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**RECAST PROJECT REPORT
(INCLUDING MINING PLAN)**

FOR

**JAMUNIA U/G MINE
(PENCH AREA)**

**WESTERN COALFIELDS LIMITED
(JOB No. - 4101781)**

**VOLUME - I
(EXECUTIVE SUMMARY)**



APPROVED ON

CAPITAL (₹ IN CRS)

SEPTEMBER 2015

LIFE

REMARKS:-

CMPDI

**REGIONAL INSTITUTE-IV, KASTURBA NAGAR,
JARIPATKA, NAGPUR, PIN - 440 014**

AN ISO 9001:2000 COMPANY

CERT. NO.: CI/8656

**Area Planning Officer
WCL, Pench Area**

RECAST PROJECT REPORT FOR JAMUNIA U/G MINE**SUMMARISED DATA**

Sl. No.	Particulars		Unit	P.R. (Departmental Option - November 2008)	Recast P.R. (Departmental Option - September 2015)			
A.	GENERAL							
1	Name of Project			Jamunia U/G Mine				
2	Name of Area/Company			Pench Area / WCL				
3	Nearest Railway Station from Project		Name / km	Parasia / 40 km approx.				
4	Nearest National / State Highway / Approach Road		Name / km	State Highway No. 19 / 40 km, Urdhan Approach Road / 2.5 km				
B.	GEOLOGICAL							
1	Name of geological blocks considered		Name	Jamunia Geological Block				
2	Area of the geological block		sq. km.	5.3				
3	Borehole Density within block		BHs/sq. km.	12				
4	Description of all coal seams within block							
Name of seam	Thickness (m)		No. of borehole intersections	Geological Reserves (Mt)	Remarks			
	Min.	Max.						
IA	0.41	0.74	6	-	Unworkable			
IB (Top)	0.54	1.00	9	-	Unworkable			
Parting	0.36	0.46	-	-	-			
IB (Bot.)	0.23	1.33	9	-	Unworkable			
IB (Comb)	0.20	4.08	43	6.258	Unworkable			
Parting	0.30	9.69	-	-	-			
IC	0.00	3.40	57	9.687	Unworkable			
Parting	0.55	8.32	-	-	-			
II	1.25	4.15	58	18.417	Workable			
Parting	0.53	6.13	-	-	-			
III	0.26	4.54	42	9.053	Unworkable			
Parting	0.30	7.73	-	-	-			
IV	2.75	6.37	41	22.930	-			
III+IV (Comb)	3.86	7.55	14	8.803	Workable			
Parting	3.07	12.64	-	-	-			
V	1.36	5.92	49	21.773	Workable			
Total Geological Reserves (Mt)				96.921				
48.773								
C.	TECHNICAL							
1	Area of the proposed mine block (with break-up of different geological blocks)		sq. km	4.00	2.92			
2	Borehole density within mine area		BH/sq. km	12	11			
3	Mine parameters (All Workable Seams)							
	Extent along strike (min. - max.)		km	3.2 km - 3.8 km	2.5 km - 3.2 km			
	Extent along dip (min. - max.)		km	0.7 km - 1.2 km	0.3 km - 1.2 km			
4	Description of coal seams proposed to be worked:							
Name of seam	Mining Area (sq. km)	Thickness range considered (m)	Average thickness (m)	Av. Grade / GCV	Av. Gradient (1 in ...)	Depth range in mining area(m)	Mineable Reserves. (Mt) (Nov. '08 vs Dec '14)	Extractable Reserves (Mt) (November 2008 vs December 2014)
II	4.00 / 2.92	1.50 to 4.15	2.85	G6 / 5504	1 in 10	120 - 260	8.90 / 6.65	6.42 / 5.04
III+IV/IV		2.85 to 4.50	4.40	G5 / 5827	1 in 10	135 - 272	14.59 / 11.14	9.44 / 7.26
V		1.52 to 4.50	3.00	G6 / 5537	1 in 10	142 - 284	9.77 / 7.43	6.90 / 5.20
TOTAL	2.92			G6 / 5648			33.27 / 25.22	22.76 / 17.50
5	Mine Entries:							
Entries Name / No.		Size (X-section / length) (m x m / m)	Gradient (1 in)	Approach (from / to) (surface / seam to seam)		Purpose		
Incline No. 1		4.8 x 3.0 / 864	1 in 4.5	Surface to Seam-V		Belt Conveyor, Travelling Road & Main Intake		
Incline No. 2		4.8 x 3.0 / 864	1 in 4.5	Surface to Seam-V		Haulage Route for Material Transport, Travelling Route and Main Intake		
Airshaft		4.5 dia. / 196	Vertical	Surface to Seam-V		Return Airway		

Area Planning Officer
WCL, Pench Area

Summarised Data (Contd.)

Sl. No.		Particulars		Unit	P.R. (Departmental Option - November 2008)		Recast P.R. (Departmental Option - September 2015)	
6	Method of mining				B & P with Caving (C.M. Technology)			
7	Panel parameters							
	No. of headings in each panel			Nos	5 / 6			
	Width of galleries / roadways			m	4.8			
	Pillar sizes			m x m	34.5 x 34.5 & 45.0 x 45.0			
8	Prododuction Parameters							
	No.of panels to be worked			Nos	19 Nos.		16 Nos.	
	Production from each panel			tpd / Mty	1200 tpd / 0.36 Mty		1400 tpd / 0.42 Mty	
9	Target Output			Mt				
	Nominal production capacity (at 100%)				0.72 Mty		0.84 Mty	
	Peak production capacity (at 125%)				0.90 Mty		1.05 Mty	
	Production capacity (at 85%)				0.612 Mty		0.714 Mty	
10	Year of achieving target production (from zero date) (November 2008 / December 2014)			Year	VII		VI	
11	Production phasing (from zero date upto target year)			Mty				
Year / Coal seam	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	Year - 6	Year - 7	
Seam-II & V	NIL	NIL	NIL	0.00 / 0.15	0.15 / 0.42	0.36 / 0.84	0.72 / 0.84	
12	Total Mine Life (at Nominal production capacity)			Years	37		26	
	Pre-construction period			Years	1		1	
	Construction period			Years	3		2	
	Production build-up period			Years	2		2	
	Production period			Years	30		20	
	Tapering / mine closure period			Years	1		1	
13	Degree of Gasiness (I / II / III)			Years	I (Anticipated)			
14	Major Equipment deployed in panels			Nos.				
	SDL				-			
	LHD				2 nos.			
	CM				2 C.M. Package Equipment			
15	Average Specific Energy Consumption			kWh/t	24.18		24.70	
16	Total Manpower			Nos	545		530	
	Existing			Nos	-		-	
	Additional			Nos	545		530	
17	Overall Output per manshift (OMS)			Tonnes	5.049		6.056	
	Existing			Tonnes	-		-	
	Additional			Tonnes	5.049		6.056	
18	Seamwise Weighted Average Grade of Coal / UHV / GCV (k.Cal./kg)			Seam-II	'C' / 4965 (UHV)		'G6' / 5504 (GCV)	
Seam-III+IV/IV				'C' / 5465 (UHV)		'G5' / 5827 (GCV)		
Seam-V				'C' / 5050 (UHV)		'G6' /5537 (GCV)		
Overall				'C' / 5190 (UHV)		'G6' 5649 (GCV)		
19	Presence of Major Surface Constraints (Forest, Nallas, Roads, Power line, etc.)			(type)	Villages, Forest, Nallas & Kutcha Roads (The Rehabilitation of Jamunia Villages / Bastis are not proposed)			
20	Coal Transport							
	i) Incline				i) By Belt conveyor			
	ii) Main Trunk Roadways				ii) By Belt conveyor			
	iii) Panels				iii) By Belt conveyor			
21	Men Transport			Man riding system	1) Chair Lift System in Incline No. 2 2) Chair Lift System in Main Trunk Roadways			
22	Surface Coal Transport (From Pit-head to Siding)				By Road			
23	Name of any specific customer / industry				Miscellaneous			
D	ENVIRONMENTAL & OTHERS							
1	Civil Construction							
	Residential houses			Nos	371		279	
	Housing satisfaction			%	67.90		52.60	
2	Water Demand							
	Colony			kL	310		240	
	Industrial			kL	600		520	

[Signature]
Area Planning Officer
WCL, Peach Area

Summarised Data (Contd.)

Summarised Data (Contd.)				
Sl. No.	Particulars	Unit	P.R. (Departmental Option - November 2008)	Recast P.R. (Departmental Option - September 2015)
3	Total land to be acquired	ha	407.00	376.940
	Government land	ha	9.06	9.053
	Tenancy land	ha	323.24	308.585
	Forest land (type of forest)	ha	74.70 (State Revenue Forest)	59.302 (State Revenue Forest)
4	Land to be acquired within minetake	ha	400.00	369.940
	Government land	ha	9.06	9.053
	Tenancy land	ha	316.24	301.585
	Forest land (type of forest)	ha	74.70 (State Revenue Forest)	59.302 (State Revenue Forest)
5	Net Present Value of Forest Land	Rs. lakhs/ha	9.20	10.43
	Total area	ha	74.70	59.302
	Total value	Rs. Lakhs	844.63	309.26
6	Habitation & Rehabilitation	Nos.		
	No. of villages within mine boundary		4	3
	No. of land oustees			N.A.
	No. of PAFs to be rehabilitated			N.A.
7	Cost of Land & Rehabilitation	Rs. Crores		
	Total cost		25.8047	43.2119
	R&R only			
8	Additional EMP Capital	Rs. Crores		
	Social Cost		0.38	0.5773
	Environment cost			
9	Average annual rainfall	mm	1500	1500
10	Make of water	Cum/day	9.163 x 10 ³	6.692 x 10 ³
11	Total installed pumping capacity (through borehole or through incline/shaft)	lps	149 lps (Through Inclines)	104 lps (Through Airshaft)
12	Drainage of the Area (Name of river/nalla)		Gunor River	
13	Any proposed diversion of nalla or power line		Nil	
E	FINANCIAL			
1	Total Capital Investment	Rs. Crores	305.6049	409.8748
	W.D.V.		-	-
	Additional		305.6049	409.8748
2	Specific Investment	Rs./tonne		
	Total		4244.51	4879.46
	Additional			
3	Total Capital Investment on P&M	Rs. Crores	229.6163	275.8892
	W.D.V.		-	-
	Additional		229.6163	275.8892
4	Specific Investment on P&M	Rs./tonne		
	Total		3189.12	3284.4
	Additional			
5	Capital Requirement upto Target Year	Rs. Crores	300.2656	408.4951
6	Year of opening of Revenue account (from zero date)	Year	V	IV
7	Earnings per manshift (EMS)	Rs.	1031.80	2073.73
8	Estimated Cost of Production	Rs./ tonne		
	At 100% production level		1129.18	1684.24
	At 85% production level		1279.67	1926.94
9	Estimated average selling price for Power sector (at 98.5% sales realisation)	Rs. / tonne	1295.80	2263.62
10	Estimated Profit / Loss (Power Sector)	Rs./ tonne		
	At 100% production level		(+) 166.62	(+) 579.38
	At 85% production level		(+) 16.13	(+) 336.68
11	Financial Internal Rate of Return (FIRR)	%		
	For Power Sector at 100% production level		(+) 7.45%	(+) 17.08%
	For Power Sector at 85% production level		(+) 2.40%	(+) 12.17%

[Signature]
Area Planning Officer
MCL, Peach Area

Sl. No.	Particulars	Unit	Summarised Data (Contd.)	
			P.R. (Departmental Option - November 2008)	Recast P.R. (Departmental Option - September 2015)
12	Break-even point for Power Sector			
	Production	Mty	0.602	0.591
	Production level	%	83.65%	70.36%
13	Mine Closure Cost (for corpus fund)	(Rs. / t)	1.00	4.47
14	Expected Completion Capital	Rs. Crores	398.7252	447.0564


 Area Planning Officer
 WCU, Ranch Area

RECAST PROJECT REPORT FOR JAMUNIA U/G MINE

EXECUTIVE SUMMARY

1.0 INTRODUCTION

1.1 HISTORY OF MINING

Jamunia Geological Block is a virgin block located in the north-eastern part of Pench-Kanhan Valley Coalfield. It lies north-east of Urdhan Block and north of Naheriya Block. The perennial Gunor River forms the southern and eastern boundary of Jamunia Block and separates Naheriya and Dhankasa Blocks. Naheriya, Thesgora and Mathani are the nearest operating underground mines and Urdhan O/C is the nearest operating opencast mine. Naheriya, Urdhan and Dhankasa blocks are the adjacent blocks to Jamunia Block. The total area of Jamunia Geological Block is 5.30 km² involving 62 boreholes with a total meterage of 12050.15m.

1.2 JUSTIFICATION OF PREPARATION OF PROJECT REPORT

The preparation of Project Report for Jamunia U/G Mine is justified on the following grounds:

- a) Coal preparation by blasting-off-solids in underground mines is a tedious, time taking and manpower oriented method. It also leads to roof deterioration if quality of drilling and blasting is not given due care. For achieving higher production and productivity, blasting-free continuous cutting technology is required, which not only ensures safety but also is cost effective.
- b) In order to make underground mining cost-effective, blasting-free continuous cutting technology is the need of the hour. Continuous cutting technology has scope for higher levels of production and leads to better roof management in the absence of blasting. Therefore this Project Report proposes to introduce continuous cutting technology in all the three workable seams (Seam-II, Seam-III + IV/IV and Seam-V) in Jamunia U/G Mine.
- c) Shortage of manpower is a common problem in all underground mines. As continuous cutting technology requires less manpower, it improves the overall O.M.S. and minimizes the other costs of the project.
- d) The demand for non-coking coal is increasing every year due to increase in demand from many power and non power sector industries. The grade of coal from Jamunia U/G Mine is varying between 'G5 to G6' over the entire life of the mine for which a ready market is available.

- e) Old mines in PENCH Area of WCL are nearing exhaustion and re-deployment of their manpower within the Area would be comparatively easier for the management rather than outside the Area.
- f) Presently, there is a great thrust to augment coal production from U/G mines. To increase the production from U/G mines, opening new mines with higher production and productivity using mass production technology is the available solution. It is proposed to introduce 2 continuous cutting packages giving a target of 0.84 Mty and a higher productivity in Jamunia U/G Mine.

1.3 SALIENT FEATURES OF APPROVED PROJECT REPORT

- 1.3.1 The Project Report (November 2008) proposed to work Jamunia U/G Mine by Bord and Pillar method and extraction by caving. The target capacity of the mine was envisaged as 0.72 Mty or 2400 tpd, which was proposed to be generated from 2 continuous cutting technology panels. The options considered during formulation of this Project Report were Departmental and Partial Hiring Option. In Departmental Option, all the activities to generate production of 0.72 Mty would be done departmentally. In Partial Hiring Option, the production of 0.72 Mty would be generated by outsourcing the production related activities by hiring of continuous cutting technology equipment.

In Departmental Option, the total capital investment was estimated as Rs. 305.6049 Crores and the project was yielding a Financial IRR of 7.45% at 100% target capacity and 2.40% at 85% target capacity. To achieve 12% IRR at 85% capacity utilization level, the premium required over and above the weighted average sale price (Rs. 1295.80/t) was about Rs. 370.41/t.

In Partial Hiring Option, the total capital requirement was estimated as Rs. 127.5223 Crores. In this option, the Financial Analysis suggests that the Project was yielding an IRR of (+) 17.61% and (+) 12.00% at 100% and 85% Target Capacity respectively.

- 1.3.2 In Partial Hiring Option, to yield 12% IRR at 85% target capacity, the outsourcing cost was worked out which is Rs. 368.42/t. This means, the project will yield 12% IRR at 85% target capacity if outsourcing cost is capped at Rs. 368.42/t.

The outsourcing cost appears to be very less where no contractor would be available to operate his machines. In view of the above, the project was recommended for approval, subject to a viable Fuel Supply Agreement with a customer on cost plus basis.

1.4 APPROVAL OF PROJECT REPORT BY COMPETENT AUTHORITY

The above report was placed before the Technical Sub-Committee of WCL Board on 24-01-2009 in the Board Room of WCL (HQ), Nagpur. As per the directions of Technical Sub-Committee, the Final Project Report for Jamunia U/G Mine was submitted to WCL Board.

After detailed deliberations, the Project Report for Jamunia U/G Mine was approved by WCL Board in its 216th meeting held on 04.02.2009 on Partial Hiring of Equipment with a Total Capital Investment Rs. 127.5223 Crores for a capacity of 0.72 Mty, subject to availability of a consumer agreeing to pay a price which yields 12% IRR at 85% capacity utilization. **(Minutes enclosed at Annexure - I).**

1.5 UPDATION OF APPROVED P.R. & PREPARATION OF RFQ DOCUMENT

Chief General Manager (P&P), WCL vide letter no. WCL/C-1(E)/(P&P)/SPP/921 dated 23.09.2013 requested CMPDI, RI-IV to update the Project Report of Jamunia U/G Mine as the project is proposed to be offered under MDO concept and RFQ document for the global bid is under finalization at CIL.

The Project Report for Jamunia U/G Mine was updated on Partial Hiring Option in October 2013 (Approved Option) and was submitted to WCL.

Further, Director (Tech) (P&P), WCL vide letter WCL/D(T)P&P/Secy./249 dated 30-11-2013, asked CMPDI, RI-IV to customize the Draft RFQ Document for inviting bids for finalizing MDO for Jamunia and Dhankasa U/G Mines of Pench Area.

As desired by WCL, the Customised Draft RFQ Document for Development and Operation of Jamunia U/G Mine through Mine Developer Cum Operator (MDO) was prepared and submitted to WCL on 10-12-2013.

Meanwhile, Model RFQ Document for Development and Operation through MDO was finalized by Coal India Ltd. and was circulated by WCL. On the basis of Model RFQ Document, WCL has requested to customize for Jamunia U/G Mine. Based on the above, Model RFQ Document was customized for Jamunia U/G Mine and was submitted to WCL. In the submitted Model RFQ document, the Indicated Project Cost was given as per the Project Report for Jamunia U/G Mine on Partial Hiring Option submitted in October 2013.

