activities. In case, the depillaring operation to be followed immediately after panel development from the bottom most point, the drivage of dip trunk headings up to the bottom most point would be required. This calls for a long gestation period resulting poor cash inflow during these periods.

The above sequence of operation is recommended for achieving the target output at the earliest, keeping in view to shorter pay back period and IRR.

The extractable reserve during development of a panel has been estimated by area method (over a pillar). For pillar size of 26m x 26m and gallery width of 4.2 m, extraction percentage during development works out to about 30%, of total coal in a pillar. For estimation of extractable reserves during final extraction, the remaining coal in standing pillars has been estimated. Of the remaining coal in pillars, 77% has been considered as extractable reserves. For a pillar size of 26mx26m, the extraction percentage during final extraction works out to 47% of total coal in a pillar. The total percentage of extraction (development & final extraction) in a panel works out to about 65% of total coal. Additionally, reserve may change slightly on account of blockage under some of the surface constraints, like villages, etc.

Summary of extractable reserves is shown in Tables 9.1 & 9.2

Table 9.1: Summary of Extractable Reserves (seam-wise)

Particulars	PROVED (Mt)			REMARKS
	Dev.	Dep.	Total	
Seam IIIT	0.6068	0.6792	1.286	Virgin
Seam IIIB	3.4092	4.7774	8.19	Standing on pillar+ Virgin
Seam II A	1.1139	1.7933	2.90	Standing on pillar+ Virgin
TOTAL	5.1299	7.2499	12.375	

B. Mining Schedule:-

The production schedule envisaged for the mine is as below:-

YEAR	1st	2nd	3rd	4th	5th	6th
Production(mt)	0.62	0.75	0.75	0.75	0.75	0.75

PRODUCTION PERFORMANCE

Production performance of Bagdewa UG for last 10 years	Coal production started in June 2002 Year-wise production is furnished below:
Year	Coal Production (Mte)
2002-03	0.03
2003-04	0.12
2004-05	0.20
2005-06	0.33
2006-07 ✓	0.41
2007-08 ✓	0.55
2008-09 ✓	0.60
2009-10 ✓	0.62
2010-11 ✓	0.61

9.2 Extractable Reserves

9.2.1 RESERVES :

Total mineable coal reserve and extractable coal reserve worked out to be 18.634 Mt and 12.375 Mt. respectively, as per RPR, 99. Balance extractable reserve as on 1.04. 2010 worked out to be 9.475 Mt.

The reserve statement for the mine block is given as below:-

RESERVES (Mt)

SEAMS	MINEABLE	EXTRACTABLE(RPR,99)	BALANCE RESERVE
Seam III T	2.20	1.286	1.286
Seam III B	12.39	8.19	5.923
Seam II A	4.044	2.90	2.266
TOTAL	**18.634**	**12.375**	**9.475**

9.3 COAL QUALITY :-

The overall quality of ROM coal for the mine, on weighted UHV average basis, is considered as 'B' non coking coal. The coal will be segregated into Steam & Slack grade. Provision for the same is made in this report.

9.4 ZERO DATE

This is completed project .Zero date of the project has been considered as the date of approval of Revised Project Report. EMP of this project has already been approved for the production 0.76 Mty .This mine will operate at maximum approved EMP production capacity.

EQUIPMENT SCHEDULE:-

The major equipment and their broad specifications and quantity currently deployed in the Project are summarised below:-

Sl.No.	PARTICULARS	NUMBERS
1.	LHD(Standard height)47 kW bucket,Cap,1.5cum,	3
2.	LHD(Standard height) 75 kW bucket,Cap, 3.0cum	3
3.	LHD (Extra low height) 47kW	1
4.	UDM 47KW/550V	4
5.	Pumps-120m head,60 lps. 110kw X 550 v, 52LSump,150m head	2
6.	Pumps-60m head,60 lps-2 nos ,38lps-1 nos. 110kw &90&55kwX 550 v, 52LSump,150m head	3
7.	Pumps-30m head, 11 lps. 15kw X 550 v,	5
8.	Drill panel-1.1KVA550/125V Drilling machine	21&30
9.	Endless Haulage 37 Kw/550, 2000m&2500m,19mm rope,	2
10.	Direct Haulage 37x550, kW NFLP L-750mx d-22mm,surface	1
11.	Voldrum Tugger Haulage 37 kW FLP,L-70M D-19mm	1
12.	Lighting Transformer,5KVA,550/125V	5
13.	1000mm Trunk Belt Conveyor, TB-1 Specifications Length-500m 125 tph, 2 x 90 kW with electricals.	1
14.	1000mm, 700m, 2x90 kW Trunk Belt, TB-2 Conveyor, 125 tph, with Electrical	1
15.	1000mm Trunk Belt Conveyor, M-Dip, Length-875m 125 tph, 2 x 55 kW with electrical	1
16	Gate belt conveyor,1000mm, 420m long, 100 tph 1 x 55 kW with electrical	1
17	Gate belt conveyor,1000mm, 75m&130m long, 100 tph 1 x 55 kW with electrical	2

Sl.No.	PARTICULARS	NUMBERS
18	Gate belt conveyor, 1000mm, 700m long, 1 x 55 kW with electrical	1
19	Gate belt conveyor, 1000mm, to be instd.at8DS/76L 1 x 90 Kw with electrical	1
20	MAIN FAN 80-140 cum/sec,40-110mm W.G, 250 Kw/3300v Motor with electrical .SIWAX-APG 2750	1

The major equipment and their broad specifications and quantity provided in this revised project Report in the Project is summarised below:-

Sl. No.	PARTICULARS	NUMBERS
1.	LHD(Standard height)47 kW bucket,Cap.1.5cum,	1
2.	LHD(Standard height) 75 kW bucket,Cap, 3.0cum	2
3.	LHD (Extra low height) 47kW	1
4.	UDM 47KW/550V	4
5	Gate belt conveyor,1000mm850m long, 300 tph 2x90 kW with Horizontal loop take up and electrical	2
6	Pony belt conveyor,1000mm, 300 tph with electrical	2
7	Endless Haulage 37 Kw/550,	1
8	Man riding System	1
7.	Pumps-30m head, 11 lps. 7.5kw X 550 v,	1
8.	CHP Modification	1

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CHAPTER-X

UNDERGROUND TRANSPORT

10.1. GENERAL CONSIDERATION

The various points which have been considered for selecting the underground transport system are mentioned below:-

General gradient of the Seam	-	G-III B & G-II A
	-	1 in 10 to 1 in 20
Gradient of the roadways:-		
i) Trunk roadways	-	1 in 25
ii) Gate Roadways	-	1 in 70 to 100
iii) Coal Transport Inclines	-	1 in 4
iv) Material transport Incline	-	1 in 4

Size of Roadway

i) Incline Cross section	-	4.2 m x 2.5m
ii) Trunk Roadway cross -section	-	4.5 m x 2.5m (or full thickness of seam)
iii) Gate Road way cross section	-	4.5m x height of seam thickness maximum up to 3m.

The width of gallery will be made 4.8m where thickness of seam is less than 1.8m

10.2 TRANSPORT LAYOUT OF THE MINE

As described earlier, the mine has two inclines and one return air shaft. Incline No.1 is equipped with Belt conveyor and being used as traveling roadway and coal evacuation. Incline No.2 is equipped with haulage for material transport. A pair of rising drifts at 1 in 4 having a cross section of 4.2 x 2.5 sq. m have been driven from G-II A seam to G-III Bottom Seam.

The broad details of belt conveyor are given below:-

Sl. No.	Particulars	Length (m)	Width (mm)	Lift (m)	KW	Speed (m/Sec)	TPH	Strength
1.	Main Incline Conv. (TCI)	460	1000	70	2x90, NFLP	2.0	125	D-5000
2.	Trunk – TC2	700	1000	50	2x90, FLP	2.0	125	D-5000
3.	Trunk TC3	875	1000	30	2x55, FLP	1.5	125	D-5000

Sl. No.	Particulars	Length (m)	Width (mm)	Lift (m)	KW	Speed (m/Sec)	TPH	Strength
4.	Gate Belt	700	1000	-15	1x55, FLP	1.5	100	D-5000
5.	Gate Belt	420	1000	-15	1x55, FLP	1.5	100	D-3500
6.	Gate Belt	130	1000		1x55, FLP	1.5	100	D-3500
6.	Gate Belt	75	1000		1x55, FLP	1.5	100	D-3500

10.3 COAL TRANSPORT SYSTEM / DETAIL OF UG BELT CONVEYOR:-

10.3.1 Coal Transport in Panel :-

LHD would discharge the blasted coal onto the face gate belt. It is proposed that each panel would be equipped with gate belt in central gallery of the panel. The gate belt conveyor would collect coal from face and discharge coal into trunk belt conveyors. In G-II A seam the material transport will be by endless haulage. The coal from the districts of G-IIIB seam would be discharged on to trunk conveyors, installed in the G-II A Seam through staple pit and small gathering belt.

10.3.2 Coal Transport in G-II A Seam:-

LHD would load the blasted coal onto gate belt which would discharge into gathering belt. The gathering belt will discharge coal into trunk belt through suitable discharge points. Coal from district would be tippled into trunk belt. The main coal evacuation trunk belt would be installed in G-II A Seam.

Two strata bunkers at interval of 300-500m for transferring the coal from G-III B seam to trunk belt installed in the bottom most seam G-II A seam. These belts receive coal from overlying seam through strata bunker (250 T).

10.3.3 Transport of coal in GIII Top & G III Bottom:-

As mentioned G III Top seam is workable in the southern part. This Revised Project Report also envisages exploiting G III top seam simultaneously as the most of the workable area falls within definition of contiguous seam (i.e. less than 9m parting). In G-III T seam coal at face will be loaded by low height LHD onto gate belt which will transfer it to gathering or gate belt of G-III B seam. In G-III bottom seam, gate belt will transfer it to gathering or trunk belt which will finally discharge coal in main trunk belt of G-III B seam to bring the coal to the surface. Whereas, in GIII B seam coal will

be discharged on to gate belt of G-III bottom through, finally coal from Seam III B will be transported through trunk belt installed in G-II A seam to the surface.

10.4. Material Transport

The material from surface is being lowered by the direct haulage of 55 kW capacity. In the trunk roads, it is being hauled by endless haulage separately for G-II A & G-III B Seam. For transport of material from Seam III (Bottom) to Seam III top will be done by Tugger haulage, in drift position and in panel, the material transport will be by endless haulage

10.5 Men Transport

Provision has been made to transport the workmen to the working face by man riding system. Capital has been provided in appendix A-3.

10.6 CAPITAL REQUIREMENT

The list of equipments along with brief specifications and capital requirement are shown in Appendix A-3.

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Chapter – XI

MINE VENTILATION

11.1 DEGREE OF GASSINESS

The degree of gassiness of Bagdewa having underground working in the Seam G III top, G III B & G II A is considered to be degree-I for the purpose of ventilation planning. However, it is proposed to carry out the gas survey and CPT for classification of gassiness of the seam as per statutory requirement.

In conformity with Coal Mines Regulation, 1957 & related circulars issued by DGMS & standards of ventilation, following criteria have been used for calculation of air quantity.

a) Restrictions on the **maximum velocity** in a drivage or mine entries

Fan drift or Ventilation shaft	-	15m/s
Man winding shaft or haulage roadways	-	8m/s
Other roadways	-	6m/s
Conveyor roadways	-	4m/s
Face	-	4m/s

b) **Minimum air quantity** requirement in a panel at LVC

Based on the production from a ventilation district - $2.5 m^3$/min./t

Based on the manpower deployed in the largest shift - $6 m^3$/min./person,

Which ever is more?

c) Requirements of **minimum velocity** at the working faces in the mine

Immediate, out bye of ventilation connection from face	- 30m / min.
4.5m from face on intake side of brattice/partition	- 30 m/min.
7.5m out bye of the discharge end of an air pipe	- 15 m/min.

d) Estimation of **aerodynamic resistance** of a path/mine

$R = k \times P \times L / A^3$ R - Aerodynamic resistance in kg $sec^2 m^{-8}$

Where, k - Coefficient of aerodynamic resistance

P - Perimeter in m

L - Length of airway in m

A - Area of x-section in m^2

e) Estimation of **pressure requirement** for a path/fan

$P = R \times Q^2$

Where, P - pressure drop in Pa

Q - Air flow through a path in m^3/s

f) Estimation of **motor power requirement** for the main fan

$Q = 1.1 \times P \times Q / (n_f \times n_t) \times 102$,

Where, P - main fan pressure in Pa
Q - Air flow through the main fan in m^3/s
n_f & n_t - fan & transmission efficiencies

g) *Standards of **Ventilation Efficiency** in a mine*

Ventilation Efficiency Quotient (VEQ) of a mine	-	60% or more
Operating Efficiency of Main fan (n_f)	-	60%
Transmission Efficiency (n_t)	-	95%

11.2 AIR QUANTITY REQUIREMENT

As per coal mines regulation in Bord & Pillar workings, the quantity of air required at the last ventilation connection (LVC) would depend upon the daily rated output (not less than 2.5 cum/min of air per daily tonne of output) or on the basis of manpower employed in the district in the largest shift (not less than 6 cum/min of air per persons) which ever is larger. The above has been considered for estimating the quantity of air required at LVC.

11.2.1 REQUIREMENT OF AIR QUANTITY BASED ON PRODUCTION

It is envisaged that to produce while working the seam 2460 tonnes of coal / day. Based on the above production per day, the total quantity of air at last ventilation connection would be 2460x2.5=6150 cum/min i.e. 102.5 cum/sec. ,Assuming the quantity of air requirement for pumping and other services is about 8 cum/sec, the total quantity air requirement would be 110.5 cum/sec.This Considering VEQ 60%, the total quantity of air to be handled by the mechanical ventilator is estimated as 169.2cum/sec, say 170cum/sec.

11.2.2. QUANTITY OF AIR REQUIREMENT ON THE BASIS OF MANPOWER EMPLOYMENT:-

The number of persons employed in the mine in the largest shift is 378 and the quantity of air required is 378 x 6 = 2268cum/min or 37.8 cum/sec. Since the quantity of air is less than the quantity required on the basis of per tonne output, this has not been considered.

11.3 VENTILATION LAYOUT OF THE MINE

Considering the total requirement of air as mentioned above, two inclines of cross-section 4.2m x 2.5 (already driven) and one air shaft (proposed) as intake and one air shaft 5.0m dia (already driven) to act as main return airway are being envisaged.

After touching the coal seam by inclines (on the rise side of the property), five heading trunk were driven along the apparent dip is Seam GIIA and G-III bottom seam. Three inner most trunk headings (TR-2 to TR-4) acts as intake airways and two outer most trunk headings as return

airways (TR-1 & TR-5). In panel of G-III bottom seam where overlying G-III top is also proposed to be worked, ventilation would be made by a pair of drift and one staple pit. Staple pits at places, also improves the ventilation. It is proposed to connect the G-III bottom seam from the extreme main dip of G-II A seam, near fault F2-F2 by staple pits.

