
Chapter - 1

INTRODUCTION

1.1 INTRODUCTION

The proposed Penganga OC is located South of existing Mugoli OC/Kolgaon OC Mines, which forms the south-western most coal bearing area of western limb of Wardha Valley Coalfield. The Mugoli Extension block assessed in the present Project Report is basically an extension of Mugoli block across the Penganga river. Hence, in Planning Committee meeting held in WCL on 05.3.2008, it was decided that the proposed Project may be re-named as Penganga OC (Mugoli Extn.). The presence of coal in this part was earlier proved in scout borehole drilled by MECL and based on a borehole drilled in this block during the period 28-03-1998 to 06-05-1998 a geological note was prepared entitled “Geological note on exploration for coal in South of Mugoli Block, Wardha Valley Coalfield, Dist-Chandrapur, Maharashtra, in April 1999”.

Later on total 44 boreholes were drilled by CMPDI in Mugoli Extn. Block with the total meterage of 4846.50 m during the period from 20-07-2005 to 12-06-2007. The yearwise and agencywise break up of the boreholes and meterage considered for this documentation are given below in Table -1.

TABLE – 1
AGENCYWISE & YEARWISE DRILLING, MUGOLI EXTN. BLOCK

Period of drilling	No. of boreholes	Meterage Drilled (m)
1. CMPDI		
2005 – 2006	26	3035.00
2006 – 2007	12	1227.00
2007 – 2008	6	584.50
Sub-Total	44	
2. MECL		
1998-1999	1	204.00
Total	45	5050.50

1.2 BACKGROUND OF PROJECT REPORTS

WCL Board in its 214th meeting held on 23-10-2008 accorded approval for the Project Report of Penganga OC for a capacity of 3.0 Mty with a capital investment of ` 339.7706 crs on partial Hiring of Equipment with notified price. (i.e., the total workload of Top OB would be catered by Departmental HEMM and Coal and parting OB will be done by Surface Miner and Shovel/Dumper respectively on Hiring). Enhanced land rates, new R&R policy 2012 and other cost parameters necessitated updation of Project Report of Penganga OC.

The Project Report (updated September,2012) on Partial Hiring option has been presented and discussed in the Technical Sub-Committee of WCL Board for Projects, held on 16.11.2012 at WCL (HQ), Nagpur.

After detailed deliberation, the Committee recommended the following to WCL Board to recommend to CIL Board –

1. For 1st Stage approval for the PR of Penganga OC for a capacity of 3.0 MTPA with a capital investment of Rs 681.05 Crs on Partial Hiring Option.
2. As the Project is not yielding the requisite IRR at Notified price, it was decided to recommend to CIL Board for approval for fixing of Project specific Notified Price of coal which will yield the requisite 12% IRR at 85% capacity utilization.

The Project Report of Penganga OCM prepared in September,2012 has been financially appraised by M/s aXYKno and the findings of the

Financial Appraisal Report are in conformity with the PR prepared by CMPDI (Refer Annexure –III).

However the PR is again financially updated to March, 2014. The salient comparative features of the proposed project are as follows :

The WCL Board in its 254th meeting held on 28th April, 2014 agreed to the

Sl No.	Particulars	Partial Hiring Option September,2012		Partial Hiring Option (Updated March,2014)	
A	Financial Parameters	For Power Sector	Other Than Power Sector	For Power Sector	Other Than Power Sector
01	Capital Required (Rs.in Crs.)	681.05		696.0687	
02	Cost of Production (Rs./t)				
a)	@ 100% of target capacity (Rs./t)	1090.53		1181.11	
	@ 85% of target capacity (Rs./t)	1233.75		1336.48	
03	Av. Selling Price (Notified) (Rs./t)	792.50	1049.00	877.00	1171.50
04	Loss (Rs./t)				
a)	@ 85% of target capacity (Rs./t)	441.25	184.75	459.48	164.98
05	Financial IRR (%)	Negative		Negative	
06	Price to yield 12 % IRR @ 85% capacity (Rs./t)	1330.33		1439.01	
07	<i>Difference between price to yield 12 % IRR @ 85% capacity & Av. Selling Price (Notified) (Rs./t)</i>	537.83	281.33	562.01	267.51

Project Report of Penganga OC Mine (March,2014), and recommended the following to CIL board :

- Approval of Project Report of Penganga OC Mine for a capacity of 3.00 Mty with capital investment of Rs.696.0687 Crores on partial hiring basis.
- Approval for fixation of project specific notified price of coal to yield requisite 12% IRR at 85% capacity utilization as it is not yielding the requisite IRR at notified price with a provision of revision of the price as per Model FSA for cost plus mines/extant guideline of CIL/MOC .

Board matter referred to above is enclosed as Annexure –I.

Till June,2014 , the above Project of Penganga OC Mine for a capacity of 3.00 Mty with capital investment of Rs.696.0687 Crs. on partial hiring basis has not been placed before CIL Board for approval. In the meantime, in pursuance to a discussion at WCL, held on 25.6.2014, it was decided to review the project so that viability of project is achieved and the same was

also discussed with CIL on 17.7.2014. Accordingly, GM (PMD), CIL, vide his letter dated 28.7.2014 returned the PR of Penganga OCP for review.

In the meantime, with reference to letter no. WCL/C-1(E)/P&P/SPP/261 date 25.6.2014, the Chief General Manager (P&P), WCL requested to review the Project report of Penganga OC with reference to discussion on projects held on 25th June 2014 at WCL HQ. It is requested to review the project report of Penganga OC following modification so that viability of project is achieved –

1. Explore possibility to increase the production capacity.
2. With deployment of surface miner it is envisaged that quality of coal may be improved by segregation of parting to improve grade of coal produced.
3. Against departmental OB removal an exercise may be carried out for partial removal of OB by balance departmental capacity of Ghughus O/C (excluding dragline).

Hence the Project Report of Penganga OC mine has been revised in July, 2014 on Partial Hiring Option considering following points:

- 1) By enhancing the annual target of the mine to 4.0 Mty .
- 2) Only upper benches of Top OB is proposed by departmental equipments (Excluding Dragline set) of Ghughus OC (2.60 Mm3/annum) and rest of the Top OB and partings will be excavated by Hiring of equipments. In this case mine capacity of Ghughus OCM is taken approximately 2.60 Mm3 for considering departmental workload in Penganga OC. Quality of Coal is improved from G11 to G10 considering removal of parting P1 & P2 of composite seam either by shovel dumper combination or Surface Miner based on suitability of existing geological conditions.
- 3) It is proposed to utilize the existing colony of Ghughus OCM. Hence about 17.94 Ha land , earlier proposed for colony outside mine area is reduced.

- 4) Due to removal of partings from coal seam, stripping ratio of the mine is increased from 3.61 m³/t to 3.67m³/t. Only 2% mining losses in coal without contamination in coal is considered.
- 5) **The Revised Project Report (July,2014) has been presented and discussed in the Technical Sub-Committee of WCL Board for Projects, held on 06.08.2014 at WCL (HQ), Nagpur. After detailed deliberation, the Committee directed CMPDI to consider the following points in the Project Report before submitting to WCL Board for approval. (Annexure-II – Minutes of TSC meeting) -**
1. Provisioning of 1.7 m³ diesel hydraulic Backhoe and 28 KL water tanker for common equipment.
 2. Provisioning for removal of black cotton soil from the site of proposed external dump to ensure stability and safety of external dump.
 3. Change in Dozer capacity from 320 HP to 410 HP.
 4. To revise the design of CHP to facilitate unloading/loading of higher capacity trucks/tippers.
 5. Provisioning of monetary compensation in lieu of employment to 50% of land-oustee.

Hence the PR is finally modified in August, 2014 complying all the directions of TSC .Due to modification of the above PR, the financial paramerers has been changed. The sailent comparative features of the proposed project are as follows :

Sl No.	Particulars	Partial Hiring Option July,2014		Partial Hiring Option August,2014)	
		For Power Sector	Other Than Power Sector	For Power Sector	Other Than Power Sector
A	Financial Parameters				
01	Capital Required (Rs.in Crs.)	465.6527		441.8209	
02	Cost of Production (Rs./t)				
a)	@ 100% of target capacity (Rs./t)	877.33		856.82	
b)	@ 85% of target capacity (Rs./t)	960.18		934.45	
03	Av. Selling Price (Notified) (Rs./t)	1057.50	1399.50	1057.50	1399.50
04	Profit (Rs./t)				
a)	@ 85% of target capacity (Rs./t)	97.32	439.32	123.05	465.05
05	Financial IRR (%)	12.25%		12.21%	

1.3 JUSTIFICATION FOR THE PROJECT

In order to meet the ever-increasing demand for non-coking coal, WCL must expand within its command area and lead the industry by successfully introducing new and viable technology for underground and opencast mines. PR of Penganga OC proposes to mine coal from half incrop to maximum depth of about 170m. The target of the proposed mine is kept 4.00 Mty for a mine life of 15 years.

1.4 CONSTRAINTS / RISK IN MINING:

ACQUISITION OF LAND

Proposed Penganga OC mine involves acquisition of **about 763.06 ha of land**. Acquisition of land is very crucial Rs.24.70 lakh/ha have been proposed for acquisition of tenancy land and Rs 14.82 lakh/ha for government land. Rs 216.3948 crores is proposed for land acquisition and compensation to land losers. The compensation package for acquisition of land is as per new R&R Policy as per CIL guidelines.

1.4.1 SHIFTING & REHABILITATION OF WIRUR VILLAGE

Wirur village is located centrally in the proposed mine area and it is essential to shift and rehabilitate Wirur Village. Therefore, **a provision of about Rs.41.8870 crores is kept for shifting and rehabilitation of Wirur village.**

1.4.2 CONSTRUCTION OF BRIDGE OVER RIVER FOR APPROACH TO PROJECT SITE

Presently there is no approach to proposed project from Mugoli/Ghuggus OC side. Penganga river is flowing between existing Mugoli OC and the proposed Penganga OC . A bridge is essential and critical for approach to project and also for Coal transportation to nearest Ghugus railway siding. Provision of Rs. 36.3384 crores is kept for construction of bridge over Penganga river. Cost Benefit Analysis has been done in PR in which the above mentioned

bridge along Penganga river is technically and economically justified for coal transportation to Ghughus Siding and also men and material transportation from existing Ghughus / Mugoli OC projects. Till bridge is constructed, coal will be transported to nearest railway siding , Ballarshah which is about 35 km. from the proposed project area.

1.4.3 One Nala is located centrally in the proposed mine area and it is essential to divert. Therefore, a provision of about Rs.16.4857 crores is kept for diversion of Nala.

Chapter - 2

MARKETABILITY & JUSTIFICATION

2.0 INTRODUCTION

The mines of WCL are under constant pressure to meet the increasing demands of non-coking coal for power houses and other bulk consumers from Western as well as Southern part of country. The proposed project is located in Wardha coalfield of Chandrapur District. The justification of this mine has been studied in the light of estimated demand for non-coking coal from power sector in Maharashtra and production forecast from existing, completed and ongoing projects of WCL.

2.1 SECTOR-WISE DEMAND OF COAL ON COMPANY

The following table shows the sector-wise demand for non-coking coal, excluding middling, on WCL:

(Fig. in Mt)

Sl. No	Sector	Projections of Demand of Coal			
		2016-17	2021-22	2026-27	2031-32
1	Steel	0.451	0.502	0.477	0.577
2	Private Cokerries / Coke Oven / Others	0.039	0.039	0.039	0.039
Sub-Total (Coking)		0.489	0.541	0.516	0.616
1	Power (Utilities)-Raw Coal	48.318	48.300	48.309	48.273
2	Power (Utilities) - Middling	0.162	0.180	0.171	0.207
3	Power (Captive)	3.866	3.866	3.866	3.866
4	Sponge Iron / CDI	0.571	0.571	0.571	0.571
5	BRK and others/LTC/SSF	6.8761	6.8761	6.8262	6.7897
6	Cement	2.380	2.380	2.380	2.380
7	Colliery consumption	0.023	0.023	0.023	0.023
Sub-Total (Non-Coking)		62.1961	62.1961	62.1462	62.1097
Total (Coking + Non-Coking)		62.6861	62.7371	62.6622	62.7257

2.2 AVAILABILITY OF COAL FROM WCL

The following table shows the availability of coal from the mines of WCL:

(Fig. in Mt)

Sl No	Sector	Projections of Availability of Coal			
		2016-17	2021-22	2026-27	2031-32
1	Existing mines	0.480	0.410	0.200	0.200
2	Completed projects	11.961	4.910	3.698	3.178
3	On-going projects	17.421	13.685	7.998	3.843
4	Future projects	15.138	25.201	29.516	31.213
5	Additional Blocks applied for Retention	0.000	0.294	2.724	4.924
	Total Availability	45.000	44.500	44.136	43.358

2.3 DEFICIT IN AVAILABILITY OF COAL FROM WCL

Following table shows the deficit in availability of coal, including middlings, from the various Existing, Completed, On-going, and Future Projects of WCL:

(Fig. in Mt)

Sl. No	Sector	Projections of Surplus / Deficit of Coal			
		2016-17	2021-22	2026-27	2031-32
1	Demand for coal	62.686	62.737	62.662	62.726
2	Availability of coal	45.000	44.500	44.136	43.358
3	Surplus / Deficit (+/-)	(-) 17.686	(-) 18.237	(-) 18.526	(-) 19.368

2.4 UTILITY OR MARKET FOR THE COAL FROM MINE / PROJECT

The mines of WCL are under constant pressure to meet the increasing demand of non-coking coal for power houses and other bulk consumers from Western as well as Southern part of country. The proposed OC project is located in Wardha coalfields of WCL. The justification of this mine has been studied in the light of estimated demand for non-coking coal from power sector in Maharashtra and production forecast from existing, completed and ongoing projects of WCL.

2.5 AVAILABLE LINKAGE OR FIRM FUEL SUPPLY AGREEMENT (FSA)

Coal from proposed project would be supplied mainly to MAHAGENCO. Although in present scenario of power generation MAHAGENCO is in great need of coal, there is distinct possibility that normal demand would not materialise. However, no firm fuel supply agreement/ linkage is available for proposed mine.

2.6 JUSTIFICATION OF OPENING THE PROJECT BASED ON MARKETABILITY

From the above tables it is indicated that supply of coal from WCL mines is not even sufficient to meet linked demand in 2016-17. Thus, there will be no problem in marketing of coal from the proposed OC Project in view of deficit in availability of coal from mines of WCL in near future. Due to revision and increase in the land cost , Report of Penganga OC Mine is prepared. The Socio-economic impacts of Project have been considered and remedial measures have been provided in the project report.

Chapter - 3

PROJECT SITE INFORMATION

3.1 LOCATION & COMMUNICATION

The area of Mugoli Extension Block falls in the Korpana tehsil of Chandrapur district of Maharashtra State. The area is bounded by Latitude $19^{\circ} 48' 19''$ and $19^{\circ} 49' 27''$ and Longitude $79^{\circ} 13' 48''$ and $79^{\circ} 15' 36''$. The block is covered in the survey of India Toposheet No.- 56 M/1 and as per national grid the coordinates of the area is Latitude N – 1060992.510 & 1063065.889 and Departure E – 3024069.419 & 3027212.719.

The Chandrapur district township is located at the distance of about 55 kms from the block via Ballarshah. Ballarshah which is located in the eastern part of the block at a distance of about 35 kms. The approach to the area at present is from Ballarshah via Pauni and Gadegaon. Nearest railway station and railway siding is at Ballarshah.

The project can also be accessible from Ghughus OC/Mugoli OC side but at present there is no bridge for crossing Penganga River. In the Project Report a bridge over Penganga River is proposed for approach to project and coal transportation. This bridge will connect the project from Ghugus siding, which is at about 20 km distance.

3.2 TOPOGRAPHY & DRAINAGE

The entire area of the block is covered by agriculture land with black cotton soil and exhibits a gently undulating topography with general slope from south to north direction. The altitude of the area ranges between 176.60 m and 189.73 m. The HFL of the area is 185 m and about whole quarry falls below HFL.

The main drainage of the area is controlled by the Penganga river, which is flowing northerly and is also demarcating the western limit of the block. Few small seasonal nalas are passing through the area and their flow direction is from south to north. These nalas joins easterly flowing Penganga river in the north which ultimately joins Wardha river near Erai village. The details of surface features and topography have been shown in Plate – II.

3.3 CLIMATE

The area is characterised by subtropical climate. The highest day time temperature recorded is 48⁰ C during winter season the temperature goes down to 10⁰ C. Monsoon are normally active during the period from 15th June to 15th September. The annual rain fall data were recorded at Mugoli O.C. Mine, WCL, Korpana tehsil, district Chandrapur for the period 1997 to 2007 July and it indicates the minimum 673.03 mm (year 1997) and maximum 1814.5 mm (year 2006) of total annual rainfall .

3.4 PRESENT LAND USE PATTERN

The block is mostly covered by privately owned cultivated land. The crops are generally seasonal such as wheat, cotton, pulses etc. The Wirur village of approximately 300 houses is located in the northern part of the area, situated closer to Penganga river, falls in proposed mine area. The other village Sonarli is located outside the area of the block at the distance at about 1.00 km in the south western direction.

Chapter - 4

GEOLOGY AND DEPOSIT APPRAISAL

4.1 HISTORY OF EXPLORATION

MECL has drilled one regional borehole MWSM-1 in the northern part of south of Mugoli Block (Mugoli Extn. Block) during the period 28-03-1998 to 06-05-1998 to locate shallow occurrence of coal further south of Mugoli O.C. Mine. Based on the data of this borehole MECL has prepared a geological note entitled "Geological note on exploration for coal in South of Mugoli Block, Wardha Valley Coalfield, Dist – Chandrapur (M.S.) in April'1999." Based on the positive borehole data, CMPDI has taken up detailed drilling to locate the occurrence of shallow coal in this area.

The entire block is virgin, since no mining activity is in progress. The nearest working opencast mine i.e. Mugoli O.C Mine is located in the north of Mugoli Extension Block.

4.2 EXPLORATION STATUS

The Project report is based on GR on Mugoli Extension Block, CMPDI, December,2007

4.3 SURVEY

- 4.3.1 All the boreholes were surveyed by CMPDI. Besides this, all the surface features i.e. high tension electric line, road and village etc. have been surveyed. Surface contours has been enlarged from toposheet and reduced level values were matched with the surface contours, and wherever needs minor changes in the surface contours, has been incorporated with the help of

borehole data and survey stations. The surface contour plan has been prepared on 2 m interval.

4.3.2 In order to connect Mugoli Extn. Block in National Grid, survey work has been carried out with reference to the coordinates of the Stations P-3 & P-3N located in Mugoli O.C. Mine, WCL & its survey data has been supplied by survey officer, Mugoli O.C. Mine. The coordinates and reduced levels of base stations are given below :

Base station	Coordinates (m)		GTS R.L (m)	WCB	Distance (m)
	Easting (m)	Northing (m)			
P-3	3011959.541	1069190.630	191.552	169° 34' 04"	59.870
P-3 N	3011948.700	1069249.511	189.733		

4.3.3 The survey work has been carried out in Mugoli Extn. Block by CMPDI with reference to survey station MUG-4 and borehole CMWMG-2 established in Mugoli O.C. Mine & its survey data are given below :

Survey station/ borehole	Coordinates (m)		GTS R.L (m)	WCB	Distance (m)
	Easting (m)	Northing (m)			
MUG-4	3011612.666	1069379.429	190.917	251° 30' 46"	218.316
CMWMG-2	3011819.716	1069448.656	190.208		

4.3.4 The rectangular coordinates in conformal conic projection system of all surveyed boreholes are provided in Annexure-I. The reduced level of all the boreholes drilled by CMPDI have been determined with reference to GTS RL'S of Stations P-3 & P-3 N of Mugoli OC Mine.

4.4 GEOLOGICAL MAPPING

The entire area of block is covered by thick cover of fertile soil. No rock exposures are available in the area. The entire geological interpretation has been made based on subsurface data generated through the boreholes drilled

in the area. The subcrop position of Composite Seam (Composite –A, B, C & D Sections) and faults are shown below the Kamthi Formation.

4.5 SURFACE GEOPHYSICAL SURVEY

The subsurface data generated through the boreholes drilled in the area reveals the geological structure below the thick cover of Kamthi Formation. No surface geophysical survey work has been conducted in the area.

4.6 HYDROGEOLOGICAL STUDIES

The boreholewise measurement of water level has been taken during the period of drilling. The rainfall data of the area have been collected from Mugoli O.C.Mine, WCL, Korpana Tehsil, Distt.Chandrapur.

4.7 QUANTUM OF TOTAL EXPLORATION INPUTS

The summary of drilling inputs considered for preparation of the present project report are given in the following Table – 4.1

TABLE – 4.1
AGENCYWISE & YEARWISE DRILLING, MUGOLI EXTN. BLOCK

Period of drilling	No. of boreholes drilled	Total meterage (m)
1. <u>CMPDI</u>		
2005 - 2006	26	3035.00
2006 - 2007	12	1227.00
2007 - 2008	6	584.50
Sub Total	44	
2. <u>MECL</u>		
1998-1999	1	204.00
Total	45	5050.50

Total 45 boreholes were drilled in an area of 2.26 Km². Borehole density is 20.

4.8 SCOPE AND LIMITATION

- a) The occurrence of coal in this area has been established by MECL by scout drilling during the period 1998-1999.
- b) The quarriable potentiality of the area has been established after detailed exploration by CMPDI during the period 2005-2007.
- c) The entire area of the block is covered by agricultural land with thick cover of fertile black cotton soil. No rock exposures are found in the area.
- d) Since, faults are not exposed on the surface, interpretation is based on the evidence obtained from the borehole data e.g. missing part thickness of coal seams, abrupt reduction in the parting and abrupt difference in the floor level of coal seams on either side of the faults. A total of 6 faults have been interpreted to occur within the block. In addition, the occurrence of few minor faults can not be ruled out. Three faults i.e. F_6-F_6 , F_7-F_7 & F_8-F_8 are continuing from Kolgaon Sawangi Block which is located in the northern part of the area on the other side of Penganga river.
- e) The faults are considered to be normal gravity faults and assumed to have 60^0 dip. All the faults are considered to be Pre-Kamthi faults and hence, all faults have been projected upto the floor of the Kamthi Formation.
- f) The subcrop of Composite Seam have been drawn at the floor of the Kamthi Formation.
- g) Various contour plans i.e. floor contours, isoparting, isochores and isograds have been prepared on the assumptions of gradual change.
- h) The analysis of the obvious dirt bands of sandstone, shale, alternate shale and sandstone, which have been included in calculation of quality data of seams, are not available. Therefore, the following values of moisture and ash have been assumed for these lithologies for calculating the equilibrated analysis (M % :2.5% and Ash % : 85).

- i) The overall quality of Composite Seam (A to D Sections) and estimation of reserves have been done after considering the full thicknesses of coal seam sections including all dirt bands upto 1.00 m thickness and excluding parting > 1.00 m thickness between the seam sections.

4.9 GEOLOGY & STRUCTURE

4.9.1 REGIONAL GEOLOGY

4.9.1.1 General

Wardha Valley Coalfield is located in the southeastern part of Maharashtra State and is bounded between Latitude N - $19^{\circ} 30'$ & $20^{\circ} 27'$ and Longitude E - $78^{\circ} 50'$ & $79^{\circ} 49'$ (As per GSI Bulletin Series-A, No.-45, Vol.-II).

The ariel extent of this coalfield has been estimated as 4000 sq. km. The NNW-SSE axis (which corresponds to the strike of the coal bearing sedimentaries) is around 100 km long with a maximum width of about 80 kms. The likelihood of extension of this coalfield in the north-northwestwards beneath the Deccan Trap can not be discounted. South-south eastwards continuation of Gondwana sediments of Wardha Valley Coalfield are considered to be extended in Godavari Valley Coalfield in Andhra Pradesh.

This coalfield has elliptically aligned coal prospects within the Barakar Formation around the core of Talchirs, which occupies the central part of the coalfield. The eastern limits of this anticlinal structure is constituted by Konda / Bhandak blocks towards north and Wirur / Subai / Chincholi blocks towards south. The western limb is constituted by Majri / Kawadi / Kolar-Pimpri blocks toward north and Ghugus / Nakoda, Mugoli / Kolgaon-Sawangi towards south. These limbs have been further affected by numerous NNW-SSE trending faults. Depending upon the alignment of these faults vis-à-vis the strike of coal bearing sedimentaries, numerous isolates coal-prospects have been deciphered in western limit of Wardha Valley Coalfield e.g. Dhorwasa, Chargaon, Kiloni / Baranj / Manora etc. Eastern limb of Wardha Valley Coalfield appears to be less dissected by the faults than the western limb.

4.9.1.2 Rock Formations

The Gondwana sediments boundary toward the east is delineated by the exposures of Archaeans. The intervening area between the faults outlines of coal bearing sediments towards the north-east, south-west and south-east is occupied by the Vindhyan Formation.

The central part of the coalfield is occupied by the Talchirs. The Deccan Trap covers the Gondwana sediments towards the west and north. Lametas are available in patches towards north. Major part of the coalfield is covered by the Kamthi Formation. The coal bearing Barakar Formation is exposed only in the western part of the coalfield in isolated patches. The Gondwana sediments appear to continue south-south-eastwards into the Godavari Valley sediments of Andhra Pradesh.

4.9.1.3 Stratigraphy

The regional geological sequence of Wardha Valley Coalfield is given in Table – 4.2

TABLE – 4.2
REGIONAL GEOLOGICAL SEQUENCE, WARDHA VALLEY COALFIELD

Age	Formation	Lithology
Recent/Sub-Recent	Detrital Mantle	Black cotton soil/sandy soil
Upper Cretaceous	Deccan Trap	Basalts
-----UNCONFORMITY-----		
Cretaceous	Lameta	Cherty limestones, chert, brown, yellowish to pale white silicified sandstones, claystone.
-----UNCONFORMITY-----		
Upper Permian to Lower Triassic	Kamthi	Red, brown and variegated clays, ferruginous coarse grained sandstone and shale bands.
-----UNCONFORMITY-----		
Middle Permian	Motur	Medium to fine grained variegated sandstones, variegated clays and shales.
Lower Permian	Barakar	Light grey to whitish sandstones with grey shale sandy shale, alternate bands of shale and sandstone, a thick coal seam (Composite Seam) with other thin carbonaceous horizons.

Age	Formation	Lithology
Upper Carboniferous to Lower Permian	Talchir	Greenish to grey sandstones, siltstone and shales
-----UNCONFORMITY-----		
Pre-Cambrian	Vindhyan	Greenish to grey quartzitic sandstone, pinkish limestone and chert.
-----UNCONFORMITY-----		
Archaean	Metamorphics	Quartzites, granites, gneisses and schist etc

4.9.2 REGIONAL STRUCTURE

4.9.2.1 Tectonic Set-up

The regional structure of the Wardha Valley Coalfield is a broad anticline plunging towards NNW. Both the western and eastern limbs of this anticline have been proved to be coal bearing. The Gondwana sedimentation in Wardha Valley Coalfield has taken place in NW-SE trending rift basins separated by Vindhyan. So far, four such coal bearing rift basins have been identified on the basis of regional and detailed exploration. These are, Main Rift Basin, Rajur-Chinchala Rift Basin, Ghonsa-Kumbharkhani Rift Basin and Marki-Mangli Rift Basin. The structure of Main Rift Basin is that of a broad plunging anticline, the axis of which is NW-SE plunging northerly. The western limb dips westerly, whereas, the eastern limb dips easterly. The area west of Pauni Extn. Block is situated in the south-western part of eastern limb of Main Rift Basin.

