PAPUM HYDRO ELECTRIC POWER PROJECT
(2 x 5 MW)

MUCK DISPOSAL PLAN

Submitted By:

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1.1 BACKGROUND OF THE PROJECT

The Government of Arunachal Pradesh (GoAP) has been encouraging private entrepreneurs in development of small and mini hydro power schemes. M/s. Sonam Hydro Power Private Limited (SHPPL) has been incorporated under the companies Act, 1956 with an objective of developing power using renewable sources.

M/s. Sonam Hydro Power Private Limited, New Delhi has been allotted 10 MW installed capacity Papum Hydro Electric Project, a small hydro project on river Papum near Longdong village in district Papum Pare of Arunachal Pradesh State, by Government of Arunachal Pradesh. The project site is about 35 km from Itanagar, the State Capital.

Concept Green Energy Pvt, Ltd., New Delhi has been preparing the Detailed Project Report (DPR) & evaluated the technical and financial viability of this scheme.

M/s. Sonam Hydro Power Private Limited envisages to develop the Papum HEP on the left bank of Papum river.

1.2 PROPOSED PROJECT

The project being developed as a run-of the river scheme envisages utilization of the water of Papum river for generation of 10 MW Hydel power by utilizing design discharge of 13.79 cumecs and gross head of 90 m available over a stretch of about 2.5 kms. The project, as conceived, comprises the following principal components:

- 25 m long raised crest type diversion weir across river Papum with intake on left bank
- Intake Structure on left bank comprising with Trashrack, Stoplogs, Gates etc.
- 15 m long RCC Intake channel to convey design discharge from Intake to Desilting chamber
- 80 m long dual tank desilting basin
- A water conductor system comprising of 1934 m long underground Head Race Tunnel (HRT), 115 m long dual pipeline over aquaduct and 155 m long RCC Power Channel
- 38 m long x 24 m wide forebay tank

- 412 m long steel liner surface penstock of dia. 2 m bifurcation into two nos. unit penstocks of dia. 1.45 m each to convey water from forebay tank to Power House
- A surface powerhouse with two units each of 5000 KW capacity located on left bank of Papum river.
- 30 m long open tail race channel.

The location of Project area is shown in Figure-1.1 below:

