.28	
	986.81	4.83	0.36	
	1000.00	6.84	0.23	
	1002.63	6.62	0.20	
	1052.74	5.59	0.17	
	1055.99	6.94	0.23	
RSO	31.27	0.22	0.27	
	34.05	0.28	0.23	
	49.01	0.24	0.34	
	114.29	0.27	0.52	
	130.74	0.41	0.47	
	144.20	0.30	0.26	
	187.54	1.66	0.31	
	190.03	0.55	0.26	
	191.38	0.92	0.19	
	224.37	0.50	0.33	
	226.75	1.04	0.21	
	255.54	1.17	0.27	
	289.69	2.37	0.23	
	291.45	0.65	0.19	
	293.25	0.90	0.21	
	317.30	1.88	0.18	
	336.90	1.44	0.36	
	375.64	1.29	0.20	
RNAA	657.74	6.01	0.15	
	658.85	6.20	0.18	

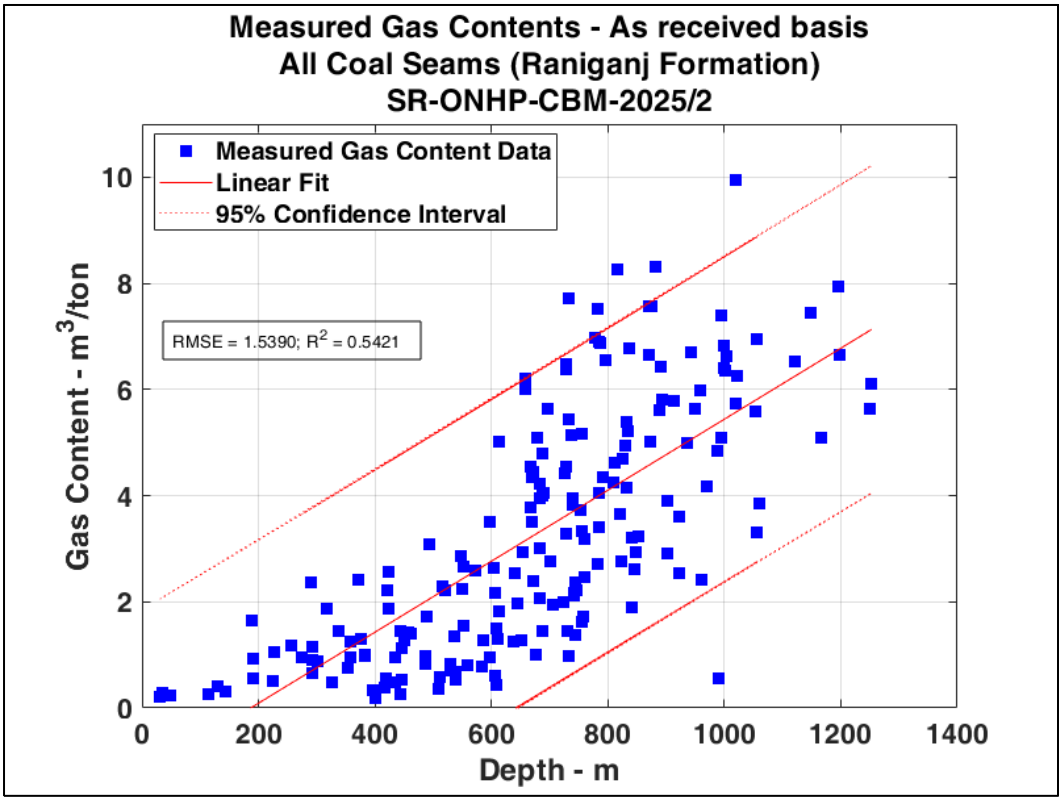


Figure 9: Measured Gas Content (As-Received basis) in SR-ONHP(CBM)-2025/2

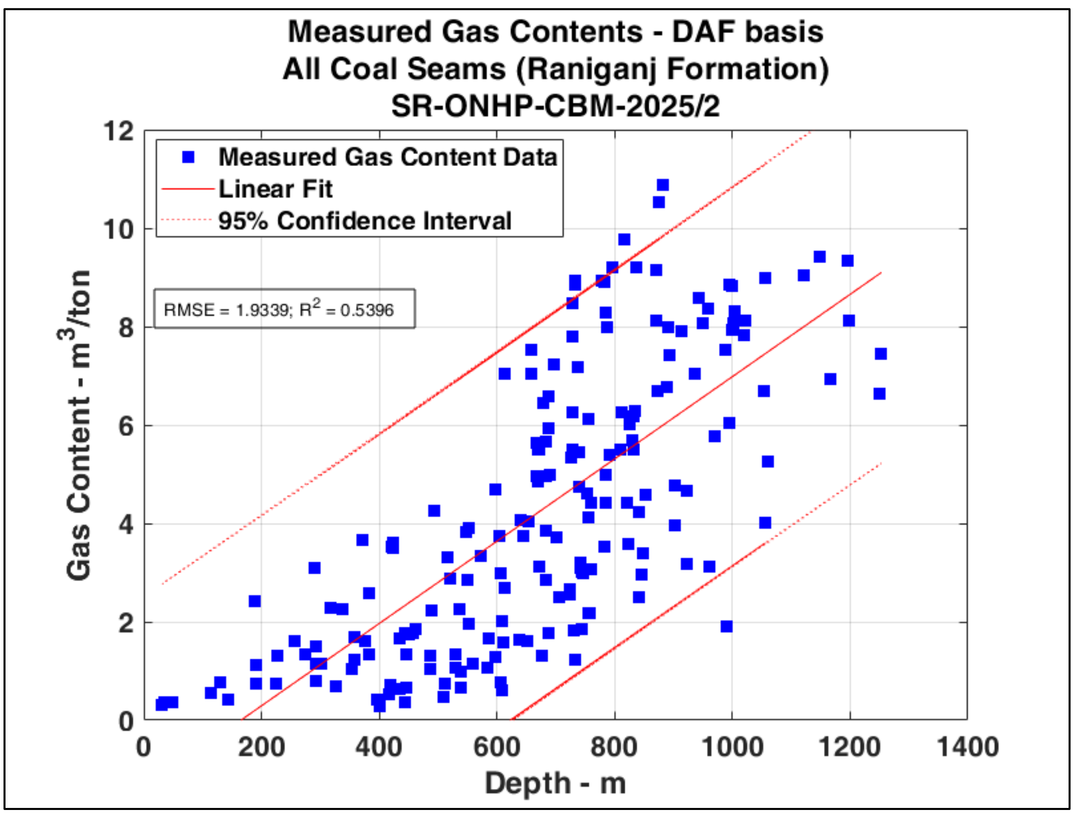


Figure 10: Measured Gas Content (DAF basis) in SR-ONHP(CBM)-2025/2

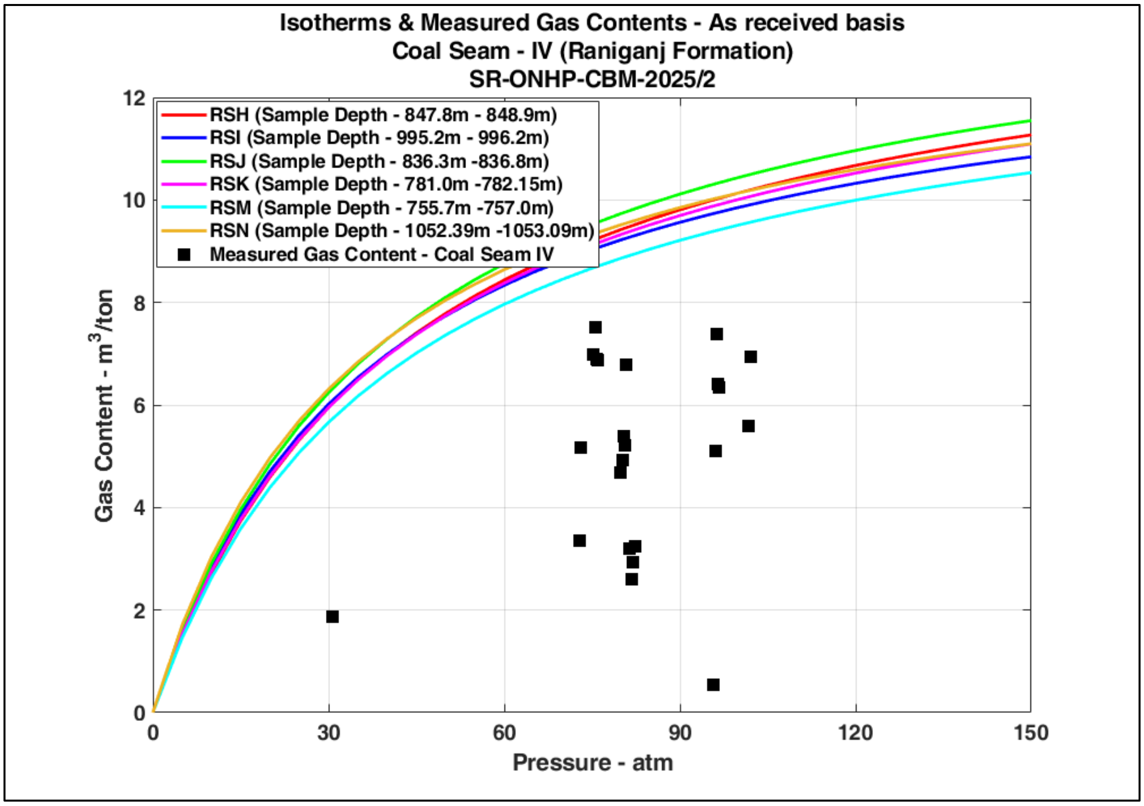


Figure 11: Adsorption isotherm & Measured Gas Content in Coal Seam IV - SR-ONHP(CBM)-2025/2

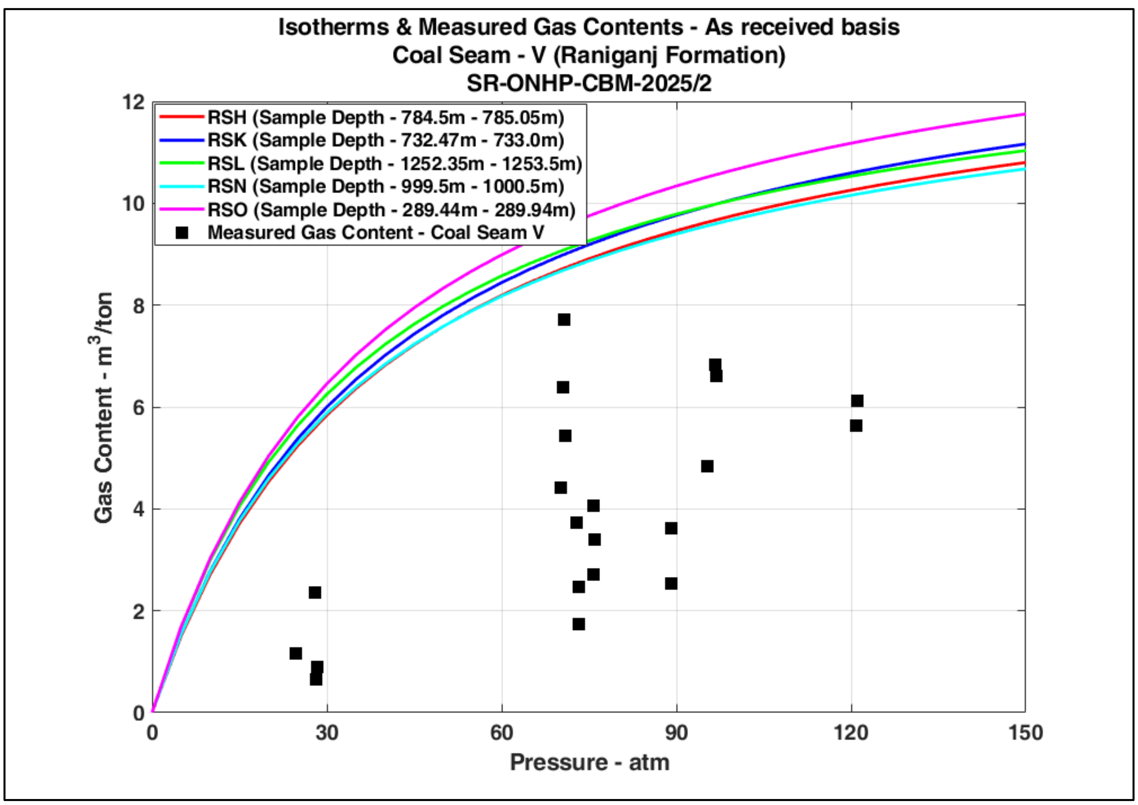


Figure 12: Adsorption isotherm & Measured Gas Content in Coal Seam V - SR-ONHP(CBM)-2025/2

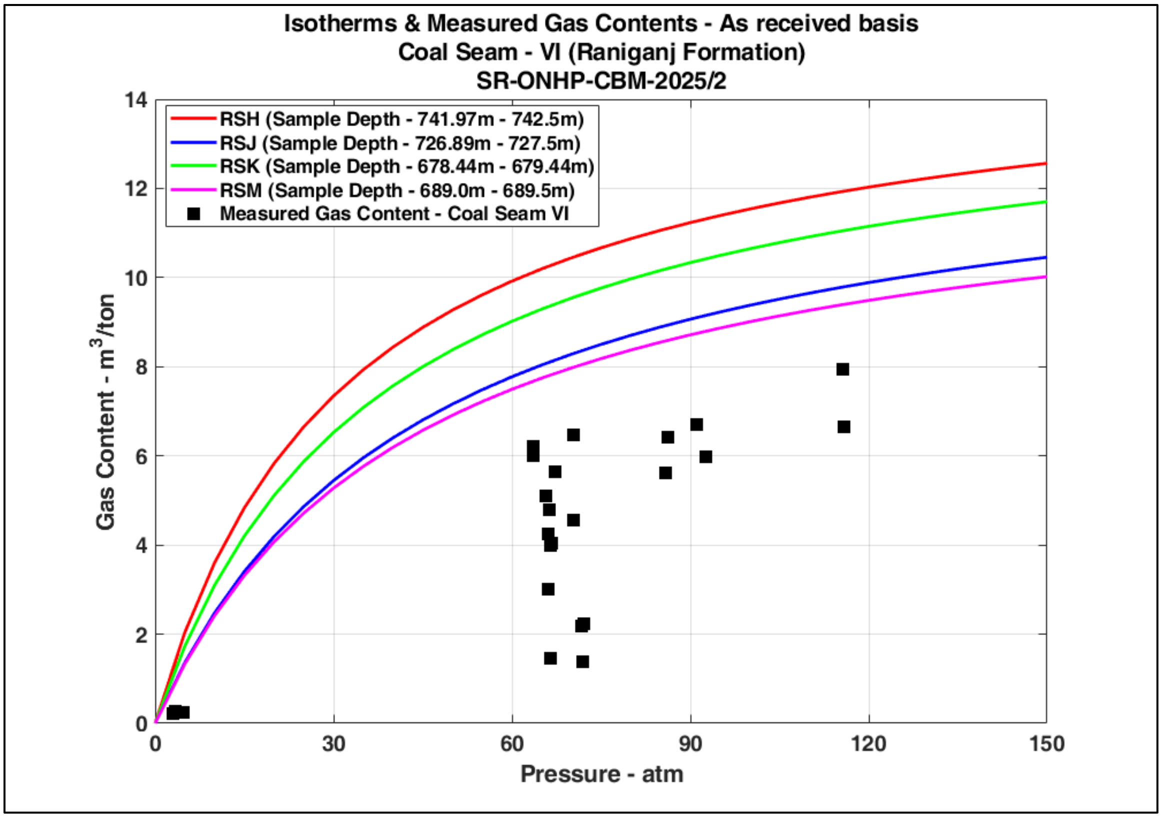


Figure 13: Adsorption isotherm & Measured Gas Content in Coal Seam VI - SR-ONHP(CBM)-2025/2

