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REVISED REPORT

MINE CLOSURE PLAN
of
DUDHICHUA OPENCAST PROJECT
(15.5 Mtpa)

[EC no. J-11015/381/2008-IA.II (M)]

नॉर्दर्न कोलफील्ड्स लिमिटेड

NORTHERN COALFIELDS LIMITED

फरवरी-2014

February - 2014

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Mine Closure Plan of Dudhichua OCP (15.5mtpa)

1.0 0 INTRODUCTION

1.0.1 Name of Mine owner:

Shri N. Das, Director (Tech./Project and Planning)

1.0.2 Location and Extent of Project/Lease Area

Dudhichua Open Cast Project is located partly in the Sonebhadra District (U.P.) and partly in the district Singrauli (M.P.)
The total land requirement for Dudhichua Opencast Project (Project area/ Lease area) has been estimated as 1752 Ha.
The location map of Dudhichua OCP is enclosed as **Plate-1.**

1.0.3 Type of Project/Lease Area:

The lease area consists of Forest and Non Forest Land:

Sl. No	Particulars	Total Area(ha)
1	Forest	750
2	Government Land	366
3	Tenancy	636
	Total	**1752**

1.0.4 Present Land use pattern

Sl. No	Particulars	Total required Area (ha)
1	Area to be excavated	868
2	Overburden/Dumps	152
3	Mineral Storage	3
4	Infrastructure (Workshop/Building)	116
5	Roads	10
6	Railways	15
7	Green Belt	160
8	ETP+CHP+Township area	219
9	Others (Safety Zone etc.)	209
	Total	**1752**

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1.0.5 Method of Mining

Considering the mining and geological conditions the combined syste of opencast mining with the use of dragline and shovel dump combination has been proposed.

1.0.6 Coal Processing Operation

There is no proposal for Coal Beneficiation for this mine. Un-washe crushed coal from Coal Handling Plant / Silo is being dispatched t power stations and other customer through MGR and public railwa system.

1.1.0 Reasons for closure

1.1.1 Exhaustion of Minerals

Depending on prevailing geo-mining & techno-economic conditions, i has been decided to mine coal up to exhaustion of reserve in the proposed block.

The Dudhichua mine has been designed for an annual capacity of 15.5 MTPA (Peak production). The geological reserve of coal of Dudhichua project is expected to be exhausted by 2023 and project need to be closed.

1.1.2 Lack of Demand

The Dudhichua mine is not to be closed due to lack of demand, but due to exhaustion of minerals.

1.1.3 Un-economic operations

The Dudhichua mine is not to be closed due to un-economic operations, but due to exhaustion of minerals.

1.1.4 Natural calamity

The Dudhichua mine is not being closed due to natural calamity, but due to exhaustion of minerals.

1.1.5 Direction/court cases

The Dudhichua mine is not being closed due to direction/court cases, but due to exhaustion of minerals.

The Mine Closure Plan has been prepared as per the Guidelines approved by the Ministry of coal, Govt. of India and notified vide communication No. 55011-01-2009-CPAM on dated 27th August, 2009, 8th September,2009, 11th January, 2012, 25th April, 2012 and &7th January, 2013.

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As per the notification all coal mine owners shall adopt a Mine Closure Plan for each of their mines comprising progressive Closure Plan and final Closure Plan duly approved by the Competent Authority.
In compliance of the notification this Mine Closure Plan for Dudhichua Opencast coal Mining Project has been prepared.

Mine closure encompasses rehabilitation process as an ongoing programme designed to restore physical and biological quality of environment disturbed by the mining to a level acceptable to all concerned. It must also aim to create a self-sustained ecosystem. Mine closure operation is a continuous series of activities starting from day one of the initiation of mining project.

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

a. To allow a productive and sustainable after-use of the site which is acceptable to the mine owner, adjacent mine owners (since all the mines are owned by the same company therefore it is done in an integrated manner), the regulatory authority, the local community and the other stake-holders.

b. To protect public health and safety.

c. To alleviate or eliminate environmental damage and thereby encourage environmental sustainability.

d. To minimise adverse socio-economic impacts.

Mine closure planning covers the progressive mining and post-mining phase of the project. Several attribute of progressive mine closure planning have to be implemented and introduced during the period of mine operation.
Progressive mine closure process is undertaken concurrently with mine development/ production activities.

1.2.0 Statutory obligations

1.2.1 Special conditions imposed while execution of lease deed

Special conditions imposed while execution of lease deed is being complied. The compliance report pertaining to conditions imposed while granting the lease renewal of 194.78 Ha Forest land is enclosed as **Annexure-1.**

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The compliance status of conditions imposed while granting lease for 13.05 Ha of Forest land to Dudhichua and Khadia Projects for forty years is enclosed as **Annexure-2.**

1.2.2 Approval of mining plan

Mining plan/PR has already been approved by NCL Board.

1.2.3 Directives/ conditions imposed by MoC/MoEF/SPCB/CPCB

The directives /conditions imposed by the MoC/MoEF/SPCB/CPCB SPC are being complied from time to time.

The Six monthly compliance report against the EC conditions imposed by MoEF has been enclosed as **Annexure-3.**

The compliance status of Air and Water consent conditions imposed by UPPCB and MPPCB is enclosed as **Annexure-4.**

The compliance report of conditions of Authorisation for Hazardous waste management is enclosed as **Annexure-5.**

There is a need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, central and state governments after mine closure. Although no comprehensive legislation exists on mine closure, the following legislations are relevant to mine closure aspects of Coal Mines:

- The Mines Act, 1952.
- Coal Mines Regulations 1957: Regulations 6, 61, 106, 112,197 etc of Coal Mines Regulations, 1957 and its related DGMS Circulars.
- The Coal Mines (Conservation and Development) Act, 1974.
- Water (Prevention and Control of Pollution Act), 1974.
- Air (Prevention and Control of Pollution), Act 1981.
- Environment (Protection) Act, 1986 and Environment Protection (Amendment) Rule, 2000.
- The Hazardous Waste (Management, Handling and Transboundary Movement) Fourth Amendment Rules, 2010.
- Mines and Minerals (Development and Regulation) Act 1957, amended up to 20-12-2009.
- Mineral Concession Rules 1960, amended up to 18-01-2000.

In addition documents like EIA/EMP submitted to MOEF and the commitments made therein also have legal status.

