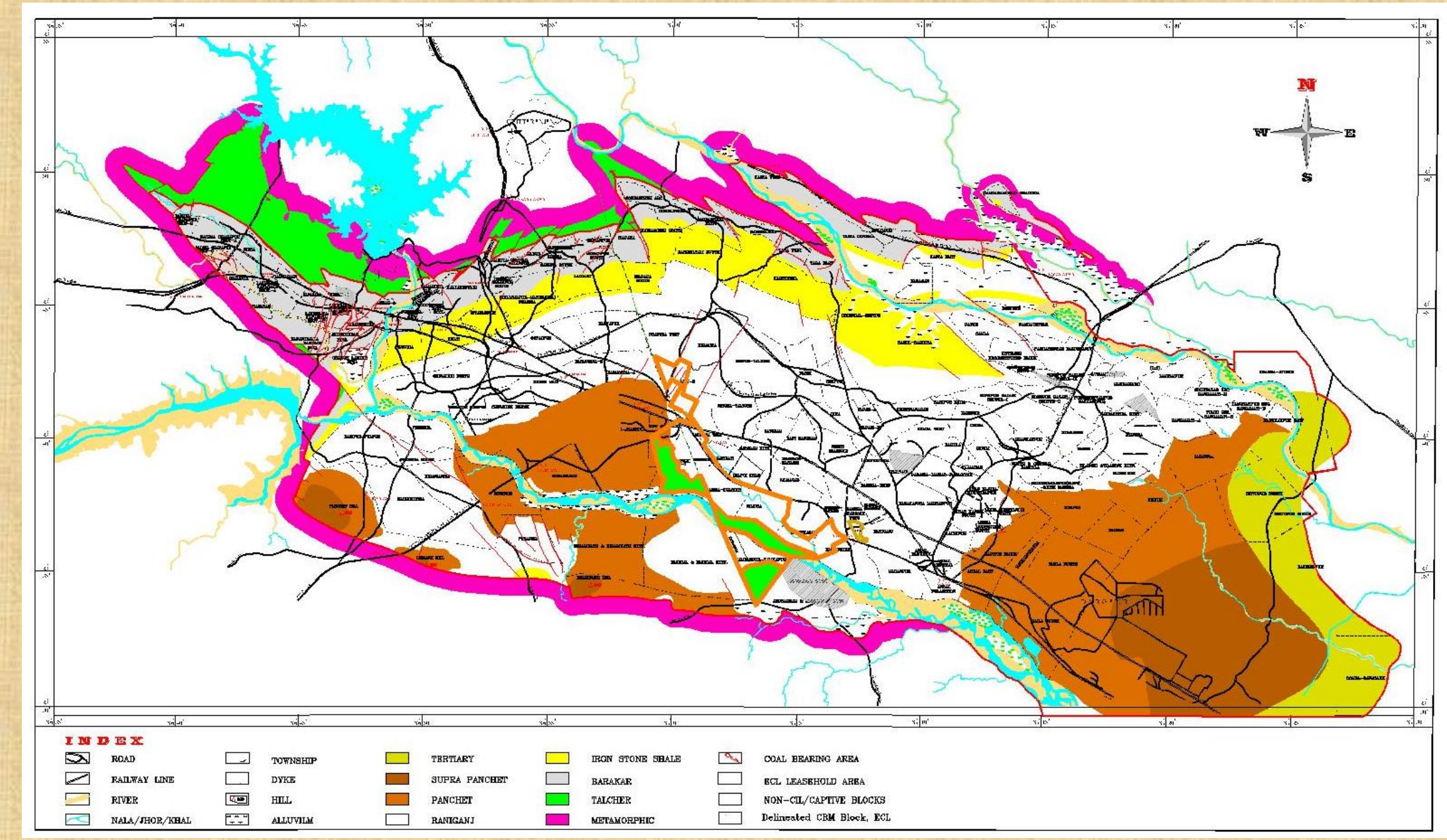
Prospect and Plan for developing CBM/CMM in Raniganj Coalfield under ECL Leasehold areas

