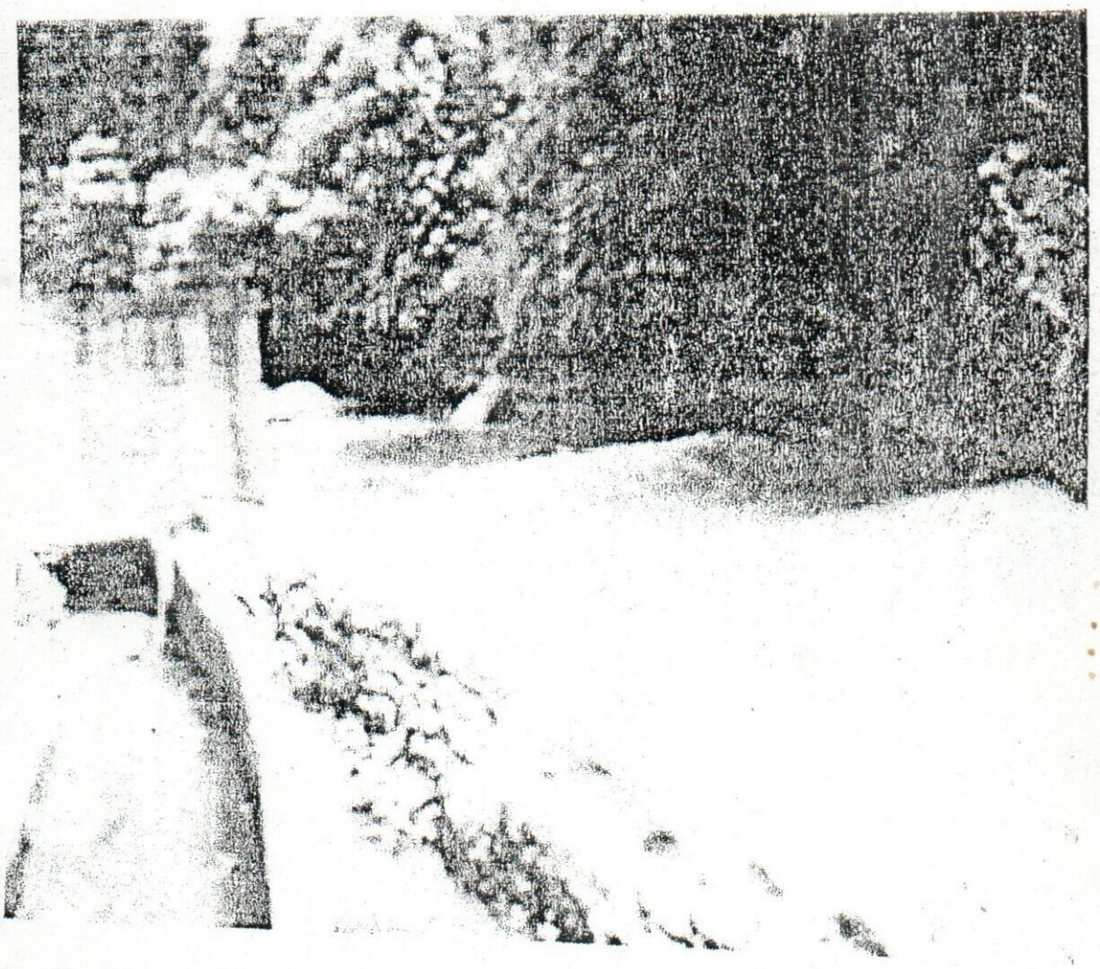
Scanned

GOVERNMENT OF ARUNACHAL PRADESH
DEPARTMENT OF HYDRO POWER DEVELOPMENT

PAYU MHS (2 x 500 kW) AT KOLORIANG



DETAILED PROJECT REPORT (RE-REVISED)

ESTIMATED COST :- Rs. 2248.98 LAKHS

JANUARY'2016

TABLE OF CONTENTS

SALIENT FEATURES

Name of Project :- **C/o Payu Micro Hydel Scheme at Koloriang in Kurung Kumey District. (2x500 KW).**

1. **LOCATION**

(a)	State	:: Arunachal Pradesh.
(b)	District	:: Kurung Kumey.
(c)	Town/Village	:: Koloriang
(d)	Access	:: 4 Km. From Koloriang township at Yapak village.
(e)	Nearest Railway Head	:: Yupia,314 Km.from Koloriang
(f)	Nearest Airport	:: Lilabari, 310 km. from koloriang

2. **HYDROLOGY**

(a)	Name of river	:: Payu River.
(b)	Catchment area	:: 28 sq km.
(c)	Type of river	:: Perennial.
(d)	Maximum Discharge	:: 3.80 cumecs.
(e)	Minimum Discharge	:: 1.00 cumecs.

3. **DIVERSION WEIR& INTAKE CHAMBER:-**

(a)	Shape	:: Trapezoidal
(b)	Length	:: 22 .00 m
(c)	Size	:: Top width = 1.00 m Bottom width = 0.80 m Av.depth = 0.80 m
(d)	Design discharge	:: 0.91 Cumecs
(e)	Bed slope	:: 1:20
(f)	Type/materials	:: R.C.C

4. **FEEDER CHANNEL**

(a)	Shape	:: Box type (Rectangular).
(b)	Size	:: 1.2x 0.85 m
(c)	Free board	:: 0.3 m
(d)	Bed slope	:: 1:450
(e)	Design discharge	:: 0.88 cumecs
(f)	Length (Feeder channel)	:: 200.00 m
(g)	Water depth	:: 0.55 m
(h)	Type	:: RCC.

5. **DESILTING TANK**

(a)	Size	:: 26 X 4.50 X 2.50 m
(b)	Type	:: R.C.C.

(c)	Free board	:: 0.30 m
(d)	Design discharge	:: 0.88 cumecs
(e)	Water depth	:: 2.20 m
(f)	Transition length U/S	:: 2 m
(g)	Transition length D/S	:: 2 m
(h)	Nos of Chamber	:: 3 chamber with Divider wall
(i)	Silt dispoal outlet	:: 300 mm dia pipe

6. **POWER CHANNEL**

(a)	Shape	:: Rectangular.
(b)	Size	:: 1.20 X 0.85
(c)	Free board	:: 0.30 m
(d)	Bed slope	:: 1:500
(r)	Design discharge	:: 0.77 cumecs
(f)	Length	:: 1340.00 m
(g)	Water depth	:: 0.55 m
(h)	Type	:: RCC.

7. **FOREBAY TANK**

(a)	Size	:: 10.00 x 4.00 x 2.60 m
(b)	Free board	:: 0.40 m
(c)	Type	:: R.C.C.
(d)	Design discharge	:: 0.70cumecs
(e)	Water depth	:: 2.20 m
(f)	Retention time	:: 2 minutes.
(g)	Provision in depth for Passing discharge over spillway	:: .30 m
(h)	Over flow arrangement	:: over flow Ogee type
(i)	Spillway crest width	:: 2 m
(j)	Provision for silt storage	:: 0.30 m
(k)	Length of spillway channel	:: 180 m

8. **PENSTOCK PIPE**

(a)	Number	:: 1 row and bifurcate into 2raw near p/house For two machine
(b)	Dia	:: 600 mm & 460 mm(ID)(as per actual materials received)
(c)	Thickness	:: 8 & 10 mm (as per actual materials received)
(d)	Length	:: 750 m
(e)	Design discharge	:: 0 .70 cumecs.
(f)	Type/Material	:: Spirally welded steel pipe

9. **POWER HOUSE**

(a)	Type	:: Surface P/house(RCC Pillar with CGI sheet Roofing and CC block walling.

(b)	Size	:: 20.00 m x 10.00mtr.
(c)	Capacity	:: 2x500 KW
(d)	Gross head	:: 190.00 mtr.
(e)	Net head	:: 171.00 mtr.

10. **TAIL RACE CHANNEL**

(a)	Shape	:: Rectangular.
(b)	Size	:: 1.20 x 0.85 mtr.
©	Length	:: 60 mtr.

11. **E & M EQUIPMENT**

(a)	Turbine	:: Horizontal
(b)	Type	:: Turbo Impulse.
(c)	Number	:: 2 Nos.
(d)	Capacity	:: 500 KW each

12. **GENERATOR**

(a)	Type of Generator	:: Synchronous
(b)	Number	:: 2 Nos.
(c)	Capacity	:: 500 KW each

13. **POWER**

(a)	Installed capacity	:: 2x500 KW.
(b)	Number of Unit generation	:: 10.69MU at 100% PLf 6.24 MU at 60% PLf.

14. **TRANSMISSION AND DISTRIBUTION**

(a)	Length	:: LT line – 2.50 km.

15.	**TOTAL ESTIMATED COST**	**:: Rs.2248.98 Lakhs**
1)	**Civil Works**	**:: Rs.1272.56 Lakhs**
2)	**E & M works**	**:: Rs 976.42 Lakhs**

Assistant Engineer
Klg S/Divn, DHPD

Executive Engineer
Koloriang Division, DHPD
Executive Engineer (Civil)
Koloriang Civil Division
Deptt. of Hydro Power Dev.
Koloriang

Superintending Engineer
Itanagar Circle, DHPD

Asstt. Surveyor of Works (C)
O/o the Chief Engineer (W/A)
Deptt. of Hydro power Dev.
Itanagar

Surveyor of Works (C)
O/o the Chief Engineer S.S.W
DHPD, Itanagar

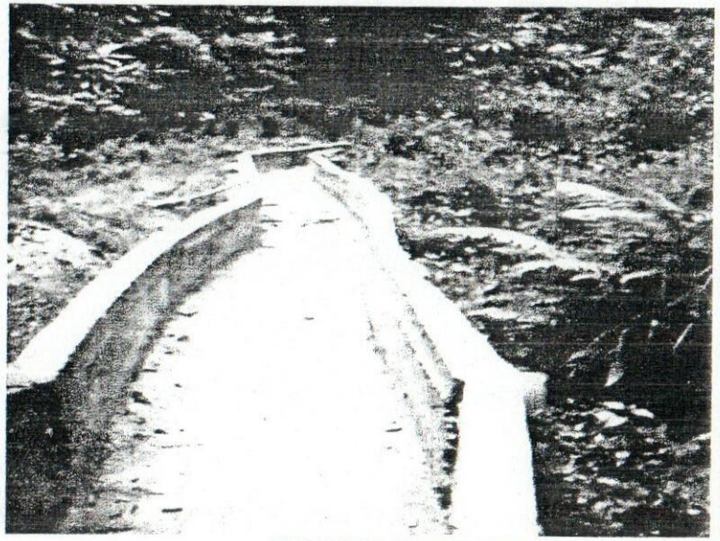
O/o Chief Engineer, DHPD

O/o Chief Engineer, DHPD

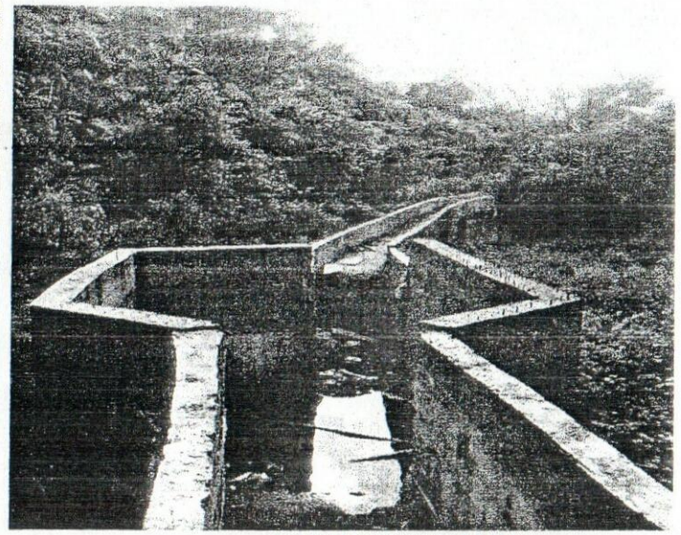
Chief Engineer
Chief Engineer (WZ)
Deptt of Hydro Power Development
Itanagar (A.P)

Payu MHS(2x500 kW) at Koloriang

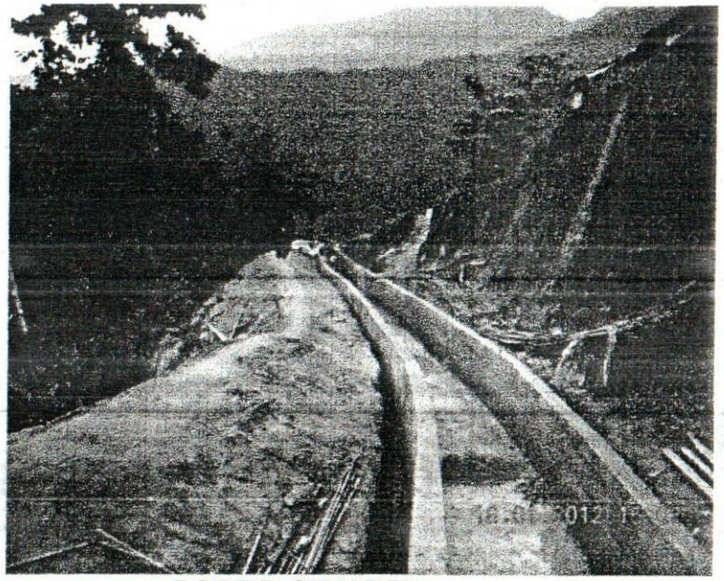
TRENCH WEIR & INTAKE



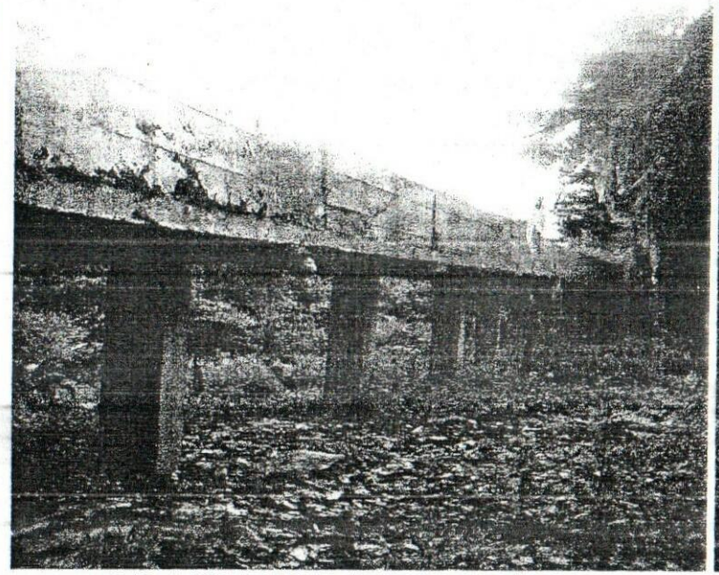
FEEDER CHANNEL



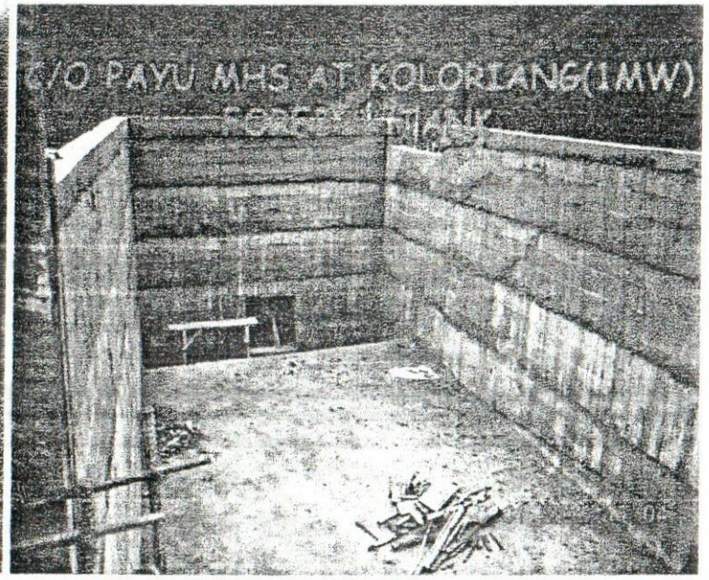
DESILTING TANK



POWER CHANNEL



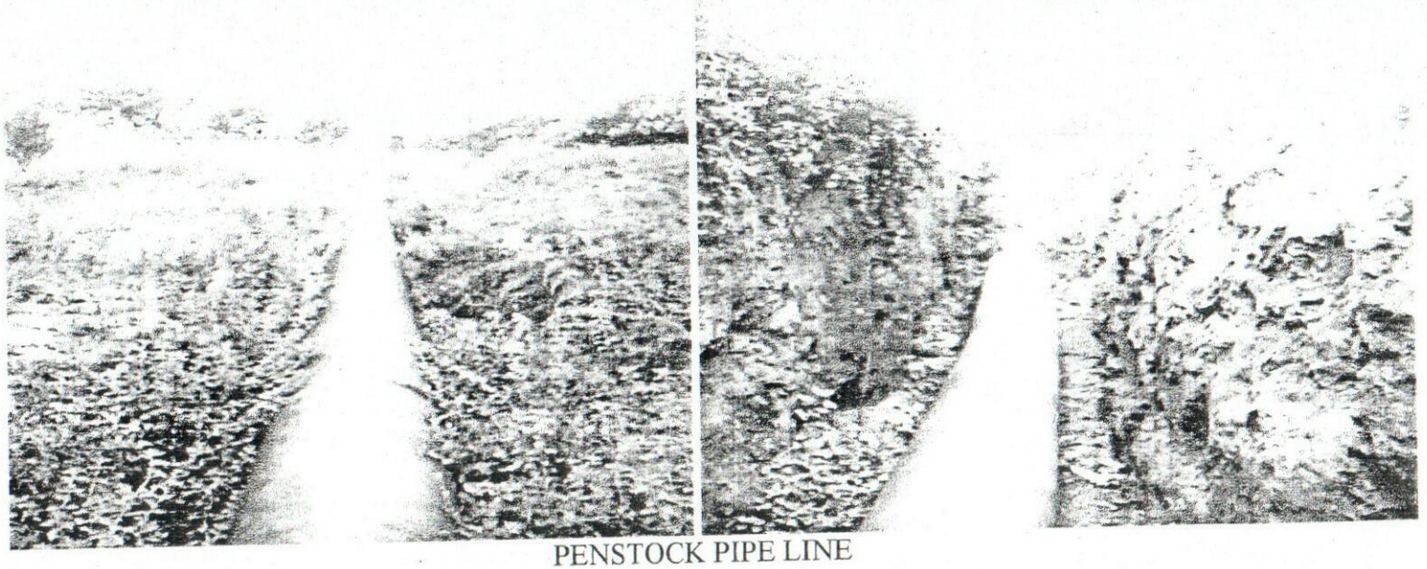
C/O AQUADUCT AT POWER CHANNEL



FOREBAY TANK

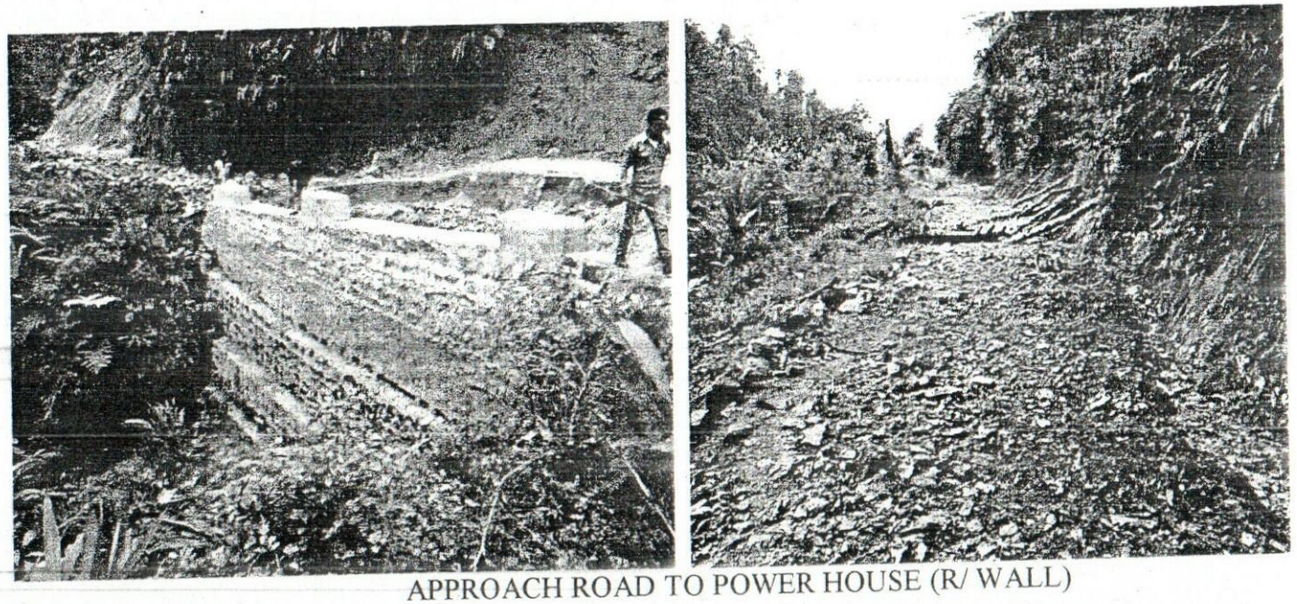
Payu MHS(2x500 kW) at Koloriang

SPILLWAY CHANNEL



PENSTOCK PIPE LINE

POWER HOUSE BUILDING & TAILRACE



APPROACH ROAD TO POWER HOUSE (R/ WALL)

CHAPTER – 1

SCOPE OF PROJECT

1.1 PROJECT SPONSOR:

Department of Hydro Power Development (DHPD), Govt. of Arunachal Pradesh is wholly entrusted with the design and construction, operation and maintenance of the power projects in Arunachal Pradesh. The state has been partially electrified through diesel generating sets and a few small hydro projects in the past. Recently 405MW Ranganadi Hydro Power Station has been constructed by NEEPCO in Lower Subansiri dist. of the State. A detailed project report (2 x 0.5 MW) was prepared by DHPD on the basis of information and data collected by DHPD field staff and technically suitability of different hydro power equipment available from various manufacturers in the Country. Water availability and power studies have duly been carried out by DHPD. These studies revealed that discharge in the river is available for about 1 MW of power generation. On review of the power potential available in the river, it was preferred to install 2 units of 0.5 MW each. i.e. a Power plant of 1 MW capacity. As such the DPR of Payu MHS was prepared and sanctioned during the year 2007-2008 , which were fully funded under PMs Package Scheme. Due to interior location of project site; improper workout of actual information/data; hike of men & material prices; so due to the above reasons the scope of quantity in original DPR and revised DPR fluctuated and generate cost escalation, hence re- revised DPR of Payu MHS has been prepared for early completion and commissioning based on latest information and data collected by DHPD Govt. of Arunachal Pradesh for an installed capacity of 1 MW (2 x 0.5 MW)

1.2 PROJECT HISTORY

The renewable sources of energy which could make substantial contribution to meet the rural energy needs are solar, biogas, wind and water power. The power potential under mini & small hydel schemes in Arunachal Pradesh is about 160 MW from 46 schemes. Although the rate of grid power supplied by DOP, Arunachal Pradesh, remains same irrespective of the point of drawal, however the fact remains that the supply of power at the tail is erratic due to low voltage with frequent and long shutdowns. Further far-flung areas are being electrified through diesel-operated sets, which are not only expensive but also too meagre to meet the demand. Power generation from Payu MHS will result in availability of power to the rural masses of the area which at present is deprived of the power and upliftment thereof.

