

CHAPTER 6

ENVIRONMENTAL MANAGEMENT PLAN

In the Singrauli region coal mining projects and thermal power stations have invited environmental problems of complex nature due to heterogeneity of mining, industrial and other anthropogenic activities. In order to protect the environment from the impact of mining and thermal power plants, it is very essential to design very carefully and implement the 'Environmental Management Programmes' in the study area so that further degradation can be checked before reaching to unmanageable limits. This will allow the area of the people to live in an acceptable limits. Environmental management includes resource management of the land where mining and thermal power stations are located. A large amount of data on various land characteristics is required for the purpose of developmental planning quite often on repetitive basis. Data collection from various agency and sources consumes time hence remote sensing technique play an important role to provide timely, accurate, latest information for proper environmental management plan. In the context of Singrauli coalfields, different environmental problem can not be seen and dealt in isolation but a combined effect of mining projects as well as thermal power plant and other activities must be taken into consideration when undertaking effective control measures. The basic approach in the present study is to develop an efficient environmental management method, leading to the characterisation, quantification and control of transformation on the areas of influence. Based on environmental impacts assessed in previous chapter the environmental management and pollution control

measures for reducing/mitigating the problem of study area are as following :

1. Reclamation of degraded land
2. Air pollution control
3. Water pollution control
4. Noise pollution abatement
5. Management of foreshores of GBP reservoir
6. Stabilising the banks of nalas and streams
7. Management of ash disposal sites
8. Socio-economic measures

6.1 RECLAMATION OF DEGRADED LAND

The degraded lands in the area include (i) mining Overburden dumps (ii) degraded forest and (iii) wastelands. The reclamation and management of these lands can be done as following :

6.1.1 Reclamation of overburden dumps

Two approaches are advised to adopt for land reclamation of overburden dumps.

6.1.1.1 Technical reclamation

6.1.1.2 Biological reclamation

6.1.1.1 Technical reclamation

Technical reclamation is the process of backfilling of excavated area with overburden and spreading of sub-soil and top-soil grading in a systematic manner and it depends on the equipment used for mining. Based on the type of equipment used for mining, the methods of reclamation suggested by Mehta (1988) are classified into following five categories.

- Shovel-dumper combination
- Bucket-wheel excavator
- Stripping shovel or dragline
- Using dragline and shovel-dumper combination
- In-pit crusher and hybrid transport system

High capacity equipment have been introduced in Singrauli coalfields when Bina and Jayant project started in 1975. OB dumps in these areas are resulting from both the dragline operation as well as shovel-dumper combination. (Plate 6.1 and 6.2).

Backfilling by dragline results in huge conical heaps of overburden and they are difficult to negotiate for plantation due to steepness. The intermittent valleys in these heaps allow flowing water to carry large quantities of silt. (Plate 6.3) To overcome the above problem, the top of OB dumps can be levelled and graded by bulldozers/scrapers (Fig.6.1).



Plate 6.1 Excavation of OB Dumps by Dragline.