1.3.0 CLOSURE PLAN PREPARATION

1.3.1 Decision of mine closure

The Dudhichua mine has been designed to produce 15.5 mtpa (Peak) Coal. The geological reserve of coal of Dudhichua project is expected to be exhausted by 2023.

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Final decision of closure will be taken by the competent authority in appropriate time.

The layout map of Dudhichua OCP is enclosed as **Plate-2**.

2.0 MINE DESCRIPTION

2.1 Geology

2.1.1 Topography

Dudhichua OCP is located in the Moher basin of Singrauli Coalfield. The project is covered under Topo sheet no 63-L/12, 9 &11 of the Survey of India and bounded by latitude 24^0 00' 00" to 24^0 10' 02" N and longitudes 82^0 39' 55" to 82^0 42' 34" E. Dudhichua Opencast Project stands out on a plateau above planes on its South- West side. The area on the top of the plateau is undulating with elevation varying from 370 m to 400 m with occasional high hills rising to 450 m.

2.1.2 Rock types

Geology of this block based on 142 boreholes, with total meterage of 13951 m and the bore-holes density for Dudhichua block is 16 boreholes per sq.kms. The lithological sequence of this block is as given below:

Lithology	Thickness in m (Normal)
Soil & sub-soil	0 -0.3
Sandstone and Shale	Up to 98.50
Purewa Top Seam	7.01 to 10.28
Sandstone and Shale	27.08 to 44.35
Purewa Bottom Seam	8.05 to 13.70
Sandstone and Shale	48.50 to 61.35
Turra Seam	17.40 to 24.99
Sandstone and Shale	61.81 to 64.33

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2.1.3 Toxic Elements study

Toxic elements studies of coal samples from coal seams of NCL mines has been tested by IIT, BHU Varanasi, Envirotech Ltd., Kolkata and is enclosed as **Annexure-6.**

2.1.4 Geological Structures

General strike is NW-SE and the dip is towards North- East, which varies from 1 in 20 to 1 in 25 (2^0 to 3^0).

2.1.5 GENERAL

The generalised geological sequence of Moher Basin is presented below

Age		Formation	Lithology
Recent		Alluvium Soil	
Permian	LOWER GONDWANA	Raniganj	Sand stone, carb shale, Fire clay &Jhingurdah Seam
		Barren Measure	Medium to coarse-grained sandstones with occasional red, green, shale bands
		Barakar	Medium to coarse to very coarse sand stone, carb shales and thick Coal Seams (Turra, Purewa Seam)
		Talcher	Khakhi to green colouredshales, sandy shales, sand stone and boulders
-Unconformity-			
-Metamorphics Basement-			

2.1.6 FAULT

There are four faults out of which only one fault affects a small portion of the block in the northern corner.

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2.2.0 RESERVE

Proved Reserve: 336.29 MT
Indicated Reserve: NA
Inferred Reserve: NA
Mineable Reserve: 335.74 MT

2.2.1 Study about category of coal

There are three working seams in the area viz. Tura, Purewa Bottom, Purewa Top Seam in the ascending order. The lower most Kota seam does not outcrop in the area and has not been investigated in detail because it is thin and inter-banded and hence has not been considered

Seam-wise Reserve

S.No	Particulars	Total	Average Grade
1	Purewa Top	50.91	F/G
2	Purewa Bottom	91.37	E/F
3	Turra	193.46	D/E
	Total	**335.74**	**D to F**

2.2.2 Balance quantity of Coal reserve at time of mine closure

There will be no coal reserve at the time of closure as the mine is expected to be exhausted at the time of closure.

2.3.0 MINING METHOD

2.3.1 Mining method

The study of the geo-mining conditions provided the following results:
Gradient of Coal Seam: Flat gradient of 2°-3°

Multiple and thick seams:

Turra seam	17 m (Min) to 25 m (Max)
Purewa Bottom Seam	8 m (Min) to 14 m (Max)
Purewa Top Seam	7.0 m (Min) to 10 m (Max)

Parting between Seams:
Parting between Turra and Purewa Bottom Seams: 54 m (Min) to 61 m (Max) in the east and 49 m (Min) to 57 m (Max) in the west sections

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Parting between Purewa Bottom and Purewa Top: 32 m (Min) to 44 m (Max) in the east and 28 m (Min) to 36 m (Max) in the west sections
OB thickness above Purewa Top Seam : 25 m (Min) to 105 m (Max)

Average S.R: 3.29 m^3/Te as per PR.

Quarry parameters of Dudhichua OCP is as follows

S.no	Particulars	Unit	South	East	West
1.	Length of Quarry along Turra Seam floor	KM	1.0-1.16	1.75	2.5
2.	Width of Quarry along Turra Seam floor	KM	0.4-0.73	1.90	1.58
3.	Maximum Depth	M	85	235	205
4.	Surface Area(Sq. KM)		8.68		

Considering geo-mining condition of Dudhichua OCP, the mine field is to be developed in two sections namely East section and West section. Considering the flat dip of coal seam (2^0 -3^0), it is proposed to excavate the OB from advance OB benches by inclined layers parallel to the roof of coal seam. This system eliminates the need to cut new horizons from the side of the seam roof and simplifies water drainage from the benches to the central sump.

A combined system of mining with the use of Dragline and Shovel - Dumper combination has been proposed. Elements of mining system have been determined in accordance with the parameters of Excavation and Transport equipment and parameters of drilling and blasting. The OB immediately above Turra seam will be side cast by Dragline with a bench height from 40 to 43 m. The dragline cut width adopted is 60m. All the OB above the dragline bench horizon is proposed to be excavated 20 m^3 shovels. The width of cut of shovel benches has been adopted as 20m. The maximum height of shovel benches is 18 m. The width of the working bench varies from 60 to 66 m which includes 20m cut width, 14 m throw, 22m haul road, 6m for power supply arrangement. The mining system parameters for O.B and Coal are as follows-

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Mining System Parameters

Sl. No.	Particulars	Unit	O.B.		Coal
			(Dragline)	(Shovel)	
1	Bench Height	m	40 to 45	15 to 18	10 to 15
2	Working Bench Width	m	70	55 to 60	45
3	Non-working Bench Width	m	70	35 to 40	25
4	Bench Slope	Deg.	70	70	80
5	Blast Hole Dia.	mm	311	250	250
6	Inclination of Bore hole		Inclined	Vertical	Vertical
7	Powder factor	Kg/m^3	0.6	0.3	0.2

