

NEYVELI LIGNITE CORPORATION LTD

A "MINI RATNA" GOVERNMENT OF INDIA ENTERPRISE



PRESENTATION ON

NEYVELI LIGNITE CORPORATION LTD

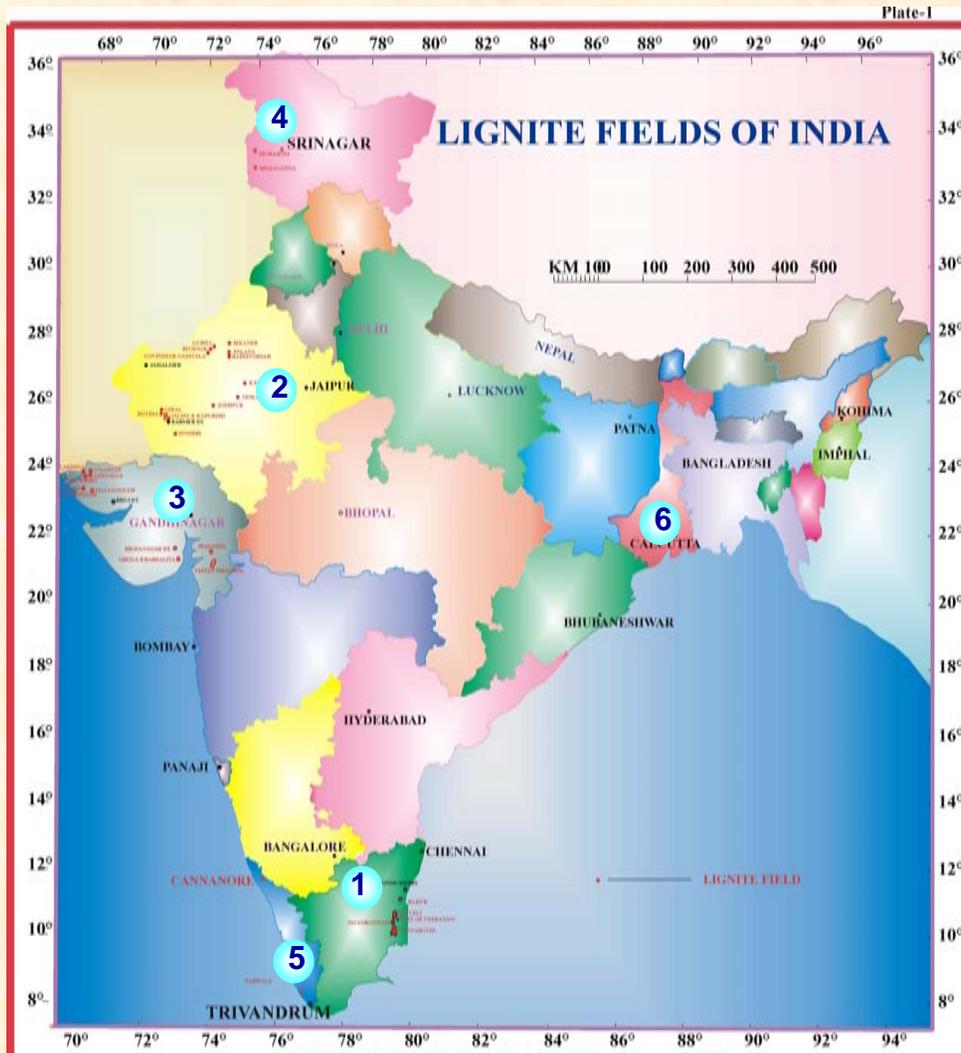


NEYVELI LIGNITE CORPORATION LTD

Neyveli Lignite Corporation Limited is a Government of India Undertaking established on 14th November, 1956 engaged in Mining Lignite and using the same for Power Generation.



LIGNITE FIELDS OF INDIA



► The Lignite Reserves in various states of India was proved and estimated by NLC.

Lignite Reserves (As on April 2007)			
Sl.No	State	In B.T	In %
1	Tamil Nadu & Pondicherry	31.744	81.91
2	Rajasthan	4.311	11.12
3	Gujarat	2.663	6.87
4	Jammu & Kashmir	0.027	0.07
5	Kerala	0.009	0.02
6	West Bengal	0.001	0.00
	Total	38.755	100.00

LIGNITE FIELDS IN TAMIL NADU

LOCATION MAP OF LIGNITE OCCURRENCES IN TAMIL NADU & PONDICHERY

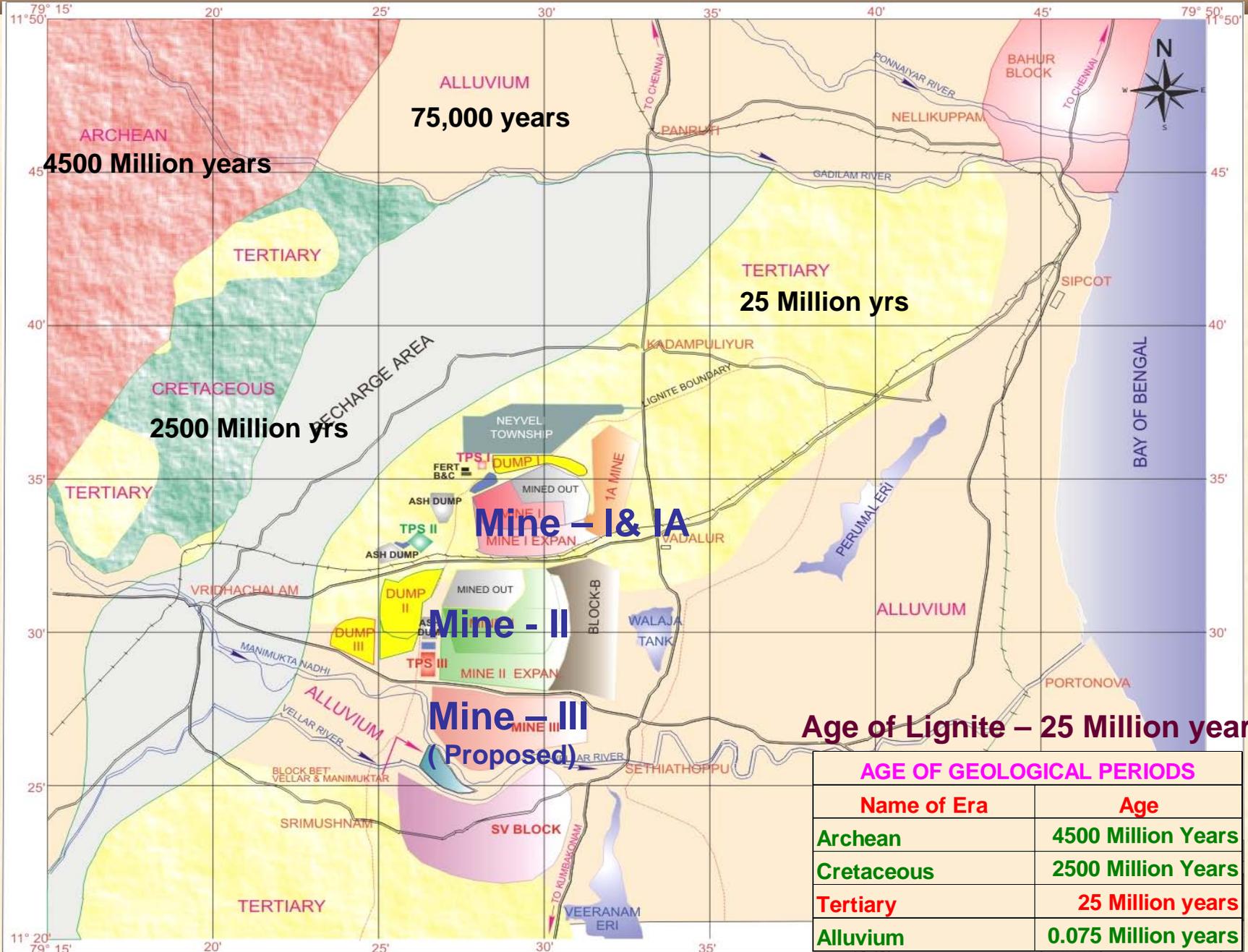


NEYVELI - 200 KM SOUTH OF CHENNAI & 60 KM SOUTH WEST OF PONDICHERY

LIGNITE FIELDS	RESERVE IN MT (GEO)
NEYVELI	3,127.00
JAYAMKONDAM	1,168.00
BAHUR (PONDICHERY)	416.61
VEERANAM	1,342.45
MANNARGUDI	23,099.77
OTHERS	2,589.80
TOTAL	31,743.63



