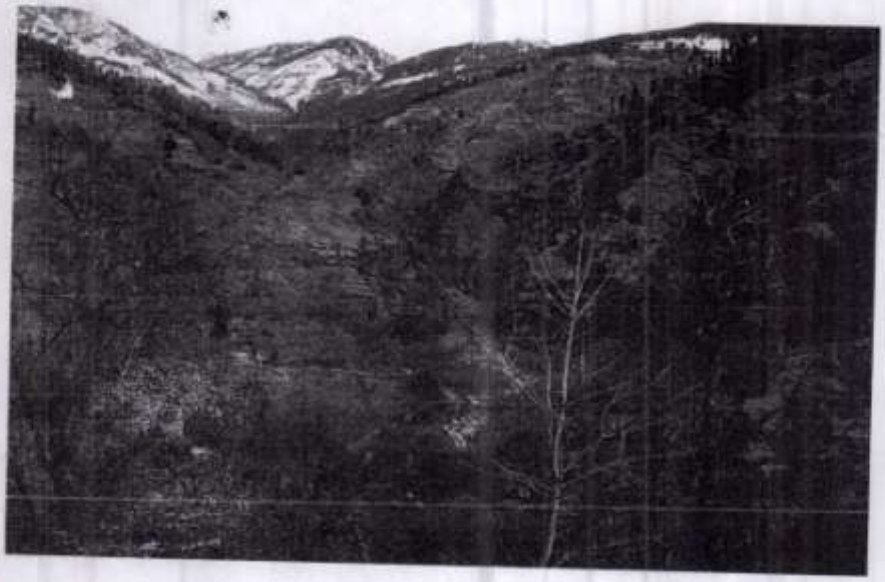
FINAL

(66)

CATCHMENT AREA TREATMENT PLAN

FOR

24 MW BARAGAON SHEP IN DISTRICT KULLU



KANCHANJUNGA POWER COMPANY PVT LTD

B-37, Sector-1 Noida-201301 Feb. 2011

Report sent to GOI vide page-65

MRG
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CHAPTER-1
INTRODUCTION

1.1 GENERAL

In the present developing state of country's economy, there is a great requirement of electrical power for both industrial and agricultural use. The current installed generation capacity in the country is about 159398 MW as on 31st March 2010. The power requirement during 2009-10 in the country was 830300 MU against the availability of 746,493MU. Thus, there was a deficit of 10.1%. It has been estimated that in the long term the projections of electricity requirement are expected to grow, with the Installed Capacity requirement by 2031-32 being about 7.6 lakh MW with 7% growth rate and 9.6 lakh MW with 8% growth rate. Further, the Report of the Working Group on Power for 10th Plan estimated the need based capacity addition of 62,213 MW during 11th Plan. Thus, it is necessary to commission projects to generate power to bridge the ever-increasing gap in demand and supply scenario.

India is endowed with rich hydropower potential; it ranks fifth in the world in terms of usable Potential. The economically exploitable potential from the river systems of the country through medium and major schemes has been assessed at 84,044 MW at 60% load factor10 corresponding to an installed capacity of around 150,000 MW. Presently, around 36863 MW power generation capacity is added from hydro power potential which is around 23% of the installed capacity of the country and further around 24.6% of available hydropower potential in the country has been harnessed. There is vast scope to contribute in bridging the demand – supply gap scenario from development of available hydro power potential in the country.

1.2 HYDRO-POWER POTENTIAL OF HIMACHAL PRADESH

Himachal Pradesh is situated in the northern part of the country and lies between latitudes 30° 22' to 33° 12' N and longitudes 75° 47' to 79° 04' E. It shares its boundary with Uttaranchal on the eastern side, Jammu and Kashmir in the north-western side, China on the north-east side and Punjab and Haryana in the southern side. The state has a geographical area of 55,673 sq. km. and population of 60,77,248 as per 2001 census records. The state has a population density of about 109 persons per sq. km.

The state is blessed with significant hydropower potential. The total power potential of various river basins in the state is estimated as 20131.75 MW, which is available in five river

basins (refer Figure-1.1). The details of basin wise hydropower potential are given in Table-1.1.

TABLE-1.1

Hydro-power potential in various river basins of Himachal Pradesh

S. No.	Basin	Identified potential (MW)
1.	Satluj	9396.75
2.	Beas	4,293
3.	Ravi	2,181
4.	Chenab	3,301
5.	Yamuna	960

Figure 1.1 Rivers flowing through Northern India; Location of State of Himachal Pradesh within India

The present installed capacityof Himachal Pradesh in medium and major hydro projects is 6344 MW (Source: HPSEB website). With rising hydro power generation and improving efficiencies in distribution of electricity, Himachal Pradesh can offer energy at stable prices for eco-friendly industrial development. Thus, there is an urgent need to develop its huge untapped hydro power potential capacity with the purpose of harnessing hydro-power resources in the state for economic well being and growth of the people in the whole region.

1.3 NEED OF THE PROJECT

As outlined in Secion-1.1, the country is facing severe power crisis, which will aggravate further, even after considering the contribution of various projects in different stages of commissioning. Thus, it is imperative to harness the untapped power potential of various river basins.

Due to paucity of resources and the increasing gap between supply and demand of power, Govt of India has sought participation of private sector in power generation. The Electricity Act 1910 and Electricity (Supply) Act 1948 have been amended to facilitate entry of the

private sector in power generation. Various incentives have been offered to attract private investors, both domestic and overseas to enter in the field of power generation.

In line with the policy guidelines of the Govt of India, the Himachal Pradesh Govt has decided to allow development of selected hydro-electric power projects in the state by the private sector. Baragaon hydro-electric project (24 MW) located in Kullu district has been allocated by Himachal Pradesh Govt to M/s Kanchanjunga Power Company Pvt Ltd

An Implementation Agreement (IA) has been signed between Kanchanjunga Power Company Pvt Ltd and Government of Himachal Pradesh for implementation of the project.

The Sanjoin Nalla is a perennial tributary of Beas River, originating at an elevation of about 4352 m from the highest peak of Shila Gaura Tibba and flows over a distance of about 13 km before joining the Beas River . The total length of Sanjoin Nalla is about 8 km from its origin to the weir site of Baragaon HEP. The Nalla flows in south east direction till its confluence with the Beas River. The Nalla bed level at proposed Trench Weir is 2396 m.

The Bijara Nalla is a tributary of Sanjoin Nalla, originating at an elevation of about 4450 m from the peak of Saman Jot and flows over a distance of about 10 km before joining Sanjoin Nalla. The total length of Bijara Nalla is about 8 km from its origin to the weir site of Baragaon HEP. The Nalla flows in east direction till its confluence with Sanjoin Nalla. The Nalla bed level at proposed Trench Weir is 2385 m.

The catchment area of Sanjoin Nalla is 36.92 sq km and Bijara Nalla is 10.54 sq km. Hence river discharge due to precipitation and snow melt in a total catchment area of 47.46 sq km is available to facilitate power generation.

The scheme involves the construction of two Diversion weirs, two desilting basins, two tunnels, Adits, Surge shaft, Penstock, a surface Power house having installation of 3 generating units, each of 8.0 MW capacity, switchyard and tailrace channel.

The project would go a long way in meeting the power requirements of the region and also address the imbalance of hydro-thermal mix vis-à-vis power generation. The project location and vicinity map is given in Figure-1.2.

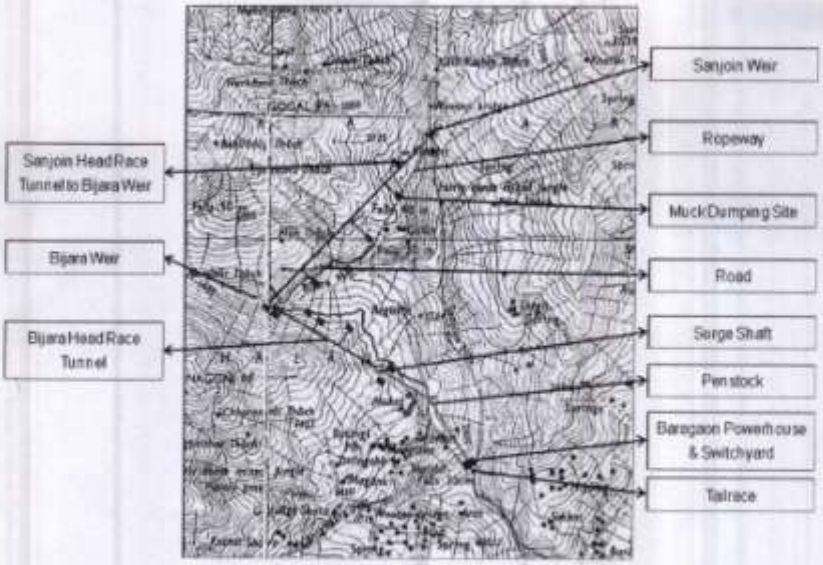

Figure 1.2.a Project location and vicinity map

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Development Officer,
Kullu [illegible] Kullu

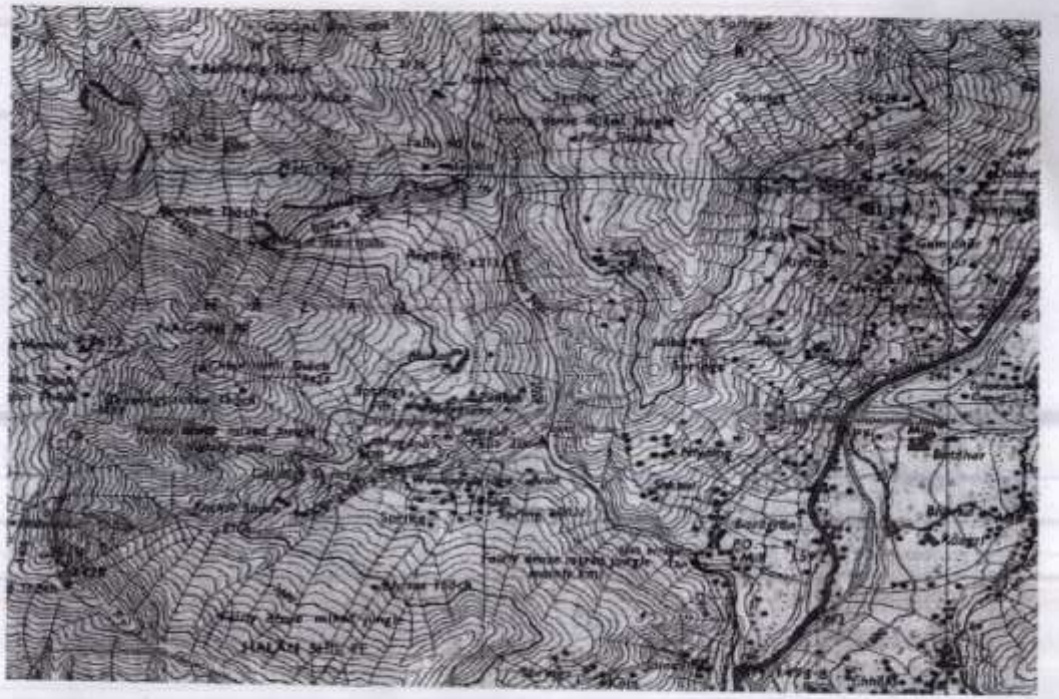

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Figure 1.2.b Project location and vicinity map

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1.4 OBJECTIVES OF CATCHMENT AREA TREATMENT PLAN

It is utmost importance to study the sedimentation and erosion from catchment as the deposition of sediment affects the water availability for the designated use. The process of sedimentation embodies the sequential processes of erosion, entrainment, transportation, deposition and compaction of sediment. The eroded sediment from catchment when deposited on streambeds and banks causes braiding of river reach and leads to serous soil erosion problems. Thus, a well-designed Catchment Area Treatment (CAT) Plan is essential to ameliorate the above-mentioned adverse process of soil erosion.

Soil erosion may be defined as the detachment and transportation of soil. Water is the major agent responsible for this erosion. In many locations, winds, glaciers, etc. also cause soil erosion. In a hilly catchment area, as in the present case, erosion due to water is a common phenomenon and the same has been studied as a part of the Catchment Area Treatment (CAT) Plan. Soil erosion leads to:

- loss in production potential
- reduction in infiltration rates
- reduction in water-holding capacity
- loss of nutrients
- increase in tillage operation costs
- reduction in water supply

Catchment Area Treatment Plan has been formulated for the total catchment areas of Sanjoin Nala and Bijara Nala at proposed diversion sites. The total catchment areas at proposed diversion sites on Sanjoin Nala is 36.92 sq km and on Bijara Nala 10.54 sq km. Maximum and minimum snowlines have been observed at 3600 m and 4500 m respectively.

The purpose of Catchment Area Treatment (CAT) Plan is to highlights the management techniques to control erosion in the catchment area of a water resource project, restoring ecosystem, improving socio-economic status of the area and adequate preventive measures for the treatment of catchment for its stabilization against future erosion.

1.5 OUTLINE OF THE REPORT

The contents of the study are arranged as follows:

Chapter 1: Gives an overview of the need for the project and hydro-power potential of the state of Himachal Pradesh. The purpose of CAT plan

Chapter 2: A brief write-up on various project appurtenances, construction schedule and related aspects have been covered in this Chapter.

Chapter 3: Describe the Study of the Catchment Area Treatment

Chapter 4: Describe the socio-economic aspects of project area

Chapter 5: Describe the proposed measures for catchment area treatment

Chapter 6: Describe the Joint Forest Management in the CAT Plan

Chapter 7: Describe the Management of Wildlife

Chapter 8: Describe the cost outlay for treatment of effective area

CHAPTER – 2

PROJECT DESCRIPTION

2.1 GENERAL

Baragaon Hydroelectric Project is proposed in Kullu district of Himachal Pradesh. The project proposes to utilize water from Sanjoin and Bijara nallas for generation of 24 MW of power. The Bijara nalla is a left bank tributary of Sanjoin nalla and joins it about 2.5 km upstream of proposed power house site. Sanjoin nalla is a right bank tributary of Beas river. The project is designed as a run of the river scheme.