Both the above reports i.e., Updated Project Report for Jamunia U/G Mine on Partial Hiring Option prepared in October 2013 and the Model RFQ Document customized for Jamunia U/G Mine prepared in January 2014 were placed before the Technical Sub-Committee of WCL Board on 16-01-2014. During the deliberations, the Committee directed CMPDIL, RI-IV to Recast the Project Report for Jamunia U/G Mine after consultation with CMPDIL (HQ), Ranchi so that the provisions in the Project Report commensurate with the stipulations given in the MDO document prepared by CMPDIL (HQ).

It was finally decided to update the Project Report for Jamunia U/G Mine on Departmental Option as on January 2014 and accordingly customize the Model RFQ Document for Development and Operation of Jamunia U/G Mine through MDO. Therefore, the Project Report for Jamunia U/G Mine was updated on Departmental Option, only for the purpose of arriving at the Indicated Project Cost in Model RFQ Document for Jamunia U/G Mine.

1.6 PLACEMENT OF UPDATED PROJECT REPORT & M.D.O. DOCUMENT FOR APPROVAL BY COMPETENT AUTHORITY

The Updated Project Report for Jamunia U/G Mine prepared on Departmental Option in January 2014 and the Customized Model RFQ Document for Development and Operation of Jamunia U/G Mine through MDO was presented by CMPDI, RI-IV before the Technical Sub Committee Meeting of WCL held on 05.02.2014.

After detailed deliberations, the Technical Sub Committee recommended the Updated Project Report for Jamunia U/G Mine on Departmental Option and Model RFQ Document for Development and Operation of Jamunia U/G Mine to be placed before WCL Board for approval.

WCL Board (held on 22.02.2014) while according Board Approval, advised CMPDI, RI-IV to explore the possibility of increasing the capacity of Jamunia U/G Mine based on the technical consideration so as to improve the economics of the mine before inviting RFQ.

WCL Board further observed that a provision should be made in the RFQ documents to take into account the expenditure already incurred by WCL for mine development activities etc., if any.

The Board after detailed deliberations, in order to facilitate early opening of Jamunia U/G Project, accorded approval for the following:

- a) Project Report of Jamunia U/G Mine at an estimated capital of Rs. 401.6701 Crores on Departmental Option only for the purpose of arriving at the indicated capital requirement for inviting RFQ/RFP.
- b) Inviting RFQ for development and operation of Jamunia U/G Mine under MDO route through Global Tender by CMC Department.
- c) Acquisition of Land and extending R&R benefits etc, as an advance action at updated estimated cost of Rs. 72.9446 crores (maximum) for Jamunia U/G Mine. (Minutes encl. at Annexure - II).

1.7 CONCEPTUAL NOTE ON THE POSSIBILITY OF INCREASING PRODUCTION CAPACITY FROM JAMUNIA U/G MINE

A Conceptual Note on exploring the possibility of increasing production from Jamunia U/G Mine was prepared in March 2014.

For capacity enhancement in Jamunia U/G Mine from 0.72 Mty, it was proposed initially to develop and depillar Seam-II and Seam-III+IV simultaneously with 4 Continuous Miners Packages, 2 in each seam. With such a strategy, the production capacity of coal in Seam-II would be 1200 tpd x 2 C.M. Packages = 2400 tpd or 0.72 Mty and in Seam-III+IV would be 1500 tpd x 2 Packages = 3000 tpd or 0.90 Mty, totalling to 1.62 Mty (5400 tpd).

After completion of development & depillaring in panels of Seam-II & Seam-III+IV, panels of Seam-V will be developed & depillared independently below the settled goaf of Seam-II & Seam-III+IV keeping a gap of atleast 5 years, while depillaring.

While working the panels of Seam-V, only 2 nos. of Continuous Cutting Packages can be introduced. During this period, a production capacity of 1200 tpd x 2 sets = 2400 tpd or 0.72 Mty of coal can be produced.

Therefore, the Revenue Life of Jamunia U/G Mine with a production capacity of 1.62 Mty while working simultaneously in Seam-II and Seam-III+IV and with a production capacity of 0.72 Mty and while working in Seam-V would be about 20 years. With a gestation period and production built-up of about 4 years, the Total Mine Life would work out to about 24 to 25 years.

1.8 DISCUSSIONS IN CMPDI (HQ), RANCHI ON ABOVE CONCEPTUAL NOTE

The Conceptual Note on possibility of increasing production capacity of Approved Jamunia U/G Project of Pench Area, WCL was discussed on 09.04.2014 at CMPDI (HQ), Ranchi for obtaining guidance.

During the discussions on the Conceptual Note in CMPDI (HQ), Ranchi, the following suggestions were given. **(Minutes enclosed at Annexure - III).**

- A) Techno-economic feasibility of operating an opencast mining project comprising of Urdhan Block, Magrahi Block and a portion of Jamunia Block may be examined with a view to extract more coal reserves at higher production capacity than underground mining.
- B) If Jamunia Project is to be taken up for underground mining, then:
 - 1. Simultaneous working in the contiguous seams may be avoided since maintaining vertical alignment of the line of extraction in the 2 contiguous seams may not be practical, especially in view of the need of induced caving of the overlying Deccan Trap.
 - 2. The number of Continuous Miners to be deployed is to be decided keeping in view at least 5 years time be made available for goaf settlement in the panels of overlying seam before the corresponding panels are worked in the underlying seam.
 - 3. The productivity of each Continuous Miner may be considered as 1400 tonnes per day instead of 1200 tonnes per day as was considered in the earlier Approved Project Report.

1.9 CONCEPTUAL NOTE FOR JAMUNIA OPENCAST MINE

As per the suggestions given by CMPDI (HQ), Ranchi, a Conceptual Note for Jamunia Opencast Mine was prepared in April 2014.

The economics in Jamunia Opencast Mine was not better as compared to the economics of Jamunia Underground Mine in the proposed Jamunia Geological Block mainly due to very high initial depth and very high stripping ratio involving huge capital expenditure for making Access trench in initial years which is revenue expenditure capitalized. The Desired Selling Price to yield 12% IRR at 85% capacity was much higher compared to Partial Hiring Option of Jamunia U/G Mine, which was updated in October 2013. Therefore, Opencast Potentiality in whole of Jamunia Block was ruled out in the prepared Conceptual Note.

1.10 DISCUSSIONS IN CMPDI (HQ), RANCHI ON ABOVE CONCEPTUAL NOTE

The Conceptual Note for Jamunia Opencast Mine, Pench Area, WCL was discussed on 21.04.2014 at CMPDI (HQ), Ranchi for obtaining guidance. During the discussions on the Conceptual Note in CMPDI (HQ), Ranchi, the following suggestions were given. **(Minutes enclosed at Annexure - IV).**

- A) The Eastern Portion of Jamunia Block, which is enclosed by Gunor River on three sides, may be planned for underground mining for a life of around 25 years. Western Portion of the Jamunia Block may be taken up as the dip side extension of Urdhan Magrahi Opencast Project which has already been planned on the rise side of Jamunia Block. This will ensure that more coal reserves can be mined out from the western part of the Jamunia Block. The same may be discussed with WCL before finalization.
- B) In the underground option where caving of the overlying basalt layer is proposed, the cost of induced caving of the deccan trap (basalt layer) should be included in the cost of production of the proposed project.

1.11 PREPARATION OF RECAST PROJECT REPORT & CUSTOMISED RFQ DOCUMENT FOR JAMUNIA U/G MINE

CMPDI, RI-IV, vide Letter No. RIN/Jamunia-Dhankasa/2014/204 dated 23.04.2014, informed WCL about the options prepared in the Conceptual Notes for exploring the possibility of increasing production from Jamunia.

Both the Conceptual Notes for exploring the possibility of increasing production from Jamunia Underground and Jamunia Opencast were enclosed with the above letter. The observations and suggestions given by CMPDI (HQ), Ranchi were also enclosed with the above letter.

A meeting was held in the chamber of Director (Tech) (P&P), WCL on 13.05.2014 and the issue of exploring possibility of increasing production from Jamunia Project was discussed at length. In the meeting, it was concluded that Jamunia Opencast Option requires higher desired selling price to yield 12% IRR at 85% target capacity which was found not to be cost effective as compared to that of Jamunia Underground Option. Also deployment of 3 nos. of Continuous Miner Packages is not found technically feasible.

Therefore, it was directed by WCL to prepare Recast Project Report by considering coal production capacity @ 1400 tonnes per day instead of 1200 tonnes per day per Continuous Miner (as considered in the Approved Project Report). Thus with the introduction of Two Continuous Miner Packages, there will be an increase in annual production capacity from 0.72 Mty to 0.84 Mty. It was also agreed to include the cost of induced caving. **(Minutes enclosed at Annexure - V).**

The Recast Project Report for Jamunia U/G Mine was prepared on Departmental and Partial Hiring Option as on June 2014. Also the Customized Model RFQ Document for Development and Operation of Jamunia U/G Mine through MDO prepared as on June 2014 was also submitted along with the Recast Project Report for Jamunia U/G Mine. The Cost Parameters of Departmental Option are considered for the purpose of arriving at the Indicated Project Cost in Model RFQ Document for Jamunia U/G Mine.

Planning Committee Meeting for the Recast Project Report for Jamunia U/G Mine was held at WCL (HQ) on 04.08.2014 **(Minutes enclosed at Annexure-VI)**. The following main decisions were taken by WCL in the Planning Committee Meeting:

1. Hiring of Continuous Miner Packages was recently approved in mines of SECL and therefore the Hiring Rate of these contracts may be obtained from SECL. If the Approved Hiring Rate to operate C.M. Package (keeping the variables at par) is found to be less than what has been considered in Recast P.R. for Jamunia U/G Mine, then the same may be considered in estimating the economics of the mine.
2. WCL suggested to consider the weighted average sale value of coal with (-) 100mm size coal for dispatch.
3. WCL opined that the coal produced from Jamunia U/G Mine would not be suitable for Power Sector and the same may be linked to industries of Non Power Sector (fetching higher sale price). Therefore WCL suggested to explore possibility to improve the economics of the project so that it can be economically viable with Notified Sale Price for Non-Power Sector.

General Manager (NT), WCL vide Letter No. WCL/NGP/C.1 (E)/NT/14/3696 dated 15.10.2014 requested RI-IV, CMPDI to finalise the Recast Project Report for Jamunia U/G Mine as per the above main decisions taken by WCL in the Planning Committee Meeting held on 04.08.2014.

Meanwhile, General Manager (L&R), WCL vide Letter No. WCL/GM(L&R)/949 dated 22.12.2014 informed about some changes in the land and capital investment on land to be incorporated in the concerned appendix (Appendix A.1). **(Letter enclosed at Annexure - VII).**

The Recast Project Report for Jamunia U/G Mine was prepared as on December 2014 taking the above main decisions into consideration and was submitted to WCL in December 2014. This report was presented by RI-IV, CMPDIL in Technical Sub Committee Meeting of WCL held on 23.01.2015.

After detailed deliberations, the Committee directed to obtain confirmation from G.M. (S&M), WCL for availability of Non Power Sector Consumers for Jamunia U/G Project. The Committee also directed RI-IV, CMPDIL to incorporate financial provision for Manriding Chair Lift System in place of Manriding Haulage Cart System in the incline. **(Minutes enclosed at Annexure - VIII)**

Incorporating the above changes as directed by Technical Sub Committee of WCL Board, the Recast Project Report for Jamunia U/G Mine for Jamunia U/G Mine prepared in January 2015 (Updated as on December 2014) was submitted to WCL on 02.02.2015.

Recently a meeting was held at WCL on 18.09.2015 in which it was decided to work out economics of Recast Project Report for Jamunia U/G Mine on Departmental Option considering operation and maintenance of C.M. Package by WCL on its own as this technology is no longer new for WCL/CIL.

Accordingly, economics of Recast P.R. for Jamunia U/G Mine has been worked out with latest revised norms of CIL and Repair & Maintenance Cost of all P&M including C.M. Package as per CMPDI norms.

The EMS has been re-estimated considering Initial Basic plus 7.97% as per the decision of 317th CIL Board meeting held on 13.07.2015 and as per letter no. GM (F)/Project costing/2485 dated 11.08.2015 with regard to updated estimate for Annual Earnings for Project Planning works.

Taking the above latest revised norms and decisions taken in the chamber of Director (Tech) (P&P), WCL on 18.09.2015, the Recast Project Report for Jamunia U/G Mine has been updated for the month of September 2015 and has been submitted to WCL.

1.12 PLACEMENT OF UPDATED PROJECT REPORT FOR APPROVAL

The Recast Project Report for Jamunia U/G Mine was presented by RI-IV, CMPDIL in the Technical Sub Committee Meeting of WCL held on 20.05.2016 at WCL (HQ), Nagpur. After detailed deliberations, the Technical Sub Committee recommended the Recast Project Report for Jamunia U/G Mine for placing before the WCL Board for:

1. Approval for the Recast Project Report (including Mining Plan) of Jamunia UG with a capacity of 0.84 Mty with a capital requirement of Rs. 409.8748 crs on Departmental Option, yielding an IRR of 12.17% at 85% capacity for Power Sector at Notified Selling Price.

2. Approval to obtain Environment Clearance upto 1.05 Mty peak capacity.

The Minutes of Technical Sub Committee Meeting held on 20.05.2016 at WCL (HQ), Nagpur is enclosed at Annexure - IX.

1.13 SALIENT FEATURES OF RECAST PROJECT REPORT (September 2015)

In the Recast Project Report for Jamunia U/G Mine (September 2015), the target capacity of the mine has been envisaged as 0.84 Mty or 2800 tpd. The production capacity of 0.84 Mty has been envisaged as 2800 tpd from 2 Continuous Cutting Technology Panels, producing 1400 tpd (0.42 Mty) each.

With total extractable reserves of 17.50 Mt and targeted production capacity of 0.84 Mty, the total life of the mine works out to be 26 years including land acquisition and construction period. Coal production starts in the 4th year of mine working and the target will be achieved in the 6th year of its operation.

The mine will be brought in revenue in the 1st production year and therefore the revenue life of mine works out to about 23 years.

Although the mine has been planned for a total target capacity of 0.84 Mty, its peak production capacity would likely to be 1.05 Mty, which is around 25% more than the target capacity. This capacity is likely to be achieved during some period especially when depillaring operation commences and mine encounters favourable geo-mining conditions. **Therefore the peak production capacity will be 1.05 Mty for EMP purpose.**

The economics of Jamunia U/G Project has been worked out on only one option namely Departmental Option with latest revised norms of CIL and Repair & Maintenance Cost of all P&M including C.M. Package as per CMPDI norms. The EMS has been re-estimated considering Initial Basic plus 7.97% as per the decision of 317th CIL Board meeting held on 13.07.2015.

In Departmental Option, the Total Capital Investment has been estimated as Rs. 409.8748 Crores. The Financial IRR for Power Sector at 100% and 85% target capacity is (+) 17.08% and (+) 12.17% respectively.

The comparison of Salient Features of Project Report for Jamunia U/G Mine Approved by WCL Board on Cost plus Basis in February 2009 and Recast Project Report for Jamunia U/G Mine prepared / updated in September 2015 is summarized below:

Sl. No.	Particulars	Approved P.R. – Dept. Option (February 2010)	Recast P.R. – Dept. Option (September 2015)
(A)	General Parameters:		
1	Total Geological Reserves (Mt)	96.921	96.921
2	Extractable Reserves (Mt)	22.76	17.50

Sl. No.	Particulars	Approved P.R. – Dept. Option (February 2010)	Recast P.R. – Dept. Option (September 2015)
3	Seam Section wise Quality & UHV/GCV:		
	a) Seam – II	'C' (5003 k.Cal/kg)	'G6' (5504 k.Cal/kg)
	b) Seam – III+IV/IV	'C' (5489 k.Cal/kg)	'G5' (5827 k.Cal/kg)
	c) Seam –V	'C' (5022 k.Cal/kg)	'G6' (5537 k.Cal/kg)
	Overall Quality	'C' (5210 k.Cal/kg)	'G6' (5649 k.Cal/kg)
4	Thickness Range in Mining Area (m):		
	a) Seam – II	1.50 – 4.15	1.50 – 4.15
	b) Seam – III+IV/IV	2.85 – 4.50	2.85 – 4.50
	c) Seam –V	1.52 – 4.50	1.52 – 4.50
5	Target Production of Coal (Mty)	0.72	0.84
6	Method of Mining	Bord & Pillar Method with Caving	
7	Main Equipment (Nos.)	C.M = 2 Packages	
8	Manpower Requirement (Nos.)	545	530
9	Overall O.M.S. (t)	5.049	6.056
(B) Financial Parameters:			
1	Capital Requirement (Rs. Crores)	305.6049	409.8748
2	E.M.S. (Rs.)	1031.80	2073.73
3	Cost of Production (Rs./t)		
	a) At 100% of Target Capacity	1129.18	1684.24
	b) At 85% of Target Capacity	1279.67	1926.94
4	Estimated Average Selling Price for Power Sector Coal (Rs./t)	1295.80	2263.62
5	Profit / Loss for Power Sector (Rs./t)		
	a) At 100% of Target Capacity	(+) 166.62	(+) 579.38
	b) At 85% of Target Capacity	(+) 16.13	(+) 336.68
6	Financial IRR for Power Sector (%)		
	a) At 100% of Target Capacity	(+) 7.45%	(+) 17.08%
	b) At 85% of Target Capacity	(+) 2.40%	(+) 12.17%

2.0 MARKETABILITY & JUSTIFICATION

The following table shows the demand for coal including middlings, from the various Existing, Completed, On-going, and Future Projects of WCL:

Sl. No.	Particulars	Coal Demand Projections (Mt)			
		2016-17	2017-18	2018-19	2019-20
1	Demand of Coal from the WCL Mines	69.28	70.08	70.58	70.58

The coal production from WCL is 40 - 45 Mt per annum since last many years and WCL is gearing up to increase the production upto 60 Mt by 2019-20. To achieve the projected 60 Mt per annum production, it is essential to open new projects like Jamunia U/G Mine. The following table shows the coal production from the mines of WCL upto 2019-20 from the various Existing, Completed, On-going, and Future Projects:

Sl. No.	Particulars	Coal Production Projections (Mt)			
		2016-17	2017-18	2018-19	2019-20
1	Existing Mines	0.25	0.25	0.20	0.20
2	Completed Projects	15.38	12.39	10.20	10.15
3	On-going Projects	22.27	21.10	25.67	28.05
4	Future Projects	10.10	16.26	18.93	21.60
5	Total	48.00	50.00	55.00	60.00

Thus, the deficit in availability of coal from the various existing, completed, on-going and future projects of WCL is as follows:

Sl. No.	Particulars	Surplus / Deficit Projections (Mt)			
		2016-17	2017-18	2018-19	2019-20
1	Demand of Coal	69.28	70.08	70.58	70.58
2	Availability of Coal	48.00	50.00	55.00	60.00
3	Surplus (+) / Deficit (-)	(-) 21.28	(-) 20.08	(-) 15.58	(-) 10.58

From the above tables, it is clear that the deficit in availability of coal including middlings from the various existing, completed, on-going and future projects of WCL will be 21.28 Mt in 2016-17. This gap between demand and supply of coal will be narrowed to about 10.58 Mt in 2019-20 provided all the future projects are opened as per schedule.