Plate 6.2 Dumping of OB Material by Shovel-Dumper Combination

Reclamation of OB Dump(Dragline) for Grading and Leveling by Scraper

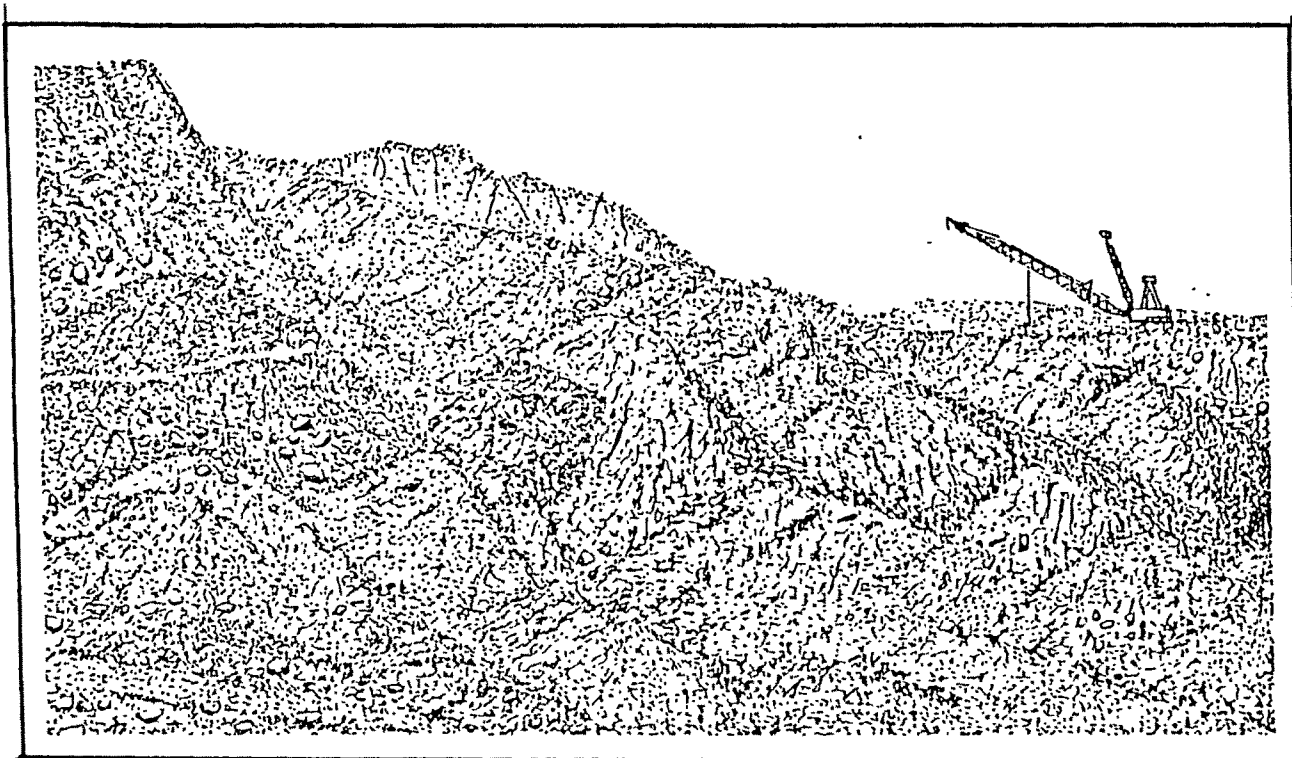


Fig. 6-1

The resultant surface need not be flat and can be undulating. The depressions if any would serve as waterbody.

The active mining areas where shovel-dumper combination is in vogue, the current OB dump may take a long time to be backfilled. These dumps are prone to soil erosion during rainy season. In order to prevent soil wash, a 2m deep and 4m wide trench should be formed along the periphery of dump. As a measure of abundant caution, a continuous rubble wall out of the stone of OB above this trench should be constructed to a height of about 1.5m and 1m thick (Fig. 6.2). This would check the stones and small pieces rolling down.

The abandoned mine (Plate 6.4) and decoaled quarry can be backfilled with OB materials. Since, OB generated is loose in nature, therefore even after backfilling a large amount of loose material still remains in the form of heaps. This should be levelled up and flatenned to a slope of about 30° (Fig. 6.3). Further these heaps must be terraced and the terraces be interconnected by waterways to avoid formation of gullies due to accumulation of water. Each terrace be properly levelled and compacted before stabilization.

6.1.1.2 Biological reclamation

As soon as the backfilling, levelling and top soiling is completed, biological reclamation of land commences. Biological reclamation is very important and it is aimed to convert the land for some productive

PLAN FOR PROPOSED PLANTING PATRONS

Staggered Trenches

Rubble wall Surround Trench (Protective)

Run in trenches

Fig. 6.2



Plate 6.3 Huge Conical Heaps of OB Dumps Resulted by Dragline.



Plate 6.4 A View of Abandoned Gorbi Coal Mine.