4.9.2.2 Deccan Trap/Lameta Formation/Kamthi Formation unconformably overlies the Motur and coal bearing Barakar Formations, preventing the coal seams to outcrop on the surface. NW-SE trending normal faults are major structural features of Wardha Valley Coalfield. These strike faults have caused repetition of strata in the many parts of the coalfield. As a result, the coal seams have occurred at shallow depth in many part of the

Wardha Valley Coalfield. These areas have opened additional opencast possibilities in this coalfield.

4.9.3 GENERAL GEOLOGY OF THE BLOCK

4.9.3.1 Location

The area west of Pauni Extn. Block under report is geologically located in the south-western part of Main Rift Basin of Wardha Valley Coalfield. It lies west of Pauni Extn. Block.

4.9.3.2 Geological Succession

The block under report is no exception to the general characteristic of Wardha Valley Coalfield and is capped by the thick cover of weathered mantle. None of the Gondwana lithological units are exposed on surface in the area under report. The geological succession therefore, has been deciphered from the subsurface data of 57 boreholes drilled within the block by CMPDI. The details of thickness of different formations viz. Soil, Kamthi, Barakar, Talchirs and Vindhya as intersected in boreholes drilled in the block are given in Annexure -II. The geological succession in the block as worked out from the borehole data and the thickness range of different formations are given in Table – 4.3

TABLE – 4.3

GEOLOGICAL SUCCESSION, MUGOLI EXTN. BLOCK

Age	Formation	Thickness range (m)		Lithology
		Minimum	Maximum	
Recent / Sub – Recent	Detrital Mantle (Soil)	4.00 (CMWVG – 11, 42 & 46	7.40 (CMWVG – 35)	Black cotton soil/sandy soil

Age	Formation	Thickness range (m)		Lithology
		Minimum	Maximum	
Upper Permian to Lower Triassic	Kamthi	0.00 (CMWVG- 54)	37.16 (CMWVG – 48)	Yellow to brown fine to coarse grained sandstones, shale and variegated clays.
-----UNCONFORMITY-----				
Middle Permian	Motur	146.45 (CMWVG-23)	207.61 (CMWVG-13)	Medium to fine grained variegated sandstone variegated clays and shale.
Lower Permian	Barakar	14.57 (CMWVG- 17)	158.38 (CMWVG – 35)	Grey to white fine to coarse grained sandstones, thin clay bands, shale, intercalation of shale & sandstone, sandy shale, shaly sandstone, carb. shale, shaly coal and coal
Upper Carboniferous to Lower Permian	Talchir	(+) 4.84 (CMWVG-42)		Green shale.

4.9.3.3 Description of Formations

a) Talchir Formation

This formation has been intersected only in borehole (CMWVG-42). The total thickness of 4.84 m has been intersected. This formation is represented by green shale.

b) Barakar Formation

The surface exposures of Barakar rocks are not found in the area of the block. The lithology of Barakar Formation encountered in the boreholes are

represented by grey to white fine to coarse grained sandstones, thin clay bands, shale, intercalation of shale and sandstone, sandy shale, shaly sandstone, carb. shale, shaly coal and coal. Generally coal seams occur almost in the middle part of Barakar Formation. The most potential seam i.e. Composite Seam occur in this formation. This formations unconformably overlain by Kamthi Formation. The Talchir Formation is conformably overlain by Barakar Formation. The total thickness of Barakar rocks varies from 14.57 m (CMWVG-17) to 158.38 m (CMWVG-35).

c) Kamthi Formation

The Kamthi Formation unconformably overlaps Motur/Barakar rocks in the area. It is generally represented by yellow to brown fine to coarse grained sandstones, shales and variegated clays. The rocks of this formation have been encountered in all the boreholes drilled in the area. The thickness of Kamthis varies from 9.85 m (CMWVG-175) to 37.85 m (CMWVG-166). The Kamthis are predominantly rich in quartz with kaolinised feldspar matrix.

d) Detrital Mantle (Soil)

The detrital mantle mainly consist of black cotton soil/sandy soil and it covers the entire area of the block. The thickness of soil varies from 4.00 m (CMWVG-11, 42 & 46) to 7.40 m (CMWVG-35). The thickness of the weathered strata in the area varies from 0.60 m (CMWVG-54) to 16.00 m (CMWVG-46).

4.9.4 GEOLOGICAL STRUCTURE

4.9.4.1 General

The area under report is covered by thick layer of Soil/Kamthi rocks. The geological structure therefore, as depicted in the floor contour plan (Plate–VIII) of Composite-D Section are based on the subsurface data generated from boreholes. Structurally the area is not much disturbed. The block

exhibits the presence of total 6 numbers of faults. Most of the faults are oblique faults running across the strike of the strata.

4.9.4.2 Strike and Dip

The general strike of the coal seam is north-south in the major part of the area with minor swing in central part of the area as determined from the floor contour plan of Composite-D Section. In the subcrop zone near boreholes CMWVG-17 & 28 the strike becomes northwest-southeast. The dip of the strata ranges from 4° to 7.5° (gradient 1 in 7.5 to 1 in 14.0) and dipping towards west and southwest direction. The eastern part of the area is generally having less gradient (1 in 14) as compare to remaining part of the block. The attitude of the seam is presented in floor contour plan.

4.9.4.3 Pattern of Faulting

The area of the block is traversed by 6 total numbers of faults. Most of the faults are oblique faults, cutting across the strike of the strata. The major i.e. F6-F6, F7-F7 & F8-F8 continuing from the northern adjoining block i.e. Kolgaon Sawangi Block and its fault numbers have been retained as mentioned in the geological report (Kolgaon Swangi, May 1993) prepared by MECL. This major fault (F8-F8) also demarcates the western limit of the block. The position of all faults (below Kamthi Formation) are shown in geological plan and floor position of faults are shown in floor contour / iso-parting/seam folio plans. The newly interpreted faults have been numbered i.e. F1-F1, F2-F2 & F3 & F3.

Due to thick cover of Soil/Kamthi rocks none of the faults are exposed on the surface. Therefore, their presence has been interpreted from the direct evidence generated through boreholes drilled in the area. Faults have been interpreted by direct evidences. i.e. omission of full or part of seam, reduction in parting between the seams and indirect evidence. i.e. through difference in

floor reduced levels on either side of the fault. All the faults have been considered as Pre-Kamthis and therefore, their surface position has been projected upto the floor of Kamthi Formation. The details of the individual faults are given in the following Table – 4.4.

TABLE – 4.4
DESCRIPTION OF FAULTS, MUGOLI EXTN. BLOCK

Sl. No.	Fault No.	Extent of faults (m)	Trend	Throw		Evidence
				Direction	Amount (m)	
1.	F ₁ – F ₁	250	NW - SE	SW	0-5	Composite –A section is omitted in borehole MWSM-1.
2.	F ₂ – F ₂	450	NNW-SSE	ENE	0 - 20	Difference in floor level on both side of the fault.
3.	F ₃ – F ₃	975	NW – SE	SW	0 – 10	Difference in floor level on both side of the fault.
4.	F ₆ – F ₆ [*]	1825	NW-SE	SW	10 - 60	Composite-A Section is omitted in borehole CMWGM-16 & difference in floor level on both sides of the fault.
5.	F ₇ - F ₇ [*]	1825	NW-SE	NE	5 - 30	Composite-A Section is omitted in borehole CMWGM-21 & difference in floor level on both sides of the fault.
6.	F ₈ – F ₈ [*]	2425	NW - SE	SW	25 (Approx.)	Composite Seam is omitted in borehole CMWGM-45 & part Composite Seam is faulted in boreholes CMWM-38, 52, 55 & 57.

NOTE - * - Indicate fault number continuing from Kolgaon Sawangi Block.

4.10 DESCRIPTION OF COAL SEAMS

4.10.1 GENERAL

- (A) The major part of Wardha Valley Coalfield is characterised by presence of one thick Composite Seam varying in thickness from 15 m to 20 m and composed mainly 2 to 3 correlatable sections i.e. Composite Top, Composite

Middle and Composite Bottom. These correlative sections are separated by well defined partings.

- (B) The detailed exploration in Mugoli Extension Block reveals the existence of 4 sections of Composite Seam i.e. Composite-A to D Sections and they are continuing from adjoining Mugoli/Kolgaon Swangi Block, which is located in the Northern part of the area. The above potential seam sections (roof) occur in the area in the depth range of 9.81 m (CMWVG – 54) to 159.26 m (CMWVG-35) as per data of boreholes drilled in the block.
- (C) In Mugoli Extn. Block, the thickness of Composite-A section varies from 0.75 m (CMWVG – 37) to 2.72 m (CMWVG – 24), Section-B varies from 0.72 m (MWSM-1) to 4.02 m (CMWVG-20); Section –C varies from 1.31 m (CMWVG-33) to 4.26 m (CMWVG-22) and thickness of Composite-D Section varies from 7.65 m (CMWVG-38) to 11.65 m (CMWVG-21). The above seam sections are mainly composed of coal and shaly coal with thin bands of carbonaceous shale and obvious dirt bands. The coal is generally of dull rank i.e. non-coking type.
- (D) For delineation of coal seam, the standard norms applicable to non-coking coal have been followed. These are as follows :
- | | | |
|--------------------|---|-----------------------------------|
| Coal | - | Ash + Moisture upto 40% |
| Shaly coal | - | Ash + Moisture > 40% and upto 55% |
| Carb. shale | - | Ash + Moisture > 55% and upto 75% |
| Obvious dirt bands | - | Ash + Moisture > 75% |
- (E) The overall analysis on 60% RH & 40° C have been determined for most of the boreholes for each of the seams sections –A+B+C & Sections – A+B+C+D. For the remaining boreholes, the analysis on equilibrated basis has been calculated (by using M100 values).

In absence of band by band analysis of obvious dirt bands (shale, sandy shale, and sandstone) 2.5 % moisture and 85 % ash has been assumed for the bands while calculating the analysis on equilibrated basis.

4.10.2 SEQUENCE OF COAL SEAMS

- (A) The sequence of coal seams encountered in the boreholes drilled by CMPDI in Mugoli Extn. Block in ascending order are furnished below in Table -4.5

TABLE – 4.5
SEQUENCE OF COAL SEAMS, MUGOLI EXTN.BLOCK

Coal seam/ Parting	Thickness range (m)		Generalised thickness range (m)
	Minimum	Maximum	
Composite-A Section	0.75 m (CMWVG – 37)	2.72 m (CMWVG – 24)	1.00 - 2.00
Parting	0.30 m (CMWVG-33)	1.95 m (CMWVG-37)	
Composite-B Section	0.72 m (MWSM – 1)	4.02 m (CMWVG – 20)	2.50 – 3.50
Parting	0.27 m (CMWVG-39)	2.74 m (CMWVG-56)	
Composite-C Section	1.31 m (CMWVG – 33)	4.26 m (CMWVG – 22)	2.00 – 3.50
Parting	3.54 m (CMWVG-15)	7.06 m (MWSM-1)	
Composite-D Section	7.65 m (CMWVG –	11.65 m (CMWVG – 21)	9.70 – 11.00

	38)		
Composite-A+B+C+D Sections (excluding > 1.00 m parting)	14.84 m (CMWVG – 11)	22.19 m (CMWVG – 24)	17.50– 20.50

- (B) It could be seen from the above table that the seams sections encountered in Mugoli Extn. Block are potential and persistent in nature in the entire area of the block.

4.10.3 COMPOSITE SEAM

The Composite Seam, which is about 21 m to 26 m thickness including all dirt bands and parting in the present area occurs in 4 sections viz. Composite-A Section, Composite-B Section, Composite-C Section and Composite-D Section. The parting between Composite-A+B+C Sections and Composite-D Section varies from 3.54 m (CMWVG-15) to 7.06 m (MWSM-1). All sections of the Composite Seam are virgin. The detailed description of Composite-A Section, Composite-B Section, Composite-C Section and Composite –D Section and Composite –A+B+C+D Sections are given below :

4.10.3.1 COMPOSITE - D SECTION

A. Depth of roof intersection

- i) Shallowest - 10.50 m (CMWVG – 50)
- ii) Deepest - 174.25 m (CMWVG – 35)

B. Floor Reduced level

- i) Minimum - 155.48 m (CMWVG-17)
- ii) Maximum - 7.21 m (CMWVG – 35)

C. Seam Thickness (m)

Range	Stratigraphic thickness range (m)
Minimum	7.65 (CMWVG – 38)

Maximum	11.65 (CMWVG – 21)
General	9.70 – 11.00

Thickness range (m)	No. of B.H.	Percentage
7.00 - 8.00	1	2.86
8.00 - 9.00	-	-
9.00 - 10.00	10	28.57
10.00 - 11.00	19	54.28
11.00 - 12.00	5	14.29
Total	35	100

The subcrop of Composite-D Section is noticed in the eastern part of the area and is also demarcating the eastern boundary of the block.

The subcrop of the seam section has been projected below the Kamthi Formation.

D. PARTING

(With Composite-C Top Section)

- i) Minimum - 3.54 m (CMWVG – 15)
- ii) Maximum - 7.06 m (MWSM – 1)

E. ROOF LITHOLOGY

- i) Immediate Roof
 - a) Dominant - Shale
 - b) Subordinate - Sandy shale and carb. shale
- ii) Within 3.00 m lithology
 - i) Dominant - Shale
 - ii) Subordinate - Carb. shale and fine grained sandstone

F. FLOOR LITHOLOGY

- i) Immediate floor
 - a) Dominant - Sandy shale and fine grained sandstone
 - b) Subordinate - Shale and carb. shale
- ii) Within 1.00 m lithology
 - i) Dominant - Fine grained sandstone
 - ii) Subordinate - Sandy shale

G DIRT BANDS (full seam thickness)

No of boreholes - 3 boreholes

devoid of dirt bands

Dirt bands	No of boreholes	No of dirt bands	Total thickness range (m)	Percentage
Combustible	31	1 - 3	0.13 – 0.87	1.22 – 7.70
Obvious	5	1	0.11 – 0.56	1.01 – 5.67
Combustible + obvious	32	1 - 3	0.13 – 1.80	1.22 – 18.23

H PROXIMATE ANALYSIS ON 60% RH 40° C

TABLE – 4.6

PROXIMATE ANALYSIS ON 60% RH & 40° C, COMPOSITE-D SECTION,
MUGOLI EXTN. BLOCK

Particulars	I – 100			IP	
	No. of B.H.	Minimum	Maximum	Minimum	Maximum
Moisture %	33	6.3 (MWSM-1)	9.1 (CMWMG-11)	6.3 (MWSM-1)	9.1 (CMWMG-11)
Ash %	33	23.1 (CMWMG-29)	32.7 (CMWMG-56)	23.1 (CMWMG-29)	32.7 (CMWMG-56)
VM %	28	21.9 (CMWMG-36) (36.6) CMWMG-36	26.7 (CMWMG-44) (41.7) CMWMG-27 & 47	21.9 (CMWMG-36) (36.6) CMWMG-36	26.7 (CMWMG-44) (41.7) CMWMG-27 & 47
FC %	28	37.5 (CMWMG-27)	42.2 (CMWMG-11)	37.5 (CMWMG-27)	42.2 (CMWMG-11)
GCV (k.Cal/kg.)	28	4349 (CMWMG-46) (7200) CMWMG-30	4856 (CMWMG-18) (7664) CMWMG-18	4349 (CMWMG-46) (7200) CMWMG-30	4856 (CMWMG-18) (7664) CMWMG-18
UHV (k.Cal/kg.)	33	3297 (CMWMG-56)	4567 (CMWMG-31)	3297 (CMWMG-56)	4567 (CMWMG-31)
G R	(General range)	D – F		D – F	

Particulars	I – 100			IP	
	No. of B.H.	Minimum	Maximum	Minimum	Maximum
A D E	(Prevalent range)	D – E		D – E	

NOTE: Values of VM% & GCV given in brackets are on DMMF basis

I. **ULTIMATE ANALYSIS**

The Ultimate Analysis is available for 5 boreholes . The boreholewise details are given below :

TABLE – 4.7
ULTIMATE ANALYSIS, COMPOSITE-D SECTION

Particulars	CMWVG-27	CMWVG-29	CMWVG-31	CMWVG-35	CMWVG-46
C%	46.1 (78.6)	48.7 (79.9)	51.6 (78.7)	50.6 (81.0)	46.7 (78.6)
H %	2.4 (4.1)	2.7 (4.4)	2.2 (3.3)	2.7 (4.3)	2.5 (4.2)
N %	1.1 (1.9)	1.1 (1.8)	1.2 (1.8)	1.1 (1.8)	1.1 (1.8)
S %	0.55	1.16	1.40	0.92	2.1
CO ₂ % (by diff.)	1.00	0.56	1.03	0.20	0.59

Note – Figures with in brackets are on DMMF basis

J **SULPHUR**

The Total Sulphur data is available for 27 boreholes and its percentage varies from 0.6% (CMWVG-27) to 2.1% (CMWVG-28 & 46). The distribution of Sulphur is available for 3 boreholes. The boreholewise details are given below :

TABLE – 4.8
SULPHUR DISTRIBUTION, COMPOSITE SECTION

Borehole No.	Pyritic Sulphur %	Sulphate Sulphur %	Organic Sulphur %
--------------	-------------------	--------------------	-------------------

	Total Sulphur (%)	Coal basis	Sulphur basis	Coal basis	Sulphur basis	Coal basis	Sulphur basis
CMWMG-27	0.55	0.24	43.6	0.09	16.3	0.22 (0.37)	40.1
CMWMG-29	1.16	0.58	50.0	0.13	11.2	0.45 (0.74)	38.8
CMWMG-35	0.92	0.46	50.0	0.12	13.0	0.34 (0.54)	37.0

Note – Figures with in brackets are on DMMF basis

K. ASH FUSION TEMPERATURE RANGE

The Ash Fusion Temperature Range is available for 3 boreholes (Annexure-VIII). The boreholewise details are given below :

TABLE – 4.9

ASH FUSION TEMPERATURE RANGE, COMPOSITE-D SECTION

Borehole No.	I.D. (°C)	H.T. (°C)	F.T. (°C)
CMWMG -27	1240	1320	1340
CMWMG -29	1240	> 1400	> 1400
CMWMG -35	1390	> 1400	> 1400

4.10.3.2 COMPOSITE - C SECTION

A. Depth of roof intersection

- i) Shallowest - 9.81 m (CMWMG – 54)
- ii) Deepest - 166.39 m (CMWMG – 35)

B Floor Reduced level

- i) Minimum - 8.38 m (CMWMG-36)
- ii) Maximum - 166.89 m (CMWMG – 54)

C. Seam Thickness (m)

Range	Stratigraphic thickness range (m)
Minimum	1.31 (CMWMG – 33)

Maximum	4.26 (CMWVG – 22)
General	2.00 – 3.00

Thickness range (m)	No. of B.H.	Percentage
1.00 - 2.00	7	21.21
2.00 - 3.00	16	48.49
3.00 - 4.00	9	27.27
> 4.00	1	3.03
Total	33	100

The subcrop of Composite-C Section has been demarcated below the floor of Kamthi Formation in the eastern part of the area.

D. PARTING

Between Composite-C & D Sections

- i) Minimum - 3.54 m (CMWVG – 15)
- ii) Maximum - 7.06 m (MWSM – 1)

Between Composite-B & C Sections

- i) Minimum - 0.27 m (CMWVG – 39)
- ii) Maximum - 2.74 m (CMWVG-56)

E ROOF LITHOLOGY

i) Immediate Roof

- a) Dominant - Carb. shale
- b) Subordinate - Shale
- ii) Within 3.00 m lithology
 - a) Dominant - Carb. shale
 - b) Subordinate - Coal and shaly coal

F. FLOOR LITHOLOGY

i) Immediate floor

- a) Dominant - Carb. shale

b) Subordinate - Shale

4.15.2 b) Within 1.00 m lithology

i) Dominant - Shale

ii) Subordinate - Carb. shale

G. **DIRT BANDS** (full seam thickness)

i) No of boreholes devoid of dirt bands - 27 boreholes

Dirt bands	No of boreholes	No of dirt bands	Total thickness range (m)	Percentage
Combustible	7	1	0.08 – 0.89	2.17 – 29.67
Obvious	2	1	0.27 – 0.50	6.34 – 24.63
Combustible + obvious	8	2	0.08 – 0.89	2.17 – 29.67

H. **PROXIMATE ANALYSIS ON 60% RH 40° C**

TABLE – 4.10

PROXIMATE ANALYSIS ON 60% RH & 40° C, COMPOSITE-C SECTION,

Particulars	No. of B.H.	I – 100		IP*	
		Minimum	Maximum	Minimum	Maximum
Moisture %	31	5.2 (MWSM-21)	9.8 (CMWMG-47)	5.2 (MWSM-21)	9.8 (CMWMG-47)
Ash %	31	17.7 (CMWMG-47)	54.6 (CMWMG-21)	17.7 (CMWMG-47)	54.6 (CMWMG-21)
VM %	29	19.4 (CMWMG-21) (34.2) MWSM-1	25.9 (CMWMG-31) (55.8) CMWMG-21	19.4 (CMWMG-21) (34.2) MWSM-1	25.9 (CMWMG-31) (55.8) CMWMG-21
FC %	29	20.8 (CMWMG-21)	42.7 (CMWMG-38)	20.8 (CMWMG-21)	42.7 (CMWMG-38)
GCV (k.Cal/kg.)	29	2569 (CMWMG-21) (7269) CMWMG-46	4830 (CMWMG-38) (7657) CMWMG-35	2569 (CMWMG-21) (7269) CMWMG-46	4830 (CMWMG-38) (7657) CMWMG-35
UHV (k.Cal/kg.)	31	648 (CMWMG-21)	5105 (CMWMG-47)	648 (CMWMG-21)	5105 (CMWMG-47)
G R (General range)	31	C – Ungraded		C – Ungraded	

Particulars	No. of B.H.	I – 100		IP*	
		Minimum	Maximum	Minimum	Maximum
A D E	(Prevalent range)	E – F		E – F	

NOTE: Values of VM% & GCV given in brackets are on DMMF basis

I. ULTIMATE ANALYSIS

The Ultimate Analysis is available for 5 boreholes. The boreholewise details are given below :

TABLE – 4.11

ULTIMATE ANALYSIS, COMPOSITE-C SECTION

Particulars	CMWVG-27	CMWVG-29	CMWVG-31	CMWVG-35	CMWVG-46
C%	43.1 (80.6)	49.8 (79.5)	46.9 (81.5)	46.9 (81.6)	42.8 (79.0)
H %	2.3 (4.3)	2.5 (4.0)	2.6 (4.5)	2.6 (4.5)	2.3 (4.2)
N %	1.0 (1.9)	1.2 (1.9)	1.1 (1.9)	1.2 (2.1)	1.0 (1.8)
S %	1.75	0.91	0.40	0.33	2.4
CO ₂ % (by diff)	0.07	0.21	0.45	1.00	1.06

Note – Figures within brackets are on DMMF basis

J SULPHUR

The Total Sulphur data is available for 28 boreholes and its percentage varies from 0.3% (CMWVG-35) to 2.4% (CMWVG-46). The Sulphur distribution is available for 3 boreholes. The boreholewise details are given below :

TABLE – 4.12

SULPHUR DISTRIBUTION, COMPOSITE SECTION

Borehole No.	Total Sulphur (%)	Pyritic Sulphur %		Sulphate Sulphur %		Organic Sulphur %	
		Coal basis	Sulphur basis	Coal basis	Sulphur basis	Coal basis	Sulphur basis

CMWMG-27	1.75	0.90	51.4	0.11	6.2	0.74 (1.4)	42.4
CMWMG-29	0.91	0.49	53.8	0.08	8.7	0.34 (0.54)	37.5
CMWMG-35	0.33	0.16	48.4	0.01	3.0	0.16 (0.28)	48.6

Note – Figures within brackets are on DMMF basis

K. ASH FUSION TEMPERATURE RANGE

The Ash Fusion Temperature Range is available for 3 boreholes . The boreholewise details are given below :

TABLE – 4.13

ASH FUSION TEMPERATURE RANGE, COMPOSITE-C SECTION

Borehole No.	I.D. (°C)	H.T. (°C)	F.T. (°C)
CMWMG -27	1250	>1400	> 1400
CMWMG -29	1260	1340	> 1400
CMWMG -35	1360	> 1400	> 1400

4.10.3.3 COMPOSITE - B SECTION

A. Depth of roof intersection

- i) Shallowest - 14.63 m (CMWMG – 43)
- ii) Deepest - 161.51 m (CMWMG – 35)

B Floor Reduced level

- i) Minimum - 12.25 m (CMWMG-36)
- ii) Maximum - 162.92 m (CMWMG – 43)

C. Seam Thickness (m)

Range	Stratigraphic thickness range (m)
-------	--------------------------------------

Minimum	0.72 (MWSM – 1)
Maximum	4.02 (CMWWMG – 20)
General	2.50 – 3.50

Thickness range (m)	No. of B.H.	Percentage
< 1.00	1	3.33
1.00 - 2.00	3	10.00
2.00 - 3.00	9	30.00
3.00 - 4.00	16	53.34
> 4.00	1	3.33
Total	30	100

The subcrop of Composite-B Section has been demarcated below the floor of Kamthi Formation in the eastern part of the area.