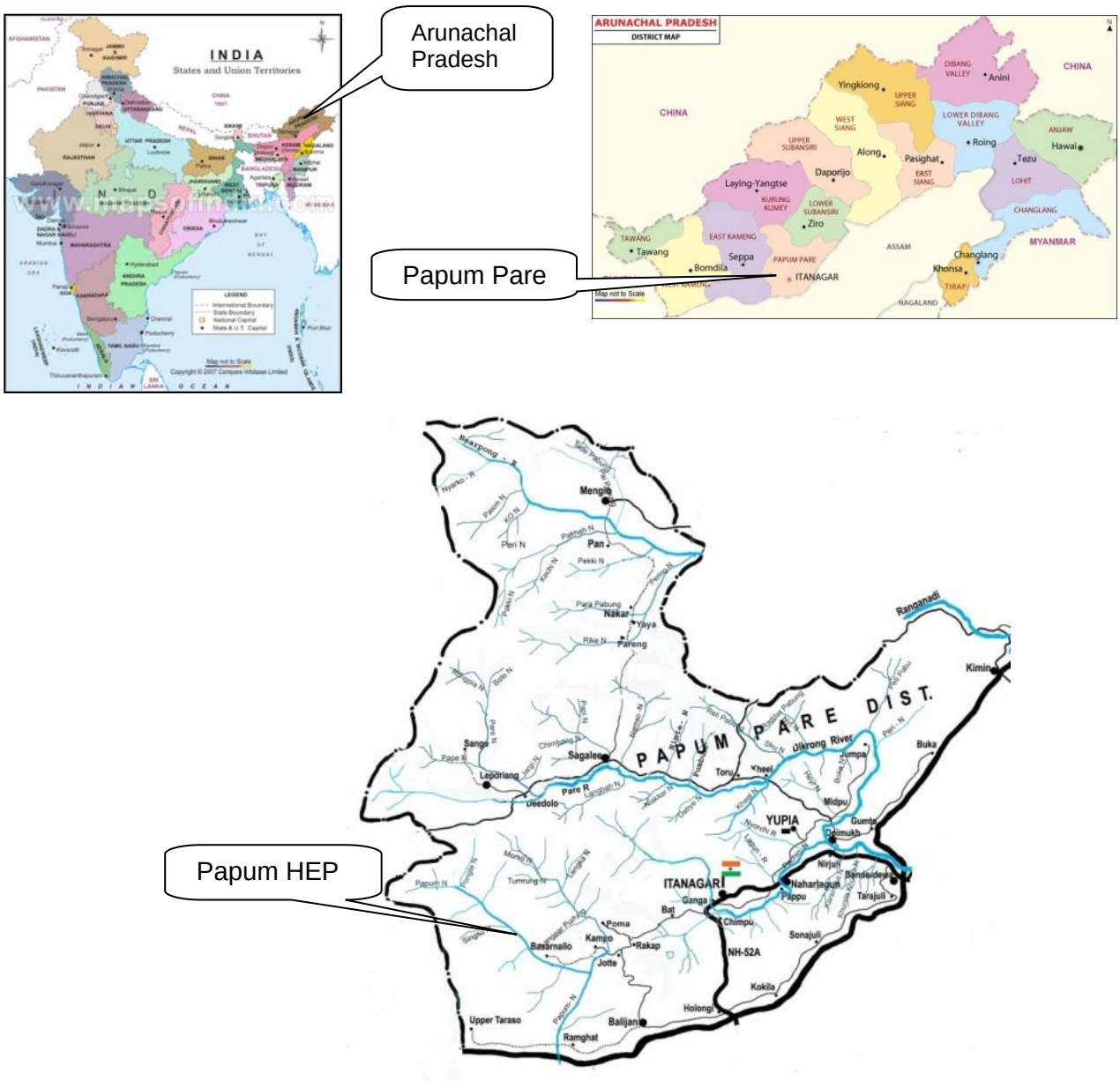

Figure-1.1: Location of the project

The power generated at this project is proposed to be transmitted to the nearest substation of the GoAP. The generated power will be evacuated through 33/11 kV transmission line to the existing substation.

The general layout has been formulated with a view to ensure least submergence behind the diversion structure and to avoid changes in the upstream regime of the river. The crest level of the Diversion weir has been kept as EL 310 m. The diversion structure has a height of only 5 m above the average riverbed level ensuring minimum submergence behind the structure. The powerhouse and the water conductor system are located on the left bank of the river. Presently a foot track is available on left bank of the river only. Therefore, a trace-cut approach road needs to be developed during construction of the project.

On the basis of techno-economic studies, it is recommended that 2 nos. TG units with a capacity of 5 MW each are to be installed with Horizontal shaft Francis turbines for this project.

Power potential studies indicate that the average annual energy generation for 10 MW installations would be 41.36 Million Units at 95% plant availability in 75% dependable year.

The total capital cost of the project is estimated as Rs. 88.15 crores. M/s. Sonam Hydro Power Private Limited propose to invest 30% of the project cost as equity and the balance amount will be raised by availing loan from Indian Financial Institutions. The cost of generation is about Rs 4.16 per Kwh.

The construction period of the project will be 30 months. M/s Sonam Hydro Power Private Limited will enter into Power Purchase Agreement (PPA) with Arunachal Pradesh Power Transmission Corporation Limited on terms and conditions similar to other small hydro-electric projects. The financial analysis indicates that the entire loan can be paid back within a period of 13 years from the date of commissioning of the project.

1.3 ADVANTAGES OF HYDROPOWER

- A renewable source of energy – saves scarce fuel reserves.
- Non-polluting and hence environment-friendly.
- Long life – The first hydro project completed in 1897 is still in operation at Darjeeling is

still in operation.

- Cost of generation, operation and maintenance is lower than the other sources of energy.
- Ability to start and stop quickly and instantaneous load acceptance/ rejection makes it suitable to meet peak demand and for enhancing system reliability and stability.
- Has higher efficiency (over 90%) compared to thermal (35%) and gas (around 50%).
- Cost of generation is free from inflationary effects after the initial installation.
- Can provide attendant benefits of irrigation, flood control, drinking water supply, recreation, tourism, etc.
- Being located in remote regions leads to development of interior backward areas (education, medical, road communication, telecommunication, etc.)

1.4 PROPOSED SITE LOCATION

The proposed Papum HEP is situated on Papum river in Papum Pare district of Arunachal Pradesh. The project site is about 35 km from Itanagar.

The nearest railway station to the project site are at Naharlagun which are about a distance of 50 Km from the project site. The Nearest Airports are at Guwahati, at a distance of 360 km and Dibrugarh, at a distance of about 250 kms respectively from the project site.