The Production from Jamunia U/G Mine will not only bridge the gap to the extent of planned production but will also establish a new mass production technology for underground mines and thus there will be an augmentation in underground production. Therefore in view of deficit coal, there is no problem in marketing of coal and opening of Jamunia U/G Mine is thus justified.

3.0 PROJECT SITE INFORMATION

3.1 LOCATION

Jamunia block is located in the north-eastern part of Pench - Kanhan Valley Coalfield, Dist: Chhindwara, Madhya Pradesh. It forms the north-eastern contiguous part of Urdhan Block and northern part of Nahariya Block. The area is covered in the Survey of India Toposheet No. 55 J/15 (RF 1:50,000) and is defined by:

Latitudes : N 22° 16' 49" and N 22° 18' 07"

Longitudes : E 78° 57' 00" and E 78° 59' 00"

3.2 ACCESSIBILITY AND COMMUNICATION

The approach to the block is through an all-weather road from Khirsadoh / Parasia upto Urdhan via Shivpuri and Thesgora mines.

The area can also be negotiated from Sarna, located 8 km north-east of Chhindwara on Narsingpur road. From Sarna, there is metalled road for about 8 km upto Palatwada. From Palatwada, the block is at a distance of about 22 km and is served by unmetalled road.

The area can also be approached from Amarwara, a Tahsil town on Chhindwara-Narsingpur State Highway in dry weather. The distance between Amarwara and Jamunia is about 40 kms. The approach upto Ghogri is through a metalled road and from Ghogri via Umaria and Banki through cart tracks. The Gunor River has to be negotiated while coming through this route.

Jamunia Block is approximately 40 km north-east of Parasia, the main mining town in Pench Valley. Chhindwara Town is located 27 kms south-east of Parasia. The state highway No. 19 connects Chhindwara with Parasia. Chhindwara is connected to Amla (120 km) through a broad gauge line of Central Railway. Parasia is the nearest rail head for Jamunia Block.

3.3 TOPOGRAPHY, DRAINAGE & HFL

The entire area of Jamunia Block is occupied by Deccan Trap Basalt, which on differential erosion has given rise to rugged terrain. In general, the slope is towards east i.e., towards Gunor River. The area in the central part is comparatively flat with gentle slope and forms valley. The northern and southern parts are occupied by hills/plateau. The northern part occupied by hills has steep slopes towards south as compared to its northern side. In the southern part the hill/plateau has maximum altitude in south-western corner. These plateaus have steep scarps towards south along the Gunor River.

The major drainage in this area is provided by southerly and westerly flowing perennial Gunor River located along the southern & eastern boundary of the block. A southerly flowing nallah in the central part of the block is the main tributary to Gunor River.

The Highest Flood Level (HFL) along the course of Gunor River in the block has not been recorded anywhere. In Nahariya Block, 720m RL was assumed as HFL and accordingly the surface contour line of 720m along the Gunor River was marked for HFL.

4.0 GEOLOGY AND DEPOSIT APPRAISAL

The Geology of the area under consideration is based on Geological Report on Exploration for Coal, Jamunia Block, MECL, December 1998. The Total Area of Jamunia Geological Block is 5.30 km².

4.1 DENSITY OF BOREHOLES

The geological assessment of the proposed Jamunia Geological Block is based on the data of 62 boreholes involving a total meterage of 12050.15m in an area of 5.30 km². The density of boreholes works out to about 12 per km².

The present geological assessment of the proposed mine area as per Recast Project Report for Jamunia U/G Mine is based on the data of 32 boreholes involving a total meterage of 6626.70m in an area of about 2.92 km². The density of boreholes works out to be 11 per km².

4.2 GEOLOGY OF THE MINING BLOCK

The geological succession of the mining block as deduced from the borehole data has been given in the following table:

Age	Formation	Lithology	Thickness (m)	
			Min.	Max.
Sub Recent to Recent	Soil (Residual & transported)	Sandy and clayey soil	0.00	7.00
Upper Cretaceous to Eocene	Deccan trap with inter - trappeans Dolorite Dyke.	Flows of Basalt with beds with clay / clayey-stone of variagated colours	28.36	95.97
----- UNCONFORMITY -----				
Jurassic	Jabalpur	Gritty sandstone & clays with red jasper pebbles	0.00	65.26
----- UNCONFORMITY -----				
Permian	Motur	Clay / clayey stone of brick red, purple & grey colour with sandstone lenses bands at places	14.00	108.96
	Barakar	Sandstone, with kaolinised feldspers interbanded with shale and coal seams	40.00 +	79.62
	Talchir	Fine grained argillaceous sandstones & green shale	6.05 +	
----- UNCONFORMITY -----				
Pre-Cambrian	Metamorphics	Not encountered in any of the borehole		

4.3 STRUCTURE OF THE BLOCK

The geological structure of Jamunia mining block has been deciphered mostly on the basis of subsurface data obtained from boreholes drilled in the block.

4.3.1 Strike and Dip

The attitude of the beds has been deciphered from the floor contour plans. The strike of the coal seams in general is east-west in the central part swerving to NNE – SSW in eastern and western parts. However, local undulations and drag effects can be seen near the faults.

The dip of the coal seam in general is towards north - west and varies from 3° to 8°. In southern part, the dip is around 3° while in western and northern part, it increases to 6° to 8° northerly. The corresponding gradient is 1 in 7 to 1 in 18.

4.3.2 Faults

Based on the sub-surface data obtained from the boreholes, 5 faults are present in the mine area with a throw of 5m to 30m.

4.3.3 Intrusives

The Gondwana sediments are covered by the flows of basalt, which are the result of wide spread volcanic activity of upper Cretaceous to Eocene periods.

The thickness of Deccan trap ranges from 16.20m to 90.74m. The Barakar formation in boreholes MPJ-32 and PU-76 has been intruded by dolerite dyke.

4.4 COAL SEAMS

The exploration in Jamunia block has proved the existence of five coal seams viz. I, II, III, IV and V, numbered from top to bottom. These Seams occur in the Middle Barakar column, which is 32.18m to 37.44 m thick.

Seam-I has split into three sections viz. Seam sections IA, IB & IC. The Seam section IB has again split into Top and Bottom sections, but in major part it occurs as IB merged seam section.

The parting between Seam-III and IV has also reduced to less than 0.30m in central and south-western part and hence in this part, Seam-III and IV has been considered as merged seam.

The Coal Seam Details as per Geological Report for Jamunia Block are given in following table:

Coal Seam with Parting	Floor Depth (m)		Thickness (m)	
Seam - IA	87.05	249.98	0.41	0.74
Seam - IB (Top)	115.43	230.50	0.54	1.00
Parting	-	-	0.36	0.46
Seam - IB (Bottom)	116.04	231.66	0.23	1.33
Seam - IB (Combined)	86.94	264.20	0.20	4.08
Parting	-	-	0.30	9.69
Seam - IC	93.11	267.02	0.00	3.40
Parting	-	-	0.55	8.32
Seam - II	95.90	270.95	1.25	4.15
Parting	-	-	0.53	6.13
Seam - III	104.86	264.10	0.26	4.54
Parting	-	-	0.30	7.73
Seam - IV	110.53	271.95	2.75	6.37
Seam - III + IV (Comb.)	103.82	196.95	3.86	7.55
Parting	-	-	3.07	12.64
Seam - V	115.28	284.25	1.36	5.92

4.5 DEPTH OF COAL SEAMS

The Depth Range of all coal seams / sections is 87m to 284m.

4.6 GEOLOGICAL RESERVES

4.6.1 Demarcation of Block Boundary

The proposed block is bounded by following features:

- a) North - An arbitrary line 200m north of boreholes MPJ-31, 27 & 28
- b) East - Gunor River and Dhankasa Block
- c) South - Gunor River and Naheriya Block
- d) West - An arbitrary line 200m west of boreholes MPJ-32 & 37 and Magrahi & Urdhan Blocks.

4.6.2 Geological Reserves

Proved Geological Reserves of 96.921 Mt (> 0.9m Thickness) and 93.771 Mt (> 1.5m Thickness) have been estimated in an area of 5.30 sq. km. for all the seams and sectors of Jamunia Geological Block. Jamunia U/G Mine has been proposed in the major part of Jamunia Geological Block.

A Net Insitu Proved Geological Reserves of 42.031 Mt have been estimated in 2.92 sq. km. area in the workable seams and workable sectors of Jamunia U/G Mining Block.

The details of Seam wise and Sector wise proved geological coal reserves considered for mining (Thickness > 1.5m) are furnished in the following table:

Workable Seams	Workable Sectors (Reserves in Million Tonnes)					
	III	V	VI	VII	VIII	Total
II	4.093	0.362	0.144	1.862	4.625	11.086
III+IV/IV	7.572	0.687	0.434	2.775	7.097	18.565
V	3.720	0.521	0.159	2.257	5.723	12.380
TOTAL	15.385	1.570	0.737	6.894	17.445	42.031

4.7 OVERALL QUALITY

The Overall Quality Parameters along with extractable reserves of the Workable Seams / Seam sections are given in the following table:

Coal Seams	Extractable Reserves (Mt)	Quality Parameters			
		M%	Ash%	UHV with Grade (k. Cal/kg)	GCV with Grade (Calculated) (k. Cal/kg)
II	5.04	7.65	20.59	5003, 'C'	5504, 'G6'
III+IV/IV	7.26	7.83	16.89	5489, 'C'	5827, 'G5'
V	5.20	7.28	20.82	5022, 'C'	5537, 'G6'
Overall	17.50	7.61	19.12	5210, 'C'	5649, 'G6'

5.0 MINE BOUNDARY, RESERVES, PRODUCTION TARGET & MINE LIFE

5.1 PARTICULARS OF WORKABLE SEAMS / SEAM SECTIONS

Out of the 10 coal seams / seam sections mentioned above, only three coal seams / seam sections namely Seam - II, Seam - III+IV/IV and Seam - V have been considered for exploitation in this report.

The reasons for the selection and omission of seams are explained in the main text (Volume-II) of the report. The particulars of workable coal seams / seam sections along with their thickness, parting and grade as per the Recast Project Report for Jamunia U/G Mine is shown in the following table:

Sl. No.	Workable Seams / Seam Sections with Parting	Thickness (m)		Grade	GCV (k. Cal./kg)
		Minimum	Maximum		
1	Seam - II	1.87	4.15	G4 - G9	6295 - 4855
2	Parting	3.95	12.20	-	-
3	Seam - III + IV / IV	2.85	7.55	G3 - G7	6661 - 5235
4	Parting	0.72	12.29	-	-
5	Seam - V	1.64	5.16	G4 - G9	6358 - 4608

5.2 PARTICULARS OF WORKABLE SECTORS

Based on the disposition of faults, Jamunia Block has been divided into eight sectors. Out of the 8 sectors, it is proposed to leave 3 sectors (Sector I, II & IV) and mine from 5 sectors only (Part Sectors III, V & VI and Full Sectors VII & VIII). The limits of the geological sectors and reasons for their selection and omission from the limits of Jamunia U/G Mine are explained in the main text (Volume-II of the report).

If the feasibility of extending Urdhan-Magrahi O/C Mine in Sector-I, Sector-II, Part Sectors of III, IV & V of Jamunia Geological Block doesn't work out, then these left out sectors would be exploited by underground from Jamunia U/G Mine side at an appropriate time.

5.3 PROPOSED MINE BOUNDARY

All the 3 workable seams have same workable area of about 2.92 km² in Jamunia U/G Mine. Based on the workable seams & sectors / part sectors, disposition of faults and the position of dyke, the proposed mine boundary of Jamunia U/G Mine is rationalized as follows:

- North - Arbitrary line 200m north of Boreholes MPJ - 31, 27, 24 & 28
- East - Gunor River
- South - Gunor River, Fault $F_{1(U)}$ - $F_{1(U)}$, Arbitrary line in between boreholes MPJ-3, MPJ-5, TG-17, PU-78 and Fault F_5 - F_5
- West - Dolerite Dyke

5.4 GEOLOGICAL, MINEABLE & EXTRACTABLE RESERVES

The following table shows the workable seam wise Geological reserves, Geological losses, Mineable reserves, Mining losses and Extractable reserves (> 1.5m thickness) considered in Recast P.R. for Jamunia U/G Mine:

Seam	Geological Reserves (Mt)	Geological Losses (Mt)	Mineable Reserves (Mt)	Mining Losses (Mt)	Extractable Reserves (Mt)
II	11.086	4.434	6.652	1.612	5.040
III+IV/IV	18.565	7.426	11.139	3.879	7.260
V	12.380	4.952	7.428	2.228	5.200
TOTAL	42.031	16.812	25.219	7.719	17.500

The geological losses are on account of barriers against faults, odd shaped areas, inaccessible places and 15m barrier against Gunor River. Out of the geological reserves of about 42.03 Mt, the geological losses are about 16.81 Mt and therefore the mineable reserves work out to about 25.22 Mt.

The mining losses are on account of barriers, angle of draw against surface features, protective pillars against mine entries, sub-panelisation, ribs in pillars and the areas where thickness is more than 4.5m in Seam-III + IV/IV & Seam-V. Out of mineable reserves of about 25.22 Mt, the mining losses are about 7.72 Mt and therefore the extractable reserves work out to about 17.50 Mt.

5.5 PRODUCTION TARGET AND LIFE OF THE MINE

5.5.1 Production Target

In the workable seams, the no. of panels to be worked is 16 excluding the main trunk roadways. It has been proposed in Recast Project Report for Jamunia U/G Mine to work 2 panels at a time with continuous cutting technology giving a production target of 1400 tpd per panel, making it to a total production target capacity of 2800 tpd or 0.84 Mty.

5.5.2 Life of the Mine

The extractable reserves in the proposed mine area have been estimated as 17.50 Mt. With a target capacity of 0.84 Mty, the total life of the mine & revenue life of the mine works out to 26 years & 23 years respectively.

6.0 PROPOSED MINE ENTRIES

6.1 It is proposed in this Recast Project Report to open the mine by a pair of inclines nomenclatured as Incline No. 1 & Incline No. 2 and an Airshaft.

A proposal for change of site of inclines (as envisaged in the Project Report for Jamunia U/G Mine approved in February 2009) has been received from Pench Area which was vetted by P&P Department of WCL. Accordingly the change of site of inclines as proposed by Pench Area was marked on the plans. As per the above change, the lengths of Incline No. 1 and Incline No. 2 are increased from 864m to 890m and from 864m to 876m respectively.

Both, Incline No. 1 & Incline No. 2 are proposed to be driven from surface upto Seam-V at a gradient of 1 in 4.5. The length of Incline No. 1 from surface upto Seam-II, Seam-III+IV/IV & Seam-V is approximately 824m, 868m & 890m respectively. The length of Incline No. 2 from surface upto Seam-II, Seam-III+IV/IV & Seam-V is approximately 811m, 855m & 876m respectively.

Similarly, Airshaft is proposed to be driven from surface to Seam-V and the depth from surface upto Seam-II, Seam-III+IV/IV & Seam-V is 179m, 191m & 196m respectively.

The length of inclines and depth of airshaft could vary depending upon the actual SRL and FRL values encountered. The exact location and its touching point in Seam-II, Seam-III+IV and Seam-V will depend upon the data of the boreholes for incline and shaft alignment and detailed survey of the acquired land. The dimensions and purpose of mine outlets are tabulated below:

Sl. No.	Mine Entry (Incline/Shaft - No./Name)	X-Section (Dia/WxH) (m/mxm)	Length/ Depth (m)	Gradient	Approach (From/To) (Seam/Section)	Purpose and mode of transport fitted, if any
1	Incline No.1	4.8 x 3.0	890	1 in 4.5	Surface to Seam-V	Belt Conveyor route & main intake route
2	Incline No.2	4.8 x 3.0	876	1 in 4.5	Surface to Seam-V	Haulage route for material transport, travelling route & main intake route
3	Airshaft	4.5	196	Vertical	Surface to Seam-V	Return air route

6.2 The following table shows the dimensions, length and year of drifting as per the proposed liquidation plan of the underground drifts for entry into various sectors catering to various requirements of the mine.

