CENTRAL COALFIELDS LIMITED

DETAILED PROJECT REPORT
FOR
KUJU OCP
(1.30 MTY)

VOLUME-I
(TEXT & APPENDICES)

REGIONAL INSTITUTE-III
NOVEMBER 2011

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Sl. No.	Particulars	Unit	Value
A.	**GENERAL**		
1	Name of Project		Kuju OCP(1.30 MTY)
2	Type of Project		New
3	Name of Area / Company		Hazaribagh Area/Central Coal Field Ltd.
4	Nearest Railway Station from project	Name km	Ranchi Road Railway Station 30 km
5	Nearest National / State Highway / Approach road	Name	National Highway 33
B.	**GEOLOGICAL**		
1	Name of geological blocks considered	Name	Kuju
2	Area of the geological blocks	sq. km	4.90Sq. km
3	Borehole Density within blocks	BHs / sq.km	23
4	Description of all coal seams within block		

Stratigraphic Sequence	***Thickness (m)***		***No. of borehole intersections***	***Net Geological Reserves (MT-Proved)***	***Remarks***
	Min.	***Max.***			
Top OB	5.70	39.12			**Kuju Opencast (1.30 MT) planned upto Seam X (maximum mine depth upto 140 m)**
XIII	2.05	3.09		0.897	
Parting	6.58	22.42			
XII	2.83	4.38		1.547	
Parting	33.53	57.35			
XI	6.32	12.75		12.811	
Parting	1.78	4.32			
XA	0.50	1.66		1.437	
Parting	15.00	21.97			
X	9.02	12.39		12.673	
Parting	11.95	19.99			
IX A	0.84	1.65		2.144	
Parting	8.00	22.15			
IX	3.47	4.52		6.081	
Parting	2.80	12.60			
VIII A	0.45	1.58		0.832	

Parting	1.00	15.86			
VIII	2.96	7.50		8.666	
Parting	4.00	31.40			
VII	2.30	6.53		1.578	
Parting	7.86	30.80			
VI	1.40	3.40		6.786	
Parting	3.25	6.23			
VA	3.04	7.74		8.559	
Parting	7.04	31.95			
V	13.00	23.30		35.211	
Parting	8.47	22.55			
IV	3.25	5.67		9.360	
Parting	4.65	7.76			
III A	0.50	1.95		1.504	
Parting	2.13	5.70			
III	3.70	8.52		13.199	
Parting	4.87	8.92			
IIB	0.65	2.20		4.421	
Parting	4.45	24.42			
II A	0.65	2.20		6.109	
Parting	27.03	34.83			
II	1.52	5.19		6.928	
Parting	4.99	16.00			
I	2.05	6.49		6.844	
Total				**156.553**	

C.	**TECHNICAL**				
					Value
1	Area of the proposed mine block			Sq. km	0.6477
2	Borehole density within mine area			BHs/sq. km	20
3	Mine parameters: Extent along strike (Avg.) Extent along dip (Avg.)			 km km	 0.783 0.580
4	Description of coal seams proposed to be worked along with the parting details				
Name of seam	***Thickness range considered (m)***	***Av. Thickness / Parting***	***Av. Grade (U.H.V.) K. Cal/Kg***	***Av. gradient (deg)***	Value

	Min	***Max***	***Thickness (m)***			***Reserves (MT)***	***OB (Mcum)***
Top OB	5.70	39.12	22.41				4.80
XIII	2.05	3.09	2.57	'C' long Flame	10 to 19 degree	0.27	
Parting	6.58	22.42	14.50				1.82
XII	2.83	4.38	3.60	'C' long Flame	10 to 19 degree	0.45	
Parting	33.53	57.35	45.44				19.27
XI	6.32	12.75	9.54	'C' long Flame	10 to 19 degree	5.31	
Parting	1.78	4.32	3.05				1.19
XA	0.50	1.66	1.08	'C' long Flame	10 to 19 degree	0.45	
Parting	15.00	21.97	18.49				5.87
X	9.02	12.39	10.70	'C' long Flame	10 to 19 degree	3.12	
	Total					**9.60**	**32.95**

	Av. Stripping Ratio	m^3/t	**3.43**
6	Method of Mining	Opencast by Shovel-Dumper Combination	
7	Target Output		
	Normative production capacity (at 100%)	Mt	1.30
	Peak production capacity (at 115%)	Mt	1.495
	Production capacity (at 85%)	Mt	1.105
8	Year of achieving Target Production (from zero date)		3 rd Year
9	Year of start of Internal Dumping		No internal Dumping as long as mine is operating
10	Production Phasing		

Year	***Year 1***	***Year 2***	***Year 3***	***Year 4***
Coal (Mt)	0.80	1.00	1.30	1.30
OB (Mcum)	2.55	3.19	4.15	4.15

			Value
11	Total Mine Life (at Norm. production capacity)	Years	8
	Pre-construction period		
	Construction period	Years	-
	Production build-up period	Years	2
	Targeted Production period	Years	6
	Tapering / mine closure period	Years	-

			Nos.	
12	Major HEMM Deployed for Coal	Capacity	**Option I**	**Option II**
	Diesel Hyd. Shovel	(6.0 Cum)	1	Outsourced
	Rear Dumper	(60T)	2	
	Diesel Drill	(160 mm)	1	
	Dozer	(410 HP)	1	
13	Major HEMM Deployed for OB (Up to Tgt Yr)	Capacity		
	Diesel Hyd. Shovel	(5.5 Cum)	2	Outsourced
	Rear Dumper	(60T)	21	
	Diesel Drill	(160 mm)	2	
	Dozer	(410 HP)	3	
14	Total Manpower (Up to Tgt Yr)	Nos.	**Option I**	**Option II**
			588	234
15	Overall Output per manshift (OMS)	Tonnes	**Option I**	**Option II**
			8.37	21.04
16	Seam-wise weighted average grade of coal (non-coking/coking)		'C' Long Flame	
17	Presence of Major Surface Constraints (nallas, road, power line, etc.)		Chowtha Nala ,Banderchua nala,NH-33,Old U/G and O/C workings,Fire & Lohagate /Lakrigate Village	
18	Coal Transport within the mine (In-pit belt conveying system or by Truck)		By Dumpers	
19	Surface Coal Transport to Siding/Despatch Point and Mode of Despatch		By Conveyor	
20	Any Railway Siding and distance		Ranchi Road Rly. Station at 12 km from the Block	
21	Name of any Specific Customer/Industry		Nearby Washery	
D.	**ENVIRONMENTAL & OTHERS**			
			Value/Name	
			Option I	**Option II**
1	Civil Construction	Existing	702	
	Residential houses	Additional	nil	
	Housing satisfaction	%	100	
2	Water Demand	Klpd		
	Colony Industrial		304	209

3	Total Land to be required Forest land	Ha	27.98	27.98
	Non-forest land	Ha	167.97	161.97
	Total	Ha	189.95	189.95
4	Land to be acquired for external dumping	Ha	70.66	70.66
5	Net Present Value of Forest Land	Rs.Lakhs/Ha	**Option I**	**Option II**
	Total Area(33.32)	Ha		
	Total Value	Rs.Lakhs	279.14	279.14
6	Habitation & Rehabilitation No. of villages within mine boundary			
	No. of PAFs to be rehabilitated	Nos.	145	
7	Cost of land & Rehabilitation Total Cost	Rs. crores	5.08	5.08
	R&R only	Rs. lakhs	152.25	152.25
8	Total EMP Capital	Rs. crores	28.55	27.6
9	Average annual rainfall	mm	1300	
10	Make of Water on the day of Maxm Rain fall	cum/day	65751	
11	Total installed pumping capacity	cum/hour	600	
12	Drainage of the Area (Name of river/nalla)		Chowtha ,Banderchua and Mourpa nala	
13	Any proposed diversion of nala /Powerline		NA	
E.	FINANCIAL		**Option I**	**Option II**
1	Total Capital Investment	Rs. crores		
	Existing		17.98	17.57
	Additional		175.18	58.83
	Total			
2	Specific Investment	Rs. / tonne	43.49	12.74
	Upto target Yr		1327.12	445.71
	Beyond target Yr		329.46	96.55
3	Total Capital Investment on P&M	Rs. crores		
	Existing		2.92	2.51
	Upto target Yr		127.24	26.29
	Beyond target Yr		40.66	10.97

4	Specific Investment on P&M	Rs. / tonne		
	Upto target Yr		963.96	199.20
	Beyond target Yr		308.00	83.10
5	Capital requirement upto target year	Rs. crores	175.18	58.83
6	Year of opening of Revenue account (from zero date)			
7	Earnings per manshift (EMS) (target year)	Rs.	1935.12	2098.15
8	Output per manshift (OMS) (target year)		8.37	21.04
9	Estimated Cost of Production	Rs. / tonne		
	At 100% production level		1277.23	981.17
	At 85% production level		1423.20	1045.16
10	Estimated average selling price	Rs. / tonne		
11	Estimated Profit	Rs. / tonne		
	At 100% production level		591.77	887.63
	At 85% production level		445.80	823.84
12	Financial Internal rate of return (FIRR)	%		
	At 100% production level		223.37	Highly +
	At 85% production level		108.21	Highly +
13	Economic rate of return (only for projects to be approved by Govt.)	%		
	At 100% production level		704.01	Highly +
	At 85% production level		225.25	Highly +
14	Desired av. Selling Price to yield 12% FIRR	Rs. / tonne		
	At 100% production level		1089.92	764.62
	At 85% production level		1231.91	824.00
15	Break-even point			
	Production	Mty	0.77	0.38
	Production level	%	58.29	28.94
16	Cost of Outsourcing (average)			
	OB	Rs/m^3	71.49	143.19
	Coal	Rs/tonne	0	50.83
17	Mine Closure Cost	Rs/te	10.99	10.99

18	Expected Completion Capital	Rs. crores	199.60	67.65
19	Financial IRR for completion cost	%	166.36	Highly +
20	Economic IRR for completion cost	%	422.11	Highly +

Two options considered for this report are as follows:

Option I- This Variant is prepared keeping in view of the following mine parameters.

- Northern Boundary: The northern surface boundary has been fixed along a safe distance 60 m from Chowtha nala.
- Southern Boundary: The surface boundary along the South has been fixed at the leasehold line of Kuju Block.
- Eastern Boundary: The surface boundary along the East has been fixed leaving a surface barrier of 60 m from Bander Chua nala.
- Western Boundary: The western boundary has been fixed at a distance of 100 m from the new diverted NH 33.

External Dump has been proposed at Pokharia Mouza (Coal Bearing & non forest land) within the lease of Kuju colliery. The external dump will be rehandled at the end of the quarry operation and backfill the quarry. Revised Geological Report of Kuju Block is under preparation annexing this sector. Bore holes are already done. Top seam (Seam XIII) occurs at a depth of around 60m from surface. In this option lead to external OB dump is less than 600 m from the pit. Coal and OB removal are proposed to excavate by departmental resources.

Option II –All parameters same as in Option I. Coal and OB removal by outsourcing means.

CHAPTER-I

INTRODUCTION

1.1 Background of the Project:

The Kuju Block is situated in the South Central part of the West Bokaro Coalfield. The four pre-nationalisation leases, called Mourpa, Kuju, Hesagora and Banwar have been re- organized in 1973,after nationalization of coal mining industry, in a single unit named Kuju colliery, which now forms the part of Kuju area of CCL.

Kuju Block is dotted by a number of pits, trenches, wells and other irregular excavations started indiscriminately without an idea of planning in pre-nationalisation period in the name of opencast mining. These excavations were supplemented by numerous inclines having limited working extent often restricted by small faults as well as due to non availability of any type of underground transport in the mine. The Kuju Block is bounded by latitude 23 ^{0} 44' 24" and 23 ^{0} 45 ' 17 " and longitude 85 ^{0} 29 ' 36" and 85 ^{0} 31' 32 ".It is covered by part of toposheet nos 73E/8 and 73 E/9 of Survey of India.

The Kuju, Mourpa and Banwar mining sections were separately operated by numerous leases, sub leases and mining contracts till nationalization of the coal company. Presently mining activities are concentrated only in Kuju and Banwar section. In Kuju section production comes from Seam X and in Banwar section production comes from multiseam quarry of seam-V,VA,VI and VII. Seasonal mining activities are restored to in the Mourpa section. Now UG mining activities are being carried out between Bander Chua nala and Mourpa nala in the seam VA , VI ,VII ,VIII and IX. Mining in this part is restricted by limited strike (around 350 m) and various faults. Extensive opencast as as well as Underground mining activities has also taken place to the west of Bander Chua nala and extended beyond old NH 33 thereby resulting in fire and subsidence of old NH 33.A number of quarries, mainly in the incrop portion of top seams has been worked in unscientific manner and filled up with OB. Area to the north of Fault F_{12} and upto Chutua nala is being explored and a Revised Geological Report of Kuju Block incorporating this area is under preparation at CMPDI. The total annual production in 2010-11 of the mine was 57817 T against the annual target of 90000 T with the help of 4 nos of SDL. Mining activities are mainly done in Seam VII(Washery grade III) and Seam VIII(Washery grade IV). The

coal produced specially from Kuju section is dispatched to Kedla washery by road transport (contractual).Chronology of different reports prepared is given below:

Table 1.1: Chronology of Previous Approved Reports

Sl No	Year of Sanction	Name of the Report	Technology adopted	Production Capacity (Mty)	Sanction Capital (Rs.crores)
1	February 1991	Scheme for Seam IX	Bord and Pillar		0.986
2	January 1995	Kuju Re Organisation	SDL	0.36	16.29 *

* - This Report has envisaged for Coal winning by SDL to provide gainful employment of the then existing manpower and to improve the techno-economic of the mine. Above Report has envisaged to work Seam IX, Seam VIII, Seam VII, Seam VI and Seam VA.

1.1.1 Present Status:

At present mining activities are being carried out through the inclines in the Eastern part of Bander Chua nala by Underground mining method. Area to the west of Bander Chua nala (which has been worked extensively by open cast as well as underground) upto the new NH-33 is considered for opencast mining. Underground mining in Seam VII (development) and Seam VIII (development and depillaring) is being carried out in the proposed opencast area. A portion of NH-33 from 70.5 kms to 72.5 km at Kuju had collapsed due to fire in abandoned underground mines. A photo (July 2011) of the site shows the villages and a temple (under construction) on the proposed opencast mine.

1.2 Agency wise Exploration Status :

Kuju Block - Total area of the block is 4.90 sq. km.

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Particulars	Meterage (m)	No. of Bore holes
NCDC	1474.54	3
CMPDI	8801.60	44
GSI	1021.95	3
CCL	699.90	11
	11997.99	61

Out of above 61 boreholes,30 boreholes involving a meter age of 5424.05 meters were drilled in Kuju sector. The Kuju sector has a borehole density of 23 boreholes/sq km.

Persistent coal seams belonging to Barakar formation are available within the block. Incrop of all the coal seams, though dissected by faults, are available in the block. The net geological coal reserve (proved) has been estimated as 156.553 MT

1.3 Justification of Preparation of Detailed project Report

The present report is justified in view of the following

- The report envisages improvement in mine economics. The underground mine is incurring heavy losses.
- Enhanced level of production from 0.057 MTY to 1.30 MTY.

- Increased recovery or percentage of extraction due to feasibility of opencast mining.
- Increased demand of coal for power generation.
- Enhanced or Improved productivity of existing manpower.
- Extraction of opencast able coal in a systematic manner so that coal seams lying below Seam X can be extracted by Underground method in future (Seam VII and VIII are already working).
- Safety of NH-33 by leaving a barrier of 100 m from the Quarry surface.

1.3 Variants Proposed in Detailed Project Report (November 2011)

Option I- This Variant is prepared keeping in view of the following mine parameters.

- Northern Boundary: The northern surface boundary has been fixed along a safe distance 60 m from Chowtha nala.
- Southern Boundary: The surface boundary along the South has been fixed at the leasehold line of Kuju Block.
- Eastern Boundary: The surface boundary along the East has been fixed leaving a surface barrier of 60 m from Bander Chua nala.
- Western Boundary: The western boundary has been fixed at a distance of 100 m from the new diverted NH 33.

External Dump has been proposed at Pokharia Mouza (Coal Bearing & non forest land) within the lease of Kuju colliery in between Bander Chua nala and Mourpa nala. Revised Geological Report of Kuju Block is under preparation annexing this area(Mourpa Sector). Bore holes are already done in the area between fault $\mathbf{F_{12}}$ and **Chowtha nala**. Top seam (Seam XIII) occurs at a depth of around 60m from surface. Lead to external OB dump is less than 600 m from the pit. Coal and OB removal are proposed to be excavated by departmental resources.

Option II –All parameters are same as in Option I. Coal and OB removal by outsourcing means.

Salient features of the proposed Mine

	Quarry Surface Area (Sq. Km)	Total Coal (MT)	Total OB (Mcum)	Average SR (Cum/T)	Mine Life(yrs.)	Remarks
Option I	0.6477	9.60	32.95	3.43	8	Coal & OB both Departmental
Option II						Coal & OB both Outsourced

1.4 Difficulties and constraints in mining with associated risk

a) Due to the steep gradient of the mine 10 ^{0} to 19 ^{0} Internal dumping is not proposed in the mine. OB is proposed to be dumped externally. Each layer of the external dump is around 30 m height and top RL of external dump is less than 90 m above the surface topography. Side road width has been taken as 20 m between different layers of dump.

b) Due to presence of irregular, old Opencast as well as Underground mining in the proposed mining area, proper care should be taken while working on the underground working, fire area and worked out small pits.

c) Hutments (180 nos.) on the proposed mining area are to be shifted elsewhere before the commencement of mining operation.

d) A bridge on the Bander Chua nala is to be constructed for OB transportation to dumping place.

e) Diesel Shovels and Drills are preferred considering the existing mine profile, easy maneuverability and life of opencast mine.

f) Forest land (22.74 hectare) for mining activities are to be acquired. No forest land is needed for external OB dumping.

1.6 Technology Upgrade:

Upgrading technology is a prerequisite for more effective use of resources and thus improving environmental performance, which becomes all the more important in view of a rapidly growing demand of coal in our country. In most cases, newer technologies and processes are both more efficient and less polluting than the technology they replace, allowing increased production using less material and causing less pollution.

Considering, what has been stated in the above paragraph, the proposed mining plan suggests flexibility in the implementation stage within the scope of the proposed mining plan to respond to improvements in technology and equipment which would result in improved profitability, productivity and mitigate environmental hazards due to mining.

CHAPTER-II
MARKETABILITY & JUSTIFICATION

2.1 Demand and Supply Scenario

The availability and demand from CCL is given in Table-2.0 below:

Table No. 2.0

Sl.No.	Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1	**Production**	**54.00**	**58.00**	**66.50**	**74.50**	**75.00**	**83.00**
2	Supply through e-Auction	5.40	5.80	6.65	7.45	7.50	8.30
3	Commitment demand on CCL sources excluding e-Auction and requirement a/c TPPs coming up beyond 1.4.2009	51.23	51.23	51.23	51.23	51.23	51.23
4	Availablility from CCL sources for TPPs coming up after 01.04.2009	-2.63	0.97	8.62	15.82	16.27	23.47
5	Commitment a/c TPPs coming up after 1.4.2009	25.34	38.39	38.39	38.39	38.39	38.39
6	**Total Commitment on CCL**	**81.97**	**95.42**	**96.27**	**97.07**	**97.12**	**97.92**
7	**Net Coal Balance/Availability (Gap)**	**-27.97**	**-37.42**	**-29.77**	**-22.57**	**-22.12**	**-14.92**

2.2 Utility or Market for the coal from project

With upcoming new industries, demand of coking and non coking coal has sharply increased. Draft Project Report of the Kuju OCP (1.30 MTY) is therefore, proposed with a view to partially fulfil the above indicated growth in demand of good quality power grade coal(Grade C –long flame).Moreover this OC may reduce the heavy losses incurred by existing Kuju underground mine.