11.4 VENTILATION LAYOUT WITHIN THE PANEL

Each panel is proposed to have six headings. Four headings on the dip side of panel would act as intake airways and two headings on rise most side of panel as return airways.

A Schematic ventilation layout of the mine is being enclosed.

Input power of the Fan Motor

This is calculated as per the formula:

$$N = \frac{1.1\ Q.H.Mine}{102 \times K_1 \times K_2 \times K_3}\ KW,$$

Where,

Q	=	Air quantity in cum/sec
H	=	Mine Fan pressure in mm of WG = 94.7
K_1	=	Efficiency factor of fan = 0.60
K_2	=	Efficiency factor of motor = 0.9
K_3	=	Efficiency factor of transmission shaft = 1
1.1	=	Power load factor which generally takes into account the performance of tolerance limit drop in voltage etc.

The Input motor power of the fan would be

$$\frac{1.1 \times 170 \times 94.7}{102 \times 0.60 \times 0.9 \times 1} = 321.51\ kW$$

Say, 330 kW

Presently, 250kw motor has been installed. The water gauge is presently recording 75 mm.

Existing Fan-

Make: SIWAX,
Fan Model - APG-2750 SL. NO - 6501'
Motor Rating: 250KW, 4 Pole, 3.3kv, RPM: 1490
Capacity; - 80-140 cum/Sec
Water Gauge: - 40-140 mm (75 mm at present)

This fan will not cater the future need of mine hence a new fan of higher capacity is being proposed the capital provision of which has been provided in appendix A-3. This will be installed in already existing air shaft.

Ventilation simulation done previously indicates maximum mine resistance of 94.7 mm and motor capacity of 210 Kw. Presently by adding an additional district present requirement of motor capacity works out to 330KW and fan capacity 170 Cum /Sec . Provision for a higher capacity fan and one additional air shaft has been provisioned in APP-A.3 to meet the statutory requirement.

11.5 AUXILIARY VENTILATION :-

It is proposed to ventilate the development panels as per statute by coursing the intake air by the help of auxiliary fan, etc.

11.6 CAPITAL PROVISION :-

Capital provision for one additional main mechanical ventilator, Fan drifts, fan installation, environmental monitoring, safety equipments, auxiliary fan etc. are provisioned in this report.

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CHAPTER-XII

WATER MANAGEMENT, PUMPING & DRAINAGE

12.1 INTRODUCTION / GENERAL

The layout of the mine has been prepared such that the working places, as far as possible, are self draining. However, at places may not help water to drain away to deal with such situations, suitable provision will be made for pumping.

It is proposed to make one main sump at the dip most point near the end of trunk roadways. The main sump would be kept at a depth of about 70 meters from the surface initially for the working of 13-14 years. For efficient and economical pumping vertical boreholes shall be drilled from surface up to the main sump. Delivery of main pumps shall pass through boreholes and discharge water on the surface.

12.2 ASSUMPTIONS :

a) PH value of mine water is taken in the neutral region i.e. neither acidic nor basic.
b) 1/3 rd of the total rainfall percolates through strata.
c) 1/10th of the theoretical inflow of water is considered to be normal seepage rate due to strata water.
d) Total yearly rainfall is distributed throughout July to October (120 days).
e) Pumping hours : 18 hrs / day
f) Sump capacity : 8 hrs inflow of water

12.3 PUMPING CAPACITY :

a) <u>DATA :</u>

i)	Maximum yearly rainfall	: 1500mm
ii)	Catchment's Area	: 4.69 Sq. Km (Initial mining area)
iii)	Depth	: 70m 120m (max.)
iv.)	No. of development districts	: 2
v.)	No. of depillaring districts	: 2
vi.)	Total no. of districts	: 4

b) CALCULATION :-

i) **Water Seepage through Strata**

= 1/3rd of accumulated water on surface due to direct rainfall.

ii) Inflow of water to the mine due to 24 hrs rainfall (assuming rainy season is spread over 120 days in a year).

$$V = \frac{1}{3} \times (4.69) \times \frac{1000000 \times 1500}{1000}$$

= 2315000 cu .m / day

iii) Maximum Inflow of water (considering 10% normal seepage)

$$Q = \frac{1.1\ V}{120}\ \text{Cum/day} = \frac{1.1 \times 2315000}{120}$$

= 21220 cum/day
= 14.73 cum/min.

iv) Considering the pumping hours = 18 hrs / day
Pumping Capacity = Q X 1.1 X 24/18 cum/min.
(Considering factor 1.1 for wear in service)

$$= \frac{14.73 \times 1.1 \times 24}{18} = 21.60 \text{ cum/min.}$$

= 360 lps

Thus, operating pump capacity works out to 360 lps.

12.4 PUMP SELECTION:

Main pump has been proposed of 80 lps, 90m head, 110 kW FLP having five (5) Nos. working and four standby. At the first stage of development up to 50m head after that intermediate pump of 30 lps, 50m head will be used and finally main pumps will be used for dewatering the mine. These main pumps have been given at the initial stage for the working of 13-14 years. Afterwards these pumps will be replaced by higher head pumps (80 lps x 150m (H) x 200 kW). Face pumps of 11 lps, 30m head, 7.5 kW have been provided for dewatering face water. Initially water will be pumped out through incline and later on pumping will be done through

borehole. Accordingly sufficient length of pipes of different diameter has been proposed.

The floor of pump room of suitable size should be at least 0.5m above the floor of transport gallery. The floor should be graded at 3 in 100 for easy drainage of water. The pump substation should be kept by the side of the pump room and its level should be higher than that of the pump room. The pump station should preferably be connected to two sources of power supply. If there are more than two delivery mains, each pump should be connected to at least two delivery mains.

12.5 SUMP CAPACITY :-

A standard capacity of 8 hrs of water inflow has been considered for calculating capacity of sump galleries.

Thus, the capacity of the main sump,

= 60 QtR

Where Q = Water Inflow in cum/min.

t = Time in hrs.

R = Reserve factor for slitting of sump galleries.

60 QtR = 60 x 21.60 x 8 x 1.2

= 12444 cum.

The water sumps should preferably be provided in the deep most horizon (of G-II Seam) from safety point of view and for ease of operation and maintenance.

The Sump should consist of minimum two galleries to facilitate Periodic cleaning. Sump galleries should be connected by cross galleries leading to suction well of sump well in pump house. Sluice valve should be provided to isolate sump galleries from one another to facilitate cleaning. The sump gallery of about 4mx3m cross-section should be graded at 1 in 50 to 100 towards the suction well. The minimum clear distance between the sump galleries and pump house should not be less than 10m if driven in stone and 15-20m if driven in coal.

The maximum inclination of the incline connecting the sump gallery with transport gallery should be 10 degree and sump gallery has to be properly ventilated in gassy mine.

12.6 CAPITAL INVESTMENT:-

Estimated capital expenditure on P&M has been provided in the report. Details are given in the Annexure –A.3.3.

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CHAPTER-XIII

COAL HANDLING PLANT & DESPATCH

13.1 INTRODUCTION

Bagdewa U.G. mine is situated at Korba Area of SECL. The annual targeted production of the mine is 0.75 Mte per year and the coal is of average grade B. It is proposed to dispatch coal in the form of steam and slack after necessary screening at CHP by trucks to the miscellaneous customers.

13.2 BASIC DATA

(i)	Targeted output of the Mine	0.75 M.Te. / year
(ii)	Life of the mine	13 years
(iii)	Mine operation	3 shifts / day
(iv)	CHP operation	3 shifts/ day
(v)	Quality of coal	Grade 'B' (Average)
(vi)	Coal size	(-) 250 mm
(vii)	Product size	(-) 50 mm for slack / (+) 50mm for Steam
(viii)	Despatch of coal	By Road
(ix)	Customer	Miscellaneous

13.3 SALIENT FEATURES OF CHP

i) Transporting of ROM coal from underground mine to fixed grizzly in to the steel hopper installed at surface by 1000 mm wide trunk belt conveyor.

ii) Segregation of ROM coal into steam and slack coal fractions while rolling over the grizzly.

iii) Separate bunker each for steam and slack coal having capacity of 2X150t overhead steel hoppers.

iv) Arrangement of loading of steam and slack coal into trucks and its weighment before dispatch.

v) Arrangement of dust suppression system to suppress dust particles.

vi) Arrangement of portable fire fighting equipment to prevent fire in the CHP.

vii) Arrangement of power supply, power control, communication and illumination for smooth operation of the CHP.

viii) Arrangement for re-handling of ground stock by Pay-loader at surface.

13.4 SYSTEM DESCRIPTION

R.O.M. Coal brought from U.G. Mine by 1000 mm wide trunk belt conveyor shall be discharged onto a fixed grizzly installed over two sets 2x150 te. Over head steel hopper. ROM coal while rolling over the grizzly shall be segregated into steam (+) 50 mm and slack (-) 50 mm fractions. Slack and steam coal segregated through grizzly shall be stored into 150 te. respective Over head steel hoppers. Steam coal and slack coal shall be loaded into trucks with the help of gate fitted below the steam and slack coal Over head steel hoppers. A road weight bridge of 100 te. capacity shall be installed near the CHP for weighment of coal loaded onto trucks. The steam and slack coal will be dispatched by trucks to the miscellaneous customers. Provision has been made for ground stock of coal. The coal shall be reclaimed with the help of pay loaders as and when required. Dust suppression system shall be provided to suppress dust particles at transfer point by spray water. Portable fire extinguishers shall be provided to prevent fire in the CHP.

Proper arrangement for power supply and illumination of the plant shall be envisaged for efficient operation of the CHP.

13.5 EXISTING CHP

Existing CHP will remain as it is. Povision of New CHP is the extension of existing CHP and addition of capacity of coal bunkerage at surface.

13.6 MANPOWER

The manpower required for smooth and efficient operation of the CHP would be 16. Details have been given in Appendix-B.

13.7 CAPITAL REQUIREMENT

Total estimated capital expenditure including civil and structural for the CHP works out to be Rs 477.03 lakhs. Details have been given in Appendix – A.3.4.

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CHAPTER-XIV

MINE FACILITIES - WORKSHOP, STORES & MAGAZINES

14.1 UNIT WORKSHOP

14.1.1. Introduction

The project will be provided with a unit workshop to meet the day to day preventive maintenance and incidental minor repair of the UG mine equipment. This workshop will also cater some of jobs required for OC mine.

Underground equipment like direct/endless haulages, drills, chain conveyors LHD's belt conveyors, pumps, vehicles etc. are taken into consideration for deciding size of machineries for the workshop.

Sufficient open space has been provided in the workshop premises for the storage of materials like structural steel and scrap etc.

14.2 SCOPE OF WORK

The workshop will deal with:

i) Daily washing of LMV
ii) Periodical lubrication and scheduled technical maintenance
iii) Incidental minor repair/replacement of components/ modules of LMV/LHD's.
iv) Incidental minor repair/replacement of components/ modules for assemblies and subassemblies of CHP equipment and accessories, pumps and pumping installations, coal tubs etc.
v) Incidental minor repair of switch gears, small motor, repairing of starters, Dynamo etc.

14.3 PROPOSED FACILITIES

For the effective management of the above scope of work, the following facilities are provided:-

i) Washing platform for LMV
ii) Running maintenance and minor repair shop for LMV.
iii) Hydraulic repair shop for running maintenance and minor repair of assemblies and subassemblies of surfaces and underground machines and plant.
iv) Machine shop, electrical repair shop, structural and fabrication shop.
v) Smithy shop
vi) Supporting facilities like small store, cycle shed, toilet security and time office, pump house, fire-fighting facilities etc.
vii) Open bituminous hard stand
viii) Proper drainage facilities
ix) Environmental control by planting trees

14.4 SHOP FUNCTIONS AND DESIGN

Following shops have been provided

i) Machine shop
ii) Electrical repair shop
iii) Structural and fabrication shop
iv) Hydraulic repair shop
v) Smithy shop
vi) LMV repair shop
vii) Carpentry shop
viii) Store

14.4.1 MACHINE SHOP

This shop will undertake machining and reconditioning of spares. It will also manufacture small spares which are in short supply.

Users should also be educated to avoid misuses of electrical power.

14.4.2 ELECTRICAL REPAIR SHOP

This shop has been designed to deal with the testing and minor repairing of electrical components of CHP equipment, pump motor, winding of small electric motors, starters, dynamos etc.

14.4.3 STRUCTURAL AND FABRICATION SHOP

This shop will undertake minor fabrication works, welding of old/new structures, building –up of materials on worn out parts, etc.

14.4.4 HYDRAULIC (MECHANICAL) REPAIR SHOP

This shop will undertake minor repairs and maintenance of LHD's, conveyors, pumps, couplings, pulleys etc. The equipment/ components will be dismantled into individual subassemblies for thorough checking. The parts/ sub-assemblies, which are completely worn-out or damaged and beyond repair would be replaced by new parts / sub-assemblies. The worn-out /damaged parts which are repairable will be reconditioned for further use. This shop will have the facility of settling tank of suitable size.

14.4.5 SMITHY SHOP

This shop will undertake repair of small steel forged parts. This will undertake repairing of mine tubs also.

14.4.6 LIGHT MOTOR VEHICLE REPAIR SHOP

The shop will cater to the needs of minor repair/replacement of parts/components and scheduled maintenance of light and heavy transport vehicles such as Jeeps, Cars, Ambulance, Trucks, Cash Van, Bus, etc.

All the light and heavy transport vehicle coming to this shop for repair must be first washed at the washing station.

14.4.7 CARPENTARY SHOP

This shop will undertake minor repair and maintenance of wooden items to be used for the mine.

14.4.8 STORE

A small store for the workshop is provided with standard size racks for day today requirement of spares and consumables.

14.5 WASHING

Most of the equipment, specially transport vehicles have to work in adverse conditions full of dust and mud, etc. which have dangerous effects on the health of these equipment. It is, therefore, essential to ensure quick and light quality cleaning of this equipment. This can be best attained by providing washing platform equipped with high pressure water and air jet cleaning machine.

Care will be taken for proper drainage of the muddy water. Ground water, reservoir has been provided near the washing platform. Mine water from mine will be available for the purpose.

14.6 STORE

A store has been provided with standard size racks for storing of spares of different equipment like LHDs, conveyors, haulages, drills, pumps and tubs etc. This will also include the open space for keeping consumable items and scraps.

14.7Magazine

Provision of magazine has been made in Appendix –A.2.1

14.8 LANDSCAPING

Open areas other than parking shall be developed as lawns, gardens and flower beds.

14.9 CAPITAL REQUIREMENT

List of additional equipment and estimated capital cost for workshop and store are furnished in Appendix – A.3.2. Total cost involvement for the workshop equipment is Rs. 65.90 lakhs.

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CHAPTER – XV

POWER SUPPLY, ILLUMINATION, TELECOMMUNICATION AND ENERGY CONSERVATION

15.1 SOURCE OF POWER SUPPLY AND VOLTAGE

The Bagdewa underground Mine is located in the Korba Area of SECL. The 33 kV substation at Bagdewa Receives power at 33 kV from Gevra 132/33 kV substation of SECL by means of two different 33 kV feeders through Singhali/Dhelwadih U/G Projects.