Leveling of OB Dump to 30° Slope for Reclamation

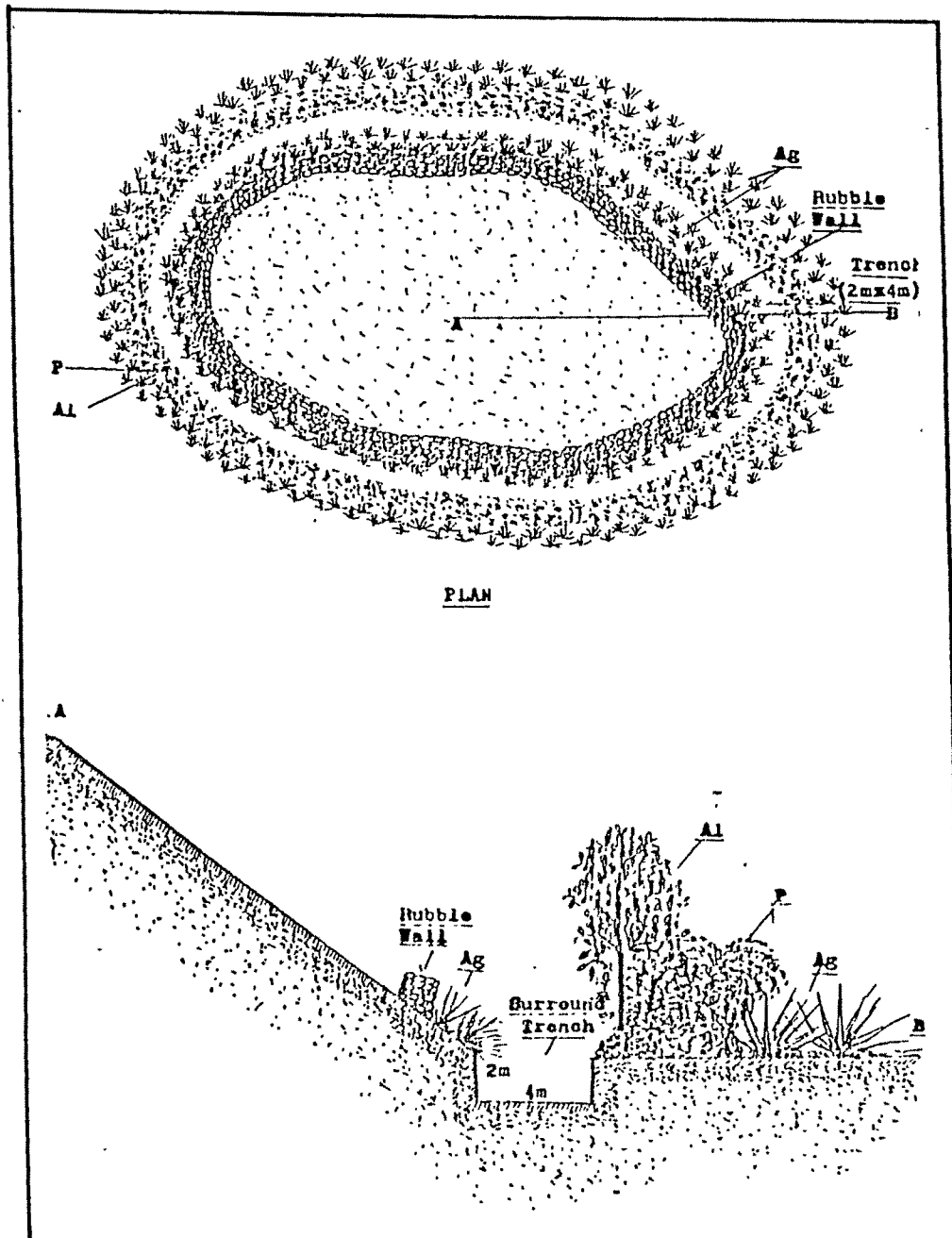


Fig. 6-3

use but it is the most difficult phase of the reclamation process because of the establishment of plant growth on the reclaimed soil which lacks in nutrients and organic matter.

Recently, with increasing ecological awareness reclamation of mined area by biological methods have gained importance. In most cases tree plantation is emphasized for reclamation of mined areas and success has been achieved (*Gupta et. al. Williams, et.al., 1994, Banergee, et. al., 1995*). Some efforts in biological reclamation has been done on 5-15 years old OB dumps in Bina and Kakri project by U.P. Forest Department and State Forest Research Institute, Jabalpur in Nigahi and Jayant blocks (Plate 6.5). After lapse of 4-5 years, soil samples analysed from reclaimed area showed good soil fertility in terms of nutrients when compared with virgin soils of nearby forest areas.

The coal bearing areas of Singrauli are mainly located on plateau composed of coarse grained sandstone which on weathering gives rise to low fertile soil (typical to lithic ultisols, capability class VIIe) supporting scrub and thin jungle therefore best use of technically reclaimed land is to put it under vegetation cover through afforestation/plantation using suitable tree species (Plate 6.6). Since the top soil is not much fertile it is not feasible to store it for top dressing. Saplings can be planted in the pits of 20 X 30 X 40 cm dimensions filled with mixture of transported soil and manure at the beginning of monsoons. In case of excessive dump height terracing at



Plate 6.5 Subabul Plantation on OB Dump of Jayant Coal Mine.



Plate 6.6 Ahera (*Terminalia Belerica*) Plantation on OB Dump of Bina Coal Mine.

10 m vertical interval is advised and then planting of tree at 2 X 2 m spacing. On the slopes, thick sowing of leguminous herbs could be resorted to as it would help in rapid binding and consolidation of soil on the slopes and improving the soil fertility. Planting of trees around the foot of the dump may check further soil erosion. Irrigation during dry season could be done as far as practicable.

Out of the total OB dumps covering an area of 37.77 sq km in 1998 only 31.16% of these dumps were reclaimed by plantation and remaining 68.84% is still to be reclaimed. The OB dumps which would remain permanently can be put under plantation of species like *Aacia auricullformis* *Albizzia lebbek*, *Acacia nilotica* and *Azadirachta indica*. Planting could be done 1 row of each, the plant spaced out 1.5 m apart in lines, the lines being 1.5 m apart. Plants could be alternate with those of the next rows. Along the slopes contour trenches can be made and seeds of *Prosopis juliflora*, could be sown on the mounds and seedlings raised in bags planted in between two trenches. In the trenches *Eucalyptus* hybrid seedlings should be planted 1.5 m apart.

The OB dumps resulting from dragline in Jayant, Dudhichua and Bina mines are difficult for plantation due to steepness. The steepness of these OB dump have to be minimised by dozer for plantation. *Eucalyptus* hybrid should be planted with a cross section of 1/3 X 1/3m and 3 m apart on side slopes of contour trenches. The OB dump with 28° slope can be formed into terraces with an inward slope. The

terrace can be planted closely with *Eucalyptus* (1.5 X 1.5 m.) and terrace slope with seedlings of *Prosopis juliflora* at 2 m X 2 m (Fig. 6.4). This close planting has been suggested with the intention to prevent direct impact of rain splash on the loose OB deposits which would otherwise cause erosion of soil.