Mine layout plan is shown in **Plate-2**

2.3.2 Mining Machinery deployed:

S.NO.	Equipment	Size/capacity	No. of equipment existing as on 1.4.2008
1	Dragline	24/88mR	4
2	Rope Shovel	10 m^3	18
3	Hyd. Shovel	1.2 m^3	2
4	RBH Electric Drill	300-330 mm	4
5	RBH Electric Drill	225-250 mm	17
6	RBH Drill	160 mm	8
7	Rear Dumper	120 T	48
8	Rear Dumper	85 T	70
9	Dozer	650/770 HP	6
10	Dozer	410 HP	19
11	Wheel Dozer/Dozer	300/480 HP	3
12	Wheel Dozer/Dozer	250/320 HP	2
13	Crane	50-100 T	2
14	Crane	30-40 T	1
15	FE Loader	5.74 m^3	2
16	Grader	280 HP	8

As per the mining plan for 15.5 MTPA it was proposed to replace all the existing 85 T rear dumpers with 120 T rear dumpers working with 10 m^3 Elec. Rope shovels. It was also proposed to replace existing 10 m^3 Elec. Rope shovel with same nos. of 20 m^3 Elec. Rope shovels working in conjunction with 170/190 T rear dumpers.

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2.3.3 Production level

The Dudhichua mine is planned to achieve its target capacity of 15.5MTPA. The Coal and O.B production schedule is given in **Annexure-7.**

3 CLOSURE PLAN

3.1.0 MINED OUT LAND

3.1.1 Proposal/Measures implemented for reclamation

The project report envisages concurrent land reclamation of mined out land. The reclamation is to be done in three phases.

Phase-I **Physical / Technical Reclamation:**

In phase-I, the mined out land area backfilled with excavated OB material up to be pre-determined level and it is leveled with dozer and grader. A layer of top soil is laid over this graded & leveled surface of backfilled mined out land.
The provision of capital fund for technical reclamation in the project report (10 MTPA) is Rs. 701.2 lakhs.

Equipment provided (Project Report, Dec'10) for land reclamation is as follows:

Sl. no	Particulars	Size	Existing as on 1.4.2005
1	Hyd. Shovel	1.2 m^3	2
2	Grader	280 HP	8
3	Dozer	410 HP	21
4	Dozer	650/770 HP	5

Phase-II **Biological and Ecological Reclamation**

Biological reclamation is the phase-II of reclamation process. Re-vegetation covers in terms of grass & trees of appropriate species are raised over the physically reclaimed land. Proper steps will be taken to restore the ecological integrity of the lease area as envisaged in the EMP. Progressive Green Belt development & Biological reclamation plan till closure is given in **Annexure-8.** Present progressive land use pattern of Dudhichua OCP is enclosed as **Plate-3**

Phase-III **Hydro Reclamation**

At the end of mine life a void of 63 Ha will be left in the excavated zone. This void will be converted in to a water body. This water reservoir may be developed for pisci-culture.

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3.1.2 Rehabilitation of mined out land

The reclamation of mined out land will be a concurrent with mining operations. The post mining land use at the end of mine life will be as follows:

Land Use	Total Area (in Ha)	Post Mining Use (in Ha)			
		Green / Forest Land	Water Body	Public Use	Others
Undisturbed Land	45	45	-	-	-
Mine Void	63	-	63	-	-
Reclaimed OB dump	900	900	-	-	-
Green belt	160	160	-	-	-
Infrastructure (Workshop, Administrative Building)	116	-	-	10	106
Colony	198	-	-	198	-
Road, Rail	25	-	-	25	-
ETP, CHP etc	21	-	-	-	21
Others (Vacant Land, Mineral Storage, Mine Batter etc)	224	-	-	-	224
TOTAL	1752	1105	63	233	351

At post mining stage area of forest / green will increase from 750 Ha to 1105 Ha.

3.1.3 Actual site restoration for post mining land use

There will be significant increase in forest cover post-mining due to proposed reclamation activities and actual site restoration with improved green cover is targeted in the final mine closure plan.

The proposed Final Dump Plan is enclosed as **Plate- 4** and reclaimed Dump Plan at post mining stage is enclosed as **Plate-5.**

3.1.4 Method of restoration/reclamation/Rehabilitation

Method of restoration/reclamation/rehabilitation has been described in the section 3.1.1

3.1.5 Afforestation in first phase mined out area while commencing the mining in second phase

Mining is being carried out in a phased manner initiating afforestation 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. In 2012-13 108500 plants were planted as per the afforestation plan of EMP. Progressive Green Belt development & Biological reclamation plan till closure is given in **Annexure-8**

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3.1.6 Progressive mine closure plan shall be prepared for a period of five years from the beginning of the mining operation

Progressive mine closure plan has been prepared for a period of five years from the beginning of the mining operation. The five yearly progressive mine closure activities with their expected cost to be incurred is given in **Table-2** of section **5.0**

3.1.7 These plans would be examined periodically in every five years period and be subjected to third party monitoring by the agencies approved by the Central Government

These plans would be examined periodically in every five years period and be subjected to third party monitoring by the agencies approved by the Central Government like the Central Mine Planning and Design Institute (CMPDIL), National Environmental Engineering Research Institute (NEERI), Indian School of Mines (ISM) etc. for the purpose.

3.2.0 WATER QUALITY MANAGEMENT

3.2.1 Details of existing Surface and Ground Water bodies in MLA

The mining area on the top of the plateau is undulating rugged topography sloping towards south and west. The local drainage is mainly radial in nature. All nallahs flowing from North to South meet Ballia nalla in the South which is semi-perennial. The drainage of Ballia nalla goes to Govind Ballabh Sagar which located in the South of Dudhichua.

3.2.2 Steps for Water Quality protection

Following water quality protection measures are taken:

a) **Control of erosion:** The possible sources of surface water erosion are the OB dumps. In order to prevent erosion from the OB surfaces massive plantation is being done on it. For reclamation of OB dumps benching and leveling is done by dozer, terracing is done manually and then U.P. Forest Department and M.P.R.V.V.N does the plantation.
In 2012 84000 trees were planted on dumps located in UP and 24500 trees were planted in dumps located in MP i.e. a total of 108500 trees were planted on dumps.