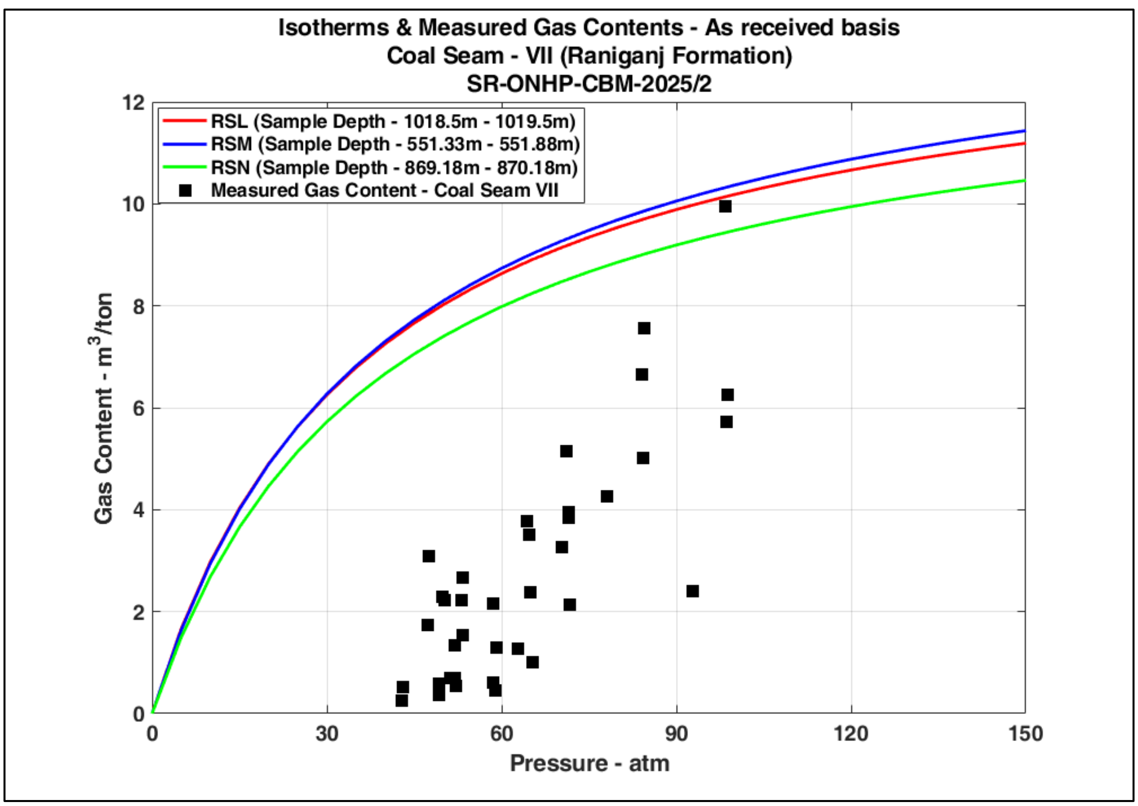


Figure 14: Adsorption isotherm & Measured Gas Content in Coal Seam VII - SR-ONHP(CBM)-2025/2

3.2.2. Coal Saturation

The coal saturation was estimated using measured gas content and isotherm data of CBM block SR-ONHP-CBM-2025/2. The degree of coal saturation in the said study area ranges from 5.0% to 98.0%. The histogram of coal saturation (Figure 15) gives P10, P50, and P90 values as 17.8%, 51.2%, and 78.0 % respectively.

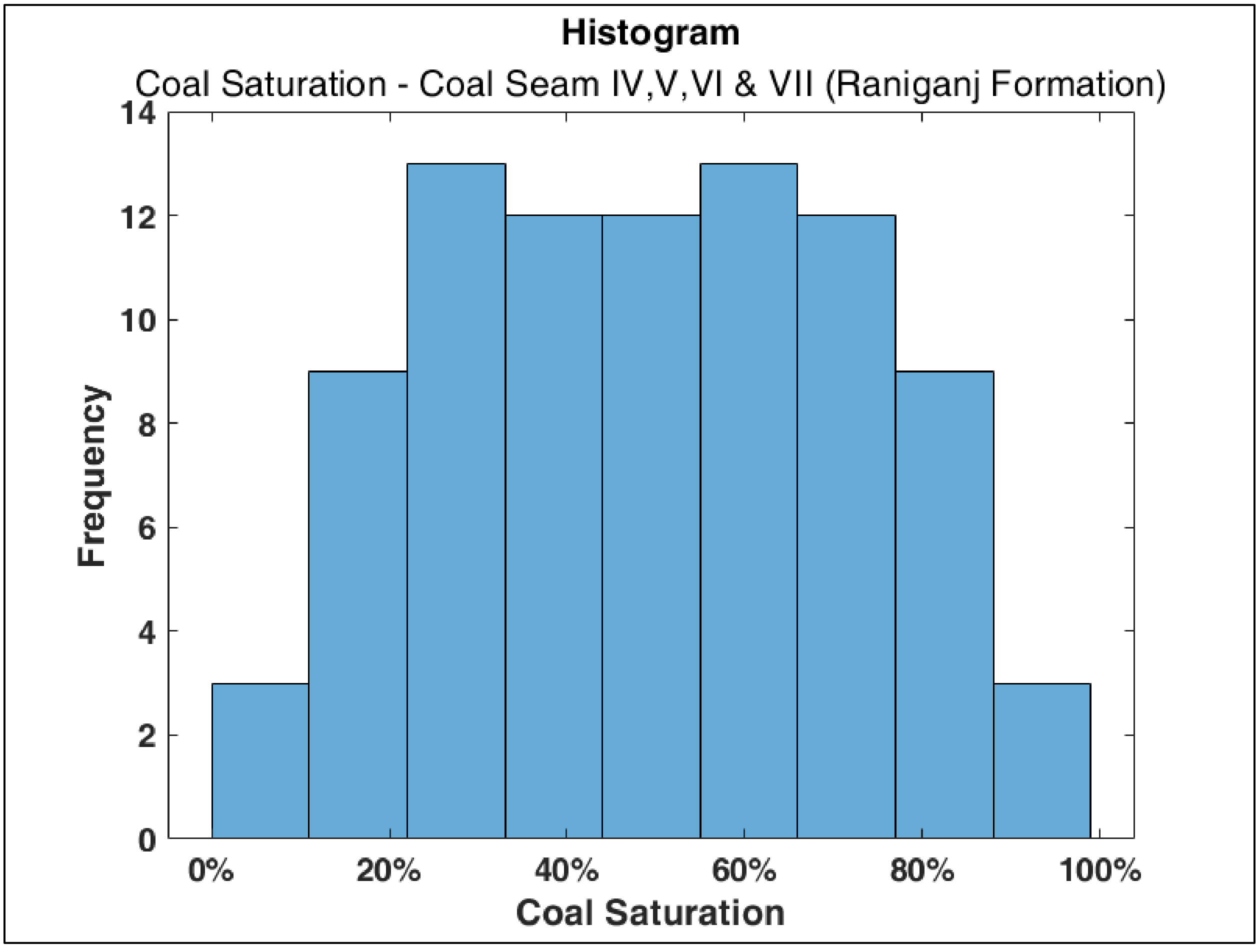


Figure 15: Histogram of estimated coal saturation in the CBM block SR-ONHP-CBM-2025/2

The cumulative distribution function (CDF) of the estimated coal saturation values is shown in Figure 16.

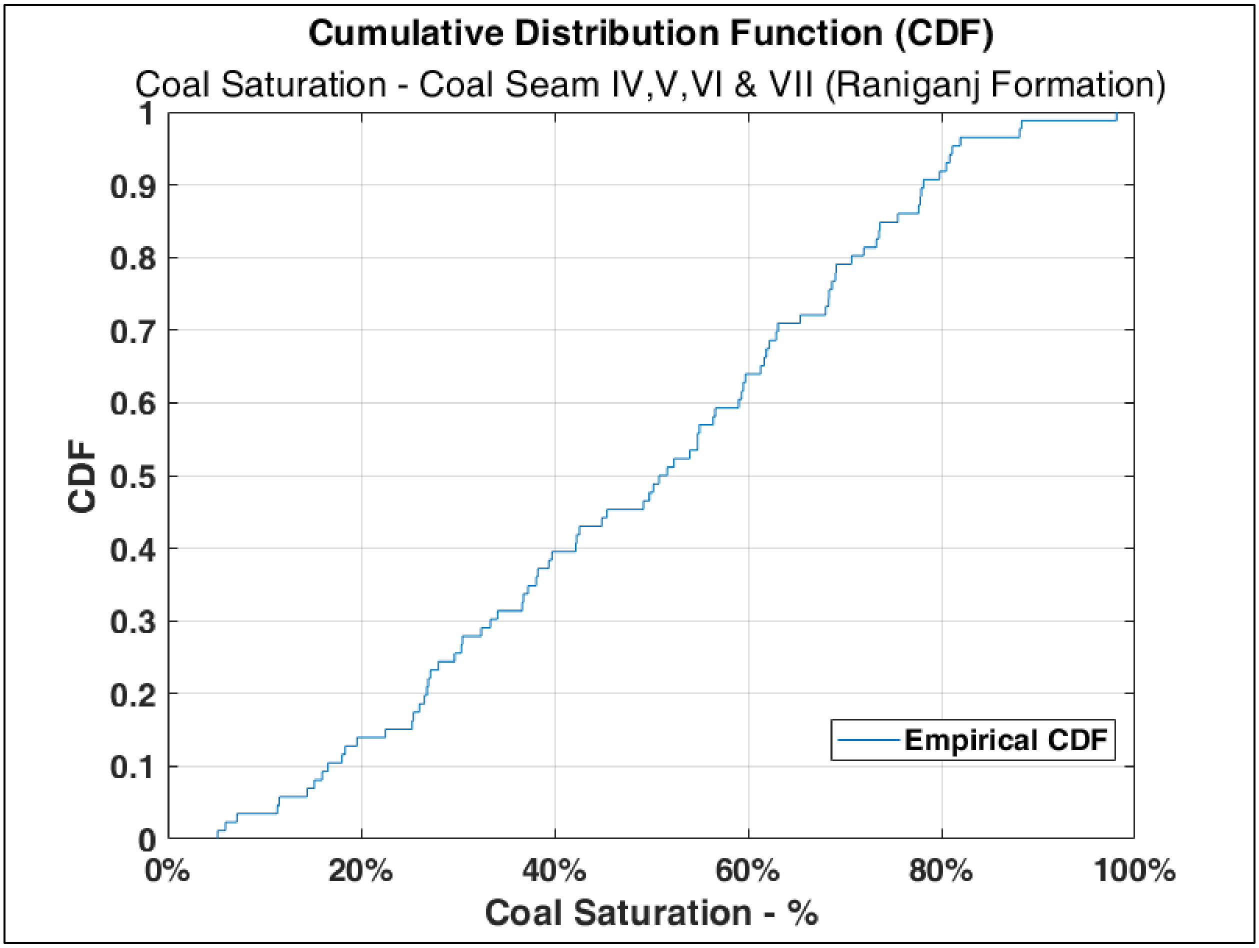


Figure 16: Cumulative Distribution Function (CDF) of coal saturation in the CBM block SR-ONHP-CBM-2025/2

To understand the variation of coal saturation at coal seam level, the estimated coal saturation values were plotted with depth for Raniganj coal seams IV, V, VI, and VII of the study area (SR-ONHP-CBM-2025/2). Figure 17 shows the variation of coal saturation with depth.

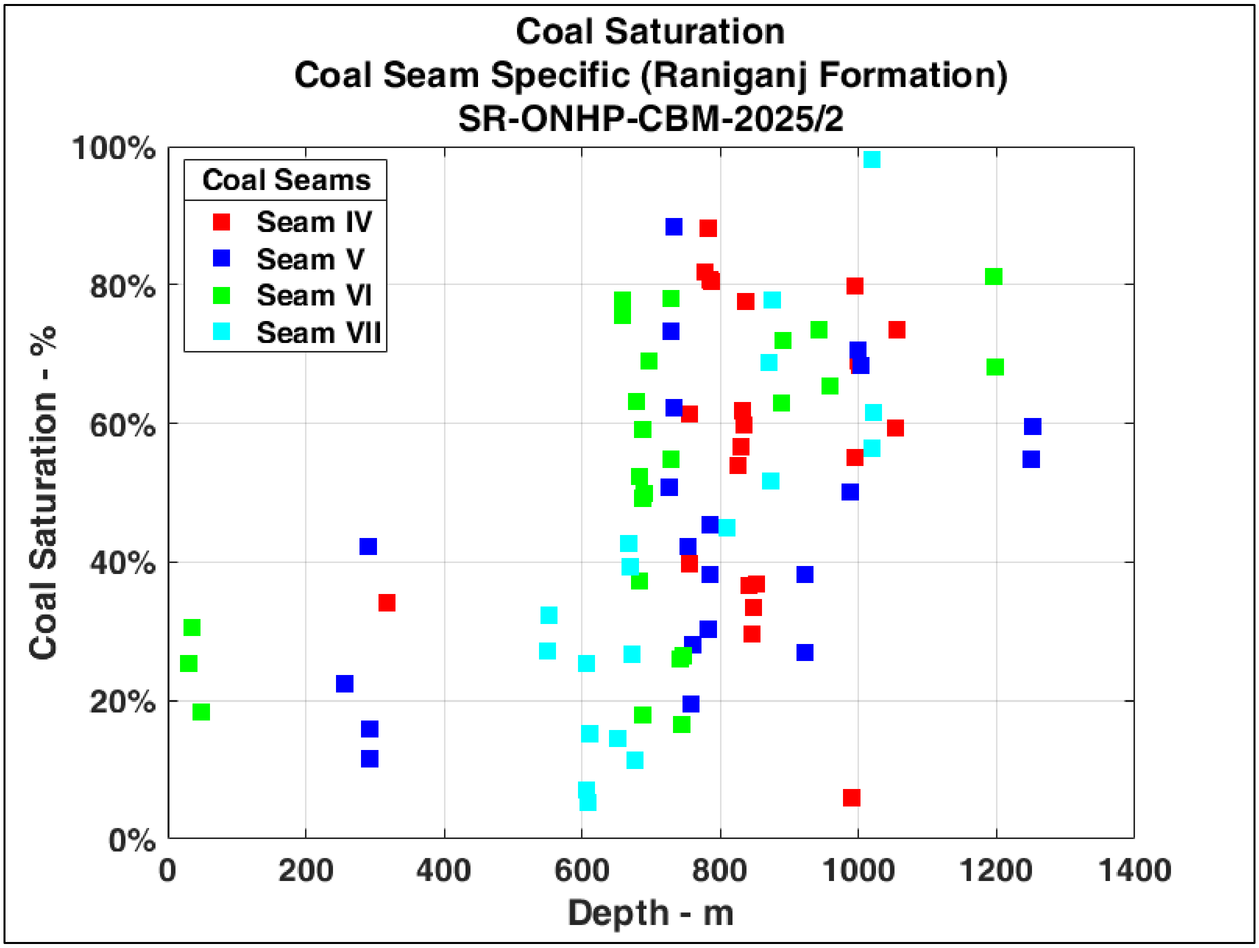


Figure 17: Estimated coal saturation of Raniganj coal seams vs depth in the CBM block SR-ONHP-CBM-2025/2

3.2.3. Ash Content

It is generally observed that the ash content, in a coal, correlates very well with bulk density. The procedure of ash content modelling is to establish a correlation between ash and density and then use the correlation to calculate the ash content from density logs. The determination of density cut-off for estimation of net pay is also derived from the ash-density plot. In typical CBM reservoir modelling, the density value obtained at 50 % ash content or higher is normally taken as the density cut-off value. The methodology to determine density cut-off determination is explained in Figure 18.