The project involves the construction of a Trench weir, Intake box channel, Desilting basin and 2620m long tunnel to divert and convey the Sanjoin water upto left bank of Bijara nalla at a location to the upstream of the Bijara Intake. This scheme also involves construction of a Trench weir, Cut and Cover box channel to the upstream of trench weir to convey the Sanjoin water from left bank to right bank of Bijara nalla, Intake box channel, Desiliting basin, 128m long tunnel to carry the Sanjoin water from right bank of Bijara nalla to the 1934m long Bijara HRT, Surge Shaft and Penstock to divert and carry the combined Sanjoin nalla and Bijara nalla discharge up to the Power house. The rated net head of the scheme is 599.5m and nominal combined discharge from Bijara and Sanjoin of 4.71m^3/s is being utilized to generate 98.12MU of energy annually in a 75% dependable year. A surface power house has been proposed with three numbers of Horizontal axis Pelton machines of 8.0 MW capacity each to generate 24MW power. Water after power generation will be discharged back in to the Sanjoin Nalla through a tailrace. An outdoor switch yard has been proposed adjacent to the Powerhouse and the generated power will be transmitted through a 132kV transmission line up to the grid at Naggar.

2.2 PROJECT DESCRIPTION

The proposed project envisages following project proponents:

2.2.1 Trench weirs and Intake structures at Sanjoin and Bijara Nalla

Construction of a rectangular trench type, reinforced cement concrete (RCC) weirs have been proposed for both Sanjoin and Bijara diversion sites and the HFL has been estimated as EL 2398.341 and EL 2387.213 respectively.

2.2.5 Adit-1 for Sanjoin Tunnel

A 75 m long D-shaped tunnel of excavated size 2.0m wide x 2.25m high has been proposed to open two faces for construction of Sanjoin tunnel.

2.2.6 Intake Box Channel -Bijara

A 47m long RCC box intake channel of size 2.2mx2.1m has been proposed to carry the discharge from the Bijara trench weir to the desilting basin.

2.2.7 Head Race Tunnel-Bijara

A 1934m long lined D-shaped pressure tunnel of clear size 1.8m wide x 2.25m high has been proposed to carry the combined discharge of Sanjoin and Bijara to the Surge shaft.

2.2.8 Surge Shaft

Surge shaft of 4.0 m dia. has been proposed at the end of HRT to care of water hammer pressure problem. The total height proposed is around 28.0 m.

2.2.9 Penstock

A 1.35m dia. main Penstock of length 1480m. has been proposed to convey water from Surge shaft to Power house.

2.2.10 Power house and switchyard

A surface power house of size 45.5m x 20m x 10m has been proposed to house three number of horizontal axis Pelton machine of 8.0 MW capacity each constituting a 24MW plant. A surface switchyard of size about 30mx50m has been proposed adjacent to the Power house.

2.2.11 Tailrace Channel

20 m long common tailrace tunnel of size 2.5m x 2.0m has been proposed to carry the water from Power house to the Sanjoin nalla. At the junction of the tailrace, boulder protection work will be done to protect the river bed from erosion.

Project layout has been shown in Figure 2.1

2.3 SALIENT FEATURES

The salient features of the project are listed as below:

LOCATION

S. No.	Description	Particulars
1	State	Himachal Pradesh
2	District	Kullu
3	Village	Mangan
4	Name of stream	Sanjoin Nalla (tributary of Beas river) Bijara Nalla (tributary of Sanjoin Nalla)
5	Nearest railhead	Kirthpur Sahib(BG)/Chandigarh(BG)
6	Across Road	Kullu – Patlikuhal – Shila Powerhouse site is at a distance of about 3.5km from Patlikuhal
7	Geographical Coordinates	Latitude $32^0$8'40" N to $32^0$9'45"N Longitude $77^0$07'16" E to $77^0$07'50"E

HYDROLOGY

S. No.	Description	Particulars
1	Catchment area at Sanjoin diversion site	36.92 sq. km.
2	Catchment area at Bijara diversion site	10.54 sq. km.
3	Design flood discharge at Sanjoin diversion site (50yr. return flood)	135 Cumecs
4	Design flood discharge at Bijara diversion site (50yr. return flood)	79 Cumecs
5	Type of stream	Perennial
6	Minimum flow (75% Dependable year)	0.504m^3/s
7	Maximum flow (75% Dependable year)	8.21m^3/s

9	Size of intake structure	Width 2.60m Length 6.5m Height 5.7m
10	Intake Bulk Head Gate	2600 x 2000mm
11	Intake Service Gate	2600 x 1600mm
12	Shingle Flushing Gate	1000 x 1200mm
13	Gate for Fishery Arrangement	750 x 500mm
14	Shingle Flushing pipe	Dia. 800mm Length 31m
15	Channel for Fish Migration	Width 750mm Depth 1500mm

INTAKE BOX CHANNEL SANJOIN

S. No.	Description	Particulars
1	Design discharge	5.181Cumec
2	Size	2200mm x 2100mm
3	Full Supply Depth	1.573m
4	Length	21.0m
5	Bed Slope	1in 975
6	Velocity of Flow	1.498m/sec

SANJOIN DESILTING BASIN, ESCAPE STRCTURE AND ESCAPE CHANNEL

S. No.	Description	Particulars
1	Design discharge	5.181 Cumec
2	Type	Hopper Bottom
3	Nos. of Chamber	1 Nos.
4	Full Supply Elevation	2395.422 m
5	Length	45m
6	Width of Chamber	6.0 m
7	Depth	Rectangular 3.25m Hopper 2.6m
8	Size of Silt Catch Drain	Width 800mm Depth 0mm to 820mm
9	Maximum Flow through velocity	0.22 m/sec
10	Crest elevation of weir	2394.781m
11	Maximum depth of flow	0.640 m

12	Silt flushing pipe	Type M.S. pipe(confirming to IS:2062) Size 800mm dia. Nos. 01 Length 17mm
13	Gate valve for silt flushing	Size 800mm Nos. 01
14	Crest Length of Escape Structure	2.5 in
15	Crest Elevation	2395.421m
16	Depth of Flow	0.325 m
17	Size of Escape Channel	1200mm x 1200mm
18	Length of Escape Channel	11m

BOX CHANNEL FROM DESILTING BASIN TO SANJOIN TUNNEL

S. No.	Description	Particulars
1	Design discharge	5.181 Cumec
2	Size	1800mm x 1550mm
3	Full Supply Depth	1.149m
4	Length	18m
5	Bed Slope	1 in 250
6	Velocity of Flow	2.506m/sec

SANJOIN TUNNEL

S. No.	Description	Particulars
1	Design discharge	5.181 Cumec
2	Type	D-Shaped lined upto Springing Level
3	Size (clear)	1800mm x 2250mm
4	Full Supply Depth	1.149m
5	Length	2620m
6	Bed Slope	1 in 250
7	Velocity of Flow	2.506m/sec

ADIT-1

S. No	Description	Particulars
1	Type	D-Shaped
2	Size(Excavated)	2000mm x 2250mm
3	Length	75m

CUT AND COVER SECTION FOR BIJARA NALLA CROSSING AT SANJOIN TUNNEL OUTLET

S. No	Description	Particulars
1	Design discharge	5.181 Cumec
2	Size	1800mm wide 2598mm high (at start) 2670mm high (at end)
3	Full Supply Depth	1.149m
4	Length	18m
5	Bed Slope	1 in 250
6	Velocity of Flow	2.506 m/sec

CONNECTING TUNNEL FROM RIGHT BANK OF BIJARA NALLA TO BIJARA HEAD RACE TUNNEL

S. No	Description	Particulars
1	Design discharge	5.181 Cumec
2	Type	D-Shaped
3	Size (Clear)	1800mm x 2250mm
4	Full Supply Depth	1.149m
5	Length (m)	128
6	Bed slope	1 in 250
7	Velocity of Flow	2.506m/sec

INTAKE BOX CHANNEL BIJARA

S. No.	Description	Particulars
1	Design discharge	5.181 Cumec
2	Size	2200mmx2100mm
3	Full Supply Depth	1.573m
4	Length	47m
5	Bed Slope	1 in 975
6	Velocity of Flow	1.498m/sec

BIJARA DESILTING BASIN, ESCAPE STRUCTURE AND ESCAPE CHANNEL

S. No.	Description	Particulars
1	Design discharge	5.181 Cumec
2	Type	Hopper Bottom
3	No. of Chamber	1No.
4	Full Supply Elevation	2384.395m
5	Length	45m
6	Width of Chamber	6 m
7	Depth	Rectangular 3.6m Hopper 2.6m
8	Size of Silt Catch Drain	Width 800mm Depth 0 mm to 820mm
9	Maximum Flow through Velocity	0.22m/sec
10	Crest elevation of weir	2383.755m
11	Maximum depth of flow	0.640 m
12	Silt Flushing Pipe	Type M.S. Pipe (confirming to IS:2062) Size 800mm dia. Nos. 01 Length 21m
13	Gate Valve for Silt Flushing	Size 800mm Nos. 01
14	Crest length of Escape structure	5.0 m
15	Crest Elevation	2384.395 m.
16	Depth of Flow	0.710m
17	Size of Escape Channel	2000mm x 2000mm
18	Length of Escape Channel	12m

BIJARA HEAD RACE TUNNEL

S. No.	Description	Particulars
1	Design discharge	5.181 Cumec
2	Type	D-Shaped fully lined
3	Size (clear)	1800mm x 2250mm
4	Type of flow	Full flow
5	Velocity of Flow	1.397m/sec
6	Length	1934m
7	Bed Slope	1 in 219

BIJARA ADIT

S. No.	Description	Particulars
Adit-2		
1	Type	D-Shaped
2	Size (Excavated)	2000mm x 2250mm
3	Length	88m
Adit-3		
1	Type	D-Shaped
2	Size (Excavated)	2000mm x 2250mm
3	Length	51m

SURGE SHAFT

S. No.	Description	Particulars
1	Type	Vertical, Circular and Lined
2	Diameter	4.0 m
3	Height	28.0m
4	Top EL	El. 2400
5	Invert EL.	El. 2373.20
6	FSL	El. 2384.389
7	Steady State Level	El. 2381.619
8	Maximum Surge Level	El. 2393.549
9	Minimum Surge Level	El. 2377.789

ADIT-4

S. No.	Description	Particulars
1	Type	D-Shaped
2	Size (Excavated)	2000mm x 2250mm
3	Length	54m

PENSTOCK

S. No.	Description	Particulars
1.	Design Discharge	5.181 Cumec
2	Size of Main Penstock	1350mm dia.
3	Length of Main Penstock	1480m
4	Size of Unit Penstock	800mm dia.
5	Nos. of Unit Penstock	03
6	Length of Unit Penstock	12.0m (2Nos.) 6.0m (1 No.)
7	Velocity	3.62m/sec
8	Steel Liner	ASTM A 516 Gr. 70 Var. from 8mm to 36mm(For Main Penstock) 22 mm (For Unit Penstock)
9	Anchor Blocks	13 Nos.
10	Expansion Joints	13 Nos.
11	Manholes (500mm dia.)	03 Nos.
12	Saddle Supports	189 Nos.
13	Saddle Plates	Confirming to IS 2062
14	Howel Bunger Valve	Size 300NB No. 01

POWERHOUSE

S. No.	Description	Particulars
1	Type of Powerhouse	Surface
2	Installed Capacity	24MW (3x8MW)
3	Generating Units	Type Horizontal axis Pelton Turbine coupled with synchronous Generator Nos. 03
4	Machine Hall	Length 34.0m Width 14.3m Height 10.0m El. 1722.2m
5	Size of Service Bay	Length 12.5m Width 14.3m Height 10.0m El. 1773.0m

6	Size of Control room	Length Width Height El.	34.0m 5.5m 4.0m 1777.0m
7	Size of Electrical Room	Length Width Height El.	34.0m 5.5m 4.0m 1777.0m
8	Elevation of c/l of Penstock	1771.0m	
9	Elevation of c/l of Machine	1773.0m	
10	Tail Water Level	1770.0m	
11	Gross Head	608m	
12	Head loss	7.8m	
13	Rated Net Head	599.5m	
14	Rated discharge	$4.71m^3/sec$ (Normal) $5.18m^3/sec$ (10% overload)	
15	Capacity of EOT crane	60/15MT	

TAIL RACE CHANNEL

S. No.	Description	Particulars
1	Size	2500mm x 2000mm
2	Length (m)	20.00

SWITCHYARD

S. No.	Description	Particulars
1	Capacity	132kV
2	Elevation	1773.0m
3	Size	30m x 50m

ELECTRO-MECHANICAL EQUIPMENT

S. No.	Description	Particulars
1	Turbine	Type Horizontal Axis Pelton Turbine Nos. 03 Capacity 8.0 MW Rated Head 599m Rated Dis. 1.57m^3/sec Overload 10%
2	Generator	Type Synchronous Nos. 03 Capacity 8.0MW Power Factor 0.85pf Rated Voltage 11kV Frequency 50Hz

INFRASTRUCTURE

S. No.	Description	Particulars
1	Realignment of Patli Kuhal-Shila Raod near Power House	100m
2	Construction of Motorable road to Power house	30m
3	Construction of Mule Track from Pankot to Adit- 3&4m	1.0km
4	Construction of Mule Track in the Diversion site area of Sanjoin and Bijara	1.0km
5	Development of Mule Track from Pankot to off taking point for Adit 2	3.5km
6	Development of Mule Track from Patli Kuhal-Shila road to Galun village	4.0km
7	Ropeway	06 Nos.
8	Steel bridge on Bijara Nalla to the u/s of Bijara Trennch Weir for access to Sanjoin Tunnel Outlet Portal	12.5m
9	Strengthening of wooden bridge across Bijara Nalla to facilitate transportation of construction material to Galun village	12m.