D. PARTING

Between Composite-B & C Sections

- i) Minimum - 0.27 m (CMWWMG – 39)
- ii) Maximum - 2.74 m (CMWWMG – 56)

Between Composite-A & B Sections

- i) Minimum - 0.30 m (CMWWMG – 33)
- ii) Maximum - 1.95 m (CMWWMG– 37)

E. ROOF LITHOLOGY

a) Immediate Roof

- i) Dominant - Shale and carb. shale
- ii) Subordinate - Clay

b) Within 3.00 m lithology

- i) Dominant - Coal and shaly coal
- ii) Subordinate - Medium grained sandstone and shale

F. FLOOR LITHOLOGY

- a) Immediate floor
- i) Dominant - Carb. shale
 - ii) Subordinate - Shale
- b) Within 1.00 m lithology
- i) Dominant - Carb. shale
 - ii) Subordinate - Shale, coal and shaly coal

G. DIRT BANDS (full seam thickness)

No of boreholes devoid of dirt bands - 3 boreholes

Dirt bands	No of boreholes	No of dirt bands	Total thickness range (m)	Percentage
Combustible	24	1 - 3	0.15 – 0.81	4.92 – 24.18
Obvious	11	1 - 2	0.14 – 0.34	4.03 – 12.73
Combustible + obvious	26	1 - 4	0.15 – 0.83	6.02 – 27.71

H. PROXIMATE ANALYSIS ON 60% RH 40° C

TABLE – 4.14

PROXIMATE ANALYSIS ON 60% RH & 40° C, COMPOSITE-B SECTION,

Particulars	No. of B.H.	I – 100		IP*	
		Minimum	Maximum	Minimum	Maximum
Moisture %	28	6.9 (MWSM-1)	9.9 (CMWMG-18)	6.9 (MWSM-1)	9.9 (CMWMG-18)
Ash %	28	23.1 (CMWMG-18)	45.9 (CMWMG-22)	23.1 (CMWMG-18)	45.9 (CMWMG-22)
VM %	23	19.9 (CMWMG-22) (41.1) CMWMG-18	28.0 (CMWMG-44) (47.5) CMWMG-22	19.9 (CMWMG-22) (41.1) CMWMG-18	28.0 (CMWMG-44) (47.5) CMWMG-22
FC %	23	26.6 (CMWMG-22)	40.4 (CMWMG-18)	26.6 (CMWMG-22)	40.4 (CMWMG-18)

Particulars	No. of B.H.	I – 100		IP*	
		Minimum	Maximum	Minimum	Maximum
GCV (k.Cal/kg.)	23	3114 (CMWMG-22) (7133) CMWMG-30	4915 (CMWMG-35) (7729) CMWMG-15	3114 (CMWMG-22) (7133) CMWMG-30	4915 (CMWMG-35) (7729) CMWMG-15
UHV (k.Cal/kg.)	28	1517 (CMWMG-22)	4346 (CMWMG-18)	1517 (CMWMG-22)	4346 (CMWMG-18)
G R A D E	(General range)	28	D – G	D – G	
	(Prevalent range)		E – F	E – F	

NOTE: Values of VM% & GCV given in brackets are on DMMF basis

I. ULTIMATE ANALYSIS

The Ultimate Analysis for Composite-B Section is available for 5 boreholes. The boreholewise details are given below :

TABLE – 4.15
ULTIMATE ANALYSIS, COMPOSITE-B SECTION

Particulars	CMWMG-27	CMWMG-29	CMWMG-31	CMWMG-35	CMWMG-46
C%	42.9 (78.97)	46.1 (79.6)	43.8 (78.5)	50.9 (79.7)	40.1 (79.3)
H %	2.5 (4.6)	2.7 (4.7)	1.9 (3.4)	3.1 (4.8)	2.4 (4.7)
N %	1.0 (1.8)	1.1 (1.9)	1.0 (1.8)	1.2 (1.9)	0.9 (1.8)
S %	0.45	0.65	0.80	0.73	0.40
CO ₂ % (by Diff)	0.66	0.12	0.28	0.56	0.77

Note – Figures within brackets are on DMMF basis

J SULPHUR

The Total Sulphur data is available for 23 boreholes and its percentage varies from 0.4% (CMWMG-19 & 46) to 2.9 % (CMWMG-16). The Sulphur distribution is available for 3 boreholes and given below :

TABLE – 4.16
SULPHUR DISTRIBUTION, COMPOSITE-B SECTION

Borehole No.	Total Sulphur (%)	Pyritic Sulphur %		Sulphate Sulphur %		Organic Sulphur %	
		Coal basis	Sulphur basis	Coal basis	Sulphur basis	Coal basis	Sulphur basis
CMWMG-27	0.45	0.23	51.1	0.06	13.3	0.16 (0.29)	35.6
CMWMG-29	0.65	0.31	47.6	0.11	16.9	0.23 (0.40)	35.5
CMWMG-35	0.73	0.40	54.7	0.05	6.8	0.28 (0.44)	38.5

Note – Figures within brackets are on DMMF basis

K. ASH FUSION TEMPERATURE RANGE

The Ash Fusion Temperature Range is available for 3 boreholes. The boreholewise details are given below :

TABLE – 4.17
ASH FUSION TEMPERATURE RANGE, COMPOSITE-B SECTION

Borehole No.	I.D. (°C)	H.T. (°C)	F.T. (°C)
CMWMG -27	1240	>1400	> 1400
CMWMG -29	1280	>1400	> 1400
CMWMG -35	1240	1330	1360

4.10.3.4 COMPOSITE -A SECTION**A. Depth of roof intersection**

-
- i) Shallowest - 22.17 m (CMWVG – 40)
 - ii) Deepest - 159.26 m (CMWVG – 35)

B. Floor Reduced level

- i) Minimum - 16.47 m (CMWVG-36)
- ii) Maximum - 156.75 m (CMWVG – 40)

C. Seam Thickness (m)

Range	Stratigraphic thickness range (m)
Minimum	0.75 (CMWVG – 37)
Maximum	2.72 (CMWVG – 24)
General	1.00 – 2.00

Thickness range (m)	No. of B.H.	Percentage
< 1.00	4	15.39
1.00 - 2.00	15	57.69
2.00 - 3.00	7	26.92
Total	26	100

The subcrop of Composite-A Section has been demarcated below the floor of Kamthi Formation in the eastern part of the area. The strike length of the subcrop is 1.8 km.

D. PARTING

Between Composite-A & B Sections

- i) Minimum - 0.30 m (CMWVG – 33)
- ii) Maximum - 1.95 m (CMWVG – 37)

E. ROOF LITHOLOGY

a) Immediate Roof

- i) Dominant - Shale and carb. shale
- ii) Subordinate - Medium grained sandstone

b) Within 3.00 m lithology

- i) Dominant - Medium grained sandstone
- ii) Subordinate - Fine grained sandstone, shale and carb. shale

F. FLOOR LITHOLOGY

- a) Immediate floor
 - i) Dominant - Shale
 - ii) Subordinate - Carb. shale
- b) Within 1.00 m lithology
 - i) Dominant - Shale
 - ii) Subordinate - Coal and shaly coal

G. DIRT BANDS (full seam thickness)

4.28.1 No. of boreholes devoid of dirt bands - 11 boreholes

Dirt bands	No of boreholes	No of dirt bands	Total thickness range (m)	Percentage
Combustible	13	1 - 2	0.10 – 0.52	4.53 – 20.00
Obvious	3	1	0.15 – 0.28	6.15 – 20.59
Combustible + obvious	15	1 - 2	0.10 – 0.52	4.53 – 20.59

H. PROXIMATE ANALYSIS ON 60% RH 40° C

TABLE – 4.18

PROXIMATE ANALYSIS ON 60% RH & 40° C, COMPOSITE-A SECTION

Particulars	No. of B.H.	I – 100		IP	
		Minimum	Maximum	Minimum	Maximum
Moisture %	24	5.9 (CMWMG-47)	8.5 (CMWMG-18)	5.9 (CMWMG-47)	8.5 (CMWMG-18)
Ash %	24	31.3 (CMWMG-34)	40.4 (CMWMG-40)	31.3 (CMWMG-34)	40.4 (CMWMG-40)

Particulars		No. of B.H.	I – 100		IP	
			Minimum	Maximum	Minimum	Maximum
VM %		22	23.5 (CMWMG-24 & 26) (44.3) CMWMG-29	26.3 (CMWMG-27) (50.0) CMWMG-24	23.5 (CMWMG-24 & 26) (44.3) CMWMG-29	26.3 (CMWMG-27) (50.0) CMWMG-24
FC %		22	27.7 (CMWMG-24)	35.0 (CMWMG-34)	27.7 (CMWMG-24)	35.0 (CMWMG-34)
GCV (k.Cal/kg.)		22	3599 (CMWMG-24) (7330) CMWMG-47	4461 (CMWMG-34) (7797) CMWMG-35	3599 (CMWMG-24) (7330) CMWMG-47	4461 (CMWMG-34) (7797) CMWMG-35
UHV (k.Cal/kg.)		24	2166 (CMWMG-24)	3518 (CMWMG-34)	2166 (CMWMG-24)	3518 (CMWMG-34)
G R A D E	(General range)	24	E – G		E – G	
	(Prevalent range)		F		F	

NOTE: Values of VM% & GCV given in brackets are on DMMF basis

I. ULTIMATE ANALYSIS

The Ultimate Analysis is available for 5 boreholes . The boreholewise details are given below :

TABLE – 4.19
ULTIMATE ANALYSIS, COMPOSITE-A SECTION

Particulars	CMWMG-27	CMWMG-29	CMWMG-31	CMWMG-35	CMWMG-46
C%	43.9 (80.1)	44.9 (80.45)	41.1 (80.8)	42.0 (82.50)	44.3 (81.06)
H %	2.4 (4.3)	2.7 (4.8)	2.5 (4.9)	2.4 (4.7)	2.8 (5.1)

N %	1.0 (1.8)	1.0 (1.8)	0.9 (1.8)	0.9 (1.7)	1.0 (1.8)
S %	1.03	0.80	0.70	0.79	0.60
CO ₂ % (by Diff)	0.29	0.03	0.05	0.01	0.02

Note – Figures within brackets are on DMMF basis

J **SULPHUR**

The Total Sulphur analysis is available for 22 boreholes and its percentage varies from 0.3 % (CMWMG-40) to 3.2 % (CMWMG-47). The Sulphur distribution data are available for 3 boreholes and given below :

TABLE – 4.20

SULPHUR DISTRIBUTION, COMPOSITE-A SECTION

Borehole No.	Total Sulphur (%)	Pyritic Sulphur %		Sulphate Sulphur %		Organic Sulphur %	
		Coal basis	Sulphur basis	Coal basis	Sulphur basis	Coal basis	Sulphur basis
CMWMG-27	1.03	0.58	56.3	0.09	8.7	0.36 (0.65)	35.0
CMWMG-29	0.80	0.46	57.5	0.07	8.7	0.27 (0.48)	33.8
CMWMG-35	0.79	0.37	46.8	0.11	13.9	0.31 (0.61)	39.3

Note – Figures within brackets are on DMMF basis

k) **ASH FUSION TEMPERATURE RANGE**

The Ash Fusion Temperature Range is available for 3 boreholes The boreholewise details are given below :

TABLE – 4.21

ASH FUSION TEMPERATURE RANGE, COMPOSITE-A SECTION

Borehole No.	I.D. (°C)	H.T. (°C)	F.T. (°C)
CMWMG -27	1220	>1400	> 1400
CMWMG -29	1260	>1400	> 1400
CMWMG -35	1300	>1400	>1400

4. 10.3.5 COMPOSITE – A+B+C+D SECTIONS (COMPOSITE SEAM)

A) i) The Composite Seam of Wardha Valley Coalfield has been represented by four Sections i.e. Sections – (A+B+C+D) in the present area of the block, as correlated in the earlier geological reports prepared by MECL in the adjoining blocks (Mugoli/Kolgaon Sawangi). Since, the Composite Seam is the most potential seam of Barakar Formation and considered suitable for opencast mining.

ii) The combined thickness of all four seam sections (A+B+C+D) excluding parting (> 1.00m) in between the seam sections has been considered for determination of coal quality & estimation of geological net proved reserves for opencast method of mining.

iii) The Composite Seam has been intersected in total 39 boreholes. The subcrop of seam sections has been intersected in 6 boreholes (Section-A in borehole i.e. CMWMG-30) Section-B in 2 boreholes. i.e. (CMWMG-17). The Composite Seam is partly faulted in 7 boreholes (CMWMG-16,21, 38, 52, 55, 57 & MWSM-1). The Composite Seam is totally omitted due to fault in 3 boreholes (CMWMG-13, 23 & 45). The full thickness of the seam has been intersected in 26 boreholes and its thickness (roof to floor excluding >1.00 m parting) varies from 14.84 m (CMWMG-11) to 22.19 m (CMWMG-24) and its average thickness varies between 17.50 m to 20.50 m. The minimum and maximum depth of occurrence (roof) of Composite Seam Sections in the boreholes varies from 9.81 m (CMWMG-54) to 159.26 m (CMWMM-35). The distinct parting has been observed between Composite – A+B+C and D Sections, which varies between 3.54 m (CMWMG-15) to 7.06 m (MWSM-1) and wherever the parting between Composite – A, B & C Sections are less than 1.00 m thickness has been considered as part of the seam thickness and accordingly its quality & geological reserves have been estimated for Composite Seam. The band by band analysis is available for 31 boreholes.

The combustible dirt band has been observed in 24 boreholes (full thickness) and its number varies between 1 and 7. Its percentage varies from 1.41% to 10.18 %. The obvious dirt bands has been noticed in 20 boreholes (full thickness) and its number varies from 1 to 3. The percentage varies from 0.79 % to 5.16 %. The total thickness of dirt bands (combustible+ obvious) varies from 0.30 m to 3.23 m and its percentage ranges between 1.94 % to 17.54 %. The Proximate Analysis on 60% RH & 40° C for full seam thickness (IP) is available for 24 boreholes. (8 determined + 16 calculated). The grade of the seam varies from E to F.

B. Depth of roof intersection

- i) Shallowest - 9.81 m (CMWMG – 54)
- ii) Deepest - 159.26 m (CMWMG – 35)

C Floor Reduced level

- i) Minimum - 16.47 m (CMWMG-36)
- ii) Maximum - 166.89 m (CMWMG – 54)

D. Seam Thickness (m)

Range	Stratigraphic thickness range (m)
Minimum	14.84 (CMWMG – 11)
Maximum	22.19 (CMWMG – 24)
General	17.50 – 20.50

Thickness range (m)	No. of B.H.	Percentage
< 15.00	1	3.85
15.00 - 16.00	1	3.85
16.00 - 17.00	3	11.54
17.00 - 18.00	5	19.23
18.00 - 19.00	6	23.07
19.00 - 20.00	7	26.92
20.00 – 21.00	2	7.69

21.00 – 22.00	-	-
> 22.00	1	3.85
Total	26	100

The subcrop of Composite Seam Sections has been demarcated below the floor of Kamthi Formation in the eastern part of the area.

E. PARTING

a) Between Composite-A & B Sections

- i) Minimum - 0.30 m (CMWVG – 33)
- ii) Maximum - 1.95 m (CMWVG – 37)

b) Between Composite-B & C Sections

- i) Minimum - 0.27 m (CMWVG – 39)
- ii) Maximum - 2.74 m (CMWVG – 56)

c) Between Composite-C & D Sections

- i) Minimum - 3.54 m (CMWVG – 15)
- ii) Maximum - 7.06 m (MWSM – 1)

F. ROOF LITHOLOGY

a) Immediate Roof

- i) Dominant - Shale and carb. shale
- ii) Subordinate - Medium grained sandstone

b) Within 3.00 m lithology

- i) Dominant - Medium grained sandstone
- ii) Subordinate - Fine grained sandstone, shale & carb. shale

G. FLOOR LITHOLOGY

a) Immediate floor

- i) Dominant - Sandy shale & fine grained sandstone
- ii) Subordinate - Shale and carb. shale

b) Within 1.00 m lithology

- i) Dominant - Fine grained sandstone
- ii) Subordinate - Sandy shale

H. DIRT BANDS (full seam thickness)

4.34.1 No of boreholes devoid of dirt bands - NIL

Dirt bands	No of boreholes	No of dirt bands	Total thickness range (m)	Percentage
Combustible	25	1 - 7	0.28 – 2.17	1.41 – 10.18
Obvious	20	1 - 3	0.14 – 1.07	0.79 – 5.16
Combustible + obvious	25	1 - 8	0.30 – 3.23	1.94 – 17.54

I. PROXIMATE ANALYSIS ON 60% RH 40° C

TABLE-4.22

PROXIMATE ANALYSIS ON 60% RH & 40° C,
COMPOSITE SEAM-(A+B+C+D SECTION)

Particulars	No. of B.H.	I – 100		IP	
		Minimum	Maximum	Minimum	Maximum
Moisture %	24	7.2 (CMWVG-31 34)	8.9 (CMWVG-11)	7.0 (CMWVG-32)	8.0 (CMWVG-46)
Ash %	24	26.4 (CMWVG-11)	39.1 (CMWVG-22)	30.4 (CMWVG-47)	39.1 (CMWVG-22)
VM %	8	21.8 (CMWVG-22) (41.0) CMWVG-39	26.2 (CMWVG-47) (44.5) CMWVG-47	21.8 (CMWVG-22 & 36) (40.7) CMWVG-18	26.2 (CMWVG-47) (44.9) CMWVG-46
FC %	8	31.8 (CMWVG-22)	36.5 (CMWVG-39)	31.8 (CMWVG-22)	37.0 (CMWVG-18)
GCV (k.Cal/kg.)	8	3664 (CMWVG-22) (7288) CMWVG-20	4385 (CMWVG-47) (7571) CMWVG-34	3664 (CMWVG-22) (7139) CMWVG-30	4385 (CMWVG-47) (7615) CMWVG-25
UHV (k.Cal/kg.)	24	2497 (CMWVG-22)	4029 (CMWVG-11)	2497 (CMWVG-22)	3642 (CMWVG-47)
G R	(General range)	24	E – F	E – F	

Particulars		No. of B.H.	I – 100		IP	
			Minimum	Maximum	Minimum	Maximum
A D E	(Prevalent range)		E – F		E – F	

NOTE: Values of VM% & GCV given in brackets are on DMMF basis

J. ULTIMATE ANALYSIS

The Ultimate Analysis for Composite-A+B+C+D Sections (roof to floor) is available for 5 boreholes. The boreholewise details are given below :

TABLE –4.23

ULTIMATE ANALYSIS, COMPOSITE- (A+B+C+D) SECTIONS

Particulars	CMWMG-27	CMWMG-29	CMWMG-31	CMWMG-35	CMWMG-46
C%	41.4 (81.3)	44.2 (81.1)	44.7 (79.4)	44.3 (82.0)	41.5 (79.3)
H %	2.4 (4.7)	2.4 (4.4)	2.4 (4.3)	2.4 (4.4)	2.4 (4.6)
N %	0.9 (1.8)	1.0 (1.8)	1.0 (1.8)	1.0 (1.8)	1.0 (1.9)
S %	1.37	1.00	0.90	0.77	1.50

Note – Figures within brackets are on DMMF basis

K. SULPHUR

The Total Sulphur analysis is available for 8 boreholes and its percentage varies from 0.7 % (CMWMG-22) to 1.8 % (CMWMG-39).

L. ASH FUSION TEMPERATURE RANGE

The Ash Fusion Temperature Range for Composite – A+B+C+D Sections (roof to floor) is available for 3 boreholes . The boreholewise details are given below :

TABLE – 4.24

ASH FUSION TEMPERATURE RANGE, COMPOSITE-A SECTION

Borehole No.	I.D. (°C)	H.T. (°C)	F.T. (°C)
CMWMG -27	1260	>1400	> 1400
CMWMG -29	1220	>1400	> 1400
CMWMG -35	1320	>1400	>1400

4.11 QUALITY PARAMETERS

The undiluted quality involving Sections A+B+C+D (I-100 basis) of Composite Seam. The Thickness average GCV for undiluted Sections A+B+C+D (I-100) for Composite Seam is tabulated below:

TABLE – 4.25

QUALITY PARAMETERS

BH. NAME	SECTIONS OF COMPOSITE SEAM	THICK. (m)	THICK AVG GCV K Cal/Kg	GRADE
CMWMG-11	ABCD	14.84	4625	G9
CMWMG-12	ABCD	18.25	4582	G10
CMWMG-14	ABCD	18.55	4497	G10
CMWMG-15	ABCD	15.45	4699	G9
CMWMG-18	ABCD	17.74	4743	G9
CMWMG-19	ABCD	16.32	4471	G10
CMWMG-20	ABCD	18.57	4577	G10
CMWMG-22	ABCD	17.6	4289	G11
CMWMG-24	ABCD	20.59	4406	G10
CMWMG-25	ABCD	16.42	4543	G10
CMWMG-26	ABCD	18.61	4673	G9
CMWMG-27	ABCD	14.65	4297	G11
CMWMG-29	ABCD	18.44	4860	G9
CMWMG-31	ABCD	19.24	4654	G9
CMWMG-32	ABCD	18.66	4569	G10
CMWMG-34	ABCD	16.83	4469	G10
CMWMG-35	ABCD	17.54	4700	G9
CMWMG-36	ABCD	17.4	4301	G10
CMWMG-37	ABCD	16.82	4435	G10
CMWMG-39	ABCD	15.43	4790	G9
CMWMG-40	ABCD	18.01	4462	G10
CMWMG-44	ABCD	15.35	4679	G9
CMWMG-46	ABCD	18.34	4335	G10
CMWMG-47	ABCD	18.28	4578	G10

The average undiluted GCV for Sections A+B+C+D of Composite Seam is 4551 (K Cal/Kg) & the grade is G10.

4.12 GEOLOGICAL RESERVES

4.12.1 BASIC ASSUMPTIONS AND NORMS FOLLOWED

- a) All 4 seam sections i.e. Composite –A, B, C & D Sections are potential and attained workable thickness (> 0.90 m) in the entire area of the block.
- b) The assessment of reserves for Composite Seam have been made in proved category.
- c) Isochores of Composite Seam (A+B+C+D excluding parting > 1.00 m) have been drawn at 1.00 m interval.
- d) Iso-quarry depth lines have been drawn at the floor of Composite-D Section considering that all 4 sections of the Composite Seam shall be mined as single seam quarry.
- e) Area falling in heave zone of the faults have been excluded while measuring the area for reserve estimation.

4.12.2 PROCEDURE

Block Boundary

The Area of Mugoli Extn. Block is about 2.260 sq. km and is located in the south-western part of western limb of Wardha Valley Coalfield. The limits of Area of Mugoli Extn. Block are as follows :

1. North - Southern edge of Penganga river
2. South - Arbitrary line joining fault $F_8 - F_8$ & subcrop of Composite Seam at the distance of 150 m from boreholes CMWWMG-44 & 45.
3. East - Subcrop of Composite Seam (below Kamthi Formation)
4. West - Fault $F_8 - F_8$ (at the floor of Composite –D Section)

4.12.3 SECTOR

Based on fault pattern, the limits of the sectors for reserve estimation have been determined. Total 3 sectors viz, I, II & III have been demarcated. THE limits of Sectors- I, II, III are given below in Table.

TABLE-4.26

LIMIT OF SECTORS, MUGOLI EXTN. BLOCK

Sector	North	South	East	West
I	Southern edge of Penganga river	Fault $F_6 - F_6$	Subcrop of Composite Seam (below Kamthi Formation)	Fault $F_6 - F_6$
II	Southren edge of Penganga river	Arbitrary line	--do--	Faults $F_8 - F_8$ & $F_7 - F_7$ & Penganga river
III	Southren edge of Penganga river	Fault $F_8 - F_8$	Fault $F_7 - F_7$	Fault $F_8 - F_8$ & Penganga river

4.12.4 Average Specific Gravity

The following average gradewise specific gravity has been considered for reserves estimation of non-coking coal of Barakar Formation :

Grade	UHV (k.cal./kg.)	Specific gravity
E	> 3360 – 4200	1.60
F	> 2400 – 3360	1.68

4.12.5 Geological Reserves

The details of quarriable net proved geological reserves is given below:

- The quarriable net proved reserves have been estimated Coal : overburden ratiowise, thicknesswise, gradewise, depthwise, and sectorwise for Composite-A+B+C+D Sections of Composite Seam after excluding > 1.00 m parting IP* for the area falling above and below HFL.
- A total of 54.898 Mt. quarriable net proved reserves have been estimated for Composite-A+B+C+D Sections of Composite Seam. Out of the above total reserves 6.449 Mt. falls within subcrop zone of Composite Seam and the balance 48.449 Mt. are for full seam thickness area. The total reserves of 24.562 Mt falls above HFL and 30.336 Mt falls below HFL area.
- Sectorwise & depthwise net proved quarriable reserves are given below in Table –4.27.

TABLE –4.27

SECTORWISE & DEPTHWISE NET PROVED QUARRIABLE RESERVES,

Sector	Depth (m)					Total reserves (Mt)
	< 50	50 - 100	100 - 150	150 - 200	> 200	
A) ABOVE HFL AREA						
SECTOR –I	1.014	-	-	-	-	1.014
SECTOR-II	-	10.754	7.281	-	-	18.035
SECTOR-III	-	0.721	4.289	0.503	-	5.513
SUB-TOTAL	1.014	11.475	11.570	0.503	-	24.562
B) BELOW HFL AREA						
SECTOR –I	2.699	-	-	-	-	2.699
SECTOR-II	4.395	8.115	4.100	2.667	0.388	19.665
SECTOR-III	-	-	2.685	4.062	1.225	7.972
SUB-TOTAL	7.094	8.115	6.785	6.729	1.613	30.336
TOTAL	8.108	19.590	18.355	7.232	1.613	54.898

4.13 SPECIALISED STUDIES

4.13.1 PHYSICO-MECHANICAL PROPERTIES

Boreholes CMWVG-33 & 53 falling in quarriable area of Mugoli Extn. Block were selected for carrying out physico-mechanical tests and coal and non-coal cores of boreholes were sent to VNIT. RQD (Rock Quality Determination) studies have also been undertaken for all boreholes on cores of different litho-units (Annexure-II). Each piece of the litho-units has been measured and with the help of the following formula RQD % has been calculated.(RESULTS ARE YET TO BE RECEIVED)

4.13.2 MINE DRAINAGE

In absence of site specific investigation for the block, it is difficult to predict quantify correct mine flow. However, attempt has been made to estimate the inflow. The average make of water during mining would be around 9800 m³/day. During monsoon depending upon the precipitation and cracks propagation due to mining, the mine flow may be double to the maximum flow estimation apart from direct collection of rain water in the mine. It is further likely to encounter excessive mine flow in the region near fault zones. Keeping in view the mine water flow likely to be encountered during mining in Mugoli OCP, it is recommended for detailed hydrogeological investigations for this block.

4.14 RECOMMENDATIONS

- a) Further exploration requirement 500 m drilling is for further proving of sub-crop, structures proving and non-coal proving. The points are marked on the floor contour plan.
- b) To prove continuity of coal occurrence in the further south of the area, 500 m drilling is proposed in first instance.

Chapter - 5

MINE BOUNDARIES, RESERVES & MINE LIFE

5.1 FIXATION OF MINE BOUNDARIES

The area of Mugoli Extension Block is about 2.260 sq m and is located in the south & western part of western limits of Wardha Valley coalfield. The limits of the proposed Penganga Opencast are given in table 5.1

5.2 MINEABLE RESERVES:

Considering flat seam, advantage of upthrown fault F7-F7 in dip side , good strike length and low stripping ratio an alternative proposing maximum evacuation of Coal Reserves from Mugoli Extension block is proposed. **In proposed Alternative the coal reserves are 44.06 Mt at the stripping ratio of 3.67 m³/t upto 170 m quarry depth. These reserves are sufficient for getting moderate mine life with high annual production and so it has been considered for project planning.**

Reserves, overburden, depth & stripping ratio for given alternative is given in the Table below :-

Table – 5.1

Quarry Boundaries			
Rise Side / East Side	West side /Dip Side	South Side	North Side
Keeping Quarry floor at Incrop of bottom section at half thickness	Keeping Quarry Surface at 175m from Penganga river	Keeping Quarry floor over fault F8-F8(Upto GR limits)	Keeping Quarry floor at Incrop of bottom section at half thickness.

SECTOR & SECTION WISE MINEABLE RESERVES:

Total reserves to be worked as per this PR is 44.06 Mt. In proposed Penganga OC, whole Quarry is divided into eight working cuts viz. **boxcut** i.e. from half incrop thickness of bottom section to 152FRL/140FRL(on downthrown side), **(Cut-1)** ie upto 142 FRL/132FRL(on downthrown side) , **(Cut-2)** ie upto 110FRL, **(Cut-3)** ie upto 90 FRL, **(Cut-4)** ie upto 70 FRL/80 FRL(on upthrown side), **(Cut-5)** ie upto 50FRL/60FRL(on upthrown side), **(Cut-6)** ie upto 20FRL/40FRL(on upthrown side) and Balance Cut (Cut-7). Details of these cuts, along with quantities of coal and overburden in each cut, is given below as detailed Volume Regime Table.