6.1.2 Reclamation of degraded forest land

The forest land which is degraded can be utilised for afforestation purpose. About 6.07% of the forest land is presently available for such activities. The suggested technique for these forest is that area should be divided into strip of 5 chains width. In alternate strips promising natural seedling / saplings the poles of important species could be preserved and tended . In the other strip site could be leaving pole crops of important species and debries burnt and miscellaneous timber and useful trees to local community should be raised. Hormones of stumps could be used. Bamboo (*Dendrocalamus strictua*) raised in polythene begs and atleast in 1 m in height should be planted in between these species in 3' diameter pites specially designed for bamboo planting. Three weedings, soil working and mulching could be given for facilitating the plants to establish themselves. Protection from the onslaught of cattle could be ensured by employment of watcher. Though it would not be practicable to fence these area with barbed wire it would be worthwhile to have a cattle trench where plots are sufficiently large or a live hedge around, sowing babul.

Reclamation of OB Dump into Terraces for Plantation

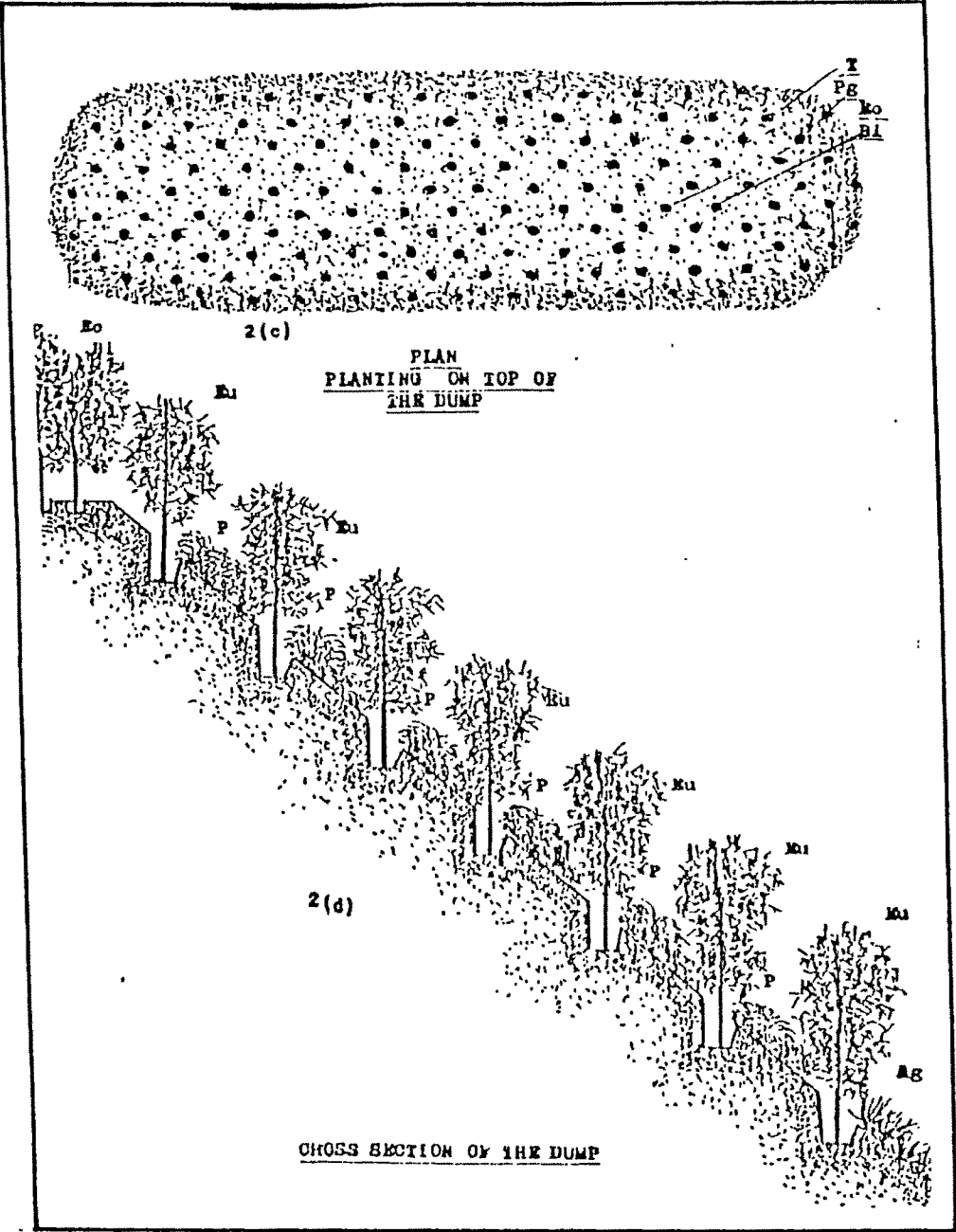


Fig. 6.4

A way of regenerating these areas is by resorting to 'rab' planting. Large gaps should be identified. No trees should be felled. Where sufficiently large patches occur with no natural regeneration the undergrowth could be cleared after suitable demarcation. The cut debris could be spread out uniformly, beaten down and burnt to achieve a uniform burn over the area.