GEOLOGICAL PLAN OF NEYVELI LIGNITE FIELD

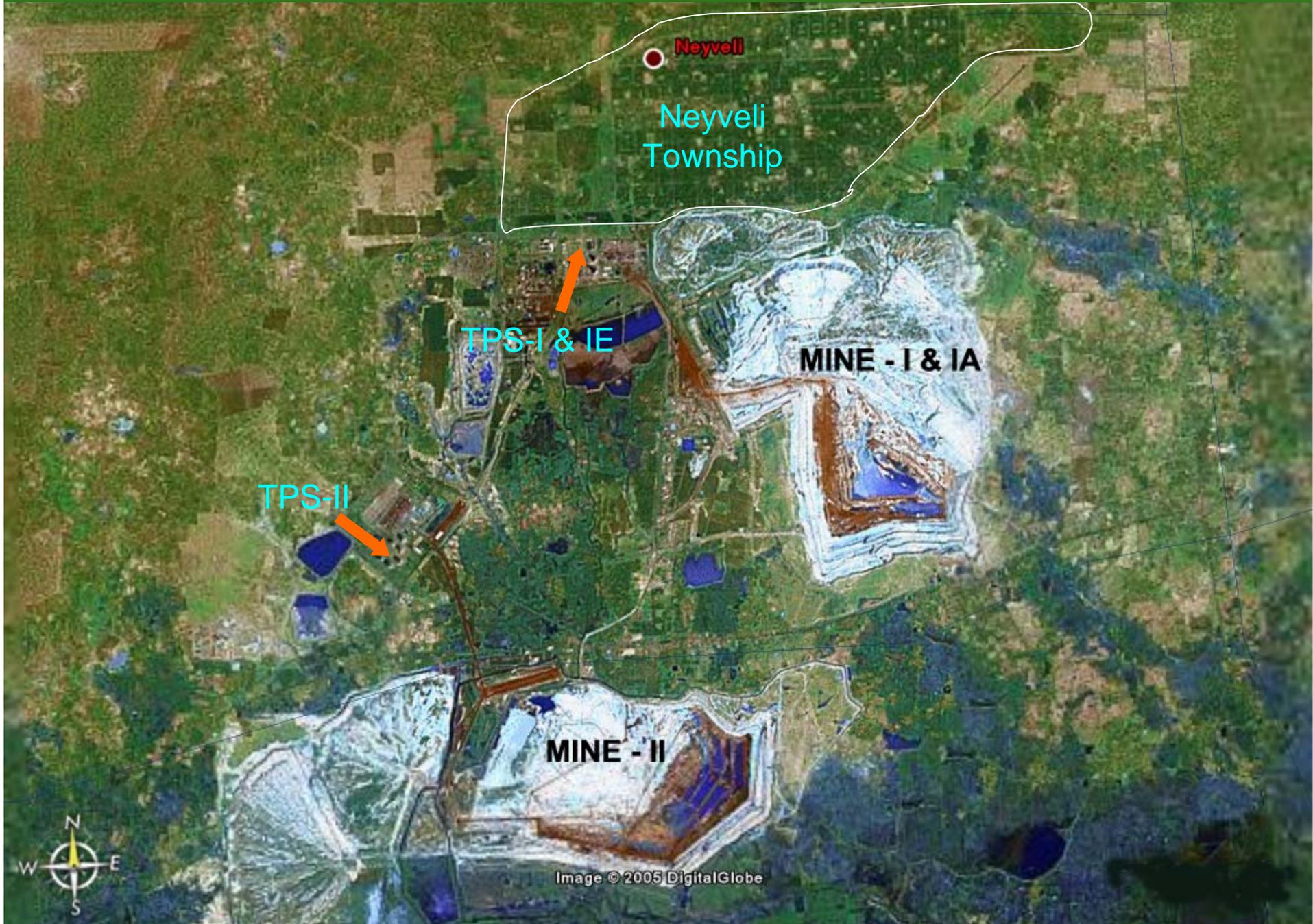


Age of Lignite – 25 Million years

AGE OF GEOLOGICAL PERIODS	
Name of Era	Age
Archean	4500 Million Years
Cretaceous	2500 Million Years
Tertiary	25 Million years
Alluvium	0.075 Million years



LOCATION OF NEYVELI LIGNITE MINES (SATELLITE IMAGE)





Units of NLC



Mining Units	Mine - I	Mine - IA	Mine - II
Mining Started on	20.05.1957	30.07.2001	14.04.1981
Lignite Production Commencement	May, 1962	March,2003	March,1985
Capacity/Annum	10.5	3.0	10.5
Technolgy applied	BWE/Con./Spr	BWE/Con. /Spr	BWE/Con. /Spr
Linked to	TPS-I & TPS-I Exp.	IPP and other	TPS-II
Thermal Units	TPS-I	TPS-I Exp.	TPS-II
Commissioned	May, 1962	1986	March,1986
Lignite First Exposed	24.08.1961	24.03.2003	30.09.1984



Salient features of Mines



Particulars	Unit	Mine - I	Mine - IA	Mine - II
Mining Area	Sq.Km.	24.69	8.36	27
Capacity/Annum	Million Tons	10.5	3.0	10.5
Lignite Reserve	Million Tons.	365	120	398
OB Thickness	Mts.	45 to 110	55 to 110	45 to 103
Lignite Thickness	Mts.	8 to 26	6 to 24	8 to 22
Average Stripping Ratio	Tons : m3	1 : 5.5	1 : 7.0	1 : 5.5
Mining Started on	Date	20.05.1957	30.07.2001	14.04.1981
Lignite First Exposed	Date	24.08.1961	24.03.2003	30.09.1984
Overburden Excavated(31.03.07)	Mill.Cu.Mtr	1376	106	970.85
Lignite Mined (31.03.07)	Million Tons.	255.9	12.21	158.61
Linked Power Station	Name	TPS - I & TPS - I Expn.	ST-CMS (Pvt.)	TPS - II
Generation Capacity	MW	1020	250	1470

OVERALL VIEW OF BENCHES (MINE I)





VIEW OF EXCAVATION BENCHES (MINE II)