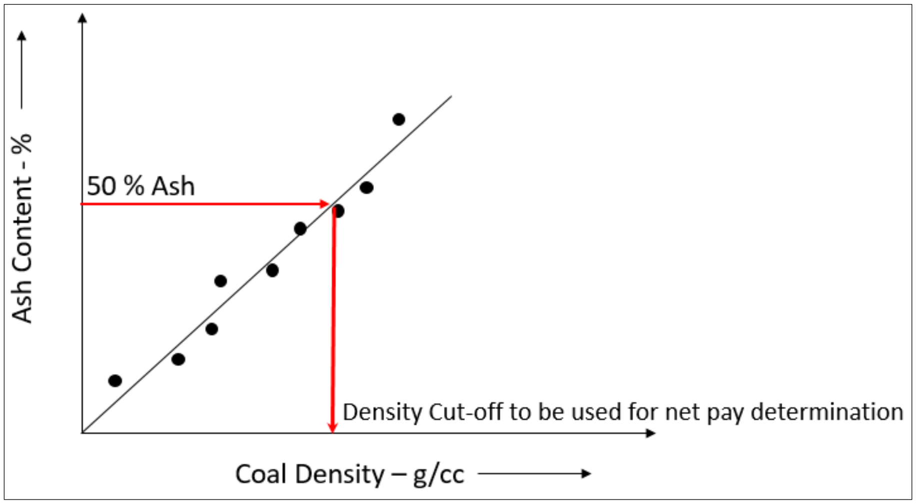


Figure 18: Methodology of density cut-off determination

In the available reports from Raniganj CBM Block SR-ONHP(CBM)-2025/2, there is no availability of bulk density data of core samples. Therefore, a correlation between ash content and bulk density couldn't be established. However, in this study, a density cut-off of 2.0 g/cc has been used in the determination of net pay thickness. It is consistent with current coal gas reservoir engineering practice and with observation from successful CBM projects across the world that higher density shaly coals also hold substantial volumes of gas.

3.2.4. Moisture Content

In a coalbed methane reservoir, the water content of coal decreases steadily with rank. Consequently, it is commonly observed that moisture content of coal decreases with depth as the rank of coal increases with depth. In CBM block SR-ONHP(CBM)-2025/2 , the analysis of moisture content data shows this behaviour though a 95% confidence interval establishes a wide range. **Figure 19** shows the variation of moisture content with depth.

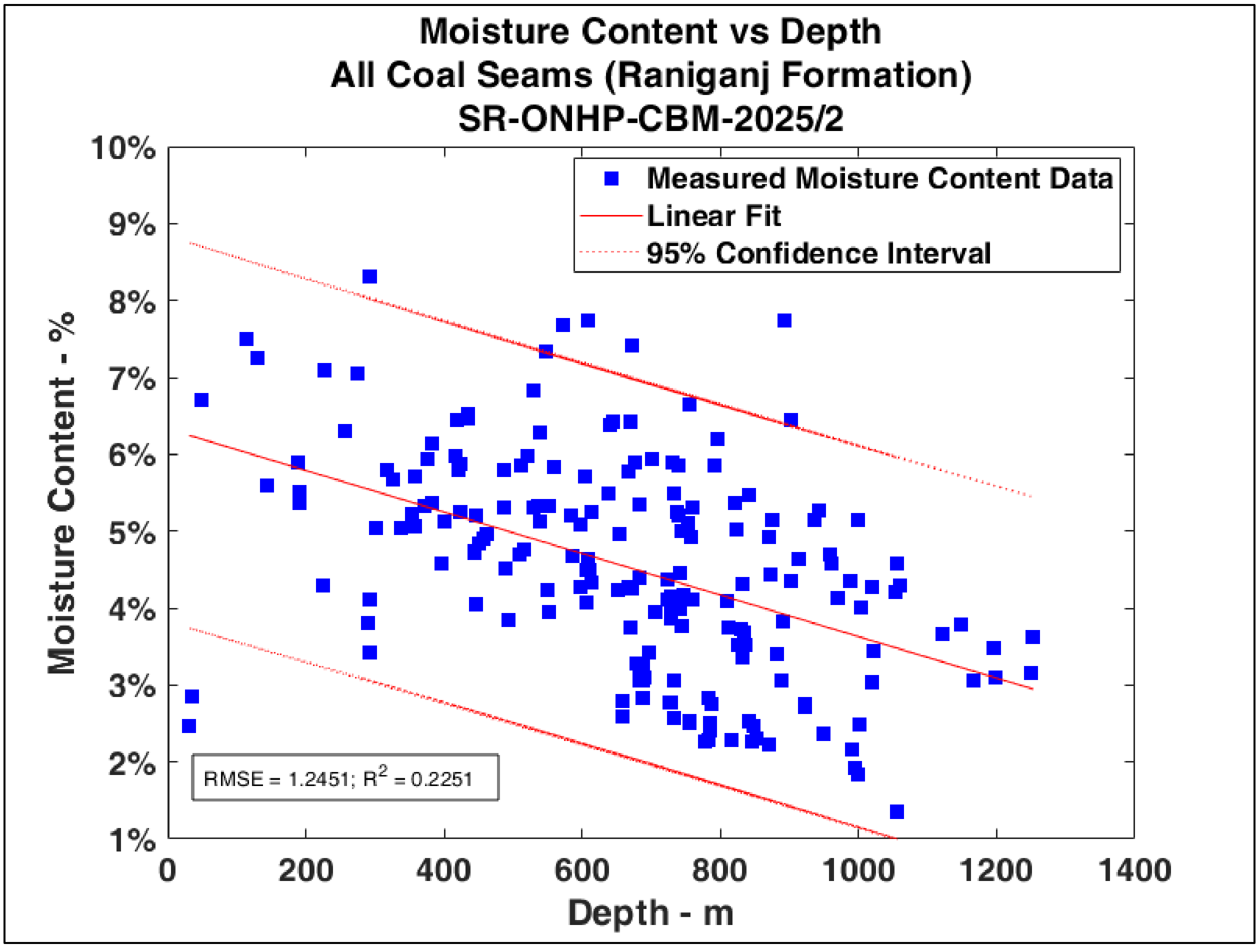
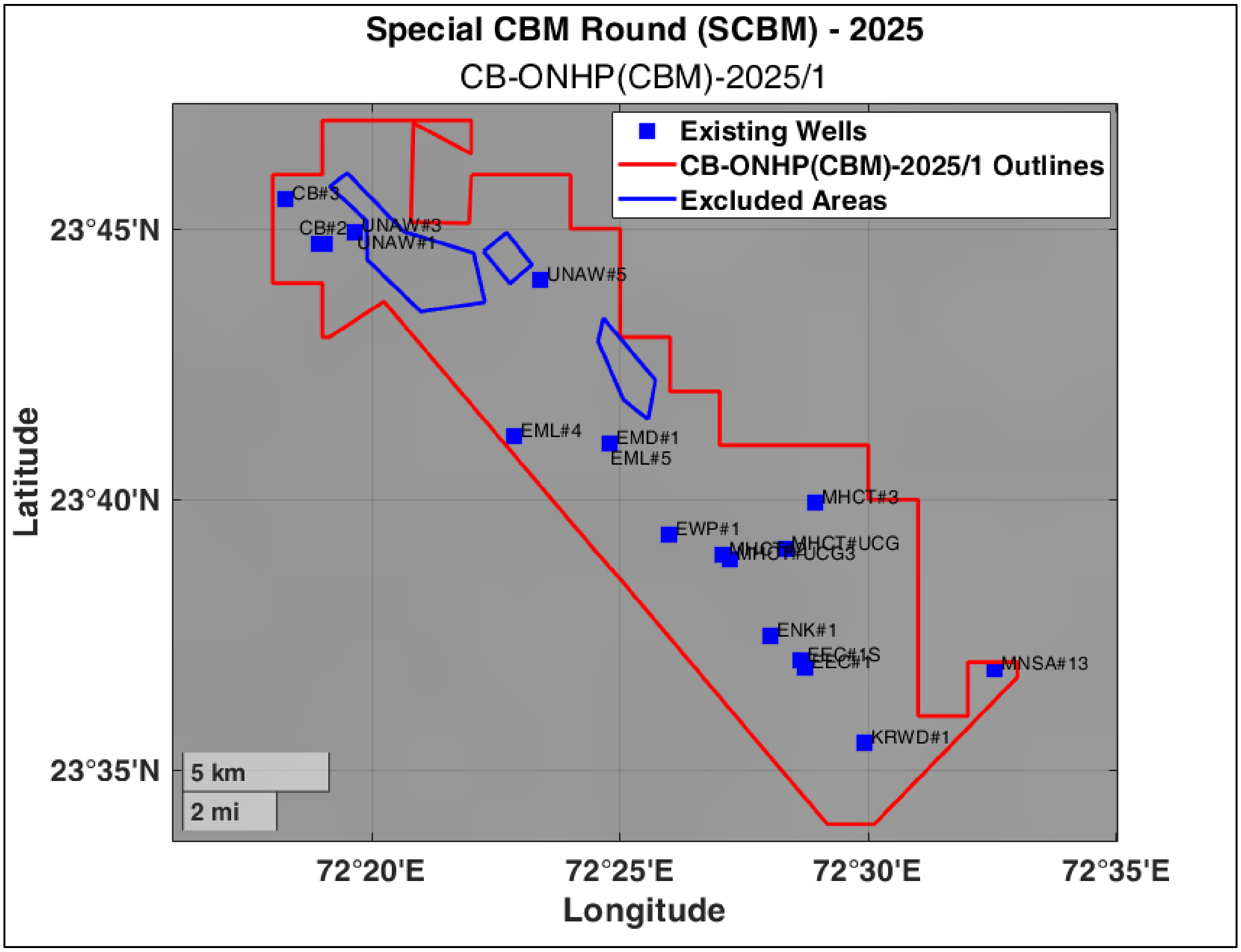


Figure 19: Moisture Content vs Depth – SR-ONHP(CBM)-2025/2

3.3. CB-ONHP(CBM)-2025/1

The Mehsana CBM Block CB-ONHP-CBM-2025/1 spreads over an area of 189 sq. km. The carved-out block is part of the big area that was previously awarded to Essar Oil ltd. (EOL) in the seventh round of exploratory bidding by MOP&NG, Government (GOI) of India. PSC was signed between GOI, ONGC and EOL on 16/07/1998. ONGC is licensee of the block. EOL is the operator having 100% share in this block and ONGC has optional carried interest up to 30% after declaration of commercial discovery. The available data from the data block provided by DGH for this study was rigorously analyzed to characterize the coal seams of this block. **Figure 20** shows the location of existing wells within the block. Although the existing wells are shown spreading over entire block, it is only two wells (EML#4 and EML#5) that are defined CBM wells according to the available well data provided by DGH; rest of the wells in the map are majorly conventional wells with few UCG wells drilled earlier.



3.3.1. Measured Gas Content

Table 2le 4 lists the gas content data (on as-received and dry-ash free basis) available in the Mehsana CBM block CB-ONHP(CBM)-2025/1. There is no data available in the data package on adsorption isotherm in the study area (CB-ONHP(CBM)-2025/1).

Table 4: Measured Gas Content Data in CB-ONHP-CBM-2025/1

Well	Sample Depth (m)		Kalol/Kadi Coal Seam	Measured As-received Gas Content (m3/t)	Measured DAF Gas Content (m3/t)	Ash Content (%)	Moisture Content (%)
	From	To					
EML#05	1033.5	1033.98	VIII	2.03	2.81	3.9%	23.7%
	1036	1036.48	VII	1.86	2.21	2.1%	13.6%
	1109.25	1109.73	VII	5.9	7.36	2.2%	17.6%
	1133.5	1133.98	VI	6.3	7.49	1.9%	13.9%
	1135.53	1136.01	V	5.35	6.37	1.8%	14.1%
	1175.95	1176.43	IV	6.69	7.59	2.1%	9.8%

The measured gas content data was analyzed in the area CB-ONHP(CBM)-2025/1 and was found to have a correlation with depth, though the available data is very limited. The as-received and DAF gas content data, when plotted with depth, show a general trend of increasing gas content with depth; however, due to the limited availability of data a large uncertainty prevails in the depth trend of gas content (Figure 21 and Figure 22)

