Mining Plan

FOR

INTEGRATED GANGARAMCHAK & BHADULIA BLOCK OCP

RANIGANJ COALFIELD

BENGAL EMTA COAL MINES LIMITED
(Joint Venture of WBPDCL, DPL & EMTA)

JANUARY, 2005
UPDATED APRIL, 05

TEXT ONLY • VOLUME-I

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EXECUTIVE SUMMARY

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1.0 Introduction

West Bengal Power Development Corporation Limited (WBPDCL), a public utility service company wholly owned by the Govt. of West Bengal, requested Govt. of India, Ministry of Coal and Mines for allotment of a suitable Coal Block for captive mining to meet the gap between demand and supply for its Power Plants.

Accordingly, Gangaramchak, Borjore and Gangaramchak Bhadulia Block of Eastern Coalfields Limited in Birbhum district of West Bengal State were allotted to WBPDCL in pursuant to letter no. 47011/7(46)/1993-CPAM/CA dated 23.06.2003 of the Govt. of India, Ministry of Coal and Mines, Department of Coal.

Govt. of India, Ministry of Coal and Mines, Department of Coal published the following notification in the Gazette of India, Exploratory, Part-II-Section 3- Sub-Section (ii), No. 634 dated 16th July, 2004 has authorized Bengal Emta Coal Mines Limited to operate the above blocks vide:

S.O.823 (E)- "In exercise of the powers conferred by item (4) of clause (a) of Sub-section (3) os Section 3 of Coal Mines (Nationalisation) Act, 1973 (26 of 1973) the Central Government hereby specifies as an end use the supply of coal from the Coal Mines of Gangaramchak, Borjore and Gangaramchak Bhadulia Block by the Bengal Emta Coal Mines Limited on an exclusive basis to the West Bengal Power Development Corporation Limited for generation of thermal power subject to the condition that the West Bengal Government through its undertakings namely West Bengal Power Development Corporation Limited (WBPDCL) and Durgapur Project Limited holds at least 26% of the voting equity share capital of Bengal Emta Coal Mines Limited (BECML)".

The present requirement of WBPDCL is having a shortfall of about 1 MT of coal between demand

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and supply in Bakreswar and Kolaghat TPS. To meet the shortfall of 1 MT of coal, Gangaramchak, Borjore and Gangaramchak Bhadulia Blocks were allotted to BECML.

This Project Report is based on the Geological Report of Gangaramchak Block prepared by Mineral Exploration Corporation Limited (MECL). This report is the integrated exploration report of Gangaramchak and Gangaramchak Bhadulia (old abandoned adjoining coal mines). The detailed exploration in Gangaramchak block (1.94 sq.km.) was taken up by MECL in January 1988 and concluded in July 1988 and the report for this area was submitted in the year 1988 itself. This report indicated presence of 13.68 million tones of net 'proved' in situ geological reserve. A total of 62 boreholes involving 3107.95 m have been drilled in the area of 1.94 sq.km. Private coal companies, M/S Gangaramchak and Bhadulia Collieries, had exploited the Kasta seam in the area by both Open Cast as well as Underground method. However these mines are abandoned since nationalization of the coal industries.

2.0 Project Site Information

The Gangaramchak Block represents an isolated elongated strip of coal bearing sediments of about 2.9 km. in length in Trans-Hingla area of the Raniganj Coalfield in the district of Birbhum, West Bengal and falls in the Kasta area of Eastern Coalfields Limited. 1.94 sq.km. is the coal bearing area proved by detailed exploration.

The block is defined by the latitude 23^0 48′ 30″ to 23^0 49′ 25″ and longitudes 87^0 12′ 30″ and 87^0 13′ 50″. It is included in the Survey of India Topo Sheet No. 73M/1 and in the Sheet No. 16 of the geological map of the Raniganj Coalfield published by the Geological Survey of India.

The area is approachable by road only. The Khayrasole-Panchra road connects the block with the Raniganj-Suri road (State Highway) at Panchra. Raswan railway station on the Andal-

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Palasthali section of the Eastern Railway is located about 4 km south west of the block.

The requirement of land for the project has been estimated at 187 ha. Class of different land uses as derived from land cover plan are given in the Table-1.

Table-1

Land Use Pattern

SL. NO.	CLASS OF LAND	Land affect due to		TOTAL (Ha)
		MINING (Ha)	OB, INFRASTRUCTURE & OTHERS (Ha)	
1	Forest*	101.19	--	101.19
2	Agricultural	18.42	--	18.42
3	Danga	28.74	37.00	65.74
4	Road & Water bodies	1.65	-	1.65
	Total	**150.00**	**37.00**	**187**

3.0 Geology & Deposit Appraisal

The lone workable Kasta seam occurs as a single composite section of thickness varying from 0.95 m. in GRC-12 to 8.90 m. in GRC-28. The seam, however, splits in two sections in the adjoining Kasta East Block. The seam is inclusive of all bands and therefore, may be at variance with that considered for quality and estimation of reserves.

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The quality of the seam is usually grade-E over the major part of the block; however, locally the quality has deteriorated to grade-F around boreholes, GRC-31, GRC-46 and GRC-19, which fall near the incrop of seam.

A total of 13.68 M.tes of reserve have been proved in this block. In the quarriable sector, total net reserve is 9.15 M.tes of coal. Out of this 7.91 M.tes of coal has been proved in the virgin area while 1.24 M.tes of coal has been estimated in the worked out area. In this report the OCP has been planned up to 1:12 cut-off ratio even at a poor economics for getting maximum coal (Net Mineable coal 9.15 Mt assuming no mining losses).

The balance net reserve on the south of the proposed OCP on the dip side is 4.53 M tes. This reserve is located mostly under Forest area and can be worked either by underground method or by High Wall mining. Underground method involves major mine construction activities like sinking of a pair of shafts, construction and installation of all facilities and infrastructures like men and material winding, Main Ventilation, underground transport system, underground mechanization etc. By underground method of mining the maximum percentage of extraction that may be achieved will be around 40%. This means about 1.04 Mt of coal will be extracted after leaving out 60m thick coal barrier against worked out OCP and safety pillars for protection of shafts and surface structures.

Alternatively High Wall mining can be adopted for improved extraction and safer mining without damaging the surface and the Forest area. However this method can be adopted only after reaching the limit line of the OCP.

In view of the limited area available for underground mining and gentle gradient, High Wall mining is considered a better option. A higher percentage of extraction of about 50% is achievable compared to underground method coupled

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with the advantage of faster rate of extraction with safety. By High Wall mining it will be possible to extract more quantity of coal as compared to underground in seam mining. In High wall mining it will not be necessary to provide 60m thick coal barrier against the worked out OCP. The net mineable reserve will be more (2.265 M. tes.).

4.0 Mine Boundary, Reserve & Stripping Ratio

In Gangaramchak block three quarries (two numbers in Gangaramchak and one in Bhadulia) have been planned as integrated OC Project. A small part of the Bhadulia patch has been considered in this option due to having its very less amount of coal, as per the viability of quarry is concerned.

With the mineable reserves of 9.15 Mte and corresponding overburden of 46.58 Mcum the average stripping ratio for quarry as a whole has been worked out to 5.09 cum/te.

Considering ultimate production of 1.0 Mte/year from 7th year vis-à-vis the mine-able reserves of the quarry take and considering gradual building up of production and lean production at the fag end of the quarry operation, the life of the project is estimated to be 12 years including the construction period of one year.

Table-2
Volume Regime of Excavation

QUARRY	LOCATION	COAL (Mte)	O.B. (Mcum)	S.R. (cum/te)
1	UP TO SEC. G-G'	5.96	29.87	5.01
2	SEC. GG' TO MM'	2.47	12.94	5.24
3	SEC. MM' TO END	0.72	3.77	5.24
TOTAL		9.15	46.58	5.09

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5.0 Mine Development Strategy

The geo-mining characteristics of the project-take is given in Table-3.

Table-3

Geo-Mining Characteristics of the Project

SL.NO.	PARAMETERS	SPECIFICATIONS
1	Dip of the seam	4^0to6^0 (1 in 14 to 1 in 9.5)
2	Volume-weight of coal	
	i) Grade-D	1.58 te/cum
	ii) Grade-E	1.67te/cum
3	Excavation Category	
	a) Coal	Category-III
	b) Overburden	
	i) Alluvium	Category-I
	ii) Hard Strata	50%Category-III & 50%Category-IV
4	Nature of Floor	Carb. & Dark gray shale
5	Area of the Block	194 Ha
6	Area of Excavation	150 Ha
7	Area of Underground Mining	44 Ha
8	Strike Length of the Block	3300 m (average)
9	Strike Length of Excavation	3200 m (average)
10	Strike Length of Underground Mining Area	1680 m
11	Dip-Rise Length of the Block	640 m (average)
12	Dip-Rise Length of Excavation	531 m (average)
13	Dip-Rise Length of Underground Mining Area	120 m to 600 m
14	Depth of Excavation	10 m to 73 m

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The schedule of quantities has been estimated stage wise as per the sequential development of the open cast mine.

The quarry has been divided into three stages for better utilization of internal dumping as well as to minimize average lead of the transporting equipment. The year wise distribution of coal and overburden has been shown in Table-4.

Table-4

Distribution of Coal & Overburden

YEAR	COAL (Mte)	O.B. (Mcum)	S.R. (cum/te)
1	0.5	2.90	5.80
2	0.5	2.90	5.80
3	0.5	2.90	5.80
4	0.5	2.90	5.80
5	0.5	2.90	5.80
6	0.76	3.88	5.11
7	1.0	5.10	5.10
8	1.0	5.10	5.10
9	1.0	5.10	5.10
10	1.0	5.10	5.10
11	1.0	5.10	5.10
12	0.89	2.70	3.03
Total	9.15	46.58	5.09

6.0 Mining System & Equipment

Overburden, irrespective of whether hard or soft, is proposed to be removed by hydraulic shovel in conjunction with rear dumper.

A combination of hydraulic backhoe and rear dumper is envisaged for removing of 6 m bench just above the underground-developed area.

Shovel-truck combination is also envisaged for extraction of coal. In this case, also, hydraulic shovel in conjunction with 15 Te truck is suggested.

Out of the total OB volume of 46.58 Mcum in the OCP, about 5.8 M.cum proposed to be excavated

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during the first two years of production, will be dumped on the rise side of quarry-1. The rest of the OB from 3rd year on ward of production will be dumped over the de-coaled area of existing mines as well as the present OCP.

The residual void created by the last cut in quarry-3 will be kept unfilled so that this quarry can be extended towards the dip side at a later date when economics of mining may permit such extension.

7.0 Mining Schedule

The mine will start coal wining along with overburden removal from the very first year. Coal production and the corresponding OB removal will be 0.5 Mte and 2.90 Mcum respectively. The quarry-1 will exhaust in the 6th year and quarry-2 will start functioning in the same year to maintain targeted production level. The calendar program of excavation has been given in Table-5.

Table-5

CALENDER PLAN OF INTEGRATED GANGARAMCHAK AND GANGARAMCHAK & BHADULIA OCP

YEAR	YEAR WISE COAL (Mte)	CUMULATIVE COAL (Mte)	OVERBURDEN (M cum)		STRIPPING RATIO (cum/te)	
			YEAR WISE	CUMULATIVE	YEAR WISE	CUMULATIVE
1	0.5	0.5	2.90	2.90	5.80	5.80
2	0.5	1.0	2.90	5.80	5.80	5.80
3	0.5	1.5	2.90	8.70	5.80	5.80
4	0.5	2.0	2.90	11.60	5.80	5.80
5	0.5	2.5	2.90	14.50	5.80	5.80
6	0.76	3.26	3.88	18.38	5.11	5.64
7	1.0	4.26	5.10	23.48	5.10	5.51
8	1.0	5.26	5.10	28.58	5.10	5.43
9	1.0	6.26	5.10	33.68	5.10	5.38
10	1.0	7.26	5.10	38.78	5.10	5.34
11	1.0	9.15	5.10	43.88	5.10	5.31
12	0.89	9.15	2.70	46.58	3.03	5.09

The population of Excavators and Dumpers in the OCP has been arrived on the basis of calendar plan of excavation and standard productivity of the dumpers.

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The year wise deployment of major HEMM for OB removal and coal production is given in the Table-6.