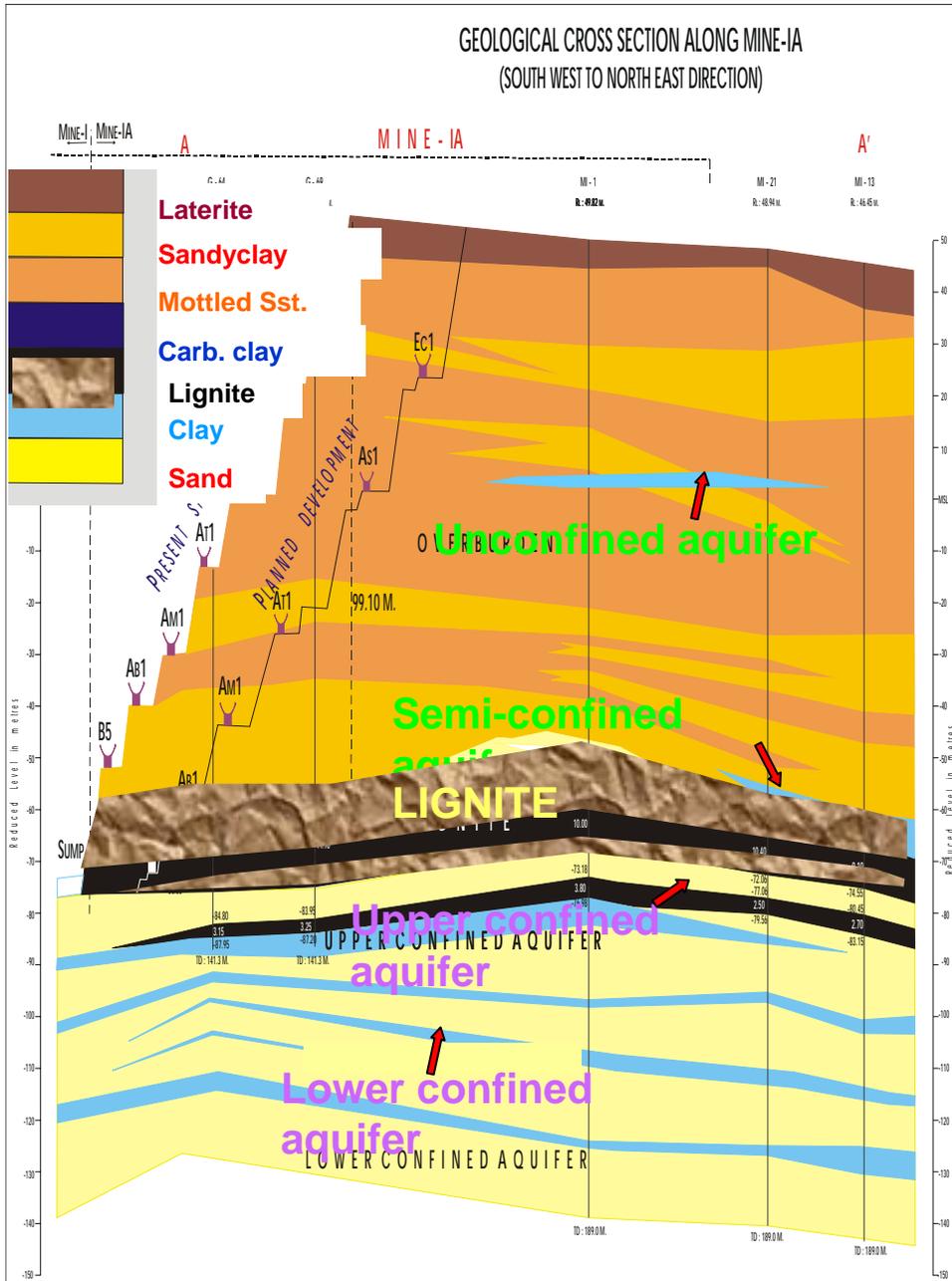


VIEW OF EXCAVATION BENCHES (MINE IA)





CROSS SECTION SHOWING HYDROLOGY & GEOLOGY



Unconfined Aquifer:

➤ Just below ground level up to a maximum depth of 50 mts comprising of lateritic sand stones/alluvium.

➤ Water level fluctuates between ground level and 15 mts

Semi-confined Aquifer:

➤ Occurs just above lignite seam in the southern parts of Mine-I and is predominant in Mine-II and further south.

➤ Its thickness varies between 5 and 10 mts.

➤ Exerts minimal pressure of about 3 to 5 kgf/cm²

Confined Aquifer:

➤ Its occurrence is predominant, thickness is around 400 mts in the core lignite region and pinches in the west

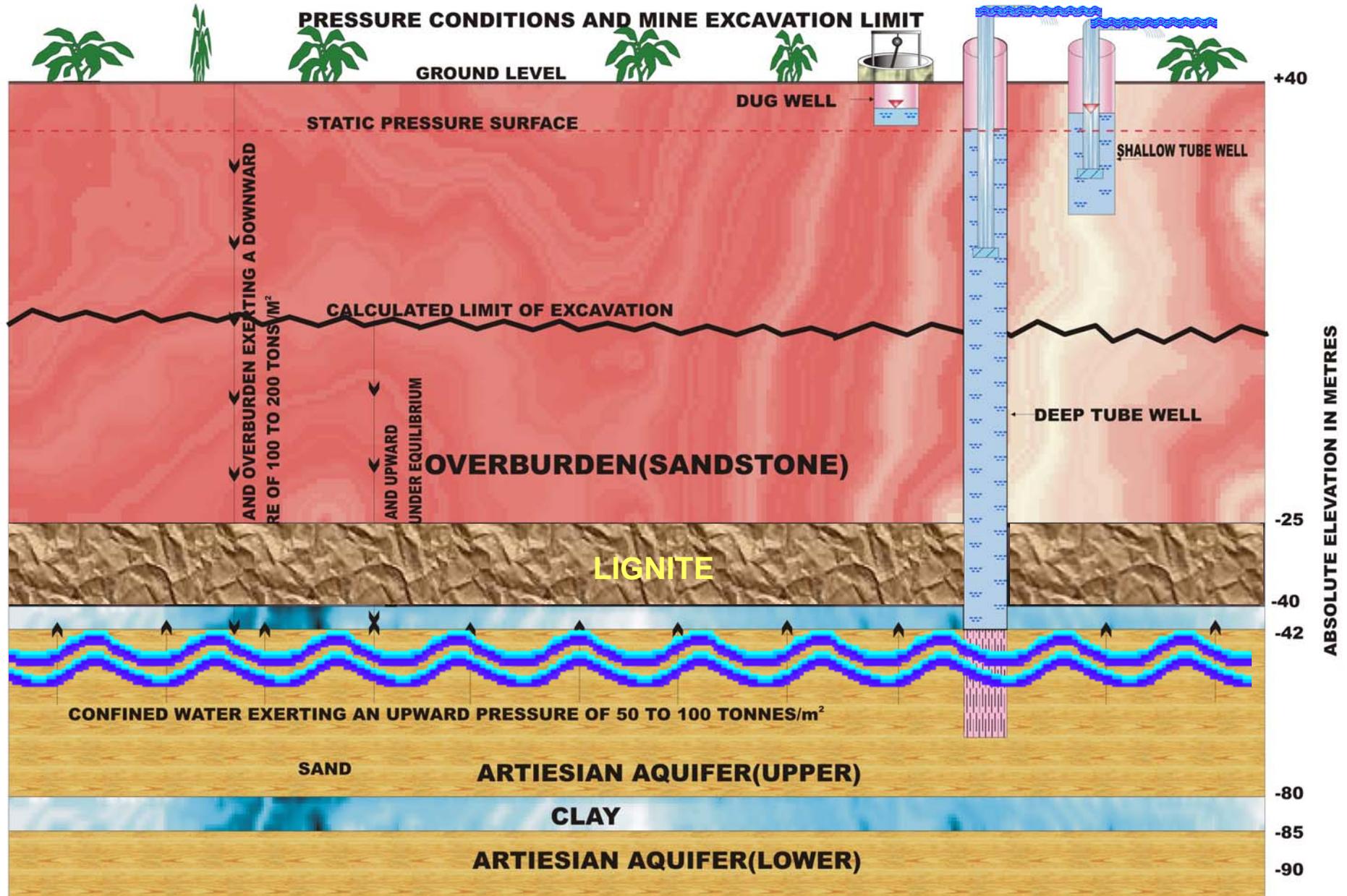
➤ Within the lignite bearing area there is continuous thick barrier of clay at a depth of around 40 to 50 mts which divides the aquifer into two parts viz. Upper and Lower confined aquifer

➤ This aquifer is mainly recharged due to rainfall in the demarcated recharge area of 420 sq.kms lying west of the lignite field.

