CHAPTER – I
INTRODUCTION

1.0 Introduction

NT-ST-Jeenagora group of mines consist of three existing mines of Lodna Area of BCCL, namely, NTST OCP (256.15 Ha), Jeenagora OC (276.05 Ha) and North Tisra UG (246.24 Ha). These mines came into operation before nationalisation. In addition, the group also includes a very small part of Joyrampur UG. At present these mines are operating in NTST-Jeenagora Group of Mines.

The above Group of Mines are covered in Cluster IX for EMP. As per the approved Terms of Reference (TOR) in the proposed scenario (from April 2012 tentatively) for preparation of the Environment Management Plan of Cluster IX of BCCL, NT/ST (Exp) OCP is proposed to be worked by carving 755.15 Ha of land from the property of above four existing mines and additional 675.98 Ha land from outside coal bearing area for OB dumping and infrastructure. Hence the area of proposed NTST Expansion OCP is 1431.00 Ha which comprises 755.15 Ha land for mining and 675.85 Ha land from non-coal bearing area for OB dumping.

Within the proposed quarry area, there are three sanctioned opencast Mines viz. North Tisra OCP, South Tisra OCP and Sulunga- Jeenagora OCP (within Jeena Gora Colliery Boundary). All these projects are operating mines and are in the category of "Completed Projects of BCCL". In addition to these OCP's , there is one Underground production units in North Tisra Colliery boundary, namely 6 Incline .The underground production units along the three above mentioned opencast mine will be closed before merging into the proposed opencast project.

The present production from the different operational units is given in Table 1.1.

Table 1.1 Present Production Units – NT-ST-Jeenagora Group of mines

Sl. No.	Working Unit	Method of work with seam	Production ('12-'13) (MTY)	Remarks
1	NT/ST OCP	OCP (IV to I seam)	0.872	Shovel Dumper Combination by Deep Hole Blasting Method
2	Jeenagora OCP	OCP (IV Top to III seam)	1.057	Shovel Dumper Combination by Deep Hole Blasting Method
3	North Tisra UG	UG (IV BOTTOM)	0.095*	Bord & Pillar method with SDLs.

***** Likely to be closed soon due to OCP operation

This mine closure plan has been prepared on the basis of Project Report on NTST Expansion OCP & approved TOR/Form–I(Proposed Scenario) and data furnished by the officials of Lodna Area/ BCCL.

1.1 Name of mine owner / company

Project: North Tisra/ South Tisra (Expn.) OCP
Area: Lodna Area
Company: BCCL
Mine Owner: Director (Technical) (Operation), BCCL (Nominated)

1.2 Address for Communication with PIN and Phone nos.

PO : Khas Jeenagora
District : Dhanbad
State : Jharkhand
PIN : 828 115
Mob(Agent) : +91-9470596903

1.3 Location of mine:

Latitude :	$23^0$41’50’’ to $23^0$43’48’’ North
Longitude :	$86^0$26’14‘’ to $86^0$27’33‘’ East
Area :	Lodna Area
Coalfield :	Jharia Coalfield

1.4 Capacity of the mine

Mine started:	Proposed
Date of start of production:	Proposed
The capacity of the mines	6.0 MTY (PEAK – 7.8MTY)

1.5 Method of Mining including equipments deployment of in the area

There are three active units working in the lease hold area of NT/ST (Expn.) OCP as depicted in the Table 1.1. The NT/ST OCP is being worked in IVT, IVB, III, IIT, II B & I by opencast method using shovel & dumper combination, departmentally. Total O.B. of the running quarry is being dumped in decoaled area of the existing quarry on the floor of I seam. Deep hole blasting is being adopted for the quarrying. Blasted coal and overburden is further loaded by shovels on to the dumpers deployed for it. In Jeengora OCP, mechanised open cast mine is being worked in geologically IV Top, IV Bottom, & III seams. On an average IV Top seam & IV Bottom seams are 4.8m & 6.1m thick respectively while III seam is about 12m thick. IV Bottom has been developed in one section and SOP.

At North Tisra UG IV Bottom seam is being worked which has been extensively developed on B&P method of mining through 6 incline. The gradient of seams is suitable for the deployment of SDLs, wherever thickness permits. The average gradient of seam is around 1 in 5. It is, therefore will follow the B&P method of mining with SDL loading onto tubs. Apart from these three units, there is some part of Joyrampur UG mine considered in the proposed NTST Expansion OCP where VIII and IV Top seams are being worked at present. The seam IV (T) is being developed by Bord & Pillar with

SDL while the VIII seam is being depillared with stowing which will be replaced by V/VI Seam.

Seam IX/X, VIIIA, VIII, V/VI/VII, VII, V/VI, IVT, IVB, III, IIT, IIB & I have been considered for exploitation within the leasehold of the proposed NT/ST (Exp) OCP. The base of the quarry will be floor of I seam.

1.6 Coal Processing/ Beneficiation Operation

At present coal production from North Tisra UG is mostly linked by rail to steel sector and power plant through JGB No. 9 siding which is 2-3 km from the mine. Coal from pit head stock to siding is transported by road contractually. A part of its production is linked to various private cokeries through road. Coal from NT/ST OC is being dispatched through JGB No. 9 and 6 sidings for different thermal power stations. Road linkage for public sale is being carried through E-Auction. The production from Jeenagora OC is being sent to power house by rail. Some coal is being transported through road sale.

In proposed NT/ST (Expn.) OCP, the non-coking coal from the project will be linked to thermal power station. NLW coal will also be linked to TPS till it is unacceptable to SAIL/Washery. Coking coal (S-II to W-IV) will be linked to SAIL/Washeries. Jhama will be linked to cement companies, refractories etc.
No beneficiation is envisaged for the current output of the group of mines.

1.7 Total Lease/Project Area involved:-

Existing	:	755.15Ha
Proposed	:	1431.00Ha(including existing)
Total	**:**	**1431.00Ha**

1.8 Type of Lease /Project Area (Ha):-

Table 1.2 Type of Lease Area

Sl. No.	Particulars	Mining Area(Ha)	Outside mining area (Ha)	Total * (Ha)
1	BCCL land	568	65	633
2	Forest land	Nil	17	17
3	Govt. land	22	65	87
4	Tenancy land	60	616	676
5	Others (Rly. Land)	18.0	Nil	18.0
	Total	668.0	763.0	1431.0

*Includes 675.98 Ha of land outside of Cluster IX, proposed to be used for external dumping.

1.9 Communication and Physiography

The proposed NT/ST (Exp) OCP is well connected by rail and road. It is about 15Km south of Dhanbad town. The Jharia – Baliapur District Board road passes parallel to northern boundary and Patherdih-Pradhankhanta Rly. Line passes adjacent to southern boundary of the project.

The area has an undulating topography with a gentle slope towards west. The mining activity which is going on in the area since long time has severely obliterated the general topography. The maximum ground elevation of 202m has been observed in the north-eastern part while the minimum elevation is 163m in south-western part at BH No. ST-2. The drainage of the area is controlled by southerly flowing Tisra jore on the west side of the property.

1.10 Type of Present and Proposed Land Use of mining area (Ha)

Table 1.3 Land Use of Mining Area(Based on Mine data)

Sl. No.	TYPE OF LAND USE		Present mining land use (in Ha)	Post mining land use (in Ha)
1	Running quarry	Backfilled	47.11	0.00
		Not back filled	63.77	0.00
2	Abandoned quarry	Back filled	115.40	0.00
		Not back filled	35.85	0.00
3	External OB dump		45.93	0.00
4	Service Building/ Mine Infrastructure		36.61	25.00
5	Coal dump		5.42	5.00
6	Road & Rail		27.04	18.00
7	CHP/Siding			45.00
8	Homestead land		680.21	0.00
9	Agriculture land		6.00	0.00
10	Forest land		17.00	17.00
11	Plantation		20.80	886.93
12	Water body		9.62	164.46
13	Barren Land		320.24	269.61
	TOTAL		**1431.00**	**1431.00**

1.11 Statutory Approvals

Table 1.4 Statutory Approval Status

Sl. No	Particulars	Status
A	Mine plan / F.R / P.R	Formulated
B	Forestry clearance	Under process
C	Env clearance	Under process
D	Consent to operate	Existing Mines
E	Any other approval from Central / State regulatory authorities for operating mine with special reference to mine closure.	Mine closure plan to be approved by BCCL Board of Directors.

1.12 Reasons for Closure

The proposed NTST Expansion OCP has been planned after merging the properties of existing NTST –Jeenagora group of mines for a nominal capacity of 6.0MTY having an extractable reserves of 145.08MT. With this rate of production, the life of the project will be 30 years. This includes 2 years of pre-construction period, 2 years of construction periods and 26 years of production periods. There may be a scope of expansion of the mine further dip-side after reaching the proposed boundary as per the PR. In such situation, it is proposed that a new Mine Closure Plan should be prepared in the changed scenario.

A Report titled "***Draft scheme for dealing with fire by excavation method below Dhanbad-Patherdih Railway Line at Lodna Area (XI/XII Seam Base)***" was prepared and the Report is likely to be implemented in future to deal with the seams on fire. If the proposal is implemented, it is proposed that a Revised Mine Closure Plan should be prepared, taking into account the new emerging scenario.

Any mines in this group may be closed in future on account of exhaustion of economically recoverable coal reserves in the lease hold area before the start of the expansion project. It may also be closed on account of other unforeseen reasons i.e. Force Majeure or directives from statutory organizations or court etc. for which information and notices shall be served to concerned Government authorities and departments. Under such conditions, a revised Mine Closure Plan should be prepared. As per guidelines of Ministry of Coal, Govt. of India, mine closure plan has to be submitted along with the mine plan for getting competent approval within one or two years of date of approval of mine plan.

1.12.1 Need of Mine Closure Planning

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. it alters or tries to alter the in-situ field stress, ground water, surface drainage system as well as the socio-economic

condition. Although mining activities are usually short term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mind set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues like reclamation, environmental protection and rehabilitation of disturbed area which should be acceptable to local community as well as the regulatory authority. Community acceptable implementation of mine closure plan bound to incur some extra cost. Neglecting this aspect will lead to future problems of attending compensation or may creep up expensive socio-economic problems.

Mine closure encompasses the restoration process designed to restore physical, chemical and biological quality disturbed by the mining activities. Mine closure is not just something that happens at the end of a mine's life, rather mine closure is an ongoing series of decisions and activities beginning in the pre-mining stage of mine and ending with a creation of self sustainable site that can be returned to the community.

Thus, a mine closure plan needs to define the liabilities, responsibilities and authorities of the different agencies like the mine management, other regulatory bodies, Central and State Governments after mine closure.

Various objectives of the advance mine closure planning are as given below.

a. To allow productive and sustainable after-use of the site, which is acceptable to the mine owner and the regulatory authority
b. To protect public health and safety
c. To eliminate environmental damage and thereby encourage environmental sustainability
d. To minimize adverse socio-economic impacts of mining activities
e. To protect the flora and fauna of the area affected by the mining
f. Effective use of the assets created during the course of mining

Primarily, the mine closure activities are planned in two stages. The initial plan identifies the activities required to be executed in line with the mining activities in progress, after the inception of the project, i.e., progressive mine closure activities. These activities may undergo subtle changes depending upon the actual site condition during implementation. Finally, a detailed closure plan is to be prepared 4-5 years before the actual closure time of the mine depending upon the existing parameters at that point of time, i.e., final mine closure activities.

1.12.2 Mine closure planning strategy in respect of NT-ST-Jeenagora Group of mines based on existing set of parameters

As the balance life of the mine is 30 years from now for the seams proposed to be worked , following activities are envisaged towards mine closure programme in respect of NT-ST-Jeenagora Group of mines.

a. Progressive mine closure activities will continue as envisaged in the project report and as enumerated in the various approvals, permits, consents etc. The progressive Closure activities are funded by levying a charge of ₹ 5.50/Te of coal for opencast mines.

   The recent guidelines issued in this regard by MoC, GoI will also be followed.

b. Although, it is very difficult to foresee the likely impacts due to closure of the mining activities in the leasehold area of the project, but in the present report, the same has been estimated and some mitigating measures have been suggested accordingly. These suggested measures along with certain other measures, as deemed fit, at the time of closure of mining activity in the seams being worked at present shall be taken up.

c. The final closure plan carrying the finer details would be prepared at the time of preparing the mine plan for last mineable patch of coal seam in the leasehold area of the group.

1.13 Approval of Company Board of Directors or any other competent authority

The closure plan will be placed to Board of Directors of BCCL for approval.

CHAPTER – II

MINE DESCRIPTION

2.1 Geology of the group

Geology of the block has been established by surface and sub surface data. The leasehold area of the NT-ST-Jeenagora Group of mines is entirely covered by Barakar formation. The coal bearing rocks of Barakar formation of Permian age occur in the NT-ST-Jeenagora Group of mines is located on the eastern edge of Jharia Coalfield, where rocks of Talchir, Barakar & Barren Measures are exposed in patches. However NT-ST-Jeenagora Group of mines is generally covered by soil which is underlain by the coal bearing rocks of the Barakar Measures.

A total of 44 boreholes have been drilled in time phases in the entire project. In addition, data of adjoining 10 boreholes have also been considered for the evaluation of geological features. The borehole density in the area is approximate 8/Sq. Km.

2.1.1 Geological Structure of the area

Dip & Strike

The general strike of the formation is North-South. In the small strip, strike of the formation swings to NNE-SSW, in the southern/south-western corner of the assessment area. The amount of dip varies from 8^0 to 11^0 westerly. The dip is however, steep towards southern part, adjacent to Fault F6-F6, because of the proximity of the area to the major fault.