The population of 35 T rear dumpers and 15 te truck have been worked out considering a maximum haul distances of 2.0 km and 2.5 km respectively.

7.1 Combined Production Phasing

Since the three Captive blocks namely Barjore, Gangaramchak and Gangaramchak-Bhadulia have been allotted to West Bengal Power Development Corporation Ltd. to meet the unlinked requirement (shortage of about 1 MTY for Bakreswar & Kolaghat TPS), an Integrated Calendar Programme of production for the above blocks is indicated below to match the above shortfall.

Table - 5.1

COMBINED PROGRAMME OF PRODUCTION FOR GANGARAMCHAK AND GANGARAMCHAK BHADULIA AND BARJORE OCPs AND YEARWISE PHASING

YEAR	YEAR WISE COAL (Mte)		YEAR WISE TOTAL COAL (Mte)	YEAR WISE OVERBURDEN (M cum)		YEAR WISE TOTAL OVERBURDEN (M cum)
	BARJORE	GANGARAMCHAK & GANGARAMCHAK - BHADULIA		BARJORE	GANGARAMCHAK & GANGARAMCHAK - BHADULIA	
1	0.1	0.5	0.6	1.12	2.90	4.02
2	0.5	0.5	1.0	3.52	2.90	6.42
3	0.5	0.5	1.0	3.52	2.90	6.42
4	0.5	0.5	1.0	3.52	2.90	6.42
5	0.5	0.5	1.0	3.52	2.90	6.42
6	0.24	0.76	1.0	0.04	3.88	3.92
7		1.0	1.0		5.10	5.10
8		1.0	1.0		5.10	5.10
9		1.0	1.0		5.10	5.10
10		1.0	1.0		5.10	5.10
11		1.0	1.0		5.10	5.10
12		0.89	0.89		2.70	2.70
Total	2.34	9.15	11.49	15.24	46.58	61.82

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Table-6

Schedule of Major HEMM

Sl. No.	Particulars	Total Strength	Phased Deployment	
			1st	2nd
A	**Overburden**			
1	4.0-4.5 cum Diesel Hyd. Shovel	6	4	2
2	3.0-3.5 cum Diesel Hyd. Backhoe	2	1	1
3	160 mm RBH Drill	4	2	2
4	35 T Rear Dumper	50	30	20
5	320 hp Dozer	6	4	2
B	**Coal**			
1	3.0-3.5 cum Diesel Hyd. Shovel	1	1	
2	160 mm RBH Drill	1	1	
3	15 te Truck	11	6	5
4	320 hp Dozer	1	1	
C	**Reclamation**			
1	410 hp Dozer	1		1
D	**Common**			
1	145 hp Motor Grader	1	1	
2	28 kl Water Sprinkler	2	1	1
3	30 T Mobile Crane	1	1	
4	3.5-4.0 cum F.E. Loader	2	1	1
5	Ripper attachment with Dozer	2	2	

8.0 Pumping & Drainage

Total pump capacity based on the above data is 2000 cum/day. Total requirement of pumps and pipes are given in Table-7.

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Table-7

Selection of Pumps

Sl. No.	Type of Pumps	No. of Pumps		
		Main	Stand by	Total
1	Main pump 300 cum/hr X 150 m head X 166 kw Suction pipe dia 200 mm and Delivery pipe dia 200 mm	4	2	8
2	Main pump 150 cum/hr X 150 m head X 90 kw Suction pipe dia 200 mm and Delivery pipe dia 150 mm	2	1	3
3	Intermediate pump 150 cum/hr X 150 m head X 90 kw Suction pipe dia 200 mm and Delivery pipe dia 150 mm	2	1	3
4	Slurry pump 40 LPS X 110 m head X 30 kw	2	1	3

To deal with muddy water and sump cleaning 4 nos. slurry pumps of capacity 40 LPS X 110 m. head have been envisaged.

A sump will be provided at the lowest point of the quarry and delivery pipes will be laid along the side of the quarry so that length of delivery pipe as well as friction can be minimized. Sump capacity will be such that it can accommodate total make of water in the day of maximum rainfall. Garland drains shall be made around the quarry so that water from out side quarry does not enter into the catchments area.

9.0 Mode of Despatch

The picking and sizing of ROM coal will be done manually and then it will be loaded to truck by pay loader for dispatch. This will also create some employment for the local people.

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The coal handling arrangement comprises the following:

i) 2 nos. pay loaders.
ii) Provision of ground stock.

10.0 Power Supply & Communication

The estimated maximum demand of the project after power factor improvement by static capacitor shall be as follows:

Installed KW in operation	2000 kw
Maximum Demand	1000 kw
	1250 KVA

To meet the above load demand, the following installed transformer capacity has been envisaged.

1 X 500 KVA 11/0.433 KV- located at Coal sub-station.

1 X 500 KVA 11/0.433 KV- located at Workshop.

11.0 Energy Conservation

Static capacitors have been envisaged to improve power factor to the desired level. Improvement of power factor will reduce the maximum KVA demand.

Cables of adequate cross-sections have been selected which will minimize power loss.

Planned lighting has been envisaged. Energy efficient lamps have been proposed and usage of incandescent lamps has been kept to a minimum.

With a view to improving the load factors, pumps are proposed to work during lean period at the beginning of each shift as far as practicable.

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12.0 Workshop & Store

The following works will be performed in the workshop:

a) Day to day and weekly maintenance of the equipment.

b) Repair of parts of machinery used in assemblies of mechanical, electrical, hydraulic and pneumatic equipment etc.

The workshop complex will consist of the following sections:

i) Dumper/Dozer washing station
ii) Dozer maintenance shop
iii) Electrical repair shop
iv) Tyre servicing section
v) Dumper maintenance shop
vi) Welding section
vii) Machine shop

In addition to those mentioned, essential items required for a well equipped workshop like material handling equipment, gauges, screen etc. have also been furnished.

The stores have been equipped with essential material handling and storage equipments. Spare parts needed for preventive maintenance and running repair will be kept in the store.

13.0 Civil Construction

As it is a new project all the non-residential buildings as required to run the project smoothly and efficiently have been envisaged. Buildings like store, workshop, sub-station etc. under the head of technological buildings and service magazine, canteen, first-aid center, lav-urinals, rest shelter etc. are under the head of statutory building and office building viz. Manager's office, CHP office, fire fighting station are under the head of service buildings and under

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welfare and community development head cycle shed for employees are envisaged.

The location of the residential buildings of the project has been envisaged near by the project maintaining a safe distance from it.

The existing road touching first access trench shall be used as approach road. The road, however has to be widened and strengthened to sustain the load of heavy vehicle.

The water supply scheme envisaged will cater for industrial and potable water needs for the project. The total water demand after considering all losses has been worked out to 0.15 MLD of potable water and 0.10 MLD of industrial water. This total demand is 0.25 MLD.

The requirement of land for civil construction is 5 Hectares, out of this 3 Hectares will be required for residential colony at the proposed colony site and 2 Hectares for industrial complex near the OCP entry point.

14.0 Manpower & Productivity

For the annual output of 1.0 Mt of coal and the peak overburden removal of 5.09 Mcum the maximum manpower needed for the project has been worked out to be 270. This peak strength of manpower is inclusive of additional requirement due to leave and sick reserves.

Year wise phasing of manpower has been shown below:

YEAR	STRENGTH
1	186
7	270

The OMS for this project with this manpower strength works out to 15.00 tones.

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15.0 Safety & Conservation

In this project it is suggested to keep the high wall angle as 70^0 to the horizontal in case of hard strata and 37^0 to the horizontal in case of alluvial soil or loose strata.

The bench is so decided that it will accommodate the equipment working on it and it will ensure safe and uninterrupted flow of traffic.

Individual bench height in OB dump will be 30 m and the width of the bench other than progressive zone is 40 m.

The sump capacity and the nos. of pumps provided will be such as to ensure normal quarry operation even after prevalent showers.

As proposed, the gradient of haul road will not be steeper than 6% in the straight portion of the road and 3% in curves or bends. But in actual practice, haul road gradient may be even flatter in some places.

Whenever blasting is done within 300 m of any surface structures access to men and materials, controlled muffled blasting has to be restored to with the DGMS after studies are made with the help of blasting experts.

Workers sustaining injury or having any ailment during work must be attended immediately. To serve the purpose a first aid center is proposed in the project. Adequate arrangement must be provided in terms of medicines and attendants in the first aid center, so that primary help/assistance can be extended to the deceased. For the movement of the ailing/-injured persons, ambulance van is provided in the roll of vehicles for the project.

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16.0 Environment Management

The total land requirement for Gangaramchak & Bhadulia OCP has been estimated at 187 Ha. The existing land use with the broad reasons for which the land will be used in the OCP is given in Table-8. Most of the land to be affected due to mining is Forest land.

Table-8

Class of Land & Reasons of Land Damage

SL. NO.	CLASS OF LAND	Land affect due to		TOTAL (Ha)
		MINING (Ha)	OB, INFRASTRUCTURE & OTHERS (Ha)	
1	Forest	101.19	--	101.19
2	Agricultural	18.42	--	18.42
3	Danga	28.74	37.00	65.74
4	Road & Water bodies	1.65	-	1.65
	Total	**150.00**	**37.00**	**187**

Arrangement for water spraying at strategic points in CHP has been provided in the PR. Afforestation is proposed to be done around the OCP area to arrest air born dust to some extent. Necessary capital provision for afforestation has been made in the report.

The mine water will be discharged into the Hingla canal through natural drainage and through Garland drains after passing through settling tanks and chemical treatment. This will prevent water pollution.

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17.0 Progressive Mine Closure

It is proposed to excavate 3-4 m of topsoil on a topsoil dump with a maximum height of 8/9 m over the void created by earlier mines and the proposed site for external dump. Simultaneously initial two years OB of the Gangaramchak block is to be dumped in the external dump to reach its maximum height as early as possible, so that topsoil can be dumped over that.

The volume of OB to be dumped externally will be 9.3 M.cum. and the rest will be dumped in the de-coaled area. The void that will remain at the end of opencast operation will have to be kept dry by regular pumping for undertaking High wall mining of the remaining reserve.

It is anticipated that the land reclamation work will continue in the mine area for a few years after the mine is closed, particularly the reclamation of the back filled area done in last 2-3 years before the closure of the mines.

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TEXT

SUMMARISED DATA

Sl.No.	Particulars		
1.	Name of Project	Integrated Gangaramchak & Bhadulia Block Opencast Project.	
2.	Location	Raniganj Coalfield, Dist. Birbhum (West Bengal)	
3.	Company	Bengal Emta Coal Mines Limited	
4.	Total Geological Reserves	13.68 Mt.	
5.	Coal Characteristics :-		
	Quality of Coal	D-E	
	UHV (Kcal/kg)	3800 – 4800	
	Ash (%)	28 – 35	
	VM (%)	20 – 28	
	Moisture (%)	2 - 3	
6.	Coal, OB & Stripping Ratio :-		
(a)	Mineable Coal (Mt.)	9.15	
(b)	OB (Mcum.)	46.58	
(c)	Avg. Stripping Ratio (Cum/te)	5.09	
7.	Method of Mining	OPENCAST (SHOVEL-DUMPER COMBINATION)	
8.	***Major Equipment***		
	Equipment	Size	Nos
	• Overburden		
	Diesel Hyd. Shovel	4.0 – 4.5 cum	6
	Diesel Hyd. Backhoe	3.0 – 3.5 cum	2
	Rear Dumper	35T	50
	• Coal		
	Diesel Hyd. Shovel	3.0 – 3.5	1
	Rear Dump Truck	15T	11
9.	Target Output (Mty.)	1.0	
10.	Main Customer	West Bengal Power Development Corporation Limited	
11.	Total Life Of the Mine (Years)	12	
12.	Capital Investment :-		
(a)	Total Capital Investment (Rs. Crores)	76.67	
(b)	Capital Cost for P & M (Rs. Crores)	72.00	
13.	Manpower (Nos.)	270	
14.	Overall OMS (Tonne)	15.00	

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CHAPTER-I

INTRODUCTION

1.1 Introduction

1.1.1 West Bengal Power Development Corporation Limited (WBPDCL), a public utility service company wholly owned by the Govt. of West Bengal, requested Govt. of India, Ministry of Coal and Mines for allotment of a suitable Coal Block for captive mining to meet the gap between demand and supply for its Power Plants.