➤ It exerts an upward pressure of 5 to 10 kgf/cm² at the base of lignite seam



PRE-MINING HYDROLOGICAL CONDITION

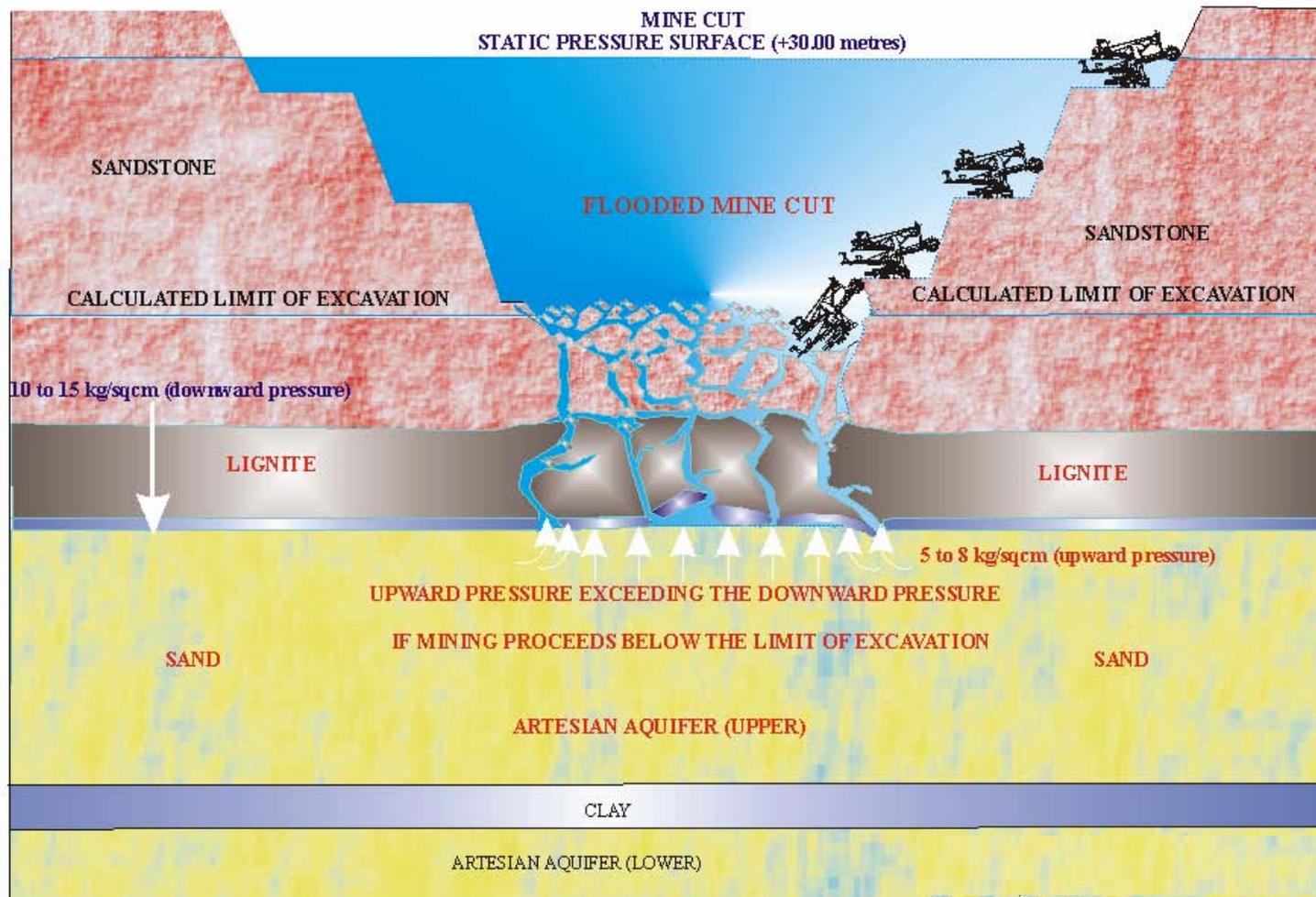




PROBLEM WHEN NOT DEPRESSURISED

PROBLEM

**BURSTING OF THE MINE FLOOR AND FLOODING OF THE MINE
DUE TO THE ARTESIAN PRESSURE**



PROBLEMI.CDR

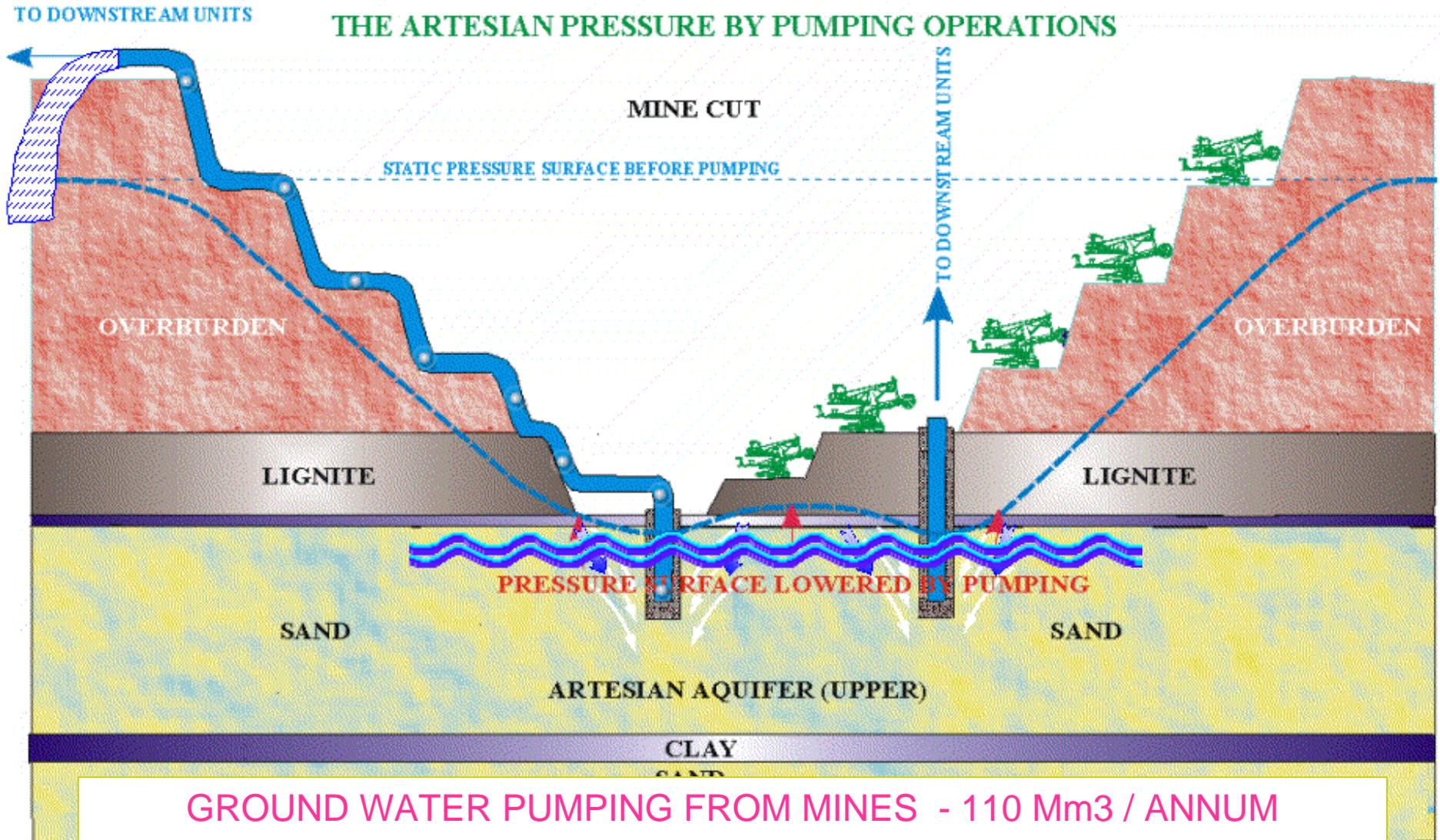




EXCAVATION WITH LOCAL DEPRESSURISATION

SOLUTION

SAFE MINING OF LIGNITE BY CONTROLLING
THE ARTESIAN PRESSURE BY PUMPING OPERATIONS



GROUND WATER PUMPING FROM MINES - 110 Mm³ / ANNUM
45 NUMBERS OF 1000 GPM PUMPS (20" DIA) ARE IN OPERATION





Specialized Mining Equipments at NLC



Bucket Wheel Excavators	Mine - I	Mine - IA	Mine - II	Total
1400 Litre Bridge type	3	-	3	6
1400 Litre Conventional	3	-	2	5
700 Litre without deep cutting	1	4	4	9
700 Litre with deep cutting	2	-	2	4
500 Litre Excavators	1	1	-	2
350 Litre with deep cutting	1	1	-	2