S.No	CUTS	COAL(Mt)			TOTAL O.B (Mm3)			STRIPPING RATIO(m3/t)
		Top section	Bottom section	Total	Top OB	Parting	Total OB	including parting
		(A+B+C)	(D)					
1	ACCESS TRENCH	0	0	0	0.17	0	0.17	
2	BOX-CUT	0.01	0.96	0.97	3.37	0.00	3.37	3.47
3	CUT-I	2.10	3.55	5.65	14.34	1.14	15.48	2.74
4	CUT-II	4.99	5.06	10.05	28.46	2.29	30.75	3.06
5	CUT-III	4.61	4.85	9.46	35.40	2.19	37.59	3.97
6	CUT-IV	3.69	4.27	7.96	31.67	1.85	33.52	4.21
7	CUT-V	2.60	2.85	5.45	21.10	1.00	22.10	4.06
8	CUT-VI	1.43	1.52	2.95	11.86	0.59	12.45	4.22
9	BALANCE CUT	0.61	0.96	1.57	5.80	0.54	6.34	4.04
	TOTAL	20.04	24.02	44.06	152.17	9.60	161.77	3.67

5.2 TARGET OUTPUT:

The annual target production proposed for the mine is 4.0 Mty for mineable reserves of 44.06 Mt. However Peak Mine Capacity of the Project would be proposed for 4.50 Mty because in EAC meeting held on 06-11-2012 the project has been recommended for grant of EC for 4.5 Mty, but formal EC is awaited. The target production of 4.0 Mt would be achieved in the 5th year as proposed in this PR.

MINE LIFE

The life of the project works out to **15 years** (including initial one year for land acquisition). It is proposed to acquire land in first year of mine life. Quarry operations would start from second year of mine life.

ZERO DATE:

The zero date of the project may be considered the date of land to be acquired. One year period before start of mining activity has been considered for acquisition of required land. The zero date of the mine may be tentatively September, 2014 and the land acquisition would be started in the beginning of financial year 2014-15.

MINE LIFE:

The total life of the proposed opencast mine is estimated as 15 years including pre-construction period. Initial one year of period has been considered for land acquisition purpose. The break-up of mine life is as under:

- **CONSTRUCTION PERIOD:**

The construction period for the mine will be one year.

- **PRODUCTION BUILD-UP PERIOD:**

Production build-up period for the mine will be three years(excluding 1 years of land acquisition).

- **PRODUCTION PERIOD:**

Production period for the mine will be eleven years.

- **TOTAL PERIOD:**

Total period for the mine life will be fifteen years including **one** years of land acquisition period.

5.3 ANY FURTHER EXPLORATION REQUIRED WITH TOTAL METERAGE AND NUMBER OF BOREHOLES TO BE DRILLED AND AREA OF FURTHER DRILLING.

Provision of Rs.30.00 lakhs has been provided in this PR in Appendix A.7 for drilling of additional boreholes (for the purpose of structural confirmation etc. as and when required).

Chapter - 6

METHOD OF MINING

6.1 GENERAL

The working is proposed by opencast method of mining and due to thick seams & coal conservation point of view Underground mining option has been ruled out . Considering flat gradient of seam which falls in the range of 1 in 7.5 to 1 in 14, surface miner is proposed for extraction of coal in Penganga OC mine. Since gradient is flat , combined seam thickness is ranging from 17.5m to 20.5 m and strike length is ranging from 550m to 1550m ,hence the target capacity of the proposed Quarry is kept at 4.0Mty.

6.2 GEO-MINING CHARACTERISTICS

6.2.1 SEAM GRADIENT - VARIATION, AV. GRADIENT OF QUARRY FLOOR

The general strike of the coal seam is north-south in the major part of the area with minor swing in central part of the area. In the subcrop zone near boreholes CMWVG-17 & 28 the strike becomes northwest-southeast. The dip of the strata ranges from 4° to 7.5° (gradient 1 in 7.5 to 1 in 14.0) and dipping towards west and southwest direction. The eastern part of the area is generally having less gradient (1 in 14) as compare to remaining part of the block.

6.2.2 GEOLOGICAL DISTURBANCES

The area of the block is traversed by 6 total numbers of faults. Most of the faults are oblique faults, cutting across the strike of the strata. The major i.e. F6-F6, F7-F7 & F8-F8 continuing from the northern adjoining block i.e. Kolgaon Sawangi Block . This major fault (F8-F8) also demarcates the western limit of the block. The newly interpreted faults have been numbered i.e. F1-F1, F2-F2 & F3 & F3.

The details of the individual faults are given in the following Table –

TABLE – 6.1
DESCRIPTION OF FAULTS, MUGOLI EXTN. BLOCK

Sl. No.	Fault No.	Extent of faults (m)	Trend	Throw		Evidence
				Direction	Amount (m)	
1.	$F_1 - F_1$	250	NW - SE	SW	0-5	Composite –A section is omitted in borehole MWSM-1.
2.	$F_2 - F_2$	450	NNW-SSE	ENE	0 - 20	Difference in floor level on both side of the fault.
3.	$F_3 - F_3$	975	NW – SE	SW	0 – 10	Difference in floor level on both side of the fault.
4.	$F_6 - F_6^*$	1825	NW-SE	SW	10 - 60	Composite-A Section is omitted in borehole CMWVG-16 & difference in floor level on both sides of the fault.
5.	$F_7 - F_7^*$	1825	NW-SE	NE	5 - 30	Composite-A Section is omitted in borehole CMWVG-21 & difference in floor level on both sides of the fault.
6.	$F_8 - F_8^*$	2425	NW - SE	SW	25 (Approx.)	Composite Seam is omitted in borehole CMWVG-45 & part Composite Seam is faulted in boreholes CMWVG-38, 52, 55 & 57.

6.2.3 PRESENCE OF IN-SEAM BAND SEAM-WISE (NUMBERS AND THICKNESS OF EACH BAND, TOTAL BAND THICKNESS

The details of presence of In seam bands Seamwise with number and thickness of each band and total band thickness are detailed in annexure No. II .

6.2.4 DETAILS OF SEQUENCE OF COAL SEAM AND PARTING

The Composite Seam, which is about 21 m to 26 m thickness including all dirt bands and parting in the present area occurs in 4 sections viz. Composite-A Section, Composite-B Section, Composite-C Section and Composite-D

Section. The parting between Composite-A+B+C Sections and Composite-D Section varies from 3.54 m (CMWMG-15) to 7.06 m (MWSM-1). All sections of the Composite Seam are virgin. The detailed description of Composite-A Section, Composite-B Section, Composite-C Section and Composite –D Section and Composite – A+B+C+D Sections are given below :

Sequence of Coal Seams, Mugoli Extension Block

Coal seam/ Parting	Thickness range (m)		Generalised thickness range (m)
	Minimum	Maximum	
Composite-A Section	0.75 m (CMWMG – 37)	2.72 m (CMWMG – 24)	1.00 - 2.00
Parting	0.30 m (CMWMG-33)	1.95 m (CMWMG-37)	
Composite-B Section	0.72 m (MWSM – 1)	4.02 m (CMWMG – 20)	2.50 – 3.50
Parting	0.27 m (CMWMG-39)	2.74 m (CMWMG-56)	
Composite-C Section	1.31 m (CMWMG – 33)	4.26 m (CMWMG – 22)	2.00 – 3.50
Parting	3.54 m (CMWMG-15)	7.06 m (MWSM-1)	
Composite-D Section	7.65 m (CMWMG – 38)	11.65 m (CMWMG – 21)	9.70 – 11.00
Composite- A+B+C+D Sections (excluding > 1.00 m parting	14.84 m (CMWMG – 11)	22.19 m (CMWMG – 24)	17.50– 20.50

6.3 MINE PARAMETERS

The seam characteristics and the profile of the quarries are as given below in Table:

Sl. No.	PARTICULARS	
1	Area of the Quarry	
(a)	On floor (ha)	174.95
(b)	On surface (ha)	240.10
2	Average strike length (m)	1050
(a)	maximum	1550
(b)	minimum	550
3	Average width (m)	
(a)	At floor	700
(b)	At surface	850
4	Depth (m)	
(a)	Initial	20
(b)	Final	170
5	Gradient of seam	1 in 7.5 to 1 in 14
6	Average thickness of seam /partings (m)	
(a)	Section A	1.50
(b)	Parting P1	1.0
(c)	Section B	3.0
(d)	Parting P2	1.2
(e)	Section C	2.75
(f)	Parting P3	5.25
(g)	Section D	10.30
(h)	Total Av. Thickness considered (A+B+C+D)	17 m (approx.)
7	Average parting between sections (m) (between C & D)	3.0
8	Mineable reserves (Mt)	44.06
9	Total OB (Mm³)	161.77
(a)	Top OB (Mm ³)	152.17
(b)	Parting (Mm ³)	9.60
10	Average SR (m³/t)	3.67
11	Grade & GCV	'G'10(4551)

6.4 CHOICE OF TECHNOLOGY:

The shovel dumper combination has been proposed for OB removal in this mine. Considering flat gradient of seam which falls in the range of 1 in 7.5 to 1 in 14, Surface Miner is proposed for extraction of coal in Penganga OC mine.

6.5 MINING SYSTEM & SYSTEM PARAMETERS

6.5.1 WIDTH & HEIGHT OF BENCHES

For overburden, keeping the bench height of 13 m, the width of working and non working benches are kept as 40 m and 25 m respectively. The mining

system as proposed is shown in the Cross-sections. Haul road would be constructed on the floor of the quarry at a gradient of 1 in 16 with a width sufficient for dumper/trucks movement, dozer path, drainage and electrification etc. Flank roads shall be developed on side batter for transport from different horizons.

6.5.2 SLOPE OF BENCHES & QUARRY

i) During Mining Operation

The slope of individual benches depends on the type of strata. In this report, the slope of individual bench is proposed as 45° in soil, alluvium and clay whereas, it is 70° in hard strata. The overall slope of the quarry in dip side during mining operation varies around 22° (from horizontal plane) depending on the nature of strata in the entire depth of quarry.

Rise side batter remains same as above in the quarry during operation time or at the end of the quarry. The overall angle of the rise side batter from horizontal plane is divided into two parts.

- 1) From surface to the depth of unconsolidated strata including clay; and
- 2) From the starting point of hard strata up to initial quarry depth.

ii) At the end of quarry

The slope of individual benches in the batter at the end of quarry remains same as that during mining operation i.e. 45° in soil, alluvium and clay and 70° in hard strata.

Overall angle considered during planning is about 40° in dip side & about 37° in rise side. However, it is proposed to conduct scientific study for slope stability in quarry benches and OB dumps by any scientific agency. For this purpose, capital provision has been made in appendix A.8.5.

6.5.3 DRILLING & BLASTING

The degree of fragmentation in opencast mine has to be optimised so that total cost of drilling, blasting, excavating, transport and crushing as a total system is minimised. In order to keep the ground vibrations within the

permissible limit as per DGMS Circular No. 7 of 1997, to avoid flying of rock fragments and also to achieve satisfactory blasting results, optimized drilling / blasting parameters depending upon rock formation using combination of relays / delays will have to be evolved. It is further recommended that at the time of actual execution, proper study for controlled blasting and ground vibration is to be done with the help of scientific body in order to evolve site specific charge distance relationship. Drills proposed for overburden benches are of 160mm diameter .

It is proposed that Site Mixed explosive should be used to save charging time and avoid storage problems of explosive. Powder factor of 3.0 m³/kg for OB has been considered in this report for planning purpose. However, during actual operation, powder factor may vary depending on the nature of actual strata. No blasting in coal will be required in as Coal is proposed to be evacuated by Surface miner .

Chapter - 7

MINING STRATEGY

7.1 INTRODUCTION

In this Revised Project Report of Penganga OC Project (August,2014) , for a mine target of 4.0Mty, the Partial Hiring Option has been envisaged in which workload of Top OB (2.60 Mm³) of the mine would be catered by Departmental HEMM and remaining balance Top OB by hiring/outsourcing. Coal and parting will be done by surface miner and shovel/dumper system on hiring . Peak programmed OB has been kept as 16.84 Mm³/annum.

CONSTRAINTS ON MINE DEVELOPMENT

ACQUISITION OF LAND

Proposed Penganga OC mine involves acquisition of **about 763.06 ha of land**. Acquisition of land is very crucial Rs.24.70 lakh/ha have been proposed for acquisition of tenancy land and Rs 14.82 lakh/ha for government land. Rs 216.3948 crores is proposed for land acquisition and compensation to land losers. The compensation package for acquisition of land is as per new R&R Policy as per CIL guidelines.

7.1.1 SHIFTING & REHABILITATION OF WIRUR VILLAGE

Wirur village is located centrally in the proposed mine area and it is essential to shift and rehabilitate Wirur Village. Therefore, **a provision of about Rs.41.8870 crores is kept for shifting and rehabilitation of Wirur village.**

7.1.2 CONSTRUCTION OF BRIDGE OVER RIVER FOR APPROACH TO PROJECT SITE

Presently there is no approach to proposed project from Mugoli/Ghuggus OC side. Penganga river is flowing between existing Mugoli OC and the proposed Penganga OC . A bridge is essential and critical for approach to project and also for Coal transportation to nearest Ghugus railway siding. Provision of

Rs. 36.3384 crores is kept for construction of bridge over Penganga river. Cost Benefit Analysis has been done in PR in which the above mentioned bridge along Penganga river is technically and economically justified for coal transportation to Ghughus Siding and also men and material transportation from existing Ghughus / Mugoli OC projects. Till bridge is constructed, coal will be transported to nearest railway siding, Ballarshah which is about 35 km. from the proposed project area.

7.1.3 One Nala is located centrally in the proposed mine area and it is essential to divert. Therefore, a provision of about Rs.16.4857 crores is kept for diversion of Nala.

7.2 MINING STRATEGY

In opencast mines generally the stripping ratio is very high during initial years and low in the concluding years. Therefore it is envisaged that the mine be developed in stages so that the equipment (HEMM) provided on the basis of peak stripping ratio are sufficient to handle the workload of initial period.

The total average strike length of proposed Penganga OC is about 1.05 km. Since the gradient of seam is flat, mining cuts are proposed such that substantial internal backfilling of OB upto surface and heightening of OB dump over quarry area and merging it with proposed external OB dump can take place (refer Quarry Layout Plan). This heightening of OB dump over internal backfilled and merging it with external OB dump will optimize acquisition of land for dumping.

Initially, Access Trench is used to touch coal seam at half thickness of incrop of bottom section. Access Trench would be driven at a gradient of 1 in 16 to touch the floor of quarry. The slope of the Access Trench batter upto unconsolidated strata is proposed to be kept at 1 in 2 from slope stability point of view and after unconsolidated strata, about 45° slope is assumed till the floor of bottom seam is touched. Provisions have been made for study of slope stability design.

The alignment of access trench is shown in Quarry layout plan and is directed towards the proposed coal handling plant. The position and alignment of access

trenches are tentative and is subject to minor changes to suit the local condition.

In proposed Penganga OC, whole Quarry is divided into eight cuts viz. boxcuts – i.e. from half incrop thickness of bottom section to 152FRL/140FRL(on downthrown side), upto 142 FRL/132FRL(on downthrown side) is (Cut-1), upto 110FRL (Cut-2) , upto 90 FRL (Cut-3), upto 70 FRL/80 FRL(on upthrown side) (Cut-4), upto 50FRL/60FRL(on upthrown side) (Cut-5), upto 20FRL/40FRL(on upthrown side), (Cut-6)and Balance Cut (Cut-7). Details of these cuts, along with quantities of coal and overburden in each cut, is given below as Volume Regime Table.

S.No	CUTS	COAL(Mt)			TOTAL O.B (Mm3)			STRIPPING RATIO(m3/t)
		Top section	Bottom section	Total	Top OB	Parting	Total OB	including parting
		(A+B+C)	(D)					
1	ACCESS TRENCH	0	0	0	0.17	0	0.17	
2	BOX-CUT	0.01	0.96	0.97	3.37	0.00	3.37	3.47
3	CUT-I	2.10	3.55	5.65	14.34	1.14	15.48	2.74
4	CUT-II	4.99	5.06	10.05	28.46	2.29	30.75	3.06
5	CUT-III	4.61	4.85	9.46	35.40	2.19	37.59	3.97
6	CUT-IV	3.69	4.27	7.96	31.67	1.85	33.52	4.21
7	CUT-V	2.60	2.85	5.45	21.10	1.00	22.10	4.06
8	CUT-VI	1.43	1.52	2.95	11.86	0.59	12.45	4.22
9	BALANCE CUT	0.61	0.96	1.57	5.80	0.54	6.34	4.04
	TOTAL	20.04	24.02	44.06	152.17	9.60	161.77	3.67

In Penganga OC, the cuts are divided by drawing Bench Profiles at 20 m depth intervals (refer Cross-section Plan). Volume of Top OB, Parting and Coal have been calculated for each cut and total quantity of the mine has been arrived at after correcting the cut quantities on the basis of actual plan readings of volumes of coal, OB and parting of Quarry. The corrected cut quantities of Top OB and Parting in accordance with sequence of mining, is utilized to arrive at the annual break-up of total Programmed OB into Top OB and Parting in every year of the mine.

7.3 DUMPING STRATEGY

- **YEAR OF STARTING OF INTERNAL DUMPING**

Considering flat gradient and shape of the mine about 33% of OB is proposed for internal dumping. Internal OB dumping of hard OB after cut-3 starts from 6th year of Quarry operation.

THE EXTERNAL DUMPING AREA IS COAL BEARING/NON-COAL BEARING.

The area of external dumping is in rise side Non Coal bearing area of the block. Since the gradient of seam is flat, mining cuts are proposed such that substantial internal backfilling of OB upto surface and heightening of OB dump over quarry area and merging it with proposed external OB dump can take place. This heightening of OB dump over internal backfilled and merging it with external OB dump will optimize acquisition of land for dumping

- **PLACE FOR BLACK COTTON SOIL DUMPING**

About 22 Mm³ of OB is of Soft OB and soil in the proposed quarry, and rest about 139.77Mm³ is hard strata. To provide stability of dumps and prevent slope failures, it is proposed to have separate dumps for Soft OB, Black cotton soil and hard OB. 90m, 45m and 10m height has been proposed for hard OB, Soft OB and Black cotton soil respectively. ***As per directive of TSC to remove BC soil below the site of proposed external dump area it is proposed to excavate 120 m channel of entire BC soil (upto 3m depth) in the circumference of proposed Rise side Hard OB and soft OB dumps to ensure safety and stability of dump based on the latest study done by CMPDI (Hq.) for external dumping of OB above BC soil in one Project of WCL. Therefore additional 2.0 Mm³ of BC soil from the place of proposed hard OB dump and soft OB dumps is excavated and dumped in the BC soil dump (2.0 Mm³) .***

YEAR-WISE EXTERNAL AND INTERNAL DUMPING AND STAGE PLAN:

YEAR	Top OB & Parting removal(Mm3) (as per PH Option) (Including BC soil below the external dump)	Volume of External Dump (Mm ³)	Volume of Internal Dump (Mm ³)	Reclamation Plan (Approx. Nos. of trees to be Planted @2500 Plants/Ha)
1	-	LAND ACQUISITION		
2	7.10+2.0*	7.10+2.0*=9.10	-	2000
3	8.22	8.22	-	2000
4	12.04	12.04	-	2000
5	12.24	12.24	-	2000
6	13.45	12.56	0.89	5000
7	15.89	15.00	0.89	5000
8	15.89	13.46	2.43	5000
9	16.81	13.92	2.89	5000
10	16.84	13.95	2.89	5000
11	12.17	-	12.17	5000
12	12.17	-	12.17	5000
13	10.55	-	10.55	5000
14	5.00	-	5.00	5000
15	3.39	-	3.39	5000
Total	163.77 (161.77+2.0*)	110.51	53.27	58000
Percentage of Dump		67%	33%	

The figures in * is the quantity of BC soil excavated from the proposed external dump of the mine , which is proposed to be dumped . Plantations on external OB dumps will start tentatively after 12th year . Till 12th year plantation activity will be along roadside, in slopes of embankment, around service buildings & infrastructures and in land for rationalization for finalising lease hold boundary of the mine(strictly in non coal bearing area). Presently internal dumping is about 33 % of total OB. This would increase, if quarry is extended in future.

YEAR	OB removal(Mm3)	Reclamation Plan (Approx. Nos. of trees to be Planted
------	-----------------	---

	(as per P.H option)	@2500 Plants/Ha)			
		Along roadside , slopes of embankment, around service buildings & infrastructures and in land for rationalization (strictly in non coal bearing area)	External OB dump	Internal OB dump and in slopes of quarry	Total
1	-	LAND ACQUISITION			
2	7.10+2.0*	2000			2000
3	8.22	2000			2000
4	12.04	2000			2000
5	12.24	2000			2000
6	13.45	5000			5000
7	15.89	5000			5000
8	15.89	5000			5000
9	16.81	5000			5000
10	16.84	5000			5000
11	12.17	5000			5000
12	12.17	5000			5000
13	10.55	2000	3000		5000
14	5.00	2000	3000		5000
15	3.39		5000		5000
Total	163.77 (161.77+2.0*)	47000	11000	-	58000

The figures in * is the quantities of BC soil excavated from the proposed external dump , which is proposed to be dumped externally.

7.4 SEQUENCE OF DUMPING OPERATIONS AND STAGE-WISE DETAILS

SL.NO.	PARTICULARS OF WORKING	QUARRY
A. 5TH YEAR STAGE		
1.	Coal Mined (Mt)	10.0
2.	OB Removed from mine (Mm ³)	39.60
2a	BC soil excavated from the proposed dump (Mm ³)	2.0
2b	Total OB (Mm ³)	41.60
3.	Stripping Ratio (m ³ /t)	3.96
4.	Excavated Quarry Area (ha)	
5.	Internal Dump (Mm ³)	-
6.	External Dump (Mm ³)	41.60
B 10TH YEAR STAGE		
1.	Coal Mined (Mt)	30.0
2.	OB Removed from mine (Mm ³)	118.50
2a	BC soil excavated from the proposed dump (Mm ³)	2.0
2b	Total OB (Mm ³)	120.50
3.	Stripping Ratio (m ³ /t)	3.95
4.	Excavated Quarry Area (ha)	
5.	Internal Dump (Mm ³)	10.00
6.	External Dump (Mm ³)	110.50
C 15TH YEAR STAGE		
1.	Coal Mined (Mt)	44.06
2.	OB Removed from mine (Mm ³)	161.77
2a	BC soil excavated from the proposed dump (Mm ³)	2.00
2b	Total OB (Mm ³)	163.77
3.	Stripping Ratio (m ³ /t)	3.67
4.	Excavated Quarry Area (ha)	240.10
5.	Internal Dump (Mm ³)	53.27
6.	External Dump (Mm ³)	110.50

7.5 DUMPING ARRANGEMENTS

7.5.1 DUMPING PLAN FOR OVERBURDEN

About 22 Mm³ of OB is of Soft OB and soil in the proposed quarry, and rest about 139.77Mm³ is hard strata. To provide stability of dumps and prevent slope failures, it is proposed to have separate dumps for Soft OB, Black cotton soil and hard OB. 90m, 45m and 10m height has been proposed for hard OB, Soft OB and Black cotton soil respectively. ***As per directive of TSC to remove BC soil below the site of proposed external dump area it is proposed to excavate 120 m channel of entire BC soil (upto 3m depth) in the circumference of proposed Rise side Hard OB and soft OB dumps to ensure safety and stability of dump based on the latest study done by CMPDI (Hq.) for external dumping of OB above BC soil in one Project of WCL. Therefore additional 2.0 Mm³ of BC soil from the place of proposed hard OB dump and soft OB dumps is excavated and dumped in the BC soil dump (2.0 Mm³). External OB dump, proposed is made of 15 m dump tier keeping berm of 6 m at 15 m height, berm of 30 m at 30 m height and again, a berm of 6 m at 45 m height. Keeping the previous bench pattern, the final angle of slope comes out to be about 24° for hard OB dump and 25° for Soft OB dump. The break-up of quarry-wise OB dumping is as follows :-***

Total External dumping– $103.00\text{Mm}^3 + 7.50\text{Mm}^3$ of Embankment = 110.50Mm^3
Total Internal dumping - 53.27Mm^3
percentage of Internal backfilling is about 33 %

Internal OB dumping of hard OB after cut-3 starts from 6th year of Quarry operation. Entire Soft OB and BC Soil of Quarry and that of 120 m channel (in the place of OB dumping area which is about 2.0Mm^3) is 24.50Mm^3 and about 24.00Mm^3 is dumped in separate External OB Dumps of Soft OB and BC Soil dump with 45 m and 10 m height respectively and remaining 0.50Mm^3 is spreaded over external OB Dump for plantation activity. It is proposed to fill the void Quarry upto surface keeping 30 m bench height and 37° slope. In internal backfilling, final angle of slope is about 23° (refer Post-mining Land Use Plan). About 33 % of Total OB is proposed to be internally backfilled. It is proposed that total parting OB will be internally backfilled .

Chapter - 8

MINING SCHEDULE AND EQUIPMENT REQUIREMENT

8.1 WORKING REGIME

Project report for proposed Penganga OC Project envisages following working regime: -

8.1.1 NUMBER OF DAYS OF WORKING IN A YEAR

330 days of working has been assumed in a year based on 7 days schedule of mine working.

8.1.2 NUMBER OF SHIFTS

As per the prevalent practice in WCL, there will be three working shifts in a day in proposed OC Project.

8.1.3 NUMBER OF HOURS IN EVERY SHIFTS

It has been envisaged in the PR that every shift will be of eight hours duration.

8.1.4 EXCAVATION CATEGORY ASSUMED

The excavation category of OB material has been assumed as 50% Category III + 50% Category IV. Whereas for Coal it is assumed as Category IV.

8.1.5 INSITU VOLUME WEIGHT t/m³.

The insitu volume weight of OB material has been assumed as 2.3 t/m³ whereas for coal it is assumed as 1.60 t/m³.

8.1.6 STRENGTH PARAMETERS OF COAL AND ROCK IF ANY - COMPRESSIVE, TENSILE, SHEAR STRENGTH, YOUNG MODULES ETC.

Boreholes CMWVG-33 & 53 falling in quarriable area of Mugoli Extn. Block were selected for carrying out physico-mechanical tests and coal and non-coal cores of boreholes were sent to VNIT. RQD (Rock Quality Determination) studies have also been undertaken for all boreholes on cores of different litho-units. Each piece of the litho-units has been measured and with the help of the following formula RQD % has been calculated.

8.1.7 LEAD

The following are the range of average haul distances (lead) for HEMM have been considered for OB and coal.

a) **For OB - 3.25 km** b) **For Coal/Parting - 3.0 km**

The lead for coal and OB for the proposed quarry have been estimated on the basis of following:

- i) Lift is calculated for each horizon of OB (up to 10m) depending on the depth of horizon and the height of its dumping place and then it is converted into lead by multiplying with gradient of haul road.

Then, for each such horizon of OB & coal, the total lead is calculated by adding following to the above calculated lead:

- a) Distance from cut edge to dump/coal yard edge,
- b) Half of the dump/coal yard length, and
- c) Half of the quarry/cut length.
- d) For turning of road

- ii) After calculating total lead for each horizon of coal or OB, weighted average lead is calculated for all the horizons (separately for coal and OB) in a cut.