1.1.2 Accordingly, Gangaramchak, Borjore and Gangaramchak Bhadulia Block of Eastern Coalfields Limited in Birbhum district of West Bengal State were allotted to WBPDCL in pursuant to letter no. 47011/7(46)/1993-CPAM/CA dated 23.06.2003 of the Govt. of India, Ministry of Coal and Mines, Department of Coal.

1.1.3 Govt. of India, Ministry of Coal and Mines, Department of Coal published the following notification in the Gazette of India, Exploratory, Part-II-Section 3- Sub-Section (ii), No. 634 dated 16th July, 2004 has authorized Bengal Emta Coal Mines Limited to operate the above blocks vide:

1.1.4 S.O.823 (E)- "In exercise of the powers conferred by item (4) of clause (a) of Sub-section (3) os Section 3 of Coal Mines (Nationalisation) Act, 1973 (26 of 1973) the Central Government hereby specifies as an end use the supply of coal from the Coal Mines of Gangaramchak, Borjore and Gangaramchak Bhadulia Block by the Bengal Emta Coal Mines Limited on an exclusive basis to the West Bengal Power Development Corporation Limited for generation of thermal power subject to the condition that the West Bengal Government through its undertakings namely West Bengal Power Development Corporation Limited (WBPDCL) and Durgapur Project Limited holds at least 26% of the voting equity share capital of Bengal Emta Coal Mines Limited (BECML)".

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1.1.5 The present requirement of WBPDCL is having a shortfall of about 1 MT of coal between demand and supply in Bakreswar and Kolaghat TPS. To meet the shortfall of 1 MT of coal, Gangaramchak, Borjore and Gangaramchak Bhadulia Blocks were allotted to BECML.

1.1.6 This Project Report is based on the Geological Report of Gangaramchak Block prepared by Mineral Exploration Corporation Limited (MECL). This report is integrated exploration report of Gangaramchak and Gangaramchak Bhadulia (old abandoned adjoining coal mines). The detail exploration in Integrated Gangaramchak block (1.94 sq.km.) was taken up by MECL in January 1988 and concluded in July 1988 and the report for this area was submitted in the year 1988 itself. This report indicated presence of 13.68 million tones of net 'proved' insitu geological reserve. A total of 62 boreholes involving 3107.95 m have been drilled in the area of 1.94 sq.km. Private coal companies, M/S Gangaramchak and Bhadulia Collieries, had exploited the Kasta seam in the area by both Open Cast as well as Underground method. However these mines are abandoned since nationalization of the coal industries. But illegal mining of coal in the area continued since then. Only recently ECL had been engaged in exploitation of the coal through systematic mechanized Opencast mining in the northwestern fringe of the block.

1.1.7 The area lies in the northeastern part of the Raniganj Coalfield. The Khayrasole-Panchra road connects the block with the Raniganj-Suri Road.

1.1.8 A number of ephemeral nalas drain the area to the Hingla River flowing to the south and east of the block.

1.1.9 The most comprehensive work on the geology and coal resources of the Raniganj Coalfield was carried out by Gee (1932). Mehta and others (1956) made a revision survey and reserve

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assessment of this coalfield during 1951-53. Only one seam i.e. Kasta seam was recognized as mine able.

1.1.9.1 The GSI has carried out regional exploration in the Kasta area during the period from 1964-1967 and the results of the investigations have been incorporated in the unpublished report entitled Report on the exploration for coal by drilling in the Kasta Area, Raniganj Coalfield, Birbhum District, West Bengal' (Ghosh 1975).

1.1.10 A total of 3107.95 m. of exploratory drilling in 62 boreholes was done by MECL in coordination with CMPDIL in the year 1988. A number of boreholes have been drilled upto the basal metamorphic rock to establish the full coal bearing formation. Only one coal seam, i.e., Kasta seam has been found to occur in this basin. The average thickness of the Kasta seam in Gangaramchak block is 5.5 m and in Bhadulia block it gradually becomes thinner (3 m).

1.1.11 The limits of the underground workings falling in the area were collected from the individual collieries. These data have been utilized by best possible orientation of these workings in respect of surveyed surface locations of inclines.

1.1.12 The average grade of the seam is 'D' to 'E'.

1.2 Project Specific Information

1.2.1 The Gangaramchak Block represents an isolated elongated strip of coal bearing sediments of about 2.9 km. in length in Trans-Hingla area of the Raniganj Coalfield in the district of Birbhum, West Bengal and falls in the Kasta area of Eastern Coalfields Limited covering an area of 3.5 sq.km. out of which 1.94 sq.km. is coal bearing area.

1.2.2 The block is defined by the latitude 23^0 48′ 30″ to 23^0 49′ 25″ and longitudes 87^0 12′ 30″ and 87^0 13′ 50″. It is included in the Survey of India Topo Sheet No. 73M/1 and in the Sheet No. 16 of the geological map of the Raniganj Coalfield published by the Geological Survey of India.

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1.2.3 The area is approachable by road only. The Khayrasole-Panchra road connects the block with the Raniganj-Suri road (State Highway) at Panchra. Raswan railway station on the Andal-Palasthali section of the Eastern Railway is located about 4 km south west of the block.

1.2.4 The requirement of land for the project has been estimated at 187 ha. Class of different land uses as derived from land cover plan are given in the Table- 3.1.

1.2.5 Gangaramchak block contains only Kasta seam. It is dipping towards southeast and gradually swinging to south in the northern area. The weathered mantle part varies from 5 m to 22.5 m.

1.2.6 The block consists of two different mines worked by erstwhile management, namely Gangaramchak OCP and Bhadulia OCP. Each has been extended from the end of existing quarries or incrops in the rise side to a coal:OB thickness ratio line of 1:12 at the dip side.

1.2.7 The project will have a targeted production of 1.0 Mt/year at an average stripping ratio of 5.09 cum/ te.

1.2.8 The basic parameters of the OCP are given in Table-1.1.

1.2.9 **Integrated Mining Plan for Gangaramchak and Gangaramchak Bhadulia Blocks:** Since these two erstwhile mines geologically occur in the same isolated basin side by side and as there is geological continuity of the coal seam and the formation, therefore an integrated Mining Plan for these two blocks have been prepared. The Integrated Mining Plan will allow continuous exploitation of the total reserves without the necessity of leaving any boundary between two blocks and thus will enable better and efficient deployment of machineries & for better conservation.

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Table-1.1

Basic Parameters of Integrated Gangaramchak and Gangaramchak - Bhadulia OCP

SL. NO.	PARAMETERS	CHARACTERISTICS
		TOTAL OCP
1	Seams considered	Kasta
2	Average Coal Thickness (m)	4.58
3	Average OB Thickness (m)	42
4	Gradient of Coal Seam/Strata	1 in 7.7
5	Maximum Depth (m)	73
2	Width along strike direction in the surface (meters)	3260
3	Width along strike direction in the floor (meters)	3140
4	Width along dip rise direction in the surface (meters)	531 (Avg)
5	Width along dip rise direction in the floor (meters)	424 (avg)
6 a 6 b 6 c	Block Area Lease Hold Area Area of Excavation at surface (Ha)	1.94 sq.Km 194 Ha 150.00
7	Area of Excavation at floor (Ha)	105.82
8	Initial depth (approx.)(m)	18 (avg)
9	Final depth(approx.)(m)	68 (avg)
10	Mineable reserve (Mte)	9.15
11	Total OB (Mcum)	46.58
12	Average Stripping ratio (cum/te)	5.09
13	Average coal quality (grade)	D - E

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CHAPTER-II

MARKETABILITY

2.1 Demand & Availability

2.1.1 The present requirement of WBPDCL is having a shortfall of about 1 MT of coal between demand and supply in Bakreswar and Kolaghat TPS. To meet the shortfall of 1 MT of coal, Gangaramchak, Borjore and Gangaramchak Bhadulia Blocks were allotted to BECML.

2.2 Linkage

2.2.1 The proposed Integrated Gangaramchak and Bhadulia will be ultimately producing 1.00 Mty. coal of grade D to E quality from 7th year. The coal to be mined from these projects will be exclusively used for generation of power by WBPDCL. It is therefore proposed to link the project through railway for maintaining the present demand to the power plants of WBPDCL.

2.2.2 It has been envisaged in the PR that the project will start coal production from 1st year after approval of the PR.

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CHAPTER-III

PROJECT SITE INFORMATION

3.1 Location

3.1.1 The proposed integrated Gangaramchak OCP, a part of an isolated strip of coal bearing sediments of about 9 km. in length in Trans-Hingla area of the Raniganj Coalfield in the district of Birbhum, West Bengal is located between the latitude 23^0 48′ 30″ to 23^0 49′ 25″ and longitudes 87^0 12′ 30″ and 87^0 13′ 50″. The block falls in Kasta area of Eastern Coalfields Ltd. and covers an area of 3.5 sq. km.

3.2 Access

3.2.1 The area is approachable by road only. The Khayrasole-Panchra road connects the block with the Raniganj-Suri Road, (state high way) at Panchra. Another unmetalled road connects both Gangaramchak and Bhadulia Collieries with Khyarasole.

3.2.2 Raswan railway station, on the Andal-Palasthali section of the Eastern Railway, is located about 4 km. South west of the block.

3.3 Climate

3.3.1 Humid tropical climate prevails over the area with summer lasting from the months of March to

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May and winter from the months of November to February. During summer, the temperature generally varies from 30^0 C to 40^0 C while in the winter it drops down to about 10^0 C.

3.3.2 The relative humidity varies from 45% to 98%. The major part of which precipitates during the period from June to October.

3.4 Physiography & Drainage

3.4.1 The area exhibits gently undulating topography with elevation ranging from 94 m to 121 m above mean sea level. The general slope of the area is

towards south west. The ground slope is rather steep both towards east and west. The block has highest elevation of 121 m in the northern part of the block.

3.4.2 A number of ephemeral nalas, drain the area to the Hingla river flowing to the south and west of the block.

3.5 Major Surface Constraints

3.5.1 Some part of the project area is covered by Forest, which are to be cleared before starting the quarrying.

3.6 Existing Land Use

3.6.1 The requirement of land for the project has been estimated at 187 ha. Class of different land uses as derived from land cover plan are given in the Table-3.1

Table-3.1

Land Use Pattern

SL. NO.	CLASS OF LAND	Land affect due to		TOTAL (Ha)
		MINING (Ha)	OB, INFRASTRUCTURE & OTHERS (Ha)	

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1	Forest	101.19	--	101.19
2	Agricultural	18.42	--	18.42
3	Danga	28.74	37.00	65.74
4	Road & Water bodies	1.65	-	1.65
	Total	**150.00**	**37.00**	**187**

CHAPTER IV

GEOLOGY & DEPOSIT APRAISAL

4.1 Regional Geology

4.1.1 Raniganj Coalfield occupies an area of 1550 sq.km. the major part of which falls in the Barddhaman district and some parts extending in Birbhum, Bankura and Purulia districts of West Bengal.

4.1.2 Talchir is the oldest sedimentary formation exposed along the north western margin of the basin. It lies unconformably over the Archaeans. The Barakar, Barren Measures, Raniganj and Panchet Formations are exposed successively from north to south. Supra-Panchets is exposed in two patches in the south west and south central parts of the basin which rests unconformably over the Panchets. The eastern part of the area is covered predominantly by laterite and alluvium. Intrusions of dolerite and/or mica peridotite in the form of thin sills and dykes have been observed also.

4.1.3 The rocks in the major part of the area dip from 5^0 to 10^0 towards south, whereas the dip near the southern margin of the basin is towards north. The northern limit of the basin is depicted by natural deposition boundary but the Main Boundary Fault marks the southern limit. The entire basin

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is traversed by two sets of normal faults with approximately NE-SW and NW-SE trends.

4.2 Geology of the Block

4.2.1 As the major part of the block is concealed under soil, few limited outcrops usually of laterate, sand stones and metamorphics are present. The geology of the block therefore has been deciphered mainly on the basis of the sub surface data from the boreholes. Though the numerous illegal pits have been sunk in the northern and north-eastern part of the block, they furnish little data as most of them are filled up with water. The available mine plans of the abandoned

mines render scanty data in this respect also. The coal bearing formation in the block belongs to Barakar Formation of the Lower Gondwanas. The statigraphic sequence of the block and the thickness of the formations intersected in the boreholes are shown in Table-4.1.