Spreading Equipments	Mine - I	Mine - IA	Mine - II	Total
20,000 TPH Spreader	1	-	2	3
11,000 TPH Spreader	3	-	2	5
8,000 TPH Spreader	1	-	-	1
6,000 TPH Spreader	-	4	-	4

Conventional Mining Equipments at NLC

Sl.No.	Equipment Category	Mine-I	Mine-II	Mine-IA	Total
1	Dozers	52	59	18	129
2	Pipe Layers	21	21	12	54
3	Backhoes	22	28	14	64
4	Shovels	01	05	00	06
5	Cranes	69	44	10	123
6	Dumpers	07	13	0	20
7	Motor Graders	04	03	01	08



CONVEYORS IN NEYVELI MINES

Width		2400mm	2000mm	1800mm	1600mm	1500mm	1500mm
Type of Belt		Steel cord	Fabric				
Conveyor length in Km	Mine-I	8.53	34.61	0.72	---	4.49	2.4
	Mine-IA	---	---	---	9.01	1.21	3.09
	Mine-II	20.56	20.41	4.86	---	---	---
	Total	29.09	55.02	5.58	9.01	5.7	5.49

Total Length of Belting in Conveyor = 230 km

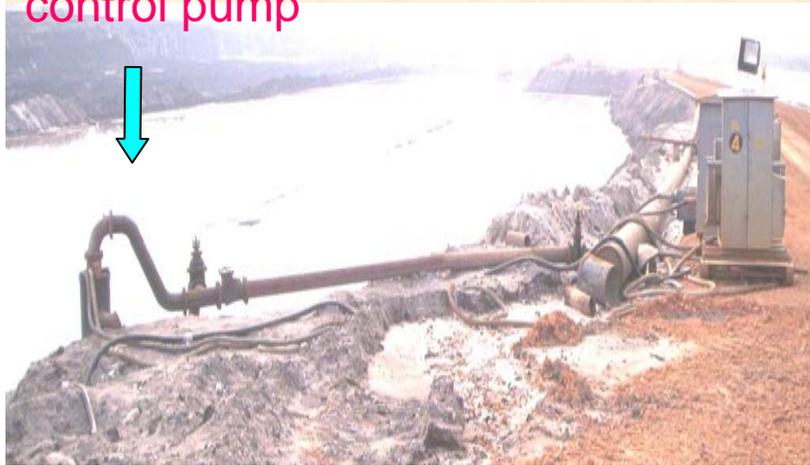




GWC & SWC OPERATIONS

Storm water
control pumps in
Floating pontoons →

Ground water
control pump ↓



GROUND WATER CONTROL OPERATIONS:

- Ever since July 1961, the pressure surface is being controlled through pumping from large diameter wells (Drilling: 36 inches/Casing:20inches) strategically located at pre-determined places.
- Effective pressure control is achieved from the upper confined aquifer alone, constituting the first 30 to 40 m of the aquifer zone immediately below lignite.

STORM WATER CONTROL OPERATIONS:

- Neyveli receives an average rainfall of 1200 to 1400 mm / annum through North-East monsoon (October-December)
- The pumps are of varying capacities Viz. 1000, 2000, 4000, and 5000GPM are used for¹⁹ dewatering the storm water and seepage water.

ISO CERTIFICATIONS

**I - ENVIRONMENT MANAGEMENT
SYSTEM - ISO CERTIFICATION
FOR NLC UNITS (ISO 14001:2004)**

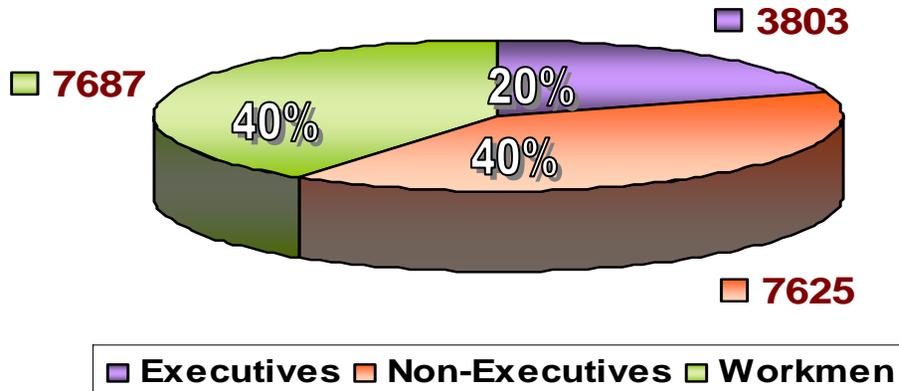
**II- QUALITY MANAGEMENT SYSTEM - ISO
CERTIFICATION FOR NLC UNITS (ISO 9001:2000)**