25TH APRIL, 2019

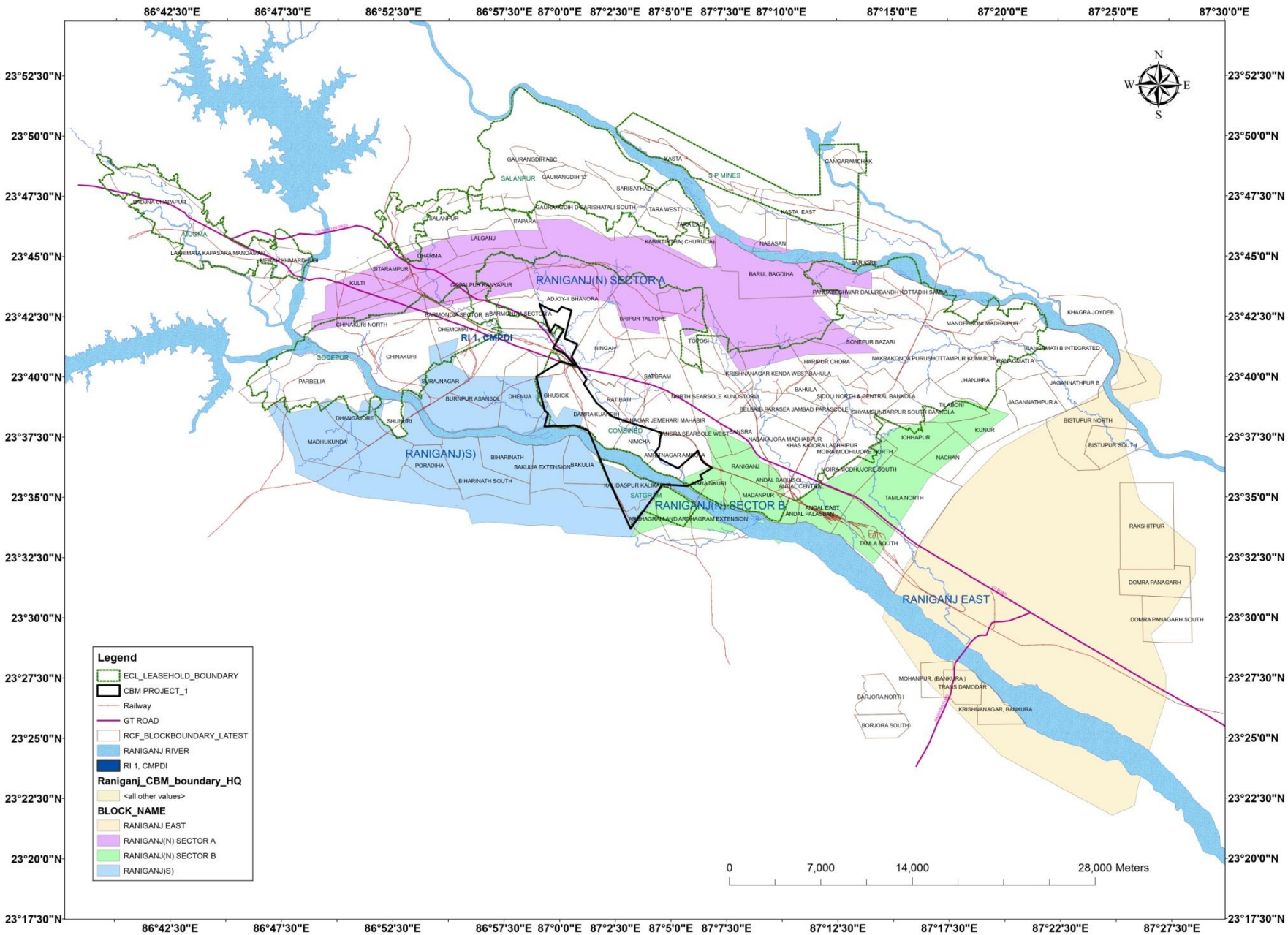
EASTERN COALFIELDS LIMITED
(A subsidiary of Coal India Limited)