Table- 4.1

Staratigraphic Sequence in Gangarachak Block, Raniganj Coalfield

STRATIGRAPHIC UNIT	LITHOLOGY (Maximum Thickness)
Recent	Soil & Alluvium (14 m.)
Quaternary	Laterite & lateritic clay & nodules (5 m.)
Unconformity	
Barren Measure Formation	Dark gray to black arenaceous shales with siderite bands at places (more than 46.52 m.)
Barakar Formation	Medium to coarse grained sandstones, grey to carbonaceous shales, sandstone & shale intercalations 7 coal seam (more than 114 m.)
Talchir Formation	Greenish shale (more than 5 m.)
Unconformity	
Archaeans	Gneisses, quartzites & schists

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4.2.2 The detrial of weathered mantle consists of alluvium, sandy soil, lateritic soil, running sand, clays and weathered Barren Measures and Barakar Formation. Its thickness varies from 5.oo m. to 22.5 m.

4.3 Status of Exploration

4.3.1 The proposal for exploration based on the meeting held between CMPDI and MECL on 26th and 27th March '87 at Regional Institute-1, Asansol of CMPDI, formulated and submitted by MECL envisaged 1700 m. of drilling in 22 boreholes. The exploration in the block commenced in January '88. The priority was assigned to the detail investigation

of the two patches likely to have quarriable potentiality as per the Co-ordination committee meeting held on 16th and 17th Feb.'88. Out of this two patches the northern patch i.e., Gangaramchak was considered more promising and therefore, investigation of this patch was started on priority basis. A geological note comprising data of 51 boreholes with special reference to the assessment of quarriable potentiality of the northern patch was submitted on 15.06.88 to CMPDIL.

4.3.2 The data obtained were further reviewed and eleven additional boreholes were drilled to complete the exploration. Thus a total of 3107.95 m. of exploratory drilling in 62 boreholes was achieved before the exploration was declared completed in the month of July'88.

4.3.3 A total no. of 62 Boreholes were drilled in 1.94 Sq. Km. area of the Integrated block. Thus the Borehole density works out to 32 Boreholes per Sq. Km.

4.4 Geology of the OCP Area

4.4.1 Out of the total 1.94 Sq. Km. of the block the present Integrated OCP covers an area of 1.5 sq. km. from the existing abandoned old quarries upto 1:12 coal:OB cut off ratio line. Boundaries of the Integrated quarry has been marked in the Geological Plan (Plate-G-2) and other plans.

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4.4.2 The strike of the beds is NE-SW in the north-western part of the block but gradually swings to nearly E-W in the north, then to NE-SW in the north-east and becomes almost NNW-SSE in the south-eastern fringe of the block with minor variations locally. The structure depicts a basinal configuration, the south-western half of which is truncated by the fault. The dip usually varies between 4^0 and 6^0 towards south-east in the north-eastern and gradually swings to south in the northern area, then to west in the eastern and south - west in south - eastern part of the block. In general the dip is gentler in the fringe area of the basin.

4.4.3 Kasta is the lone seam developed in the block. It incrops in an arcuate pattern to the north and east of the block, however in the west the incrop is disrupted by a fault. The seam has been exploited by underground mining both in Gangaramchak and Bhadulia collieries. It has also been illegally mined both by underground and open cast methods in the incrop region.

4.4.4 Altogether two normal faults have been deciphered within the block. The faults have been designated as F_1-F_1 and F_2-F_2 from west to east. The fault F_1-F_1 has a general NW-SW trend and runs sub-parallel to fault F_2-F_2 NEAR grc-10. It has a throw of 55 m. near GRC-61. Fault F_2-F_2 also has a general NW-SE trend with throw of around 30 m. towards north but possibly increases southward.

4.4.5 **Coal Seam Information**

4.4.5.1 The Kasta the lone workable seam occurs as a single composite section of thickness varying from 0.95 m. in GRC-12 to 8.90 m. in GRC-28. The seam, however, splits in two sections in the adjoining Kasta East Block.

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4.4.5.2 The quality of the seam is usually grade-E over the major part of the block, however, locally the quality has deteriorated to grade-F around boreholes, GRC-31, GRC-46 and GRC-19, which fall near the incrop of seam. In boreholes GRC-24 and GRC-5 the quality of the seam determined on the basis of UHV falls marginally in F grade.

4.4.5.3 In the developed area 70% of the working section of coal has been considered as the reserved standing on pillars.

4.4.5.4 In absence of any determined value, the specific gravity of the coal for the different grades has been assumed as given below:

GRADE	SPECIFIC GRAVITY
D	1.58
E	1.67

The coal reserves have been categorized as "Proved".

4.4.5.5 A total of 13.68 M.tes of reserve have been proved for open cast and underground propositions of Kasta seam. In the quarriable sector, out of 9.15 M.tes coal, 7.91 M.tes of coal has been proved in the virgin area while 1.24 M.tes of coal has been estimated in the worked area. In this report mine boundary has been considered up to 1:12 cut-off ratio even at poor economics for getting maximum coal.

4.4.5.6 The remaining net reserve of coal available for underground mining will be 4.53 M.tes. With High wall mining 50% of the net reserve will be extracted i.e., 2.265 M tes.

4.4.5.7 Basis of calculation has been given in the Table-4.2.

Table-4.2

Estimation of Reserve in Open cast & Underground Area

Sl.	Area	Net	Net	Net	Remarks

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No.		Geological Reserve (M.te)	Mineable Reserve for Open Cast (M.te)	Mineable Reserve for U/G Mine (M.te)	
1	Open Cast Mine	9.15	9.15		No mining loss
2	High wall Mining	4.53		2.265	Overall extraction - 50%
Total		**13.68**	**9.15**	**2.265**	

4.4.6 **Geo-technical Evaluation**

4.4.6.1 No geo-technical studies have been done for coal or rock in the Block.

4.4.7 **Hydrogeology**

4.4.7.1 Hydro geological investigation has been done in the Block. Water levels observed in dug-wells around and within the area throughout the seasons to get the status of the water table. Samples of water from different wells have been collected for testing.

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CHAPTER V

MINE BOUNDARIES

5.1 Selection of Mining Option

5.1.1 In the Integrated Gangaramchak - Bhadulia block three access trenches (two numbers in Gangaramchak and on in Bhadulia) have been planned in order to reduce long haul distances and accordingly considered as Quarry 1, 2 and 3 respectively. The quarriable reserve in Bhadulia sector is less due to thinning out of the seam.

5.1.2 The present report has been formulated covering reserves up to 1:12 cut-off ratio to get higher reserve even with a poor economics.

5.2 Mine Boundaries Delineation

5.2.1 The floor of the opencast mine is limited to Kasta Seam floor in the entire quarry take.

5.2.2 **Surface Boundary**

5.2.2.1 The surface boundary of the Integrated Open cast mines is given in Plate-G-3. The limits of Quarry 1,2 and 3 are as below:

5.2.2.2 **Quarry-1**

a) Northern Boundary

In the north, the edge of the quarry is fixed on the open edge of the numerous illegal quarries where the thickness of the seam reached its full thickness mostly.

b) Eastern Boundary

Towards east the quarry is divided in two parts along the section G-G' within the Gangaramchak quarry able sector.

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c) Southern Boundary

In the south the quarry edge on the floor is fixed on the line where the coal : overburden ratio varies between 1:10 to 1:12 to get maximum coal from open cast method on marginal profit.

d) Western Boundary

In the west the block boundary of the property is the surface edge of the quarry.

5.2.2.3 **Quarry-2**

a) Northern Boundary

In the north, the edge of the quarry is fixed on the open edge of the numerous illegal quarries where the thickness of the seam reached its full thickness mostly.

b) Eastern Boundary

Towards east the quarry is divided in two parts along the section M-M' between Gangaramchak and Bhadulia geological block.

c) Southern Boundary

In the south the quarry edge on the floor is fixed on the line where the coal : overburden ratio varies between 1:10 to 1:12 to get maximum coal from open cast method on marginal profit. In this sector stripping ratio has become higher due to incorporation of under ground developed area.

d) Western Boundary

In the west the block boundary of the property is fixed along the section G-G', a line of partition between quarry-1 and quarry-2.

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5.2.2.4 **Quarry-3**

a) Northern Boundary

In the north the floor of the quarry is fixed on the concealed incrop where the thickness of the seam is 1 m. The surface edge of the quarry and towards west the surface edge of the quarry merges with the existing quarry edge.

b) Eastern Boundary

Towards east the surface edge of the quarry is kept within the geological block boundary.

c) Southern Boundary

In the south the quarry edge on the floor is fixed on the line where the coal : overburden ratio varies between 1:10 to 1:12 to get maximum coal from open cast method on marginal profit.

d) Western Boundary

In the west the block boundary of the property is fixed along the section M-M', a line of partition between quarry-2 and quarry-3.

5.3 Mineable Reserves

5.3.1 While arriving at the mineable reserve no mining loss from the net geological reserve have been considered in virgin area. However in case of underground-developed areas, 30% reserve has been deducted for first extraction to arrive at net geological reserves. Quarry wise mine-able reserves along with overburden required to be removed for that is given in Table-5.1.

5.4 Stripping Ratio

5.4.1 With the mineable reserves of 9.15 Mte and corresponding overburden of 46.58 Mcum the average stripping ratio for quarry as a whole has been worked out to 5.09 cum/te. The average

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stripping ratios of individual quarries have given in the Table-5.1.

5.5 Production Target

5.5.1 With the limited mineable reserves of 9.15 Mte and in order to utilize the excavators for maximum attainable life the annual production capacity of the mine has been envisaged to be 1.0 Mte.

5.6 Life of the Mine

5.6.1 Considering a final production of 1.0 Mte/year vis-à-vis the mine-able reserves of the quarry take and considering gradual building up of production and drop in production at the end of the quarry operation, the life of the project is estimated to be 12 years.

Table-5.1

Volume Regime of Excavation

QUARRY	LOCATION	COAL (Mte)	O.B. (Mcum)	S.R. (cum/te)
1	UP TO SEC. G-G'	5.96	29.87	5.01
2	SEC. GG' TO MM'	2.47	12.94	5.24
3	SEC. MM' TO END	0.72	3.77	5.24
TOTAL		**9.15**	**46.58**	**5.09**

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CHAPTER VI

MINING STRATAEGY

6.1 Surface Constraints on Mine Development

6.1.1 In this project take, there is some surface constraints which may create delay in implementation of the project. The problems due to the presence of illegal mines and accumulated huge water are to be solved first to open initial box-cut. The diversion of existing road passing through the property of quarry-1 is also to be looked after in the initial phase.

6.1.2 Most of the part of the Gangaramchak and some part of the Bhadulia block are covered with Reserve Forest. Identification of suitable land to substitute the property after discussing with Forest Department is to be sought.

6.2 Geo-Mining Characteristics

6.2.1 The geo-mining characteristics of the project-take is given in Table-6.1

Table-6.1

Geo-Mining Characteristics of the Project

SL.NO.	PARAMETERS	SPECIFICATIONS
1	Dip of the seam	4^0to6^0 (1 in 14 to 1 in 9.5)
2	Volume-weight of coal	
	i) Grade-D	1.58 te/cum
	ii) Grade-E	1.67 te/cum
3	Excavation Category	
	a) Coal	Category-III
	b) Overburden	
	i) Alluvium	Category-I
	ii) Hard Strata	50%Category-III & 50%Category-IV
4	Nature of Floor	Carb.& Dark gray shale

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6.3 Selection of Mining Method

6.3.1 Possibility of higher size of hydraulic shovel or rope shovel or Dragline is ruled out due to varying thickness (2 m to 7 m) of seam as well as less reserve and short life of the mine. The applicability of the Surface Miner is also not viable due to limited reserve and short life and less production. Those machines involves not only higher cost but has longer life also, and require larger reserve. The utilization of Electrical machineries are also not economically viable due to non availability of adequate and reliable power supply and for consideration of flexibility of operation.

6.3.2 Overburden, irrespective of whether hard or soft, is proposed to be removed by hydraulic shovel in conjunction with rear dumper.

6.3.3 A combination of hydraulic back-hoe and rear dumper is envisaged for removing of 6 m bench just above the underground developed area.