**III - OCCUPATIONAL HEALTH AND
SAFETY ASSESSMENT SERIES
OHSAS CERTIFICATION FOR NLC UNITS (OHSAS 18001:1999)**



HUMAN RESOURCE STRENGTH

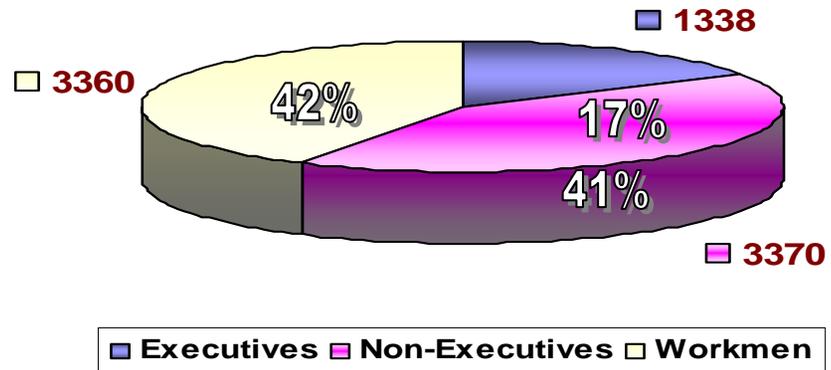
Human Resource of NLC



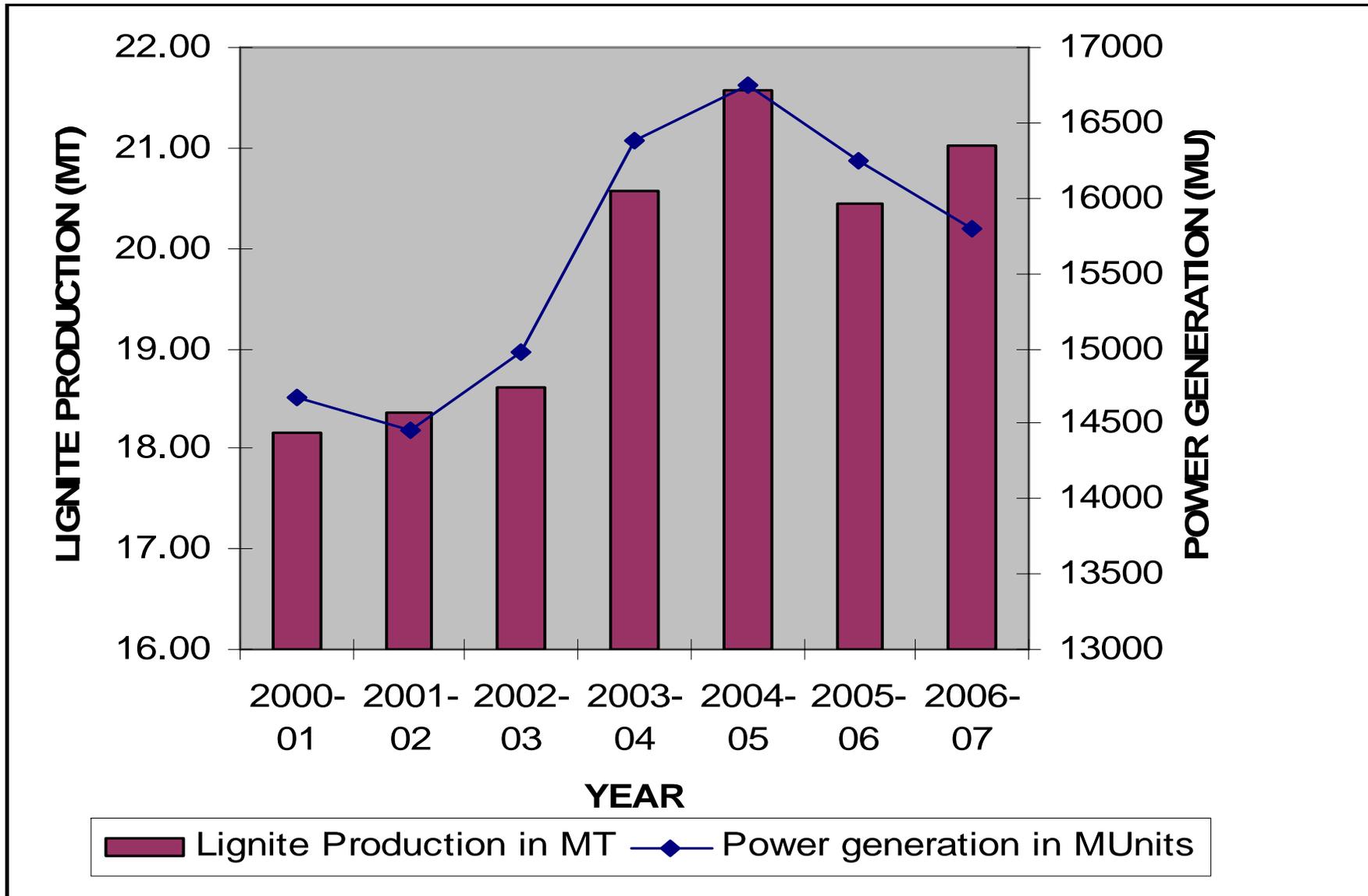
**Total Employees
in NLC = 19115**

**Total Employees
in Mines = 8068**

Human Resource of Mines

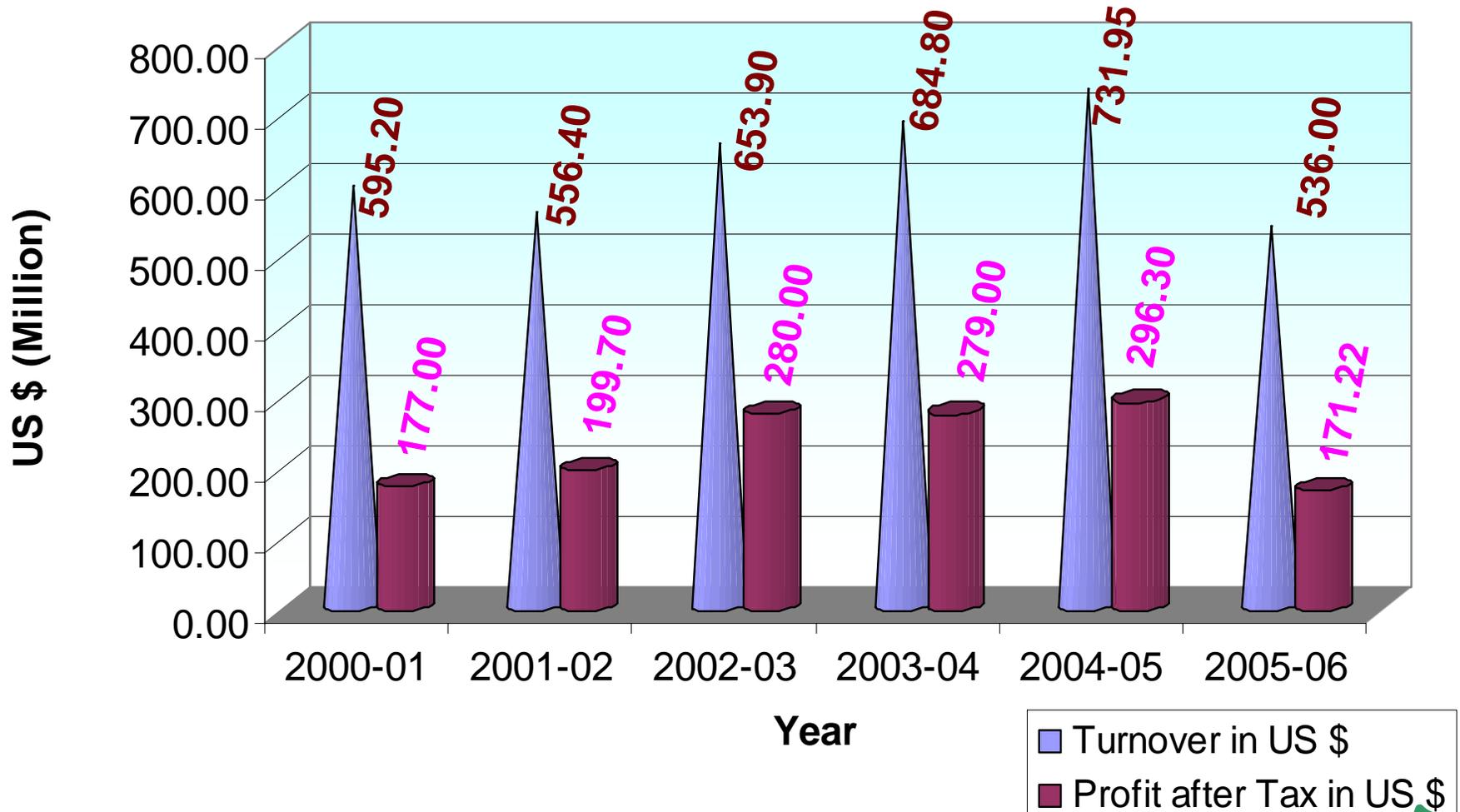


PRODUCTION PERFORMANCE DURING LAST FIVE YEARS



FINANCIAL PERFORMANCE DURING LAST FIVE YEARS

FINANCIAL PERFORMANCE IN US \$ (Million)



The image shows a landscape where a vibrant green field of tall grasses occupies the foreground. In the middle ground, a row of young trees and shrubs separates the field from a large industrial site. The industrial facility includes a long conveyor belt system, several buildings, and a tall structure with a crane-like mechanism. The sky is overcast with grey clouds.