The geographical co-ordinates of the project site are as follows;

a. Power House: Latitude $27^0$02’37” N and Longitude $93^0$22’45” E,
b. Weir: Latitude $27^0$03’37” N and Longitude $93^0$21’41” E.

The project area is marked on satellite image in Figure-1.2 below:

Figure-1.2: Location of the project on Satellite image

The project area is marked Toposheet in Figure-1.3 below:

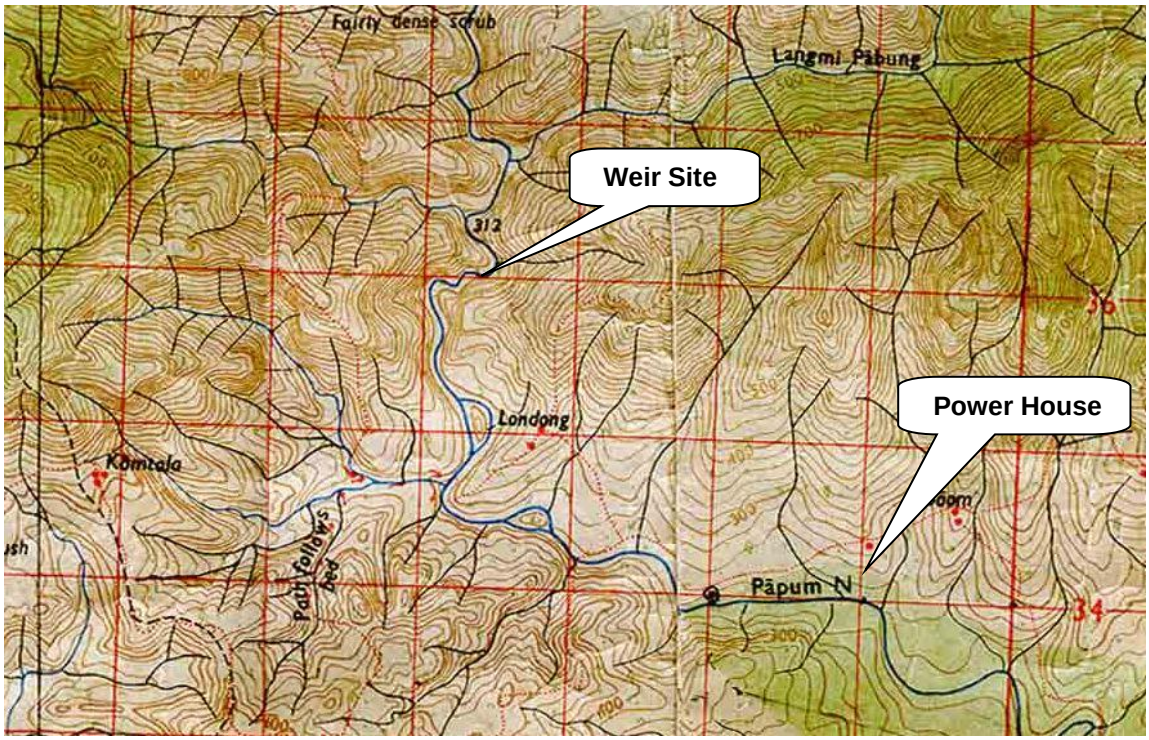

Figure-1.3: Location of the project on Toposheet

1.5 JUSTIFICATION OF THE PROJECT SITE

Any hydel project is a site-specific project for the following reasons:

- There should be sufficient flow of water in the stream to generate power.
- There should be sufficient head difference available for running the turbines.
- The site should be easily accessible.
- Power evacuated facilities should be available within a short distance.

The basic advantages of the proposed Papum HEP are as following:

a. Less Human Habitation In The Vicinity – The powerhouse is proposed to be set up at a distance of around 1 km from the village. Within a km area radius from the proposed project there are very less houses. Thus, the population likely to be affected by the project is negligible.

b. No/ Minimal Impact On Fauna – The project site is proposed to be located across River Papum. The total project activities lie all along the river without disturbing the river and other areas. Hence will not have any impact on the fauna located in the study area.

c. No/ Less Waste Generation – It is proposed to utilize most of the excavated material for the construction of the components of the project. In view of the above, the proposed project site is considered appropriate for construction of the small hydro project.