6.3.4 Shovel-truck combination is also envisaged for extraction of coal. In this case, also, hydraulic shovel in conjunction with 15 Te truck is suggested.

6.3.5 Mine system parameters are shown in the Table-6.2.

Table-6.2

Mine System Parameters

Sl.No.	System Parameters	Overburden	Coal
1	Maximum Bench Height (m)	10	Full thickness
2	Working Bench Width (m)	40	40
3	Non Working Bench Width (m)	20	20
4	Bench Slope (^{0})	70	70
5	Blast Hole Dia (mm)	160	160
6	Powder Factor (kg/cum)	0.32	0.20

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6.4 Mine Development Strategy

6.4.1 The gestation period required in this OCP before the commencement of the coal production is low. The quarry will be opened up from the edge of the existing old quarry where coal is already exposed. Initial access trench will be the continuation of existing haul road of the quarry leading to the exposed coal floor.

6.4.2 Mine will be opened with box-cut development in quarry-1 by extending/excavating the existing OB bench of the quarry along the strike as well as dip. When coal will be sufficiently exposed, coal mining operation will be started. The proposed will start coal production from the 1st year of operation. During this period the production will be 0.5 Mte.

6.4.3 After box-cut the quarry face will be advancing along strike direction as well as towards dip. The sequence of operation of the open cast mine are shown in the plates G-7 TO G-9. Schedule of mine development is such that the target of production will be achieved during the 2nd year of project life.

6.4.4 The strategy of development is to take the advantage of the exposed quarry face, to reduce the gestation period so that the mine will be under revenue without much delay.

6.5 Schedule of Quantities

6.5.1 The schedule of quantities has been estimated stage wise as per the sequential development of the open cast mine.

6.5.2 The quarry has been divided into three stages for better utilization of internal dumping as well as to minimize average lead of the transporting equipment. The year wise distribution of coal and overburden has been shown in Table-6.3.

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Table-6.3

Distribution of Coal & O.B.

YEAR	COAL (Mte)	O.B. (Mcum)	S.R. (cum/te)
1	0.5	2.90	5.80
2	0.5	2.90	5.80
3	0.5	2.90	5.80
4	0.5	2.90	5.80
5	0.5	2.90	5.80
6	0.76	3.88	5.11
7	1.0	5.10	5.10
8	1.0	5.10	5.10
9	1.0	5.10	5.10
10	1.0	5.10	5.10
11	1.0	5.10	5.10
12	0.89	2.70	3.03
TOTAL	**9.15**	**46.58**	**5.09**

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CHAPTER VII

MINING SYSTEM AND EQUIPMENT

7.1 Design Criteria

7.1.1 So far as the working parameters are concerned, the basic design criteria adopted for the mine is given in Table-7.1.

Table-7.1

SL. NO.	PARAMETERS	SPECIFIED VALUES
1	Number of working days	300
2	Number of shifts per day	3
3	Duration of each shift in hours	8

7.1.2 The geo-mining characteristics, dealt with in Chapter-VI, forms the basis of other design criteria.

7.2 Selection of Equipment

7.2.1 Higher size electric Rope Shovel/Hydraulic Shovel is not generally considered in such small mines due to the involvement of higher Capital investment for a short period of mine life and for better economy of operation.

The application of Surface Miner is also ruled out due to the same reason, though it improves the quality of coal up to a certain extent. However, in such small mines sizing and shale picking of coal by manual means in coal yard will be adequate.

7.2.2 Overburden, irrespective of soft or hard, will be excavated by diesel hydraulic shovel of 4.0-4.5 cum bucket and is proposed to be hauled by 35 T rear dumper.

7.2.3 3.0-3.5 cum bucket diesel hydraulic backhoe is suggested to remove overburden up to 6 m above the under ground developed working for safety reasons.

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7.2.4 For coal, diesel hydraulic shovel of bucket 3.0-3.5 cum, is proposed in conjunction with 15 te tipping truck.

7.2.5 For drilling blast holes, 160mm diameter diesel RBH drill is suggested to work with shovel in OB benches. For coal bench, also RBH drill of 160nn is provided.

7.2.6 Again, 320hp dozer is also proposed as auxiliary equipment to work with OB and coal shovels in face as well as to work on the OB dump.

7.2.7 Other equipment such as motor grader, FE loader, crane and vibratory compactor are envisaged as equipment under common heads.

7.2.8 **Application of Surface Miner Technology:** A part of the OCP area is developed by old underground mines. Moreover the seam thickness of Kasta seam in this block is inconsistent. These restrict the use of Surface Miner. Besides the limited life of the Project and low level of production do not justify investment of huge capital required for adoption of Surface Miner Technology.

7.3 Equipment Productivity

7.3.1 The annual productivity of excavators has been worked out on the basis given in Table-7.2.

Table-7.2

Productivity Criteria

SL. NO.	PARAMETERS	DESIGN CRITERIA
1	Excavation Category	
	a) Coal	Category-III
	B) O.B.	50%Cat.-III + 50% Cat.-IV
2	Average overall standard utilization of shift hours of Diesel Hydraulic Shovel	56%
3	Factor allowed for traveling and positioning etc.	0.85

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7.3.2 Based on the operating condition mentioned earlier and the above norms, the productivity of the various excavators have been worked out and given in Table-7.3.

Table-7.3

Productivity of HEMM

SL. NO.	HEMM	PRODUCTIVITY (M.cum/yr)
1	4.0-4.5 cum Diesel Hydraulic Shovel for OB	0.95
2	3.0-3.5 cum Diesel Hydraulic Backhoe for OB	0.83
3	3.0-3.5 cum Diesel Hydraulic Shovel for Coal	0.76
4	35 T rear Dumper for OB for 2.0 km lead	0.1165
5	15 te tipping truck for Coal for 2.0 km lead	0.0588

7.4 Drilling and Blasting

7.4.1 Coal, being considered as category-III material, is hard and required drilling and subsequent blasting for fragmentation before excavation. However, in underground-developed area solid pillars are to be marked from pre surveyed data for drilling.

7.4.2 Apart from the soft strata at the top, the OB, being harder than coal is required to be drilled by 150-200 mm drill.

7.4.3 Vertical drilling is suggested for both OB and coal bench.

7.4.4 Fragmentation/ loosening of rocks will depend on category of materials, depth and quantum of charge used, stemming as well as burden and spacing of blast holes.

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7.4.5 In normal OB benches of 10-15 m height conventional drilling pattern (with deck charging if required after trials) is to be adopted with the following broad parameters. The drilling machine will be 160 mm dia RBH drills. The burden and spacing of the holes are calculated as 5-6 m and 6-7 m respectively. Sub-grade drilling may be done in OB benches except where the OB bench is

above coal seam. The extent of sub-grade drilling to be fixed by blasting trials during implementation.

7.4.6 The drilling and blasting parameters in case of 6 m bench above developed coal seam are as under:

Hole dia-115 mm
Burden-3.5 m
Spacing-1.0 to 1.2 times the burden.

7.4.7 In coal seam, the height of bench will be equal to the coal seam thickness. 115 mm dia RBH drill will be deployed for drilling in coal bench. The depth of hole will be equal to the height of coal seam. The spacing and burden will have to be determined during actual implementation of the OCP. Holes will be bottom charged.

7.4.8 To assess the requirement of explosives, the following powder factors have been taken into consideration:

O.B.	0.32 kg/cum
Coal	0.20 kg/cum

On the basis of the above, the peak requirement of explosives per day has been worked out to be about tones. Considering a storage of one week's consumption and also requirement of secondary blasting about 18 tonne storage is provided. One magazine of 18 tonnes capacity is proposed.

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7.5 System Parameters

7.5.1 The elements of mining system for Gangaramchak-Bhadulia OCP has been shown in plate-4. The final stage quarry plan of the OCP has been shown in Plate-5.

7.5.2 In this OCP conventional benching pattern will be followed as the seam gradient is within the permissible range. The height of the OB bench will be kept 12-15 m as far as practicable. The width of non-working benches will be kept as 25 m

to enable smooth operation of the equipment. The width of cut for both coal and OB will be 20 m.

7.5.3 The layout of haul roads both inside and outside the quarry has been shown in Plate-4. The width and grade of haul roads will be 25 m and 6% respectively.

7.5.4 The calendar plan of coal production and OB removal and scheduling of major HEMM have been given in Chapter-VIII.

7.6 Waste Disposal Technique

7.6.1 Out of the total OB volume of 46.58 Mcum in the OCP, about 5.80 Mcum is proposed to be excavated during the first two years of production, will be dumped on the rise side of quarry-1. The rest of the OB from 3rd year on ward of production will be dumped over the de-coaled area of existing mines as well as the present OCP.

7.6.2 The residual void created by the last cut in quarry-3 will be kept unfilled for undertaking High wall mining.

7.6.3 Year wise proportion of OB in external and internal is shown in the Table-7.4.

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Table-7.4

Year wise Distribution of Dump

Year	External Dump		Internal Dump		Total Dump	
	Area (Ha)	Vol (Mm^3)	Area (Ha)	Vol (Mm^3)	Area (Ha)	Vol (Mm^3)
1	14	2.9			14	2.9
2	20	5.8			20	5.8
3	26	7.3	7	1.4	33	8.7
4	27	7.8	12	3.8	39	11.6
5	27	8.5	18	6	45	14.5
6	27	9	27	9.38	54	18.38
7	27	9.3	42	14.18	69	23.48
8	27	9.3	56	19.28	83	28.58
9	27	9.3	70	24.38	97	33.68
10	27	9.3	84	29.48	111	38.78
11	27	9.3	98	34.58	125	43.88
12	27	9.3	106	37.28	133	46.58

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CHAPTER VIII

MINING SCHEDULE

8.1 Calendar Plan

8.1.1 The calendar program of excavation has been drawn up for the OCP on the basis of the adopted mine development strategy enumerated in Chapter-VI (Ref. Table-6.1 for volume regime of excavation) and also considering the time frame of land acquisition and construction of infrastructures.

8.1.2 The mine will start coal winning along with overburden removal from the very first year. Coal production and the corresponding OB removal will be 0.5 Mte and 3.5 Mcum respectively. The quarry-1 will exhaust in the 6th year and quarry-2 will start functioning in the same year to maintain targeted production level. The calendar program of excavation has been given in Table-8.1.

8.2 ROM coal quality

8.2.1 As the major portion of the coal belongs to grade-D-E, the weighted average grade of the coal will be grade-E.

Table-8.1

CALENDER PLAN OF GANGARAMCHAK & BHADULIA OCP

YEAR	YEAR WISE COAL (Mte)	CUMULATIVE COAL (Mte)	OVERBURDEN (M cum)		STRIPPING RATIO (cum/te)	
			YEAR WISE	CUMULATIVE	YEAR WISE	CUMULATIVE
1	0.5	0.5	2.90	2.90	5.80	5.80
2	0.5	1.0	2.90	5.80	5.80	5.80
3	0.5	1.5	2.90	8.70	5.80	5.80
4	0.5	2.0	2.90	11.60	5.80	5.80
5	0.5	2.5	2.90	14.50	5.80	5.80
6	0.76	3.26	3.88	18.38	5.11	5.64
7	1.0	4.26	5.10	23.48	5.10	5.51
8	1.0	5.26	5.10	28.58	5.10	5.43
9	1.0	6.26	5.10	33.68	5.10	5.38
10	1.0	7.26	5.10	38.78	5.10	5.34
11	1.0	9.15	5.10	43.88	5.10	5.31
12	0.89	9.15	2.70	46.58	3.03	5.09

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8.3 Equipment Schedule

8.3.1 The population of Excavators and Dumpers in the OCP has been arrived on the basis of calendar plan of excavation (Table-8.1) and standard productivity of the dumpers (Table-7.2)

8.3.2 The year wise deployment of major HEMM for OB removal and coal production is given in the Table-8.2.

8.3.3 The population of 35 T rear dumpers and 15 te truck have been worked out considering a maximum haul distances of 2.0 km and 2.5 km respectively.

