

PRE-FEASIBILITY REPORT OF KOTRE BASANTPUR PACHMO OCP (5.0 MTY)

Kotre Basantpur Pachmo Opencast Project of Central Coalfields Limited is located in northern part of West Bokaro Coalfield (WBCF). It consists of two geological blocks both located in Jharkhand. The first block, Kotre-Basantpur falls in Ramgarh district. The other block Pachmo falls in Bokaro district. It is a coking coal project. The blocks are virgin at present.

1.1 PROJECT REPORT FOR KOTRE BASANTPUR PACHMO OCP

The “Project Report of Kotre-Basantpur Pachmo OCP, CCL (5.0MTY)” has been prepared based on the “Geological Report on Basantpur-Kotre Block” prepared by CMPDI in Feb 1997, “Geological Report on Pachmo Block” prepared by CMPDI in Sept 1998. This report envisages mining of seams up to Seam-II through Opencast method.

The normative and peak production of the project is 5.0MTY of Washery-IV grade coal. The present report envisages two Variants. The capital is given in Appendix-A of respective Variants. The broad details of the various variants proposed in the PR are as follows:

Variant-I

In Variant-I, coal production and OB removal has been envisaged to be done departmentally. Crushed and sized coal (-100mm) will be dispatched to nearby washery. Crushing of coal till 12 years will be done at Pit top and later coal will be brought to surface by High Angle Conveyor (HACs) after in-pit crushing. The variant proposes departmental coal crushing and conveying.

Variant-II

In Variant-II, coal production, OB removal has been envisaged to be outsourced. The coal crushing & conveying (including application of HACs), pumping, workshop and security are also proposed to be outsourced.

During the initial years, the ROM coal from the OCP will be sent to Kedla Washery situated at a distance of about 600m from the proposed storage bunker. In later years, the excess coal will be sent to upcoming Tapin Washery.

As suggested by CCL during the discussion of Draft PR, for evacuation of washed coal from Kedla Washery, provision for 10.25 km long railway siding from Kedla Washery to Dania Railway station (in the East Central Zone of Indian Railways) has been made.

1.2 LOCATION AND APPROACH

Kotre-Basantpur block and Pachmo block is located in the northern part of West Bokaro Coalfield. **Kotre-Basantpur** block, having an area of 3.75 sq km, is under the command area of Hazaribagh Area of Central Coalfields Limited in Ramgarh District, Jharkhand. The block is bounded by latitudes 23°48'30" and 23°49'24" North and longitudes 85°34'18" and 85°36'05" East. **Pachmo** block, having an area of 2.70 sq km, lies in Bokaro District of Jharkhand and is bounded by latitudes 23°48'06" and 23°48'58" North and longitudes 85°36'28" and 85°37'57" East. Both the blocks are covered in Survey of India toposheet no. 73E/9 (in 1:50000 scale).

Kotre-Basantpur block is connected to NH 33 between Ranchi and Hazaribagh by an all-weather metaled road leading from Charhi to Kedla washery. This road terminates in the south-western corner of the block near Kedla washery. The block is also connected by few kutcha seasonal roads. However, an all-weather road connection to the interior of the block does not exist.

Pachmo block lies adjacent to Kotre-Basantpur block in the east. Their common boundary falls in Pachmo nala. The block is approachable by a 2 km long dry weather kutcha road from Loiyo-Charhi metaled road near Ichakdih village. This road crosses Chutua Nala immediately east of Ichakdih village. The block is also connected by a few kutcha seasonal roads. The office of the General Manager, Hazaribagh Area of CCL at Charhi, is located at a distance of about 15km from the south west corner of Kotre-Basantpur block.

The Dania Railway station is about 4 kms from the eastern boundary of the block. It is located near the foothill of the Lugu hill in the North- Eastern part of the West Bokaro Coalfields on Gomoh Barkakana loop line of the East Central Zone of Indian Railways.

The block is about 40km from Hazaribagh & about 95km from Ranchi via Charhi. The nearest commercial airport is situated at Ranchi.

1.3 PHYSIOGRAPHY AND CLIMATE

The climate is tropical with severe summer. The temperature during summer (March to June) goes as high as 45°C. The summer days are hot with dusty winds but nights are generally pleasant. The minimum summer temperature is around 20°C. The winters (November to February) are cold and the minimum temperature recorded is 4°C.

The rainy season is generally from June to October. The total rainfall in a year on an average is about 1200 mm of which about 80% of the precipitation is during rainy season.

The Kotre-Basantpur and Pachmo blocks lie between Hazaribagh plateau in the north and Damodar valley in the south. The Lugu hill (peak 976m), is only 10km to the east. The topography of

the area is more or less flat with gentle undulations which at times is dissected by ravines and gullies at places. There are numerous seasonal nalas emerging from the high range (Hazaribagh plateau) which flow mostly towards south and forms prominent nalas and meet the major nalas of the block.

The area to the north of blocks are marked by metamorphics. The ground elevation varies from 305m (in the south) to 365m (in the north). The general elevation varies from 330 to 350m in the area and the general slope of the ground is towards south.

Chutua nala, a prominent tributary to Bokaro River, flows roughly west to east near the southern boundary. North to south flowing Pachmo nala, Kotre nala and Jhumra nala joins Chutua nala in the area. To the east of Pachmo nala, another prominent nala, Baghraiya nala flows from north to south. It meets Baghlata nala in the south east of the area which finally joins Bokaro River. The Chutua nala is more or less perennial in nature for a major part of the year except for hot summer days. Rest nalas of the block become dry during summer season but they experience flash floods during rainy season. Drainage of the block is mainly controlled by Chutua nala and to some extent by Baghlata nala. Both of these nala ultimately discharges the total run-off to Bokaro River in the east.

1.4 PRESENT STATUS OF MINE

Coal mining activity has not yet started in these blocks. Mining activity in the adjoining blocks Kedla and Jharkhand in the south is undergoing. The block is covered by different land types viz., forest, tenancy, GMK, GMA and JJ.

1.5 EMP CLEARANCE

EMP for Kotre Basantpur Pachmo OCP (5.0 MTY), CCL needs to be prepared.

1.6 REHABILITATION & RESETTLEMENT

About 1000 PAFs (based on Census-2011) would be required to be rehabilitated from 8 (eight) villages namely, Basantpur, Kotre, Pachanda, Pachmo, Hurdag, Rahawan, Baghraiya and Purnapani falling within the leasehold area of the OCP.

1.7 DIFFICULTIES AND CONSTRAINTS IN MINING WITH ASSOCIATED RISK

- i) Kotre Basantpur Pachmo OCP is a virgin mine. The block is covered by forest and non-forest land. The area north of the block is marked by metamorphic, whereas, that in the west by Barren Measures. The topography of the area is more or less gently undulating and a number of seasonal nalas (Kotre, Jhumra, Pachmo, Baghraiya along with other streams) emerge from

the high range (Hazaribagh plateau) which flow towards south through the mining area and meets west to east flowing Chutua nala and Baghlata nala. Flow of water from the nalas, into the mining area needs to be arrested by constructing and maintaining garland drains along the quarry periphery. In addition to these, four nallas (Kotre, Jhumra, Pachmo & Baghraiya) needs to be diverted away from the mining area as and when the mine approaches them. Financial provision for a total length of 11.7 km nala diversion has been made in the Project Report. The scheme for nala diversion prepared for TATA STEEL is under revision at CMPDI.

- ii) The projectised area is structurally complicated having a total of 11 major faults (throw varying from 0-300m). The gradient of the strata is quite steep. It varies from 8deg to 25deg. However in major part it is 8deg to 15deg.
- iii) A huge quantity of OB will be generated during mining. With steep gradient of the strata, concurrent internal dumping will be restricted. A large area for external OB dump will be required. The OB has been proposed to be dumped in the metamorphic, to the north of Kotre Basantpur block. The topography of the area available for OB dump is hilly (RL gradually increases from 360m in the northern quarry boundary to 410m further north) thereby restricting OB accommodation.
- iv) Steep gradient of the quarry restricts internal OB dumping quantities and thus increases external OB dump requirement. To overcome this difficulty it is proposed that the benches are formed along dip and concurrent backfilling may be started as soon as a portion of the mine reaches its dip side boundary limit. However when benches are formed along rise to dip, partial outsourcing may not be possible as the same bench will encounter both coal and OB and it will not be possible to demarcate area for either coal outsourcing or OB outsourcing.
- v) Embankment along the Chutua nala for a stretch of about 2 km is proposed as a safety measure.

2.0 BRIEF GEOLOGY

The Basantpur-Kotre and Pachmo blocks are situated on the northern limb of the prominent northern syncline of the West Bokaro Coalfield. The axial region of the synclinal structure roughly passes in East-West direction.