**MINES ENVIROMENTAL CONTROL MEASURES
TOWARDS DEGRADATION
OF LAND**

LAND RECLAMATION MEASURES

RECLAMATION DETAILS IN MINES

S. N	Description	Area in Hectares	
		Mine-I & IA	Mine-II
1	Active Mining area	1942	1254
2	Backfilled area	900	455
3	Afforested area	429	220

RECLAMATION FOR AGRICULTURE

- **Levelling**
- **Ploughing**
- **Incorporation of inputs per Hectare (Saw Dust -25 T, Lignite Dust – 10T, Gypsum – 3T, Urea –65 KG, Muriate of Potash –65 KG, Super Phosphate – 65 KG, Farm Yard Manure/Press Mud –100 M³)**
- **Ploughing two times after applying inputs**
- **Sowing the Green Manure seeds , 3 spells of 60-90 days interval**
- **Ploughing the Green Manure grown up crops in – situ**
- **Field is ready for cultivation.**



RECLAMATION FOR AFFORESTATION

- **Preparation of area (Levelling) .**
- **Making pit size of 0.6mx0.6mx0.6m**
- **Filling the pit with red earth,cattle manure, coir pith, fly ash in 1: 1: 1 ratio.**
- **Addition of bio-fertilizer –Azospirillum, Phospho Bacteria and Mycorohizae each 5 grams Humic acid 5 grams., Neem cake –100 grams, DAP –25 grams.**
- **Plantation of tree saplings and gap filling.**
- **Watering ,Weeding and Up- keeping .**

LAND RECLAMATION FOR AFFORESTATION

Chemical Reclamation: . In order to transform the dump spoil into fertile lands, soil inputs viz. Saw Dust, Lignite dust, Fly ash, Gypsum, Pressmud, Farm yard manure, urea, super phosphate, potash, micronutrients (Cu, Zn, Mn, Mo & B) have been added to dumped soil.

Bio-reclamation using Bio -fertilizer: A pilot plant facility was setup to produce bio -fertilizer using lignite as carrier. Application of bio -fertilizer increased crop productivity by 15 – 40%.

Biological Reclamation using VAM Fungi: VA-Mycorrhiza (VAM) a kind of fungi is found to have beneficial effects on growth of plants. It is observed that VAM application is highly beneficial to the growth of plants (Increase in growth varied from 10 -45 %).

Utilisation of Fly ash in Reclamation: Lignite fly ash contains plant nutrients like Ca, Mg, K, P, S, Cu, Zn, Mn, Fe, B, Mo etc. Crops like paddy, groundnut and maize were tested and found that **20T/ha of fly ash increased the yield of paddy by 20 – 40%**

Reclamation using Lignite based Humic acid: NLC has successfully developed a process for extracting humic acid in the form of Potassium humate from lignite. Humic acid helps to retain the nutrients and increases the yield from 20 -30% in mine spoil.

Ash Pond Reclamation : Plant species like Neem, Casurina, Cashew, Teak, White babul and Tamarind were planted at the ash pond and the plants were found to have better growth which helped to arrest soil erosion and dust generation completely.

Cultivation of Jatropha plant in mine spoil.

Stage-I: Jatropha at Plant stage



Stage-II: Flower ready for ripening



Stage-III: Fruits ready for Bio-diesel extraction



NLC IN THE ENDEAVOUR TO PRODUCE BIO DIESEL FROM JATROPHA PLANTS



Integrated Farming System

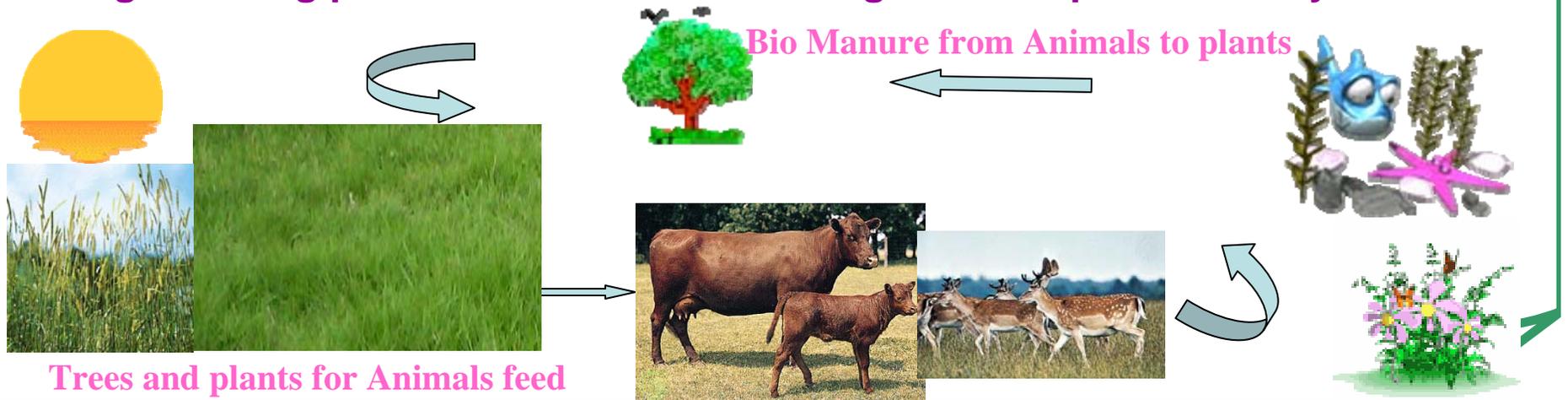
Objectives:

- **Evolving eco-friendly integrated farming systems suitable for mine spoils.**
- **Standardization of crop husbandry and allied enterprises for generating profitable agricultural productive systems.**
- **Improving soil fertility for sustainable crop production**
- **Evaluation of seed hardening and seed pelleting technologies to various tree and crop species for the successful establishments in mine dump soil.**
- **Monitoring soil physical and bio-chemical properties in rehabilitated mine spoil-eco system**
- **Monitoring the restoration potential of bio-diversity.**
- **Exploitation of microbial systems for improving the mine spoils to sustain crop production.**

PROJECT: Transforming NLC Mine spoils into productive Agricultural Land through Eco-friendly Integrated Farming System

Location	: NLC Mines I & II
Area of operation	: 6 ha. each in Mine I & II
Project Cost	: 449.48 Lakhs (US \$ 1.096 Million)
NLC Component	: 240.66 Lakhs (US \$ 587,025)
TNAU Component	: 208.82 Lakhs (US \$ 509,317)
Commencement of the project	: April 2004
Project Period	: Four years (2004-2007)
Objective	: Evolving eco-friendly

Integrated Farming System (IFS) suitable for rehabilitation of NLC mine spoil through standardization of crop husbandry and allied enterprises for generating profitable and sustainable agricultural productive system.



AIR POLLUTION - CONTROL MEASURES

Ambient Air Quality Standards prescribed by Central Pollution Control Board (micro gram/cubic meter)

SPM	SO₂	NO_x	
200	80	80	For Residential, Rural & other areas.
500	120	120	For Industrial areas.

The values of AAQ are well within the limit. The same will be maintained in future also. The annual average values of AAQ concentration of SPM, SO₂ and NO_x on 8 locations for the year 2005-06 is given below.

Annual Avg. Conc. (Mg/NM³)

	Block-29	Block-6	Block-8	Vadakkuthu	Umangalam	Mudhanai	Vadalur	Periya kurichi
SPM	76.54	78.79	88.91	93.68	90.60	96.52	100.58	121.71
SO₂	4.12	4.32	4.32	4.60	3.88	4.21	2.56	3.06
NO_x	16.41	16.50	16.90	16.76	19.47	20.66	16.83	17.93

BIRD-EYE VIEW OF DENSE FOLIAGE IN NEYVELI TOWNSHIP

Green belt development: NLC had raised 17.1 Million trees in the region over a period of time.