The burnt patches could be planted with Sal depending on whether it is sal or non-sal area, *Bobax malabricum*, *Eugenia jambolana*, *Terminalia tomentosa* and *Bassia latifolia*. The patches could be properly protected and tended (Fig. 6.5).

6.1.3 Reclamation of wastelands

Wasteland could be reclaimed by regulating these lands for afforestation purposes. In view of the large cattle population, land with or without scrubs should be put under silvipasture practices. Silviculture is essentially a system of growing trees and grasses together. The trees selected could be fast growing, have fodder and firewood importance.

The tree species recommended are subabul, babul, neem and amla along with grass species, kusal, chhir and rusa. The area could be ploughed by a tractor and contour furrows made on all possible terrain

Reclamation of Degraded Forest Through Rab Planting

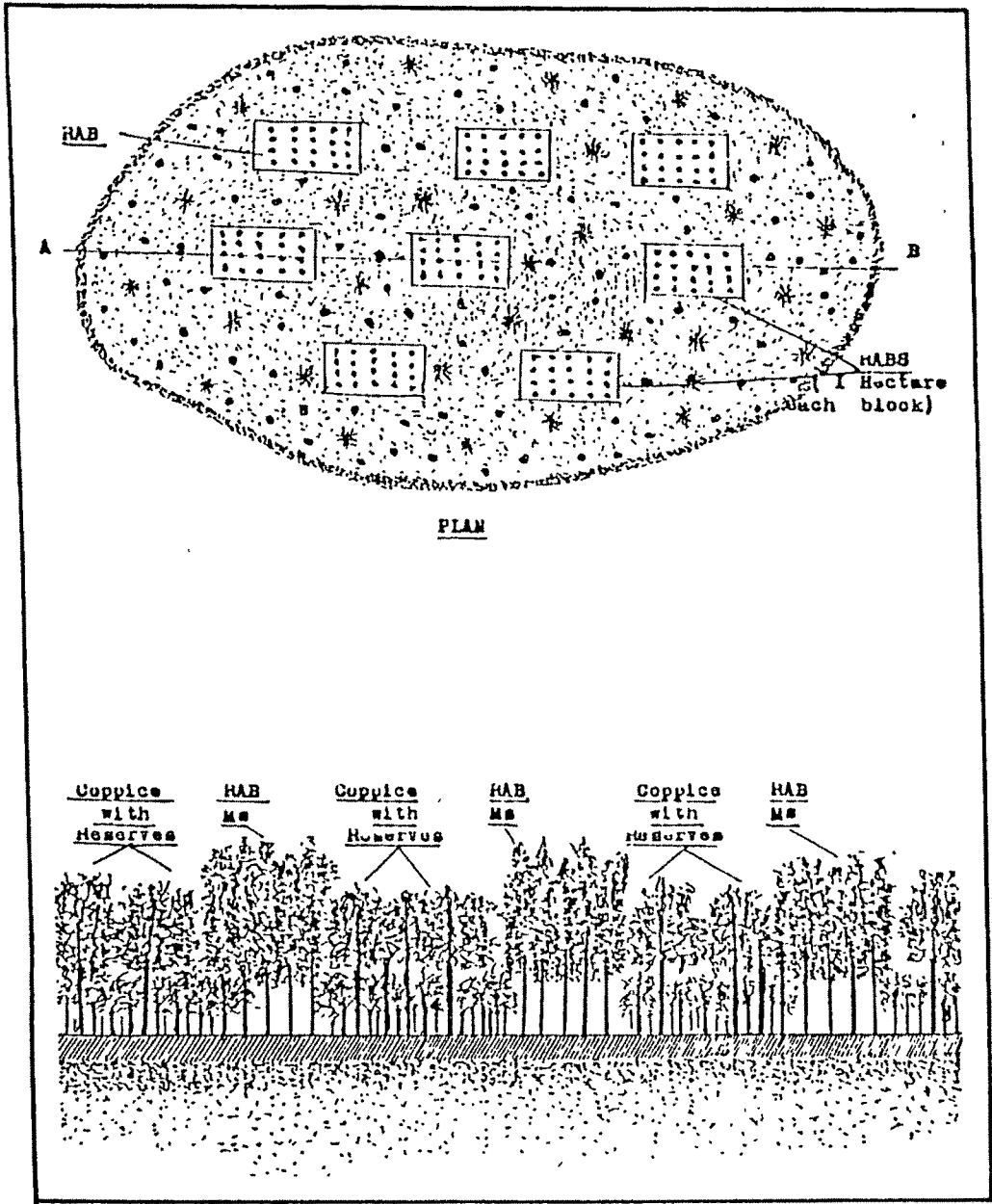


Fig. 6-5

conditions. The wild unpalatable grasses and weeds could be removed. In the contour furrow tree species could be raised.