Sl. No.	Drift No.	X-Section (mxm)	Length (m)	Gradient	Approach (From / To) (Seam/Section)	Anticipated year as per liquidation plan	Purpose and mode of transport fitted, if any
1	D1 to D5	4.8 x 3.0	52m each	1 in 4.5	Drifts in Main Trunk Roadways crossing Fault F ₃ -F ₃ from Seam-II to Seam-II crossing Seam-IV	V Year	3 Intakes Roads (Belt, Haulage & Traveling) & 2 Return Roads
2	D6 to D10	4.8 x 3.0	22m each	1 in 4.5	Drifts in Main Trunk Roadways crossing Fault F ₃ -F ₃ from Seam-II to Seam-V	V Year	3 Intakes Roads (Belt, Haulage & Traveling) & 2 Return Roads
3	D11, D12 & D13	4.8 x 3.0	105m, 105m & 72m	1 in 4.5, 1 in 4.5 & 1 in 3	Drifts from Main Trunk Roadways to Panel-13 crossing Fault F ₆ -F ₆ from Seam-II to Seam-II crossing Seam-IV	VI Year	Belt & Haulage Roads & Return Roadway
4	D14, D15 & D16	4.8 x 3.0	36m, 36m & 25m	1 in 4.5, 1 in 4.5 & 1 in 3	Drifts from Main Trunk Roadways to Panel-14 crossing Fault F ₆ -F ₆ from Seam-II to Seam-II crossing Seam-IV	VIII Year	Belt & Haulage Roads & Return Roadway
5	D17 & D18	4.8 x 3.0	52m each	1 in 4.5	Drifts from Main Trunk Roadways to Panel-14 crossing Fault F ₆ -F ₆ from Seam-II to Seam-V	XXIII Year	Belt Conveyor & Haulage Intake Roadways
6	As Fault F ₆ -F ₆ ends near the return heading, therefore drifting for return air route has not been proposed from Main Trunk Roadways to Panel 14 crossing Fault F ₆ -F ₆ from Seam-II to Seam-V.						
7	Drifts are not proposed from Main Trunk Roadways to Panel 13 of Seam-V because Seam-II is in juxtaposition with Seam-V.						
8	Strata Bunker (2 Nos.)	4.8m dia.	12 to 15m	Vertical	Seam-II to Seam-V	-	Storage of coal and transfer of coal from upper to lower Seams where transport arrangement is provided.

The guidelines for estimation of average cost per meter for construction of circular shaft and inclines were issued by CMPDI (HQ) with a provision for escalation in labour and material components. As per the above guidelines, the average cost per meter length for drifage of inclines and sinking of airshaft has been estimated after due escalations.

The length of inclines & stone drifts and depth of airshaft proposed in this recast project report are tentative and as per the available geological data given in the geological report and could vary depending upon the surface RLs and floor RLs encountered during actual drifage.

Thus, at the time of actual drivage of the inclines / drifts, a section should be drawn to firm up the starting and ending position of the inclines & drifts so as to arrive at actual length.

The average time frame for drivage of inclines is considered as 50m/month and the average time frame for sinking of airshaft is considered as 10m/month taking faster drivage / sinking by mechanised means.

7.0 GEO-MINING PARAMETERS AND MINING STRATEGY

7.1 The following table gives a brief description of the Geo-mining Parameters of the workable seams:

Particulars	Characteristics of Workable Seams		
	Seam-II	Seam-III+IV / IV	Seam-V
1) Area (km ²):			
a) Block Area	5.30	5.30	5.30
b) Mining Area	2.92	2.92	2.92
2) No. of B.H. intersections within Mine Area	31	30	26
3) Borehole Density (BH/ km ²)	11	10	9
4) Seam Thickness Range (m):			
a) Block Area	1.25 - 4.15	2.75 - 7.55	1.36 - 5.92
b) Mining Area	1.87 - 4.15	2.85 - 7.55	1.64 - 5.16
5) Workable Thickness range (m)	1.87 - 4.15	2.85 - 4.50	1.64 - 4.25
6) Average Mining Thickness (m)	2.85	4.40	3.00
7) Average Seam Gradient	1 in 10	1 in 10	1 in 10
8) Depth Range (m):			
a) Block Area	95.90 - 270.95	103.82 - 271.95	115.28 - 284.25
b) Mining Area	119.58 - 260.07	135.35 - 271.95	142.45 - 284.25
9) Range of parting with surface or upper Seam	Seam-IC & II = 0.71m - 8.32m	Seam-II & III+IV = 3.95 - 12.20m	Seam-III+IV & V = 0.72 - 12.29m
10) Grade of Coal (range)	E - A	D - A	E - B
11) Average Grade/GCV of Coal	G6 / 5504	G5 / 5827	G6 / 5537
12) Gassiness (Anticipated)	Degree-I	Degree-I	Degree-I
13) Immediate Roof	Shale, Are. Shale	Shale, Are. Shale	Shale, Are. shale
14) Immediate Floor	Sandstone, Arg. Sst	Sandstone, Are. Shale	Shale, Are. Shale
15) Proved Geological Reserves (Mt) (> 1.5m thickness)	11.086	18.565	12.380
16) Proved Mineable Reserves (Mt) (> 1.5m thickness)	6.652	11.139	7.428
17) Proved Extractable Reserves (Mt) (> 1.5m thickness)	5.040	7.260	5.200
18) Status of Mining	Virgin Property, U/G Coal Production yet to be started.		

7.2 SURFACE CONSTRAINTS ON MINE DEVELOPMENT

The area under consideration has a rugged terrain and comprises of hills and valleys. About 41 ha of the area under consideration, falls under forest land. Rest of the area is tenancy and government land. The location of Inclines, Airshaft and Mine Infrastructure is envisaged over tenancy land.

A southerly and westerly flowing Gunor River is located along the southern and eastern boundary of Jamunia Block. A southerly flowing nallah in the Central Western part of the block is the main tributary to Gunor River. The HFL of Gunor River in the neighbouring Naheriya Block is 720m and accordingly in Jamunia Block also, the contour line of 720m RL along the Gunor River has been marked for HFL.

The depillaring coal reserves are blocked beneath and within the safety barrier of Gunor River, nallah, land lying below HFL and mine entries. No danger is envisaged to the mine from Gunor River and nalla, as the mine entries have been proposed sufficiently above the HFL.

There exist 3 small villages / bastis within the revised mine boundary and coal reserves are likely to be blocked beneath and within the safety barrier zone of these villages. No problem is anticipated to these bastis / villages as only development is envisaged beneath and within the angle of draw zone and hence no rehabilitation of these villages / bastis is required.

At present, the approach to the project is through a kutchra road from Urdhan, which passes through the bastis/villages. It is proposed to construct another road for the project from Urdhan side for coal transportation. The proposed road will be constructed over tenancy land avoiding forest land.

7.3 UNDERGROUND CONSTRAINTS ON MINE DEVELOPMENT

The nearest underground mines where depillaring has been carried is Naheriya & Mathani. While estimating the extractable reserves in Jamunia U/G Mine, incubation period of six months has been considered as experienced in nearby mines.

A water body namely Gunor River forms the part of southern and eastern revised mine boundary. A 15m wide barrier of solid coal is proposed to be left against the banks of Gunor River wherever it forms the boundary of the mine. Only development of coal seams is done below and within safe distance of Gunor River and its HFL and the 2 to 3 small bastis/villages. The width of this solid coal pillar barrier has been estimated considering angle of draw as 35°.

The cavability of Deccan Trap needs to be determined, along with its physico-mechanical properties and RQD of borehole cores. If the Deccan Trap proves to be easily cavable, then the mine will face no difficulty in caving of roof. In case the Deccan Trap is difficult to cave, blasting from the surface or underground will have to be carried out to fracture the Deccan Trap formation and induce caving at regular intervals.

In Jamunia U/G Mine, the 3 workable coal seams are contiguous in nature and the panel layout in all these seams has been superimposed. It is proposed to develop and depillar Seam-II in all the workable part sectors / full sectors and then develop and depillar Seam-III + IV/IV below the settled goaf of Seam-II. Similarly it is proposed to develop and depillar Seam-V below the settled goaf of Seam-II and Seam-III + IV/IV.

The above method of extraction indicates that though all the 3 workable seams are contiguous in nature, these seams will be developed and depillared independently and under the settled goaf of the upper workable seams. Subsidence cracks may likely to reach the surface where the thickness of hard strata is less than 15 times the thickness of extraction.

It is proposed to acquire the whole land in Jamunia U/G Mine. If need arises, induced caving by blasting from surface or underground may have to be carried out in order to cave the Deccan Trap formation and pack the goaf.

It is also proposed to fence off the acquired land and prevent unauthorized thoroughfare and regularly fill up the subsidence cracks with incombustible material to prevent spontaneous combustion in the caved goaf.

7.4 SELECTION OF MINING METHOD

7.4.1 Opencast Mining Method

A Conceptual Note on Opencast Option in Jamunia Geological Block was prepared in April 2014. This Conceptual Note covers the entire area of Jamunia Geological Block excluding Sector I & II of Jamunia Geological Block which was already considered in the P.R. for Urdhan-Magrahi Expn. OC Mine.

As per the Conceptual Note, the Total Mineable Coal Reserves, Total Overburden and Average Stripping Ratio works out to 38.46 Mt, 811.04 Mm³ and 21.09 m³/t (without re-handling of OB) & 23.27 m³/t (with re-handling of OB) respectively.

The Economics in Opencast Option is not better as compared to Underground Option mainly due to very high stripping ratio and very high initial depth involving huge capital expenditure for making Access Trench in initial years. The entire capital for making access trench is revenue expenditure to be capitalized. Due to very high cost of production and high desired selling price to yield 12% IRR, Opencast Potentiality in whole of Jamunia Geological Block has been ruled out in present scenario.

However, Sectors I & II in full and Sectors III, IV & V in part have been left out from the purview of Jamunia U/G Mining Block as the above sectors are potential for opencast workings. Whenever the Project Report for Urdhan-Magrahi Expansion Opencast Mine gets recasted/revised, then these sectors will be considered for opencast mining.

7.4.2 Underground Mining Method

At greater depths, the management of roof becomes difficult and this problem aggravates further due to blasting. Therefore mass production continuous cutting technology will be necessary not only for addressing the above problem but also for producing bulk production of coal from underground mines with better productivity and comparatively less capital investment.

In this report, it has been suggested to introduce Continuous Cutting Technology to harness the Bord & Pillar method, which is already available in this country resulting in increase of output from Jamunia U/G Mine.

7.5 INDUCED CAVING

For the success of continuous miner technology during extraction stage and overall safety of the mine personnel, it is a must that roof should cave by itself at regular intervals. If the immediate roof caves but does not fully pack the goaf, then there is a possibility of dynamic loading over a large expanse resulting in safety problems. For proper packing of goaf, the Deccan Trap basalt formation should also cave at regular intervals. If the basalt formation does not cave by itself, induced caving by blasting from the surface or underground would have to be adopted to fracture the formation.

Induced caving by blasting from surface at greater depths has not been carried out in any underground coal mines of CIL. Induced caving by blasting from the surface under shallow cover and from underground at greater depths has been tried with mixed results in some mines of SECL.

The situation in Jamunia U/G Mine is different from that in SECL mines. In the absence of any field data generated in conditions similar to Jamunia U/G Mine, study for cavability characteristics by a scientific agency has to be done. Financial provision for these scientific studies has been kept in this Recast Project Report. A financial provision of Rs. 6.52/t has been kept in the cost of production for induced blasting in this report.

7.6 MINE DEVELOPMENT STRATEGY

For the development of the proposed Jamunia U/G Mine, the following strategy is envisaged:

- a) Acquisition of land for mine infrastructure, mine entries, caving and township, which includes Tenancy, Government and Forest lands.
- b) Construct approach road with culverts for gaining unrestricted access to inclines site from existing Urdhan O/C embankment avoiding forest land.
- c) Arrange for temporary and permanent power supply and water supply arrangement at the mine entries site and start of drivage / sinking.

- d) Drivage of the inclines (2 nos.) from surface upto the floor of Seam-V crossing Seam-II and Seam-III + IV/IV at a gradient of 1 in 4.5.
- e) Development of five nos. of main trunk headings in Seam-II & Seam-V to be done simultaneously in Sector-III. The pillars in main trunk headings will be rectangular in shape, 45m along the strike and 34.5m along the dip. It is proposed to drive the main trunk headings using continuous cutting machines. After the development of main trunks is done upto Fault F₃-F₃, in Seam-II & V, development of flanks will be started in Seam-II.
- f) Meanwhile drifting is proposed to be done simultaneously to cross Fault F₃-F₃ in both Seam-II & Seam-V. The main trunk headings and pillars in all the seams are proposed to be superimposed.
- g) By the time, the main trunk headings reach Fault F₃-F₃, sinking of airshaft of 4.5m diameter with 196m depth upto the floor of Seam-V in Sector-III along with installation of main fan in the fan drift is to be completed.
- h) Once the main trunk roadways are developed in Seam-II and Seam-V upto the block boundary in the northern side, full fledged two flank continuous cutting panels will be introduced to give the target production in 6th year.
- i) Construct coal handling arrangement and other service, welfare and residential buildings for the smooth operation of the mine.
- j) To transfer the coal from Seam-II to Seam-V, 2 nos. strata bunkers of 150 t capacity will be made in the parting between Seam-II and Seam-V in main trunk headings. Coal will be discharged from trunk belt conveyor installed in trunk headings of Seam-II to the trunk headings of Seam-V through these bunkers and finally coal will be brought upto incline by trunk belt conveyor installed in Seam-V. The coal coming from the panels of Sector-III of Seam-II will be dropped in the bunker on the incline belt conveyor installed in Seam-V.
- k) The main trunk headings will be five in number in all the workable seams, out of which, one will be used as belt roadway for coal transportation, the other as haulage roadway for material and the third heading will be used for travelling of men with a man riding arrangement in the form of chair lift system. All the above said three roadways will be intake roadways. The extreme sides of the main trunk headings will serve as return roadways.
- l) After the development and extraction of Seam-II is completed, development of main trunk headings and development of panels will be started in Seam-III + IV/IV.

It is proposed to depillar the panels of Seam-III + IV/IV after a gap of at least 4 to 5 years as compared to the respective panels of upper workable seam i.e., Seam-II.

Similarly after the development and extraction of Seam-III + IV/IV is completed, development of panels will be started in Seam-V. It is proposed to depillar the panels of Seam-V after a gap of at least 4 to 5 years as compared to the respective panels of Seam-III + IV/IV.

- m) The average parting between Seam-II & Seam-III + IV/IV is about 7m and Seam-III+IV/IV & Seam-V is about 5m. It is proposed to develop along the floor of Seam-III+IV/IV. In the panels, wherever the parting is less than 3m between Seam-III+IV/IV and Seam-V, development along the roof in Seam-III+IV/IV has to be done to maintain a minimum parting of 3m.
- n) The dimension of pillars in main trunk headings and panels are as per CMR-99 for a gallery width of 4.8m. The pillars in the panels & main trunk headings are superimposed in all the workable seams.
- o) Beyond the northern boundary, the area is unexplored. In this report, it is proposed to explore the area beyond the proposed northern boundary for which exploratory drilling is proposed. After the exploration, if the continuity of same set of seams is established with similar structure and same geo-mining conditions, then some more area / coal reserves can be annexed upto the Gunor River on the northern side.

8.0 METHOD OF MINING & PRODUCTION PARAMETERS

8.1 METHOD OF DEVELOPMENT

Jamunia U/G Mine is proposed to be developed on Bord & Pillar method. The main trunk headings and the panels will generally consist of 5 headings as this is the standard and most productive width for a continuous cutting technology district. In the panels, which are near to the faults or in odd shaped areas, the number of headings may be increased or decreased in view of conservation of coal as against creating another panel.

The pillar sizes in the panels will vary as per depth in each sector for a gallery width of 4.8m. The pillars in panels will be square shaped. During the development of main trunk roadways, the development height would be restricted to 3.0m or seam thickness of workable seams whichever is less. During the development of panels, the development height would be restricted to 4.5m or seam thickness of workable seams whichever is less.

Since the maximum cutting height of proposed cutting machine is about 4.5m, it is proposed to develop and support in one phase in the panels where no further heightening will be involved. The galleries will be supported one time only using good quality roof bolts so that scope for secondary support is ruled out. Removal of support, particularly resin grouted roof bolts is impossible without blasting.

The standard layout for development using continuous cutting machine with 5 headings is explained as follows:

- a) One drive for the cutting machine to cut
- b) One drive being roof bolted
- c) One drive being cleaned
- d) One drive having the ventilation and direction lines extended
- e) One drive ready for cutting

This layout ensures that the cutting machine always gets a supported face to cut and there is no idling of equipment due to shortage of working faces.

8.2 COAL & MATERIAL TRANSPORT

A 1000 mm wide, 200 tph gate belt conveyor is proposed to be installed in the center drive to ensure equal tramming distances and cable lengths on each side of the loading point. At the in-bye end of the conveyor, a sledge mounted and guarded return pulley frame, graduated loading section (at least 3m in length) equipped with impact rollers and anchor chains shall be provided. The conveyor shall be provided with an effective bottom belt scrapper.

Material such as roof bolting consumables, spare parts, cables, lubricants, ventilation stopping materials etc. will be transported to within one pillar of the gate belt tail end by means of haulages.

8.3 VENTILATION

Intake ventilation air reaches the faces along the rise/dip three drives of the panel coursed by brick stoppings suitably plastered to minimize leakages. The stoppings are to be maintained within a maximum of 2 pillars of the gate belt tail end. The remaining two drives are used as return airways.

Leakage through the last connection is to be controlled by temporary stoppings. Minimum 20 m³/sec to 25 m³/sec quantity of air is required in the LVC of the continuous cutting machine panel as per the international practice.

Ventilation of each blind end is achieved by forced auxiliary ventilation and the continuous cutting machine water spray system, dust scrubber system. Two auxiliary fans with duty of 12 m³/sec and reinforced flexible ducting forcing the air into the working faces are to be installed.

8.4 CLEAN WATER & POWER SUPPLY

Clean water at neutral pH and minimum suspended solids is required at the rate of 250 litres per minute at 200 kPa pressure for cooling motors, drilling and dust suppression. The clean water shall be supplied by means of a 100 mm diameter pipe range installed in the conveyor drive. Near the gate belt tail end, a manifold distributes the clean water to the equipment through flexible trailing pipes.

Power is supplied to the district load center at 3.3 kV. The district load center consists of a 1500 kVA 3.3kV / 1.1kV step down transformer along with a distribution board with a number of safety devices to supply power at 1100V to all the equipment except LHDs etc which operate at 550V.

8.5 STRIKE DEVELOPMENT

The development in panels will be done using the continuous cutting machine package, which operates on a "place changing" system. Place changing is where the cutting machine cuts for a specific distance beyond the last row of supports using radio or umbilical cord remote control of the cutting machine.

For Jamunia U/G Mine this distance is assumed to be around 6.0m based on the likely strata behavior. The work force at all times operates under supported roof. Once a "place" is complete, the continuous cutting machine is trammed to an adjacent face in the same heading or in the adjacent heading to commence the cutting cycle again.

