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PROJECT REPORT
FOR
BASUNDHARA (WEST) EXTENSION
OPENCAST PROJECT

(NORMATIVE CAPACITY 7.00 MTY)
(PEAK CAPACITY 8.75 MTY)
(COST BASE OCTOBER, 2013)

IB-VALLEY COALFIELD

MAHANADI COALFIELDS LIMITED



DECEMBER, 2013
CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
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SUMMARISED DATA



**BASUNDHARA WEST EXTENSION OCP (7.0 Mty)
(PEAK CAPACITY 8.75 MTY)**

SUMMARISED DATA

Sl. No.	Particulars	Unit	Value
A.	GENERAL		
1	Name of Project		Basundhara west extension OCP
2	Name of Area /Company		Mahanadi Coalfields Ltd.
3	Nearest Railway Station from project	Name km	Himgir 35
4	Nearest National / State Highway / Approach road	Name	- Sundargarh-Raigarh all weather road is passing near bye block - Sundargarh is connected by Sambalpur-Rourkela State Highway-10 Distance of Sundargarh- 46 km
B.	GEOLOGICAL		
1	Name of geological blocks considered	Name	1. Chaturdhara. Block
2	Area of the geological blocks	sq. km	Chaturdhara block.- 3.57
3	Borehole Density within blocks	BHs / sq.km	15.4
4	Description of all coal seams within block (Siarmal & Siarmal Extn. and Banapatra blocks)		

Stratigraphic Sequence	Thickness (m)		No. of borehole intersections	Geological Reserves (Mt)	% of total geological Reserve
	Min.	Max.			
RAMPUR-I	1.11	9.61	49	25.69	22.61
PARTING	0.1	2.99			
RAMPUR-II	0.58	5.77	47	13.78	12.13
PARTING	0.10	3.0			
RAMPUR-III	2.42	8.57	46	21.39	18.83
PARTING	1.82	7.14			
RAMPUR-IVB	0.33	3.58	44	4.82	4.24
PARTING	0.58	8.12			
RAMPUR-IV	3.44	15.95	34	41.75	36.75
PARTING	0.43	7.60			
RAMPUR-V	0.58	6.70	33	6.18	5.44

C.	TECHNICAL		
1	Area of the proposed mine block	sq. km	Basundhara West Ext. OC over Chaturdhara block = 3.06/sq. km.
2	Mine parameters (seam-wise) Extent along strike (min. – max.) Extent along dip (min.-max.)	km km	Max 2757 m Min 951 m Max 1326 m Min 410 m

3	Description of coal seams proposed to be worked along with the parting details						
Name of seam	Thickness range (m)					Mineable Reserves (Mt)	Volume of OB(Mcum)
Top OB	5-70						80.66
RAMPUR-V	2-3					4.33	
PARTING	3-30						2.57
RAMPUR-IV	11-15					40.87	
PARTING	1-7						5.31
RAMPUR-IVB	1-2					4.91	
PARTING	1-7						5.68
RAMPUR-III	4-6					15.29	
PARTING	1-8						2.00
RAMPUR-II	2-4					9.76	
PARTING	1-7						1.00
RAMPUR-I	4-6					17.57	
Total Coal OB						92.73	97.22
4	Av. Stripping Ratio	cum/t		1.05			
5	Method of Mining			Shovel-dumper, surface miner			
6	Target Output Nominal production capacity (at 100%) Peak production capacity (at 125%) Production capacity (at 85%)	Mt Mt Mt		7 Mty 8.75 Mty 5.95 Mty			
7	Year of achieving Target Production (from zero date)			Year-3 (Third year)			
8	Year of start of Internal Dumping			3			

9. Production phasing (from zero date upto target year) (for departmental variant)

Year	CAOL	O.B.
Year-1	1.50	2.18
Year-2	5.50	3.32
Year-3	7.00	5.45

10	Total Mine Life (at Nom. production capacity)	Years	15	
	Production build-up period	Years	2 years (upto year-2)	
	Full Production period	Years	12 years (upto year-14)	
	Tapering / mine closure period	Years	1 year	
11	Major HEMM Deployed for OB (departmental variant)	Size/Capacity	No. (upto Target year)	No. (beyond Target year)
	ELEC. HYD. SHOVEL	10.0 cum	1	1
	RLEC. ROPE SHOVEL	5.0cum	1	
	DISEL HYD. BACKHOE	5.0 cum	1	
	DISEL HYD. BACKHOE	2.5-3.0 cum	2	
	REAR DUMPER	100 T	7	13
	REAR DUMPER	60 T	27	1
	REAR DUMPER	35T	1	
	DRILL	250 mm	2	1
	DIESEL DRILL	160 mm	6	
	DOZER WITH RIPPER ATTACHMENT	860HP	1	
	DOZER	410 HP	4	
12	Major HEMM Deployed for Coal(departmental variant)	Size/Capacity	No. (upto Target year)	No. (beyond Target year)
	SURFACE MINER	3000-3800mm	2	
	FRONT END LOADER	5-6 cum	4	
	REAR DUMPER	60 T	6	6
	REAR DUMPER	50 T	9	
	DOZER	410 HP	3	
	WHEEL DOZER	300 HP	1	

13	Total Manpower		Variant	Variant-I	Variant-II	
		Nos.	Upto target	649	215	
		Nos.	Beyond target	205	9	
14	Overall Output per manshift (OMS) including existing manpower	Tonnes	44.84 (Variant-I) 46.17 (Variant-II)			

15	Presence of Major Surface Constraints (nallas, road, power line, etc.)	(type)	Presence of 316 PAFs in two nos. villages (Telendih and Ratansara (part))			
16	Coal Transport within the mine (In-pit belt conveying system or by Truck)		Truck transportation face to surface.			
17	Surface Coal Transport to Siding/Despatch Point and Mode of Despatch		Truck transportation pit head to existing railway siding.			
18	Any Railway Siding and distance		Proposed Siding			
19	Name of any Specific Customer/Industry		Basket Linkage			
D. ENVIRONMENTAL & OTHERS						
1	Civil Construction Residential houses	Nos.	Variant Upto target Beyond target	Variant-I 80 143	Variant-II 0 0	
2	Water Demand (upto target year)	MLD	Variant Potable Industrial	Upto target 0.07 1.26	Beyond target 0.12 1.18	Total 0.19 2.44
3	Total Land to be acquired Government land Tenancy land Forest land	Ha Ha Ha Ha	516.77 99.12 148.68 268.97			
4	Land to be acquired within mine take area (excavation area) Total Forest land	Ha Ha Ha	306.05 189.72			
5	Land to be acquired outside mine take area (Beyond Excavation Area) Approach Road, Infrastructure, etc.) Non-forest land Forest land	Ha Ha Ha	196.14 116.89 NIL			
6	Land to be acquired for external dumping Non-forest land Forest land	Ha Ha	NIL NIL			