Faults

A total of 7 faults having throw ranging from 2m to 20m have been deciphered in the area.

Pyrolitisation

The area is free from pyrolitisation, however seam II (Bottom) and I seam have been affected due to pyrolitisation in small part of the area, and the seam is partially/fully burnt in small part of the area.

2.1.2 General Description of coal seams

In NT-ST-Jeenagora Group of Mines, detailed drilling has proved existence of number of workable coal seams of over 0.50m thickness from XI/X to I seam.

2.1.3 Seam sequence

The generalised sequence of coal seams and the intervening partings in proposed NT/ST (Exp) OCP are given in Table 2.1.

Table 2.1 Generalised Seam Sequence and Parting

Seam/Parting	Thickness (m)	
	Minimum	Maximum
IX/X	8.17	12.06
P	14	38
VIIIA	1.00	5.47
P	4	30
VIII	1.45	3.93
P	2	3
V/VI/VII	15.10	17.74
P (VIII to VII)	3	22
VII	5.02	9.57
P	2	20
V/VI	4.32	8.44
P	20	33
IV TOP	1.52	6.95
P	13	19
L-5	0.76	2.60
P (L-5 to IVB)	2	6
P(IVT-IVB)	12	29
IVB	1.98	7.02
P	18	33
III	8.60	19.81
P	1	16
II TOP	0.90	5.75
P	1	13
II BOT	1.22	7.46
P (III to II Comb)	3	6
II (Comb)	5.80	7.6
P (IIB to I)	2	18
P (II Comb to I)	4	13
I	1.82	8.28

2.1.4 Reserves, Types and Quality

Balance mineable reserves have been given in the Table 2.2.

Table-2.2 Seam wise Grade & Reserve(as per PR)

Seam	Grade	Bal. Min. Res. (MT)
IX/X	W-IV	1.08
VIIIA	W-IV	2.27
VIII	W-III	2.69
V/VI/VII	W-IV	3.16
VII	W-IV	4.99
V/VI	W-IV	9.19
IVT	F	9.42
L-5	D	1.21
IVB	F	11.52
III	E	52.42
II Comb	E	5.32
IIT	D	7.42
IIB	E	12.37
I/I & IIB	W-IV	22.02
		145.08

Note: The reserve data estimated is based on the actual situation prevailing in the area. This reserve includes jhama also.

2.2 Mining Details

2.2.1 Boundary Details of NT-ST-Jeenagora Group of mines

North: - Colliery boundary between N. Tisra & Goluckdih/Kujama Collieries.

South:- Incrop of I seam in Bhulan Bararee thrust zone

East:- Intcrop of I seam and Metamorphics.

West:- 200m margin from incrop of XI/XII seam

2.2.2 Present Working Seams

North Tisra/South Tisra Opencast Mine: This opencast mine is operating within the sanctioned area and exploiting IV to I seams. Present production level is 0.872MTY.

Jeenagora Opencast (Patch): Production from III, IVB & IVT seams are being done in the name of Jeenagora (Patch) OC. OB Dumping in being done internally over the coal bearing area. Present production level is 1.057MTY.

Thus, total production from l these two opencast mines is 1.929MTY.

North Tisra UG: Total production from the underground unit from within the proposed quarry area is 0.095MTY. The winning of coal is being carried out from IVB seam.

2.3 Mining Methods

The proposed NTST Expansion OCP opencast is an expansion of the existing opencast mines. In the existing opencast mines, though infrastructure has been created but they are suitable for small level of production. The proposed opencast is a large mine with higher level of mechanisation. Therefore, all necessary infrastrcture need to be created for the larger project.

In the first two years of implementation of the proposed project (1st & 2nd) land will be acquired and shifting / rehabilitation of houses will be done to make the site available for working. During 3rd & 4th year of the project necessary infrastructure will be created like Workshop / Store, Power Supply arrangement, Feeder Breaker, Railway Siding etc. During these four years of construction (1st to 4th) of the expansion project, existing opencast mines will continue to produce coal & excavate OB. In fact the operation of the existing mines will be tailored to prepare the mine for larger level of mechanisation for the proposed 6.0 mty Opencast.

OB excavation and coal production from the proposed opencast will start by 5th year of operation and target will be achieved by 6th year. By this year all major construction activities will be completed for sustaining the production level for the entire project life.

2.3.1 The status of working and fire in different seams:

The status of exploitation of various coal seams and the area under fire considered in this report is based on the mine working plan supplied by the colliery authorities. The status of working and the fire limit of different seams are given below:

IX/X Seam: This seam has been extensively worked by UG method. The seam has been goaved in major part of the area and is under fire. This seam has also been quarried out in outcrop region.

VIIIA Seam: This seam has been quarried out in patches along the incrop region and extensively worked by underground method in major part of the area. The seam has been goaved also in major part, particularly in northern side of the area. The seam is under fire in northern part.

VIII Seam: The seam has been extensively worked by UG method. It has been quarried out along the incrop region. The seam has been goaved also in major part. The seam is under fire in northern half of the area.

V/VI/VII Seam: This combined seam is restricted to northern part of the area. The seam have been developed in two sections and quarried also towards incrop side. The seam is goaved at places. Seam is on fire in the northern part of the area.

VII Seam: This seam is quarried out in major part of incrop region. The seam has been worked through inclines in major part. It is developed in one section in major part and two sections working in small area in Jeenagora colliery only. The seam has been goaved also in patches. The part area of the seam is on fire also.

V/VI Seam: This seam is also extensively developed in the entire area and quarried out in incrop region. The seam has been goaved also in central part of the area. The seam has been developed in one section by underground method. The seam is under fire also in part area.

IV Top Seam: The seam is quarried in incrop region only and the seam is virgin in major part of the area. It has developed also through underground working in Jeenagora Colliery only.

IV Bot. Seam: The seam has been worked by underground method and it is quarried also. In small part, the seam is goaved and depillared.

III Seam: The seam has been quarried out in incrop region and it is extensively developed also. Two section of workings have been done in major part of the area.

II Top Seam: This seam has been mainly worked by opencast method. Underground development is restricted to South Tisra colliery only.

II Bot Seam: This seam is developed by UG method in major part of the area and quarried also in incrop region. The seam is virgin in dip side.

I Seam: This seam is developed only by underground method. In the northern side, the seam is goaved in incrop side. The seam is quarried also in small part.

2.3.1 OB dumps and their status

Table 2.3 OB Dump Status

	External OB Dump	Internal OB Dump
Nos.	Nil	4 (D1, D2, D3,D4)
Area (Ha)	Nil	(D1=31.9, D2=65.4, D3=7.15,D4=11) Total=115.45
Volume (capacity)	Nil	35 million Cum
Height (m)	----	D1=50, D2=70, D3=40,D4=50
Status	----	Active- D1, D2, D4 Dormant-D3

2.3.2 Depth of Workings & Mine Entries

At present all working seams occur at depth of 102 m in the quarry. All the underground mine entries except for the Incline of NT UG in the leasehold area are sealed or dozed off.

The details of existing outlets of North Tisra UG are as follows :

Name of the Outlet	Sunk in	X-sec. (mXm)	Purpose	winder/ Fan
1/6 Incline	IV Bot.	3.5X2	Intake, production	Haulage – 115 KW
3/6 Incline	IV Bot.	3.0X2	Intake, travelling	
Fan drift Adjacent to 3/6 Inc.	IV Bot.	4.25X2	Return	Fan- PV-160

2.3.3 Major Equipments

Table 2.4A List of major opencast equipment at NT ST OC

SL. No.	Existing Equipment	Annual Productivity/ Eqpt (MM^3)	No. Of Equip ment	Total annual Capacity (MM^3)
A	EXCAVATION CAPACITY			
1	5.0 m^3 Elect Rope Shovel with RD – 35 T	0.86	07	6.02
2	2.7 m^3 Elect. Hyd Shovel with RD – 35 T	0.65	02	1.3
3	1.3 m^3 Diesel Backhoe with RD – 35 T	0.40	01	0.40
4	1.2 m^3 Diesel Backhoe with RD – 35 T	0.30	01	0.30
5	Dragline 6/45	1.00		1.00
B	TRANSPORTATION CAPACITY (Avg. Lead - 1.00KM)			
1	Rear Dumper 35 Te with 5 m^3 Electric Rope Shovel		28	
2	Rear Dumper 35 Te with 2.7 m^3 Electric Hyd Shovel		06	
3	Rear Dumper 35 Te with 1.3 m^3 Diesel Backhoe		03	
4	Rear Dumper 35 Te with 1.2 m^3 Diesel Backhoe		03	
C	MINE CAPACITY (MM^3/Year)			

Table 2.4B List of major opencast equipment at Jeenagora OC

Sl No	Existing equipment	Bucket capacity (m^3)	No of equipment	Annual capacity Mm^3.
1	EKG - 399	5	1	0.86
2	EKG - 266	4.6	1	0.79
3	EKG - 519	5	1	0.86
4	H-55 (HYD)	3.3	1	0.68
5	TATA Hitachi (HYD)	2.8	1	0.54
	TOTAL	**--**	**5**	**3.73**
DUMPER				
1	35 Te Rear Dumper	--	21	(0.18 x 21)= 3.78
2	Water tanker	--	1	--
	TOTAL		**22**	**3.78**
DRILL				
1	IDM – 30 (160 mm)	--	1	N/A
2	IDM – 70 (250 mm)	--	1	N/A
3	R (Colla) (150 mm)	--	1	N/A
4	ICM – 260 (100 mm)	--	1	N/A
	TOTAL	--	4	N/A
DOZER				
1	155 D	320 HP	3	--
Crain	9 (T)	--	1	--
Motor Grader	Middle Blade	135 HP	1	--

Table 2.4C List of major UG equipment at North Tisra UG

Sl No	Existing equipment	No of equipment
I	**SURFACE**	
1	Haulage 150 HP	1No
2	Ventilation Fan PV -160	1No
II	UNDERGROUND	
1	SDL	3 nos.
2	Endless Haulage 50 H P	1 no.
3	Direct Haulage 75 H P	2 nos.
4	Main Pump 150 H P	2 nos.
5	Pump 70 H P	2 nos.
6	Air Compressor 60 H P	3 nos.
7	T S U (315 KVA)	4 nos.
8	Main Pump 1000 GPM	1 no.

Table 2.4D List of major opencast equipment proposed at NT-ST-Jeenagora Group of Mines(NTST EXPN. OCP)

Sl.No.	Particulars	Peak Population
A.	**HEMM for OB**	
1	10 m^3 Electric Rope Shovel	8
2	5 m^3 Electric Rope Shovel	2
3	250 mm (Elec.) Drill	8
4	160 mm (Elec.) Drill	2
5	410 HP Dozer	8
6	320 HP Dozer	2
7	85 t RD	96
8	35 t RD	26
B	**HEMM for Coal**	
1	3.8-4.2 m^3 Elec. Hyd. Shovel	4
2	2.8 m^3 Elec. Hyd. Backhoe	1
3	160 mm (Elec.) Drill	5
4	320 HP Dozer	6
5	35 t RD	47
C	**Common for HEMM**	
1	280 HP Motor Grader	2
2	50 t Rough Terrain Crane	1
3	10 t Vibratory Roller for Haul Road	2
4	Jack Hammer Drill	10
5	3.96 m^3 / min Compressor	4
D	**HEMM for Misc. Activities &for Ecology & Environment**	
1	1.5 m^3 Diesel Hyd. Backhoe	2
2	8.5 m^3 / 10 t Tipper	8
3	28 KL Water Sprinkler	3
4	Mobile Env. Lab. Van	1
5	410 HP Dozer (for Reclamation)*	4

Infrastructure Facilities:

Existing

A) Magazine – Location, capacity and Licence no.

NT-ST OC has surrendered its license. At present required explosive is procured from the Magazine located in the leasehold area of the Barari Colliery. The specification of the Magazine is given below:

Location – west side of 6 Pit.

Capacity:

E- 25 (6) 962/ BI-1143	E-25 (6) 964/ BI-1145
Explosive class – 3. 1950 Kg.	Explosive Class – 3. 1950 Kg.
Class 6, Div- 1, 10,000 mts.	Class-6, Div I , 5000 mtrs.
Class 6, Div 3 5000 Nos.	Class 6, Div 2 5000 mtrs.
Class 6, Div 44000 Nos.	Class 6 Div 3 44, 000 Nos.
As any one time shall not exceed	At any one time shall not be exceed.
Not more than 10 times shall be in a month.	Not more than 5 times shall be in a month
Area - 6300 m^2	

B) Workshop

Existing:

NT-ST OC

Two workshops (one for NT OCP and other for STOCP) with independent store have been functioning with all required facilities including required manpowers.

Jeenagora OC

The repair and maintenance of excavation equipment are being done at the Jeenagora OCP Excavation Workshop. This workshop has the following facilities:

1. Washing of dumpers.
2. Welding.
3. Charging of batteries.
4. Auto repair shed.

5. Dumper shed.
6. Diesel fuelling shed.

North Tisra UG

There is a Pit Head Workshop. Help is taken for major works from Area Central Workshop. The colliery store is available. We are collecting materials from Lodna Regional Store and preserving the materials at Collieary Store from where the Mine is served.