Table-8.2

Schedule of Major HEMM

SL. NO.	PARTICULARS	TOTAL STRENGTH	PHASED DEPLOYMENT	
			1 ST	2 ND
A	**Overburden**			
1	4.0-4.5 cum Diesel Hyd. Shovel	6	4	2
2	3.0-3.5 cum Diesel Hyd. Backhoe	2	1	1
3	160 mm RBH Drill	4	2	2
4	35 T Rear Dumper	50	30	20
5	320 hp Dozer	6	4	2
B	**Coal**			
1	3.0-3.5 cum Diesel Hyd. Shovel	1	1	
2	160 mm RBH Drill	1	1	
3	15 te Truck	11	6	5
4	320 hp Dozer	1	1	
C	**Reclamation**			
1	410 hp Dozer	1		1
D	**Common**			
1	145 hp Motor Grader	1	1	
2	28 kl Water Sprinkler	2	1	1
3	30 T Mobile Crane	1	1	
4	3.5-4.0 cum F.E. Loader	2	1	1
5	Ripper attachment with Dozer	2	2	

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CHAPTER IX

WATER MANAGEMENT

9.1 Pumping and Drainage

9.1.1 Inflow of water

9.1.1 Predominantly the area is occupied by drainage basin of Hingla Nala and sub-basins of its tributaries like Kalandara Jhor and Kasai Kaner Jhor and Nova Jhor passing through Novapara in the southern parts of the nala. North-eastern part is drained by Sal river. Both Hingla and Sal are tributaries of Ajay river (which touches southern fringe of the area) which in turn is tributary of Damodar river.

9.1.2 All tributaries of Hingla, flowing north of it, have south-westerly drainage. Kander jhor originating at Bagdahari is longest (12 km) in this part and originates from south of village Lakhanpara. Hingla originates near village Banagaria and traverses about 75 km., flowing in south and south-east direction, before meeting river Ajay.

9.1.3 Central part shows sub-dendritic to sub-parallel drainage system while the southern part has sub-parallel to parallel drainage system.

9.1.4 Stream frequency, north of Hingla, is 2.0 to 2.2 per km., while in the south it is 0.4 to 0.6 per km.

9.1.5 The target area, which in general has south-easterly slope, falls between the two. East of line joining boreholes GRC-41, 58 and 6 drains with south-easterly flow into Nova jhor while the west of it with southwesterly flow drains into Kandar jhor.

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9.2 Hydro Geology

9.2.1 Introduction

9.2.1.1 Hydro-geological regime of a geometric region is mostly controlled by three major aspects namely (i) Topography (ii) Geology and (iii) Climate besides the ground water and associated phenomena such as the mode of occurrence and movement of water, the direction and velocity of water flow, the rate and magnitude of fluid potential fluctuation, the quantity of water present in the formations i.e. conduit and storage functions of aquifers, the recharge-discharge process, the infiltration phenomena, the relation/interaction of surface and ground water, the type and change of chemical quality of waters in space and time, etc.

9.2.2 Ground Water Conditions/Regime

9.2.2.1 Water levels observed in dug wells in the area indicate that the ground water depth varies during summer between 4.0 m. to 18.0 m. in the Buffer Zone and between 10 to 15 m. in the Target Area. Average depth of water level rises up to monsoon when it is minimum. These details, as observed in some of the wells adjoining to the block are given in Table-9.1.

Table 9.1

Ground Water Level around Gangaramchak Block

Villages	No. of Wells	Dist. & Direction from the Block (m)	Water Levels (m)		
			Summer (May)	Monsoon (Aug.)	Winter (Dec.)
Gangpur	1	Within 150m.,NW	17.75	13.60	15.50
Sagarbanga	3	Within 2000m., NW	3.90	1.90	3.15
			6.80	3.90	5.20
			9.00	5.50	6.75
Bhadulia	6	Within 1200m., South	7.30	4.70	5.20
			5.30	2.40	3.75
			4.60	2.90	3.95
			4.55	2.50	3.85
			4.10	2.70	2.90
			4.60	2.50	3.70

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Fluid potential fluctuation between the two extreme climates is around 4.0 m.

9.2.2.2 Recharge to the aquifer is mostly through precipitation, which is around 1352.9 mm per annum and is around 10 % of the annual rainfall. Detail of rainfall data as recorded during 33 months commencing from January 1986, are as follows:

a) Average number of total rainy days in a year	70
b) Maximum rainfall recorded on a single day	105.00 mm
c) Average rainfall on a rainy day in a year	17.56 mm
d) Average rainfall on a rainy day during monsoon	53.00 mm

9.2.2.3 Ground water in entire region is potable with pH ranging between 7 to 7.5 and total dissolved solids (TDS) between 240 to 300 mg/liter.

9.3 Assessment of Capacity

9.3.1 The following assumptions have been made to arrive at the pumping requirement of the mine.

i) Maximum rainfall in a single day during monsoon is 105 mm.

ii) Catchment area is considered as the maximum open excavated area.

iii) Seepage through backfilled area, strata and surface is 20 % of water inflow due to direct rainfall.

iv) Pumping capacity is provided on the basis of pumping the accumulated water of the maximum rainfall/day in 5 days with 20 hrs pumping per day.

v) 25 % reserve pumping capacity is kept as standby.

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9.4 Requirement of Pumps

9.4.1 Based on the above the pumping requirement of the mine is worked out as follows:

i) Catchment area 0.8 sq. km.

ii) Water inflow to the catchment area due to direct rain on the day of maximum rainfall 84000 cu.m./day.

iii) Seepage through backfilled area, strata and surface run off 16800 cum/day.

iv) Total make of water 100800 cum/day.

v) Total pumping capacity 1008 cum/hr. In addition, 25 % of the above total pumping capacity has been kept as stand by.

The head of the pumps has been estimated as 150 m.

9.5 Selection of Pumps

9.5.1 Total pump capacity based on the above data is 2000 cum/day. Total requirement of pumps and pipes are given in Table-9.2.

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Table-9.2
Selection of Pumps

Sl. No.	Type of Pumps	No. of Pumps		
		Main	Stand by	Total
1	Main pump 300 cum/hr X 150 m head X kw Suction pipe dia 200 mm and Delivery pipe dia 200 mm	4	2	8
2	Main pump 150 cum/hr X 150 m head X kw Suction pipe dia 200 mm and Delivery pipe dia 150 mm	2	1	3
3	Intermediate pump 150 cum/hr X 150 m head X kw Suction pipe dia 200 mm and Delivery pipe dia 150 mm	2	1	3
4	Slurry pump LPS X 70 m head	3	1	4

9.5.2 Slurry pumps

9.5.2.1 To deal with muddy water and sump cleaning 4 nos. slurry pumps of capacity 13.88 LPS X 41 m. head have been envisaged.

9.6 Sump

9.6.1 A sump will be provided at the lowest point of the quarry and delivery pipes will be laid along the side of the quarry so that length of delivery pipe as well as friction can be minimized. Sump capacity will be such that it can accommodate total make of water in the day of maximum rainfall. Garland drains shall be made around the quarry so that water from out side quarry does not enter into the catchments area.

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CHAPTER X

MINE INFRASTRUCTURES

10.1 Surface Coal Handling Arrangement & Despatch

10.1.1 Introduction

10.1.1.1 The picking and sizing of ROM coal will be done manually and then it will be loaded to truck by pay loader for dispatch. This will also create some employment for the local people.

10.1.1.2 The coal handling arrangement comprises the following:

i) 2 nos. pay loaders.
ii) Provision of ground stock.

10.1.2 Mode of Despatch and Quality

10.1.2.1 ROM coal from the proposed OCP will be brought to the surface by means of 15 Te tipping trucks.

10.1.2.2 Visible shale will be picked up manually in stock yard and then crushed in smaller size (below 200mm) manually and also by dozing. Crushed coal will be carried by tipping trucks to the nearest railway siding for dispatch to WBPDCL.

10.1.2.3 Sized and picked coal will be loaded into Rail wagons by Pay loaders. Movement of wagon by Railways will be in full rake size of P or N type wagons

10.1.2.4 A provision of ground stock (3000 Te approx.) has been envisaged. For reclamation of ground stock and loading into the trucks, 2 nos pay loaders have been provided in the yard.

10.1.3 Dust Suppression

10.1.3.1 Dust suppression arrangement by water spraying has been provided at all dust generating point e.g. roads and ground stock.

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10.1.4 Fire Extinguishers

10.1.4.1 Fire extinguishers has been provided at all strategic locations specially near drive house, electric motor etc.

10.1.5 Coal Despatch

10.1.5.1 Coal will be dispatched by rail to the Power Houses of WBPDCL.

10.2 Power Supply & Communication

10.2.1 Source of Power

10.2.1.1 At present the availability of power is from M/S. West Bengal State Electricity Board at 11 kv at the existing Kasta Mine.

10.2.1.2 In the proposed system, power supply to the project has been envisaged at 11 kv from WBSEB by extension of the existing system.

10.2.2 Maximum Demand & Transformer Capacity

10.2.2.1 The estimated maximum demand of the project after power factor improvement by static capacitor shall be as follows:

Installed KW in operation	2000 kw
Maximum Demand	1000 kw
	1250 KVA

To meet the above load demand, the following installed transformer capacity has been envisaged.

1 X 500 KVA 11/0.433 KV- located at Coal sub-station.

1 X 500 KVA 11/0.433 KV- located at Workshop.

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10.2.3 System Voltage

10.2.3.1 The utilization voltage of various power consuming units installed in the project shall be as follows.

Main pump	3.3 KV
Other pumps	415 volt
Workshop	415 volt

10.2.4 Surface Power Supply

10.2.4.1 The main 11 KV sub-station has been proposed to be located on the OB side of the mine where 11 KV shall be stepped down to 3.3 KV and fed to various quarry bed power consumers. From the main OB sub-station power shall be fed at 11 KV to CHP- cum - Coal sub-station, which in turn shall feed power to CHP and workshop.

10.2.5 Quarry Power Supply

10.2.5.1 Quarry Power Supply has been envisaged at 3.3 KV from the 3.3 KV overhead lines along the quarry periphery. From the 3.3 KV overhead lines, 3.3 KV cable feeders shall feed the main pumps and unitized transformer stations. The unitized transformer stations shall step down the voltage to 415 volt and feed the small pumps.

10.2.6 Earthing

10.2.6.1 Effective earthing system is being to ensure safety to working personnel and prevention of shock hazards. Earthed neutral system has been chosen for all the voltages.

10.2.6.2 On the surface there shall be an earthing grid surrounding the main sub-station. The equivalent resistance of the earthing grid shall perfectly be kept below one ohm. All metallic parts of the electrical installation and neutral points of transformers be rigidly connected to the earthing grid by two distinct and separate connections as

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envisaged in I.E. Rules, 1956 (amended up to date).

10.2.7 Illumination

10.2.7.1 Adequate levels of illumination has been envisaged at quarry haul road, sub-station, mine site surface areas and road etc. For the purpose, necessary lighting transformers have been provided. Besides this adequate nos. of lighting transformers have been provided for quarry face lighting.

10.2.8 Communication

10.2.8.1 Effective and reliable means of communication system is being proposed between the various working places. This will ensure free and quick flow of information.

10.2.8.2 One digital telephone exchange 50 EPABX lines and connection to ten no. of P&T trunk lines and 10 nos. of tie lines for effective communication between production units, quarry workings, workshop, main and site project offices Sub-stations etc.

10.2.8.3 A few VHF wireless sets to be installed in Project Office, Quarry Office, Workshop, Shovel and on transport vehicles of key executives of the Project.

10.2.8.4 Approval of Competent Authorities of Govt. of India and State Authorities has to be taken for such communication system.

10.3 Energy Conservation

10.3.1 In preparing this report, attempts have been made to ensure optimum utilization of available power. The various strategies being adopted towards saving and conserving this scarce commodity are broadly summarized below:

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10.3.1.1 Pumping

a. Proper drains would be constructed to avoid standing of rain/pumped out water over worked out zones.

b. To ensure minimum frictional head loss, optimum section of main pumping ranges have been selected commensurate with economy.

c. Normally there would be no parallel operation of pumps.

d. Adequate sump capacity is provided so that frequent starting and running of pumps are avoided.

10.3.1.2 Electrical Energy

a. Static capacitors have been envisaged to improve power factor to the desired level. Improvement of power factor will reduce the maximum KVA demand.

b. Cables of adequate cross-sections have been selected which will minimize power loss.

c. Planned lighting has been envisaged. Energy efficient lamps have been proposed and usage of incandescent lamps has been kept to a minimum.

d. With a view to improve load factors, pumps are proposed to work during lean period at the beginning of each shift as far as practicable.