1.3 INCENTIVES FROM MNES

The Govt. of India has entrusted the Ministry of New & Renewable Energy (MNRE) with the task of overseeing the development of small hydro project generation up to an installed capacity of 25 MW which signifies the thrust attached to this activity by the Govt. of India. The main points of MNRE Policy related to Small Hydro Schemes are as follows:

a) Promotional Incentive schemes for carrying out detailed survey and Investigation (DSI) and preparation of Detailed Project Reports (DPRs) for Small Hydro Power (SHP) project sites up to 25 MW potential. It envisages DSI incentive up to Rs 3.00 lakhs (Three lakhs) per site and DPR incentive up to Rs 2.00 lakhs (Two lakhs) per project.

b) Interest Subsidy scheme for Commercial SHP Projects up to 25 MW station capacity. It envisages interest subsidy up to 7.5% for Hilly areas, North-East States, Sikkim and A&N Islands and up to 5% for other areas.

c) Capital Subsidy Scheme for setting up of Small Hydro Power projects up to 25 MW station capacity in the State Sector. It envisages financial support up to Rs.75000/- per KW for SHP projects in the N-E Region and Sikkim, up to Rs. 45,000/- per KW in Middle Himalayas, Ladakh and A&N Island and up to Rs. 30,000/- per KW in another hilly area.

Scheme for financial support to works for Renovation, Modernisation and Capacity Upgrading of old Small Hydro Power (SHP) projects up to 25 MW station capacities. It envisages financial support for R&M works up to Rs.2.00 crores per MW.

The Ministry recently provides Capacity Subsidy as per the following pattern:

Areas	**Below 500 KW**	**500KW and Upto 1MW**	**Above 1MW & Up to 5 MW**	**Above 5MW & Up to 15 MW**
NE Region & Sikkim	90% cost of the project upto Rs. 75,000 per KW	90% cost of the project upto Rs. 60,000 per KW	75% cost of the* project upto Rs. 4.5 Cr. per MW	Equipment cost+ 25% of Civil Cost limited to Rs. 22.50 Crs. /project
Middle Himalayas, Ladakh, A&N	Equipment cost + 50% of Civil Cost up to	Equipment cost +50% of Civil Cost up to Rs.	Equipment cost +25% of Civil Cost up to Rs. 3.00 Cr per	Equipment cost +25% of Civil Cost limited to Rs. 15Crs.

	Rs. 45,000 per KW	45,000 per KW	MW	/project
Other Areas (only notified hilly region)	Equipment cost + 50% of Civil Cost up to Rs. 30,000 per KW	Equipment cost +50% of Civil Cost up to Rs. 30,000 per KW	Equipment cost +25% of Civil Cost up to Rs. 1.50 Crs. Per MW	Equipment cost +25% of Civil Cost limited to Rs. 7.5Crs. /project

*The project cost is restricted to the items which are directly related to the project work.

1.3.1 PATTERN OF RELEASES

The Govt. of India share will be released on a pro-rata basis according to the following pattern subject to fulfillment of relevant terms , and availability of funds :

Initial release with sanction letter	10%
After award of work order and furnishing copies thereof and obtaining all statutory clearances including forest clearances and acquisition of Land.	20%
Progressive release after demonstration of physical and financial progress.	20%
Progressive release after demonstration of physical and financial progress	20%
Progressive release after demonstration of physical and financial progress	20%
Progressive release after successful commissioning of the project	5%
Final release after three months of satisfactory operation post-commissioning, submission of Audited SOE, UCs, `as built' report etc.	5%

At all stages of release of payment, except in case of initial release, further release will depend upon State Govt.'s commitment of availability of matching funds, which is in proportion of the balance cost of the project to be met by the State Authority/ Executing Agency. This pattern of release may be revised by MNES keeping in view the actual progress of work.

1.4 MAIN COMPONENTS OF THE PROJECT

The Payu MHS comprises of the following main components:

a) A gated weir across the Payu River for diverting the river water for power generation. The gated weir will cover full width of the river.

b) An intake (Head Regulator) on the right side of weir with one gate for regulation of water to the intake channel.

c) 300 m long rectangular Feeder Channel to lead the water from intake to Desilting Tank.

d) A Desilting Tank to remove sediment particles above 1 mm size.

e) A Power Channel on the right bank of Payu River to lead the design discharge to Forebay tank. The power channel length is 1300 m and rectangular in shape.

f) A forebay tank to ensure supply of immediate water demand on starting the generation units and to remove sediment particles above 0.2 mm size.

g) A spillway on one side of forebay tank to allow water to escape from forebay tank in case of emergency shut down of the machines as well as for spillway arrangement. Water from spillway channel is discharged back into river Payu.

h) 1 (one) no pressurized penstock pipe for taking the water from forebay to the power house and its subsequent bifurcation into 2 (two) penstock pipe near the power House.

i) A gate valve for each unit at the upstream of power house to run and stop the turbine.

j) A surface power house for accommodating turbo generator sets, its auxiliaries, control panel, battery room, maintenance space, office room and stores. An EOT crane shall be provided for handling of the equipments inside the machine hall. The approximate building size of the power house is 20m x10m.

k) A manually operated draft tube gate for each unit for isolation of the draft tube to facilitate dewatering for inspection and maintenance.

l) A Tail Race Channel connected to Payu river lead the water coming out from the turbines. The tail race channel is also rectangular in shape.

m) An open switchyard is envisaged by the side of the power house main building. Power will be stepped upto 33 KV level through 11/33 KV generator transformers. Two 33KV bays have been envisaged to feed 33KV lines being constructed in the area by DOP.

1.5 CAPTIVE POWER

Captive power requirement during the construction of project would be met by Power available / D.G. Sets to be procured, installed and maintained during the construction period

Overall, the project will be a self contained, providing necessary basic facilities to the personnel working during construction and O&M stages.

CHAPTER - 2
INTRODUCTION

Basic site data has been collected by DHPD Arunachal Pradesh.

2.1 GEOGRAPHICAL DISPOSITION

Payu MHS is located on the hills of North East region of the country on the Payu river at Koloriang of Arunachal Pradesh (District Kurung Kumey).

2.2 TOPOGRAPHY OF THE BASIN

The area forms parts of north eastern Himalayan hills. A topographical survey of the site has been carried out and details are discussed in chapter 3 of the report.

2.3 GEOLOGY

The Area contains granodiorite rock with magmatic banding as well as foliation parallel to the magmatic banding. Apart from these massive in situ grandiosities, big boulders of these massive rocks are also present, which may cause problems for the construction of any structure. There are several slide zone along the channel. Therefore, it is advisable that the proper precautions should also be taken during the construction. The detailed geological aspects are discussed in chapter -5.

2.4 METEOROLOGY:

No meteorological data such as rainfall data relevant to this scheme are available. The annual rainfall and temperature can be obtained from Irrigation Atlas -1987 published by CBIP.

2.5 HYDROLOGY

The details of computed discharge data are shown in the chapter of Hydrology.

2.6 COMMUNICATION FACILITIES

The Payu MHS is well connected by an existing 4 Km all weather road from Koloriang township to Payu project site located at Yapak village. The nearest rail head is Yupia. Nearest airport is at Lilabari, which is 329 Km. from the Koloriang.

The distance of project site from nearby important towns of Arunachal Pradesh are as follows:

ROUTE	DISTANCE	TERRAIN
Koloriang-Payu project site	4 km	Hilly
Naharlagun-Koloriang	314 km	Plain & Hilly
Lilabari-Koloriang	329 km	Plain & Hilly

2.7 CLIMATIC CONDITIONS

The minimum and maximum temperatures recorded in winter and summer are 15^0 C and 30^0 C respectively. Due to great aridity and high altitude this area falls in rain fall shadows hence the rain fall is not much. The construction season is almost round the year except some period during the rainy season of July-September.

2.8 SEISMICITY

Payu MHS is located in zone V as recommended by Indian Standard Code of practice. Accordingly the basic seismic coefficient for the site is 0.08.

2.9 LAND RIGHTS

The land required for the Payu MHS belongs to State Govt., Department and private parties. The total approximately land for construction of project is 1 hectre

2.10 WATER RIGHTS

The water used in hydroelectric plant is non-consumptive. The scheme utilizes the water of the river Payu which will be discharged back into the river after power generation. Since it is non-Consumptive use of water, therefore there shall be no objection to its utilization for hydro power generation by State Govt. and shall be available free of charge.

2.11 PROJECT OBJECTIVES

Payu MHS is envisaged on Payu river at Koloriang in Kurung Kumey District. The area has a vast potential for development of small hydro electric power and presently it does not have many small hydro stations in the area.

The development of Payu MHS is important as it is very suitable to meet the power demand of Koloriang Circle of Kurung Kumey District in particular and the State as whole. Development of this scheme shall:

a) Improve basic living conditions and education standard.

b) Establishment and sustain small-scale and rural agro based industries.

c) Improve agricultural productivity by getting assured reliable and stable power supply for the irrigation needs.

d) Improve and further promote tourism in the valley.

The development of the project will benefit the state in the following ways :

i) The development of the project will save precious diesel which is required to run D.G. Sets.

ii) The D.G. power generation exhausts carbon mono oxide & carbon dioxide in atmosphere. Therefore development of project will arrest discharge of these gases.

iii) The development of the project will save fuel wood.

iv) The proposed project can meet the energy requirement of about one lakh persons annually, which would eventually reduce urban migration.

The development of Payu MHS is quite favorable due to availability of proven technology, short gestation period of project, cheap and simple operation due to proximity of other similar projects, no escalation in cost of production, long service life and no bad impact on environment. This would not only stimulate the economic activity in the area but would also help in preserving and developing a well balanced eco-environment.

2.12 PLAN OF DEVELOPMENT

The scheme is being constructed to the extent possible with locally available construction materials and manpower. Items like cement, steel, electrical, and mechanical equipment etc. are being / will be transported by road from nearby towns.

CHAPTER – 3

SURVEY AND INVESTIGATION

3.1 TOPOGRAPHICAL SURVEY

The Survey work of the project has been conducted by DHPD, Govt. of Arunachal Pradesh. The detailed survey was carried out at the site from weir site to power house site along the river Pinchi. This survey covered the area from proposed location of the weir to tail race channel in scale of 1 : 200 with 5 m contour interval.

But, the topographical survey of diversion weir available in 1:450 scale and forebay area to tail race available in 1:450 scale covered mainly the location of the structures as proposed by Department of Hydro Power Development, Govt. of Arunachal Pradesh. Longitudinal section of penstock from the location of the forebay tank as proposed by DHPD, in vertical and horizontal scale of 1:400 is also available. Longitudinal section of Pinchi river from the weir site as proposed by DHPD is also available in a vertical scale of 1:450 and horizontal scale of 1:200.

CHAPTER - 4

HYDROLOGY

4.1 DISCHARGE DATA

Discharge data of Payu river has been measured by the Department of Hydro Power Development, Govt. of Arunachal Pradesh and the same data has been taken for analysis.

- Minimum Discharge : 3.80 cumec
- Maximum Discharge : 1.00 cumec

4.2 DESIGN FLOOD STUDIES

4.2.1 Unit Hydrograph Method :

(Recommended by Central Water Commission Report No. 1/73)

In the absence of concurrent rainfall run off data, it is not possible to develop a unit hydrograph. However, synthetic UH based upon physiographic characteristics of the catchment as recommended by Central Water Commission Report No. 1/73, has been derived as detailed below :

i) Rainfed Catchment area of the basin 'A' = 18 sq.km. = 9.20 sq.miles.

ii) Soil Type : Silty clay gravel matrix hilly soil

iii) Unit hydrograph parameters

Qtp = 320 $A^{3/4}$, where

A = Catchment area in SQ miles

= 320 x $(12.48)^{3/4}$ = 2124.77 cusecs

qtp = Qtp/A

where :

A = Area of the Basin in sq. miles

Qtp = Peak of UH in cusecs

Qtp = 2124.77/12.48

= 170.25 ~ 170

Duration of rainfall excess (tc) = 280/ $(qtp)^{0.9}$

= $280/(170)^{0.9}$

= 2.75 hrs.

CHAPTER - 5
GEOLOGY

5.1 GENERAL

The Himalaya forms one of the highest mountain chains in the world, with more a 30 peaks, rising to the height of 8848 m above sea level. The Himalayan belt stretches from west to east in a curvilinear fashion along a regional strike of about 2400 km in length and is characterised by the two syntaxial bends i.e, the western syntaxial band at Nanga Parbat and the eastern syntaxial band at Namcha Barwa as its eastern and western extremities respectively. The width of the Himalaya from north to south varies between 230 km to 300 km with an average width approximating 270 km. To the north, the Himalaya is bordered by the high plateau of Tibet and to the northwest by the mountain ranges of Karakoram and Hindu-Kush. To its south lies the Peninsular Indian subcontinent.

The Himalaya is divided, from west to east, into three distinct regions; the Western, Central and Eastern Himalaya. The Nepal Himalaya occupies the central segment, and to its west and east lies the western Himalaya and the eastern Himalaya respectively. From south to north the Himalaya can be grouped into six parallel, longitudinal mountain belts of varying width, each having distinct physiographic features and its own geological history :

1. Outer or Sub-Himalaya.
2. Lesser of Lower-Himalaya
3. Higher or Great Himalaya
4. Tethyan or Tibetan Himalaya
5. Indus-Tsangpo Suture Zone
6. Trans-Himalaya

5.2 REGIONAL GEOLOGY

Arunachal Pradesh is divisible into four distinct physiographic segments, each having a different geology and tectonic history. The Payu project is located in Nishi Hill segment which is eastern extension of Himalayan segment. The Nishi Hills are comprised of thick sequence of metasediments and associated granite gneiss, granodiorite and granite with mafic and ultramafic intrusive, collectively referred as Kurung complex. It has a regional NW-SE trend, abutting against the Naga-Patkoi ranges along Nishi thrust.

Payu is the main river, draining the Nyapin circle. It originates in the north west-south east trending mountain ranges in China. Flowing south east wards and running parallel to the ranges, it swings south wards before cutting through the ranges and entering India.

5.3 SITE GEOLOGY

The project lies in granodiorite formation. The granitoid clans include diorite, tonalite and granodiorite. The diorite granodiorite intrusions occasionally contain bands of mafic rocks and schist, metamorphosed to medium to high grade. In general, the foliation of the rocks trend NW-SE, with varying dips towards north east. The data point to four events of deformation in the rock mass. The folds (F_1) developed due to first deformation are tight isoclinals and reclined with ENE-WSW trend and low plunge to SW, the fold F_2 folds, related to second deformation trend NW-SE with low to moderate plunge to NW and are moderately tight isoclinals folds, the F_3 folds of third deformation are open and broad, running parallel to general NW-SE trend of Kurung complex while the F_4 folds are also open and broad, but folds trend NE-SW with easterly plunge.

The granodiorite rocks are cut by the 3 equally developed prominent sets of joints. The main foliation dips towards south east with moderate to high (average 60^0) dip. The first joint dips towards south-west with a high (average 75^0) dip, where as the second set also dips towards south-west with a low (average 32^0) dip. The third set is almost vertical with a strike of about N 65^0-N 245^0. Apart from insitu rock there are big boulders of these massive rocks which may be given due attention. The soil cover, well developed at places may cause several slide problems along channel.

5.4 SEISMICITY

Arunachal Pradesh is one of the most seismologically active zones, being situated at the trijunction of three plates. It is continuously under stress field and undergoing crystal adjustments. The manifestations of these movements are identified in the form of reactivation of some of the existing major tectonic lineaments and developments of cross faults along which block movements have taken place. As a result of these adjustments and release of stress, seismic waves are generated causing earthquakes. Based on intensity of earthquakes, there are five seismic zones. The area under reference falls under zone 5, having intensity of IX to XII of M.M. scale and magnitude is corresponding to 7.0 to 8.1. Almost all epicenters of recorded earthquakes are found concentrated along major faults which were active in the past.

CHAPTER - 6

ENVIRONMENTAL AND ECOLOGICAL ASPECTS

6.1 GENERAL

Payu MHS envisages the power generation from river Payu and this development is without any poundage. Mini/small hydel development projects, while sharing all the benefits of hydro electric generation, harness a renewable source of energy in extremely environmentally benign manner. Social costs therefore are almost nil to even an environmentally conscious state. Being small it does not involve any submergence or violation of the sanctity of forest.

The locations of all the components are so selected that it involves about 6-10 m wide strip of land for the power and other channels in almost 2.20 km length and some small areas each for power house and forebay tank as acquired. It does not cause any environmental/ ecological imbalance of the area.

Forest wood, petroleum products like Kerosene and diesel are presently being used as domestic fuel in this area. Availability of reliable electrical energy is expected to reduce over dependence on such depleting fuel and saving of petroleum products like diesel and Kerosene.

The scheme would also help in enhancement of economic activity of the local people due to availability of electricity and improve their living conditions. The public health and education conditions are likely to be improved.

The magnitude of construction activity will not induce migration of labour in this area; as sufficient local labour is available and thus local ecology will not be pressurised.

In addition, it is proposed to carry out plantation in the scheme area wherever possible.

The Performa prescribed by the Department of Environments for the project has been duly filled in and is attached as Table 6.1.

TABLE - 6.1

QUESTIONNAIRE ISSUED BY THE DEPARTMENT OF ENVIRONMENT FOR RIVER VALLEY PROJECTS

1. DETAILED BASIC INFORMATION AFFECTING THE ENVIRONMENT

1.01	Predominant existing land use pattern (agriculture land reserve and the forests etc.) in the project area and upto 10 km. upstream.	:	For agricultural purposes.
1.02	Break up of submerged area total	:	The project is on Payu submerged area (1hectares). River at Koloriang in Kurung Kumey dist. No submergence is caused due to this small hydel scheme .
	Forest Land	:	
	Cultivated Land	:	
	Shrubs & Fellow	:	
	Rocky Outcrop	:	Nil
	Wet Land	:	
	Open Water	:	
	Other Use	:	
1.03	*(a)* Forest Type in Catchment and Submerged areas	:	NA
	(b) Extent and nature of forest to be cut for construction of roads, colony and other appurtenant works.	:	Nil
1.04	Duration of project's construction	:	12 months.
1.05	Estimated peak labour strength - *Skilled - 20* *Unskilled - 10*	:	No population would be shifted by this project, however labour required would be available from the area.
	Labour to be recruited from Outside affected local population - *Skilled* - *Unskilled* -		
1.06	Population density in the area per sq. km.	:	Lesser populated.
1.07	Number of villages and population to be displaced -	:	No displacement of population of villages.
	No. of Villages - Nil *Size of Villages* - Nil		
	Affected families in each village -	:	*Nil*
	ST - SC - Other - Nil		
	Occupation of the affected people-		

Agriculture	- Nil		
Industrial labour	- Nil		
Forest Based	- Nil	:	There is no displacement of any population due to construction of the project. The Information required is not relevant.
Owner cultivators by size of landing holdings -			
Marginal (1.0 hect.)	-Nil		
Small (1.0 - 2.5 hect.)	-Nil		
Medium (2.5 - 5.0 hect.)	- Nil		
Big (over 5.0 hect)	- Nil		

1.08	Resettlement	:	Resettlement is not required.
	Is a rehabilitation committee being constituted.		
	Existing guidelines, if any for compensation.	:	Not required.
	Level of compensation in cash and kind.	:	N.A.
	Number of oust families likely to be settled in new settlement.	:	N.A.
	Size of proposed new settlement.	:	N.A.
	Layout plans/master plans for new settlements.	:	N.A.
	Distance of new settlements from the present habitat.	:	N.A.
1.09	Number and type of facilities (e.g. school, post offices, bank, panchayat ghar, police station, approach road, drainage and water supply etc.) proposed to be provided.	:	Nil.
1.10	Is the affected area covered by development programmes like IED, SED, Drought prone area, tribal development etc.	:	No.
1.11	Any proposal to provide or create employment for oustees; nature & quantum of employment to be provided.	:	There would be no oustees due to construction of the project.
1.12	What is the expected rate of siltation ?	:	Not applicable for this project.
	Is down stream area subject to flooding.	:	Not applicable for this project.
1.13	Wind at Dam site (diagram giving statistical information concerning direction and speed of the wind at the site).	:	Not applicable for this project.

1.14	Hurricane tornadoes, cyclones	:	Nil
	Frequency of occurrence	:	Not applicable
	Wind velocity (average)	:	Not applicable
1.15	Plan of area, on the reservoir periphery subject to erosion, slides and slips.	:	Not applicable
1.16	The depth of ground water table -		
	Maximum	:	N.A.
	Minimum	:	N.A.
	Quality of ground water potable/ non potable/fit for irrigation/ industry	:	Potable
1.17	Present ground water use pattern in the command area under irrigation.	:	Only surface water from streams used in the command area.
1.18	Based on the experience of similar project in the area, specify the inter action between the altered surface water patterns and underground aquifers and their recharge.	:	This being hydel project, hence not applicable.

2.00 ENVIRONMENTAL STATUS

2.01	*(a)* Indicate known pollution sources in the region (indicate the industrial like chemicals, textiles & other thermal power units, mining operations etc).	:	Nil
2.02	Indicate the industrial and other development project likely to be taken up in the area during the next five to ten years.	:	The area has potential for further industrial development.
2.03	*(a)* Does the area support economically viable aquatic life, fish, crocodiles ?	:	No
	(b) Are there any fish/crocodile breeding ground in the river tributaries in the submergence ?	:	No
2.04	Does the site contain a wild life (including birds) habitat, breeding area, migration route including the number of wild life available in the area.	:	No
2.05	Is the site a potential wild life sanctuary?	:	No
2.06	Specify any rare or endangered species of flora and fauna in the effected area along with their	:	No

	approx. number and measures to salvage/rehabilitate them.		
2.07	Is the area a tourist resort ?	:	No
2.08	Are any monument/sites of cultural, historical, religious, archeological or recreational importance including wild life sanctuaries, national park etc. likely to be affected by the proposed project. If so, details thereof.	:	No
2.09	Does the proposed area suffer from endemic health problems due to water/soil borne diseases.	:	No

3.0 ENVIRONMENTAL IMPACTS

3.01	What measures are planned to develop the site to enhance its aesthetic aspects (i.e. recreation & water sport facilities and picnic sites etc.).	:	Suitable plantation is envisaged.
3.02	Will the project help in flood control, reduction for even eradication of flood havoc down stream ?	:	Not applicable
3.03	Are any changes in water salinity expected ? If yes, give details of proposed measures to counteract this.	:	No
3.04	Are problems of water logging envisaged in the command area ? If so, give details of proposed steps to combat the problem.	:	The project is not expected to change any existing situation.
3.05	Will the reservoir be used for fisheries development, fish culture as well as fish breeding, crocodile, farming etc. ? If yes, give details thereof.	:	Not applicable
3.06	Will fish ladders/lift and like arrangements be provided to allow movements of important migratory fish population ?	:	Not applicable
3.07	Measures proposed to prevent grazing the cultivation on reservoir slopes to avoid erosion & premature silting up the impoundment.	:	Not applicable

3.08	Will any important natural resources (minerals, coal, timber etc. be lost or their use precluded because of the presence or operation of the project ? If yes, specify the resources estimated loss.	:	No
3.09	What is potential loss in aquatic production on site up and down stream, fish and other useful animals and plants.	:	No
3.10	Will the formation and use of the water body result in the introduction or enhancement of water born disease ?	:	Not applicable
3.11	Will the impeded reservoir lead to:	:	There is no reservoir.
	i) Noxious aquatic weeds like salina, water Hyacinth etc.	:	Nil
	ii) Intermittent host (vector) like snails, mosquitoes etc.	:	Nil
3.12	How will acuatic weeds be controlled in submerged areas so as to provide an improved habitat as for fishery exploitation.	:	No area would be submerged due to construction of the project.
3.13	Will the project induce adverse climatological changes (regarding temperature, humidity, wind and precipitation including modifications to macro and micro climate).	:	No
3.14	What impact is expected on geological factors (eg. seismic impact or reservoir loading) ?	:	No impact
3.15	Indicate the magnitude of impact due to population pressure on :	:	No impact
	i) Felling of trees for firewood.	:	Nil
	ii) Forest fires.	:	Nil
	iii) Over grazing leading to depletion of the pastures.	:	Nil
	iv) Visual population and damage to scenic values.	:	Nil
3.16	What arrangements are being made ?	:	The question of indiscriminate felling of trees for firewood does not rise. The arrangements of the fuel for labour would be made by the agencies constructing the project.
	i) To meet fuel requirements of the labour force during construction period to prevent indiscriminate felling of trees		

for firewood ?

ii) For compensatory afforestation: Not applicable

iii) To enforce anticipating laws ? : Not applicable

iv) To control flow of sediments & pollutants due to fertilizer and pesticide runoff for cultivated area. : Not applicable

v) For restoration of land in construction areas (filling, grading and reforesting etc. to prevent erosion). : Not applicable

vi) For soil conservation in the catchment ? : Not applicable

4.0 COST OF ENVIRONMENTAL STUDIES AND PROJECT MANAGEMENT

4.01 Provision for Environmental studies/surveys need for this project. : It is a part of the project.

4.02 Cost of proposed remedial and mitigative measures, if any, to protect the environment. : Not required

4.03 Has the cost of environmental studies/protection measures been considered in the cost benefit analysis of the project. : Not required

CHAPTER – 7

OPTIMISATION STUDIES

7.1 GENERAL

The Chapter contains the optimization study of power potential of the project on the basis of the discharge data of the stream. The Project is Located at Yapak village, which was about 4 km from Koloriang township.