Proposed:

A workshop has been proposed to render services to routine maintenance, minor as well as capital repair of the equipment envisaged for N.Tisra / S.Tisra (Expansion) OCP. Both Excavation Workshop and E & M Workshop will be for maintenance of departmental equipment. Storage facilities will be provided for storing spares and consumables required for the Project. Mobile crane and fork lift truck have been provided for material handling and transportation

C) Fuelling station:

Existing:

There is a Diesel fuelling shed is available at Jeenagora OC.

Proposed

For fuelling the vehicles, fuelling stations fully equipped with required facilities has been provided. Racking System for stores has been provided for proper placement of consumables.

D) Pumping and Drainage

Existing: The seams encountered in this project are IX/X, VIIIA, VIII, VII, V/VI/VII, V/VI, IV T, IV B, III, II T, II B & I. Most of the seams are developed to varying extent. Presently the quarry operates up to II seam for which 3 nos. of submersible pumps are deployed for dewatering the needs of the quarry. Boreholes for these pumps extend up to 112 M depth in I seam. These three boreholes are located on the dip most side of the present quarry boundary.

North Tisra UG

Underground water from faces and developed area is collected in underground main sump. Coal particles and other solid tiny particles are settled in the main Sump. The fresh water is discharged by main pumps to surface in tank through boreholes.

Details of the pumps are given as follows:

Seam	Pump No.	Details of Pumps			Location Dip/ Level	Delivery through pit/inc./ BH	Discharge at settling tank/Nala/ River
		GPM	Head	KW			
IV Bot.	1	1000	200 m	110	-2 Dip, 35L	BH	Tank
	2	600	150 m	110	M/D, 36L	BH	Tank
	3	600	150 m	110	1Dip, 36L	BH	Tank

- Pumping Hours/day : 16 hrs
- Make of Water in Monsoon : 2000 GPM
- Make of Water in Lean Period : 1400 GPM
- Installed Capacity of main Pumps : 2200 GPM
- Quantity of Water Discharged on Surface :

Jeenagora OC

Present pumping arrangement

Presently 3 Bore holes submersible pumps are in operation with capacity of 500 GPM.

Total 500 x 3 = 1500 GPM.

Period	Installed capacity in GPM	Total Discharge (KLD)	Quantity wise use (KLD)				
			Domestic	Industrial	Other	Sulungajore	Total
Lean	500	1600	70	200	15	1315	1600
Monsoon	1500	4800	70	100	15	4615	4800

NTST OC

- Installed capacity of main pumps discharging water to surface – 1600 GPM.
- Quantity of water being discharged to surface – 1000 GPM.
- Point of discharged of water – Surface
- Use of discharged water.

  Industrial use – 252 KLD.
  Domestic – 200 KLD.

Proposed: Considering the project area, ultimate depth and life of the mine, the pumping capacity has been proposed to cover the entire mining activities under single stage of pumping operation. With the basic considerations as above, make of water has been estimated as 446512 Cum. (98.26 million gallon.) and the pumping requirement for the mine works out as to 21.55 Cum (It includes 30% reserve pumping capacity) up to the end of the project.

Water settling tank / pond (cemented floor) of 0.6 million gallon capacity has been envisaged for this project. This tank will be suitably located between the outside edge of quarry and Tisra river. The pumped out quarry water will be discharged into the proposed settling tank. Dust / contamination will be settled in the pond. Overflow water will be discharged into theTisra Jore.

In a separate fire dealing report titled “Scheme for Dealing with Fire at Lodna Area below DP Rly. Line (XI/XII Seam Base)” a surface water reservoir will be provided near Bararee Colliery site. This water reservoir will act as a reservoir for this project too.

The proposed reservoir receives water from pumping discharge of various collieries of Lodna Area (viz. Joyrampur, Bararee, Bagdigi, Lodna & Jealgora). The water from respective collieries will be guided into the reservoir from where water will be pumped to fire dealing site / faces of the proposed opencast.

E) Proposed Surface Coal Handling

Feeder Breaker

Six (6) nos. of feeder breakers having each of 300 to 350 tph capacity have been proposed for sizing of ROM coal down to (-) 100 mm to handle proposed production. The proposed feeder breaker will be installed near the Railway siding which will be located at SW corner of the proposed opencast mine.

Belt Conveyor

The crushed coal will be carried out by an elevating belt conveyor for a distance of about 100 m.

Loading & Transport arrangements

Loading of coal at surface stock yard into tippers as well as at Railway siding into wagon will also be arranged by BCCL with leased out equipment. This is as per present practices prevailing in BCCL mines. The tippers for transportation of coal from surface coal dump to the site of feeder breaker and to transport sized coal from hopper of the feeder breaker to spread all along the length of the proposed Railway siding will be arranged and organised by BCCL management with leased out equipment.

Railway Siding

There will be two nos. of conventional Railway siding of full length for accommodating two nos. of full rake capacity (each of 58 box wagons) proposed for this OCP. The loop take up arrangement for this siding will be such that there will be single entry at one end and single exist point at other end drawn from Patherdih Rakhitpur main line.

F) Power Supply Arrangement

Existing:

At present North Tisra , South Tisra and Jeenagora colliery receive power at 11 kV from Goluckdih 33 kV sub-station of BCCL. For power supply to these three collieries , three Nos. of 11 kV feeders viz. North Tisra , South Tisra and Jeenagora feeders emanate from one 7.5 MVA 33 / 11 kV transformer installed at Goluckdih sub-station .

The existing electrical load on these three feeders is as follows

a) North Tisra Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
Chhat Talab	2500 kVA 11/3.3 kV	North Tisra u/g (6 Incl.)
No.6 sub-stn.	2 MVA 11/3.3 kV 500 kVA 11/.55 kV 500 kVA 11/.44 kV	North Tisra OCP
Borehole sub-stn.	500 kVA 11/.55 kV	Submersible pumps
LUJ sub-stn.	500 kVA 11/.55 kV	LUJ pit colliery
No.6 Feeder Breaker	2 x 500 kVA 11/.55 kV	No.6 Feeder Breakers

b) South Tisra Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
G.J sub-stn.	3150 kVA 11/6.6 kV 630 kVA 6.6/.44 kV	South Tisra OCP - Dragline - Drill
South Tisra sub-stn.	2 MVA 11/3.3 kV 500 kVA 11/.55 kV 250 kVA .55/.44 kV	South Tisra OCP

c) Jeenagora Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
B.J. sub-stn.	250 kVA 11/.44 kV 300 kVA 11/.55 kV	Light Submersible pump
No.9 Feeder Breaker	1000 kVA 11/.55 kV	No.9 Feeder Breakers
K.T. sub-stn.	1000 kVA 11/3.3 kV 500 kVA 11/.55 kV 250 kVA 11/.44 kV	Jeenagora OCP Submersible pumps Light
E.B. sub-stn.	1000 kVA 11/.55 kV 300 kVA .55/.44 kV	Submersible pumps Light

Existing NTST OCP receives power at 3.3 kV by two Nos. of overhead lines which run along the periphery of the quarry to feed quarry bed power consuming units. From the Golden Jeenagora sub-station two Nos. of 6.6 kV overhead lines run to the quarry bed to feed power to one Dragline and one Drill at 6.6 kV.

Jeenagora OCP receives power at 3.3 kV by two Nos. of overhead lines coming from K.T. sub-station and running along the periphery of the quarry.

No. 6 Incline and LUJ pit colliery receive power at 11 kV from North Tisra Feede

In the proposed scheme Existing North Tisra, South Tisra and Jeenagora Opencast mines will continue to work for about four years. Thereafter, they will be merged and expanded to one single project viz. North Tisra / South Tisra (Expansion) OCP. Existing underground mines viz. N.Tisra 6 Incline will also be closed in due course. LUJ Pit of N.Tisra is already closed. Till then the existing power supply system of these mines will continue.

The following existing substations being used for No.6 Incline , LUJ pit colliery, and North Tisra , South Tisra and Jeenagora Opencast mines are proposed to continue till the new expanded Opencast project comes :

Sub-station	Being used for
No.6 sub-station	North Tisra OCP & No.6 Incline
LUJ pit sub-station	LUJ pit underground colliery
South Tisra sub-station	South Tisra OCP
Golden Jeenagora sub-station	South Tisra OCP
K.T. sub-station	Jeenagora OCP

After merger of the two OCPs, these sub-stations will be removed along with their overhead line feeders.

At present one No. 7.5 MVA 33 / 11 kV transformer installed at Goluckdih 33 kV sub-station feeds power to different collieries of North Tisra , South Tisra and Jeenagora area . In the proposed scheme , to meet the increased power demand of the Noirth Tisra / South Tisra (Expansion) OCP (Approximately 3 MVA over existing load) , the installed transformer capacity of Goluckdih 33 kV sub-station is required to be strengthened. One more 7.5MVA 33 / 11 kV transformer is proposed to be installed at Goluckdih 33 kV sub-station for this purpose . Thus , two Nos. of 7.5 MVA 33 / 11 kV transformers installed at Goluckdih 33 / 11 kV sub-station shall be used to meet the power demand of the new North Tisra / South Tisra (Expansion) OCP. From each of these two transformers three Nos. of 11 kV feeders will emerge for North Tisra / South Tisra (Expansion) OCP. Other existing power consuming units connected to the existing 7.5 MVA transformer shall continue to receive power from this transformer in addition.

Proposed:

Following sub-stations are proposed to be installed for North Tisra / South Tisra (Expansion) OCP for its various power consuming units :

Quarry sub-station – I : For HEMMs and pumps in the quarry
Quarry sub-station – II : For HEMMs and pumps in the quarry
Feeder Breaker sub-station – I : For 3 Nos. of Feeder Breakers
Feeder Breaker sub-station – II : For 3 Nos. of Feeder Breakers
Workshop sub-station : For HEMM and E&M workshop
Office building sub-station : For office building and other infrastructures

Two Nos. of 11 kV sub-stations viz. Quarry Sub-station-I and Quarry Sub-station-II will be installed near two nos. of entries of the quarry. These two sub-stations shall receive power at 11 kV by two nos. of separate Overhead Line feeders from Goluckdih sub-station. All the quarry power consuming units shall be fed power from these two substations.

Two more 11 kV Feeders will emanate from Goluckdih sub-station and shall run along the quarry periphery to the proposed location of Feeder breakers and workshop. They will feed power to the Feeder Breaker Sub-station-I, Feeder Breaker Sub-station-II and Workshop at 11 kV.

ii) Quarry Power Supply :

Installed transformer capacity of Quarry Sub-station-I and Quarry Sub-station-II will be as follows :

2 MVA 11 / 6.6 kV Transformer - 2 Nos.
2 MVA 11 / 3.3 kV Transformer - 1 No.
250 kVA 11 / 0.415 kV Transformer - 1 No.

a) Power Supply to HEMMs :

From the proposed Quarry sub-station I and II, 6.6 kV and 3.3 kV overhead lines will run along the periphery of the quarry for power supply to HEMMs and other quarry power consuming units in the quarry bed.

G) Telecommunication

EPABX system with 200 lines is proposed to be installed for the project with telephone sets in the office building, other infrastructural building and at all other strategic points. RAX sets of BCCL network shall also be provided at all strategic points.

H) Existing Infrastructural facilities available (Road, water supply etc.) :

NT-ST OC

Non metal Road is available from the mine area to nearest DB Road (Lodna and Jharia) leading to Dhanbad - Sindri. The water supply to residential areas is only through borehole pumps. Mine water is used for industrial purposes like sprinkling in the road as well as for washing of HEMM.

Jeenagora OC

Pucca Road has been provided from mine area to the nearest Bhaga – Jeenagora D.B. Road, which connects office & work shop to area office and dispensary.

North Tisra UG

D.B.Road - Jharia-Lodna DB road passes through the middle of the property**.**

Company's Road. – Network of kuchcha/pucca colliery roads exist in the leasehold of the Mine.

Water supply – Drinking water is supplied from MADA (200 KLD) through pipe network. For other miscellaneous domestic work mine water is supplied (350 KLD).

I) Existing effluent treatment plant & sewage treatment plant (Mine & Colony) with quantity per month:

There is no such plant available in the Mine. However, domestic effluent is disposed off in soak pit and solid waste is dumped off in abandoned quarry.

J) Location of Hospital, School, habitation and their distance from the mine:

NT-ST OC

Location	Distance from OCP
Hospital Near Colliery OCP workshop	1.0 KM
School Near project office	1.0 KM
Habitation within lease hold area	1.2 to 3.0KM

Jeenagora OC

1. One Dispensary with duly qualified Doctor, Paramedical staff and other staff has been functioning inside the mine for the treatment of employees.

2. Well equipped Regional Hospital is available for the whole Lodna Area.

3. Primary Schools situated within half kilometres and High School with in 5 KM. Sulunga Basti is situated within 1 KM.

North Tisra UG

Sl. No.	Name of Feature	Location	Distance (Km.)
1.	Middle School	Madhuban, Lodna Section	2
2.	Colliery Hospital	MOCP Colony	1
3.	Regional Hospital,	Lodna	7
4.	Central Hospital	Dhanbad	16
5	Residential Buildings along DB Road, Tilabani Basti, Madhuban Lodna Area, Depo Dhowra.	Within leasehold area of the Mine.	

2.5. Details of coal beneficiation plant and its use after closure of mine

There are no coal beneficiation arrangements in the leasehold area.

CHAPTER – III

CLOSURE PLAN AND RELATED ACTIVITIES

3.1 Closure Planning details of mine

The progressive mine closure activities will continue as envisaged in the project report and as enumerated in the various approvals, permits, consents etc. It is very difficult to predict the various parameters which would be prevalent at the time of final mine closure and also to foresee the likely impacts due to closure of the mining activities (when the entire reserve in the block would get exhausted). However, broad mine closure activities need to be identified under the various heads.