1.6 INFRASTRUCTURE REQUIREMENTS

The proposed Papum HEP will require the following infrastructure for construction and operation and maintenance of the hydropower station.

a. Land: Total land requirement estimated for the proposed project is 6.95 Ha.

b. Water: Water will be used at the facility for construction, power generation and domestic purpose.

However, the power generation does not consume any water. Water requirement during construction has been estimated at about 100 KLD for construction and domestic purposes. Water for construction purpose will be drawn from the river course using portable pumps.

Potable water for the staff will be obtained from the bore well & packaged drinking cans during the operation phase.

c. **Power:** It is proposed to derive the construction power supply and temporary lighting arrangements from 250 kVA emergency DG set proposed for the plant. This DG set will later be used as plant emergency DG set. In addition, temporary lighting arrangement will be derived from state transmission line, which is normally available near the proposed plant during the period of construction.

d. **Access and service roads:** Construction of new approach roads to the project sites are required upto intake, water conductor, forebay and Power House.

e. **Manpower:** Manpower requirement for the proposed project during its construction stage will be approximately 100 persons (depends on the contractor). Whereas about 10 persons will be employed during the operation phase of the project. The plant will operate in three shifts.

f. **Site office and quarters:** Permanent housing: For routine supervision and erection of equipment, permanent accommodation consisting of 2 quarters shall be constructed in the beginning. These quarters shall be used for supervision of operation & maintenance of the plant in the O&M phase of the project.

   After the construction of the scheme, the accommodation required for the skeleton O & M staff shall be constructed near the powerhouse location. A field hostel of 5 quarters shall also be constructed for construction team.

   Temporary housing: All sites can be reached within half an hour from the road head. Houses will be rented at nearby villages for use by the construction team. However, some additional temporary houses will be constructed nearby the project site.

Construction camps: The following minimum number of temporary stores and workshops need to be constructed at the site as listed below:

Diversion weir & Power house Complex: 2 stores, 2 workshop, 2 contractor's offices and Resident Engineer's (RE’s) office Actual allocation of space for site offices and staff residential quarters would be finalized after the process of land acquisition is complete.

MUCK DISPOSAL PLAN

2.1 INTRODUCTION

For construction of different components of the project, substantial surface and underground excavation in over burden and rock for Weir intake structure, intake channel, desilting chambers, headrace tunnel, power channel, forebay tank, penstock, powerhouse and tailrace channel would be generated. The excavation shall result in large quantity of excavated material i.e. muck which have to be evacuated, disposed off and roller compacted or laid on mild slopes with the excavation work to such designated areas where the muck piles do not substantially interfere with either environment / ecology or the river flow regime and do not cause turbidity impairing the quality of water. The disposal of muck has to be scientifically planned keeping in view the economic aspects necessitating nearness to the muck generating component of work, which understandably reduce the travel time of dumpers, less interference to surface flow and ground water aquifer and disposition of habitation.

Based on the quantities of surface and underground excavation including 10% over break a muck management plan, therefore, has been formulated to manage the disposal of muck and restore such areas from further degradation of the environment.

2.2 QUANTITY OF MUCK

The total quantity of muck expected to be generated has been estimated to be of the order of about **42,439 cum** in open excavation and **37,669 cum** in rock excavation. From underground excavation work it is estimated that a total of **25,980 cum** muck will be generated. The total muck (excluding swell factor) to be generated is **1,06,088 cum (1.06 lakh cum)**. The details are given in Table-2.1. About 40% of rock excavation is expected to be used for producing coarse, fine aggregate for concrete production and in fillings for developing areas for construction facilities. Further, additional quantity of rock will be utilized for stone in wire crate and masonry works. Total quantity of excavation in common soil and quantity of rock excavation would have to be disposed in designated muck disposal area.

Table-2.1: Quantity of muck to be generated from different components

Sl. No.	Component	Open Excavation (cum)		Underground Excavation (cum)
		In Soil	In Rock	
1	Weir and Intake	150	2220	
2	Intake Channel	778		
3	Desilting Basin	10,137		
4	Head Race Tunnel	1,600	2,400	25,980
5	Aquaduct	502		
6	Power Channel	3,139	3,139	
7	Forebay Tank	2,325	2,326	
8	Penstock	1,344	1,345	
9	Power House	2,464	1,239	
10	Approach Roads	20,000	25,000	
	Total	**42,439**	**37,669**	**25,980**

2.3 DUMPING SITES

The identification of muck disposal areas is done in line with the topographic and site specific conditions. Muck is to be dumped in 4 pre-identified sites. Total capacity of these sites is about 50,000 cum. The quantity of excavated muck to be accommodated at each site is given in Table-2.2.