The Gondwana column available in the Pachmo and Kotre-Basantpur block is represented by rocks of Barakar, barren measure and Karharbari formation. Coal seams are occurring in Barakar and Karharbari formations. Barren Measures are absent in Pachmo block unlike Basantpur-Kotre Block while Barakar, Karharbari are found in both the blocks. The Barakars are well developed and contains the potential coal seams designated as I to XIII. Beside this there are a number of thin coaly horizons

which attain workable thickness in certain parts and have been named as A, B, C of the main seams like VIIA, VIIB, VIIC, VIIIA, VIIIB, VIIIC, etc. The Karharbari contains only one coal seam called 'O' seam. The sequence of coal seams and their intervening parting are established from GSI, NCDC and CMPDI boreholes.

The Basantpur-Kotre and Pachmo Block combined having an area of 6.45 sq. km. A total of 35054.23 m of drilling in 172 boreholes has been done in the block by NCDC (NCWBK series), GSI (WBKB Series) and CMPDI (CMK, CMB, CML & CMPM Series). The overall borehole density is 20.31 boreholes per sq. km.

2.1 Deposit Structure

The strike of the formation in Kotre-Basantpur block is broadly E-W with southerly dip of about 8-18° (1 in 3 to 1 in 7) in major part of the property. However, the dip near the southern part of the block is northerly.

In the eastern part of Kotre-Basantpur falls Pachmo block. This block exhibits gentle warp having almost E-W strike in the north-west. Towards the center the strike swings to a NW-SE trend which finally once again swing to an E-W trend in the eastern corner of the block beyond Baghraiya nala. The dip in Pachmo Block generally ranges from 8° to 25° (1 in 2 to 1 in 7). However the dip in major part of the block varies from 10° to 15° (1 in 4 to 1 in 6).

Kotre-Basantpur block is characterized by moderate structure. Kotre-Basantpur has 9 faults with throw varying from 5m-150m. Out of these faults F1_c, F2 and F14 are major faults. The Pachmo block on the other hand is characterized by a fairly simple structure with only 7 faults of throw varying from 5m to 300m. Out of these faults 4 faults (F1, F3, F6 & F7) are seen to continue into the Pachmo Block from the adjoining Kotre-Basantpur block.

2.2 Coal Seam

Sequence of coal seams and their intervening parting as established from the borehole records of GSI, NCDC and CMPDI is given below:

Table: The sequence of coal seams and partings

Coal seams/ Parting	Thickness Range (m.)		Borehole Intersection	Reserve (MT)	
	Min.	Max.		Proved	Indicated
XIII	1.29	4.54	6	1.201	0.000
Parting	4.15	31.2		0.000	0.000
XII	0.82	2.86	9	1.752	0.000
Parting	2.6	21.94		0.000	0.000

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Coal seams/ Parting	Thickness Range (m.)		Borehole Intersection	Reserve (MT)	
	Min.	Max.		Proved	Indicated
XIA	0.15	2.1	11	0.000	0.000
Parting	2.8	34.84		0.000	0.000
XI	2.48	4.52	15	4.669	0.000
Parting	2.8	37.16		0.000	0.000
XA	0.3	1.28	14	0.000	0.000
Parting	12.05	28.78		0.000	0.000
X	0.45	6.63	22	9.293	0.000
Parting	2.4	14.48		0.000	0.000
IXA	0.1	1.17	17	0.000	0.000
Parting	2.93	23.65		0.000	0.000
IX	0.13	2.88	27	4.232	0.000
Parting	4.8	25.66		0.000	0.000
VIIIC	0.26	2.14	32	0.365	0.000
Parting	9.85	32.82		0.000	0.000
VIIIB	0.12	1.85	38	1.161	0.000
Parting	3.27	17.21		0.000	0.000
VIIIA	0.15	3.5	43	0.644	0.000
Parting	4.32	28.89		0.000	0.000
VIII	0.59	4.65	47	9.378	0.000
Parting	2.2	31.47		0.000	0.000
VIIC	0.13	1.91	43	0.000	0.000
Parting	3.38	37.82		0.000	0.000
VIIB	0.15	3.33	27	0.000	0.000
Parting	9.35	32.49		0.000	0.000
VIIA	0.2	2	32	0.000	0.000
Parting	0.58	6.65		0.000	0.000
VII/VI COMB.	3.05	9.66	55	30.626	0.000
VII/VI/VA COMB.	5.74	13.37	10	7.062	0.000
Parting	1.04	4.38		0.000	0.000
VA	1.12	7.4	56	23.111	0.000
Parting	5.49	46.51		0.000	0.000
V	2.19	9.65	69	36.780	0.000
Parting	4.97	24.91		0.000	0.000
IV	0.25	8.39	73	34.035	0.000
Parting	10.2	22.12		0.000	0.000
IIIA	0.15	1.4	9	0.000	0.000
Parting	5.26	11.88		0.000	0.000

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Coal seams/ Parting	Thickness Range (m.)		Borehole Intersection	Reserve (MT)	
	Min.	Max.		Proved	Indicated
III	0.09	8.17	70	17.640	8.208
Parting	11.9	30.9		0.000	0.000
IIA	0.1	4.8	24	5.806	0.809
II	0.26	12.45	35	15.546	6.477
Parting	4.45	8.75		0.000	0.000
II TOP	0.71	7.63	18	4.136	1.824
Parting	0.43	5.17		0.000	0.000
II BOT	0.97	5.2	16	4.657	2.524
II(T+B)	1.07	6.41	7	0.000	0.000
Parting	11.8	43.63		0.000	0.000
I	0.15	6.57	44	5.294	4.163
Parting	20.7	104.01		0.000	0.000
LOCAL	0.1	3.78	28	4.691	4.307
Parting	40.27	56.34		0.000	0.000
SEAM 'O'	0.4	3.65	14	0.000	0.000
TOTAL				222.079	28.312

2.3 QUALITY:

Details of quality parameters of seams in Kotre-Basantpur Pachmo combined Block is given below:

Proximate Analysis and Coking Propensity of seams

Coal Seams	Type of Analysis	Proximate Analysis			UVM%	CV	C.I.	C.T.	S.I.	Grade
		M%	Ash%	VM%						
XIII	Ex-Band	1.0-2.0	20.7-31.7	24	32.3	5460	-	E	2	WI-WIV
	In-band	1.3-1.7	29.0-37.4	22.9	29.9	-	-	-	-	WIV-UG
XII	Ex-Band	1.1-1.7	22.8-28.0	24.3-25.1	30.0-31.2	5760	-	G	-	WII-WIII
	BCS	1.0-1.3	24.2-43.2	20.3-24.8	28.4-31.2	-	-	-	-	WIII-UG
XIA	Ex-Band	1.1-1.6	20.8-26.8	24.6-24.7	29.7-31.8	5310	-	F/G	3-3 ½	WI-WIII
	BCS	1.2-1.5	40.8-48.8	-	-	-	-	-	-	F-G
	INBAND	1.0-1.6	26.8-48.8	20.0-24.6	26.8-31.8	-	-	-	-	WIII-WIV
XI	Ex-Band	0.9-2.3	21.0-26.8	23.0-23.8	28.4-32.4	-	14-18	D-G	1-3	WI-WIV
	BCS	1.5-1.9	29.9-33.4	21.6-21.7	-	-	-	-	-	WIV
	INBAND	0.9-1.9	27.9-38.9	20.6-22.8	28.0-29.2	-	-	-	-	WIII-UG
XA	Ex-Band	1.0-1.4	23.9-48.6	-	-	-	-	-	-	WII-UG
	Inband	1.0-1.3	27.2-51.2	-	-	-	-	-	-	WIII-UG
X	Ex-band	0.07-1.9	19.2-28.2	22.6-24.5	27.7-31.0	5950	16	E/F-G	1 ½ -3 ½	WI-WIV
	BCS	1.2	24.3-29.4	22.7	-	-	-	-	-	WIII