The mines falling in the NTST-Jeenagora Group are covered in Cluster IX for the purpose of EMP.

3.1.1 Mined out land & proposed final land use

After completion of mining activities, the quarried area shall be reclaimed by developing ponds, water bodies and plantation, which will not only improve the aesthetic value of the area but also be used for some productive purpose like pisciculture and water supply to the local communities. Formation of water bodies which develops aquatic life and with the plantation around it will lead to restoration of ecology of the area.

At present opencast mine is being worked in IVT, IVB, III, IIT, IIB and I seams, which along with other seams(upto X Seam) have balance extractable reserve of about 145.08 MT.

The proposed conceptual post-mining land use plan vis-à-vis present land use is provided in Para 1.10.

a. Total Mined out area (Ha) – Present + Proposed----568.38 Ha
b. Backfilled area (Ha)---------- 403.93 Ha.

c. Balance left mined out area (Ha) which will not be backfilled--164.59 Ha.
d. The balanced left mined out area will be developed into ponds which will be used for Pisciculture & water supply to the local villagers.

As regards, the underground void, if any, which will remain at the time of closure of the mine, the same will get gradually filled with water. The necessary precautions for the safety of the neighboring mine would be taken care of before deciding the voids to get water filled. Further, the water filled in UG voids will help in maintaining the water level in the nearby area. The Pit/Shaft will be covered with RCC structure with suitable opening for future inspection by competent person.

3.2 Water quality management

3.2.1 Drainage pattern of the area (pre and post closure)

3.2.1.1 Existing drainage pattern

The area has an undulating topography with a gentle slope towards west. The maximum elevation of 202m has been observed in the North-eastern part while the minimum elevation is 163m in the south-western part. The drainage of the area is control by the southerly flowing Tisra Jore on the west.

3.2.1.2 Post closure drainage pattern

Major area of the mine will be quarried out. Kuccha garland drain will be made around the periphery of the quarry. This garland drain will be connected to Tisra Jore which is not likely to be disturbed by mining operation. Thus, this garland drain will drain off the rain water away from the mine. Various measures to prevent water pollution will be taken.

3.2.2 Water Quality Status of Surface and Ground Water

3.2.2.1 Present Practice

The samples were analyzed for relevant physical, chemical and bacteriological parameters for drawing up the base line data.

All the basic precautions and care were taken during the sampling to avoid contamination. Analysis of the samples was carried out as per established standard method and a procedure prescribed by the relevant IS codes and standard methods (AAPHA).

Standards followed

Standard for mine water - GSR-742(E):2000
Standard for surface water - IS 2296:1982
Standard for drinking water - IS 10500:1991

3.2.2.2 Present status of water quality

The monitoring of water quality under Baseline Environment Data Generation for Cluster IX has been conducted by CIMFR, Dhanbad by collecting water samples from ground water, surface water and mine water discharge / workshop discharge (if any) for the proposed project. The various purposes of the water environment monitoring are as follows:

- To assess the water quality characteristics for critical parameters;
- To evaluate the impacts on agricultural productivity, habitat conditions, creational resources and aesthetics in the vicinity ; and
- To facilitate predication of impact on water quality by project activities

The results as per CIMFR, Dhanbad Report are given subsequently.

To assess the quality of lotic system (surface water), water samples were collected from the following locations (Refer to CIMFR, Dhanbad Report):

Table 3.1: Sampling Locations for Water Quality Monitoring in Cluster –-IX

S.N.	Sample	Sample Code	Description	Sampling Site	Remark
1.	Surface Water	SW-1	Kashi Jore	Bararee	Core Zone
2.		SW-2	Kari Jore	Burragarh	Buffer Zone
3.		SW-3	Pond water	Hurriladih	Buffer Zone
4.	Drinking Water	GW-1	Groundwater	Lodna	Core Zone
5.		GW-2	Groundwater	Joyrampur	Core Zone
6.		GW-3	Groundwater	Sudamdih	Buffer Zone
7.	Effluent water	EW-1	Mine water	Jeenagora	Core Zone
8.		EW-2	Mine water	Hurriladih	Buffer Zone

The physico-chemical characteristics of surface water samples collected from three different locations in Cluster IX have been presented in Table 3.2.

Table 3.2: Physico-chemical characteristics of surface water in Cluster-IX Mining Area

S.N.	Parameter and Unit	SW-1	SW-2	SW-3	IS:2296
1.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	--
2.	Colour (True) (Hazen unit)	5.43	4.13	7.43	300
3.	pH (max) (min : 6.5)	7.9	7.5	7.4	8.5
4.	Conductivity (25^{o}C) µS/cm	1275	1262	623	--
5.	DO (mg/L) (minimum)	4.7	5.2	6.3	4
6.	BOD (3d, 27oC) (mg/L)	8.65	9.69	8.45	3
7.	Total Coliforms (MPN/100 mL)	312	232	423	5000
8.	Total Dissolved Solids (mg/L)	992	926	446	1500
9.	Oil and Grease (mg/L)	0.064	0.050	0.032	0.1
10.	Mineral oil (mg/L)	-	-	-	--
11.	Total Hardness (mg/L as $CaCO_3$)	562	368	156	--
12.	Chlorides (mg/L as Cl)	58.7	113.8	47.7	600
13.	Sulfates (mg/L as SO_4)	304.5	152.1	55.6	400

S.N.	Parameter and Unit	SW-1	SW-2	SW-3	IS:2296
14.	Nitrates (mg/L as NO_3)	29.3	19.2	2.52	50
15.	Free CO_2 (mg/L)	1.23	1.18	1.34	--
16.	Free NH_3 (mg/L as N)	0.14	0.45	1.12	--
17.	Fluorides (mg/L as F)	1.05	1.14	1.32	1.5
18.	Calcium (mg/L)	87.8	68.54	23.05	--
19.	Magnesium (mg/L)	83.3	47.85	23.82	--
20.	Copper (mg/L)	0.040	0.035	0.022	1.5
21.	Iron (mg/L)	0.167	0.134	0.054	50
22.	Manganese (mg/L)	0.045	0.054	0.026	--
23.	Zinc (mg/L)	0.076	0.078	0.067	15
24.	Boron (mg/L as B)	0.098	0.115	0.075	--
25.	Barium (mg/L)	0.086	0.096	0.074	--
26.	Silver (mg/L)	BDL	BDL	BDL	--
27.	Arsenic Total (mg/L)	0.016	0.012	BDL	0.2
28.	Mercury (mg/L)	BDL	BDL	BDL	--
29.	Lead (mg/L)	0.017	0.021	0.023	0.1
30.	Cadmium (mg/L)	BDL	BDL	0.006	0.01
31.	Chromium (VI) (mg/L)	0.036	0.043	0.033	0.05
32.	Selenium (mg/L)	BDL	BDL	BDL	0.05
33.	Cyanide (mg/L)	0.020	0.015	0.012	0.05
34.	Phenols (mg/L)	BDL	BDL	BDL	0.005
35.	Anionic detergents (mg/L as MBAS)	ND	ND	ND	1
36.	PAH (mg/L)	ND	ND	ND	--
37.	Pesticides (ug/L)	Absent	Absent	Absent	--
38.	Percent Sodium (%)	22.4%	43.7%	51.2%	--
39.	Sodium Absorption Ratio (SAR)	1.08	2.34	2.25	--

ND=Not Detected, BDL: Below detection limit

The analytical results of physico-chemical analysis of surface water samples collected from Kashi and Kari jores (stream) near Bararee and Burragar and ponds water near Hurriladih has been given in **Table 3.2**. To assess the quality of the surface water resource the results has been compared with the prescribed surface water standards IS-2296 for Class 'C' water (tolerance limit for stream water used drinking water sources with conventional treatment followed by disinfection). It can be seen that pH of the water is slightly alkaline in nature and found well within the prescribed limit of 8.5. In general the total dissolved solids and other analysed

parameters are found well within the threshold values. Concentration of sulphate varies between 55.6 and 304.5 mg L^{-1} and is below the prescribed value of 400 mg L^{-1} (IS-2296). The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits. It shows that the surface water of the area is fit for its designated use as a drinking water source with conventional treatment followed by disinfection.

The physico-chemical characteristics of ground water samples collected from three different locations in Cluster IX have been presented in Table 3.3.

Table 3.3: Physico-chemical characteristics of groundwater in Cluster-IX Mining Area

S.N.	*Parameters*	Station Code			IS: 10500
		W-1 (Lodna)	W-2 (JoyRampur)	W-3 (Sudamdih)	
1.	Colour, Hazen units	Colorless	Colorless	Colorless	Un-objectionable
2.	Odour	Un-objectionable	Un-objectionable	Un-objectionable	Un-objectionable
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity NTU Max	0.76	1.23	2.13	10
5.	Dissolved Solids mg/l, Max	1186	828	399	500
6.	pH Value	7.6	8.1	7.48	6. 5 to 8. 5
7.	Total hardness (as $CaCO_3$) mg/l, Max	749	553	213	300
8.	Calcium (as Ca) mg/l, Max	112.9	95.5	66.2	75
9.	Magnesium (as Mg) mg/l, Max	113.6	76.4	11.5	75
10.	Copper (as Cu) mg/l, Max	0.030	0.031	0.015	0.05
11.	Iron (as Fe) mg/l, Max	0.112	0.106	0.065	0.3
12.	Manganese (as Mn) mg/l, Max	0.054	0.038	0.164	0.1
13.	Chlorides (as Cl) mg/l, Max	63.1	17.7	84.5	250
14.	Sulphate (as SO_4) mg/l, Max	414	365	16.2	150
15.	Nitrate (as NO_3)	16.7	5.3	23.61	45
16.	Fluoride (as F) mg/l)	1.32	0.96	0.30	0.6 to 1. 2
17.	Phenolic Compounds (as C_6H_5OH) mg/l, Max	BDL	BDL	BDL	0.001
18.	Mercury (as Hg) mg/l, Max	BDL	BDL	BDL	0.001
19.	Cadmium (as Cd) mg/l, Max	0.010	0.013	0.009	0.01
20.	Selenium(as Se mg/l, Max	BDL	BDL	BDL	0.01
21.	Arsenic (as As) mg/l, Max	0.012	0.019	0.008	0.05

S.N.	*Parameters*	Station Code			IS: 10500
		W-1 (Lodna)	W-2 (JoyRampur)	W-3 (Sudamdih)	
22.	Cyanide (as Cn) mg/l, Max	BDL	BDL	BDL	0.05
23.	Lead (As Pb) mg/l, Max	0.039	0.028	0.015	0.1
24.	Zinc (as Zn) mg/l, Max	0.065	0.059	0.063	5
25.	Arionic detergents (as MBAS), mg/l, Max	0.064	0.055	0.037	0.2
26.	Chromium (as Cr^{6++}) mg/l, Max	0.040	0.038	0.044	0.05
27.	Polynuclear aromatic hydrocarbon (PAH) mg/l, Max	ND	ND	ND	
28.	Mineral Oil mg/l, Max	BDL	BDL	BDL	0.01
29.	Residual, free chlorine, mg/l, Min	0.14	0.12	0.016	0.2
30.	Pesticides	Absent	Absent	Absent	Absent
31.	Radioactive materials a) Alpha emitters uc/ml, Max b) Beta emitters uc/ml, Max	ND	ND	ND	10^{-8} 10^{-7}

ND=Not Detected, BDL: Below detection limit

To assess the status of drinking water quality of IX area, three ground water samples were collected from hand pump at Lodna, Joyrampur and Sudamdih in May 2011 and analysed for parameters as per the drinking water standards (BSI 1993). The hydro-chemical parameters of the groundwater of the study area were compared with the prescribed limit of Indian Standard for drinking water (BIS 1991) to asses the suitability for drinking and public health purposes (**Table 3.3**). The analytical results show that most of the analysed parameters are well within desirable limits and water is potable for drinking uses. pH of the analysed groundwater are found well within the safe limit of 6.5 - 8.5, prescribed for drinking water by BIS (1991). The turbidity is one of the important physical parameters for water quality defining the presence of suspended solids in water which causes the muddy or turbid appearance of water body. The consumption of high turbid water may cause a health risk as excessive turbidity can protect pathogenic microorganisms from effects of disinfectants and also stimulate the growth of bacteria during storage. In the study area the turbidity in the groundwater are found below the recommended value of 5 NTU. The total dissolved solid (TDS) and Total Hardness (TH) exceed the desirable limit of 500 mg L^{-1} and 300 mg L^{-1} in the groundwater samples of Lodna and Joyrampur but below the desirable limit in the groundwater samples of Sudamdih. However, TDS is well within

the maximum permissible limit of 1000 mg L^{-1} in Joyrampur groundwater. Concentration of Ca, Mg, SO_4 and F are also slightly exceeding the desirable limit in the groundwater of Lodna area though it is below the maximum permissible limit of IS-10500. The other analysed parameters like Cl, NO_3, Na etc. were found below the desirable level.

Heavy metal analysis in the groundwater samples indicated that all the analyzed heavy metals like As, Cd, Cr, Pb, Zn, Mn and Fe are found either below the detection limit or less than the desirable limit for drinking water.

The physico-chemical characteristics of effluent water samples collected from three different locations in Cluster IX have been presented in Table 3.4.