Table-2.2: Details of Muck Disposal Sites

Sl. No.	Dumping Yard	Location	Area (Ha)	Capacity (cum)
1	D1	Near Intake	0.30	9,000
2	D2	Near Intake	0.61	18,300
3	D3	Near Aquaduct	0.50	15,000
4	D4	Near Forebay	0.20	7,700
	Total		**1.61**	**50,000**

2.4 CRITERIA FOR SELECTION OF DUMPING SITES

Based on the geological nature of the rocks and engineering properties of the soil, a part of the muck can be used as construction material. However, the balance requires being suitably disposed. In the proposed project only 58,000 cum of muck generated from excavation is to be reused for aggregate, boulder and fillings for developing areas for construction facilities. Rest of the 48,088 cum is to be disposed at muck disposal sites in a total area of 1.61Ha.

The following points were considered and followed as guidelines for finalization of the areas to be used as dumping sites:

i) The dumping sites have been selected as close as possible to the project area to avoid long distance transport of muck.

ii) The sites are free from active landslides or creep and care has been taken that the sites do not have a possibility of toe erosion and slope instability.

iii) The dumping sites are either at higher level than the flood level or are away from the river course so that the possibility of muck falling into the river is avoided.

iv) There is no active channel or stream flowing through the dumping sites.

v) The sites are far away from human settlement areas.

The selection of muck disposal sites was done based upon site inspections and available best conditions of the land availability, land stability, accessibility from the portals, sloping pattern, minimum vegetative and tree cover, away from any ecological sensitive area, river bed conditions and away from high flood levels of the Papum river and its tributaries. After surveys 4 suitable sites were identified (D1, D2, D3 and D4). The proposed locations are spread over land area of 1.61 Ha. Total capacity of muck disposal areas is more than total quantity of unused muck to be disposed (see Table-2.2). The unused excavated material expected to be comprised of fragmented rock mixed with soil would be piled at an angle of repose around 30° at the proposed dumping sites. This will be done to provide stability to the slopes and also to provide ample space for planting of trees which would further help in holding and consolidation of the material stacked at the proposed dumping sites.

The description regarding the stabilization of the stacked material along the proposed roads has been discussed in the following paragraphs. The options like dumping muck in stages and allowing it to consolidate/ settle through the monsoon, compacting the dumped muck with dozer movement, zoning the dump judiciously to ensure the stability of 30° slope under all superimposed conditions will be utilized.

2.5 METHODOLOGY OF DUMPING

The main objectives of process of muck dumping and restoration of these muck disposal sites are:

- to protect and control soil erosion;
- to create greenery in the muck disposal areas;
- to improve and develop the sites into recreational sites;
- to ensure maximum utilization of muck for the construction purpose;
- to develop the muck disposal sites/ dumping yards to blend with the surrounding landscape;
- to minimise damages due to the spoilage of muck in the project area.

In Papum HEP, during identification of the dumping sites above mentioned aspects were kept in mind. All possible alternate sites were inspected and examined before rejecting or selecting any site. All the dumping sites:

i) have minimum possible forest cover,

ii) the settlement areas are far away from the identified dumping sites so as to have least impact on human life,

iii) the proposed dumping sites are located at a distance varying from 30m to 40m away from the HFL at these sites as all the dumping sites are at a higher level than the flood level from the river course to provide protection from high flood, and

iv) the identified muck sites are close to the sites from where muck is to be generated to avoid hazards related to transport of muck to long distances.

2.6 DUMPING PROCESS

The generated muck will be carried in dumper trucks covered with heavy duty tarpaulin properly tied to the vehicle in accordance with best ebgineering practices. All precautionary measures will be followed during the dumping of muck. All dumpers will be well maintained to avoid any chances of loose soil from being falling during the transportation. All routes will be periodically wetted with the help of sprinklers prior to the movement of dumper trucks. Dumping would be avoided during the high speed wind, so that suspended particulate matters (SPM) level could be maintained. Further, the dumping will be avoided during heavy traffic. After the dumping the surface of dumps will be sprayed with water with the

help of sprinklers and then compacted.