7	Net Present Value of Forest Land Total Area Total Value	Rs.Lakhs /Ha Ha Rs.Lakhs	Rs.7.50 lakh/ha 268.97 2017.28 lakhs incl NPV
8	Habitation & Rehabilitation No. of villages within mine boundary No. of land oustees No. of PAFs to be rehabilitated	Nos.	2 nos. 1396 316
9	Cost of land Total Cost	Rs. crores	Rs.9486.21 crores(total considered with in target year)
10	Total EMP Capital R&R cost (excluding land)	Rs. crores	Rs.94.19 crores Rs.71.43 crores
11	Drainage of the Area (Name of river/nala)		Basundhara river
12	Any proposed diversion of nala or power line		No

E. FINANCIAL			Variant-I	Variant-II
1	Total Capital Investment Upto target year Additional Beyond target year	Rs. crores	479.15 141.26	335.69 62.31
2	Specific Investment (upto target year) Total	Rs. / tonne	684.51	479.57
3	Total Capital Investment on P&M(upto target year)	Rs. crores	182.01	54.79
4	Specific Investment on P&M (upto target year) Total	Rs. / tonne	313.46	78.27
6	Year of opening of Revenue account (from zero date)		Year-3	Year-3
7	Earnings per manshift (EMS)	Rs.	3760.92	2611.36
8	Estimated Cost of Production At 100% production level At 85% production level	Rs. / tonne	352.60 401.83	264.07 291.89
9	Estimated average selling price	Rs. / tonne	688.00	688.00
10	Estimated Profit At 100% production level At 85% production level	Rs. / tonne	335.40 286.17	423.93 396.11
11	Financial Internal rate of return (FIRR) At 100% production level At 85% production level	%	55.42 38.87	104.24 81.06

12	Economic rate of return At 100% production level	%	89.05	131.07
13	NPV at 12% At 100% production level At 85% production level	Crores Crores	848.82 513.64	1284.98 965.51
13	Break-even point Production Production level	Mty %	3.18 45.41	1.90 27.18
14	Cost of Outsourcing (average) OB Coal	Rs/cum Rs/t Rs./t	Not applicable	65.31 Not applicable
15	Mine Closure Cost (for corpus fund)	Rs./t	5.74	5.74
16	Expected Completion Capital	Rs. crores	686.87	521.02
17	Financial IRR for completion cost	%	37.91	59.76
18	Economic IRR for completion cost	%	61.33	88.61

EXECUTIVE SUMMARY

EXERCISE 10

BASUNDHARA (WEST) EXTENSION OPENCAST PROJECT (7.0 MTY)

EXECUTIVE SUMMARY

1.1 INTRODUCTION

The Basundhara West Extension OCP is located in north-western central part of Ib River coalfield of Odisha, known as Gopalpur sector, (Plate G-1). This coalfield is the southern middle part of lower Gondwana basin of Son Mahanadi Valley and occupies an area of about 1460 sq.km with potential coal bearing area of around 1050 sq.km. The Ib River coalfield lies in between latitude 21°31' to 22°14' North and longitude 83°32'00" to 84°10'00" East and falls mainly in Sundergarh, Jharsuguda and Sambalpur districts of Odisha.)

The proposed Basundhara West Extension OCP has been formulated within Chaturdhara block in the Gopalpur Sector of Ib-valley coalfield. Basundhara river separates Chaturdhara block from Basundhara block. Basundhara river is the boundary of Siarmal-Basundhara block and Basundhara-Chaturdhara blocks. But due to river Basundhara on western side, approach to Chaturdhara block has become a major hurdle for its development. Initial overburden from proposed quarry is to be carried to void of Basundhara West OCP. Barrier coal between Basundhara and Chaturdhara to be left due to non diversion of Basundhara river. Diversion of Basundhara river is not possible due to its perennial water supply to that area. The Project Report is based on Geological Reports of Chaturdhara block. The proposed mine area lies on the west of Basundhara West OCP (7.0 Mty) on the western side of Basundhara river. Basundhara West OCP is an ongoing project with remaining life of two years. To its west lies the private captive block Rampia, to its south Chaturdhara nala and Banapatra block, to its north incrop (floor line) of Rampur-I seam and to its east Basundhara river and Basundhara West OCP.

As per the latest estimate, the projected gap between demand and availability of MCL by the terminal year of XII Plan (2016-17) is estimated to be 28.32

Mt from Ib-valley coalfield alone. Further new coal linkages have been given to MCL for which MCL has already issued LOA. The proposed project will meet the coal demand from the coalfield, especially to the new consumers and reduce the gap between demand and availability.

The coal seams in the block under consideration for the project (Basundhara West Extension-Chaturdhara) are thick and occur at shallow depth. The entire coal reserves of 115.97 Mt have high quarriable potentiality.

Considering the coal demand on MCL and quarriable potential of the blocks, formulation of the present opencast mine for rated capacity of 7.0 Mty is justified.