10.4 Workshop & Stores

10.4.1 The aim of the workshop is to render service for day to day repair and maintenance needs of the heavy earth moving equipment like shovels, dumpers, drills etc. and also other equipment like pumps, motors, switch gears etc. Since the project is located in a relatively isolated place, due care has been taken to make it self-efficient as far as practicable.

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10.4.2 The workshop has planned for two shifts working. However, shift maintenance will be done in all the three shifts. In estimating and selecting the equipment the normal types of breakdown have been taken into consideration.

10.4.3 The following works will be performed in the workshop:

a) Day to day and weekly maintenance of the equipment.

b) Repair of parts of machinery used in assemblies of mechanical, electrical, hydraulic and pneumatic equipment etc.

10.4.4 Shop Facilities

10.4.4.1 The workshop complex will consist of the following sections:

i) Dumper maintenance shop

ii) Dozer maintenance shop

iii) Electrical repair shop

iv) Tyre servicing section

v) Dumper/Dozer washing station

vi) Welding section

vii) Machine shop

10.4.5 Other Items

10.4.5.1 In addition to those mentioned, essential items required for a well equipped workshop like material handling equipment, gauges, screen etc. have also been furnished.

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10.4.6 Stores

10.4.5.1 The stores have been equipped with essential material handling and storage equipments. Spare parts needed for preventive maintenance and running repair will be kept in the store.

10.5 Civil Construction

10.5.1 General

10.5.1.1 The projected life of the project is 8 years and the annual production is 1.0 MTY. As such specifications of temporary type construction for non-residential and residential buildings have been envisaged.

10.5.2 Non-Residential Buildings

10.5.2.1 As it is a new project all the non-residential buildings as required to run the project smoothly and efficiently have been envisaged. Buildings like store, workshop, sub-station etc. under the head of technological buildings and service magazine, canteen, first-aid center, lav-urinals, rest shelter etc. are under the head of statutory building and office building viz. Manager's office, CHP office, fire fighting station are under the head of service buildings and in welfare and commodity head cycle shed for employees are envisaged.

10.5.3 Residential Buildings

10.5.3.1 The location of the residential buildings of the project has been envisaged near by the project maintaining a safe distance from it.

10.5.4 Approach Road and Service Road

10.5.4.1 The existing road touching first access trench shall be used as approach road. The road, however has to be widened and strengthened to sustain the load of heavy vehicle.

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10.5.5 Haul Road

10.5.5.1 The part of the haul road above floor has to be hardened with boulder and the remaining part which follows the apparent gradient of floor need not to be required hardened.

10.5.6 Water Supply

10.5.6.1 The water supply scheme envisaged will cater for industrial and potable water needs for the project. The total water demand after considering all losses, has been worked out to 0.15 MLD of potable water and 0.10 MLD of industrial water. This total demand is 0.25 MLD.

10.5.7 Source and Scheme of Water Supply

10.5.7.1 For residential and non-residential complex, the source of water is considered to be well water after having due consideration of the life of the project and its production. The Hingla Canal/Dam may also be considered as source of water.

10.5.7.2 It is proposed to construct 3 nos. of wells (2 nos. for colony and 1 no. for service complex) with raw water pump and pump houses with two stand by pumps. The water will be conveyed through 75 mm dia CI pipe of class A and conforming to IS 1236.

10.5.7.3 Two nos. of RCC OH tanks are envisaged, one no will be for colony with an aggregate 50,000 litre capacity and the other will be for industrial complex with an aggregate 35000 liter capacity.

10.5.7.4 Distribution of potable water to the consumer in the colony shall be by gravity from RCC OH tank. It is proposed to provide individual house connection.

10.5.7.5 Distribution pipeline network in the industrial complex would be designed taking into consideration the flow sheet, pressure requirement and other relevant factors.

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10.5.8 Requirement of Land

10.5.8.1 The requirement of land for civil construction is 7 Hectares, out of this 4 Hectares will be required for residential colony at the proposed colony site and 3 Hectares for industrial complex near the OCP entry point.

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CHAPTER XI

MANPOWER, PRODUCTIVITY & TRAINING

11.1 Manpower

11.1.1 For the smooth implementation of the project sufficient manpower has been provided in the report. Considering the operation of various plant and machineries and their maintenance skilled personnels of various trades have been provided. Similarly, adequate strength of personnels has been suggested for the common services also.

11.1.2 For the annual output of 1.0 Mt of coal and the peak overburden removal of 5.10 Mcum the maximum manpower needed for the project has been worked out to be 270. This peak strength of manpower is inclusive of additional requirement due to leave and sick reserves.

11.1.3 Year wise phasing of manpower has been shown below:

Year	Strength
1	186
7	270

11.1.4 Category of Manpower

11.1.4.1 Requirement of personnel according to the scale/grade/category has been given broadly in the Table-11.1.

Table-11.1
Distribution of Manpower

Sl. No.	Particulars	Total No.
1	Unskilled	20
2	Semi-skilled	10
3	Skilled	65
4	Highly skilled	140
5	Statutory Personnel	20
6	Executive	15
	Grand Total	**270**

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11.2 Productivity

11.2.1 With the annual production of 1.0 Mty and total manpower of 270 the overall productivity of the project has been worked out to be 15.00 Tonnes.

11.3 Training

11.3.1 For the smooth operation of the plant and machineries especially the heavy earth moving machines the personnel responsible for operation and maintenance of the machines, need proper/adequate training.

11.3.2 Initially in order to avoid delay in implementation, trained operators are to be recruited and subsequently batch wise training to the operators shall be given in phases. For advance training, if required, operators may have to be sent to the manufacturer of the various machineries.

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CHAPTER XII

SAFETY & CONSERVATION

12.1 Safety Status

12.1.1 Introduction

12.1.1.1 Safety aspect is the prime consideration for any operation. Without looking into this project work should not be implemented. To achieve this objective, selection of mining method as well as various excavating equipments has been done. And again, to substantiate, sufficient men and materials have been provided in this project. This is done, primarily, to ensure uninterrupted quarry operation. Sufficient care has to be taken so that a satisfactory level of safety status is maintained throughout the life of the project.

12.1.2 Manpower for operation & Maintenance

12.1.2.1 For the successful and timely completion of various operations sufficient manpower has been suggested in this project. Strength of various personnel are considered to complete various jobs as per schedule. The distribution of workload envisaged is such that no individual or group of workmen will face difficulty in accomplishing the jobs in time.

12.1.3 Stability of Benches

12.1.3.1 Sliding of bench sides are a common feature in opencast mining. As such, side slope of the bench has been decided to have the stability against sliding whenever equipments are working on it. Inclination of the high-wall bench depends, broadly, on category of materials of the concerned strata. In this project it is suggested to keep the high wall angle as 70^0 to the horizontal in case of hard strata and 37^0 to the horizontal in case of alluvial soil or loose strata.

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12.1.3.2 Bench height is governed by the maximum digging depth/cutting height of the excavators. In this project, different types of excavators are envisaged and as such the bench height will be of varying dimension conforming to the specification of the digging equipment. The bench is so decided that it will accommodate the equipment working on it and it will ensure safe and uninterrupted flow of traffic.

12.1.3.3 Dumping of spoil is to be done judiciously from the beginning to guard against sliding. Dump is to be formed in layers with proper compactions. Individual bench height will be 30 m and the width of the bench other than progressive zone is 40 m. In the internal dump width of the bench in all the decks will be kept as 60 m to avoid collision of dumpers with rolling boulders in the next lower bench.

12.1.4 Water Management

12.1.4.1 Incoming water of the catchment area is proposed to be arrested from rushing into the quarry by digging garland drain all round the quarry. The cross-section of the drainage channel will be designed on the basis of run off. The garland drains will be periodically maintained.

12.1.4.2 For smooth and uninterrupted flow through the channel, proper gradient is to be maintained.

12.1.4.3 Constant efforts are to be made to ensure that the working face and the haul road pavement are dry. Proper drainage system will be provided in haul roads and other roads to guard against damage of pavement and slippery condition during monsoon. For the purpose, water is to be pumped out from the sump regularly. The sump capacity and the nos. of pumps provided will be such as to ensure normal quarry operation even after prevalent showers.

12.1.4.4 Flood protection embankment is to be constructed on the Project Side against Hingla Canal in order to protect the quarry from flooding during

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monsoon. The embankment will be so constructed that the RL at the top of the embankment is 5 m above the HFL line.

12.1.5 Gradient and Width of Haul Road

12.1.5.1 For smooth plying of dumpers the haul road gradient should not be steep. As proposed, the gradient of haul road will not be steeper than 6% in the straight portion of the road and 3% curves or bends. But in actual practice, haul road gradient may be even flatter in some places.

12.1.5.2 The width of main haul road including access trench is specified as 30 m. This will accommodate two lanes of dumper traffic, dozer carriageway etc. The flank haul roads are 14 m wide, proper camber is to be maintained at the pavement level as per practice of high way engineering. At curves, required super-elevation and radius of curvature are to be provided to counteract the centrifugal reaction. For drainage of water, to prevent slippery- condition of the pavement, side ditches are to be provided wherever needed. Berms of sufficient width are to be kept along the length of the road to increase the effective width of the road, particularly, at bends or curves.

12.1.6 Dust Suppression

12.1.6.1 Water spraying has been envisaged on Haul Roads starting from quarry bench to external dump yard to suppress dust generated during various mining operations and movement of dumpers and heavy vehicles.

12.1.7 Blasting

12.1.7.1 Controlled blasting techniques including muffled blasting will be adopted during blasting within 300 m zone but beyond 100 m from villages, dwellings, surface structures, roads etc. Total quantity of explosive to be detonated at a time will be so regulated that ground vibration which may affect the nearby structures, are kept within the stipulated value.

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12.1.8 Prevention of Damage to the Buildings in the Vicinity

12.1.8.1 Before adopting certain blasting parameter, trial blasting is to be carried out after studying the rock characteristics and the surrounding structures. From the series of trial blasting with varying parameters, optimum blast design can be evolved and should be adopted in practice.

12.1.8.2 From trial blasting quantities of charge per hole can be determined to keep the ground vibration within permissible limit and the problem of fly rock is minimized over and above desired fragmentation can be achieved.

12.1.8.3 Safe value of particle velocity of vibration per second which will not cause any damage to buildings/structures of sound construction are 50 mm/sec. for soils weathered or soft rock and 70 mm/sec. for hard rock.

12.1.9 Illumination and Signaling

12.1.9.1 Illumination and Signaling is part and parcel of a project dealing with men and machines. As such proper arrangement of signaling and illumination is to be made for the safety of the men at work and equipments deployed at sites. All the places of activities such as haul road, quarry bed, near the major plant and machineries are to be adequately illuminated.

12.1.9.2 Signaling arrangements for the movements of heavy earth moving machineries are proposed to be done to avoid accident involving men and equipments. Similarly, before blasting operations, proper signal is to be propagated well in advance so that persons at work and the machineries can move to a safer place.

12.1.9.3 Portable emergency lighting arrangements will be provided in sufficient numbers at each working machines, over and above the permanent fixtures so that in case of power failure/shedding some illuminations are available for signaling safe movement of men and machines.

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12.1.10 First Aid

12.1.10.1 Workers sustaining injury or having any ailment during work must be attended immediately. To serve the purpose a first aid center is proposed in the project. Adequate arrangement must be provided in terms of medicines and attendants in the first aid center, so that primary help/assistance can be extended to the deceased. For the movement of the ailing/-injured persons, ambulance van is provided in the roll of vehicles for the project.

12.2 Conservation

12.2.1 Adequate sump capacity proper drainage system and garlanding have been taken into account to keep the pumping capacity at its optimum level. Optimum section of delivery ranges commensurate with economy has been selected.

12.2.2 Energy efficient lamps have been envisaged to illuminate industrial sites, quarry haul roads etc. thus minimizing the use of incandescent lamps.

12.2.3 The preventive maintenance of the HEMM and overhauling of the engines should be done as per the existing norms to reduce excessive POL consumption. The gradient of haul roads and other quarry roads would also be kept within the specified safe limits to reduce excessive consumption of POL.