The installed capacity of this project has been proposed as 1 MW comprising 2 units of 0.5 MW each in the surface power station Payu at Koloriang, District headquarter of Kurung Kumey District.

7.2 AVAILABLE FLOW

The minimum and maximum discharge at Payu river has been measured.

7.3 INSTALLED CAPACITY

The power potential studies for power output and energy generation has been worked out as 0.50 MW. For computation of Power potential, the overall efficiency has been taken as 0.95.

7.3.1 Unit Size

Payu MHS is planned to meet the local load at Koloriang Circle in Kurung Kumey District of Arunachal Pradesh, as intimated by Department of Hydro Power development, Govt of Arunachal Pradesh. In view of the current practice, it is to opt for largest size hydro units permissible within the parameters of economy, operating efficiency, maintenance, optimum utilization of available water, transport limitations, etc. Therefore 2 units of 0.5 MW each Horizontal axis Francis turbines have been proposed.

Studies have also been conducted for various alternatives of Unit sizes keeping 1 MW as Installed Capacity of the Power station and found that 0.5 MW Unit size is the optimum size for this Project on technical and economical point of view and also from the angle of the transport limitation.

CHAPTER – 8

POWER STUDIES

8.1 GENERAL

This chapter contains data and the result of studies of the Power position in India with particular reference to North-eastern Power Grid, the consequence of Power production at the proposed Payu Small Hydro-electric Project.

8.2 POWER SYSTEM

The Power System in India has grown from small, isolated stations, serving limited consumers in and around large cities, into large regional Power Grids. The generating capacity installed in the country has already grown to 100553 MW by March 2001.

For the purpose of system planning and operation the country has been divided into following five geopolitical regions: Northern, Western, Southern, Eastern and North-Eastern regional power grids and the transmission system are being progressively inter-connected for efficient operation of these five regional grids.

The objective of the system development is to evolve self-sufficient regional grid catering to the individual regional power demands. It is also aimed at achieving the maximum benefits from integrated operation, through a proper mix of thermal and hydro generation and ultimately to tie the five regional grids together to form a strong National Power Gird, providing even greater reliability.

The proposed Payu Micro Hydel Project would initially be a stand alone Power Station and may form to be an integral part of the North Eastern regional Grid to contribute in projected energy requirement in future

8.3 POWER POSITION IN NORTH EASTERN REGION

The North-Eastern region comprises the states of Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura called land of Seven sisters. The North-Eastern Grid comprises the power system controlled by the Electricity Boards/ Departments of the above states.

Even considering the coordinated operation of existing hydro, nuclear and thermal stations, as well as benefits from ongoing projects and also from the scheme cleared by CEA.

8.4 POWER GENERATION

8.4.1 Existing and New Generation Facility

8.4.1.1North Eastern Region

The total installed capacity in North Eastern Region is about 1800 MW at present. Out of this 600 MW is from hydro units and rests are from Thermal / others and thus the hydrothermal mix is 35:65. The load demand forecast up to the 11th five-year plan has been discussed in section 8.3.1 Corresponding to these forecast the Hydro and Thermal (Including Nuclear) power plants proposed to be added to the system are shown in the different tables attached herewith. Factors like slippage in commissioning of the units, unforeseen outages have not been taken into account.

Based on latest projections the power supply position from 9th to beginning of 11th five-year plan is summarized in table 8.1 and 8.2 for north-eastern. It is seen from the tables that a surplus peak capacity of 10.16% & 10.58 % and energy surplus of 15.30 % & 15.747 % exist in 2006-2007 without and with Payu Micro Hydel Project when first full year of energy benefits of Payu MHS are likely to come. However, it is based on the assumptions that all likely capacity additions of 1365 MW will result in end of 12th plan. Besides this, the need of Payu Micro Hydel project has been initially considered to meet out local load in Kurung Kumey District (Arunachal Pradesh) and shall be connected to the north-eastern grid at a later stage. The Payu Micro Hydel Project will have an installation capacity of 1 MW.

CHAPTER - 9
CIVIL WORKS

9.1 LAYOUT OF THE PROJECT

Simple and cost effective type of civil works has been planned for the scheme. A gated weir across the river Payu will divert the water to intake tank. The water from intake tank is fed to settling basin through a rectangular intake channel for removal of sediment. After that, the water is taken to forebay tank through 1300 m long power channel. Water is taken to power house through penstock. From power house water will be fed back to river Payu through tail race channel.

The capacity of forebay tank ensures supplies of immediate water demand for starting the generating units. A bye pass on one side of forebay tank allows water to escape in case of emergency shut down of machines. The Hydel Power Station will comprise the following civil works:

a) Weir
b) Intake Chamber
c) Feeder Channel
d) Desilting Tank
e) Power Channel
f) Forebay Tank
g) Spillway Channel
h) Penstock
i) Power House
j) Tail Race Channel
k) Approach Road
l) Buildings and T&Ps

9.2 WEIR AND INTAKE CHAMBER

A diversion structure is required across the river for diverting the stream water for power generation. It is proposed that the weir shall be constructed, in full width of stream to avoid any restriction to flow that could cause an afflux. Wing wall up and down stream both bank has been construct for safety of future flood.

9.3 FEEDER CHANNEL

The water feed from diversion weir is led to desilting tank through a 300 m long rectangular R.C.C. channel. The design features of channel are as follows :

i) The rectangular intake channel has been provided with a bed width of 1.20 m and depth of 0.85 m. For a design discharge of 0.83 cumecs The slope of channel provided is 1 in 450.

9.4 DESILTING TANK

As the river Payu carries appreciable quantities of coarse silt during rainy season, a settling tank for settling the pebbles/coarse sand (1 to 33 mm) is considered necessary to minimize the abrasion effects on the turbine runners. Consequently a settling tank has been proposed in order to remove sediment particles above 1 mm size.

i) The design discharge for power generation is 0.83 cumecs. The feeder channel has been designed with 20% more water to take care of seepage, leakage, evaporation and silt flushing. Thus the design discharge of feeder channel is 0.83 cumec. The flushing of silt during monsoon periods is proposed to be carried out in day time.

ii) Particles coarser than 2 mm size have been proposed to be trapped in the tank.

iii) The size of tank has been kept as 15x6x3.3 m in length, Transition length of 3 m and 2 m at intake and out let end respectively, width 6 m and depth of 3.00 m. The settling tank is proposed to be made in R.C.C. with M-20 concrete mix.

9.5 POWER CHANNEL

The water fed from settling basin is led to forebay tank through power channel running along the contour on the right bank of river.. Along its course, the power channel crosses about 3 nos. of existing nallahs for which various cross drainage works have been provided. The power channel has been designed to carry forward silt particles up to 2 mm size to forebay tank as most of the bed load/suspended silt above 2 mm size present in water would get removed in the settling basin. The design features of power channel are as follows :

i) The section for channel adopted is rectangular section with R.C.C. The bed width of the channel is 1.50 m and the full supply water depth is 0.85 m. The section is designed as hydraulically efficient section to carry a discharge of 0.73 cumecs to compensate the water losses due to seepage, evaporation and silt flushing at forebay. The total depth of channel is 0.60 m. The slope of channel is 1 in 500.

A free board of 0.25 m is considered necessary for the channel for any likely afflux caused by possible dropping of stones/boulder into the channel from the hill slopes.

9.6 FOREBAY

The forebay, penstock and power house are treated as an integrated unit so far as their location is concerned. The power channel terminates into a forebay tank. The forebay would be located on a rather flat area followed by the penstock provided along moderately sloping hill side leading to the power house on a flat terrace. The geology and terrain is favourable. The layout will not involve any significant excavation for the forebay. The forebay has been provided for desilting of sediment particles above 0.2 mm size and to ensure supply of immediate water demand on starting the generating units. The design features of forebay tank are as follows:

i) Storage time has been kept 2 minutes as per guidelines issued by Central Electricity Authority-1982. Accordingly, the size of tank is kept as 11 m x 6 m x 3.10 m.

vi) A MS bell mouth of circular section is provided at the inlet of penstock to reduce the entry losses.

vii) 2 Nos. mild steel trash rack to clear spacing is provided at penstock intake to check the entry of trash into penstock.

9.7 PENSTOCK

Water from forebay is being taken to the power house to run hydraulic turbine through pressurised penstock pipes running from forebay tank. One number mild steel penstock pipe about 750 m long is proposed to be installed. Penstock made of other material such as R.C.C., P.V.C., high density polythene plastic etc. are not economical for such sizes and conditions in comparison to steel pipes. Various criterion adopted for penstock design are as follows :

i) 1 row of 8 mm & 10 mm thick welded steel penstock of 600 mm inner dia&450 mm ID is proposed. The material of penstock shall confirm IS : 2002, Grade-2.

ii) The optimum dia is determined by minimising the sum of annual loss of generation due to friction and annual working cost including interest on capital loan, depreciation, O&M charges. This diameter will develop 1.407 m/s maximum velocity in the penstock.

iii) The penstock is proposed to be kept exposed to the environment duly supported over saddles and anchor blocks.

iv) The penstock intake is provided with bell mouthing to have smooth entry of water and to reduce entry losses.

v) A slide type gate alongwith manually operated screw hoist arrangement is proposed near the penstock intake to control the flow in penstock alongwith a by-pass valve of 150 mm NB which shall fill the penstock in the start to have balancing head across the gate valve.

vi) A trash rack before the bell mouthing is provided for preventing entry of trash in the penstock.

vii) An air vent tube of 300 mm dia is provided just downstream of penstock intake gate for passage of air during filling and emptying of the penstock.

9.9 POWER HOUSE BUILDING

Power house building is a simple structure housing the generating units, auxiliary equipments, control panels and suitable outlet for tail water discharge. The main features of the power house building are as follows :

i) The building of size 20 m x 10 m in plan is provided to accommodate 2 machines of 500 KW each, control panels, auxiliary equipments etc. One service bay for the maintenance of machine is also provided in the same space.

ii) The height of the building is kept 5.10 m including the position of Crane to facilitate handling of equipment during erection and maintenance.

iii) Walls of the building are made of stone masonry with intermediate R.C.C. columns.

iv) An E.O.T. Crane of 10 tons capacity to facilitate the handling of equipment is provided over rails supported on R.C.C. columns.

v) A trench of 0.3 m x 0.3 m with slope of 1 in 100 for drainage is provided around the power house building discharging into tail race channel to cater to rain water, plinth protection etc.

vi) Machine foundation has been provided as block foundation of reinforced cement concrete of M 20.

vii) Two nos. draft tube gates with chain pulley block.

viii) A valve of 50 mm dia may be provided for dewatering of the penstock.

9.10 TAIL RACE CHANNEL

Turbine discharge shall be fed back to river Payu through the tail race channel. The width of the Tail Race Channel is 1.20 m with a depth of 0.85 m. The length of Tail Race channel is approximately 100 m including upstream transition. To dissipate energy and to prevent erosion on account of high velocity occurring due to steep slope of terrain, the tailrace channel has been provided with a series of falls. At the end of channel where it joins with river, protection works have been provided consisting of boulders in crates.

9.11 SWITCHYARD

An open swtichyard has been envisaged by the side of power house main building.

9.12 APPROACH ROAD

A suitable motorable approach road length of 1.6 km is proposed to be constructed to reach the power house site for transportation of equipment. Suitable provision in cost for this road construction has been made.

9.13 BUILDINGS AND T&Ps

Provision has been kept for office, stores, residential buildings and for T&Ps.

CHAPTER – 10

POWER PLANT ELECTRICAL AND MECHANICAL EQUIPMENT

10.1 INTRODUCTION

The Payu run-of-river hydel scheme is envisaged for installation of 2 generating units of 0.5 MW each, operating under a rated net head of 181 m and placed in a surface powerhouse, located on right bank of Payu river. The generation voltage is proposed to be 11 kV. This voltage will be stepped up to 33 KV voltage level by step-up transformers. The step-up generator transformers have been proposed to be of three-phase type. The generator transformers will be connected to generators by means of 11 KV XLPE Cable. The generator transformers will further be connected to 33KV switchyard by means of 33 kV single core XLPE cables.

10.2 SCOPE

The scope of E&M works of Power House shall start from reducer piece from penstock at the entrance of power station to MIV and upto but excluding draft tube gates. The scope of switchyard E&M works shall include supply, erection, testing and commissioning of S/Y equipments upto outgoing 33 KV line bay (gantry). Provision for spreading of gravel, which is the activity to be taken after equipment earthing is kept in E&M works.

10.3 MECHANICAL EQUIPMENT

10.3.1 Turbines

The turbine would be of horizontal shaft, Francis type, directly coupled to the generator. Turbine shall have an overload capacity of 10% with a discharge of 4.476 cumecs at rated head. The efficiency of the turbine would be around 90%. The turbine speed of 1000 rpm has been selected. The turbine shall be complete with spiral casing, draft tube, guide bearing, guide apparatus etc.

The runner would be of 13(Cr.), 4(Ni) stainless steel to improve resistance to wear/cavitation. The turbine characteristics would be selected such that the optimum efficiency of the turbine falls close to rated output of the unit.

10.3.2 Main Inlet Valves

Each unit would be provided with a main inlet valve of butterfly type of 1000 mm diameter approximately (to be left to vendor to optimize) at the turbine inlet, to facilitate the inspection and maintenance of underwater parts of the turbine by closing it without draining the penstock. The main inlet valve would be hydraulically operated. The valve would be designed for operation under a maximum hydraulic transient pressure. The valve would be

complete with sealing arrangement, manually operated by-pass valve for pressure equalization to facilitate its operation with least possible wear and tear, dismantling joints, body drain valve and MIV open, close and intermediate position indicator.

10.3.3 Penstock

One penstocks of 600 mm dia shall emanate from forebay and shall be connected to each hydro turbine MIV via 2 bifurcated penstocks of 450 mm dia. The maximum velocity of the water in the penstock would be limited to about 1.407 m/sec. Expansion joints of suitable design would be provided for restricting the length contraction within the requisite permissible limits for normal operation, as well as for worst hydraulic transient conditions.

Penstock-water drainage valve would be provided to facilitate the water to drain to draft tube under gravity. Air releasing valve would also be provided on the penstock near the intake from forebay structure.

10.3.4 Governor

Governor shall be provided for each unit for automatic control and operation of generating unit. The governor will enable automatic control of guide vane opening and will be complete with provision for indications of speed, gate opening and gate limit position on the governor cubical as well as on unit control panel to facilitate operation/supervision of the unit.

Instead of oil-air pressure system, Nitrogen gas cylinders will be used with high-pressure nitrogen gas acting as pressurized air. Oil at high pressure from the pressure vessel shall be utilized for controlling the guide vanes and operation of MIV.

Governor will also provide for emergency shutdown of unit in case of : -

- Loss of pressure in the oil pressure vessel of the governor oil system.
- Excessive temperature rise of governor oil.
- Excessive speed rises in the unit.
- Emergency closing of the main inlet valve when the turbine speed rises to a value as recommended by manufacturer as per design practice.
- Electrical faults.

10.3.5 Power House EOT Crane

It is proposed to install one 10 T (main hook)/ 5 T (Aux. Hook) EOT crane and will be designed to travel the full length of the powerhouse. The EOT crane will be used to handle the rotor. The capacity of EOT crane has been selected on the basis of preliminary assessment of rotor weight (highest weight to be handled by EOT crane).

10.4 AUXILIARY SYSTEMS OF THE POWER STATION

10.4.1 Cooling Water System

Cooling water for the Cooling Water system will be either tapped from penstock or pumped from draft tube. This will be decided during detailed engineering. Necessary equipment/ system will be included to provide silt free water for cooling requirements to minimize damages due to silt. The water for cooling requirement is meant for following systems mainly:

- For direct cooling of various hydro-set bearings and other cooling systems.
- For shaft seal.

10.4.2 Potable Water and Sanitary Service

Water from the cooling water system would be used to supply the plant's potable and sanitary water needs. The potable water would be filtered and chemically treated as required.

10.4.3 Drainage and Dewatering System

A dewatering system would be provided in the station with a suitable number of pump motor sets arranged to dewater the draft tube. A separate station drainage system, with a suitable number of pump sets, would also be provided to drain and pump off miscellaneous inflows, and ground water seepage in the power house. Starting and stopping of the pumps would be automatic, controlled by level switches in the dewatering/ drainage sumps.

10.4.4 Fire Fighting System

A complete fire fighting system comprising of deluge valve, fire alarm etc shall be installed for powerhouse and switchyard. Besides this portable fire fighting equipment shall also be used.

10.4.5 Workshop

A small workshop with machine tools, etc. would be provided to carry out normal repairs of the equipment in the powerhouse.

10.4.6 Testing equipment

A small test laboratory will be provided to carry out normal testing of the powerhouse equipment. The laboratory will be equipped with custom made HV test set, oil testing set, meggers, relay testing set etc.

10.5 ELECTRICAL EQUIPMENT

10.5.1 Generators

Each generator would be of horizontal shaft, salient pole type and directly coupled to the turbine. It would be rated for a continuous load of 1000 KW at a power factor of 0.95 and 3 phase, 50 Hz rated voltage of 11 KV with a

provision for working at an overload capacity of 10%. The generator bearings would be pad type Babbitt lined placed in oil bath. The lubrication oil will act as coolant to take away the heat generated at the bearings during the operation of the generator. The windings of the generator would be provided with Class F insulation. The line terminals of the generator would be suitable for connection of 11 KV power cable terminals. The cable would be used to facilitate power flow from the generator to the generator-transformers and for grounding the star point through a neutral grounding transformer. The generators would be air-cooled. Braking system would be provided on the generator to stop the machine after the closure of guide vanes and MIV.

Generator protection will be provided through digital/static/electromagnetic relays having necessary protections.

10.5.2 Captive Power

Captive power requirement during the construction of the project at power house and dam site areas would be met by D.G.Sets to be procured, installed and maintained during the construction period by successful contractor at his own cost and shall be located at suitable places.

10.5.3 Switchyard

The outdoor switchyard location upstream/downstream side of the powerhouse shall be decided on site contours, availability of flat terrain (if any), power evacuation arrangement etc. Power generated from the Powerhouse would be evacuated to Koloriang or as decided by Department of Power, Arunachal Pradesh. A single circuit 132 KV feeder has been desired by Department of Power, Arunachal Pradesh. The transmission lines 33KV &132KV shall be constructed by Department of Power, Arunachal Pradesh. One reactor of 5MVAR shall be placed in switchyard. The station load shall be supplied by unit auxiliary transformers as shown in Single Line diagram.

Switchyard level shall be above max. tail water level and proposed at EL784 m. The tentative area of switchyard has been taken as 70m x 50m.

10.5.4 Protection System

Protection system of generator shall include differential protection, over current, protection, over speed protection, over voltage protection, stator earth fault protection, generator transformer overall differential protection, UAT over current protection Buchholz alarm/trip, reverse power protection, negative phase sequence protection, rotor earth fault, field failure

protection, winding temperature trip, bearing temp very high trip and, emergency shutdown etc.

10.5.5 Equipment Grounding

The power station and switchyard equipments would be provided with separate main grounding grids and the two grids may be interconnected depending on site conditions. All current carrying equipments in the powerhouse and the switchyard would be grounded separately and connected to the respective earth mats. The grounding system would be designed to minimize the step touch potential within acceptable safe limits.

10.5.6 Excitation System

The excitation system of the generator would be of brushless type. The characteristics of the field exciting system would cater the varied excitation current with in a short notice under normal as well as fault conditions. The windings of excitation system would be of class B insulation.

10.5.7 Generator Step-Up Transformers

The step-up transformers proposed would be outdoor type 4.0 MVA, 11/33 KV, 3 phase, 50 Hz, ONAN cooling type. The transformers would be equipped with off-load tap changer to regulate the voltage. Each transformer would be connected to surface switchyard through 33KV XLPE cable. The transformers will be equipped with necessary protection equipments and relays. For meeting emergent conditions, one spare transformer would be provided.

10.5.8 Control, Metering & Relaying System

Control, metering and relaying system will be of the latest state of art available in the market at the time of procurement.

The power generating station would be centrally controlled from the central Control room/ station, which will be PC based computerized workstation. Metering will include measurement of all standard quantities and recorders for constant monitoring of power generated and transmitted.

Control would include all the necessary devices and techniques required to efficiently control the various systems of the plant, monitor the systems, their operation and identify points of trouble. The automatic control would include automatic unit start/ stop, synchronizing, emergency shut down etc. of units. All protection, metering, control and plant supervisory systems will be seamlessly integrated.

Additionally, unit controllers will be provided locally near each unit with provision for human machine interface, for the local control of units and its

associated auxiliaries. On-line monitoring and plant supervisory system will be provided for monitoring and diagnostics need of plant for optimum and smooth operation.

10.5.9 Auxiliary Power Requirements

Auxiliary Power requirements of the unit auxiliaries would be provided through unit auxiliary boards (UAB) fed from the dry type unit auxiliary transformers rated 100 kVA, 11KV/415 V, 3 phase units. Power for the unit auxiliary transformers would be tapped from the respective generator terminals. As the power station is likely to be stand alone power station feeding in a radial mode, Also two 100 KVA, 415 V, DG sets would be provided to meet the start up power and emergency station supply. Provision of station service transformer has not been kept.

The UABs would be interconnected to permit transfer of power from one UAB to the other, with suitable unit interlocks to prevent paralleling of the unit auxiliary supplies. The UAB's and UAT's would be located close to the units, in the equipment gallery of the Powerhouse.

10.5.10 Illumination

The power plant lighting would comprise interior and exterior lights as appropriate for the powerhouse & switchyard. A separate emergency lighting system, fed from the station battery system, would be provided for essential locations, e.g. control room, exits etc.

The illumination levels would be as per Illuminating Engineering Society (IES) recommendations. Lamps would be mercury vapour, sodium vapour, fluorescent or incandescent type to suit the requirements of the areas to be illuminated.

10.5.11 D.C. Supply System

A 110 V DC system with battery bank would provide power for the control of switchgear for the protection and control equipment and for emergency lighting of powerhouse. The battery bank would be provided with two battery chargers, each equipped with float-cum-boost charging facility with all protective devices necessary to protect the system from damage. Distribution boards would be provided for feeding various DC loads of the units

10.5.12 Power Evacuation

The responsibility of power evacuation system as per present scenario remains with Department of Power, Arunachal Pradesh. The Power shall be transmitted to Koloriang via 132KV line as intimated by DOP, Arunanchal Pradesh and to feed other nearby loads the Power will be given at 33KV level.

CHAPTER - 11
CONSTRUCTION MATERIALS

11.1 GENERAL

The natural materials like stones required for stone masonry and for manufacturing of aggregate, screened gravel and sand are available in the nearby area. However, their sources have to be finalised after carrying out necessary tests for their acceptance.

11.2 STONE CHIPS

Stone required for concrete aggregate and masonry are proposed to be exploited from the river bed. The stone chips shall be hard, strong, dense, durable and angular in shape and free from dirt, clay, lumps and other deleterious materials. The hard rock material obtained from excavation can also be used for other works.

11.3 SAND

Sand shall be clean, sharp, strong angular and composed of hard siliceous material. The percentage of all deleterious materials including silt, clay etc. shall not exceed 5%. Sand containing more than 10% of fine grains passing through 76 mesh sieve or having the fineness modulus less than 2 shall not be used for concrete work.

11.4 CEMENT & REINFORCEMENT STEEL

Planning and procurement of items like cement, steel and timber has to be initiated well in time as these are available in the markets of Banderdewa.

Ordinary Portland cement complying with the requirement of IS: 269 shall be used for making plain and reinforced concrete, cement grout and mortar.