ENERGY BENIFIT

S. No.	Description	Particulars
1	Annual Energy Generation in 75% dependable year with 95% plant availability	98.12MU

CONSTRUCTION PERIOD

S. No.	Description	Particulars
1	Construction Period of Infrastructure	6 months
2	Construction Period of Main activities	30 months

ESTIMATED COST

S. No.	Description	Particulars (Cost in lacs)
1	Pre-Operative Expenses	1348.12
2	Land Cost	513.96
5	Civil Cost	4792.45
6	E&M Cost	5436.06
7	H & M Works Cost	971.41
8	Transmission Line Cost	333.05
9	Engg. & Consultancy	300.00
10	Total Cost	13695.04
11	Escalation during construction	684.75
12	Interest during construction	2329.01
13	Financial Management Charges	99.79
14	**Capital cost of the project**	**16808.60**

FINANCIAL ASPECTS

S. No.	Description	Particulars
1	Cost per MW	7.00 lacs
2	Rate of Interest of Loan	11.50%
3	Tariff Rate (for sale)	Rs. 3.50/kwh
4	Fee Power for first 12 years	12%
5	Tariff Cost (First year)	Rs. 3.83/kwh
6	IRR (After Tax)	12%

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CHAPTER-3
STUDY OF CATCHMENT AREA TREATMENT-BARAGAON SHP

3.1 INTRODUCTION

The proposed Baragaon S. H. E. Project is located near the Halan-II village, Patlikuhal, in the Kullu district of Himachal Pradesh. The proposed project falls under the Kullu forest division of Kullu district. The Baragaon S. H.E. Project proposed to utilize water from Sanjoin and Bijara nallas for generation of 24 MW of power. The diversion weir sites at Sanjoin and Bijara nallas are located at latitude of 32° 10' 29.99", 32° 09' 35" and longitude 77° 07' 28.86", 77° 06' 21.68, respectively at an elevation of 2396 m and 2385 m above mean sea level. The power house site is located at latitude 32°8'30.25''and longitude 77°07'53.52'' at an elevation of 1773 m above mean sea level. The area around the proposed project is located in the Lesser Himalaya in Beas Basin and is characterized by sharp crested ridges and deeply dissected valleys.

The Sanjoin Nalla stream, which originates as a small stream, called Khapri Khol that rises from the Sagor Jot near Kaliani Pass (32° 13' N, 77° 03' E) in the Lower Himalayas at an elevation of about 4800 m above mean sea level (amsl) in Kullu district. After flowing in the south-easterly direction for about 2 km, it (Khapri Khol) is joined by another stream arising from Taluapet Glacier at an elevation of about 4400 m amsl (32° 11' N, 77° 4' E). The combined stream flows in the easterly direction for about 2 km and is joined by Dopu ka Nal (Dopu Ka Nalla; 32°12' 12''N, 77°5' 46''E) at an elevation of about 3300 m amsl. The combined stream, namely Sanjoin Nalla, then forces its way through the lower Himalayan range (Kullu district). After flowing in the south and south-easterly direction for about 6.5 km, it is joined by its right bank tributaries namely, Bijara Nalla near Reglikut at an elevation of about 2200 m amsl, and, Kanighatra Nalla near Aron at an elevation of about 1800 m amsl. The main stream flows further south and south-east to join river Beas on its right bank near Joindi at an elevation of about 1480 m amsl. A small hydro project site, namely KKK Hydro, is located on Sanjoin Nalla before its confluence with river Beas (32°8'7.97''N, 77°8'11.51''E).

There are two major sub-basins in the Baragaon watershed namely, the Sanjoin sub-basin and the Bijara sub-basin. The total catchment area at proposed diversion sites on Sanjoin Nala is 36.92

sq km and on Bijara Nala 10.54 sq km. Maximum and minimum snowlines have been observed at 3600 m and 4500 m respectively.

Figure 3.1 gives the extent and location of the Baragaon watershed and the catchment area considered for the present study is given in Figure-3.2 as raw satellite imagery.

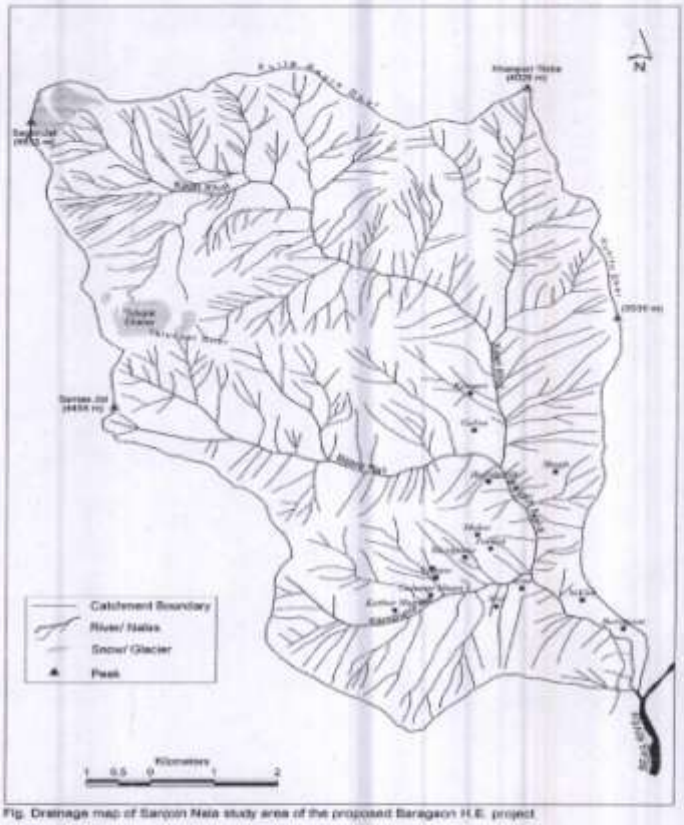
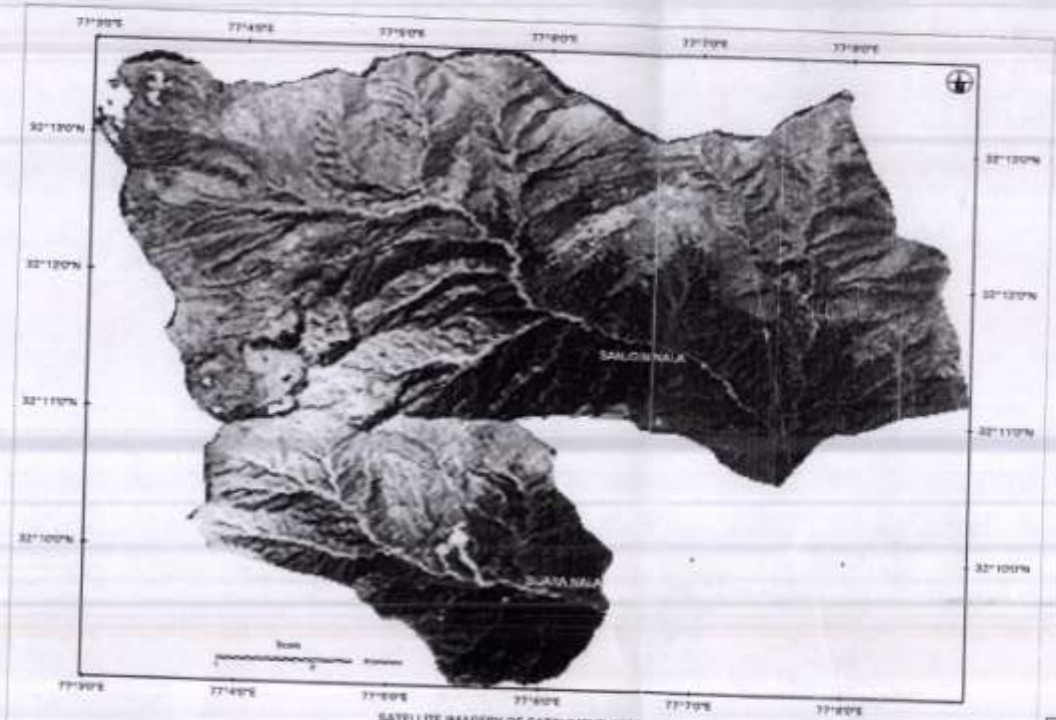


Fig. Drainage map of Sangon Nala study area of the proposed Baragaon H.E. project

Figure 3.1



SATELLITE IMAGERY OF CATCHMENT AREA

Figure 3.2

3.2 NEED FOR CATCHMENT AREA TREATMENT

It is utmost importance to study the sedimentation and erosion from catchment as the deposition of sediment affects the water availability for the designated use. The process of sedimentation embodies the sequential processes of erosion, entrainment, transportation, deposition and compaction of sediment. The eroded sediment from catchment when deposited on streambeds and banks causes braiding of river reach and leads to serous soil erosion problems. Thus, a well-designed Catchment Area Treatment (CAT) Plan is essential to ameliorate the above-mentioned adverse process of soil erosion.

Soil erosion may be defined as the detachment and transportation of soil. Water is the major agent responsible for this erosion. In many locations, winds, glaciers, etc. also cause soil erosion. In a hilly catchment area, as in the present case, erosion due to water is a common phenomenon and the same has been studied as a part of the Catchment Area Treatment (CAT) Plan. Soil erosion leads to:

- loss in production potential
- reduction in infiltration rates
- reduction in water-holding capacity
- loss of nutrients
- increase in tillage operation costs
- reduction in water supply

The Catchment Area Treatment (CAT) plan highlights the management techniques to control erosion in the catchment area of a water resource project. Adequate preventive measures are thus needed for the treatment of catchment for its stabilization against future erosion.

The catchment area treatment involves

- Understanding of the erosion characteristics of the terrain and,
- Suggesting remedial measures to reduce the erosion rate.

In the present study '**Silt Yield Index' (SYI)**, method has been used. In this method, the terrain is subdivided into various watersheds and the erodibility is determined on relative basis. SYI provides a comparative erodibility criteria of catchment (low, moderate, high, etc.) and do not provide the absolute silt yield. SYI method is widely used mainly because of the fact that it is easy to use and has lesser data requirement. Moreover, it can be applied to larger areas like sub-watersheds, etc.

was used to estimate the soil loss. The formats of outputs from each layer were firmed up to match the formats of inputs in the program. The grid size to be used was also decided to match the level of accuracy required, the data availability and the software and time limitations. Ground truthing and data collection was also included in the procedure.

For the present study, IRS P6-LISS III digital satellite data was used for interpretation & classification. The data has been procured in raw digital format and has been geo-referenced using Survey of India topographical sheets with the help of standard data preparation techniques in standard image processing software. The interpretation of geo-referenced satellite data has been done using standard enhancement techniques, ground checks and experiences of qualified professionals. A detailed ground truth verification exercise has been undertaken as a part of field survey to enrich the image interpretation process. The classified land use map of the catchment area, considered for the study, is shown as Figure-3.3. The land use pattern of the catchment area is summarized in Table-3.1.

Table 3.1: Land use classification for catchment at diversion sites

Landuse/Landcover	Area in percentage	Area in sq km
River/Water Bodies	1.19	0.57
Open Areas	32.46	15.41
Agricultural Areas	1.48	0.70
Dense Vegetation	21.93	10.41
Light Vegetation	4.70	2.23
Shrubs/Bushes/Grasses	34.55	16.40
Snow Covered Areas	1.78	0.85
Settlement/Exposed rocks	1.91	0.91
Total	**100.00**	**47.46**

LANDUSE CLASSIFICATION OF CATCHMENT AREA

Figure 3.3

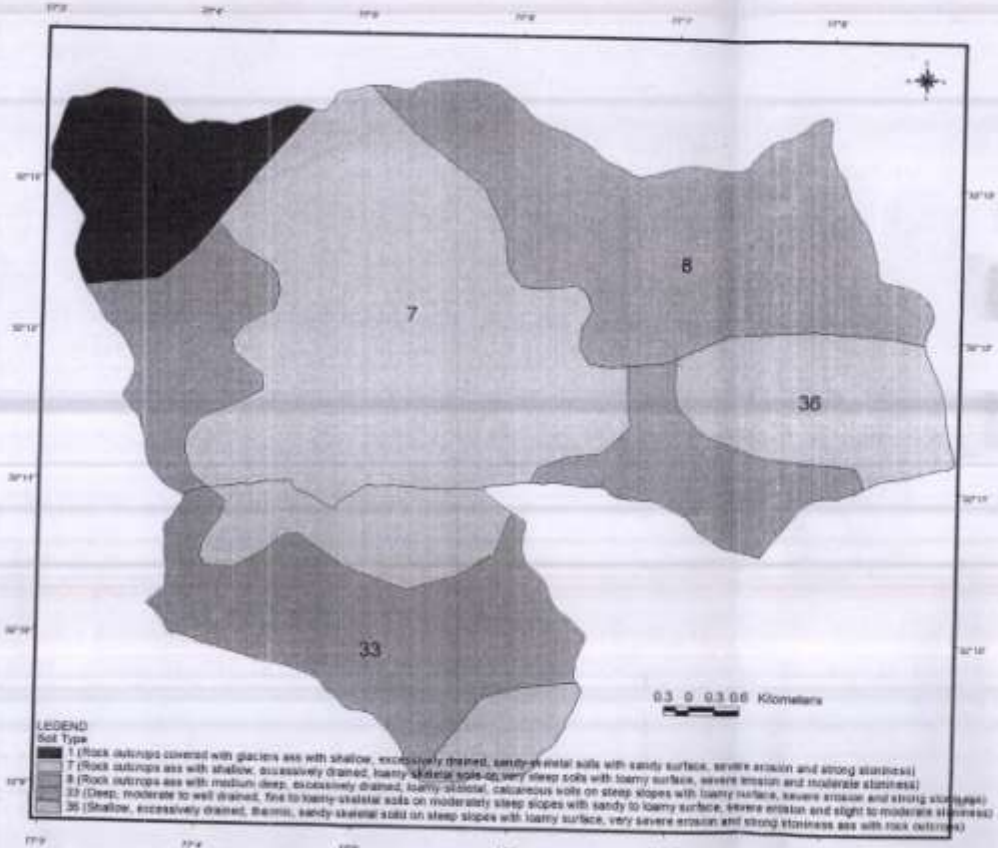
Derived contours from topographical maps were used for preparation of Digital Elevation Model (DEM) of the catchment area and to prepare a slope map. The first step in generation of slope map is to create surface using the elevation values stored in the form of contours or points. After marking the catchment area, all the contours on the topographical maps were derived. The output of the digitisation procedure was the contours as well as points contours in form of x, y & z points. (x, y - location and z - their elevation). All this information was in real world co-ordinates (latitude, longitude and height in meters above sea level).

A Digital Terrain Model (DTM) of the area was then prepared, which was used to derive a slope map. The slope was divided in classes of slope percentages. The areas falling under various standard slope categories have been tabulated below in Table 3.2. The slope map is enclosed as Figure-3.4.