2.3 Available Linkage or firm Fuel Supply Agreement (FSA)

Coal from this project is being proposed to dispatch to the basket linkage to consumers in Power Sector and E-Booking.

2.4 Justification of opening the project based on Marketability (to fulfill the gap in demand) and/or firm linkage (FSA)

The availability figures till end of XII th plan period (2016-17), as shown in the Table 2.0, have been obtained from CCL. It appears from the figures that till 2011-12 there is a gap of about 27.97 MT which includes both Power as well as Washery grade coal. After considering the production from the upcoming project this gap reduces by 1.30 MT in power grade. The gap in demand and availability of coal over the year justifies implementation of this project.

CHAPTER-III

PROJECT SITE INFORMATION

3.1 Location

Kuju block is situated in the West Bokaro coalfield in the district of Ramgarh, Jharkhand. The Block falls between the latitude 23 ^{0} 44 ‘ 24 “ N to 23 ^{0} 45 ‘ 17 “ N and longitudes 85 ^{0} 29 ‘ 36 “ E to 85 ^{0} 31 ‘ 32 “ E. The Block covers an area of 4.90 Sq Km.To the east of Kuju Block is the Ara Block while Topa Block falls on the west. Pundi Block lies to the north of Kuju Block. The Kuju Block has metamorphic contact on the south.

Limiting Boundaries of the Projectised Area:

- Northern Boundary: The northern surface boundary has been fixed along a safe distance 60 m from Chowtha nala.
- Southern Boundary: The surface boundary along the South has been fixed at the leasehold line of Kuju Block.
- Eastern Boundary: The surface boundary along the East has been fixed leaving a surface barrier of 60 m from Bander Chua nala.
- Western Boundary: The western boundary has been fixed at a distance of 100 m from the new diverted NH 33.

3.2 Accessibility and Communication:

The National Highway No-33 passes through the western part of the Block. Due to fire, new NH-33 has been constructed and old has been abandoned .The nearest station is Ranchi Road,on Gomoh barkakana loop line of the railway.It is about 12 kms. from the block. New railway line (Koderma- Hazaribagh Rly. Line) is under construction in the western part of this block beside the NH-33. Two new Railway Stations namely, Kuju and Mandu are coming up at a distance of around 2-3 kms and 3-4 kms from the mine respectively. A photo showing the progress of railway line laying and earth cutting near NH 33 is given below.

3.3 Climate and Rainfall Data:

Due to mining activities, the ecology of the area has been badly affected. The climate of the region is tropical. The summer (April to June) is very hot and temperature varies from 28 ^{0} C to 40 ^{0} C. The winter is also extreme. According to the rainfall data available from 'Mandu Rain Gauging Station' the maximum rainfall recorded was 480.80 mm in July 1965.The Kuju Block receives maximum rainfall of about 300 mm in the month of July, every year. Summer days are hot with dusty wind, but nights are generally pleasant. The winter (November-February) is cold and the minimum temperature recorded is 4^0C. The Rainy season is generally from June to October.

3.4 Topography with drainage pattern of area:

The topography of the kuju Block is rugged forming hills and valleys due to

numerous rivulets. The general ground slopes towards north and south -east. The drainage of the block is controlled by easterly flowing Chowtha nala. The tributary Bander Chua nala , Banwar and Mourpa nala flowing from south to north joins Chowtha nala. The highest point of elevation is around 410 m on NH - 33 near the boreholes CMKJ-10,8 and 26.The lowest elevation along the Chutua nala is around 335 m.

CHAPTER-IV

GEOLOGY AND DEPOSIT APPRAISAL

4.1.1 Background/Introduction - The four pre-nationalisation leases called Mourpa, Kuju, Banwar and Hesagora have been re-organised in 1973 after nationalization of coal industry, in a single unit named as Kuju colliery. Geological report on Kuju block comprises of Mourpa, Kuju and part of Banwar leases where as Hesagora section has been covered under a separate Geological report on Hesagora block.

4.1.2 Different GRs prepared at different period for the blocks under reference – 1) Geological report on Kuju block, West Bokaro Coalfield (CMPDI, RI-III August 1981)

4.1.3 Block Boundaries – East – Common lease hold boundary with Ara Colliery, West – Line joining boreholes CMKJ 23 & 27, North – Part of Bahera and Chowtha nala, (southern limit of lease hold of Pundi block in north) South – Metamorphic Barakar contact

4.1.4 Exploration Status

Number of boreholes and meterage drilled by the various agencies and period of drilling thereof, in the block area in tabular form is given in Table 4.1 below

4.1.5 Density of boreholes in block area – 12.5 BH per Sq. Km.

Table 4.1 : Summary of Exploratory Boreholes

Year	Agency	Block Name	Area (sq. km)	Number of BH	Meterage
	GSI	Kuju	4.08	3	1021.95
	NCDC			3	1474.54
June'76 to Feb'80	CMPDI			44	8801.60
Total				50	11298.99

4.1.6 Geology and Structure of Block area – The Kuju block is located in the South Central part of WBCF and lies on the southern limb of the southern synform. The Gondwana in the block is represented by rocks of Barren Measures, Barakars and Karharbari Formations. The drilling activity however, was mainly confined in Barakar Formation. The Talchir Formation and post Barren Measures sequence are absent in Kuju block.

4.1.7 Brief geological setting within the block –

Coal bearing formations and their general behavior –

Karharbari Formation – The only coal seam belonging to the Karharbari formation is Seam-0. Thickness of this formation in the block is about 72m. It has developed in the north eastern part of Mourpa section and gradually pinches out towards west and south portion of the block.

Barakars – The entire area is covered by the rocks of Barakar formation attaining a thickness of more than 450m in the block. This is the major coal bearing formation containing 24 co relatable coal seams. The Barakars are characterized by thick sequence of coarse to medium grained sandstones inter banded with alternating bands of sandstone and shales and coal seams.

Barren Measures - This formation is exposed in the north eastern and north western part of the block. It has a thickness of about 150m. The rock types are grey shales and carbonaceous sandy shales with sideritic bands.

Burnt outcrop – Burnt outcrop of coal seams are noticed in all the three sections of Kuju block. The entire outcrop of seam X along Banderchua Nala makes prominent upland along the burnt portion. The burning has resulted in baking of shale into buff/brown/white coloured shale. Similar phenomenon is noticed in the overlying seam XI in the same area. In Mourpa section burnt rocks are noticed where outcrop of seams VI/VII have been affected by surface burning. In Banwar section outcrop of seams V, VA & VI have been affected by surface burning.

Igneous intrusion – No igneous intrusion have been recorded in the borehole or in the mine working.

4.1.8 Sequence of coal seams and partings within the block area

Table 4.2 : Sequence and brief description of Coal Seams in the block

Seam	Thickness range (m)	Grade range	BH intersections	Geological Reserve (MT)
Surface Cover				
XIII	1.72-3.14	D-E	11	3.815
Parting	11.06-19.06			
XII	1.36-4.72	D-F	11	5.696
Parting	45.10-64.74			
XI	6.69-14.62	E-W IV	25	25.512
Parting	1.80-13.85			
XA	0.25-1.80	C-W II	21	3.443
Parting	14.52-26.75			
X	8.45-15.65	C-W III	22	27.545
Parting	10.82-19.99			
IXA	1.04-1.68	D-W II	16	4.249
Parting	7.80-29.60			
IX	3.47-4.52	E-W III	24	11.150
Parting	2.80-12.60			
VIIIC	0.12-0.35			
Parting	4.54-24.52			
VIIIB	0.25-1.04			
Parting	7.67-19.39			
VIIIA	0.45-1.58	SG II-W II	24	1.874
Parting	6.51-21.45			
VIII	4.19-7.60	F-W IV	27	15.254
Parting	3.26-31.40			
VIIB	0.50-2.18	SG I-W I	22	4.125
Parting	11.77-29.16			
VIIA	0.30-1.35			
Parting	6.27-30.80			
VII	2.30-6.53	SG II	28	14.514
Parting	5.53-23.35			
VI	1.40-3.40	SG II	25	9.633
Parting	2.24-13.37			
VA	3.99-7.74	C-W II	25	15.101
Parting	6.22-31.95			
V	10.74-19.60	D-W III	25	53.038
Parting	6.17-26.91			
IV	2.95-5.67	W II- IV	22	14.960
Parting	2.25-7.90			
IIIA	0.50-1.95	E-W III	22	3.267
Parting	1.72-10.16			
III	3.18-8.60	F-W IV	21	31.278

Parting	1.95-13.68			
IIB	0.40-3.77	F-W III	18	6.733
Parting	5.83-26.70			
IIA	1.20-3.85	G-W IV	17	9.692
Parting	7.50-34.83			
II	1.52-6.37	W III- IV	17	10.326
Parting	2.78-42.15			
I	0.68-6.85	G-W IV	17	10.219
Parting	50.15-54.06			
0	3.08-6.76			

4.1.9 Structural setting of the block – The Kuju block lies on the southern limb of the southern synform. Due to presence of various strike and oblique faults the strike of the formation varies widely .

4.1.10 Dip and Strike – The strata dips toward west in the in the western part and north & north-west in the northern part. Generally the gradient of the seam is steeper in the Mourpa section as compared to Kuju and Banwar sections. The amount of dip varies from 10^{o} to 15^{o} in less disturbed area to 25^{o} to 35^{o} in more disturbed area. The strike shows a gradual change from N-S to NE-SW to almost E-W.

4.1.11 Fault –In Kuju block a total of 37 faults have been interpreted based on surface and sub-surface data. Brief description of the faults falling in and around the proposed mine/project boundary is given below.

Table 4.3 : Brief Description of Faults in the block

Fault	Location	General Trend of fault trace	Amount of throw(m) & direction	1. Strike 2. Dip 3. Evidence
F5	Major fault, marks the southern boundary of the block in eastern part	E-W in eastern part and turns to WNW in western part of the block	250-400m Northerly	1. Drag effect in Quarry No.1 Q (K) of Seam-X 2. Seam-VII abutting against Qry.7C Q (K) of Seam-X NW of CMKJ-31 3. CMKJ-22 strata between Seams X and II omitted. 4. CMKJ-8 strata above Seam-V to XI omitted.
F6	Western part of the mine	N-S	30-90m Westerly	1. field evidence, variation in dips on either side of fault.
F7	SW part of the mine	WNW-ESE	20-150m North easterly	1. Sudden termination of quarry of seam XI 7A/B Q(K) in strike 2. Part of seam IX to VIII omitted in CMKJ-8
F8	SW part of the mine	NW-SE	10-20m North easterly	1. Displacement of incrop of seam XIII in quarry No. 7Q(K) 2. CMKJ-9 faulted 3. Seam XI omitted in CMKJ-10
F9	NE part of mine	NW-SE	10m North easterly	1. Field evidence occurring in Hesagora block
F12	Major fault, NE part of mine	Low angle Curvilinear, N-S to E-W	50-250m Easterly near BH CMKJ-19 to northerly near BH CMKJ45	1. Barren Measures come in juxtaposition with seam X quarry no. 3Q(K) 2. Omission of strata observed in BH CMKJ-9,16,20,57 & WBKU-4

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4.1.12 Description of Coal Seams

Important coal seams of the project area and their general behaviour – Seams X, XA, XI, XII & XIII have been considered for opencast mining in the present project report.

Description of Individual coal seams of the project area dealing with the following:

4.1.13 Seam – X

Stratigraphic position – Seam X is fairly consistent and thick horizon in Kuju. It has been encountered in 22 BHs. It overlies seam IXA with a parting ranging from 10.82-19.99m and underlies seam XA with a parting range of 14.52-26.75m. The shallowest and deepest floor depths are at 55.31 and 235.92 m respectively.

Thickness - The seam ranges in thickness from 8.45 to 15.65 m. Average thickness of seam varies from 9-13m

Dirt band – Seam X is highly interbanded in nature. Number of dirt bands varies from 4 to 16 and their cumulative thickness varies from 0.64 to 3.25m.The percentage of dirt bands vary from 6.4 to 21.5

Roof and Floor – Carbonaceous shale and occasionally medium to coarse grained sandstone forms the roof of the seam while floor is generally of grey shale and intercalation of sandstone and shale.

Quality - Analytical parameters of seam-X is tabulated below

Proximate Analysis Air dried basis			**Ultimate Analysis Dmmf basis**				**Coking propensity**		
M%	**Ash% (Inb.)**	**VM%**	**C%**	**H%**	**CV (Kcal/Kg)**	**VM%**	**CI**	**CT**	**SI**
1.5-3.4	21.7-26.1	26.7-28.4	84.3-85.9	5.1-5.4	8160-8380	33.9-35.1	5/7-18/20	C-E	

Washability – The result available for borehole CMKJ-19 indicate that the yield of cleans at 1.5 sp. Gr. is about 63.2% having an ash content of 14% (the raw coal ash being 23.2%).

Grade – The coal of seam X is high volatile and weakly caking in nature. The grade varies from non coking grade C to medium coking WG-III

Reserve – The net proved reserve of the seam is 12.67 MT and indicated reserve is 14.87 MT

4.1.14 Seam-XA

Stratigraphic position – It is a thin seam encountered in 21 BHs. It overlies seam X with a parting ranging from 14.62 to 26.75m and underlies seam XI with a parting ranging from 1.80 to 13.85m. The shallowest and deepest floor depths are at 28.93 and 206.97m respectively.

Thickness – The seam ranges in thickness from 0.25 to 1.95m. Normal thickness of the seam varies from 1.12 to 1.8m.

Dirt band – The seam is generally free from dirt band.

Roof and Floor – Carbonaceous shale and occasionally medium to coarse grained sandstone forms the roof of the seam while floor is generally of carbonaceous shale.

Quality - Analytical parameters of seam-XA is tabulated below

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.5-3.6	23.4-24.4	24.7-28.0	83.8-85.3	5.1-5.5	8185-8435	33.0-37.7	9/11-24/26	C-G/G1	

Grade –. The coal of seam XA is high volatile and medium to strongly caking in nature. The grade varies from non coking grade C to medium coking WG-II.

Reserve - The net proved reserve of the seam is 1.44 MT and indicated reserve is 2.01 MT

4.1.15 Seam-XI

Stratigraphic position – It is the youngest thick and persistent horizon encountered in 25 BHs. It serves as a marker horizon. It overlies seam XA

with a parting ranging from 1.80 to 13.85m and underlies seam XII with a parting ranging from 45.10 to 64.74m. The shallowest and deepest floor depths are at 25.55 and 203.34m respectively. The seam has been partly quarried in the incrop region.

Thickness – It ranges from 6.69 to 14.62m. However, the normal and consistent thickness is 10.0 to 13.0m

Dirt band – Seam XI is highly interbanded in nature. Number of dirt bands varies from 7 to 23 and their cumulative thickness varies from 1.52 to 3.91m.The percentage of dirt bands vary from 14.4 to 31.25%

Roof and Floor – Carbonaceous shale and occasionally medium to coarse grained sandstone forms the roof of the seam while floor is generally of grey shale.

Quality - Analytical parameters of seam-XI is tabulated below

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.6-3.3	30.8-35.7	25.6-27.5	84.2-86.2	5.2-5.5	8205-8435	36.2-38.8	4/6-19/21	B-E/F	

Washability – The result available for borehole CMKJ-19 & CMKJ-44 indicate that the yield of cleans at 1.5 sp. Gr. is about 41% having an ash content of 16-18%.

Grade – The coal of seam XI is high volatile weakly caking in nature. The grade varies from non coking grade E to medium coking WG-IV.

Reserve - The net proved reserve of the seam is 12.81 MT and indicated reserve is 12.70 MT

4.1.16 Seam-XII

Stratigraphic position - It has been encountered in 11 BHs. It overlies seam XI with a parting ranging from 45.10 to 64.74m and underlies seam XIII with a parting ranging from 11.06 to 19.07m. The shallowest and deepest floor depths are at 14.90 and 138.27m respectively. The seam has been partly quarried in the incrop region.

Thickness – It ranges from 1.36 to 4.72m. Generally thickness of the seam varies from 2.5 to 3m.

Dirt band – Seam XII is interbanded in nature. Number of dirt bands varies from 2 to 8 and their cumulative thickness varies from 0.28 to 1.18m.The percentage of dirt bands vary from 11.4 to 32.4%

Roof and Floor - grey shale and occasionally medium to coarse grained sandstone forms the roof of the seam while floor is generally of carbonaceous shale.

Quality - Analytical parameters of seam-XII is tabulated below

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.8-4.1	30.0-42.2	21.8-26.2	83.4	5.4	8160	36.6	5/7	C	

Ash Fusion Range(^{o}C) – IDT- 1110-1150, HT- >1290-1350

Grade – The coal of seam XII is non caking in nature. The grade varies from non coking grade D to F

Reserve - The net proved reserve of the seam is 1.55 MT and indicated reserve is 4.15 MT

4.1.17 Seam-XIII

Stratigraphic position – This is the youngest seam encountered in 11 BHs. It overlies seam XII with a parting ranging from 11.06 to 19.07m and underlies about 10.0-13.0m below the Barren Measures-Barakar contact. The shallowest and deepest floor depths are at 12.36 and 150.00m respectively.

Thickness – The seam ranges in thickness from 1.72 to 3.14m. However, the normal thickness of the seam is 2 to 2.25m. The seam has been partly worked by open cast method in incrop region.

Dirt band – Seam XIII is interbanded in nature. Number of dirt bands varies from 1 to 5 and their cumulative thickness varies from 0.10 to 0.60m.The percentage of dirt bands vary from 4.8 to 16.7%.

Roof and Floor - Carbonaceous shale and occasionally medium to coarse grained sandstone forms the roof of the seam while floor is generally of grey shale and intercalation of sandstone and shale.

Quality - Analytical parameters of seam-XIII is tabulated below

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.9-4.3	25.6-32.1	23.7-27.0	83.3-84.4	5.0-5.5	8140-8200	33.9-35.7	5-9/11	A/B-D	

Ash Fusion Range(^{o}C) – IDT-1180- 1240, HT - >1400, FT - >1400

Grade – The coal of seam XIII is non caking in nature. The grade varies from non coking grade D to E

Reserve - The net proved reserve of the seam is 0.9 MT and indicated reserve is 2.92 MT

4.2 Geo-technical information

Details of Physico-mechanical properties determined for various litho units in core of Borehole no. CMKJ-6 & 19 of Kuju block are tabulated below

Sl. No.	Litho-unit description	Comp.- Strength Kg/cm^2	Split Tension Kg/cm^2
1	Conglomerate	275-769	66.86
2	C.Gr. Sandstone, gritty sandstone including pebbly sandstone	152-546	19.07-45.67
3	Medium grained sandstone	265-986	51.22-107.92
4	Fine grained sandstone	320-1210	35.30-43.43
5	Shaly sandstone & intercalated sandstone and shale	288-1084	31.45-124.63
6	Grey shale	276-735	25.26-79.92
7	Carbonaceous sandy shale	358-467	42.45-68.22
8	Carbonaceous shale	160-645	15.69-27.05
9	Carbonaceous shale with siliceous streak	301-350	38.36-43.97

4.3 Geological Reserves

4.3.1 Brief methodology adopted for reserve estimation –

Isochore and isograde of individual seams have been drawn. The area of the inter-play of isochore and isograde of individual seam has been measured with the help of planimeter. The reserve below isochore of 0.90m for various seams has been excluded from estimation.

The area thus measured has been multiplied with average thickness of the enclosing isochore so as to arrive at the volume of coal.

Heave zone of the fault on the floor of the individual seam and 40m barrier along nalas and 60m barrier on both sides of the National High way have been excluded from reserve estimation.