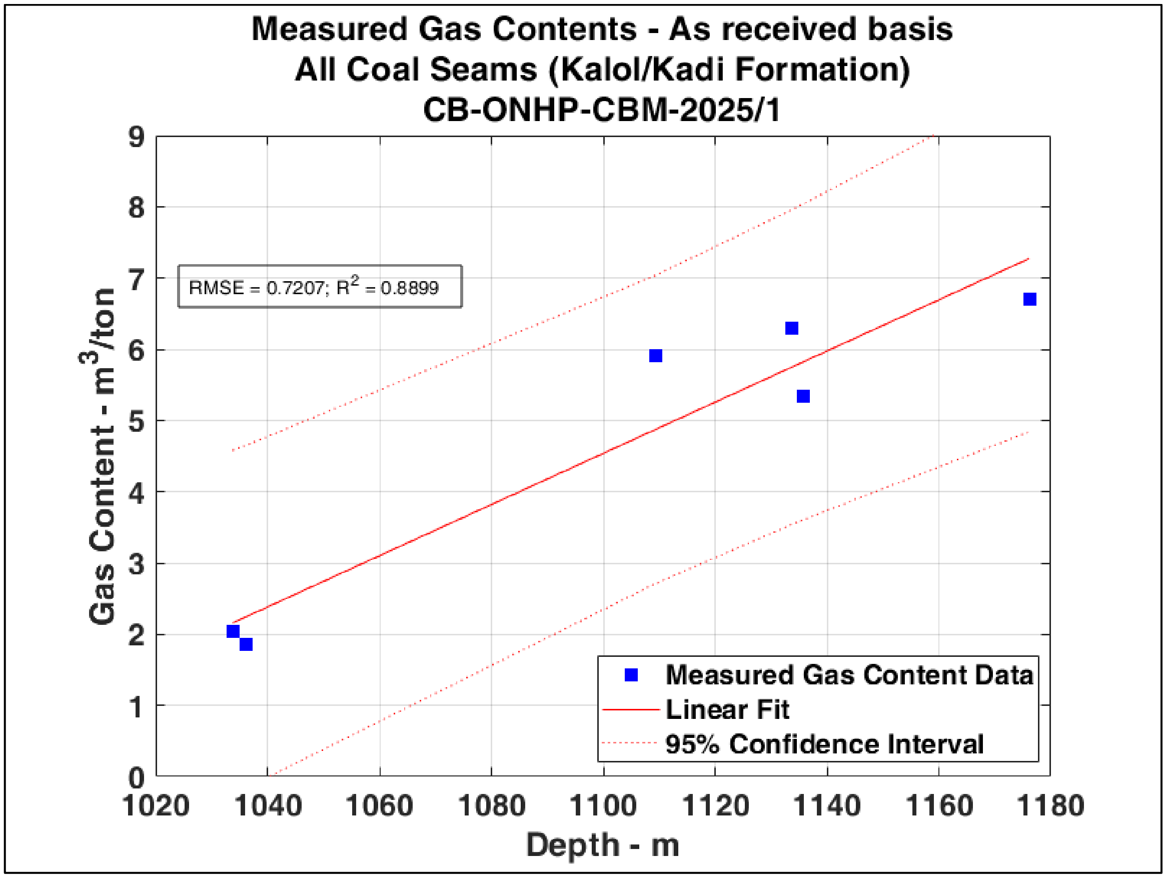


Figure 21: Measured Gas Content (As-Received basis) in CB-ONHP(CBM)-2025/1

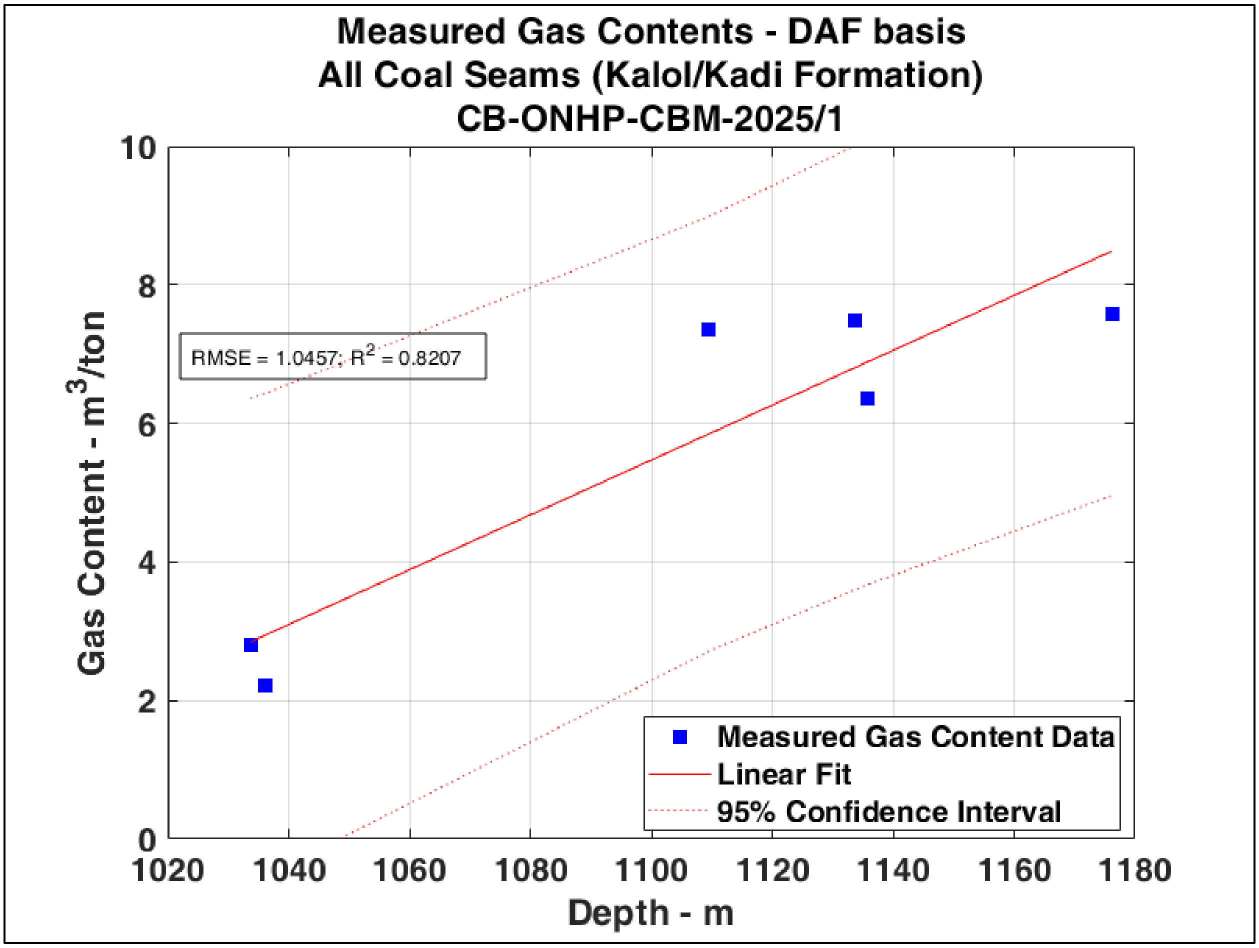


Figure 22: Measured Gas Content DAF basis) in CB-ONHP(CBM)-2025/1

4. Property Modelling

After a comprehensive study of data, the construction of static model was initiated. Barakar coal formation was taken as reference target formation in the Geocellular model in the CBM block SR-ONHP(CBM)-2025/1, whereas in CBM block SR-ONHP(CBM)-2025/2, Raniganj formation was taken as reference target. In the CBM block CB-ONHP(CBM)-2025/1, Kalod/Kadi formation is taken as reference target. A 3D reservoir model was initiated in PETREL/MATLAB to represent the corresponding coal formation. The reservoir parameters contributing to in-place volumes have been modelled through a rigorous workflow of property modelling.

Structural Model

Seismic data required to develop structural model is not available for all the CBM blocks. The available data from exploratory wells drilled by ONGC in the earlier exploration campaign served as the basis for generating regional trends on structural tops/bottom, coal continuity, and coal quality. Development of structural models from discrete data requires Geostatistical Modelling approach, in which different interpolation methods such as Convergent Interpolation, Kriging, Gaussian Simulation, Moving Average etc. are used. Reliability of the method adopted is assessed by using Histogram Analysis and continuity of interpolated data. In the present case, convergent interpolation method has been found reliable for most of the cases. Structural maps were generated using seam tops and bottoms through geostatistical interpretation as discussed.

Figures A1 to **A5 (APPENDIX A)** show the elevation maps of structural top and bottoms of the coal formation of CBM blocks of CBM block SR-ONHP(CBM)-2025/1 and CBM block SR-ONHP(CBM)-2025/2.

Net Pay Model

A combination of density log and gamma ray log was used to define facies; coal was defined using density log cut-off of 1.8 gm/cc. For modelling of cumulative net pay, stratigraphical thickness map has been generated using difference between geo statistically interpolated well markers (Raniganj top and bottom in CBM Block SR-ONHP(CBM)-2025/2 and Barakar top and bottom in CBM block SR-ONHP(CBM)-2025/1) of each well. Coal facies were defined as Net-to-Gross (NTG) 1.0, while other facies were assigned NTG of 0.0. The values of NTG at well control points were then used to populate the grid cells using geostatistical distribution workflow. **Figure B1** to **Figure B2 (APPENDIX B)** show net pay maps for the CBM blocks studied in this project.

Gas Content

A rigorous analysis of the available gas content data was done. In the absence of any reliable trend of gas content with depth with wide variation in coal saturation at individual seam level, it is difficult to frame a realistic gas content model. One of the approaches is to use the available in-situ gas content data to generate geo statistically populated gas content maps. This approach is used to model gas content for each CBM block.

The gas content data from desorption study is available from core wells in CBM blocks SR-ONHP(CBM)-2025/1 and SR-ONHP(CBM)-2025/2. From the available gas content data, preparation of map from discrete data set requires the approach of Geostatistical Modeling, in which different interpolation methods such as Convergent Interpolation, Krigging, Gaussian Simulation, Moving Average etc. are used. Reliability of the method adopted is assessed by using Histogram Analysis and continuity of interpolated data. In the present case, convergent interpolation methods have been found reliable for most of the cases.

The gas content (in-situ) maps is shown in **Figure C1** to **Figure C2 (APPENDIX C).**

Error! Reference source not found.**le 5** lists the blocks and range of values of different subsurface parameters.

Table 5:Range of Subsurface parameters in each CBM block

BLOCK NAME SCBM 2025	Area (km2)	Gas Content (m3/ton)			Cumulative Coal Thickness (m)			Raniganj/Barakar top Depth(m)		Raniganj/Barakar bottom Depth(m)		Coal Saturation (%)		
		Min	Max	Average	Min	Max	Average	Min	Max	Min	Max	Min	Max	Average
SR-ONHP(CBM)-2025/1	200.5	0.83	6.41	2.5	12.37	81.31	35.58					15.0%	100.0%	55.0%
SR-ONHP(CBM)-2025/2	130.4	0.89	6.0	2.82	18.62	62.60	31.78	25	700	410	1321	15.0%	100.0%	55.0%

5. GIIP Estimation of CBM Blocks

5.1. Basis

The estimation of gas-in-place in the Special CBM Round blocks is based upon a robust reservoir characterization workflow leading to development of a full field static functional model with integration of geological, petrophysical and reservoir engineering data.

5.2. Methodology

In CBM reservoirs, the gas-in-place calculation is based on formula

$$\text{Gas} - \text{in} - \text{place}, \text{m}^3 = \text{Area} * \text{Net Pay} * (\text{GC})_{\text{As Received}} * \rho \quad (5)$$

In above expression, $(\text{GC})_{\text{As Received}}$ is as received gas content in m^3/t, area is lateral span of CBM reservoir in m^2, net pay is pay thickness based on density cut-off in meters, and ρ is pure coal density i.e. 1.4 g/cc.

5.3. Results for Gas-in-Place

Error! Reference source not found. presents Gas-in-Place estimates for all CBM Blocks

Table 6: CBM Resource Volume of the CBM blocks

BLOCK NAME SCBM 2022	Area (km2)	CBM Resource Volume (BCM)
SR-ONHP(CBM)-2025/1	200.5	29.90
SR-ONHP(CBM)-2025/2	130.4	18.58
CB-ONHP(CBM)-2025/1	189.01	27.78

The resource map of CBM blocks SR-ONHP(CBM)-2025/1 and SR-ONHP(CBM)-2025/2 are presented in the **APPENDIX D**.