15.2 CONNECTED LOAD AND MAXIMUM DEMAND

A number of different electrically operated equipment/drive are deployed in the mine. For selection of transformers in the main substation, additional connected load of all equipment, workshop, underground transport and lighting, LHD panel have been considered. Power Balance of additional loads of all electrical equipments of Bagdewa U/G project (for achieving annual production of 0.75 Mty) has been shown in Table- 1.1. One number 1 MVA, .33/3.4 kV transformer has been envisaged to cater for the additional power demand of 747 kVA. This transformer is to be installed in the existing surface substation. As per Power Balance table, total additional connected load of the project comes to 1198 kW. The maximum demand at corrected power factor of 0.96 (lag) comes to 747 kVA.

15.3 ENERGY CONSUMPTION

The energy consumption has been calculated considering active power, annual number of working hours of equipment/ installation wise for existing and proposed loads. The details of the energy consumption for existing and additional load are given in Table 1.2 & 1.3 respectively. The estimated energy consumption for the Project shall be 11.874 MkWh.. This includes 4% loss in distribution networks.

The specific energy consumption will be approximately 15.83 kWh per ton of coal produced at the targeted production of 0.75 Mt/yr. This includes 4% loss in distribution networks.

15.3.1 Voltage and System Earthing

The details of utilisation voltages, system of earthing are given in the table below-

EQUIPMENT	VOLTAGE
Incoming supply voltage	33 kV
Ventilation Fan	3.3 kV
Surface &Underground Transport	550 V
Main Pumps/ Face pumps	3300V/550 V
Auxiliary fans	550V
Workshop and CHP	415V
Lighting substation (surface)	230V (L-L)
Lighting U/G	110V (L-L)

Restricted neutral system has been envisaged for underground distribution.

15.4 MAIN SUBSTATION

In the earlier RPR (0.405 Mty) it was proposed to establish a 33 kV substation for this Project. Two nos. 33/3.4 kV ,1600 kVA transformer was envisaged to be installed near the incline mouth to cater the loads of this mine and other service facilities. Additionally one number 1 MVA, 33/3.4 kV transformer needs to be installed at the surface along with the existing transformers.

The major functional components for the proposed substation are as follows :

15.4.1 Outdoor Installations

- 33 kV Bus section.
- 33 kV Isolators
- 33 kV Primary control circuit breakers.
- 33 kV /3.4 kV, 1600 kVA & 1000 kVA Transformers.
- 33 kV Current Transformers and Potential transformers.
- 33 kV lightning arresters.
- 33kV/240V (L-L), 100 kVA Lighting transformer
- 3.3kV/565 V, 315 kVA Transformer
- 3.3 kV/ 433V, 160 kVA Transformer
- 33 kV Lightning Arrestor

15.4.2 Indoor Installations

- Remote Control panel for 33 kV Circuit Breakers.
- 3.3 kV Switch Boards.
- 415 V Switch Board
- 230 V (L-L) Lighting Switch Board.
- Capacitor Banks.
- Battery and Battery charger

15.4.3 3.3 kV Indoor Type Switch Boards

i) A 15 panel, 3.3 kV indoor type switch board has been proposed for secondary control of the main transformers feeding power to mine and control of power supply to different load centers of the Project. The switch board comprises 15 numbers Vacuum Circuit Breakers for the following functions:

- Incoming feeders controller	2 Nos.
- Bus Coupler (sectionalizer)	1 No.
- Ventilation Fan feeder controller	2 Nos.
- Capacitor Bank feeder controller	2 Nos.
- U/G feeder controller	2 Nos.
- 3.3/ 0.565 kV, 315 kVA Transformer primary controller	1 No.
- 3.3/ 0.433 kV, 160 kVA Transformer primary controller	1 No.
- Colony and water supply	1 No.
- Reserve	3 Nos.
Total	**15 Nos.**

The incoming Panels shall be provided with Digital type microprocessor based Power meter and outgoing feeder control panels shall be provided with Digital type ammeter & energy meters.

ii) One number 6 panel, 3.3 kV indoor type switch board (VCB) with break up of one number incomer, two nos. U/G feeder, one number capacitor bank and two nos reserve shall be provided with 1 MVA,33/3.4 kV transformer secondary

15.4.4 315 kVA,3.3/0.565 kV Transformer and 550V Switch Board:-

A 315 kVA, 3.3 kV/565 V transformer will be installed in the outdoor yard to feed power to different surface loads through a 4 panel 550 V switch board. The switch board consists of four nos. air circuit breakers for following functions:-

- One number ACB for incomer control.
- One number ACB for Conveyor Belt
- One number for Direct Haulage
- One number as reserve

15.4.5 160 kVA,3.3/0.433 kV Transformer and 415V Switch Board:-

A 160 kVA, 3.3 kV /433V transformer will be installed in the substation to cater to different surface loads to be fed through a four panel 415 V indoor type switch board. Four numbers of air circuit breakers will be used in the switch board for the following functions:-

- One number ACB for incomer control.
- One number ACB for CHP
- One number for Workshop
- One number as reserve

15.4.6 Lighting Main Distribution Board

It is proposed to install one number 33 kV / 240 V(L-L), 100 kVA lighting transformer at the main substation outdoor yard for meeting the requirements of lighting loads on surface. It will feed power to a 9 panel 230 V (L-L) indoor type switch board installed at main substation. This distribution board consists of one number 400 A, MCCB , 8 numbers 2 pole 63 A MCBs. They will feed power to the following purposes :

- One no. 400 A, 25 MVA, MCCB for incoming
- Two numbers 63 A MCB for Office Lighting
- One no. 63 A MCB for substation lighting
- One number 63 A MCB for cap lamp room
- One number 40 A MCB for canteen
- One number 63 A MCB for store
- Two number 63 A MCB for reserve

15.5 PROTECTION OF SUBSTATION, CONTROL AND SIGNALLING

Vaccum Circuit Breakers conforming to IS: 2516(current) shalll be used for incoming feeder control and primary control of the 1000 kVA transformer. The operating voltage of the spring charging motor and the tripping device of the VCB will be fed through the in-built rectifier provided in the circuit breaker. The VCB in conjunction with current transformer conforming to IS:2705 (current) offer protection of the transformers against over current, short circuit and earth fault. These circuit breakers shall also trip for internal fault of transformers, actuated by differential relay , winding and oil temp relays.. For these following protection have been envisaged :

(i) Combined IDMTL and high set instantaneous relay consisting of three overload units (range 50% to 200%), one earth fault unit (range 10% to 40%) and three high set instantaneous units (range 400% to 1600%)

(ii) Triple pole percentage differential relay for transformer differential protection

(iii) Auxiliary relays for oil and winding temp. and alerm. The tripping circuit of the transformers shall have provision for connection to the auxiliary contacts of auxiliary relays for oil and winding temp. alarm.

(iv) The live parts of the circuit breakers will be properly shrouded as per relevant safety rules. Remote control of 33 kV circuit breakers will be performed by the control panel located in the control room of the substation.

The following system of signaling will be used in the substation:-

- Signaling to inform personnel about automatic tripping of circuit breaker due to fault.
- Warning signal about occurrence of abnormality in any particular device.
- Signal to show actuation of automatic and protective relays.(flags and pointer on relays)

Similar control, protection and signaling devices will be incorporated in the 3.3 kV indoor panels also. Additionally insulation monitoring device will be provided in the 3.3 kV bus.

15.6 PROTECTION AGAINST LIGHTNING

Lightning arrestors conforming to IS: 3070 and IS: 4004 will be provided in the substation yard for protection against lightning. For protection against direct strokes 30 m high lightning masts will be erected.

For the protection of the substation building from lightning, spikes will be provided on the roof of the building and will be connected by means of G.I. flats. Earth pits of sufficient quantity will be provided around the building and will be connected to form a grid to which the above earthing grid will be connected through down conductors.

15.7 INTERLOCKING SYSTEM

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

The 3.3kV sectionaliser circuit breaker in the 3.3 kV switchboard panel will have electrical inter-lock with the incoming 3.3 kV circuit breakers to avoid parallel operation of transformers. Primary and Secondary control circuit breakers will be connected for inter tripping, i.e the secondary control circuit breaker will trip automatically when the primary circuit breaker trips.

15.8 EARTHING

In order to maintain the earth resistance of the substation below 1 ohm, sufficient number of earth pits have to be provided in the substation premises. All these earth pits shall be interconnected. Substation earthing shallconform to IS: 3043 (current). The neutral of the 1000 kVA transformer shallbe earthed through resistance with individual earth pit. The other transformer neutrals shall be solidly earthed with individual earth pits. The earthing of underground equipment shall be through the armouring of the cable.

15.9 SAFETY AND FIRE FIGHTING

The boundary of the substation outdoor yard shall be suitably fenced by wire-net fencing which will be suitably earthed by independent earth pit. Soak pits shall be provided for each transformer for collection of the oil leaked to avoid any damage due to fire. Rubbles shall be spread in the yard and the ground in the out door yard shalll be treated for anti grass..

Fire fighting facilities shall be provided with the help of the following:-

- Shovels and sand buckets
- Portable foam type chemical fire extinguishers
- CO_2 fire extinguishers

The following appliances shall also be provided:-

- Electrician rubber gloves for HT working
- Standard discharging rod
- Danger Notice plate
- First - Aid box complete with necessary contents
- Electric shock treatment chart.
- Rubber matting tested for an insulation level of 1100V.
- Trolley mounted ladder (FRLS type)
- Safety belt etc.

15.10 MAINTENANCE AND TESTING TOOLS AND TACKLES

The following tools and tackles shall be used:

- Insulation tester 500 V, 6000V, 2.5 kV and intrinsically safe meggar.
- Earth resistance tester
- Clip Volt Ampere meter (Tong Tester)
- AVO meter
- Transformer oil tester
- Cable jointer kit
- Portable Ammeter, voltmeter, etc
- High voltage cable testing apparatus
- Hand operated crimping tool

15.11 POWER FACTOR

To maintain a high system power factor of around 0.96, even during the maximum demand hours, one set of 3.3 kV capacitor banks having a capacity of 450 kVAR will be provided in the 6- panel 3.3 kV switch board.. The capacitor banks shall have the facility to connect and disconnect required number of units automatically depending upon the loading pattern of substation. The capacitor bank shall be provided with automatic control facility.

15.12 UNDERGROUND POWER DISTRIBUTION

15.12.1 Underground Substation

Two numbers .3.3 kV feeders of 95 sq mm size shall be drawn from project's main substation through overhead lines and boreholes to connect the main underground power distribution centres to supply power to additional loads in underground.

It is proposed to install two numbers of power distribution centers (PDC) at suitable places inunderground. These PDCs shall feed power to IHD district, pumping loads and transport system etc.

The working districts shall be supplied power from the power distribution centre at 550 V through 315 kVA, 3.3/0.565 kV transwitch units.

All the underground feeders shallbe protected by fail safe sensitive earth leakage protection device. The earth fault current shall be limited to 750 mA with tripping at 80-100 mA for restricted neutral system for utilisation voltage of 550V. Apart from the provision for such single point earth leakage protection device in the transformer, each gate end box and section switch shall be provided with individual sensitive earth leakage protection relays.

15.12.2 Transwitch Units

An additional 5 numbers 315 kVA, 3.3kV/565V transwitch units have been proposed for catering the additional underground loads of this Project. These transwitch units shall receive power from the underground power distribution boards at 3.3 kV by means of PVCDWA copper conductor cables. Underground equipment will be fed power at 550 V from these transwitch units.

15.12.3 Cables

For 550 V operating voltage, the presently used 650/1100 V grade cable can be used in both earthed and unearthed power system. A change over to restricted neutral system will also not render the presently used cable unsuitable. However, in case of isolated neutral power supply system, the 3.3 kV grade cable shall be designated as 3300/3300 volts (Unearthed).

15.12.4 Underground Illumination

Traveling roads, loading points, pumping stations, u/g substations and other working places will be illuminated by FLP bulk head fittings and flood lights to provide required level of illumination. Necessary provision for lighting transformers (5kVA, 550/115V), light fittings, cables etc have been made in this report.

15.13 TELECOMMUNICATION:-

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

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

15.10.1 Proposed Communication System:-

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

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

a) Communication for Underground:-

The CDS System having 30 lines, is proposed for U/G Communication, which will be installed near the pit office. The system consists of surface unit, isolator and IS Underground Unit including IS telephones. The underground units should be intrinsically safe and DGMS approved to use in the underground Indian coal mines. The system should have facility to interlink with the surface exchange so that the persons from any location from the important surface unit can communicate to the persons working in different location of underground and vice-versa to meet the main requirement of safety and production.

b) Surface/Administrative Communication:-

To meet all the requirements of data and voice communication, 250 lines (Expandable up to 500 lines) of IP Enabled Exchange is proposed having the following main features:

IP Enabled Exchange:-

A 250 lines automatic telephone exchange has been envisaged for the effective communication between the various units on the surface. The EPABX will preferably employ PCM-TDM technique with a non blocking structure. The EPABX shall have all the latest features like E1 port, LAN/WAN port etc. EPABX shall be interfaced with BSNL exchange for extending external communication having STD/ ISD facility. Self-diagnositic facility shall be provided for EPABX extensions. Sufficient numbers of junction lines are to be provided for terminating BSNL. Tie and Trunk lines.

Technical Specification of EPABX

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

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

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

Exchange shall have both voice and data switching capacity.

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

System software shall have auto-diagnositic programme to detect the fault and localize them.

The exchange should support multi-media application as per latest trend. It should be possible to connect PCs host computers etc. without modem through Digital/SND lines.

Exchange shall be DoT/TRC approved with ISDN facility.

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

Networking Facility:-

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

i) BSNL junction and extension exclusively for BSNL lines.
ii) Exchange shall also be able to inter-face directly with OFC/DECT systems if required.

a) Loop disconnect tie lines
b) Ring down hot line.
c) Direct inward dialing trunk and outward dialing trunk. (2W/4W E&M Trunks)
d) ISDN lines.

Features:-

a) Flexible numbering scheme
b) Privacy of calls
c) DTMF DID facility junctions
d) Conferencing
e) Automatic call back on busy extn.
f) Call transfer and Call pick up
g) Last number redial

c) BSNL Communication:

It is proposed to provide 30 Nos. of BSNL telephone extensions to the project in order to facilitate external communication and to link the project with the BSNL's national telephone network. The BSNL telephones shall be provided at the offices and residences of important officials. The BSNL communication facility can be extended by terminating about 10 BSNL lines on the proposed IP enabled EPABX and configuring the same.

d) BSNL 2 Mbps Leased Line

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

e) Specification for router:-

Data interface	2 nos. high speed data interface with DOT-35 1 no RS-232 Sync/Async port 1no. Ethernet LAN PORT
Link protocol	V.35 / X.21, SDLC and TCP/IP
Protocol support	TCP/IP , RIP
Management	SNMP
Power Supply	230V AC + /- 10% single phase

f) LAN and Internet:-

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

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

i) Payrolls
ii) Financial Accounting
iii) Inventory control
iv) Accident records etc.
v) Material Management
vi) Production, dispatch schedule and variances
vii) Resource Utilisation & MIS

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

A Local Area Network with 10 PCs is proposed for this project. There shall be an L3/L4 switch centrally located, which shall be connected to L2 switches which are proposed desktop connection. The L2 switches at distent locations shall be connected to the l3/l4 switches through the gigabit uplink port. Suitable OS and other application software will be provided. Suitable printers, plotters, CD/DVD writer shall be provided. A server with Windows XP/ Windows / VISTA shall also be provided.