Project & Planning Department
Eastern Coalfields Limited

GEOLOGICAL MAP OF RANIGANJ COALFIELD



RANIGANJ COALFIELD



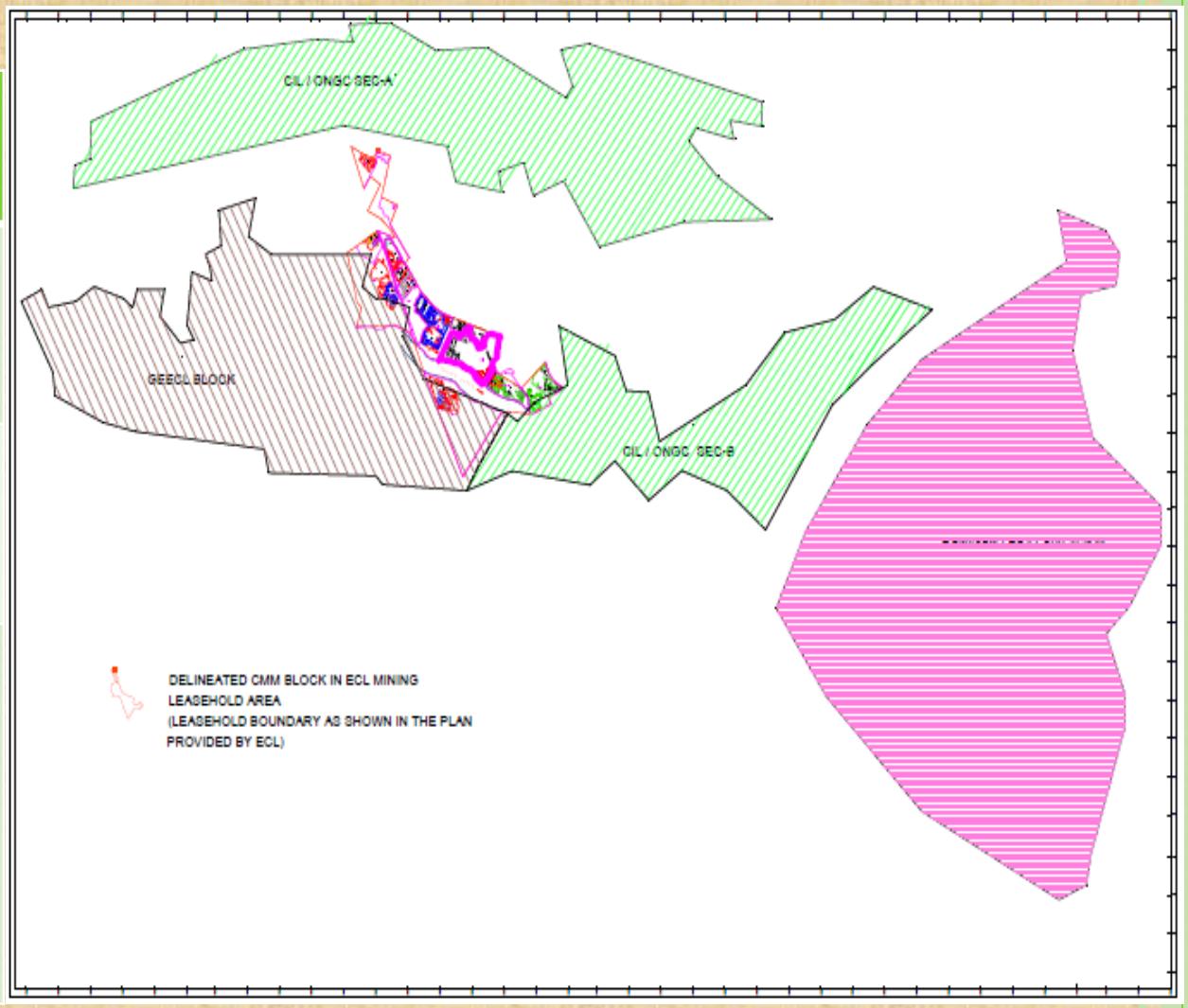
RANIGANJ COALFIELD

- Raniganj Coalfield covers an area of 1500 km^2 and has total coal reserves of 50 billion tonnes, spread across Indian states of West Bengal and Jharkhand.
- Half graben configuration
- Southern & Western boundary is E-W & N-S boundary fault
- Major fault trend is NW-SE, NE-SW; throw varies from 1m to 200m
- Salma Dyke (dolerite dyke) divides the Raniganj Coalfield in two parts
- Types of igneous intrusives: Mica Peridotite dykes and sills and Dolerite dykes
- Barakar Measure- 14 coal seams ranging from 1.2m to 38m. Maximum thickness is 700m.
- Raniganj Measure- 14 coal seams ranging from 1.2m to 18m. Maximum thickness is 1030m.
- Raniganj Coalfield produces the best quality of non-coking coal in India, with average ash percentage of less than 20%. The main features of this coal are high volatile content, long flame, quick ignition and high heat value.

CBM Activity in the Raniganj Coalfield

- **3 CBM blocks allotted by the government are in different stages of development in Raniganj Coalfield**