The specific gravity of the individual seam has been considered separately for different grades. A mathematical average of ash % of individual grade have been considered and 1% of the average ash thus calculated, has been added to 1.29 & 1.28 (respectively for coking and non coking coal) to arrive at the Sp. Gr. for individual grade. Grade wise Sp. Gr. considered for estimation of reserve are given below

Grade	Av. Ash %	Sp. Gr.
Coking coal		
SG-I	<15.0	1.44
SG-II	16.5	1.46
W-I	19.5	1.49
W-II	22.5	1.52
W-III	26	1.55
W-IV	31.5	1.61
Non coking coal		
Grade D	28	1.56
Grade E	34	1.62
Grade F	40	1.68
Grade G	51	1.79

Volume of the coal has been multiplied by the Sp. Gr. of the coal falling in the particular grade to obtain the gross in situ reserve. A deduction of 10% of the gross reserve has been made in order to obtain the net in situ reserve of the coal.

4.3.2 Seam-wise and category wise net Geological Reserves within the block area is given below

Table 4.5 : Seam-wise and category wise Geological Reserve of Kuju

Seam	Category			Total
	Proved	Indicated	Inferred	
XIII	0.897	2.918		3.815
XII	1.547	4.149		5.696
XI	12.811	12.701		25.512
XA	1.437	2.006		3.443
X	12.673	14.872		27.545

IXA	2.144	2.105		4.249
IX	6.081	5.069		11.150
VIIIA	0.832	1.042		1.874
VIII	8.666	6.588		15.254
VIIB	1.578	2.547		4.125
VII	8.969	5.545		14.514
VI	6.786	2.847		9.633
VA	8.556	6.545		15.101
V	35.211	17.827		53.038
IV	9.360	5.6		14.96
IIIA	1.504	1.763		3.267
III	13.199	18.079		31.278
IIB	4.421	2.143	0.169	6.733
IIA	6.109	3.153	0.070	9.692
II	6.928	3.118	0.280	10.326
I	6.844	3.131	0.244	10.219
Total	**156.553**	**124.108**	**0.763**	**281.424**

Coal type wise and category wise reserve in Kuju block is summarized below

Coal type	**Category**			**Total**
	Proved	**Indicated**	**Inferred**	
Medium coking (SG-I to W-IV)	107.2	94.3	0.8	202.3
Medium coking (Ungraded)	15.9	14.9	-	30.8
Semi coking (Grade –I & II)	2.4	0.3	-	2.7
Semi coking (Ungraded)	19.3	4.7	-	24.0
Non coking	11.7	9.9	-	21.6
Total	**156.5**	**124.1**	**0.8**	**281.4**

CHAPTER-V

MINE BOUNDARY, RESERVES AND MINE LIFE

5.1 Introduction

Mining activities, both opencast and underground has taken place earlier in this block. Now all mining activities are suspended in the proposed mining area due to fire and proximity to old NH-33. Underground mining activities are being carried out in Kuju mine near substation. Balance Coal and OB quantity of the quarry has been estimated after deducting all mined out quarries and UG workings.

Quarry Area(Sq Km)	Coal(MT)	OB(Mcum)	SR(cum/T)	Life(yrs.)	Av.Grade
0.6477	9.60	32.95	3.43	8	"C" long flame

It is proposed to exploit the coal seams in the Quarry from Seam XIII to Seam X. The proposed quarriable block is based on the "Geological Report of Kuju Block, West Bokaro Coalfield" prepared in August 1981. The parameters of the opencast minefield and the technical condition of its development make it feasible to produce 1.30 MT of ROM coal per annum with normal technical indices i.e., deployment of equipment, strike length of the quarry, annual advances of the faces, etc.

Five (5) numbers of coal horizons, namely Seams XIII, XII, XI, X A and X are occurring within this mining block. Seam X is the base seam of the proposed quarry.

5.2 Mine Boundaries:

Mine boundary optimization is considered keeping in view of the following parameters:

- Northern Boundary: The northern surface boundary has been fixed along a safe distance of 60 m from Chowtha nala.
- Southern Boundary: The surface boundary along the South has been fixed at the leasehold line of Kuju Block (metamorphic line).

- Eastern Boundary: The surface boundary along the East has been fixed leaving a surface barrier of 60 m from Banderchua nala.
- Western Boundary: The western boundary has been fixed at a distance of 100 m from the new diverted NH 33.

5.3 Mineable Reserves:

The quarry boundary has been optimized to the extent that the extractable reserve has been maximized to produce coal @ 1.30 MTY within the proposed boundary.

5.4 Quarry Floor consideration:

Quarriable reserve has been considered upto Seam X only. Seam IX A of average thickness of 1.1 m occurs at parting of 17.0 m (avg.) from Seam X.

5.5 Seam wise details of Mineable Reserves:

Name of seam	Thickness variation (m)	Net insitu Geological Reserve in Kuju Block(MT)	Mineable Reserve (MT)
XIII	2.05-3.09	3.815	0.27
XII	2.83-4.38	5.696	0.45
XI	6.32-12.75	25.512	5.31
X A	0.50-1.66	3.443	0.45
X	9.92-12.39	27.545	3.12
Total		**66.011**	**9.60**

5.6 Reason for difference in Mineable Reserve and Net insitu Geological Reserve:

- Geological Block area is-4.90 Sq km where as Quarry Area is-0.65 Sq km.(it is a part of Geological Block)
- Remaining area consists of Mourpa sector(to be annexed in revised GR), Banwar sector(no mining activity) and area bounded by block boundary in the east and Bander chuan nala in the west (Kuju underground mine in operation).
- Reserves extracted by under ground as well as opencast have been deducted from geological reserve to estimate the mineable reserve (in the proposed quarry).

- Quarry area is reduced considerably while keeping a safe barrier from Chutua nala , Banderchua nala and NH-33 thereby decreasing the mineable reserve within the Quarry.
- Coal lost due to fire near NH-33 is deducted to attain mine able reserve.

5.7 Target Output & Mine Life:

The mine has been planned for a nominal production capacity of 1.30 MT per annum of coal and peak production 1.62 MTY. The target has been assessed based on geological constraints, optimization of mining operations, size of the quarry, rate of advance, type of mining system adopted , existing developed workings and old worked out quarries Etc.

Mine Life:

The project will sustain a quarry life of eight years. The break-up of total period is as follows:

- Production build-up period – Two years
- Targeted production period - Six years

CHAPTER-VI

METHOD OF MINING

6.1 General

Considering the geo mining characteristics of the mining block i.e. thin seams, steep gradient of the seams within the quarry, occurrence of geological disturbances, abandoned old opencast mines, developed galleries and presence of fire, mining with shovel-dumper combination is proposed to work in Kuju Opencast mine.

6.2 Geo-Mining Characteristics

The Geo-Mining characteristics of the proposed Kuju OCP (1.30 MTY) are given in the table below. A total no. of five coal horizons is occurring within the quarriable area.

6.2.1 Seam Gradient – The dip of the formation varies from 10^{O} - 19^{0} in the proposed quarry towards east west.

6.2.2 Assessment of Quarriable Potentiality

A study was carried out in this report to find out the possibility of opencast working upto seam X. Average grade of coal produced from this quarry is expected to be Grade C (long flame).Feasibility of extracting coal upto 140 m depth including developed area of underground workings by opencast method is studied and it is found technically feasible to convert the underground mine to opencast mine upto seam X.

Following points are considered while preparing this quarry:

- Seam X has been considered as base seam.
- Coal seam roof and floor surface as generated in the MINEX model has been used for the quarry planning purposes and estimation of coal reserve.
- Topography, fault position etc. has been considered as provided in the Geological Report of Kuju Block and plan supplied by the project.

- Based on the MINEX model an estimate of the gross insitu geological reserve falling within the proposed quarry has been estimated.
- The net geological reserve in the quarry has been estimated by deducting coal reserve already quarried or depillared and coal already extracted in developed/standing pillars with the following consideration
    - Reserve already quarried or depillared-Insitu coal reserve falling within the vertical limits (at a slope of 70 degree) of top edge of the mined out quarries have been completely deducted for seams worked earlier. In case of underground B&P depillared pillars, coal reserves falling within the depillared panel area have been completely deducted.
    - Percentage of extraction of coal for opencast in remaining developed pillars has been estimated by deducting a fixed percentage of 40% for coal extracted during underground B&P development.

6.2.3 Details of sequence of coal seam and parting

Name of Parting/Seam	Thickness of parting /coal (m) with range	
	Min	Max
Top OB above Seam XIII	5.70	39.12
Seam XIII	1.72	3.14
Parting between XIII & XII	11.03	13.46
Seam XII	2.63	2.93
Parting between XII& XI	48.03	52.46
Seam XI	10.86	11.46
Parting between XI & X A	2.20	4.82
Seam X A	1.12	1.32
Parting between X A & X	15.02	16.43
Seam X	10.82	11.18

6.3 Mine parameters

Particulars	Minimum(m)	Maximum(m)
Strike length	614	952
Depth of quarry	35	145
Dip rise length (on floor)	472	787
Final Quarry Floor area (in Sq Km)	0.40	
Final Quarry Surface area (in Sq Km)	0.65	
Mineable reserves (Mt)	9.60	
Total OB (Mcum)	32.95	
Average Stripping Ratio (Cum/Tonne)	3.43	
Seam gradient (Avg. gradient of the quarry floor)	10 - 19 deg	

6.4 Choice of Technology:

Considering the geo-mining conditions shovel-dumper combination with drilling and blasting has been proposed for mining the quarry. Other technologies like Dragline, Bucket Wheel Excavator, Surface miners are ruled out for this quarry.

Shovel Dumper Combination

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:

1. The strike length of the mine
2. Annual rate of advance
3. Total volume of overburden and coal to be handled annually
4. The individual thickness of coal seam and partings
5. The geo-mining condition of the mine.
6. The type of mining system to be used like Inclined Slicing or Horizontal Slicing.
7. The intuitive economics of the mine
8. Presence of geological disturbances like faults, intrusions etc.

Keeping in view of the Geological and Mining parameters of Kuju OCP mining area i.e. steep gradient of the seam (10^0-19^0), rated output of 1.30 MTY, Shovel-dumper mining system with horizontal slicing has been envisaged for the quarry.

6.4 Equipment Selection

Following options are considered for this mine-

- **Option I-** Coal and OB both Departmental and external dump is on Pokharia Mouza(Coal bearing and non forest land) at a distance of around 600 m from mine.
- **Option II** –All parameters are same as in Option I. Coal and OB removal is by outsourcing means.

Considering the average strike length of the quarry, gradient and thickness of the seam, annual load of excavation, lead of HEMM, presence of developed UG mines and abandoned quarries the following equipments have been selected.

Coal Winning:

Coal will be mined by 6.00 cum diesel hydraulic shovel with back hoe attachment in combination with 60T rear dumpers. This attachment will be useful tools in handling faulted area operation, coal wedge removal, working over developed area and temporary sump formation in horizontal slicing method. For the estimation of the dumpers population in coal, the lead for coal transportation has been considered for each year and for each seam. Coal will be transported through batters. Ramp is provided (1 in 10 gradient) to facilitate HEMM movement in between different horizon. Possibility of haul road on floor is ruled out due to steep gradient of coal seam. A hydraulic shovel with backhoe is proposed in common to deal with developed workings from upper bench. While working developed seams by opencast method, further occurrence of fire can not be ruled out, so adequate precautions are required to deal with fire as soon as it appears. 1.2 Cum Back hoe, F E loader and water sprinkler have been for common mining activities. Productivity of these FE loader and backhoe has not been considered while calculation the requirement of HEMM for the mine. The

coal will be transported right from the coal face to the feeder breaker through the haul roads made along the batters of the quarry.

Overburden Removal:

OB / partings are envisaged to be removed by 6.0 cum diesel hydraulic shovel in combination with 60T rear dumpers. OB will be transported through batters like Coal transportation. Ramp is provided (1 in 10 gradient) to facilitate HEMM movement in between different horizon to the external dump site as shown in the dump plan.

Drilling and Blasting:

Drilling and blasting operations for loosening the coal and OB are necessary before excavation by shovels. For the purpose of drilling in coal and OB benches 160mm Diesel RBH drills have been provided. One wagon drill of 100mm-120mm has been provided to deal with thin coal seam/partings and wedge formation. Controlled or muffled blasting will be practiced near the important surface infrastructures.

Mining system & system parameters:

As the seams are steeply dipping the mine will follow horizontal slicing method. The mining system has been depicted in the cross section of the mine.

The following mining parameters have been considered in the project.

Sl. No.	Particular	Unit	Value
1	OB Bench Height for 6.0 cum Diesel Hydraulic shovels	m	10
2	Coal Bench Height for 6.0 cum Back Hoe	m	10
3	Working bench width	m	40
4	Non - Working bench width	m	20
5	Width of Permanent haul road	m	20

6	Usual height of the spoil dump bench	m	30
7	Maximum height of spoil dump	m	87
8	Bench Slope for OB and coal	Deg	70
9	Bench Slope for dump	Deg	37
10	Overall pit slope for Quarry	Deg	43
11	Blast Hole dia for OB and Coal for Quarry	mm	160
13	Blast Hole depth in OB and Coal bench	m	12-14
14	Powder Factor for OB	Kg/cum	0.3-0.4
15	Powder Factor for Coal	Kg/Te	0.2-0.3

6.5 Precautions to be taken during mining operation due to existing UG workings, abandoned old quarry and probable break out of fire:

a) Quarry shall be worked by Heavy Earth Moving Machinery only. No manual operation in the quarry will be done.

b) HEMMs, except drilling machines shall not be deployed on the bench where thickness of coal or overburden above the UG galleries, as proved by advance boreholes or other suitable methods, is less than 6m.

c) Exposed coal faces (including UG galleries)shall be kept covered with fine grained incombustible OB material to prevent breathing of air and control fire to dip side working. This cover shall be removed only at the time of coal extraction.

d) Overburden containing carbonaceous material shall not be dumped within 30m of the exposed side of the coal benches. Hot overburden shall be quenched and cooled at dump sites.

e) No person shall be allowed at any place in the opencast working where the thickness of overburden and/or coal over any gallery is less than 1.5m.

f) Except for the purpose of inspection and support work no person shall be allowed in the underground mine beneath and within 200 m of the opencast excavation. The person visiting UG will take all safety precautions for safe working.

g) The rate movement of active coal face should be faster and stagnation of Coal face should be avoided.

h) **Blasting in fire area**

i) No explosive other than slurry and emulsion explosive shall be used.

ii) Blasting shall be done with detonating fuse down the hole. Fresh drill holes should be tightly plugged at the mouth.

iii) Temperature inside the hole shall be measured by Bi-Metallic thermocouple heat sensor (before filling with water) and if the temperature exceeds $80^{o}C$ in any hole the hole will not be charged.

iv) All blast holes shall be kept filled with water. When any hole is traversed by cracks or fissures the hole shall not be charged unless it is lined with an asbestos pipe and the hole filled with warter. In addition, bentonite should be used for sealing any cracks at the bottom of the hole.

v) Detonating fuse shall not be laid on hot ground without taking suitable precautions.

vi) Charging and firing of holes in any one round shall be expeditiously completed and in any case within 2 hours.

vii) A parting of at least 2m between the bottom of a short hole and roof of underground gallery shall be left intact.

viii) Effective muffling of hot shot holes with old wire rope screens shall be done for prevention of flying hot fragments.

ix) No blasting shall be done in crushed or broken ground.

x) No person shall be employed within 150m when blasting the heated material.

xi) The spacing of hole in the coal/Ob benches lying immediately above the galleries shall be so adjusted that the holes do not lie immediately above the galleries in order to ensure that blast holes do not directly fire into the underground working.

xii) All holes in the coal/Ob benches lying immediately above the galleries dshall be charged with water impulses or with moist sand of at least 0.6m in length at the bottom of the hole.

xiii) No person including a shot firer shall take shelter within 100m of the quarry opening. Such shelter shall be of an approved design.

6.6 Mining Strategy to work the balance reserves beyond the present opencast proposal

Considering the steep dip nature of the property dip side extension of the proposed quarry through opencast operation appears to be a difficult proposition. Majority of the seams to the dip side of the proposed quarry have underground potentiality. These seams may be worked in future by under ground mining methods. The High wall of the proposed quarry may be regraded and utilised to mine the balance coal reserves through underground means.

While working above underground workings and fire, suitable precautions as laid down by DGMS vide its various Circulars should be strictly observed.

LIST OF HEMM

COAL & OB BOTH DEPARTMENTAL

OPTION - I

Particulars	Size / Capacity	YEARS							
		1	2	3	4	5	6	7	8
OB									
Diesel Hyd Shovel	6.0 Cum	1	2	2	3	3	3	3	3
Rear Dumper	60 T	11	15	21	23	27	30	30	30
RBH Drill (Diesel)	160 mm	1	2	2	3	3	3	3	3
Dozer	410HP	2	3	3	4	4	4	4	4
Coal and Mixed benches									
Diesel Hyd Backhoe Shovel	6.0 Cum	1	1	1	1	1	1	1	1
Rear Dumper	60 T	2	2	3	3	3	3	4	4
RBH Drill (Diesel)	160 mm	1	1	1	1	1	1	1	1
Dozer with Ripper Attachment	410HP	1	1	1	1	1	1	1	1
Common									
Hyd. Shovel (with backhoe)	1.2 Cum	1	1	1	1	1	1	1	1
Dump Truck	10T	1	1	1	1	1	1	1	1
Grader	280HP	1	1	1	1	1	1	1	1
RT crane	50T	1	1	1	1	1	1	1	1
RT crane	20T	1	1	1	1	1	1	1	1
FE Loader	5-6 Cum	1	1	1	1	1	1	1	1
Wagon Drill	100-120mm	1	1	1	1	1	1	1	1
Tyre Handler	35kN	1	1	1	1	1	1	1	1
Water Sprinkler	28KL	1	2	2	2	2	2	2	2
Wheel Dozer	460 HP	1	1	1	1	1	1	1	1
Vibratory Compactor	30T	1	1	1	1	1	1	1	1
Fuel Truck	16KL	1	1	1	1	1	1	1	1
Fire Truck		1	1	1	1	1	1	1	1
Reclamation									
F E Loader	5-6Cum				1	1	1	1	1
Water Sprinkler (wide spray system)	28 KL				1	1	1	1	1
Dozer	410 HP				1	1	1	1	1

LIST OF HEMM
COAL & OB BOTH OUTSOURCED
OPTION - II

Particulars	Size / Capacity	YEARS							
		1	2	3	4	5	6	7	8
OB									
Diesel Hyd Shovel	6.0 Cum	Outsourced							
Rear Dumper	60 T								
RBH Drill (Diesel)	160 mm								
Dozer	410HP								
Coal and Mixed benches									
Diesel Hyd Backhoe Shovel	6.0 Cum								
Rear Dumper	60 T								
RBH Drill (Diesel)	160 mm								
Dozer with Ripper Attachment	410HP								
Common									
Hyd. Shovel (with backhoe)	1.2 Cum	Outsourced							
Dump Truck	10T								
Grader	280HP								
RT crane	50T								
RT crane	20T								
FE Loader	5-6 Cum								
Wagon Drill	100-120mm								
Tyre Handler	35kN								
Water Sprinkler	28KL								
Wheel Dozer	460 HP								
Vibratory Compactor	30T								
Fuel Truck	16KL								
Fire Truck									
Reclamation									
F E Loader	5-6Cum				1	1	1	1	1
Water Sprinkler (wide spray system)	28 KL				1	1	1	1	1
Dozer	410 HP				1	1	1	1	1

CHAPTER-VII

MINING & DUMPING STRATEGY

7.1 Constraints on Mine Development

a) **Underground Workings and old quarried area:** The proposed mining area contains old underground workings in Seam XII, X A and X (other seams like Seam VIII and Seam VII also worked by UG). Suitable statutory precautions need to be taken during the extraction of these seams.

b) **Fire:** Mine is to be worked with suitable precaution while working near the fire in Seam XII.

c) **Built-up:** An extensive built up area is located within the proposed quarry(around 180 hutments).Villages known as Lohagate and Lakri gate is located on the proposed mine area. These needs to be shifted and/or rehabilitated.

d) **OB Dumping site:** Within the leasehold area of the mine, non coal bearing area is not available upto a lead of 5 km. So it is proposed to dump the OB on coal bearing area and to re handle it later.

e) **Approach to Dump:** A bridge over Banderchua nala is to constructed for HEMM movement from the quarry to external dump site.

f) **Forest Land Acquisition:** Forest Land of 22.74 Hac is to be acquired for mining operation within the quarry**.**

The above constraints have been considered while formulating mining/dumping strategy.