Internet connection shall also be provided.

g) L3/L4 Switch

The L3/L4 Switch shall have 24 nos of 10/100 ports and gigabit ports for connecting to the distantly located L2 switches. The switch shall have sufficient backplane and throughput along with QoS features for both voice and data.

Technical Specification

- 24, 10/100 base auto sensing ports + Expansion module slot for gigabit modules for connecting to L2 switches.

- Standards Compliance – support IEEE 802.3 X (flow control) IEEE 802.1 p (prioritisation), IEEE 802.1 Q (V- LAN Trunking) , IEEE 802.1 d (spanning tree protocol)
- Management – Have built-in SNMP web based and command Line Interface for Management. SNMP v1 /v2 /v3, RMON.

h) 24 Port L2 Switch

The managed L2 switch shall be a workgroup switch 24 port 10/100 having a gigabit uplink port. The switch shall have sufficient backplane and throughput along with QoS features for both voice and data connectivity.

Technical Specification

- Configuration: 24 nos 10/100 Auto sensing Ports + 1 gigabit uplink port.
- The switch should support QoS classification of incoming packets for QoS flow based on Layer 4 fields.
- Standard Compliance – Support IEEE 802.3 x (flow control) IEEE 802.1 p , IEEE 802.1 Q (V- LAN Trunking) , IEEE 802.1 d (spanning tree protocol)
- Management – Have built-in SNMP web based and command Line Interface for Management. SNMP v1 /v2 /v3, RMON.

15.11.0 Electronics Attendance System :-

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

Master Slave Digital Clock

Four digital display units indicating hours and minutes, shall be installed at Key location in the administrative building , project office , pit office and other selected areas. These will be controlled from a master station located in the dispatcher control room. Digits should be readable in day and night from a distance of at least 25 meters.

15.11.1 Specification of UPS :-

a) Capacity : 2kVA, single phase
b) AC input voltage : 220/230 V, 1 Ph, +/- 15-20% variation
c) Frequency: 50 Hz +/- 5%
d) AC output voltage : 230 V AC ,1 Ph
e) Power factor : 0.8 lagging to unity
f) Regulation : Both line and load +/- 1%
g) Wave form : Sinusoidal, <5% THD
h) Noice level : 55 db
i) Charger : Constant voltage limited current type, charging time for 90% discharged battery maximum 10 hrs.
j) Battery : Sealed Maintenance Free (of total capacity around 3100 watt hours)
k) Battery Back –up : 4 hrs at full load.
l) Certifications : EU/EN/ UL/ ISO-9001
m) Rack mount Design : 19" mountable with sliding guides.
n) Communication : RS 232 interface port & Ethernet port with Web management supports.

Features:

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

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

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

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

15.11.2 Testing and Measuring Equipment :-

a) Digital Multimeter:

Hand-held and compact type with necessary probes, covers etc.
4 ½ digit with sharp LCD display

	Function	Range	Accuracy
a.	DC voltage measurement	500 mV to 1600V	+/- 0.025%
b.	DC current measurement	500 mA to 10A	+/- 0.2%
c.	AC voltage measurement	500 mV to 750V	+/- 0.3%
d.	AC current measurement	500 mA to 10A	
e.	Resistance measurement	500W to 50 MW	
f.	Easy calibration facility		
g.	Over load protection in all ranges		
h.	Power supply	Battery (6 V or 9V) operated.	
i.	Frequency	0.6 Hz to 500 KHz ,	+/- 0.03%
j.	Capacitance measurement	50 nF to 50 micro F,	+/- 1.0%
k.	Component test	for diode & transistor	
l..	Continuity test	Continuity Buzzer	
m.	Standard Accessories	Test lead, Rubber Holster	

b) Power Supply:

The DC power supply of different range is proposed for testing & calibrating of the electronic cards and equipment. The variable DC output from 0 to 30 V and fixed DC output of +5 V and +/- 12 V are proposed in the same power supply unit. The specifications are given below:

Input voltage	-	220V AC +5 %, 50Hz
Output voltage	-	a) 0-30 V @ 0-5 A (variable) b) 5 V (fixed output) @ 3 A c) +/- 12 (fixed output) @ 1.5 A
Display	-	Digital for voltage and current
Output polarity	-	Positive and negative
Protection	-	Overload
Ripple voltage	-	Less than 1 mv p-p

c) Tools and accessories :

Suitable tools sets such bas screw drivers of different sizes, soldering iron, desoldering pump solder, wire cutter, wire stripper etc. are required for proper maintenance of the system .

15.12 Signaling System:-

Provision for intrinsically safe signaling bell with transformer have been kept to provide audio alarm for the start and stop of haulages.

15.14 ENERGY CONSERVATION AND UTILISATION

15.14.1 Introduction and Objective

This para deals with electrical energy utilisation in Bagdewa Underground Project. Major power consuming items may be grouped as follows:

- U/G mining equipment, transport equipment, pumps etc.
- CHP, Workshop and main mechanical ventilator.
- Surface illumination and underground illumination.

Our basic objective is to see that the mining machines and allied apparatus operate with optimum efficiency with minimum consumption of energy to produce the required quantity of coal.

The devices adopted in respect of design and operation of various systems to achieve proper energy utilisation and conservation are narrated in the following paragraphs.

15.15 POWER SUPPLY

In this project the main substation will receive power at 33 kV and 3.3 kV has been chosen as main distribution voltage. Utilisation voltage for underground equipment will be 550 V. The main pumps will be operating at 3.3 kV/550V. While selecting the size of overhead conductors and cables, the following aspects have been considered.

1) $I^2 R$ losses are reduced to minimum
2) Voltage regulation is low and the drop should be within 5% at the load end.
3) The improved power factor should be maintained around 0.98 (lagging).
4) Lower size conductors /cables will not be selected so that the losses can be kept at minimum.

15.16 SELECTION OF TRANSFORMERS

In the main substation two numbers of 1600 kVA, 33 /3.4 kV transformers were proposed in the earlier RPR. Additionally one number 1000 kVA, 33 /3.4 kV transformer has been envisaged to be installed at the surface substation. It would be better if the transformers are loaded at 50%-60 % of their ratings to minimize the internal losses of transformers.

15.17 ENERGY CONSUMPTION

Energy consumption of Bagdewa Underground Project has been assessed on the basis of number of working hours per year of equipment concerned. Estimated Annual Energy Consumption including additional loads is expected to be about 11.874×10^6 units (kWh).

Specific energy consumption will be about 15.83 kWh per ton of coal produced at the targeted production of 0.75 Mt/yr which is reasonable.

15.18 POWER FACTOR IMPROVEMENT

In this Project, static capacitor banks with automatic control facility have been provided in main substation to improve the system power factor near to 0.96. Installation of capacitors will reduce the billing cost as well as system losses and also increase the capability of main substation to supply power.

15.19 EQUIPMENT SIZE AND LOAD

During selection of motors for various mining equipment optimum rating of the motor should be chosen. However considering mining conditions and availability of equipment, a little oversize is desirable for reliable operation of equipment. Idle running of belt conveyors, haulages, etc. shall be avoided as far as possible to reduce the energy consumption.

15.20 PUMPING

Adequate sump capacity is provided so that frequent starting and stopping of pumps are avoided and allow the pumps to used in non peak hours as well. Baffle walls will be provided in the sump which allow the bulk of the suspended particle to settle down so that relatively clear water is pumped out. This will increase pumping efficiency, lower power requirement, increase impeller life and stability of the system. Recirculation of water and stage pumping will be avoided as far as possible. Pumping system will be designed such that with minimum head desired pumping capacity is achieved.

15.21 ILLUMINATION

Energy consumption towards lighting can be reduced to a great extent by adopting the following methods :

i) Usage of low energy consumption and high lumen output lamps for street lighting, industrial areas, etc.
ii) Reducing lighting in non populated areas.
iii) Use of timer contactor for ON/OFF as automatic switches for street lights.

15.22 TOWNSHIP

It is proposed to install meters to assess energy consumption on group basis and control the domestic electrical energy consumption.

15.23 CAPITAL EXPENDITURE

The additional capital requirement along with brief specifications for Electrical P&M are shown at Appendix A.3.1 which also includes miscellaneous expenditure(Electronic surveillance for office,colony, security.Networking of Office of Manager & Agent etc.)

Table- 1.1

POWER BAQLANCE FOR ADDITIONAL ELECTRICAL P&M FOR BAGDEWA UNDERGROUND MINE, KORBA AREA

Sl. No.	EQUIPMENT	Qty.	UNIT LOAD	TOTAL LOAD	DEMAND FACTOR	POWER FACTOR	ACTIVE POWER	REACTIVE POWER	APPARENT POWER
			(kW)	(kW)		COS(PHI)	(kW)	(kVAR)	(kVA)
A	LIGHTING, WORKSHOP, COLONY,CHP Etc.								
A1	Workshop	LS	10.00	10.00	0.50	0.70	5	5	7
A2	Lighting (U/G)	LS	10.00	10.00	0.90	0.90	9	4	10
A3	Colony and Water Supply	LS		50.00	0.75	0.90	38	18	42
A4	CHP with Reciprocating Feeder	LS	80.00	80.00	0.65	0.70	52	53	74
A5	Main Vent Fan 330 kW in place of 250 kW			80.00	0.80	0.75	64	56	85
B	TRANSPORT								
B1	Trunk Belt Conveyor,2x90 kW	2	180.00	360.00	0.65	0.70	234	239	334
B2	Gate Belt Conv.,2x90 kW	1	180.00	180.00	0.65	0.70	117	119	167
B3	Trunk Endless Haulage	1	55.00	55.00	0.50	0.70	28	28	39
C	LHD Panel (1 No)								
C1	LHD 1,5 cu.m capacity .	2	37.00	74.00	0.65	0.70	48	49	69
C2	LHD 3.0 cu.m capacity .	1	75.00	75.00	0.65	0.70	49	50	70
C2	Universial drill M/c	4	47.00	188.00	0.65	0.70	122	125	175
C3	Portable Roof Bolting Machine (Standby)	1	7.50		0.65	0.70	0	0	0
C4	Drill Machine,(Standby)	2	1.10		0.65	0.70	0	0	9
C5	Face Pump	1	7.50	7.50	0.70	0.80	5	4	7
C6	Pump	2	9.30	18.60	0.70	0.80	13	10	16
C7	Auxilary Fan.	1	15.00	15.00	0.65	0.70	10	10	14
	TOTAL			1203.10		0.72	793	770	1106

Table:1.2

ESTIMATED ENERGY CONSUMPTION FOR EXISTING ELECTRICAL P&M FOR BAGDEWA UNDERGROUND MINE, KORBA AREA

Sl. No.	EQUIPMENT	Qty.	UNIT LOAD	TOTAL LOAD	DEMAND FACTOR	ACTIVE POWER	ANNUAL WORKING	YRLY POWER CONSUMPTION
			(kW)	(kW)		(kW)	HRS.	(kWh)
A	FAN							
A.1	Main Ventilation Fan (To be changed to 330 kW Motor)	1	250.00	250.00	0.80	200	8760	1752000
B	LIGHTING, WORKSHOP, COLONY,CHP Etc.							
B.1	Lighting of Office, industrial premises etc	LS	75.00	75.00	0.90	68	2700	182250
B.2	Workshop	LS	150.00	150.00	0.50	75	1800	135000
B.3	Lighting (U/G)	LS	75.00	75.00	0.90	68	8760	591300
B.4	Colony and Water Supply	LS		1000.00	0.75	750	3650	1916250
B.5	CHP	LS	15.00	15.00	0.65	10	2700	26325
C	TRANSPORT							
C1	Incline Belt Conveyor,2x90 kW	1	180.00	180.00	0.65	117	2700	315900
C2	Trunk Conveyor Belt 2x90 kWSeam V	1	180.00	180.00	0.65	117	2700	315900
C3	Trunk Conveyor Belt 2x55 kWSeam V	1	110.00	110.00	0.65	72	3600	257400
C4	Trunk/Gate Conveyor Belts (TB4	5	110.00	550.00	0.65	358	3600	1287000
C5	Direct Haulage,110kW, (Surface)	2	37.00	74.00	0.50	37	2700	99900
C6	Trunk Endless Haulage,	1	37.00	37.00	0.50	19	900	16650
C7	Tugger Haulage	1	37.00	37.00	0.50	19	350	6475
D	LHD Panel							
D.1	LHD, 1.5 cu. m	3	37.00	111.00	0.65	72	3600	259740
D2	LHD, 1.5 cu. m	1	47.00	47.00	0.65	31	3600	109980
D3	LHD, 3 cu. m	3	75.00	225.00	0.65	146	3600	526500
D4	Universial drill M/c	4	47.00	188.00	0.65	122	3600	439920
D5	Portable Rool Bolting Machine (Standby)	1	7.50		0.65	0	3600	0
D6	Drill Machine,(Standby)	1	1.10		0.65	0	3600	0
D7	Face Pump	2	7.50	15.00	0.70	11	2700	28350
D.8	Auxilary Fan.	2	15.00	30.00	0.65	20	3600	70200
F	PUMPING							
F.1	Main Pump, 120 m, 60 lps	2	110.00	220.00	0.70	154	2850	438900
F.1	Main Pump, 60 m, 60 lps	2	55.00	110.00	0.70	77	2850	219450
F.1	Main Pump, 30 m, 11 lps	3	22.00	66.00	0.70	46	2850	131670
F.1	Main Pump, 60 m, 38 lps	1	55.00	55.00	0.70	39	2850	109725
	TOTAL			3800.00		2624		9236785
	Add distribution losses at 4%							369471
	TOTAL ANNUAL ENERGY CONSUMPTION FOR EXISTING P&M						(X)	9606256

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Table:1.3

ESTIMATED ENERGY CONSUMPTION FOR ADDITIONAL ELECTRICAL P&M FOR BAGDEWA UNDERGROUND MINE, KORBA AREA

Sl. No.	EQUIPMENT	Qty.	UNIT LOAD	TOTAL LOAD	DEMAND FACTOR	ACTIVE POWER	ANNUAL WORKING	YRLY POWER CONSUMP-TION
			(kW)	(kW)		(kW)	HRS.	(kWh)
A	LIGHTING, WORKSHOP, COLONY,CHP Etc.							
A1	Workshop	LS	10.00	10.00	0.50	5	1800	9000
A2	Lighting (U/G)	LS	10.00	10.00	0.90	9	8760	78840
A3	Colony and Water Supply	LS		50.00	0.75	38	3650	0
A4	CHP with Reciprocating Feeder	LS	80.00	80.00	0.65	52	2700	140400
A5	Main Vent. Fan to be replaced with 330 kW motor in place of 250 kW motor			80.00	0.80	0	8760	0
B	TRANSPORT							
B1	Trunk Belt Conveyor,2x90 kW	2	180.00	360.00	0.65	234	2700	631800
B2	Gate Belt Conv.,2x90 kW	1	180.00	180.00	0.65	117	3600	421200
B3	Trunk Endless Haulage	1	55.00	55.00	0.50	28	900	24750
C	LHD Panel (1 No)							
C1	LHD 1,5 cu.m capacity .	2	37.00	74.00	0.65	48	3600	173160
C2	LHD 3.0 cu.m capacity .	1	75.00	75.00	0.65	49	3600	175500
C2	Universial drill M/c	4	47.00	188.00	0.65	122	3600	439920
C3	Portable Roof Bolting Machine (Standby)	1	7.50		0.65	0	3600	0
C4	Drill Machine,(Standby)	2	1.10		0.65	0	3600	0
C5	Face Pump	1	7.50	7.50	0.70	5	2700	14175
C6	Pump	2	9.30	18.60	0.70	13	2650	37107
C7	Auxilary Fan.	1	15.00	15.00	0.65	10	3600	35100
	TOTAL			1123.10		729		2180952
	Add distribution losses at 4%							87238
	TOTAL ANNUAL ENERGY CONSUMPTION FOR ADDITIONAL P&M						(Y)	2268190
	TOTAL ANNUAL ENERGY CONSUMPTION FOR PROJECT						X + Y	11874446

Specific Energy Consumption for 0.75 Mty Production kwh/te 15.83

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Chapter – 16

CIVIL CONSTRUCTION

16.1 GENERAL:

Bagdewa under ground project is situated in Korba area of SECL, which is a developed mine. The location and general topography of the proposed block has been elaborated elsewhere in this report.