Table 3.4: Physico-chemical characteristics of effluent (mine water) in Cluster-IX Mining Area

S.N.	Parameter	EW-1 (Jeenagora)	EW-2 (Hurriladih)	Inland Surface water IS:2490
1.	Colour and odour	Colorless	Colorless	Of Annexure-1
2.	Suspended solids mg/l, max.	39.8	54.8	100
3.	pH value	7.7	8.3	5.5 to 9.0
4.	Temperature (^{0}C)	26.4	25.8	Shall not exceed 5ºC above the receiving water temperature
5.	Total Dissolved Solids mg/l	502	711	2100
6.	Oil and grease, mg/l max.	2.87	2.65	10
7.	Total residual chlorine, mg/l max.	0.28	0.19	1.0
8.	Ammonical nitrogen (as N), mg/l max.	6.76	5.87	50
9.	Total nitrogen (as N), mg/l max.	8.56	9.24	100
10.	Free ammonia (as NH_3), mg/l max.	4.23	5.34	5.0
11.	Biochemical oxygen demand, BOD (3 days at 27ºC), mg/l max.	5.67	5.54	30
12.	Chemical oxygen demand, mg/l max.	67.8	75.3	250
13.	Arsenic (as As), mg/l max.	0.012	0.027	0.2
14.	Mercury (as Hg), mg/l max.	0.008	0.012	0.01
15.	Lead (as Pb), mg/l max.	0.034	0.043	0.1
16.	Cadmium (as Cd), mg/l max.	0.012	0.015	2.0
17.	Hexavalent chromium (as Cr^{+6}), mg/l max.	0.037	0.030	0.1
18.	Total Chromium (as Cr), mg/l max.	0.065	0.068	2.0
19.	Copper (as Cu), mg/l max.	0.032	0.029	3.0
20.	Zinc (as Zn), mg/l max.	0.098	0.088	5.0
21.	Selenium (as Se), mg/l max.	0.009	0.012	0.05

S.N.	Parameter	EW-1 (Jeenagora)	EW-2 (Hurriladih)	Inland Surface water IS:2490
22.	Nickel (as Ni), mg/l max.	0.025	0.031	3.0
23.	Cyanide (as CN), mg/l max.	0.009	0.012	0.2
24.	Fluoride (as F), mg/l max.	1.67	0.97	2.0
25.	Dissolved phosphates (as P), mg/l max.	0.67	0.54	5.0
26.	Sulphide (as S), mg/l max.	0.95	0.76	2.0
27.	Phenolic compounds (as C_6H_5OH), mg/l max.	0.072	0.054	1.0
28.	Radioactive materials a. α emitters micro cure, mg/l max. b. β emitters micro cure, mg/l max.	ND	ND	10^{-7} 10^{-6}
29.	Manganese (as Mn)	0.097	0.070	2 mg/l
30.	Iron (as Fe)	0.314	0.348	3 mg/l
31.	Vanadium (as V)	0.116	0.122	0.2 mg/l
32.	Nitrate Nitrogen	93.05	39.78	10 mg/l

ND=Not Detected, BDL: Below detection limit

Mine water samples discharged from Jeenagora and Hurladih underground mine were collected to assess the effluent water quality. The analytical results were compared with the inland surface water quality standard as per the IS-2490 and presented in **Table 3.4**. The mine water of the area is found to be alkaline in nature and measured pH was well within the prescribed limit of 5.5 to 9.0 as per IS:2490. Total Dissolved Solid Concentration in the discharged mine water were also found much below the recommended limit of 2100 mg L^{-1} for inland surface water as per IS:2490. The suspended sediment are found 39.8 and 54.8 mg L^{-1} respectively in the mine water of Jeenagora and Hurriladih which is less than the permissible limit of 100 mg L^{-1}. Concentration of heavy metals in the mine water of the area are also to be found within the permissible limit as per IS:2490.

3.2.2.3 Practice after the closure

The above practice of monitoring of quality of water would be continued for a period of 3 years after cessation of mining activities in the area. If required, corrective action/steps would be taken to mitigate any adverse effect on local water regime. The responsibility of maintaining the quality of drinking water will be entrusted on the State Authorities after 3 years of mine closure.

3.2.3 Measures for Control of Pollution (Details for Pollution Control Arrangement)

3.2.3.1 Impact due to Water Pollution and its Management

The mine discharge water may contain high-suspended solids and other pollutants. The treatment scheme thus needs to focus on the removal of suspended solids from the water. Mine water must be treated to meet the prescribed standards before being discharged into water bodies. When the water is used for agricultural or domestic work, it shall undergo further treatment, as established by Scientific Studies conducted in this regard. The important factors to be considered in selecting the appropriate method for treatment are as follows:

(a) Settling tank will be provided to collect the mine discharged water for settling the suspended solids.

(b) The flow and the quality of mine water vary seasonally. Therefore settling tank should be so constructed that it will be able to absorb these fluctuations.

(c) The mine water must be neutral in nature before discharge and therefore necessary neutraliser may be provided to maintain the pH of the settling pond water.

(d) In order to reduce the dependence on fresh water sources for meeting the demands of water in the mining related operations, the entire mining water will be utilised. The effluent free mine water will be utilised in water spraying for dust suppression, hydraulic stowing, equipment washing and other industrial requirements.

(e) Mine water discharge and drainage in the core zone has been planned to be regulated in a manner so that impact on surface and other water bodies of the area is not affected. No major diversion of surface drainage channel is required. Expected increase of solids particles due to surface handling of coal shall be controlled by:

i. Construction of garland drains around the OB dump & coal stock area

ii. Construction of settling tanks of adequate size for removal of particulate matters

iii. De-silting of settling ponds and drains at regular intervals

iv. Effluents from washing areas, garage and workshop will be collected in garlands and routed through a settling ponds and oil and grease trap. The solid wastes generated shall be treated as per the provisions of Hazardous Waste Management Act. The water shall be recirculated for washing.

3.2.4 Water Balance of the area

Hydrogeology and Aquifer characteristics of the area

Groundwater occurrence and storage in study area are mainly controlled by the geological setup of the area. The ability of geological formation to store and transmit water is dependent on its formation parameters, such as porosity and hydraulic conductivity. Based on these two parameters, the rock formation of the area may be classified as hard and soft rocks. Hard rocks (mainly crystalline and consolidated sedimentary rocks) are characterized by very little porosity. Ground water in such rocks circulated to a limited extent through the secondary openings represented by joints, cracks, fissures and such other planes of discontinuity. Soft rocks represented by sandstone, pebbles and loose sand, posses higher degree of primary porosity and as such characterized by higher water storage capacity. As greater part of the study area is underlain by Precambrian crystalline rocks, the weathered residual of the hard rocks as well as the fractures, joints, fissures, faults and other zones of discontinuity are the principle repositories of ground water in the area. The weathered zone is usually of limited thickness, fractures and joints generally close up with depth. The thickness of weathered mantle in the hard rock zone of area is about 10-20 meter in the topographic lows. Ground water in the weathered and fracture zones of hard rocks occur under unconfined condition. Ground water circulating through fracture zone is sometimes held under pressure. Depth of the water table in the hard rock of the area generally ranges from 3.0m to 15.0m below ground level.

The Gondwana sediments form the semi-consolidated formations and are better water potential zone. The splintery shales of Talchir and basal pebbles bed, the variegated Barren Measure shales and the sandstones are the major litho units of the Gondwana Formations. Gondwana sandstones in general, are known to constitute good aquifers at many places. Ground water occurs under unconfined condition in the weathered mantles varying depths from 4.23 – 12.34m as observed in the dugwells and semi-confined condition in the deeper aquifers. Depth of water level for pre-monsoon period varies from 5–12m below ground level and it stretches to a deeper depth of 7-12m in some places. The pre-monsoon water level rises due to recharge and becomes 2 - 8 m below ground level around the area during post-monsoon period.

Rainfall is the principal recharge source to groundwater. The area experiences an average annual rainfall of about 1200-1400 mm. Besides rainfall, the mine water discharge from the local mining areas and existing water bodies including water logged in abundant mine quarries are also contributed to the ground water recharge as return flow. In the study area, ground water is withdrawn usually by means of open dug wells and small diameter hand operated tube wells for domestic and irrigation purposes. The tube wells are most often deeper (25m – 58m) than the dug wells and tap the aquifer below the weathered mantle. As the area is being located in the hot-tropical belt, the temperature regime is very high; the daily maximum reaches to over 45^0C in summer. Due to excessive heat, the loss of moisture through evaporation is considerably high (60-65%). During the wet monsoon seasons, the net evaporation is less than the precipitation, resulting in surplus water which loss through either surface runoff or being part of the subsurface storage. The surface run-off and sub-surface storage of water depends upon various factors including the amount of rainfall, topography of the area, land use pattern, soil type, slope, physiographic, drainage pattern and hydro-geomorphology of the catchment/ sub-catchment. The study area is having gentle slope towards south and south east. Water received on the slopes, gets collected in low-lying area and is thus ultimately absorbed in the top soil cover and become part of the ground water flow according to the slope to form seasonal streams/nallas.

In the mining area, the water levels are bound to be affected and disturbed. The mining area of JCF area is highly disturbed and the permeability of individual geological units is spatially variable and depends on lithology, fracturing and attenuation with depth. The porous and more open-jointed sandstone members tend to form aquifers, the shaly members are aquitards, which may be leaky but are poorly permeable & form poor permeable barriers to the vertical groundwater movement.

Water quality monitoring will be done for three years after closure. The sampling stations shall be one number mine water with quarterly frequency and two numbers ground water samples in core and buffer zone with quarterly frequency.

3.2.5 Acid Mine Drainage Source

Not Applicable

3.2.6 Water Management

3.2.6.1 Existing mine water discharge details

a. Mine water is pumped out in a settling tank. Clean water coming out from the settling tank is used for dust suppression, stowing and other Industrial uses.
b. Excess pumped out mine water is allowed to flow into the surface water bodies.
c. Drains are provided around the coal stock to collect run-off for diverting into settling pond before discharge into the natural water courses.

Present pumping arrangement in opencast mine:

- Make of water:
  Monsoon: 8M Gallons/day
  Lean period: 1 M Gallons/ day.
- Installed capacity of main pumps discharging water to surface.: 1600 GPM
- Pumping hours/day : 18 hrs.

Pumps Installed for Dewatering and Domestic supply:

Type of Pumps	Total Nos.	Capacity (GPM)
Submersible Pump	1	1000
Pontoon Pump	2	300

3.2.7. Post closure Mine water discharge

Once the reserve is exhausted, the entries into the mine would be securely sealed for safety purposes. However, if for the safety of the future mine or any neighboring mine, pumping is required from the worked seams, then the arrangements for pumping will be kept intact and the water shall be discharged into the surface water bodies after passing the same through settling tank on the surface. The accumulated water in underground workings may be utilized to meet water shortage in nearby areas.

3.3 Air quality management

3.3.1 Present practice

a. At present air borne dust is suppressed by:

- Sprinkling water on the various roads of the mine where the vehicles ply.
- Water sprinkling at the various points where coal is handled.
- Proper loading of trucks to avoid any spillage of coal.
- Proper maintenance of I.C. engines.

The monitoring of air quality under Baseline Environment Data Generation for Cluster IX has been conducted CIMFR, Dhanbad and test results of air samples are furnished in Table 3.6A and 3.6B.

Table 3.5: Details of Sampling Locations

Stn. Code	Location	Source of Air Pollution
CORE ZONE		
CA_1	North Tisra	Mining and transportation of coal, domestic works and poor condition of road, heavy vehicular movement.
CA_2	Jeenagora	Domestic, background pollutants due to agricultural, domestic works and mining and transportation activities in buffer zone.
CA_3	Barari	Mining and transportation of coal, domestic works and poor condition of road, vehicular movement
CA_4	Lodna	Household Coal burning and poor condition of road and heavy vehicular movement, etc.

Stn. Code	Location	Source of Air Pollution
BUFFER ZONE		
BA_1	Golakdih	Mining and transportation of coal, coal burning and poor condition of road, heavy vehicular movement.
BA_2	Simlabahal	Mining and transportation of coal, domestic works and poor condition of road, heavy vehicular movement
BA_3	Patherdih	Mining and transportation of coal, domestic works and poor condition of road.
BA_4	Bhaga Mining Institute	Mining and transportation of coal, domestic works and poor condition of road, vehicular movement.