7.2 Mining Strategy / Mining Sequence

The quarry is proposed to be worked by horizontal slicing method by shovel-dumper combination (considering the steep seams). Batter roads along with ramps are designed to evacuate coal and OB from this mine.

7.3 Dumping Strategy

Spoil Dump

Total volume of overburden of the proposed OCP has been estimated as 32.95 Mcum.

All the OB is proposed to be dumped externally on the Mourpa Sector(within the leasehold of the project) at a distance of about 600 m. It is coal bearing area and Geological Report of this is to be prepared .It is further proposed to rehandle this dump to fill up the void created by worked out quarry. Maximum dump RL is 440 m which is 84m(average) above the surface topography. There is no forest land in the proposed dump area.

Box Cut and 2 nd (Second) year Stage Dump Plan

Box Cut of the mine has been proposed near the location of Bore hole No-NCWBP-9 having surface RL of 360m.It is proposed to touch the coal seam Seam X floor at the floor RL of 330m.Approach to this from the entry is shown in the Box cut plan and is designed having the gradient of 1 in 16.This entry to the mine is just below the proposed infrastructure location.Approach road to mine from NH 33 is also indicated on the plan. Box cut plan also represents the 2 nd year of quarry operation. Particulars are given below

Sl No	Particulars	Value
1	Quarry Area (Sq KM)	0.364
2	Maximum Quarry Depth(m)	68
3	External Dump area (Sq Km)	0.348
4	Total Dump capacity(Mcum-solid)	8.30
5	Forest land required for mining Operation(Sq km)	0.106
6	Forest Land required for External dump(Sq Km)	-Nil-

Dump Management Plan for Box Cut / 2 nd year stage Plan is given below

Year	Dump Progressive(Mcum)	External with RL
1	2.55	+380
2	5.75	+410

5 th (Fifth) Year Stage Dump Plan

A stage plan of fifth year Quarry Operation is designed keeping in view of OB removed till fifth year and quarry position at the end of fifth year. External OB has been designed upto the surface RL of 440m. Each parting will be accommodated in the intermediate dump benches and top OB will be accommodated in the Top Benches. Particulars are given below:

Sl No	Particulars	Value
1	Quarry Area (Sq KM)	0.496
2	Maximum Quarry Depth(m)	69
3	External Dump area (Sq Km)	0.468
4	Total Dump capacity(Mcum-solid)	18.44
5	Forest land required for mining Operation(Sq km)	0.199
6	Forest Land required for External dump(Sq Km)	-Nil-

Dump Management Plan upto 5 th year is given below

Year	Dump Progressive(Mcum)	External with RL
1	2.55	+380
2	5.75	+380
3	9.90	+380,+410
4	14.05	+410,+440
5	18.44	+410,+440

Final Stage Dump Plan

Dumping sequence and pattern is same as in fifth year stage plan. Particulars are given below;

Sl No	Particulars	Value
1	Quarry Area (Sq KM)	0.648
2	Maximum Quarry Depth(m)	145
3	External Dump area (Sq Km)	0.706
4	Total Dump capacity(Mcum-solid)	32.95
5	Forest land required for mining Operation(Sq km)	0.227
6	Forest Land required for External dump(Sq Km)	-Nil-

Dump Management Plan for final stage is given below

Year	Dump Progressive(Mcum)	External with RL
1	2.55	+380
2	5.75	+380
3	9.90	+380,+410
4	14.05	+410,+440
5	18.44	+410,+440
6	23.28	+410,+440
7	28.12	+410,+440
8	32.95	+410,+440

RL wise Dump Capacity

Dump RL	Total External(Mcum) Dump
+380	14.88
+410	10.80
+440	7.27
Total	32.95

Top Soil Management

The salvaging, stockpiling and re-application of topsoil to be used as growth medium in the reclamation of Internal & External overburden dumps within the

mining area is a major environment protection programme. Soil management in opencast mine is necessary to re-establish the stability & productivity of lands disturbed due to mining activity.

7.4 Sequence of Dumping Operations and Stage-Wise Details

Sl. No.	Particulars	Value
1.	Coal Mined (MT)	9.60
2.	OB removed (M cum)	32.95
3.	Stripping Ratio (M cum/t)	3.43
4.	Excavated quarry area (Sq Km)	0.65
5.	Internal dump (Mcum)	Nil

Dumping Arrangements

The maximum RL of the external dump is +440m. The height of the individual bench in the external dumps is 30m.

The void left at the end of mine life is 0.397 Sq km as no internal dumping is proposed due to steep gradient of seams which is 61 % of the total quarry area. The void is proposed to be filled by rehandling of external OB dump (after completion of mine) or Initial OB dump of Hesagora mine (adjacent to Kuju mine) whichever occurs earlier.

CHAPTER-VIII

MINING SCHEDULE & EQUIPMENT PHASING

8.1 Design criteria:

The following design criterion has been adopted for the mining operations as per prevalent norms of mine design considered in CIL mine.

No. of annual working days - 330

No. of daily shifts - 3

Duration of each shift - 8 hrs.

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.

Excavation Category:

a) Coal - Cat-III

b) OB - 50% Cat.III+50% Cat.IV

c) Alluvium - Cat.I/II

Insitu Volume Weight:

For Coal - 1.60

For OB - 2.40

The material having compressive strength between 125 to 250 kg/cm ^{2} is classified as Cat III and between 250 to 1250 kg/cm ^{2} as Cat IV.

8.2 Annual productivity of HEMM

Productivity of Excavators

Equipment	Annual Productivity (MCum)
6.0Cum Diesel Hydraulic Shovel + 60T RD in OB	1.63
6.0Cum Diesel Hydraulic Shovel + 60T RD in Coal	1.77

Productivity of Rear Dumpers(Mcum)

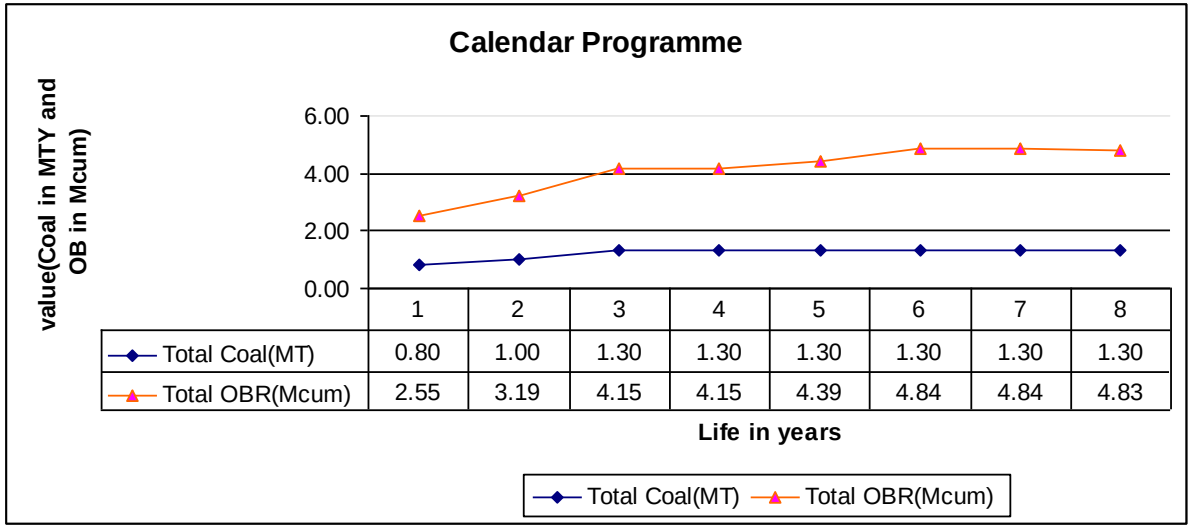
Annual Productivity of 60T Rear Dumper with 6.0 Cum Diesel Hydraulic Shovel

Lead (Km)	In OB	In Coal
0.5	0.3368	0.4022
1.0	0.2622	0.3159
1.5	0.2199	0.2665
2.0	0.1948	0.2368
2.5	0.1783	0.2170
3.0	0.1612	0.1968
3.5	0.1482	0.1812
4.0	0.1381	0.1689
4.5	0.1298	0.1590
5.0	0.1231	0.1509
5.5	0.1173	0.1440
6.0	0.1125	0.1381
6.5	0.1083	0.1331
7.0	0.1047	0.1286

8.3 Calendar Programme of Excavation

The mining schedule has been formulated based on the adopted sequence of opencast mine development at optimum conditions of mining operations for the entire life of Kuju OCP. Seam wise parting wise calendar plan is enclosed. Balance mineable Coal and OB has been estimated after deducting all worked out areas(Underground development and opencast workings both).Due to existing site condition and nature of coal deposit below seam X it is proposed to take the entire extractable coal by opencast method within a optimum time frame of eight years.

PARTICULARS	UNIT	YEAR OF QUARRY OPERATION								TOTAL
		1	2	3	4	5		6	7	8	
Total Coal	**Mte**	**0.80**	**1.00**	**1.30**	**1.30**	**0.85**	**0.45**	**1.30**	**1.30**	**1.30**	**9.60**
Seam 13	MTe	0.01	0.01	0.02	0.02	0.01	0.02	0.06	0.06	0.06	**0.27**
Seam 12	MTe	0.01	0.02	0.02	0.02	0.01	0.04	0.11	0.11	0.11	**0.45**
Seam 11	MTe	0.52	0.65	0.84	0.84	0.55	0.20	0.57	0.57	0.57	**5.31**
Seam 10A	MTe	0.05	0.06	0.08	0.08	0.05	0.01	0.04	0.04	0.04	**0.45**
Seam 10	MTe	0.21	0.26	0.34	0.34	0.22	0.18	0.52	0.52	0.52	**3.12**
Total OBR (Natural)	**Mcum**	**2.55**	**3.19**	**4.15**	**4.15**	**2.70**	**1.69**	**4.84**	**4.84**	**4.83**	**32.95**
Top OB	Mcum	0.37	0.47	0.61	0.61	0.40	0.25	0.70	0.70	0.70	**4.80**
Part Bet 13 &12	Mcum	0.08	0.10	0.14	0.14	0.09	0.13	0.38	0.38	0.38	**1.82**
Part Bet 12 &11	Mcum	1.42	1.77	2.31	2.31	1.50	1.04	2.98	2.98	2.97	**19.27**
Part Bet 11 &10A	Mcum	0.11	0.14	0.18	0.18	0.12	0.05	0.13	0.13	0.13	**1.19**
Part Bet 10A &10	Mcum	0.56	0.71	0.92	0.92	0.60	0.23	0.65	0.65	0.65	**5.87**
S.R	**Cum / Te**	**3.19**	**3.19**	**3.19**	**3.19**	**3.19**	**3.72**	**3.72**	**3.72**	**3.72**	**3.43**



8.4 Drilling & Blasting Operation:

Salient Physico-Mechanical Features of OB Rock and coal

Overburden rocks consist of medium grained sandstone to coarse grained sandstone. Assumed category of rock is 50% of CAT-3 + 50% of CAT-4.

Type, capacity and productivity of drills

This mining plan envisages the drills for Top OB bench and for partings and coal:

	Top OB bench	Partings/coal
	160mm drill	160mm drill

Elements of Drilling and Blasting:

Drilling of top OB, Partings and Coal envisages to be done by 160mm drills. Drilling of coal & OB benches is recommended to be done vertically at 90^0. It is suggested to use slurry explosive in cartridge/site mixed slurry for better result and enhance safety with proper stemming material. Secondary blasting is not suggested in any circumstances. Mine is already having explosive storage capacity to cater daily explosive requirement to meet underground mining needs.

Powder Factor

- For OB -0.3 Kg/Cum of OB
- For Coal-0.2 Kg/Te of Coal

8.5 Year wise Weighted Average lead (in Km):

YEAR-WISE AVERAGE LEAD FOR OPTION I & II									
PARTICULARS	**UNIT**	**YEARS**							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
COAL	Kms	0.58	0.73	0.89	1.04	1.20	1.31	1.41	1.51
OBR	Kms	1.14	1.55	1.97	2.39	2.81	2.94	3.07	3.20

CHAPTER-VIII

MINING SCHEDULE & EQUIPMENT PHASING

8.1 Design criteria:

The following design criterion has been adopted for the mining operations as per prevalent norms of mine design considered in CIL mine.

No. of annual working days - 330

No. of daily shifts - 3

Duration of each shift - 8 hrs.

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.

Excavation Category:

a) Coal - Cat-III

b) OB - 50% Cat.III+50% Cat.IV

c) Alluvium - Cat.I/II

Insitu Volume Weight:

For Coal - 1.60

For OB - 2.40

The material having compressive strength between 125 to 250 kg/cm ^{2} is classified as Cat III and between 250 to 1250 kg/cm ^{2} as Cat IV.

8.2 Annual productivity of HEMM

Productivity of Excavators

Equipment	Annual Productivity (MCum)
6.0Cum Diesel Hydraulic Shovel + 60T RD in OB	1.63
6.0Cum Diesel Hydraulic Shovel + 60T RD in Coal	1.77

Productivity of Rear Dumpers

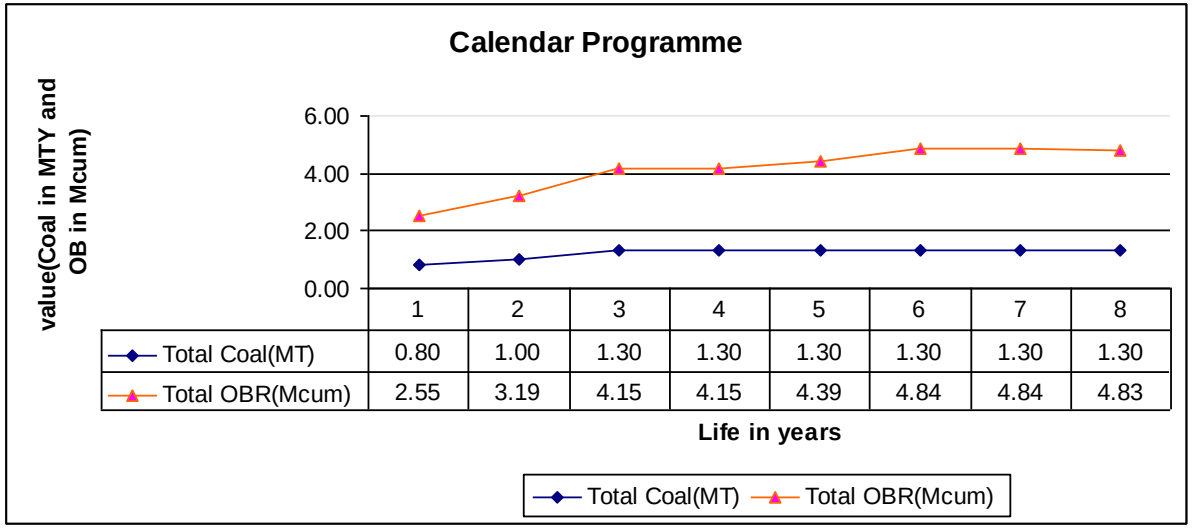
Annual Productivity of 60T Rear Dumper with 6.0 Cum Diesel Hydraulic Shovel

Lead (Km)	In OB	In Coal
0.5	0.3368	0.4022
1.0	0.2622	0.3159
1.5	0.2199	0.2665
2.0	0.1948	0.2368
2.5	0.1783	0.2170
3.0	0.1612	0.1968
3.5	0.1482	0.1812
4.0	0.1381	0.1689
4.5	0.1298	0.1590
5.0	0.1231	0.1509
5.5	0.1173	0.1440
6.0	0.1125	0.1381
6.5	0.1083	0.1331
7.0	0.1047	0.1286

8.3 Calendar Programme of Excavation

The mining schedule has been formulated based on the adopted sequence of opencast mine development at optimum conditions of mining operations for the entire life of Kuju OCP. Seam wise parting wise calendar plan is enclosed. Balance mineable Coal and OB has been estimated after deducting all worked out areas(Underground development and opencast workings both).Due to existing site condition and nature of coal deposit below seam X it is proposed to take the entire extractable coal by opencast method within a optimum time frame of eight years.

PARTICULARS	UNIT	YEAR OF QUARRY OPERATION								TOTAL
		1	2	3	4	5		6	7	8	
Total Coal	**Mte**	**0.80**	**1.00**	**1.30**	**1.30**	**0.85**	**0.45**	**1.30**	**1.30**	**1.30**	**9.60**
Seam 13	MTe	0.01	0.01	0.02	0.02	0.01	0.02	0.06	0.06	0.06	**0.27**
Seam 12	MTe	0.01	0.02	0.02	0.02	0.01	0.04	0.11	0.11	0.11	**0.45**
Seam 11	MTe	0.52	0.65	0.84	0.84	0.55	0.20	0.57	0.57	0.57	**5.31**
Seam 10A	MTe	0.05	0.06	0.08	0.08	0.05	0.01	0.04	0.04	0.04	**0.45**
Seam 10	MTe	0.21	0.26	0.34	0.34	0.22	0.18	0.52	0.52	0.52	**3.12**
Total OBR (Natural)	**Mcum**	**2.55**	**3.19**	**4.15**	**4.15**	**2.70**	**1.69**	**4.84**	**4.84**	**4.83**	**32.95**
Top OB	Mcum	0.37	0.47	0.61	0.61	0.40	0.25	0.70	0.70	0.70	**4.80**
Part Bet 13 &12	Mcum	0.08	0.10	0.14	0.14	0.09	0.13	0.38	0.38	0.38	**1.82**
Part Bet 12 &11	Mcum	1.42	1.77	2.31	2.31	1.50	1.04	2.98	2.98	2.97	**19.27**
Part Bet 11 &10A	Mcum	0.11	0.14	0.18	0.18	0.12	0.05	0.13	0.13	0.13	**1.19**
Part Bet 10A &10	Mcum	0.56	0.71	0.92	0.92	0.60	0.23	0.65	0.65	0.65	**5.87**
S.R	**Cum / Te**	**3.19**	**3.19**	**3.19**	**3.19**	**3.19**	**3.72**	**3.72**	**3.72**	**3.72**	**3.43**



8.4 Drilling & Blasting Operation:

Salient Physico-Mechanical Features of OB Rock and coal

Overburden rocks consist of medium grained sandstone to coarse grained sandstone. Assumed category of rock is 50% of CAT-3 + 50% of CAT-4.

Type, capacity and productivity of drills

This mining plan envisages the drills for Top OB bench and for partings and coal:

	Top OB bench	Partings/coal
	160mm drill	160mm drill

Elements of Drilling and Blasting:

Drilling of top OB, Partings and Coal envisages to be done by 160mm drills. Drilling of coal & OB benches is recommended to be done vertically at 90^0. It is suggested to use slurry explosive in cartridge/site mixed slurry for better result and enhance safety with proper stemming material. Secondary blasting is not suggested in any circumstances. Mine is already having explosive storage capacity to cater daily explosive requirement to meet underground mining needs.