The slopes of OB dumps are restricted to overall slope of 28°. Such a mild slope not only caters the stability requirement of dumps but also decelerates the surface runoff thereby minimizing the erosion.

The haul roads are properly paved and wherever possible black top roads are provided to minimize erosion.

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b) **Sedimentation:** Siltation ponds have been properly designed and constructed to collect the runoff from the mine and allows its sedimentation. The water so collected is being utilized for watering the mine area, roads, green belt development etc.

c) **Diversion of water courses:** No water courses were encountered in the mine lease area so no such diversion was needed.

d) **Water Treatment:**

There is a STP of 2.00 MLD capacity in the project for treatment of domestic sewage from colonies. The schematic diagram of the STP is enclosed as **Figure-1.**

For treatment of effluent generated from workshop and CHP there is an ETP of 30.00 MLD capacity. The schematic diagram of the ETP is enclosed as **Figure-2.**

Most of the treated water except for rainy season is reused for sprinkling on haul roads for dust suppression and in CHP.

e) **Control of siltation:** To arrest the silt brought by surface runoff Catch drains have been constructed around the OB dumps which have their out let in siltation ponds made to collect these surface runoffs and mine water.

At the toe of the dump Gabion wall of length 2503 m has been constructed in 2012-13 to control siltation.

A series of open drains have been provided on dump body to arrest surface run-off and prevent siltation.

The result of Drinking and Effluent water quality of Dudhichua OCP for 2013-14 is given in **Annexure-9.**

f) **Hydrogeology Study in the area:**

Ground water profile in general follows the land profile. A ground water divide is running across the centre of the area from west to east. A flat water table with a gradient of $7.5X10^{-3}$, sloping towards south/south east has been observed in this area towards G.B.P Sagar. On the northern side. The aquifer units present above the working coal seams are the major sources for inflow in to present and proposed mine working. With the presence of shale and compaction, the seepage from mine floor may be considered as negligible. The various hydro geological units developed in the Dudhichua OCP is given below:

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Hydrogeological units developed in the Dudhichua OCP

Hydrogeological Unit	Formation	Thickness (m)
Phreatic aquifer (Top)	Soil, sub-soil, weathered sandstone and sandstone with clay and shale intermittent beds	Up to 98
Aquiclude	Coal seam – Purewa Top (Working seam)	7 – 10
Aquifer (Middle)	Medium grained sandstone with thin shale	0 – 27
Aquiclude	Coal seam – Purewa bottom (working seam)	8 - 14
Aquifer (Lower)	Medium to coarse grained sandstone with thin shale	48 - 61
Aquiclude	Coal seam – Turra (Working seam)	17 - 25

In the unconfined aquifer ground water moves laterally through the inter- granular pore space in the sand stone. Where as in lower aquifers the ground water movement is restricted mainly through joints and fractures (i.e. Secondary porosity) developed. With the presence of intercalated shale and carbonacious shale beds and reduction in permeability with depth, the lower aquifers are poor in potential. The deeper aquifers are divided in to multi aquifer system due to clay, shale beds and persistent impervious thick coal seam (i.e Purewa Top an Purewa bottom and Turra seam). The deeper aquifers behave as unconfined aquifers at the top outcrop region.

g) Water Balance chart

As the local ground water levels may get affected by open cast mining, the net annual ground water recharge and draft in the study area was estimated as 38.06 M.Cu.m. and 25.40 M.Cu.m respectively. Thus, the balance available annual ground water resource projected in the area is as follows-

The ground water recharge balance of study area is as follows:

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Ground Water Recharge Balance in Study Area (10K.M. radius)

A.	**Net Annual Ground water Recharge**	**: 38.06 Mm^3**
B.	**Net Annual Ground water Draft**	:
	i) Irrigation Use	: 0.31 Mm^3
	ii) Community Use	: 18.83 Mm^3
	iii) Net Mine Discharge	: 6.26 Mm^3
	Net Annual Ground water Draft	**: 25.40 Mm^3**
C.	**Balance Annual Ground water Recharge (A-B)**	**: 12.66 Mm^3**

To assess the impact of opencast mining on local water regime, a regular seasonal monitoring of ground water level and quality is being carried out by establishing a network of 33 nos. existing dug wells in the study area. Analysis of ground water samples from monitoring wells around Dudhichua Project indicate that the water quality is generally suitable for domestic use, the pH ranges from 6.62 to 7.24 standard unit, concentration of dissolved solid, sulphate, iron, manganese, nitrate, fluoride and other heavy metals are found within the drinking standard (IS-10500).In the study area **ground water level variation** is as follows:

Sl.No.	Season	Water level (bgl) in m, Yr.-2013 (Study area- 10 Km radius)
1	Pre-monsoon	2.03 m to 19.82 m
2	Post- monsoon	1.05 m to 18.35 m

As per the ground water assessment report prepared by Central Ground Water Board (N.C.Region) , Bhopal ,M.P., the stage development in the Mayurpur block (where 89% of Dudhichua OCP is located), Sonebhadra District, U.P is 19.86% and the region falls within the category "safe". Remaining area of the project (11%) falls in the Waidhan block of Sidhi District of M.P also come under the same category.

The result of Ground water level & quality measured in 2013-14 is given in **Annexure- 10**

Location map for Observation dug well is enclosed as **Plate-6**.

h) Treatment of Acid Mine Drainage:

There is no such problem of Acid mine drainage at this mine.

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3.3.0 AIR QUALITY MANAGEMENT PLAN

3.3.1 Existing Air Quality Status:

With progressive mine operation & closure, the Ambient air quality of Dudhichua OCP is being monitored regularly on fortnightly basis for all seasons by measuring the concentration of SPM,RPM, SO_2, NO_x.The existing ambient air quality of Dudhichua OCP is being monitored at six locations/ stations, which are as follows.

Sl. No	Location	Rationale behind sampling
1	DA1: Core Zone (Old View pt.)	500 m away from Haul road, to assess t immediate effect of active mining.
2	DA2: Core Zone (Central Substation)	This location is selected to assess the impacts of drilling, blasting, loading of co and OB on AAQ.
3	DA3 : Core Zone (Substation)	To assess the impact of mining activities East Section
4	DA4 : Core Zone (Pump House)	To assess the impact of mining activities West Section
5	DA5 : Buffer Zone (Karwari Village)	The site is located inside the mine lease area situated in the eastern side of the mine. Until the village is rehabilitated the location needs to be monitored regularly
6	DA6: Residential Zone (Sector B&C residential colony near Alankar Bhawan)	This station is selected to assess the Ai quality in residential area as this is likely t be effected by Nigahi OCP situated NW and TPS situated in SE of the station.