A gabion wall of around 3 m has been proposed to hold the muck on the lower part of the dumping site and shall be raised prior to dumping of muck (see Figure-2.1). Loose muck would be compacted layer-wise. The muck brought by dumpers will be spread in layers behind the wire crate walls and then compacted by rollers till the top level is achieved. The retaining wall shall be laid with proper berm and the muck dumped behind it in layers and compacted by rollers. The process shall be repeated up to 50 cm level below the desired height which shall be laid with good soil for providing grass cover. At a regular vertical interval of 1.5 m and 3.0 m c/c masonry drains (catch water drains) shall be provided to drain off the rain water. Proper fencing of the entire area will be done.

The muck disposal area will ultimately be covered with fertile soil and suitable plants will be planted adopting suitable bio-technological measures. The project authorities would ensure that the dumping yards blend with the natural landscape by developing the site with gentle slope, patches of greenery in and around them.

The Rehabilitation plan of muck dumping sites includes engineering and biological measures. Most of the total unused excavated muck would be placed at an angle of repose to avoid any slippage of the muck at the proposed dumping sites. Besides, required quantity would be stacked along the roads, which would be utilised either in widening of the road or in newly constructed roads. In the former case slopes would be broken up by creating benches across the slope. This will be done to provide stability to the slopes and also to provide ample space for planting of trees which would further help in holding and consolidating the material stacked at different sites. As stated earlier, efforts will be made to dispose the muck within short distances from sites of its generation.

The capacity/volume of the muck dumping sites is more than the volume of the muck to be disposed. All measures would be adopted to ensure that the dumping of muck does not cause injury or inconvenience to the people or the property around the area. The spillage of muck into the river at any site would be prevented by making concrete retaining walls to retain the muck pile. It shall be ensured that dumping is carried out at a minimum distance of 30 m away from the active river bank. The top surface would be leveled and graded after the capacity of any dumping site is exhausted. The top surface will be covered with soil and grass seeding will be ensured to promote vegetation cover.

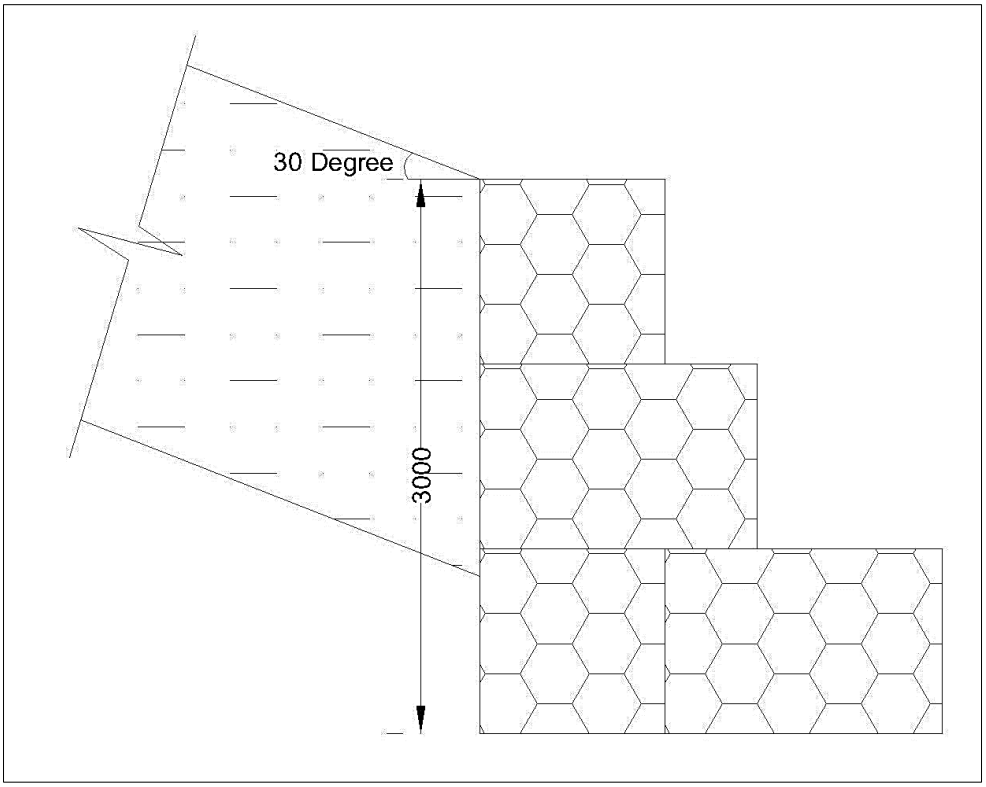

Figure-2.1: Cross Section of proposed gabion wall

2.7 REHABILITATION OF DUMPING SITES

The project authorities would ensure that the dumping yards blend with the natural landscape to develop the sites with gentle slopes, bunds, terraces, water ponds, and patches of greenery in and around them. The re-vegetation of dumping yards through 'Integrated Biotechnological Approach' would be undertaken. It may be necessary to inoculate the spoil dumps for development of landscape as the soils would be poor in nutrients. This can be developed through culture of microorganism or vermiculture practices at the nurseries developed for this purpose.