Once the continuous cutting machine has been trammed out of a particular heading, the roof bolting machine is trammed in to support the area mined by the cutting machine. The machines therefore operate independently and have greater flexibility for both cutting and roof bolting operations.

The width of the cutting drum of the continuous cutting machine is about 3.3m. The continuous cutting machine sumps in between 0.5m and 0.75m at roof level on one side of the gallery, the rear stab jack on the machine lowered and the head sheared down to floor level. This cycle is repeated 3 to 4 times, the roof and floor trimmed and the operation repeated for the remaining 1.5 m gallery width. The depth of each web is 0.8 m.

8.6 METHOD OF EXTRACTION

In Jamunia U/G Mine, extraction of developed pillars by continuous cutting machine is proposed by caving at all places, which are outside the angle of draw regions of surface features. It is anticipated that permission to extract the pillars formed during development will be granted by DGMS prior to completion of development. Pillar extraction would then commence immediately upon reaching the panel boundary.

Full mining height will have to be maintained during development in the panels and pillar extraction will commence without any advance support being required. The infrastructure, conveyor, material transport system, power, water, pumping and ventilation are in place from the development phase. The same equipment is required for pillar extraction as for development.

Pillar extraction may follow the traditional 'diagonal line' or the preferred 'straight line' method with continuous cutting machine. The disadvantage of the 'diagonal line' system with fully mechanized equipment is the creation of excessive tramming distances, which effectively restricts production.

The protection afforded by the 'diagonal line' was originally developed for a hand loading scenario due to the long time period the pillar had to stand while being extracted and the number of working places required by cyclic drill blast and hand-loading method. The 'straight line' method reduces both tramming distances and cable lengths to a minimum while optimizing tramming routes.

Pillar extraction will be by splitting and slicing of pillars. The pillars will be split into two / three parts depending upon the pillar size, by driving dip splits and the slices will be driven from the splits / original galleries at 60° as against 90° to the split direction. Splitting of pillar will be restricted to a distance of one pillar from the pillar under extraction.

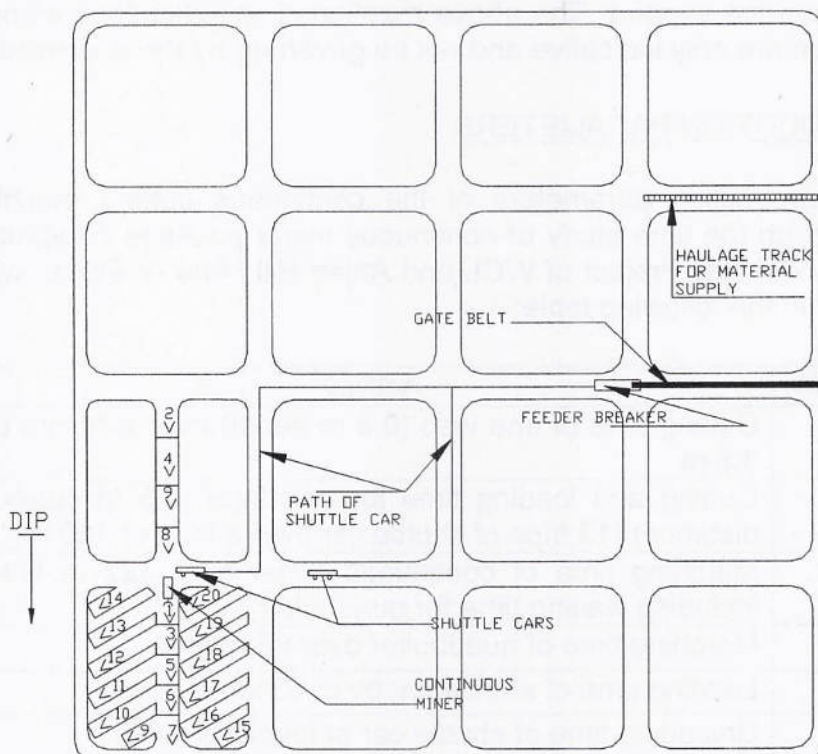
The proposed mining cycle for pillar extraction and the sequence of operations is as under:

- Cut 1 is driven a maximum of 15 m. For the purposes of this report, it has been assumed to be maximum 6m.
- The continuous cutting machine is trammed to cut 2 and commences cutting while cut 1 is supported by the roof bolter.
- Once the continuous cutting machine completes cut 2 and roof bolting is completed in cut 1, the continuous cutting machine commences cut 3.
- The roof bolter supports cut 2 while the cutting machine completes cut 3.
- This process is repeated for cut 4.
- The pillar will be split right through and closely spaced roof bolts installed at all the proposed goaf edges. These bolts serve the purpose of breaker line so the need of skin-to-skin chocks at goaf edges with corner props may not be needed. In poor roof conditions, the split is not driven right through the pillar and a 2 m thick coal rib is left against the goaf edge as an additional protection. This reduces the in-panel extraction by 1%.
- Flanking cuts 5, 6 and 7 are then taken from the cover of the supported pillar split (cuts 1 and 3). Further support is generally not necessary since the continuous cutting machine operates within 15 m of the face and the continuous cutting machine operator and shuttle car operator are always under the last row of support.
- Additional coal may be extracted from the 'snooks' (remnant portions of the coal pillars) as the continuous cutting machine is retreated judiciously dependent upon the face conditions at the time of extraction.
- The remaining flanking cuts are taken in a similar manner from the cover of the original fully supported development drive.

All activities required to be undertaken in the LHD district before commencement of depillaring will hold good for the continuous cutting machine district also.

All provisions of CMR 1957 and DGMS circulars w.r.t. fencing of surface area, formation of sub-panels, standards of construction of isolation stoppings, isolation of every panel immediately after it has been goaved out, inspection of depillaring districts & around the goaved out areas, maintenance of records, maintenance of subsidence records, plans / sections, information regarding local falls etc. and submission of copies thereof to the DGMS etc, will hold good for the continuous cutting machine district also.

The figure showing the above explained cuts for pillar extraction and sequence of operations with continuous cutting technology is given below:



8.7 SUPPORT SYSTEM

In order to ensure good quality roof supporting, dedicated roof bolting machines and strict quality control in workmanship and bolting consumables is required.

It is proposed to install resin encapsulated roof bolts in the continuous cutting machine district. Since the unsupported cut-out distance may likely to be about 6.0 m for Jamunia U/G Mine, the time lag in supporting the freshly exposed roof has to be minimized by installing a bolting system, which sets faster and has high bond strength.

The support system during development stage will be designed based on the RMR of immediate 2m to 3m roof strata and the guidelines for design of support system laid down by DGMS in its circulars.

4 nos. resin encapsulated bolts of 2.4m length with W-Strap of length 4.4m are proposed in a row at 1.2m spacing for a gallery width of 4.8m in the freshly exposed area. The spacing between the adjacent rows will be 1.2m. The geologically disturbed zones will be additionally supported.

During extraction stage, the splits are proposed to be supported by 4 nos. resin encapsulated roof bolts, 2.4m length with W-Strap of length 4.4m, in a row at 1.2m spacing. The spacing between the rows will also be 1.2m.

At the goaf edges, the bolting density will be increased with additional number of rows of bolts. The increased density at the goaf edges will serve as breaker-line support. The above mentioned specifications along with support system are only indicative and will be governed by the approved SSR.

8.8 PRODUCTION PARAMETERS

The production parameters of the continuous cutting machine panel are based on the time study of continuous miner package equipment carried out at Tandsi U/G Project of WCL and Anjan Hill Mine of SECL, which has been given in the following table:

Sl. No.	Activity	Time Frame
1	Cutting time of one web (0.8 m depth) over a height of 3.5 m	30 seconds
2	Cutting and loading time for one face (3.5 m cut-out distance) (13 trips of shuttle car over a lead of 100 m)	1 hour 19 minutes.
3	Marching time of continuous miner over 122 m lead including waiting time for quadbolter	34 minutes
4	Marching time of quadbolter over 95 m lead	20 minutes
5	Loading time of shuttle car by continuous miner	45 seconds
6	Unloading time of shuttle car at feeder breaker	75 seconds
7	Cycle time of shuttle car over 45 m lead	195 seconds
8	Cycle time of shuttle car over 100 m lead	274 seconds
9	Tramming speed of shuttle car	1.3 m/sec
10	Tramming speed of continuous miner	3.6 m/min
11	Tramming speed of quadbolter	5 m/min
12	Installation time of 6 bolts with W-strap	25 minutes
13	Installation time of 6 bolts without W-strap	20 minutes
14	Installation time of 1 bolt.	260 seconds

Based on the analysis of time study and the support system, the production parameters of the continuous cutting machine district for Jamunia U/G Mine are tabulated as under:

Sl. No.	Activity	Time Frame
1	Cutting time at one face for unsupported cut-out distance equal to 6 m and gallery dimensions 4.8 m width & 4.5m height	22 minutes
2	Loading, unloading and marching time for 20 nos. shuttle car trips required to carry the cut coal to the feeder breaker.	46 minutes
3	Marching time of continuous cutting machine from one face to next in the same heading over a distance of 20 m (average)	6 minutes
4	Cutting and loading time in second face in same heading	46 minutes
5	Marching time from one heading to adjacent heading over a lead of 130 m	36 minutes
6	Total time required for 2 cutting and loading cycles plus marching time	134 min. say 2 hrs.15 min
7	Time required for bolting 4 nos. holes with W- strap	16 minutes
8	Bolting time per face for cut-out distance 6.0 m	80 minutes
9	Marching time of roof bolter from one face to next in same heading over a lead of 20 m	4 minutes
10	Bolting time in second face in same heading	80 minutes
11	Marching time of roof bolter from one heading to the adjacent heading over a lead of 130 m	26 minutes
12	Total time for bolting 2 faces plus marching time	190 min. = 3 hrs.10 min.

Coal produced in one round = $4.8 \times 4.5 \times 6 \times 2 \times 1.5 = 389 \text{ t}$

Time available for production in 3 shifts = 16 hours.

Possible no. of rounds of cutting = $(16 \times 60) \div 135 = 7 \text{ cycles}$

Production per day = $(16 \times 60 \times 389) \div 135 = 2766 \text{ t.}$

Time available for roof bolting in 3 shifts = 16 hours.

No. of cycles of roof bolter $(16 \times 60) \div 190 = 5 \text{ cycles.}$

Production per day on the basis of average of cutting & bolting assuming deployment of 2 nos twin boom roof bolters simultaneously = $389 \times 6 = 2334 \text{ t}$

Therefore, production per day for an average thickness of 2.8m in Seam-II = $(389 \times 6 \times 2.8) \div 4.5 = 1452 \text{ t. (Say 1400 tonnes)}$

Therefore, Production capacity proposed in Seam-II is 1400 tonnes per day.

The average daily production for Seam-II had been considered as 1200 tonnes per continuous cutting panel in the Approved Project Report. As experience to operate Continuous Cutting Technology is now gained in many Indian coal mines, CMPDI (HQ) has advised to consider the productivity of each C.M. as 1400 tpd instead of 1200 tpd as considered in approved report.

Therefore, the average daily production for Seam-II has been considered as 1400 tonnes per continuous cutting panel. With 2 continuous cutting machine panels, the proposed target capacity works out to 2800 tpd or 0.84 Mty. This target capacity has been kept keeping in view the average thickness of Seam-II as 2.8m. Since the average thickness of Seam-III+IV/IV and Seam-V is more than the average thickness of Seam-II, the production may increase in the other two seams.

Accordingly, in the Recast Project Report for Jamunia U/G Mine, it has been proposed to keep the target capacity as 2800 tpd (1400 tpd for each district) for 2 proposed continuous cutting machine panels.

9.0 MINING & EQUIPMENT SCHEDULE

9.1 MINING SCHEDULE

One year has been kept for Land Acquisition, Forest Clearance and EMP Clearance etc after final approval of the report by competent authority,.

After Acquisition of Land and getting all clearances, Tender and Work Award for inclines & airshaft, drivage of inclines (Length of Incline - 1 = 890m & Length of Incline - 2 = 876m, both upto Seam-V crossing Seam-II & Seam-III+IV/IV) and sinking of airshaft (Depth = 196m upto Seam-V) will be completed in 2 years time period i.e., from 2nd year to 3rd year.

After touching the three workable coal seams by two nos. of inclines, development of main trunk headings would start in Sector-III of Seam-II and Seam-V simultaneously by deploying 2 sets of continuous cutting machines in 4th year. The production for 4th year is proposed as 0.15 Mty or 500 tpd from the main trunk headings of Seam-II and Seam-V.

The production for 5th year is proposed as 1400 tpd or 0.42 Mty from panels of Seam-II and main trunk headings in Seam-II and Seam-V by deploying 2 sets of continuous cutting machines. In 6th year, development and depillaring of panels of Seam-II and development of main trunk headings of Seam-II & Seam-V is envisaged and the target production of 2800 tpd or 0.84 Mty would be achieved in this year by deploying 2 sets of continuous cutting machines.

Since all the three workable seams i.e., Seam-II, Seam-III+IV/IV and Seam-V are contiguous in nature, therefore it is not possible to depillar all the three seams simultaneously. Therefore, the extraction of panels in the workable seams is proposed keeping a gap of atleast 4 to 5 years after the extraction of the respective panels of top seams.

The time lag mentioned above is based on the observation that most of the strata movement due to caving occurs within one year and the goaf generally settles down completely over a period of 4 to 5 years.

The mine will achieve target production of 0.84 Mty or 2800 tpd in 6th year of mine life by deploying 2 continuous cutting panels. The seam wise and year wise production schedule till the achievement of target capacity is shown in the following table:

Seam	Production Phasing upto Target Year (Tonnes)					
	I Year	II Year	III Year	IV Year	V Year	VI Year
Seam - II	-	-	-	75000	210000	718480
Seam - III+IV/IV	-	-	-	-	-	-
Seam - V	-	-	-	75000	210000	121520
TOTAL	-	-	-	150000	420000	840000
				0.15 Mty	0.42 Mty	0.84 Mty

It can be seen from the above table that the target coal production in Jamunia U/G Mine is proposed to be achieved in 6th year of mine life. The target production will continue from other workable seams till 25th year of mine life and in 26th year, the production will taper down to 0.128 Mt. as per the proposed liquidation plan.

The Liquidation Plan showing year-wise and panel-wise coal extraction schedule of coal for the life of the mine is given in the following table:

Year	Working Seam	Working Panels	Dev./ Dep.	Panel Reserves (Tonnes)	Panel Production (Tonnes)	Yearly Production (Tonnes)	Yearly GCV of Coal (k.Cal./kg)	Yearly Coal Grade
1	Final Approval of Project Report on Cost Plus Basis & Land Acquisition is proposed to be completed.							
2 - 3	After Land Acquisition and clearances, Tender and Work Award for Inclines & Airshaft, Drivage of Inclines (Length of Incline 1 & 2 = 890m & 876m upto Seam-V) and Sinking of Airshaft (Depth = 196m upto Seam-V) proposed to be completed in two years, which also include preparatory works for Development of Main Trunk Roadways, Construction of Fan Drift, Installation & Commissioning of Main Mechanical Ventilator, Laying of Belt Conveyors in belt incline and, Man Riding System and Marching of Equipment required for Continuous Cutting Technology etc..							
4	II	Main Trunks upto Fault F ₃	Dev	183241	75000	150000	5521	G6
	Sub-Total (1 st C.M. District)				75000			
	V	Main Trunks upto Fault F ₃	Dev	160451	75000			
	Sub-Total (2 nd C.M. District)				75000			
5	II	Main Trunks upto Fault F ₃ Contd.	Dev	108241	108241	420000	5521	G6
	II	Panel-6	Dev	99570	99570			
	II	Main Trunks beyond Fault F ₃	Dev	221227	2189			
	Sub-Total (1 st C.M. District)				210000			
	V	Main Trunks upto Fault F ₃ Contd.	Dev	85451	85451			
	V	Main Trunks beyond Fault F ₃	Dev	246069	124549			
	Sub-Total (2 nd C.M. District)				210000			
6	II	Main Trunks beyond Fault F ₃ Contd.	Dev	219038	219038	840000	5509	G6
	II	Panel-12	Dev	75026	75026			
	II	Panel-12	Dep	135936	125936			
	Sub-Total (1 st C.M. District)				420000			
	V	Main Trunks beyond Fault F ₃ Contd.	Dev	121520	121520			
	II	Panel-10	Dev	86113	86113			
	II	Panel-10	Dep	200069	200069			
	II	Panel-9	Dev	103883	12298			
	Sub-Total (2 nd C.M. District)				420000			