The Project Report has been prepared at cost base of October, 2013 with following two variants:

VARIANT-I : COAL & OB BY DEPARTMENTAL MEANS
VARIANT-II : COAL BY DEPARTMENTAL & OB BY OUTSOURCING MEANS

2.1 MARKETTING AND JUSTIFICATION

The proposed Basundhara west Extension OCP has no consumer specific linkage. A basket of new consumers may be linked to the project who have been issued LOA (Letter of Assurances) by MCL under NCDP-2007. Based on the information collected from MCL and transport logistics, the proposed new consumers for Basundhara west Extension OCP may be as below:

New consumers linked to MCL/ Ib-valley coalfield

Sl. No	Name of the Consumer	Capacity (MW)	Total Linked quantity (Mty)
1	Vedanta Aluminium Ltd- CPP	675	3.07
2	Sterlite Energy Ltd.	600	2.57
3	Vedanta Aluminium Ltd.	540	2.46
4	Ind-Barath Energy Ltd	2x250	3.07
5	Talwandi Sabo Power Ltd., PSEB,		7.72
6	Rajiv Gandhi Thermal Power Plant, Khedar, Hissar Phase-I, Haryana		3.24
7	Parli Unit-II TPS, MSEB	250	1.2

Sl. No	Name of the Consumer	Capacity (MW)	Total Linked quantity (Mty)
8	Paras Expn.-II TPS, MSEB	250	1.2
9	CESC Ltd. Phase-I,	500	2.83
10	Vishakhapatnam TPS of HNPCL		3.24
11	DB Power Ltd., Bhopal.	500	2.49
12	Thermal Power Tech Corpn. (I) Ltd., Hyderabad.	1000	4.27
13	Sirkazhi Power Hyderabad.	1000	4.27
14	NCC Vansadhara Mega Power Projects, Hyderabad	1000	4.27
15	East Coast Energy Pvt., Hyderabad.	1000	4.27
16	Other CPP & Sponge iron plants		4.62
Total			54.79

From the above quantity of 54.79 Mty of coal linked to various new consumers who may be supplied coal from Ib-valley coalfield. Basundhara west Extension OCP will meet the demand of 7.0 Mt. which will replace Basundhara west OCP in future. The consumer wise quantity may be known after signing of FSA, which are to be executed after achieving the desired milestones as per the guidelines of NCDP-2007.

3.1 LOCATION

The proposed Basundhara west Extension OCP has been formulated within Chaturdhara block in the Gopalpur Sector of Ib-valley coalfield.

The Chaturdhara block is located in north-western central part of Ib River coalfield of Odisha, known as Gopalpur sector. This coalfield is the southern middle part of lower Gondwana basin of Sone-Mahanadi Valley and occupies an area of about 1460 sq.km. with potential coal bearing area of around 1050 sq.km. The Ib River coalfield lies in between latitude 21°31' to 22°14' North and longitude 83°32'00" to 84°10'00" East and falls mainly in Sundergarh, Jharsuguda and Sambalpur districts of Odisha.

The Chaturdhara block, lie towards north western part of Ib River coalfield in Odisha state and together covers an area of 3.57 sq.km. The block is situated between the Latitude 22°04'0"-22°05'0"N and Longitude 83° 40'39" – 83°42'02" E in Survey of India topo-sheet no.-64N/12 on RF 1:50,000.

4.1 GEOLOGY

Chaturdhara OCP (Basundhara West Extension, 7.0 Mty) is located in the north western part of Ib-valley coalfield, Odisha (ref. Plate I).

The boundary of Chaturdhara OCP is defined as below;

North	-	Incrop (floor line) of Rampur I seam.
East	-	Basundhara river and Basundhara West block.
South	-	Chaturdhara Nala and Banapatra block.
West	-	Rampia block.

A total of 55 boreholes have been drilled within the area involving a total meterage of 4196.45m. (excluding 1 borehole No. HGR - 18 drilled by GSI involving 164.10m.) in an area of 3.57 sq.km. Coal bearing area is 3.57 sq.km out of which major part is covered by forest. The borehole density/sq.km is about 15.4.

Three coal seams viz. Ib, Rampur and Lajkura have been proved to occur in this block under report. Ib-seam is the bottom most seam occurring in the area. This seam is thin and impersistent and has no potentiality in this block except for eastern part of the block. Rampur seam is the thickest seam and occur in 6 sections viz. RAMPUR I, RAMPUR II, RAMPUR III, RAMPUR IV B, RAMPUR IV and RAMPUR V. Parting between Ib seam and Rampur group of seams varies from 4.62m. to 12.85m. Lajkura is the uppermost seam occurring in this area and is restricted along southern boundary and largely falling within barrier zone of Chaturdhara Nala, where it is occurring in 3 sections viz. LAJKURA I, LAJKURA II B and LAJKURA II T1 (incrop). The parting between Lajkura and Rampur seam varies from 71.04m. to 75.73m. Representative graphic litholog of boreholes are given in plate no. VIII.

Band by band analysis has been carried out for all boreholes. Seam overall proximate analysis has also been carried out on 60% RH and 40°C for BCS and I₁₀₀ samples. In BCS samples, all dirt bands of carbonaceous shale (Ash+Moisture > 55%) and obvious dirt bands have been excluded. In I₁₀₀ samples, dirt band (Ash +

moisture > 55%) and obvious dirt bands having thickness more than 1m have been excluded. Since seam overall proximate analysis carried out on 60% RH and 40°C generally does not tally with the correlated seam splits, the seam overall data in respect of moisture% and ash% have been computed afresh. Seam overall data have, thus, been calculated from band by band data. The calculated values obtained from band by band data on air dried basis have been converted to equilibrated basis (60% RH & 40°C) by using M_{100} values for respective coal seams. Average M_{100} value for different coal seams are as follows:

Lajkura	–	Not assessed.
Rampur V	–	8.4
Rampur IV	–	7.6
Rampur IV B	–	9.5
Rampur III	–	6.6
Rampur II	–	6.6
Rampur I	–	16.6
IB	–	Not assessed.

M_{100} value of Rampur Bottom seam as per GR of Chaturdhara block is taken as such for present correlation of its splits seams namely Rampur III, Rampur II & Rampur I considered for PR purpose.

Summarized quality including UHV of seams is given in seam-wise description.

Thickness range of different formations as encountered in the boreholes drilled in Chaturdhara Block

Formation	Thickness (m)	
	Min	Max
Recent/Sub-recent	0.80 (CMHG-021)	6.25 (CMHG-200)
Barakar	8.00 (CMHG-025)	134.80 (CMHG-069)
Karharbari	3.84 (CMHG-088)	27.06 (CMHG-066)
Talchir	1.05 (CMHG-018)	17.20 (CMHG-001)
Precambrian	3.00 (CMHG-023)	12.25 (CMHG-188)

The behaviour of strata is smooth with minor undulations. The strike is roughly E-W which gradually turns to ESE-WNW in the western part of the block. The dip is southerly and varies from 6° to 8°. Extreme values of 4° and 11° have, however, been recorded on the surface along southern bank of Chaturdhara nala in the eastern and western part of the area respectively. Floor contours plans have been drawn for Rampur group of seams in Plate no. IV 1 to IV 6.