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CHAPTER XIII

ENVIRONMENTAL MANAGEMENT

13.1 Introduction

13.1.1 Opencast Mining in the project area will create the following possible adverse environmental impact:

i) Land damage
ii) Air pollution including dust
iii) Noise pollution
iv) Water pollution
v) Disturbance to civil life in the area

13.2 Land Damage and Reclamation

13.2.1 The total land requirement for Gangaramchak & Bhadulia OCP has been estimated at 187 Ha, the break up of which is given in the Table-13.1.

Table-13.1

Pre-Mining Scenario of Land required for OCP

SL. NO.	CLASS OF LAND	Land affect due to		TOTAL (Ha)
		MINING (Ha)	OB, INFRASTRUCTURE & OTHERS (Ha)	
1	Forest	101.19	--	101.19
2	Agricultural	18.42	--	18.42
3	Danga	28.74	37.00	65.74
4	Road & Water bodies	1.65	-	1.65
	Total	**150.00**	**37.00**	**187**

13.2.2 The existing land use pattern with the broad reasons for which the land will be used in the OCP is given in above Table.

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13.2.3 The geological set up of the deposit permits simultaneous mining and backfilling. It has been envisaged to start backfilling from 2nd year of production. Out of a total OB volume of 46.58 Mcum, it will be possible to backfill about 37.28 Mcum.(about 80%) of OB into the quarry void. However a residual void along the high wall shall be kept so that this quarry can be extended further to the dip side at a later date when economics of the mine permits. The total out side OB dump including the void created by illegal mining is 19.30 Mcum. The height of the external OB dump will be kept at about 60 m from surface to reduce sterilization of land. The total land occupied by external OB dump is 27 Ha.

13.2.4 The post mining surface topography of the project will be a 60 m high hill from the existing surface, which will be stepped downward towards a lagoon of average depth of around 50 m. The post-mining scenario of the reclaimed land is shown in the Table-13.2.

Table-13.2

Post Mining Scenario of the Reclaimed Land

Sl.No.	Particulars	Area (Ha)	Remarks
1	Top dump Surface of R.L. 180 m	36	Top soil will be spread over the top surface
2	Lagoon	12	May be used as water reservoir
3	High wall side quarry bench	14	
4	Remaining Reclaimed area	96	Afforestation will be done

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13.2.5 The residual coal of the Gangaramchak and Bhadulia block will be mined by underground method or high wall mining from which another 1.31 Mte coal may be obtained. The void created by this process will be stowed by sand up to the 50 m hard cover line. The residual part will be filled with water by natural process.

13.2.6 It has been proposed to resort to biological reclamation of external and internal OB dump for which capital provision has been made.

13.3 Air Pollution

13.3.1 Dust will be raised in the atmosphere due to excavation, loading and transportation and dumping of OB and coal in the OCP. Provision of 2 nos. 28 KL water sprinklers has been made in the report for dust suppression in the haul road and benches. Arrangement for water spraying at strategic points in CHP has been provided in the PR. Afforestation is proposed to be done around the OCP area to arrest air born dust to some extent. Necessary capital provision for afforestation has been made in the report.

13.4 Water Pollution

13.4.1 The mine water will be discharged into the Hingla canal through natural drainage which may pollute the water of the canal. The provision of settling tank at the surface for the out-flowing water of garland drain will minimize the quantity of suspended material.

13.5 Village Rehabilitation & Compensation to the Land Looser.

13.5.1 There is only one village in the geological block (Bastavpur), which is more than 400 m away from the direct excavation area. Therefore, the village need not be rehabilitated. However, the land losers affected due to direct mining will be compensated as per approved Govt. package.

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CHAPTER XIV

PROGRESSIVE MINE CLOSURE

14.1 Salient Features

Progressive Mine Closure has been planned as an integral activity of the Mining Plan. Mine closure planning shall commence before the start of mine operation and shall be reviewed periodically and necessary modification if needed, during its life cycle shall be made to ensure safety and to cope up with social and environmental challenges.

Progressive Mine Closure has been planned -

a) To allow productive and sustainable after use of the site, which is acceptable to the mine owner and the regulatory authority.

b) To protect public health and safety.

c) To eliminate environmental damage and thereby encourage environmental sustainability.

d) To minimize adverse socio-economic impacts.

e) To protect the flora and fauna of the area.

f) Effective use of the assets.

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14.2 Project Description

14.2.1 Out of the total area of 194 ha of the leasehold of Gangaramchak & Bhadulia Project, excavated area will be 150 ha.

14.2.2 Mining operations will be carried out in phases in the two locations- first in Gangaramchak block and second in Bhadulia block.

14.2.3 Area left for underground mining will be only 44 ha. Cost of sinking of shafts and/or driving of incline for extraction of coal by conventional Board & Pillar method will become too high as compared to the residual reserve. State of Art technology, like High wall Mining may be adopted for better techno-economic results and better percentage of extraction.

14.2.4 3-4 m thickness of topsoil will be first removed and dumped separately outside the quarry area on the adjoining non coal-bearing land and over the void created by illegal mines. The height of the soft soil dump will be limited to 8m to 9m.

14.2.5 The over burden removed during the first two years of the project life will be dumped on the adjoining non coal bearing land outside the excavation area. As per the plan, the operation of mining will be carried out in such manner that this external dump attains its planned height (about 60m above ground level) within the first two years so that soft soil can be spread over it at the earliest possible. Further rehabilitation of the dump, will be carried out by planting vegetation and trees over the leveled/sloped dump top and sides.

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14.2.6 From the third year onwards the entire quantity of OB removed from the mine will be filled back into the void created by extraction of coal. In this manner the void of the mine will be progressively filled up as the workings of the mine advance towards the dip side limit of the mine.

14.2.7 As soon as the back filled dump attains its planned height (about 60m above the original ground level) it will be covered by a layer of soft soil spread over it. This will be followed by plantation of suitable trees and vegetation.

14.2.8 When the workings reach the dip side limit of the open cast mine a void area measuring about 12 ha will be left. This will ultimately become a water body. This can cater to water requirement for irrigation, plantation and for fish cultivation.

14.2.9 This water body can be developed as a tourist and recreation spot.

14.2.10 The area of the void filled up during the last two or three years before completion of the mining operations will be constantly developed after the mine closure to be upgraded as agricultural/forest land.

14.3 Land Situation at Mine Closure

14.3.1 Thus at the end of the project life the mine area would have one hill about 60 m high from the original surface level occupying 36 ha, one water body occupying 12 ha. And about 96 ha reclaimed excavated area.

14.3.2 The only encroachment over the leasehold area visible would be the mine infrastructure facilities.

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14.4 Post-Mine Closure Activities

14.4.1 Removal of Mine Structures

14.4.1.1 Mine workshop, scrap yard, mine office buildings, magazine and other mine-associated structures will be removed in post closure phase unless these can be used for any social/industrial purpose in agreement with local administration.

14.4.2 Completion of Land Restoration

14.4.2.1 The land reclamation work will continue in the mine area for a few years after the mining activities cease, particularly the reclamation of area back-filled in last 2-3 years before the completion of excavation activities.

14.4.3 Removal of mine Equipment

14.4.3.1 The mine equipment in the mine area will be withdrawn for relocation to some other area or for sale depending upon the situation.

14.4.4 Relocation of Manpower

14.4.4.1 The mine employees will have to be either retrenched or relocated elsewhere depending upon the prevailing situation at the time of mine closure.

14.4.5 Regulatory Authorities

14.4.5.1 All safety and environmental stipulations imposed by the Govt. will be undertaken to the entire satisfaction of the concerned regulatory authorities.

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27/6/05

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ANNEXURE

Annexure-I

CAPITAL INVESTMENT

Coal (MtY)- 1.00
O.B. (Mm^3)- 5.10
S.R. (m^3/t)- 5.09
Life (Years)- 12

Amount in Rs. Crores

Sl.No.	Particulars	Total Capital
1	**Land**	**1.87**
2	**Buildings**	
	a) Service	0.15
	b) Residential	0.20
	Total	**0.35**
3	**Plant & Machinery**	
	a) HEMM	72.00
	Total	**72.00**
4	**Electrical**	0.20
5	**Furniture & Fittings**	0.10
6	**Vehicles**	0.15
7	**Development Expenditure**	2
Total		**76.67**

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NO. 47011/7(46)/1993-CPAM/CA
GOVERNMENT OF INDIA
MINISTRY OF COAL

New Delhi, dated the 23rd June, 2003

To

M/s. West Bengal Power Development Corporation Ltd.,
New Secretariat Building, B-Block, 6th Floor, 1-K S Roy Road,
Kolkata-700001.

Subject: Proposal for allocation of coal blocks for captive mining for supply of coal to power plant.

I am directed to refer to your letters dated 2.7.1998, 2.12.1998, 22.12.98, 24.11.2000, 15.11.2001 and 9.8.2002 on the subject mentioned above and to say that your request for allocation of the following coal blocks for development on captive basis for supply of coal to meet the requirement for expansion of existing power plants was considered in the 18th meeting of the Screening Committee for screening proposals relating to captive mining of coal/lignite blocks by power generating companies, companies engaged in the manufacture of iron and steel and production of steel held on 5.5.2003.-

1. Damalia,
2. Narainkuri,
3. Ronal Mangalpur,
4. Ujala & Tuani,
5. Avirampur & Pandaveswar,
6. Gangaramchak,
7. Sonepur Bazari B, OCP,
8. Samla,
9. Barjora (on North Bank of Ajoy River in Birbhum),
10. Gangaramchak Bhadulia
11. Kasta

2. After due deliberations, the Screening Committee decided to allocate Gangaramchak, Barjora and Gangaramchak Bhadulia coal blocks to your company for development on captive basis to meet the annual unlinked requirement (shortage of about 1 mt. for Bakreshwar and Kolaghat TPS). The allocation of these coal blocks is subject to the following conditions:-

(i) these coal blocks are meant for meeting the coal requirement for the expansion of existing power projects of WBPDCL and not the existing ones.

(ii) The coal mined from these blocks shall exclusively be used for power generation as an end use in the expansion of the Bakreshwar and Kolaghat TPS.

27/6/03

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3. The allotment of the captive blocks will also be subject to the following conditions:-

(i) The end use for which coal mined from the captive block should be utilised may be clearly specified in the mining lease containing conditions imposed by the Central Government mentioned in this letter conveying offer by the Screening Committee of captive blocks to WBPDCL.

(ii) All the conditions imposed by the Central Government while conveying the previous approval to the State Government under Section 5(1) of the Mines and Minerals (Development & Regulation) Act, 1957 for grant of mining lease in favour of captive mining party should clearly form part of the lease deed to be executed between the concerned State Government and the party.

(iii) In case the captive block has been offered for washing-cum-power generation or other end use, the deed must clearly specify that the beneficiated coal from the washery will exclusively be used for power generation or other end use as approved by the Central Government and not for sale, trading or other work.

(iv) No coal shall be sold, delivered, transferred or disposed of except for the stated captive mining purpose except with the previous approval of the Central Government.

(v) There should be complete synchronization between the captive coal mining operations and the development of end-use plant so that no situation arises where the company is left with coal extracted from the captive block when the end-use plant / expansion unit is yet to be operationalised.

4 Violation of any of the conditions mentioned in paras 2 & 3 above will render the allocation of a block/ grant of the lease ,as the case may be, liable for cancellation.

5. You are requested to take necessary action for obtaining lease of mining rights and also comply with various legal / commercial formalities for development of a block within a period of 6 months. You are also requested to interact with CIL/ECL for payment of exploration charges within a period of 6 months and also to finalise the arrangement for transportation of coal in consultation with Ministry of Railways.

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27/06/03

6. The progress in this regard should be reported to this Ministry every 3 months from now.

Yours faithfully,

(S.K. Kakkar)
Under Secretary to the Government of India.

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c. (Min.), Hons., AISM., FIE (I),
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Appendix-A

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TO WHOM IT MAY CONCERN

I, Subhash Chandra Chatterjee, the Recognised Qualified Person (RQP) approved under section 22(C) of Mineral Concession Rules 1960, by Ministry of Coal, vide Letter No. 13016/48/2004-CA dated 06.08.2004 for a period of 10 years to prepare Mining Plans in respect of any coal and lignite block commencing from 17.10.2002, do hereby certify that in the Mining Plan prepared for Gangaramchak and Gangaramchak-Bhadulia Block OCP, the Lease boundary is within the Block boundary.

(SUBHASH CHANDRA CHATTERJEE)

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27/02/08