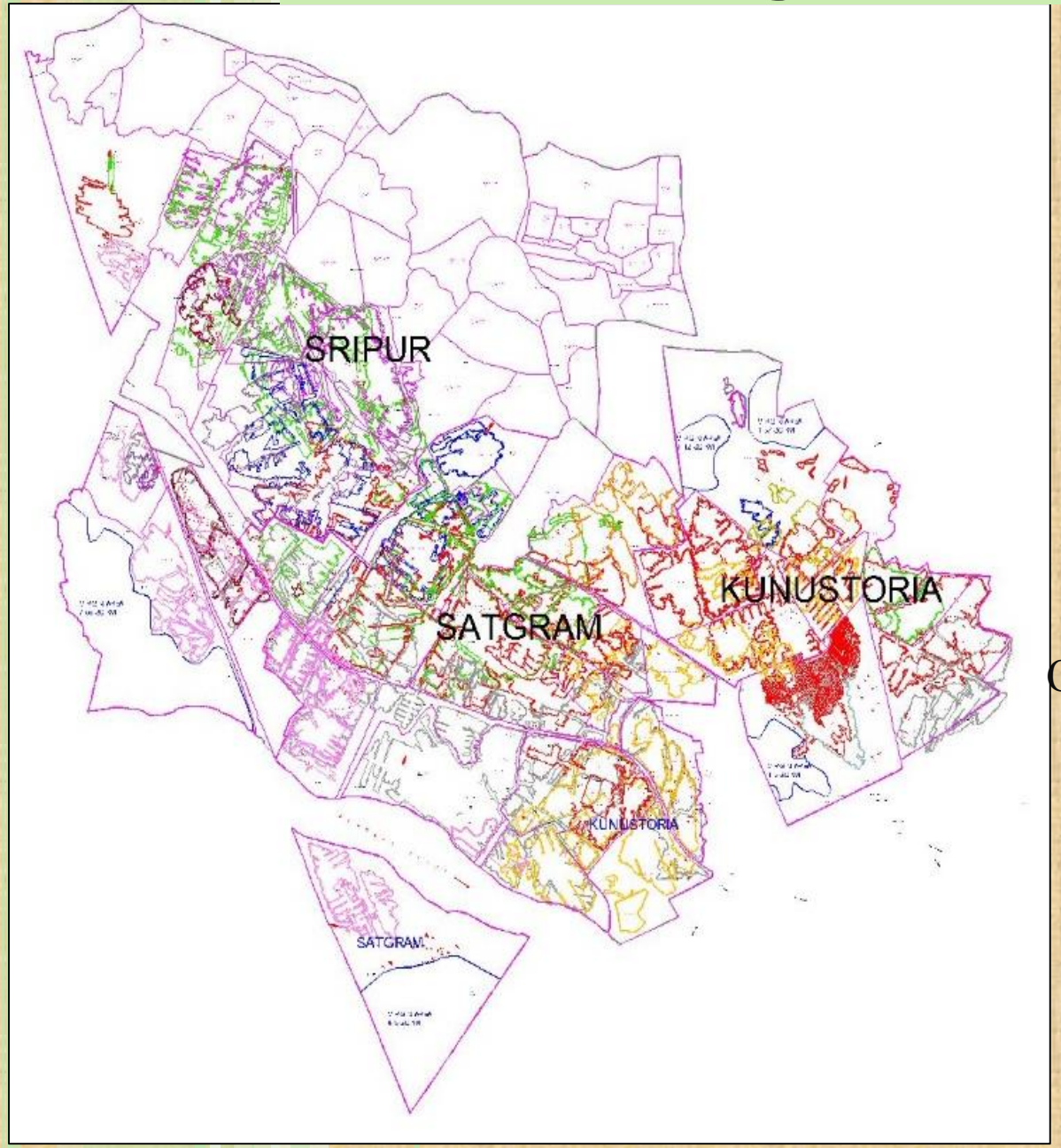
CBM blocks	Area (Sq. km)	Allotted to	Status
Raniganj South CBM block	210	M/s GEECL	Commercial
Raniganj East CBM block	500	M/s Essar Oil Limited	Commercial
Raniganj North CBM block	350	ONGC-CIL	FDP submitted, Development not yet actualized