The result of Ambient Air quality as measured in 2013-14 is given in **Annexure-11.**

3.3.2 Measures to control Air pollution:

With existing control measures, the ambient air quality of the core & buffer zone is found to be well within the permissible limit and therefore no further control measures are required

Following mitigation measures are in vogue:

- All drills are fitted with dust collection arrangements
- Approach roads to mine and service roads are provided with black topping to reduce dust generation.
- Water sprinklers are provided for dust control on haul roads
- Green belts provided along roads & plantation in vacant land in industrial & township areas for dust control
- In Coal Handling Plant (CHP), dust control system and automatic sprinklers are provided at coal receiving pits. Fixed sprinklers are provided for coal bunkers, transfer points and loading points.

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For Dudhichua OCP monitoring of Ambient Air Quality and above Air Quality Control measures will continue for progressive mine operation & closure. After closure Ambient Air Quality will be monitored for a period of 3 years , if required further control measures will be taken.

3.4.0 WASTE MANAGEMENT

3.4.1 Details of type, quality and quantity of OB, Coal rejects, location plan longitude, latitude

Solid waste that would be generated in course of coal mining are overburden material consisting of fragments of sandstone of assorted size. They have not been found to generate acid mine drainage or leach high quantity of heavy metals.

The Open cast mining of Dudhichua involves removal of 1133.41Mm^3 of overburden. The top elevation of the dumps will be slightly more than the surrounding elevation. The spoil from dragline is proposed to be side-casted in the decoaled floor of Turra seam. The OB from upper benches being handled by Shovel-Dumper system is to be stacked up to the extent possible over the dragline cast spoil within the pit. However, a part of the OB spoil is to be disposed off in External dump.

The break-up of internal & external dump is as follows-

Sl no	Dump	OB Quantity (Mm^3)	Dump Area (Ha)
1	Internal Dump	999.41	748 Ha
2	External Dump	134	152 Ha
	Total	1133.41	900 Ha

Proposed calendar programme of coal production & waste (O.B.) management is given in Annexure-7
The proposed Final Dump Plan is enclosed as **Plate- 4** and reclaimed Dump Plan at post mining stage is enclosed as **Plate-5.**

3.4.2 Year –wise progress of OB removal in terms of height of OB dump and No. of benches etc.

Proposed calendar program of coal production & waste (O.B.) management is given in **Annexure-7.**
The cross sections of proposed final dumps is shown as **Plate-7** which also shows the year-wise target of dump height.and no. of benches to be achieved.

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3.4.3 Their disposal practice

The OB generated is managed in the forms of external and internal dumps. The OB is simultaneously been backfilled in decoaled pits. To avoid dump failure internal and external OB dumps are to be formed in benches/decks as per following specifications:

Particulars	External Dump	Internal Dump
Dump Area (Ha)	152	748
Volume of OB (m^3)	134	999.41
No. of Decks	5	7
Deck Height (m)	30	30
Deck slope	37°	37°
Overall Slope Angle	27°	28°
Berm Width (m)	40	40

3.4.4 Stabilization of waste-Physical, biological year wise progress to be achieved

Details have already been given in 3.1.1 and **Annexure-8**

Status of Area quarried and OB dumps reclaimed as on 31.03.13 at Dudhichua Project

Detail	UP state					MP State	Total
Land disturbed due to mining excavation (in Ha)	321					368	689
External OB dump Nos.	1	2	3	4	5	6	
Status	Inactive	Inactive	Inactive	Inactive	Active	Inactive	
Area of External OB dump in Ha	39	34	35	15	41	55	219
Area of external OB dump reclaimed (in Ha)	29	34	35	15	37	55	205
Area of Internal OB dump (in Ha)	321					148	469
Area of Internal OB dump Reclaimed (in Ha)	47					16.35	63.35

Only 14 ha of the External dump remains to be reclaimed and will be done according to the proposed reclamation plan in the EMP. The internal dump is being reclaimed simultaneously with the progress of mine. Of the total 469 Ha of internal dump (till 31/03/13) 63.35 ha has been fully reclaimed and the rest will be done according to EMP.

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3.4.5 Measure for prevention of siltation, erosion and dust generation, and their dispersal in the air, environment, leaching in the surface and ground water

Several mitigation measures are employed for stabilization of the dump and prevent siltation & erosion.

- At the toe of the dump Gabion wall of length 2503 m has been constructed in 2012-13 to control siltation.
- A series of open drains have been provided on dump body to arrest surface run-off and prevent siltation.
- Grasses have been grown on slopes to minimize soil erosion.

3.4.6 Details of reclamation and afforestation with mining activity

Details have been given in 3.1.1 and **Annexure-8.**

3.4.7 Waste material re-handled or back filled in the final voids for safety

As per mine plan of Dudhichua OCP, major portion of quarry will be back filled and reclaimed; only an area of 63 ha would turn out to be void. In due course of time, dip side of void will be filled with rain & ground water. This water reservoir may be developed for pisci-culture.

At the time of final closure of mine, fencing with RCC post and barbed wire will be erected around the water body.

To maintain proper depth of water amicable for pisci-culture, the void will be back filled with O.B. dump material to certain height. In the final mine closure plan, design of voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation wherever possible and for hydro reclamation wherever feasible.

3.4.8 Efforts for minimum land requirement and degradation of land due to external OB

The dump plans of the project has been planned to accommodate maximum possible OB volume in internal OB dump and rest a small part in external OB dumps, so that land requirement for external OB dump is minimum for whole life of different projects.

While designing the OB dumps of the project, technical parameters such as width, height, slope of dump etc. have been taken into consideration for safe OB dumping, so that there is minimum impact on environment and land degradation.

3.4.9 Proposal to recharge and stabilize the water table in the surrounding areas

The project has already constructed two ponds, one in south east side and another on north east side for conservation measures to augment

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the ground water resources. This will help in recharging and stabilizing the groundwater table in the surrounding area.
Besides above, three ground water recharging pits have been constructed at CGM office for rain water harvesting.

The project has already taken up the groundwater table monitoring of dug-wells in and around the project area to watch any depletion in water table.