Table-3.2: Areas falling under different slope categories

Slope category (percentage)	Area in percentage	Area in sq km
0-15	3.66	1.74
15-30	6.14	2.91
30-45	15.22	7.22
45-60	21.90	10.39
60-75	22.57	10.71
> 75	30.52	14.48
Total	**100.00**	**47.46**

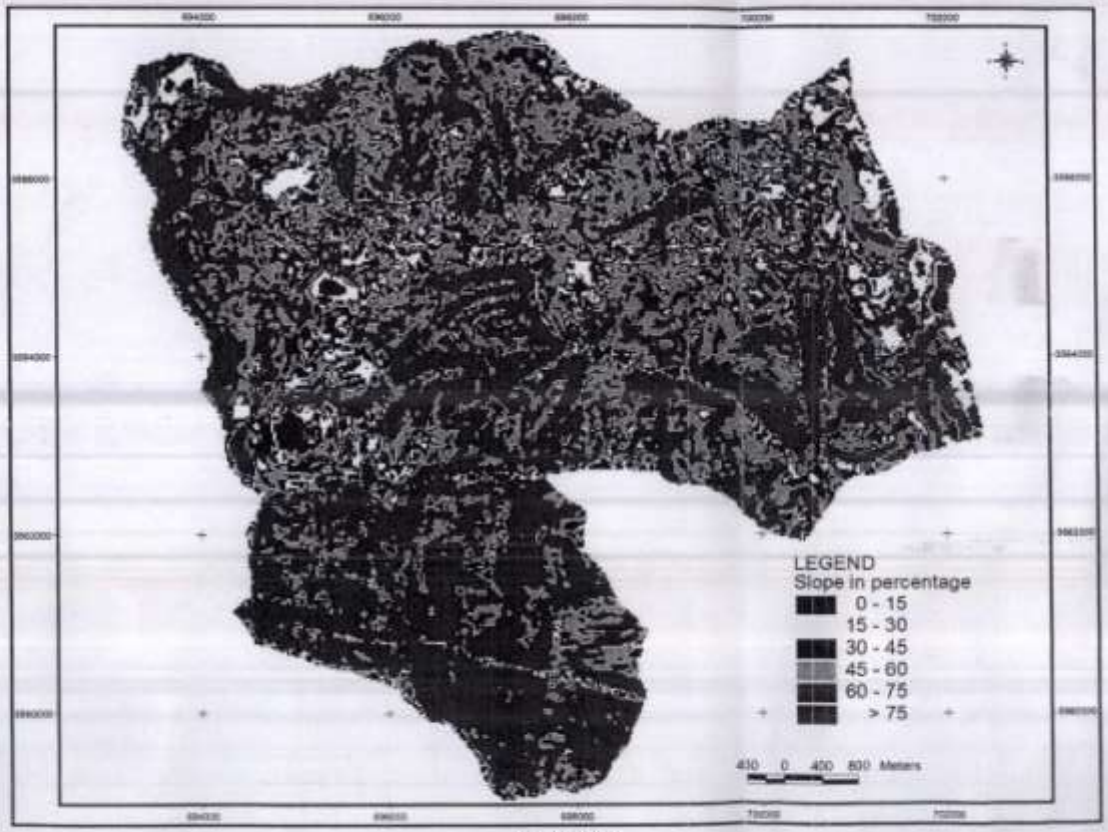
Soil map has been digitized and produced using soil maps collected from Natural Resources Atlas of Himachal Pradesh. Various layers, thus prepared, were used for Modeling. Soil map has been shown as Figure 3.5. The legend for soil classes has been given subsequently.



SOIL MAP

Figure 3.5

KANCIL



SLOPE MAP

Figure 3.4

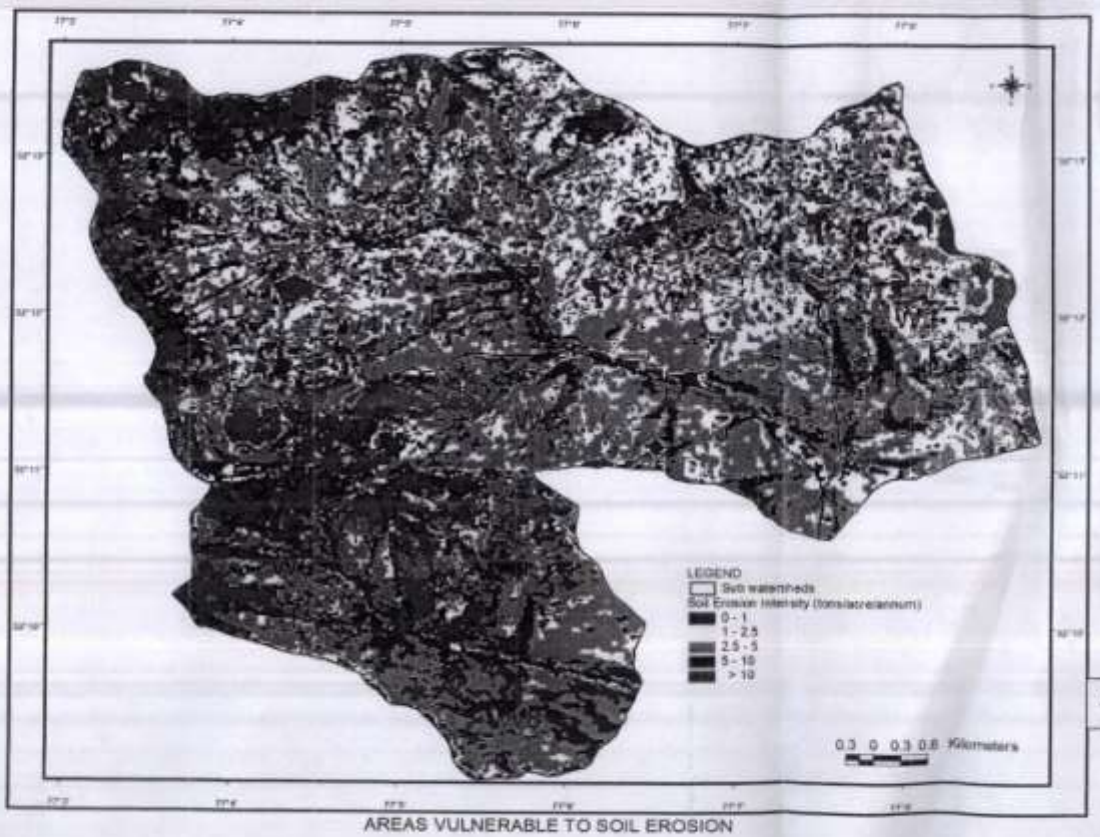
Software was prepared using standard modeling techniques to calculate the soil loss using input from all the layers as described below:

Modeling: The river catchment area has been divided into small grids of 25m*25m. The vector layer so generated of 25 m grid size was updated by land use/ land cover details, soil information and slope values in GIS software using different maps as generated above. Soil loss has then been calculated for each grid using modeling techniques through information derived from updated grids with the help of a customized computer software/program.

A thematic map has been prepared using these calculated soil erosion values for delineating areas prone to soil erosion in the catchment area. The percentages of catchment area falling in different soil vulnerability classes are given in Table 3.3 and shown in Figure 3.6

Table 1.3: Soil loss ranges for the river catchment

S. No.	Soil loss range in tons/acre/annum	Area in sq km	Area in percentage
1	< 1	6.52	13.73
2	1 – 2.5	9.85	20.76
3	2.5 – 5.0	15.97	33.65
4	5.0 – 7.5	6.77	14.27
4	7.5 – 10.0	3.44	7.24
6	> 10.0	4.91	10.35
	Total	47.46	100.00



AREAS VULNERABLE TO SOIL EROSION

Figure 3.5

3.4.1 Output Presentation

The result of the modeling was interpreted in pictorial form to identify the areas with high soil erosion rates. The primary and secondary data collected as a part of the field studies were used as an input for the model.

3.4 ESTIMATION OF SOIL LOSS USING SILT YIELD INDEX (SYI) METHOD

In '**Silt Yield Index' (SYI)**, method, the terrain is subdivided into various watersheds and the erodibility is determined on relative basis. SYI provides a comparative erodibility criteria of catchment (low, moderate, high, etc.) and do not provide the absolute silt yield. SYI method is widely used mainly because of the fact that it is easy to use and has lesser data requirement. Moreover, it can be applied to larger areas like sub-watersheds, etc.

The Silt Yield Index Model (SYI), considering sedimentation as product of erosivity, erodibility and arial extent was conceptualized in the All India Soil and Land Use Survey (AISLUS) as early as 1969 and has been in operational use since then to meet the requirements of prioritization of smaller hydrologic units within river valley project catchment areas.

The erosivity determinants are the climatic factors and soil and land attributes that have direct or reciprocal bearing on the unit of the detached soil material. The relationship can be expressed as:

Soil erosivity = f (Climate, physiography, slope, soil parameters, land use/land cover, soil management)

Silt Yield Index

The Silt Yield Index (SYI) is defined as the Yield per unit area and SYI value for hydrologic unit is obtained by taking the weighted arithmetic mean over the entire area of the hydrologic unit by using suitable empirical equation.

Prioritization of Watersheds/Sub-watersheds

The prioritization of smaller hydrologic units within the vast catchments is based on the Silt Yield Indices (SYI) of the smaller units. The boundary values or range of SYI values for different priority categories are arrived at by studying the frequency distribution of

SYI values and locating the suitable breaking points. The watersheds/ sub-watersheds are subsequently rated into various categories corresponding to their respective SYI values.

The application of SYI model for prioritization of sub-watersheds in the catchment areas involves the evaluation of:

a) Climatic factors comprising total precipitation, its frequency and intensity,
b) Geo-morphic factors comprising land forms, physiography, slope and drainage characteristics,
c) Surface cover factors governing the flow hydraulics and
d) Management factors.

The data on climatic factors can be obtained for different locations in the catchment area from the meteorological stations whereas the field investigations are required for estimating the other attributes.

The various steps involved in the application of model are:

- Preparation of a framework of sub-watersheds through systematic delineation
- Rapid reconnaissance surveys on 1:50,000 scale leading to the generation of a map indicating erosion-intensity mapping units.
- Assignment of weightage values to various mapping units based on relative silt-yield potential.
- Computing Silt Yield Index for individual watersheds/sub-watersheds.
- Grading of watersheds/sub-watersheds into very high, high, medium, low and very low priority categories.

The area of each of the mapping units is computed and silt yield indices of individual sub-watersheds are calculated using the following equations:

a. Silt Yield Index

To calculate silt yield index, the methodology developed by All India Soil & Land Use Survey (Department of Agriculture, Govt. of India) has been followed, where each erosion intensity unit is assigned a weightage value. When considered collectively, the weightage value represents approximately the relative comparative erosion intensity. A basic factor of K = 10 was used in determining the weightage values. The value of 10 indicates a static condition of equilibrium between erosion and deposition. Any addition to the factor K (10+X) is suggestive of erosion in ascending order whereas subtraction, i.e. (10-X) is indicative of deposition possibilities.

Delivery ratios were adjusted for each of the erosion intensity unit. The delivery ratio suggests the percentage of eroded material that finally finds entry into reservoir or river/ stream. Area of each composite unit in each sub-watershed was then estimated.

Silt yield index (SYI) was calculated using following empirical formula:

$$SYI = \frac{\Sigma (Ai * Wi) * Di * 100}{Aw} ; \quad \text{where } i = 1 \text{ to } n$$

where,

Ai	=	Area of i^{th} unit (EIMU)
Wi	=	Weightage value of i^{th} mapping unit
n	=	No. of mapping units
Aw	=	Total area of sub-watershed.
Di	=	Delivery ratio

Delivery ratios are assigned to all erosion intensity units depending upon their distance from the nearest stream. The criteria adopted for assigning the delivery ratio are as follows:

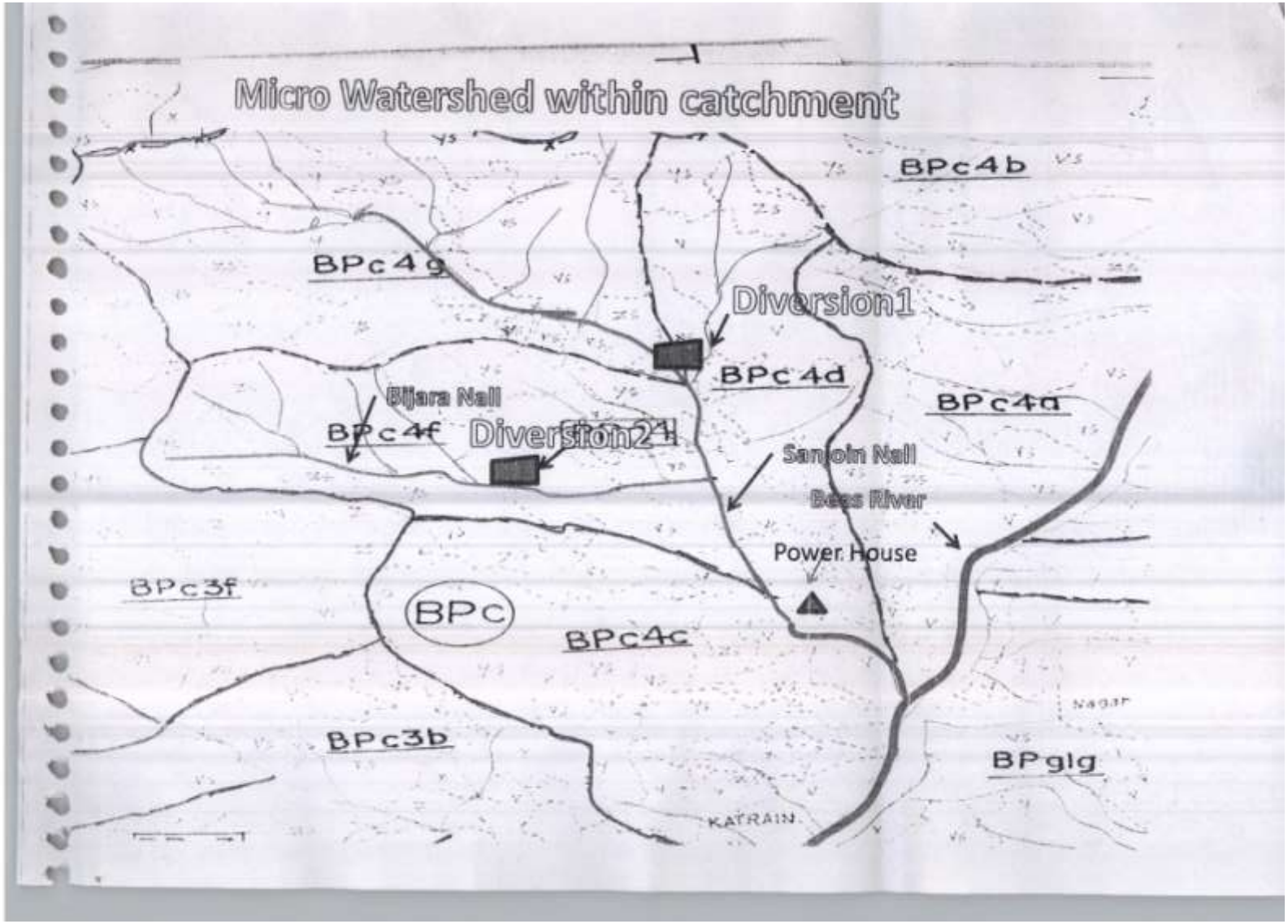
Nearest Stream	Delivery ratio
0 - 0.9 km	1.00
1.0 - 2.0 km	0.95
2.1 - 5.0 km	0.90
5.1 - 15.0 km	0.80
15.1 - 30.0 km	0.70

The SYI values for classification of various categories of erosion intensity rates are given in Table-3.4.