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Coal Seams	Type of Analysis	Proximate Analysis			UVM%	CV	C.I.	C.T.	S.I.	Grade
		M%	Ash%	VM%						
	Inband	1.2-2.0	20.8-46.2	22.0-24.1	29.0	-	-	-	-	WI-UG
IXA	Ex-band	0.7-1.4	16.7-23.6	22.3-25.0	27.2-29.6	-	-	E/F	-	SGII-WGII
	BCS	-	25.9	-	-	-	-	-	-	WGIII
	Inband	0.6-1.1	25.9-27.5	20.0	25.1	-	-	-	-	WIII
IX	Ex-band	1.0-1.7	18.2-30.2	22.7-24.1	27.5-30.1	6170 (8545)	20	F-G	2-4	WI-WIV
	BCS	1.0	29.3-38.1	22.4	-	-	-	-	-	WIV-UG
	Inband	0.9-1.6	22.1-47.4	17.7-24.1	23.6-29.7	-	-	-	-	WII-UG
VIIC	Ex-band	1.2-1.6	19.2-30.8	22.0-25.2	26.8-30.1	-	26	G-G3	2-5 ½	WI-WIV
	BCS	1.0-1.2	28.5-48.1	17.1	-	-	-	-	-	WII-UG
	INBAND	1.0-1.8	29.6-48.1	17.1-21.0	-	-	-	-	-	WIV-UG
VIIB	Ex-band	1.2-1.8	20.6-32.3	21.7-25.6	26.2-31.7	5830- 6075 (8580- 8685)	22	F/G	1 ½-3 ½	WI-WIV
	BCS	-	20.6-34.6	-	-	-	-	-	-	WI-WIV
	Inband	0.7-1.8	23.8-34.6	19.7-23.2	26.8-29.2	-	-	-	-	WII-WIV
VIIIA	Ex-band	0.9-1.8	21.2-33.5	19.0-23.9	26.1-29.1	6110 (8605)	23	F/G	1 ½-3 ½	WII-WIV
	BCS	1.0-1.2	26.0	43.9	-	-	-	-	-	WIII-UG
	INBAND	0.7-1.4	25.5-49.2	14.1-21.9	27.5-29.1	-	-	-	-	WIII-UG
VIII	Ex-band	0.5-1.7	19.7-29.3	20.7-25.3	24.9-32.7	6080- 6285 (8575- 8670)	20	F-G	1 ½-3	WI-WIV
	BCS	0.8-1.2	19.7-38.6	16.9-24.9	24.0-31.4	-	21	-	-	WI-UG
	INBAND	0.5-1.3	27.8-36.6	27.5	-	-	-	-	-	WIII-UG
VIIC	Ex-band	0.7-1.5	20.6-32.8	19.5-25.7	25.8-32.3	5095 (8730)	-	F/G	3 ½	C-F
	BCS	-	30.8-39.5	-	-	-	-	-	-	D-E
	INBAND	0.9-1.5	22.1-42.2	18.9-23.8	25.8-30.3	-	-	-	-	D-UG
VIIB	Ex-band	0.9-1.0	21.5-29.3	20.6-23.7	26.4-30.2	-	-	F	-	WII-WIV
	BCS	1.0	36.3-36.9	-	-	-	-	-	-	E-F
	INBAND	0.7-1.5	26.1-42.1	17.6-23.0	25.3-30.9	-	-	-	-	WIII-UG
VIIA	Ex-band	0.8-1.3	21.0-33.4	18.8-22.9	24.9-27.4	-	26	G-G2	2-6	WI-WIV
	BCS	1.1	25.4-27.4	21.3	-	-	-	-	-	WIII
	Inband	1.0-1.1	25.4-27.4	21.3	-	-	-	-	-	WIII
VI/VII COMB	Ex-band	0.5-1.3	14.8-24.9	20.5-26.9	24.6-31.9	6520- 6670 (8605)	-	D-G/G1	2-3	SI-WIII
	BCS	0.4-1.0	17.8-25.0	22.4-24.0	-	-	-	-	-	SII-WIII
	Inband	0.5-1.2	18.4-34.1	20.1-25.7	24.8-32.0	-	-	-	-	WI-WIV

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		M%	Ash%	VM%						
VA/VI/V II COMB	Ex-band	0.4-1.4	18.6-33.4	18.8-26.3	23.6-31.6	6270-6455 (8730)	20/24	F/G1	2-3 ½	WI-WIV
	BCS	0.6	20.2-34.1	21.4	-	-	-	-	-	WI-WIV
	Inband	0.5-1.4	23.4-41.1	16.5-22.0	22.9	-	-	-	-	WIII-UG
VA	Ex-band	0.4-1.4	17.6-30.1	21.2-24.9	25.3-31.5	5660-6270	-	F-G1	3-5	SII-WIV
	BCS	0.4-0.8	22.6-30.0	20.8-24.2	-	-	-	-	-	WII-WIV
	Inband	0.4-1.2	17.8-35.2	20.5-24.2	25.2-32.3	-	-	-	-	SII-UG
V	Ex-band	0.4-1.3	18.5-31.6	18.4-24.1	22.3-31.1	5870-6200 (8650-8730)	16-23	E-G1	1-3 ½	WI-WIV
	BCS	0.4-1.3	23.6-34.8	18.0-23.2	-	-	-	-	-	WI-UG
	Inband	0.4-1.3	18.5-47.7	17.8-23.2	22.9-27.1	-	-	-	-	WI-UG
IV	Ex-band	0.4-1.3	20.7-31.7	17.6-31.2	21.4-39.4	4590-6320 (8130-8725)	19-23	E-G1	1-3	WI-WIV
	BCS	0.4-1.3	24.0-35.2	17.2-22.2	-	-	-	-	-	WII-UG
	Inband	0.4-1.3	24.0-47.7	16.5-22.2	21.1-28.4	-	-	-	-	WIII-UG
III	Ex-band	0.4-1.2	20.3-34.6	17.8-24.6	21.3-33.6	6015 (8715)	18/20	F-G	1 ½ -2 ½	WII-WIV
	BCS	0.4-1.0	24.7-37.6	17.2-21.3	-	-	-	-	-	WIII-UG
	Inband	0.4-1.3	24.4-45.2	15.8-24.4	21.6-33.8	-	-	-	-	WIII-UG
IIA	Ex-band	0.4-1.2	21.3-35.0	15.7-22.3	21.9-27.9	6045-6450 (8670-8690)	25	F-G3	2-4 ½	B-E
	BCS	0.4-1.2	31.8-45.7	15.7-18.1	-	-	-	-	-	E-F
	Inband	0.4-1.2	31.8-47.3	15.7-19.0	-	-	-	-	-	E-G
II	Ex-band	0.5-1.0	14.0-31.7	17.3-25.4	19.2-31.7	-	18	-	-	SI-WIV
	Inband	0.6-1.0	17.3-48.5	15.8-21.7	21.3-33.7	-	-	-	-	SII-UG
II TOP	Ex-band	0.4-1.3	23.5-30.2	17.6-21.4	21.5-26.9	5570	-	F	2	B-D
	BCS	0.4-1.0	23.4-38.8	15.8-20.6	-	-	-	-	-	D-E
	Inband	0.4-1.2	23.4-39.8	15.8-20.6	-	-	-	-	-	D-E
II BOT	Ex-band	0.5-1.3	22.3-33.4	17.6-21.5	21.0-26.3	4090	-	-	-	B-D
	BCS	0.6-1.0	31.2-45.0	14.9-16.1	-	-	-	-	-	D-F
	Inband	0.4-1.2	31.2-46.6	14.9-18.9	-	-	-	-	-	D-G
II COMB	Ex-band	0.9-1.0	24.2-28.5	17.8	22.0	-	19	F/G	1 ½ -6	C-D
	BCS	-	29.2-46.6	-	-	-	-	-	-	D-G
	Inband	0.8-1.0	29.2-43.3	17.1	-	-	-	-	-	D-F
I	Ex-band	0.4-0.9	20.2-32.7	16.7-19.2	19.5-22.8	-	14	E/F	1 ½	B-D
	BCS	0.5-0.8	41.2-48.8	13.1-15.8	-	-	-	-	-	F-G

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Coal Seams	Type of Analysis	Proximate Analysis			UVM%	CV	C.I.	C.T.	S.I.	Grade
		M%	Ash%	VM%						
	Inband	0.5-1.1	41.2-52.8	13.1-15.8	-	-	-	-	-	F-UG
LOCAL BELOW SEAM I	Ex-band	0.6-1.4	18.6-26.5	16.0-26.5	18.1-32.3	-	14	F	1	WI-WIII
	Inband	0.6-1.4	19.3-37.6	16.0-26.5	18.1-32.3	-	-	-	-	WI-UG
SEAM 'O'	Ex-band	0.4-0.9	18.8-28.8	15.7-19.0	17.9-22.8	-	-	F	-	WI-WIII
	BCS	0.4-1.0	25.6-30.0	15.6-18.9	-	-	-	-	-	WIII-UG
	Inband	0.4-0.9	25.6-30.0	15.6-18.9	-	-	-	-	-	WIII-UG

Seams IIA, II TOP, II BOT & I occurring in Pachmo block have been indicated to fall in non-coking coal category owing to high ash content but on careful scrutiny of quality data they appear to fall as coking coal. This is justified by following points.

1. C.V. on dmmf basis which gets a range of 8700-8800
2. C.I. having a range from 18-22
3. C.T. of range F/G.

LTGK (C.T.) determines the coking propensity of coal. This test is a more reliable indication of coking property.

2.3.1 PROJECTED COAL QUALITY

The weighted average grade of the coal is 'W-IV' (Washery Grade-IV) with weighted average Ash of 31.71%.

3.0 MINING, DUMPING AND MINE SCHEDULE

Kotre-Basantpur and Pachmo blocks are adjacent to each other and the boundary between the blocks is along the southerly flowing Pachmo nala, which is a tributary of Chutua nala. The coal seams occurring in the Kotre-Basantpur and Pachmo blocks are contiguous to each other and same set of coal seams occur in both the blocks as seam-I to XI in ascending order. Additionally, seam XII & XIII occur only in Kotre-Basantpur block. The blocks are found suitable for exploitation by opencast mining method upto seam II as the base of quarry. Hence both the blocks are proposed to be exploited by a single quarry. The seams below seam II are not suitable for exploitation by opencast mining.