Table 3.6A: Ambient Air Quality in Cluster-IX Mine Area

Core Zone – North Tisra (CA_1)

(Pre-monsoon Season: April 2011 to June 2011)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_x**
2011-April	*1st Week*	6/4/2011	57.9	111.4	30.3	55.7
		8/4/2011	58.4	106.2	31.9	55.4
	2nd Week	11/4/2011	51.8	89.3	30.9	52.9
		13/04/2011	61.2	111.3	23.9	50.6
	3rd Week	21/04/2011	47.2	81.4	33.8	47.9
		23/04/2011	52.4	90.3	29.8	58.7
	4th Week	28/04/2011	49.2	84.9	31.4	49
		30/04/2011	53.0	91.4	25.2	44.8
2011-May	*1st Week*	4/5/2011	61.7	110.2	32.3	49.7
		6/5/2011	57.0	103.7	27	50.7
	2nd Week	12/5/2011	61.3	105.7	31.9	56.7
		14/05/2011	61.4	113.7	23.9	58.3
	3rd Week	18/05/2011	58.6	104.7	29.2	57.1
		20/05/2011	56.4	100.7	21	47.2
	4th Week	25/05/2011	56.5	97.4	27.1	50.2
		27/05/2011	60.8	112.6	26.6	54.4
2011-June	*1st Week*	5/06/2011	61.4	105.8	28.8	53.6
		7/06/2011	60.9	110.8	28.1	55.3
	2nd Week	11/06/2011	65.8	117.5	30.6	57.2
		13/06/2011	56.6	97.5	26.1	54.4
	3rd Week	19/06/2011	48.5	83.7	21.5	43.1
		22/06/2011	49.7	85.7	21.7	38.4
	4th Week	27/06/2011	50.2	86.5	27.4	38.8
		29/06/2011	52.0	89.6	19.3	42.6

Minimum	**47.2**	**81.4**	**19.3**	**38.4**
Maximum	**65.8**	**117.5**	**33.8**	**58.7**
Average	**56.3**	**99.7**	**27.4**	**50.8**
Std. Deviation	**5.5**	**11.7**	**4.3**	**6.3**
98th Percentile	**63.9**	**115.8**	**33.1**	**58.5**

Table 3.6B: Ambient Air Quality in Cluster-IX Mine Area

Core Zone – Jeenagora (CA_2)

(Pre-monsoon Season: April 2011 to June 2011)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_x**
2011-April	*1st Week*	6/4/2011	60.8	110.6	28.2	52.1
		8/4/2011	60.6	104.4	27.6	56.3
	2nd Week	11/4/2011	50.8	92.4	26.2	49.2
		13/04/2011	51.5	92	23.6	48.5
	3rd Week	21/04/2011	57.1	98.4	25.9	48.1
		23/04/2011	49.5	85.4	32.4	50.5
	4th Week	28/04/2011	51.3	88.4	36.3	45.3
		30/04/2011	48.9	84.3	28.9	48.3
2011-May	*1st Week*	4/5/2011	53.7	92.5	28.2	47.2
		6/5/2011	55.3	95.4	28.4	47
	2nd Week	11/5/2011	54.5	93.9	29.2	47.5
		13/05/2011	53.9	93	26.3	46.3
	3rd Week	18/05/2011	61.0	105.1	29.1	52.2
		20/05/2011	52.1	89.9	27.2	47.5
	4th Week	25/05/2011	57.6	99.3	32.4	45.3
		27/05/2011	69.1	130.3	35	50.4
2011-June	*1st Week*	6/6/2011	60.8	104.9	36.1	49.6
		8/06/2011	59.5	114.5	35.9	53.1
	2nd Week	11/6/2011	39.7	68.4	27.6	41.7
		13/06/2011	48.3	83.3	30.2	51.5
	3rd Week	20/06/2011	40.8	70.4	22.3	40.1
		22/06/2011	43.3	74.7	25.3	38.2
	4th Week	27/06/2011	50.1	86.3	24.2	32.9
		29/06/2011	48.3	83.3	25.7	37.7
Minimum			**39.7**	**68.4**	**22.3**	**32.9**
Maximum			**69.1**	**130.3**	**36.3**	**56.3**
Average			**53.4**	**93.8**	**28.9**	**46.8**
Std. Deviation			**7.7**	**15.8**	**4.2**	**6.1**
98th Percentile			**65.3**	**123.0**	**36.2**	**54.8**

Table 3.7: National Ambient Air Quality Standards
(As per MoEF Notification on* 16th November, 2009*)

Sl. No.	Pollutant	Time weighted average	Concentration in Ambient Air		
			Industrial, Residential, rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulpher Dioxide (SO_2), $\mu g/m^3$	Annual* 24 hours**	50 80	20 80	- Improved West and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (Size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM - Beta attenuation
4	Particulate Matter (Size less than 2.5 µm) or PM_2 $\mu g/m^3$	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM - Beta attenuation
5	Ozone (O_3) $\mu g/m^3$	8 hours* 1 hour**	100 180	100 180	-UV photometric - Chemiluminescence -Chemical Method
6	Lead (Pb) $\mu g/m^3$	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide(CO) mg/m^3	8 hours* 1 hour**	02 04	02 04	-Non Dispersive Infra Red (NDIR)Spectroscopy)
8	Ammonia(NH_3) $\mu g/m^3$	Annual*	100	100	- Chemiluminescence

Sl. No.	Pollutant	Time weighted average	Concentration in Ambient Air		
			Industrial, Residential, rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
		24 hours**	400	400	- Indophenol blue method
9	Benzene(C_6H_6) µg/m^3	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(o) Pyrine (BaP)-Particulate phase only, ng/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic(As), ng/m^3	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel(Ni), ng/m^3	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note – Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limit specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation

3.3.2 Practice after the closure of the mine

a. As the sources of dust and fume generation would no longer be present, the present practice of arresting the air pollution, as enumerated above may be discontinued. However, water sprinkling would be done on the roads, which remain in use after the mine closure.

b. Quality of air would be monitored for a period of 3 years after cessation of mining activity. 3 samples at fortnight frequency for 3 years, one sample in core zone and one sample each in upwind and downwind direction will be collected and analyzed.

3.4 Dump Reclamation

External dump

The external OB dumps shall be formed in suitable lifts of appropriate height keeping an overall slope not exceeding 36^0 from the horizontal. In course of mining and after the completion of the final lift, the external OB dump shall be biologically reclaimed. The dumps shall be afforested by selecting proper plant species in consultation with State Forest Department.

As per new Guidelines for Preparation of Mine Closure Plan GOI (Ministry for Coal) Dated 7th January, 2013 all efforts should be made and reflected (in the Project Report/Mining Plan) to keep land requirement bare minimum for external OB dumping to minimise land degradation. This may necessitate increase of dump height to the maximum extent keeping in view the safety requirement with special emphasis on stability analysis. After back filling of quarry voids, the left out void may be allowed to be filled with water. This will help to recharge and stabilize the water table in the neighbourhood and the local populace will benefit from it.

Internal Dumps

The residual voids, if any, will serve as a lagoon and may be utilised as water reservoir for the locality. The entire area shall be suitably fenced. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

The underground unit is not likely to generate any solid waste during the mining operation.

3.5 Details of Surface Structures proposed for dismantling

3.5.1 Infrastructure details

As far as possible, industrial structures will be utilized by the adjacent mines. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. SERVICE BUILDINGS: The service buildings/ structures, viz. workshop, stores, office building, cap-lamp room, Pit top office, winding rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B.OTHER INFRASTRUCTURES: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures.

The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and UG assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

3.5.2 Post closure disposal/Re-use of the Buildings, Plants & Machineries

a. Disposal or reuse of existing HEMM, CHP, workshop and railway siding for OC

   Since the opencast is proposed to be operated through outsourced HEMM, disposal will not be required.

b. Disposal or reuse of haulage, ventilation, workshop and railway siding for UG.

   At the time of closure of the mine, it is expected that most of the equipments would complete its rated life and would be surveyed off as per the Company's guidelines. The surveyed off equipments would be auctioned as per prevalent norms.

   However, if some of the equipments would not have covered their rated life, they would be diverted to the neighbouring projects for gainful utilisation.

   There is no railway siding in the leasehold.

c. Disposal or reuse of transmission lines and sub-station

As per the electricity demand of the existing neighbouring projects, an analysis would be made as to whether the existing sub-station and transmission lines could be gainfully used or not. If the scope of gainful utilization is not found, they will be dismantled and the usable items/spares/conductors etc. would be dispatched to needy Areas/Projects.

d. Disposal or reuse of residential and non-residential buildings

At the time of final closure, a list of surface buildings would be prepared in detail. Thereafter following steps would be taken in chorological order in respect of the available buildings:

- An assessment would be made to find that whether the available buildings can be used by the existing neighboring projects or any new project that might have come up in the vicinity.
- In case, the listed assets cannot be utilized by the nearby project, efforts would be made to sale these assets after making the list available to potential purchasers and asking the interested purchasers to submit sealed bids.
- Thereafter, the state agencies/local agencies may be asked to take possession of the buildings, if they required few of them.
- When there would be no takers, the buildings would be demolished and usable items would be recovered for future use.

Table 3.8 Proposals for Infrastructure Facilities

Sl. No.	Particulars	Action Suggested
A	CHP	This will be dismantled and land will be covered with plantation
B	Workshop	-Do-
C	Railway Sidings	There is a proposal of Rly. Siding in the project.
D	Colony	These will be handed over to the State Government if fit for use or will be dismantled.
E	Details of non-residential buildings	-Do-

F	Other facilities (ETP /STP)	-Do-

3.6 Safety and Security Arrangement

3.6.1 Mine entry

After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. Flags/Boards with warning signals shall be posted at vulnerable places to avoid chances of accidents. However, the guidelines / instructions from DGMS, if any, will be followed.

Sealing details and dimensions shall also be prepared for the purpose. The minimum thickness of mine sealing will be 100cm RCC (M20) with nominal reinforcement. For incline entry, the mine entry path of 5 m will be filled with debris and clay before sealing the mine.

Details of fencing around abandoned quarry, indicating the length of the fencing

As explained earlier the proposed OCP patches will not be backfilled and the void will act as water reservoir. It is proposed to develop a water lagoon in the area. The water lagoon may be handed over to State Authorities for conversion into a picnic spot.

The void of the quarry would be properly fenced to avoid any inadvertent entry of animals or human beings. Sufficient Boards and danger signs shall be placed all around.

Later on, the responsibility of keeping the fencing secured would be entrusted on the State Authorities.

The entry into the mine is the haul road. This haul road will remain for entry into the picnic spot. Both side of this haul road will be afforested.

3.6.2 Slope stability arrangement for high wall and back filled dumps

During operation of the mine, overall slope will be maintained at an angle not exceeding 22^0- 28^0. Vegetation cover will also be provided along the slopes to arrest any failure.

As regards stability of back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality.

During operation, the external and internal OB dump will be developed with 40 m berm width and maximum height of 60m in case of external OB dump and the overall dump slope shall not exceed **22^0- 28^0**. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.

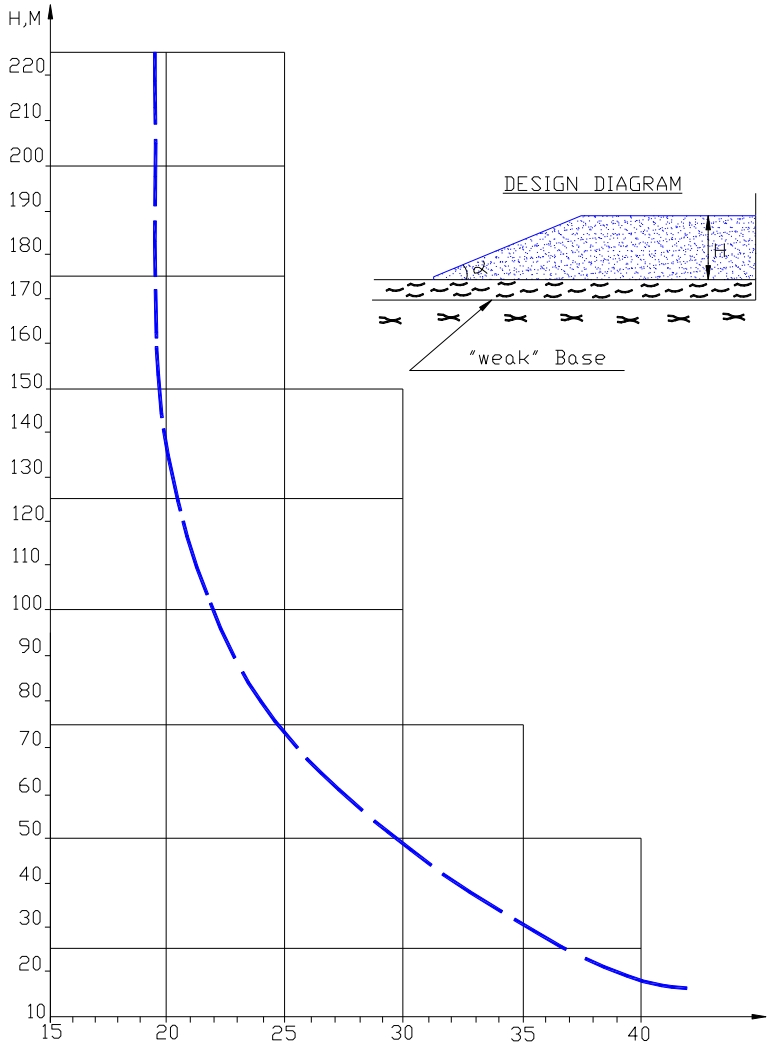


Fig. 5.5.4. Graph illustrating dependence of stable slope angle (α) on height (H) of ex-site dumps formed on "weak" Base

3.6.3 Providing one time lighting arrangement

Sufficient lighting as per standard is provided at all the required places, i.e., pit office, haulage room, fan house, cap lamp room, mine entry, workshop, sub-station haul road in quarry etc.

After closure of the mine, the lighting arrangements will be kept maintained at all locations which are not required to be demolished or dismantled like sub-stations, transformers, community services, pump-houses, water-

treatment/ filtration plants, waterlines, power lines, roads etc. to be utilised for the neighbouring projects and local communities.

3.6.4 Survey records of workings

All the mine workings including subsidence areas, roads, ponds, tanks etc. shall be resurveyed and records shall be updated. Copy of such records shall also be submitted to the appropriate competent authorities, such as DGMS and State Authorities.