Table 3.4: Criteria for erosion intensity rate

Priority categories	SYI Values
Very high	> 1300
High	1200-1299
Medium	1100-1199
Low	1000-1099
Very Low	<1000

The erosion category of various watersheds in the catchment area as per a SYI index has been estimated. The objective of the SYI method is to prioritize sub-watershed in a catchment area for treatment. The area under very high and high erosion categories is to


Micro Watershed within catchment
BPc4b
BPc4g
Diversion1
BPc4d
Bijara Nall
BPc4f
Diversion2
BPc4a
Sanjoin Nall
Beas River
Power House
BPc3f
BPc
BPc4c
BPc3b
BPg1g
KATRAIN

be treated at the project proponent's cost. Hence, CAT plan shall be suggested for very high and high erosion categories, the expenses of which have to be borne by project proponents.

3.5 MICRO WATERSHED IN THE CATCHMENT

There are the following sub- watersheds spread in the Baragoan catchment/project site as per the All India Land & Soil's Land use survey organization New Delhi in Agriculture Report No.455,as shown in map 3.8

Watershed Code	Area in Ha.	Priority	Sediment yield Index	Total Area
BPC4G	2012	H	1205	2012
BPC4F	1796	M	1149	1796
BPC4D	570	M	1135	1140
BPC4C	400	VH	1250	2308
Total Micro water Shed Area in Project Site	4778			

The above micro watersheds in the catchment area have been depicted in the topo-sheet shown in Figure 3.8.

3.6 WATERSHED MANAGEMENT – AVAILABLE TECHNIQUES

Watershed management is the optimal use of soil and water resources within a given geographical area so as to enable sustainable production. It implies changes in land use, vegetative cover, and other structural and non-structural action that are taken in a watershed to achieve specific watershed management objectives. The overall objectives of watershed management programme are to:

- increase infiltration into soil;
- control excessive runoff;
- manage & utilize runoff for useful purpose.

2. **Biological measures**

- Development of nurseries
- Plantation/afforestation
- Pasture development
- Medicinal development
- Social forestry

The basis of site selection for different biological and engineering treatment measures under CAT are given in Table-3.5.

Table 3.5: Basis for selection of catchment area treatment measures

Treatment measure	Basis for selection
Social forestry, fuel wood and fodder grass development	Near settlements to control tree felling
Contour Bunding	Control of soil erosion from agricultural fields.
Pasture Development	Open canopy, barren land, degraded surface
Afforestation	Open canopy, degraded surface, high soil erosion, gentle to moderate slope
Barbed wire fencing	In the vicinity of afforestation work to protect it from grazing etc.
Step drain	To check soil erosion in small streams, steps with concrete base are prepared in sloppy area where silt erosion in the stream and bank erosion is high due to turbidity of current.
Nursery	Centrally located points for better supervision of proposed afforestation, minimize cost of transportation of seedling and ensure better survival.

CHAPTER – 4

SOCIO-ECONOMIC ASPECTS

4.1 INTRODUCTION

Development projects are planned based on the availability of exploitable natural resources and on commissioning they act on growth foci. This attracts flow of finances, investments, jobs and other livelihood opportunities, which brings in people from different cultural and social background. Such planned activities not only provide impetus to the local economy but also bring about a multi-dimensional economic, social and cultural change. Most often it has been observed that such development projects are commissioned in economically and socially backward areas, which are inhabited by some of the indigenous populations. Commissioning of development project invariably brings about a number of desired and undesired impacts along with it.

Himachal Pradesh is one of the highest per capita incomes among the states of India. Due to the abundance of perennial rivers, Himachal Pradesh sells hydro electricity to other states such as Delhi, Punjab & Rajasthan. The economy of the state is mainly dependent on three sources like hydroelectric power, tourism and agriculture resources. Himachal is surrounded by Jammu and Kashmir on north, Punjab on west and south-west, Haryana and Uttar Pradesh on south, Uttarkhand on south-east and by Tibet on the east. The literal meaning of this state is region of snowy mountains.

The state of Himachal Pradesh lies between 32^0 22' 40'' to 33^0 12' 40'' N latitudes and 75^0 45' 55'' to 79^0 04' 20'' E longitudes. It is bounded by Jammu & Kashmir in the north, Tibet in the east, Uttarakhand in the south-east and Punjab and Haryana in the south. The state has geographic area of 55,673 sq km demarcated into 12 districts, 109 tehsils/sub-tehsils and 57 urban areas with a human population of 6,077,900 (Census of India, 2001). The state is divided into twelve districts (Bilaspur, Chamba, Hamirpur, Kangra, Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur, Solan and Una). The districts are further sub-divided into sub-divisions, tehsils and sub tehsils. The people are predominantly Hindus (95.43%) with sprinkling of muslims (1.97%), Christians (0.13%), Sikhs (1.19%), Buddhist (1.25%) and Jains (0.02%). The

population presents an admixture of Gaddis, Gujjars, Kinnars, Lahaulis and Pangawals. Hinduism is the predominant religion followed in this state.

According to the 2001 census, the population of Himachal Pradesh is 60.8 lakh, in which the male population has 30.9 lakh and the female is 29.9 lakh (Table 3.32). The population of Scheduled Tribes and Scheduled Castes is 2.4 lakh and 15 lakh, respectively. The total inhabited villages in state are 17,495 whereas number of towns and cities is 57 only. The state has 12 districts, 51 sub-divisions, 75- tehsils, 34 sub- tehsils and 75 blocks.

The prominent rivers arising from mountainous areas of Himachal are Sutlej, Beas, Parbati and Ravi – all south and southwest flowing rivers. The perennial availability of water and the geographic terrain have allowed harnessing of hydro-energy from these rivers. The present project proposed by Kanchanjunga Power Company Pvt. Ltd. is one such scheme in the state.

The Baragaon H.E. project is located on Sanjoin nalla (Tributary of Beas River) and Bijara nalla (Tributary of Sanjoin Nalla) in district Kullu, proposes to utilize water from these Nallas for generation of 24MW of power. The catchment area of Sanjoin Nalla is 36.92 sq km and Bijara Nalla is 10.54 sq km. The project involves construction of a trench weir, Intake Box Channel, Desilting basin and 2620 m long tunnel to divert and convey the Sanjoin water upto left bank of Bijara Nalla at a location to the upstream of Bijara intake. For making an assessment of the socio-economic status of the area field surveys were conducted in the villages around the proposed project. This information was supplemented with secondary sources like Primary Census Abstracts and Statistical Handbook of District Kullu.

I. Kullu District

Kullu is a sparsely populated, centrally located district of the state. It is bounded on the North and East by Lahul & Spiti district, on the Southeast by Kinnaur district, on the South by Shimla district, on the Southwest and West by Mandi district and on the Northwest by Kangra district. The entire stretch from Kullu to Mandi, has gentle slopes patched with fields and apple orchards against the blackdrop of lush green mountain ranges. Kullu town, the district headquarters, is easily accessible by road on national highway number 21 (NH-21); 70 km. from Mandi and 312 km. from Chandigarh.

The Kullu district consists of 4 sub-divisions, 4 tehsils and 2 sub tehsils namely Sainj and Ani. There are 204 gram panchayats in the district. It has 5 development blocks.

The proposed Baragaon H. E. Project is located at about 3.5 km from Patli Kuhal and connected from Patli Kuhal-Shila road. Patlikuhal is situated on Manali – Kullu National Highway.The nearest railway stations are at Kiratpur Sahib and Chandigarh located at a distance of about 238 km and 320 km respectively from the project site. The nearest airport is at Bhuntar, about 30 km from power house site. Patli Kuhal is well connected to the district headquarter Kullu with a 20 km long motorable road. Patli Kuhal is also headquater of development block Nagar.

According to the 2001 census, total human population of district Kullu is recorded to be 381571. Of this population 51.8% are males and 48.1% females. The rural population of the district accounts for 92.1%, while the urban population is only 7.8%. The population of Scheduled Castes and Scheduled Tribes are 107897 and 11351 respectively (Table 4.1). The Scheduled Castes population constitutes 28.2% of the total human population while Scheduled Tribes constitute 2.97% of the total population of the district. Total literacy rate in the district is 72.9% in which male has 85.7% and female has 65.7%. The literacy rate in the district is higher than other neighbouring Himalayan states. The population structure of district Kullu shows that the population is predominantly Hindu (92.31%), followed by Muslims, Sikhs, Christians and Jains. The Hindu population is comprised of Brahmins, Rajputs, Scheduled Castes and Scheduled Tribes. The sex-ratio of Kullu district is 927. The density of population in the district is 68 persons per sq km.

Pahari and Hindi is the main spoken language of the district in rural areas while in urban areas Hindi, Urdu and Punjabi is spoken commonly. The staple food of the people is rice, wheat, maize and barley and minor millets. Besides agriculture, livestock rearing is an important occupation of villagers which plays an important part in their economy. Cows, buffaloes, sheep, goats, etc. are the common animals reared by the rural communities for milk, ploughing of fields, dung, meat and wool. The climate varies from sub-temperate to sub-arctic. Forests and forest produce along with tourism sustain the economy of the district. Horticulture also plays an important part in the

	Himachal Pradesh			District Kullu			Tehsil Manali		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Lit. Rate (%)	76.5	75.1	88.9	72.9	71.6	88	76.8	76	81
Sex Ratio	968	989	795	927	940	782	832	885	569

SC=Scheduled Castes, ST=Scheduled Tribes, HH=households, (***Source*: Census, 2001**)

II Manali Tehsil

The proposed Baragaon H.E. project lies in the tehsil Manali, which covers an area of about 3551 sq km. Manali is located about 40 km away from Kullu town. Total number of village panchayats in Manali tehsil is 19 of with 9627 households. The population density of Manali Tehsil is 832 persons/sq km.

a) Demographic Profile

According to 2001 census the population of Manali Tehsil is about 44,212, of which male and female population is 24,129 (54.5%) and 20,083 (45.4%), respectively (Table 4.2). The age group of 0-6 years constitutes only 11.4% (5,048) of the total population (Table 3.32). Scheduled Castes comprise 16.3% of the total population with more or less similar sex ratio. Scheduled Tribes constitute about 10% of the total population. Out of the total population of Manali 46.3% have been recognised as main workers of which 64.6% are males and 35.3% are females. The marginal workers constitute 13.8% of the total population, which is dominated by females.

The various project components come under Nagar development block, which has 37 villages. Total population of Nagar block is 87,080. The Scheduled Castes (SC) and Scheduled Tribes (ST) population are 19,617 and 6889 respectively. The population in the age group of 0-6 years accounts 11,439. The sex ratio in Nagar block is 932 while in Manali tehsil it is 832.

Table 4.2: Demographic profile of Manali Tehsil and Nagar Block

S.No.	Demographic Attributes	Tehsil Manali	Nagar Block
1	Number of Villages	19	37
2	Total Population	44212	87080
3	Male Population	24129	45,056
4	Female Population	20083	42024
5	SC	7207	19617

S.No.	Demographic Attributes	Tehsil Manali	Nagar Block
6	ST	4460	6889
7	Literacy	76.7	72.4
8	Sex Ratio	832	932

SC=Scheduled Castes, ST=Scheduled Tribes, HH=households, ***(Source: Census, 2001)***

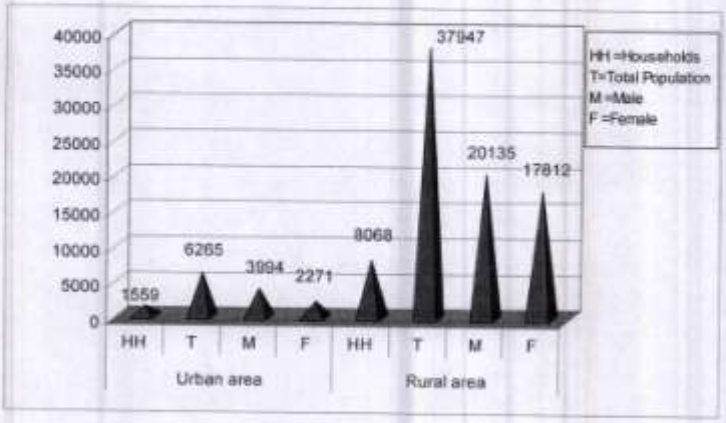


Figure 4.1: Population in Rural and Urban areas of Manali Tehsil

b) Educational Profile

As per 2001 census, the literacy rate in Manali tehsil is about 76.7% while in Nagar block it is about 72.4 % (**Table 4.3**). In comparison to males (85.4%) literacy in females is low (65.6%). There is one Government degree college in Kullu. There is lack of secondary and senior secondary schools as compared to primary education facilities. According to census (2007-08) there is one Post Graduate college at Manali tehsil (**Table 4.3**).

Table 4.3: Educational profile of Manali Tehsil and Development Block Nagar

	No. of Educational Institutions			
	PS	MS	SSC	College
Manali Tehsil	60	12	10	1
Nagar Block	140	24	10	0

PS=Primary School, MS=Middle School, SSC=Senior Secondary School (***Source: Census, 2007 - 08***)

c) Health Care Facilities

There are only 2 hospitals in the entire Kullu district (**Table 4.4**). There is only 1 Community Health Centre, one Child Welfare Centre and 2 Primary Health Centers and 14 sub – centers located in the Manali Tehsil. There is one CHC located in Patli Kuhl.