6. APPENDIX A –Top and Bottom Structural Maps

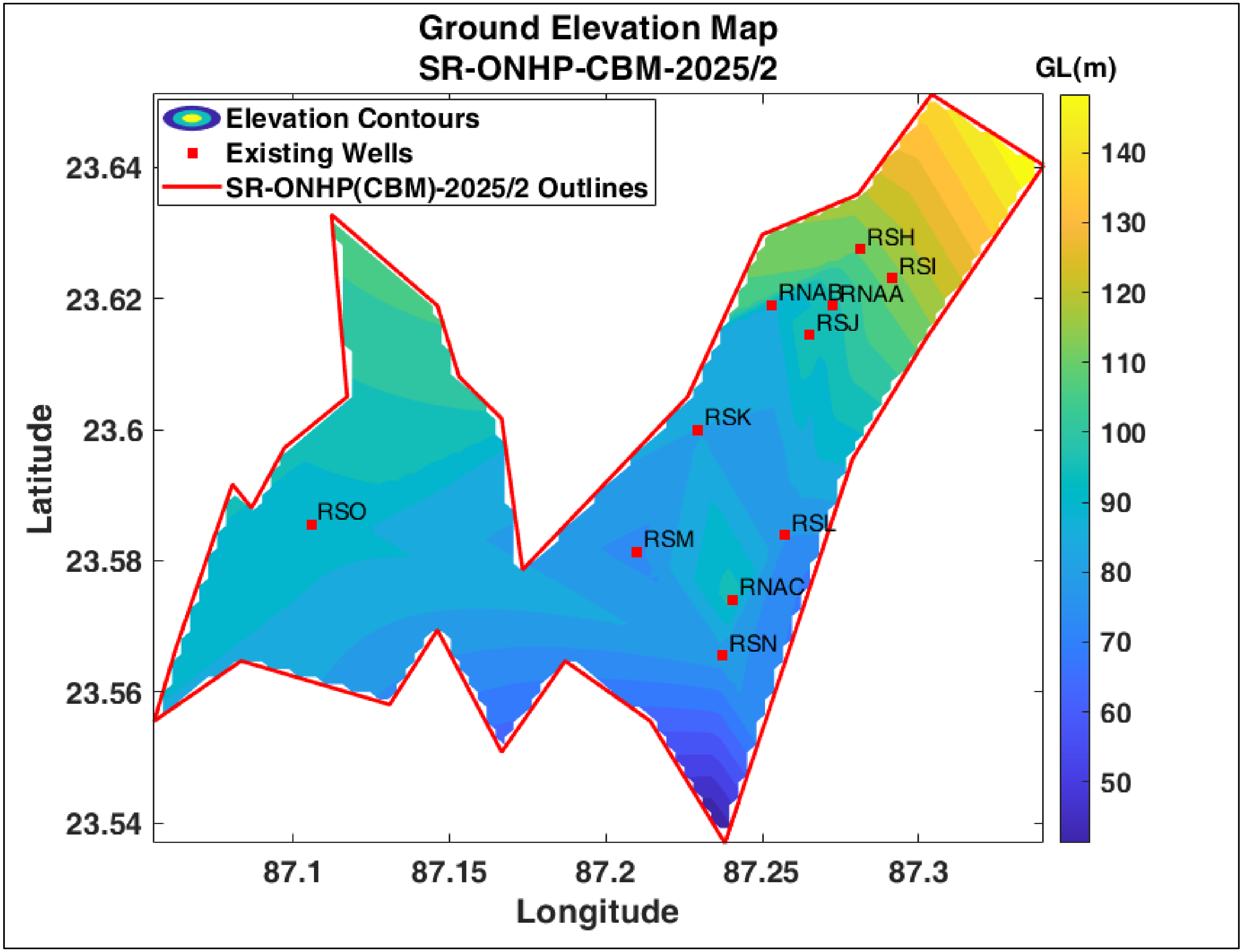


Figure *A1*: Ground Elevation Map – SR-ONHP(CBM)-2025/2

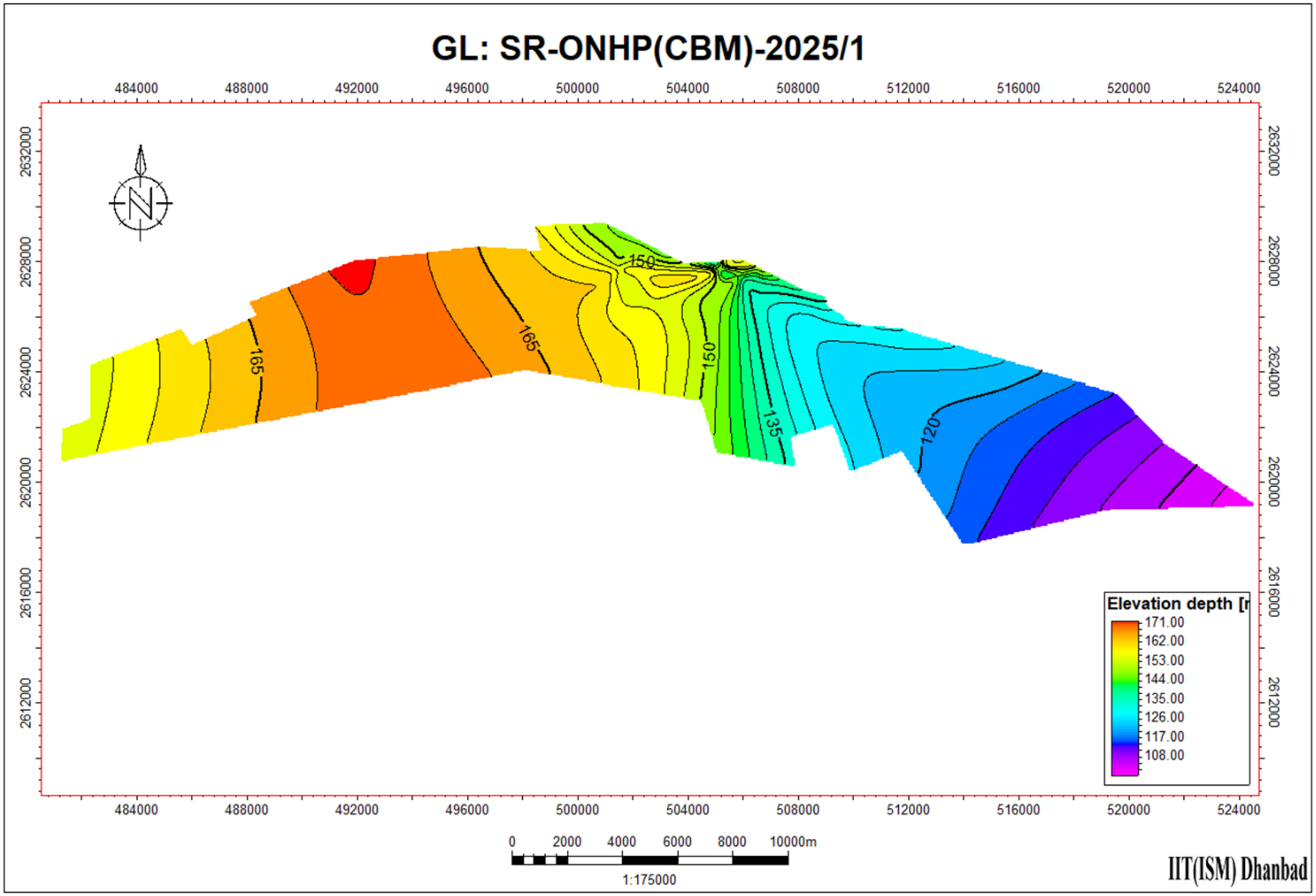


Figure *A2*: Ground Elevation Map – SR-ONHP(CBM)-2025/1

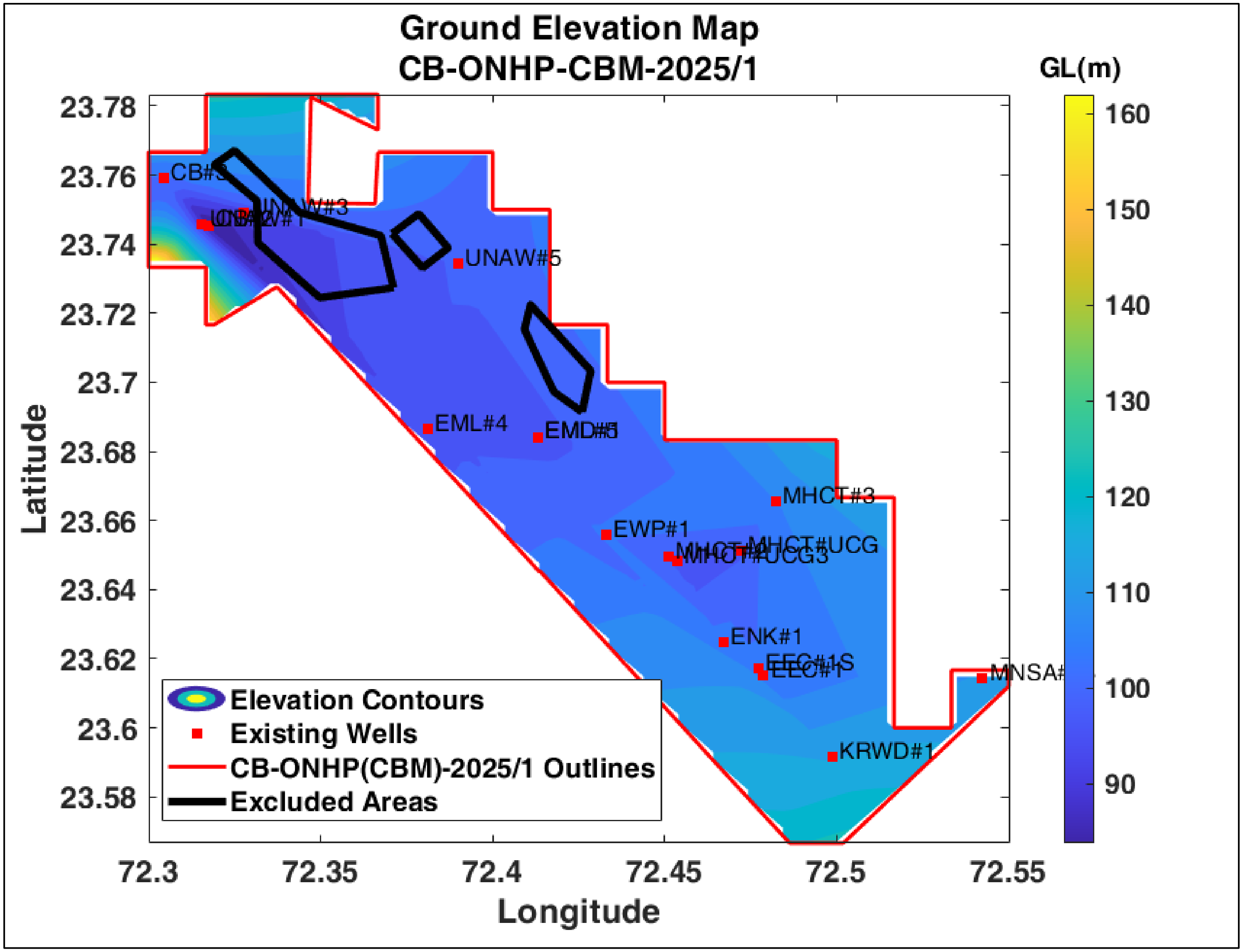


Figure *A3*: Ground Elevation Map – CB-ONHP(CBM)-2025/1

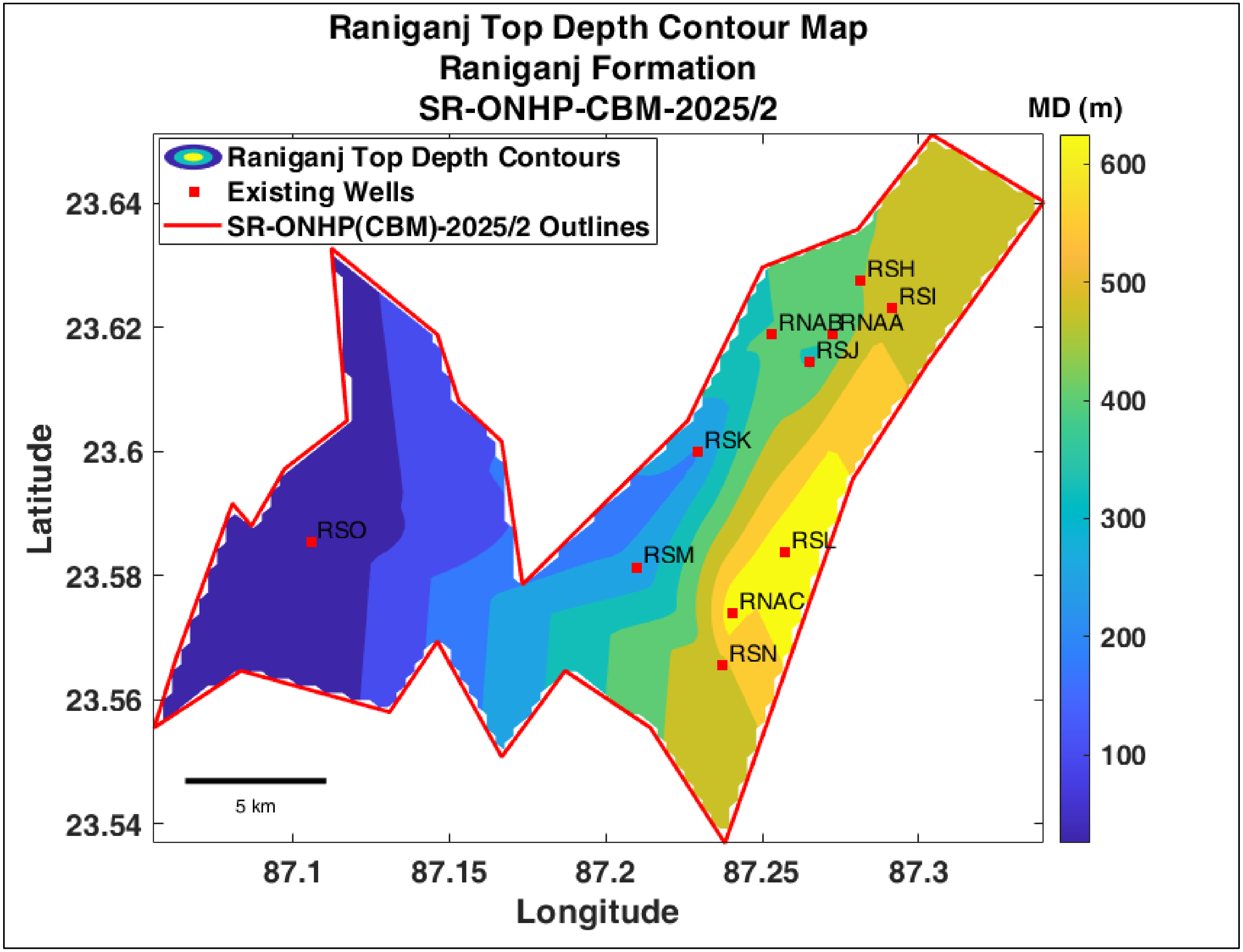


Figure *A2*: Structural Map – Raniganj Top – SR-ONHP(CBM)-2025/2

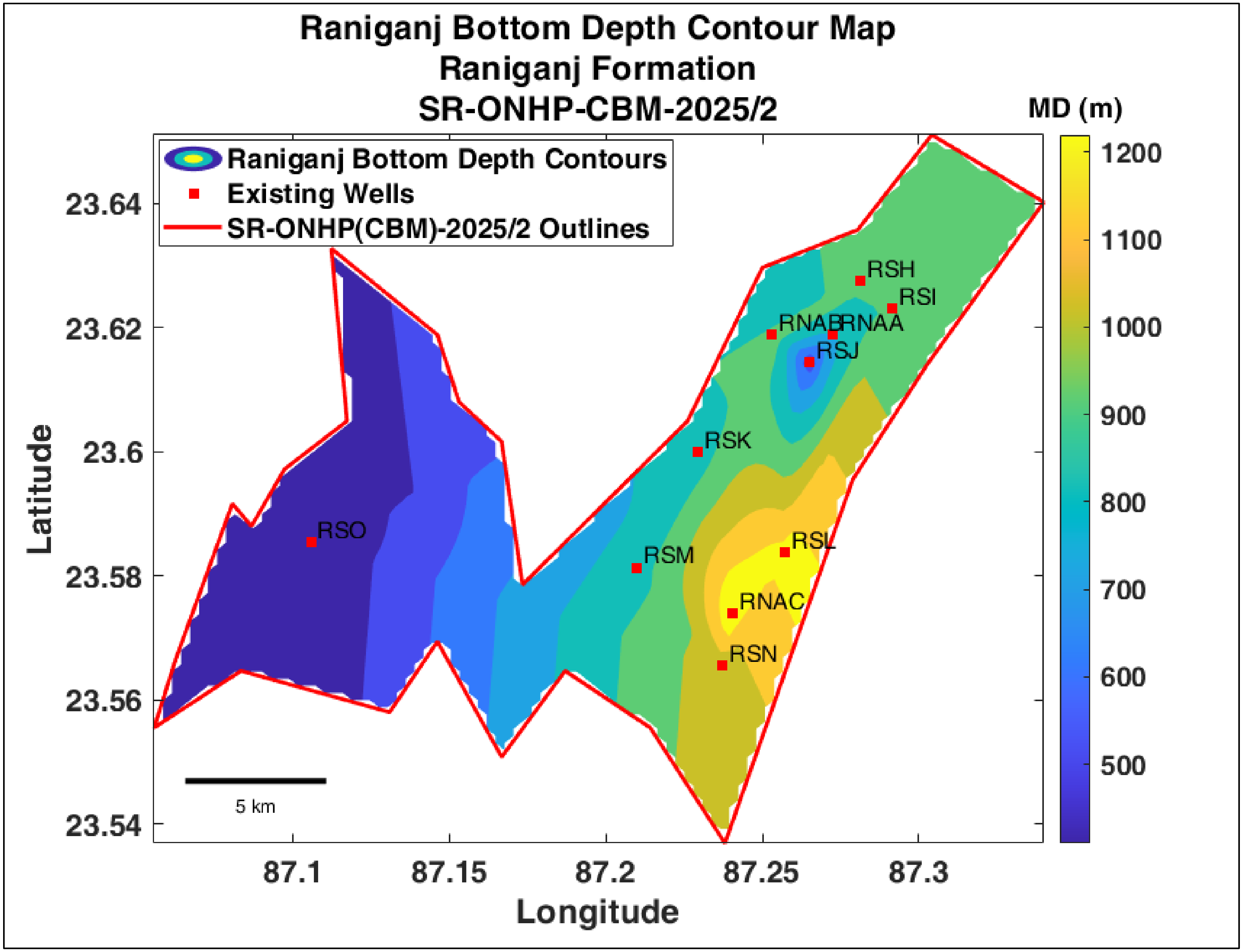


Figure *A3*: Structural Map – Raniganj Bottom – SR-ONHP(CBM)-2025/2

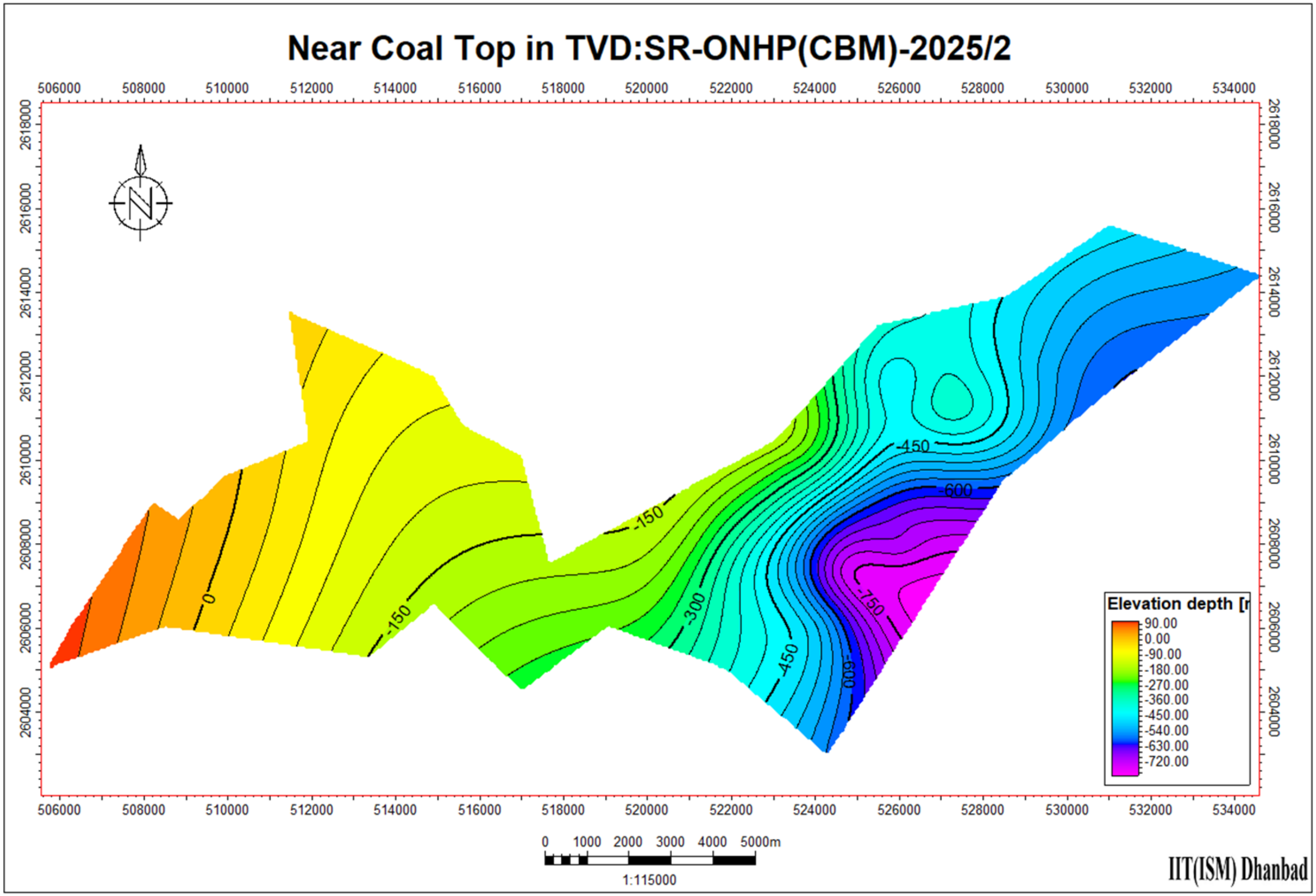