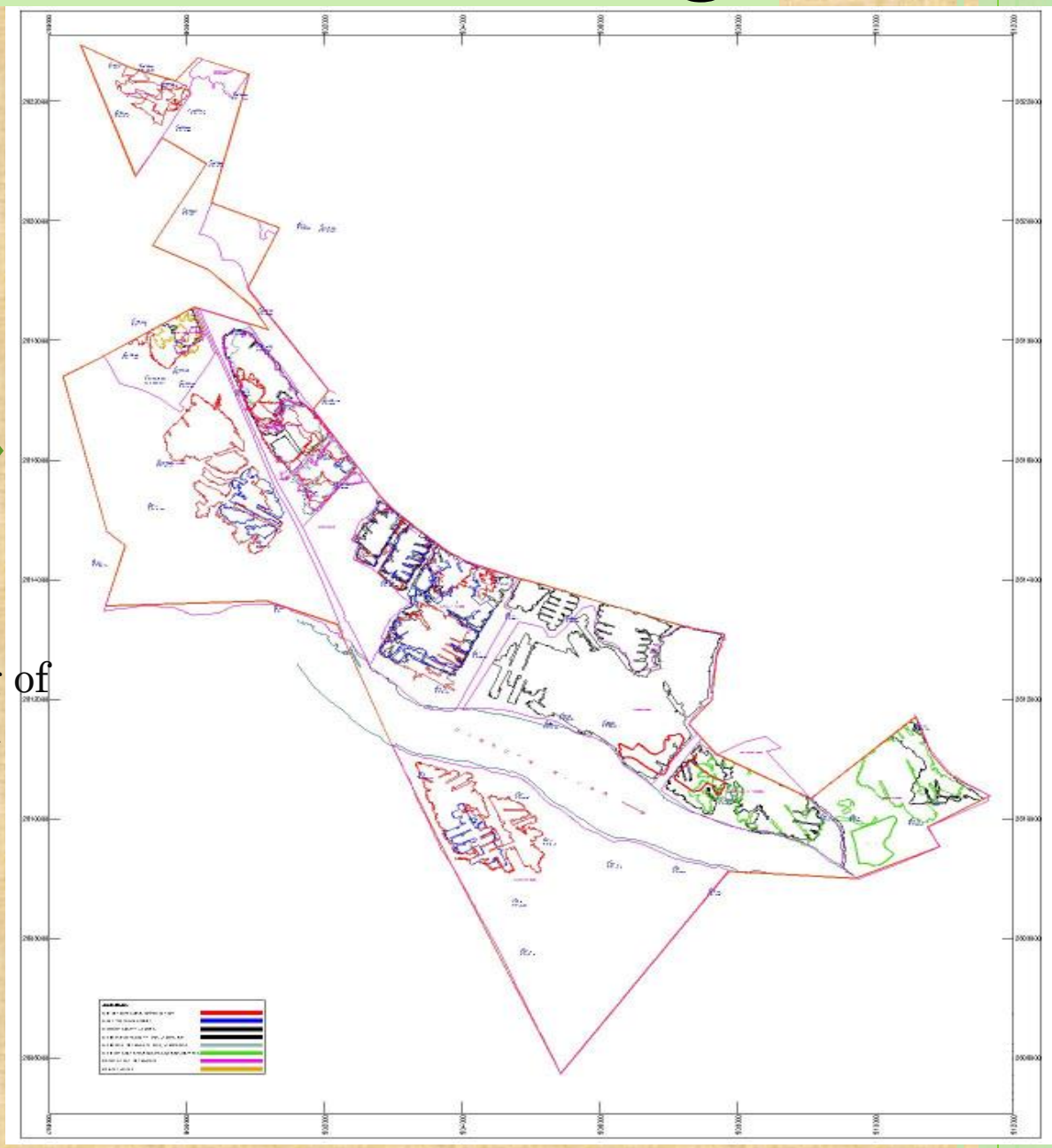
Delineation of CBM Block Of ECL

- The CMM block has been delineated as per the government's mandate of limiting the block within the ECL mining leasehold area.
- While delineating the block, virgin areas with complete column of coal seams was attempted. Due to limited availability of complete virgin area, the areas with a number of virgin seams lying below the developed seams were examined.
- The areas housing seams with high degree of gassiness (Degree II to III) and their proximity to Salma dyke were observed to be favorable.
- Coal column of Seam VI and below found to be virgin below single to multiple seams workings in a large part of the area in the Sripur, Satgram and Kunustoria areas.
- Thus a combination of a) an area of complete virgin coal column and b) virgin seams below developed seams was demarcated.