16.1.1 Life & Type of Specification:

The planned life of the proposed block is 13 years for this revised project report provision. All civil structures should preferably be constructed over non-coal bearing area. Proposed service infrastructures should preferably be located near the working area as per service requirement.

16.1.2 Nature of soil:

In general poor soil is available in this area.

16.1.3 External Services:

Coal transportation and linkage has been dealt separately.

16.2 COST INDEX & SPECIFICATION OF BUILDING:

The preparation of cost estimates for civil infrastructures is based on prevailing cost index of the area in December'2010. The cost index value has been calculated from market rate of the area. The same was provided by the staff officer (Civil) of the area. Standard guidelines provided by B.P.E have been adopted for arriving at cost index value. Considering the prevalent rates of materials and labour in Korba Area, the cost index works out to 1814 in December 2010 with reference to 100 base in Delhi as on 1.10.76. The detailed calculation for Cost Index is shown in Appendix A.2.3.

16.3 SERVICE BUILDINGS:

16.3.1 Provision of Service/Welfare Building:

Considering the enhanced production requirement and its operational criteria, assessment of essential service buildings have been finalised with the planners and the same has been provided in this report. Considering the utility of the services of existing infrastructures provided in the original PR, the additional provisions has been envisaged which covers only one additional Magazine.

16.3.2 Site of Service Building:

All the proposed service buildings will be located around the mine and preferably on stable ground with due consideration of land availability and minimum blockage of coal in order to facilitate the service available from the existing other service buildings.

16.3.3 Salient features of important service buildings:

Existing.

16.3.3.1 Workshop:

Existing.

16.3.3.2 Store:

Not envisaged.

16.3.3.3 Sub Station:

Existing.

For other structures following type of construction have been envisaged.

1. Ground water reservoir: - RCC structure
2. Water Treatment plant: - RCC structure
3. Magazine - RCC framed structure

16.3.4 Cost Estimate:

The details of cost estimate, as per prevalent cost index, against service buildings have been elaborated in appendix A.2.1.

In a typical domestic roof top rain water harvesting system, rain water from the roof is collected in storage vessel or tank for use during periods of scarcity. Such systems are usually designed to support the drinking water and cooking needs during the scarcity time and comprise a roof, a storage tank and guttering to transport water from the roof to the storage tank. In addition, a flush system to divert the dirty water, which contains debris, collected on the roof during non-rainy period and a filter unit to remove debris and contaminants before water enters the storage tank are also provided. The roof top rain water can also be used for recharging of the ground water through recharge pits or putting into the dried bore wells/ open dug wells.

16.4.5 Unit cost and Cost Estimate:

The details of cost estimate, unit cost with prevalent cost index, against residential buildings have been elaborated in appendix A.2.2.

16.5 ROAD AND CULVERTS:

16.5.1 Colony Roads & Culverts:

For a total 447nos. of balance quarters colony roads of 2200m length has been provided. Single lane concrete road has been considered. Tentative cost in respect of total road length including provision of culverts and tree guards etc. as per norms have been elaborated in Appendix- A.8.2.1.

16.5.2 Service Roads & Culverts:

Nil

16.5.3 Approach Roads & Culverts:

Nil

16.5.4 Diversion of Non CIL Roads:

Nil

16.6 WATER SUPPLY AND SEWERAGE DISPOSAL ARRANGEMENT:

16.6.1 Colony water supply and sewage:

Existing Bagdewa mine is developed area and presently equipped with residential complex including water supply arrangement. Based on conventional norm for water supply, water demand for the additional quarters works out to around 0.37 MLD .For domestic requirement 135 litres of water per head for a family comprising of 5 members and for non-resident persons 45 litres per head has been adopted. Detailed calculation of water demand has also been provided.

The water demand has been envisaged to be met from under ground water. Water from under ground will be collected to ground reservoir at different suitable locations near colony site. From ground reservoir water will be pumped to overhead reservoirs after treatment in the water treatment plant and the same will be distributed to the desired locations through gravity.

The sewerage disposal system for colony is existing with conventional septic tank and soaks pit arrangement. The same is to be extended for additional quarters also. However, for improving the existing environment DETP will be constructed for residential area.

16.6.2 Industrial water supply & sewage:

Total industrial water requirement for the additional production from the mine works out to 0.04 MLD..

This water demand has been envisaged to be met from under ground water. Under ground water will be pumped and delivered to ground reservoir at different suitable locations near industrial site. From ground reservoir water will be distributed to the desired locations through pumping.

Industrial sewerage will be collected at a centrally located settling tank and after settlement of industrial waste the supernatant liquid is to be disposed of in nearest natural water course.

14.6.3 Capital Requirement:

Capital requirement against colony water supply and industrial water supply has been elaborated in appendix A.8.3.

Capital requirement against colony sewerage and industrial sewerage has been elaborated in appendix A.8.3a .

16.7 SURFACE REORGANISATION AND REHABILITATION, IF ANY:

This aspect has been dealt separately in the Mining write-up portion.

16.8 CONSTRUCTION MANPOWER :

This has been taken into consideration.

CHAPTER-XVII

MANPOWER, PRODUCTIVITY & TRAINING

17.1 MANPOWER ASSESSMENT

The total requirement of manpower works out to 1121. The requirement of manpower has been worked out keeping in view the mine layout, deployment of equipment and statutory requirement. An allowance of 16% has been made on account of leave and sickness for time rated and staff manpower. The details of job wise and category wise requirement manpower has been shown in Appendix-B. The break-up of total manpower in group viz., workers monthly paid staff and officers is given below:-

Sl. No.	Manpower group	Underground	Surface	Total
1	Daily Rated Workers	811	126	940
2	Monthly Paid Staff	97	59	156
3	Executives	18	7	25
TOTAL		926	195	1121

It may be noted that number and category / scale of persons employed may be changed in actual practice within the overall provision of manpower. The requirement of manpower as far as possible will be met from the surplus manpower to the extent feasible. Recruitment shall be given to land oustees as per CIL norms. A summary of manpower required category-scale wise along with wages / salaries and a benefit is also given in Appendix-B.1 (updated up to nov.2010).

17.2 PRODUCTIVITY

At the target level of production of 0.75 MTPA, the overall OMS works out to be 2.56 including the social manpower.

On the basis of production, the phased requirement of manpower is broadly worked out and is given below:-

Year	Production (Mty)	Progressive Manpower(Nos.)
1	0.62	877
2	0.75	1121
3	0.75	1121
4	0.75	1121
5	0.75	1121

To achieve the production target in different years of its operation trained manpower should be made available to the Project, so that manpower does not become the bottleneck in obtaining the target production.

17.3 TRAINING :-

The additional manpower provisioned for the project in this RPR under various categories needs to be imparted training. These training programmes are to be imparted by group training center and by SECL HQ.

17.4 ORGANISATION :-

A good organizational set up at project level has to be made to implement the Project within Projected Period.

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CHAPTER-XVIII

SAFETY PRECAUTIONS AND COAL CONSERVATION

18.1 GENERAL

While planning the mine, all safety precautions as required by CMR 57 & DGMS have been taken into consideration. However, constant vigil is required by the mine authorities particularly on the following sources of danger.

18.2 DEGREE OF GASSINESS

Bagdewa UG is an operating mine. All the coal seams have been touched and its degree of gassiness determined.All the seams are categorized degree-I.One main mechanical ventilator of adequate capacity to cater to the ventilation requirement as well as for dilution of various gases including inflammable gases of the mine has been installed at the mine. Provision for an additional inseam air pit has been made in the RPR. The other following precautions should also be taken:

(i) Adequate provisions have been made in the report towards building up and maintenance of standards of ventilation as per Reg. 130 of CMR-1957.

(ii) Regular monitoring of atmosphere for presence of noxious and inflammable gases in the Goaf should be made.

(iii) The auxiliary fans should effect brisk ventilation of headings / workings.

(iv) The provisions of Reg. 124, 142 and various circulars issued by the DGMS should be effectively complied with.

In addition to the above, other provisions of CMR 1957 related to gas and ventilation shall also be complied effectively for safe working.

When main dip will be developed up to certain distance in the overlying seam, further gas survey for this project should be carried out for determining the gassiness of the seam. If the change in the gassiness is noticed, the provisions have to be changed accordingly. In this report, following provisions are made as precautions against danger from gas emission.

A. Precautions against Inflammable gases & noxious gases

Coal dust generated during mining activity needs to be suppressed at the source of generation. There is possibility of formation of air borne dust which may become an explosive mixture. Adequate precautionary measures should be taken for dust suppression at faces and all transfer points.

- Provision has already been made for Methanometer and other appliances related with mine environment for regular monitoring of methane and other noxious gases in the mine.

- Provision of auxiliary fan has been made for ventilating the long and blind headings, so that dust and other noxious gases can be removed as quickly as possible.

- All electrical equipment provided in the underground shall be of DGMS approved & FLP type.

- A geological plan should be maintained showing all faults and other geological disturbances which may be encountered during course of mine development and updated regularly. Gas survey should be conducted immediately after encountering faults and emission of methane should be monitored at regular intervals to take precautions against accumulation of inflammable gases in the working faces.

B. **Environmental Monitoring**

To ensure safe operation of the mine, following aspects should be measured periodically and adequate precautions should be taken for monitoring as per statutory requirement:

i) Fire damp (CH_4)
ii) Carbon-Monoxide (CO) & other noxious gases
iii) Temperature
iv) Humidity
v) Coal dust concentration

The various provisions regarding monitoring and remedial measures for each of the above as per CMR, 1957 and other related circulars should be complied with effectively. The monitoring should be conducted for active workings as well as unused / disused and isolated / sealed-off workings in the mine.

18.3 INNUNDATION

In southern side of mine boundary Kholar nala is flowing. Proper drainage system needs to be maintained so that no water is accumulated on surface. HFL lines of the nalla should be properly marked on the plan and before commencement of depillaring operation, survey of these nallas as well as HFL line has to reascertained. As precautionary measures, a barrier of about 60m from the edge of the nalla will be left. It is proposed that below nallas (part of which are within the working property) and ponds, only development will be carried out. In addition, exploratory boreholes should be plugged as it may also form a source of inundation. In low cover area, developed cracks (if

any) should be filled up and compacted to avoid any source of surface inundation. In addition, all statutory obligations during mining operation would be complied with.

18.3.1 Precautions during extraction

(i) It is important that before depillaring is carried out, a proper contour survey will be made and the effect of subsidence on surface drainage will be assessed. This will help to plan effectively filling the surface cracks / subsidence trough which may be due to caving.

(ii) Before start of extraction of a panel, garland drains etc. will be made to ensure that the flow of rain water is away from the proposed caved area.

(iii) The panels have been laid such that it ensures self drainage of water.

18.4 UNDERGROUND PUMPING

Adequate pumping capacity and pumps have been provided to take care of dewatering required during the rainy season. The main sump has been proposed of adequate size having a capacity to hold at least 20 hrs of water inflow.

Periodical inspection monitoring of above possible sources of surface / underground inundation, especially during rainy season, will be done.

18.5 SPONTANEOUS HEATING & FIRE

The following sources of heating /fire is apprehended:-

18.5.1 Spontaneous Heating

Adequate measures will have to be taken to seal off the old workings and the goaved out area. While depillaring, sub panels will be made such that they are extracted within the incubation period. Proper cleaning o fallen coal and stone dusting of workings will be done so that these loose coal susceptible to spontaneous heating is not available. Surface cracks over goaved out area will be filled with mutti and non combustible over burden so that breathing of air is prevented.

18.5.2 The other Precautionary measures are :-

i) Coal pillar in trunk roads have been made of adequate size.

ii) Panels are to be worked within incubation period

iii) Monitoring of Co/Co2 ratio in main return airway of panel as well as the main return of the mine.

iv) All the underground workers to be provided with self rescuer.

v) Provision and marking of escape routes from accident prone area are to be maintained properly.

18.5.3 Inflammable Materials

Inflammable material should not be stored in underground except in permitted /authorized area. Due precautions will be taken in use of welding sets, repair of FLP electrical etc in underground workings to prevent out burst of fires.

18.5.4 EXPLOSION

Adequate ventilation has been provided to dilute accumulation of inflammable gases and attempts will have to be made to meet the ventilation standard as stipulated by Coal Mines Regulation. All the depillared panels should be sealed off permanently by explosion proof stopping as per specification laid in coal mine regulation and circulars issued there under. Provision has been made for necessary flame proof equipment, water spraying in district and monitoring apparatus for detecting gases and its concentration. All kinds of roof fall (containing carbonaceous material) should be cleared and cavity in roof, so formed, should be filled up or properly ventilated to avoid accumulation of fire damp. The statutory precautions shall be taken in use and transport of explosives. Only permitted / sheathed explosives along with delay detonator shall be used for blasting of solids.

All loose coal and accumulated coal dust on various structures, machineries etc. will be cleaned on regular basis. The provision of stone dusting in the roadways and stone dust barrier will be made as required by statutes.

18.6 AIR POLLUTION :-

To avoid the air pollution in the mine, adequate quantity of air to dilute the inflammable and noxious gasses to a safe limit, is provided. Sufficient quantity of air shall be coursed up to the face to remove all smoke and noxious gases in the shortest possible time after each blasting. Care has to be taken in ventilation planning to ensure that sufficient air is available at the last ventilation connection.