No positive evidence of any fault anywhere within the block has been observed either during mapping or in the boreholes. However possibility of occurrence of minor faults/slips of less than 5 metres throw, cannot be ruled out.

Three numbers of geological cross-sections along A-A', B-B' and C-C' are given in Plate no. VII.

For the sake of convenience, every split of coal horizons (Rampur and Lajkura seams) has been named and described as an individual coal seam. The representative isochore/isograd and isoparting plans have been given in Plate nos. V 1 to V 6 and VI 1 to VI 6 respectively.

Quality and thickness details of coal seams and their range, assessed on the basis of borehole analysis, are given in the seam-wise tables in Geology chapter.

5.1 MINE BOUNDARY, RESERVES AND MINE LIFE

It has been proposed to open and run a new mine over the virgin Chaturdhara block with an area of 3.06 sq.km., annexed to the mine to the west of Basundhara river (flowing on the west of Basundhara Expansion OCP).

Considering the river on its east and nala on the south, mine boundaries have been fixed and are described below (ref. Plate MIN-I).

- | | | |
|-------|---|--|
| North | : | Incrop of Rampur-I seam. |
| East | : | Surface boundary is arrived after leaving 60m surface barrier against Basundhara river and straightening/smoothing in the south east corner. |
| South | : | Surface boundary is fixed after leaving surface barrier of 60 m against Chaturdhara nala. |
| West | : | Surface boundary is arrived after leaving 7.5m gap from the western block boundary of Chaturdhara block. |

It is estimated that 92.73Mt of mineable coal would be available for extraction within the boundaries explained above against the total net geological reserve of 113.61 Mt (excluding the reserve in Lajkura seam of 2.37Mt).

The total overburden to be removed is estimated as 97.22Mcum. Thus overall stripping ratio works out to 1.05cum/t. While assessing coal reserve, specific gravity of 1.70 is adopted.

An annual target of 7.0 Mt is proposed. At the targeted capacity, the mine life would be 15 years. It is envisaged that a peak capacity of 8.75 Mty can be achieved under the present geomining conditions.

6.1 METHOD OF MINING

The proposed mining block represents presence of multiple coal seams with intermediate varying partings. Seams occur in wide area having power grade coal

reserve. So this will make the project most viable by adopting opencast mining method.

The strata dip southerly and the gradient varies from 6° to 8°. The block is structurally simple with no positive evidence of any fault anywhere within the block. In general, the block exhibits a simple structural disposition.

Following table shows broad mining parameters of the proposed mine:

Geo-Mining Characteristics
(including mined out area)

Sl. No.	Particulars	Unit	As per Extn. PR (7.5 Mty)
1	Area		
i)	Along floor(Total)	Ha	254.05
ii)	Along surface(Total)	Ha	306.05
2	Mineable Reserve	Mt	92.73
3	Overburden	Mcum	97.22
4	Stripping ratio	M ³ /t	1.05
5	Annual production	Mt	7
6	Life of quarry	Yrs.	15
7	Strike length		
i)	Minimum	m	951
ii)	Maximum	m	2757
8	Depth of quarry		
i)	Minimum	m	3
ii)	Maximum	M	116
9	Avg. seam thickness	M	24.05
10	Gradient	-	3° - 8°
11	Quarry perimeter Total	M	8653.82

Two variants have been prepared for working the proposed mine.

- **OVERBURDEN REMOVAL AND COAL PRODUCTION BY DEPARTMENTAL MEANS (VARIANT-I)**
- **COAL RODUCTION BY DEPARTMENTAL AND OVERBURDEN REMOVAL BY OUTSOURCING MEANS (VARIANT-II)**

MINING OF OVERBURDEN AND COAL BY DEPARTMENTAL MEANS

In this variant it is assumed that all mining operations will be done by departmental equipments.

Overburden below the top soil will be excavated by 10cum electric hydraulic shovel, 5cum diesel hydraulic shovel and 5 cum electric rope shovel. Partings are proposed to be excavated by smaller capacity hydraulic shovel. For better management and higher capacity utilization, large size excavators have been proposed. When compared with rope shovels, they are better in maneuverability and have lesser cycle time. Their modular design enables achieving higher availability. They are also more useful for selective mining of bands and for wide variations in strata thicknesses.

The top soil and sub-soil upto a depth of 1.5m will be excavated and stacked separately or utilised directly for covering the backfill. At present 5.0 cum electric rope shovels, 3.7cum hydraulic shovels and 2.5/1.5 hydraulic shovels or backhoes are deployed for overburden removal.

Two types of drills have been proposed. 250 mm drills will be deployed for benches in thicker parting and top overburden, 160 mm drills will be deployed for thinner parting horizons.

Dozer of 410 HP have been proposed. At places dozing and loading by front-end-loaders have to done for thin seams/partings. Other supporting equipments like graders, cranes, tire-handler etc, of appropriate sizes have been provided.

MINING OF COAL BY DEPARTMENTAL AND OVERBURDEN BY OUTSOURCING MEANS

In this variant, variant-II, various activities (drilling, excavation, loading and transportation) involved in overburden removal will be done by outsourcing means. Coal extraction will be by departmental means. Equipments provided for coal extraction as per sanctioned report of 7 Mty will continue to work departmentally and will be replaced as and when necessary. In overburden removal similar type of above mentioned HEMM are preferred for operational efficiency and to avoid traffic congestion and environmental pollution.

7.1 MINING & DUMPING STRATEGY

The proposed mining area includes an extension of the approved quarry boundary, by approximately 3.3km to its west. This results in an additional quarry area of 306.05 ha (3.06 sq.km.). This area has been annexed on the western side of the quarry, crossing Basundhara river, flowing from north to south. There is no constraint in mine development upto the presently fixed mine/ quarry boundaries.

The seam gradient varies from 3° to 8°. Variant-I proposes both coal mining and overburden removal to be completely departmental. In variant-I, higher capacity shovels are proposed to be deployed for top overburden removal. Partings are proposed to be removed by smaller capacity shovels. All the equipments viz. the drills, dozers, shovels and dumpers are to departmental.

In variant-II, total OB removal operation is to be fully outsourced for the total life of the quarry.