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WCL, Ranch Area

Year	Working Seam	Working Panels	Dev./ Dep.	Panel Reserves (Tonnes)	Panel Production (Tonnes)	Yearly Production Tonnes	Yearly GCV of Coal (k.Cal./kg)	Yearly Coal Grade
7	II	Panel-12 Contd.	Dep	10000	10000	840000	5521	G6
	II	Panel-11	Dev	88847	88847			
	II	Panel-11	Dep	181248	181248			
	II	Panel-13	Dev	275198	139905			
		Sub-Total (1 st C.M. District)			420000			
	II	Panel-9 Contd.	Dev	91585	91585			
	II	Panel-9	Dep	247240	247240			
	II	Panel-8	Dev	118719	81175			
		Sub-Total (2 nd C.M. District)			420000			
8	II	Panel-13 Contd.	Dev	135293	135293	840000	5504	G6
	II	Panel-13	Dep	683529	284707			
		Sub-Total (1 st C.M. District)			420000			
	II	Panel-8 Contd.	Dev	37544	37544			
	II	Panel-8	Dep	178421	178421			
	II	Panel-7	Dev	186375	186375			
	II	Panel-7	Dep	254032	17660			
		Sub-Total (2 nd C.M. District)			420000			
9	II	Panel-13 Contd.	Dep	398822	398822	840000	5504	G6
	II	Panel-14	Dev	76941	21178			
		Sub-Total (1 st C.M. District)			420000			
	II	Panel-7 Contd.	Dep	236372	236372			
	II	Panel-6	Dep	140027	140027			
	II	Panel-5	Dev	104677	43601			
		Sub-Total (2 nd C.M. District)			420000			
10	II	Panel-14 Contd.	Dev	55763	55763	840000	5504	G6
	II	Panel-14	Dep	53383	53383			
	II	Panel-15	Dev	63827	63827			
	II	Panel-15	Dep	33877	33877			
	II	Panel-16	Dev	77869	77869			
	II	Main Trunks beyond Fault F ₃	Dep	392396	135281			
		Sub-Total (1 st C.M. District)			420000			
	II	Panel-5 Contd.	Dev	61076	61076			
	II	Panel-5	Dep	137768	137768			
	II	Panel-4	Dev	82975	82975			
	II	Panel-4	Dep	103891	103891			
	II	Panel-3	Dev	74272	34290			
		Sub-Total (2 nd C.M. District)			420000			
11	II	Main Trunks beyond Fault F ₃ Contd.	Dep	257115	257115	840000	5567	G6
	III + IV	Main Trunks upto Fault F ₃	Dev	267015	162885			
		Sub-Total (1 st C.M. District)			420000			
	II	Panel-3 Contd.	Dev	39982	39982			
	II	Panel-3	Dep	86234	86234			
	II	Panel-2	Dev	80422	80422			
	II	Panel-2	Dep	97937	97937			
	II	Panel-1	Dev	84716	84716			
	II	Panel-1	Dep	32851	30709			
		Sub-Total (2 nd C.M. District)			420000			
12	III + IV	Main Trunks upto Fault F ₃ Contd.	Dev	104130	104130	840000	5826	G5
	III + IV	Main Trunks beyond Fault F ₃	Dev	311393	311393			
	III + IV	Panel-12	Dev	95803	4477			
		Sub-Total (1 st C.M. District)						
	II	Panel-1 Contd.	Dep	2142	2142			
	III + IV	Panel-11	Dev	123019	123019			
	III + IV	Panel-11	Dep	250958	250958			
	III + IV	Panel-10	Dev	123019	43881			
		Sub-Total (2 nd C.M. District)						
13	III + IV	Panel-12 Contd.	Dev	91326	91326	840000	5827	G5
	III + IV	Panel-12	Dep	180008	180008			
	III + IV	Panel-13	Dev	314381	148666			
		Sub-Total (1 st C.M. District)			420000			
	III + IV	Panel-10 Contd.	Dev	79138	79138			
	III + IV	Panel-10	Dep	285814	285814			
	III + IV	Panel-9	Dev	154913	55048			
		Sub-Total (2 nd C.M. District)			420000			

Year	Working Seam	Working Panels	Dev./ Dep.	Panel Reserves (Tonnes)	Panel Production (Tonnes)	Yearly Production Tonnes	Yearly GCV of Coal (k.Cal./kg)	Yearly Coal Grade
14	III + IV	Panel-13 Contd.	Dev	165715	165715	840000	5827	G5
	III + IV	Panel-13	Dep	774335	254285			
	Sub-Total (1 st C.M. District)				420000			
	III + IV	Panel-9 Contd.	Dev	99865	99865			
	III + IV	Panel-9	Dep	368692	320135			
	Sub-Total (2 nd C.M. District)				420000			
15	III + IV	Panel-13 Contd.	Dep	520050	420000	840000	5827	G5
	Sub-Total (1 st C.M. District)				420000			
	III + IV	Panel-9 Contd.	Dep	48557	48557			
	III + IV	Panel-8	Dev	183474	183474			
	III + IV	Panel-8	Dep	265271	187969			
	Sub-Total (2 nd C.M. District)				420000			
16	III + IV	Panel-13 Contd.	Dep	100050	100050	840000	5827	G5
	III + IV	Panel-14	Dev	108622	108622			
	III + IV	Panel-14	Dep	73915	73915			
	III + IV	Panel-15	Dev	112800	112800			
	III + IV	Panel-15	Dep	66523	24613			
	Sub-Total (1 st C.M. District)				420000			
	III + IV	Panel-8 Contd.	Dep	77302	77302			
	III + IV	Panel-7	Dev	304978	304978			
	III + IV	Panel-7	Dep	415689	37720			
	Sub-Total (2 nd C.M. District)				420000			
17	III + IV	Panel-15 Contd.	Dep	41910	41910	840000	5827	G5
	III + IV	Panel-16	Dev	116978	116978			
	III + IV	Panel-6	Dev	150400	150400			
	III + IV	Panel-6	Dep	184786	110712			
	Sub-Total (1 st C.M. District)				420000			
	III + IV	Panel-7 Contd.	Dep	377969	377969			
	III + IV	Main Trunks beyond Fault F ₃	Dep	504362	42031			
	Sub-Total (2 nd C.M. District)				420000			
18	III + IV	Panel-6 Contd.	Dep	74074	74074	840000	5827	G5
	III + IV	Panel-5	Dev	171289	171289			
	III + IV	Panel-5	Dep	225439	174637			
	Sub-Total (1 st C.M. District)				420000			
	III + IV	Main Trunks beyond Fault F ₃ Contd.	Dep	462331	420000			
	Sub-Total (2 nd C.M. District)				420000			
19	III + IV	Panel-5 Contd.	Dep	50802	50802	840000	5697	G6
	III + IV	Panel-4	Dev	133689	133689			
	III + IV	Panel-4	Dep	162612	162612			
	III + IV	Panel-3	Dev	133689	72897			
	Sub-Total (1 st C.M. District)				420000			
	III + IV	Main Trunks beyond Fault F ₃ Contd.	Dep	42331	42331			
	V	Panel-11	Dev	116184	116184			
	V	Panel-11	Dep	237016	237016			
	V	Panel-10	Dev	116184	24468			
	Sub-Total (2 nd C.M. District)				420000			
20	III + IV	Panel-3 Contd.	Dev	60792	60792	840000	5682	G6
	III + IV	Panel-3	Dep	151525	151525			
	III + IV	Panel-2	Dev	158756	158756			
	III + IV	Panel-2	Dep	195873	48927			
	Sub-Total (1 st C.M. District)				420000			
	V	Panel-10 Contd.	Dev	91715	91715			
	V	Panel-10	Dep	269935	269935			
	V	Panel-9	Dev	138510	58350			
	Sub-Total (2 nd C.M. District)				420000			
21	III + IV	Panel-2 Contd.	Dep	146946	146946	840000	5652	G6
	III + IV	Panel-1	Dev	135778	135778			
	III + IV	Panel-1	Dep	49276	49276			
	V	Panel-12	Dev	70166	70166			
	V	Panel-12	Dep	124705	17834			
	Sub-Total (1 st C.M. District)				420000			

Year	Working Seam	Working Panels	Dev./ Dep.	Panel Reserves (Tonnes)	Panel Production (Tonnes)	Yearly Production Tonnes	Yearly GCV of Coal (k.Cal./kg)	Yearly Coal Grade
	V	Panel-9 Contd.	Dev	80160	80160			
	V	Panel-9	Dep	329654	329654			
	V	Panel-8	Dev	129511	10186			
	Sub-Total (2 nd C.M. District)				420000			
22	V	Panel-12 Contd.	Dep	106871	106871	840000	5537	G6
	V	Panel-13	Dev	248316	248316			
	V	Panel-13	Dep	610424	64813			
	Sub-Total (1 st C.M. District)				420000			
	V	Panel-8 Contd.	Dev	119325	119325			
	V	Panel-8	Dep	184786	184786			
	V	Panel-7	Dev	170593	115889			
Sub-Total (2 nd C.M. District)					420000			
23	V	Panel-13 Contd.	Dep	545611	420000	840000	5537	G6
	Sub-Total (1 st C.M. District)				420000			
	V	Panel-7 Contd.	Dev	54704	54704			
	V	Panel-7	Dep	230938	230938			
	V	Panel-6	Dev	68933	68933			
	V	Panel-6	Dep	85002	65425			
Sub-Total (2 nd C.M. District)					420000			
24	V	Panel-13 Contd.	Dep	125611	125611	840000	5537	G6
	V	Panel-14	Dev	95741	95741			
	V	Panel-14	Dep	61595	61595			
	V	Panel-15	Dev	94000	94000			
	V	Panel-15	Dep	55436	43053			
	Sub-Total (1 st C.M. District)				420000			
	V	Panel-6 Contd.	Dep	19577	19577			
	V	Panel-5	Dev	86689	86689			
	V	Panel-5	Dep	112720	112720			
	V	Panel-4	Dev	66844	66844			
	V	Panel-4	Dep	81306	81306			
	V	Panel-3	Dev	81699	52864			
Sub-Total (2 nd C.M. District)					420000			
25	V	Panel-15 Contd.	Dep	12383	12383	840000	5537	G6
	V	Main Trunks beyond Fault F ₃ Contd.	Dep	437955	407617			
	Sub-Total (1 st C.M. District)				420000			
	V	Panel-3 Contd.	Dev	28835	28835			
	V	Panel-3	Dep	94857	94857			
	V	Panel-2	Dev	95741	95741			
	V	Panel-2	Dep	117442	117442			
	V	Panel-1	Dev	89358	83125			
Sub-Total (2 nd C.M. District)					420000			
26	V	Main Trunks beyond Fault F ₃ Contd.	Dep	30338	30338	127911	5537	G6
	V	Panel-16		58489	58489			
	Sub-Total (1 st C.M. District)				88827			
	V	Panel-1 Contd.	Dev	6233	6233			
	V	Panel-1	Dep	32851	32851			
Sub-Total (2 nd C.M. District)					39084			
1 - 26	Grand Total					17497911	5649	G6

9.2 SCHEDULE OF EQUIPMENT PROCUREMENT

The schedule of equipment procurement is detailed in Appendix-A.3 in Departmental Option along with the phasing of quantity and capital requirement. The population of main equipment is tabulated as under for ready reference.

Sl. No.	Equipment	Population (Nos.)
1	Continuous Cutting Machine	2 Packages
2	Shuttle Car	4
3	Feeder Breaker	2
4	Twin Boom Roof Bolter	4
5	Electricals for C.M. Package	2 sets
6	Initial Spares for C.M. Package	2 sets
7	Load Haul Dumper / Multi Utility Vehicle	2
8	Hydraulic Roof Bolters	2
9	Anchorage Testing Machine	4
10	Exploders	4
11	Main Mechanical Ventilator	1
12	Auxiliary Ventilator	4
13	Ventilation ducting	0.8 km
14	Portable Gas Detector for U/G Coal Mines	2
15	U/G Safety Boring Machine	1
16	Self Rescuer	430
17	Chair Lift Man Riding System in Incline No.2	1
18	Chair Lift Man Riding System in Main Trunks Roads	1
19	Gate Belt Conveyor sets	6
20	Trunk Belt Conveyor sets	7
21	PVC Belting (1000mm wide)	6.3 km
22	PVC Belting (1200mm wide)	5.9 km
23	Endless Haulages	5
24	Tugger Haulages	2
25	Haulage Rope	11.9 km
26	Rails @ 15 kg/m	240 t
27	Pulling & Lifting machines	6

In addition to above, Electrical & Power Supply including Electronics & Telecommunication, Workshop, Pumping and Coal Handling Arrangement Plant & Machinery have been provided in the Recast Project Report for Jamunia U/G Mine as per requirement.

10.0 TRANSPORT

10.1 PROPOSED COAL TRANSPORT SYSTEM

Two inclines are proposed in Recast Project Report for Jamunia U/G Mine. Incline No. 1 will be used for coal transport from underground to surface by belt conveyors and Incline No. 2 will be used for men and material transport.

It is proposed to provide two continuous cutting machine districts for coal production initially from Seam-II. In each district, continuous cutting machine will cut coal at coal faces and load into shuttle cars by inbuilt gathering arms and chain conveyor. The shuttle cars will carry coal and feed to the hopper of a feeder breaker installed in the central gate road.

10.1.1 Face Transport

In each district, cutting machine will cut coal at coal faces and load into shuttle cars by inbuilt gathering arms and chain conveyor. The shuttle cars will carry coal and feed to the hopper of a feeder breaker installed in the central gate road. Crushed coal from the feeder breaker will be loaded onto gate belt conveyor GB4 and GB6 in both the panels.

10.1.2 Gate Transport

In the first district, Gate belt conveyor GB4 will receive coal from feeder breaker and discharge onto a Gate belt conveyor GB3. GB3 will discharge coal onto another Gate belt conveyor GB2. Gate belt conveyor GB1 will receive coal from GB2 and discharge onto a Trunk belt conveyor TB6 or TB7 provided in Seam-II.

In second district, Gate belt conveyor GB6 will receive coal from Feeder Breaker and discharge onto another Gate belt conveyor GB5. GB5 will discharge coal onto a Trunk belt conveyor TB6 or TB7 provided in Seam-II. All gate belt conveyors will be 1000mm wide and are provided with 90kW drive each and are designed to carry 200 tph capacity of coal.

10.1.3 Trunk Transport

Trunk Belt Conveyor TB4 will be provided in Seam-V from incline bottom to Fault F₃-F₃ and Trunk Belt Conveyor TB5 will be installed in the drift across Fault F₃-F₃. TB5 will receive coal from Trunk belt conveyor TB6 and discharge onto a 200t capacity Strata Bunker from Seam-II to Seam-V just before Fault F₃-F₃. Trunk belt conveyor TB4 will receive coal by 400 tph capacity reciprocating feeder provided from strata bunker near Fault F₃-F₃. Trunk belt conveyors TB4, TB3, TB2 and TB1 operating in series will be brought upto surface for further transportation.

Trunk belt conveyor TB3 will receive coal by 400 tph capacity reciprocating feeder from strata bunker near incline bottom. Trunk belt conveyors TB3, TB2 and TB1 operating in series will bring coal upto surface for further transportation. After development and depillaring of Seam-II is completed, all these conveyors will be shifted to Seam-III+IV/IV. Trunk belt conveyor TB1 will discharge coal onto an overhead twin hopper of 2 x 100t capacity (on surface) for storage of coal.

An electronic belt weigher, continuous type, will be provided on Trunk belt conveyor TB1 near Incline No. 1 (on surface) for weighing of coal from mine.

All Trunk Belt Conveyors are of 1200mm wide, 2.0m/sec speed, which are designed to carry 400tph capacity. TB1, TB2, TB3, TB6 and TB7 are provided with 2 x 90 kW each. TB4 and TB5 are provided with 90kW & 37kW drive respectively.

10.2 MEN & MATERIAL TRANSPORT

A Man Riding Chair Lift System of 75 kW and a Direct Haulage of 75 kW is proposed to be provided on surface near Incline No. 2 for men transport and material transport respectively. A Man Riding Chair Lift System of 75 kW is also proposed for further movement of workmen in Main Trunk Roadways.

For transport of material in trunk route, an endless haulage of 37 kW will be provided parallel to man riding chair lift system in a separate trunk road. Two nos. of endless haulages each of 37 kW will be provided parallel to trunk belt conveyor in Seam-II and Seam-V. Two nos. of endless haulages each of 37 kW will be provided in the drift across Fault F₃-F₃ in Seam-II & V.

In gate roadways, men will travel along side of the belt conveyors. 2 nos. of endless haulages each of 37 kW will be used for transport of material in gate roadways to continuous cutting machine districts. At the faces, material will be transported manually.

11.0 VENTILATION

11.1 INTRODUCTION

Exhaust ventilation system has been proposed for this mine with two inclines (both of them will act as downcast airways) and one return airshaft (upcast airway). The main mechanical ventilator will be installed at the fan drift of airshaft with properly constructed airlock arrangement at the top of the shaft.

11.2 VENTILATION SYSTEM DESIGN

The assessment of air quantity, fan pressure, mine resistance, capacity of main fan etc. for proposed Jamunia U/G Mine has been done for 2 stages of mine workings in Seam-II i.e., Stage-I & Stage-II.

In Stage-I, the panels close to main trunk roads are considered for simulation study during the 6th year of mine operation i.e., the year of achieving target production. In Stage-II, the farthest panels from main trunk headings are considered for simulation study during 22nd year of mine operation.

11.3 SIMULATION RESULTS & FAN SPECIFICATION

As per the simulation study conducted in different stages in Jamunia U/G Mine, the main mechanical ventilator (exhaust type) should be able to provide the required air quantities & pressure at different mine resistance either by changing fan blade angle or RPM of fan motor.

The following table shows the Air Quantity requirement & Air Pressure at different mine resistance and estimated Fan motor capacities in different stages of workings:

Sl. No.	Particulars	Stage - I	Stage - II
1	Air requirement at LVC	50 m ³ /sec	50 m ³ /sec
2	Air requirement at fan with overall VEQ of 50%	100 m ³ /sec	100 m ³ /sec
3	Air Pressure at Main Fan (Pa. / mm of WG)	722 / 74	850 / 87
4	Mine Resistance (Gauls)	0.0722	0.085
5	Estimated air kW	73	85
6	Fan motor with system efficiency of 50% (kW)	146	170

This report proposes a fan, which would cater to both the stages of the mine and a fan motor of about 200 kW power is proposed. However, for initial years, a smaller fan of lesser motor capacity may be sufficient during mine development stage for temporary phase. Provision for such small capacity fan / motor has not been kept in this report and it is proposed to be arranged by WCL from other mines where spare fan / motor would be made available.

Since the location of airshaft is about 275m away from the incline bottom, the main mechanical ventilator cannot be operated in the fan drift until the inclines are connected with the airshaft. This may take about 5 - 6 months time. During this period, one of the incline will act as intake airway & the other as return airway. A small exhaust fan will be installed at the mouth of return incline for ventilation purpose during this period. Once the inclines & airshaft are connected with galleries, main mechanical ventilator as suggested in this report will start functioning in the fan drift.

The auxiliary fans proposed in this report will be able to discharge an airflow of 12m³/sec at a pressure of 100 mm WG. The fan motor required for these auxiliary fans will be of 22.5 kW. 800 m ventilation ducting (1000mm size) is also proposed for the required air supply.

12.0 WATER MANAGEMENT & PUMPING

The production from Jamunia U/G Project of Pench Area is proposed to be 0.84Mtpd or 2800tpd from two continuous cutting machine districts.

12.1 CLEAN WATER SUPPLY ARRANGEMENT FOR C. M. DISTRICT

It is proposed to supply clean water from surface sump to the two continuous cutting machine districts through a 100 mm diameter pipe range installed along the main incline and trunk route. Two 11lps, 150m head pumps will be installed at the surface sump for each continuous cutting machine district to ensure the availability of desired quantity of clean water at required pressure at the working districts. One identical pump will be kept as standby.