These cutwise leads are adopted for calculating the requirement of HEMM during the life of the mine. The programmed OB (yearwise) is estimated on the basis of natural OB to be excavated to get the targeted output of coal and this natural OB depends on the stripping ratio of different cuts.

8.2 EQUIPMENT SCHEDULE

For top overburden removal 2 nos. of 5-6 m³ Diesel/Electrical hydraulic shovels have been provided along with matching nos. of 60 T Rear Discharge Dumpers . ***As per directive of TSC , provision has been kept for 1.7m3 diesel hydraulic Backhoe and 28 kL water tanker in Common HEMM and 410 HP Dozer instead of 320 HP Dozer for Top OB.*** Other necessary common HEMM have also been provided for smooth operation of project. Total HEMM provision is tabulated below :-

Sl. No.	HEMM	Nos.
I. For upper benches of Top OB		
1.	5-6 m3 Diesel /Electrical hydraulic shovel	2
2.	60 T RD Dumpers	14
3.	160 mm dia. RBH Drills	2
4	410 HP Dozers	2
II. Lower Benches of Top OB Coal & Parting by hiring		
III. For Common		
1	12-20 t Crane	1
2	8 t Mobile Service Crane	1
3	1.7 m3 Diesel Hyd. B/H	1
4	Water tanker 28 kl	1
5	Fire fighting Truck	1
6	280 HP Motor Grader	1
7	Mobile Maintenance Van	1
8	Diesel Bowser (8kl)	1
9	Tyre Handler	1

***In this option, it is proposed to cut coal by surface miner and parting by shovel/dumper system or Surface miner depending of suitable geological condition of the mine. Surface Miner will cut coal and the coal heap will be loaded by front-end loader to Dumper/trucks. The coal will be transported upto surface/pit head by Dumper/trucks. Parting will be dumped internally in the extracted Coal Quarry area.**

The yearwise phasing of HEMM has been provided in Appendix A.3 along with its capital provision. Yearwise replacement of main HEMM has been provided in cash flow statement (Appendix D1).

8.3 ANNUAL PRODUCTIVITY OF HEMM PROPOSED (For Departmental Equipment)

(A) Top Overburden:

Sl.No	Particulars	Productivity /Yr
1.	5.0 – 6.0 M3 Electric hydraulic shovel with 60 T Rear Discharge dumpers	1.43 Mm ³
2	60T Rear Discharge Dumpers for 2.75 km lead with 5.5 m ³ Electric Hyd. Shovel	0.2058 Mm ³

However haul road construction and maintenance will be done departmentally and departmental provisions for coal handling plant, pumping for mine, E&M workshop, survey equipment (see App. A, A-3)

with related and supervisory manpower is given. It is proposed to work the quarries in three shifts per day of 8 hours each assuming 330 working days per year.

8.4 MINING SCHEDULE

The proposed report has been prepared for a target capacity of 4.0Mt/annum. The parameters of opencast mine field and technical conditions of its development make this target feasible with normal indices namely length, width & depth of the excavated block, thickness of coal seam, seam gradient, method of mining, deployment of equipment etc. Moreover, with proposed target of 4.0 Mty the rate of deepening works out to about 15 m per year, which is close to prevailing rate of deepening in existing mines of WCL.

Calendar Programme, which is given in Table has been prepared on the basis of estimation of coal and overburden in box cut and various cuts drawn on different floor levels and volume of overburden in access trench of the quarry. The peak stripping ratio is arrived by considering advance stripping in order to maintain the target production rate. Calendar Programme showing yearwise , coal production and overburden removal is shown as follows :-

Calendar Programme of Excavation (Surface Miner on hiring)

YR	COAL Mt		NATURAL OB (Mm3)		PROGRAMMED TOP OB (Mm3)		PARTING(Mm3)		Total OB (Mm3)	
	Annual	Cum	Annual	Cum	Annual	Cum	Annual	Cum	Annual	Cum
1	LAND ACQUISITION									
2	1.00	1.00	3.62	3.62	7.10	7.10		0.00	7.10	7.10
3	2.00	3.00	5.48	9.10	7.77	14.88	0.45	0.45	8.22	15.32
4	3.00	6.00	8.22	17.32	11.37	26.25	0.67	1.11	12.04	27.36
5	4.00	10.00	12.04	29.36	11.35	37.60	0.89	2.00	12.24	39.60
6	4.00	14.00	12.24	41.60	12.56	50.16	0.89	2.90	13.45	53.05
7	4.00	18.00	13.45	55.05	15.00	65.16	0.89	3.79	15.89	68.95
8	4.00	22.00	15.89	70.95	15.00	80.17	0.89	4.68	15.89	84.84
9	4.00	26.00	15.89	86.84	15.92	96.09	0.89	5.57	16.81	101.66
10	4.00	30.00	16.81	103.66	15.95	112.04	0.89	6.46	16.84	118.50
11	4.00	34.00	16.84	120.50	11.27	123.32	0.89	7.35	12.17	130.67
12	3.00	37.00	12.17	132.67	11.50	134.81	0.67	8.02	12.17	142.83
13	3.00	40.00	12.17	144.83	9.88	144.70	0.67	8.69	10.55	153.38
14	2.50	42.50	10.55	155.38	4.44	149.14	0.56	9.24	5.00	158.38
15	1.56	44.06	6.39	161.77	3.03	152.17	0.36	9.60	3.39	161.77
TOTAL		44.06		161.77		152.17		9.60		

From IV Cut onwards, Strike Length of mine reduces and get tapered. Therefore, coal target from 12th Year is reduced to 3.00 Mt and in 14th Year to 2.50 Mt .Programmed OB also includes 0.17 Mm³ OB of Access Trench to be excavated in first year of Quarry Operation.

8.5 EQUIPMENT SCHEDULE ~ SCHEDULE OF EXPENDITURE ON HIRING/ OUTSOURCING OF EQUIPMENT

As described earlier, the entire Coal/Parting and part Top OB(excluding 2.60 Mm³ excavation of upper benches of Top OB which is proposed by departmental equipments) will be Cut / Excavated by hiring/outsourcing of equipment. The rates for Coal cutting by Surface Miner by hiring/outsourcing of equipment for the proposed mine have been estimated on the basis of work awarded for Gevra Area ,SECL . Similarly, rates for excavation of Top OB/ Parting by hiring/ outsourcing of HEMM (by shovel/dumper) have been estimated on the basis of FD's approved rates by WCL . The rates of above contract are updated with change in price of diesel for August, 2014. Rates are being adopted in this report for planning purpose and economic evaluation of the project. These rates may vary at the time of actual implementation. It is also suggested here that before awarding the work to hiring agency, geological structure should be further confirmed by drilling additional boreholes. Yearwise weighted average rates of hiring for Coal/Parting taken for planning and costing purpose is given below.

YEARWISE WEIGHTED AVERAGE RATES OF HIRING FOR Coal/Parting

Year	Coal (Mt)	Rate (Rs/t)	Parting P3 (Mm ³)	Rate (Rs/m ³)	Parting P1+P2 (Mm ³)	Rate(Rs/m ³)	Top OB by Hiring (Mm3)	Rate (Rs/m ³)
1	-		-					
2	1.00	66.08					4.50	67.15
3	2.00	69.41	0.32	62.82	0.13	62.82	5.17	71.46
4	3.00	69.41	0.47	62.82	0.19	62.82	8.77	75.77
5	4.00	69.41	0.63	62.82	0.26	62.82	8.75	75.77
6	4.00	69.41	0.63	62.82	0.26	62.82	9.96	80.08
7	4.00	69.41	0.63	62.82	0.26	62.82	12.40	82.25
8	4.00	70.52	0.63	62.82	0.26	62.82	12.40	82.25
9	4.00	70.52	0.63	62.82	0.26	62.82	13.32	82.25
10	4.00	70.52	0.63	62.82	0.26	62.82	13.35	82.25
11	4.00	71.63	0.63	62.82	0.26	62.82	8.67	82.25
12	3.00	71.63	0.47	62.82	0.19	62.82	8.90	82.25
13	3.00	71.63	0.47	62.82	0.19	62.82	7.28	82.25
14	2.50	71.63	0.39	62.82	0.16	62.82	1.84	82.25
15	1.56	72.73	0.25	62.82	0.10	62.82	0.43	82.25

- These rates includes:
- For Top OB/PARTING : excavation, drilling, dozing, loading , transportation and dumping at specified places (including diesel cost) and 12.36% Service Tax.
- FOR COAL :Cutting of coal by surface miner, loading into trucks and transportation and unloading at CHP (including diesel cost) and 12.36% Service Tax .

Chapter - 9

QUALITY

9.1 QUALITY:

Undiluted quality involving Sections A+B+C+D (I-100 basis) has been carried out for the of Composite Seam. Borehole wise seam thickness, average GCV for undiluted Sections A+B+C+D (I-100) for Composite Seam is tabulated below:

BH. NAME	SECTIONS OF COMPOSITE SEAM	THICK. (m)	THICK AVG GCV K Cal/Kg	GRADE
CMWMG-11	ABCD	14.84	4625	G9
CMWMG-12	ABCD	18.25	4582	G10
CMWMG-14	ABCD	18.55	4497	G10
CMWMG-15	ABCD	15.45	4699	G9
CMWMG-18	ABCD	17.74	4743	G9
CMWMG-19	ABCD	16.32	4471	G10
CMWMG-20	ABCD	18.57	4577	G10
CMWMG-22	ABCD	17.6	4289	G11
CMWMG-24	ABCD	20.59	4406	G10
CMWMG-25	ABCD	16.42	4543	G10
CMWMG-26	ABCD	18.61	4673	G9
CMWMG-27	ABCD	14.65	4297	G11
CMWMG-29	ABCD	18.44	4860	G9
CMWMG-31	ABCD	19.24	4654	G9
CMWMG-32	ABCD	18.66	4569	G10
CMWMG-34	ABCD	16.83	4469	G10
CMWMG-35	ABCD	17.54	4700	G9
CMWMG-36	ABCD	17.4	4301	G10
CMWMG-37	ABCD	16.82	4435	G10
CMWMG-39	ABCD	15.43	4790	G9
CMWMG-40	ABCD	18.01	4462	G10
CMWMG-44	ABCD	15.35	4679	G9
CMWMG-46	ABCD	18.34	4335	G10
CMWMG-47	ABCD	18.28	4578	G10

The average undiluted GCV for Sections A+B+C+D of Composite Seam is 4551 (K Cal/Kg) & the grade is G10. Hence ,for costing purpose average Quality without dilution is considered.

Chapter - 10

PUMPING & DRAINAGE

10.1 GENERAL :

The proposed project is located at Wani Area. In absence of sufficient hydro-geological data and actual make of water of the mine, ground seepage is assumed 15% of maximum rainfall water accumulated in a day. Pumping provision made in this report is sufficient to sustain the production for target plus five years.

10.2 THE SOURCE OF WATER :

The source of water accumulation in the quarry area are as follows :

- (i) Ground water flow to the quarry
- (ii) Rain water falling directly within the excavated area
- (iii) Rain water from beyond excavated area.

10.3 PREDICTION OF MAXIMUM RAINFALL IN A DAY :

Table –I
Based on data collected from **Area- Wani**
Ghugus o/c (2001-10)

S.No.	Year	Max. prev. Filation in a day(hn)in mm	Modal Coeff. K= hn/ ham	(K-1)	(K-1) ²	$P\% = \frac{(N - 0.3)}{100} \times \frac{1}{(M + 0.4)}$
1	2010	303	1.959	0.959	0.92	6.731
2	2001	223	1.441	0.441	0.194	16.346
3	2005	210	1.357	0.357	0.127	25.962
4	2002	190	1.228	0.228	0.052	35.577
5	2006	180	1.164	0.164	0.027	45.192
6	2008	122	0.789	-0.211	0.045	54.808
7	2003	113	0.730	-0.270	0.073	64.423
8	2007	98	0.633	-0.367	0.135	74.038
9	2004	62	0.401	-0.599	0.359	83.654
10	2009	46	0.297	-0.703	0.494	93.269
	M= 10	1547			2.426	

Calculated Rainfall in mm (h):

i) Mean value of recorded max. rainfall $h_{am} = \sum h_n / 10 = 1547 / 10$
 $= 154.7 \text{ mm}$

ii) Co-efficient of variation

$$C_v = \sqrt{\frac{\sum (K-1)^2}{(M-1)}} = \sqrt{2.426/9} = 0.519$$

iii) Co-efficient of Asymmetrical ratio (C_s) = $3 C_v = 3 \times 0.519 = 1.557$

Table –II

S.N.	Probability %	F (C_s) = ϕ	$M_s = \phi \times C_v$	$K_s = M_s + 1$	$h = K_s \times h_{am}$
1	0.1	5.3	2.75	3.75	580.2
2	1	3.36	1.74	2.74	424.5
3	5	1.96	1.02	2.02	312.1
4	10	1.33	0.69	1.69	261.5
5	30	0.29	0.15	1.15	178.0
6	50	-0.24	-0.12	0.88	135.4
7	75	-0.73	-0.38	0.62	96.1
8	95	-1.12	-0.58	0.42	64.8
9	99	-1.23	-0.64	0.36	55.9
10	99.9	-1.28	-0.66	0.34	51.9

Calculation of probability :

Life of the mine : 14 years

Probability % : 1

$$\frac{1}{14} \times 100 = 7.14$$

Life of mine (Yrs.)

The probability curve was drawn as shown in **fig. 1** from the probability curve, it was found that the maxm. Probable rainfall at 7.14% probability will be to the tune of 230mm.

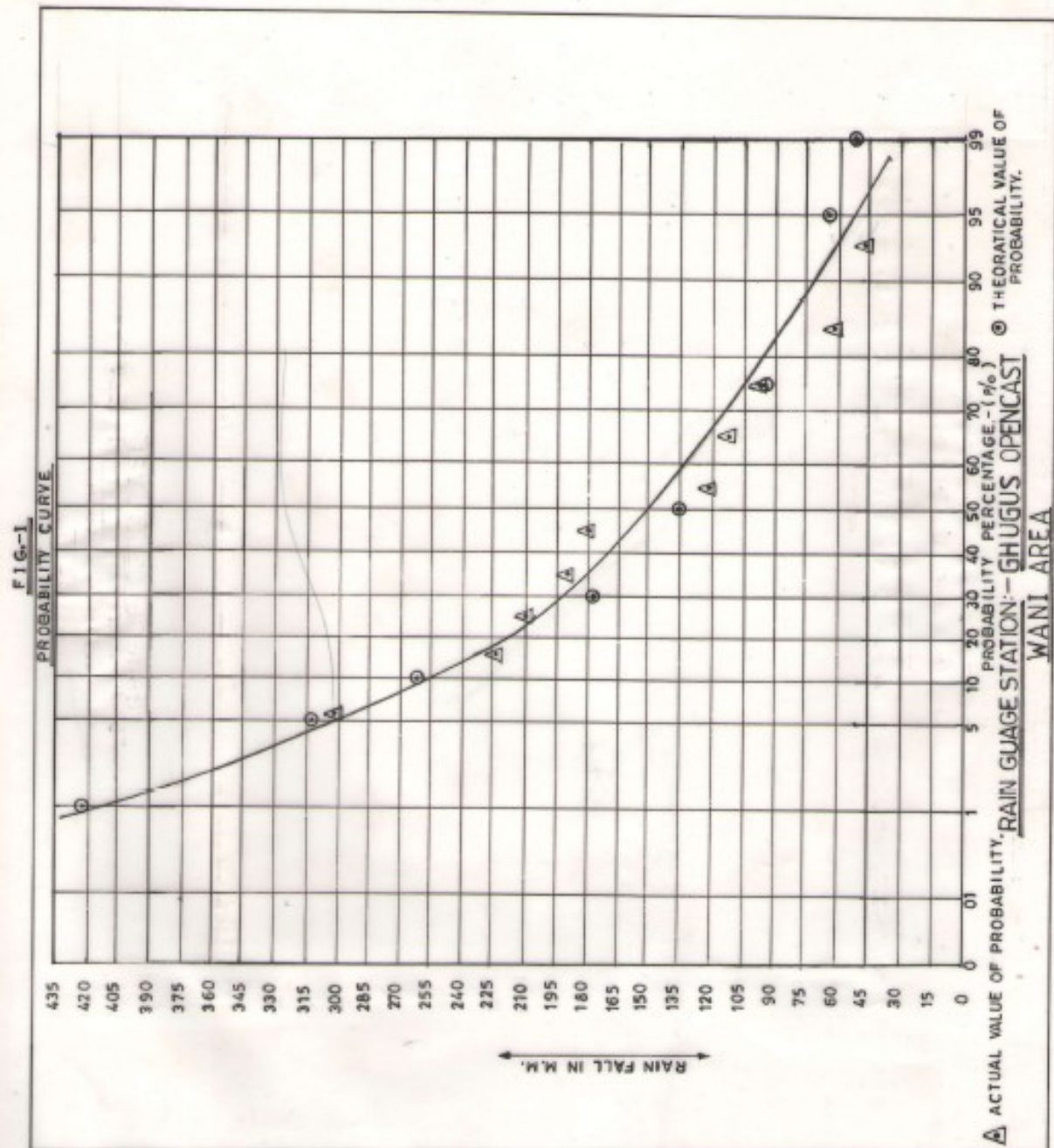


Figure-1

10.4 CALCULATION OF PUMPING CAPACITY :

The Pumping capacity required at the time of five years after reaching the target has been calculated as under:-

S.N.	DISCRIPTIONS	CALCULATED DATA
1	Maximum exposed area (ha)	205.00
2	Maximum backfilled area (ha)	nil
3	Surface area of mine considered for excavation (ha)	205.00
4	Area beyond excavation (ha),5% of item (3)	10.25
5	Run-off co-efficient for	
	(a) Open excavation	0.70
	(b) Area beyond excavation	0.10
6	Rainfall infiltration co-efficient for backfilled area	0.20
7	Probable max. rainfall in a day (mm)	230
8	Water collected in the quarry due to exposed area and area beyond excavation (cum/day)	332408
9	Required pumping capacity to handle the whole water of the rain water in 100 hrs (lps)	923
10	Seepage due to strata (15% of Item 9)	139
11	Total pumping capacity	1062
12	Depth in target plus five years (m)/ after 10 th year	110

Pumping system has been designed for the volume of water accumulated in the mine at the target plus five year production considering maximum rainfall in a day as **230mm**. Peak pumping capacity worked out as **382269** cum. Above volume of water will be dewatered in **5** days at the rate of **20** hrs pumping per day. Pumping capacity per day thus worked out as **76454** cum.

10.4 SELECTION OF PUMPS DELIVERY RANGES

- (i) Eight stainless steel pumps of 180 lps x 150m head have been proposed. Out of eight pumps, two pumps are standby.
- (ii) Four stainless steel pumps of 80 lps x 80m head have been proposed for the initial stage and auxiliary pumping.
- (iii) One diesel engine operated pump, 80 lps, 60m head has been proposed.
- (iv) Five stainless steel face pumps of 11 lps x 30 m head have been envisaged in this report and out of five pumps, one is standby.
- (v) Two delivery ranges of 406.4mm dia. pipe have been proposed for main pumps of 180lps x 150m head and maximum two pumps will be connected in each delivery.
- (vi) Two delivery ranges of 312mm dia. pipe have been proposed for main pumps of 180lps x 150m head and maximum one pump will be connected in each delivery.
- (vii) Four delivery ranges of 219 mm dia. pipe have been proposed for auxl. pumps of 80lps x 80m head and maximum one pump will be connected in each delivery.
- (viii) 80 mm dia. G.I. pipe will be used for face pumps. No piping provision have been made for standby pumps.

10.6 SUMP :

The sumps shall be made at the one end of strike in the dip side. The working benches shall be graded suitably, so that the entire water flows down to the sump.

10.7 DRAINAGE OF WATER ON SURFACE :

Fresh garland drains shall be made before every monsoon at the peripherally of active edge of the quarry to prevent the surface rain water to enter the quarry. A sedimentation pond/ lagoon shall be made between the quarries and mine water will be discharged into it. After sedimentation of suspended particles, the fresh water will be discharged into river/ nallah.

10.8 PROCUREMENT, INSTALLATION AND OPERATION

In mines the pump has to be shifted from one location to another to suit the working conditions, as such the performance of the pump is greatly effected. The following points should be kept in mind to get satisfactory results.

- (i) The pump should be procured multistage.
- (ii) The pump characteristic curves (H vs Q) should be steep and the rating of the motor should be 10% more than power required at cut off point.
- (iii) 10% increase in rated head should give 25% decrease in rated discharge
- (iv) 10% decrease in rated head should give 15% increase in rated discharge
- (v) The pump shall be installed as close to the sump as possible and difference of sump water level and pump center line should not be more than 4-4.45 m. The length of suction pipe should not be increased unnecessarily.
- (vi) As far as possible the pump should be allowed to operate at rated head.
- (vii) The pumps of same make, same specifications and same characteristic shall be used for parallel operation of pumps.

10.9 The details of pumps, pipes, pipe fittings and estimated capital requirement including installation and foundation cost of above have been given in Appendix – **A.3.4**

Chapter - 11

COAL HANDLING & DESPATCH ARRANGEMENTS

11.1 Plant Description

11.1.1 Receiving Hoppers

The Run-Off-Mine coal from quarry will be received into the 6x150t capacity receiving hoppers near quarry mouth by means of rear discharge dumpers/Trucks. Receiving pit are six in numbers and each has capacity of 150t. The ROM coal will be loaded into the trucks by 300tph capacity reciprocating feeders installed below each hopper for further dispatch point.

11.1.2 Ground Stocking:

In case of no off-take of coal from receiving hoppers, coal will be ground stocked near the receiving pit. Later coal will be fed to receiving hoppers by Trucks/tippers and pay loaders for loading into the truck for further transport.

11.1.3 Dust Control System

Dust suppression system has been envisaged for dust control in and around coal despatch system premises.

11.1.4 Fire Protection System

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

11.1.5 Plant cleaning system

To facilitate cleaning at strategic locations ample number of high pressure water servicing points have been envisaged. Locations of service points will be such that any working area in the plant or equipment working place can be

reached through a 15/20 m long hose. These service points will be provided with quick connecting hose couplings for easy fixing and dismantling of hoses.

For washing of the plant area, sump pumps of suitable design and capacities have also been envisaged wherever required.

11.1.6 Weighment

Two numbers of 100t capacity computerized electronic road weighbridge with print out facilities have been provided for weighment and record of dispatch.

11.2 ELECTRICALS

The electrical system shall comprise:

- Power reception and distribution system as per system requirement.
- Centralized sequence control–cum–interlocking, automation, signaling, fire detection and instrumentation system
- Illumination of plant and adjacent area
- Earthing

11.3 CIVIL & STRUCTURAL WORKS:

RETAINING WALL

As proposed , one RCC retaining wall of height 14.640 from G.L. and length 60 m suitable for retain the earth in slopes for discharging coal by Trucks/dumpers to the hopper is conceived. The retaining wall shall have a pair of wing wall of length 11 m and the backfilling returned with proper slope.

TRUCK LOADING HOUSE

6 no's of Hopper each of capacity 150 t are provided in truck loading house (without tripper conveyer).

ALIED STRUCTURES

Provision for hardstand below the truck loading hoppers and also for a distance of 8m up and down the approach are included in the cost estimate. The estimate also includes a sump of 20 cum, hard stand below the hopper and open yard for transformer. General land development of the entire CHP area, soil investigations and provisions for foundations in poor soil etc. has all been kept in the cost estimate.

11.4 CAPITAL INVESTMENT REUIREMENT

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

Chapter - 12

MINE FACILITIES

12.1 BRIEF TEXT

12.1.1 Introduction :

To provide maintenance and repair of various HEMM, CHP, equipment, pumps, LMVs, electrical etc of the mine, independent full fledge unit workshop has been envisaged for the project. Proposed workshop will consist of two types of maintenance and repair shops. These maintenance and repair shops will be as follows: -

i) Excavation workshop: -

This workshop would extend basic engineering support in respect of maintenance and repair of various HEMM deployed in the mine. Capital repair of HEMM and other equipment would be carried out at central workshop, Tadali.

ii) E & M workshop: -

Separate E & M workshop facilities have also been provided to carry out maintenance & repair of the CHP, equipment, pumps, LMVs, electrical etc.

These workshops are essentially a unit workshop and will depend on central/regional workshop for major repair and part manufacture. Shovel and drill maintenance & minor repairs will be carried out at site and components/assemblies requiring running repair will be dismantled from the machine and transported to the workshop for necessary repairs. Provision of dumper repair and maintenance facilities has been made taking into account that 60t dumpers will be deployed in the project.

12.1.2 Maintenance Facilities :

Work load, equipments, electrical load and manpower of the workshop has been assessed on the basis of population of various HEMM, CHP, equipment, pumps, LMVs, electrical etc and fulfill their running repairs and maintenance.

12.1.3 Scope of Work :

Following activities are proposed to be carried out in the respective workshop:

12.1.3.1 Unit Excavation workshop:

- i) Daily cleaning, by weekly washing of dumpers and other HEMM. daily inspection, checking of air system, hydraulic system, electrical & mechanical system of dumpers.
- ii) Daily oiling, greasing, lubrication of assemblies/ sub-assemblies of various HEMM.
- iii) Replacement of leaky hoses, tubes, filters, air cleaners etc.
- iv) Tyre replacement and tyre inflation.
- v) Incidental minor repairs/ replacement of assemblies/ sub- assemblies.
- vi) Changing of piston rings, valves, crankshaft bearings, packing, parts of transmission, axles, differentials etc.
- vii) Battery charging, repairs of self-starters, dynamos, coil of HEMM.
- viii) Machinery/ minor repairs/ limited manufacture of various parts of HEMM as per the requirement.
- ix) Welding on dumper bodies, shovels, buckets etc.
- x) Miscellaneous structural works.
- xi) Scheduling for repair needs at central workshop.

12.1.3.2 Main Workshop :

Central/Regional workshops are envisaged main workshop for this project. These workshop will provide all the support to unit workshop under their scope.

1.3.3**Unit E&M Workshop:**

Following activities are proposed to be carried out in the respective workshop:

- i) Maintenance and repair of CHP equipment, Pumps, LMVs, Electrical etc of the Project.
- ii) Manufacture of spares to a limited extent
- iii) Transformer oil filtration

12.2 PROPOSED FACILITIES:

In order to carry out the above activities the following facilities are proposed in the workshop:

- i) Maintenance and repair sheds for all functional shops.
- ii) Stores sheds
- iii) POL store
- iv) Washing stations
- v) Pavement for parking of mining equipment/HEMM
- vi) Material handling facilities
- vii) Switch room
- viii) Supporting facilities like pump house, security post, fire fighting etc.
- ix) Material handling facilities for workshop and stores.
- x) Store yard
- xi) Mobile servicing van and mobile refueling facilities
- xii) E&M workshop shed consisting of machine shop, Mechanical repair, Electrical repair, welding and structural sections.
- xiii) LMVs repair shed
- ix) Washing platform
- xv) Workshop office

xvi) Necessary provision for plant and equipments, tools, testing equipment etc has been provided in the respective shops for efficient repair and maintenance of the HEMM and other equipment of the project.

In addition to the above, mobile crane, tyre handler etc. have been proposed in this report for field servicing/ maintenance of HEMM.