In the quarry, the overburden removed in the first two years is to be dumped externally, outside the present quarry. Of the total overburden volume of 97.22Mm³, 7.66 Mm³, removed in the 1st three years, is to be dumped outside the quarry. The 36 ha patch on the south eastern end of Basundhara West expansion quarry has been earmarked for the above mentioned volume..

From year-3 onwards the total volume of overburden removed from the quarry will be backfilled inside the extension quarry, A total volume of 89.56Mm³ is to be backfilled in this extension quarry, upto +360m, tier, shown in stage plans of Yr-5, Yr-10 and final stage dump plan (ref. Plate Nos. MIN-III, MIN-IV, MIN-V).

Total overburden removed	=	97.22Mm ³
To 36ha Expn. quarry void	=	7.66Mm ³
To Extn. quarry's internal dump	=	89.56Mm ³

Average height of the internal dump above surface level will be around 50m, overall slope of internal dump is around 26°, individual dump tiers will be constructed

at a maximum height of 30m at an angle of 37° and a leveled berm of width 30m is kept between individual tiers.

8.1 MINING SCHEDULE & EQUIPMENT PHASING

Yearly schedule of overburden removal and coal extraction is based on sector-wise quantities of coal and overburden. Year-wise schedules of coal production and overburden removal and stripping ratio are given in tables below. Normative capacity is 7.0 Mty

It is envisaged that peak production of 8.75 Mty can be achieved under present geo-mining conditions.

PRODUCTION PROGRAMME

YEAR	Coal(Mt)	OB(Mcum)	SR(cum/t)
Yr 1	1.50	2.18	1.45
Yr 2	5.50	3.32	0.60
Yr 3	7.00	5.45	0.78
Yr 4	7.00	6.14	0.88
Yr 5	7.00	6.11	0.87
Yr 6	7.00	6.07	0.87
Yr 7	7.00	8.02	1.15
Yr 8	7.00	8.66	1.24
Yr 9	7.00	8.65	1.24
Yr 10	7.00	8.68	1.24
Yr 11	7.00	8.84	1.26
Yr 12	7.00	8.85	1.26
Yr 13	7.00	9.14	1.31
Yr 14	7.00	7.01	1.00
Yr 15	1.73	0.10	0.06
TOTAL	92.73	97.22	1.05

PRODUCTION PROGRAMME VARIANT – I & II

Year	Coal (in Mt)	Parting (in Mcum)	Top OB (in Mcum)	Total OB (in Mcum)	SR (in cum/t)
Yr 1	1.50	0.21	1.97	2.18	1.45
Yr 2	5.50	1.03	2.29	3.32	0.60
Yr 3	7.00	1.21	4.24	5.45	0.78
Yr 4	7.00	1.25	4.89	6.14	0.88

Yr 5	7.00	1.22	4.89	6.11	0.87
Yr 6	7.00	1.18	4.89	6.07	0.87
Yr 7	7.00	1.18	6.84	8.02	1.15
Yr 8	7.00	1.17	7.49	8.66	1.24
Yr 9	7.00	1.16	7.49	8.65	1.24
Yr 10	7.00	1.19	7.49	8.68	1.24
Yr 11	7.00	1.35	7.49	8.84	1.26
Yr 12	7.00	1.36	7.49	8.85	1.26
Yr 13	7.00	1.36	7.78	9.14	1.31
Yr 14	7.00	1.59	5.42	7.01	1.00
Yr 15	1.73	0.10	—	0.10	0.06

16.56

80.66

The above calendar programme is subject to timely possession of land, forestry clearance/ EMP clearance/ R & R etc.

Two variants have been prepared to operate the mine:

VARIANT- I : BOTH COAL & OB DEPARTMENTAL

OVERBURDEN REMOVAL

By departmental drilling-blasting and shovel dumper working as adopted.

COAL EXTRACTION

Coal production is by departmental surface miner, pay loader and rear dumpers. Total 7.0 Mty production will be by surface miner, pay loader and dumpers through departmental agencies.

VARIANT- II : COAL DEPARTMENTAL & OB OUTSOURCED

OVERBURDEN REMOVAL

OB to be completely outsourced.

COAL EXTRACTION

Coal production is by departmental surface miner, pay loader and rear dumpers. Total 7.0 Mty production will be by surface miner, pay loader and dumpers through departmental agencies.

9.1 COAL QUALITY

The litho unit, which contains the Ash + Moisture value more than 55% and upto 75%, is considered as combustible (carbonaceous shale) band and the litho unit, which contains Ash + Moisture value more than 75% is considered as non-combustible band (grey shale, sandy shale, alternate bands of shale and sandstone, sandstone etc). Combustible or non-combustible litho units occurring within the seam are considered as in-seam dirt bands. The coal seams, except two seams of Basundhara West Extn. OCP are inter banded.

Dilution and admixture of bands with coal is the main reason for deterioration and slippage of coal quality. The coal reserve and its quality and grade has been estimated on I100 basis i.e. bands less than 1.0 m thick is included with coal seams. Bands more than 1m thick are to be separated. So utmost planning is required to deal with such bands occurring within coal seams

For selective mining and to segregate the bands, Surface Miner has been proposed for coal extraction in both the variants. To maintain and improve the coal quality, following steps are required to be done:

- i) The coal seam is thick and has to be worked in a number of benches.
- ii) The presence of separable bands in the seam makes the system rigid and complicated. Further, if the bands are not separated and bulk mining is adopted, there will be deterioration in the coal quality.
- iii) The OB benches should be kept sufficiently in advance of the coal benches in operation.
- iv) Coal top should be kept clean before blasting is done in coal benches.
- v) Dirt bands, particularly over 1m thickness shall be mined separately. Auxiliary equipments for this have been provided.

10.1 PUMPING AND DRAINAGE

In the proposed extension report of Basundhara west opencast mine of 7.0mty, the excavated area and the maximum depth of the mine has been calculated and accordingly volume of water to pump out from the catchment area has been analyzed. The existing pumps deployed against the Basundhara west mine are not sufficient to deal with additional production. So, additional pumps and pipe fittings will be required.

The principal drainage in the block is controlled by a Basundhara river flowing west to east on the southern side of the block as well as south to north on the eastern side of the block. The river maintains base flow even in the summer.

Two variants have been made for this project namely OB & Coal departmental variant and OB outsourcing & coal departmental variant. For Both the variants the pumping will be same.