Powder Factor

- For OB -0.3 Kg/Cum of OB
- For Coal-0.2 Kg/Te of Coal

8.5 Year wise Weighted Average lead (in Km):

YEAR-WISE AVERAGE LEAD FOR OPTION I & II									
PARTICULARS	**UNIT**	**YEARS**							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
COAL	Kms	0.58	0.73	0.89	1.04	1.20	1.31	1.41	1.51
OBR	Kms	1.14	1.55	1.97	2.39	2.81	2.94	3.07	3.20

CHAPTER-IX

COAL QUALITY

Quality parameters of seams considered for the present report are given below:

Seam-X

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.5-3.4	21.7-26.1	26.7-28.4	84.3-85.9	5.1-5.4	8160-8380	33.9-35.1	5/7-18/20	C-E	

Seam- XA

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.5-3.6	23.4-24.4	24.7-28.0	83.8-85.3	5.1-5.5	8185-8435	33.0-37.7	9/11-24/26	C-G/G1	

Seam- XI

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.6-3.3	30.8-35.7	25.6-27.5	84.2-86.2	5.2-5.5	8205-8435	36.2-38.8	4/6-19/21	B-E/F	

Seam-XII

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.8-4.1	30.0-42.2	21.8-26.2	83.4	5.4	8160	36.6	5/7	C	

Seam-XIII

Proximate Analysis Air dried basis			Ultimate Analysis Dmmf basis				Coking propensity		
M%	Ash% (Inb.)	VM%	C%	H%	CV Kcal/Kg	VM%	CI	CT	SI
1.9-4.3	25.6-32.1	23.7-27.0	83.3-84.4	5.0-5.5	8140-8200	33.9-35.7	5-9/11	A/B-D	

The coals of seam X, XA & XI are high volatile and weakly caking in nature. Though the coal of seam XA has better caking property, their general grade varies from non coking grade C- E long flame to medium coking WG-II-IV. The coals of seam XII & XIII are non caking in nature. Their general grade varies from non coking grade D to F.

CHAPTER - X
PUMPING AND DRAINAGE

The pumping system of Kuju Open cast project of CCL has been designed to dewater the inflow of water due to precipitation within the active pit limit during the monsoon and non-monsoon season and the ground water discharged from aquifers to enable the mining activity to continue round the year.

The planning of dewatering the mine has been done in such a way that the working faces and haul roads will remain dry as far as possible. The layout of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self drainage of water to the sump at the lowest level of the quarry.

10.1 SOURCE OF WATER

The intake of rainwater to the opencast mine is non-uniform during the year. The maximum rainwater intake will be during the period of about four months (middle of June to middle of October) in a year. During dry season, seepage from strata is expected to be moderate and the same can be dealt by running required number of pumps provided for pumping during monsoon. During this period, repair & overhauling of the pumps will be done by rotation.

It is proposed to make garland drains around the quarries and divert the surface water including rainwater from catchments area to near by natural course of water / nallah.

The main pumps will handle the quantity of water inflow during a day of peak rainfall in monsoon.

During the heavy monsoon period, the work in lower most bench may have to be stopped as it will not be possible to pump out the entire make of water on the wettest day. Therefore, it is proposed to draw a part of the lower-most bench which would then act as sump.

Water accumulated in the sump will be pumped out to the surface and discharged into the nallah flowing outside the quarry. It is proposed to create a sedimentation lagoon by constructing a series of check dams across the nallah. The lagoon will help to separate the suspended solids from the mine water.

Water overflowing the check dams would join near-by nallah and finally Choutha river.

Surface drainage and flood protection

All the smaller natural channels of water and nallah, finally join the Choutha river form the group representing the surface water resources in the region. A suitable garland drain is proposed to arrest the rainwater entering into the mine.

The surface drainage and flood protection system for the mine will include:

- Diversion of water courses to other water courses away from the mining area.
- Diversion dams/ bunding arrangement as part of water course diversions to prevent water entering the mining area.
- Cross drainage structures where the haul road and other access roads cross diversions.
- Various inlet, outlet and erosion protection structures.

In-pit Drainage Work

- During the rainy season, water will be allowed to accumulate in the sump on the floor of lower most Seam of the quarry.
- Sumps are provided for the dewatering pumps which will transfer in-pit water for controlled discharge off the site.

  The planning of dewatering the mine shall be done in such a way that the working faces and haul roads in the quarry shall remain dry as far as possible. The layout of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self drainage of water to the sump at the lowest level of the quarry.

  Water accumulated in the mine sump will be pumped out to the surface and finally discharged into the near- by nala which finally join Choutha river.

10.3 GENERAL CONSIDERATIONS

10.3.1 The pumping requirement has been calculated on the basis of the following general considerations:-

- The geographical location of the Project.
- Meteorological data from the area / nearest rain-gauge station concerning rainfalls.

- Life of the mine and percentage probability of maximum rainfall in one day during the life of the mine.
- General climatic conditions, Surface features of the terrain beyond the boundary of the mine / opencast working.
- Catchments area, Mined out areas and areas beyond excavation, and dumped / spoil dump area.
- Run-off characteristics of the area.
- Depth of the quarries at different stages.
- Inflow to the quarry of UG water & seepage from near by nala/ river.
- Desired location at the surface where the quarry water can be discharged, considering the Surface drainage system.
- Maximum number of days to pump out the accumulated water in the quarry during peak rainfall in monsoon and the number of pumping operation hours per day.
- Geological characteristics of OB and coal seams.
- Desired location at surface where quarry water can be discharged considering the surface drainage system.
- Effective working hours – 20 hours/day for pumping calculation, but in monsoon period pumping may be done round the clock.

10.3.2 **BASIC DATA**

The following data has been taken into consideration for arriving at the volume of water accumulating in the quarry and the size of the pumps :-

(a)	Maximum depth of the proposed mine	:	145 m
(b)	Probable maximum rainfall in a day in monsoon period from the probability curve	:	152mm
(c)	Depth and Catch-ment area stage wise	:	Given in the stage wise calculation of water volume.
(d)	Run-off Co-efficient considered	:	i) For mined out area = 0.7 ii) For internal dump area = 0.15 iii) For area beyond excavation = 0.10

(e) Inflow of water to the quarry due to seepage and underground precipitation : 10% of probable water accumulation due to near by Choutha river.

(f) The rainfall data has been adopted as recorded. **:** IMD, Hazaribag

10.4 ASSEMENT OF MAXIMUM RAINFALL IN A DAY

This has been drawn from the probability curve of rain-fall data received from IMD, Hazaribag for last 12 years. The calculation has been done taking into consideration the entire area of the quarry of the proposed mine for its entire years of operational life. The probable maximum daily rainfall has been taken as 152 mm for calculation purpose.

10.5 CALCULATIONS AND ASSESSMENT OF VOLUME OF WATER TO BE PUMPED

The calculation has been done taking into consideration the entire area of the quarry of the proposed mine.

Pumping system has been designed for the volume of water accumulated in the mine at the final stage of production considering probable maximum daily rainfall as 152mm.

Pumping capacity worked out as under (considering water to be pumped out in 120 hrs @ 20 hrs pumping per day). The volume of maximum precipitation of water in the mine taking 10% for seepage and underground precipitation due to nearby nallah / Choutha river on the day of maximum rainfall has been as under**:**

QUARRY

At the end of	Catchment's area in km^2				Depth of mine (m)	Max. ^{m} probable rainfall in a day (mm)	Volume of water ('000 Cum/day)
	Total quarry area	Mined-out area	Internal dump area	Area beyond excavation			
5th year	0.50	0.50	0.00	0.025	65	152	58.938
8th year	0.65	0.65	0.00	0.0325	145	152	76.619

10.6 PUMPING CAPACITY

PUMPING CAPACITY REQUIRED :

Probable water accumulation on the day of maximum rainfall taking 10% for seepage and underground precipitation = 76619Cum.

Pumping capacity/hr = 638 Cum/hr (177 lps).

10.7 SELECTION OF PUMPS AND DELIVERY RANGES:

On the basis of the calculation and providing standby pumping capacity, the main pumps have been provided for each quarry.

Main Pumps

Three nos. of 300 Cum./hr.x 170 m head pumps and three nos. 300Cum /hrx90 m head pumps have been provided for the mine.

Low Head Pumps

Besides the above main pumps three nos. of 150 Cum./hr.x 60 m head pumps have also been provided to dewater the quarry for their initial years of operation when depth of quarries will be less.

Diesel Pumps

One number of 300 Cum./hr x 170 m head diesel pump has been provided for emergency requirement.

Face Pumps and Slurry Pumps

Three nos. of Face Pumps of 50 Cum./hr. x 60 m head and three nos. of Slurry Pumps of 80 Cum./hr. x 45 m head capacities have been provided to pump out the water & slurry respectively accumulated near the working faces.

b) **SELECTION OF DELIVERY RANGES**

The delivery ranges have been selected on the basis of the pumping capacity during probable maximum rainfall and velocity of flow within the reasonable limit. The delivery ranges for different capacity of pumps have been selected for nominal diameters as 250mm, 200mm, 150mm and 100mm for the pumps as per manufacturer's standard.

10.8 **ESTIMATED CAPITAL COST**

The details of cost estimate along with the phased requirement have been given in Appendix-A.3.4 of pumps, pipes and fittings.

CHAPTER-XI

COAL HANDLING & DESPATCH ARRANGEMENTS

11.1 INTRODUCTION

Kuju OCP has been designed for production capacity of 1.3 MTY. Accordingly Coal handling plant has been proposed to handle 1.3 MT of coal per annum. ROM coal from mine will be transported to receiving pit of CHP through Rear discharge dumper.

At receiving pit coal will be crushed down to (-)200 mm by twin shaft sizer of adequate capacity. Coal from the sizer will be received by a belt conveyor C1 for onward conveying of crushed coal to proposed washery near Kuju siding through series of belt conveyors.

The coal handling plant has also been provided with suitable repair, communication and other auxiliary facilities to meet the day to day requirement in the plant operation.

11.2 DESIGN PARAMETERS

11.2.1 BASIC DATA

Description	Considered data
Production capacity in MTY	1.3
No. of working days / annum	330
No. of working shifts / day	3
Duration of each shift (hours)	8
Effective working hours/day	15
Feed size of R.O.M coal in mm	1200
Product size of coal in mm	(-) 200
Loading /despatch hours	Round the clock.
Average Grade of coal	C long flame
Consumer	Proposed Integrated Washery
Mode of Despatch	By belt conveyors

11.2.2 **CHP WORKING SCHEDULE**

Crushing and conveying will be done in three shifts per day and seven days a week.

11.2.3 **SYSTEM CAPACITY**

The handling capacity of the CHP has been decided to match with the production capacity of the mine. In order to meet the fluctuations of coal output from the mine due to irregularities of despatch / transport system and seasonal fluctuations, the design capacity of CHP has been fixed as 500 tph.

11.2.4 **SALIENT FEATURES**

The proposed CHP consists of the following units:

Receiving pit (for one no. of Sizer)

- One no. twin shaft sizer(Primary) of 500 TPH nominal capacity at receiving pit to crush coal to -200 mm size.
- Apron feeder to feed coal into primary sizer.
- One set of conveyor system of 1200 mm wide and 500 tph from receiving pit to transfer house.
- One number of magnetic separator.
- One number of metal detector.
- One number of belt weigher to weigh crushed coal.
- Miscellaneous facilities like dust control system, fire fighting and ventilation system. Plant cleaning and Infrastructure for preventive maintenance are also envisaged.
- Necessary Electrical, interlocking, signalling and communication facilities.

11.2.5 **SYSTEM DESCRIPTION**

ROM coal of (-) 1200 mm size transported in 60 te rear discharge dumpers will be fed into receiving pit hopper. The coal from the receiving pit hopper will be fed into the Primary sizer through apron feeder provided below the receiving hopper. Crushed coal (-) 200 mm will be transported by 1200 mm wide belt conveyor (C 1) and discharged into transfer hopper which will be collected by subsequent conveyors to transport to overground bunker before washery. The reclaim conveyor below the over ground bunker will feed coal to the proposed Integrated washery. The system after first conveyor C1 is under the scope of **proposed integrated washery near Kuju railway station** .

11.2.6 **PLANT DESCRIPTION**

11.2.6.1 **Receiving Pit and Crusher Complex**

The Run-Off-Mine coal from the open cast Project shall be received into receiving pit by means of rear discharge dumpers. Receiving pit has been provided with sufficient capacity hopper. The ROM coal will be unloaded into the receiving hopper of twin shaft sizer. The coal will be reclaimed by apron feeder and fed to twin shaft sizer for crushing to specified size of (-) 200 mm. Crushed coal of (-) 200 mm will be collected by the conveyor(C1) of 1200 mm wide and 500 tph, installed underneath the twin shaft sizer and to carry up to first transfer point.

11.2.6.2 **Load out system**

Washed coal from washery will be loaded into railways wagons at proposed Kuju siding by RLS and finally dispatched to the customer.

11.2.6.3 **Dust Control System**

The Dust control system envisages both dust extraction as well as dust suppression system.

Dust Extraction system

The objective of the system is to extract coal dust from various dust generating points, clean the dust laden air by trapping coal particles and finally discharge clean air into the atmosphere so that dust concentration in the CHP premises, even under the critical / worst operating condition is minimum. Suitable dust extraction system has been provided in the crushing unit.

Dust Suppression System

The objective of this system is to eliminate the air born coal dust or suppress the dust at its source. The system involves confinement of the dust within the dust producing area by a curtain of moisture and wetting the coal dust by direct contact between the particles and droplet of water. Adequate number of precision anti-clog nozzles will be installed at suitable locations for suppressing dust by spraying water mixed with suppressant. Suitable control for dust suppression shall be provided and the system shall be so inter-locked that it functions only when the conveyor system is operating.

11.2.6.4 **Noise Control**

Noise pollution causes fatigue to operating personals. Provision will therefore be made to keep down the noise level to the extent possible. All machine mountings will have in their foundations anti-vibration pads/sheets for reducing the vibration and thereby noise.

11.2.6.5 **Fire Fighting System**

Necessary fire fighting system has also been envisaged for the plant, which includes fire hydrant tees at strategic locations at equal spacing of 25 to 35 meters with suitable water supply pipe lines. Also portable type fire extinguishers to deal with electrical / oil /ordinary fires shall be provided at all strategic locations in the plant.

11.2.6.6 **Plant cleaning system**

To facilitate cleaning at strategic locations required number of high pressure water servicing points has been envisaged. These service points will be so located that with a 15/20 m long hose any working area in the plant or equipment working place can be reached. These service points will be provided with quick connecting hose couplings for easy fixing and dismantling of hoses.

To handle discharge from plant effluent and washing of the plant area, sump pumps of suitable design and capacities have also been envisaged where required. Plant effluent shall be discharged through open drain/ pipe.

11.2.6.7 **Plant Preventive Maintenance**

For effective maintenance of all the equipment, there will be sufficient working space around the equipment/machinery. All the equipment and conveyor discharge drums/transfer points, etc shall have covered and well ventilated housing complete with access stair ways, hand rails, platforms, cross-over ladders, etc as required.

Necessary mono-rails electric hoists and chain pulley blocks at suitable points of adequate capacity will also be provided on respective floors.

11.2.6.8 **Weighment**

For the purpose of weighment of coal handling and dispatched in the CHP, one belt weigher has been provided on conveyor C1 of the CHP.

11.3 ELECTRICALS

The electrical system shall comprise:

- Power reception and distribution system
- Centralized sequence control–cum–interlocking, automation, signaling and instrumentation system
- Illumination of plant and adjacent area
- Centralized welding circuit
- Earthing

11.4 CAPITAL INVESTMENT REQUIREMENT

The details of cost estimate for capital requirement of CHP have been shown in Appendix – A.3.5.0

11.5 DRAWINGS

A tentative key plan of the proposed coal handling Plant has been given in the drawing no. R3/E&M/M/ 2613.

11.6 RAILWAY SIDING

The coal produced from this mine has been proposed to feed to nearby proposed integrated washery. Therefore final despatch of coal will be made through washery. As such no railway siding has been proposed for this mine.

CHAPTER-XII

WORKSHOP

(COAL & OB DEPARTMENTAL)

12.0 Introduction

Kuju OCP is a new mine of Central Coalfields Limited. This project report has been prepared for a targeted production of 1.30 MTY. So, a new unit workshop has been proposed. This unit workshop is envisaged to cater the need of daily maintenance, schedule maintenance, lubrication, routine inspection, minor repair and replacement of parts/sub-assemblies of HEMM such as- Dumpers, Dozers, Shovels, and Drills etc. Minor repair of assemblies and sub-assemblies of pumps, CHP equipment, electrical etc. deployed in the project will also be performed in this workshop.

Any major repair of equipment and manufacturing of spares on large scale are beyond the scope of this workshop. These works will be carried out in Regional Repair Shop or Central Workshop, Barkakana.

This unit workshop will have two parts – Excavation and E&M workshops. Apart from this, Project store and other common facilities have been provided. A schematic layout plan of the workshop is shown in drawing No. R 3 E &M M 02610 for option I & II .

12.1 Excavation Workshop

This part of workshop will have the facilities for attending to schedule maintenance, minor and medium repair or replacement of parts/sub-assemblies of face and transport equipment such as – Shovels, Drills, Dozers, Dumpers, Graders, Crane and other miscellaneous equipment used for mining operation.

All dumpers and dozers coming to workshop for their daily as well as schedule maintenance will be first washed at the washing stations provided in the workshop and then brought to the respective maintenance shop like daily maintenance shop and schedule maintenance (lubrication & Inspection) shop as per their schedule.

In daily maintenance shop, the equipment will be checked for lubrication, tyre inflation, oil levels etc.

The equipment for scheduled preventive maintenance as per recommended schedules of the manufacturers will be directed to schedule maintenance shop where their complete lubrication will be taken care along with diagnosis of their technical state.

Maintenance of Shovels, drills and minor repairs will be carried out at the site. The components/assemblies requiring further repair will be dis-assembled from the machine and the dis-assembled components will be brought to the Repair shop. In case of major repair, these will be sent to central workshop.

Broadly this workshop will have the following functional shops:

i) Machine shop
ii) Electrical Repair shop
iii) Assembly & Sub – Assembly shop
iv) Radiator Repair shop
v) Welding & Structural shop
vi) Dumper Daily Maintenance shop
vii) Schedule Maintenance (Inspection and lubrication) shop
viii) Dozer Repair shop
ix) Washing Station
x) Stores & common facilities

i) Machine shop

This shop will have the necessary machine tools for restoration of worn-out parts and manufacture of small non-complicated spare parts, which are in short supply, and required for repair of HEMM.

ii) Electrical Repair shop

This shop will have the facilities for carrying out the minor and medium repairs of the electrical components of the mining equipment. The repair facilities have been limited to the parts replacement and repair of self-starter, Dynamo, Battery charging etc.

iii) Assembly and Sub-assembly Repair shop

Assembly & sub-assembly shop will have the facilities for repairing the assembly and sub-assembly of motor transport equipment. Since most of the machine will be of similar make and model, they will be treated under unit replacement method. The repaired assemblies will be drawn from the shop and fitted to the equipment of same make and model.

iv) Radiator Repair shop

This shop will carry out the repair and over-hauling of radiators. It is equipped with water tap for proper flushing and cleaning of radiators, testing stand and other repair tools and equipment.

v) Welding & Structural shop

This shop will take-up the welding of buckets of shovels and other jobs of dumpers etc. It will also under take other non-standard welding works.

vi) Dumper Daily Maintenance shop

Checking of water and oil levels, greasing of lubrication points, checking of air pressure of tyres, brake testing etc. will be performed in this shop.

vii) Dumper Schedule Maintenance (Lubrication and Inspection shop)

The schedule maintenance (lubrication and Inspection) of the dumpers as per schedules recommended by the manufacturers will be done in this shop.

For this purpose pressurised lubrication system has been provided.

viii) Dozer Repair shop

This shop is meant for carrying out the maintenance and repair of dozers. The repair will be done mainly by the replacement of parts, units and sub-assemblies.

The entrance & exit of dozers will be from one side only.

ix) Washing Station

High-pressure water and steam jet washing unit for dumper and dozer have been envisaged for washing.

x) Stores & Common facilities

A small store is provided for storage of 10 days consumption of spares & consumables required for repair & maintenance of HEMM & other mining equipment.

The different repair shops will draw day-to-day requirement of spares & other consumables from this store.