Coal Mining Activity and Block Carving



Carving of Block



Block falls in the Burdwan districts of West Bengal state

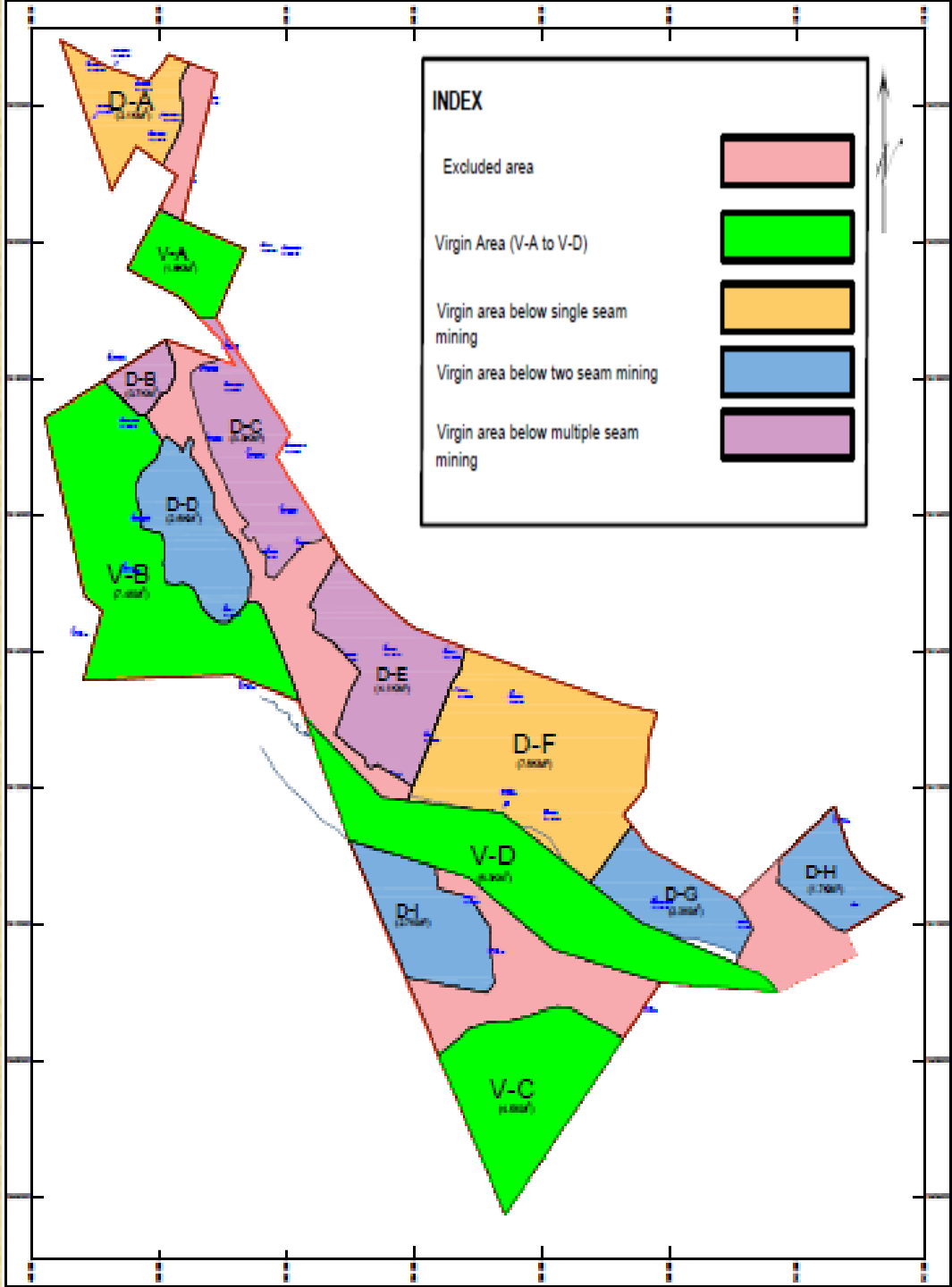
Salma Dyke intersects the Block

Raniganj CBM Block

Area- 57 Km^2

Location - South Central

Sector Wise Virgin and Developed area, CBM Block, Raniganj CF



AREA CATEGORY OF THE IDENTIFIED BLOCK

Sl. No.	AREA CATEGORY	Area sq. km
1	Complete virgin area	11.07
2	Complete virgin area below Damodar river	6.35
3	R-VI & below virgin under single seam working(R-VIII)	7.25
4	R-VI & below virgin under multiple seams working	33.16
	TOTAL	57.83

DEPTH RANGE & SEAM SEQUENCE OF THE TARGETED SEAM

SEAM	Depth Range (m)	Thickness Range (m)
R-VI	150-375	2-5
R-V	200-450	1-2
R-IV	360-620	3-6
R-III	450-670	2-4
R-II	530-780	2-5
R-I	580-840	1-3

CBM Gas-In-Place

- The GIP in different sectors is broadly assessed as below:

Total Gas-in-Place Resource, CMM block, Raniganj Coalfield			
	Area (Km^2)	GIP (BCM)	Total GIP (BCM)
Virgin Area below Developed Area	40	2.20	3.93
Virgin Area	11	1.17	
Area below Damodar River	6	0.56	

Reservoir Modelling: Carried out by M/s Advanced Resources International (ARI) Inc.

Simulation Model (models were run for 25 years in order to simulate gas and water production rates and cumulative production volumes)

- Virgin areas
  - Area under the Damodar river will be accessed with horizontal wells
  - Area except under the Damodar River will be developed with vertical wells
- Developed area
  - The horizontal wells will access only the R-IV seam, the most prospective for CMM/CBM resource.

Project Implementation Concept

Typically, CBM production is a long gestation project with a multi-phase development process, involving following phases

Phase 1: Coring

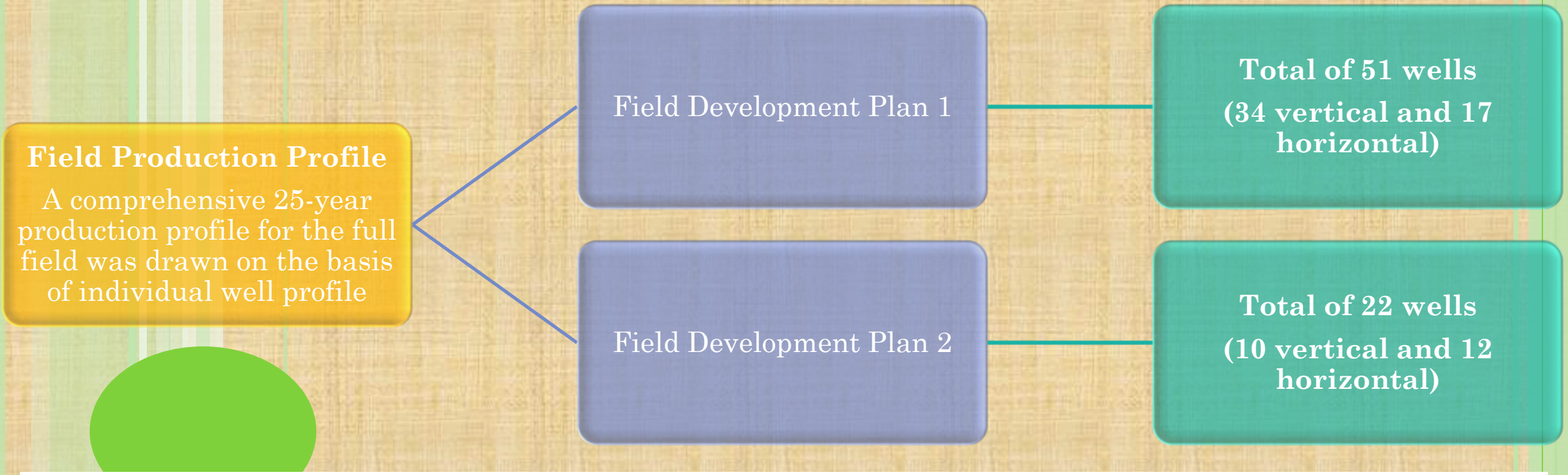
- Series of core wells are drilled to obtain samples of coal which are then tested