6.2 AIR POLLUTION CONTROL

6.2.1 Control of dust and particulates

The menace of dust pollution in the mining lease area (MLA) due to blasting, transport of overburden, loading and transport of coal can be effectively controlled with preventive and suppressive measures. Spraying of water along the haul road, service roads, OB dumps, coal piles and blasting sites can mitigate the problem to some extent. Control of dust outside the MLA can be accomplished by establishing green belts around the mines, township and along the road. A tree curtain of about 50 m width around the periphery of mining area and critical targets is recommended. It is important that the vertical shape of these green belt could be multitier in such a way that an effective screen is created at all levels. The desirable trees closer to mining area are *Prosopis juliflora*, *Cassia siamea*, *Nerium indica* and *Leucaena leucocephala* followed by rows of trees like *Azadirachta indica*, *Pongamia pinnata*, *L. leucocephala* etc. The outermost row could be of tall and fast growing trees like *Eucalyptus* etc.

There could also be green belt between two mines. The intervening space for e.g., between Kakri and Bina mines which is wide enough

could have a reasonably good green belt. The structure of the green belt is important. Its width between mines and townships (southern side) could be wider than that of northern side i.e., 20 rows of trees on the south, south-west and eastern sides and 10 rows on the northern side. The width of the green belt between two mines depends on the space available. The width in northern side could be kept narrow due to existence of forest.

In the northern side the first four rows from the mine could be *Prosopis* and next six rows could be *Eucalyptus tereticornis* planted in quincunx. This could be done where the wind belt would be of 10 rows. In the east, west and southern side, the green belt could contain 8 rows of *Prosopis* and 12 rows of *Eucalyptus*. The green belt between two mines could be atleast 10 rows of *Eucalyptus tereticornis* closely spaced 1.5 m and in quincunx spacing Fig. 6.6.

The trees in the green belt could be tall, wind firm, broad leaved ones to be effective. Mining could be planned in such a way that there is provision of space for these green belt.

Air pollution due to flyash from stacks of thermal power plant could be reduced considerably by having a barrier of foliage in the form of dense crown of tall trees which could prevent the ash and other particle to settle on the colonies. A hectare of dense vegetation may arrest in its crown at least 25 to 30 tonnes of dust. The trees can be planted along

the roadside, strips of open land in plant premises, area around office and other buildings etc. Some of the pollutant tolerant plants suitable for pollution abatement are *L. leucocephala*, *Albizzia lebbek*, *P.longifolia*, *Azadirachta indica*, *Terminalia arjuna*, *Tamarindus indica*, *Delbergia sissoo*, *Ficus glomerata*, *F. bengalensis*, *F. religiosa* etc.

6.2.2 Control of Stack emission from thermal power plants

The long range pollution control strategy has to apply source emission limitation to sources. The emission from power plant must employ engineering control methods to check pollution. For preventing particulate it should be mandatory for all the STPS/TPS to install a combination of mechanical collectors and electrostatic precipitators to achieve the desired efficiency. The gases from the effluent stream in the stack can be separated by means of wet scrubbing. The formation of No_x can effectively be controlled making suitable adjustment of air and flame temperature. Raising of stack heights may also be resorted to depending on the characteristics of gases.

6.3 WATER POLLUTION CONTROL

The pollution of water due to industries, domestic effluent, mines and surface run-off can be minimised adopting suitable control measures. No industrial or domestic effluent should be disposed to natural water sources without proper treatment. Industrial effluent can have zero

effluent when provided with close circuit treatment plant. The suspended particles in mine water can be settled in sumps before being pumped out and the sump could be cleaned at regular intervals.

6.4 NOISE POLLUTION ABATEMENT

The noise level due to mining can be effectively controlled by choosing suitable machinery and equipment and their proper and regular maintenance. When mine workers are exposed to noise level greater than 90 dB for 8 hr. they must be provided with ear plugs. Green belt separating colonies, office etc., may also abate the noise pollution problem to some extent.

The denser and mixed type of vegetation is more effective barrier against noise. In addition to planting of green belts, under-wood in these areas could be permitted to grow. The shrubs and weeds could not be cut except to help the planted trees. Inter planting could also be resorted to. But when a close spacing is adopted several trees fails to grow-up and remain in the 2nd and 3rd storey and the objective is achieved.

6.5 MANAGEMENT OF FORESHORES OF GBP RESERVOIR

The foreshores of GBP reservoir are susceptible for encroachments leading to erosion of soil and subsequent silting of the reservoir over

the years. The water of the GBP gradually recedes to the mean flood (MFL) level. The belt between high flood level (HFL) and mean flood level needs protection, especially where there is no vegetation. Where the contour eases, the width increases and flatter areas are likely to be encroached and cultivated. In order to prevent this, a massive plantation on foreshore of the lake could be under taken either by NCL (Plate 6.7), NTPC and Renusagar thermal power station (Birla Group) jointly or by the UP and MP Departments under its social forestry programme. Suitable species like *Salix terasperma*, *Acacia arabica*, *Malaleuca leucodendron*, *Terminalia arjuna*, *Engenia jambolana* and *Bambusa arundinacea* could be planted in the strip between MFL and HFL and in the blank sided of foreshores as they can stand in partial water logging Fig. 6.7.