The method of mining adopted to extract coal and OB in Kotre Basantpur Pachmo OCP will be shovel-dumper combination of mining systems. This method has been proposed considering the following geo-mining conditions of the Kotre Basantpur Pachmo OCP viz.

- (i) Gradient of seam floor, viz., 8° - 18° in Kotre-Basantpur & 8° - 25° in Pachmo block

- (ii) Multiple seams with variable thickness and
- (iii) Smooth, flexible and easy operation

3.1 PIT FORMULATION STRATEGY

The pit formulation strategy adopted is typically suitable for maximising extraction of the coal reserve keeping in view of economics, important surface features and safety of the mine workings. The safety of the mine working will become important as the quarry attains maximum depth of about 285m. The starting of the quarry has been proposed from the incrop of seam-II near fault F4 (Borehole CMB-19 & CMB-20) in the western side of Basantpur- Kotre side and it will gradually advance to dip side in the initial 11-12 years. Thereafter, it will move laterally along strike in the eastward direction i.e., towards Pachmo side. Coal from the seams will be transported through the flank roads to surface for the first 10-11 years. Once the quarry reaches its southernmost extent and attains maximum depth of about 285m, the coal will be brought to two distinct levels within the quarry for in-pit crushing and subsequent conveying to surface by High Angle Conveyors. This will allow complete dumping in the quarry void as the need for keeping the southern flank roads will be eliminated. Henceforth, further need for external OB dumping space will not be required.

3.2 QUARRY BOUNDARY

The boundaries of the proposed quarry as shown in the Final Stage Quarry Plan have been fixed in the following manner.

East: The extent of eastern surface of the quarry has been fixed by keeping a minimum of 7.5m barrier from the eastern block boundary of Pachmo block as a barrier against adjoining Lalgahr Block.

West: The western floor boundary has been fixed along the incrop of Seam-II.

North: The northern floor boundary has been fixed along the fault F1

South: In the south-western side, the surface boundary has been kept at the surface trace of fault F2 (near the Kotre-Basantpur block southern boundary). In the south-eastern side, the southern boundary has been kept along the surface trace of Fault F3, which also forms the southern block boundary of the Pachmo block. In the south-central part, the surface boundary has been fixed after keeping a barrier of minimum 40m against Chutua nala and a minimum of 80m from the tentative alignment of the railway siding proposed by CCL to transport coal from Kedla Washery to Dania railway

station. The said alignment is being suggested here for early finalization of the Project Report which is subject to change after actual survey by Railway Authorities.

However, necessary straightening of boundary has been made for convenience of mining.

An embankment along the Chutua nala is proposed to safeguard against inrush of water into the mine. The embankment should be at least 3.0m above the HFL of Chutua nala. The embankment should be designed, constructed and maintained as per the Indian Standard

3.3 MINEABLE RESERVE

The cumulative mineable reserve is estimated to be as 153.63 MT with corresponding volume of O.B estimated as 734.53 Mm³ with an average stripping ratio of 4.78 cum/t.

10% of Geological loss and 5% of Mining loss has been considered to arrive at the mineable reserve of the project. The seams having less than 1m thickness has been excluded for the calculation of the mineable reserve.

Seam wise details of Geological vis-à-vis Mineable Reserves

S N	Seam Name	Avg Thickness considered (m)	Thickness range (m)	Geological Reserve (MT)	Mineable Reserve (MT)
1	XIII	2.00	(1.29 - 4.54)	1.201	0.59
2	XII	2.00	(1.10 - 2.86)	1.752	0.80
3	XI	3.50	(2.48 - 5.20)	4.669	2.91
4	X	4.00	(1.00 - 6.63)	9.293	5.92
5	IX	2.00	(1.00 - 2.88)	4.232	3.13
6	VIII C	1.10	(1.00 - 1.40)	0.365	0.36
7	VIII B	1.20	(1.00 - 1.50)	1.161	0.80
8	VIII A	1.20	(1.00 - 1.60)	0.644	0.63
9	VIII	2.00	(1.30 - 3.45)	9.378	6.44
10	VI/VII	7.00	(4.80 - 9.66)	34.722	27.17
11	VA	4.50	(1.72 - 7.40)	26.077	17.46
12	V	5.00	(1.19 - 9.65)	36.780	22.92
13	IV	5.00	(1.00 - 7.40)	34.035	20.64
14	III	3.50	(1.00 - 8.17)	25.848	16.22
15	IIA	2.50	(1.00 - 4.80)	6.615	3.75
16	II Top	3.00	(1.00 - 7.63)	5.960	3.54
17	II Bot	3.00	(1.00 - 6.41)	7.181	4.55
18	II	6.00	(1.00 - 12.45)	22.023	15.80
19	I	-	(0.15 – 6.57)	9.457	-
20	Local	-	(0.10 – 3.78)	8.998	-

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S N	Seam Name	Avg Thickness considered (m)	Thickness range (m)	Geological Reserve (MT)	Mineable Reserve (MT)
	TOTAL			250.398	153.63

Reserve Balance:

The account of mineable reserve vis-à-vis geological reserve is given in the table below:

S N	Particulars	Coal (MT)
Kotre Basantpur Block		
1	Net Geological reserve	148.40
2	Net Geological reserve lost due to Chutua Nala	17.43
3	Net geological reserves in Seam Local, below OC mine floor (not opencastable)	9.00
4	Net Geological reserve available (1-2-3)	121.97
Pachmo Block		
5	Net Geological reserve	101.99
6	Net Geological reserve lost due to barrier from eastern block boundary	0.50
7	Net geological reserves in Seam I, below OC mine floor (not opencastable)	9.46
8	Net geological reserves near BH CMB-72, below OC mine floor (seams IV, III & II not opencastable due to fault)	0.73
9	Net Geological reserve available (5-6-7-8)	91.31
10	Net Geological reserves including batter (4+9)	213.28
11	Net Geological reserve lost in batter	51.56
12	Net Geological reserve available in quarry (9-10)	161.71
13	Net Mineable reserve available in quarry	153.63

3.3.1 SECTORWISE MINEABLE RESERVES

The calendar programme has been drawn by dividing the whole mining block into different sectors. The sector wise mineable reserves have been given in the following table.

Sector wise and Seam wise details of Mineable Reserves (MT)

Coal (MT)	Sectors												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Seam XIII				0.23	0.28	0.06	0.01						0.59
Seam XII				0.54	0.19	0.05	0.02						0.80
Seam XI		0.00	0.01	1.27	0.56	0.88	0.16	0.02					2.91
Seam X		0.00	0.00	1.86	1.43	1.75	0.69	0.13	0.05	0.00			5.92

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Seam IX		0.00	0.00	1.49	0.46	0.71	0.38	0.03	0.03	0.01	0.01	0.02	3.13
Seam VIII C						0.18	0.15	0.01	0.01	0.00	0.00	0.01	0.36
Seam VIII B						0.24	0.46	0.07	0.01	0.00	0.00	0.01	0.80
Seam VIII A						0.24	0.35	0.03	0.01	0.00	0.00	0.01	0.63
Seam VIII		0.00	0.11	2.47	0.75	0.82	1.60	0.56	0.08	0.01		0.03	6.44
Seam VI/VII		0.33	2.11	10.74	2.76	1.98	5.09	2.86	0.56	0.22	0.12	0.40	27.17
Seam VA		0.28	1.33	5.61	1.68	1.73	3.56	2.21	0.46	0.17	0.08	0.35	17.46
Seam V		0.51	1.20	7.42	2.38	2.46	3.33	3.68	1.43	0.27	0.08	0.14	22.92
Seam IV		0.70	1.01	5.78	2.04	1.78	2.05	3.62	2.74	0.41	0.08	0.42	20.64
Seam III	0.04	0.83	0.68	3.94	1.88	1.01	1.01	2.19	3.53	0.47	0.09	0.56	16.22
Seam II A						0.14	0.23	0.44	1.84	0.78	0.16	0.15	3.75
Seam II TOP							0.81	0.45	0.78	0.82	0.37	0.30	3.54
Seam II BOT							1.09	0.53	0.94	1.15	0.52	0.32	4.55
Seam II	0.42	2.45	1.72	5.06	4.53	1.62							15.80
Total	0.46	5.11	8.18	46.41	18.93	15.63	21.02	16.85	12.47	4.33	1.52	2.71	153.63

3.4 MINE PARAMETERS

Final Stage Mine Parameters

Parameters	Unit	Minimum	Maximum
Dimensions of the quarry along strike (on floor)	m	800	5500
Depth of quarry	m	10	285
Dip rise length (on floor)	m	500	1200
Final Quarry Floor area	km ²	3.993	
Final Quarry Surface area	km ²	6.485	
Mineable reserves	(Mte)	153.63	
Total OB	(Mcum)	734.53	
Average Stripping Ratio	(cum/t)	4.78	
Mine Capacity (Maximum)	(MTY)	5.0	

3.5 TARGET OUTPUT AND QUARRY LIFE

The OCP has been planned for nominal capacity/peak capacity of 5.0 MTY. The peak production will be achieved in 4th year of quarry operation (7th year of mine life).