Phase 2: Pilot assessment

- Six wells (including 5 vertical & 1 horizontal wells) are to be drilled over a limited area of the prospect field to build a production model that determines the well spacing and, therefore, the number of wells required for full development

Phase 3: Development/ Commercial

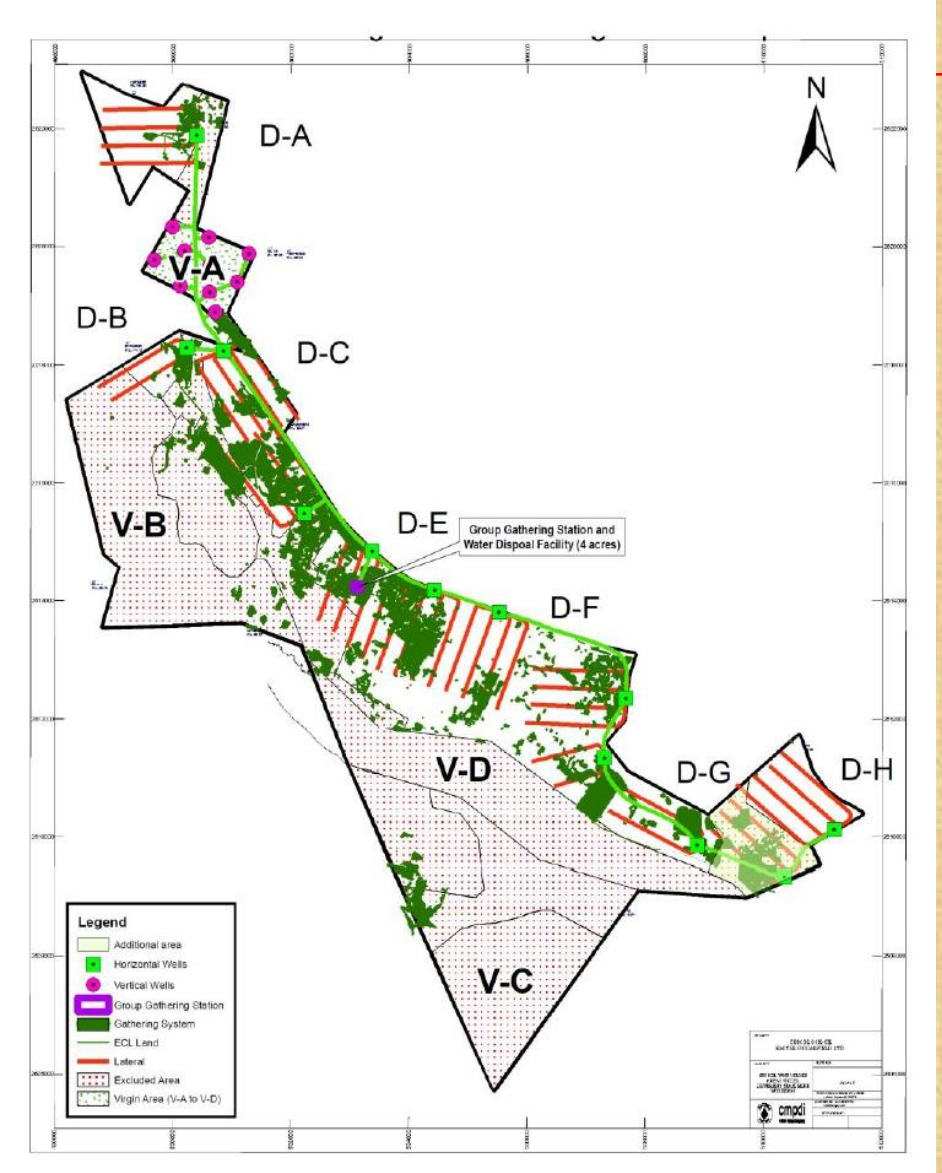
- Wells are drilled in a phased manner Commercial production stage for the project is perceived for 25 years



- **To estimate the total recoverable resources associated with the Raniganj block, the number of potential well locations was estimated taking into consideration the drillable area within the block**
- **The field-wise gas and water production forecasts assume vertical wells are drilled at a rate of two wells per month, and each horizontal leg is drilled at a rate of one every two weeks (e.g. one horizontal well consisting of four lateral legs to be drilled in two months).**

FDP-1

FDP-2


N
D-A
V-A
D-B
D-C
V-B
D-E
Group Gathering Station and
Water Dispoal Facility (4 acres)
D-F
V-D
D-G
D-H
V-C
Legend
Additional area
Horizontal Wells
Vertical Wells
Group Gathering Station
Gathering System
ECL Land
Lateral
Excluded Area
Virgin Area (V-A to V-D)

CURRENT STATUS OF CBM/CMM PROJECT

- Gas-in-place has been established .
- CMPDI has awarded the work of reservoir modelling techno-economic feasibility study to ARI , USA and the report is finalized .
- Reservoir model has been submitted by ARI , USA . Pre feasibility report has been submitted by CMPDI in May 2018.
- MDO Mode: CBM/CMM is a new area for CIL/ECL. Hence it has been decided to take up the project in MDO mode as recently done for Jharia block CBM project and economics as per MDO mode should be included in the PFR.