6.6 STABILISING THE BANKS OF NALAS AND STREAM

The small nalas and stream carry surplus water discharge of the mines and rain water. Their banks are eroded and needs protection. On either sides of the banks of nalas and streams a vegetation strip of 10 m wide should be maintained. Immediately adjoining the flow, 2 rows of bamboos on each side could be planted followed by other miscellaneous species. A special variety of mango useful for pickling and Ipomea sp could be planted adjacent to the water cources. Whenever erosion of the bank is perceive rip rap oandom rubble of stone at the bottom, turfing on the top of it and planting with Eugenia



Plate 6.7 **Foreshore Plantation along GBP Reservoir
Near Renusagar.**



Plate 6.8 **Disposal of Coal Ash Slurry From Singrauli
STPS In Ash Pond.**

GBP Reservoir Foreshore Plantation Between MFL and HFL

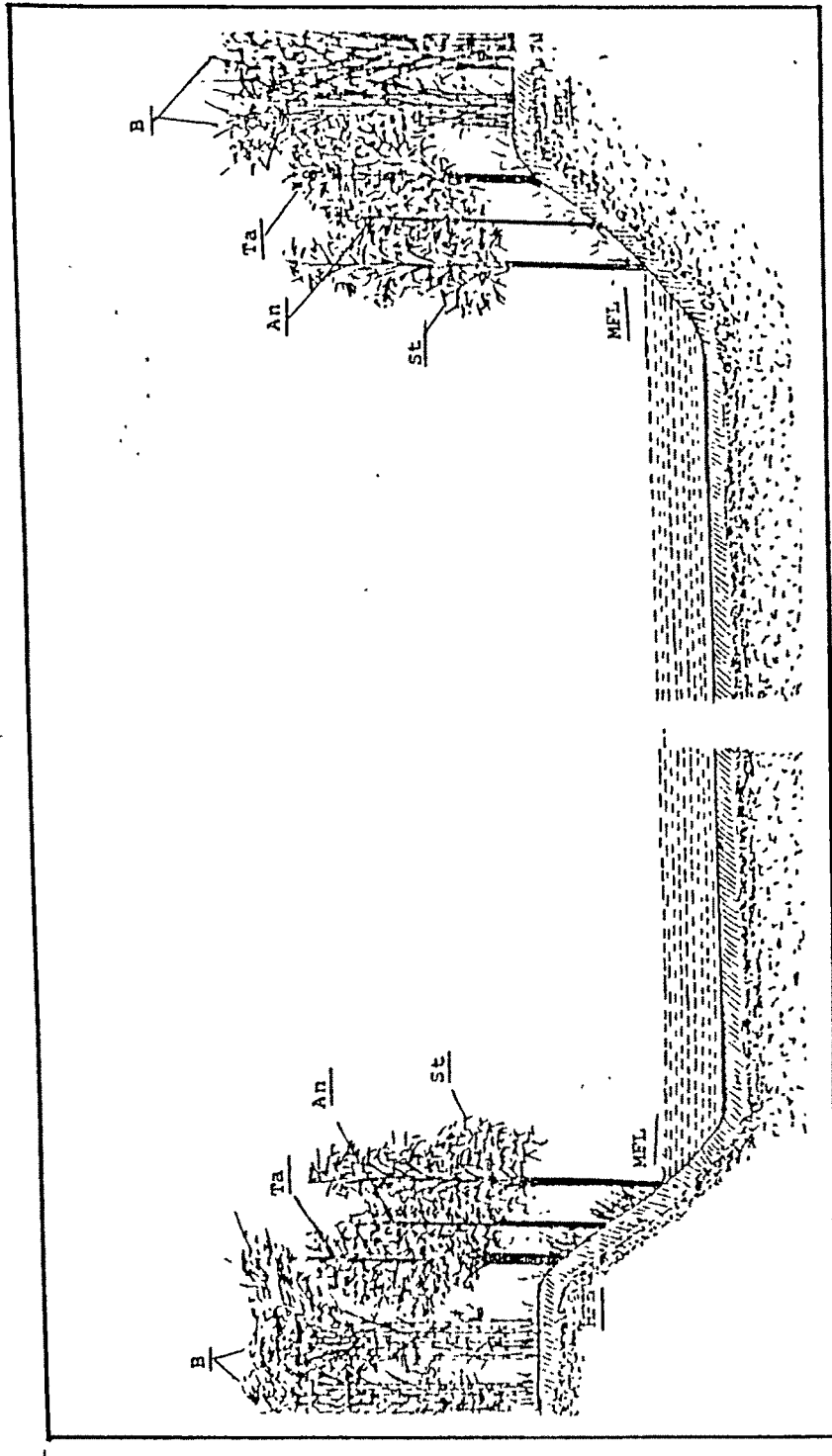


Fig. 6.7

could be done (Fig. 6.8). Scoured banks could be duly plugged with brush wood check dams. *Cassia siamea* could be sown and bamboos planted in their catchment. *Agave* could be planted at the toe of the check dam to stabilise the soil.