A fully equipped fuelling station is also provided for fuelling the vehicles and transport equipment.

12.2 E&M Workshop

Considering the nature of repair and maintenance of E&M equipment, which is different from the HEMM, a separate E&M workshop has been envisaged.

This part of the workshop will have the facilities for schedule maintenance, day to day maintenance and minor & medium repair by parts/unit replacement method of all E&M equipments deployed in the project such as- pumps, electrical equipment etc.

Broadly this workshop will have the following functional shops:

i) Machine shop
ii) Mechanical Repair shop
iii) Electrical Repair shop
iv) Smithy shop

i) Machine shop

This shop will undertake machining and reconditioning of spares. It will also manufacture small spares, which are in short supply and required for the repair of E&M equipment.

ii) Mechanical Repair shop

The equipment like pumps and pumping installation experiencing incidental problem in the field and requiring minor repairs will be brought to this shop where they will be inspected and repaired.

Apart from this the normal maintenance/repair of the pumps & CHP equipment will be done in this shop.

iii) Electrical Repair shop

This shop will deal with the testing and minor repairing of electrical components of CHP equipment, pumps, switchgears etc.

iv) Smithy shop

This shop will deal with the manufacture of small hand forging components required for the repair need of E&M equipment.

12.3 Project Store

This workshop will have a project store to meet the total requirement of proposed workshop as well as additional requirement of the project. Only day-to-day requirement of spares and consumables will be kept in the workshop store for smooth functioning of workshop.

12.4 Working Schedule

This workshop will work mainly in two shifts of 8 hrs. duration but a group of technical personnel will also be provided in the third shift to look after the field repairs of mining equipment deployed in this shift.

12.5 Capital Investment

The details of P&M provided for the workshop along with their estimated cost have been given in Appendix-A.3.3.

CHAPTER-XIII

POWER SUPPLY, ILLUMINATION AND COMMUNICATION

13.1 Power Supply

13.1.1 Source of Power & Supply Voltage

Kuju substation cum switching station (installed capacity 2 x 10 MVA, 33 /11 kV) is the source of power for the Mines in Kuju area. This sub-station is located at Marpa which is about 5 km from Kuju Project. This Sub-station receives power at 33kV by means of 2 nos. 33 kV OHTL feeders from DVC's S/S at Naisarai.

13.1.2 Proposed Scheme of Power supply & Distribution.

It is proposed to install a 33/6.6 kV, 2x2MVA sub-station for distribution of power to cater power demand of surface and quarry loads of the Project. This proposed sub-station will receive power at 33 kV through double circuit 33 kV OHTL to be erected from Mourpa Switching cum sub-station.

Provision for 5 Km. length of 33 kV double circuits OHTL with "WOLF" conductor and other accessories have been made for this purpose.

13.1.2.1 Main Sub-station.

The substation proposed for this project will have the following major outdoor and indoor installations.

- Outdoor Installations.

i) 33 KV outdoor terminal structures, bus Sections for receiving power.

ii) 33 KV, outdoor, Isolators with / without earthing switch / with earthing switch & D.O fuses.

iii) 33 KV, outdoor type SF6 C.Bs.

iv) L.A. for 33 KV system voltages.

v) 33 KV CTs & PTs

vi) Power transformer, 2000 kVA, outdoor 33/6.6 kV (restricted earthed):

vii) Lighting transformer, 160 KVA, 33/0.23KV (L-L).
viii) Outdoor Illumination.
ix) Sub-station earthing.

- Indoor Installations .

i) 33 KV Remote control panels for SF6 C.B.s
ii) 6.6 KV VCB panels Switch Board comprising incomers, sectionaliser and, outgoing control feeders.
iii) 230V LDB.
iv) Indoor Illumination.
v) 110 V D.C. Distribution Board.
vi) Battery, Battery Chargers.
vii) Capacitor banks, 6.6 KV

- Earthing with grid.

- 6.6 KV Sectionalized Indoor type Switch Board .

The various functions of the VCBs in the switchboards energized from the secondary of the 33/6.6 kV power transformers installed at the substation will be as described below:

2 nos. Incomers, 1 no. sectionaliser, 2 nos. capacitor bank, 2 nos. outgoing control to pumping installations, 2 nos. for quarry lighting, 1 no. for Workshop, 2 nos. for colony and 2 nos. as spare. (Total 14 Nos)

- 230 V Lighting main distribution board.

The 230 V (L-L) switch boards energised from the secondary of the160 kVA, 33/ 0.23 kV (L-L), pole mounted type lighting transformers installed at the substation will comprise 1 no. Incoming 3 pole MCCB and 7 nos. outgoing 2 pole MCBs.

- Connected Load / Maximum Demand (Refer Table : 13.1 A)

  The connected load, load in operation and maximum demand for the project have been estimated as under:

  i) Connected Load : 3694 kW

  i) Load in operation : 2831 kW

  ii) Maximum Power Demand For The Whole Project: 1705 kVA

  The transformers for the substation have been selected considering overall power factor of 0.98, starting of large HT motors and 100 % stand-bye capacity.

- Protection of S/S, Controlling & Signaling.

  SF6/ VCBs shall be used for primary control of both the 33/6.6 kV transformers. The circuit breaker shall in conjunction with current transformer for protection of the transformers against O.C, S.C, and E.F. These circuit breakers shall also trip for internal fault of transformers actuated by winding temperature relays.

  For protection against lightning, lightning arrestors conforming to IS: 3070 and IS: 4004 will be provided in the substation yard. Shield wires will be provided for outdoor yard equipment to protect them from direct strokes. For protection of building from lightning, spikes will be provided over the building and these will be interconnected by means of flats to form a grid. This grid will be connected to the earth pits at the four corners of the building by means of down conductors.

  Remote control of 33 KV circuit breakers shall be performed by the control switches built in the control panel in the substation room.

  Signaling system in the substation will be as follows.

- Signaling to inform the personnel about automatic tripping of circuit breakers due to fault.
- Warning signal about occurrence of abnormality in any particular device.

Signaling to show actuation of automatic and protective relays (flags and pointer on relays)

Similar control, protection and signaling devices are to be incorporated in the 6.6 KV indoor panels also.

- Interlocking & Earthing System.

The air break isolators associated with the 33 KV circuit breakers will be interlocked with the circuit breakers to avoid mal- operation.

The 6.6 KV Sectionalizer C.B. in the 6.6 KV switch board will have electrical interlock with the incoming circuit breakers to avoid parallel operation of transformers.

Main earthing grid shall be provided around the periphery of all the substations for interconnection of grids as well as to earth all the electrical equipment.

The transformer body and the lightning arrestors provided for the transformers are required to be earthed separately as per IE rules but the earth connections should be interconnected to minimize the earth resistance so that protections to the transformers is most effective. The LAs are to be located as close to the transformers as possible.

Substation earthing shall conform to IS: 3043(current). The resistance to earth shall not exceed 5 ohm. Separate earth pits would also be constructed around workshop, CHP. GI strips of adequate size connecting the main earth bus laid around the workshop would properly earth all the drives in the workshop etc.

Restricted earth neutral system has been envisaged for 6.6 kV side distributions. The neutral of all the power transformers in the substations / quarry shall be earthed through resistance with individual earth pits.

Quarry and other lighting transformers, 6.6 /0.23 kV, Phase to Phase shall, are Un-earthed.

13.1.2.2 Energy Consumption

Estimated energy consumption by different electrical loadsat targeted rate of production works out at 5.561 MKWh / Annum (Refer Table: 13.1 A)

13.1.2.3 Utilization voltage.

The utilization voltages of various equipment / installation of the project are as given below.

a) Incoming supply Voltage: 33 KV
b) Utilization Voltage for Workshop Equipment: 415 V
c) Pumps 110 kW and above: 6.6 kV
d) Pumps below 110 kW : 415 V
e) Township: 0.415 kV
f) CHP: 6.6 kV / 0.415 kV
g) Mine Area Lighting: 230 Volt (L-L)

13.1.2.4 Power factor Improvement.

2 sets of capacitor banks each rated at 6.6 kV would be installed at each bus section of the 6.6 kV split – bus switch board installed at substation. The capacitor banks would have the facility to connect or disconnect the required number of units automatically through contactor and automatic power factor correction and relay panel combination depending upon the loading pattern at the substation.

13.1.2.5 Power Supply & Distribution.

i) Power Supply to Pumps.

6.6 KV OHTL feeders originating from the main substation is proposed to be drawn along the quarry periphery for feeding power to pumps deployed in this project. All these OHTL feeders shall receive power from the 6.6 kV indoor type sectionalized switchboard installed at the substation building. Depending upon the various stages of quarry operation these feeders may have to be shifted or extended.

From these OHL feeders drawn up to the quarry / pumping station, power shall be tapped by means of outdoor type isolators and power cables to energize the respective field switches / unitized substations etc. meant for supplying power to different pumps and other installations.

ii) Power Supply to Workshop.

Power supply to workshop has been envisaged at 6.6 kV from main S/S. At the workshop, power at 6.6 kV will be stepped down to 0.433 kV for supplying power to various power consumers of the workshop. The estimated cost of electrical equipment viz. incoming OHL/Cable up to workshop, transformer along with primary and secondary control C.Bs for external electrification has been included in this report. The cost of internal electrical power distribution / illumination scheme within the workshop has been included in the Appendix for workshop.

13.2 Illumination.

I) Haul Road Illumination.

For illumination of permanent haul roads, 250 W HPSV lamps and luminaires mounted on 11/13 m (approx.) high steel poles have been envisaged. Temporary

haul roads shall be illuminated according to the position of working and available facility.

ii)Illumination of Quarry General Area/ Dump Area.

Illumination of quarry general area/dump area will be done with 400W HPSV lamp in flood light fixtures mounted on lighting towers.

Sufficient no. of 25 / 10 kVA, 6.6 kV / 0.23 kV (L – L) transformers have been provided for illumination of quarry general area / dump area / haul road / face etc.

iii)Service Road Illumination.

150 W HPSV lamps in street light luminaries are proposed for service road illumination in the project. The luminaries on steel tubular poles 11/13 m high is proposed for this purpose.

iv)Township Street Illumination.

150 W HPSV lamps in street light luminaries are proposed for colony road illumination in the project. The luminaries on steel tubular poles 9 m high is proposed for this purpose. Some areas in the colony may be illuminated with 250 W HPSV lamps also.

13.3 Power balance / Annual energy consumption / Year wise energy consumption

Based on the deployment of different equipment / installations in all the quarries of the project, a power balance has been prepared to know the maximum power demand and maximum annual energy consumption and other related matters of the whole project (Refer Table - 13.1 A). Maximum Annual Power bill and maximum annual energy consumption has also been calculated (refer Table

13.2 A). Year wise phasing of energy consumption, specific consumption and power bill has also been calculated. (Refer Table 13.3 A)

13.4 Salient Electrical Features & Cost Estimate.

- **Salient Electrical Features: Option I**

Max. Demand (At An Improved P.F Of 0.98): 1705 kVA.

Maximum Annual Power Consumption: 5.561 Mkwh.

Maximum Annual Power Bill: 1.89 Crores.

Specific Power Consumption: 4.278 kWh / t.

Power Cost: Rs. 14.545 / t.

Capacitor Bank Required: 667 kVAr.

Transformer Proposed: 2 x 2000 kVA, 33 / 6.6 kV.

1 x 160 kVA, 33 / 0.23 kV(L- L).

- **Salient Electrical Features: Option II**

Max. Demand (At An Improved P.F Of 0.98): 1357 kVA.

Maximum Annual Power Consumption: 4.705 Mkwh.

Maximum Annual Power Bill: 1.5997 Crores.

Specific Power Consumption: 3.619 kWh / t.

Power Cost: Rs. 12.306 / t.

Capacitor Bank Required: 547 kVAr.

Transformer Proposed: 2 x 2000 kVA, 33 / 6.6 kV.

1 x 160 kVA, 33 / 0.23 kV(L- L).

- Cost Estimate(P&M – Electrical)

The estimated total capital investment on P&M – electrical including the substation buildings has been worked out. Details of such items are given in APPENDIX – A.3.2 (A).

13.5 COMMUNICATION

Coal production has become highly capital intensive due to large scale mechanisation for production and transportation using the modern technology. To cope with mechanisation, to maintain safety and to improve the efficiency there is a need to establish an efficient means of voice and data communication. The effectiveness and reliability of decision making process depends on a reliable means of information exchange among the different units of surface and Opencast mines which totally depends upon the integrated telecommunication systems for voice and data.

In order to improve operational efficiency of the mine, it is necessary to integrate its operational units, at surface, service units, maintenance units, stores, workshops, administration deptt., road and rail despatches etc. with efficient and reliable communication links which may provide all facilities to be made available for quick decision making, for safety, production and transportation.

13.6 PROPOSED COMMUNICATION SYSTEM

The proposed communication system should cater the need of voice communication among personnel related to mine operation, administration and equipment maintenance. The system also takes into account the data communication requirement for mine operation and planning along with the latest office automation facilities.

While preparing the system, due consideration has been given to the state-of-art networking architecture involving the communication of voice, data and multimedia over the same network path, so as to avoid duplicated investment in network and proper conservation of bandwidth.

13.7 SURFACE/ADMINISTRATIVE COMMUNICATION:

To meet all the requirements of data and voice communication, 250 lines of IP Enabled Exchange is proposed having the following main features:

13.7.1 IP ENABLED EXCHANGE

A 250 line automatic telephone exchange has been envisaged for the effective communication between the various units on the surface. The EPABX will preferably employ PCM-TDM technique with a non-blocking structure. The EPABX shall have all the latest features like E1 port, LAN/WAN port, etc. EPABX shall be interfaced with BSNL exchange for extending external communication having STD & ISD facility. Self-diagnositic facility shall be provided for EPABX extensions. Sufficient no. of junction lines are to be provided for terminating BSNL, Tie lines for connecting existing nearby exchanges and Trunk lines.

A. TECHNICAL SPECIFICATION OF EPABX

The exchange shall be microprocessor based stored programme control and PCM-TDM switching with state of art technology.

Exchange shall be suitable to be operated with DP , DTMF,digital and IP telephones.

The line cards slots/channels in the main cabinet must be universal type, so that any type of line can be used in any line slot/channel and there shall be no limitation in slot position.

Exchange shall have both voice and data switching capacity.

Krone type MDF having capacity equivalent to ultimate capacity of the exchange with GD tubes for high voltage protection and polyswitches for current protection on all extensions and trunks.

System software shall have auto-diagnostic programme to detect the faults and localise them.

The exchange should support multi-media application as per latest trend. It should be possible to connect PC's, host computers etc. without modem through Digital/ISDN line.

Exchange shall be DoT/TRC approved with ISDN facility.

The IP Gateway port of the exchange can be connected with the LAN backbone network for VOIP communication.

B. NETWORKING FACILITY

Exchanges are required to operate in any one of the following and shall be suitable for both.

i) BSNL junction and extension exclusively for BSNL lines.

ii) Exchange should also be able to inter-face directly with OFC/DECT systems, if required.

System should be capable to network with the following types of lines:

a. Loop disconnect tie lines.

b. Ring down hot line.

c. Direct inward dialling trunk and outward dialling turnk. (2W/4W E&M Trunks).

d. ISDN line.

C. FEATURES

a. Flexible numbering scheme

b. Privacy of calls

c. DTMF DID facility junctions.

d. Conferencing

e. Automatic call back on busy extn.

f. Call transfer and Call pick up.

g. Last number radial.

13.7..2 BSNL COMMUNICATION (FIXED LINE AND MOBILE COMMUNICATION)

It is proposed to provide 10 Nos. BSNL telephone extensions to the Mine Office in order to facilitate external communication and to link the Mine with the BSNL's national telephone network. The BSNL telephones shall be provided at the offices and some of the residences of important officials since the existing colony is already having this facility. The BSNL communication facility can be extended by terminating about 5 BSNL lines on the proposed IP enabled EPABX and configuring the same. Besides fixed line BSNL telephones, 15 nos. of Mobile connections with sets may also be provided to important personnel of the project.

13.7.3 BSNL 2MBPS LEASED LINE

A BSNL 2 Mbps Leased Line is proposed for communication with Area HQ. This leased line shall be used both for voice and data communication with Area HQ. A multi service voice and data router shall be used in this network. The router will be equipped with 2 Nos. of WAN port and one 1 No. of LAN port minimum.

13.7.4 SPECIFICATION FOR ROUTER

Data Interface : 2 Nos. high speed data interface with DOT-35
1 No. RS-232 Sync/Async port.
1 No. Ethernet LAN port.

Link protocol	: V.35/X.21, SDLC and TCP/IP
Protocol support	: TCP/IP, RIP
Management	:SNMP
Power Supply	: 230V AC +/- 10% single phase.

13.7.5 LAN AND INTERNET

It is proposed to deploy electronic data processing facilities for production planning, control and project management etc. The system envisages playing a key role in establishment of highly effective Data Base Management System (DBMS) and Management Information System (MIS) etc.

The type of computer would be small business computer with broad facilities and also have specific facilities to carry out:

- Pay rolls
- Financial accounting
- Inventory control
- Material management
- HEMM utilisation, breakdown analysis, idle time analysis etc.
- Production, despatch schedule and variances.
- Accident records etc.
- Resource utilisation & MIS.

Before initiating action for installation and implementation of the above EDP system, a detailed system study would have to be carried out, with clearly defined system objectives for identifying the data processing needs and management information system needs of the project. Based on the results and findings of the study, the system configuration and specification have to be decided.

A Local Area Network with 10 PCs is proposed for this project. The PCs will be connected to a 24 port L2 switch. The proposed network structure will be that of a workgroup. Suitable OS and other application software will be provided and the network shall facilitate sharing of information and computing resources amongst different departments/ disciplines. The network shall be capable to add more nodes as and when the number of users grows and it will be equipped with the latest state-of-art technology.

Internet connection shall also be provided.

13.7.6 VHF Communication for quarry operation:

VHF dialing type Walkie-Talkie sets/trunked radio will be provided to important personnel for communication in the mine. These will work in the band 150-174 MHz. with a channel spacing of 12.5 KHz/25KHz, with an output of 2W. Type of operation will be FM, simplex. The system shall have telephone patch facility for interfacing with the exchange. It should also have control channels for trunking facilities.

13.7.7 Wireless Radio System

Point to Point Radio system is proposed for connecting the Important locations with the area office. This will be integrated with LAN & EPABX Exchange to serve the data and voice communication.

13.7.8 24 PORT L3 SWITCH

The managed L3 Switch shall be a workgroup switch 24 port 10/100 having a gigabit uplink port. The switch shall have sufficient backplane and throughput along with QoS features for both voice and data connectivity .

A. TECHNICAL SPECIFICATION

- Configuration: 24 Nos. 10/100 Auto sensing Ports + 1 gigabit uplink port.

- The switch should support QoS classification of incoming packets for QoS flows based on Layer 2,Layer 3 and Layer 4 fields.

- Standard Compliance- support IEEE 802.3 x (flow control), IEEE 802. 1p), IEEE 802.1Q (V-LAN Trunking), IEEE 802.1d (spanning tree protocol)

- Management- Have built-in SNMP, Web based and Command Line Interface for Management. SNMP v1/v2/v3, RMON.

13.7.9 L2 SWITCH (24 PORT 10/100 BASETX + 2 * EXPANSION SLOTS)

a. Non-blocking, wire speed switching and routing.

b. Configuration: 24 Nos. 10/100 Auto sensing Ports + Two Module expansion slots which will accommodate the 1000 SX or 1000 Base LX or 1000Base-Long haul(70Km).

c. MAC Address support: 8000 MAC Address min.

d. Backplane: 8 Gbps min.

e. Forwarding Rates: 6.5 Million PPS min. for supporting wire speed switching.

f. The switch should support QoS classification of incoming packets for QoS flows based on Layer 2, Layer 3 and Layer 4 fields.

g. Standard Compliance- support IEEE 802.3 x (flow control), IEEE 802.1p), IEEE 802.1Q (V-LAN Trunking), IEEE 802.1d (spanning tree protocol).

h. Weighted Round Robin (WRR) queuing algorithm to ensure that low priority queues are not starved.

i. Power supply should have integrated IEEE 802.3 af compliant POE (Power over Ethernet)

j. Stackable

k. Management- Have built-in SNMP, Web based and Command Line Interface for Management. SNMP v1/v2/v3, RMON.

l. Support link aggregation for increasing Backbone bandwidth.