MARKET INFORMATION

- CBM/CMM site is near to Asansol.
- The nearest airport is Durgapur, which is approximately 45 km away .
- The state’s largest industrial centers are Asansol, Kolkata, and Durgapur.
- Coal is the predominant source of energy in West Bengal, but demand for natural gas has steadily increased over the years. Being a cleaner and more efficient fuel than coal .
- CBM, which is essentially natural gas, is the cleanest burning and most versatile hydrocarbon energy resource available.

MARKET INFORMATION

….CONTINUED

- Onsite electricity generation appears to be the most practical utilization option in the local and regional CMM market .

- Prominent companies in the vicinity include – the IISCO Steel Plant, Durgapur Steel Plant and Alloy Steel Plant of the Steel Authority of India Limited (SAIL), ALSTOM Projects, Graphite India Ltd and Philips Carbon Black.

- In URJA GANGA Gas Pipeline Project, GAIL has program of laying pipeline passing through Durgapur.

Economic Evaluation (As per ARI)

Economic Results (USD @ 70 INR)

Dev. Plan 2 (@8$/MMBTU)		
	As per ARI (in INR)	**As per ARI (in USD)**
Gas Price	19.78 Rs/m^3	8 USD/mmbtu
IRR	33 %	33 %
NPV-12	266 Crores	38 million
BEP	13.38 Rs/m3	5.41 USD/mmbtu
Total Wells	22 Wells	22 Wells
CAPEX	595 Crores	85 million
OPEX	112 Crores	16 million
Recoverable Volume	0.84 BCM	30 BCF

Departmental option (Plan 2) – As per CIL format

MDO Mode

Reasons for consideration of MDO option

- Capacity Building in this field of operation
- Huge Capital Investment
- Diversified Business for ECL/CIL

Economic evaluation of MDO option

MDO rate is not readily available with our industry/market at present.

For economic evaluation of MDO option, the desired /estimated rate/m^3 is worked out based on estimated cash flows prepared by ARI through back calculation method.

The estimated rate comes to around 0.18 USD/m^3 (INR 12.60/m^3) after consideration of 12% rate at 100% capacity utilization.

The Capital requirement for MDO option (Only LAND capital) for Development Plan 2– 12.58 Million USD (Rs. 88.09 Crores @ Rs. 70/- per USD)

Financial Results

Sl.No.	Particulars	Units	100% capacity	85% capacity
1	Capital investment	Rs. Cr.	88.09	88.09
2	Estimated MDO rate	Rs./CM	12.60	
3	Modified IRR (12% Reinvestment rate)	%	22.04	20.50
4	NPV @ 12% rate	Rs. Cr.	265.67	214.64
5	Desired selling price @12%	Rs/CM	14.17	14.45
6	Desired selling price @12%	$/MMBTU	5.73	5.85

N.B. – For calculation @ 85% capacity utilization, operating cost is assumed as 100% variable component

Disclaimer: The calculations are based on existing practices & norms and actual at the time of implementation of the project may be highly varied.

MDO Option (Plan 2)

PROSPECT OF CBM IN RANIGANJ COALFIELD

- A large number of the mines in Raniganj coalfield are Degree-II & degree-III types.
- About sixty one (61) mines are declared abandon ,of which thirty one (31) mines have been observed to have CBM potentiality.
- An assessment of GIP (Gas-in-place) has been done by us as shown in the table .
- As mining is difficult ,so it will be logical to extract CBM from the virgin seams.
- There is CBM gas potentiality in Raniganj North sector (part-B) the zone where JV exists between ONGC & CIL.
- Some of the running mines of Raniganj coalfield also have CBM potential where pre-drainage can be considered.
- Jagannathpur-A & B need to be studied for CBM prospect as they are adjacent to Raniganj East sector of ESSAR .

WORKING MINES GAS-IN-PLACE DATA

Abandoned Mines total Gas-in –Place: **4545.84 million cubic metres**
Working Mines total Gas-in-Place: **12404.56 million cubic metres**

Grand Total of CBM-in-Place in Raniganj Coalfield under ECL leasehold area- **16950.40 million cubic metres**

HIGHLIGHTS

- Applied for lease below Damodar : The work is under process
- EC from NEERI
- Draft NIT is in process by CMPDI


Thank You!