Figure *A4*: Structural Map – Near Coal Top in TVD – SR-ONHP(CBM)-2025/2

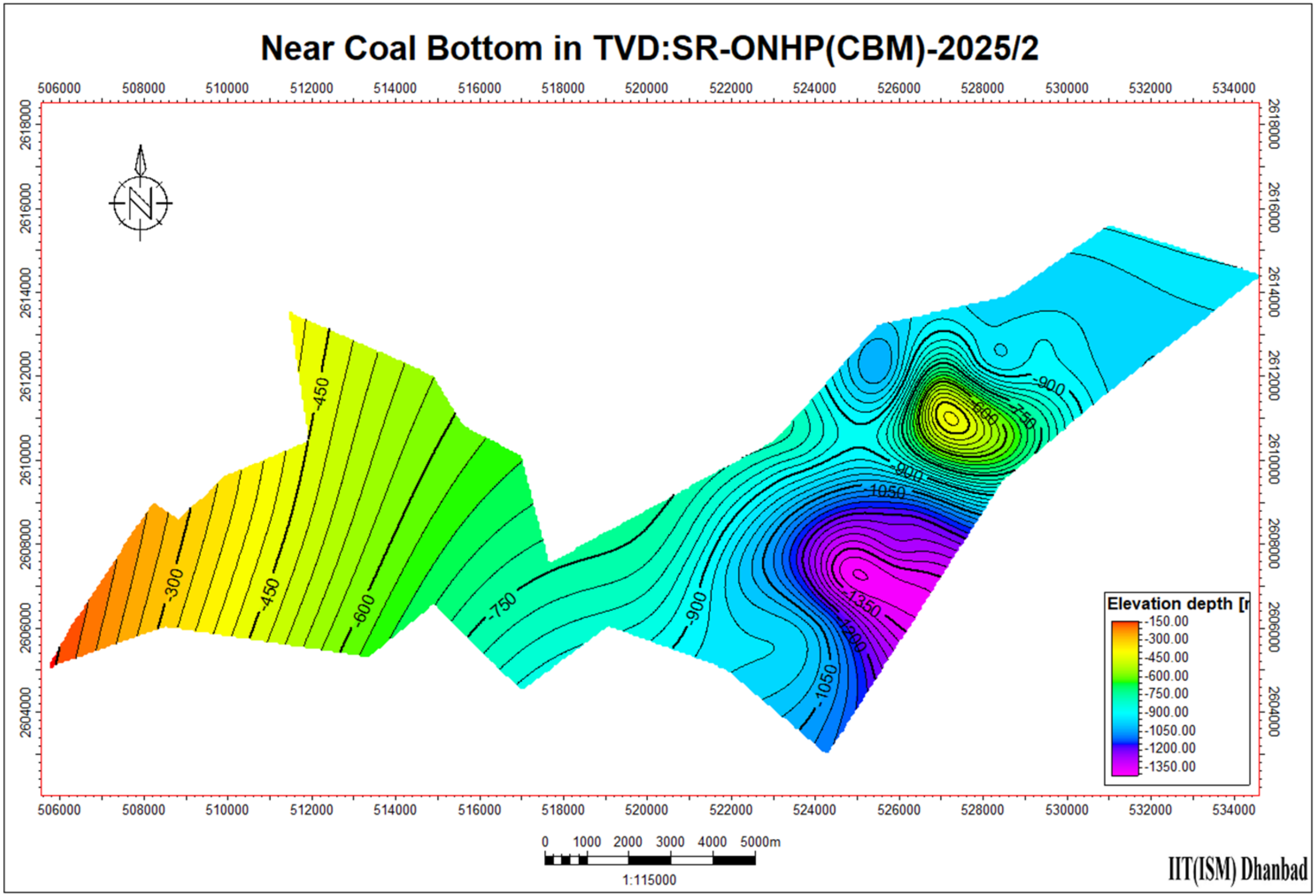


Figure *A4*: Structural Map – Near Coal Bottom in TVD – SR-ONHP(CBM)-2025/2

7. APPENDIX B – Net Pay (Cumulative Coal Thickness) Maps

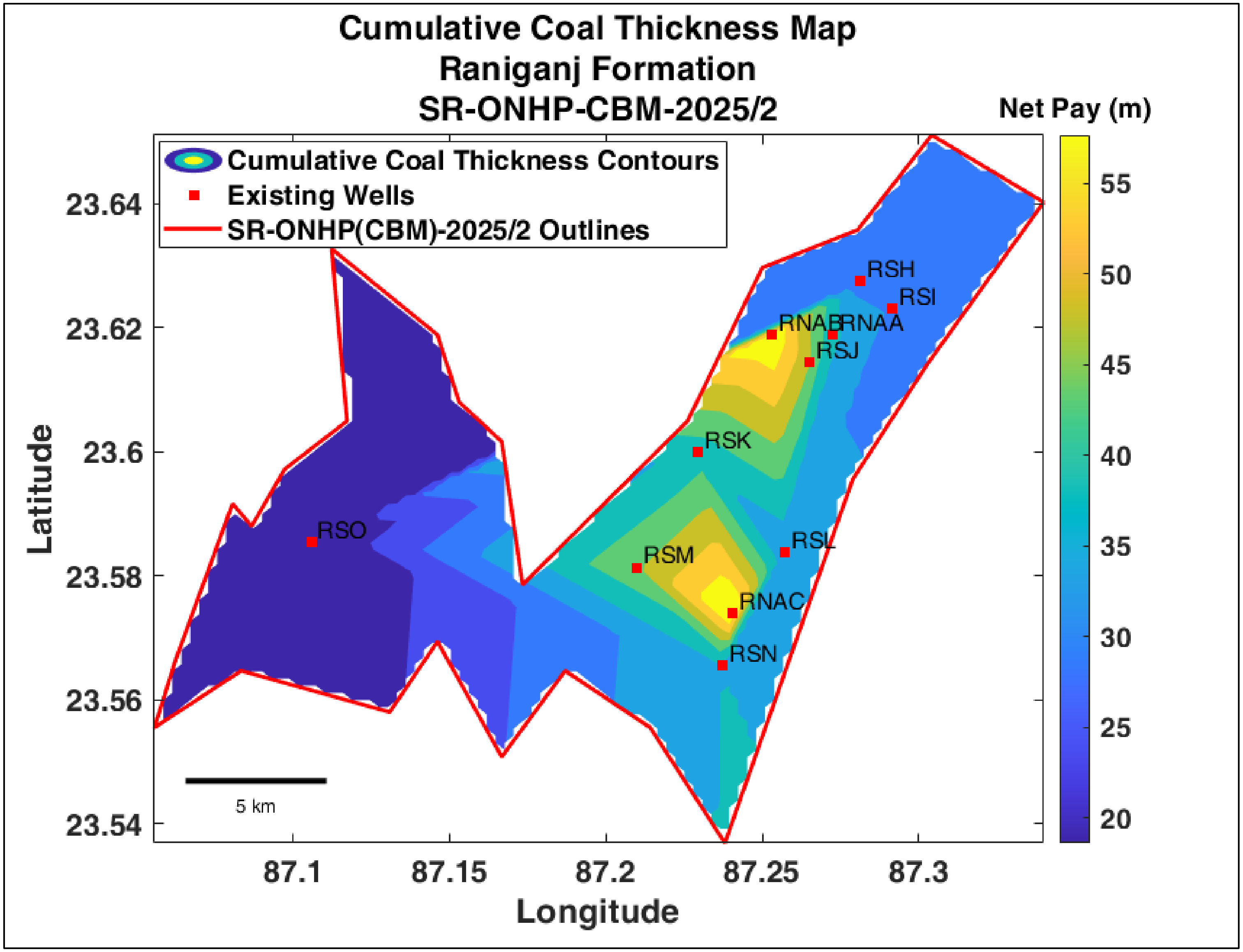


Figure *B1*: Cumulative Net Coal Pay Map - SR-ONHP(CBM)-2025/2

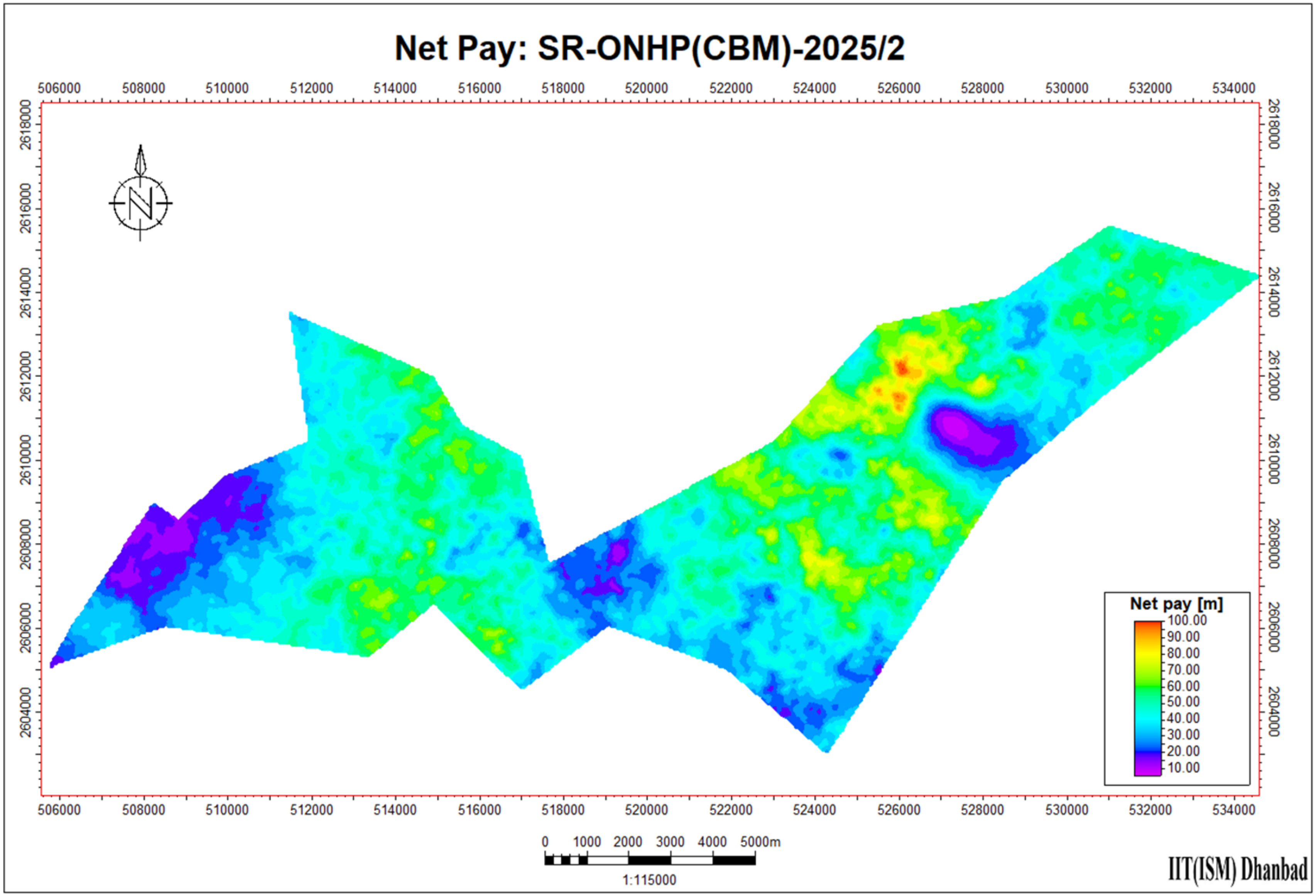


Figure B2: Cumulative Net Coal Pay Map - SR-ONHP(CBM)-2025/2

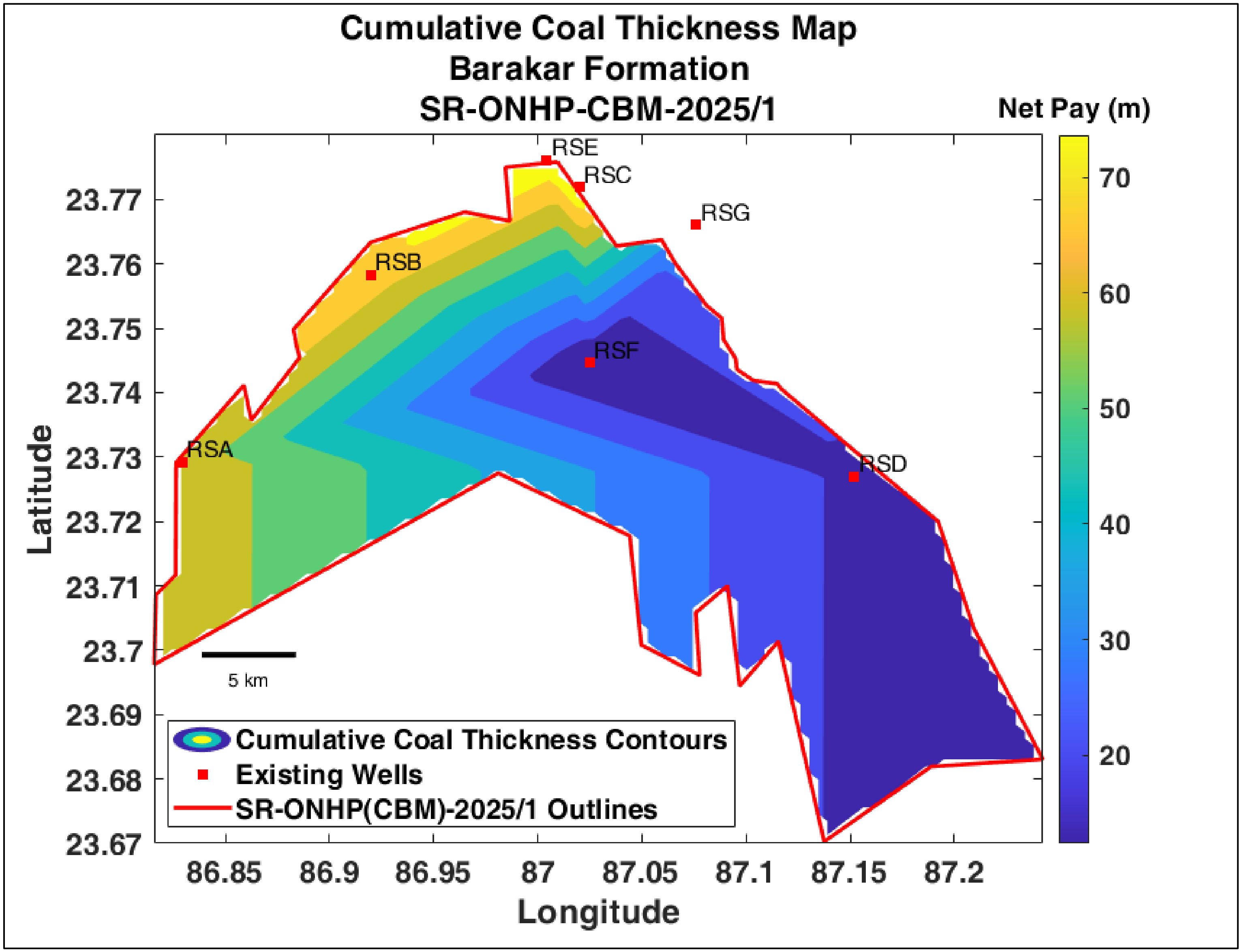


Figure *B3*: Cumulative Net Coal Pay Map - SR-ONHP(CBM)-2025/1