Reinforcing bars for concrete shall be high strength deformed steel bars confirming to IS : 1786-1985. All reinforcement bars shall be free from dust, loose rust, coats of paints, oil or other coatings which may destroy or reduce bond.

Cement and steel in bulk quantities will be transported directly from the godown stockyards by road transport to the project site.

11.5 OTHER MATERIALS

Industrial gases, CGI sheetings and other material required for the project will be transported to site by road transport from nearby factories/stockyards.

The quantity of explosives required is small. This could be managed with a portable magazine.

11.6 MANUFACTURED ITEMS

The manufactured or bought out items include :

i) Fabricated structures like penstock & hand rails, trash rack, draft tube, gates, roof cover and their fittings.

ii) Generating equipments - Turbine, governor, generator, control panels, main inlet valve, switchgear and other auxiliary equipments.

iii) The other bought out items like pipes, valves, ventilation equipments, fire fighting equipment, lighting fittings/accessories and other building accessories.

These items are proposed to be procured by competitive bidding, i.e., inviting tenders.

CHAPTER – 12

SUMMARY RECOMMENDATIONS

12.1 RECOMMENDATIONS

After the study of flow and head available for the proposed site, on river Payu in Arunachal Pradesh, the total power generated is estimated as 1000 kW. For this two units each of 500 kW of Turbo Impulse turbine are selected. This requires a total capital cost of Rs. **2248.98 Lakhs**. The re-revised proposal seems to be techno-economically favorable, over a long run as maintenance is very less.

In addition to above, the area is industrially undeveloped due to acute shortage of power. People depend on forest wood and petroleum products like diesel, petrol, kerosene oil etc. for their domestic needs. Availability of reliable electrical energy is expected to reduce over dependence on such depleting fuel. By and large, the socio-economic condition of the people in the area is far below the national average standard. Therefore, the installation of the proposed power plant will help in development of socio-economic conditions of the people.

CHAPTER – 13

COST ESTIMATE

13.1 GENERAL

Re-Revised Costs of the various components of the scheme have been worked out in sufficient details so as to arrive at a realistic revised cost estimate.

a) Cost of major Electro-mechanical equipment and HM works are based on budgetary prices obtained from various manufacturers.

b) The revised costs have been worked out on the basis of APSR 2007 plus 60% enhancement.

13.2 WORKS

13.2.1 *Civil Works*

Re-Revised Cost towards civil works to be executed includes feeder Channel, Desilting Tank, Power Channel, Forebay, Spillway Channel, penstock pipe & Approach Road etc. A total provision of Rs. **2248.98 lakhs** i/c 3% contingencies has been made in revised cost estimate plus 1% labour Cess, @1% Education Cess, 1% Quality Check & @4% VAT

Electrical and Electro-Mechanical Works

Main equipment of the power house like Turbine and its auxiliaries, Generator and its auxiliaries, control panels, EOT crane etc. has been included under this head.

Equipment like control and relay panels, 3.3 kV switchgear & auxiliary switchgear etc. are covered under indoor electrical equipment. DC system covers for battery, battery charger & Dcdb etc.

Total revised estimated cost for electrical and electromechanical equipment with 2 x 500 kW units works out as **Rs. 976.42** lacs including hydro mechanical works .

CHAPTER – 14

REASON FOR COST ESCALATION

The re-revised estimated Cost of Rs. **2248.98 Lakhs** against the revised estimated cost of **Rs 1416.09** Lakhs has been framed for which the details are furnished as below:-

1. FEEDER CHANNEL

In original and revised DPR scope of work for back cutting earth work and construction of retaining wall were not kept and as per site location and as also due to heavy landslides and erosion construction of aforementioned work is necessary to avoid any further hindrance and the quantity, which is reflected in this estimate is the actual at the site and the same is kept in re-revised DPR.

2. POWER CHANNEL

Additional cost was involved in re-revised DPR due to construction of aquaduct, C/o culvert-4 nos., C/o Retaining Wall-4 nos. and back cutting earth work as per site condition Due to heavy landslides and erosion cost difference is high due to above said reasons. Previous estimates the work quantities of above work were not included and the quantity reflected in this estimate is the actual at the site. Moreover, no provision of aforementioned work in previous estimate was kept at Power Channel. However, of such location are detected in the site and accordingly provision has been kept in this estimate

3. DESILTING TANK

As per necessity and to avoid any further hindrance, there is no scope of work was found in previous estimates. So, in this estimate provision for construction of CC Drain for flushing out pipe have been kept at the workable cost as per area.

4. FOREBAY TANK AND SPILLWAY CHANNEL

As per site condition and to avoid any further risk the length of spillway channel adopted in this estimate is larger than the revised estimate which was previously 100 mtr.and now it is 180 mtr., total 80 mtr. of spillway channel length was extended. So, due to above reason, scope of work for the same is kept in this estimate at the workable cost as per area.

5. PENSTOCK PIPE

In this estimate actual qnty. Of cutting, joining and welding of pipe as per site and which is workable at site by gas and electric welding is worked out and also construction of culvert and earth work formation and trenching work is necessary as per site condition. Hence cost difference occurred. Whereas, no such provision is kept in the previous estimate.

6. APPROACH ROAD

As per necessity, additional construction of retaining wall is required at various chainage. Hence, on observing the necessity for early completion and commissioning of the project provision for the same is kept in this re-revised DPR.

7 . INCREASE IN COST OF MEN AND MATERIALS

The original DPR was sanctioned in the year 2007-2008 vide Govt. Order No. PWRS/HPD/W-1662/5433-43 DTD.07.08.2008 based in the estimate prepared and processed in the year 2007 & vide No. M.13048/2(Aru)2006/SP-ACA, dated 20/2/2008 the project has been funded under PMs Package Scheme for an amount of Rs.939.21 Lakhs and then the revised DPR was sanctioned in the year 2012-13 for an amount of Rs.1416.09 Lakhs. On scrutiny, it has been found that Cost Index of 52.5% over APSR 2000 was used in the original DPR & revised DPR, which is currently not workable. Hence, to cover up the increase in the cost of men and materials over time, Cost Index of 60% over APSR 2007 (@ 7.5% per annum) has been used in the revised estimate.

Assistant Engineer
Koloriang Sub Division,DHPD

Sd/-
A.S.W.
Koloriang Civil Division,DHPD

Executive Engineer
Koloriang Civil Division,DHPD
Executive Engineer (Civil)
Koloriang Civil Division
Deptt. of Hydro Power Dev.
Koloriang

GENERAL ABSTRACT OF COST

NAME OF WORK :-C/O PAYU MHS AT KOLORIANG (2 X 500 KW)

(Rs.in Lakhs)

Sl. No.	Sub-head of work	Sanctioned Orginal DPR Estimated Cost	Sanctioned Revised DPR Estimated Cost	As per Re-Revised DPR Estimated Cost		Difference	Remarks
				To be Executed	Total		
I	CIVIL WORKS						
1	Intake Weir	29.05	30.06	0.00	30.06	0.00	
2	Intake chamber	5.85	6.43	0.00	6.43	0.00	
3	Feeder Channel	16.51	86.57	34.04	120.61	34.04	
4	Desilting Tank	11.56	11.56	4.41	15.97	4.41	
5	Power Channel	117.5	143.92	94.34	238.26	94.34	
6	Forebay Tank & Spillway Channel	16.66	22.85	41.99	64.84	41.99	
7	Penstock Pipe	94.28	209.19	136.30	345.49	136.30	
8	Power House Building & Tailrace	23.97	39.15	37.47	76.62	37.47	
9	Approach Road	172.56	172.93	29.61	202.54	29.61	
10	Cartage of materials	0.00	31.14	0.00	31.14	0.00	
11	Residential Buildings	25.63	27.36	0.00	27.36	0.00	
12	Special T&P	26.20	26.20	15.00	41.20	15.00	
TOTAL OF CIVIL WORKS :-		**539.77**	**807.37**	**393.16**	**1200.53**	**393.16**	
	Add 1% Labour cess	---	8.07		12.01		
	Add 1% Eductn. cess	---	8.07		12.01		
	Add VAT 4%	---	32.29		48.02		
GRAND TOTAL OF CIVIL WORKS		**539.77**	**855.81**		**1272.56**		
II	E&M WORKS	**560.28**	**560.28**	**387.70**	**947.98**	**387.70**	
	Add 1% Labour cess	---	---		9.48		
	Add 1% Eductn. cess	---	---		9.48		
	Add Quality Check 1%	---	---		9.48		
GRAND TOTAL OF E&M WORKS :-		**560.28**	**560.28**		**976.42**		
III	OTHER WORKS						
1	Plantation		0.00				
2	Establishment		0.00				
3	Maintenance during construction		0.00				
5	Miscellaneuos		0.00				
6	Losses on stock		0.00				
7	Indirect charges		0.00				
TOTAL OF OTHER WORKS:-			**0.00**				
TOTAL PROJECT COST :-		1100.05	1416.09		2248.98	780.86	

Assistant Engineer(C)
Koloriang Sub-Division,
DHPD,Koloriang

Executive Engineer(C)
Koloriang Division,
DHPD,Koloriang

A.S.W(C)
O/o SE(C),DHPD
Itanagar

Superintending Engineer(C)
Itanagar Circle,
DHPD,Itanagar

A.S.W.
O/o Chief Engineer(Civil)
DHPD,Itanagar

Surveyor of Works(Civil)
O/o Chief Engineer(Civil)
DHPD,Itanagar

Supdtg.Surveyor of Works(Civil)
O/o Chief Engineer(Civil)
DHPD,Itanagar

Chief Engineer(Civil)
DHPD,Itanagar

Chief Engineer (WZ
Deptt of Hydro Power Develop
Itanagar (A.P)

GENERAL ABSTRACT OF COST FOR CIVIL WORKS

AME OF WORK :-C/O PAYU MHS AT KOLORIANG (2 X 500 KW)

(Rs.in Lakhs

Sl. No.	Sub-head of work	Sanctioned Orginal DPR Estimated Cost	Sanctioned Revised DPR Estimated Cost	As per Re-Revised DPR Estimated Cost	Difference	Remarks
I	CIVIL WORKS					
1	Intake Weir	29.05	30.06	30.06	0.00	
2	Intake chamber	5.85	6.43	6.43	0.00	
3	Feeder Channel	16.51	86.57	120.61	34.04	
4	Desilting Tank	11.56	11.56	15.97	4.41,	
5	Power Channel	117.50	143.92	238.26	94.34	
6	Forebay Tank & Spillway Channel	16.66	22.85	64.84	41.99	
7	Penstock Pipe	94.28	209.19	345.49	136.30	
8	Power House Building & Tailrace	23.97	39.15	76.62	37.47	
9	Approach Road	172.56	172.93	202.54	29.61	
10	Cartage of materials	0.00	31.14	31.14	0.00	
11	Residential Buildings	25.63	27.36	27.36	0.00	
12	Special T&P	26.20	26.20	41.20	15.00	
	OTAL OF CIVIL WORKS :-	**539.77**	**807.37**	**1200.52**	**393.16**	
	Add 1% Labour cess	---	8.07	12.01	3.93	
	Add 1% Eductn. cess	---	8.07	12.01	3.93	
	Add VAT 4%	---	32.29	48.02	15.73	
	RAND TOTAL OF CIVIL ORKS	**539.77**	**855.81**	**1272.56**	**416.75**	

Assistant Engineer(C)
Koloriang Sub-Division,
DHPD,Koloriang

Executive Engineer(C)
Koloriang Division,
DHPD,Koloriang

A.S.W(C)
O/o SE(C),DHPD
Itanagar

Superintending Engineer(C)
Itanagar Circle,
DHPD,Itanagar

A.S.W.
O/o Chief Engineer(Civil)
DHPD,Itanagar

Surveyor of Works(Civil)
O/o Chief Engineer(Civil)
DHPD,Itanagar

Supdtg.Surveyor of Works(Civil)
O/o Chief Engineer(Civil)
DHPD,Itanagar

Chief Engineer(Civil)
DHPD,Itanagar

Chief Engineer (WZ)
Deptt of Hydro Power Development
Itanagar (A.P)

fference	Remarks

GOVERNMENT OF ARUNACHAL PRADESH
DEPARTMENT OF HYDRO POWER DEVELOPMENT

C.P.W.D. code para :-81

C.P.W.D.-1

State:- Arunachal Pradesh | Division:- Ziro EM | Branch:- DHPD

ESTIMATE NO :- 2015-2016

NOTE :- The entires against each item below should be made in accordance with the classification prescribed in Appendix No. 4 C.P.W.D. code.

Name of Work :- C/o Payu MHS (2 X 500 KW) at Koloriang

(SH: Electro Mechanical Works)

Estimate framed by Er. Tayum Udik Taba, Superintending Engineer (EM), Western EM Circle, Department of Hydro Power Development, for a probable cost of **Rs. 976.42 Lakhs**.

Report.

This detailed estimate amounting to **Rs. 976.42 Lakhs (Rupees Nine Hundred Seventy Six Lakh Forty Two)** only i/c 3% contingencies, Education Cess 1% and Labour cess 1% etc. has been framed to cover the probable cost of the above mentioned work and to obtain administrative approval & expenditure sanction from the competent authority.

History

The Payu MHS(2x500 KW) at Koloriang is one of the most important hydel, as is located nearest to the District Head Quarter and could be an important source of power supply to Koloriang Township. The project was sanctioned vide order No. PWRS/HPD/Est-83/2011-12/1282-302, Dtd. 28/03/2012. The civil Construction works is almost completed but installation of EM Equipments is not yet started due to abandonement of contract by the turnkey contractor. The work for C/o Payu SHP at Koloriang was awarded to M/s Biecco Lawrie Limited, Kolkata a Public Sector Undertaking of Ministry of Oil & Natural Gas, Government of India vide Agreement No.CE/HPD/AGMNT/2010-11/41, Dtd. 14/09/2010. The turnkey contractor after having supplied some of the EM components has abandoned the contract since 2012. Now, the works is to be commissioned through third party or departmentaly. The revised estimate is necessitated due to cost escalation and requirement of additional items as per site condition.

Design & Scope.

This estimate provides for following scopes:- C/o Payu MHS (2x500KW) at Koloriang

Specification	:-	The work shall be carried out as per CPWD/IRC specification and specification followed in Arunachal Pradesh.
Rate	:-	Approved Rate/MR
Cost	:-	**Rs.976.42 Lakhs**
Method	:-	Departmentally/Contract
Contingency	:-	3%
Time	:-	Three Months

Executive Engineer (EM)
Ziro EM Division
DHPD, Ziro

Superintending Engineer (EM)
Western E-M Circle,
DHPD, Itanagar

Chief Engineer (EM / Generation)
Department of Hydro Power Development
Itanagar

GENERAL ABSTRACT

NAME OF WORK :- C/o Payu MHS (2x500KW) at Koloriang

Sl. No.	Item	As per Original DPR / Estimate	As per Revised DPR / Estimate	Remarks
1	As per detail revised estimate (E&M works)	56027983.00	97642235.67	

Revised Amount Rs 97642236.00

Say Rs. 976.42 Lakhs

(Rupees Nine Hundred Seventy Six Lakh Forty Two Thousand) only

Executive Engineer (EM)
Ziro EM Division
Deptt. of Hydro Power Development,
Ziro

Superintending Enginer (EM)
Western E-M Cicrle
Deptt. of Hydro power Development
Itanagar

Chief Engineer (EM / Generation)
Deptt. of Hydro Power Development
Itanagar

ference	Remarks

NAME OF WORK :- C/o Pavu MHS at Kolorlang (2 X 800 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Already Executed			Scope as per Re-Revised DPR To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
I.	(S.H.:-Intake Weir)																
1	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m.																
	(a) Hard Soil	Cum	0.00	42.00	0.00	830.00	42.00	34860.00									
	(b) Ordinary Rock	Cum	455.00	160.10	72845.50	1387.22	160.10	222093.92									
	© Hard rock requiring blasting	Cum	515.00	266.80	137402.00	2067.22	266.80	551534.30									
2	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	65.32	2186.80	142841.78	31.60	2186.80	69102.88									
3	Providing and laying cement concrete 1:2:4 (1 cement:2 coarse sand:4 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	45.68	2745.70	125423.58	0.00	2745.70	0									
4	Pumping out water caused by spring, tidal or river seepage, broken water mains, drains or the like etc.	K.Ltr	3000.00	23.40	70200.00	3000	23.40	70200.00									
5	Cement concrete in or under water and on liquid mud i/c cost of pumping and bailing out water and ramming sluice etc.	Cum	350.00	46.90	16415.00	330.00	46.90	15477.00									
6	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings	Sqm	382.00	787.30	300748.60	159.20	787.30	125338.16									
	(b) Walls	Sqm	352.80	113.80	40148.64	301.60	113.80	34322.08									
7	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars.	Kg.	9856.76	23.30	229662.51	5706.80	23.30	132968.44									
8	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1 : 1.5 : 3	Cum	45.61	3161.10	144177.77	21.88	3161.10	69164.868									
	(a) 1 : 1.5 : 3	Cum	62.80	3790.00	238012.00	30.00	3790.00	113700.00									
10	Dry stone pitching 22.50 cm thick i/c supplying of stone and preparing surface complete.	Sqm	789.56	172.30	136041.19	80.00	172.30	13784.00									
11	Labour charges for laying boulder apron with man size boulders by hand packing the stones within dry masonry template cross walls to ensure regular and orderly disposit:on of the full intended quantity of stone in the apron including labour for building these walls about 1 m thick and to the full height of the specified thickness of the apron at interval of 30 mtrs all along the length and width of the apron with local carriage of the stone within 60 mtrs complete.	Cum	0.00	122.50	0.00	246.00	122.50	30135.00									
12	Random rubble masonry with hard stone in foundations and plinth in cement mortar 1 : 6 (1 cement : 6 fine sand) including levelling up with cement concrete 1 : 6 : 12 (1 cement : 6 coarse sand : 12 stone aggregate 20 mm nominal size) at plinth level.	cum	120.00	2191.00	262920.00	60.00	2191.00	131460.00									
14	Steel work in single section including cutting, hoisting, fixing in position and applying a priming coat of red lead paint																
	a) In Flats up to 10 mm in thickness	Qntl	10.89	1674.75	18238.03	6.38	1674.75	10684.91									

NAME OF WORK : C/o Pavu MHS at Kolariangi (2 X 600 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
15	Dewatering and diversion works during construction i/c cofferdams,foundation treatment,re-grading of river beds i/c any lead lift and disposal of excess materials at site.	L. S					LS	100000									
16	Extra for water proofing and quick setting compound		0	LS	10000.00	0	LS	10000									
				Total	1945076.59		Total	950764.55									
	Add enhancement 45% per annum over APSR '2000				875284.4639		Add 60% Cl over 784061	784061									
	Add enhancement 75% per annum over APSR '2000				.....			470436.60									
								713073.41									
			D	Total:-	2820361.05			2918335.56									
	Add 3% contigencies over D				84610.83151			87550.07									
				G/Total:-	**2904971.88**		G/Total:-	3005885.63									
	Say Rs.																
			Say Rs in lakh		**29.05**	Say Rs in Lakh		30.06									

NAME OF WORK :- C/o Payu MHS at Kuturiana (2 x 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR: Already Executed			Scope as per Re-Revised DPR: To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	II (S.H.:-Intake Chamber)																
1	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m.																
	(a) Hard Soil	Cum	2.5	42.00	105.00	1.089	42.00	45.74									
	b) Ordinary rock with or without blasting	Cum	10	160.10	1601.00	4.356	160.10	697.40									
	(c) Hard Rock requiring blasting	Cum	12.5	266.80	3335.00	5.445	266.80	1452.73									
2	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	4.8	2186.80	10496.64	4.8	2186.80	10496.64									
3	Cement concrete in or under water and on liquid mud i/c cost of pumping and bailing out water and ramming sluice etc.	Cum Mtr depth	8	46.90	375.2	8	46.90	375.20									
4	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings	Sqm	2.16	78.30	169.128	2.16	78.30	169.13									
	(b) Walls	Sqm	72	113.80	8193.6	72	113.80	8193.60									
	c) Suspended floors, roofs, landings shelves and their supports, balconies and chajjas (3.5 m height)	Sqm	14.04	181.80	2552.472	14.04	181.80	2552.47									
5	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars	Kg	1037.52	23.30	24174.216	1037.52	23.30	24174.22									
6	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1 : 1.5 : 3	Cum	3.89	3161.10	12296.679	3.89	3161.10	12296.68									
7	Reinforced cement concrete work in walls (any thickness) including attached pillasters, buttresses, plinth and string courses, fillets etc. from top of foundation upto floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 of thickness not exceeding 6mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :-																
	(a) 1 : 1.5 : 3	Cum	3.6	3790.00	13644	3.6	3790.00	13644.00									
8	Reinforced cement concrete work in suspended floors,roofs,landing,balconies upto two floor levelincluding finishing and plastering the exposed surfaces with cement mortar 1 : 3 of thickness not exceeding 6mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :-																
	a) 1 ; 2: 4	Cum	1.94	3530.00	6848.20	1.94	3530.00	6848.20									
				C	**83791.14**			**80945.99**									
9	Providing and fixing scour pipe 300 mm	Mtr.	50	420.00	21000.00	50	3000.00	150000.00									
10	Providing & Fixing M.S Sluice valve	No.	1	225000.00	225000.00	1	225000.00	225000.00									
11	Providing & Fixing M.S Sluice gates	No.	1	200000.00	200000.00	1	100000.00	100000.00									
					446000.00			**475000.00**									
	Add enhancement 45% over C				37706.01	Add 75%		60709.50									
			D	Total:-	567497.15			616655.49									
	Add 3% contigencies on (D)				17024.91			18499.66									
				G/Total	584522.0601		G/Total	635155.16									
				Say Rs.	**5.85**		Say Rs.	**6.35**									
				In Lakhs			In Lakhs										

Engineer (Civil)

NAME OF WORK :- C/o Payu MHS at Kolorlang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	III. (S.H.:- Feeder channel)																
1.	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.(For Back Cutting)																
	a) Hard Soil	Cu.m.										2073.75	68.50	142,051.88			APSR2007
	(b) Ordinary Rock	Cum										3732.75	171.30	639,420.08			APSR2007
	C) Hard Rock requiring blasting	Cu.m.										2488.50	361.60	899,841.60			APSR2007
2	Earthwork in excavation over areas (exceeding 30 cm in depth, 1.50 m in width as well as 10 Sq.m. on plan) including disposal of surplus excavated earth lead upto 50 m and lift upto 1.50 m, disposed earth to be levelled and neatly dressed.																
	a) Hard Soil	Cu.m.	680.00	39.88	27,118.40	1670.00	39.88	66,599.60									
	(b) Ordinary Rock	Cum	900.00	146.50	131,850.00	3600.00	146.50	527,400.00									
	C) Hard Rock requiring blasting	Cu.m.	900.00	215.70	194,130.00	3600.00	215.70	776,520.00									
3	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m.																
	(a) Hard Soil	Cum	90.80	42.00	3,813.60	167.30	42.00	7,026.60									
	(b) Ordinary Rock	Cum	130.00	160.10	20,813.00	283.00	160.10	45,308.30									
	(c) Hard Rock requiring blasting	Cum	130.00	266.80	34,684.00	283.00	266.80	75,504.40									
3	Providing and laying cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	60.20	2186.80	131,645.36	105.20	2186.80	230,051.36									
4	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1 :11/2:3	Cum	68.90	3161.10	217,799.79	136.40	3161.10	431,174.04									
5	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :																
	a) 1 : 1.5 : 3 (1 cement : 1.5 corase sand : 3 stone aggregate 20 mm nominal size)	Cum	60.20	3790.00	228,158.00	136.70	3790.00	518,093.00									
6	Reinforced cement concrete in suspended floors, roofs, landings and balconies upto floor two level including finishing and plastering the exposed surface with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface but excluding cost of centring and shuttering and reinforcement with 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size).	Cum	7.20	3530.00	25,416.00	74.70	3530.00	263,691.00									
7	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings	Sqm	110.00	78.30	8,613.00	200.00	78.30	15,660.00									
			140.00	113.80	15,932.00	650.00	113.80	73,970.00									