Systematic and regular sample and analysis of mine air is also very essential. Provision for sufficient number of monitoring and sampling equipment has already been made.

18.7 ROOF / STRATA CONTROL

In this mine, roof bolting is the main constituent of roof support system in the primary as well as secondary development headings. The

RMR of the rock in the mine is 60-62. However, RMR should be determined on regular basis. On the basis of the RMR, systematic support rules have to be framed and approved by DGMS for each seam.

A. **Precautions due to contiguity of the seams**

(i) Workings in seams G –III T, G-III B &II A should be vertically coincident. It has also been proposed vertically coincident trunk roadways in the three seams.

(ii) Verticality should be checked by putting holes at alternate junctions of gallery.

(iii) The thickness of parting should not be less than 3.0m in any case.

(iv) In addition to above, the provisions of Reg. 104 of CMR, 1957 and circulars issued by DGMS should be strictly complied with.

B. **Precautions for strata control/ Parting stability**

(i) While development or depillaring of the panel, the supporting should be done as per the approved SSR.

(ii) Although, the immediate roof predominantly comprises of sandstone to shale; adequate monitoring of parting should be undertaken to prevent any premature collapse.

(iii) In case of roof bolting, it must be supplemented with the conventional support as and when required.

(iv) The scientific body should conduct Cavability study of the strata for the project.

(v) Adequate number of convergence recorder, load cells, etc. should be installed while depillaring in any panel to prevent from air blast.

(vi) Record of local fall and main fall should be properly maintained and analyzed in the safety committee meeting, so that the general awareness regarding local fall and main fall can be created among the workers and officials.

(vii) All other steps as needed by the situation in accordance with the provisions of regulations & circulars should be taken to avoid any mishaps due to roof fall.

(viii) The scientific body to ascertain the parting stability between the seams should do a mathematical modeling or Numerical modeling or any other method.

(ix) In addition to above, all other provisions of CMR, 1957 which is attracted by strata problems together with various related circulars should be effectively complied for safe working of the mine.

(x) As and when required, induced blasting may also be used to bring down the roof.

The provisions of Reg. 108 of CMR, 1957 and various circulars related with it should be effectively complied.

18.8 SIGNALLING & LIGHTING

Sufficient lighting as per standards will be provided at all the required places i.e. at coal transfer points, loading points, working faces, along trunk and gate belts, feeder breaker, switch gear and maintenance area. Adequate lighting provision has to be made at workshop and coal dispatch area to avoid accidents and to maintain safe working condition. Good communication between face, conveyor drives, key points in u/g, surface control rooms, offices, workshop etc., is essential for efficient operations. Intrinsically safe signaling equipment of audio-visual type should be installed in u/g for smooth & efficient communication between various points.

18.9 CONSERVATION

From conservation point of view, small patches in seam G-III T has been identified and included to form part of the project.

18.10 SCIENTIFIC STUDIES

The following scientific studies are suggested / proposed:

- Hydro geological studies
- Study for Incubation period &degree of gassiness.
- Studies for determining the stability of parting between the seams.
- Cavability & roof behavior study
- Strata Monitoring
- Physico-mechanical properties

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CHAPTER – XIX

ENVIRONMENT MANAGEMENT

19.1 Existing Environment Quality

This project is a part of Bagdewa Geological Block located in Korba Area of SECL in Korba District of Chhattisgarh State. The Bagdewa Underground mine is an operating mine where development is going on in G-III Bottom seam with the help of LHDs. The project was approved for 0.405 Mt level of production on 21.07.1999. In this RPR, it is proposed to work four districts (one additional) in the G-III Bottom and other seams to increase the production capacity of the mine from 0.405 to 0.75 Mty (Peak 0.76Mty.) with deployment of 03 (three) extra LHDs. The existing environmental data in respect of air quality, water quality, noise level, flora fauna, socio economical data etc. are available and introduced below.

19.1.1 Ambient Air quality in core and buffer zone

CMPDI on behalf of SECL carries out regular environmental monitoring by establishing different monitoring stations at Bagdewa U/G and its surrounding area (buffer zone). Air quality data as available for Oct – Dec '07 is incorporated. This indicates that the SPM, RPM, SO_2, & NO_2 values in respect of different category are within the permissible limit of NAAQS.

(Values are in $\mu gm/m^3$)

Parameters monitored		SPM		RPM		SO_2		NO_x	
Monitoring Location	Category	Min	Max	Min	Max	Min	Max	Min	Max
Core Zone									
A_1 –Mine Managers Office of Bagdewa UG	I	212	276	68	112	17	23	12	22
Buffer Zone									
A_2 - Mahalpur village	R	85	125	25	45	8	15	7	13
A_3 - Between Sutara & Korbi village	R	110	130	35	40	11	13	15	17
A_4 - Jawali village	R	100	132	35	45	10	14	12	15
A_5- Dhelwadih SAM office	I	227	268	87	104	17	22	18	22
A_6- Singhali SAM office	I	168	262	54	98	16	24	17	23

R = Residential; I = Industrial;

Standard (NAAQS) Maximum Permissible Limit (In $\mu g/m^3$)

Category	SPM	RPM	SO_2	NO_X
Industrial(Old Mines) "A-O"	600	300	120	120
Residential "B"	200	100	80	80

19.1.2 Water Quality

The drinking water quality data as obtained for the quarter Oct to Dec '07, at the different sampling stations in respect of different parameters are within the desirable limit as shown below:-

Parameters	Bagdewa village well water (W-4)	Dhelwadih colony Drinking water (W-3)	Permissible limit as per IS 10500
pH	7.41-7.57	7.36-7.54	6.5-8.5
Fluoride (mg/l)	0.22-0.30	0.29-0.31	1
Iron(mg/l)	<0.05	<0.05	0.3
Chlorides(mg/l)	16-23	16-24	250
Sulphates(mg/l)	22-38	25-32	200
Nitrates (mg/l)	4.11-5.72	4.17-4.29	45
Calcium (mg/l)	17.6	17.6-19.2	75

The effluent water quality data for Oct – Dec '07, at the Bagdewa U/G & surrounding areas in respect of different parameters are also within the permissible limit, which are given below:-

Location	Parameters as per GSR 742 (E) dated 25.9 2000	Season	Permissible limit as per GSR742 (E)(Effluent dated 25/09/2000)
		Oct. 07 to Dec.07	
Bagdewa mine effluent water (W_1)	pH	7.57 to 7.71	5.5 to9.0
	Total suspended solids (mg/l)	51 to 62	100
	COD (mg/l)	55 to 75	250
	Oil & grease (mg/l)	Nil	10
Kholar Nallah water after likely contamination with treated mine water (W_{-2})	pH	6.94 to 7.28	5.5 to9.0
	Total suspended solids (mg/l)	24 to 37	100
	COD (mg/l)	30 to 50	250
	Oil & grease (mg/l)	Nil	10

19.1.3 Noise level

The noise data (Leq.Values) for Oct – Dec '08, at different locations of Bagdewa U/G for different categories of area is under permissible limit in dB (A).

Location of sampling station	Noise level					
	Day Time (75)			Night Time (70)		
A. Core Zone	Max	Min	Avg	Max	Min	Avg
N_1 -SAM Office of Bagdewa UG	69.2	65.5	67.28	57.6	56.7	57.53
B. Buffer Zone (Residential)	Day Time (55)			Night Time (45)		
	Max	Min	Avg	Max	Min	Avg
N_2 – Mahalpur village	48.3	45.5	47.07	39.1	35.9	37.67
N_3 – Between Sutara & Korbi village	53.5	48.5	51.07	39.2	37.0	38.43
N_4 - Jawali village	48.62	45.6	47.05	38.75	35.6	37.00
C. Buffer Zone (Industrial)	Day Time (75)			Night Time (70)		
	Max	Min	Avg	Max	Min	Avg
N_5 -SAM Office of Dhelwadih	74.3	68.3	71.66	62.2	59.0	60.87
N_6- Singhali SAM office	72.2	70.3	71.45	64.2	61.1	62.4

Noise Level Standards

As per Ministry of Environment & Forest, New Delhi, Notification S.O 123(E) dated 14.02.2000, and GSR 742 (E) dated 25.09.2000; the maximum permissible limits in dB(A) of ambient noise level are as follows: -

SL NO.	CATEGORY OF AREA	LIMITS IN dB(A)	
		Day time (6.00 am to 10.00 pm)	Night time (10.00 pm to 6.00 am)
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45

19.1.4 Flora and Fauna

Floral and faunal diversity was assessed in the core zone of Bagdeva UG project site and the buffer zone which lies within 10 km radius circle from the boundary of the core zone of the project, excluding the core zone.

There is 282.28 Ha. of forest land involved in the mine take area . It is a part of Katghora protected forest division. Forest area as it is today is unclassified. In the absence of scientific management in the past these zamindari forests have suffered from heavy felling of trees. Biotic pressure put by man and domestic animals of surrounding areas is also tremendous.

Flora

Sal (Shorea roubsta) is the main commercial species of this forest associated predominantly with saja (Terminalia tomentosa), Achar (Buchanna lanzen), Dhaora (Anogeissus latifolia) etc. Fast spread of Dudhi (Holarrhena antidycentrica) in patches is suppressing the regeneration of main species. The crop density is 0.4 to 0.6and quality of forest is IV b with distinctive upper canopy and undergrowth only. The climbers and grasses are a few.

Fauna

The core zone exhibited a very few species of Mammals, Fishes, Amphibians, Reptiles and Birds, which are quite common for all the terrestrial environments. Existing wild life includes Felis chaus or jungle cat, Indian mongoose, Grey langur & Golden Jackal are some of the common inhabitants of the area.

19.1.5 Socio-economic Status

Socio economic profile, basic and civic amenities details within 10-km. radius of the project are based on available census data of Korba District.

Out of the total population of 56933 persons, 50.66% are male and 49.34% are female. Scheduled castes account for 9.50% of total population and scheduled tribes 39.46 %. In case of literacy 49.70% population is literate. The main workers, marginal workers and non-workers are 30.00%, 13.78% and 56.22% of the total population respectfully. Out of main workers, 34.65% are cultivators supported by 22.59% agricultural labourers, and 1.55% in household industries and other allied activities like live stock, forestry, transportation & storage, communication, trade and commerce, manufacturing processing services and repairs etc.

It has been found that there is a good network of infrastructural facilities of civic amenities within the buffer zone. The present level of availability of the civic amenities may be attributed to the existence of several coal-mining projects in the neighborhood.

19.2 Environment Impact

19.2.1 **Air Quality:** The extent of pollution created by mining operation mainly depends upon the type of minerals to be exploited and the type of mine. Since coal will be mined at this project, it is felt that there shall no release of toxic substances & materials to the natural environment due to non-toxic & non-polluting quality of coal. As this mine is an underground mine there will be no dust produced from mining activity.

19.2.2 **Water Quality**

The water will be consumed in various activities associated with Bagdeva UG, Expn. (0.76 Mty) and pollution thereof has been broadly identified at:

i) Water pollution from vehicle washing & workshop.

ii) Water pollution after domestic use.

iii) Water pollution from mine water.

19.2.3 **Ground Water Resource**

The present lean period mine discharge from Bagdewa UG is about 14,850 cum/day (5.42 M. Cum M. Cum/yr.). Of this about 2488 cum/day has been utilized by the mines towards domestic and industrial water needs. The balance mine water discharge has been gainfully utilised by the local people for irrigation and only the over flow reaches the local drainage. About 20% of this mine discharge is anticipated as return flow to the groundwater system.

The net annual ground water recharge in the study area was estimated as 42.20 M. Cum. Thus, the available annual groundwater recharge, after adjusting all groundwater withdrawals, has been projected as 31.01 M. Cum.

Impact of mining on local water regime:

The impact of underground mining on local water regime is dependant mainly on mine parameters, groundwater recharge and aquifer parameters. The impact varies, in time and space, at different stages of mining.

The radius of influence on groundwater levels, due to Bagdeva UG, was estimated to vary from minimum 261 m to maximum 577 m from the mine. Due to low potential aquifers and copious recharge, the zone of influence would be smaller than the predicted. So also, with sufficient recharge from mine discharge, the impact will be reduced further.

However, the actual resource potential & likely impact would be assessed during preparation of E.M.P for this mine considering the mine expansion and aquifer parameters.

19.2.4 Noise Impact

The noise impact will involve the following area considering the sound level greater than 90 dB in continued exposure.

i) The operators of stripping & coal winning equipment.
ii) Fixed plant equipment with high noise level.
iii) Exhaust system internal combustion engine.
IV) Machinery of aerodynamic origin.
V) Worn out parts of moving machinery.

The nearby villagers will also have some exposure of high noise level.

The existing noise levels at different locations in core and buffer zone of proposed Bagdewa UG are within prescribed limits.

Suitable mitigatory measures are to be taken for the impulsive impact of noise at the equipment emitting the higher noise levels at working place so that it is kept below the level as prescribed by Directorate General of Mine Safety (DGMS).

It is anticipated that the noise level at the work-zone and surrounding area will not increase, as same type of equipment will be deployed for the proposed expansion of Bagdewa UG.

19.2.5 Flora and Fauna

There are no endangered or endemic species of Flora and Fauna occurring in the core and buffer zone areas. No national park or sanctuaries are situated in the buffer zone or nearby, nor does the area form a breeding ground for migrating fauna.

In buffer zone, forest area will not be disturbed by any mining related activity. No migration of fauna is reported by forest department due to existing mining activities in the area. Massive plantation work in a scientific way by project authorities in this area may attract birds and other fauna in future. The area is also thinly populated. As such, consequent to the underground mining operation, deterioration in quality of life or loss of amenity is not envisaged.

19.2.6 Land Use

The land use pattern showing the existing as well as additional land requirement (In Ha.) is given in the table below.

(Area in Ha.)

Sl.No.	Particulars	Forest	Tenancy	Govern ment	Total
1	Land already acquired	282.28	143.51	76.81	**502.60**

No additional land required in unit – I.

19.2.7 Socio-Economic Status

The areas of impact as anticipated on the area include the following:

a) Employment opportunities: both directly and indirectly.
b) Acceleration of economic activities and urbanisation in the region with the creation of new employment opportunities.
c) Scope of In-migration:
d) Improvement of Educational, Health, Sanitation, Literacy level, communication, Vocational Training etc.
e) Social Forestry by plantation of trees on the vacant land of the project with the involvement of local population.

19.3 Environment Management

19.3.1 Air Quality Management

i) Coal Transporting: - At pit head CHP, Sufficient arrangement has been provided to suppress the coal dust at vulnerable points.