11.1 COAL HANDLING PLANT

The existing coal handling plant of Basundhara west OCP consists of two Numbers of Feeder breaker circuits to crushed the ROM coal size upto (-)200mm and loaded through the existing truck loading hoppers. Presently, the crushed coal is being despatch by road to existing Kanika siding. The blast free coal is also being despatch to the Kanika siding by trucks.

The proposed Basundhara west extension is planned to have a capacity of 7.0 mty. Total life of the project is 15 years. The entire production of coal will be blast free coal size of (-)100mm and the same will be despatch from coal face to surface coal stock by departmental dumpers. Contractual transport will be done from surface coal stock to Kanika siding about 35 km through trucks. The coal will be dispatched through the wharf-wall siding located at Kanika by basket linkage to meet the demand of the future thermal power stations.

Two variants have been made namely – OB & Coal Departmental variant and OB outsourcing and Coal Departmental variant. For both the variants, the coal transportation will be through Kanika siding.

Capital provision has been made for construction of 2nd spur in Kanika siding.

12.1 WORKSHOP & STORES

The proposed Basundhara west opencast mine of 7.0 Mty is planned to have a capacity to handle the production of 7.0 Mty from the mine. The existing workshop and stores will be utilized in present project also in order that additional equipments and workshop complex and stores to meet the production beyond target years. To cater the additional production the present excavation workshop will not be sufficient for repair and overhauling of the equipment.

It is proposed that repairing and overhauling of the E&M equipment will be done from the additional equipment provided and also additional investment for store is required for the extension of the project.

The additional equipments of workshops for both HEMM and E&M are proposed to be located in the existing W/S.

Two variants have been made namely – OB & Coal Departmental variant (Var-I) and OB outsourcing and Coal Departmental variant (Var-II). For variant-II the overhauling and maintenance of HEMM workshop will be departmental due to the extraction of coal departmentally.

13.1 POWER SUPPLY AND COMMUNICATION

The Basundhara west Expn. (Chaturdhara) project will receive power at 33kV through 33 kV overhead transmission line (wolf conductor) coming from existing 33/6.6 kV substation at Basundhara OCP. Considering the stretch and progress of mine, it is proposed to construct one separate substation near mine expansion. The total estimated connected load and maximum demand comes to the tune of 3792.96 kW & 1961.20 kVA and 1241.20 kW & 807.41 kVA for departmental and out sourcing

variants respectively. This maximum demand has been achieved after improving the p.f. to 0.98 and considering diversity of 0.8. For improving p.f. to 0.98, adequate capacitor banks have been provided. To meet the above power demand (in two variants) there will be 2 nos. of 2.0 MVA, 33/6.6 kV transformers in project substation to cater the load of HEMM, pumping, workshop, colony and lighting etc.

ENERGY CONSUMPTION

The peak annual energy consumption estimated for the project is in the tune of 11.00 MWh and 4.37 MWh for departmental and out sourcing variants respectively.

Based on the existing power tariff of GRIDCO, the annual power bill will be of the order of ₹ 614.56 and ₹ 245.06 lakhs for departmental and out sourcing variant respectively.

The above energy consumption is based upon the maximum demand.

CAPITAL INVESTMENT FOR ELECTRICAL P&M

The capital investment for the project for electrical power supply, distribution, illumination, earthing, automation and communication has been estimated as ₹ 994.87 and ₹ 780.39 Lakhs for departmental and out sourcing variant respectively.

Detailed break-up of the item-wise capital requirement has been given in **Appendix-A.3.2.**

UTILISATION VOLTAGE

Considering the existing system 6.6kV is taken for shovel, drills, HT drives in major pumps etc., 415V for smaller loads in pumps, colony etc. and lighting at 220-240V.

ILLUMINATION

Adequate provision has been kept for quarry, haul road, dump and general illumination etc.

TELECOMMUNICATION

Provision has been kept for voice and data communication, truck dispatch communication and administrative communication. Voice and data networking including LAN and internet have been provided. Adequate provision has been made towards total communication of the project.

ENERGY CONSERVATION

Measures have been proposed and capital provided for energy conservation in various aspects. Bank of static capacitor has been provided to improve power factor.

14.1 CIVIL CONSTRUCTION **VARIANT-I: COAL AND OB BOTH DEPARTMENTAL**

The cost of civil construction is based on a cost index of 3360 as prevalent in IB valley coalfield area.

SERVICE BUILDINGS

There is provision for HEMM workshop complex, field workshop, store complex etc. along with other related facilities upto target year only. Existing welfare buildings will cater the need for the expansion project.

RESIDENTIAL BUILDINGS

Additional provision of 223 quarters (80 units up to target year + 143 units beyond target year) has been made for 315 nos. additional manpower (111 nos. up to target year + 204 nos. beyond target year).

COLONY ROADS AND HAUL ROAD

Provision has been made for 1486 mtr. colony roads ,3500 mtr haul road and 1500 mtr coal transportation road.

Detailed are given in A.8.2.

WATER SUPPLY

The requirement of water for both potable and industrial purposes inclusive of fire-fighting has been estimated as per BPE norms. Integrated water supply scheme has been taken into consideration to cater the need of water supply.

SEWERAGE SYSTEM

Provisions have been made for sewage treatment plants both for residential and service building including workshop, mine area. Details of water supply and sewerage are given in appendix-A.8.3.

VARIANT-II: OB OUTSOURCING

The cost of civil construction is based on a cost index of 3360 as prevalent in IB valley coalfield area.

SERVICE BUILDINGS

Provisions have been made for HEMM workshop having facilities for repair and maintenance of dumpers with washing arrangement. Provisions has also been made store to cater the need for project.

RESIDENTIAL BUILDINGS

No additional provision for quarters have been given in this variant since the existing manpower in the project is more than the one required for outsourcing.

COLONY ROADS AND HAUL ROAD

Provision has not been made for colony roads.

Details are given in A.8.2.

WATER SUPPLY

The requirement of water for both potable and industrial purposes inclusive of fire-fighting has been estimated as per BPE norms. Integrated water supply scheme has been taken into consideration to cater the need of water supply.

SEWERAGE SYSTEM

Provisions have been made for sewage treatment plants both for residential and service building including workshop, mine area. Details of water supply and sewerage are given in appendix-A.8.3.