3.5.0 TOP SOIL MANAGEMENT

3.5.1 Details of top soil available and its utilization

At Dudhichua OCP, it is found that top soil is found in patches, which is then used for reclamation of dumps.

3.5.2 Quantity and details of preserving it

Top soil removed will be stock-piled only when it is impractical to promptly redistribute on required area. Two sites in the east and west portion of the mine and of 5.00 ha of area each have been earmarked for storage of top soil. The map showing the location of these sites has been enclosed as **Plate-8**
Stock piled top soil shall be selectively placed on pre designed area
A vegetative cover will be generated immediately on the stock pile to prevent erosion.

3.6 MANAGEMENT OF COAL REJECTS FROM WASHERY

There is no proposal for Coal Washery for this mine. Un-washed crushed coal from Coal Handling Plant / Silo is being dispatched to power stations and other customer through MGR and public railway system.

3.7.0 INFRASTRUCTURE

3.7.1 Details of existing infrastructural facilities

Several infrastructures have been provided that includes:

i. Workshop facilities
ii. Office complex
iii. Townships
iv. Coal Handling Plants
v. Railway siding for transportation of coal
vi. Power Network including sub-stations
vii. Industrial and municipal effluent treatment plants
viii. Community facilities

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3.7.2 Decommissioning proposed and their dismantling and disposal proposal

At the end of mining operations, it is proposed to decommission the Industrial infrastructures. However, before such decommissioning other infrastructures like office complex, residential complex, roads, pipelines and transmission line and community facilities, the possibility of re-use of these infrastructures for the neighboring mines shall be explored.

Salvaged materials/equipments would be used for creating infrastructures facilities for coal mines that are likely to be developed in the coalfield in future. The unusable materials will be disposed off (including the hazardous materials, if found any, according to conditions imposed while granting authorization for handling hazardous materials). After decommissioning of industrial infrastructure facilities, the leasehold area will be leveled.

The community facilities developed during the mine life like educational facilities, health facilities etc. would be continued even after the mine closure. The final closure plan will envisage interaction of mining company with the State or local bodies for running these facilities.

3.8 DISPOSAL OF MINING MACHINERY

The machineries that can be used would be diverted to new/existing projects. Other machineries that have exhausted its life will be disposed off by auctioning and removed from the site.

3.9 SAFETY & SECURITY

While carrying out all kinds of mining and allied activities in the mine, the safety rules in force as per Rules& Regulations made under Mines Act, 1952 is being observed and required safety measures are taken. There will be various elements of safety & security at the time of mine closure, which will be dealt under above Rules & Regulations. The Safety & Security hazard include the followings.

Safety hazards including management of fire:

In the Final mine closure plan, action for control of likely fire areas of the mines will be discussed. Action will also be suggested to cover all the safety aspects.

Management of Pit Slopes and Waste Dumps:

The final quarry slopes has been so designed and then subsequently developed that after the closure of the mine, there is no likelihood of any slope failure. The final slope of the quarry has been designed with above consideration. However, strict compliance with the proposed

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final slope of quarry would be made as given in Quarry & Surface Layout Plan and subsequent slope stability studies.

Waste Dumps:

The external waste dump shall be developed as per the proposed design so that slope failures do not create any safety hazard to the local community. The external dump will be formed in number of decks, each deck will have 30 m (maximum) height & slope of 37° (maximum) to avoid dump slope failure, overall dump slope shall be maintained within 28°. Waste dumps shall be provided with garland drains and vegetation cover on surface of these dumps.

Fencing around mined out area:

To prevent illegal mining and considering safety of human & fauna, mined out area shall be properly fenced and all the entries to the mine shall be effectively sealed.

Management of final voids:

As per mine plan of Dudhichua OCP, major portion of quarry will be back filled and reclaimed; only an area of 63 ha would turn out to be void. In due course of time, dip side of void will be filled with rain & ground water. This water reservoir may be developed for pisci-culture.

At the time of final closure of mine, fencing with RCC post and barbed wire will be erected around the water body.

To maintain proper depth of water amicable for pisci-culture, the void will be back filled with O.B. dump material to certain height. In the final mine closure plan, design of voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation wherever possible and for hydro reclamation wherever feasible.

3.10.0 ECONOMIC REPERCUSSIONS OF CLOSURE OF MINE

3.10.1

a) **Number of local residents employed**
A total of 267 persons have been employed in NCL.

b) **Status of continuation of family occupation**
As many landowners from whom the land has been acquired, have also land mass beyond mine lease hold area and they are still enjoying with early family occupation. Many project affected persons have also purchased new land mass beyond project area after getting compensation and are also continuing with their family occupation.

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c) Scope of joining the occupation back

Near the end of the mine life, manpower will start getting reduced. The reduction of manpower could be done as per the following options:

i. Natural retirement
ii. Retraining and redeployment of younger groups in other mine.
iii. Transfer of experienced middle aged groups to other projects.

3.10.2

a) Compensation given:

The project has already provided compensation and rehabilitation of affected families. There are a total 529 land losers and all of them has been compensated as per CIL's R& R norms. There are total of 416 homesteads and all of them have been compensated according to company's policy of R&R.

b) Compensation to Employees:

Since employees are to be redeployed on closure of mine, they will continue to enjoy the regular pay and other benefits. As such there is no need for additional compensation.

3.10.3

a) Satellite Occupations connected to the mining industry:

Number of satellite occupations like transport, explosive industry, electrician, automobile mechanic, local shops, dairy etc. is connected with the mining industry.

b) Number of persons engaged therein

No such study has been carried out to determine the number of persons engaged in satellite occupations.

c) Continuance of such business after mine closure

Once the mine closes, some of these activities would be affected. But this effect would not be severe, as there are other mines and townships close to this mine.

3.10.4

a) Rehabilitated status of MLA

Four villages have been affected due to the project viz. Chilkadand, Madhauli, Duhichua and Karwari. For the displaced people of Chilkadand village rehabilitation site is Jawahar nagar (UP) and for those of rest of the villages it is Jaitpur (MP).

A comparison of socio-economic conditions before and after the commencement of the project shows that the socio-economic conditions have improved significantly due to the generation of new employment opportunities availed by the people and the Rand R activities of the project.