19.3.2 Water Quality

The effluents of liquid wastes from different sources as stated earlier, will get polluted. Besides the above effluents in the form of pumped out mine water, both due to seepage as well as precipitation will also be available. The state of pollution and remedies adopted for their control has been dealt below para-wise.

i) Water pollution from vehicle washing and workshop:

Since this water is mainly consumed in the maintenance and repair workshop of plant & equipment, floor washing of vehicles, it is felt that the pollution in the effluent from workshop shall mainly comprise of oil and greases besides other suspended solids. For removal of oil and grease and suspended solids, provision of sewage disposal arrangements with oil and grease trap and settling tanks etc. have been kept. The use of water in the workshop and vehicle washing is proposed to be done in a closed circuit. It is therefore felt that the C.O.D. of industrial effluent will be brought more or less the same as that of supply water for which provision of rapid gravity pressured filter with complete chlorinating unit has been provided. The clear water so obtained therefrom may be re-circulated for use. Under such circumstances, pollution of water due to effluent from workshop and vehicle washing area is not foreseen.

ii) Water pollution from dust suppression:

To avoid formation of dust due to abrasion of wheels of heavy equipment and wind, it has been proposed to spray water on haul roads and other roads, working places etc. Since dust is liable to be generated from dried surface only, spraying of water on dry surface of haul roads etc. will not form any effluent. As such, pollution on account of effluents from haul roads etc. has not been foreseen.

iii) Water pollution after domestic use:

The effluents available in the form of domestic sewerage from township and other sources namely toilets, canteens etc. have been proposed to be treated prior to discharge into surface chamber.

Domestic sewerage generated in the industrial area is proposed to be treated in Effluent Treatment Plants.

iv) Water pollution from mine water:

The mine water is proposed to be initially collected at the main sump located within the mine from where it will be pumped out to the surface and collected in a sedimentation tank. Then clear water will be discharged into nearby nalla.

The quality of mine discharge would be within the tolerable limits, as specified by M.O.E.F. As such no specific treatment for mine discharge is felt necessary. However, at the time of monitoring of environmental pollution during mining operations, if any specific treatment is felt necessary; the same shall be incorporated.

16.3.3 Noise Management

The following control measures are proposed as to protect workers / habitants from any continued exposure to a sound level greater than 90 dB.

i) The operators of stripping and coal winning equipment are accommodated in cabins which are acoustically designed and air conditioned and form a part of the equipment, the level of sound inside the cabin is below 90 dB.

ii) For Fixed plant installations with high noise level, noise absorbent padding shall be provided between the foundation and the base plate of the plant.

iii) For reduction of high noise level from exhaust system of internal combustion engine, use of reactance type silencers is proposed.

iv) For reduction of high noise level of aerodynamic origin, use of absorption type silencers is proposed.

v) Regular maintenance and prompt replacement of worn-out parts is proposed.

19.3.4 Flora and Fauna Management

There are no endangered or rare species of flora and fauna in and around the project area. In buffer zone, forest area will not be disturbed by any mining related activity. Massive plantation work in a scientific way by project authorities in this area may attract birds and other fauna in future. The area is also thinly populated. As such, consequent to the opencast mining operation, deterioration in quality of life or loss of amenity is not envisaged.

Conservation plans of schedule I & II animals, if any, will be prepared and implemented.

19.3.5 Land Resource Management

As the mine is an underground there will be no land degradation. Some subsidence will occur which will be under control.

19.4 Environment Management System

Environment Management System involves two factors:

i) The protective measures to be taken and system to be developed to avoid and control the pollution during the operation of the mine itself and also for the other operations related to the mine as well as after closer of the mine.

ii) To comply with the above protective measures and to implement the systems the capital and revenue provisions involved.

The capital provision made for environment protection; land reclamation measures and other revenue cost per annum on environmental obligations are to be given.

19.5 Capital Provision

Environmental and social cost has been provisioned separately.

CHAPTER-XX

MINE CLOSURE PLANNING

20.1 PREAMBLE

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. in-situ stress field, ground water, surface drainage system as well as the socio-economic condition. Although mining activities are usually short term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mind set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues viz. reclamation and environmental protection, rehabilitation of disturbed area. Community implementation of mine closure plan will incur some extra cost, neglecting this aspect will lead to future problems of attending compensation or expensive socio-economic problems.

Hence, efforts have been made to identify the likely impacts on geo-environmental and socio-political set-up due to closure of the proposed mine during the planning stage itself, so that it will offer an opportunity to generate resources for mitigative measures during closure of the mine.

20.2 LIFE CYCLE CONCEPTS

Mining projects have a definite life cycle. All the mines have to eventually close their operation. The reasons for the closure may be many including economic conditions, depletion of mineable resource or any other unforeseen safety reasons.

In the present project proposal the mine life cycle planning is governed by the reserves content in the proposed mining area. Here, it is planned to exploit seams, seams III T & B, II A. in the proposed mine area. The mine life is estimated as 13 years. It is suggested that the activities for closure will be initiated at an early stage of project life in a gradual/planned manner.

20.3 MINE CLOSURE PHASE

The mine closure phase is supposed to be closed when the mine is de-commissioned, facilities at site are removed, the mine entries are sealed / fenced off, the management of waste dump/tailing is completed and the site is released in ecologically sustainable state suitable for proposed land use.

The likely impacts due to closure of the mine in so far as the geo-technical/safety/environment and socio-political aspects are concerned and the suggested mitigative measures are elaborated as under:

A) Technical aspects:-

i) Mine Entries: It is suggested that mine openings & workings will be properly closed & sealed so as to prevent any danger to post-mining uses of area.

ii) Service Buildings: The service buildings/structures will be removed/ demolished or may be used for some offices and the land covered under them restored for productive uses.

iii) Hazardous substances: Prior to surface demolition/restoration, a surface audit will be undertaken on all surface structures, spoil heaps, lagoons etc. to assess whether there are any hazardous materials that could cause problem i.e. explosive, asbestos, chemical oil etc.

iv.) Disposal of assets: A list of surface and UG assets (P&M) will be prepared and made available to potential purchasers or transferred to other new/working mines of the company. This will ensure that the assets perform till its economic life and have better utilisation of assets.

B) Environmental aspects

i) Post closure Env. Monitoring: It is suggested that the air & water quality parameters in the mined out area is monitored by some agency even after closure of the mine.

ii) Land reclamation and rehabilitation: The area on surface is mainly covered by forest, tenancy, cultivable & Govt. land. The method of mining is depillaring by caving under low to moderate depth of cover. The degradation of surface is expected due to caving. If any cracks / voids are created due to underground mining activities, it will be restored to original profile by filling up cracks / voids. The post-mining surface profile is should also ensure no accumulation of water and to maintain the general drainage pattern. It is suggested that the site restoration is progressive so that the restoration is more or less similar to the rate of mining.

The objective of restoration of post mining area will be determined through consultation with local community and the govt. authority, so that the potential/ required end use of the mined out land is determined in advance. Such usage may be agriculture, forestry, amenity development or nature reserve. Necessary capital provision in the revenue account is indicated in the report.

C. Socio-political aspects

i) Mining Community: Due to closure of mining operation persons directly employed in the mine will be surplus. It is suggested that suitable manpower plan may be formulated by the mining company sufficiently before closure of mine for redeployment of the work force in other units of the company.

The community in the region is highly dependent on agriculture and other activities. The existence of mine is likely to provide employment or other indirect benefits to the community. The mine closure is likely to create negative impact on the socio-economic condition of the region. It is suggested that the mine owner will interact with the local govt. to establish strategy for supporting the project affected community of the region by promoting investment in non-mining related enterprises.

ii) **Mining Township and Water supply:** It is suggested that the civic facilities developed during the mining phase will be transferred to the local govt./ municipality so that, the region transforms smoothly into post-mining phase.

The plan of closure shall be implemented in consultation with all stakeholders including state government.

20.4 FINANCIAL ASPECT

A corpus fund is proposed to be created and provision has been made in Appendices A.8.4 and will be released at the time of undertaking mine closure activity. It may include cost of all closure activities, post-mining land use, organisation for executing closure activities, post-project monitoring activities, etc.

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CHAPTER XXI

LAND REQUIREMENT, R&R PACKAGE &PROJECT IMPLEMENTATION SCHEDULE

21.1 LAND ACQUISITION

21.1.1 Quantum & Type of Land

Land over the mining area:

The mining area under the project covers Bagdewa UG project is about 5.02 sq. km. The details of the land use within the proposed mine boundary is shown in Table(21.1 as under (refer Plate-V III: Land Use Plan):

Table -21.1: Details of Land Use within the Bagdewa project

Sl. No.	Name of the Village	Tenancy(Ha)	Govt. (Ha)	Revenue Forest (CJJ/BJJ)(Ha)	Total(Ha)
1	Bagdewa, Lakhanpur Amarpr, Bijaypur	143.51	76.81	282.28	502.60

Large part of the area in the project falls under intensively cultivated land, villages, etc. It is expected that surface subsidence will occur while depillaring under shallow to moderate depth of cover and involving two seams.

In view of likely damage on the surface land, it is proposed to acquire tenancy, govt. land, etc. and forestry clearance has already been obtained. Purchase / acquisition of tenancy land should be initiated.. Provision has, also, been made for rehabilitation of the villages falling within the proposed mine boundary. However, barrier has been left in the underground against faults, 15m hard cover line and nalla on the surface.

Land requirement for the mine:

Bagdewa UG being an operating underground project, no additional land is required for the construction of colony, roads, etc. Provision has been made for acquiring entire land falling within the project boundary similar to previous RPR.

The details of head-wise land requirement and capital provision have been provided in Appendix-A.1.

21.1.2 Status of Notification

The existing mining area under the Bagdewa UG is notified under CBA Act. Additional area annexed on the North East side is Forest area for which mining right/clearance has been obtained. Process of acquiring land may be initiated at the earliest.

21.1.3 Time-frame for acquisition with capital provision

The phasing of the quantity of land and its capital provision is shown in Appendix-A.1.

21.2 R&R PACKAGE

Rehabilitation and Resettlement has been envisaged tentatively as detail is still awaited from the area authorities, the provisions have been detailed in Appendix A.8.1.

21.3 PROJECT IMPLEMENTATION SCHEDULE

Bagdewa UG is an operating mine and a completed project. All major infrastructures have been constructed. The activity for project i.e. further mine development, land acquisition will commence only after the sanction of the Project Report. Initially effort would be made for land acquisition for the depillaring operation.

Zero Date:

The zero date for the project has been considered as the date of sanction of RPR. The project construction activities would start from Year 1. It has been assumed that the activity of land acquisition would be completed in two (2) years. EMP clearance of the project is already obtained for 502.60 Ha.

For timely implementation of project, it is essential that all activities related to construction of the project are properly scheduled, closely monitored and effectively supervised. All departments will have their own implementation schedule to get the project constructed within the time frame. The resources should be made available in time as soon as the project report gets sanctioned to prevent time & cost over run.

The construction activities are required to be identified in detail for appropriate monitoring and timely implementation of the proposed project so that the project achieves its target output within time frame.

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Chapter – XXII

FINANCIAL EVALUATION

22.1 GENERAL

Bagdewa UG project is an operating mine with semi mechanised technology (UDMs & LHDs). The previous RPR and Present report envisages underground mining of seams III TOP, III BOTTOM and II A in same mining area of about 5.02 sq. K.m. with B & P technology, deploying 10 sets of LHDs for coal lifting, UDMs for coal face drilling, roof drilling for support and belt conveyor for coal transport to surface, Provision has been made in this RPR of Bagdewa UG project for an average production of 0.75Mty.

Earlier RPR for Bagdewa UG project was prepared for a capacity of 0.405 Mty and the total capital requirement worked out to Rs 2392.72 Lakhs This revised RPR of Bagdewa UG Project projects a Total capital of Rs 11760.28 lakhs. The total additional capital proposed to be spent over a period of 13 years is Rs. 8711.95 lakhs. The Head wise break up of the total capital estimates and the yearly phasing has been given in Appendix A.

Prices of plant and Machinery are based on the data supplied by the area and the Standard Price list circulated by CMPDI (HQ) Ranchi in December 2009.

The salary and wages have been computed as per NCWA VIII .and taking Midpoint under each category of scale.

Particulars	
Target Production (Mty)	0.75
Total Capital Investment (Rs. Lakhs)	11760.28
Additional Capital Investment (Rs.Lakhs)	8711.95
Specific Investment (Rs. / tonne)	1568.03
Total Capital Investment on P&M (Rs. Lakhs)	4294.27
Specific Investment on P&M (Rs. / tonne)	572.57

22.2 COMMERCIAL READINESS

A project will be treated to have reached the stage of commercial readiness to yield production on sustainable basis from the year when all the following criteria have been achieved –

For Underground projects:-

1) Minimum essential mine development works like drivage of main inclines / adits / drifts / shafts, etc. installation of haulage arrangements and ventilation arrangement, pit top and pit bottom transport arrangements as required for attaining targeted level of coal production as per RPR have already been constructed and commissioned. Bagdewa is an operating mine major infrastructure already exists.

2) In case of projects with Bord and Pillar System of mining, underground workings have adequately progressed and adequate number of main mining equipment have been commissioned to enable target of the first year.

3) The land required for the project (up to target year) has been acquired.

4) Construction of CHP and railway siding has been completed or adequate alternative arrangement for sizing and dispatch of coal have been commissioned for the project.

The project will be in commercial readiness from 1st year as it is an existing project with the facilities required for achieving first year production. Some additional infrastructure facilities required for target to be completed by the Second Year. Most of the infrastructure facilities, like approach road, CHP, workshop, service buildings, power supply, water supply and other development activities for mine operation already exist at the mine.

22.3 MANPOWER, EMS & OMS

Considering the phasing of equipment (as per mining schedule) manpower requirement has been estimated as 1121 with B&P technology The detailed break-up of manpower into various services and the estimated annual wages/salary and benefit cost has been shown in Appendix-B and B.1 respectively. The salary, wages and benefit of workers, staff and officers have been calculated as estimated and circulated by CMPDI (HQ), Ranchi.

The overall EMS works to Rs. 1631.33 respectively. Correspondingly, the overall OMS at target production capacity works out to 2.56 t.

22.4 FOREIGN CAPITAL

No foreign capital will be involved in this project for procurement of equipment.

22.5 COST OF PRODUCTION

The cost of production has been estimated without considering loan capital. The break-up of different cost elements is shown in Appendix-C. The cost of production at different operation level is given in Appendices C.1 & C.3. Summary of production cost at production level of 100% & 85% of target production is as under:

Particulars	
Cost of Production (Rs. /t) (at 100%)	1301.59
Cost of Production (Rs. /t) (at 85%)	1483.38

Salient points regarding estimation of revenue costs are mentioned below:-

a) **Salary/Wages :** Based on the midpoint of salary/wages of NCWA VIII the salary/wages cost has been calculated which takes into account relevant pay scales, VDA with reference to latest AICPI and other perks applicable.

b) **Store :**

1) **Timber/Roof Bolting:** Based on approximate consumption pattern and/or as estimated unit cost in UG mines in the Area.