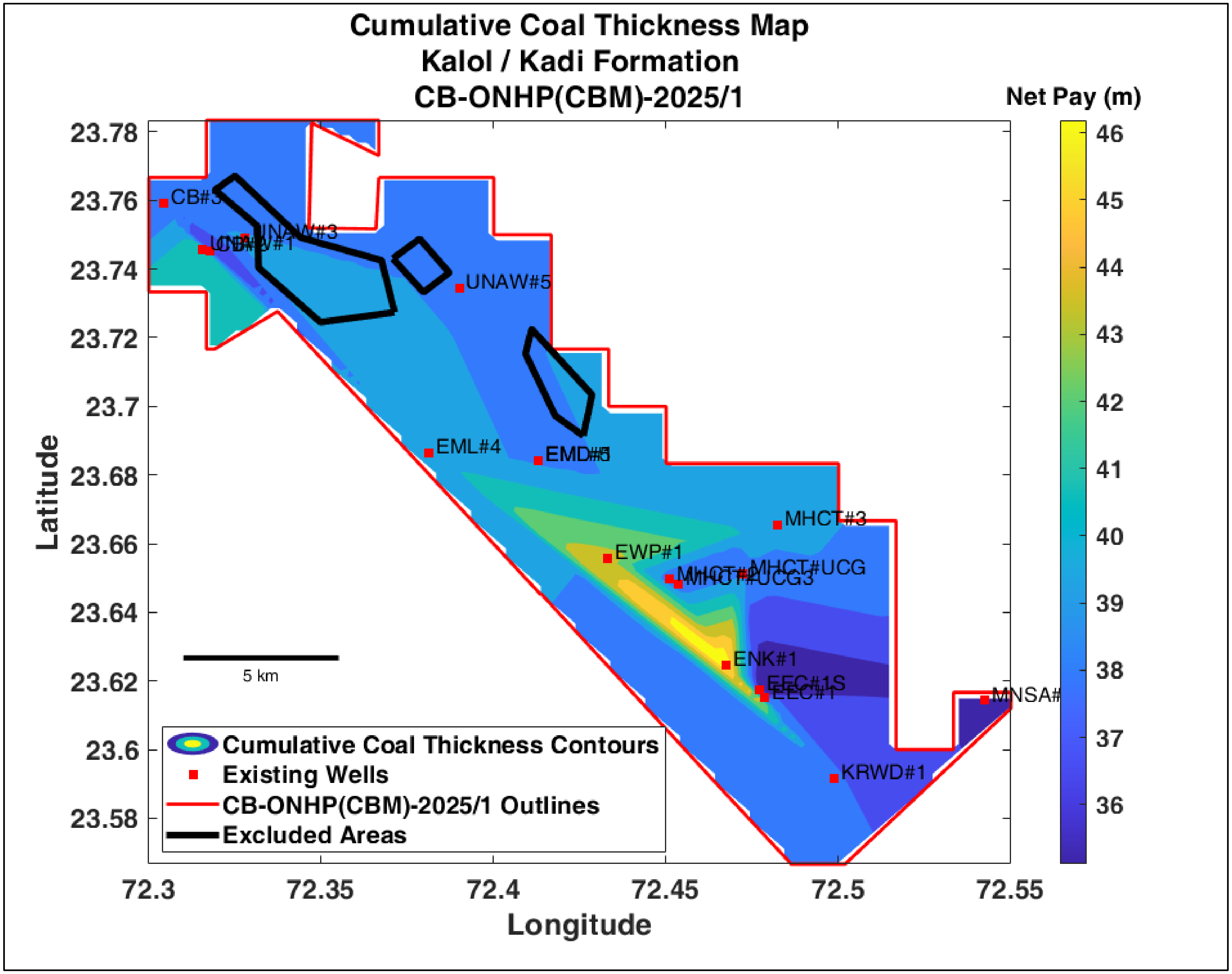


Figure *B4*: Cumulative Net Coal Pay Map - CB-ONHP(CBM)-2025/1

8. APPENDIX C – In-Situ Gas Content Maps

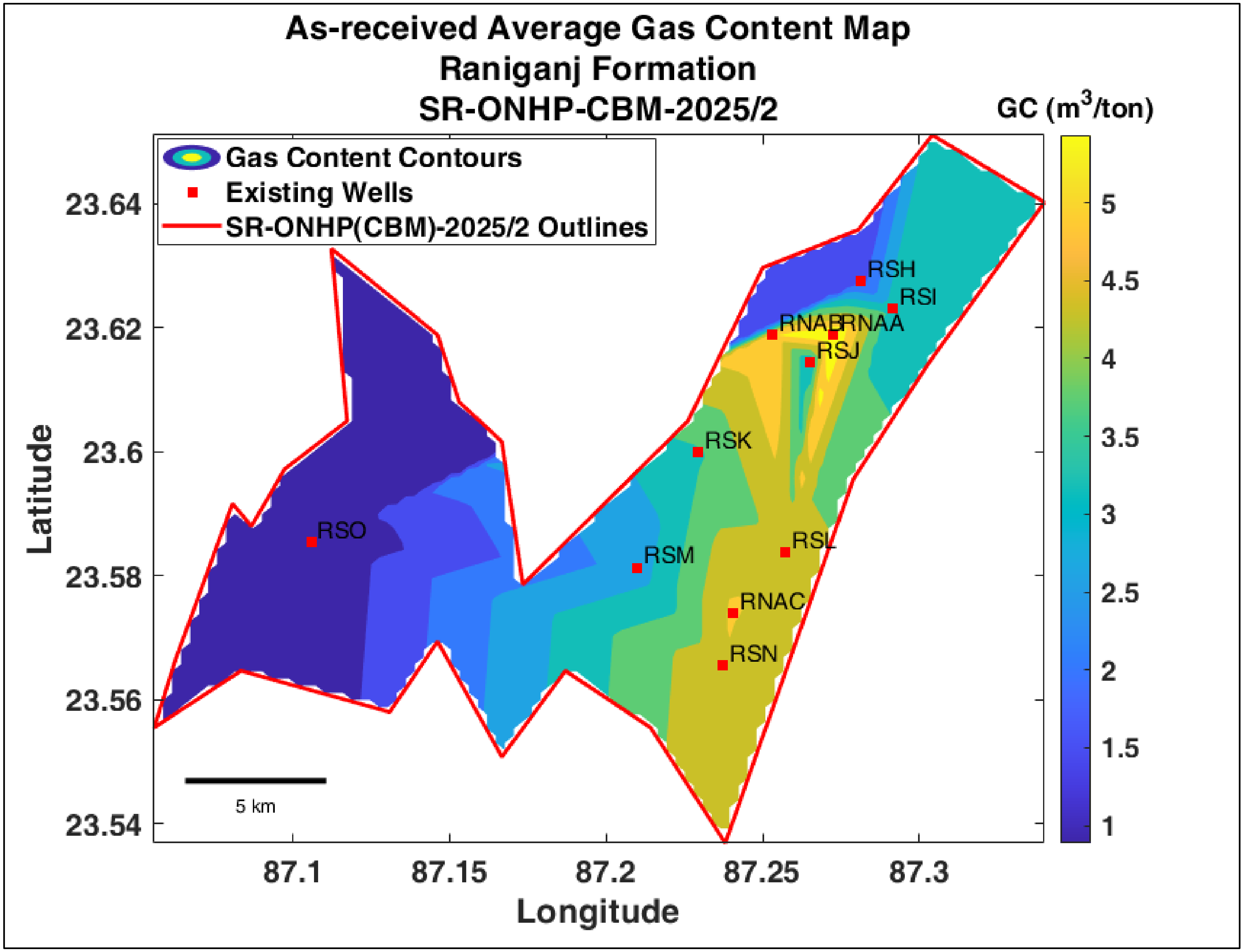
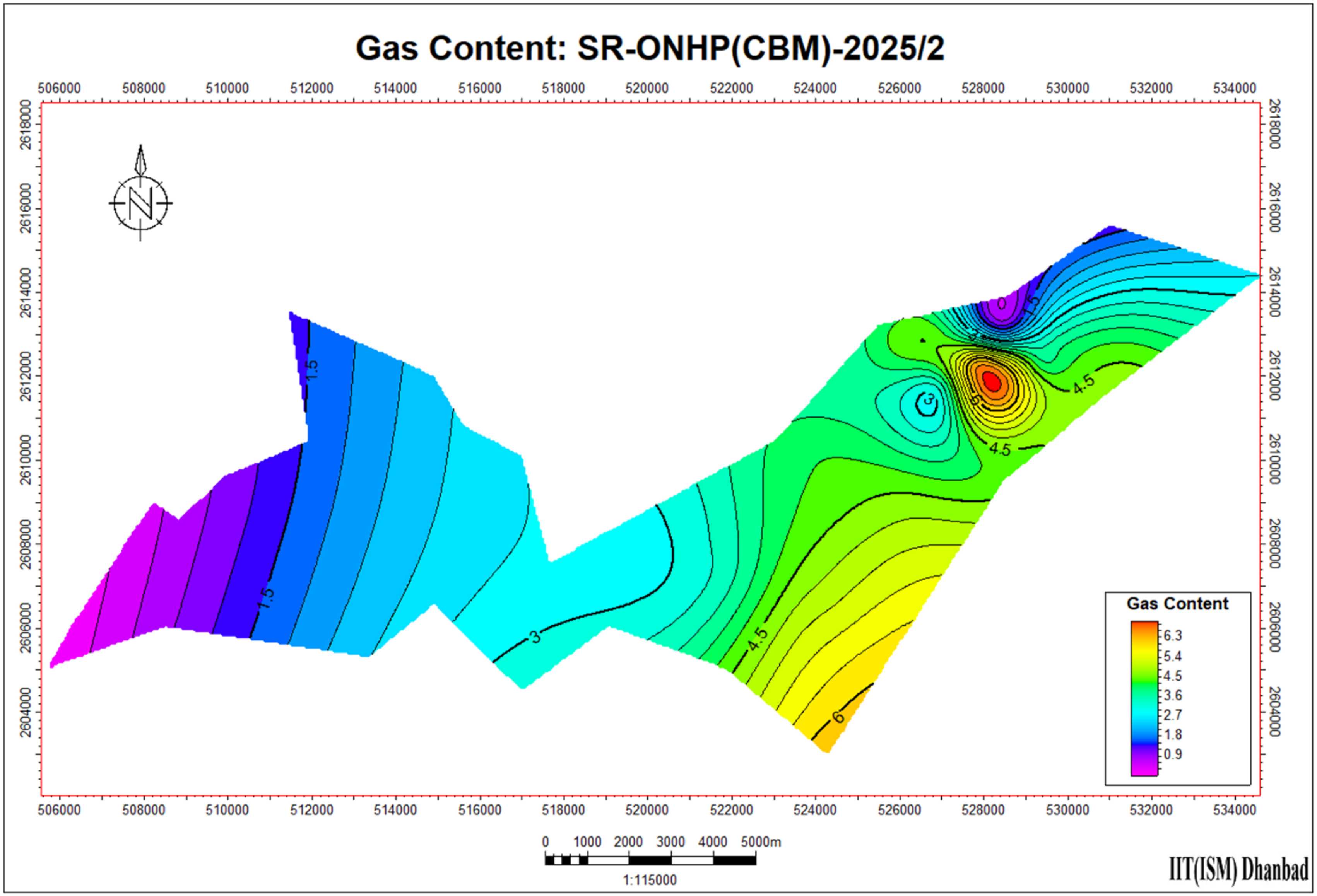


Figure *C1*: In-situ Gas Content (in m³/ton) - SR-ONHP(CBM)-2025/2



Gas Content: SR-ONHP(CBM)-2025/2
506000
508000
510000
512000
514000
516000
518000
520000
522000
524000
526000
528000
530000
532000
534000
2618000
2616000
2614000
2612000
2610000
2608000
2606000
2604000
N
1.5
3
4.5
6
Gas Content
6.3
5.4
4.5
3.6
2.7
1.8
0.9
0 1000 2000 3000 4000 5000m
1:115000
IIT(ISM) Dhanbad