3.5.1 Quarry Life

The total life of the project is 36 years. The break-up is as under:

- Construction period: 3 years
- Production build-up period: 3 years
- Production period with peak capacity: 29 years
- Tapering period: 1 year
- Total period: 36 years.

3.6 MINING STRATEGY

First three years mine operation will be dedicated to the land acquisition and construction purposes. All the activities related to mine development would be carried out in this period.

Total sixteen numbers of seams from Seam XIII to II are occurring in the proposed area with gradient varying from 8° to 25°. Seam II has split into II Top and II Bottom in the eastern part of the quarry (in Pachmo Block). The gradient of the coal seams in the considered proposal is 8deg to 18deg with little scope of concurrent backfilling. This would result in requirement of huge external dump area if coal and OB benches are formed along strike. The area surrounding the proposed opencast are as follows:

- i) coal bearing in the south with presence of a major nala (Chutua nala),
- ii) non-CIL coal blocks in the east (Lalgarh North and South blocks),
- iii) Kedla Washery and upcoming Tapin Washery in the west,
- iv) Although the area to the north of the quarry is marked by metamorphic but it has hilly terrain due to Jhumra pahar in the east.

So the only non-coal bearing area available is in the northern part of the quarry which is mostly covered by forest land. Even this area will be insufficient to accommodate the external OB dump requirement of the quarry, if coal and OB benches are formed along strike.

To overcome this difficulty it is proposed that the benches are formed along dip and concurrent backfilling may be started as soon as a portion of the mine reaches its dip side boundary limit. This may facilitate minimum external dumping. The overburden of the initial period is bound to be dumped

externally. Initial dumping of OB is being proposed to be done in north-west of the quarry in the metamorphic (mostly forest land) which is adjacent to the top edge of the proposed quarry. Subsequently OB will be dumped in the further north of the OCP.

Mining operation will start from 4th year from the incrop of Seam-II on the western side of the quarry near CMB-19 and CMB-20. It will touch the floor of Seam-II at two different RL of 360 m and 340 m due to presence of Fault F4 (southerly throw of 30m). During initial years of mine operation, benches will be formed along dip and also along strike. Benches along strike is proposed to be used to extend the portion of the mine along dip to reach ultimate dip side boundary to facilitate internal dumping at the earliest. The benches along dip would be used for future production of the mine with concurrent backfilling.

The quarry will gradually advance in rise to dip from north to south direction. The quarry is proposed to reach its dip most side (southern side) in the initial 12 years of mining operation. By the end of 12 years (excluding construction period), the quarry will attain its maximum depth of about 285m. Thereafter, it will move laterally along strike and will go towards Pachmo side (in the east).

Once the quarry floor crosses the fault F5 (trending NW-SE, having south-westerly throw of 30-50m), huge internal dumping space will be created as this fault may act as the toe of the internal OB dump in the quarry floor.

The quarry will be able to achieve its rated production of 5.00 MTY by the end of fourth year (7th year of mine life). The mine will be able to sustain the rated production level for the next 29 years.

Calendar Plan for production of coal vis-à-vis OB is given in para 3.13 below.

In the initial years, the coal will be transported by Rear Dumpers to the surface using the south batter roads and the OB will be sent to the External Dump using the north batter roads. The quarry floor will reach the southernmost side by 11-12 years. By this period, the entire external OB Dump area will be filled with three decks of 30m each (at an overall slope of 24° - 28°). Henceforth, the entire western part of the quarry (leaving about 60-100m barrier from the eastern advancing coal faces) will be available for internal dumping. To make way for safe and stable internal dump, the area over the southern side batter will also need to be packed. Now coal transportation to surface from the southern batter of coal will be stalled. This will entail introduction of High Angle Conveyors and in-pit crushing from this point.

Thus from 13th year onwards, coal will be transported by High Angle Conveyors after in-pit crushing. For this, two sets of in-pit crusher and HAC is being proposed at two distinct horizons (at 120m and 240m). The existing batter roads will be utilised for the purpose. The complete system will be

advanced every 4-5 years. The set at 120m level will be able to handle 3-4 MT of ROM coal, while the set at 240m will need to handle 1-2 MT of ROM coal. Coal from the quarry is coking coal with average grade falling in Washery Grade-IV category.

The entire OB will now be dumped in the internal dump and no further external dump will be required. The various levels of internal dump will be accessed from the respective floor contours and batter roads. The haul road layout of the mine has been shown in different stage plans prepared for the purpose. The width of the working and non-working benches has been kept at 40m and 25m throughout the life of the mine except first few years.

3.7 DUMPING STRATEGY

The dumping strategy has been formulated with due consideration of the following aspect:

1. Minimal use of the land for external dumping.
2. Rationalization of the lead distance for hauling.
3. Stability of the dump both internal and external, which ultimately leads to the safety of the person working in the mine.

Based on the above criteria the following dumping strategy has been adopted. Initial dumping of OB is being proposed to be done in north-west of the quarry in the metamorphic (mostly forest land) which is adjacent to the top edge of the proposed quarry. Subsequently OB will be dumped in the further north of the OCP.

A part of the strata in the incrop side is little flatter as compared to the rest of the property. This will allow concurrent internal dumping during the initial years. Part internal OB dumping will start in the third year where the strata (floor of Seam-II) is flatter (about 8-10deg) which will continue till fifth year. The external dump will be flushed with the internal dump.

Afterwards, internal dumping needs to be stopped due to steep floor gradient. The entire OB from the quarry will be placed in the External OB Dump till about 12 years of quarry operation. By this period, the entire external OB Dump area will be filled with three decks of 30m each (at an overall slope of 24° - 28°).

Henceforth, the entire western part of the quarry (leaving about 60-100m barrier from the eastern advancing coal faces) will be available for internal dumping. To make way for safe and stable internal dump, the area over the southern side batter will also needs to be packed. Maximum height of top most level of dump (external as well as internal) has been kept 60m above immediate ground level.

About 30% of OB needs to be dumped externally. About 380.39 Ha (including 362.38 Ha of forest land) additional land will be required for the same.

The details of external OB dumps is given below:

Dump	Volume (MCum)	Top RL (m)	Average height from surface (m)
External	218.42	+480	90
Internal	516.11	+450	90
Total	734.53	+480	90

To preserve top soil, top most level of the external dump has been proposed.

3.8 DUMPING ARRANGEMENT

Total overburden quantity estimated for Kotre Basantpur Pachmo Opencast Project is 734.53 Mcum. Out of which 218.42 Mcum of OB has been proposed to be dumped externally. The proposed dump height is maximum 90m from immediate surface level. Total three decks of height 30m each leaving 30m wide berms on each deck have been proposed. In the initial period entire OB will be dumped in the external OB dump.

The internal dumping will be carried out from the benches in the batter. Dumpers movement will be so planned as to avoid the unnecessary movement of dumpers in different horizons.

To maintain the stability of the internal and external OB dumps, the precautions detailed in para 3.17.2 and 3.17.3 should be strictly adhered. Provision for Slope Stability Radar or similar instrument has been made for the project for regular monitoring of bench, quarry highwalls and spoil dumps stability.

3.9 DESIGN CRITERIA

Following design criteria has been adopted for the mining operation.

Nos. of annual working days	-	330
Nos. of Daily shift	-	3
Duration of each shift	-	8 hrs

The opencast mine is to be worked on the above three shifts per day and seven days per week, schedule and the number of working days per year are adopted as 330.

3.10 WORKING REGIME

The opencast mine would be worked on the above 3 shift/day basis and 7 days/week schedule and the number of working days /year are adopted as 330 considering annual public holidays, unscheduled delays and bad weather effect particularly in rainy season.

Annual 330 working days has been calculated considering following assumptions:-

Calendar days per annum	-	365
Less- Public Holidays	-	(-) 8
Unscheduled delays	-	(-) 5
Bad weather effect	-	(-) 22

Available Working days per annum

with Sunday as working day:	-	330
Number of days of working in a year	-	330
Number of shifts	-	3
Number of hours/shift	-	8

Excavation category assumed.

(i)	Coal	:	Cat. III
(ii)	O.B	:	50% Cat.III + 50% Cat.IV
(iii)	Alluvium	:	Cat. I/II

Insitu volume weight of OB in T/Cum	-	2.4
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The material having compressive strength between 125 to 250 kg/cm² is classified as Cat III and between 250 to 1250 kg/cm² as Cat IV.

Av. Specific Gravity of Coal in different coal seams

<u>Seam</u>	<u>Avg Sp Gr</u> <u>(te/m³)</u>	<u>Seam</u>	<u>Avg Sp Gr</u> <u>(te/m³)</u>
i) Seam XIII	1.61	x) Seam VI/VII	1.54
ii) Seam XII	1.60	xi) Seam VA	1.56
iii) Seam XI	1.63	xii) Seam V	1.61
iv) Seam X	1.59	xiii) Seam IV	1.61
v) Seam IX	1.61	xiv) Seam III	1.63
vi) Seam VIII C	1.60	xv) Seam II A	1.68
vii) Seam VIII B	1.59	xvi) Seam II TOP	1.65
viii) Seam VIII A	1.68	xvii) Seam II BOT	1.69
ix) Seam VIII	1.60	xviii) Seam II	1.69

3.11 ANNUAL PRODUCTIVITY OF HEMM

The main mining and transport equipment will be operating on 3 shifts/day and 7 days/week operating schedule. The number of operating days/year has been adopted as 330.