13.7.10 MASTER SLAVE DIGITAL CLOCK

Four-digit display units indicating hours and minutes, shall be installed at key location in the administrative building, coal handling plant, workshop and other selected areas. These will be controlled from a master station located in the dispatcher control room. Digits should be readable in day and night from a distance of at least 25 meters.

13.7.11 ELECTRONICS ATTENDANCE SYSTEM

This system shall be for attendance monitoring and evaluation. The whole attendance system consists of card reader/data collection terminals, hardware and support software with inbuilt clock and timer. The plastic card with contact less chip/magnetic stripe having the unique identification will be read by special reader unit, installed at attendance room. The card can be personalized by digital printing, thermo printing or by embossing.

13.7.12 UPS

Uninterrupted Power Supply (UPS) shall be used in case of main power failure for LAN and Computer centre.

SPECIFICATION OF UPS

(1) Capacity : 2KVA, Single phase

(2) AC Input voltage : 220/230V, 1 phase ± 15-20% variation

(3) Frequency : 50 Hz ± 5%

(4) AC outpur voltage : 230 VAC, 1 phase

(5) Power factor : 0.8 lagging to unity

(6) Regulation : both line and load ± 1%

(7) Wave form : Sinusoidal, < 5% THD

(8) Noise level : 55db

(9) Charger: Constant voltage limited current type, charging time for 90% discharged battery maximum 10 hrs.

(10) Battery : Sealed Maintenance free (of total capacity around 3100 watt hours)

(11) Battery Back-up: 4hrs at full load.

(12) Certifications: EU/EN/UL/ISO 9001

(13) Rack mount Design: 19” mountable with sliding guides.

(14) Communication: RS232 interface port & Ethernet port with Web management supports.

Features:

(1) The 2 KVA UPS with 4 hrs. Battery back-up & accessories shall have the facility of Input voltage cut off device to protect the 2 KVA UPS with 4 hrs. Battery back-up & accessories against excessive over/under voltage conditions at the input side.

(2) The system shall have surge suppression to prevent hardware damage.

(3) The system shall have facility for continuous display of load and battery charging conditions and automatic cut off device to avoid over loading and over charging.

The 2 KVA UPS with 4 hrs. Battery back-up & accessories system shall be true on-line state of the art based system capable of providing precise sine wave out put to the load.

13.8 BUDGETARY COST ESTIMATE

The Budgetary cost estimate for departmental and outsourcing is enclosed in Appendix A & B respectively.

13.9 MANPOWER REQUIREMENT

To maintain the IP Enabled Exchange, Managed switch, LAN and other system, the manpower requirement for E&T is as follows:

Sl. No.	Manpower	Nos.
1	E2/E3	1
2	Asstt. Foreman/Foreman	1
3	Technician	2
4	Lineman/Helper	2

CHAPTER – XIV

CIVIL CONSTRUCTION

14.1.1 INTRODUCTION

The life of this project has been estimated as 8 years. For service and welfare buildings, permanent type of construction has been proposed. The cost estimate for civil construction has been prepared based on the cost index. The cost index has been worked out as 2485 in the month of July'2011 with respect to 100 base at Delhi as on 01.10.1976.

14.2 BUILDINGS

14.2.1 RESIDENTIAL BUILDINGS

For residential buildings 55% housing satisfaction has been provided. The maximum manpower provision for this project is 659 in option-I, and 248 in option-II. Maximum number of quarters required is 362 for option-I, and 136 for option-II at 55% housing satisfaction. There are 702 no. of quarters existing, so provision has not been made for construction of residential building. The details of number of houses given in Appendix A.2.1

14.2.2 SERVICE BUILDINGS

It is proposed to utilize existing facilities of service and welfare buildings. Provision has been made in this report for construction of Site office, workshops, Store, substation, first aid center, canteen & rest shelter etc. Details of service buildings and statement showing capital investment have been given in Appendix- A.2.2

14.3 ROADS & CULVERTS

14.3.1 APPROACH ROAD TO PROJECT

It has been proposed to construct 0.5 km. long approach road to the project. The estimated capital investment for this road along with the culverts has been furnished in Appendix- A.8.2.2

14.3.2 HAUL ROAD

The maximum length of haul road has been estimated as 0.5 km for Options I and 1.5 km for Options II. The estimated capital investment for haul road along with the culverts and bridge has been furnished in Appendix- A.8.2.1

14.3.3 DIVERTION OF NH 33

Within the proposed area of quarry, NH 33 had collapsed due to fire in the abandoned UG mine. The diverted road has been constructed by NH Authority at the cost of Rs. 1277.50 lakh. This amount has to be paid by CCL to NH Authority before starting mining operations. Provision has been made for this in the report.

14.4 WATER SUPPLY AND SEWERAGE

14.4.1 WATER DEMAND

The maximum industrial water requirement for the project has been assessed as follows:

Option-I -0.067 MGPD and Option-II -0.046 MGPD

14.4.2 SOURCE OF WATER

Source of water for industrial use will be mine water.

14.4.3 INDUSTRIAL WATER SUPPLY

Details of industrial water supply scheme along with the estimated capital expenditure have been furnished in Appendices A.8.3.1

14.4.4 INDUSTRIAL SEWERAGE

Details of industrial sewerage scheme along with the estimated capital expenditure have been furnished in Appendices A.8.3.2.

CHAPTER- XV

15.0 SAFETY & CONSERVATION:

Deploying HEMM or any equipment in the mine for winning of coal shall be planned in confirmation with the prevailing statutory provisions as per Mines Act 1952 and CMR 1957 applicable for safety in opencast mines. However, all statutory rules, regulations, applicable laws etc. and statutory requirement related to Govt. licenses, workers compensation, Insurance, etc., including minimum wage act for workers employed in the mine shall have to be adhered to. Rules, if any imposed by local/State/Central authorities are to be complied by the mine authorities. Mine authorities shall have to supply various protective equipments viz. helmet, shoes etc. to the workmen at their cost.

All the regulations & schedules of Coal Mines Regulations 1957 relating to opencast mining have to be adhered to and implemented in order to maintain day to day safety precautions as per stature.

SAFETY ASPECTS FOR DEPLOYMENT of DEPT EQUIMENT
OUTSOURCING/HIRING OF HEMM/EQUIPMENT:

Special precaution should be taken while deploying workers in the mine. Before employing any labour to the mine proper vocation training should be imparted and recommendations of VIII Safety Conference should be strictly followed. Management for deployment of labours by outside agency shall fix terms and conditions. Some of the major aspects are as follows: -

A) **For persons**:

i) No persons shall be deployed unless he is trained at VTC

ii) Records in Form-B & Form-D shall be maintained.

iii) Records of Vocational training Certificate and driving license of operators shall be kept at the mine and shall be made readily available for inspection by management.

iv) No person shall be employed unless the person holds VTC certificate and Management is informed. A record of it shall be maintained.

v) Qualified competent persons shall maintain adequate supervision.

vi) Outside agency (if any deployed in mine) shall follow safety guidelines and safety instructions from Project Authorities.

B) For Machineries as recommended by DGMS Cir. (Tech.) 1 of 1999:

i) All the machineries to be deployed in mines should be checked before deployment by competent authority.

ii) Regular checking of m/c deployed by outside agency shall be done. No unfit machine shall be deployed before the defect is rectified.

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

iv) The trucks deployed outside agency shall be provided with Audio visual alarms, proper light for use at night and period when natural light is not sufficient. Also audio-visual alarms for reversing on trucks shall be provided.

Other Precautions for machines

i) RTO certificate photo copies of all vehicles shall be submitted to management

ii) Daily welding, monitoring, inspection shall be done by the agency's mechanic as directed by management.

iii) Machine manufacturers should be asked to give risk analysis details in respect machines deployed by outside agencies.

iv) Suitable type of the fire extinguishers shall be provided in every machine.

C) **General:**

i) No person/vehicle shall be deployed at any place other than authorized place.

ii) All workers should obey lawful instruction of mine management.

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

iv) All drivers shall obey 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/owner so that Notices of accidents in a accordance of (Reg.9 of CMR 1957) and Section 23 of Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.

vi) Mine shall be operated in such a way so as to minimize pollution in the mine.

Stability of Benches, Quarry High walls and Spoil Dumps:

During quarry operations, it is necessary to adopt required mining parameters for the stability of benches, high walls and spoil dumps. It is also mandatory to examine systematically the fencing of mine workings, landslides 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, highwall slopes and spoil dumps should be carried out and the dimensions be modified if necessary to suit the local conditions.

Precautions against Danger from Surface Water

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

2) Inspections for any accumulation of rainwater, obstruction in normal drainage and weakening in embankment.

3) Standing order; for withdrawal of working persons in case of apprehended danger.

4) During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places.

5) Nallah or water inlets may be diverted or isolated by embankments if so required.

Prevention of Flooding of Equipment Deployed at Bottom Horizons :

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

1) Drivage of initial trenches and coal cutting on bottom benches should be done during the dry period of the year.

2) Ramps should be made for quick shifting of equipment from bottom horizons, liable to be flooded during monsoon period, to the top horizons.

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.

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

2) 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.

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

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

Dust Suppression & Dilution of Exhaust Fumes:

The following measures should be adopted for dust suppression at all quarry working places, dumps, haul roads, CHP and near other auxiliary mining operations.

1) Spraying with water on all working faces & haul roads, by special spraying machines or water-sprinkler.
2) While drilling holes, it is necessary to use dust extraction devices.
3) Installation of local dust suppression and air conditioning devices in cabins of excavators and drilling rigs may be considered.
4) Leveling of spoil dump surface.
5) 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: -

1) To spread out the sources of dust formation and omission of harmful gases throughout the working area of the quarry.
2) Drilling & blasting operations should be timed for periods of maximum wind activity during the day.
3) Dumpers may be provided with purifiers for exhaust gases.

Measures to be taken for Fire Fighting and Fire Prevention:

In addition to statutory provisions, the measures for fire fighting and prevention of fires are as follows:

1) Organization of special cell for systematic observations to examine and prevent fire.
2) Removal of spillage of coal on benches and cleaning of coal horizons to prevent cases of coal heating.
3) Storage of lubricants and cotton waste in enclosed fireproof containers in working places.
4) Provision of fire extinguishers

Measures to be taken while Drilling Blasting:

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

1) Drilling and Blasting in quarry should be done in accordance with the provisions of Mines Safety Act, rules and regulations. While working above underground workings DGMS Circulars should be strictly adhered to.

2) Adequate safety measures have to be taken during blasting operation in the quarry so that men/machine is not affected.

CONSERVATION

Conservation of coal enjoins maximum recovery of in-situ reserves of coal and its proper utilization.

Coal deposits in Kuju OCP mining block upto Seam X are potential seams for opencast mining, both qualitatively and quantitatively. These aspects are taken into account during mine planning and operation in ensuring maximum recovery.

Opencast mining using shovel dumper system is one of the very important technology of coal production of thick or even thin seams from shallow depth upto economic stripping ratio (cubic metre of overburden required to be removed to raise one tonne of coal). The coal production from opencast method in Indian mining is more than 75% of total production. This trend is likely to continue in near future.

CHAPTER – XVI

ENVIRONMENTAL MANAGEMENT

The Environment Management Plan is one of the most important subjects to deal with after the preparation of the Project Report.

The EMP deals with present land status, land use during mining, post mining use of the land and its impact on the present environment scenario.

During mining operation, degradation of land, air, water, soil, noise, flora and fauna etc. occurs. Socio economic, hydro-geological strata are also affected and these are taken into consideration at the time of preparation of EMP.

16.1 Existing Environment Quality

Pre-mining observation is to be done in the above mentioned field. A base line data in environmental study is to be done and accordingly Environmental Impact is assessed. These basic data are taken from Pre-feasibility report, PR, Terms of Reference (TOR) etc. It covers the core zone of the project as well as Buffer zone, which is 10 km away from periphery of the core zone.

At present, The Project Report is under preparation. So, all the parameters related with environment will be studied for preparation of Environment Management Plan.

16.2 Environmental Impact Assessment

The mining operation in Kuju OCP will generate a series of activities, which will produce air pollutions, waste water and effluent. It generates high noise level, degrade land and also will have impact on flora fauna. The project activities would also have impact on socio-economic profile of the area.

It is proposed to assess the likely impact of the mining in and around the surrounding of the project.

16.3 Environmental Control Measures

Mitigation measures are broadly divided into preventive measure and suppression measure. Stress is given on mitigation measure, which is well effective and economical and are discussed in detail in EMP report.

16.4 Environment Management Plan

For effective implementation, mid-term corrective measures, monitoring and control measure of environmental management plan depends on time bound action programme. The success of environmental management plan depends on the well set-up organization with dedicated persons. The objectives for preparation of Environmental Management Plan are:

To implement environmental control and protection measures;

Subsequent environmental monitoring of the efficacy of various control measures;

Plantation / Green Belt Development;

Land restoration;

Keeping in view of the above, details of the organizational structure responsible for the implementation of environmental control and mitigation measures as well as monitoring of such implementation will be discussed in the EMP.

16.5 Cost Estimate

All the above activities in EMP accrue some cost. The estimated capital for capital outlay in mines and capital expenditure on environmental protection measures are provided in the Detailed Project Report of Kuju OCP in Appendix-A.8.1 and Appendix-F respectively.

16.6 Company Social Responsibility

Company also performs some social works such as opening of primary schools and higher secondary schools for providing the education to local people, establishment of dispensaries and hospitals, medical camps for providing better health facilities, vocational training to unemployed youth for better employment digging of wells and bore wells for drinking water facilities etc. for welfare of the local people. These works are done with the fund generated @ 2% of retained earnings under the head of company social responsibility scheme.

16.7 Rehabilitation and Resettlement

Rehabilitation site is yet to be proposed for about 145 PAFs. Resettlement and rehabilitation will be done according to R&R Policy of Coal India Limited

CHAPTER-XVII

17.0 LAND

17.1 TOTAL LEASEHOLD AREA FOR KUJU OPENCAST:

The total requirement of land for Kuju Opencast Project has been estimated as 189.95 Ha. for option-I & II. This includes 27.98 Ha. of forest land and 161.97 Ha. of non-forest land. The non-forest land consists of tenancy land and GMK land. Out of the total 22.98 Ha of forest land, 5.24 Ha of forest land is in the safety zone which is not to be acquired. The break-up of land on different heads for all option are shown in the following tables. All areas of land are in Ha.

Option-I & II **Table 17.1**

Sl. no	Particulars	Forest land in Ha.	Non-Forest land in Ha.	Total
1	Quarry	22.74	42.03	64.77
2	External OB dump	0.00	70.66	70.66
3	Infrastructures(W/S, CHP, S/S)	0.00	4.67	4.67
4	Others-Vacant land / Proposed Green Belt	0.00	12.72	12.72
5	Safety zone	5.24	31.89	37.13
6	Total Area Required	27.98	161.97	189.95
7	Forest land not to be acquired	-5.24	0.00	-5.24
8	Total Land to be acquired	22.74	161.97	184.71
9	Land already acquired	0.00	62.46	62.46
10	Total Land to be acquired	22.74	99.51	122.25

CHAPTER-XVIII

Mine Closure Planning

Mine closure encompasses rehabilitation process as an ongoing programme designed to restore physical, chemical and biological quality disturbed by the mining to a level acceptable to all concerned. It aims at leaving the area in such a way that rehabilitation does not become a burden to the society after mining operation is over. It must also aim to create as self-sustained ecosystem.

Mine closure operation is a continuous series of activities starting from day one of the initiation of mining project. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities in the progressive mine closure plan.

Final mine closure plan as per statute, shall be considered to have its approval at least nine months before the date of proposed closure of mine. This period of nine months is reckoned as preparatory period for final mine closure operations.

Kuju Mine shall have mine closure plan, which shall of two types:

a) Progressive Mine Closure Plan; and
b) Final mine closure plan

18.1 – Progressive Mine Closure Plan

18.1.1 Reclamation

A total of 184.71 Ha. Land for option-I & II is required for Kuju opencast. This mining plan has been prepared for Kuju geological block to exploit 1.30 million Te of coal per annum from opencast method by deploying shovel dumper combination.

The plan envisages OB dumping mostly as external dump. It is proposed to reclaim physically and biologically the excavated pit of Kuju mine after dumping by OB material.

The mined out area and external OB dump are proposed to be reclaimed as follows:

Phase-I: Physical /Technical Reclamation

In Ist phase OB dump shall be dozed and leveled to a bench slope angle of 37^0.
A layer of top soil is laid over this graded and leveled surface of OB dump. The internal dump (after opencast mining operation) shall be dozed and leveled to a bench slope of 28^0 to safe guard any slope failure during mining operation.

Phase-II : Biological Reclamation:

Biological reclamation is the Phase-II of reclamation process. Re vegetation covers in terms of grass, trees of appropriate species are raised over physically reclaimed OB dump.
The reclamation of external OB dump shall be done concurrently with the Kuju mine operation.
The total requirement of land for Kuju Opencast Project of 1.30 MTY in option-I & II has been estimated as 189.95 Ha including forest land in safety zone. The break-up of land use is shown in the following tables.

Option-I & II

Table – 1

Sl. no	Particulars	Forest land	Non- Forest land in Ha.	Total
1	Quarry	22.74	42.03	64.77
2	External OB dump	0.00	70.66	70.66
3	Infrastructures(W/S, CHP, S/S)	0.00	4.67	4.67
4	Others-Vacant land / Proposed Green Belt	0.00	12.72	12.72
5	Safety zone	5.24	31.89	37.13
6	Total Area Required	27.98	161.97	189.95
7	Forest land not to be acquired	-5.24	0.00	-5.24
8	Total Land to be acquired	22.74	161.97	184.71
9	Land already acquired	0.00	62.46	62.46
10	Total Land to be acquired	22.74	99.51	122.25

18.1.2 Air Quality Management Plan:

Following mitigation measures are required to done to control the air quality during mining operation:

a) All blast hole drills are to be fitted with dust collection arrangements
b) Water sprinklers are to be provided for dust suppression on haul roads and industrial area.
c) Creation of green belt along roads and plantation in vacant land.
d) Air Quality of mine shall be taken and analyzed on a regular interval.

18.1.3 Water Quality Management Plan:

Following water Quality protection measures are suggested:

a) Industrial effluent treatment plant
b) Sedimentation pond for treatment of mine water
c) Garland drains to arrest surface run-off flowing in to mine pit.
d) Intercepting drains to collect water from external dumps.
e) Biological reclamation of disturbed land to arrest siltation.

18.1.4 Waste Management:

Solid wastes that will be generated in course of coal mining are overburden material consisting of fragments of sandstone/shale of assorted size. They have not been found to generate acid mine drainage or leach high quantity of heavy metals.

In option-I & II a total of 32.95 Mcum of OB will be removed and it is proposed to be dumped externally and at the end of quarry operation it will be re handled and will be dumped in the quarry.

Several mitigation measures are proposed to for stabilization of external dump and prevent siltation and erosion.

a) A Toe wall is proposed at the foot of the external dump.
b) A series of open drains to be provided on dump body to arrest surface run-off and prevent siltation.
c) Grasses are to be grown on dump slopes to minimize soil erosion.

18.1.5 Top Soil Management

In mining plan, it has been proposed to excavate top soil separately. This top soil shall be used for reclamation of the external & internal OB dump and other degenerated land for vegetation.