6.7 MANAGEMENT OF ASH DISPOSAL SITES

Flyash dump sites are sources of air and water pollution in the area (Plate 6.8). and these must be draped with plant cover. Flyash with proper moisture level can easily support vegetation. The species that can be grown on the disposal sites are *Ipomea fistulosa*, *Tephrosia purpurea*, *Cynodon dactylon*, *Typha angustata* and *Polygonum barbatum*. Ash disposal sites on the GBP reservoir shore could be eschewed until it can be established that there is no danger of leaching. A large amount of flyash produced as waste should be utilised for making bricks etc., and its further utilisation potential to be explored.

A monitoring programme could be initiated to keep constant vigil on the quality of ash transported water which is discharged to ash pond finally goes to GBP reservoir. The ash transported water should be recirculated, as it would help in keeping the effluent water quality high and avoid heavy water withdrawal from GBP reservoir and also avoid water pollution problems.

Plantation on Eroded Banks of Stream

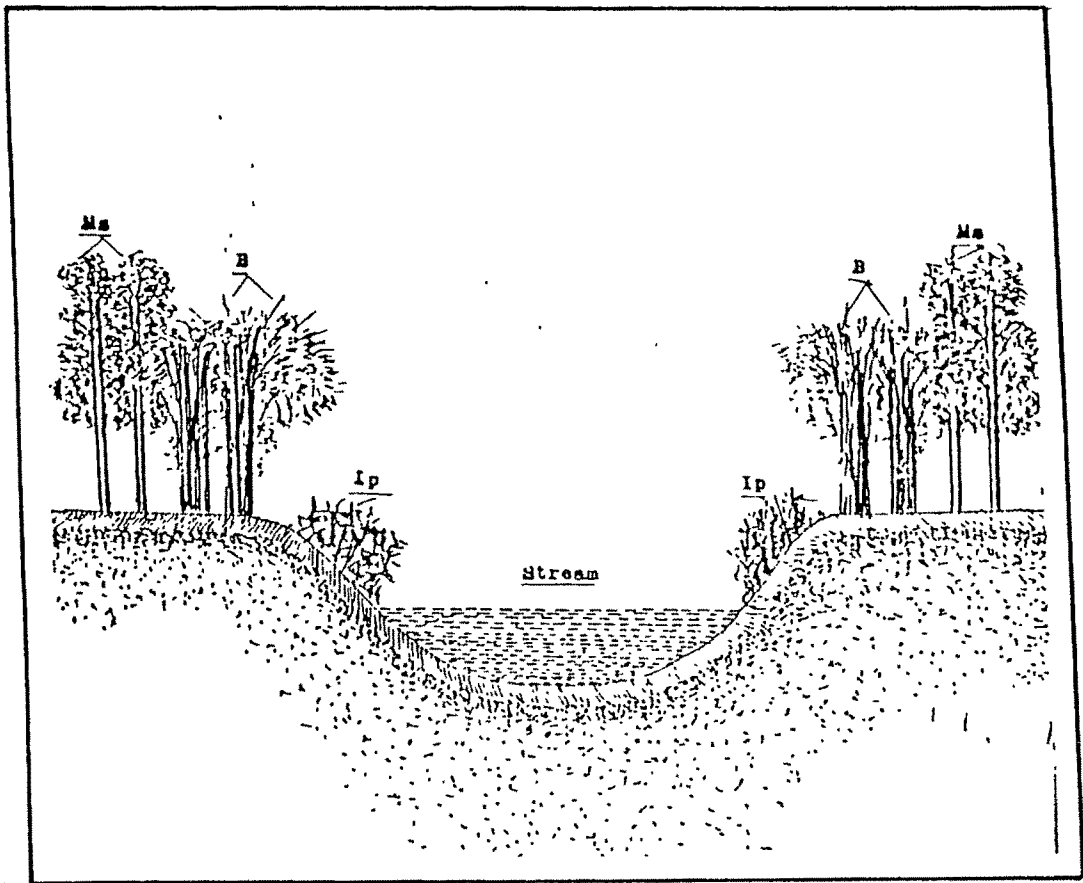


Fig. 68

6.8 SOCIO-ECONOMIC MEASURES

A proper rehabilitation measure has to be adopted prior to the development of mines and rehabilitants whose land has to be acquired could be resettled properly with preference of employment in the projects. Also adequate monetary compensation could be provided to land losers so that they have enough opportunity to earn their livelihood. These persons who can not be employed in the projects can be imparted, training for taking up jobs for self employment, like poultry farming, dairy development and cottage industries etc. Basic amenities like health services, education, road, electricity, drinking water etc. also be provided for their better living.

Northern Coalfields Ltd. and National Thermal Power Corporation should take benefits and guidance of Government's Integrated Rural Development Programmes (IRDP) i.e. health care schemes, handicrafts and housing schemes, besides providing clean air, water and better facilities to the people. Community participation in forest management through JMF, social forestry schemes will be useful specially for plantation around the townships and thermal power stations. Various schemes launched by the Ministry of Rural Development and Environment, Govt. of India i.e. Soil Conservation in the Catchment of River Valley Projects (RVP), Integrated Watershed Management Projects (IWMP), Rajeev Gandhi Watershed Mission and Wasteland Development Programmes will be effective for conservation and sustained development of the area.