Figure *C2*: In-situ Gas Content (in m^3/ton) - SR-ONHP(CBM)-2025/2

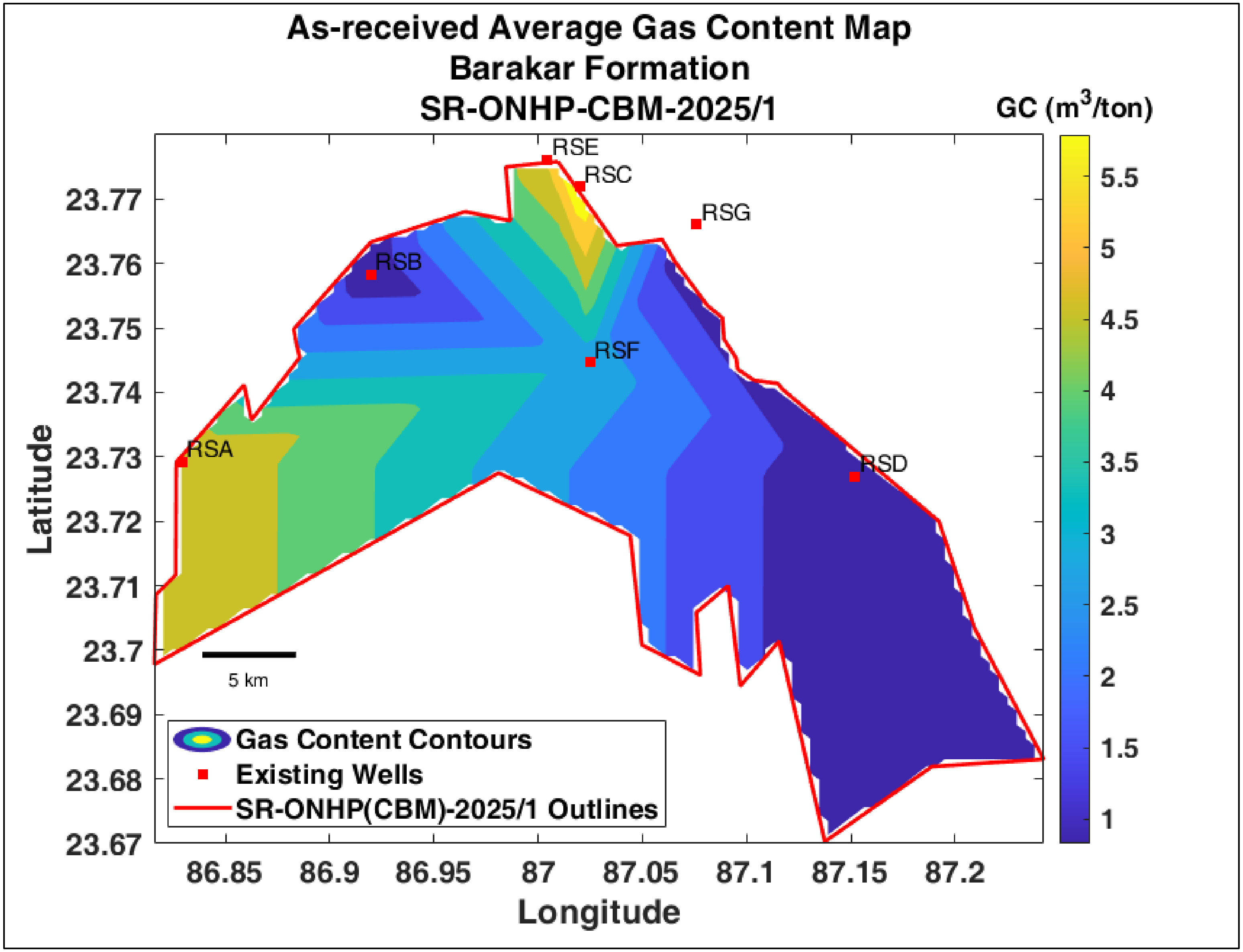


Figure *C2*: In-situ Gas Content (in m^3/ton) - SR-ONHP(CBM)-2022/1

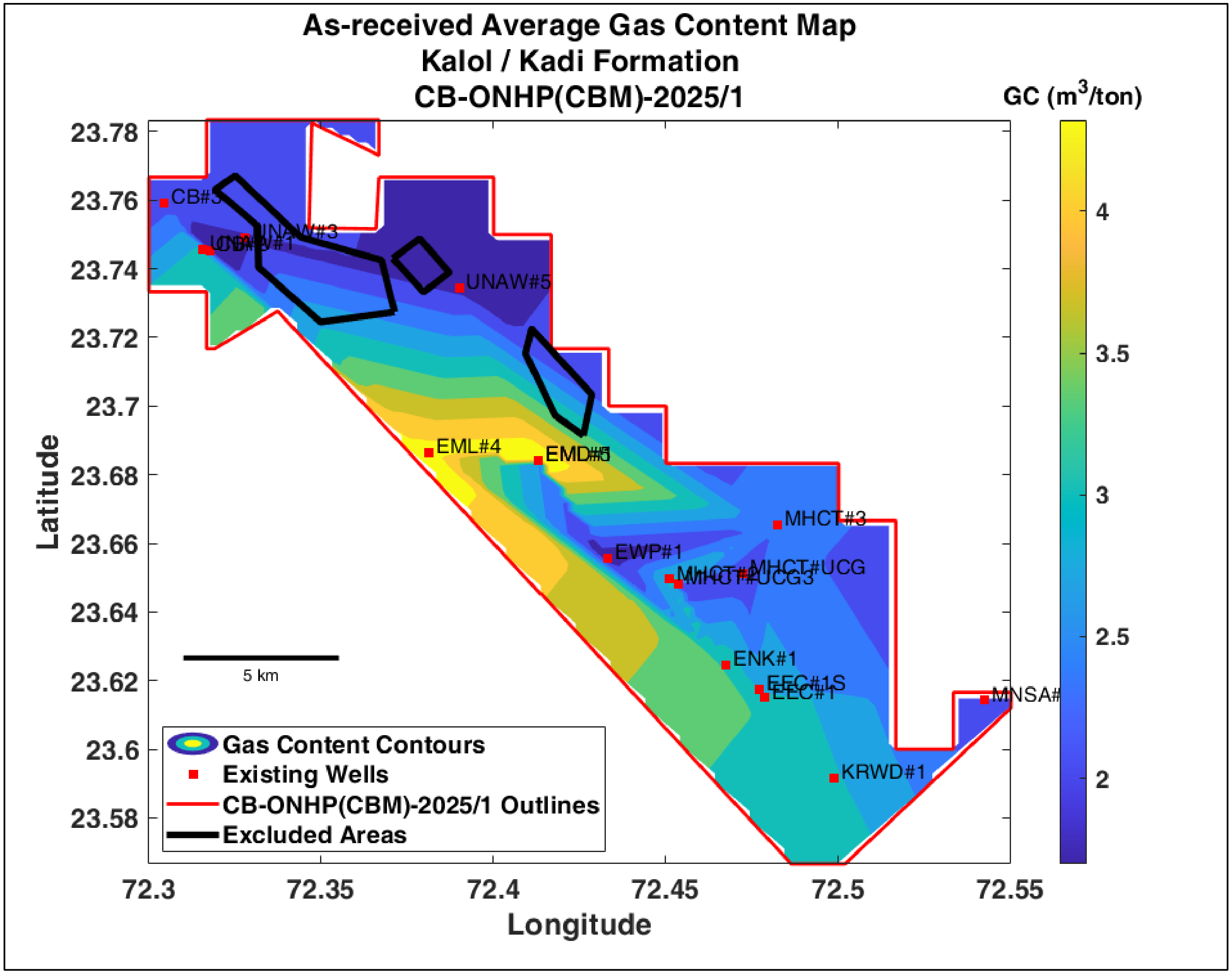


Figure *C3*: In-situ Gas Content (in m^3/ton) - CB-ONHP(CBM)-2025/1

9. APPENDIX D – Resource Volume Map

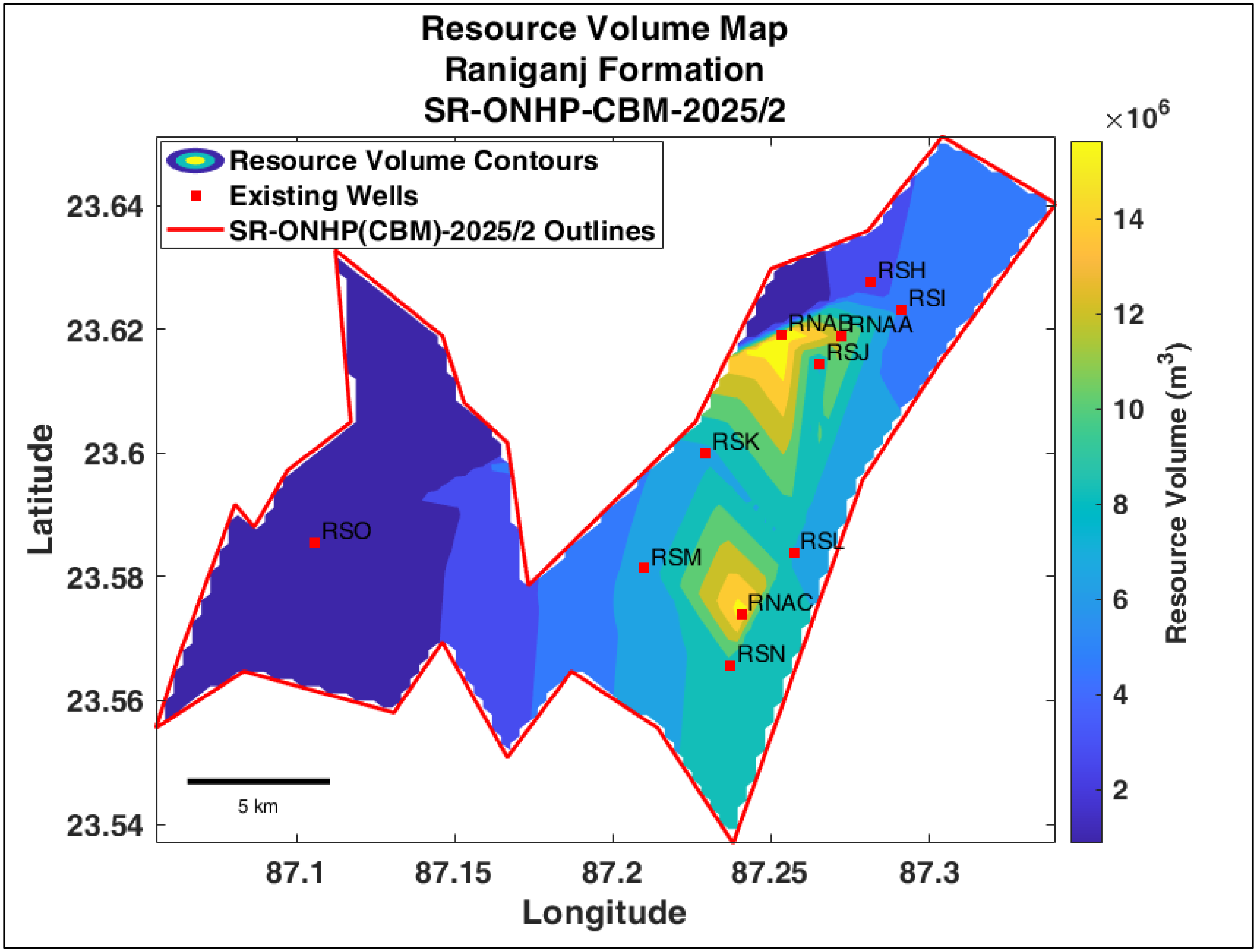


Figure *D1*: Resource Volume Map - SR-ONHP(CBM)-2025/2

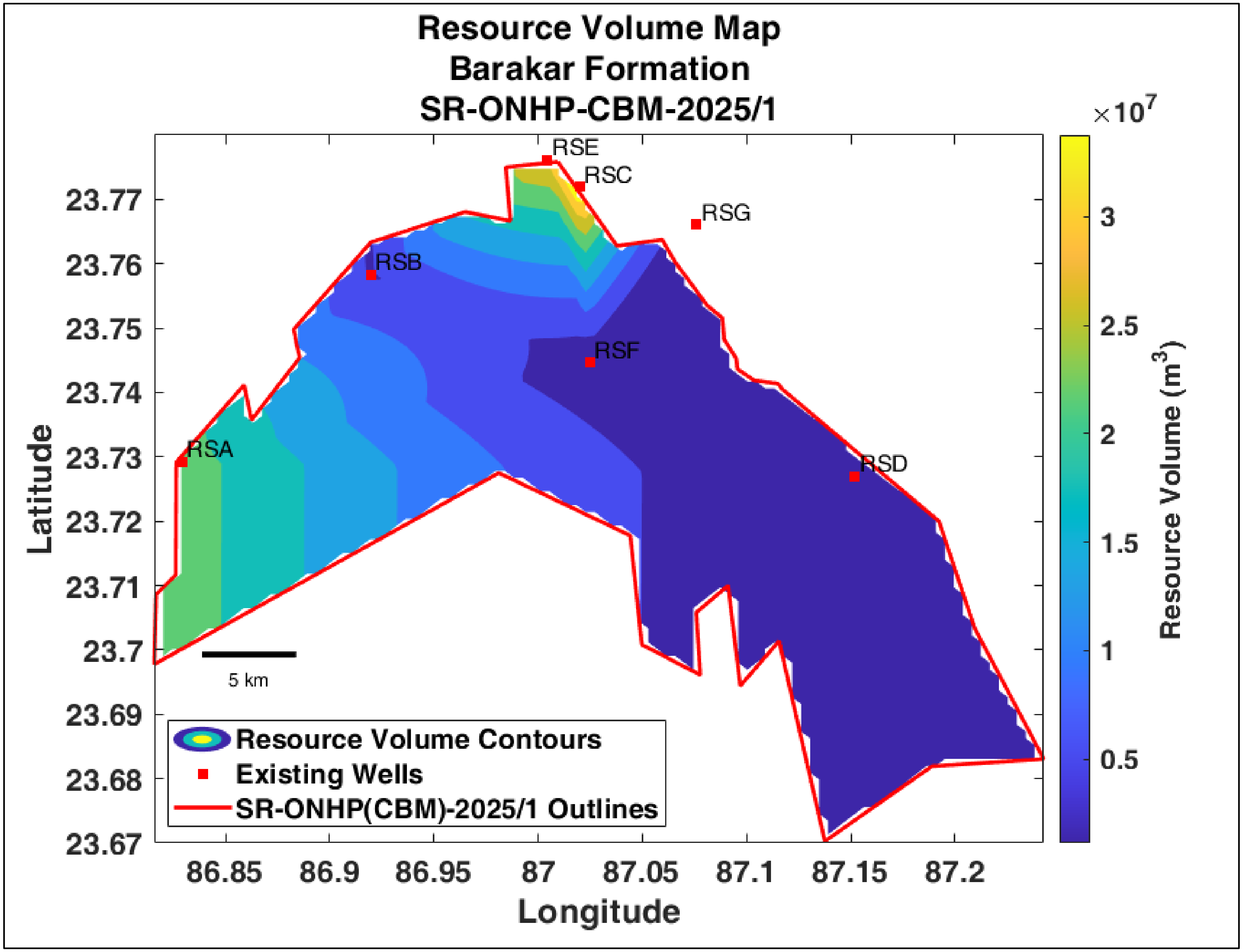


Figure *D2*: Resource Volume Map - SR-ONHP(CBM)-2025/1

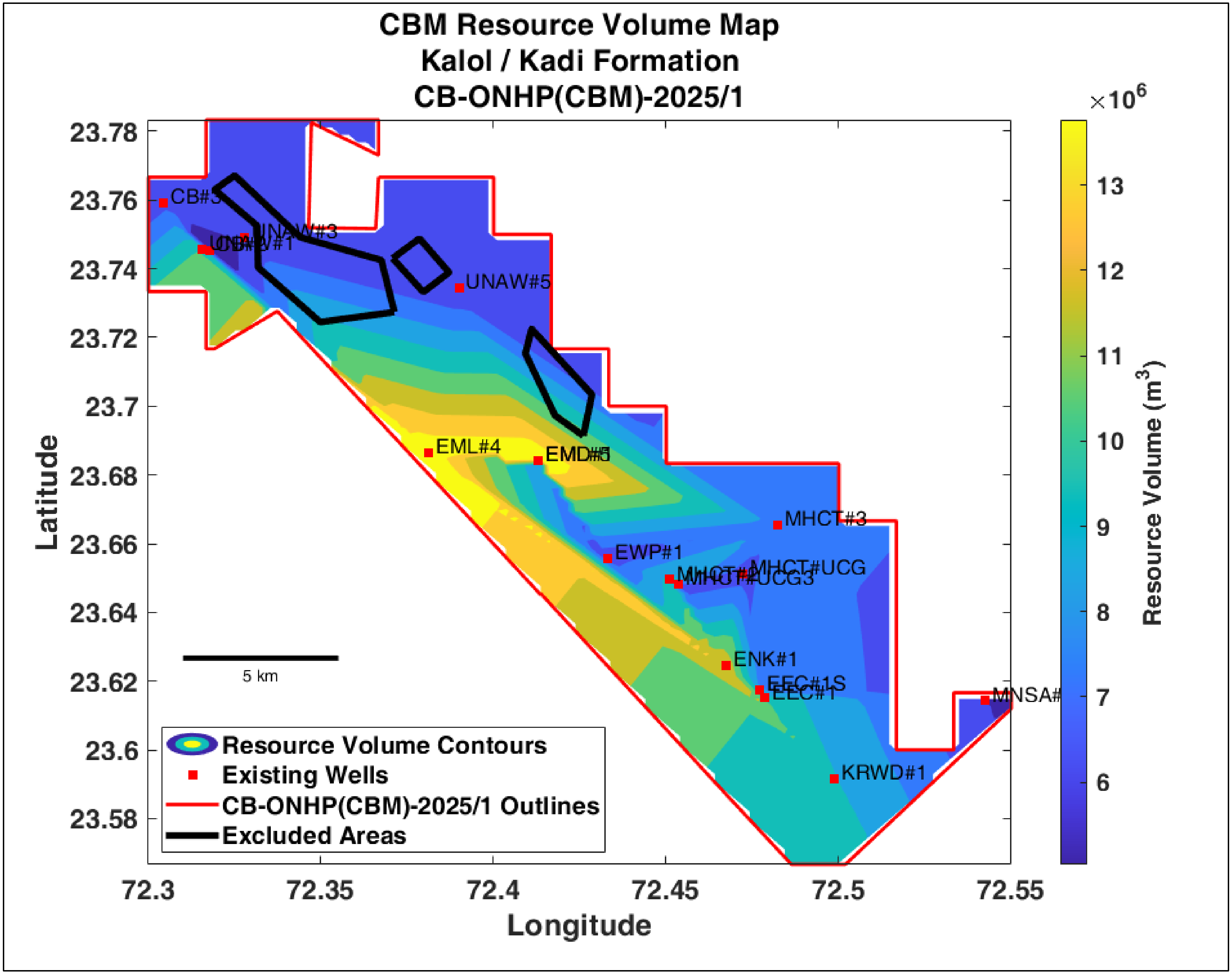

CBM Resource Volume Map
Kalol / Kadi Formation
CB-ONHP(CBM)-2025/1
Latitude
Longitude
Resource Volume (m3)
×10^6
5 km
CB#3
UNAW#3
UNAW#1
UNAW#5
EML#4
EMD#5
MHCT#3
EWP#1
MHCT#UCG
MHCT#UCG3
ENK#1
EEC#1S
EEC#1
MNSA#
KRWD#1
Resource Volume Contours
Existing Wells
CB-ONHP(CBM)-2025/1 Outlines
Excluded Areas

Figure *D3*: Resource Volume Map - CB-ONHP(CBM)-2025/1