18.1.6 Safety & Security

While carrying out all kinds of mining and allied activities in the project, the safety rules in force as per Rules and Regulations made under Mines-Acts- 1952 will be observed and required safety measures taken. Circulars issued time to time regarding safety to the personnel and equipment of the mine and to improve the working conditions of the mine, the mining plan envisages:

- Measures to prevent industrial accidents
- Measures to ensure stability of benches and OB dumps.
- Measures to ensure safety of equipment
- Measures to control fire
- Measures to control dust and emission of noxious gases
- Measures for pollution control.

18.2 Final Mine Closure Plan (Conceptual)

Mine closure operations is proposed to be undertaken after examination and detailed study that there is no further expansion possibility of the mine and the void is to be suitably filled up so that the land is utilized gainfully by the society. Intermediate stoppages of operations due to any reasons for a period of time do not come under the proposed scheme of mine closure. This chapter proposes following aspects:-

A. Technical Aspects
B. Environmental Aspects
C. Social Aspects
D. Financial Aspects

18.2.1 TECHNICAL ASPECTS:

Safety aspects.

- ✓ Pit slopes and waste dumps.
- ✓ Hydrology and hydrogeology.
- ✓ Details of decommissioning of the infrastructures.
- ✓ Closure of entries like pits and entry to the mine.

18.2.2 Safety:

After attaining the final stage dump (including internal Dump) the remaining portion between dump toe and final stage Quarry floor should be fenced properly so that no human being or stray animals should be trapped within. Internal dumps are proposed to be suitably re-graded to avoid deep trenches.

18.2.3 Pit Slopes and waste dumps:

The final pit slopes are designed to avoid any slope failure. Technical study is proposed to be conducted before deciding upon the final slope. Both the external and internal Dumps are designed in such a way that there are minimal chances of slope failure. The external Dump is sloped ultimately in the overall range of 25 degree to 28 degrees. The internal dump slopes are designed at milder gradient so that even with the percolation of water in the dip side of the quarry, the dumps remain stable. It is proposed that the internal and external dump must be provided with toe walls/ silt arrestors and garland drains. Vegetation cover on surface of these dumps is proposed to be ensured as a final closing operation.

18.2.4 Hydrology and Hydrogeology:

In the mine closure plan, the surface flow pattern of precipitation and mine water drainage is envisaged to be examined and the water channel suitably laid down so that this is acceptable to the local community and it do not disturb the general hydrology of the area. Efforts are proposed to be made to regenerate the ground water resources.

18.2.5 Decommissioning of the infrastructure:

The coal project develops lot of infrastructure for sustaining their operations. These include Workshop, Coal Handling Plant, Railway Siding, Office Complex, Residential Complex, Roads, Pipe Lines and Transmission Line. Decommissioning of the infrastructure should be planned in such a way that the Land occupied by these infrastructures is released. However these infrastructures are proposed to be reused for the neighboring projects /mine.

18.2.6 Closure of entry to the mine:

All entries to the mine must be effectively sealed. This will prevent illegal mining, entry of fire and water etc.

18.3 ENVIRONMENTAL ASPECTS

- ✓ **Air, water, dust.**
- ✓ **Reclamation of forest/vegetation.**
- ✓ **Management of recharge areas.**
- ✓ **Acceptable surface and ground water flows.**
- ✓ **Alternative use of land**

18.3.1 Air, water, dust:

It is proposed that air quality; water quality and dust level is to be monitored. Necessary actions to check the pollution from the closed mine, if any, in respect of air, water and dust is to be taken after examining the local site conditions then prevailing.

18.3.2 Reclamation of Forests/vegetation:

It is proposed that major portion of the project area is covered with vegetation. This will involve both forest land as well as non-forest land. Certain areas, mostly industrial areas, where service building are proposed to be located and to be used are not proposed for plantation.

18.4.1 Management of recharge areas:

It is proposed that the recharge areas are fully utilized and sufficient availability of water, if feasible, is ensured to enhance ground water availability.

18.4.2 Surface and ground water flows:

In the final stage, wherever the mine water is likely to flow out to surface and meet the natural drainage system, the quality of water is proposed to be assessed and flow pattern for mine water be properly modified/ redesigned. Alternately, the water treatment arrangements may be considered depending upon the local site conditions.

18.4.3 Alternative use of land:

During the mining operation, the land usage changes from its pre-mining scenario. The final stage land use plan shows the use of land in a post-mining scenario when coal-mining operations have completed. Alternative use of land, specially released from infrastructure areas and vacant areas, as proposed to be planned and properly designated for post-mining land uses depending on the existing conditions prevailing at that point of time. While for OB dumps and acquired forest areas, vegetation and afforestation has been proposed as a final land use. While agriculture may be the best land use, if feasible, and if it is supported by some irrigation facilities.

18.5.1SOCIAL ASPECTS:

- ✓ **Re-deployment of work force.**
- ✓ **Management of community facilities**
- ✓ **Canalization of available water**

18.5.2 Re-deployment of work force:

The peak work force required for mine operations is in the first few years of the mine when construction activities as well as operational activities achieved their peak.

This work force slowly goes down with completion of development and when only the operational work remains. Again near the end of the mine life, say 4-5 years before closure, the activity of the mine starts getting reduced and therefore management gets opportunity to taper the operational manpower. After closure, skeleton service people are proposed to be left for continuing with the actual closure operations. The reduction of manpower could be done as per the following options:

- Natural retirement.

- Implementation of VRS schemes for age group of +50.
- Retraining and redeployment of younger groups – 40.
- Transfer of experienced middle-aged groups between 40-50 years to other projects.

Retrenchment of people with suitable compensation after exhausting all the above options may be considered.

18.5.3 Management of Community Facilities:

The community facilities are proposed to be developed by coal projects for betterment of the neighboring community. The project management provides or assists in developing educational facilities, health facilities, community halls and also some communication facilities. After the mine closure, these facilities are to be continued for the neighboring communities to the possible extent. The closure plan will envisage interaction of mining company with the state or local bodies who will take over these facilities and run the same for the community. The coal companies towards running these facilities, which is proposed to be taken care of by the local/state bodies, may make a onetime payment.

18.5.4 Canalization of available water:

If it is found that the mine is having sufficient water and on closure, the mine water flows into the surface watercourses, canalizing this water for surrounding community for their irrigational/domestic uses may be taken up.

18.6 FINANCIAL ASPECTS:

- ✓ Creation of a corpus fund for the final mine closure
- ✓ Cost of progressive closure activities.
- ✓ Cost towards organization for executing the closure activities.
- ✓ Cost of the post project monitoring
- ✓ Bond/insurance for the closure cost

Financial Assurance :

As proposed above, many activities are to be undertaken for progressive mine closure plan concurrently with the mine operation and final closure plan after the closure of the mine, which naturally will involve expenditure. Some of the closure activities will, in fact, form part of normal mining operations. However, some activities are proposed to be addressed only after completion of the coal mining operations.

It is proposed to create a fund for mine closure from the retain earnings of the project @ Rs. 6 lakhs per hectare of lease hold area. This comes to Rs 15.96 crores for Option-I & II for the corpus, Apart from this, an amount of Rs 8.22 Crores is proposed for capital expenditure on HEMM for progressive mine closure activities. Provision has also been made for corporate social Responsibility as per Coal India norms. After the completion of the coal mining, an organization consisting of persons of different disciplines is proposed to be maintained to undertake and implement the closure activities. The organization may be provided with a vehicle for discharging day-to-day duties. Maintenance cost of this organization is proposed from the retain earnings of the project. A small team consisting of 2-3 technical people may be required to oversee the efficacy of the closure activities. This monitoring may be conducted for 4-5 years after the mine closure activities.

18.7 Disaster Management Plan & Risk Management :

There are various elements of risks in operation of the mine. They include following :-

- **Slope failure of External OB dump** –OB proposed is planned to be stacked in external dumps having a total height of 80m in three tiers of 30m each. The OB material consists of assorted size of sandstone fragments, other geological strata and sub-soil. It has to be ensured that slope of OB Dumps do not fail as it would cause damage to life & property.

- **Slope failure of Internal Dump** –The slope of the backfilled mass is dynamic i.e. it moves every day. It has to be ensured that slope of backfilled mass is safe otherwise it may pose risk to life & property and interrupt the mining operations.
- **Stability of High walls** – In course of opencast mining slopes if created on high wall sides in coal and OB/ interburden formations unless properly planned, they may fail. It is proposed to undertake slope stability analysis to avoid slope failure.
- **Fire** – There may be fire in working, store, industrial installations and other service building provided for the mine.
- **Inundation** – The open pit will collect water from direct precipitation and surface run-off from surrounding areas. This may lead to inundation of the mine pit.
- **Seismic activities** – The project is located in low risk seismic zone area.

Ameliorative Measures

Following ameliorative measures have been envisaged to be taken to prevent the risks/accidents

- Slope stability analysis is required to be conducted for high wall slopes, External Dumps and Internal Dump slopes.
- Adequate fire fighting arrangements to be made.
- For preventing mine inundation, sufficient pumping arrangements have been made to pump out the pit water continuously.
- Garland drains have been proposed around mine pit to intercept surface run-off.
- Medical facilities – A hospital with necessary infrastructure, doctors and paramedical staff and ambulance has been proposed to take care of emergency situation

CHAPTER-XIX

MANPOWER & PRODUCTIVITY

19.0 Introduction

Manpower requirements are assessed on the basis of 7 days week and 330 days of annual working. The designation wise and category/scale wise break-up of the manpower with phasing for the above options has been given in Appendix-B. Comparative manpower under broad heads along with OMS for the all variants is as follows

19.1 Manpower requirement for KUJU OCP (1.30 MTY) has been given below.

Sl No	Manpower Particulars	Category	OPTION - I		OPTION - II	
			Upto Target Yr	Beyond Target Yr	Upto Target Yr	Beyond Target Yr
1	Unskilled	I	89	91	22	24
2	Semi skilled	II, E	44	44	15	15
3	Skilled	C, D, III,IV, V, VI	135	135	51	51
4	Highly skilled	A, B	113	158	0	10
5	**Total Workers**		**381**	**428**	**88**	**100**
6	Monthly Paid		165	188	118	119
7	Officers		42	43	28	29
8	**Total Manpower**		**588**	**659**	**234**	**248**
9	**OMS**		**8.37**		**21.04**	
10	**EMS**		**1935.12**		**2098.15**	

The Detailed manpower requirement has been provided in App. B & B.1

19.2 Training

Most of the opencast projects of CCL are being operated departmentally. Therefore, for departmental option, trained manpower may be available in CCL. Further it is suggested that new recruited are to be trained as per the standing guidelines stipulated in the V.T Rule of DGMS and the existing Training Schedules of CIL prior to actual placement in the job/ mine. For periodical training and development need, a Group VTC for Area may be formed. If required, facilities at these training centers should be augmented periodically.

CHAPTER XX

Project Implementation Schedule

20.1 PERT Network for a Target coal production of 1.30 MTY is enclosed overleaf.

Chapter – XXI

ECONOMICS

21.0 For Project Report of KUJU OCP, at the peak rated target production of 1.30 Mty of coal, the estimated economics has been worked out considering departmental & outsourcing workings for both Coal winning & OB removal.

The estimated economics has been discussed in the subsequent paragraphs.

21.1 Total Capital Investment

Initial capital investment has been provided in the proposal till the year of achieving rated coal production. The capital investment, both Initial as well as beyond target year, has been proposed from the internal resources of the Company. The capital requirements are given below:

(Amt in Rs. lakhs)

Head-Wise Capital	Existing Investment as on 31/03/2011	Option I	Option II
Land	989.06	356.25	356.25
Residential Buildings	171.55	0.00	0.00
Service Buildings	44.24	1588.96	296.25
(a) HEMM	34.83	8529.75	0.00
(b) Other than HEMM	257.07	4194.57	2629.41
Furniture	21.10	25.00	12.00
Vehicles	19.87	181.72	127.40
Prospecting & Boring	136.72	108.12	108.12
Capital Outlay in Mines	0	578.75	551.54
Roads & Culverts	45.22	1574.56	1574.56
Water Supply	32.19	293.17	198.57
PR preparation Cost	46.15	87.15	29.27
TOTAL	1798.01	**17518.00**	**5883.36**
Total Initial Capital Investment		**19316.00**	**7640.57**

In Capital investment of Outsourcing Option II HEMM & Workshop has not been provided.

The details of capital investment under various heads viz. Land (A.1), Buildings (A.2), Vehicles (A.6), Prospecting & Boring (A.7) and Development (A.8), are given in the appendices mentioned against each of them.

Phasing of initial Capital for the project is as follows:

(Amt in Rs. lakhs)

		Total	1 year	2nd year	3rd Year
Departmental Option	Option I	**17518.00**	11446.68	3412.02	2659.29
Out Sourcing Option	Option II	**5883.36**	4157.35	1220.21	505.80

21.2 Capital Investments for P&M

Capital investment on P&M is given in Appendix-A.3. The detailed break-up for HEMM, Electrical, Pump & Pipes, Workshop and Other P&M etc. are given in Appendix-A.3.1 to A.3.5 for all the options separately.

The requirement of capital investment on P&M worked out for the options is given below:

Sl No	**Particulars upto target year**	**Capital Requirement in Rs. Crs**	
		Departmental Option I	**Outsourcing Option II**
1	Investment on P&M	127.24	26.29
	Specific Investment Rs./te	963.96	199.20
2	Investment on HEMM	85.30	0.00
	Specific Investment Rs./te	646.21	0.00

Method of Estimation of Capital Cost

The method of estimation of capital investment for P&M, Civil estimates, Development Capital, Revenue expenditure capitalised etc. is as follows.

Prices of Plant & Machinery

For the plant and machinery, as far as possible, the prices have been taken from the Standard Price List of Mining Equipment published by CMPDI and whenever information regarding price was not available, a broad estimate was made.

21.3 Estimated Cost of Civil Construction

The basis for the estimation of the cost of civil construction viz. residential buildings, service buildings, roads etc. has been given in Appendices - A.2.1, A.2.2 & A.8.2.

21.4 Capital Investment on Vehicles

The total estimated capital investment on vehicles upto target year is Rs. 1.82 crores for Departmental Option I and Rs. 1.27 crores for Out sourcing Option II.

21.5 Development

Under this head, estimated investment is given for (a) capital outlay in mines (Appendix A.8.1), (b) Roads and culverts, including haul roads (A.8.2), (c) Water Supply & Sewerage (A.8.3). The details of each item are given in the respective Appendix.

21.6 Opening of Revenue Account

The proposed PR of the KUJU OCP to produce target 1.30 Mty has been planned to come under revenue account from 1st year.

21.7 Estimates of Operating Cost

Appendix-C gives the details of average cost and profitability. The method adopted in estimating the costs are briefly explained as follows:

(a) Wages

The requirement of manpower for the targeted production of 1.30 MTY for 8 yrs is estimated category wise/ scale wise. Prevalent pay scales for executives and non- executives (NCWA-VIII) are adopted. End points of the relevant pay scales of executives & non-executives have been considered in estimating the salary and wages cost. The average wages cost per Tonne has been shown in Appendix – C and is also shown in Table C below.

(b) Stores

Stores cost consists (1) diesel and lubricants, (2) explosives and detonator, (3) spares for routine repairs etc. Prevalent norms have been followed in estimating stores cost. The average store cost per tonne has been shown in Table C below.

(c) Power

The average Power cost per Tonne has been shown in Table C below based on annual KWH consumed.

(d) Miscellaneous Expenditure

This covers the expenditure on printing & stationery, postages, telephone, repairs and maintenance of assets other than P&M, workshop debits for annual servicing and overhauling of HEMM, insurance and taxes for vehicles, normative contractual cost of major maintenance of HEMM. The average Miscellaneous cost /Tonne has been shown in Table C below.

(e) Final Mine closure Cost

A fund equal to Rs. 6.60 lakhs/hectare of land is proposed to be created towards a fund for final mine closure. The fund has been distributed over the revenue life of mine in the 8 years with a yearly escalation of 5%.

(f) **Administrative Charges**

This includes area overhead, apex overhead etc. and the cost has been taken as per the actual administration cost of CCL.

(g) Interest on Working Capital

Rate of the interest on working capital is taken as 14.50% per annum.

(h) Interest on Loan Capital:

As the investment for the project is proposed to be met from the internal resources of the Company, there is no impact due to interest on loan capital.

(i) Coal Outsourcing cost & OBR Outsourcing cost.

Production of Coal and OB Removal for Option No. II is proposed to be outsourced.

The coal outsourcing cost includes **excavation cost** (Rs. 25/t) as per prevailing contracts in CCL, **transportation cost** as per the applicable distance ranges at ESM rates, and **Pay loader** (Rs. 7.40/t) charge. These costs are likely to change in future.

The OB outsourcing cost includes **Excavation and transportation** of OB as per the prevailing contracts in CCL. The composite rate adopted in the proposal is Rs. 54.09/cu.m for an average lead of 2.87 Kms, which does not include explosive costs and includes diesel escalation clause. These costs are likely to change in future.

For Option I and II OB will have to be re-handled and is proposed by outsourced agency. This will be taken-up form year 9^{th} to 12^{th} . The outsourcing cost has been considered accordingly for an average lead of 2.5 km.

Over and above these costs applicable service tax has been provided.

(j) Depreciation

Depreciation on assets is computed as per the prevalent norms. The straight-line method of charging depreciation has been adopted.

(k) Cost & Profitability

The details of the average cost and profitability estimates, at 100% capacity and at 85% capacity are given in **Appendix-C &C1**. The CPT & profitability has been shown for 8 years life of the project. These have been summarised in the table below:-

	Option I		Option II	
	100%	85%	100%	85%
	Average Cost Rs/T			
Salaries & Wages	256.12	301.32	104.51	122.95
Stores cost	362.16	400.51	59.23	65.51
Power cost	13.57	15.36	11.48	13.00
Miscellaneous cost	59.40	63.59	37.25	39.88
Final Mine Closure Cost	10.99	12.93	10.99	12.93
Coal Outsourcing Cost	0.00	0.00	50.83	50.83
OB outsourcing/ Rehandling cost	245.42	245.42	491.60	491.60
Administrative Expenses	140.00	164.71	140.00	164.71
Interest on working capital	52.57	58.19	43.78	46.47
Depreciation	137.00	161.17	31.70	37.29
Total Cost/t (In Rs.)	1277.23	1423.20	981.37	1045.16
Sales Value/Te (In Rs.)	1869.00	1869.00	1869.00	1869.00
Profit/Loss Per Tonne (In Rs.)	591.77	445.80	887.63	823.84

Cost of production and profitability at different levels of output is tabled below for 8 Yrs. of the project.

	Option I		Option II	
Capacity Utilisation	Cost Per Ton	Profit per Ton	Cost Per Ton	Profit per Ton
100%	1277.23	591.77	981.37	887.63
95%	1320.76	548.24	1000.40	868.60
90%	1369.13	499.87	1021.53	847.47
85%	1423.20	445.80	1045.16	823.84
80%	1484.02	384.98	1071.74	797.26
75%	1552.95	316.05	1101.86	767.14
70%	1631.72	237.28	1136.28	732.72

(I) Selling Price

The declared Selling Price per tonne of coal has been adopted for the long flame Grade -C i.e. Rs. 1830/- with additional charges of Rs. 39/ per tonne for sizing of coal up to -200mm.

Break-even point of the project for departmental Option I is at 58.29% and for Outsourcing option II is at 28.94%.

21.8 FINANCIAL ANALYSIS

The year-wise cash flows at 100% and 85% capacity utilisation have been estimated and are detailed in Appendix-D. & D.1, respectively. The cash-flows exclude depreciation and interest on loan capital. The financial IRR on total capital of the project at 100% and 85% level of the rated output have been worked out based on the estimates of the aforesaid cash flows. These have been worked out for both the variants which is summarised in the table below.

Sl. No.	Particulars	Option I	Option II
1	Internal Rate of return %		
	At 100% Capacity	223.37	Highly Positive
	At 85% Capacity	108.21	Highly Positive