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Improved conditions for the displaced people of Chilkadand village

Sl. No.	Civil amenities	Jawahar nagar R&R centre	Chikadand prior to start of mine
1	Educational facilities (Nearest) Primary School Middle School High School	 1 no. 1-5 Km (Bina, NCL) 1-5 Km (Bina, NCL)	 1 no. 10-15 Kms (Waidhan) 10-15 Kms (Waidhan)
2	Medical facilities (Nearest) Dispensary Hospital	 1 no. 1-5 Km (Shaktinagar)	 1-5 Km (Jayant ,NCL) 10-15 Km (Waidhan)
3	Water Supply Hand Pump Well	 31 nos. 3 nos.	 5 nos. 5 nos.
4	Power Supply	Yes	No
5	Road a) Black Topped road b) WBM Road c) Mud Road	 3 KM 1 Km NIL	 NIL NIL 3 Km
6	Street Light	10 ns.	Nil
7	Community Hall	1 no.	Nil
8	Distance from Highway (Waidhan-varanasi)	0.5 Km	3 Km

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Improved conditions for the displaced people of Karwari, Duhichua and Madhauli village

Sl. No.	Civil amenities	Jaitpur R&R center	Status prior to start of mine		
1	Educational facilities (Nearest)				
	Primary School	1 no.	1 no.	5-10 Km (Singrauli)	10-15 Km (Singrauli)
	Middle School	1 Km (Jayant NCL)	5-10 Km (Singrauli)	5-10 Km (Singrauli)	10-15 Km (Singrauli)
	High School	1 Km (Jayant NCL)	5-10 Km (Singrauli)	5-10 Km (Singrauli)	10-15 Km (Singrauli)
2	Medical facilities (Nearest)				
	Dispensary	Camp by NCL	5-10 Km (Singrauli)	5-10 Km (Singrauli)	10-15 Km (Singrauli)
	Hospital	0-5 Km (NSC)	5-10 Km (Singrauli)	5-10 Km (Singrauli)	10-15 Km (Singrauli)
3	Water Supply				
	Hand Pump	12 nos.	7 nos.	2 nos.	3 nos.
	Well	8 nos.	5 nos.	4 nos.	6 nos.
4	Power Supply	Yes	No	No	No
5	Road				
	a) Black Topped road	5 KM	NIL	NIL	NIL
	b) WBM Road	2 Km	3 Km	NIL	NIL
	c) Mud Road	NIL	6 Km	3 Km	2 Km
6	Street Light	In progress	NIL	NIL	NIL
7	Community Hall	1 no.	NIL	NIL	NIL
8	Distance from Highway (Waidhan-varanasi)	1 Km	8 Km	15 Km	12 Km

b) Other Remnant activities

The remaining rehabilitation activities will be carried out at the time of final mine closure.

3.10.5 Expectation of society on closure of mine:

The mine extends several community development facilities to the population living in this vicinity. On closure of the mine this will cease. The project affected persons (PAPs) are provided many civic facilities on the line of the management of community facilities dealt above. The final closure plan will envisage interaction of mining company with the State or local bodies for running these facilities.

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4.0 Time scheduling for Abandonment

Mine closure in terms of progressive internal and external dumping, technical & biological reclamation is concurrent with the mining process. With present rate of production life of Dudhichua mine is expected to be up to the year 2023-24.

Detailed mine closure plan shall be prepared & submitted before actual closure. However, tentative closure activities at the time of mine closure are scheduled below:

Sl.no	Activities	Year after closure				
		1st Year	2nd Year	3rd Year	4th Year	5th Year
1.	Mine Pit & Dump Management	■				
2.	Pit water body Management	■	■	■		
3.	Plantation and its after care	■	■	■	■	■
4.	Disposal of Mining Machinery	■	■	■		
5	Infrastructure Dismantling		■	■	■	
6	Environmental Monitoring	■	■	■		
7	Fencing			■	■	

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5.0 Abandonment Cost

Table1: Progressive and Final Mine Closure Cost Distribution of Dudhichua OC Mine			
Sl. No	Activity	Closure Cost (Rs. in lakhs)	Remarks
A	**Dismantling of Structure**		To be included in final mine closure plan
	Service Buildings	35.91	
	Residential Buildings	479.46	
	Industrial structures like CHP, Workshop, field sub-station etc.	53.87	
B	**Permanent Fencing of mine void and other dangerous area**		To be included in final mine closure plan
	Random rubble masonary of height 1.2m including leveling up in cement concrete 1:6:12 in mud mortar	269.35	
C	**Grading of high wall slopes**		To be included in final mine closure plan
	Leveling and grading of high wall slopes	317.84	
D	**OB Dump Reclamation**		
	Handling/Dozing of external OB dump into mine void	15920.97	71% for progressive and 17.66% for final mine closure
	Bio-reclamation including soil spreading, plantation and maintenance	71.83	Equal weightage throughout the life of the mine
E	**Landscaping**		
	Landscaping of the cleared land for improving its aesthetic	53.87	To be included in final mine closure plan
F	**Plantation**		
	Plantation over area obtained after dismantling	89.79	To be included in final mine closure plan
	Plantation around the fencing	35.91	
	Plantation over the cleared off external OB dump	3.59	
G	**Monitoring/testing of parameters for three years**		For 3 years after mine closure
	Air quality	39.51	
	Water quality	35.91	
H	**Enterpreneurship Development (Vocational/skill development training for sustainable income of affected people**	46.69	Equal weightage throughout the life of the mine
I	**Miscellaneous and other mitigative measures**	359.15	Equal weightage throughout the life of the mine
J	**Manpower cost for supervision**	143.66	Equal weightage throughout the life of the mine
	TOTAL	**17957.33**	

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Table2: Progressive Mine closure activities and cost to be incurred

Sl. No.	Activities	Expenditure to be incurred in Rs. (lakhs)	
D	**OB dump reclamation**	**2012-2016**	**2017-2018**
	Handling/ Dozing of external OB dump into mine void	8074.206	3229.682
	Bio-reclamation including soil spreading, plantation and maintenance	29.92916667	11.97166667
H	**Entrepreneurship Development**		
	Vocational/skill development for sustainable income of affected people	19.45416667	7.781666667
I	**Miscellaneous and other mitigative measures**	149.6458333	59.85833333
J	**Manpower cost for supervision**	59.85833333	23.94333333
	Total	8333.0935	3333.237

From 2019 onwards the final mine closure activities will start and the cost incurred will be as given in **Table1.**

The estimated cost of various progressive and final mine closure activities are given below:

The mine closure cost has been estimated as Rs **17957.33**lacs. Other than Mine closure activities this cost also include all post environmental monitoring cost for 3 years, supervision charges for 3 years, power cost, protective and rehabilitation measures including their maintenance and monitoring, miscellaneous charges etc.