A manifold will be installed near each feeder breaker for the supplying of clean water to continuous cutting machine, roof bolters & feeder breakers, hydraulic roof bolters through 50mm dia., 200m length fire resistant armoured hose. The pipe range shall be extended along with the extension of each gate belt conveyor to continuous miner district through a 80 mm diameter pipe range installed along the conveyor roadway.

12.2 MAKE OF WATER

In absence of hydro-geological data, make of water is assumed on the basis of maximum annual rainfall, seepage due to underground, water accumulated from supply of water to the proposed continuous cutting machines, hydraulic roof bolters and water spraying system at different districts. The pumping capacity from the main sump to surface has been calculated as mentioned in the below given table:

Sl. No.	Particulars	Calculated Data
1	Mineable area	2.92 Km ²
2	Maximum rainfall in a year	1500 mm
3	Days in rainy season assumed	120 days
4	Average daily rainfall	12.50 mm
5	Run off coefficient	0.167
6	Seepage into U/G workings per day	6083.33 m ³
7	Ground water seepage co-efficient	0.10
8	Seepage due to Ground water per day	608.33 m ³
9	Total water accumulated in a day	6691666.667 litres
10	Pumping Capacity for 18 hours pump operation in a day	103.269 litres per second

3 nos. (2 working + 1 standby) of 80 lps x 200m x 250 kW, 3.3 kV FLP Pumps, 5 nos. of 38 lps x 120m x 90 kW, 550/440V FLP Pumps, 6 nos. (4 working + 2 standby) of 11 lps x 30m x 9.3 kW, 550/440V FLP Face Pumps, 2 nos. of 38 lps x 100m x 75 kW, 550/440V FLP Pumps and 3 nos. (2 working + 1 standby) of 11 lps x 150m x 37 kW, 550/440V NPLP Pumps have been provided in the Recast Project Report for Jamunia U/G Mine.

13.0 COAL HANDLING ARRANGEMENT

A small coal handling plant / arrangement has been proposed near Belt Incline No. 1 to handle the entire production of coal from the mine. The CHP will have facilities like storage, weighment of coal etc. The mode of despatch will be by road with the help of trucks to miscellaneous consumers.

Coal from underground will be brought to surface by trunk belt conveyor TB1 of 1200 mm wide through Incline no. 1. Trunk belt conveyor TB1 will discharge coal onto a single roll crusher which will crush the ROM coal to (-) 100mm size. The (-) 100mm size coal will be collected by CHP belt conveyor C1 of 1200mm wide which will transport coal and discharge into 2 x 100t capacity overhead twin hoppers. Trucks will be loaded from below these overhead hoppers with the help of reciprocating feeders provided at the bottom openings of the hoppers.

An electronic road weighbridge of 100t capacity will be provided near the CHP, which will be used for weighment of empty and loaded trucks and will have printing facility for keeping records and preparation of bills.

14.0 UNIT WORKSHOP

The unit workshop at mine level will provide basic engineering support in the form of the repairs, maintenance, replacement of minor spare parts etc. The facilities and manpower provided in this workshop would be sufficient enough to cater to the routine needs of various underground mining machines operating in the project. Washing, greasing, checking of brake system, hydraulic system etc. would also be undertaken in the unit workshop. Washing, cleaning & repair of LMVs, assemblies, defective parts etc are also envisaged. Jobs that shall be carried out in the unit workshop shall be in the form of unit replacement of assemblies or replacement of defective parts.

The workshop is proposed to be provided with all necessary plant & machineries, tools, accessories, tackles, diagnostic & testing equipments etc. so that repair cum maintenance needs of the production machines may be fulfilled efficiently. However, it is proposed in this report to carry out maintenance of Continuous Cutting Equipment along with associated equipment departmentally and accordingly provision has been made in the Cost of Production (Appendix-C) for the above job.

15.0 UNIT STORES

A small but independent unit stores has been envisaged to cater the routine needs of consumables, spares, POL, etc of the mine. Unit stores shall have the backing of the area stores and central stores for its smooth functioning.

16.0 POWER SUPPLY AND ILLUMINATION

16.1 SOURCE OF POWER SUPPLY

Jamunia Underground Mine is being planned for a target production of 2800 tpd (0.84 Mty) with continuous cutting technology. The nearest HT substation is Amarwada which is approximately at a distance of 25 km from where power can be drawn at 132 kV/33 kV, 40 MVA grid substation. It is proposed to draw 25 km long 33 kV overhead line from Amarwada 132 kV/33 kV, 40 MVA substation for feeding power to Jamunia U/G Mine.

An approximate amount of Rs. 500 Lakhs has been provided in Appendix A.8.1 under the head of Incoming Power Supply Arrangement from Amarwada MPSEDCL substation. The amount includes Permanent Incoming Power Supply and Temporary Power Supply Arrangement also.

Township for this project will be separate but adjacent to Nahariya - Urdhan Township situated at Bokai Village, which is at a distance of approximately 6.0 km from Jamunia U/G Mine and approximately 2 km from existing Nahariya U/G Mine. The power supply to this Bokai Township already exists and the same system will continue in future also once the township of Jamunia U/G Mine will be constructed.

16.2 CONNECTED LOAD & MAXIMUM DEMAND

The details of connected load and Maximum Demand of the proposed Jamunia U/G Mine and its Township are as given below:

Sl. No.	ITEM HEAD	Departmental Option
1.	CONNECTED LOAD:	
	a) Only mine	7116 kW
	b) Only township	614 kW
	c) Total	7730 kW
2.	LOAD IN OPERATION:	
	a) Only mine	6811 kW
	b) Only township	614 kW
	c) Total	7425 kW
3.	PROJECTED MAXIMUM DEMAND:	
	a) Only mine	4291 kVA
	b) Only township	447 kVA
	c) Total	4737 kVA

16.3 SALIENT FEATURES OF ELECTRICAL PARAMETERS

The salient features of electrical parameters of the proposed Jamunia U/G Mine for Departmental Option are given below:

Sl. No.	Particulars	Departmental Option
1.	Specific Energy Consumption (Including Township)	24.70 kWh / t
2.	Specific Power Cost (Including Township)	Rs. 247.16/t
3.	Fixed Percentage of Power Cost	46.02 %
4.	Variable Percentage of Power Cost	53.98 %
5.	Specific Demand	5.639 MVA/Mt.
6.	Capacitor Bank Provided (Including Township)	3150 kVAR
7.	Average Cost of Purchased Power	Rs. 9.64 / kWh

17.0 CIVIL CONSTRUCTION

- 17.1 The total life and revenue life of this project is about 26 years and 23 years respectively, therefore all civil works have been envisaged on permanent specifications. It should be ensured that all the residential buildings are constructed on non-coal bearing area.

The Building Cost Index for the M. P. Region has been worked out to 479 in 2015 (2nd half) taking the prevalent rates of materials and labour. This Building Cost Index is with reference to base 100 in Nagpur as on 1.1.1992.

Keeping in view the needs and requirements of this mine, provision for service buildings such as Project office / Manager office, Unit workshop, Unit Stores, Sub-station, statutory buildings, community buildings and other welfare buildings have been provided.

[Handwritten signature and official stamp of the project engineer]

17.2 PROVISION OF QUARTERS & SITE FOR TOWNSHIP

Total manpower proposed for this project is 530 in Departmental Option. The proposed quarters will be constructed near existing Bokai Township. Considering density of existing villages / towns in the local region and the necessity of the project, 279 Nos. typed quarters have been envisaged which satisfies 52.60% of the proposed manpower for Departmental Option in Jamunia U/G Project. The proposed quarters are to be constructed in an area adjacent to Bokai Township so that community / welfare buildings and water supply scheme can be combined together.

17.3 PROVISION OF ROADS & CULVERTS AND WATER SUPPLY & SEWAGE

For approaching the mine site and within the service buildings and colony, sufficient provision of roads & culverts and sufficient provision of water supply & sewerage arrangement has been kept in the Recast Project Report.

18.0 MANPOWER, PRODUCTIVITY & TRAINING

18.1 The manpower requirement for the proposed Jamunia U/G Mine has been assessed keeping in view the location of working districts in Jamunia U/G Mine, work culture and work load norms prevalent in nearby mines. The manpower assessment for continuous cutting machine panels in Jamunia U/G Mine is based on the deployment pattern in mines of Coal India Ltd. where similar technology is in vogue.

The proposed manpower, production and productivity for a target capacity of 0.84 Mty for Departmental Option of the proposed Recast Project Report for Jamunia U/G Mine are tabulated as below:

Sl. No.	Group Name	Departmental Option			
		Including Welfare		Excluding Welfare	
		Strength (Nos.)	OMS (t)	Strength (Nos.)	OMS (t)
1	Underground	420	7.659	420	7.659
2	Surface	110	28.926	97	32.802
	Total	530	6.056	517	6.209

18.2 TRAINING:

Mechanisation with continuous cutting technology has been proposed in Jamunia U/G Mine and therefore, training should be imparted to all personnel connected with operation and maintenance of different machines. For operation of continuous cutting machine and its other package equipment, training should be imparted either by machine manufacturer or at other mines of WCL / CIL, where this technology is in operation. For other jobs, services of Chhinda VTC will have to be utilized till another VTC is established to cater to the requirements of the new mines. Supervisory training will be imparted at Supervisory Training Institute, Chhindwara.

19.0 SAFETY & CONSERVATION

The Recast Project Report for Jamunia U/G Mine has been drawn up keeping all the safety aspects in view. All the precautions that have been laid in CMR, 1957 under the Mines Act, 1952 and the conditions imposed by DGMS on various operations have to be followed strictly without any deviation.

The coal seams in the proposed Jamunia U/G Mine are anticipated to be 'Degree-I' gassy seams. It is necessary that gassiness of the seams should be ascertained just after touching coal seams. All the precautions laid down for mining problems like inundation, dust suppression, fire & spontaneous heating, roof control and subsidence etc. have to be carefully followed.

19.1 EXEMPTIONS / RELAXATIONS REQUIRED FROM DGMS

Introduction of continuous cutting technology will require exemptions from certain provisions of Coal Mines Regulation from DGMS. Some of the exemptions specific to the continuous cutting technology are as follows:

- i) Increasing development height upto 4.5m from 3m in all the working panels of workable seams wherever the seam height is more than 3m.
- ii) To circulate quantity of air required at LVC of the continuous cutting machine panel as per DGMS permission for Anjan Hill mine of SECL and Tandsi U/G Mine of WCL. Here DGMS had specified minimum air velocity of 0.5 m/sec over the machine or at a distance of 4.5 m from the face on the intake side, whichever is more instead of 2.5m³/min/tonne of daily output.
- iii) Increasing gallery / split / slice width from 4.8m (max.) to 6.6m for ensuring full utilisation of the machine and preventing cutting of corners of the pillars.
- iv) Working in slices without support.
- v) Extraction of pillars without installing breaker-line supports in the form of chocks at the goaf edge.
- vi) Reduction of the standard pillar size as contained in CMR 99.
- vii) Corners of the pillars to be rounded to allow easier vehicular access.
- viii) Use of two or more number of auxiliary ventilators in a district.
- ix) Permission to deploy less no. of Surveyors and Assistant Managers in relation to the scales of deployment as per CMR.
- x) Permission to extract Seam-III + IV/IV below the settled goaf of Seam-II and Seam-V under the settled goaf of Seam-II and Seam-III+IV/IV in spite of the three seams being contiguous.

Other exemptions may also be required to approve the machinery and/or mining system.

19.2 SCIENTIFIC STUDIES

It is necessary to undertake the following scientific studies for proper implementation of this report:

- To undertake Cavability Study of Deccan Trap Basalt Formation and suggest the Blast Hole Geometry in case caving has to be induced by blasting from the surface or underground.
- To undertake Subsidence Prediction Studies to determine the Maximum Subsidence and Maximum Tensile Strain below Forest, Tenancy and Government Land.
- To undertake the Physico-Mechanical Properties of rocks for designing the support system & caving characteristics of the roof strata. It will be necessary to determine 'Rock Mass Rating' for preparing the Support Plan so that Systematic Support Rules can be framed.
- To undertake the mapping of the direction of Horizontal Stresses and its Magnitude.
- To undertake Gas Survey so that actual gas content of coal is determined in order to ascertain the actual degree of gassiness of the coal seams.
- To determine the maximum unsupported Cut-out Distance during development and extraction stage.
- To undertake Hydro-geological Studies for quantifying ground water and to assess the impact of caving on existing ground water regime. This data will also assist in identifying source of water for industrial use.

20.0 ENVIRONMENT MANAGEMENT

Proposed Jamunia U/G Mine is located in Pench Area of WCL. Ministry of Environment & Forests accorded Environment Clearance (Phase-I) to Jamunia Underground Coal Mine of WCL for a Normative Production Capacity of 0.72 MTPA and Peak Capacity of 0.828 MTPA in a ML Area of 332.30 ha without any Forest Land on 31-12-2012.

The Recast Project Report for Jamunia U/G Mine is being prepared for a Normative Capacity of 0.84 Mty and a Peak Production Capacity of 1.05 Mty. The total land base required for the project is 292 hectares under All Rights and 7 hectares under Surface Rights. Bord & Pillar method of mining in conjunction with caving is proposed with continuous cutting technology. A revised EMP may have to be prepared based on this Recast Project Report.

The Ambient Air Quality, Water Quality, Noise Levels, Flora & Fauna, Micrometeorological Data and Socio-Economic status in core and buffer zone will have to be determined on the basis of Base Line Data Generation.

20.1 IMPACT ON LAND USE

The total land base required for the project is 292 hectares under All Rights and 7 hectares under Surface Rights. This being an underground mine, minimum degradation of surface features may be anticipated. The plantation is likely to be carried out along the transportation route and no much change is anticipated in the post mining land use pattern.

20.2 SUBSIDENCE EFFECTS

Underground mining with caving has been proposed in Jamunia U/G Mine. Subsidence Prediction Studies are proposed to be carried out involving a Scientific Agency to assess the subsidence on surface due to underground mining and its impact on surface features like villages, nallas, forest, road, tenancy & government land, etc.

The surface topography is hilly in nature and some portion is covered with forest. Depillaring is not proposed under the surface features taking angle of draw of 35° into consideration.

20.3 CAVABILITY CHARACTERISTICS

The Cavability characteristics of Basaltic Deccan Trap need to be determined. If the Deccan Trap proves to be easily cavable, then the mine will face no difficulty in caving of roof while depillaring. In case if Deccan Trap is difficult to cave, blasting from the surface or underground may have to be carried out to fracture the Deccan Trap formation and induce caving at regular intervals. Scientific Studies are suggested to be carried for Cavability of Roof over Deccan Trap Formation.

20.4 ASSESSMENT OF ENVIRONMENTAL IMPACT & MITIGATION MEASURES

Assessment of environmental impact and mitigation measures for air, water, noise, land use, animal life, plant life, transportation, population, risks and human health will be taken care of.

20.5 CAPITAL & REVENUE COSTS

In addition to the Capital Cost of Rs. 57.73 Lakhs including Service Tax, Revenue Cost of Rs. 6.00 per tonne of coal produced has been considered for the entire life of Jamunia U/G Project for the mitigation of environmental impacts.

21.0 MINE CLOSURE COST

As directed through memorandum No. 55011-01-2009-CPAM of Government of India, Ministry of Coal, Shastri Bhawan, New Delhi dated 27/08/2009, Mine Closure Plan has to be enclosed with all PRs / EMPs. In the Annexure to this memorandum, guidelines for preparing the Mine Closure Plan and assessing the capital cost of mine closure have been specified.

Mine Closure cost has been computed based on the recent guidelines circulated by Government of India, Ministry of Coal, Shastri Bhawan, New Delhi. The closure activities will include subsidence survey for a period of 3 years after mine closure, filling of subsidence cracks, fencing of caved out area and post-project monitoring for a period of 3 years after mine closure.

Taking the recent guidelines into consideration, the Mine Closure Cost in this Recast Project Report for Jamunia U/G Mine works out to Rs. 4.47/t. The detailed calculations are tabulated as under:

CALCULATION OF MINE CLOSURE COST			
1	Total Area of the Mine (ha)		291.57
2	WPI value as on August 2009 (Base WPI)		129.6
3	WPI value of current available month (August 2015 - Provisional)		176.7
4	Ratio of WPI (August 2015 : August 2009)		1.36342593
5	Amount to be considered for underground (Rs. / ha)		100000
6	Total Mine Closure Corpus Fund (Rs. 000s)		39753
7	Total Life of Jamunia U/G Mine (Years)		26
8	Annual Mine Closure Corpus Fund for 2015-16 (Rs. 000s)		1529
YEAR	Amount per Year (Rs. 000s)	Production (Mt)	Amount per Tonne (Rs/t)
2015-16	1529	-	Revenue Expenditure Capitalised Period
2016-17	1605	-	
2017-18	1685	-	
2018-19	1769	0.150000	11.79
2019-20	1857	0.420000	4.42
2020-21	1950	0.840000	2.32
2021-22	2048	0.840000	2.44
2022-23	2150	0.840000	2.56
2023-24	2258	0.840000	2.69
2024-25	2371	0.840000	2.82
2025-26	2490	0.840000	2.96
2026-27	2615	0.840000	3.11
2027-28	2746	0.840000	3.27
2028-29	2883	0.840000	3.43
2029-30	3027	0.840000	3.60
2030-31	3178	0.840000	3.78

YEAR	Amount per Year (Rs. 000s)	Production (Mt)	Amount per Tonne (Rs/t)
2031-32	3337	0.840000	3.97
2032-33	3504	0.840000	4.17
2033-34	3679	0.840000	4.38
2034-35	3863	0.840000	4.60
2035-36	4056	0.840000	4.83
2036-37	4259	0.840000	5.07
2037-38	4472	0.840000	5.32
2038-39	4696	0.840000	5.59
2039-40	4931	0.840000	5.87
2040-41	5178	0.127911	40.48
Total	78136	17.497911	
Mine Closure Cost to be put in Appendix - C (Rs./t)			4.47

From the above table, it can be seen that the Total Amount of Mine Closure Cost Corpus Fund works out to Rs. 7.8136 crores and the activity wise break-up of this amount is shown in the following table:

Sl. No.	Activity	% of Total Mine Closure Cost	Amount (Rs. 000s)
A	Dismantling of structures:		
	Service Buildings	3.50%	2734.76
	Residential Buildings	37.58%	29363.51
	Industrial Structures like CHP, Workshop, Field Substation, Cap lamp room, Haulage, Fan Installation etc.	6.33%	4946.01
B	Permanent sealing of mine entries (incline mouth and air shaft):		
	Sealing of incline mouths and air shafts.	2.32%	1812.76
C	Subsidence Management	1.75%	1367.38
D	Landscaping:		
	Landscaping of the clear land for improving its aesthetics	5.80%	4531.89
E	Plantation:		
	Plantation over the cleared area obtained after dismantling and on other Barren Spaces.	10.00%	7813.60
F	Monitoring / Testing of parameters for three years:		
	Air Quality	3.83%	2992.61
	Water Quality	3.34%	2609.74
G	Entrepreneurship development (Vocational / Skill Development) Training for sustainable income of affected people:	4.65%	3633.32
H	Miscellaneous and other mitigative measures:	11.60%	9063.78
I	Man power cost for supervision:	9.30%	7266.65
Total		100%	78136

22.0 LAND ACQUISITION

22.1 Quantum of type of land

The Total Land involved in this project is about 299 hectares (292 ha under All Rights and 7 ha under Surface Rights) as per this Recast Project Report for Jamunia U/G Mine. The breakup of 299 ha of land is approximately 246 ha of Tenancy Land, 5 ha of Government Land & 41 ha of Forest Land required for the Project and 7 ha Tenancy Land required for Township.