This act as a dust barrier by absorbing dust penetration into Township side. Trees reduce mean temperature by 2 degree Celsius. Trees in an acre of land has the potential to absorb six tones of sulphur dioxide. This bring down noise level by 10 decibels per every 10m wide green belt development



Green belt development: NLC had raised 17.1 Million trees in the region over a period of time. This acts as a dust barrier by absorbing dust penetration into Township side. Reduce mean temperature by 2 degree Celsius. Bring down noise level by 10 decibels per every 10m wide green belt development Trees in 0.405 ha of land has the potential to absorb six tones of sulphur dioxide

Electro Static Precipitators (ESP): High efficiency ESP (100%) is installed in the Flue gas exhaust of Thermal power plants. Tall chimneys upto a height of 220 metres are constructed for wide dispersion of flue gases.

Employing machineries with Electrical power: Most of the machineries used in mines are electrically operated and hence the emission of carbon & noxious gases, which is usual with diesel- operated machines, has been substantially reduced.

Dilution of gaseous emissions: The Neyveli lignite mines are spread over a large area. Natural ventilation dilute of any gaseous emission by diesel vehicle.

Sharp teeth for Bucket Wheel Excavator : Using sharp tooth for bucket wheel excavators to reduce dust generation.

POLLUTION CONTROL AT THERMAL POWER STATIONS



- **Installation of High efficiency 99.5% Electrostatic precipitator.**
- **Construction of tall chimneys for wider dispersion of the gases.**
- **On line monitoring system is available.**
- **Water sprinkler system is available for dust control in LHS.**
- **Fly ash utilization is done to 80% and efforts are being made to achieve 100%.**
- **On line SPM and analyzer is in operation in all units**
- **Green belt development has been taken on a large scale basis in line with the requirement of TNPCB.**
- **Flow meters are available for all inlets of water and values are recorded.**

WATER CONSERVATION MEASURES AND POLLUTION CONTROL

Water Conservation and Pollution control measures:

- ❖ **Optimisation of ground water pumping:** NLC has optimized the pumping operations by localized draw down of water around lignite excavation area.
- ❖ **Rainwater harvesting & Artificial recharging:** Rainwater harvesting system has been introduced in the mines, power plants and township.
Artificial recharging of ground water work is taken at Nadiyapattu and Maligampattu villages near Neyveli and has proved very successful.
- ❖ **Storm water treatment:** 8000 GPM of storm water pumped from Mine-I has been diverted to treatment plant at surface. The treated water is sent to township for domestic use
- ❖ **Sewage treatment plant:** A modern sewage treatment plant has been established for treating sewage water from township and the treated water is let out for irrigation purpose

SOCIAL IMPACT
-CONTROL MEASURES
- Resettlement and
Rehabilitation

Resettlement & Rehabilitation

Possible adverse effects of displacement:

- ❖ Displacement of people
- ❖ Deprivation of land, livelihood and shelter
- ❖ Restriction of access to traditional resource bases
- ❖ Socio-cultural environmental impacts Psychological consequences.
- ❖ The weaker sections of society likely to be affected to a greater degree.

Measures:

- ❖ Mine Planning oriented towards minimum disturbance to Human Environment.
- ❖ A Corporate Resettlement and Rehabilitation Policy to assess the impact on human environment and to address all the R&R issues.
- ❖ A standing R&R Action Plan evolved from long local experience to cover all sections of the affected population.
- ❖ Displaced persons Resettled in well-developed, well-connected and conveniently located Resettlement Centres (RCs).
- ❖ Offering regular/temporary jobs to the land affected subject to vacancy, suitability etc.
- ❖ Imparting training for skill development/up-gradation.
- ❖ Hence there are no major resettlement problems.



OTHER ACTIVITIES

- In addition to the mining activities, NLC has also endeavored to be a socially responsible organization. The company has mooted many projects for developing the villages around the vicinity of the mines.
- The water pumped out is utilized for irrigating 8100 hectares of land for the farmers of the adjoining villages.
- The company also provides roads, drinking water and drainage systems to the adjoining villages.
- For maintaining ecological balance it has a well planned Reclamation/ Afforestation programme.

FUTURE MINE

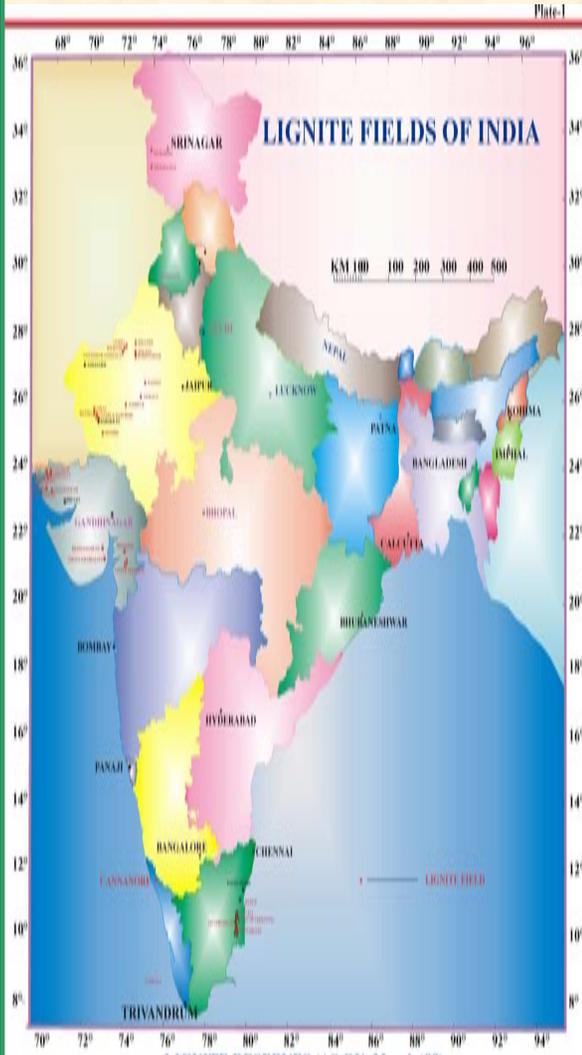
PROJECTS

OF NLC LTD.



FUTURE PROJECTS

PROJECTS UNDER IMPLEMENTATION



Details	Mine - II	TPS - II	Barsingsar	Barsingsar
	Expn.	Expn.	Mine	TPS
Location of Project	Neyveli, Tamil Nadu	Neyveli, Tamil Nadu	Rajasthan	Rajasthan
Sanctioned Capacity	4.5 MTPA	500 MW	2.1 MTPA	250 MW
Capital cost - in Million Rs (in Million USD)	21610 (527)	20310 (495)	2540 (62)	11140 (272)
Commissioning schedule	June 2009	June 2009	June 2009	June 2009

FUTURE PROJECTS

PROJECTS UNDER FORMULATION

Sl. No	Project	Location	Details	Outlay - Million INR (US \$)
1	Jayamkondam	TN, India	13.5 MTPA & 1600 MW	89995 (2195)
2	Valia	Gujarat, India	8.0 MTPA & 1000 MW	56375 (1375)
3	Mine-III	TN, India	8.0 MTPA & 1000 MW	56990 (1390)
4	Bithnok	Rajasthan, India	2.25 MTPA & 250 MW	15662 (382)
5	RIRI	Rajasthan, India	4.5 MTPA & 500 MW	30586 (746)



CONCLUSION

1. **With rich experience gained over past four & half decades in the mining cum power sector, today NLC has transcended as a pioneer in lignite exploitation**
2. **In Neyveli, three operating Mechanised mines and linked modernized thermal power stations are working to their fullest capacity.**
3. **The technology base and innovations have been improved upon from the word go when it was transferred from Germany in late fifties in a raw fashion to a peak level for Neyveli's geo-mining conditions.**
4. **The success story of NLC in both mining with BWE and effective & efficient de-pressurization of high confined pressure of the aquifer below lignite seam have opened new vistas for starting further mining prospects with greater confidence**