All the spoiled areas will be developed as per the latest technology of dumping, impact of rain, time and angle of soil setting. In addition sprinkling of water may also be resorted to, if required to avoid or minimize dust pollution. Proper drainage system also has to be provided to ensure unobstructed flow of runoff. Planting with suitable species of trees, shrubs and other biomass will also be initiated.

The following engineering and biological measures have been proposed for the development of spoiled areas.

2.7.1. Engineering Measures

For stacking of dumped material retaining wall is proposed to be built before dumping of any material on to the sites (refer Figure-2.1). In all total length of about 731 running meters (rmt) of retaining walls would be required to be built (for details see table below).

Sl. No.	Dumping Yard	Length of Retaining wall (rmt)
1	D1	180
2	D2	220
3	D3	194
4	D4	137
	Total	**731**

In addition, leveling would also be done after dumping the material on every cycle and simultaneously improving the drainage of the disposal site. All the approach roads to various project structures will be constructed by employing the methodology recommended by National Highway with minimal environmental damage. The methodology consists in developing the formation width is half cutting and half filling, so that the materials obtained from cutting are utilized in filling. The excavation on hill side will be done to get a stable slope for the materials encountered. At places breast wall, gabion walls shall be done in natural slope to retain filled material, particularly where there is problem of retaining the hill slope. To minimise the environmental damage, construction material like stones, sand, etc., required for the construction of road will be obtained mostly from the excavated material.

i) Gabion Wall

The total length of retaining walls proposed to be constructed at different muck dumping site would be about **731 m**. Total financial outlay for the retaining walls is **Rs. 100.97 lakhs** and details are given in Table-2.3.

ii) Compaction and Levelling

Compaction is an engineering measure, which would reduce bulk density of the muck thereby optimising the use of muck disposal area and would make it suitable for the plantation and other biological measures. Top surface would be levelled and graded to make the alternative use. The muck will be spread in 50 cm thick layers. Top surface would be levelled and graded to make the alternative use. On top a layer of soil would be spread

to make the land suitable for plantation. The total cost for the process of compaction is **Rs.5.00 lakhs.**

iii) Fencing

Fencing is a bio-engineering measure. After rehabilitation of muck the dumping areas need protection for some time from disturbing by human and domestic animals. For this reason fencing over the muck deposits is required. Barbed wire strands with two diagonal strands, clamped to wooden/ concrete posts placed at 3 m distance are proposed around the dumping piles. Project authorities will establish temporary wind barriers around 3 sides of dumps in close of settlement area.

The muck is proposed to be filled in layers properly compacted. The cost of the same has been given in Table-2.3. In addition catch water drains are also proposed to be built and levelling of soil would also be done after dumping the material on every cycle and simultaneously improving the drainage of the disposal site. The estimated cost of engineering measures would be **Rs. 117.97 lakhs.**

Table-2.3: Cost of Engineering Measures

Sl. No.	Description	Qty. (cum)	Unit	Rate (Rs.)	Amount (Rs. Lakhs)
I	**Construction of Retaining wall**				
	1) Excavation	1,100	cum	150	1.65
	2) PCC	165	cum	5,323	8.78
	3) Gabion wall	3,650	cum	2,400	87.60
	Sub-Total (1 + 2 + 3)				**98.03**
	Contingencies and Fencing etc. @ 3% of cost of works				2.94
	Sub-Total (I)				**100.97**
II	**Construction of Check dams along periphery of muck disposal sites**				**10.00**
III	**Site Clearance for dumping area and compaction for different layers and leveling – Lump sum**				**5.00**
IV	**Construction of drainage channels (200 rmt)**				**2.00**
GRAND TOTAL (I + II + III + IV)					**117.97**