However, the Acquisition of Tenancy, Government and Forest Land (376.940 ha), the rates of Tenancy & Government Land, rates of NPV of Forest Land and other charges imposed by State Government have been considered in the concerned Appendix as per the data given by L&R department of WCL (vide letter no. WCL / GM (L&R) / 537 dated: 01.10.2013).

The Project Report for Jamunia U/G Mine was approved by WCL Board on 22.02.2014 in which the total land provision was 376.94 hectares. Accordingly the acquisition of 376.94 hectares land is in final stage.

Though the Total Land involved as per this Recast Project Report for Jamunia U/G Mine is 299 hectares, the land provision of 376.94 hectares given by WCL has been retained in this Recast Project Report.

Out of 376.94 ha land, 299 ha land is actually required for Recast Project Report for Jamunia U/G Mine prepared in September 2015. The remaining 77.94 ha land to be acquired under Jamunia U/G Mine will be utilised in Expansion Project Report for Urdhan-Magrahi O/C Mine. The cost of 77.94 ha land will have to be transferred from Jamunia U/G to Urdhan-Magrahi O/C Report later on.

The breakup of land requirement as per 376.94 ha is summarized below:

Type of Rights	Govt. Land (ha)	Tenancy Land (ha)	Forest Land (ha)	Total land Requirement (ha)
All Rights	9.053	301.585	-	310.638
Surface Rights	-	7.000	-	7.000
Mining Rights	-	-	59.302	59.302
Total	9.053	308.585	59.302	376.940

Land & Revenue Department of WCL, vide their letter WCL/GM(L&R)/949 dated 22.12.2014 (**Letter enclosed as Annexure-VII**) pointed out some changes to be made in the financial provisions to be made under land head. The data provided in the above referred letter has been considered while finalizing the provisions of land acquisition which were given in Appendix A.1.

Accordingly, the Total Land required for Jamunia U/G Mine is 376.94 hectares, out of which 310.638 hectares would be acquired under All Rights, 7.00 hectares under Surface Rights and 59.302 hectares under Mining Rights.

Capital Provision for Tenancy and Government Land to be acquired under All Rights, Surface Rights and Mining Rights has been envisaged.

As per the above referred letter, 50% NPV payment for 59.302 hectares of forest land has been considered @ Rs. 10.43 lakhs per hectare under Mining Rights. A lumpsum amount of Rs. 20.00 lakhs has been considered under the head of charges imposed by State Government for diversion of Forest Land.

As per the above referred letter, one time Monetary Compensation @ Rs. 5 Lakh per Acre for the 50% of Tenancy Land Losers in lieu of employment as per recent CIL R & R Policy has been considered in this report. For rest land losers, employment in lieu of Monetary Compensation may be considered by WCL as per Approved CIL R&R Policy.

In this Recast Project Report, the rehabilitation of Jamunia bastis / village are not proposed as only development has been considered beneath these villages taking angle of draw into consideration. However, In the Expansion Project Report for Urdhan-Magrahi O/C Mine submitted to WCL (yet to be approved), the rehabilitation of Jamunia bastis / village have been proposed, as overburden dumping has been proposed on the above land.

22.2 Time frame for Acquisition & Capital Provision

The Provision of Capital of Rs. 43.2119 Crores under Land Acquisition Head which includes Cost of Tenancy, Government Land, One Time Monetary Compensation to the Tenancy Land Losers and NPV for Forest Land, etc. has been kept in first year after approval of the Recast Project Report. The detailed break-up of Capital Provision for Land is given in Appendix - A.1.

23.0 PROJECT IMPLEMENTATION SCHEDULE

23.1 Once the Recast Project Report is approved, the authorities should take up the following major activities leading to the achievement of target production:

- a) EC clearance for Phase-I is approved as per the earlier approved project report for a normative capacity of 0.72 Mty and peak capacity of 0.828 Mty. Final Approval of EMP along with Forestry Clearance has to be obtained.
- b) A new EMP may have to be prepared as per the Recast Project Report for Jamunia U/G Mine for a normative capacity of 0.84 Mty and peak capacity of 1.05 Mty. Also approval of EMP and Forestry Clearances has to be obtained from MOEF.
- c) Land Acquisition for Mine Entries, Approach Road, Surface Infrastructure, Caving and Colony.
- d) Construction of Approach Road upto Mine Entries Site.

- e) Temporary and Permanent Water & Power Supply Arrangement
- f) Surveying, Locating and Fixing up the Site for Mine Entries.
- g) Tender and Work Award for Inclines and Airshaft.
- h) Drivage of Inclines and Sinking of Airshaft.
- i) Construction of Fan Drift, Fan House and Installation of Main Fan.
- j) Development of Main Trunk Headings upto Fault F_3 - F_3 in Seam-II and Seam-V simultaneously using Continuous Cutting Machines.
- k) Establishing ventilation connection between the Inclines and Airshaft and Commissioning of Main Mechanical Ventilator.
- l) Tendering & Drivage of 5 nos. Drifts in main trunk headings of Seam-II and Seam-V crossing Fault F_3 - F_3 .
- m) Development of Panel No. 6 of Seam-II and further development of main trunks headings in Seam-II and Seam-V.
- n) Tendering & drivage of 3 nos. drifts from main trunk headings of Seam-II to Panel No. 13 and Panel No. 14 of Seam-II crossing fault F_6 - F_6 .
- o) Further development of main trunk headings of Seam-II and Seam-V upto the mine boundary and development of Panels 12, 10 & 9 of Seam-II and extraction of Panels 12 & 10 of Seam-II to achieve the target production in VI year after approval of Recast Project Report.
- p) Construction and Commissioning of Coal Handling Plant/Arrangement.
- q) Construction of Civil Works.
- r) Procurement of Plant & Machinery as per phasing
- s) Scientific investigations.
- t) Arrangement to transfer / recruit / train the work force for the operation of different requirements and also for the construction activities.
- u) Any other activity, which may be required for smooth implementation of the project.

The time frame of the major activities leading to achievement of target capacity is shown in the Harmonogram. The average time frame for drivage of inclines, open cutting and drifting is considered as 50m/month and the average time frame for sinking of airshaft is considered as 10 m/month.

23.2 CONSTRUCTION SCHEDULE

The gestation period of the mine has been assessed as 3 years. This period will be devoted to Land Acquisition, Forestry Clearance, EMP Approval and other preparatory jobs. Drivage of inclines and Sinking of airshaft will be completed in 2 years time from 2nd to 3rd year. Drivage of main trunk headings in Seam-II and Seam-V shall be done simultaneously with 2 sets of continuous cutting machines in 4th year. The mine will start production in 4th year and will come into revenue in first production year.

The mine will produce 500 tpd or 0.15 Mty in 4th year and 1400 tpd or 0.42 Mty in 5th year and 2800 tpd or 0.84 Mty in 6th year, which is the target year with 2 nos. of continuous cutting package equipment.

The year after the approval of Recast Project Report has been considered as first year. The phasing of production and manpower is tabulated as under:

Year	I	II	III	IV	V	VI
Production (tpd)	-	-	-	500	1400	2800
Production (Mty)	-	-	-	0.15	0.42	0.84
Manpower	5	10	30	180	370	530

24.0 FINANCIAL EVALUATION

- 24.1 The Recast Project Report for Jamunia U/G Mine proposes to work by Mechanised Bord & Pillar method and extraction by caving. The target capacity of the mine has been envisaged as 0.84 Mty or 2800 tpd from 2 nos. of Continuous Cutting Technology Panels, producing 1400 tpd each.

With total extractable reserves of 17.50 Mt and targeted production capacity of 0.84 Mty, the total life of the mine works out to be 26 years including land acquisition and construction period. Coal production starts in the 4th year of mine working and the target will be achieved in the 6th year of its operation.

The grade of coal has been assessed as 'G5 to G6' (Average Grade = G6) in different years of mine life considering all in-seam bands irrespective of thickness and nature. It is proposed to despatch the processed ROM coal from the mine.

The economics of Jamunia U/G Project has been worked out on only one option namely Departmental Option.

24.2 CAPITAL INVESTMENT

The following table shows the Total Capital Investment (given in Appendix - A) under the major heads in Departmental Option in Recast Project Report for Jamunia U/G Mine prepared in September 2015:

A/C Head	Particulars	Total Capital Investment (Rs. Lakhs)
01	Land	4321.19
02	Buildings:	
	a) Service Buildings	447.24
	b) Residential Buildings	1717.87
03	Plant & Machinery	27588.92
04	Furniture & Fittings	30.00
05	Railway Siding	0.00
06	Vehicles	6.55
07	Prospecting & Boring	298.62
08.1	Capital outlay in mines	3893.52
08.2	Roads & Culverts	564.16
08.3	Water Supply & Sewerage	458.89
08.4	EMP & PR Preparation Cost	202.30
08.4 (A)	Env. Pollution Control Measures	57.73
08.5	Scientific Research Costs	75.00
09	Net Rev. Expenditure Capitalized during development period	1325.49
	Total Capital Investment	40987.48

24.3 FOREIGN CAPITAL

The total foreign exchange requirement including customs duty, port handling cost, inland transportation, etc. for the imported equipment of two nos. Continuous Miner packages in Departmental Option works out to Rs. 189.8256 crores considering exchange rate of 1 US \$ = Rs. 65.7531, which was the ruling rate on 21.09.2015.

24.4 BASIS OF PRICES OF P&M & CIVIL WORKS

The pricing of Plant and Machinery is based on the Standard Price List of June 2015 (escalated upto September 2015) circulated by the Underground Mining Division of CMPDI (HQ), Ranchi. The cost of Civil Works has been estimated on the basis of Civil Cost Index 479 for Madhya Pradesh in 2nd Half of year 2015.

24.5 OPENING OF REVENUE ACCOUNT

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:

Commercial Readiness:

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

- i) Minimum essential mine development works like drivage of main inclines / adits / drifts / shafts etc., installation of winding arrangements & ventilation arrangement, pit top and pit bottom transport arrangements as required for attaining targeted coal production as per project report have been constructed and commissioned.
- ii) In case of projects with B&P method of mining, underground workings have adequately progressed and adequate number of main mining equipment have been commissioned to enable opening of the first development panel. In case of projects where production from longwall mining has been envisaged within the target year, longwall face has been commissioned. In case of mines necessitating stowing for attaining target production, all arrangements of stowing have been completed.
- iii) Construction of CHP and railway siding has been completed or adequate alternative arrangement for sizing and dispatch of coal have been commissioned for the project.
- iv) The land required for the project (up to target year) has been acquired.

All the required approvals, land acquisition, drivage of inclines and sinking of airshaft for proposed Jamunia U/G Mine will take 3 years time to bring the proposed mine into commercial readiness for production on sustainable basis.

Most of the infrastructural facilities like Approach Road, CHP, Workshop, Service Buildings, Power Supply, Water Supply and other developmental activities required for mine operation are likely to be completed by then.

Therefore, Jamunia U/G Mine will have cash surplus in the first year of touching coal, i.e., IV year of mine operation and the mine is proposed to come into Revenue from IV Year.

24.6 COMPLETION CAPITAL

The expected completion capital for Jamunia U/G Mine works out to Rs. 447.0564 Crores in Departmental Option.

24.7 MANPOWER & O.M.S.

The manpower requirement has been estimated as 530 for Departmental Option for a production capacity of 0.84 Mty.

The overall OMS of the mine including the welfare manpower works out to 6.056t and excluding the welfare manpower works out to 6.209t in Departmental Option.

24.8 E.M.S.

The EMS has been re-estimated considering Initial Basic plus 7.97% as per the decision of 317th CIL Board meeting held on 13.07.2015 and as per letter no. GM (F)/Project costing/2485 dated 11.08.2015 with regard to updated estimate for Annual Earnings for Project Planning works.

The EMS estimated as per above decision for Departmental Option works out to Rs. 2073.73 in September 2015 which is considered for determining economics in this report.

24.9 UNIT COST OF PRODUCTION

Appendix 'C' shows the cost of production in Departmental Option as on September 2015 in Jamunia U/G Mine. However, the following table shows the Cost of Production:

Sl. No.	Particulars	CPT at 100%	CPT at 85%
1	Salaries and Wages	348.37	409.85
2	Stores	284.95	315.12
3	Power	247.16	267.23
4	Environment Pollution Control	6.00	7.06
5	Miscellaneous Expenses (incl. W/D)	78.42	85.06
6	Mine Closure Cost	4.47	5.26
7	Induced Caving Cost	6.52	6.52
8	Administrative Overhead	187.22	220.26
9	Depreciation	414.09	487.17
10	Interest on Working Capital @ 14.50%	48.04	54.00
11	Interest on Loan Capital @ 11.50%	59.00	69.41
	Total Cost of Production	1684.24	1926.94

The Cost of Production in Departmental at 100% and 85% levels of capacity utilization works out to Rs. 1684.24/t and Rs. 1926.94/t respectively.

In Stores Cost component given in the above table, the Repair and Maintenance Cost consists of two parts namely (i) Direct Plant & Machinery i.e., Coal winning, Loading, Supporting, Safety & Transport Equipment and (ii) Other P&M such as Electrical, Workshop, Pumping and CHP Equipment.

The Repairs & Maintenance Cost has been treated as 60% fixed cost and 40% variable cost and is determined on the following norms:

- i) 20% of annual depreciation of direct P&M, i.e., equipment required for coal preparation, loading, support, ventilation, safety and transport of coal up to the incline mouth and material up to the working face.
- ii) 2% of capital cost of other equipment, i.e., equipment deployed in Electrical & Power Supply including Electronics & Telecommunication, Workshop, Pumps & Pipe Fittings and CHP Equipment.

During the Technical Sub-Committee Meeting held for Project Report of Tawa-II Expansion U/G Mine on 28-05-2010, it was directed by the committee mainly to include Maintenance Service Rate (on MARC pattern) in Departmental Option as WCL has no expertise in operating Continuous Miner departmentally. Accordingly, the latest Maintenance Service Rate and Maintenance Spare Parts of Sarpi U/G Mine, ECL was considered and the Store Cost was worked out after due updation in Recast P.R. for Jamunia U/G Mine prepared in January 2015.

Recently a meeting was held at WCL on 18.09.2015 in which it was decided to work out economics of Recast Project Report for Jamunia U/G Mine on Departmental Option considering operation and maintenance of C.M. Packages by WCL on its own as this technology is no longer new for WCL/CIL.

Accordingly, the store cost for Recast P.R. for Jamunia U/G Mine (September 2015) has been worked out with Repair & Maintenance Cost of all P&M including C.M. Packages as per CMPDI norms and considered in the cost of production.

24.10 GRADE OF COAL & WEIGHTED AVERAGE SELLING PRICE

The annual grade of coal despatch during its total life of the mine varies from grade 'G5' to 'G6' as per GCV depending upon the year wise location of working panels and seams. The weighted average sale value considering 98.5% of the year-wise grade of coal and Rs. 79/t as processing charge for dispatching (-) 100 mm size coal works out to Rs. 2263.62/t for Power Sector.

24.11 CAPITAL INVESTMENT, PROFITABILITY & IRR

The Total Capital Investment, Cost of Production, Profitability and IRR at 100% and 85% target capacity in Departmental Option (September 2015) is tabulated below:

Sl. No.	Parameters	Departmental Option	
		100%	85%
1	Total Capital Investment (Rs. Crores)	409.8748	
2	Cost of Production (Rs./t)	1684.24	1926.94
3	Average Selling Price for Power Sector (Rs./t)	2263.62	2263.62
4	Profit / Loss for Power Sector (Rs./t)	(+) 579.38	(+) 336.68
5	I.R.R. for Power Sector (%)	(+) 17.08%	(+) 12.17%

25.0 CONCLUSION

In this Recast Project Report for Jamunia U/G Mine, the Financial Evaluation has been worked out on only Departmental Option as on September 2015.

The Total Capital Investment works out to Rs. 409.8748 Crores. The Cost of Production is estimated to be Rs. 1684.24/t and Rs. 1926.94/t at 100% and 85% target capacity respectively.

With an average sale price of Rs. 2263.62/t for Power Utilities (Including IPPs), Fertilizer & Defence Sectors, the mine is expected to make a profit of Rs. 579.38/t and Rs. 336.68/t at 100% and 85% target capacity respectively.

The I.R.R. at 100% and 85% target capacity works out to (+) 17.08% and (+) 12.17% respectively for Power Sector.

The proposed Jamunia U/G Project is achieving desired IRR at 85% capacity for notified price of coal for Power Sector.


Area Planning Officer
WCL, Peach Area