The annual productivity of excavators has been calculated on the following basis:

(a) Excavation Category

(b) Average overall standard utilization of shift hours

Hydraulic Shovel : 61% (3 shifts/day)

(c) Factor allowed for traveling and positioning, etc.

Hydraulic Shovel : 0.85

Based on the above operating conditions the estimated annual productivity of proposed excavators and Rear Dumper as per CMPDI norms are given below in Table.

Table: (Shovel Productivity (Mcum per year))

Sl.	E q u i p m e n t	Annual Productivity (Mcum)
	<u>FOR O.B.</u>	
1.	6 Cum Diesel Hyd.Shovel + 60 T RD	1.62
2.	11 Cum Diesel Hyd.Shovel + 100 T RD	3.00
	<u>FOR COAL</u>	
1.	5 Cum Diesel Hyd. Backhoe + 60 T RD	1.51
2.	6 Cum Diesel Hyd.Shovel + 60 T RD	1.75

3.12 EQUIPMENT SELECTION

The equipment selection process is the most critical part of the project planning. The following selection criteria have been considered for selecting the size and type of the equipment:

- The strike length of the mine.
- Annual rate of advance/deepening.
- Total volume of overburden and coal to be handled annually.
- The individual thickness of coal seam and partings.
- The geo-mining condition of the mine.
- The type of mining system to be used like Inclined Slicing or Horizontal Slicing.
- The economics of the mine.
- Presence of geological disturbances like faults, intrusions etc.

Based on the above selection criteria and keeping in view of the Geological and Mining parameters of Kotre Basantpur Pachmo OCP, shovel-dumper combination of mining system is most suitable in the area under consideration. The proposed opencast mine has therefore, been designed to be operated by shovel dumper.

The proposed place of deployment (in partings, seams, etc.) of the selected equipment is given below.

List of HEMM:

Particulars	Capacity
COAL	
Diesel Hyd Shovel	5.5-6.5 cum
Diesel Hyd Backhoe	4.3-5.0 cum
Rear Dumpers	60 Te
RBH Drill (Diesel)	160mm
Dozer with ripper attachment	410 HP
OB	
Diesel Hyd Shovel	10-12 cum
Diesel Hyd Shovel	5.5-6.5 cum
Rear Dumpers	100 & 60 Te
RBH Drill (Diesel)	160 & 250 mm
Dozer	410 & 700-880 HP

3.12.1 Coal Winning

For coal production, 5.5-6.5 cum diesel hydraulic shovel and 4.3-5.0 cum diesel hydraulic backhoe with 60T RD have been proposed. However, in thick coal seams, 10-12cum hydraulic shovels in conjunction with 100T RD will have to be utilised. This type of shovel will be shared from the HEMM provided for OB removal. Similarly the balance capacity of 5.5-6.5 cum Hydraulic shovel shown in coal HEMM schedule will be utilised in OB removal.

Provision of Dozer with ripper attachment has been made to minimize mixing of coal with OB where the parting gets reduced. It will also be useful in faulted area as well as temporary sump formation in horizontal slicing method. For the estimation of the dumpers population, the lead for coal transportation has been considered for each year and for each seam. Two FE Loader has also been provided in common category for different mining operations. Diesel hydraulic backhoe shovels of smaller capacities are proposed in common to handle thin partings and dirt bands.

3.12.2 OB removal

Considering the annual work load of overburden/ partings, the OB benches along with major parting are proposed to be taken using two different shovel dumper configurations. The top OB and thick partings are proposed to be excavated by 10-12 cum diesel hydraulic shovel with 100T RD. Thinner partings are proposed to be excavated by 5.5-6.5cum diesel hydraulic shovels with 60T RD. For the estimation of the dumper population, the lead for OB transportation has been considered for each year and for each bench. OB will be transported through batters on the flanks of the mine similar to Coal transportation. Inter bench transport ramps is provided (1 in 10 gradient) to facilitate HEMM

movement in between different horizon or inter benches. Horizon of each haul road from both flanks is linked with the internal dump horizon in the quarry. Gradient of the floor is moderately steeper, so safety of dump slope towards running face of the mine is a prime concern for internal dumping.

3.13 CALENDER PROGRAMME:

The mining schedule has been formulated based upon the adopted sequence of mine development. Initial three years has been considered as construction period for the project. In the first three years, activities like land acquisition, construction work related to the rehabilitation of project affected people, and construction of infrastructure like, road, OH power line, diversion of nala, etc will take place.

Based on the normative annual capacity of the mine as 5.0 MT, the proposed mining schedule is generated for 36 years of mine life.

The targeted coal production from the mine is envisaged in 7th year. Peak overburden load for the project has been estimated as 28.93 Mcum of overburden removal with peak-stripping ratio of 5.79 cum/te, in 13th year (16th year of mine life). The average stripping ratio is 4.78 cum/te.

The summarized mining schedule for coal extraction and corresponding overburden load for the project, seam-wise annual coal & OB production schedule has been provided in the tables below.

Period	Year	Coal Production (MT)	OB Removal (Mcum)	Stripping Ratio (cum/te)
Construction	Y1	-	-	-
	Y2	-	-	-
	Y3	-	-	-
Capacity build-up	Y4	0.40	1.31	3.28
	Y5	1.50	5.73	3.82
	Y6	3.00	10.91	3.64
	Y7	5.00	18.45	3.69
Production	Y8	5.00	21.10	4.22
	Y9	5.00	28.68	5.74
	Y10	5.00	28.68	5.74
	Y11	5.00	28.68	5.74
	Y12	5.00	28.68	5.74
	Y13	5.00	28.68	5.74
	Y14	5.00	28.42	5.68
	Y15	5.00	27.82	5.56
	Y16	5.00	28.93	5.79

Period	Year	Coal Production (MT)	OB Removal (Mcum)	Stripping Ratio (cum/te)
	Y17	5.00	28.78	5.76
	Y18	5.00	25.45	5.09
	Y19	5.00	24.57	4.91
	Y20	5.00	24.07	4.81
	Y21	5.00	23.02	4.60
	Y22	5.00	23.59	4.72
	Y23	5.00	23.59	4.72
	Y24	5.00	23.63	4.73
	Y25	5.00	26.01	5.20
	Y26	5.00	26.51	5.30
	Y27	5.00	27.01	5.40
	Y28	5.00	27.01	5.40
	Y29	5.00	21.89	4.38
	Y30	5.00	20.53	4.11
	Y31	5.00	20.53	4.11
Production	Y32	5.00	18.96	3.79
	Y33	5.00	17.10	3.42
	Y34	5.00	17.10	3.42
	Y35	5.00	16.27	3.25
Tapering	Y36	3.73	12.81	3.44
Total		153.63	734.53	4.78

3.14 EQUIPMENT SCHEDULE

The requirement of mining equipment e.g., shovels, dumpers, drills and dozers etc. have been estimated as per annual productivity based on adopted design criteria and workload determined by the calendar plan considering the physical location of equipment within the operating mine. For calculating the number of dumpers, year wise leads have been taken into account for OB and Coal transportation separately.

The Project Report proposes two variants. Variant-I: Coal production and OB removal both Departmental & Variant-II: Coal production and OB removal both outsourced. The description of Variants has been detailed in Chapter 1, (Introduction), para 1.5. The envisaged requirements of HEMM for various Variants are given below:

EQUIPMENT SCHEDULE (VARIANT-I)

**Pre-Feasibility Report of Kotre Basantpur Pachmo OCP
(5.0 MTPA)
Hazaribagh Area, Central Coalfields Limited**

HEMM	Capacity	Construction			Capacity build-up				Max ^{m*}
		1	2	3	4	5	6	7	
OB									
Diesel Hyd Shovel	10-12 Cum					1	2	4	7
Diesel Hyd Shovel	5.5-6.5 Cum				1	2	4	5	6
Rear Dumper	100 T					7	16	33	72
Rear Dumper	60 T				4	12	24	43	66
Diesel RBH Drill	250 mm					1	2	4	5
Diesel RBH Drill	160 mm				1	2	4	5	6
Dozer	700-880 HP					1	2	4	7
Dozer	410 HP				2	2	4	5	6
Coal									
Diesel Hyd Shovel	5.5-6.5 Cum					1	1	1	1
Diesel Hyd Backhoe	4.3-5.0 Cum						1	1	1
Rear Dumper	60 T				1	3	7	12	16
Diesel RBH Drill	160 mm				1	1	2	2	2
Dozer with Ripper Attachment	410 HP				1	2	3	3	3
Common									
Diesel Hyd Backhoe	4.3-5 Cum				1	1	1	2	2
Diesel Hyd Backhoe	2-3 Cum				1	1	1	1	1
FE Loader	5-6 Cum				1	1	1	2	2
Dump Truck	20 T				2	3	4	6	6
Drill	110-120 mm				1	1	2	2	2
Grader	250-280 HP				1	1	2	2	4
Wheel Dozer	460 HP				1	1	2	2	3
R T Crane	40T				1	1	1	1	1
R T Crane	20T				1	1	1	1	1
Mobile Crane	8-14T				1	1	1	1	1
Dozer with Ripper Attachment	850 HP				1	1	1	2	2
Tyre Handler					1	1	1	2	2
Water Sprinkler	28KL				1	2	2	3	4
Reclamation									
Water Sprinkler	28 kL					1	1	2	2
Dozer	410 HP					1	1	2	2

: Mist type- off and on Highway.