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 600 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	b) Suspended floors, roofs, landings shelves and their supports, balconies and chajjas (3.5 m height)	Sqm	150.00	181.80	27,270.00	690.00	181.80	125,442.00									
8	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars	Kg.	1650.00	23.30	38,445.00	18570.00	23.30	432,681.00									
				c	1,105,688.15		A	3,694,436.00									
9	Providing & supplying expansion joints @30 m c/c	Nos.	0	0.00	-	17.4	17890.00	311286									
10	C/o Retaining Wall																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cu.m.										21.56	68.50	1,477.03			APSR2007
	(b) Ordinary Rock	Cum										38.81	171.30	6,648.58			APSR2007
	C) Hard Rock requiring blasting	Cu.m.										25.88	361.60	9,356.40			APSR2007
ii)	Providing and laying in foundations and plinth cement concrete 1 : 5 : 10 (1 cement : 5 coarse sand : 10 graded stone shingle 40 mm nominal size) excluding the cost of centring and shuttering.	Cu.m.										12.00	2024.20	24,290.40			APSR'2007
iii)	Random rubble masonry with hard stone in foundations andplinth incement mortar 1 : 6 (1 cement : 6 fine sand) including levelling up with cement concrete 1 : 6 : 12 (1 cement : 6 coarse sand : 12 stone shingle 20 mm nominal size) at plinth level.	Cu.m.										144.90	2364.30	342,587.07			APSR'2007
										Total				2,065,673.03			
	Add enhancement 45% over C				497,559.67					Add 60% CI				1,239,403.82			
	Add enhancement 75% over APSR '2000on (A)							2770827						3,305,076.85			
			D	Total	1,603,247.82		Total	6,776,549.00									
	Add 3% contigencies on (D)				48,097.43			203296.47		Add 3% Contingencies				99,152.31			
				G/Total	1,651,345.25		G/Total	6979845.47						3,404,229.16			
				Say Rs.	16.51		Say Rs.	69.80					Say Rs.	34.04	103.84	34.04	
				In Lakh			In Lakh						In Lakhs				

Executive Engineer (Civil)
Koloriang Civil Division
Deptt. of Hydro Power Dev.
Koloriang

NAME OF WORK :- C/o Payu MHS at Kolorlang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	IV (S.H : Desilting Tank)																
1.	Earthwork in excavation over areas (exceeding 30 cm in depth, 1.50 m in width as well as 10 Sq.m. on plan) including disposal of surplus excavated earth lead upto 50 m and lift upto 1.50 m, disposed earth to be levelled and neatly dressed.																
	a) Hard Soil	cum	280.0	39.80	11,144.00												
	(b) Ordinary Rock	cum	420.0	146.50	61,530.00												
	C) Hard Rock requiring blasting	cum	420.0	215.70	90,594.00												
2	Earth work inexcavation in foundation trenches not exceeding																
	(a) Hard Soil	Cum	89.33	42.00	3751.86												
	(b) Ordinary Rock	Cum	150.00	160.10	24015.00												
	(c) Hard Rock requiring blasting	Cum	150.00	266.80	40020.00												
3	Providing and laying cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	50.60	2186.80	110652.08												
4	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1 :11/2:3	Cum	36.60	3161.10	115696.26												
5	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :																
	a) 1 : 1.5 : 3 (1 cement : 1.5 corase sand : 3 stone aggregate 20 mm nominal size)	Cum	36.80	3790.00	139472.00												
6	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(b) Walls etc.	Sqm	120.00	113.80	13656.00												
7	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars	Kg	4050.00	23.30	94365.00												
				C	704,896.20												
8	C/o CC Drain for flushing out channel																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cu.m.										160.00	68.50	10,960.00			APSR'2007
	(b) Ordinary Rock	Cum										288.00	171.30	49,334.40			APSR'2007
	C) Hard Rock requiring blasting	Cu.m.										192.00	361.60	69,427.20			APSR'2007
ii)	Providing and laying in foundations and plinth cement concrete 1 : 5 : 10 (1 cement : 5 coarse sand : 10 graded stone shingle 40 mm nominal size) excluding the cost of centring and shuttering.	Cu.m.										8.00	2024.20	16,193.60			APSR'2007
iii)	Centring and shuttering including strutting proping etc. and removal of form work for:	Sqm															
	i) Walls including attached buttresses, pilasters etc.											240.00	166.50	39,960.00			APSR'2007

/o Payu MHS at Koloriang (2 X 500 KW)

head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Already Executed			Scope as per Re-Revised DPR To be Executed			Total	Difference	Remarks
		Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
ent concrete 1 : 2 : 4 (1 cement : coarse nominalsize)excludingthecostofcentring	Cum										24.00	3415.20	81,964.80			APSR'2007
ing Pipe 300 mm dia	Mtr			0												
e Valve 300 mm dia	No			100000.00												
% over C				317203.29						Total			267840.00			
ver APSR '2000on (A)										Add 60% C I			160704.00			
(D)		D	Total -	1122099.49									428544.00			
				33662.98						Add 3% contingencies			12856.32			
			G/Total -	1155762.47									441400.32			
			Say Rs:-	11.56								Say Rs.	4.41	15.97	4.41	
			In Lakh													

Executive Engineer (Civil)
Koloriang Civil Division
Deptt. of Hydro Power Dev.
Koloriang

NAME OF WORK :- C/o Payu MHS at Kolortang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	V. (S.H.:- Power Channel)																
1.	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.(back cutting)																
	a) Hard Soil	Cu.m.										1,675.0	68.50	114737.50			APSR2007
	(b) Ordinary Rock	Cum										3,015.0	171.30	516469.50			APSR2007
	C) Hard Rock requiring blasting	Cu.m										2,010.0	361.60	726816.00			APSR2007
2	Earthwork in excavation over areas (exceeding 30 cm in depth, 1.50 m in width as well as 10 Sq.m. on plan) including disposal of surplus excavated earth lead upto 50 m and lift upto 1.50 m, disposed earth to be levelled and neatly dressed.																
	a) Hard Soil	Cu.m.	3,200.00	39.80	127,360.00	3,200.00	39.80	127,360.00									
	(b) Ordinary Rock	Cum	5,600.00	146.50	820,400.00	6,500.00	146.50	952,250.00									
	C) Hard Rock requiring blasting	Cu.m.	5,600.00	215.70	1,207,920.00	8,000.00	215.70	1,725,600.00									
3	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m.																
	(a) Hard Soil	Cum	178.60	42.00	7,501.20	120.60	42.00	5065.20									
	(b) Ordinary Rock	Cum	580.60	160.10	92,954.06	482.40	160.10	77232.24									
	(c) Hard Rock requiring blasting	Cum	580.60	266.80	154,904.08	603.00	266.80	160880.40									
4	Providing and laying cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	402.60	2186.80	880,405.68	201	2186.80	439546.80									
5	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1 :11/2:3	Cum	380.60	3161.10	1,203,114.66	402.00	3161.10	1270762.20									
6	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :																
	a) 1 : 1.5 : 3 (1 cement : 1.5 corase sand : 3 stone aggregate 20 mm nominal size)	Cum	540.20	3790.00	2,047,358.00	341.70	3790.00	1295043.00									
7	Reinforced cement concrete in suspended floors, roofs, landings and balconies upto floor two level including finishing and plastering the exposed surface with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface but excluding cost of centring and shuttering and reinforcement with 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size).	Cum	-	3530.00	-	0	3530.00	0.00									

NAME OF WORK :- C/o Payu MHS at Kolorlang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
8	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings	Sqm	780.60	78.30	61,120.98	402.00	78.30	31476.60									
	(b) Walls etc.	Sqm	1,236.90	113.80	140,759.22	4556.00	113.80	518472.80									
	b) Suspended floors, roofs, landings shelves and their supports, balconies and chajjas (3.5 m height)	Sqm	345.00	181.80	62,721.00		181.80	0.00									
9	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars.	Kg.	45,520.60	23.30	1,060,629.98	59496.00	23.30	1386256.80									
10	C/o Aquaduct																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cum										81.00	68.50	5548.50			APSR2007
ii)	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.											20.25	3156.90	63927.23			APSR2007
iii)	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings											142.80	113.90	16264.92			APSR'2007
	(b)Column and Beam											435.00	203.50	88522.50			APSR'2007
iv)	Reinforcement for RCC work including bending binding and																
	(a) Cold twisted bars.	Kg.										4124.97	42.90	176961.08			APSR'2007
v)	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	a) 1:2:4	Cum										93.24	3810.40	355281.70			APSR'2007
11	C/o Retaining Wall- 4 Nos.																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cu.m.										155.00	68.50	10,617.50			APSR'2007
	b) Ordinary Rock	Cu.m.										465.00	171.30	79,654.50			APSR'2007
ii)	Providing and laying in foundations and plinth cement concrete 1 : 5 : 10 (1 cement : 5 coarse sand : 10 graded stone shingle 40 mm nominal size) excluding the cost of centring and shuttering	Cu.m.										64.00	2024.20	129,548.80			APSR'2007
iii)	Random rubble masonry with hard stone in foundations andplinth incement mortar 1 : 6 (1 cement : 6 fine sand) including levelling up with cement concrete 1 : 6 : 12 (1 cement : 6 coarse sand : 12 stone shingle 20 mm nominal size) at plinth level	Cu.m.										772.80	2364.30	1,827,131.04			APSR'2007
12	C/o Culvert- 4 nos.																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and																

NAME OF WORK :- C/o Payu MHS at Kolorlang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m																
	a) Hard Soil	Cu.m.										425.52	68.50	29,148.12			APSR'2007
	b) Ordinary Rock	Cu.m.										638.28	171.30	109,337.36			APSR'2007
ii)	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.											84.90	3156.90	268008.18			APSR'2007
iii)	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :	Cu.m.															
	a) 1 : 1.5 : 3 (1 cement : 1.5 corase sand : 3 stone aggregate 20 mm nominal size)											84.90	4390.80	372761.36			APSR'2007
iv)	Reinforced cement concrete in suspended floors, roofs, landings and balconies upto floor two level including finishing and plastering the exposed surface with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface but excluding cost of centring and shuttering and reinforcement with 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size)											50.00	3988.00	199400.00			APSR'2007
v)	Centring and shuttering including strutting, propping etc and removal of form work for :																
	a) Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.											876.80	166.50	145987.20			APSR'2007
	b) Suspended floors, roofs, landings shelves and their supports, balconies and chajjas (3.5 m height)											92.00	265.40	24416.80			APSR'2007
vi)	Reinforcement for RCC work including bending binding and																
	(a) Cold twisted bars	Kg.										3116.39	42.90	133693.27			APSR'2007
vii)	Providing and laying cement concrete 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size) excluding the cost of centring and shuttering in :																
	a) Walls including attached buttresses, pilasters and their caps and bases and string courses etc up to floor two level.	Cum										7.20	3450.40	24842.88			APSR'2007
viii)	Providing and laying Pitching on slopes laid over prepared filter media including boulder apron laid dry in front of toe of embankment complete as per drawing and Technical specifications Stone filling behind the wall with hard stone as per the direction of the Engineer-in- Charge	Cum										403.20	757.00	305222.40			APSR'2007
				C	7,867,148.86			5,184,736.04				Total		5724298.34			
								2,805,210.00									
							Add 60% CI	1683126.00									
								4488336.00									
9	Providing and supplying expansion joints 30 m c/c	no															
10	C/o side drain of 50 cm wideat top and 40 cm wide base and 50 cm deep wit RRM in cm 1:6	m				3.00		241200.00				Add 60% C.I		3434579.00			
11	C/O Super passage of 2m span	No				2.00	85000.00	170000.00									
12	C/O R/ wall of average heigt 5m with RRM in CM 1:6	m															
13	C/O R/ wall of average heigt 4m with RRM in CM 1:6	m															

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
14	C/O boulder crated wall with boulders of size 150 to 300 mm i/c laying of sausage wire	m															
	Add enhancement 45% over C				3,540,216.99			3,888,552.03									
	Add enhancement 75% over APSR '2000on (A)																
			D	Total :-	11,407,365.85			9,484,488.07						9158877.34			
	Add 3% contigencies on (D)				342,220.98			284,534.64			Add 3% Contingencies			274766.32			
								134,650.08									
				G/Total :-	11,749,586.82			14,392,008.79					G/Total :-	9433643.66			
				Say Rs.	117.50			143.92					Say Rs.	94.34	238.26	94.34	
				In lakh				In lakh									

Executive Engineer (Civil)
Koloriang Civil Division
Deptt. of Hydro Power Dev.
Koloriang

NAME OF WORK :- C/o Payu MHS at Kolodang (2 X 800 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	VI. (S.H.:- Fore Bay tank)																
1.	Earthwork in excavation over areas (exceeding 30 cm in depth, 1.50 m in width as well as 10 Sq.m. on plan) including disposal of surplus excavated earth lead upto 50 m and lift upto 1.50 m, disposed earth to be levelled and neatly dressed.																
	a) Hard Soil	Cu.m.	95.6	39.80	3,804.88	269.42	39.80	10,722.92				285.96	68.50	19,588.26		APSR'2007	
	(b) Ordinary Rock	Cum	95.6	146.50	14,005.40	269.42	146.50	39,470.03				285.96	171.30	48,984.95		APSR'2007	
	C) Hard Rock requiring blasting	Cu.m.	150.32	215.70	32,424.02	382.08	215.70	82,414.66				381.28	361.60	137,870.85		APSR'2007	
								-									
2	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m.							-									
	(a) Hard Soil	Cum	75.60	42.00	3,175.20	144.88	42.00	6,084.96				89.68	60.90	5,461.27		APSR'2007	
	(b) Ordinary Rock	Cum	89.60	160.10	14,344.96	315.19	160.10	50,461.92				224.19	221.10	49,568.41		APSR'2007	
	(c) Hard Rock requiring blasting	Cum	120.60	266.80	32,176.08	224.51	266.80	59,899.27				134.51	355.90	47,873.53		APSR'2007	
								-									
3	Providing and laying cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	38.6	2186.80	84,410.48	64.54	2186.80	141,136.07				37.94	3156.90	119785.41		APSR'2007	
								-									
4	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-							-									
	(a) 1 :11/2:3	Cum	36.80	3161.10	116,328.48	37.09	3161.10	117,245.20				55.09	4024.40	221,712.24		APSR'2007	
5	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :							-									
	a) 1 : 1.5 : 3 (1 cement : 1.5 corase sand : 3 stone aggregate 20 mm nominal size)	Cum	62.80	3790.00	238,012.00	46.82	3790.00	177,447.80				137.03	4390.80	601,675.71		APSR'2007	
								-									
6	Centring and shuttering including strutting propping etc. and removal of form work for,							-									
	(a) Foundation, footings	Sqm	118.00	78.30	9,239.40	17.28	78.30	1,353.02				29.28	113.90	3,334.99		APSR'2007	
	(b) Walls etc.	Sqm	350.00	113.80	39,830.00	580.24	113.80	66,031.31				852.24	166.50	141,897.96		APSR'2007	
								-									
7	Reinforcement for RCC work including bending binding and placing in position complete.							-									
	(a) Cold twisted bars.	Kg.	9875.60	23.30	230,101.48	9230.43	23.30	215,069.02				21133.53	42.90	906,628.44		APSR'2007	
								-									
8	Stone filling behind the wall with hard stone as per the direction of the Engineer-in-charge.	Cum	40.00	585.70	23,428.00	123.39	585.70	72,269.52				155.39	757.00	117,630.23		APSR'2007	
9	Dry stone pitching 22.50 cm thick i/c supplying of stone and preparing surface complete.	Sqm	28.8	172.30	4,962.24	0	172.30	-									
10	Steel work in single section including cutting, hoisting, fixing in position and applying a priming coat of red lead paint							-									
	a) In Flats up to 10 mm in thickness	Qntl	1.3	1674.75	2,177.18	2.5	1674.75	4,186.88									
								-									
11	Providing and fixing MS hand railing of 0.75 m height 20 mm	Kg	35	68.10	2,383.50	50	68.10	3,405.00									

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Already Executed			Scope as per Re-revised DPR To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
12	Extra for providing and mixing water proffing materials in cement concrete workds in proportion as recommended by manufacturers.	Per bag of 50 kg bag cement used in the mix	1000.00	179.50	179,500.00	500.00	179.50	89,750.00									
13	Random rubble masonry with hard stone in foundations and plinth in cement mortar 1 : 6 (1 cement : 6 fine sand) including levelling up with cement concrete 1 : 6 : 12 (1 cement : 6 coarse sand : 12 stone aggregate 20 mm, nominal size) at plinth level.	cum	0		-	0	2191.00	-									
14	C/o 2.5 mtrs chain link fencing around the forebay tank	m	0		-	34	465.60	15,830.40									
8	C/o CC Drain for flushing out channel																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m																
	a) Hard Soil	Cu.m.										59.63	68.50	4,084.31			APSR'2007
	(b) Ordinary Rock	Cum										107.33	171.30	18,384.77			APSR'2007
	C) Hard Rock requiring blasting	Cu.m.										71.55	361.60	25,872.48			APSR'2007
ii)	Providing and laying in foundations and plinth cement concrete 1 : 5 : 10 (1 cement : 5 coarse sand : 10 graded stone shingle 40 mm nominal size) excluding the cost of centring and shuttering.	Cu.m.										4.50	2024.20	9,108.90			APSR'2007
iii)	Centring and shuttering including strutting proping etc. and removal of form work for:	Sqm															
	i) Walls including attached buttresses, pilasters etc.											135.00	166.50	22,477.50			APSR'2007
iv)	Providing and laying cement concrete 1 : 2 : 4 (1 cement : coarse sand : 4 gradedstoneshingle40mmnominalsize)excludingthecostofcentring and shuttering in walls	Cum										13.50	3415.20	46,105.20			APSR'2007
				C	1,030,303.30		A	960,047.71						2,548,045.42			
								192,730.26									
							Add 60% CI	115,638.16									
								308,368.42									
15	Providing and fixing Flushing Pipe 300 mm dia	m			-	1.00	60000.00	60000.00									
16	Manufacturing and supplying of Bell mouth 600 mm dia including fixing of trash rack for bell mouth compiete	No	1.00	124000.00	124,000.00	1.00	80000.00	80000			Add 60% CI over APSR 2007			1,528,827.25			
17	Providing and fixing Sluice 300 mm dia	No	0.00	0.00	-	1.00	90000.00	90000						4,076,872.68			
								538368.42									
	Add enhancement 45% over C				463,636.48						Add 3% Contingencies			122,306.18			
	Add enhancement 75% over APSR '2000on (A)							720,035.78									
				D	Total:-	1,617,939.78	B	Total:-	2,218,451.91									
	Add 3% contigencies on (D)				48,538.19			66,553.56									
					G/Total :-	1,666,477.98		G/Total :-	2,285,005.47					4,199,178.86			
					Say Rs.	16.66		Say Rs.	22.85					Say Rs.	41.99	64.84	41.99
					In lakh			In lakh									

Executive Engineer (Civil)
Koloriang Division
Deptt. of Hydro Power Dev.
Koloriang

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	VII. (S.H.:- Penstock Pipe)																
1.	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cu.m.										152.84	68.50	10,469.54			APSR'2007
	(b) Ordinary Rock	Cum										458.52	171.30	78,544.48			
	C) Hard Rock requiring blasting	Cu.m.										917.04	361.60	331,601.66			
2	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m. (For Trenching of penstock pipe line- chainage-310 to 390 m)																
	(a) Hard Soil	Cum										152.84	60.90	9307.96			APSR'2007
	(b) Ordinary Rock	Cum										458.52	221.10	101378.77			
	(c) Hard Rock requiring blasting	Cum										917.04	355.50	326007.72			
3	Earth work inexcavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m																
	(a) Hard Soil	Cum	46.41	42.00	1949.22	77.63	42.00	3260.46									
	(b) Ordinary Rock	Cum	123.50	160.10	19772.35	232.88	160.10	37284.09									
	(c) Hard Rock requiring blasting	Cum	123.50	266.80	32949.80	388.13	266.80	103553.08									
4	Providing and laying cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum	70.20	2186.80	153513.36	37.22	2186.80	81392.70									
5	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in :-																
	(a) 1 :1 1/2:3	Cum	320.50	3161.10	1013132.55	73.13	3161.10	231171.24									
6	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :																
	a) 1 : 1 5 : 3 (1 cement : 1 5 corase sand : 3 stone aggregate 20 mm nominal size)	Cum	42.60	3790.00	161454.00	382.50	3790.00	1449675.00									
7	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings	Sqm	96.00	78.30	7516.80	171.00	78.30	13389.30									
	(b) Walls etc.	Sqm	680.00	113.80	77384.00	1425.00	113.80	162165.00									
8	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars.	Kg	9875.60	23.30	230101.48	36450.00	23.30	849285.00									

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
				C	1697773.56		C	2931175.87									
9	Manufacturing and supplying of SAIL make spirally welded steel pipe/ERW pipe of 900outer dia 10mm thick as per specified in the relevant I.S codes 3529	kg	42673.68	36.85	1572525.11												
10	Fabrication and supplying i/c erection,laying of SAIL make spirally welded steel pipe?ERW pipe of 612outer dia 10mm thick bend by gas cutting, grinding and welding etc as per the drawing for horizontal and vertical bend single layer wall thickness to withstand a static hydraulic pressure of 10 kg.cm² and of T1 steel make having tensile strength of 7500 kg/cm² i/c transportatioq and delivery at project site of suitable length to match with penstock pipe.	No	30.00	15000.00	450000.00	30.00	15000.00	450000.00									
11	Cutting, joining and welding of penstock pipe including lpading and unloading etc. complete	Inch	9850.00	301.00	2964850.00	15000.00	301.00	4515000.00				20348.46	301.00	6124886.46			
12	C/o Culvert- 2 nos.																
i)	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cu.m.										186.17	68.50	12,752.30			APSR'2007
	b) Ordinary Rock	Cu.m.										345.74	171.30	59,224.41			APSR'2007
ii)	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.											42.45	3156.90	134004.09			APSR'2007
iii)	Reinforced cement concrete in walls (any thickness) including attached pillasters, buttresses, plinth and string course, fillets etc from top of foundation up to floor two level including finishing and plastering the exposed surfaces with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface excluding cost of centring, shuttering and reinforcement in :	Cu.m															
	a) 1 : 1.5 : 3 (1 cement : 1.5 corase sand : 3 stone aggregate 20 mm nominal size)											96.00	4390.80	421516.80			APSR'2007
iv)	Reinforced cement concrete in suspended floors, roofs, landings and balconies upto floor two level including finishing and plastering the exposed surface with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surface but excluding cost of centring and shuttering and reinforcement with 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size)											25.00	3988.00	99700.00			APSR'2007
v)	Centring and shuttering including strutting, propping etc and removal of form work for :																
	a) Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc											438.40	166.50	72993.60			APSR'2007
	b) Suspended floors, roofs, landings shelves and their supports, balconies and chajjas (3.5 m height).											46.00	265.40	12208.40			APSR'2007
vi)	Reinforcement for RCC work including bending binding and																
	(a) Cold twisted bars.	Kg.										6385.83	42.90	273951.97			APSR'2007