Table 4.4: Number of hospitals and health centers in Kullu district and Manali Tehsil

	Allopathic	PHC	PHSC	CWC
Manali Tehsil	1	2	15	1
Nagar Block	0	1	28	2

PHC= Primary health centre, PHSC= Primary health sub centre, CWC= Child welfare centre. (**Source: Census, 2001**)

d) Occupation Pattern

Agriculture has traditionally been the major feature of Himachal Pradesh's economy. Besides this the economy of the villages in the area depends mainly on the government and non-government services. The major cash crops like Paddy, Maizes, Rajmas, Potato, Apple, etc., are found in this area. About 43.6% of the total population falls in the main workers category in whole Kullu district while 46% of the total population in Manali Tehsil falls in the main worker category (**Table 4.5**).

Table 4.5: Occupation pattern in Manali Tehsil

Work Force			Main Worker			Marginal worker			Non worker		
T	M	F	T	M	F	T	M	F	T	M	F
26613	15911	10702	20503	13245	7258	6110	2666	3444	17599	8218	9381

T = Total, M = Male, F = Female (***Source*: Census, 2001**)

f) Houses and Equipment

In the rural areas, majority of houses are single storeyed, the roofs are sloping designed for the snowfall resistance and made of slates or shingles. The walls of houses are generally built of stone and wood. The timber mainly comprises of Toon, Kail and Deodar. In Manali proper modern designed houses have also come up. Charpai, mats of paddy straws, Kharchas and Asans are the common items of household furniture in the interior villages. Wooden boxes and steel trunks are found in each house for valuable things and clothes. However, these items are nowadays being replaced by chairs, tables and sofa sets.

4.2 SOCIO-ECONOMIC STATUS IN THE STUDY AREA

The main objectives of the present study was to assess the socio-economic status of the villages in the study area based upon information collected from the primary and secondary sources **(Fig.4.3)**. Secondary data/information was collected from published sources mainly from Census of India – Census Data, 2001 and also from district gazetteers and statistical handbook. Primary data has been collected by Village level survey using a customized questionnaire for the purpose. Interactions with the local people especially with the village Pradhan and eminent persons was undertaken to collect first hand information.

The project study area is spread across 6 panchayats namely Baragaon, Hallan - II, Shigli, Bari, Riyara and Pangan (**Table 4.7**). Most of the people, living in these panchayats are rajputs. All the main component of Baragaon H.E. Project lies in the Hallan-II village panchayat. This village panchayat comprises Makot, Pankot, Shila, Khaseri, Gulun etc. small villages.

This section deals with the overall village summary of the socio-economic standards and the amenities available to the local people living therein.

a. Demographic Profile

The numbers of households are 1338 and the total human population of these villages is 6730 of which 1122 belong to schedule castes and 855 belong to schedule tribe; which constitutes the maximum population. The maximum number of households is in Bari panchayat having the total population of 2337 and the least number of households is in Shigli village with population of

387. There is no Schedule caste in Shigli and Riyara village panchyat. The demographic profile of villages in study area is given in **Table 4.8**

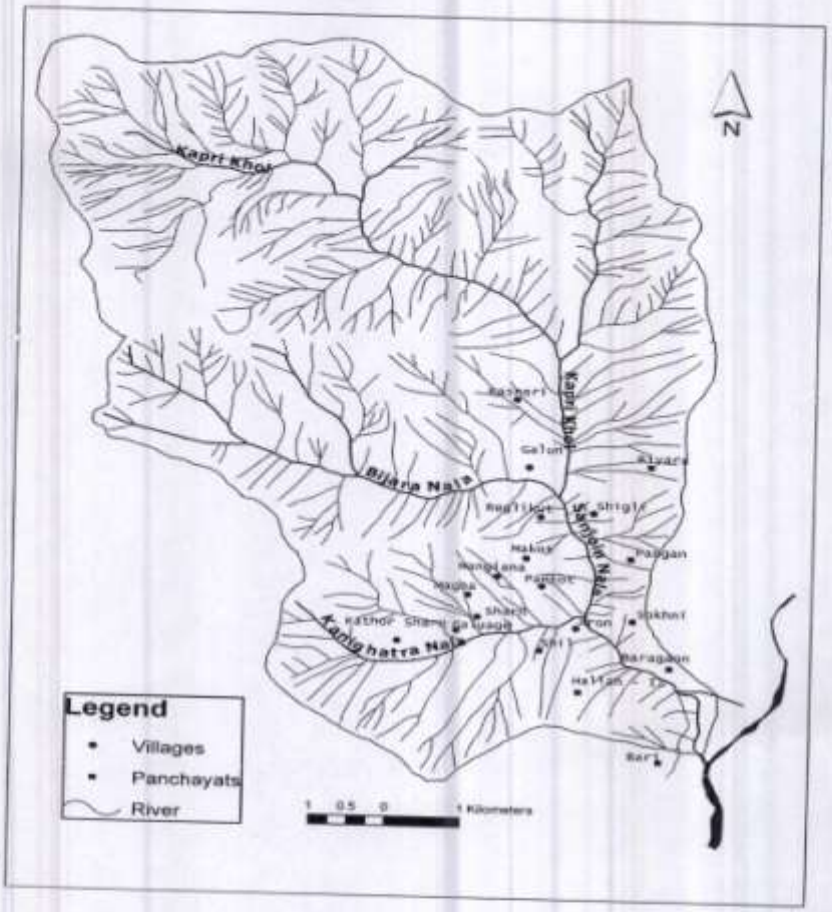


Figure 4.3: Map showing villages in the study area

Table 4.8: Demographic Profile of the Village Panchayats in and around the project area

S. No.	PANCHAYAT	HH	Total Population			Scheduled Castes			Scheduled Tribes		
			T	M	F	T	M	F	T	M	F
1	Baragaon	361	1631	845	786	433	214	219	217	110	107
2	Hallan-II	157	737	386	351	38	23	15	0	0	0
3	Shigli	81	387	204	183	0	0	0	2	1	1
4	Bari	370	2337	1207	1130	545	278	267	266	138	128
5	Riyara	120	669	328	341	0	0	0	87	44	43
6	Pangan	249	969	456	513	106	54	52	283	113	170
	TOTAL	**1338**	**6730**	**3426**	**3304**	**1122**	**569**	**553**	**855**	**406**	**449**

(HH = Households, M= Male, F= Female, T= Total, **(Source: Census 2001)**

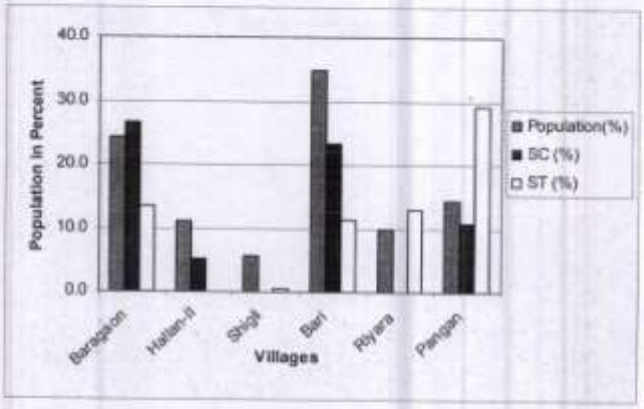


Figure 4.4: Population structure in study area village panchyats

b. People and Culture

The people living in the villages are predominantly Hindus. They are generally co-operative to each other and the society is characterized by simplicity and egalitarian values. Women enjoy a high status and old people are given due respect and reverence. Fairer skin and hazel-colored eyes are commonly seen among the people. Their main languages are a mixture of Hindi and Pahari.

The culture of the people is same as the Hinduism culture. As fairs and festivals symbolizes the whole meaning of life, even in the toughest condition of existence people forget all their worries and tensions to make most of the festivity. Especially in the mountainous region festival adds extra charm and beauty to nature. A large number of fairs and festivals are organized in this Valley.

c. Educational Profile

The educational profile of the people in the study area is not satisfactory. There are 10 primary schools, 3 middle schools; only one senior secondary schools (Pangan Village) in the entire study area. There is no college in the related panchayats. The maximum literate people are in Bari panchayat. The (**Table 4.9**) shows the educational profile of villages in study area.

Table 4.9: Number of Educational institutions in the study area

S. No.	Panchayat	Primary School	Middle School	Senior Sec. School	College	Literacy		
						T	M	F
1	Baragaon	2	1	0	0	1116	661	455
2	Hallan-II	2	1	0	0	358	218	140
3	Shigli	2	0	0	0	221	135	86
4	Bari	2	0	0	0	1640	919	721
5	Riyara	1	0	0	0	455	260	195
6	Pangan	1	1	1	0	640	348	292
	TOTAL	**10**	**3**	**1**	**0**	**4430**	**2541**	**1889**

T = Total, M = Male, F = Female **(Source: census 2001)**

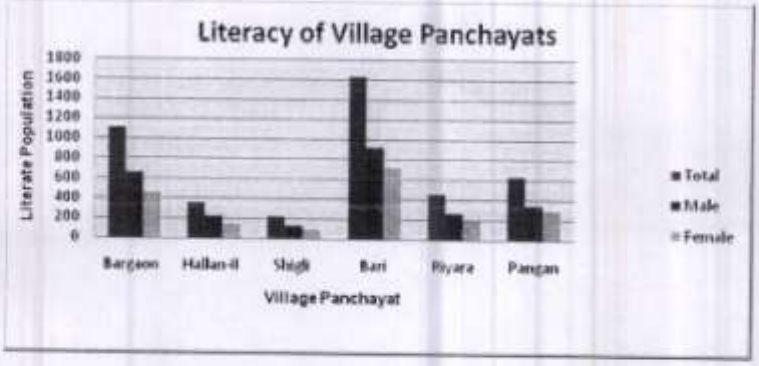


Figure 4.5: Literacy rate in study area village panchayats

d. Health Care Facilities

Health care facilities are few in numbers in the study area. Local people are forced to travel long distances for their basic medical needs. Commonly the seasonal diseases like colds, cough, thyroid problems and certain respiratory diseases are reported in the area. There are no allopathic, ayurvedic, homeopathic hospitals and Child Welfare Centre in the study area (**Table 4.10**). There are 4 Primary Health Sub Centre (PHSC) but there is no Primary Health Centers (PHC).

Table 4.10: Number of hospitals and health centers in the study area

Panchayat	Allopathic	Ayurvedic	Homeopathic	Ayurvedic Disp.	PHC	PHSC
Baragaon	0	0	0	0	0	1
Hallan-II	0	0	0	0	0	1
Shigli	0	0	0	0	0	0
Bari	0	0	0	1	0	0
Riyara	0	0	0	0	0	1
Pangan	0	0	0	0	0	1
TOTAL	**0**	**0**	**0**	**1**	**0**	**4**

PHC= Primary Health Centre, PHSC=Primary Health Sub Centre, CWC=Child Welfare Centre **(Source: Census 2001)**

e. Occupation and Income pattern

Most of the population depends upon agriculture (especially of Apple Orchards), Horticulture and animal husbandry for their livelihood. There is no industry in Government or private sector in the area. Total workforce in the study area is 55.6% while 38.2% of the population falls in main worker category. 17.4% of the population is marginal workers (**Table 4.11**). Average income of the area is Rs.3500-4000 (aprox.) per month.

Table 4.11: Occupation Pattern of Village Panchayats

S. No.	PANCHAYAT	Work Force			Main worker			Marginal worker			Non - Worker		
		T	M	F	T	M	F	T	M	F	T	M	F
1	Baragaon	1081	614	467	700	414	286	381	200	181	550	231	319
2	Hallan-II	539	276	263	402	206	196	137	70	67	198	110	88
3	Shigli	193	105	88	86	76	10	107	29	78	194	99	95
4	Bari	1007	580	427	796	473	323	211	107	104	1330	627	703
5	Riyara	409	201	208	305	160	145	104	41	63	260	127	133
6	Pangan	518	266	252	284	176	108	234	90	144	451	190	261
	TOTAL	**3747**	**2042**	**1705**	**2573**	**1505**	**1068**	**1174**	**537**	**637**	**2983**	**1384**	**1599**

T = Total, M = Male, F = Female (***Source*: Census, 2001**)

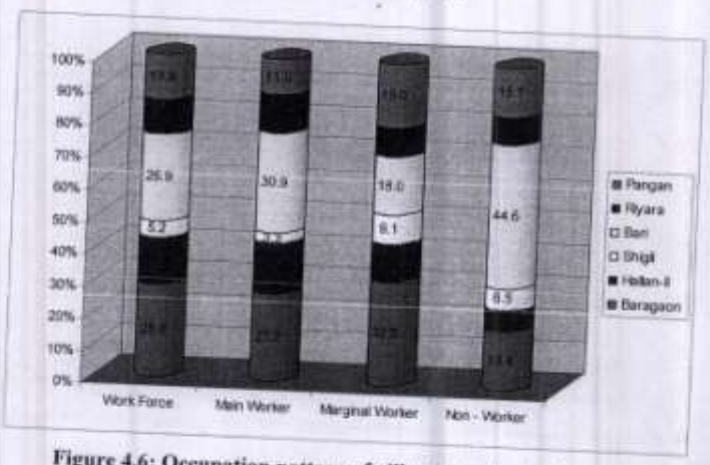


Figure 4.6: Occupation pattern of village panchyats of study area

CHAPTER-5

PROPOSED MEASURES FOR CATCHMENT AREA TREATMENT

5.1 CATCHMENT AREA TREATMENT PLAN

In the present report, CAT Plan as per the slope, land use pattern, soil characteristics has been suggested based on the prioritization of sub watersheds using SYI method and field survey/visit/studies done jointly by Forest Department (Kullu) and User Agency. The area will be treated in integrated manner by providing suitable bio-engineering structure, vegetative cover over the degraded areas and various soil conservations. The proposed plan includes the forest protection, forest infrastructure development, awareness, development of eco tourism, fuel savings in the forest, training to forest officials and local stakeholders. The wild life skills will be built up to staff and local communities to proper management of wildlife in the project vicinity.

The proposed CAT plan will be implemented in the catchment and project area by joint management of forest and user agency. For optimal integration into the project, manageable links for funding, operation, training and monitoring have been proposed. The costs for implementation of the measures for catchment area treatment have also been estimated.

The proposed treatment measures for the catchment area and project area of Baragaon SHP have been depicted over SOI toposheets as shown in Figure 5.1.