* : The maximum number of HEMM will be required after 7th year (target year).

EQUIPMENT SCHEDULE (VARIANT-II)

Equipment	Y1	Y2	Y3	Y4	Y5	Y6	Y7					Y34	Y35	Y36
OB	OUTSOURCED													
Coal	OUTSOURCED													
Common	OUTSOURCED													
Reclamation	OUTSOURCED													

3.15 DRILLING & BLASTING

The drilling and blasting operations for loosening of coal and OB are necessary before excavation by shovels. The dozers provided in the project will carry out the site preparation. The blasthole drilling will be done in patterns decided in advance depending on the strata hardness and as per the conditions laid down by DGMS.

Blasthole drills of 250/160 mm diameter will be used for drilling in OB/ partings and coal benches.

The standard practice involving the electric detonators for the initiation of detonating cord, detonating relays to achieve hole-to-hole delays, use of Heavy ANFO, slurry or emulsion explosives as the column charge will be used for blasting.

Elements of drilling & blasting in OB & Coal

Overburden and coal will be blasted at a powder factor 0.3kg/cum and 0.2 kg/cum respectively using 250/160mm diameter drill for OB & coal. The drillhole pattern (along with Burden & Spacing) will depend on actual site condition. Special precaution needs to be taken during drilling and blasting so that formation of boulders and/ or mixing of coal with OB is avoided.

Operating conditions of the drills

250/160mm diesel drills are envisaged to work on 3 shifts/day and 330-days/year schedules.

The requirement of drills has been assessed considering:

- (a) workload as per calendar programme of excavation,
- (b) annual productivity of drills and
- (c) physical deployment of drills.

Provision for secondary blasting should be kept to a minimum. Proper blasthole design of the OB and coal bench will reduce the necessity of secondary blasting. The burden and spacing of each bench should be designed in such a manner that it should produce the necessary fragmentation with

due consideration to safety of men and machine. The actual blast-hole design should be done only after conducting field trials and controlled blasting should be practised.

3.16 LAND DETAILS

The total requirement of land in the present proposal for Kotre Basantpur Pachmo Opencast Project has been estimated as 1162.87 Ha. The total requirement of land includes 1006.17 Ha of forest land (714.22 Ha of Notified Forest and 291.95 Ha of GMK JJ) and 156.70 Ha of non-forest land. It includes land for colony and R&R site falling outside the leasehold boundary. The break-up of land under different heads are shown in the following tables:

Sl. no	Particulars	Total Area in Ha.
1	Quarry	651.61
2	External OB Dump	380.39
3	Infrastructures (W/S, CHP, S/S, Magazine, etc.)	37.87
4	Road	20.38
5	Embankment against Chutua nala	3.13
6	Green Belt	3.77
7	Safety Zone	65.71
Total Project Area		1162.87

3.17 SAFETY MEASURES

Safety of men and machine deployed in the mining area should be properly taken care of irrespective of whether the mining activities are performed by departmental or by outsourcing option. All the regulations & schedules of Coal Mines Regulations 2017 relating to opencast mining have to be adhered to and implemented in order to maintain day to day safety as per stature.

3.17.1 SAFETY ASPECT OF WORKMEN & HEMM

Special precaution should be taken while deploying workers in the mine. Before employing any person to the mine proper vocation training should be imparted and recommendations of various Safety Conferences should be strictly followed. Some of the major aspects are as follows:-

A) For persons:

- i) No persons shall be deployed unless he is trained at VTC and holds VTC Certificates. A record of the same shall be maintained.
- ii) Records in Form-B and Form-D shall be maintained.

iii) Records of driving license of operators shall be kept by competent authority and shall be made readily available for inspection by management.

iv) Adequate supervision shall be maintained by competent persons, including officials and technicians.

B) For Machineries: Provisions of Regulation 109, 110, 216 & 217 of CMR 2017 and DGMS Cir. (Tech.) 1 of 1999 should be strictly adhered to along with the following:

i) All machinery and plant used in connection with working of a mine shall be of good design, sound construction, and suitable material, adequate strength, free from patent defect and properly maintained.

ii) The owner, agent and manager shall provide adequate training facilities and ensure proper training of persons employed for operation and maintenance of machinery and plant.

iii) No person except an engineer or other competent person under his supervision shall undertake any work on machinery and plant in which technical knowledge or experience is required.

iv) All the machineries to be deployed in mines shall be so designed as to afford the operator clear and uninterrupted vision all around.

v) Every heavy earth moving machineries, including trucks and tippers, used in mine shall be fitted with adequate safety features or devices as specified by DGMS. All equipment shall be provided with audiovisual alarms, proper light for use at night and fitted with suitable type of the fire extinguishers.

vi) Truck mounted drill machines designed for tube well drilling for sources of water shall not be used and only proper type of blast hole drill machine, especially designed for mining purpose, shall be used in the mine.

vii) Every heavy earth moving machinery shall be under the charge of a competent person (Operator or Driver), authorized in writing by the Manager.

viii) All persons employed or to be employed to operate heavy earth moving machinery shall be trained and their competency shall be evaluated by a Board constituted by the management, who shall be persons who are not connected with imparting of training.

ix) A proper record of repair and maintenance along with inspection done by competent authority and defect pointed out shall be maintained and signed by authorized person.

x) Only such fitters or mechanics possessing driver's or operator's license, shall be allowed to carry out test-run of heavy earth moving machineries.

xi) No person other than the operator or the driver or any person so authorised in writing by the manager shall be allowed to ride on a heavy earth moving machinery

C) General:

i) Every person shall strictly adhere to the provisions of the Act and of the rules and regulations and to any order or direction issued by the manager or an official with a view to the safety or convenience of persons not being inconsistent with the Act, rules and these regulations; nor shall he neglect or refuse to obey such orders or directions.

ii) Every person shall, immediately before proceeding to work and immediately after terminating work at the end of his shift have his name recorded in the appropriate register.

iii) Risk Management Plan of tipper/pay loader shall be made and implemented.

iv) All operators/drivers so authorised by the Manager shall observe the Regulation 62 and 63 of CMR 2017 and obey the systematic traffics rules prepared by management

v) Before deploying workers they must be trained and briefed about safety aspects in opencast mine. However during course of execution of the work, if any accident occurs whether major or minor, the matter shall have to be immediately informed to mine management i.e. Colliery Manager/Agent/GM of Area so that Notices of accidents in accordance of (Reg. 8 of CMR 2017) and Section 23 of The Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.

vi) Mine authority shall operate transport system in such a way so as to minimize pollution in the mine.

3.17.2 STABILITY OF BENCHES, QUARRY HIGHWALLS AND SPOIL DUMPS

During quarry operations, it is necessary to adopt required mining parameters for the stability of benches, highwalls and spoil dumps. It is also mandatory to examine systematically the fencing of mine workings, land slides and cracks between benches. It is required to maintain well-graded and wide roads on benches keeping the width of working areas sufficient for spreading of blasted rock and movement of the mining and transport equipment.

During actual mining operation, systematic observations of the condition of benches, high wall slopes and spoil dumps should be carried out and the dimensions be modified if necessary to suit the local conditions. To ascertain the optimum slope angles for stability of quarry benches, highwalls and spoil dumps, scientific study of slope stability along with hydro-geological study of the area needs to be under taken.

During actual mining operation, systematic observations of the condition of benches, high wall slopes and spoil dumps should be carried out and the dimensions be modified if necessary to suit the local conditions.