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
vii)	Providing and laying cement concrete 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size) excluding the cost of centring and shuttering in :																
	a) Walls including attached buttresses, pilasters and their caps and bases and string courses etc. up to floor two level.	Cum										14.40	3450.40	49685.76			APSR'2007
viii)	Providing and laying Pitching on slopes laid over prepared filter media including boulder apron laid dry in front of toe of embankment complete as per drawing and Technical specifications Stone filling behind the wall with hard stone as per the direction of the Engineer-in- Charge.	Cum										201.60	757.00	152611.20			APSR'2007
13	Fabrication and supplying of 612 outer dia MS Sluice valve to match with penstock pipei/c thread brass spindle of reqd. lenght as per the sitecondition,MS wheel and flanges of required dia i/c nuts,bolts and gaskets to withstand a static hydraulic pressure of 2 kg/cm² i/c transportation and delivery at project site of suitable length to match with penstock pipe(at F/Bay end).	No	2.00	175000.00	350000.00	2.00	275000.00	550000.00									
14	Fabrication and supplying of 450 outer dia MS Sluice valve to match with penstock pipei/c thread brass spindle of reqd. lenght as per the sitecondition,MS wheel and flanges of required dia i/c nuts,bolts and gaskets to withstand a static hydraulic pressure of 10 kg/cm² i/c transportation and delivery at project site of suitable length to match with penstock pipe(at P/H end).	No	1.00	250000.00	250000.00	2.00	200000.00	400000.00									
15	Fabrication and supplying i/c erection of MS pressure relief valve of suitable size to relieve hydraulic pressure formed in penstock pipe in excess of 10 kg/cm² i/c all necessary fittings and transportation and delivery at project site complete.	No	1.00	600000.00	600000.00	2.00	60000.00	120000.00									
16	Fabrication and supplying of 600 mm(OD) MS expansion joints of double sleeve type i/c packing rings, shifting box and packing glands to withstand a pressure of 10 kg/cm2 and of T 1 steel make having tensile strength of 7500 kg/cm2 i/c transportation and delivery at site copmplete.	No	3.00	50000.00	150000.00	10.00	210000.00	2100000.00									
17	Fabrication and supplying of 150 mm (ID) MS air vent pipe of 6000mm length i/c MS fasteners to fasten to the outer side of the froebay wall i/c transportation and delivery at site	No	1.00	4500.00	4500.00	2.00	8000.00	16000.00									
18	Erection and laying of sluice valve to true alignment with P/pipe i/c fitting of flanges with gaskets and electrical resistance welding of minimum 6mm thick wherever required complete as per direction of Engineer-in-charge. (Total no. 4)	Job	1.00	250000.00	250000.00	1.00	30000.00	30000.00									
19	Erection and laying of expention joint to true aligment with P/pipe i/c. edge preparation and Electrical resistance welding of minimum10mm thick wherever required complete as per direction of Engineer-in-charge. (Total no. 10)	Job	1.00	100000.00	100000.00	10.00	2500.00	25000.00									
20	Erection and laying of belimouth to true aligment i/c. holding down straps edge preparation and Electrical resistance welding of minimum 10mm thick wherever required complete as per direction of Engineer-in-charge. (Total no. 2)	Job	0.00	17500.00	0.00	1.00	30000.00	30000.00									

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
21	Erection of vent pipe i/c. fastening to the outer face of the forebay wall and electrical resistance welding of minimum 10mm thick wherever required complete as per direction of Engineer-in-charge. (Total no. 2)	Job	0.00	10000.00	0.00	1.00	5000.00	5000.00									
					6691875.11			8241000.00					Total	8270845.11			
	Add enhancement 45% over C				763998.10			2198381.90				Add 60% CI over APRS 2007		4962507.07			
	Add enhancement 75 over APSR '2500 (A)			Total:-	9153646.77		Total:-	13370557.77						13233352.18			
	Add 3% contigencies on (D)				274609.40			401116.73				Add 3% contingencies		397000.5654			
				G/Total:-	9428256.17		G/Total:-	13771674.51				G/Total		13630352.75			
				Say Rs. In Lakh	94.28		Say Rs. In Lakh	137.72					Say Rs.	136.30	274.02	136.30	

Executive Engineer (Civil)
Koloriang Civil Div
Deptt. of Hydro Powe.
Koloriang

Sl.no	Sub-head/Item of works	unit	Qnty.	Rate	Amount	Already Executed			Already Executed			To be Executed			Total	Difference	Remarks
						Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
1	Earth work in excavation in foundation trenches not exceeding 1.5m in width or 10 sqm on plan or drains not exceeding 1.5m in width or 10 sqm on plan including dressing of sides and ramming of bottoms, lift upto 1.5m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50m.																
	a) Hard Soil	cum	36.03	42.00	1513.26	36.03	42.00	1513.26									
	b) Ordinary Rock	cum	72.06	160.10	11536.81	72.06	160.10	11536.81									
	c) Hard Rock requiring blasting	cum	72.06	266.80	19225.61	72.06	266.80	19225.61									
2	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	cum	48.77	2186.80	106639.30	48.77	2186.80	106650.24									
3	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1 :2:4 (1 cement:2 coarse sand: 4 stone aggregate 20 mm nominal size)	cum	97.53	3161.10	308295.76	97.53	3161.10	308302.08									
4	Reinforced cement concrete work in lintels, beams and bresumers up to floor two level including finishing and plastering the exposed surface with cement mortar 1 : 3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give a smooth and even surfac																
	(a) 1 :2:4 (1 cement:2 coarse sand: 4 stone aggregate 20 mm nominal size)	cum	7.97	3530.00	28116.45	7.97	3530.00	28134.10									
5	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundaion & footiings, bases of columns etc., and mass concrete	sqm	367.90	78.30	28806.57	397.90	78.30	31155.57									
	b) Column, Pillars, posts and struts etc.	sqm	145.20	113.80	16523.76	145.20	113.80	16523.76									
	c) Lintles, beams, girders, bressumers and cantilevers etc.	sqm	151.20	109.10	16495.92	151.20	109.10	16495.92									
6	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a) Cold twisted bars.	kg	6301.20	23.30	146818.05	6301.20	23.30	146817.96									
	(b) Mild Steel and Medium Stell bars :	kg	533.98	21.90	11694.25	533.98	21.90	11694.16									
7	Random rubble masonry with hard stone in foundations and plinth in cement mortar 1 : 6 (1 cement : 6 fine sand) including levelling up with cement concrete 1 : 6 : 12 (1 cement : 6 coarse sand : 12 stone aggregate 20 mm nominal size) at plinth level.	cum	16.20	2191.00	35494.20	16.20	2191.00	35494.20									
8	Half brick masonary(with best available local bricks) in cement mortar 1:4(1 cement:4 coarse sand) in foundation and plinth)	sqm	777.80	285.00	221673.00	777.80	285.00	221673.00									
9	Extra for Half brick masonary in superstructure above plinth level and upto floor two level.	sqm	777.80	10.10	7855.78	777.80	10.10	7855.78									
10	Cement concrete flooring 1:2:4 (1 cement:2 coarse sand: 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement)																
	a) 40 mm thick	cum	187.00	165.20	30892.40	187.00	165.20	30892.40									

Sl.no	Sub-head/Item of works	Scope as per sanctioned Original DPR				Scope as per Sanctioned Revised DPR			Scope as per Re-Revised DPR								
						Already Executed			Already Executed			To be Executed			Total	Difference	Remarks
		unit	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
11	Providing corrugated G.I.sheet roofing fixed with galvanished iron J or L hooks, bolts & nuts 8 mm dia with bitumen and G.I.limpet washers or with G.I.limpet washers filled with white lead complete; excluding the cost of purlins, rafters and trusses.																
	a) 0.63 mm thick GI Sheet	sqm	549.40	356.60	195916.04	549.40	356.60	195916.04									
13	Providing ridges or hips 60 cm overall in plain G.I.sheet fixed with galvanished iron J or L hooks, bolts and nuts 8 mm dia.,G.limpet and bitumen washers complete.																
	a) 0.63 mm thick GI Sheet	sqm	13.80	214.50	2960.10	13.80	214.50	2960.10									
12	Providing and fixing 4.0 mm thick asbestors plain sheet ceiling of approved quality with necessary nails etc., complete; excluding the cost of purlins, rafters and trusses.	sqm	200.00	208.80	41760.00	200.00	208.80	41760.00									
14	Providing and fixing plain, square edged wooden beading 38 mm x 12 mm section with screws of approved quality for ceiling.																
	a) Best local approved quality wood	Per 10 Dm3	400.00	19.90	7960.00	400.00	19.90	7960.00									
15	Providing approved best available local wood (class-B II) work in frames of doors, windows clerestory windows and other frames, wrought framed and fixed in position	Per 10 Dm3	7.22	85.20	615.09	7.22	85.20	615.14									
16	Providing best available local wood (class-BII) work in frames of false ceiling, partitions and trusses etc., sawn and put up in position	Per 10 Dm3	468.58	78.20	36642.93	468.58	78.20	36642.96									
17	Providing and fixing panelled, glazed or panelled and glazed shutters for doors, windows and clerestory windows including aluminium butt hinges with necessary screws																
	a) 38 mm thick best available local wood class-BI	Per 10 Dm3	21.90	775.40	16981.26	21.90	775.40	16981.26									
18	Providing and fixing 2.50 cm thick approved local wood eaves boards 23 cm wide with necessary mouldings etc.	sqm	86.00	83.00	7138.00	86.00	83.00	7138.00									
19	Providing and fixing MS grills of required pattern in wooden frames of windows etc. with MS flat, square or round bars with round headed bolts and nuts or by screws																
	a) Ornamental grill	kg	40.00	63.20	2528.00	40.00	63.20	2528.00									
20	15 mm cement plaster 1:3 (1 cement:3 fine sands) on the rough side of single or half brick wall.	sqm	286.40	79.80	22854.72	286.40	79.80	22854.72									
21	12 mm cement plaster 1:3 (1 cement:3 fine sands)	sqm	148.80	67.40	10029.12	148.90	67.40	10035.86									
22	White washing with whiting on new work (three or more coats) to give even shade.	sqm	576.00	7.40	4262.40	576.00	7.40	4262.40									
23	Applying priming coat with ready mixed pink primer of approved brand and manufacture on wood work complete.	sqm	241.91	15.30	3701.22	241.91	15.30	3701.22									
24	Construction of cement concrete drain 30 cm wide and 23 cm deep in cement concrete 1:3:6 (1 cement:3 sand: 6 hard graded stone chips/shingle 40 mm and down gauge) 8 cm thick on sides and bottom and plastering on all exposed surface with 12 mm thick cement mortar 1:3 (1 cement:3 fine sand) including shuttering complete.	mtr	80.00	230.90	18472.00	68.00	230.90	15701.20									
25	C/o Page wire fencing with MS Angle post alround the P/House	mtr	105.00	2300.00	241500.00	140.00	4000.00	560000.00									
26	Extra for supplying and fixing steel gate	Nos.	0.00	0.00	0.00	1	100000	100000									
25	C/o Compound wall around the Power House, Switchyard and Staffs Quarter																
i	Earthwork in excavation over areas (exceeding 30 cm in depth, 1.50 m in width as well as 10 Sq.m. on plan) including disposal of surplus excavated earth lead upto 50 m and lift upto 1.50 m, disposed earth to be levelled and neatly dressed.																
	a) Hard Soil	Cum										24.30	68.30	1659.69			APSR2007
	b) Ordinary Rock(With or without blasting)	Cum										72.90	171.30	12487.77			APSR2007
	c) Hard rock requiring Chiselling(where blasting is required)	Cum										145.80	361.60	52721.28			APSR2007

Sl.no	Sub-head/Item of works	Scope as per sanctioned Original DPR				Scope as per Sacntioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
						Already Executed			Already Executed			To be Executed					
		unit	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
ii	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in	Cum										31.20	3156.90	98495.28			APSR2007
iii	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(b)Column and Beam	sqm										275.00	204.50	56237.50			APSR2007
iv	Reinforcement for RCC work including bending binding and placing in position complete.																
	(a)Cold twisted bar	Kg.										3190.00	42.90	136851.00			APSR2007
v	Reinforced cement concrete work in foundations, footings, bases of columns etc. and mass concrete excluding the cost of centring,shuttering and reinforcement in:-																
	(a) 1:2:4	Cum										39.88	3468.3	138298.46			APSR2007
vi	Brick work with best available local bricks 75 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand).	Sqm										287.50	2507.00	720762.50			APSR2007
26	**C/o CC Foot steps from Power House to BRTF Road for easy maintenance of penstock pipe.**																
i	Earth work in rough excavation, banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller or wooden or steel rammers and rolling every 3rd and top most layer with power roller of minimum 8 tonne and dressing up in embankment forroad, flood banks, marginal banks and guide banks or filling up ground depressions lead upto 50 m and lift upto 1.50 m.																
	a) Hard Soil	Cum										60.00	68.30	4098.00			APSR2007
	b) Ordinary Rock	Cum										180.00	171.30	30834.00			APSR2007
	c) Hard rock	Cum										360.00	361.60	130176.00			APSR2007
ii	Providing and laying cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 40 mm nominal size) excluding the cost of centring and shuttering in foundation and plinth.	Cum										252.00	3156.90	795538.80			
iii	Centring and shuttering including strutting propping etc. and removal of form work for,																
	(a) Foundation, footings	sqm										840.00	113.50	95340.00			APSR2007
				C	1604902.00		A	2023021.75						2273500.28			
	Add 45% enchanement over C				722205.90												
				Total:-	2327107.91												
	Add 75% enchanement over A							1517266.311						1364100.17			
							Total	3540288.06					Total	3637600.45			
	Add 3% Contingencies				69813.24			106208.6418						109128.01			
				G/Total:-	2396921.14		G/Total:-	3915285.00					G/Total:-	3746728.47			
				Say Rs. In Lakh	23.97		Say Rs. In Lakh	39.15					Say Rs. In Lakh	37.47	76.62	37.47	

Executive Engineer (Civil)
Division
Dev.

NAME OF WORK :- C/o Payu MHS at Kolorlang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	IX (S.H.:-Approach road to P/House)																
Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned DPR			Scope as per sanctioned Revised DPR Already Executed			Scope as per Re-Revised DPR Already Executed			To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
1	Earthwork in excavation over areas(exceeding 30 cm depth,1.50 m in wide as well as 10 sqm on plan) including disposal of surplus excavated earth lead upto 50 m																
	a) Hard Soil	Cum	6160	39.80	245168.00	11880	39.80	472824.00									
	b) Ordinary Rock (with or Without blasting)	Cum	7700	146.50	1128050.00	14850	146.50	2175525.00									
	c) Hard Rock requiring blasting	Cum	1540	215.70	332178.00	2970	215.70	640629.00									
	Deduct for quantum of earthwork of all types disposal directly by throwing into valley without involving any lead and lift																
	a) Ordinary and Hard Soil	Cum	3080	17.80	54824.00	13365	17.80	237897.00									
	b) Soft Rock and hard Rock	Cum	4620	28.80	133056.00	8910	28.80	256608.00									
2	Removing of mixed earth & rocks clearing the site	Cum	10800	62.60	676080.00	22275	62.60	1394415.00									
3	Laying wearing course with stone aggregate including screening, sorting, spreading to template and consolidation with road roller 8-10 tonne, including spreading and consolidation of binding materials. (Payment to be made for quantity of stone aggregate u	Cu.m.	2250	132.40	297900.00	1348.65	132.40	178561.26									
4	C/O R/ wall of average heigt 5m with RRM in CM 1:6	m	72	18313.41	1318565.52	70	18313.41	1281938.70				60	18313.41	1098804.60			
5	C/O R/ wall of average heigt 4m with RRM in CM 1:6	m	80	13180.73	1054458.40	55	13180.73	724940.15				45	13180.73	593132.85			
6	C/O boulder created wall with boulders of size 150 to 300	No.	50	7277.00	363850.00	40	7277.00	291080.00									
7	C/O Culverts of 2m span	No.	10	595000.00	5950000.00	10	350000.00	3500000.00									
8	C/O of CC side drain	m	0	0.00	0.00	1300	100.00	130000.00									
				(c)	11554129.92		(A)	11284418.11						1691937.45			
	Add enhancement 45% over C				5199358.46												
	Add enhancement 75% per annum over APSR '2000 (A)																
				Total :-	16753488.38		Total :-	11284418.11									
	Add 3% contigencies on (B)				502604.65			338532.54						1268953.09			
				G/Total :-	17256093.04		G/Total :-	11622950.65						2960890.54			
				Say Rs. In Lakh	172.56		Say Rs. In Lakh	116.23					Say Rs.	29.61	145.84	29.61	

Executive Engineer (Civil)
Kolorlang Civil Division
Deptt. of H.P. Power Dev.
Kolorlang

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

SCHEDULE OF QUANTITIES

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	X (S.H.:-Cartage of Construction materials																
Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned DPR			Scope as per sanctioned Revised DPR Already Executed			Scope as per Re-Revised DPR Already Executed			To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
1)	Cartage of construction materials such as Cement,steel sluice valve,sluice gate etc.	-						-						-			
	1) From Banderdewa to Koloriang (320 km)	MT/km				1458.51	11.50	5283452.475									
2	Cartage of construction materials M.S Penstock pipe																
	1) From Banderdewa to Choba (257 km)	Km/mtr				750.00	6.15	4612.5									
3	Cartage of construction materials sand, aggregates by head load to work site																
	1) From quarry site (lead= 1 km)	kg/km															
							Total Rs =	5288064.975									
							Say Rs In Lakh	52.88									

Executive Engineer (Civil)
Koloriang
Deptt. of Hydro
Koloriang

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
									Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	XI. Residential Building																
Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned DPR			Scope as per sanctioned Revised DPR Already Executed			Scope as per Revised DPR Already Executed			To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
	Types of Building																
1	C/O of Bachelor Barrack (5 unit)	Nos	0	346478.00	0.00	4	420000.00	1680000.00									
2	SPT-III	Nos	1	1041000.00	1041000.00			0.00									
3	SPT-II	Nos	1	675400.00	675400.00			0.00									
4	SPT-I	Nos	0	0.00	0.00			0.00									
5	STORE	Nos	0	0.00	0.00	1	300000.00	300000.00									
				C	1716400.00			1980000.00									
	Add cost index 45%				772380												
				Total:-	2488780.00		Total:-	1980000.00									
	Add 3% contigencies on (D)				74663.4			59400.00									
				G/Total	2563443.40		G/Total	2039400.00									
				Say RS	25.63		Say RS	20.39									
				In Lakh			In Lakh										

Executive Engineer
Koloriang Civil D
Dept. of Hydro P
Itng

NAME OF WORK :- C/o Payu MHS at Koloriang (2 X 500 KW)

Sl.no	Sub-head/Item of works	unit	Scope as per sanctioned Original DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR						Total	Difference	Remarks
						To be Executed			Already Executed			To be Executed					
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
XII	Special T&P																
			Scope as per sanctioned DPR			Scope as per sanctioned Revised DPR			Scope as per Re-Revised DPR								
Sl.no	Sub-head/Item of works	unit				To be Executed			Already Executed			To be Executed			Total	Difference	Remarks
			Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount	Qnty.	Rate	Amount			
1	Truck TATA (4X4)	Nos.	1	1300000.00	1300000												
2	Tractor	Nos.	1	400000.00	400000												
3	Light Vehicle	Nos.	1	450000.00	450000							2	750000	1500000			
4	Generator	Nos.	1	120000.00	120000												
5	Welding machine	Nos.	1	100000.00	100000												
6	Concrete mix machine	Nos.	1	150000.00	150000									1500000			
				Total:-	2520000												
				Say Rs. In Lakh	25.20								Say Rs. In Lakh	15.00	40.20	15.00	

Executive Engineer (Civil)
Koloriang Civil Division
Deptt. of Hydro Power Dev.
Koloriang

SCHEDULE OF RATES - ORIGINAL ESTIMATE
(C.P.W.D Code, Para 230-232)
DETAILED REVISED ESTIMATE

State : Arunachal Pradesh.
Branch: E & M

Division : Ziro EM Dividsi
Sub-Division : EM Sub-Division, Palin

Name of Works: - C/o Payu MHS (2x500KW) at Koloriang
(SH:Electro-Mechanical works)

Sl. No.	Description of Works	As per Original DPR /Estimate				As per revised DPR / Estimate			Difference		Remark
		Unit	Qty	Rate	Amount	Qty	Rate	Amount	Qty (Col. 7-4)	Amount [Col. (9-6)]	
1	2	3	4	5	6	7	8	9	10	11	12
1	Turbine complete (Specification at section-I) for crossflow/turbo Impulse including the following.	Set	2	8255800.00	16511600.00	2	11351725.00	22703450.00	0	6191850	The project was sanctioned in the year 2010-11 and was abandoned by the turnkey contractor M/s Biecco Lawrie Limited, Kolkata. Now, the project is to be commissioned through 3rd party. Hence, revised estimate is framed by adding cost index @ 7.50% per annum for 5 years.
a	Governor with oil pressure system	Set	2	5818600.00	11637200.00	2	8000575.00	16001150.00	0	4363950	
b	Butterfly Valve 625KVA	Set	2	899400.00	1798800.00	2	1236675.00	2473350.00	0	674550	
c	Synchronisation/Induction type Generator ~~315~~KVA	Set	2	3599400.00	7198800.00	2	4949175.00	9898350.00	0	2699550	
d	Generator control pannels with protective Switchgear for 1 No. outgoing system including Synchronizing arrangement.	Set	1	3400000.00	3400000.00	1	4675000.00	4675000.00	0	1275000	
2	Spares for turbines as per specification.	Set	2	935400.00	1870800.00	2	1286175.00	2572350.00	0	701550	
3	Spares for Generator as per specification.	Set	2	58200.00	116400.00	2	80025.00	160050.00	0	43650	
4	Installation of turbines Governors, Generators, Butterfly Valves and control pannels with all accessories including necessary commissioning and testing as per specification. 33KV	Job	2	4400000.00	8800000.00	2	6050000.00	12100000.00	0	3300000	
5	2X630 KVA, 0.415/~~11KV~~ step up transformer & OCB with standard Switchyard.	Job	1	1800000.00	1800000.00	1	2475000.00	2475000.00	0	675000	
6	L.T. Line 3 phase 5 wire	Km	2.5	465000.00	1162500.00	2.5	639375.00	1598437.50	0	435937.5	
7	U.G. Cable	Lot	1	100000.00	100000.00	1	137500.00	137500.00	0	37500	
8	300AH, 48/110Volt Station battery and charger complete with DC distribution board.	Set				1	455000.00	455000.00	1	455000	
10	250 KVA, 33/0.415 KV Station transformer	No				1	1456000.00	1456000.00	1	1456000	
11	EOT crane 15T capacity complete with rails, running wires etc	No				1	3640000.00	3640000.00	1	3640000	
13	Earthlings of equipment and network including lighting protection	Mtrs				1	691600.00	691600.00	1	691600	

DIVERSION WEIR

1 Earth work in excavation in foundation trenches

	Weir	22.00	X	2.10	X	1.20	=	55.44 cum
	Cutoff wall	20.00	X	0.70	X	1.50	x 2=	42.00 cum
	wing wall	20.00	X	1.70	X	0.50	=	17.00 cum
								114.44
(a)	Ordinary	0%					=	0.00 cum
(b)	Hard soil	0%					=	0.00 cum

Sl. No.	Description of Works	As per Original DPR /Estimate				As per revised DPR / Estimate			Difference		Remark
		Unit	Qty	Rate	Amount	Qty	Rate	Amount	Qty (Col. 7-4)	Amount [Col. (9-6)]	
1	2	3	4	5	6	7	8	9	10	11	12
14	50 KW disel generating set i/c control panel.	No				1	1092000.00	1092000.00	1	1092000	
16	33 KV circuit breakers.	No				3	728000.00	2184000.00	3	2184000	
17	33KV lighting Arrestors.	No				9	65520.00	589680.00	9	589680	
18	33 kv bus isolator.	No				3	273000.00	819000.00	3	819000	
19	33 kv line isolator.	No				2 ~~1~~	364000.00	364000.00	1	364000	
20	33 kv potential transformer.	No				9 ~~6~~	100100.00	600600.00	6	600600	
21	33 kv current transformers.	No				9	109200.00	982800.00	9	982800	
22	GI structures, insulators, conductors and hardware etc.	No				1	2730000.00	2730000.00	1	2730000	
23	Pale fencing with gate.	RM				84	4331.60	363854.40	84	363854.4	
24	Earthlings and shielding system for complete switchyard.	Lot				1	364000.00	364000.00	1	364000	
25	Control/Relay panels for 33kv transformer and feeder.	Set				1	910000.00	910000.00	1	910000	
	Total				**54396100.00**			**92037171.90**		**37641071.90**	
				Add 3 % Contigencies	1631883.00			2761115.16		1129232.16	
					56027983.00			**94798287.06**		**38770304.06**	
				Add 1 % Labour Cess	0.00			947982.87		947982.87	
				Add 1 % Educational Cess	0.00			947982.87		947982.87	
				Add 1 % Quality Control	0.00			947982.87		947982.87	
	Grand Total				**56027983.00**			**97642235.67**		**41614252.67**	

Note: Original estimate was framed based on rate as per Agreement No. HCD/DOP(C)/02 of 2003-04

Executive Engineer (EM)
Ziro EM Division
Deptt. of Hydro Power Development,
Ziro

Superintending Engineer (EM)
Western E-M Circle
Deptt. of Hydro power Development
Itanagar

Chief Engineer (EM / Generation)
Deptt. of Hydro Power Development
Itanagar

DIVERSION WEIR

1 Earth work in excavation in foundation trenches

Weir	22.00	X	2.10	X	1.20	=	55.44	cum
Cutoff wall	20.00	X	0.70	X	1.50	x 2=	42.00	cum
wing wall	20.00	X	1.70	X	0.50	=	17.00	cum
							114.44	
(a)	Ordinary	0%				=	0.00	cum
(b)	Hard soil	0%				=	0.00	cum
(c)	Soft rock	50%				=	57.22	cum
(d)	Hard rocl	50%				=	57.22	cum

2 Providing & laying C.C 1:3:6

Weir	22.00	X	2	X	0.20	=	8.80	cum
Cutoff wall	20.00	X	1.00	X	0.20	x 4 =	16.00	cum
Abutment	20.00	X	1.70	X	0.20	=	6.80	cum
							31.60	

3 Providing & laying of C.C. 1:2:4

weir	0.00	X	0.00	X	0.00	=	**0.00**	cum
C/wall	0.00	X	0.00	X	0.00	x 4=	**0.00**	cum
C.C blocks	0.00	X	0.00	X	0.00	x 2=	**0.00**	cum
							0.00	cum

4 R.C.C in 1:11/2:3 in walls

Weir	0.00	X	0.00	X	0.00		0.00	cum
Cutoff wall	20.00	X	2.00	X	0.30		12.00	cum
Cutoff wall	20.00	X	3.00	X	0.30		18.00	cum
							30.00	cum

5 R.C.C in 1:11/2:3 in mass concrete

Weir	22.00	X	1.80	X	0.30	=	11.88	cum
Cutoff wall	25.00	X	1.00	X	0.20	x 2 =	10.00	cum
							21.88	cum

6 Centering & shuttering in

(a) Wall any thickness

Weir	22.00	X	0.70	x	4	=	61.60	sqm.
Cutoff wall	20.00	X	3.00	x	4	=	240.00	sqm.
							301.60	

(b) Foundation & footing

Weir	22.00	X	1.80	x	2		79.20	sqm.
Cutoff wall	20.00	X	1.00	x	4		80.00	sqm.
							159.20	sqm.