12.3 WORKSHOP AND STORES LAYOUT:

For efficient operation and effective supervision, the layout of facilities in the workshop have been prepared taking into consideration the sequence of operation for maintenance & repair, minimum inter-shop movement of men & material etc. The area of each shop/ shed has been worked out after studying the space requirement and layout design of machines and also providing reasonable working and movement space. The general layout plan of excavation workshop and E&M workshop is provided in this report.

12.4 WORKSHOP AND STORE PLANT & MACHINERY :

The plant and machinery provided in this workshop is sufficient to meet the requirement of the scope of the workshop. Adequate P& M for main functional shops including stores have been provided. Besides that adequate provision for washing equipment, material handling equipment, floor cleaning equipment, ventilation equipment, general purpose tools, special purpose tools, installation & commissioning, electrical for workshop P & M and initial spares have been provided.

12.5 PROJECT STORE :

One small and independent unit stores at convenient location has been provided to cater the routine needs of consumables, spares, POLs etc. This will depend on Regional/Central stores for major spares.

12.6 CAPITAL INVESTMENT :

Total capital investment requirement has been given in appendix A.3.3.

12.7 LIST OF WORKSHOP P & M :

Details of shop wise P & M requirement for excavation workshop, their cost and phasing have been given in appendix A.3.3.1 and for E & M workshop in appendix A.3.3.2.

12.8 DRAWINGS :

Location of the workshop and stores will be decided at the time of start of the mine at convenient location for maintenance & repair. Overall area, Covered area, paved area, roads, gates, provision of repair bays, details of workshop complex, functional shops, bracket height, height of different shops, location of washing and fuel delivery station etc are given in appendix A.2.1 & drawing of workshop given in this project. Separate complex of unit store with separate entry have been provided at convenient place. Drawing of unit store has not been provided in this report.

One dozer repair shop has been provided at pit top for maintenance and repair of dozers of the project with facilities of dozer repair shed, washing system with sump and pump house. Drawing of dozer shop is not given in this report.

Chapter - 13

POWER SUPPLY, ILLUMINATION & COMMUNICATION

13.1 POWER SUPPLY

13.1.1 Source of Power :

The proposed Penganga OC Mine is located at a distance of approximately 20 kms from Ghughus Township of WCL.

Presently, Mugoli OC mine receives power at 11 kV, through a 16 kms long overhead line originating from 66 kV Matardevi substation, Ghughus. In addition to Mugoli OC mine, this 11 kV feeder is also supplying power to other mines of Wani Area like Niljai II, Ghughus Dragline etc.

As per the demand chart developed for the proposed Penganga mine, it is seen that the maximum demand of the mine will be in the range of 2864 Kva including township. The existing 11 kV overhead line originating from Matardevi substation may not be able to meet this maximum demand requirement of the proposed mine.

As per the letter provided by the Area official, MSEDCL, Gadchandur substation is the nearest substation which is approximately 25 kms from the Penganga OC coal Block.

The projected maximum demand of Penganga opencast works out to 2864 kVA (including colony). As per MSEDCL Norms, beyond 1500 kVA, power should be provided at 33 kV level and keeping in view of voltage regulation of line drawing power from such a long distance of 25 km, it is therefore, proposed to have one separate 33 kV express feeder connection from MSEDCL, Gadchandur substation, to cater the power requirement of Penganga opencast mine.

Hence, Considering the above, it is proposed to erect a 25 kms long OH line from Gadchandur MSEDCL 220 kV / 33 kV substation to Penganga OC Mine, where a 33 kV/3.4 kV, 2 x 2.5 MVA, substation is proposed to be installed, which will cater the power requirement of proposed Penganga OC Mine.

A provision of Rs. 410 lakhs (including service tax) have been made in Appendix A.8.1 for incoming power supply arrangement of Penganga OC

Mine. This includes the cost of 33 kV, 25 km long OHL from Gadchandur MSEDCL 220 kV / 33 kV substation and associated 33 kV bay and switchgear.

It is also proposed to install a mine substation having capacity 2 x 2.5MVA, 33 kV/3.3 kV, substation near proposed opencast mine access trench of Penganga O/C Mine, which shall cater to the demand of Penganga O/C Mine.

An amount of Rs 20 lakh lump sum has been provided for dismantling of HT/LT feeder and telephone lines passing through the mine boundary and which are redundant.

Thus a total amount of Rs. 4.25 crore (including service tax @ 12.36% on 40% amount) has been provided in Appendix A.8.1 to meet the above cost.

13.1.2 Proposed Stage:

Mine Power Supply:-

As per the demand chart developed for the proposed Penganga OC Mine, it is seen that the maximum demand of the mine will be 2589 kVA for Surface Minor Option.

Hence, Considering the above, it is proposed to draw power at 33 kV OH line originating from Gadchandur MSEDCL 220 kV substation to the proposed location of Penganga OC Substation, where a 33 kV/3.3 kV, 2 x 2.5 MVA, substation for Surface Minor option is proposed to be installed which will cater the power requirement of proposed Penganga OC Mine.

Connected Load, Maximum Demand etc. :

The estimated maximum demand of mine loads of Penganga OC Mine (as detailed in power demand table) works out to 2320 kVA.

No additional quarters have been provided in the township. For cost-economics analysis, the load of the total 172 nos. of quarters has been considered.

The maximum power demand due to this township (total 172 Nos. of

quarters) will be approximately 276 kVA.

POWER DEMAND CHART FOR PR FOR PENGANGA OC (MUGOLI EXTENSION) MINES

AUGUST, 2014

SURFACE MINER ON HIRING

COAL PRODUCTION : 4.000 MTY

Sl. No.	EQUIPMENT / INSTALLATION	UNIT LOAD	INSTALLED QUANTITY	WORKING QUANTITY	ANNUAL WORKING HOURS	CONNECTED LOAD	TOTAL LOAD IN OPERATION	DEMAND FACTOR	POWER FACTOR	ACTIVE POWER (KW)	ARCCOSINE OF P.F	REACTIVE POWER (KVAR)	APPARENT POWER (KVA)	ANNUAL ENERGY CONSUMPTION (MKWH)
1. OVERBURDEN														
OB PRODUCTION BY DIESEL EQUIPMENT														
Sub-- Total (1.)						0	0			0		0	0	0.000
2. COAL WINNING														
COAL PRODUCTION BY DIESEL EQUIPMENT														
A	COAL HANDLING PLANT	150	1	1	4950	150	150	0.9	0.7	135		138	193	0.668
Sub-- Total (2.)						150	150			135		138	193	0.668
3. COMMON														
A	Workshop	350	1	1	3960	350	350	0.5	0.7	175		179	250	0.693
PUMPING LOADS														
1	180 LPS, 150 M HEAD(3.3 KV)	400	6	5	800	2400	2000	0.8	0.7	1600		1632	2286	1.280
2	180 LPS, 150 M HEAD(3.3 KV)	400	2	1	4745	800	400	0.8	0.7	320		326	457	1.518
3	80 LPS, 80 M HEAD(550/440 V)	110	4	4	200	440	440	0.8	0.7	352		359	503	0.070
4	11 LPS, 30 M HEAD (550/440 V)	9.3	5	4	3285	47	37.2	0.8	0.7	30		30	43	0.098

Sub-Total (Pumping Load)														
						3687	2877			2302		2348	3288	2.966
Sl. No.	EQUIPMENT / INSTALLATION	UNIT LOADED	INSTALLED QUANTITY	WORKING QUANTITY	ANNUAL WORKING HOURS	CONNECTED LOAD	TOTAL LOAD IN OPERATION	DEMAND FACTOR	POWER FACTOR	ACTIVE POWER (KW)	ARCCOSINE OF P.F	REACTIVE POWER (KVAR)	APPARENT POWER (KVA)	ANNUAL ENERGY CONSUMPTION (MKWH)
C	Surface, Quarry, OB dump, & other service establishment illumination load	200	1	1	4380	200	200	0.9	0.85	180		112	212	0.788
D	Office Loads & other misc loads	60	1	1	3300	60	60	0.9	0.85	54		33	64	0.178
Sub-- Total (3.)						4297	3487			2711		2672	3806	4.625
TOTAL (1.+ 2.+ 3.)						4447	3637			2846		2810	3999	5.293
Taking Diversity Factor as										1.25		2277	2248	3199
At Improved Power Factor of 0.98										0.98		2277	462	2323
Capacitor Bank Required												1785		
Capacitor Bank Provided												1800		
System Losses (@ 5%)														0.265
MINE'S SUB-TOTAL						4447	3637			2277		448	2320	5.558

Sl. No.	EQUIPMENT / INSTALLATION	UNIT LOAD	INSTALLED QUANTITY	WORKING QUANTITY	ANNUAL WORKING HOURS	CONNECTED LOAD	TOTAL LOAD IN OPERATION	DEMAND FACTOR	POWER FACTOR	ACTIVE POWER (KW)	ARCCOSINE OF P.F	REACTIVE POWER (KVAR)	APPARENT POWER (KVA)	ANNUAL ENERGY CONSUMPTION (MKWH)
TRANSFORMER SELECTED FOR MINE														
2500 KVA, 33 KV / 3.4 KV -- 2 Nos.,														
100 KVA, 33 KV / 230 V (L - L) -- 1 No.														
TOWNSHIP ELECTRICITY LOAD														
1	QUARTERS ALL TYPE INCLUDING ALL MISC. LOAD Existing quarters to be utilised - 172 Additional all types - NIL			172		378	378	0.9	0.85	340		211	400	0.471
Taking Diversity Factor as		1.25								272		169	320	
At Improved Power Factor of 0.98									0.98	272		55	278	
Capacitor Bank Required												113		
Capacitor Bank Provided												125		
System Losses (@ 5%)														0.024
TOWNSHIP'S SUB-TOTAL						378	378			272		44	276	0.495
PROJECT OVERALL TOTAL						4825	4015			2549		491	2596	6.053
TRANSFORMER SELECTED FOR														

TOWNSHIP

Township Power Supply :

The existing arrangement of power supply for township will continue.

13.1.2.1 Main Sub-station:

It is proposed to install the substation at a suitable location near the access trench for Penganga OC Mine.

The capacity of the main substation shall be 2 x 2.5 MVA, 33kV / 3.4kV.

- **Outdoor Installations :**

13.2.1 Surface Power Distribution :

A 3.3 kV, 13 panel sectionalized power distribution board with all circuit breakers, will be provided inside the substation building to receive power from the secondary of the two nos. of 2500 kVA, 33 kV/3.4 kV transformers. The power distribution board with all protections provided in the sub station will control power supply to all the installations of the project. The details of the Switch board will be as follows:-

- Incoming feeder control C.B with CT ratio 450/5	2 Nos.
- Sectionalizer control C.B with CT ratio 450/5	1 No.
- Capacitor bank control C.B with CT ratio 200/5	2 Nos.
- Quarry pumping feeder control C.B with CT ratio 300/5	2Nos.
- Spare C.B with CT ratio 300/5, 200/5, 150/5 ,100/5	4 Nos.
- Workshop feeder control C.B with CT ratio 100/5	1 No.
- CHP feeder control C.B with CT ratio 150/5	1 Nos.
Total :	13 Panels

- **Lighting Switch Board :**

A station transformer 100 kVA, 33 kV/230(L-L) V will be installed at both the substation to have an independent power supply to meet the lighting loads & other miscellaneous loads of service buildings, service roads, approach roads, area around substation etc. At the secondary of station transformer a 230 V TP power distribution board with 10 panels for control of lighting loads shall be provided. The distribution board receives power through a MCCB of 400 A, 230 V with H.R.C Fuse of 250 Amps.

- **CONNECTED LOAD, MAXIMUM DEMAND**

The details of connected load and Maximum Demand of the proposed Penganga OC mine and its colony are as given below :-

S.No.	ITEM HEAD	SURFACE MINER OPTION
1.	CONNECTED LOAD	
	a) Only Mine	4447kW
	b) Only Colony	378 kW
	c) Total	4825 kW
2.	LOAD IN OPERATION	
	a) Only mine	3637kW
	b) Only township	378 kW
	c) Total	4015 kW
3.	PROJECTED MAXIMUM DEMAND	
	a) Only mine	2320 kVA
	b) Only township	276 kVA
	c) Total	2596 kVA

- **Protection of Substation, Control and Signaling, interlocking & Earthing :-**

Vacuum circuit breakers shall be used for primary control of all the transformers. The operating voltage of the spring charging motor and the tripping device of the VCB shall be fed through the in built rectifier provided in the circuit breaker. The VCB shall in conjunction with current transformer 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 and winding and oil temperature relays. For these, the following protections have been envisaged.

- i) Combined IDMT and high set instantaneous relay consisting of three overload unit (Range 50% to 200%) one earth fault unit (range 10% to 40%) and three high set instantaneous units (range 400% to 1600%).
- ii) Auxiliary relays for oil and winding temperature and alarm.

The tripping circuit of the transformers shall have provision for connection to the auxiliary contacts of auxiliary relays for oil and winding temperature alarm. Gas –actuated relay like Buchholz Relay (As per IS) shall be provided.

The live parts of the circuit breakers shall be properly shrouded as per relevant safety rules.

Remote control of 33 kV circuit breakers will be performed by the control switches built in the control board of the attendant's room.

Separate and independent 48 V DC source from storage cells for better control circuit operation shall be provided. If necessary, VCB power pack for DC supply may be by-passed if independent source is provided.

The following system of signaling will be used in substation.

Signalling to inform personal about automatic tripping of circuit breakers due to fault.

Warning signal about occurrence of abnormality in any particular device.

Signalling to show actuation of automatic and protective relays, flags and pointer on relays. Fault annunciation panel with standard provision of windows along with hooter alarm and blinking etc. shall be provided.

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

Protection Against Lightning :

For protection against lightning, lightning arrestors conforming to IS: 3070 and IS : 4004 are to be provided in the substation yard. For protection against direct strokes 15 m high lightning masts will be erected.

For the protection of the building from lightning an earthing net on the roof of the buildings connected to the earth pits at the four corners of the building will be provided.

Interlocking System :

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

The 3.3 kV sectionaliser circuit breakers in the 3.3 kV switch board panel will have electrical interlock with the incoming 3.3 kV circuit breakers respectively to avoid parallel operation of transformers. Primary and secondary control circuit breakers are to be connected for inter tripping i.e. the

secondary control circuit breaker shall trip automatically when the primary control circuit breakers trips.

Safety & Fire Fighting

Permanent boundary wall (2 M height) shall be constructed along the boundary of the substation. The height of the boundary wall shall be extended by wire net fencing up to 1 M. Soak pits shall be provided for each transformer in order to prevent damages due to oil leakage. Rubbles shall be spreaded in the yard to prevent fire hazard.

Fire fighting facilities should be provided by the help of the following :

Sand bucket

Portable foam type chemical fire extinguisher

CO₂ fire extinguisher

The following safety appliances shall also be provided

Electrician rubber gloves for HT working

Standard discharging rod

Danger notice plate

First aid box complete with necessary content

Electric shock treatment chart

Rubber matting tested for an insulation level of 1100 V

Trolley mounted ladder, safety belt etc.

TOOLS AND INSTRUMENTS FOR MAINTENANCE OF ELECTRIC EQUIPMENT :

The following tools & tackles shall be used

Insulation tester 500 V, 6000 V, 2.5 kV and intrinsically safe megger

Earth resistance tester

Clip volt ampere meter (Tong tester)

AVO meter

Transformer oil tester

Cable jointer kit

Portable Ammeter Voltmeter etc.

Oil filtering machine for transformer oil

Analog multi meter

Lux meter

High voltage cable testing apparatus

Hand operated crimping tool

FRP ladder, mine truck mounted ladder etc

Earthing: The neutrals of the main transformers in the main substation will be earthed through resistance to restrict earth fault current to minimum as per existing IE rules & DGMS guidelines. As per the Indian Electricity Rules, Rule(116), :- In the interest of safety, appropriate equipment shall be suitably placed in the mines for automatically disconnecting supply to any part of the system, where a fault including, an earth fault, occurs. Fault current shall not be more than 50 amps in 3.3KV/6.6KV systems in opencast mines. The magnitude of the earth fault current shall be limited to these specified values by employing suitable designed, RESTRICTED NEUTRAL SYSTEM of power supply. For 3.3 KV system, an external resistance of suitable rating in ohm should be provided along with monitoring relay between transformer neutral point and earth electrode/pit. Independent earth pits will be constructed as per IS:3043 (current) at the substation for earthing of lightning arrestors, transformer neutrals, substation fencing etc. In addition to the above, adequate number of earth pits would be constructed in the main substation for earthing of various electrical equipment in the substation. Earthing of various equipment in opencast would be provided through overhead G.I wire running along the overhead conductor of the various quarry feeder. Separate earth pits will also be constructed around workshop. All the drives in the workshop. would be properly earthed by G.I strips of adequate size connecting to the main bus laid around the workshop connecting all the earth pits. Separate earth pits will be laid at the service buildings for earthing of various equipment/installations.

13.1.2.2 Energy Consumption :- The annual energy consumption of the Penganga OC mine has been calculated in the enclosed power demand chart.

13.1.2.3 System Voltage :-

The utilization voltages of various equipment/ installations proposed for this project are given below:

Installation	Voltage
- Incoming power supply	33 kV
- Quarry power distribution	3.3 kV
- Workshop Power Supply	3.3 kV/ 415 V
- CHP Power Supply	3.3 kV/ 415 V
- Pumps	3.3 kV/ 440 V)
- Surface illumination	230 V (L-L)
- Colony Power Supply	11 kV /3.3kV/ 415 V/ 230 V

13.1.2.4 Power Factor Improvement :-

3 phase capacitor banks of 3.3 kV, 75 /150 KVAR rating of suitable capacity will be provided at main substation (This is shown in the electrical drawing of schematic diagram of power distribution) to achieve a power factor of 0.98. The capacitor banks will have the facility to connect or disconnect the required number of units.

13.1.2.5 Quarry Power Supply Distribution:-

Quarry Power Supply Distribution:-

It is proposed to draw two nos. of 3.3 kV over head line from the 13 panels switchboard of main substation to the pump house inside the quarry for supplying power to pumps . From the overhead lines, power will be tapped off by means of isolator and field switch to energize the power distribution board at pump house.

The conductors of all the overhead lines will be of 150 sq.mm ACSR conductors. An earth conductor of the same diameter will also be drawn along with the above conductors for facilitating earthing of the equipment and installations

Power Supply to Pumps:-

Two nos. of 3.3 kV over head line will be drawn from the main substation to the pump house inside the quarry for supplying power to pumps. One set of 3.3

kV, 15 panel, 630 A sectionalized switch board has been provided for power supply to 400 kW, 3.3 kV pumps. One of the 3.3 kV panel shall act as incoming control for the 3.3 kV / 440 V transformer provided for power supply to LT pumps. A transformer 3.3 kV / 440 V, 500 kVA is proposed to be installed for power supply to LT pumps in quarry. A 12-panel LT distribution board with one no. incoming ACB, 4 nos of outgoing ACB for controlling of LT pumps & 6 nos of SFU for Face pumps.

- **Power Supply to Workshop:-**

A 3.3 kV/440V, 500 kVA, transformer is to be installed in the workshop to feed power to workshop equipment, Office, Stores etc. This transformer shall receive power at 3.3 kV from the project main station.

13.2 Illumination :-

Illumination of general quarry area/dump area:

Illumination of quarry general area/dump area will be by 400 W, HPSV lamps fitted in flood light luminaries. A cluster of six lamps mounted on 15 m high lighting towers will be provided. Sufficient nos. of such towers have been provided.

Haul road Illumination :

The illumination of haul road is permanent in nature and will be illuminated by 250 W HPSV lamps fitted in street light fittings. These fittings will be mounted on 12.0 m high poles installed along the length of haul road either on one side or on two sides depending on the width of haul road.

Illumination of production faces :

The production faces will be illuminated by 400 W HPSV lamps fitted in symmetrical flood light fittings and mounted on 5.5 m high towers (self supporting) or may be mounted on HEMM itself.

Service road and approach road illumination :

The service road and part of approach road will be illuminated by 150 W HPSV lamps fitted in street light fittings mounted on 10.5 m high poles along

the length of road.

Pole mounted transformers of 25 kVA, 6.6 kV/230 V (L-L) lighting transformers along with lighting distribution boards comprising 1 No. incomer control 63 A, 2 pole MCB), 2 nos. out goings (30 A, 2 pole MCB) have been provided for feeding the illumination/lighting loads as mentioned above.

13.4 Power Balance and annual energy consumption:-

The various groups of electrical receivers and their operating loads, the estimated maximum demand, transformer capacity and power consumption are given in the table of Power Demand developed for the Penganga OC mine.

Specific energy consumption for the Penganga OC mine for Surface Miner on Hiring options is 1.51 kWh/Te. All other salient electrical parameters are given in 13.5.

13.5 Salient Electrical features and Cost Estimate:-

COST ESTIMATE :-

The estimated phased capital investment requirement for electrical plant and machinery and communication along with brief specifications are given in Appendix A.3.2.

The present two part tariff of MSEDCL as applicable for July, 2014

Description	Industrial/Mine load	Township
i) M.D Charges	Rs.190 / kVA / month	Rs.190 / kVA / month(for Industrial feeder)
ii) Energy charges	Rs.7.01 / KWH	Chapter - 1 Rs.4.82 / KWH
Weighted Average of TOD rates for		
22.00 to 06.00	Rs. 7.01 - Rs.0.85	

06.00 to 09.00	Rs. 7.01 + Nil	
09.00 to 12.00	Rs. 7.01 + Rs.0.80	
12.00 to 18.00	Rs. 7.01 + Nil	
18.00 to 22.00	Rs. 7.01 + Rs.1.10	
iii) FCA charges + Infra Charges	Rs. 0.4957 / kWh + Rs. 0.09 / kWh	Rs. 0.4957 / kWh + Rs. 0.09 / kWh
iv) Electricity duty	9% of [(i)+(ii)+(iii)]	15% of [(i)+(ii)+(iii)]
v) TAX ON SALE	Rs. 0.08 / kWh	Rs .0.08 / kWh

Based on the above tariff the power cost estimate of the mine has been calculated and placed in the table given below:-

S.No.	ITEM HEAD	TOTAL HIRING OPTION
1.	SPECIFIC ENERGY CONSUMPTION (Including township)	1.51 kWh/t
2.	SPECIFIC POWER COST (Including township)	Rs. 14.02 /t
3.	FIXED PERCENTAGE OF POWER COST	79.74 %
4.	VARIABLE PERCENTAGE OF POWER COST	20.26 %
5.	SPECIFIC DEMAND	0.649 MVA/Mt.
6.	CAPACITOR BANK PROVIDED	
	a) Only mine	1800 kVAR
	b) Only township	125 kVAR
	c) Total	1925 kVAR
7.	AVERAGE COST OF PURCHASED POWER	Rs. 9.26 /kWh
8.	TARGET PRODUCTION OF COAL	4.000 Mty

The details of capital of electrical P & M and estimated capital required is given at Appendix-A.3.2.

13.5 CONSERVATION OF ENERGY

The under mentioned points have been considered, while making this report, keeping in mind the utmost need for conservation of energy.

i) Planning and designing of transmission and distribution network.

While planning / designing of power transmission and distribution network, adequate sizes of cables are selected to minimize line losses and voltage drop. It is also suggested to lay ultimate sizes of cables so that the duplicate work is avoided and line losses are bare

minimum during construction stage also.

ii) Improvement of Power Factor :

Capacitor banks at 3.3 kV side in quarry & 415 V side in township have been provided to improve the system power factor to 0.98 and thereby reduce the maximum demand.

iii) Staggering of Pumping Load :

Pumping should not normally be done during peak hours of production. Adequate sump capacity has been provided so that frequent running of pumps are avoided to facilitate staggered pumping. Desilting of main sump is also to be done at regular intervals.

iv) Illumination and Township Power Consumption :

Illumination contributes a substantial percentage of total power consumption. For efficient use of energy as well as to conserve it, high lumen output lamps like HPSV lamps have been proposed for general illumination of township and the areas in the vicinity of the mine, viz. Workshops, yards, roads etc. Other major actions proposed for reducing the lighting energy consumption are :-

- a) Use of time limit switches in street lighting circuits to establish control over lighting operations as well as to reduce wastages during daylight hours.
- b) Reducing illumination level in non-productive areas ;
- c) Switching off departmental lights during lunch periods and other extended off periods :
- d) Checking soundness of capacitors, chokes, starters etc.
- e) Introduction of Electronic static energy meters in individual quarters to control the energy consumption.
- f) Use of electronic chokes for fluorescent lamps.

v) Providing Energy Meters:

To monitor actual consumption of energy in different areas such as pumping feeder, CHP feeder , OCM installations, township, etc. provision of energy meters has been kept on outgoing feeder control circuit breakers.

- vi) It is highly recommended to use compact fluorescent lamps (CFL, 1x18 W or 2x18 W) in place of incandescent lamps (100 W) and T-5 type tube lights with electronic chokes (28 W) in place of conventional fluorescent tube lights, (55W) where ever possible in the project or township. This will result in substantial energy savings.
- vii) It is also recommended to use hard PVC coated bunch of conductors, in place of ACSR conductors for overhead lines wherever supply is to be given to residential complexes or township to avoid pilferage of electricity in between by unauthorized shops and Jhuggi-Jhopadi .
- ii) Selection of Transformers
While selecting number and capacity of transformers in the main substation, care is taken so that transformation losses are minimum.
- iv) Staggering of Pumping Load
Pumping should not normally be done during peak hours of production.

13.6 COMMUNICATION SYSTEM

INTRODUCTION

For effective management of different production, service units and for ensuring safety, the following communication facilities have been envisaged for Penganga OC Mine.

Coal production has become highly capital intensive due to large scale mechanization and use of modern technology. To cope up with mechanization and improve the efficiency there is a need to establish efficient means of communication in terms of providing integrated voice and data connectivity. The effectiveness and reliability of decision making process depends on a reliable means of information exchange between different units and establishments of an integrated telecommunication system incorporating both voice and data is of utmost importance.

In order to improve operational efficiency of Penganga OC Mine, it is necessary to integrate its operational units, service units, maintenance units,

stores, workshops, administration departmental Road and rail dispatches etc. with efficient and reliable communication links which may provide multimedia facilities to be made available for quick decision making.

Proposed Communication System :

The proposed communication system should cater the need of voice communication among the mobile, fixed personnel related to mine operation, administration and equipment maintenance. The system also takes into account the data communication requirement for the mine operation and planning along with the latest office automation facilities. Suitable provision has also been kept for tracking the critical responsible persons.

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

Administrative Communication:

a) IP Enabled Exchange :

In order to cater to the need of surface communication an IP enabled Exchange of required capacity of lines is proposed for facilitating voice communication between various offices, residential buildings and other strategic points within the mines. This exchange is directly interfaced with the Ethernet layer 3 switch and radio modems so that any subscriber of this exchange can communicate with area office also. The proposed IP enabled exchange should have the following main features :

- i) Offered system should be a fully digital system using time division multiplexing/ pulse code modulation with 100% non-blocking architecture.
- ii) The main controller card should have CPU of 32-bit microprocessor or more with stored programme controlled technology.
- iii) The main system memory should be ROM based for faster booting time, faster initialization etc.