It is proposed that treatment measures shall be implemented over ten years phase wise treatment plan has been described in Chapter 8 and the detailed estimation has been worked out based on the prevailing rate of year 2010-11 in Chapter 8.

The extent of the works and the corresponding financial outlay proposed in the CAT plan are tentative. The site specific exact quantum of work and their financial requirement would be prepared at the time of implementation. The detailing of the plan would be done later and any additional requirement of the fund, if any, will be met from the provision under the contingency head of the CAT plan.

The following measures have been proposed to undertake for implementation in the area as follows:

1. Biological Measures
   a. Afforestation of Degraded forest land
   b. Enrichment Plantation
   c. Energy Plantations

d. Nursery Development

II. Soil and Moisture Conservation

a. Bio-Engineering Measures

i. Raising of Bio engineering plants

ii. Planting of Bio engineering plants

b. Soil Conservation works

i. Vegetative Structures -fascines, brush-wood check dams, bamboo crib etc

ii. Civil structure

- Dry stone
- Crate wire structure
- Water harvesting structure

III. Development & Management of Wild Life

IV. Protection of Forests

V. Eco-Tourism Development

VI. Payment for Eco-Services

VII. Forest Infrastructure Development

VIII. Research, Training and capacity build up, publicity and awareness

IX. Monitoring and evaluation

X. Operational support to Forest Dept

XI. Contingency

As described earlier, the CAT plan has been suggested for sub watersheds using SYI method (Table 5.1) with very high and high erosion categories and accordingly, measures for treatment of CAT plan has been planned.

TABLE - 5.1
Erosion intensity categorization as per SYI classification

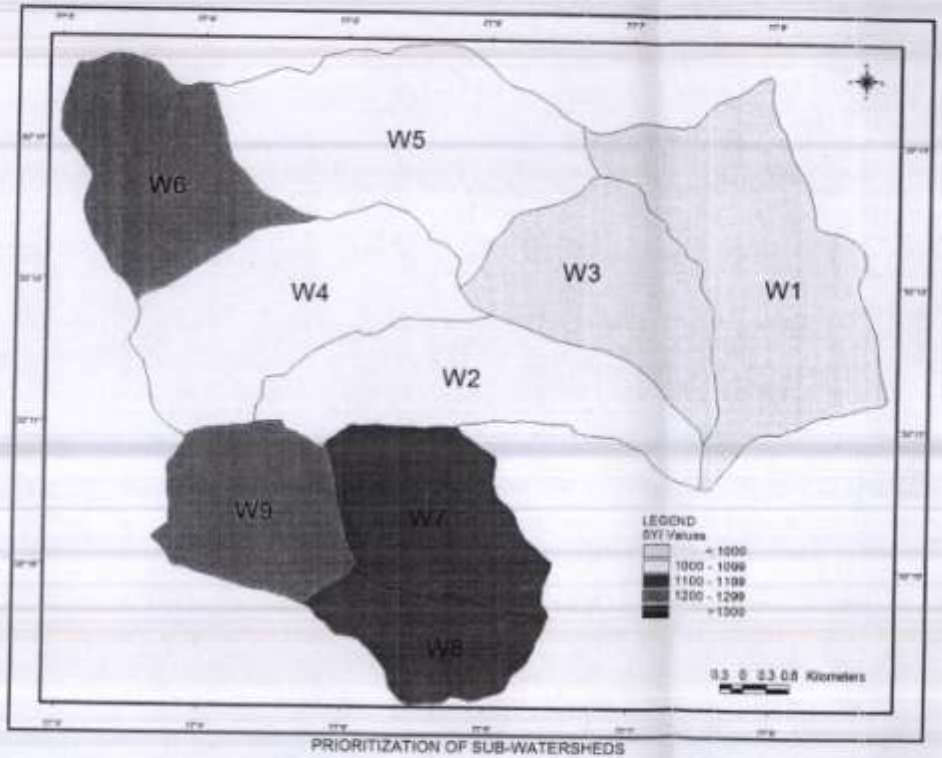
Sub watershed	Area in sq km	SYI	Priority Category
W1	7.878	938	Very Low
W2	5.564	1073	Low
W3	4.94	987	Very Low
W4	6.151	1061	Low
W5	7.652	1077	Low
W6	4.738	1202	High
W7	4.201	1181	Medium
W8	2.571	1175	Medium

W9	3.767	1265	High
Total	47.46		

TABLE – 5.2
Erosion intensity rates of catchment area

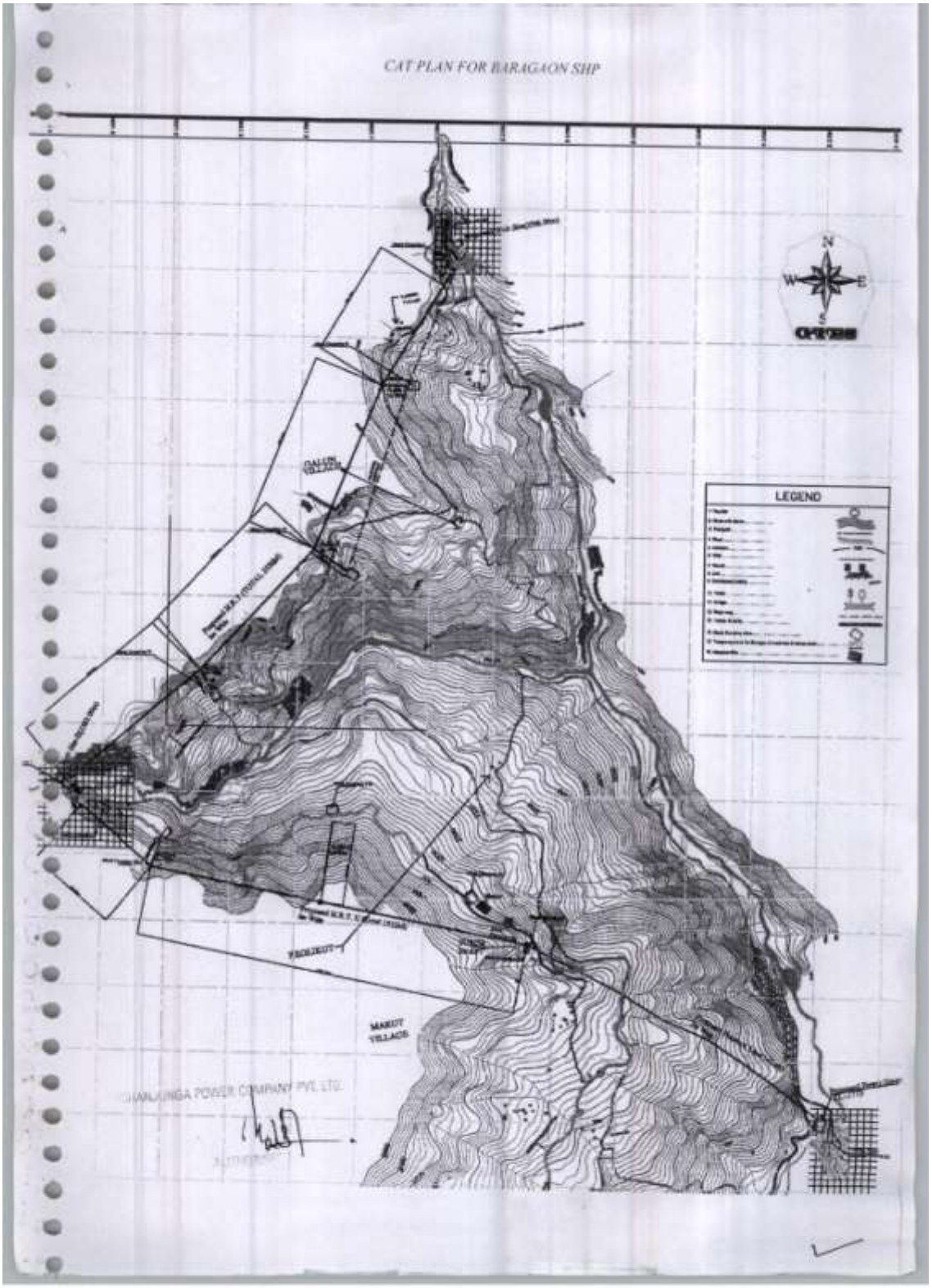
Erosion intensity categorization as per SYI values	Area in sq km	Percentage of catchment area
Very High	-	-
High	8.51	17.92
Medium	6.77	14.27
Low	19.37	40.81
Very Low	12.82	27.01
Total	47.46	100.00

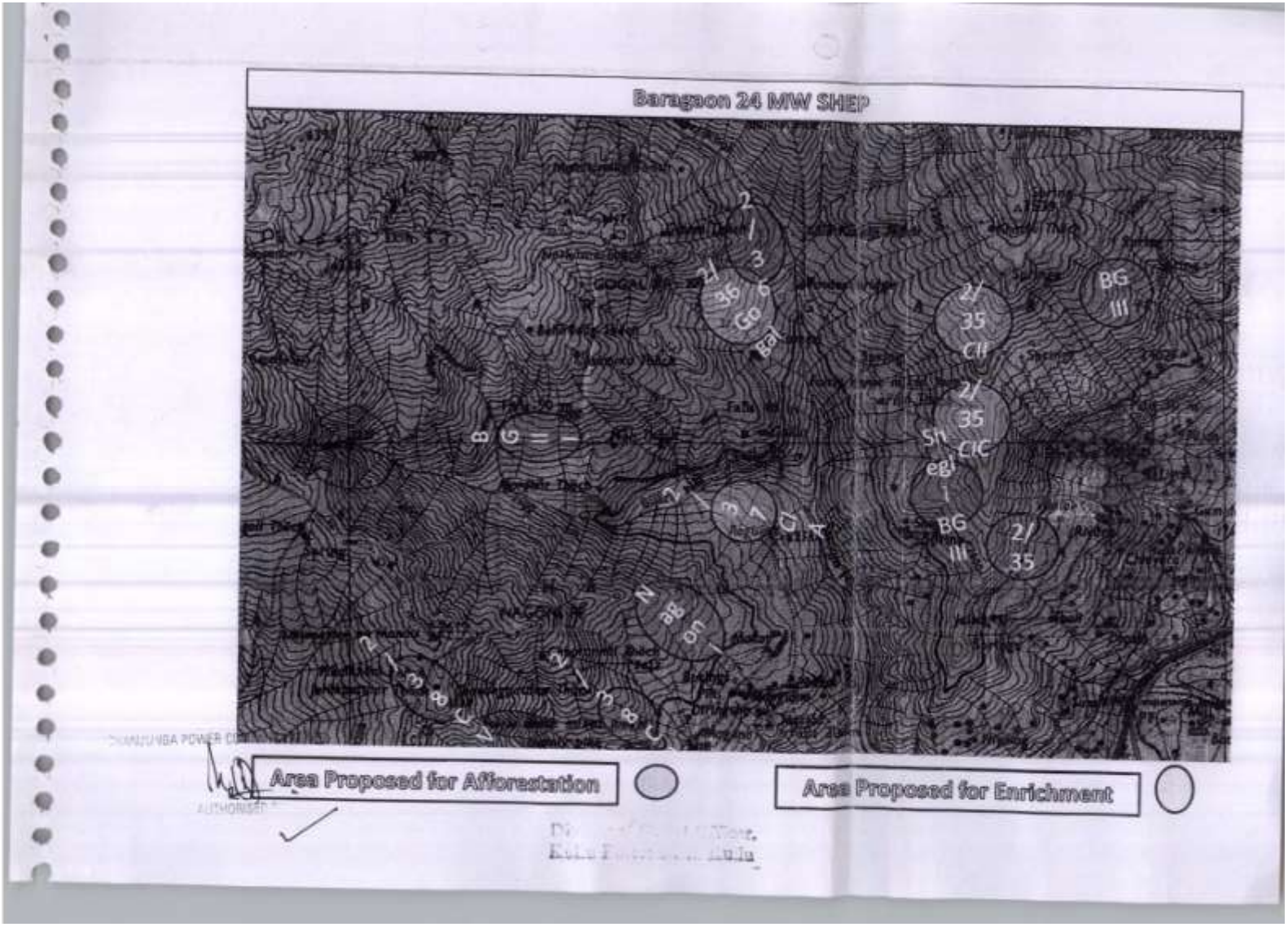
The objective of the SYI method is to prioritize sub-watershed in a catchment area for treatment. The area under very high and high erosion categories accounts for about 17.92% of the total catchment area. (Table 5.2, Figure 5.2) and accordingly measures have been identified in the catchment area.