7 Reinforcement for R.C.C work

(a) Cold twisted bars

110 kg/cum of R.C.C work = **5706.8** kg

8 Providing & suplying of trash rack as per design

50 kg/sqm of length of weir = 1.16 X 22 X 2 = **6.38** qt

10 Laying concrete under wate 11 x 30 x 1 = **330.00** cum

11 Diversion of river = **1** job

12 Stone pitching

2 x 2.00 X 20.00 X 2.00 = **80.00** cum

13 P & L RRM 1:6:12 (R/wall or Wing wall for protection of Weir, F/ channel)

20.00 X 1.50 X 2.00 x 2 = **60.00** cum

14 Supplying and stacking stone agg.

Soling of Aprons

2.00 X 2.00 X 2.50 x 24.60 **246.00** cum

15 Labour charges for laying boulder....

2.00 X 2.00 X 2.50 x 24.60 **246.00** cum

16 Extra for water proofing and quick setting cement

= L.S

INTAKE CHAMBER

1	Earth work in excavation foundation...							
	3.30	X	3.30	X	1.00	=	10.89	cum
	(a) Hard soil	10%				=	**1.089**	cum
	(b) Soft Rock	40%				=	**4.356**	cum
	(c) Hard rock	50%				=	**5.445**	cum
2	Providing & laying C.C 1:3:6							
	3.30	X	3.30	X	0.10	=	**1.09**	cum
3	R.C.C in 1:1.5:3 in foundation,footings etc							
	3.30	X	3.3	X	0.15	=	1.63	cum
4	Cement concrete in or under water..							
	3.30	3.30	X	0.40	X	0.80	=	**3.48**	cum
5	R.C.C in 1:1.5:3 in walls							
	2 x	3.30	X	2.5	X	0.15	=	2.48	cum
	2 x	3.30	X	2.5	X	0.15	=	2.48	cum
	Less for opening of	1.2		2.5	x	0.15	= (-)	0.45	cum
	Less for opening of feeder cha	1.2		2.5		0.15	= (-)	0.45	cum
								4.05	cum
6	R.C.C in 1:2:4 in suspended floor							
	3.30	X	3.30	X	0.15	=	**1.63**	cum
7	Reinforcement for R.C.C work							
	(a) Cold twisted bars							
	110 kg/cum of R.C.C work							**804.87**	kg
8	Centering & shuttering in							
	(a) Wall any thickness							
	4	X	3.30	X	2.50	=	33.00	sqm
	4	X	3.30	X	2.50	=	33.00	sqm
							66.00	
	(b) Foundation & footing							
	2	X	3.30	X	0.30	=	**1.98**	sqm
	(c) Suspended floor							
	2	X	3.30	X	0.15	=	**0.99**	sqm
	1	X	3.30	X	3.60	=	**11.88**	sqm
							12.87	sqm
9	Providing & supplying of sluice gate						1	Nos
11	Providing & supplying of flush pipe 300 mm dia					=	**100**	m
12	Providing & supplying of sluice valve					=	1	Nos

FEEDER CHANNEL

1 Earth work for formation cutting Back Cutting
Chainage- 0

A1 = $\frac{2.5+2.10}{2}$ x 8 + .50 x2.00 x 2.10 = 20.50 Sqm

A2 = $\frac{3+2.8}{2}$ x 9 + $\frac{2.8+2}{2.00}$ x 3 + 0.50 x 1.5x2 = 34.80 Sqm

Average= $\frac{20.50 + 34.80}{2}$ x 300 = 8295.00 Cum

Hard soil	25%	=	2073.75 cum
Ordinary rock	45%	=	3732.75 cum
Hard rock	30%	=	2488.50 cum

2 Earth work in excavation in foundation trenches

300.00 X 1.50 X 0.85 = 382.50 cum

(b) Hard soil	20%	=	76.50 cum
(c) Soft rock	40%	=	153.00 cum
(d) Hard rock	40%	=	153.00 cum

3 Providing & laying C.C 1:3:6

300.00 X 1.5 X 0.10 = 45.00 cum

4 R.C.C in 1:1.5:3 in foundation and footings..

300.00 X 1.50 X 0.15 = 67.50 cum

5 R.C.C in 1:11/2:3 in walls

300.00 X 0.85 X 0.15 x 2 = 76.50 cum

6 R.C.C in 1:11/2:3 in suspended floor

300.00 X 1.50 X 0.15 = 67.50 cum

7 Centering & shuttering in

(a) Wall any thickness

300.00 X 0.85 X 2.00 nos = 510.00 sqm

(b) Foundation & footing

300.00 X 0.15 X 2.00 nos = 90.00 sqm

(c) Suspended floor

300.00 X 1.50 X 1.00 nos = 450.00 sqm

300.00 X 0.15 X 2.00 nos = 90.00 sqm

540.00 sqm

8 Reinforcement for R.C.C work

(a) Cold twisted bars

80 kg/cum of R.C.C work = 16920.00 kg

9 Expansion joints @ 30m c/c

300 / 50.00 = 6.00 Nos.

17.40 Mtr.

10 C/o Retaining Wall

i) Earth work in excavation over areas

0.5 x2.5x $\frac{2.10+1.(}{2}$ x 60 = **86.25** cum

Hard soil	25%	=	21.56 cum
Ordinary rock	45%	=	38.81 cum
Hard rock	30%	=	25.88 cum

ii) PCC 1:5:10

2 x 0.10 x60 = **12.00** cum

iii) RR 1:6

$\frac{2 + 0.30}{2}$ x 2.10 x 60 = **144.90** Cum

DESILTING TANK

1 Earth work for formation cutting

	18.00		12.00	7.50	=	1620.00	cum
(a)	Hard soil		30%		=	**486.00**	cum
(b)	Ordinary rock		40%		=	**648.00**	cum
(c)	Hard rock		30%		=	**486.00**	cum

2 Earth work for foundation and trenching

18.00	X	6.00	3.00	=	324.00	cum
Hard soil	20%			=	64.80	cum
Ordinary rock	40%			=	129.60	cum
Hard rock	40%			=	129.60	cum

3 Providing & laying C.C 1:3:6

3.00	3.6	0.10	=	1.08	cum
2.00	3.6	0.10	=	1.08	cum
10.00	6.30	0.10	=	6.30	cum
				8.46	cum

4 R.C.C in 1:2:4 in mass concrete

10.00	6.3	0.15	=	9.45	cum
2.00	3.6	0.15	=	1.08	cum
3.00	3.6	0.15	=	1.62	cum
				8.46	cum

5 R.C.C in 1:2:4 in walls

main wall	2	3.00	0.15	1.80	=	1.62	cum
	2	10.00	0.15	3.30	=	9.90	cum
	2	2.00	0.15	1.80	=	1.08	cum
						12.60	cum

6 Centering & shuttering in

(a) Wall any thickness

M/Wall	2	2	3.00	1.80	=	21.60	sqm
	2	2	10.00	3.00	=	120.00	sqm
	2	2	2.00	1.80	=	14.40	sqm
						156.00	sqm

7 Reinforcement for R.C.C work

(a) Cold twisted bars

80 kg/cum of R.C.C work = **1684.8** Kg

8 C/o CC Drain for flushing out channel **80.00** Mtr

Earth work for formation cutting

Chainage- 0

A1 = $\frac{2+2.5}{2}$ x 2 + .50 x1.6 x 1x80 = 640.00 Cum

Hard soil	25%	=	160.00	cum
Ordinary rock	45%	=	288.00	cum
Hard rock	30%	=	192.00	cum

PCC 1:5:10

1 x 80 x 1 x 0.10 = 8.00 Cum

Centering & shuttering(walls)

2x2 x 0.75x 80 = **240.00** Sqm

Providing & laying cement concrete 1:2:4

2x0.60 x 0.15x 80	=	**14.40**	Cum
1x0.80 x 0.15x 80	=	**9.60**	Cum
		24.00	Cum

8 Silt flushing pipe 300 mm dia

1 = **50.00** m

9 Providing fixing sluice valve 300 mm dia 1 Nos.

POWER CHANNEL

Jungle clearence

0.00 X 0.00 = 0 sqm.

Earth workin excacation over areas for back cutting

Chainage- 0

A1 = Ch.100 = $\frac{2.6+2.70}{2}$ x 2+ 2.7+2 x2.00 + .50 x2 x 1.00 = 11.00 Sqm

A2 = $\frac{2.10+2.5}{2}$ x 5+ $\frac{2.5+2}{2.00}$ x 4 + 0.50 x 2x2 = 22.50 Sqm

Average= $\frac{11.00 + 22.50}{2}$ x 400 = 6700.00 Cum

	Hard soil	25%				=	1675.00 cum
	Ordinary rock	45%				=	3015.00 cum
	Hard rock	30%				=	2010.00 cum
Earth work for formation cutting		1340.00	1.50	0.60			1206.00 cum
	Hard soil	10%					120.60 cum
	Ordinary rock	40%					482.40 cum
	Hard rock	50%					603.00 cum
Earth work in excavation in foundation trenches							
	1340.00	X	1.50	X	0.10	=	201.00 cum
(b)	Hard soil	10%				=	20.10 cum
(c)	Soft rock	40%				=	80.40 cum
(d)	Hard rock	50%				=	100.50 cum
Providing & laying C.C 1:3:6							
	1340.00	X	1.50	X	0.10	=	201 cum
C.C in 1:1.5:3 in foundation and footings...							
	1340.00	X	1.50	X	0.20	=	402.00 cum
C.C in 1:2:4 in walls							
	1340.00	X	0.15	X	0.85	x 2 =	341.70 cum
C.C in 1:2:4 in Suspended floors etc							
	0.00	X	0	X	0.00	=	0.00 cum

Centering & shuttering in

(a)	Wall any thickness						
		1340.00	X	0.85	x	4	**4556** sqm.
(b)	Foundation & footing						
		1340.00	X	0.15	x	2	**402.00** sqm.
c)	Suspended flo	0.00	X	0.00	x	0	0.00 sqm.
		0.00	x	0.00	x	0	0.00 sqm.
							0.00 sqm.

Reinforcement for R.C.C work

(a) Cold twisted bars

80 kg/cum of R.C.C work = **59496.00** kg

Abutment & Aquaduct

Earth work	Cum	1.5	1.5	1.2	30	**81**
P.C.C (1:3:6)	Cum	1.5	1.5	0.3	30	**20.25**
R.C.C						
Shuttering & F	Sqm	1	4	0.7	30	84
		0.7	4	0.7	30	58.8
						142.8
Plastering&C	Sqm	2.2	2	0.5	30	66
		2.2	1	0.5	30	33
		4	4	0.7	30	336
						435

Steel Twisted Bar	Kg				
Abutment	a) 5 mm dia Bar @ 110mm c/c=	44			
	b) 10 mm dia Bar =	7.2			
	c) 12 mm dia Bar =	7.2			
Wing walls	a) 5 mm dia Bar @ 200mm c/c=	70.5			
	b) 12 mm dia Bar =	20			
	c) 20 mm dia Bar =	20			
Foundations	a) 12 mm dia Bar =	24			
Steel Required	a) 5 mm dia Bar =	114.5	0.222	25.419	
	b) 10 mm dia Bar =	7.2	0.627	4.5144	
	c) 12 mm dia Bar =	51.2	0.888	45.4656	
	d) 20 mm dia Bar =	20	2.48	49.6	
				124.999	
	e) Add 10% for wastage			12.4999	
Total Steel required				137.4989	Kg
For 30 nos of Column =				**4124.967**	Kg

Concrete (1:2:4)

Abutment	Cum	2.2	0.5	0.5	30	16.5
Column	Cum	4.2	0.7	0.7	30	61.74
Foundation	Cum	1	1	0.5	30	15
						93.24

b Retaining Wall- 4 Nos.

th work in excavation over areas

0.5 x2.5x $\frac{2.10+1.0}{2}$ x 80 x 4 = **620.00** cum

Hard Soil 25% = **155.00**

C 1:5:10 O/Rock 75% = **465.00**

1:6 2 x 0.10 x80 x4 = **64.00** cum

$\frac{2+0.30}{2}$ x 2.10 x 80 x4 = **772.80** Cum

4 nos .Culvert

th work

utment	Cum	9.5	4.5	4.2		179.55 x 4 =	718.20		
ing Wall	Cum	2.7	2.5	3.2	4	86.4 x 4 =	345.60		
						265.95	**1063.80**	HS-40%	**425.52**
								OR-60%	**638.28**
C (1:3:6)									
utment	Cum	9.2	4.2	0.35		13.524 x 4 =	54.096		
ng Wall	Cum	2.5	2.2	0.35	4	7.7 x 4 =	30.8		
S						21.224	**84.896**		
ab	Sqm	9.2		2.5		23 x 4 =	92.00		
rapet	Sqm	2.5	1.2	4		12 x 4 =	48.00		
utment	Sqm	9.2		4	4	147.2 x 4 =	588.80		
ng Wall	Sqm	2.5		3	8	60 x 4 =	240.00		
						219.2	**876.80**		

Twisted Bar	Kg					
b	a) 20 mm dia Bar @ 150mm c/c=		189.9			
	b) 12 mm dia Bar @ 150mm c/c=		163.3			
apet	a) 10 mm dia Bar @ 110mm c/c=		110.4			
	b) 5 mm dia Bar @ 110mm c/c=		104			
Required	a) 5 mm dia Bar =	104	0.222	23.088 x 4 =	92.352	
	b) 10 mm dia Bar =	110.4	0.627	69.2208 x 4 =	276.8832	
	c) 12 mm dia Bar =	163.3	0.888	145.0104 x 4 =	580.0416	
	d) 20 mm dia Bar =	189.9	2.48	470.952 x 4 =	1883.808	
				708.2712 =	**2833.0848**	
	e) Add 10% for wastage			70.82712 =	283.30848	
Steel required				779.10	**3116.39**	

(1:2:4)

	Cum	9	2.5	0.5		11.25 x 4 =	45.00
apet	Cum	2.5	1	0.25	2	1.25 x 4 =	5.00
						12.50	**50.00**
Walls(1:1.5:3)							
ment		9	0.5	4	2	36 x 4 =	144.00
g Wall		2	0.5	3	4	12 x 4 =	48.00
						48	**192.00**

wisted bar									
ment	a) 16 mm dia Bar @ 160mm c/c=			498.75	X	2=	997.5		
	b) 10 mm dia Bar @ 200mm c/c=			399	X	2=	798		
g Wall	a) 16 mm dia Bar @ 160mm c/c=			93.75	X	4=	375		
	b) 10 mm dia Bar @ 200mm c/c=			93.75	X	4=	375		
Required									
	a) 16 mm dia Bar =			1372.5	X	1.579	2167.1775	x 4=	**8668.71**
	a) 10 mm dia Bar =			1173	X	0.627	735.471	x 4=	**2941.884**
							2902.6485		**11610.594**
	e) Add 10% for wastage						290.26485		1161.0594
							3192.91335		**12771.65**

filling

11.2 1.5 3 2 = 100.8 x 4 = **403.20**

nsion joints @ 50m c/c

1340 / 50.00 = 48 Nos.

ide drain of 50 cm wideat top and 40 cm wide base and 50 cm deep wit RRM in cm 0.00 m

Super passage of 2 m span 2.00 Nos.

oulder crated wall with boulders of size 150 to 300 mm i/c laying of sausage wire 0.00 m

Forebay Tank

1 Earth work for formation cutting

F/Bay Tank	13.00	X	8.00	X	1.10	=	114.40	cum
Spillway	180.00	X	2.33	X	2.00	=	838.80	cum
							953.20	Cum
	Hard soil	30%				=	285.96	cum
	Ordinary rock	30%				=	285.96	cum
	Hard rock	40%				=	381.28	cum

2 Earth work in excavation in foundation trenches

F/Tank	11.4	X	6.4	X	3.00	=	218.88	cum
Spillway	180.00	X	1.5	X	0.85	=	229.50	cum
							448.38	cum
	Hard soil	=	20%			=	89.68	cum
	Soft rock	=	50%			=	224.19	cum
	Hard rock	=	30%			=	134.51	cum

3 Providing & laying C.C 1:3:6

F/Tank	11.40	X	6.4	X	0.15	=	**10.94**	cum
Spillway	180.00	X	1.5	X	0.10	=	**27.00**	cum
							37.94	cum

4 R.C.C in 1:1.5:3 in foundation and footings

F/Tank	11.40	X	6.40	X	0.2	=	14.592	cum
Spillway	180.00	X	1.50	X	0.15	=	40.50	cum
							55.09	cum

4 R.C.C in 1:1.5:3 in walls

F/Tank	2 x 11.40	X	3.10	X	0.2	=	14.136	cum
	2 x 6.00	X	3.10	X	0.2	=	7.44	cum
(-)	1.50	X	0.85	X	0.2	=	0.26	cum
Spillway	2 X 180.00	X	1.60	X	0.2	=	115.20	cum
							137.03	cum

5 Centering & shuttering in

a) foundation and footings

F/Tank	11.40	X	0.20			=	2.28	sqm
Spillway	180.00	X	0.15			=	27.00	sqm
							29.28	sqm

b) Walls

Spillway	180.00	X	0.85	x	4	=	612.00	sqm
Forebay	11.4	X	3.30	x	4	=	150.48	sqm
	6.80	X	3.30	x	4	=	89.76	sqm
							852.24	sqm

6 Reinforcement for R.C.C work

Cold twisted bars

110 kg/cum of R.C.C work **21133.53** kg

7 Stone filling behind the walls

F/Tank	21.60	X	1.00	X	3.10	=	66.96	cum
	5.30	X	1.00	X	3.10	=	16.43	cum
Spillway	180.00	X	0.5	X	0.80	=	72.00	cum
							155.39	cum

8 Dry stine pitching 22.5 mm thick..

30.00 X 4 X 0.40 = 0.00 cum

9 Steel workin Single secrtion...

a) in flats upto 10 mm thickness.

= 4.5 X 2 x 50 kg/sqm = 225 kg

11 P & L MS hand railing...

12 Extra for Prvdg and mixing water profing materials...

14 C/o of 2.5 mtrs fencing around the forebay tank

15.00	X	2	=	30.00	mtr
8.00	X	2	=	16.00	mtr
				46.00	mtr

45.00 Mtr

15 C/o CC Drain for flushing out channel

i) Earth work for formation cutting
Chainage- 0

$$A1 = \frac{2+2.5}{2} \times 2 + .50 \times 1.6 \times 1 \times 45 = 238.50 \text{ Cum}$$

Hard soil	25%	= 59.63 cum
Ordinary rock	45%	= 107.33 cum
Hard rock	30%	= 71.55 cum

ii) PCC 1:5:10

1 x 45 x 1 x 0.10 = 4.50 Cum

iii) Centering & shuttering(walls)

2x2 x 0.75x 45 = **135.00** Sqm

iv) Providing & laying cement concrete 1:2:4

2x0.60 x 0.15x 45	=	**8.10** Cum
1x0.80 x 0.15x 45	=	**5.40** Cum
		13.50 Cum

16 P & F Sluice valve 300 mm dia **1.00** No

17 Manufacturing & supplying bell mouth 600 mm dia **1** No

18 Providing & supplying Scoure pipe300mm dia **15** m

Penstock Pipe

Anchor block & Saddle Block

1 Earth work in excavation over areas

CH-310	(2+2.8)/2	x2.50	+	(2.8 +2.00)/2.00	x 1	+	0.50	x 2x 0.80	=	9.20	Sqm
CH-390	(2+2.8)/2	x2.00	+	(2.8 +2.10)/2.00	x 1	+	0.50	x 2.10x 0.80	=	8.09	Sqm
Average-	**(8.09 + 9.20)/2.00**	x 80.00	=	692.00	Cum	A					
CH-383	(2+2.9)/2	x2.00	+	0.50	2.90x1.20				=	4.90	Sqm
CH-463	(2+3.00)/2	x3.00	+	(3.00 +2.80)/2.00	x 1	+	0.50	x 2.80x 0.80	=	11.52	Sqm
CH-120	(2.50+2.50)/2	x1.80							=	4.50	Sqm
Average-	**(4.90 + 11.52+4.50)/3.00**	x 120.00	=	836.40	Cum	B					
		Total A+B	=	1528.40							
	Hard soil	=	10%			=				**152.84**	cum
	Ordinary rock	=	30%			=				**458.52**	cum
	Hard rock	=	60%			=				**917.04**	cum

2 Earth work in excavation in foundation& trenches

Anchor	15	(2.50 + 3.50)/2.00			x	3.50	x	3.00	=	472.50	cum
Saddle	75	(1.20 + 1.50)/2.00			x	1.50	x	2.00	=	303.75	cum
										776.25	cum
	Hard soil	=	10%			=				77.63	cum
	Ordinary rock	=	30%			=				232.88	cum
	Hard rock	=	50%			=				388.13	cum

Providing & laying C.C 1 :3 :6

Anchor	15	X	2.30	X	2.30	X		0.15	=	11.90	cum
Saddle	75	X	1.50	X	1.50			0.15	=	25.31	cum
										37.22	

R.C.C in 1:11/2:3 in Walls any thickness

Anchor	15	(2.50 + 3.50)/2.00			x	2.50	x	2.50	=	281.25	cum
Saddle	75	(1.20 + 1.50)/2.00			x	1.00	x	1.00	=	101.25	cum
										382.50	cum

R.C.C in 1:11/2:3 in foundations, footings ...

Anchor	15	X	2.50	X	3.50	X		0.30	=	39.375	cum
Saddle	75	X	1.50	X	1.50	x		0.20	=	33.75	cum
										73.13	cum

Centering & shuttering in

a) Anchor Block

a) Foundation & footing

	15	X	3.50	X	0.30		X	4	=	**63.00**	sqm
b) Walls	15	X	3.50	X	2.50		X	4	=	**525.00**	sqm

a) Saddle Block

a) Foundation & footing

	75	X	1.20	X	0.30		X	4	=	108.00	sqm
b) Walls	75	X	1.50	X	2.00		X	4	=	900.00	sqm

Reinforcement for R.C.C work

(a) Cold twisted bars

80 kg/cum of R.C.C work **36450.00** kg

Manufacturing and supplying of penstock pipe 600 mm O.D thickness 10 mm

Ax(OD-ID)xthickness x7850 kg/m

Outer dia =	610	inner dia =	600							
3.14	X	0.010	X	300.00	6 x 1000	X	7850	=	88.74	Kg/M
				X	750 mtrs length			=	**66552.30**	Kg

Fabrictn and supplying i/c erection....bending if pipe by gas, cutting,joining etc.