-
- iv) It should be possible to save the data from system memory to the hard disk.
 - v) The system should be equipped with 1 No. in built-Ethernet LAN port for direct connecting to the office LAN.
 - vi) The system should be equipped with 2 Nos. RS-232C interfaces for direct connectivity with PCs, printers etc.
 - vii) It should be possible to maintain the system from any PC in the LAN.
 - viii) The system should have in built Auto-Diagnostic features for regular & periodic administration, diagnostic maintenance etc. and generation of various reports related to the health of the system.
 - ix) The system should be able to support simultaneous transmission of voice and data up to 19.2 Kbps in Asynchronous mode and 64 Kbps in synchronous mode.
 - x) The system should support incoming CL1 facility on Analog lines using CL1 analog phones.
 - xi) The system should be capable of accommodating the DTMF phones, cordless phone, answering machines, digital nutlike telephone, ISDN phones, DECT wireless phones.
 - xii) The system should support the following types of signaling as given below :
 - CO & P&T trunk lines
 - DTMF loop
 - 2 Wire E&M
 - 4 Wire E&M
 - LD-DID lines
 - DTMF Analogue subscriber lines
 - R2MFC
 - 2 Mb E1
 - ISDN (BRI & PRI) signaling
 - Digital tie lines
 - VOIP on trunks
 - DECT Wireless

- xiii) The system should be able to support upto 16 parting in 1 single conference.
 - xiv) The system should be able to support in skin IP Gateway card which converts the circuit switched voice into data packets and transmit them across the office LAN & WAN to distant location. The same in skin IP Gateway converts the incoming data packets into circuit switched voice and transfers them to the desired extension during reception.
 - xv) The system should be able to support in skin card based 8 port Voice Mail System.
 - xvi) The system should be able to support Computer Telephony Integration (CTI).
 - xvii) The offered system must be compatible with DSL technology (ADSL) for providing data over the existing copper network.
 - xviii) The system should be able to provide CL1 (Calling line identification) facility on analog extension with analog CLIP phones.
 - xix) The EPABX system should support call detailed recording, billing facility.
- b) BSNL Communication:
- It is proposed to provide 10 Nos. 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 4 BSNL lines on the proposed IP enabled EPABX and configuring the same.
- c) Point to Point Radio Communication:
- To connect mine with Area (HQ), a point to point radio is proposed for voice & data communication.
- The IP based Point to Point System shall operate at 2.4 to 2.5 Hz ISM band with data speed upto 11 Mbps. Each MW Radio shall be IP configured and compatible to the proposed VSAT based COAL NET of CIL with following important features:
- Easy configuration

- VOIP gateway with quality voice and Analog Interface with easy configuration
- Should support dynamic polling
- 10/100 Base T Ethernet Interface
- System shall be highly secured
- Enable connectivity with multiple LAN with different IP subnet
- Capable of software up-gradation and configuration of remote radios from any node in the proposed network
- Routing support for all standard IP protocol
- Should work without signal fading out of 10 km from point to Multipoint under LOS
- The system should have high gain antenna for successful performance and safe transmission of data/voice
- The system shall support one point to 300 remote base stations

Operational Communication

a) VHF/UHF Communication

To facilitate Voice Communication among the moving maintenance and operational persons, walkie-talkie sets are proposed.

VHP dialing type Walkie-talkie sets/ trunked radio will be provided to important personnel for communication in the mine. These will be working in the band 150-174/450-527 MHz with a channel spacing of 12.5 KHz/25 25 KHz, with an output of 5 W. Type of operation will be FM simplex. The systems shall have telephone patch facility for interfacing with the exchange. It should also have control channels for trunking facilities.

Specifications :

General :

Frequency	-	136-174/403-470/450-527 MHz (on-line programmable)
Channel Capacity	-	Min. 4
Power supply	-	7.5 V +/-20%

Weight	-	Max. 500 grams
Average battery life Ni Cd/Ni MH	-	8- 10 hours
Environment Protection	-	1 P 54, impact resistant, dust & humidity Protection.

Transmitter :

Frequency	-	136-174/403-470/540-527 MHz
Frequency separation	-	Full band split
Channel spacing	-	12.5/20/25 KHz
Frequency stability	-	+/-0.00025% approx.
Power	-	5 W
Modulation	-	FCC or any other
Audio response	-	+1 to – 3 dB
Audio Distortion	-	3 %

Receiver :

Frequency	-	136-174/403-470/540-527 MHz (on-line programmable)
Frequency separation	-	Full band split
Frequency stability	-	+/-0.00025% approx.
Sensitivity	-	0.25 mV
Inter-modulation	-	E1A, 70 dB
Adjacent channel/sensitivity	-	60 dB @12.5 KHz/70 dB @25 KHz
Spurious Rejection	-	70 dB
Rated Audio	-	500 mW
Audio Distortion	-	3 %
Hum and Noise	-	45 dB @ 12.5 KHz
Audio Response	-	+1 to 3 dB

Data Communication :

In view of growing need of information technology and an efficient and reliable means to access data from anywhere, a local area network (LAN) for the whole project is required to share the existing resources. The objective of this proposal is to link all proposed 10 PCs of the Project with each other and with area, in a single network facilitating sharing of information and computing resources amongst different departments/disciplines. The network shall be

capable to add more nodes as and when the No. of users grow and it will be equipped with the latest state of art technology.

The PCs will be utilized for the following applications:

- i) Personnel Information System (Payroll, bio-data etc.)
- ii) Financial accounting
- iii) Project Planning & Monitoring
- iv) Sales Accounting and Analysis
- v) Material Management
- vi) HEMM utilization, breakdown analysis, idle-time analysis etc.
- vii) Production Planning & Monitoring
- viii) Resource Utilizations & MIS

For optimum utilization of hardware and software, a Local Area Networking of 10 PCs is proposed. Through LAN, Data Transfer, Message transfer and Mail Transfer are possible.

Following LAN Components are needed :

Layer 3 Managed Ethernet Switch :

Switches are required to interface the radio modems with the local area networking (LANs) and also with IP enabled exchanges. 24 Port Layer 3 Managed Switches are proposed here for non-blocking routing of voice and data over the network with bandwidth aggregation.

The proposed layer 324 Port Ethernet switches have the following facilities ;

- Non-blocking, wire speed switching and routing for Ethernet, Fast Ethernet and Gigabit Ethernet.
- Support for VOIP (H-323) transcending and gateway capability for 4.729 and 4.711
- Intelligent QOS to clarify the traffic based on application importance and priority
- Routing & Switching services for IP enabled exchanges

- Support for IEEE 802.3X half and full duplex on all ports.
- Supports for all types of authorization, authentication and security services.

\

Chapter - 14

ENERGY CONSERVATION

14.1 CONSERVATION OF ENERGY

The under mentioned points have been considered, while making this report, keeping in mind the utmost need for conservation of energy.

i) Planning and designing of transmission and distribution network.

While planning / designing of power transmission and distribution network, adequate sizes of cables are selected to minimize line losses and voltage drop. It is also suggested to lay ultimate sizes of cables so that the duplicate work is avoided and line losses are bare minimum during construction stage also.

ii) Improvement of Power Factor :

Capacitor banks at 3.3 kV side in quarry & 415 V side in township have been provided to improve the system power factor to 0.96 and thereby reduce the maximum demand.

iii) Staggering of Pumping Load :

Pumping should not normally be done during peak hours of production. Adequate sump capacity has been provided so that frequent running of pumps are avoided to facilitate staggered pumping. Desilting of main sump is also to be done at regular intervals.

iv) Illumination and Township Power Consumption :

Illumination contributes a substantial percentage of total power consumption. For efficient use of energy as well as to conserve it, high lumen output lamps like HPSV lamps have been proposed for general illumination of township and the areas in the vicinity of the mine, viz. Workshops, yards, roads etc. Other major actions proposed for reducing the lighting energy consumption are :-

- a) Use of time limit switches in street lighting circuits to establish control over lighting operations as well as to reduce wastages during daylight hours.
 - b) Reducing illumination level in non-productive areas ;
 - c) Switching off departmental lights during lunch periods and other extended off periods :
 - d) Checking soundness of capacitors, chokes, starters etc.
 - e) Introduction of Electronic static energy meters in individual quarters to control the energy consumption.
 - f) Use of electronic chokes for fluorescent lamps.
- v) Providing Energy Meters:
- To monitor actual consumption of energy in different areas such as pumping feeder, CHP feeder , OCM installations, township, etc. provision of energy meters has been kept on outgoing feeder control circuit breakers.
- vi) It is highly recommended to use compact fluorescent lamps (CFL, 1x18 W or 2x18 W) in place of incandescent lamps (100 W) and T-5 type tube lights with electronic chokes (28 W) in place of conventional fluorescent tube lights, (55W) where ever possible in the project or township. This will result in substantial energy savings.
- vii) It is also recommended to use hard PVC coated bunch of conductors, in place of ACSR conductors for overhead lines wherever supply is to be given to residential complexes or township to avoid pilferage of electricity in between by unauthorized shops and Jhuggi-Jhopadi .

Chapter - 15

CIVIL CONSTRUCTION WORKS

15.1 CIVIL CONSTRUCTION

15.1.1 Life of the project & specifications

The proposed Penganga OC project falls in Wani Area of Western Coalfields Ltd .The estimated life of this project is about 15 years . As such all civil works have been envisaged on permanent specifications. It should be ensured that all the service & residential buildings are constructed on non-coal bearing area.

Nature of Soil

The soil in this region is predominantly black cotton. As such provision in the estimate has been made accordingly. In the estimates, provision for soil investigations has also been kept. It is suggested that before undertaking detailed engineering and construction work, geo-engineering investigations of soil should be done.

Building Cost Index

The Building Cost Index for the Maharashtra Region has been worked out to 505 in 2014 (2nd half) taking the prevalent rates of materials and labours. This Building Cost Index is with reference to base 100 in Nagpur as on 1.1.1992. The detailed calculations of Building Cost Index are shown in Appendix-A.2.3. Cost index with reference to base 100 at Delhi as on 1.10.1976 works out to 3030.

Contingencies & Sales Tax on Works Contracts

Contingencies @ 3% and Service tax @ 12.36% on 40% of total Work have also been taken for all items of Civil Works.

External Services

The details of different External Services viz. Roads, Culverts, Sewer Disposal etc. are provisional and may vary after detailed layout and engineering as per site requirements.

15.2 SERVICE BUILDINGS

Keeping in view the needs and requirements of this project, service buildings such as Project Office, Manager Office, Excavation Workshop, E & M Workshop, Unit Stores, Sub-station, Rest Shelter, Canteen, Garage, Security Room, & Stores, etc. have been provided. The details are shown in App. A.2.1.

Excavation Workshop:

For the medium & minor repair shed for 60t dumpers as well as its daily and scheduled maintenance, a shed of 13 m height with 10 bays open on both sides has been provided which will be suitable for 30t EOT crane facility.

Apart from above shed there is a 6m high main workshop building consisting of engine shop, hydraulic equipment repair shop, radiator repair shop, electrical repair shop, machine shop, Tire repair shop and suitable for 10t electric hoist.

In addition to above shed and main workshop building, excavation workshop consists of washing ramp for dumpers, office and stores, sub-station building, ground water reservoir of 100 kl capacity, pump house, waste oil tank, fuel station etc with concrete pavement and a compound wall with a gate.

E & M Workshop:

E & M workshop consists of main workshop building, LMV repair shed, LMV washing ramp, workshop office, workshop stores, switch room, cycle and scooter shed, security post, bituminous pavement, underground water tank, pump house, washing platform and lavatories along with a boundary wall with gate.

Stores

Unit Store has been provided considering the requirement of all the sections of the project.

Sub-Station

Provisions of sub-station for the project have been made. Substation building has been proposed with a clear height of 4.5m, foundation and flooring for heavy electrical equipment, cable ducts, RCC louvers for ventilation etc.

Estimated Amount for Service Buildings

The details and estimated amount of the proposed Service Buildings are shown in Appendix – A.2.1.

15.3 RESIDENTIAL BUILDINGS:

Manpower & Nos. of Quarters

The total manpower proposed for this project is 307. Since existing Ghuggus OCM will be exhausted in next 2/3 years, it is decided to utilize the existing colony of Ghuggus OCM. Hence no provision has been made for additional quarters. The provision has been made only for hostel accommodation.

Type of Construction

Constructions being of permanent nature, all the Type quarters have been proposed with double storeyed construction.

Estimated amount for residential quarters

The details of quarters and their unit rates have been given in Appendix A.2.2 & A.2.4 respectively.

15.4 ROADS AND CULVERTS

Approach Roads to mine

For approaching mine about 5.3 km long ,double lane, approach road is required. Accordingly, provision for approach road and culverts have been made in Appendix A.8.2.1.

Colony Roads and Culverts

No provision has been made for colony road as there is no provision for additional quarters.

Haul Roads & Culverts

For transportation of coal, provision of Haul road of 1km length has been made in Appendix A.8.2.2 & Appendix A.8.2.3 .

Service Roads & Culverts

For approaching from Mine to Dump and different Service Buildings 1.0 km. long Sector Road on Stratum 'C' specification with culverts, drain, tree guards etc. has been proposed in Appendix A.8.2.4.

Estimated Amount for Roads and Culverts

The estimated amount and other details for Colony road, Approach road, Service road and Haul road are given in Appendix-A.8.2.

15.5 WATER SUPPLY ARRANGEMENT

Water Demand

No provision has been made for water supply in the colony . Water demand for project site has been worked out to 560 Kl . Water demand for project site includes water to be supplied for washing of HEMM, dust suppression, fire fighting, water sprinkling on roads, etc.

(B) Industrial Water Demand for Project including Potable Water demand for Persons working in the Project For Opencast Projects

a) Water requirement for total manpower of Project @ 45 litres/capita/day	15255Litres
b) Water requirement for washing of dumpers @ 1800 litres/day/dumper	82800
c) Water requirement for dust suppression in CHP & other Industrial premises @ 22500 litres/day/ million tonnes of coal produced every year	67500
d) Water requirement for fire fighting in coal @ 45000 litres/day/million tonnes of coal produced every year	135000
e) Water requirement for road watering @ 67500 litres/day/million tonnes of coal produced every year	202500
f) Water requirement of Service Buildings @ 10% of item (a) above	1530
g) Allowance for loss & wastage @ 10% of (a) to (f)	50500
Total Water Demand	555085
Say	560000

Source of Water

For project site, sub-soil water has been envisaged as the source. Accordingly, bore-well provisions have been made . However, it is suggested that the source of water may be ascertained after carrying out hydro-

geological investigations as regards the quality and quantity of water.

Salient features of Water Supply arrangement

Project Site

Sub-soil water through bore well has been proposed to be conveyed to O.H. reservoirs via ground sumps. Further, water from O.H. reservoir shall be supplied under gravity to different buildings after chlorination.

It is, however, suggested that permanent water supply arrangement should be formulated after carrying out detailed survey, investigations for the adequate source of water and detailed engineering.

Estimated Amount of Water Supply

The details and estimated amount for Water supply to the colony and for the industrial use are given in Appendix-A.8.3.1 and A.8.3.3 respectively.

15.6 SEWAGE DISPOSAL ARRANGEMENT

To avoid any discharge of effluent into natural watercourses, sewage disposal arrangement has been envisaged. Estimated amount for sewage disposal arrangement for project site and required surface drains are given in Appendix A.8.3.2 & A.8.3.4 respectively. However, final economical scheme may be formulated after detailed survey & engineering considering the site parameters.

15.7 NALA DIVERSION AND HIGH LEVEL RIVER BRIDGE

Provision has been made for diversion of 4.8 km nala. In absence of detailed data from the project, width of nala is assumed as 50 m and the depth of nallah is considered as 8m.

Also a 480m long high level river bridge has been proposed from Mugoli site

to proposed open cast mine for which necessary cost provision made as given in Appendix A8.1.

15.8 CONSTRUCTION MANPOWER

The proposed civil engineering manpower in the project report is for the repair & maintenance works of the project i.e., for repair & maintenance of buildings, roads, water supply, sewage disposal arrangement, etc. Personnel required for the construction period of the project are not included in the total manpower proposed for the project. Following construction manpower has been proposed for the construction period only.

i)	DY. GM (C)	1 No.
ii)	Sr Mgr. (C)	1 No
iii)	Dy. Manager/Astt manager	1 Nos.
iv)	Engineering Asstt./Overseer (C)	1 Nos.
v)	Accountant	1 No
vi)	Clerk	1 No

It is proposed to arrange this manpower for the construction period from the total available manpower in WCL under Civil Engineering Discipline.

Chapter - 16

LAND REQUIREMENT

16.1 The total requirement of the land for Penganga OC Project would be 763.06 ha. Out of this land, the proposed land required for the project comprises of surrounding villages namely Wirur, Gadegaon, Borgaon & Sonarli. Land of these villages is mostly used for cultivation purpose. Cash crops like cotton, chillies etc are also grown apart from standard agricultural product like rice, wheat & jawar. The break up of the type of land required for Penganga OC Project is as follows :

Sl.No.	Particulars	Total Land (ha)
1	Tenancy land to be acquired for mine	612.10
2	Government Land	131.73
3	Village rehabilitation (Tenancy land)	15.00
4	Land for Bridge (Tenancy Land)	4.23
	Total	763.06

Rate of tenancy land and Govt. land has been considered as Rs. 10.00 lacs per Acre and Rs. 6.00 lacs per Acre respectively. In addition to the land cost, a compensation package for acquisition of land as per new R&R Policy, as per CIL guidelines, has been also considered. ***As per the directives of Technical Sub-Committee of WCL, provisioning of monetary compensation in lieu of employment to 50% of land oustees to be considered for planning purpose.*** Hence the total cost of land, as per the directive of TSC including 50% monetary compensation package, works out to **Rs.216.3948 crores**. Break up of proposed land use during mining for Penganga OC Project is as given below

Sl. No.	Particulars	Land (in ha)
a)	Total Excavation area	240.10
b)	Proposed External OB Dump	253.60
c)	Infrastructure & Bridge	26.23
d)	Village rehabilitation	15.00
e)	Approach roads / Embankment	95.30
f)	For rationalisation of boundary/Blasting zone	132.83
	Total	763.06

16.2 COMPENSATION & REHABILITATION

Payment of compensation for land losers has been estimated as per compensation package of R&R policy of CIL. In this PR one time monetary compensation in lieu of employment is proposed to be paid to **half of** land losers (**ie 50% of land losers ,as per the decesion taken in TSC meeting of WCL**). But in lieu of monetary compensation, employment may be considered by WCL as per revised CIL R & R policy. It is contemplated that the entire exercise of land acquisition shall be completed in initial one year of project before start of quarry operation in Second year. Wirur village is located in proposed Quarry area and it is proposed to be shifted. Provision of Rs.41.8870 crores has been made for shifting and rehabilitation of Wirur village in the PR. (As per latest CIL R & R Policy,2012,Clause no 8.1 C(ii) ,an one-time lump sum payment of Rs. 3.00 lakh with other benefits per homestead in lieu of alternate house provision has been kept in this PR However as alternate arrangement for village shifting in lieu of lump sum payment may be provided with kind approval of competent authority by WCL as an alternate arrangement, for which land provision has already been considered in the above sheet.) **During the deliberation Technical Subcommittee directed to obtain a certificate from concerned department duly approved by competent authority regarding scope of gainful utilization of progressive manpower to be inducted against land acquisition considering manpower requirement of WCL as a whole.In this connection, a certificate in this regard from GM(P&IR), WCL, is enclosed as Annexure .**

Chapter - 17

MANPOWER, PRODUCTIVITY & TRAINING

17.1 MANPOWER ASSESSMENT

The requirement of manpower for proposed Penganga OC in Partial Hiring Option is 307 . The manpower requirement for proposed OC Mine has been calculated on the basis of 3 shift operation for 330 days in a year. The manpower requirement for this project has been detailed in Appendix-B and B.1 of the project report. The manpower requirement of this project has been summarised as follows :

Table-17.1 Manpower Requirement

Sl. No.	Particulars	Partial Hiring Option
1.	Executives	21
i)	Monthly rated staff	77
ii)	Daily rated staff	209
3.	Total	307

17.2 MANPOWER PHASING AS PER PROJECT IMPLEMENTATION SCHEDULE AND BUILDING UP OF PRODUCTION CAPACITY

The year-wise cumulative manpower upto target production in Partial Hiring option is tabulated below:

Sl No	Option	I Year	II Year	III Year	IV Year	V Year	Total
1	Partial Hiring option	50	120	240	270	307	307

17.3 PRODUCTIVITY :-

The annual capacity of this mine has been rated as 4.0 Mt of coal. In the Partial Hiring option the manpower employed would be 307 and the overall OMS works out to 49.353.

17.4 TRANSPORT OF PERSONNEL (OPTIONAL)

Suitable number of Vehicles has been provided for transport of personnel in the Appendix A.6.

17.5 TRAINING

Manpower requirement for this project will be taken from various projects of area. However, for unskilled/semiskilled/skilled & highly skilled manpower, persons will be taken as and when required from existing OC mines of Wani Area or from other areas of WCL.

For training of manpower, facilities of existing VTC of Wani Area, will be utilised for both departmental manpower as well as for workers deployed by out sourcing agency as per recommendation of latest Safety Conference. Hence no extra provision has been made in this report. The Manpower on the basis of group operation has been indicated in table-.

Production and Manpower Classification

S.No.	Particulars	
		Partial Hiring Option
1	Coal Production (Mty)	4.0
2	Peak OB removal (Mm ³ /y)	16.84
3	Manpower on the basis of group operation (Nos.):	
i)	Coal	35
ii)	Overburden	87
iii)	Common	183
iv)	Reclamation	2
	Total	307

Chapter - 18**SAFETY & CONSERVATION****18.1 SAFETY**

The project report has been drawn in conformity with the prevailing statutory provisions as per Mines Act, 1952 and CMR, 1957 applicable for safety in Opencast Mines. However, all statutory rules, regulations, applicable laws etc. and statutory requirement related to Govt. licences, workers compensation, Insurance, etc. shall have to be adhered to. All the regulations & schedules of Coal Mines Regulations, 1957 relating to opencast mining have to be adhered to and implemented in order to maintain day to day safety precautions as per statute. **Recommendations from scientific studies shall be strictly followed at the time of the execution of the project for keeping adequate width,height and slope of benches with running sand.**

18.2 SAFETY ASPECT FOR BLASTING OPERATIONS

As explosives are required in bulk for blasting in OC mines, provision of regulation - 164 A of CMR 1957 should be ensured.

All blasting operations shall be carried out in day light. Suitable precautions shall be taken as per statute before and after blasting operations. Controlled blasting technique has to be practised to minimise fly off rocks and ground vibrations and keep them within safe limits . In order to keep the ground vibrations within the permissible limit as per DGMS Circular No. 7 of 1997, to avoid flying of rock fragments and also to achieve satisfactory blasting results, optimized drilling / blasting parameters depending upon rock formation using combination of relays / delays will have to be evolved. It is further recommended that at the time of actual execution, proper study for controlled blasting and ground vibration is done with scientific body in order to evolve site specific charge distance relationship.

18.3 SLOPE STABILITY

It is suggested that following action may be taken to deal with slope stability problem.

- i) Vulnerable area may be identified and marked on quarry plan.
- ii) Observation of actual alignment of fault planes, its throw, joints, etc. may be recorded during the process of exploitation.
- iii) Water drainage system may be properly implemented to prevent accumulation of water in cracks. Also dumps should be leveled to prevent accumulation of water over it. Proper drainage in dumps should be also provided to prevent erosion of toe of dump.
- iv) Regular monitoring of tension cracks, horizontal and vertical movement of strata in critical area may be done.
- v) Rise side slope to be reinforced if required because it has to stand through out quarry life. No dumps/surface structures to be located within 15m of quarry edge as it will act as surcharge there by destabilizing the slope.
- vi) Undercutting of slopes should not be done.
- vi) Proper hydrogeological studies to be done if water table is at level of slope it should be brought down by using submersible pumps to prevent hydrostatic pressure.
- vii) Proper selection of site for dumping to be done. Before dumping, place should be made free from loose material. Dumping should be done in layers
- ix) After completion of dumping operations dumps to be stabilised by growing suitable vegetation.

Provision for reclamation of dumps has been provided in Appendix C. Reclamation to be done by spreading 0.50 m soil over dumps and its slope after necessary grading and levelings. After this vegetation will be grown over the dumps. While growing plants at dumps care must be taken to retain flora and fauna of the area. Provision of Rs. 20.00 lakhs has been kept to undertake technical studies for determining slope stability studies.

18.4 SAFETY ASPECTS FOR OUTSOURCING/HIRING OF HEMM

Special precaution should be taken while deploying workers in the mine. Before employing any labour to the mine proper vocation training should be imparted and recommendations of recent Safety Conference should be strictly followed. Terms and conditions shall be fixed by management for deployment of labours by leaser of HEMM as well as machineries. Some of the major aspects are as follows :

A)

For persons :

- i) No persons shall be deployed unless he is trained at VTC
- ii) Records in Form-B & Form-D shall be maintained.
- iii) Records of Vocational Training Certificate and driving licence of operators shall be kept by HEMM outsourcing agency and shall be made readily available for inspection by management.
- iv) Salaries shall be distributed in front of management representative.
- v) No person shall be employed unless person holds VTC certificate and Management is informed. A record of it shall be maintained.
- vi) Adequate supervision shall be maintained by qualified competent persons.

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

- i) All the machineries to be deployed in mines should be checked before deployment.
- ii) Regular checking of m/c deployed by leaser of HEMM shall be done.
No unfit m/c shall be deployed before the defect is rectified.
- iii) A proper record of repair and maintenance alongwith inspection done by management and defect pointed out shall be maintained and signed by authorised person.
- iv) The trucks deployed by leaser of HEMM shall be provided with Audio visual alarms, proper light for use at night and period when natural light is not sufficient. Also audio visual alarms for reversing on trucks shall be provided.

Other precautions for machines

- i) RTO certificate photo copies of all vehicles shall be submitted to management.
- ii) Daily welding, ,monitoring, inspection shall be done by the HEMM outsourcing agencies mechanic as directed by management.
- iii) Machine manufacturers should be asked to give risk analysis.
- iv) Suitable type of the fire extinguishers shall be provided in every machines.

C) **General** :

- i) No person/vehicle shall be deployed at any place other than authorised place.
- ii) All workers should obey lawful instruction of mine management.
- iii) Risk Management Plan of tipper/pay loader shall be made and implemented.
- iv) All drivers shall obey systematic traffic rules prepared by management.
- v) Before deploying workers they must be trained and briefed about safety aspects in opencast mine. However during course of execution of the work, if any accident occurs whether major or minor, the matter shall have to be immediately informed to mine management i.e, Colliery Manager/Agent/GM of Area so that Notices of accidents in accordance of (Reg. 9 of CMR 1957) and Sector 23 of Mines Act 1952 may be given and other necessary steps may be taken in accordance of Section 23 of Mines Act ,1952 & Reg. 9 of CMR ,1957 and other relevant laws.

Chapter - 19

ENVIRONMENTAL MANAGEMENT

19.1 INTRODUCTION

The Project Report of Penganga OC was earlier prepared for a target capacity of **3.00 Mty(Normative), 4.50 Mty(Peak)**. The capital cost of the project was 33977.06 lakhs. The Project Report was approved by WCL Board in 22-10- 2008. However, as per directives of MOEF, the Form – I application was prepared based on the peak capacity at 4.50 Mty and was submitted to MOEF through MOC. The Form – I was subsequently discussed in EAC on 23.03.2009. The Terms of Reference (TOR) has been received from MOEF vide its letter no. J-11015/46/2009-IA.II(M) dated 15.04.2009. As directed in the aforesaid TOR, Public Hearing Document was submitted to Maharashtra Pollution control Board (MPCB) on 28.11.2009. The public Hearing has been completed on 3/3/2012.