2.7.2. Biological Measures

Top surfaces and slopes of all dumping areas would be left with a total area of about **1.61 Ha.** These areas will be treated for the purpose of plantation. Vegetation cover controls the hydrological and mechanical effects on soils and slopes. Therefore, biological measures to

stabilize the loose slope are essential. In order to implement the biological measures in dumping areas the following activities would be taken into account. The biological measures include the following:

i) Soil Treatment

Muck dumped at various sites is not considered to be nutrient rich as it is excavated from tunnels and other structures. In order to make it suitable for the plantation it will be provided bio treatment. The work plan will be formulated for re-vegetation of the dumping sites through Integrated Biotechnological Approach.

ii) Plantation

The selected species will be planted after their nurseries have been developed. The dumping areas are very small therefore; separate nursery would not be required. The nurseries developed for the implementation of CAT plan can be used for the rehabilitation of dumping areas. Nearly 1-2 years old saplings would be used for the plantation. The plantation can be carried out in lines across the slopes. Grass and herb species would be used in the inter space of tree species. They will help in providing the continuous chain of support in retaining debris, reinforcing soil and increasing the infiltration capacity of the area.

After the completion of muck dumping process and compaction area of 1.61 Ha will be available for the plantation. About 500 saplings will be planted at these dumping sites.

In order to stabilize the stacked dumped material, vegetation cover would be provided to hold dumped material over a period of time. Following steps are envisaged:

- Plantation of suitable tree species and soil binding using bio-fertilizer technology.
- Turfing of the exposed area and improvement of environment with ornamental species.
- Protection with mechanical support.
- Social fencing through mass public awareness.

The work plan formulated for re-vegetation of the dumping sites through ‘Integrated Biotechnological Approach’ is based on following parameters:

i) Evaluation of dumped material for their physical and chemical properties to assess the nutrient status to support vegetation.

ii) Formulation of appropriate blends of organic waste and soil to enhance the nutrient status of rhizosphere.

iii) Isolation and screening of specialized strains of mycorrhizal fungi, rhizobium, azotobacter and phosphate solubilizers (biofertilizers inoculum) suitable for the dumped material.

iv) Mass culture of plant specific biofertilizer and mycorrhizal fungi.

The afforestation with suitable plant species of high ecological and economic value which can adapt to local habitat will be undertaken with 400-600 plants per hectare depending upon the canopy cover required.

Remedial measures would be carried out on an area of 1.61 Ha. The estimated cost of these measures would be **Rs. 9.27 lakhs**. This cost includes the cost of turfing of slopes, preparation of ground, spreading of manure, etc., providing 5 cm of soil cover and transportation and carriage. It also includes the cost of fencing, irrigation, watch and ward, etc. (see Table-2.4).

Table-2.4: Cost of Biological Measures

Sl. No.	Particular	Qty.	Rate (Rs.)	Amount (Rs. Lakhs)
1	Rolling of muck	LS		2.00
2	Pitting (0.45 m x 0.45 m x 0.45 m)	500 pits	35.00/pit	0.18
	Manure and soil filling in pits	500 pits	5.00/pit	0.02
3	Raising of plants (including nursery cost, manure, transport etc.)	1.61 Ha	1,20,000.00	1.93
4	Turfing with grasses	400 sqm	35.00/sqm	0.14
5	Fencing, maintenance, watering, transport, etc.	LS		5.00
	Total			**9.27**

2.8 MONITERING AND COMPLIANCES

Muck shall be dumped from bottom in layers of 50-70 cm depending on size of boulders.

i) Each layer shall be rolled compacted.

ii) A layer of soil shall be spread on top of it to make it suitable for plantation.

iii) Water testing facilities shall be set up for checking quality parameter of water.

iv) Soil samples shall be regularly collected and tested for checking the level of contamination.

v) Prescribed norms and approvals will be sought from APSPCB wherever necessary.

vi) All norms of Forest department, APSPCB and MoEF&CC and their acts related to muck disposal shall be complied with.

vii) Design consultant shall be engaged for designing of retaining structures.

viii) Plantation shall be done on the reclaimed land and native variety of plants and trees shall be planted.

2.9 FINANCIAL REQUIREMENT

The estimated cost of the relocation and rehabilitation of excavated material is given in Table-2.5. The total cost of these measures will be **Rs. 127.24 lakhs.**

Table-2.5: Financial requirements for implementation of Muck Disposal Plan

Sl. No.	Item	Amount (Rs. Lakhs)
1	Engineering Measures	117.97
2	Biological Measures	9.27
	Total	**127.24**