15.1 SAFETY AND CONSERVATION

Adequate provisions have been made for safe working of the mine in form of design of operational systems, provision of safety measures for safe use of explosives, electricity and HEMM etc.. Sufficient financial provisions have been made under different heads for procurement of necessary safety equipments.

Adequate skilled & trained manpower has also been provided, for compliance of safety provisions. Regular training/refresher courses, "on job" training shall be conducted & mock rehearsals shall be made to make the manpower conversant with various rules, regulations, methods of prevention & combat with hazards.

Embankment is not required because HFL against Basundhara river is 259 m above the mean sea level. Surface of the quarry is more than 10 m above the HFL.

Sufficient provision has been made in the approved PR for the prevention & control of fire in the project store, both E&M & HEMM workshops & sub-stations by

way of installing fire extinguishers of right type & size. Timely inspection & refilling of fire extinguishers will be done.

The exposed ends of the coal seams and OB shall be left with a safe slope to avoid slope failure and collapse of benches. Similarly, at the end of mining operation, safe terminal pit slope is provided to avoid pit failure. At design stage, a safe angle of not steeper than 40 degrees has been proposed as quarry slope. Detailed site specific tests for slope stability shall be carried out and site specific parameters determined. Present provision is a broad guideline.

Site mixed slurry (SMS) has been proposed to be used for good fragmentation and obviate storage of bulk quantum of explosives.

For proper blasting and minimising the adverse side effects due to blasting viz. noise, ground vibration, back-breaks, air blast and fly rocks etc., the optimal blast design parameters are suggested to be used, after field trials.

16.1 ENVIRONMENTAL MANAGEMENT

For air, water and noise pollution control measures, the samples are collected and tested round the year with appropriate frequency at strategic places for environmental monitoring purposes.

ENVIRONMENTAL IMPACT

AIR QUALITY

The mining and its related activities will cause ambient air pollution. The ambient air will be polluted due to presence of RPM, SPM, SO₂ & NO_x which will be generated due to various activities related to the project. The concentration of pollutants will vary depending upon micro-meteorological parameters of area.

WATER QUALITY

The likely sources of water pollution from this project will be as follows:

- * Sanitary (Domestic) wastewater.
- * Industrial wastewater from workshop.
- * Mine discharge water.
- * Surface run-off passing through coal stockpiles and OB dump.
- * Storm water from leasehold and built-up areas.

The impact of mining at this project on both surface water source and ground water resource has been assessed as follows:

➤ SURFACE WATER SOURCES

- * Disruption of natural drainage pattern in the core zone.
- * Deterioration of water quality & pollution of water bodies.
- * Siltation and choking of water courses causing scarcity of surface water and flooding problem in the area.

◆ IMPACT ON VILLAGE HABITATION

The core zone of the project comprising of excavation zone, infrastructure area, OB dump sites, safety zone for blasting, etc., covers partly and/or fully the land from six (2) villages namely, Telendih village and Ratanpur Village (Part) About 239 families will be displaced due to mining and other associated activities of this project. These families will be resettled and rehabilitated socially, culturally and economically along with other displaced such as major married sons, unmarried daughters of 30 years of age, etc., as per latest Norms of Govt. of Odisha, May, 2006. Details of project affected families and project affected persons are given below:

Name of village	Project affected families	Project affected persons
Telendih village	199	928
Ratansara Village (Part)	117	468
Total	316	1396

However, the exact number of project affected families will be known after due enumeration by the Project Authority.

CAPITAL PROVISION

A. ESTIMATED COST FOR EIA-EMP

The estimated capital investment for pollution control measures and land reclamation and social cost has been provided for the project.

Estimated Capital Requirement on EIA & EMP Of Chaturdhara OC Project 7.00 Mty

SI. No.	Particulars	Capital investment (Departmental) (Rs.lakh)
1	Resettlement & rehabilitation package excluding cost of land	7143.00
2	Pollution abatement measure cost	
	- Water sprinkler	-
	- Dust suppression	-
	- Fire fighting	-
3	Effluent treatment cost	
	- IETP (incl. supervision and contingency charge)	2.28
	- DETP (incl. supervision and contingency charge)	10.71
	Garland drain	358.13
4	Compensatory afforestation cost(including NPV)	1778.80
5	Arboriculture	56.75
6	IPDP	25.00
7.	Rain water harvesting	25.00
8.	i) Scientific studies/ reclamation studies	15.00
	ii) Env. Data generation	5.00
	Total :	9419.67

NPV : Net Present value

The estimated investment for social responsibility will be @ Rs.5.00 per tonne. MCL will undertake social corporate responsibility in various spheres. Different peripheral development and community development works will be taken.

17.1 LAND REQUIREMENT AND SURFACE REORGANISATION

Total land requirement under different heads and land required upto 5th year is indicated in table below:

Sl. No.	Particulars	Total requirement (ha)	Requirement up to 5 th yr. (ha)
1	Quarry excavation area including forest land	306.05	107.27
2	Blasting danger zone area (excluding external dump site & forest land)	150.29	126.44
3	External OB dump	0.00	Initial dumping will be in left out void area of Basundhara west OCP
4	Infrastructure (approach road, CHP)	5.00	5.00
5	Residential colony	0.00	0.00
6	Resettlement site	45.85	45.85
7	Embankment against Chaturdhara & Basundhara river (considered in safety zone)	0.00	0.00
	Total :	507.19	284.56

Provision for initial capital requirement, i.e. capital requirement upto target year (5th year) has been made for acquiring land required upto 5th year. Provision for the balance land has been made separately under "beyond target year". The non-forest land has been considered to be consisting of 20% Government non-forest land and 80% tenancy land. The rates of land has been taken as Rs.5.00 lakhs/ha for Govt. non-forest land and Rs.42.00 lakhs/ha for tenancy land and NPV for forest land has been taken as Rs.7.50 lakhs/ha.

18.1 MINE CLOSURE PLANNING

- All coal mines shall adopt Mine Closure Plan comprising progressive closure plan and final closure plan duly approved by the competent authority as per circular No.55011-01-2009-CPAM, Govt. of India,

Ministry of Coal, dated 27th August, 2009 and No.55011-01-2009-CPAM, Govt. of India, Ministry of Coal, dated 07th January, 2013.

- Coal projects who has been accorded approval of Mining Plan / Project Report without mine closure plan are required to prepare and obtained the approval of Mine closure plan within a period of 1 year as per the circular.