Provisions laid down in Reg. 106 and 108 of the Coal Mines regulation 2017 shall be strictly adhered to for the safety of quarry and OB/ spoil dumps. In addition to this, the following precaution should be considered:

i) The spoil dump height should not exceed 90m from immediate surface level with an overall slope of 28° or less. In the event of encountering steep floor gradient, floor blasting should be done and the area properly levelled by dozer before spoil dumping.

ii) No working or construction should be allowed within the 60m toe of the OB dump.

iii) Before dumping the OB on the floor of seam, at least 10m length all along the strike length should be made horizontal at every 50 meter by floor dinting/blasting.

iv) Dump should be created in such a way that there is no chance of accumulation of water in and around the base of dump as it will adversely affect the shear strength of the base material of dump. It must be ensured that there is no stagnant water at the toe of dump and the top of the dump.

v) The toe and face of the dump should not be eroded or cut at any point of time to avoid slope failure. A suitable toe wall should be created along the dump periphery.

vi) Formation of dumping should be done in square or circular or any regular shape as far as possible.

vii) Proper drainage system should be provided to bring down rain water by construction of inclined drain on dump face and catch drain on all benches.

viii) During active period of dump, all rain water should be diverted away from mining site as far as possible.

ix) Sump and pumping capacity should be sufficient to accommodate peak surface run-off and seepage of water.

x) Gabion wall and garland drain should be constructed and maintained to trap the surface run-off and sludge coming from dump.

xi) Plantation and grassing should be done on top and slope of the dump respectively.

xii) Regular monitoring is required for development of tension crack, gullies, movement of soil mass, stagnation of water and any other unusual occurrence. In case of dump movement, rate of movement of dump should be monitored. Special attention should be given at curve area/turning area of the dump.

3.17.3 OTHER PRECAUTIONS AND SAFETY MEASURES IN SPOIL DUMPING

With increasing size of opencast mine, the quantity of OB removal is also increasing. The dumping of OB can be external, internal or both. The stability of spoil dump is the main concern for an opencast mine. Poor management of overburden dump results the instability of dump slope in opencast mine. In few decades destabilizations especially internal dumps have taken place in coal mines, therefore, it has become necessary to adopt the scientific methodology for spoil dumping along with the following statutory steps / measures.

- i) The width of any bench in waste dumps shall not be less than its height and a scientific study is to be made, in case the planned height of the dump is beyond 30m.
- ii) In case of any existence of any road nearby, dumping shall be done in such a way that the distance between the toe of the dump and road is not less than twice the overall dump height. If it is inevitable, arrangement shall be made for diversion of road; so that it is away from the stated safe distance.
- iii) The top soil and sludge shall not be dumped at the floor to create the base of the dump.
- iv) For reducing the ground water pressure in the dump rock above phreatic surface, effective drainage system shall be provided both inside and outside the overburden dump. In this regard, the guidelines provided in DGMS Circular (Tech) No-2 of 2001 in designing pit slope shall be followed.
- v) The dump area shall be substantially fenced, in accordance with the CMR, to prevent inadvertent entry of any person to the dump.
- vi) Precautions shall be taken to prevent spontaneous heating and fire in the carbonaceous shale and coal dumped along with overburden.
- vii) Gabion walls, wherever required shall be provided round the periphery of dump for prevention of floor heaving and to facilitate the drainage of water accumulated near toe of external dump. It also acts as retaining wall to some extent.
- viii) Internal dumping on the seam floor having steeper gradient shall not be carried out unless, it is ensured that the dump stability factor of safety is well within the allowable range. For this a scientific study on slope stability of dump considering the geo-engineering/mining parameters must be carried out and dumping shall be done in accordance with guidelines as suggested in the study report.

3.17.4 PRECAUTIONS AGAINST DANGER OF INUNDATION FROM SURFACE WATER

Following are the precautions required to be taken against danger of inundation from surface water:

i) Adequate protection against any danger of inrush of surface water into the mine or part shall be provided and maintained to the satisfaction of DGMS, whose decision shall be final.

ii) The entrance into the mine shall be so designed, constructed and maintained that its lowest point (which means the point at which a body of rising water on surface can enter the mine) shall be not less than 3.0 meters above the highest flood level at that point.

iii) Every year, during the rains constant watch shall be kept on the flood levels on the surface of the mine and if at any time the levels cross the highest levels earlier recorded, such levels shall be marked by permanent posts along the edges of water and the new highest levels thus observed shall be recorded with the date as the highest flood level on the plans by an actual survey.

iv) If water dams or reservoirs are built across rivers and water courses on the upstream side of the mine, arrangements shall be made for communication between appropriate authorities for the purpose of ascertaining the quantity and timing of water released from the dams which is likely to endanger safety of the mine and arrangement for similar communication shall be made when water level rises on the upstream side which is likely to endanger the mine.

v) The highest flood levels and danger levels at least 1.2 meters below the highest flood level, shall be permanently marked at appropriate places on the surface and whenever water rises towards the danger level at any place, all persons shall be withdrawn from the mine sufficiently in advance and for this purpose adequate arrangements of quick communication to all parts of the mine by effective systems shall be provided and maintained.

vi) No working shall be made in the mine at any spot lying within a horizontal distance of 15 meters from either bank of a river or nala.

vii) A competent person shall, once at least in every fourteen days during the rainy season and once at least in every thirty days during other periods of the year, examine every protective measure provided under regulations 149, whether in use or not, for their stability, and a report of every such examination shall be recorded. The protective measures and workings shall also be inspected, once at least in every quarter by the Manager personally.

viii) A careful assessment is to be made against the danger from surface water before the onset of rainy season. The necessary precautions should be clearly laid down and implemented.

ix) A garland drain needs to be provided to drain away the surface rainwater from coming into the mine.

x) An embankment, 3.0m above the HFL, along the Chutua nala should be made. Inspections for any accumulation of rainwater, obstruction in normal drainage and weakening in the embankment should be made.

xi) Standing order for withdrawal of working persons in case of apprehended danger. During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places.

3.17.5 PROTECTION OF EQUIPMENT DEPLOYED AT BOTTOM HORIZONS FROM FLOODING

During the heavy monsoon period, the mining operation in the lower-most bench may have to be stopped. Therefore, it is proposed to drown the lower-most bench, which would work as a sump. The water will be pumped out and discharged into the nearby Nallah / River.

For ensuring safety of the equipment while working out bottom horizons with no access to surface profile, the following measures should be taken:

- (i) Drivage of initial trenches if any and coal cutting on bottom benches should be done during the dry period of the year.
- (ii) Ramps should be made for quick shifting of equipment from bottom horizons, liable to be flooded during monsoon period, to the top horizons.

3.17.6 PRECAUTIONS AGAINST DANGER FROM BLASTING

Following measures should be taken while drilling and blasting operations in the quarry:

- i) Drilling and Blasting in quarry should be done in accordance with the provisions of Mines Safety Act, rules and regulations.
- ii) Adequate safety measures have to be taken during blasting operation in the quarry so that men / machine are not affected.
- iii) Blasting pattern and area to be blasted should be carefully evolved for best results and the blasted coal should be loaded as early as possible.
- iv) Controlled or muffled blasting will be practiced near the important surface infrastructures and also within 100m of the vacant land. Besides this, necessary safety precautions should be clearly laid down and implemented whenever, any important surface features like public roads, rail, civil infrastructures / buildings etc. fall within radius of the blasting zone.

3.17.7 PREVENTION OF ELECTRIC SHOCKS

During mining operations, all the statutory provisions of the Indian Electricity Rules 1956, and Indian Standards for installation and maintenance of electrical equipment etc. should be observed.

- i) For protection from electric shocks to persons, all electrical equipment with voltage up to 1000V should be provided with Earth Leakage Relay, which will automatically disconnect electrical circuits.

ii) Closed mobile substations and switchgears should be mechanically interlocked which exclude the possibility of opening the door when oil switch and air circuit breakers are in operation.

iii) All metal parts of electrical equipment should be properly earthed to avoid failure of insulation.

iv) All H.T lines and cables located within the blasting zones should be disconnected during charging & blasting operations.

3.17.8 DUST SUPPRESSION & DILUTION OF EXHAUST FUMES

For precaution against dust, Regulation 143, 144 and 145 of CMR 2017 should be observed. Beside this the following measures should be adopted for dust suppression at all quarry working places, dumps, haul roads, CHP and near other auxiliary mining operations.

i) Spraying with water on all working faces & haul roads, by special spraying machines or water-sprinkler.

ii) While drilling holes, it is necessary to use dust extraction devices.

iii) Installation of local dust suppression and air conditioning devices in cabins of excavators and drilling rigs may be considered.

iv) Leveling of spoil dump surface.

v) Separate dust suppression arrangement should be provided for CHP.

To prevent collection of harmful mixtures in the atmosphere, from the different sections of quarry workings, it is recommended:-

To spread out the sources of dust formation and omission of harmful gases throughout the working area of the quarry, the following precautions should be taken:

i) Drilling & blasting operations should be timed for periods of maximum wind activity during the day.

ii) Dumpers may be provided with purifiers for exhaust gases.

3.17.9 OTHER PRECAUTIONS AND NECESSARY ACTION

i) During quarry operations, it is necessary to maintain well-graded and wide roads on benches keeping the width of working areas sufficient for spreading of blasted rock and movement of the mining and transport equipment.

ii) Backfilling of old worked out quarry will be started from first year of quarry operation.

iii) The proposed 60m barrier left against the water logged old quarry will be mined out judiciously with safety and precautionary measures after completion of backfilling the void of old quarry and consolidation of dumped material. However, during extraction any symptoms of seepage of water / water matter is observed through the barrier, mine workings / operations should be immediately stopped till stoppage of seepage of water or any other water matters.

iv) Top soil quarried out from the proposed quarry will be used in reclamation of the dumps to its fullest extent from environmental view point.