Maintenance of records pertaining to Progressive Mine Closure

The Mine management shall maintain following Progressive mine closure plans for every 5 year period:

A Progressive mine closure plan for surface activities

This plan shall be maintained at a scale of 1: 4000 showing the entire progressive mine closure activities (surface) carried out on yearly basis. The plan shall be updated on annual basis and shall be signed by appropriate authorities from the Project and the Area. After every annual renewal, the plan shall be placed before HOD (Env.) of the Company for scrutiny and approval.

The UG unit is likely to be closed soon and entire Group is considered as an OC Unit for the purpose of Closure. However, if , for any reasons , whatsoever, UG Operation is continued, a progressive mine closure plan showing the UG activities shall be maintained. This plan shall also be updated on annual basis and signed by all the above mentioned officials.

Besides the above plan, a progressive mine closure register shall also be maintained by the mine management. This register shall carry details of the progressive mine closure activities carried out on yearly basis. The details to be maintained in the said register shall cover inter alia the name of activity, place, period of execution, executing agency, expenditure incurred, proof of expenditure incurred, final status of the area where activity was executed, plan on which such activity has been shown etc.

The entries into the said register shall be signed by the appropriate authorities from the Project and the Area. At the end of the year the said register (along with two plans) shall be placed before HOD (Env.) of the Company for scrutiny and approval.

3.6.5 Disposal management of hazardous material

At the time of closure, assessment would be made as to find whether there is any hazardous material that could cause problem. Such hazardous material e.g. explosives, chemicals, oil etc. shall be appropriately disposed off.

3.7 Entrepreneurship development Program

As the mine progresses, more and more local people gets indirectly dependent on the mine for their sustainable income. After closure of mine there would be no source of income for these people. In order to ensure that these people do not suffer in the post closure period, the Project authorities in consultation with BCCL (HQ) shall make efforts to develop entrepreneurial skills in the local people by imparting skill development/vocational training programs. It is expected that after developing adequate entrepreneurial skills, the local people would be able to run their own business in the post closure period and maintain a sustainable income for their livelihood.

3.8 Miscellaneous activities

In future, the prevalent geo-mining/environmental conditions in and around the project area may require execution of some other progressive mine closure activities not covered in the preceding paragraphs. Such activities may be carried out by the mine after observing the needful formalities and obtaining approval of HOD (Env.) of the Company.

3.9 Execution of progressive mine closure activities and 5 yearly monitoring

After observing the necessary administrative/financial formalities, the mine authorities shall execute the identified progressive mine closure activities,

whenever and wherever required. The executed activities shall be shown on the above said plans and recorded in the said registers.

The executed progressive mine closure activities shall be monitored on 5-yearly basis by 3rd party (ISM, CMPDI, NEERI etc.).

The 5 yearly return from escrow fund would be equal to expenditure incurred on progressive mine closure activities during last 5 years or 80 % of total deposited amount in the escrow account (including interest) whichever is less. The said return would be subject to above said monitoring of progressive MCP by a third party (ISM/CMPDI/NEERI etc.).

As the 5 yearly return from escrow fund is linked with the expenditure incurred on progressive mine closure activities during last 5 years, it is very important that progressive mine closure records, plans, expenditure details along with proof are properly maintained.

At this juncture it is important to note that some of the progressive mine closure activities, enumerated in the preceding paragraphs, are legal obligations specified in Project reports, EMP, permissions obtained from statutory bodies such as CPCB, SPCB, DGMS etc. The Project authorities are bound to comply with these obligations.

3.10 Re-deployment of work force

The current manpower of the project is 1752. And at present, it is very difficult to assess the manpower of the project, which will remain at the time of closure of mining activities in the presently worked seams. As some of the seams of the block is still virgin and is most likely to be mined in future, the remaining manpower will be gainfully utilized in continuing mining activity.

3.11 Emancipation from the community facilities and the facilities to the PAPs

3.11.1 The Project affected Persons (PAPs) and also the local communities are being provided many civic facilities, such as educational facilities, health

facilities, and drinking water. As some of the seams of the block are still virgin and are most likely to be mined in future, these facilities, in all probability, will be kept maintained.

3.11.2 However, at the time of final closure after exhaustion of entire mineable reserve these facilities will be entrusted upon the local bodies/Trust of PAPs/State bodies after consultation with local people and state authorities so that same could continue even after the mine closure. If needed, a lump sum reasonable amount would also be paid to the local bodies/Trust of PAPs/State bodies after proper approval for proper upkeep and maintenance of various community facilities.

3.11.3 To ensure that no financial loss due to the closure of mining activity in the presently worked seam occur to the local community engaged indirectly to the existing mine, following steps would be taken:

- It has been seen in past that in the event of closure of a mine, the local people indirectly dependent on the mine switch over their economic/professional activities in the existing/new or expansion mines located in the nearby area. Local management, if needed, extends some basic helps to them in such type of switching over. Hence, it is expected that in this project also the transition of the local people from one area to the other area for their sustenance would not be any problem.

- It is proposed that reclaimed and afforested land will be handed over to State Forest Dept. for the benefit of local ecosystem. The forest wealth can also be utilised by local people or tribal in the form of fruits and fodders.

- The proposed picnic spot would be handed over to a society of local people for commercial use of the picnic spot by them.

CHAPTER – IV

ECONOMIC REPURCUSSION

4.0 Economic Repercussions of closure of mine

4.1 Manpower of the project

The total proposed manpower strength of NT-ST-Jeenagora Group of Mines is 1752 (as per UCE of Proposed NTST Expansion OCP, October, 2011).

Table 4.1Present Manpower

Manpower	Strength (Nos.)
EXECUTIVE	87
NON EXECUTIVE	1665
TOTAL	1752

Post Closure Manpower

It has been proposed to monitor and implement the post-closure activities departmentally. Departmental manpower will be needed after closure of the mine for monitoring and implementation of the post closure activities. Manpower required for the same is given in Table- 4.2.

Table 4.2: Manpower required for monitoring and implementation of Mine Closure Activities

Sl. No.	Category of Manpower	Requisite heads
1	Officer-in-charge/ Manager (Mining)	2
2	Overman-in-charge	3
3	Foreman/Overseer-in-charge	3
TOTAL		**8**

4.2 Assessment of income scenario of local people

As NT-ST-Jeenagora Group of Mines is basically an opencast mining project in the long run, a lot of surface excavation will be undertaken. Moreover, the basic mining infrastructures have been made on the company acquired land. So there will be displacement of some local people from this project. Sufficient fund has been provided in the Jharia Action Plan to rehabilitate and resettlement of the project affected people of this project.

After the closure of the mine, the manpower deployed in the mine will be further redeployed in other mines of BCCL to make no loss of sustenance income of the eligible employee.

4.2.1 At present, it is very difficult to assess the manpower of the project, which will remain at the time of closure of mining activities in the existing project.

4.2.2 The local communities are being provided many civic facilities, such as educational facilities, health facilities, and drinking water. At the time of final closure after exhaustion of entire mineable reserve these facilities will be entrusted upon the local bodies/Trust of PAPs/State bodies after consultation with local people and state authorities so that same could continue even after the mine closure. If needed, a lump sum reasonable amount would also be paid to the local bodies/Trust of PAPs/State bodies after proper approval for proper upkeep and maintenance of various community facilities.

4.2.3 To ensure that no financial loss due to the closure of mining activity in the presently worked seam occur to the local community engaged indirectly to the existing mine, following steps would be taken:

- It has been seen in past that in the event of closure of a mine, the local people indirectly dependent on the mine switch over their economic/professional activities in the existing/new or expansion mines located in the nearby area. Local management, if needed, extends some basic helps to them in such type of switching over. Hence, it is

expected that in this project also the transition of the local people from one area to the other area for their sustenance would not be any problem.

- It is proposed that reclaimed and afforested land, if any, will be handed over to State Forest Dept for the benefit of local ecosystem. The forest wealth can also be utilised by local people in the form of fruits and fodders.

CHAPTER – V

TIME SCHEDULE FOR POST-CLOSURE ACTIVITIES

5.1 It is very difficult to predict the various parameters which would be prevalent at the time of final mine closure (when the entire block reserve would get exhausted) and therefore a mine closure activity schedule cannot be rigidly prepared at this point of time.

5.2 The closure of mine involving technical aspects, environmental aspects, socio-political aspects and financial assurances as implementing post-closure activities will run for three years. The time schedule envisaged for completion of all closure activities is presented in the following table in the form of bar chart.

Table 5.1 Implementation Schedule for post-closure activities for NT-ST-Jeenagora Group of mines.

Sl. No.	Major Activities	Time Period	Year-wise Phasing			
			Y1	Y2	Y3	Y4
1	Technical aspects	2 years				
2	Environmental aspects	2 years				
3	Post closure environment monitoring	3 years				
4	Socio-political aspects	3 years				

5.2.1 Technical Aspects:

i) **Safety & security**: In the mine closure plan, action will be taken to cover all the safety aspects including management of fire & subsidence and mine inundation.

i) **Management of pit slopes and waste dump**:

The same has been addressed in detail in the Para No. 3.4 and in Para. 3.6.2.

ii) **Management of hydrology and hydro-geology**: After closure of mining activities, the workings will be waterlogged which will help in maintaining the water table in the surrounding areas and may become a source of water supply to the neighbouring areas.

iii) **Closure of Mine Entries**: After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. However, the guidelines / instructions from DGMS, if any, will be followed.

iv) **Disposal of mining machinery**: All the opencast machineries, which will have residual life, will be shifted to the other collieries of the area/company. The salvaging and shifting operation of mining machinery and other equipment will be done considering the ground realities during the period 1 (one) year advance of final mine closure.

v) **Details of surface structure proposed to be dismantled**:

As far as possible, industrial structures will be utilised by the adjacent mine. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. **Service Buildings**: The service buildings/ structures, viz. workshop, stores, office building, Site office, rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B. **Other Infrastructures**: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures. The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and OCP assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

5.2.2 Environment Aspects

i) **Mined-out land and proposed final land use:** At NT-ST-Jeenagora Group of mines it is proposed to extract coal by opencast method. The existing infrastructures, if not usable, will be dismantled and the land will be graded & will be handed over to the local authorities for community use.

ii) **Air & Water quality management:** Appropriate air and water pollution control measures will be taken to contain the air and water pollution for maintaining the ambient air and water quality within the stipulated standards besides making the mining operation eco-friendly in the project. These measures (both preventive and suppressive) are enumerated in Para 3.2.3 of the present report.

iii) **Management of waste:** The solid wastes generated by the mine during the coal production are non-hazardous and non-toxic in nature. The above solid wastes will be disposed off by backfilling the mined out area and then re-vegetating without causing any siltation problem on surface water bodies.

However, scientific studies shall be undertaken regarding applicability of solid wastes for various uses. Toxic solid wastes like used oil, used batteries, oily sludge, besides filters and filter materials containing oil during maintenance of vehicles, will be generated by the mining project. Used oil will be stored in drums safely for disposal through auction to the authorized re-processors. Similarly, used batteries will be stored safely for auction to the authorized re-processors. The oily sludge, besides filter and filter materials, will be disposed off in impervious layer lined pits without causing environmental hazards.

iv) **Management of final voids**: It will be dealt as per the directive provided in the EMP.

v) **Land reclamation and rehabilitation:** If any cracks or void is created due to mining activities, it will be restored to original profile by filling up cracks/ voids. It is proposed that the site restoration should be kept progressive so that the restoration is more or less similar to the rate of mining.

vi) **Reclamation of forest/ vegetation and plantation:** 17 Ha of forest land is required for the project. Moreover, regular plantation will be taken up during the life of the mine to create green barrier. The plant species will be selected in consultation with the state forest department.

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

5.2.3 Post Closure Environment Monitoring

After cessation of mining and its related activities, there will be no effect on ambient air and water quality due to this mine as proper mitigation measures for air and water pollution control are to be taken by the authorities of the mine. However, the air and water quality parameters in the mined out area will be monitored by some external agency for next three years after closure of the mine.

Air and water samples will be taken from the specified sampling stations at regular frequency for 3 consecutive years after the closure of the mining project. 1 sample of mine water will be collected and analyzed with fortnightly frequency and 2 samples of ground water from core & buffer zones with monthly frequency. Similarly, 1 air sample will be taken at core zone, and 1 air sample each in upwind and downwind directions of the project at fortnightly frequency.