Progressive mine closure plan is for the purpose of providing protective reclamation and rehabilitation measures in a mine or part thereof.

Final Mine Closure Plan is for the purpose of decommissioning rehabilitation and reclamation in the mine or part thereof after cessation of mining and its related activities that has been prepared in the manner to address all environmental aspects taking into consideration.

The final mine closure activities would start towards the end of mine life, and may continue even after the reserves are exhausted and / or mining is discontinued till the mining area is restored to an acceptable level to create a self sustained ecosystem.

19.1 MANPOWER REQUIREMENT

The present Extension Project Report in Chaturdhara block has been prepared for two variants as given below:

Variant-I: Total OB departmental and total coal production, 7.0 Mty coal by departmental means by surface miner

Variant-II: Total OB outsourcing for 15 years and Coal production of 7.0 Mty will be done same as explained in Variant-I above.

Manpower for OB removal, coal extraction together with common services and land reclamation considering 330 working days and 16.5% absenteeism in a year has been estimated for all the variants.

Additional manpower requirement has been estimated for the above two variants as given below:

Break-up of additional manpower requirement for variant-I is given below.

Sl. No.	Particulars	Total Manpower
1	OB	349
2	Coal	124
3	Common	346
4	Land reclamation	35
	Total :	854*

* including existing manpower.

Break-up of manpower requirement for variant-II is given below:

Sl. No.	Particulars	Manpower
1	OB	20
2	Coal	53
3	Common	107
4	Land reclamation	35
	Total :	215

PRODUCTIVITY

OMS for Variant- I incremental production works out to 44.84 t.

OMS for Variant – II incremental production works out to 113.05 t.

Considering the total existing manpower of 538, the OMS for total production works out to 46.17t (details in Annexure-VII).

20.1 PROJECT IMPLEMENTATION SCHEDULE

a) EXPECTED SANCTION OF PR

The project report is expected to be 1st stage sanctioned by the MCL Board by June,2014. Final sanction of PR will be after EMP clearance and Stage –I forestry clearance.

b) EXPECTED TIME OF EMP SANCTION

The Final EMP of Basundhara west extension will be prepared and submitted to MoEF in June,2015 and the EMP is expected to be approved in September,2015.

c) LAND ACQUISITION

In Chaturdhara block total 516.77 ha land is required for 7.0 Mty project. Out of 516.77 ha land, 268.97 ha is forest land. The land required upto 5 years is 284.56 ha. Out of 284.56 ha land 124.77 ha forest land and 159.79 ha is non forest land. Total provision of land has been made in Yr 1.

e) PROCUREMENT OF HEMM

Action for procurement of HEMM shall be taken up in phases. Similarly, appointment/training of manpower, specially technical hands required for operation and maintenance of HEMM, shall be done in phases. Equipment shall be procured as per the schedule given in **Appendix-A.3.1.**

f) ACTIVITIES OF THE PROJECT

List of activities for Variant-I & Variant-II are given in **Plate No. Gen-IV & Gen IVA.**

21.0 FINANCIAL EVALUATION**VARIANT- I : DEPARTMENTAL VARIANT**

The investment is based on the price as applicable for March,2013 as per the P&M price list of CMPDI published in June,2012 (cost base March 2013) after giving due escalation.

Initial Capital Investment

Sl. No.	Particulars	Amount (upto target year)
1	Balance capital investment (Rs.crores)	479.15
2	Specific investment (Rs./annual)	684.51
3	Balance capital Investment on P&M (Rs.crores)	182.01
4	Specific investment on P&M (Rs./annual t)	313.46
5	Balance capital Investment on HEMM (Rs.crores)	148.96
6	Specific investment on HEMM(Rs./annual t)	212.81

Cost of production for different level of production, 100%, 85%.

Sl. No.	Particulars	Amount (Rs./t)
1	Cost of production at 100%	352.60
2	Cost of production at 85%	401.83

Profitability(Profit/ Loss) AT 100% and 85% level of production

Sl. No.	Particulars	Amount
1	Profit at 100% level (Rs./t)	335.40
2	Profit at 85% level (Rs./t)	286.17
3	BEP	
a)	(%)	45.41
b)	(Mty)	3.18
4	FIRR (%)	
a)	At 100% production level	55.42
b)	At 85% production level	38.87

22.1 VARIANT-II: OUTSOURCING VARIANT

In this variant the activities involved in actual overburden removal like drilling, loading and transportation of OB will be done contractually. Activities involved in coal extraction like drilling and excavation for conventional coal winning, cutting by surface miner and loading by front end loader and transportation of coal by dumper upto shiftable reclaim feeder located inside the mine will be done by departmentally. Further transport from inpit receiving arrangement to railway siding, assumed to be done contractually. Activities associated with mining like haul road construction and maintenance, pumping, land reclamation and all other auxiliary operations related to mining are also proposed to be through departmentally, blasting will be done through

departmental means. A very small fleet of departmental auxiliary equipments have been also provided in this variant for emergency auxiliary operations.

Rate of extraction, drilling, loading and transport by outsourcing agencies has been assumed from prevalent rates of MCL for finding out the economics of this variant. **Scope of outsourcing and rate of these activities may be reviewed at a later date while awarding contract to the outsourcing agencies.**

Initial Capital Investment

Sl. No.	Particulars	Amount (upto target year)
1	Balance capital investment (Rs.crores)	335.69
2	Specific investment (Rs./annual)	479.57
3	Balance capital Investment on P&M (Rs.crores)	54.79
4	Specific investment on P&M (Rs./annual t)	78.27
5	Balance capital Investment on HEMM (Rs.crores)	38.91
6	Specific investment on HEMM(Rs./annual t)	55.59

Cost of production for different level of production, 100%, 85%.

Sl. No.	Particulars	Amount (Rs./t)
1	Cost of production at 100%	264.07
2	Cost of production at 85%	291.89

PROFITABILITY (PROFIT/LOSS) AT 100% AND 85% LEVEL OF PRODUCTION.

Sl. No.	Particulars	Amount
1	Profit at 100% level (Rs./t)	423.93
2	Profit at 85% level (Rs./t)	396.11
3	BEP	
a)	(%)	27.18
b)	(Mty)	1.90
4	FIRR (%)	
a)	At 100% production level	104.24
b)	At 85% production level	81.06