This cost has been estimated based on the guide line provided by Ministry of Coal i.e. Rs 7.0833 (June-2011) lakhs per Hectare of the mine lease hold area of 1752 ha. However, this is subject to modification based on wholesale price index as notified by Govt. of India from time to time.

The above fund will be generated annually over the remaining life of the mine i.e. 12 years from 2011-12.The annual closure cost is computed considering the total lease hold area at the above mentioned rate and dividing the same by the mine life. An amount equal to the annual cost is to be deposited each year throughout the mine life compounded @5% annually.

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6.0 Financial Assurance

For financial assurance, Northern Coal Field Ltd shall open an Escrow Account with any Scheduled Bank, with the Coal Controller Organization (on behalf of the Central Government) as exclusive beneficiary. The above annual closure cost compounded @ 5% annually will be deposited annually for 12 years. Year wise deposition of closure cost is given in **Annexure- 12**. The owner of the company may select the Scheduled Bank where the Escrow Account is to be opened and inform the same to Coal Controller, Kolkata. The amount being deposited will be reviewed with such periodicity as deemed fit by the Coal Controller.

Mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mine 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 at the end of the Final Mine Closure shall be released to mine owner/leaseholder on compliance of all provisions of Closure Plan duly signed by the lessee to the effect that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller.
An agreement, outlining detailed terms and conditions of operating the Escrow Account, shall be executed amongst the mining company, the Coal Controller and the concerned bank in order to give effect this.

7.0 Responsibilities of Mine Closure

It is the responsibility of the Mine owners to ensure that the protective measures contained in the mine closure plan including reclamation and rehabilitation works have been carried out in accordance with the approved mine closure plan and final mine closure plan.

The owner shall submit to the Coal Controller a yearly report before 1st July of every year setting forth the extent of protective and rehabilitative works carried out as envisaged in the approved mine closure plans (Progressive and Final Closure Plans.

M. K. Prasad
General Manager
Dudhichua Project

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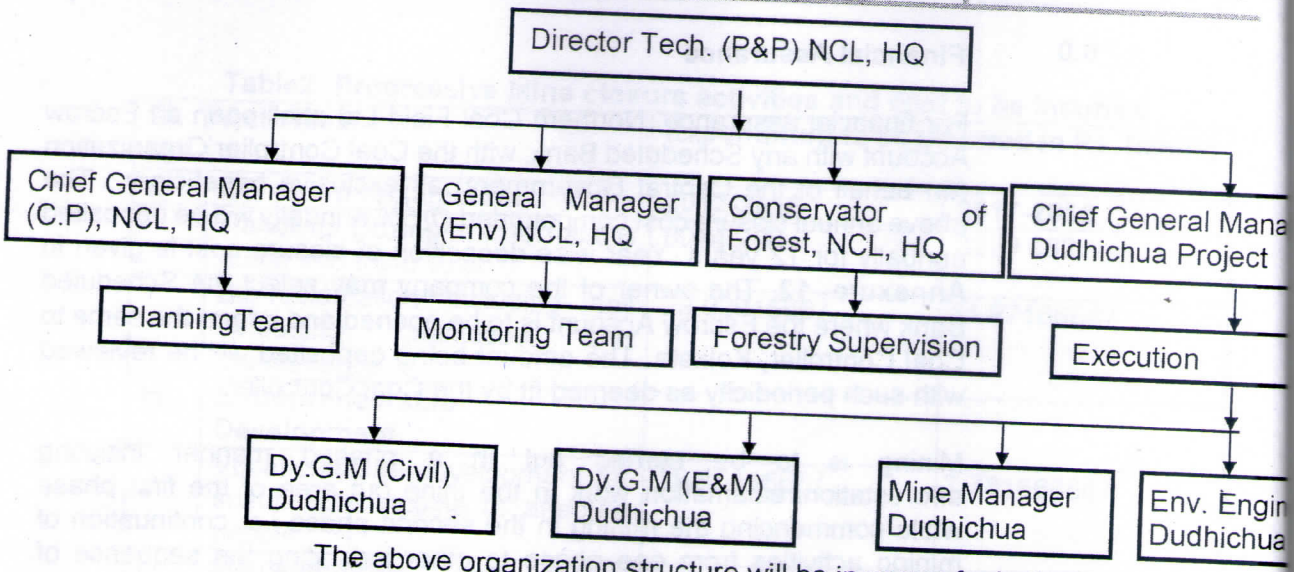

The above organization structure will be in vogue for both progressive & final mine closure.

Chief General Manager:

Chief General Manager of Dudhichua will be responsible for progressive mine closure as well as final Mine Closure Plan. General Manager (Env), NCL will provide technical & other assistance from corporate level.

Dy.G.M (Civil):

He will have following responsibilities

1. Fencing work and Plantation work for Green belt development & Biological reclamation
2. Measures for control of erosion, siltation, water/ effluent treatment etc
3. Ground water monitoring & rain water harvesting
4. Dismantling / demolition operation
5. Cleaning of mining sites, Landscaping, barbed wire fencing
6. Management and Development of final void for pisci-culture.

Dy.G.M (E&M):

He will have following responsibilities

1. Pumping & dewatering operation
2. Environmental control measures in Industrial structures & CHP
3. Lighting arrangement

Mine Manager/ Env. Engineer:

Mine Manager / Env. Engineer will have following responsibilities

1. Progressive & final technical reclamation of land, void, dump.
2. Environmental monitoring & control in the mines
3. Post environmental monitoring for 3 years
4. Disposal of Mining Machineries

8.0 Provision for Mine closure

The mine owner shall be required to 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 by the mine owner for surrendering the reclaimed land to the State government concerned.

The balance amount at the end of the final Mine Closure shall be released to mine owner on compliance of all provisions of Closure Plan duly signed by the mine owner to the effect that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State government, statutory organizations, court etc. and duly certified by the coal Controller. This should also indicate the estimated extractable coal reserves and coal actually mine out.

If the coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan in respect of which financial assurance was given has not been or will not be carried out in accordance with mine closure plan, either fully or partially, coal controller shall given the mine owner a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days prior to the date of the order to be issued after giving an opportunity to be heard.

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