MOEF has accorded Environmental clearance for the production of 3.00 MTPA with peak Capacity of 4.50 MTPA in existing mining leasehold area of 781.00 ha vide letter no. J-11015/46/2009-IA-II(M) on 31/01/13 . In the subsequent paragraphs an attempt has been made to assess the likely environmental impacts due to proposed mining activities.

Reasons for Updation of Project Report :

Government of Maharashtra vide letter no MMS-06/2011/CR-144/A-2/Dt.09.05.12 issued by Principal Secretary (Forest), has enhanced land compensation rates for land being acquired by WCL to ` 6 lakhs/Acre for barren land, ` 8 lakhs/Acre for non irrigated land and ` 10 lakhs/Acre for irrigated. Also, the new rehabilitation and re-settlement policy of Coal India Ltd, 2012 has been approved by the CIL Board in its 279th meeting held on 12th & 13th March, 2012.

Enhanced land rates, new R&R policy 2012 and other cost parameters necessitated updation of Project Report of Penganga OC.

Finally, the Revised PR of Penganga OCP (Aug.,2014) with increased target capacity of 4.00 Mty and mine life of 15 years was approved by WCL Board for the additional capital of Rs.441.8209 crores with no change in leasehold area of the project and dumping area.

19.2 EXISTING ENVIRONMENTAL QUALITY:-

19.2.1 AMBIENT AIR QUALITY IN PROJECT AREA:-

Regular Environmental monitoring is being carried out by Env Dept. RI-IV CMPDI Nagpur for the existing Kolgaon OCP (nearby to the proposed mine) at following AAQ Monitoring Locations

<u>S.No.</u>	<u>Details of Location</u>	<u>KOLGAON OCP</u>	<u>Code No.</u>
1.	Manager Office	-	WKOA-1
2.	Kolgaon Village	-	WKOA-2
3.	Kailash Nagar township (Filter Plant)	-	WKOA-3
4.	SAM Office	-	WKOA-4

1. Manager Office : WKOA-1							
(24 hourly values in µg/m³)							
Month	Dates of Sampling			Parameters			
	From	-	To	SPM	PM-10	NO _x	SO ₂
MAY. 2014	12.05.14	-	13.05.14	460	218	7	75
JUNE. 2014	25.06.14	-	26.06.14	231	80	53	32
Permissible Limits				200	100	80	80

2. Kolgaon Village : WKOA-2							
(24 hourly values in µg/m³)							
Month	Dates of Sampling			Parameters			
	From	-	To	SPM	PM-10	NO _x	SO ₂
MAY. 2014	12.05.14	-	13.05.14	39	18	7	76
MAY. 2014	29.05.14	-	30.05.14	526	154	7	48
JUNE. 2014	13.06.14	-	14.06.14	247	134	21	8
JUNE. 2014	25.06.14	-	26.06.14	169	37	30	22
Permissible Limits				200	100	80	80

3. Kailashnagar township near Filter plant (colony) : WKOA-1							
(24 hourly values in µg/m³)							
Month	Dates of Sampling			Parameters			
	From	-	To	SPM	PM-10	NO _x	SO ₂
MAY. 2014	13.05.14	-	14.05.14	430	188	5	118
JUNE. 2014	13.06.14	-	14.06.14	210	99	43	11
JUNE. 2014	26.06.14	-	27.06.14	234	93	13	22
Permissible Limits				200	100	80	80

4. SAM Office : WKOA-4							
(24 hourly values in µg/m³)							
Month	Dates of Sampling			Parameters			
	From	-	To	SPM	PM-10	NO _x	SO ₂
MAY. 2014	12.05.14	-	13.05.14	293	121	6	112
JUNE. 2014	26.06.14	-	27.06.14	145	32	45	31
TLV as per Env.(Protection) Amendment Rule 2000				600	300	120	120

Core zone (Mine Leasehold Boundary)

All most all the values are found to be well within the Standards for Coalmines stipulated by Ministry of Environment & Forests (MoEF).

Buffer zone (10 Km radius from ML Boundary

All most all the values of SPM, RPM, and SO₂ and NO_x are well within the CPCB norms. Almost

19.2.2 WATER QUALITY

Mine water discharge is collected on fortnightly basis in plastic zaricane and is transported to the laboratory for analysis. As per the Environment (Protection) Amendment Rules published vide Gazette dt. 25.9.2000, water samples are analysed fortnightly for the parameters - pH, TSS, Oil & Grease and COD and once in a year for all parameters as per General Standard for Discharge of Env. Pollutants, Schedule VI, Part A, Environment. Protection Act 1986, vide GSR-422(E) dt. 19.05.1993

Location: - Drinking Water from Filter Plant

Date – 30.05.14

Sl. No	Parameter	Analysis Result	Standard (IS 10500 : 1991)	
			Desirable limit	<i>Permissible limit in the absence of alternate source</i>
1.	Colour (Hazen)	<5	5	25
2.	Odour	Unobjectionable	Unobjectionable	-
3.	Turbidity (NTU)	2	5	10
4.	pH value	7.97	6.5 to 8.5	<i>No relaxation</i>
5.	Total Hardness (as CaCO ₃) (mg/l)	360	300	600
6.	Iron (mg/l)	<0.06	0.3	1.0
7.	Chlorides (mg/l)	48	250	1000
8.	Residual, Free Chlorine (mg/l)	0.03	0.2	-
9.	TDS – mg / l	750	500	2000
10.	Calcium (mg/l)	76.8	75	200
11.	Magnesium (as Mg)- mg/l	39.85	30	100
12.	Copper (mg/l)	0.16	0.05	1.5
13.	Manganese (mg/l)	0.10	0.1	0.3
14.	Sulphate (mg/l)	164	200	400
15.	Nitrate (mg/l)	7.36	45	100

16.	Fluoride (mg/l)	0.84	1.0	1.5
17.	Nickel – mg/l*	<0.1	0.02	No relaxation
18.	Hexavalent Chromium mg / l	<0.1	0.05	No relaxation
19.	Cadmium (mg/l)	<0.0005	0.01	No relaxation
20.	Lead as (pb) (mg/l)	<0.0005	0.01	No relaxation
21.	Zinc as (Zn) (mg/l)	<0.01	5	15
22.	Nickel – mg/l*	<0.1	0.02	No relaxation
23.	Alkalinity (mg/l)	120	200	600
24.	Boron (mg/l)	BDL	1	5

EFFLUENT WATER QUALITY MONITORING DATA

KOLGAON OCP

Name of the Location : Mine Water discharge - WKOW - 1

Month	Date of sample collection	Analysis Results			
		pH	TSS (mg / l)	COD(mg / l)	O & G (mg / l)
APRIL 2014	08.04.14	7.28	<25	< 40	< 2
APRIL 2014	25.04.14	7.55	28	< 40	< 2
MAY 2014	12.05.14	7.31	64	< 40	< 2
MAY 2014	29.05.14	7.47	36	< 40	< 2
JUNE. 2014	13.06.14	7.73	72	< 40	< 2
JUNE .2014	26.06.14	8.20	46	< 40	< 2
TLV as per Env. (Protection) Amendment rule 2000		5.5 -9.0	100	250	10

All parameters of water samples monitored are within permissible limit.

19.2.3 NOISE LEVEL QUALITY

Day time and Night time Noise level data are recorded fortnightly on following locations of Kolgaon ocp.

Day time and Night time Noise level data are recorded fortnightly on following locations of **Kolgaon OCP**

Name of the Location : CHP - WKON-1

Month	Date of Data collection	Noise Level in dB(A)		Remarks
		Day Time	Night Time	
APR. 2014	03.04.14	51.3	53.0	

MAY. 2014	13.05.14	55.4	56.7	
MAY. 2014	21.05.14	55.4	56.7	
JUN.2014	13.06.14	55.3	55.0	
JUN.2014	25.06.14	48.3	47.2	
Noise Level Standard as per Env. (Protection) Amendment rule 2000		75	70	

Recorded Noise level data are well within permissible limits.

19.2.4 FLORA AND FAUNA

An Environmental Impact Assessment (EIA) study was conducted to generate baseline data of flora and fauna for Penganga OC Mine Area during winter months jan' 2010 .

Endangered Flora : No endangered plant species in Core zone .

Endemic Flora : NO endemic plant species have been found in Core zone.

Endangered species (as per Wildlife (Protection) Act : No Endangered

Fauna was recorded in core zone .

Migratory Species of the Project areas : No endemic species were observed in Core zone .

Migratory corridors and Flight Paths : No migratory corridors and Flight paths were present in Core zone .

Endangered Species (as per Wildlife (Protection) Act : No Endangered Fauna was recorded in Buffer zone .

Endemic Species of the project areas : no Endemic species were observed in the Buffer zone .

19.2.5 SOCIO ECONOMIC STATUS

Wirur Village is located in core zone area of the mine . There are 446 families in wirur village which is proposed to be resettled at new location as proposed

in the PR. Provision of Rs 41.8870 Crores has been kept for shifting and rehabilitation of the Wirur village in the PR.(As per latest CIL R & R Policy , 2012 , clause no 8.1 C (ii), an one time lump sum payment of Rs 3.00 lakh with other benefits per homestead in lieu of alternate house provision has been kept in this PR.

19.2.6 LAND RESOURCE

The existing scenario of the land required for the proposed project is summarized in the following table as:-

Sl.No.	Particulars	Total Land (ha)
1	Tenancy land	631.33
2.	Government land	131.73
3.	Zudpi Jungle	-
	TOTAL	763.06

19.3 ENVIRONMENTAL IMPACT

19.3.1 AIR QUALITY IMPACT

Due to coal transportation, wind erosion of OB dumps, and coal handling dust is likely to be generated. Conc. of NO_x may likely to increase due to the increased of vehicular movement.

19.3.2 WATER QUALITY IMPACT

Analysis of water pumped out from existing Near By mines around the proposed project shows that even untreated water meets the acceptable limits, so quality of water pumped out from the proposed project will be less likely to have any significant pollution load even in untreated condition.

19.3.3 GROUND WATER IMPACT

The groundwater quality in the area is being monitored regularly by CMPDI , an ISO – 9001 company and the results indicate the groundwater and mine water quality in the area is potable and does not contain any toxic elements .

Generally, the water quality is mostly alkaline in nature with pH value of 7.28 to 8.20 of potable quality with low to medium concentration of total suspended solids (TSS) are to the tune of 28 to 72 mg/l . Normally , the coal mining activity does not induce any unwanted chemical or elements into the groundwater affecting the water chemistry . So it is expected that no serious pollutant will be observed in the mine discharged water.

The mine water will be discharged onto surface after passing through the sumps and sedimentation tanks. Hence , no quality degradation of mine water is anticipated.

NOISE IMPACT

Existing noise level at the mine site is likely to increase due to the increased number of vehicular movement and deployment of additional HEMM.

19.3.4 FLORA AND FAUNA

No changes in the diversity of species or number of any species of animal are anticipated.

19.3.5 SOCIO-ECONOMIC STATUS

Rehabilitation of Wirur village is being envisaged in PR. Impacts on Socio-Economic status would be most likely observed as change in standard of living of the project affected people.

19.3.6 LAND USE

Regarding land use during mining, in addition to excavation of quarry for coal, overburden dump will be created along with development of other mine related infrastructure.

19.4 ENVIRONMENT MANAGEMENT

19.4.1 AIR QUALITY MANAGEMENT

Ambient Air quality of the Kolgaon OC (nearby project) is being regularly monitored as per Environmental Protection Amendment Rules 2000, and the same would be continued for the proposed project after starting of the project .

Ambient Air Quality will be controlled by black topping of roads, water spraying on roads, biological reclamation of OB dumps, green belt around CHP, OB dump, and along coal transportation roads on both sides etc.

19.4.2 WATER QUALITY

Penganga OC Project is a new mine. The control measures like provision of settling tank for mine water discharge; Effluent Treatment Plant, etc. will be constructed, as is being done in the nearby existing projects of WCL. The regular Water Quality Monitoring as per Environment Protection Amendment Rules, 2000 is being undertaken, and the same would be carried out for the proposed project after getting statutory clearances.

Mine pumped out water, after sedimentation, will be utilized within mine premises and balance will be used for supplementing any shortage of water in the nearby villages. Effluent from workshop will be treated in ETP & thereafter recycled. Similarly, water from CHP, after sedimentation will also be recycled.

19.4.3 NOISE MANAGEMENT

Penganga OC Project is a new mine, the control measures will be undertaken as is being done in the nearby existing projects of WCL. The worker exposed to high noise level will be provided with earplugs & ear muffs. Proper enclosure and regular maintenance of equipment will be done. Plantation along road and around industrial & service building will be done to reduce the noise level.

The regular Ambient Noise Quality monitoring as per Environment Protection Amendment Rules, 2000 is being undertaken and the same would be carried

out for the proposed project after getting statutory clearances.

19.4.4 FLORA AND FAUNA MANAGEMENT

Adequate plantation has been proposed with native species to maintain the diversity and also to attract the fauna.

19.4.5 SOCIO-ECONOMIC STATUS

The eligible land losers will be suitably rehabilitated. As per extant CSR Policy 2% of last three years average net profit or Rs 2/tonne of company production , which ever is higher has been, which will be used for social and economical upliftment of the proposed project affected people.

As rehabilitation of Wirur village is being envisaged in PR, Suitable changes would be made in accordance with CIL R&R policy and applicable regulatory requirements in vogue.

19.5 ENVIRONMENT MANAGEMENT SYSTEM

To have a close watch on the environmental condition and implementation of the various measures suggested, a multi- disciplinary approach is essential. At present WCL headquarter acts as apex body which supervises the activities relating to environment at project level through the General Manager. General Manager of the area coordinates the activities of various disciplines in the area to render all necessary assistance at the implementing level i.e. the project . Area Nodal Officer (Environment) monitors all aspects of environment on behalf of the General Manager. He also takes suitable steps for generation of environment data along with its analysis and interpretations.

As far as plantation is concerned horticulturist with suitable backup staff is provided in the area for undertaking the plantation jobs including rising of a nursery.

Sub-Area Manager is responsible for mechanical reclamation of the area. He is also responsible for biological reclamation with the assistance of GM's office.

19.6 CAPITAL PROVISION**16.6.1 ENVIRONMENTAL AND SOCIAL COST TO BE PROVIDED SEPARATELY**

Suitable provisions for Sedimentation pond for treatment of mine waste water , Effluent treatment plant for treatment of workshop effluent , Installation of fixed type sprinklers for dust control (including water reservoir, pump, pipeline etc.) , Digital Mapping for land use plan etc has been kept in Appendix A 8.4a .

Also as per extant CSR Policy 2% of last three years average net profit OR Rs 2/tonne of company production , which ever is higher has been proposed in the PR.

Chapter - 20

MINE CLOSURE PLANNING

20.1 OBJECTIVES OF CLOSURE PLANNING

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social & environmental challenges. Various other objectives are as follows.

- a) To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority.
- b) To protect public health and safety.
- c) To alleviate or eliminate environmental damage and thereby encourage environmental sustainability.
- d) To minimise adverse socio-economic impacts.

20.2 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, new technology and remain flexible enough to cope with unexpected events. Following steps have to be undertaken in relation to Mine Closure Planning :

- (a) Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems viz; explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids. This could ensure that the sale of assets give better financial gain.

- (b) In order to identify potential impact, necessary hydro-geological studies into post-mining groundwater recharge has to be done. The void of the mine can be proposed as a water resource to be utilised for aquaculture.
- (c) Work force on roll of WCL may be redeployed for gainful utilisation of employees of WCL.
- (d) As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of mine. Once established it may be updated annually.

20.3 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following :

- a) The protection of mine boundary, building and other structure on the project site against access by unauthorised persons.
- (b) The maintenance of all mechanical, hydraulic and waste management system
- (c) The continuation of all monitoring programs.
- (d) The control of all contaminated effluents
- (e) The securing of all petroleum products, chemicals and waste.
- (f) The rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

20.4 CLOSURE COSTS

The proposed Penganga OC Project has been planned upto 170 m depth and it is most likely that this will be extended further in dip side in future . Based on recent guidelines for mine closure activities Rs 6.00 lakhs/ha of total land requirement with escalation in every year is considered in this PR which works out to be Rs.22.57/t throughout the mine life in order to undertake mine closure activities (for plantation in slope of dumps & quarry, for protection of mine boundary and continuation of monitoring programme and control of contaminated effluents). This Closure cost may be reviewed under the changing circumstances and new legislative guidelines on time to time.

Chapter - 21

PROJECT IMPLEMENTATION SCHEDULE

21.1 GENERAL

The proposed Penganga OCP is located adjacent to existing Mugoli Nirguda OCP but Penganga river is flowing between the two Projects. ; Hence, this project has to be provided with all infrastructural facilities independently in order to ensure its proper development. The two main phases in project construction would be :

21.2 PRE AND POST SANCTION ACTIVITIES BEFORE STARTING EXCAVATION

Pre Sanction Activities	Post Sanction activities before starting excavation
Detailed surveying of the area to locate various infrastructural facilities.	Preparation of budgetary estimates for construction of various infrastructural facilities like Bridge, nala diversion, Workshop, Approach Road, etc.
Customer of coal production to be finalised.	Posting of core management group.
Coal despatch arrangements to be finalised.	Acquisition of essential land.
Dialogue with State Government and other appropriate authorities to expedite land acquisition.	Procurement of HEMM and OPM equipment.
Dialogue with MSEB to finalise temporary and permanent sources of power supply.	Creating facilities for erection and commissioning of equipment.
Preparation and submission of EMP.	Starting construction of permanent approach road.
Soil investigation for construction work.	Starting construction of workshop, office, stores, etc.
	Selection, recruitment and training of manpower for the project as per manpower budget.

21.3 DEVELOPMENT ACTIVITIES AFTER STARTING EXCAVATION

1. Completing construction of all infrastructural facilities like Workshop, Office, Garage, Stores, etc.
2. Permanent power supply arrangement.
3. Procurement of OPM equipment.

21.4 PROJECT CONSTRUCTION GROUP

To ensure timely completion of the project, it would be necessary to have a project construction team for Penganga Opencast Project right from the date of sanction of the project. This would ensure proper co-ordination amongst the various agencies essential in the project construction period. After the completion of the project, some of the personnel could be retained at the project itself and some may be shifted to other projects as the need arises.

Chapter - 22

PROJECT ECONOMICS

22.1 INTRODUCTION

The proposed Penganga OC Project envisages to mine out 44.06 Mt coal with a target production of 4.0 Mty. **The mine would produce grade 'G 10' Processed ROM coal with GCV of 4551 kcal/kg throughout mine life .**

22.2 ADDITIONAL CAPITAL INVESTMENT

The initial capital of the project , till the year of achieving rated capacity, is Rs.438.1445 Crores and Rs.3.6764 Crores beyond this. Thus, the total estimated capital investment for the proposed Penganga OC project, having an annual capacity of 4.00 Mt of coal and 16.84 Mm³/y of Peak OB, works out to Rs.441.8209 crores or capital outlay is Rs 1104.55 /t of annual target production and the specific investment/m³ of excavation considering both coal & OB is Rs.246.29. The headwise provisions are shown as below :-

Total Capital Investment (Amt. in Rs.crores)

A/c Head	Particulars	Capital Provisions
01	Land	259.2818
02	Civil Structure	9.8632
03	Plant & Machinery	90.5118
04	Furniture & Fittings	0.3300
06	Vehicles	0.2920
07	Prospecting & Boring	0.3000
08	Mine Development	76.0142
09	Revenue Expenditure Capitalised	5.2279
	Total	441.8209

22.3 PRICING OF PLANT AND MACHINERY, CIVIL WORKS

The pricing of P&M is based on the standard price list of June 2013 circulated by the specialist cell of CMPDI, Ranchi. There is no requirement of foreign exchange for this project. The cost of civil works has been estimated on the basis of Cost Index of 505 at Maharashtra as on II half of the year 2014 with a base of 100 in Nagpur on 1.1.1992.

22.4 OPENING OF REVENUE ACCOUNT

The revenue of this project would open in the 2nd year with a production of 1.00 Mt in first production year of Quarry Operation .

22.5 CRITERIA FOR OPENING OF REVENUE ACCOUNT

The revenue account is opened in the 2nd year of the project (1st production year).

The norms for bringing Coal Projects into Revenue Account, as decided in the meeting held under the chairmanship of JS & FA on 9/6/04 are as follows :

- 1) Revenue Expenditure to be Capitalised should be net of Sales Receipts of Coal produced during the construction period.
- 2) The period of construction has to be defined, to determine the Commercial Readiness of the Project to yield on a sustainable basis
- 3) In case of Opencast Projects, the volume of Stripping Ratio of OB and in case of UG Projects, the completion of required developmental activities during the above period of construction have to be clearly defined
- 4) Based on the above, the capitalization of revenue expenses/opening of revenue account will be decided.

Accordingly, a definition of the term “ Commercial Readiness “ of a project has been drafted and based on this, a norm for capitalization of revenue

expense / opening of revenue expenditure of a project has been suggested as under:

22.6 Commercial Readiness :

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

(i) 30% of the total volume of excavation (coal and OB) envisaged in the target year

(ii) The land required for the project, upto target year, has been acquired. Within the above mentioned construction period, the project is in commercial readiness, as it would be able to yield production on sustainable basis and most of the infrastructure facilities like Road, CHP, Workshop, Service Building, Power Supply, Water Supply and Development activities for mine operation, would be completed and accordingly, capital provision has been made.

In this Proposed Project, the mine will have cash surplus in the second year of project (including one year for land acquisition) after considering the sales realization of the Notified price of Power Sector Coal for G10 Grade @ 85% capacity utilization in Partial Hiring Option.

22.7 MANPOWER AND OMS

The manpower employed would be 307 and the overall OMS works out to 49.353 t. However the CIL OMS works out to be 51.889 t.

22.8 EMS AND WAGES

The EMS is based on as per CMPDI norms which comes out to be **to Rs 2982.37 and the salaries** and wages cost works out to Rs. 58.58/t.

22.9 COST OF PRODUCTION

Total cost of production works out to be Rs. 856.82/t and Rs.934.45/t at 100% and at 85% of target capacity respectively.

22.10 AVERAGE SELLING PRICE

The 95% of average selling price has been calculated as **Rs.1057.50/t and Rs.1399.50 /t for Power Sector** and for Non Power Sector respectively (-100 mm size) with average yearwise grade 'G10'with GCV of 4551 k.cal/kg processed ROM coal throughout the mine life.

22.11 PROFIT AND LOSS

The profit with average sale value of coal as Rs.1057.50 /t for power sector works out to be Rs. 200.68/t and Rs.123.05/t at 100% and 85% capacity respectively. The profit with average sale value of coal as Rs.1399.50 /t for Non-Power Sector works out to be Rs. 542.68/t and Rs.465.05/t at 100% and 85% capacity respectively.

23.13 IRR

The IRR of the project at 100% and 85% capacity comes out to be **21.03% and 12.21% for Power Sector** respectively.

22.12 BREAK-EVEN PRODUCTION:

It is estimated that the project will achieve break-even point at above 100% of rated capacity.

22.13 COMPLETION COST:

The estimated cost of completion, based on WPI and Civil Indices, is Rs. 498.5764 Crores.

22.14 RISK ANALYSIS :

The detailed percentage-wise variation in different heads for power sector, are shown in the table of Risk Analysis below –

RISK/ SENSITIVITY ANALYSIS (PARTIAL HIRING OPTION - POWER SECTOR)									
VARIATIONS (INCREASE OVER 100% / DECREASE BELOW 100%)									
PARAMETERS		0%	5%	10%	15%	20%	25%	50%	100%
INCREASE IN LAND & REHABL. EXP	Sale Price for 12% IRR (Rs.,t)	856.51	1005.05	971.44	977.51	983.58	989.65	1020.02	1080.75
INCREASE IN MINE DEVELOPEMENT EXP (A.8.1)	Sale Price for 12% IRR (Rs.,t)	856.51	960.58	961.88	963.17	964.47	965.76	972.24	985.18
INCREASE IN CAPITAL	Sale Price for 12% IRR (Rs.,t)	856.51	969.44	979.59	989.75	999.90	1010.05	1060.81	1162.33
INCREASE IN WAGES/SALARIES	Sale Price for 12% IRR (Rs.,t)	856.51	962.18	965.06	967.95	970.83	971.89	988.14	1016.99
INCREASE IN STORE COST	Sale Price for 12% IRR (Rs.,t)	856.51	965.12	970.95	976.78	982.60	988.43	1017.58	1075.86
INCREASE IN POWER COST	Sale Price for 12% IRR (Rs.,t)	856.51	960.17	961.05	961.92	962.80	963.68	968.07	976.85
INCREASE IN OPERATING COST	Sale Price for 12% IRR (Rs.,t)	856.51	997.10	1034.92	1072.73	1110.54	1148.35	1337.42	1715.54
INCREASE IN SALES REALISATION	Sale Price for 12% IRR (Rs.,t)	856.51	906.41	853.54	800.66	747.79	694.91	430.54	-98.21
DECREASE IN CAPACITY UTILISATION	Sale Price for 12% IRR (Rs.,t)	856.51	991.32	1023.35	1055.38	1087.41	1119.44	1279.60	1599.91
DECREASE IN SALES REALISATION	Sale Price for 12% IRR (Rs.,t)	856.51	1012.16	1065.04	1117.91	1170.79	1223.66	1488.04	2016.79

22.15 CONCLUSION

In this Revised Project Report of Penganga OC Project (August,2014) , for a mine target of 4.0Mty, the Partial Hiring Option has been envisaged in which workload of part of Top OB (2.60 Mm3) of the mine would be catered by Departmental HEMM and remaining balance Top OB by hiring/outsourcing. Coal and parting will be done by surface miner and shovel/dumper system on hiring .Total Cost of Production is Rs.934.45 /t and the IRR works out to 12.21% at 85% of target capacity as against Weighted Average Sale Price of Rs.1057.50 /t ((Power sector). This option may be considered for approval since IRR at 85% production capacity is coming more than 12% (i.e. 12.21%). **The salient comparative features of the proposed Revised Project Report of Penganga OC (August,2014) for 4.0 Mty** with that of earlier Approved PR of June, 2008 for 3.0 Mty are as follows :

Sl No.	Particulars	Partial Hiring Option (June,2008)		Partial Hiring Option (Revised August ,2014)	
		For Power Sector	Other Than Power Sector	For Power Sector	Other Than Power Sector
A	Financial Parameters				
01	Capital Required (Rs.in Crs.)	339.7706		441.8209	
02	Cost of Production (Rs./t)				
a)	@ 100% of target capacity (Rs./t)	627.55		856.82	
	@ 85% of target capacity (Rs./t)	703.90		934.45	
03	Av. Selling Price (Notified) (Rs./t)	796.00		1057.50	1399.50
04	Profit (Rs./t)				
a)	@ 85% of target capacity (Rs./t)	168.45		123.05	465.05
05	Financial IRR at 85% mine capacity	19.75%		12.21%	36.31%