5.2.4 Socio-Political Aspects

i) **Re-deployment of work force**: Due to closure of mining operations, the persons directly employed in the mine will be surplus. Suitable manpower re-deployment plan may be formulated by the mining company sufficiently before closure of mine for re-deployment of the work force in other units of the company. Alternatively, they would be given option of voluntary retirement.

ii) **Civic facilities**: It is proposed that the civic facilities developed during the mining phase will be transferred to the local government/ municipality so that the region transforms smoothly into post mining phase. A one-time payment should be made by the mine for obtaining its release from providing these facilities, which will there from be taken care of by the local and state bodies.

iii) **Channelisation of available water**: If the mine has sufficient water, this can be used for domestic and agriculture purpose by the local community. The water from this area shall be discharged after treatment for domestic and agricultural usages.

iv) **Emancipation for project affected population**: The village/ basti which are to be rehabilitated at North Tisra, Jeenagora OCP and South Tisra as per Master Plan of JCF (March'08) are given in Table No. 5.2A, 5.2B and 5.2C:

Table 5.2A Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
BCCL Colony No. 1/O1	142	47	47	5	241
SG Section Basti /O3	41	0	0	0	41
Tilaboni Basti/O2	15	122	122	6	265
Tilaboni Basti/O2	0	153	0	0	153
Total(Phase-I)	**198**	**322**	**169**	**11**	**700**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**198**	**322**	**169**	**11**	**700**

Table 5.2B Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
Central Sulunga Colony No.1/ O9	90	1	5	1	97
E.B. Section colony no. 1/O1	19	9	0	0	28
E.B. Section colony no. 1/O1	0	0	10	0	10
EB Sec. Colony No. 2/O2	58	0	0	1	59
Khas Jeenagora Colony No.1/O3	88	0	0	0	88
Khas Jeenagora & Kalisthan /O5	40	0	0	1	41
Khas Jeenagora Colony No. 2/ O4	107	0	0	5	112
Khas Jeenagora Colony no. 3/ O6	64	43	10	1	118
Khas Jeenagora Colony no. 4/O7	13	0	0	1	14
Total(Phase-I)	**479**	**53**	**25**	**10**	**567**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**479**	**53**	**25**	**10**	**567**

Table 5.2C Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
B.J. & S.T. Section/ O3	110	85	42	3	240
Huchuktand Basti/O1	29	95	24	2	150
No.1 Pit S.T. Section /O2	38	21	0	0	59
Total(Phase-I)	**177**	**201**	**66**	**5**	**449**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**177**	**201**	**66**	**5**	**449**

5.3 Although, it is very difficult to conclusively predict the likely impacts due to closure of the mining activities in the in the leasehold area of the Instant Project and the likely activities that would be taken up at that point of time, but a broad mine closure activity schedule may be prepared as per guidelines of Ministry of Coal. The post closure implementing activities will run for three years. The activities given overleaf as per the given bar chart are most likely to be implemented.

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN NT- ST JEENAGORA GROUP OF MINES(OC)

(LIFE OF THE MINE: 30 YEARS)

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
A	**Dismantling of Structures**										
	Service Buildings	2 years									
	Residential Buildings	2 & ½ years									
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years									
B	**Permanent Fencing of mine void and other dangerous area**										
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years									
C	**Grading of highwall slopes**										
	Levelling and grading of highwall slopes	2 years									
D	**OB Dump Reclamation**										
	*Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation									

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
	*Technical and Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation									
E	**Landscaping**										
	Landscaping of the open space in the leasehold area for improving its esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation									
F	**Plantation**										
	Plantation over cleared area obtained after dismantling	2 years									
	*Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation									
	*Plantation over the external OB Dump	Throughout the life of the mine									
G	**Post Closure Env Monitoring / testing of parameters for three years**										
	Air Quality	3 years									
	Water Quality	3 years									

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
H	***Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**	Throughout the life of the mine									
I	***Miscellaneous and other mitigative measures**	Throughout the life of the mine including 3 years after cessation of mining operation									
J	**Post Closure Manpower cost for supervision**	3 years									

NOTE: *: To be covered under Progressive Mine Closure activities also**.**

NOTE: The progressive mine closure will be done as per the provisions made out in the Project report and as per the situation/requirement that may arise in course of execution of the Project Report.

CHAPTER – VI

MINE CLOSURE COST

6.0 Mine Closure activities would be a constant exercise for the mine which would begin with the commencement of mining operations and continue till post closure. The mine closure activities would naturally entail certain expenditures, which will have to be borne by the mine operator. There would be two types of expenditures on account of mine closure activities in respect of NT-ST-Jeenagora Group of mines:

6.1 Revenue expenditures

This would cover the activities which are being executed along with normal mining operation and would continue to be executed in course of execution of the project. The cost of progressive mine closure activities is already part of the project cost.

6.2.1 Expenditures to be incurred just prior to actual mine closure and in the post closure period

6.2.2 As per MOC guidelines, a corpus escrow account @ ₹ 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ ₹ 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of final mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

In NT-ST-Jeenagora Group of Mines, the proposed project area is about 1431.0Ha. Therefore, the entire 1431.0Ha of project area (existing and

proposed) has been considered for the calculation of closure cost of the area based on OC norms.

The money deposited in the Escrow Account has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

6.2.2 As per the above guidelines these rates will stand modified based on Whole Price Index as notified by Government of India from time to time. Thus the total expenditure on this front may be calculated in following manner:

- The total amount for mine closure activity in respect of the proposed NT-ST-Jeenagora Group of Mines = 1431.0 Ha X ₹6.00 lakhs X 1.35416 =₹11626.875 lakhs

*** The amount has been escalated based on WPI of July, 2013(175.5) vis-à-vis WPI of August '09(129.6).**

6.2.3 It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI(dt. 07.01.2013) the *"annual closure cost is to be computed considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

Jharia Coalfield is characterized by occurrence of a number of working coal horizons, giving a leverage of extended working life of the mines. Some more seams can come in the lap of workable horizons due to improvement in mining

technology in times to come. The underground mines in leasehold of JCF are generally small capacity mines, giving a false impression of very long lives due to small level of current production level. There may be a strategy in future to amalgamate the mines for higher production level to attain the economics of scale. The existing OC Mines working at shallow depth may be worked at a greater depth, In such a situation, the life of the mine arrived at with current level of production for the balance reserve may not be workable in the long run.

In view of the above, for the purpose of mine closure cost calculations, the life of the mine has been taken from formulated project report of NT-ST-Jeenagora Group of Mines as mentioned in the approved TOR/Form-I. Since the proposed life of the NT-ST-Jeenagora Group of Mines was calculated as 30 years, the life of NT-ST-Jeenagora group will be also 30 years.

To arrive, at the annual cost, to be deposited in each year in an escrow account, the mine closure cost has been divided by 30, as shown below:

- Amount to deposited in 1st year will be--------₹ 387.563 lakhs
- Amount to be deposited in 2nd year will be—₹ 387.563 (1 + 5%)^1 lakhs
- Amount to be deposited in 3rd year will be—₹ 387.563 (1 + 5%)^2 lakhs

6.2.4 In the above fashion, an amount will be deposited every year up to the last year of mine life by applying the following formula:

- Amount to be deposited in Nth year will be --- ₹ 387.563 (1 + 5%) ^(n-1) lakhs

6.2.5 The amount calculated by the above formula shall be deposited every year by BCCL in the Escrow Account opened with the Coal Controller organisation in a scheduled Bank. An agreement, outlining detailed terms and conditions of operating the said Escrow Account shall be executed amongst BCCL, the Coal Controller and the commercial Bank.

6.2.6 Thus, total amount that shall be deposited for final mine closure activities **NT-ST-Jeenagora Group of Mines** during the considered period of 30 years stands out to be ₹ 25749.206 lakhs as per the present status of the mine. The Break-Up cost of Mine Closure of NT-ST-Jeenagora Group of Mines Yearwise is given in Table No. 6.1.

Table No. 6.1 Yearwise Break-Up Mine Closure Cost

Year	Amount to be deposited per year ₹ in Lakhs
1	387.563
2	406.941
3	427.288
4	448.652
5	471.085
6	494.639
7	519.371
8	545.339
9	572.606
10	601.237
11	631.298
12	662.863
13	696.007
14	730.807
15	767.347
16	805.715
17	846.000
18	888.300
19	932.715
20	979.351
21	1028.319
22	1079.735
23	1133.721
24	1190.407
25	1249.928
26	1312.424
27	1378.045

Year	Amount to be deposited per year ₹ in Lakhs
28	1446.948
29	1519.295
30	1595.260
Total	25749.206

6.2.7 Based on the existing mine closure planning norms, the above calculated cost at WPI of July 2013 on mine closure may be tentatively grouped under different heads as given in Table No. 6.2 as per the guidelines of CMPDI(HQ).

Table 6.2 Break up Costs of Mine Closure Activities

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	51.498
	Residential Buildings	687.504
	Industrial Structures like CHP, Workshop, field sub-station, etc.	77.248
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	386.238
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	455.761
D	**OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	22829.246
	Bio-Reclamation including soil spreading, plantation and maintenance	102.997
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its aesthetics	77.248
F	**Plantation**	
	Plantation over area obtained after dismantling	128.746
	Plantation around fencing	51.498
	Plantation over the cleared external OB Dump	5.150

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	56.648
	Water Quality	51.498
H	**Entrepreneurship Development(Vocational/skill development training for sustainable income of affected people**	66.948
I	**Miscellaneous and other mitigative measures**	514.984
J	**Manpower Cost for Supervision**	205.994
	TOTAL	**25749.206**

6.2.8 Thus, total amount that shall be deposited for final mine closure activities of **NT-ST-Jeenagora Group of Mines** mine during the period of 30 years has been estimated as **₹ 25749.206 lakhs** based on UG norms at WPI of July 2013.

6.2.9 *Mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 80% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Annexure of the Guidelines. The amount released should be equal to expenditure incurred on the Progressive mine closure in past five years or 80% whichever is less. The balance amount shall be released to mine owner/leaseholder at the end of the final Mine Closure on compliance of all provisions of Closure Plan. This compliance report should be duly signed by the lessee and certify that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and certified by the Coal Controller.*

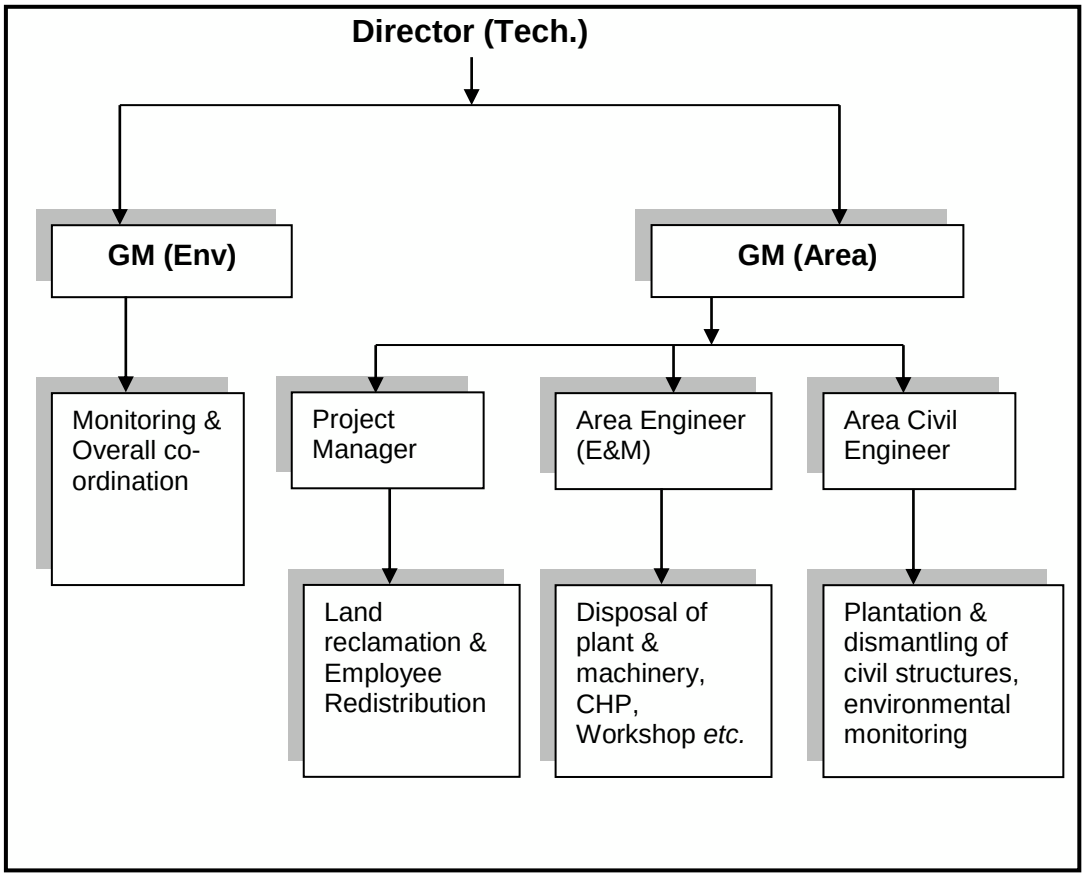
6.2.10 However, the additional amount beyond the escrow account, if any estimated later on, will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline)**.**

CHAPTER-VII

IMPLEMENTATION PROTOCOL

7.1 As the mine closure activities would continue even after cessation of mining activities, an organization consisting of different discipline would be formed to undertake the implementation of mine closure activities as well as monitoring of the same**.** Such activity shall continue for a period of three years after the closure of mining activity in the mine. Once the closed mine becomes stabilized in respect of safety, environmental and social aspects, the monitoring team would be withdrawn.

7.2 For implementing the mine closure activities and monitoring thereof, the following organisational structure at Corporate level has been proposed:



7.3 Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If need be, proper mitigation measures will be taken up after evaluating the environmental quality. Before closure of the mine, Area GM will prepare survey and disposal report and the same will be submitted to DGMS for acceptance.

7.4 When the mine closure activities would take final shape and the entire are under influence is brought to an acceptable shape, BCCL would obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works in accordance with the approved mine closure plan/final mine closure plan have been carried out for surrendering the reclaimed land to the State Government concerned.

CHAPTER – VIII

PLANS ENCLOSED

The following underground and surface plans have been enclosed along with this mine closure report plan:

a. Location Plan of Cluster IX
b. Surface cum Topographical plan of Cluster IX showing surface features, contours, roads, depot/siding, OB dumps, quarries (working/old/discontinued), subsidence, plantations, habitations, vacant land, surface water bodies, natural drainage and mine discharge water channels
c. Geological Plan of Cluster IX
d. Working plan of IV B Seam- North Tisra UG
e. Surface Plan of existing NTST OC.
f. Final Stage Dump Plan of NTST Expansion OCP