2) **POL & Miscellaneous store cost:** As per CMPDI norms.

c) **Power:** Detailed calculation of specific energy consumption per tonne of output is given in the chapter for power supply, illumination, etc. Power cost per unit kWh is considered as average Rs.6.0/unit.

d) **Misc. expenses including w/debit:** As per CMPDI norms.

e) **Depreciation:** Based on latest schedule of depreciation of CIL.

f) **Administration charges:** It is taken as Rs.48.99 per tonne of annual output based on average cost per tonne of SECL of preceding year.

g) **Interest on**

i) Working capital - @ 14.5%

h) **CSR** cost has been considered @ Rs.5/Te

22.7 GRADE OF COAL & SELLING PRICE

The overall grade of ROM coal for this Project has been assessed as B, on weighted average basis. The Financial Evaluation has been done base on the avergé selling grade and selling price of coal has been considered as per CILs last revision made on 26.02.2011 to be effective from 00 hours of 27.02.2011. The overall weighted average selling price of ROM coal has been estimated at 98.5% of sales realization. This includes sizing charges, transportation and loading charges. For overall economic evaluation of this Project (IRR calculation) year-wise weighted average selling price of ROM coal has been considered. The average selling price of coal has been estimated to be Rs.3658.03 /t,

22.8 PROFITABILITY

The average selling price and profitability at different level of operation is presented in Appendix-C.1 & C.3. The profitability at production level of 100% and 85% of target production are as under:

Particulars	
Av. Selling Price (Rs./t)	3658.03
Profit (Rs./t) (at 100%)	2356.44
Profit (Rs./t) (at 85%)	2174.65

22.9 BREAK-EVEN PRODUCTION

Applying the norms formulated by CMPDI for assessing the variability of the different cost elements for underground mine, it is break-even capacity is as under:

Particulars	
Break-even Capacity (%)	31.42
Break-even Production (Mty)	0.23

22.9.1 TRANSPORTATION & LOADING CHARGES

Coal will be transported from mine site to Surakachhar siding by trucks. At the surface, coal will loaded onto trucks through overhead hoppers. For transportation of coal from mine site to the siding, transportation charges of Rs 61.61 /t has been taken, while loading charges has been considered as Rs. 5.9 /t.

The distance of coal transportation from mine site to siding is more than 22.60 km, sized coal (-200mm) is likely to be available, hence additional sizing charges of Rs. 39.0 / t has been charged. The transportation and loading charges will be realized from the customer as per the pricing policy.

22.10 INTERNAL RATE OF RETURN (IRR)

The financial Internal Rate of Return (FIRR) of the Project for above mentioned alternatives is as tabulated below:

Particulars	
Financial IRR (at 100% apacity)	692.31
Financial IRR (at 85% capacity)	528.85

During IRR calculation, the total capital has been distributed head-wise up to target year considering requirement of the project. The year-wise production and year-wise selling price, considering grade of coal for respective years, have been considered for IRR calculation. The above IRR has been estimated without considering loan capital.

22.11 COMPLETION COST OF THE PROJECT

Considering initial investment, completion cost of the project has been estimated as Rs.12201.37 lakhs.

22.12 CONCLUSION

Technological option has been evaluated for Bagdewa UG project. The summary of the result is as under:

Particulars	
Target Production (Mty)	0.75
Total Capital Investment (Rs. Lakhs)	11760.28
Capital Investment on P&M (Rs. Lakhs)	4294.27
Cost of Production (Rs./t) (at 100%)	1301.59
Cost of Production (Rs./t) (at 85%)	1483.38
Av. Selling Price (Rs./t)	3658.03
Profit (Rs./t) (at 100%)	2356.44
Profit (Rs./t) (at 85%)	2174.65
Break-even point (%)	31.42
Break-even production (Mty)	0.23
FIRR (at 100%)	692.30
FIRR (at 85%)	528.84

The B & P technology with high capacity LHD and UDMs for Bagdewa UG project has achieved the stipulated rate of financial IRR of 12% at 85% of target production level required for approval. In an effort to introduce mechanization in underground mines of SECL/CIL, This technology appears to be most appropriate for the project.

Hence, the project is recommended with B & P technology with high capacity LHD (3cum) with UDM combination for a target production of 0.75 Mty. The project can produce 0.76 Mty in case of favorable geo-mining conditions but it may not be on sustainable basis. Hence, peak production is considered as 0.76 Mty against normative production, i.e 0.75 Mty. The normative and peak production is 0.75 Mty and 0.76 Mty, respectively. This report is being submitted for obtaining approval for annual peak coal production level.

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APPENDICES

FINAL REVISED PROJECT REPORT FOR BAGDEVA U/G (.75MTY)
STATEMENT SHOWING THE ESTIMATED HEADWISE CAPITAL INVESTMENT
FOR THE PROJECT ALONG WITH PHASING

APPENDIX-A

(AMOUNT IN RS.'000)

Sl.No	PARTICULARS	EXISTING CAPITAL (31.03.2009)	ADDIT. CAPITAL REQD.	TOTAL CAPITAL	EMP CAPITAL	PHASING						RATE OF DEPRECI A-TION %	ANNUAL DEPRECI ATION
						YEAR 0	YEAR I	YEAR II	YEAR III	YEAR IV	YEAR V		
1.	LAND	4527	285761	290288		4527	120857	82452	82452				
2.	BUILDING:-												
	a) SERVICE	16349	884	17233		16349		442	442			7.69	1325.615
	b)RESIDENTIAL	37199	138802	176001		37199	50000	38802	50000			1.72	3027.217
3.	PLANT & MACHINER	114546	314881	429427		114546	101518	130448	73458	5719	3738	5.15-100	29698
4.	FURNITURE & FITTINGS	268	260	528		268	200	60				5	26.4
5.	RAILWAY SIDING											5.55	
6.	VEHICLES	2898	2700	5598		2898	2700					7.07-11.31	622
7.	PROSPECTING & BORING		1200	1200					500	700		7.69	92.30769
8.	DEVELOPMENT											"	
8.1	CAPITAL OUTLAY IN MINES	112589	51500	164089		112589	40750	8750	2000			7.69	12622.23
8.2	ROADS & CULVERTS	8498	18767	27265		8498		5767	3000	10000		7.69	2097.308
8.3	WATER SUPPLY & SEWAGE DISPOSAL	2992	54356	57348		2992		20356	14000	20000		7.69	4411.385
8.4	EMP CPITAL(OTHERS)		1200	1200	26200			1200				7.69	92.30769
8.5	RESEARCH & DEVELOPMENT												
8.6	PR PREPERATION COST	4967	883.885	5850.885		4967	883.885					7.69	450.0681
	TOTAL OF 8	129046	126706.9	255752.885	26200	129046	41633.9	36073	19000	30000			19673.3
	TOTAL OF 1 TO 8	304833	871194.9	1176027.89	26200	304833	316909	288277	225852	36419	3738		54464.84
9.	OTHER EXPENCES OF REVENUE NATURE CAPITALISED DURING THE DEVELOPMENT PERIOD(NET)												
	TOTAL OF 1 TO 9	304833	871194.9	1176027.89	26200	304833	316909	288277	225852	36419	3738		54464.84
10.	LESS DEPRECIATION DURING THE DEVELOPMENT PERIOD												
11.	OTHER CAPITAL											5	
	TOTAL CAPITAL INVESTMENT	304833	871194.9	1176027.89	26200	304833	316909	288277	225852	36419	3738		54464.84

ESIMATED COMPLETION CAPITAL 1220137.67

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REVISED PROJECT REPORT BAGDEVA UG(0.75 Mty)

STATEMENT SHOWING THE CAPITAL INVESTMENT ON LAND

(Amount in Rs. Lakhs)

Sl. No.	Particulars	Total Land Requirement (Ha)	Total Capital	Existing		ADDITIONAL			Year-wise Phasing of Additional Capital				
				LAND AREA (Ha)	AMOUNT	Forest /TenancyLand (Ha)	UNIT RATE	Total	Year 1	Year 2	Year 3	Year 4	Year 5
A.	AREA WITHIN PROPOSED MINE BOUN	502.6											
A.I	Mining rights area												
1	Land Use within mining area												
a	Forest Land (Revenue / Reserve)												
b	Tenancy Land	143.510		21.554		117.79	21	2473.55	824.52	824.52	824.52		
c	Govt. Land	76.81				76.81	5	384.05	384.05				
	(Expenditure already incurred on Land)				45.27								
d	colony surface right			4.168									
A.II	Forest Land for Depillaring							0.00					
a	Net Present Value of Forest Land(50%)	282.28		282.28									
	GRAND TOTAL	502.600	2902.87		45.27	194.60		2857.60	1208.57	824.52	824.52		

Job No. 501085

Note : 1 Rate of purchase of tenancy land is considered as Rs.21.0Lakhs/Ha as provided videChattisgarh state Notification.
2. The estimates of area and capital provision for land requirement are tentative and may vary during implementation
3.The rate for compensation for tenancy land has been taken as average Rs 2Lakhs per Ha
(Land details given are tentative.Miner changes in figures of additional land to be acquired may take place at the time of actual acquisition due to unforseen discrepencies/anamolies in different records with different departments of state govt.)

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APPENDIX-A.2

Revised Project Report for Bagdewa Under Ground Mine (0.75 Mty)

Statement showing the Capital Expenditure on Civil Works

(Amount in Rs. Lakhs)

Sl.No.	Particulars	Sanctioned RPR Amount	Existing as on 31/03/10 Amount	Additional Amount	Total Amount
1.	Service Buildings	140.00	163.490	8.840	172.330
2.	Residential Buildings	400.18	371.990	1388.020	1760.010
3.	Roads and Culverts	43.68	84.980	187.670	272.650
4.	Water Supply arrangement	73.40	29.920	171.480	201.400
6.	Sewerage System	30.27	0.000	372.080	372.080
	Total	687.53	650.380	2128.090	2778.470

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Revised Project Report for Bagdewa Under Ground Mine(0.75 Mty)

Statement Showing the Estimated Capital Expenditure on Service Buildings

(Amount in Rs. Lakhs)

Sl. No.	Particulars	Unit	Sanctioned RPR Amount	Status	Existing Amount as on 31/03/10	Additional Provision			Total Amount
						Area/ Length	Rate (Rs) at 1814 CI	Amount	
1	Project Office	Sq.m.	17.23	Existing					
2	Stores shed	Sq.m.	14.39	Existing					
3	Boudary wall	RM	16.13						
4	Workshop			Existing					
	i) Various shops (clear height 6m)	Sq.m.	14.27						
	ii) Boundary wall	RM	1.86						
	iii) Bituminous pavement	Sq.m.	3.66						
	iv) Electrical switch room, control room, stores, engineer's room etc.	Sq.m.	6.50						
	v) Washing platform	Sq.m.	0.30						
	vi) Toilet	Sq.m.	1.14						
	vii) Reservoir	Ltr.	0.30						
	viii) Pump House	Sq.m.	0.28						
	ix) Stock/ scrap yard	Sq.m.	1.77						
	x) LMV/scooter/cycle shed	Sq.m.	1.62	Existing					
	xi) Time/ security office	Sq.m.	0.33						
	xii) Gates	No.	0.45						
5	Sub-Station			Existing					
	i) Building	Sq.m.	5.15						
	ii) Boundary wall	RM	1.81						
	iii) Yard	Sq.m.	3.00						
6	Canteen (50 seater)	Sq.m.	4.70	Existing					
7	Dispensary	Sq.m.	6.34						
8	First Aid Centre	Sq.m.	0.73	Existing					
9	Lavatories & Urinals (4 seater)	Sq.m.	1.90						
10	Service Magazine	Sq.m.	4.00	Existing		86.00	9977.00	8.58	
11	Vocational Training Centre	Sq.m.	0.00						
12	Cap Lamp Room (800 lamps)	Sq.m.	5.72	Existing					
13	Garage	Sq.m.	3.10	Existing					
14	Fan House	Sq.m.	5.00	Existing					
15	Haulage Engine House	Sq.m.	4.20	Existing					
16	Security Room/ Cabin	Sq.m.	0.21						
17	Parks & Play ground		2.50						
18	Soil Investigation		1.00						
19	Internal roads to service buildings		6.66						
20	Total		136.25						
21	Miscellaneous 3%		3.75						
22	Telephone Exchange			Existing					
23	Clay catridge shed			Existing					
24	Weigh Bridge			Existing					
25	MTK			Existing					
	Total		140.00		163.49			8.58	172.07
	Contingencies @ 3%							0.26	
	Grand Total		140.00		163.49			8.84	172.33

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Appendix - A.2.2

Revised Project Report for Bagdewa Under Ground Mine (0.75 Mty)

Statement Showing the Estimated Capital Expenditure on Residential Buildings

(Amount in Rs. Lakhs)

Sl. No.	Category/Scale	Type of Qtr.	Sanctioned RPR Provision		Existing as on 31/03/10		Balance requirement			Total Amount
			Qtr. No.	Amount	Qtr. No.	Amount	Balance Qtrs. reqd.	Unit cost at 100 CI	Total cost at 1814 CI	
1	Cat-I toVI and Grades B,C,D&E	MQ	465	206.17			362	0.150	985.00	
2	8571.79 and 8575.06	A	5	6.92	108		0	0.157	0.00	
3	8880.56 to 15199.08 and Grade -A,Spl.Grade	B	88	123.78	34		54	0.224	219.42	
4	E1 to E6	C	12	35.24	6		6	0.359	39.07	
5	E7 and above	D	1	4.75	0		1	0.772	14.00	
6	Hostel type Accommodation		24	23.32			24	0.099	43.10	
7	Provision for rain water harvesting							LS	19.00	
8	Provision for land development and horticulture							LS	28.00	
	Total		595	400.18	148	371.99	447		1347.59	1719.58
	Contingencies @ 3%								40.43	
	Grand Total			400.18		371.99			1388.02	1760.01

Note : 1. Since no additional manpower is required, no. of balance quarters requirement will remain unaltered over RPR provision.
2. Excess A type quarters have been adjusted against MQ type requirement.
3. All quarters will be of minimum (G+3) configuration considering optimal utilisation of land.

Appendix-A.2.3

Revised Project Report for Bagdewa Under Ground Mine (0.75 Mty)

Statement showing the Building Cost Index with reference to 100 Base in Delhi as on 1.10.75 in December 2010

SL. NO.	DESCRIPTION	UNITS	RATES AS ON 1.10.75 AT DELHI	RATES AT AREA	PERCENTAGE INCREASE (RATIO BETWEEN COL.5&4)	WEIGH-TAGE	COST INDEX
1.	2.	3.	4.	5.	6.	7.	8.
1	BRICKS	1000	106.15	1500	14.13	16.0	226.08
2.	SAND 67% COARSE. 33 % FINE	Cu.M	21.92	150	6.84	5.0	34.20
3.	CEMENT	QUINTAL	35.28	470	13.32	21.0	279.72
4.	STONES 50% - 40mm AGGREGATE 50% - 20mm	Cu.M	27.10	820	30.26	6.5	196.69
5.	TIMBER (SAL/BIJA SAL)	Cu.M	2021.00	33550	16.60	18.0	298.80
6.	MILD/TOR STRUCTURAL STEEL	QUINTAL	183.20	3650	19.92	10.0	199.20
7.	LABOUR :						
	a) MASON	EACH	9.89	192.00	19.41	8.5	164.99
	b) CARPENTER	EACH	9.89	192.00	19.41	4.0	77.64
	c) UNSKILLED	EACH	4.41	135.00	30.61	11.0	336.71
					TOTAL		1814.03
					SAY		1814

Job No. 501085

RI.V,CMPDI