Cutting , joining, welding i/c loading unloading of P/Pipe. 30 Nos

	3.14(610+2x14)/25.40	=	78.87		Per/Inches	
For total joints to be welded	=	258 joints	x	78.87 p/inch =	**20348.46**	**Inch**

W/o 2 nos .Culvert

Earth work									
Abutment	Cum	9.5	4.5	4.2		179.55 x 2 =	359.10		
Wing Wa	Cum	2.7	2.5	3.2	4	86.4 x 2 =	172.80	HS	**186.165**
						265.95	**531.90**	OR	**345.735**
CC (1:3:6)									
Abutment	Cum	9.2	4.2	0.35		13.524 x 2 =	27.048		
Wing Wa	Cum	2.5	2.2	0.35	4	7.7 x 2 =	15.40		
						21.224	**42.448**		
R & S									
Slab	Sqm	9.2		2.5		23 x 2 =	46.00		

ii)Parapet	Sqm	2.5	1.2	4		12 x 2 =	24.00
iii)Abutmer	Sqm	9.2		4	4	147.2 x 2 =	294.40
iv)Wing W	Sqm	2.5		3	8	60 x 2 =	120.00
						219.2	**438.40**
Cold Twisted Bar	Kg						
i)Slab	a) 20 mm dia Bar @ 150mm c/c=			189.9			
	b) 12 mm dia Bar @ 150mm c/c=			163.3			
ii)Parapet	a) 10 mm dia Bar @ 110mm c/c=			110.4			
	b) 5 mm dia Bar @ 110mm c/c=			104			
Steel Requ	a) 5 mm dia Bar =			104	0.222	23.088 x 2 =	46.176
	b) 10 mm dia Bar =			110.4	0.627	69.2208 x 2 =	138.4416
	c) 12 mm dia Bar =			163.3	0.888	145.0104 x 2 =	290.0208
	d) 20 mm dia Bar =			189.9	2.48	470.952 x 2 =	941.904
	e) Add 10% for wastage					708.2712 =	**1416.5424**
Total Steel required						70.82712 =	141.65424
						779.10	**1558.20**
RCC (1:2:4)							
i)Slab	Cum	9	2.5	0.5		11.25 x 2 =	22.50
ii)Parapet	Cum	2.5	1	0.25	2	1.25 x 2 =	2.50
						12.50	**25.00**
RCC Walls(1:1.5:3)							
i)Abutment		9	0.5	4	2	36 x 2 =	72.00
ii)Wing Wall		2	0.5	3	4	12 x 2 =	24.00
						48	**96.00**
Cold twisted bar							
i)Abutment	a) 16 mm dia Bar @ 160mm c/c=			498.75	X	2=	997.5
	b) 10 mm dia Bar @ 200mm c/c=			399	X	2=	798
ii)Wing Wa	a) 16 mm dia Bar @ 160mm c/c=			93.75	X	4=	375
	b) 10 mm dia Bar @ 200mm c/c=			93.75	X	4=	375
Steel Required							
	a) 16 mm dia Bar =			1372.5	X	1.579	2167.1775 x 2= **4334.355**
	a) 10 mm dia Bar =			1173	X	0.627	735.471 x 2= **1470.942**
							2902.6485 **5805.297**
	e) Add 10% for wastage						290.26485 580.5297
							3192.91335 **6385.8267**
Stone filling							
		11.2	1.5	3	2 =	100.8 x	2 = **201.60**

1 Fabrictn and supplying of Sliuce Valve 600 mm dia at Forebay end

2 Fabrictn and supplying of Sliuce Valve 600 mm dia at P/House end — 2 Nos

3 Fabrictn and supplying of MS Pressure relief Valve — 2 Nos

4 Fabrictn and supplying of MS Expansion Joints 600 mm dia — 2 Nos

5 Fabrictn and supplying of MS Air Vent Pipe 600 mm dia — 8 Nos

6 Erection and laying of sluice valve to true alignment wit p/pipe — 2 Nos

7 Erection and laying of expansion joints to true alignment wit p/pipe — 1 Job

8 Erection and laying of bell mouth to true alignment wit p/pipe — 1 Job

9 Erection of vent pipe i/c fastening to outer face ..... — 1 Job

DETAILS OF MEASUREMENT

E OF WORK :- C/o Payu MHS at Koloriang (2x500Kw)

Power House / Tailrace Channel

No	Item of works	Unit	No.	L.	B.	H.	Qnty.	Remarks
	Earth work in excavation in foundation trenches ..... upto 50m lead							
	a) Foundation:	cu.m.	22	1.7	1.50	1.50	84.15	
	b) Plinth wall:	cu.m.	18	3.00	0.50	1.00	27.00	
	c) Machine Foundation :	cu.m.	2	3.00	3.00	3.00	27.00	
	d) Tail Race :	cu.m.	1	60.00	1.00	0.70	42.00	
						Total	**180.15**	
	Calssification of soil :-							
	a) Hard soil	20%	36.03	cu.m.				
	b) Ordinary rock	40%	72.06	cu.m.				
	c)Hard rock	40%	72.06	cu.m.				
	Provinding & laying C.C. 1:3:6(base							
	a) Post:	cu.m.	22	1.70	1.50	0.15	8.42	
	b) Plinth wall:	cu.m.	18	3.00	0.50	0.15	4.05	
	c) Machine Foundation :	cu.m.	2	3.00	3.00	0.15	1.35	
	d) Tail Race Channel :	cu.m.	1	60.00	1.00	0.15	9.00	
	e) Flooring:	cu.m.		[(20 x 10)-(3 x 3 x 3) x .15			25.95	
						Total	**48.77**	
	R.C.C. 1 : 2 : 4							
	(i) Column	cu.m.	22	5.5	0.3	0.3	10.89	
			22 x		[(0.30 x 2	x 0.20	3.64	
			22	0.30	0.30	5.10	10.10	
	(ii) Machine Foundation:	cu.m.	2	3.00	3.00	3.00	54.00	
	(iii) Tail Race Channel :	cu.m.	60		x (0.70 x		18.9	
						Total	**97.53**	
	R.C.C. works in lintels, beams and bresumers .... 1:3 .. Shuttering and reinforcement							
	(b) 1:2:4							
	(i) Plinth beams	cu.m.	18	3	0.25	0.25	3.38	
	(ii) Lintel Beams:	cu.m.	18	3.00	0.15	0.15	1.22	
	(iii) Post Plate beams:	cu.m.	18.00	3.00	0.25	0.25	3.38	
						Total	**7.97**	
	Centering and Shuttering ...							
	(a) Foundation, foorings							
	(i) Foundation	cu.m.	22	1.25	0.30	5.00	41.25	
		cu.m.	22	0.30+1.25 / 2	0.20	5.00	17.05	
		cu.m.	22	1.20	0.30	5.00	39.60	
	ii) Machine Foundation:	cu.m.	2	3.00	3.00	3.00	54.00	
	iii) Tail Race Channel:	cu.m.	1	60.00	0.90	4	216.00	
						Total :	**367.90**	
	(b) Column, Pillar, Posts and Struts etc.							
		cu.m.	22	5.50	0.30	4	145.20	
	(c)Lintels, beams, girders							
	(i) Plinth beams	cu.m.	18	3	0.25	4	54.00	
	(ii) Lintel Beams:	cu.m.	18	3.00	0.15	4	32.40	
	(iii) Post Plate beams:	cu.m.	18	3.00	0.30	4	64.80	
						Total :	**151.20**	

No	Item of works	Unit	No.	L.	B.	H.	Qnty.	Remarks
	Reinforcement for R.C.C - work -							
	Reinforcement for R.C.C work -							
	(a) Cold Twisted bars 12 mm Ø rod							
	i) Base Jally :	mtr	22 x 12 nos x 2 rods	1.2	--	--	633.60	
	ii) Column ---------- (8 Nos 12 mmØ	mtr	2 x (3 + 1.2 + 0.2 + 0.3 + 0.3) x 4				440.00	
	iii) Lintel Beams (12 mm Ø)	mtr	4	40.00	3.00	--	480.00	
			4	20.00	3.00	--	240.00	
	iv) Post Plate beam (4 Nos)	mtr						
			4	40.00	3.00	--	480.00	
			4	20.00	3.00	--	240.00	
					Total :		2513.60	
					x 0.89 Kg/m=		2237.104	Kg
	10 mm Ø rod							
	i) Lintel Beams	mtr	4	40.00	3.00	--	480.00	
			4	20.00	3.00	--	240.00	
	ii) Machine Foundation Vertical :	mtr	18	x (2.5+2.5+2.5) x 11			1485.00	
	Horizontal:	mtr	18	x (2.5+2.5+2.5) x 10			1350.00	
	iii) Tail Race Channel							
				(0.7+0.7+0.7) x 500 x 2			2100.00	
				(5+5+5) x 60			900.00	
					Total :		6555.00	m
					x 0.62 Kg/m =		4064.1	Kg
	(b) Mild Steel and Medium Stell bars :							
	(i) Pillar :	mtr	22	x (0.25+0.25+0.25+0.25+0.10) x 37			895.40	
	(ii) Plinth Beam:	mtr	18	x (0.20+0.20+0.20+0.20+0.10) x 37			599.40	
	(iii) Lintel Beam	mtr	18	x (0.10+0.10+0.10+0.10+0.10) x 37			333.00	
	(iv) Post Plate Beam	mtr	18	x (0.20+0.20+0.20+0.20+0.10) x 37			599.40	
					Total :		2427.20	
					x 0.22 Kg/m =		533.984	Kg
	Random Rubble Masonry With Hard Stone ... 1:6:12 at Plinth Level							
	(i) Plinth beams	cu.m.	18	3.00	0.30	1.00	16.20	
	Half brick Masonry ..... 1:4 in foundation & Plinth	Sq.m		4 x [(20X10)-(2.5x1.5)-(1.5x1.2)]			777.80	
	Extra for Half brick Masonry in Superstructure above plinth level and upto floor level.						777.80	
	C.C.flooring 1:2:4 ... finished with a floating coat of neat cement							
	a) 40 mm thick	Sq.m		(20x 10) - (3 x 3)		-4	187.00	
	Providing corrugated G.I Sheet roofing fixed with galvanised							
	a) 0.63 mm thick G.I. Sh	Sq.m	2	22	12		528.00	
			Add for lapping : 2 No. x (0.3+0.3) x2 x .4 x 20				16.00	
			Add for Walling : 2 No. x 2(0.5 x 1.08x2.5)				5.40	
						Total :	549.40	
	Providing Ridge or hips 60 cm overall in plain G.I. Sheet.....							
	a) 0.63 mm thick G.I. Sh	Sq.m		(20+1+1)			12.00	
			Add for lapping : 3 x 2 side x 0.30				1.80	
						Total :	13.80	
	Providing and fixing 4.00 mm thick asbestos plain sheet ceilling of approved quantity...	Sq.m		20.0	10.0		200.00	

S.No	Item of works	Unit	No.	L.	B.	H.	Qnty.	Remarks
14	Providing and fixing plain, square edged wooden beading 38mm x 12mm ...							
	i) Best quality approved	m		20 x 2 x 10			400	
15	Providing approved best available local wood (class B-II) in frames of doors, windows.....							
	Doors							
	i) D1	dm^3	1	1 x25x2x(5 x 3 inches = (1.27 x 0.762) = 48.89		dm^3		
				25	2	0.968	48.39	H = (01.27 x 0.76 = 0.967
	ii) D2	dm^3						
	windows.....			2	1.5	0.968	2.90	
	i) W1	dm^3	4	2	1.5	0.968	11.61	
	ii) W2	dm^3	4	2	1.2	0.968	9.29	
						Total :	**72.19**	**Cudm**
							7.22	**Per 10 Dm^3**
16	Providing approved best available local wood (class B -II) work in frames of false ceiling partition & trusses etc, sawn & put up in position.....							
	a)Trusses							
		a) dm^3						
		b) dm^3		3	33	0.968	95.81	
		c) dm^3		3	20	0.968	58.06	
		d) dm^3		3	15	0.968	43.55	
				3	10	0.968	29.03	
						Total :	226.45	
					105.48 x 3 truss =		**679.35**	
	b) Purlin							
		a) Dm^3	3	10	90	0.581	1567.74	(2 Sides)& H=(0.762x0.762) =0.581dm
	c) False Ceiling							
		a) Dm^3	3	20	70	0.581	2438.70	(2 Sides)& H=(0.762x0.762) =0.581dm
						Total :	4685.80	
							468.58	**Per 10 Dm^3**
	Providing & fixing panelled, glazed or panelled & glazed shutters for doors, windows..							
	a) 38 mm thick							
	i) Doors	sq.m.	2	2.5	1.5	--	7.50	
	ii) Windows	sq.m.	8	1.5	1.2	--	14.40	
						Total	**21.90**	
	Providing & Fixing 2.50 cm thick (wooden works) approved local wood caes board 23 cm wide ..							
	Providing & fixing MS	m		(22+22+10.50 x4)			86.00	
	grills of required pattern in wooden frames of window.....							
	a) Ornamental grill	kg		1.5 x 1.2 of weight			40	
	15 mm thick cement plaster 1:3.....							
	half Brick walls	sq.m.	4	17.9	4.00	--	286.40	
			4	8.8	4.00	--	140.80	
							427.20	**sqm**
	12 mm thick cement plaster 1:3.....							
	Pillar:	sq.m.	22	4.00	0.30	4	105.60	(Side = 4)
	Lintel Beam:	sq.m.	18	3.00	0.15	2	16.20	(Side = 2)
	Post Plate beams	sq.m.	18	3.00	0.25	2	27.00	(Side = 2)
							148.80	**m^2**

S.No	Item of works	Unit	No.	L.	B.	H.	Qnty.	Remarks
22	White washing three or more coats on new							
	a) Brick Works :	sq.m.	4	17.9	4.00	--	286.40	
			4	8.8	4.00	--	140.80	
	b) Pillar :	sq.m.	22	4.00	0.3	4	105.60	
	c) Lintel beam:	sq.m.	18	3.00	0.15	2	16.20	
	d) Post plate beam:	sq.m.	18	3.00	0.25	2	27.00	
						Total :-	**576.00**	**sqm**
23	Applying priming coat wi ready mix pink primer.... on wood work complete	sq.m.						
	a) Doors	sq.m.	2	2.50	1.50		7.50	
	b) Windows	sq.m.	8	1.50	1.20		14.40	
	c) Eave-board	sq.m.		87.00	0.23		20.01	
	d) Ceiling	sq.m.		20.00	10.00		200.00	
						Total :-	**241.91**	
24	C/O cement concrete drain 30 cm wide and 23 cm deep in C.C. 1:3:6	m		22+22+12+12			68.00	m
25	C/o Page wire fencing with MS angle	m		40 x2 + 30x2			140	mtrs
26	P & F steel gate						1	No

27 C/o Compound wall around Power House, Switch Yard and Staffs quarter

no	Item of works	length	breadth	height	Unit	Amount
	Earth Work	135		1.5	1.2 Cum	243
	Calssification of soil :-					
	a) Hard soil	10%				24.3
	b) Ordinary rock	30%				72.9
	c)Hard rock	60%				145.8
	PCC	130		0.8	0.3 Cum	31.2
	C & S					
	i)Columns in every 2.5 mtr c-c	4		0.5	3.5 Sqm	7
	ii)Beams	4		0.4	2.5 Sqm	4
	For 25 nos					11
	RCC					275
	i)Columns in every 2.5 mtr c-c	0.5		0.5	3.5 Cum	0.875
	ii)Beams	0.4		0.4	4.5 Cum	0.72
	For 25 nos					1.595
	Reinforcement for R.C.C work					39.875
		Cold twisted bars				
		80 kg/cum of R.C.C work				3190.00
	Brick Work	125		2.3		287.5

C/o CC Foot steps from Power House to BRTF Road for easy maintenance of penstock pipe.

Item of works	length	breadth	height	nos	Amount	Unit
Earth Work	1.5	0.8	0.5	1000	600	Cum
Calssification of soil :-						
a) Hard soil	10%				60	Cum
b) Ordinary rock	30%				180	Cum
c)Hard rock	60%				360	Cum
PCC	1.2	0.6	0.35	1000	252	Cum
C & S						
Foundation and footing	1.2		0.35	1000	420	Sqm
	0.6	2	0.35	1000	420	Sqm
					840	

APPROACH ROAD to P/House

1 Earthwork in excavation over areas.....

App. Road to P/ House(new formation cutting)

$$\frac{\{(4.50+6.00)}{2} \times 8.50) + 1/2 \times 4.50 \times 2\}\} \times 65m$$

1800	x	5	x	6.6	=	29700	Cum

Classified Qnty.

1) Hard Soil	=	40%	=	11880	Cum
277.39		50%	=	14850	Cum
3) Hard Rock =		10%	=	2970	Cum

2 Laying stone aggregate for wearing course

1800.00	X	3.75	X	0.20	1348.65	cum

3 C/O R/wall of average heigt 5m with RRM in CM 1:6 60 m

4 C/O R/wall of average heigt 4m with RRM in CM 1:6 45 m

5 C/o Boulder crated wall 40 nos

6 C/O culverts of 2m span 10 No.

7 C/O of Side Drian 1300 mtr

Cartage of Construction materials.

1 Cartage of construction materialsby mechanical transportation like cement, Steel, Sand Agg, Sliuce valve, P/Pipe etc

(Qnty as Per T.C Statement)

1) Cement	=			3267.37 MT
2) M.S Bars	=			655.76 MT
3) Sluice Valve (600 mm)	=	4 x	400Kg/no	1.6 MT
4) Sluice Valve(450 mm)		3	150kg/no	0.45 MT
5) Scour pipe	=	165 m@ 28Kg/m		4.62 MT
6) Sluice gate	=			0.12 MT
				3929.92 MT

3 Cartage of Penstock Pipe by mechanical transportati 53.24 MT

DESIGN OF MAJOR CIVIL COMPONENTS

I DETERMINATION OF POWER POTENTIAL AND REQUIRED DISCHARGE

If,

Enter data	H	190.00	m
Enter data	H loss	19.00	m
	H net	171.00	m
	Q	0.70	cumec
	Efficiency	0.85	
Enter data	P =	1000.00	kw

if

P	=	1000.00	kw
Hn	=	171.00	m
*no. of mac Q	=	0.70	cumec

II DIVERSION WEIR:

(TRAPEZOIDAL SECTION.)

Design of trench:

Qd	=	0.91	Required design discharge(power draft+30% extra)
n	=	0.015	
Bed slope		0.0022	(1:20)
Side slope		0.10	(1:10)
Top width		0.96	m
Enter data Base width		0.8	m
Enter data Depth		0.80	m
Area		0.70	sqm
Perimeter		2.41	m
R		0.29	
Q	=	0.97	cumec

III FEEDER CHANNEL

(RECTANGULAR SECTION.)

Q h	=	0.88	Required desing discharge(power draft+25% extra)
n	=	0.015	
Bed slope		0.0022	1:450
Enter data Width		1.15	m
Depth		0.575	m
Area		0.66	sqm
Perimeter		2.3	m
R		0.288	
Q	=	0.90	cumec

(TRAPEZOIDAL SECTION.)

Q h	=	0.88	Required desing discharge(power draft+25% extra)
n	=	0.015	
Bed slope		0.002	(1:500)
Side slope		0.10	(1:02)
Top width		1.04	m
inter data Base width		0.90	m
inter data Depth		0.70	m
Area		0.68	sqm
Perimeter		2.31	m
R		0.29	
Q=		0.90	cumec

IV DESILTING TANK

Q s=		0.88	Required design discharge(power draft +25% extra)

	Width	4.50	m
	Depth	2.2	m
	Horizontal velocity in chamber,	0.089	m/sec
	Settling velocity Vs,	0.75	(Assuming silt particle size upto 0.1mm is to be removed,specific gravity 2.65 gm/ sqcm, temparature of water 10 degree C)
	Time for vertical settling	293.33	sec
	Length of desilting tank	25.97	mtr

V. POWER CHANNEL

(RECTANGULAR SEC.)

Q h	=	0.77	Required design discharge(power draft+10% extra)
n	=	0.015	
Bed slope		0.0022	(1:450)
Width		1.1	m
Depth		0.55	m
Area		0.605	sqm
Perimeter		2.2	m
R		0.275	
Q=		0.80	cumec

(TRAPEZOIDAL SEC.)

Q h	=	0.77	Required design discharge(power draft+10% extra)
n	,=	0.015	
Bed slope		0.002	(1:500)
Side slope		0.10	1:02
Top width		0.94	m
Base width		0.80	m
Depth		0.70	m
Area		0.61	sqm
Perimeter		2.21	m
R		0.28	
Q=		0.77	cumec

V. FOREBAY TANK

Qf	=	0.70	cumec (power draft)
Retention time		2.00	minutes (ref. Clause 5.3.5 of Guidelines for development of small Hydro Electric Schemes)
Capacity of tank		84.16	cum
Water depth		2.20	m
Area		38.254	sqm
Width		4.00	m
Length		9.56	m
Free board		0.5	m

VI. SPILLWAY CHANNEL

Qs	=	0.70	(CBH^(3/2)
C	=	2.00	
H	=	0.60	m
B	=	0.75	m

VII. PENSTOCK

Dia of Penstock pipe by SARKARIA FORMULA

Q	=	0.70	(design discharge i.e. power draft)
Net head,H =		171.00	m

Rated HP of turbine, P = 1439.11 (W*H*Q* 0.9/75)

Economic dia of P/S

(a) (0.62XP^(0.43)/H^(0.65)

= 0.500 m

(b) (3.55(Q^(2))^(1/4)/(2gH)^(1/4)

= 0.391 m

Average of (a) & (b) 0.445 m

Dia of Penstock pipe by DONALDS FORMULA

Economic dia of P/S = (0.176(P/H)^(0.466)

0.382 m

Adopt dia 0.600 m

THICKNESS REQUIRED = (PD/2en) ; where,
P = Water pressure I/c water hammer 40% ; D = Dia of p/s
e=permissible stress in steel=1400 kg/sqcm
n= efficiency of longitudinal joint (0.9)

Gross head = 190.00 in m

Area of p/s = 0.28 sqm

discharge through each pipe 0.70 cumecs

velocity = 2.48 m/sec

Thickness required = 7.83 mm i/c 1.5 mm for corrosion

Thickness from handling criteria

T = 1.265 mm

Adopt minimum thickness as per IS 3589 : 1991 as per clause 12.1 Table 3 6.00 mm

Adopt the following dimensions for the civil components:--

1 Trench weir: (Trapezoidal)

Bottom width	:	0.8 m
Top width	:	0.96 m
Av. Depth	:	0.80 m
Bed slope	:	1:20

2 Feeder channel:
(Rectangular)

			Trapezoidal sec.	
Top Width	:	1.15 m	Top Width :	1.04 m
Bottom width		0.00	Bottom width:	0.90 m
Depth	:	0.575 m	Depth :	0.70 m
Bed slope	:	1:450	Bed slope :	1:450 m
Free board	:	0.3 m	Free board :	0.3 m

3 Power channel:
(RECTANGULAR SEC.)

			Trapezoidal sec.	
Width	:	1.1 m	Top Width :	1.04 m
Depth	:	0.55 m	Bottom width:	0.90 m
Bed slope	:	1:450	Depth :	0.70 m
Free board	:	0.30 m	Bed slope :	1:450 m
			Free board :	0.3 m

4 Desilting tank:

Length	:	25.97 m
Width	:	4.50 m
Depth	:	2.20 m
Free board	:	0.30 m

5 Forebay tank:

Length	:	9.56 m
Width	:	4.00 m
Depth	:	2.20 m
Free board	:	0.30 m

6 Spillway:

width	:	0.75 m
Depth	:	0.60 m

7 Penstock pipe:

Dia	:	600.00 mm (ID)
Length	:	750.00 mtr
No.	:	2 No.
Thickness	:	10.00 mm