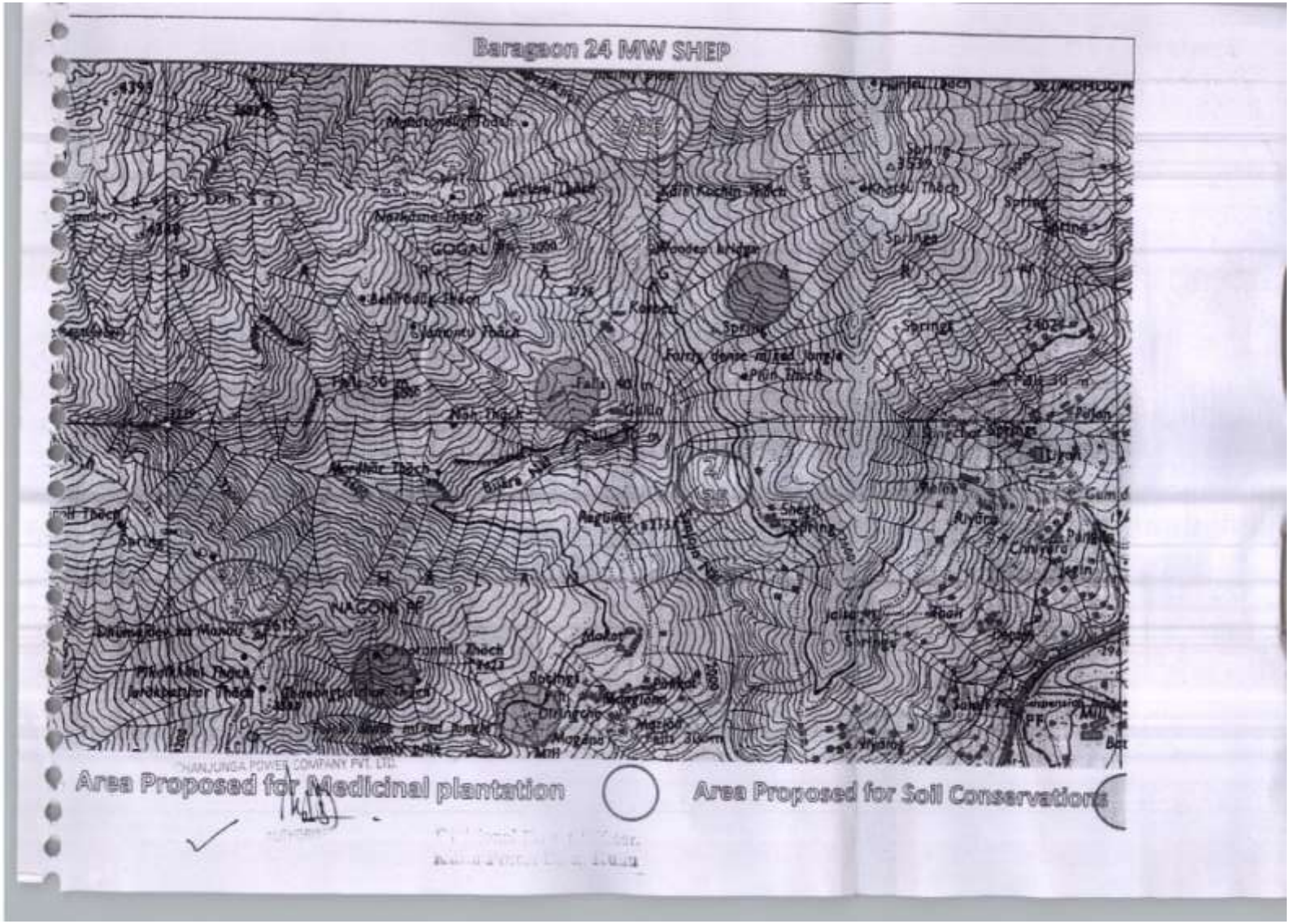


PRIORITIZATION OF SUB-WATERSHEDS

Figure 5.2


CAT PLAN FOR BARAGAON SHP
N
W
E
S
LEGEND
MARIOT VILLAGE


Baragnon 24 MW SHEP
Area Proposed for Afforestation
Area Proposed for Enrichment


Baragaon 24 MW SHEP
Area Proposed for Medicinal plantation
Area Proposed for Soil Conservations

DESCRIPTIONS OF MEASURES FOR CATCHMENT AREA TREATMENT

5.2.1 Biological Measures

a. Afforestation and Natural Regeneration:

Area under forest and tree cover will be expanded through systematic planning and implementation of afforestation and rehabilitation programme in degraded and open forests and available non forest lands.

The area available for planting above diversion weir's is very less as most of the area is either stocked or rocky. Only few degraded area are available and therefore some of area for afforestation is being suggested above diversion weir. However keeping environment cause in mind, area between power house and diversion weir also suggested for this measures.

Regeneration of tree felled areas will be ensured in a time bound manner and productivity of plantations will be increased through use of improved seeds and planting stock. The indigenous fruit bearing plants viz. Bird cherry,kainth pear etc., vital from wildlife point of view are proposed to be planted so as to enrich the habitat & ensure the sufficient availability of food. Monoculture especially of Chir pine will be discouraged and mixed plantations of broad-leaved fodder, fuel wood and wild fruit species will be promoted near the habitations. This activity will increase forest cover and will provide habitat to the animals. Afforestation programme is proposed to carry out in degraded and waste land. However 20% of the total afforestation has been proposed for medicinal trees and 10% of the total afforestation has been proposed for fruit trees. The remaining 70% afforestation would be planted as local species available in the vicinity.A total of 140 Ha has been identified for planting under this scheme for a total outlay of Rs 49.14 lacs.

Maintenance of afforestation with the help of user Group

Proposed afforestation will be maintained with the help of local user group through systematic planning and implementation of maintenance will be ensured in a time bound manner and to providing the right of fodder and Grass use to the user group mixed plantations of broad-leaved fodder, fuel wood and wild fruit/Medicinal trees species will be promoted near the habitations. This activity will help the forest conservation in the vicinity this scheme for a total outlay of Rs 10.52 Lacs has been allocated in CAT Plan outlay maintenance amount will be spend on the user

groups.. The detailed estimations have been done for the said plantation in Chapter 8 – Cost Estimates.

b. Enrichment Plantation

Enrichment planting will be carried out in degraded forest area in the Catchment, so as to increase stocking in already existing open forest. This has to be a selective process and should result in better diversity/abundance of key species. A norm of 600 plants per Ha (notional) would be adopted and tall plants of the desired species would be planted under this component. Since such planting would be scattered in the nature, the traditional barbered wire fencing is not to be done; instead of individual protection to the tall plants using thorny bushes, will be resorted to Provision for such individual protection has been included in the cost norms. No maintenance is being prescribed under this component and the proposed plantation will be started after 3 years from the implementation of this Catplan.

A total of 140 Ha has been identified for planting incl. thorny brush protection guard under this scheme for a total outlay of Rs 25.90.lacs. The preliminary forests identified for this purpose are 2/38 Cv, BG-III Branphat, BG-III Shegali, BG-III Nagoni, 2.35 Cia, 2/36 Gogal, 2/38 Cic and BG-III Mohrudhar and depicted in the SOI toposheet as shown in Figure 5.1. The detailed estimations have been done for the said plantation in Chapter 8 – Cost Estimates.

c. Energy Plantation

Energy plantation would be carried out to fulfill the wood and fodder requirements of the local people. The locally available fuel wood and fodder plant species in various agro-climatic conditions will be planted. The energy plantation would be carried out in 65 Ha land in the vicinity of the habitations. Owing to the increased biotic pressure in the areas, greater emphasis would be placed on effective closure and hence 5 strand barbed wire fencing would be adopted. 5000 plants per ha would be planted, but there would be no maintenance costs involved. The provisions for outlay of Rs 46.22 lacs incl. the fencing has been considered under this scheme and described in Chapter 8 – Cost Estimates.

d. Nursery Development

There are two old forest nurseries within the project vicinity which are considered for production of quality seedlings/rhizomes. The nurseries will also be taken to accelerate timely production of

seedling requirement for plantation in the catchment and to grow the herbal stock seeds. These will be utilized to implement the plantations.

The following nurseries in the project vicinity will be taken up under the CAT plan of Baragaon to develop.

Nurseries in Project Area

Name of the Range	Location
Patlikuhal	Patlikuhal
Patlikuhal	Shila

The work on raising/ development of nurseries will start from first year and the plants will be maintained subsequently. The provision for vermin composed unit has also been proposed,under this scheme. The provisions for outlay of Rs 33.93 lacs under this scheme the plant for enrichment will be maintained for 3 years in the nurseries which have been considered in Chapter 8 – Cost Estimate.

5.2.2 Soil and Moisture Conservation

The streams / nallahs of the sub-basins of Sanjoin and Bijara Nalla of Baragaon watershed are required to be treated depending upon the sites/ locations. The sites are identified and have been depicted in the SOI toposheets as shown in Figure 5.1. The provision for this works has been made in CAT plan outlay of Rs 57.10 lacs towards these measures have been considered in Chapter 8 – Cost Estimates. The 50% outlay of soil and measure conservation has been budgeted for Bio-engineering measures and 50% for soil conservation works. However, the detailed plan for site specific will be prepared at the time of implementation of the plan. The proposed plan is tentative and any additional requirement of outlay will be met through the contingency of the plan. Presently, the following locations have been identified for the treatment.

Sn	Location
1	Chanak Pather Nalla
2	Rogel Nalla
3	Kazal Bihal
4	Bhat Bai

5	Rata Nalla
6	BG-III Soh Dhar
7	BG-III Shilla Nalla

Treatment shall be taken from top to bottom in a scientific way and the following measures will be implemented under this head.

a. Bio-Engineering Measures

The bioengineering methods are being developed for controlling the soil erosion. The reasons for their use are non availability of stones, steels, cement. Sand etc at the site and also at places, various biological materials like grass tufts, pine needles and various agricultural waste is being used to stabilize the loose soil on slops or in gullies. The bio engineering species will be raised and planted every year up to ten year of the plan. Wherever feasible, stress would be on undertaking Bio-Engineering measure and the detailed site specific plan will be workout at the time of implementation of the plan.

b. Soil Conservation works

These works will be conducted as erosion control works in gullies and eroding stream and river training works. This component concentrates on protection works where lasting benefits will be assured in the lower catchment area. Works will concentrate on construction of site specific physical structures accompanied by tree planting to stabilize banks and planting for short vegetative cover in the landside prone areas through brushwood and perennial grasses. Before treatment of any nalla, a site specific estimate will be prepared and got approved every year. The following measures has been proposed to undertake these works

a. Vegetative Structures -fascines, brush-wood check dams, bamboo crib etc. Live hedge vegetative spurs along the nallahs shall be put up. Local species, which are known as good soil binder like Salix, Alnus nitida, Ailanthus, Hippophae spps etc. will be planted

b. Civil structure

- Dry stone structure would be constructed to protect the erosion around the nalla
- The eroded and effected Nallahs will be channelized and protected by constructing crate wire of check wall/check dams and spurs.
- Water harvesting structure would treat the drainage line in the area.

5.2.3 Development & Management of Wild Life

The wild life management is well described in Chapter 7 and various provisions have been considered for development in the Chapter 8 – Cost Estimates.

5.2.4 Protection of Forests

a. User Group/ JFMC

In order to encourage participation of local people in protection of forests efforts should be made to organize the local stake holders into all activities envisaged under this plan wherever possible, should be undertaken with active engagement of the local people such as Afforestation etc. In the event of effective protection of forests, plantation by the local people, mechanism should be evolved to make the funds available under maintenance to such user groups/JFMC. A provision of Rs 3 lacs of aforementioned component is being made under this head to provide for expenses related to organizing local people into the groups for imparting necessary knowledge and awareness and also for incentive money to exemplary User Group/JFMC. The provisions for these measures have been considered in the cost estimation of CAT plan in Chapter-8.

b. Const./Repair of Boundary Pillars

The repair / construction of Boundary Pillars shall be undertaken in forests, where ever required, especially near habitations and orchards. Geo-referencing of the boundary pillar will be done. A total provision of Rs 8 lacs has been made under this head. The provisions for these measures have been considered in the cost estimation of CAT plan in Chapter-8.

c. Forest protection in view of influx of outside workers

The outside workers will be engaged for various works in the project vicinity. In the absence of fuel for cooking, they would resort to tree cutting and using wood as fuel. This would lead to heavy biotic pressure on the existing forest. To avoid such a situation, it is proposed to provide LPG and/ or kerosene available to these migrant workers on the cost sharing basis. The supply of LPG and kerosene can be ensured on regular basis. A total provision of Rs 2.5 lacs has been made under this head. The provisions for these measures have been considered in the cost estimation of CAT plan in Chapter-8 in cost estimation.

5.2.5 Eco-Tourism Development

This natural and cultural richness of Himachal Pradesh coupled with its simple peace loving people and traditional hospitality makes the State a most favored tourist destination. Anybody with a zest for life, a spirit of adventure and a love for nature will find all that his heart desires amongst the pristine environs of Himachal Pradesh.

The State's wild frontiers have hitherto remained out of reach for tourists mainly due to lack of infrastructural availability. Most of the tourism, till now, has been limited to the towns, with occasional stories to the nearby forests and other attractions. The State, live to the need for providing better opportunities to the visitors to enjoy its natural beauty and cultural heritage, now aims to allow the use of its infrastructure for the benefit of the tourists.

The State Govt has published Eco tourism policy 2005 to proper implementation of eco tourism in the State with objective of preserve and protects the natural, historical and cultural heritage of Himachal Pradesh.

In view of the above, the eco-treks from Dwara Village to Baragarh Fort via Nagoni has been identified to repair under the CAT plan. The path is historical heritage which connects to Baragarh. It has been observed that some of tourists are interested to visit to the Fort. After repair of the trek, the frequency of the tourist will increased and new destination in the State will be added.

The provision for outlay of Rs 5 lacs under this scheme has been allocated in cost estimation of CAT Plan Chapter-8 .

5.2.6 Payment for Eco-Services

Eco services works in the area will be coupled with awareness, capacity building, development activities and institution nurturing of village community/local people to conserve the ecosystem, heritage and natural beauties. The following activities are proposed under Eco services in CAT plan.

- Animal husbandry & Dairy Development: This will address better feed and breed improvement programme of local animals focusing on behavioral changes in the community for stall-feeding. The various works will be carried out but not limited to following
  - Nutritious fodder grasses introduction and its spreading through village motivators

- Plantations as well as nurseries will be developed.
- Installation of mini community thresher.
- Better stall feeding practices
- Study of carrying capacity of grazing pastures
- Awareness in animal health programme
- Breed improvement
- Developing paraprofessional for primary animal health services

- Agriculture Improvement, Horticulture, floriculture & Vegetable Farming: The various works will be carried out but not limited to following

- Breed improvement of traditional crop
- Organic compost making
- Organic certification of agriculture and horticulture product
- Demonstration of organic high value agricultural crops and implementation
- Rejuvenation of old orchards.
- Planting of fruit trees of nuts and oil seeds.
- Medicinal Plants
- Training for production of seasonal vegetable
- Value addition support
- Market research support

- Fuel Saving Device: In the villages of the project area, the main source of energy is fuel wood which is one of the main causes of ecological degradation. Cutting and burning of wood will not only deplete the forest area but also is one of the sources of air pollution which emits suspended particulate matter, carbon monoxide and polycyclic hydrocarbons. Women and children are mainly affected by these pollutants.

  In order to reduce the pressure from forest resources in the project vicinity, it is proposed to provide following on sharing basis

  - LPG to local people as kitchen fuel
  - Pressure cookers to the local people as effective kitchen facilities
  - Pressure Solar Cookers to the local people as alternative source of energy

It is also proposed to provide off-grid renewable in the area through of installation of solar light in street.

Further, the CFL will be distributed in the area to save the energy and promote the energy conservation in the area.

The provision of outlay of Rs 45.81 lacs has been allocated for above proposed eco services in the cost estimation of CAT Plan Chapter-8.

5.2.7 Forest Infrastructure Development

In the field level forest staff of the division has to serve in far-flung and difficult places for optimum management of forest resources, implementation of plan for conservation of the forest and wild life. Regular repair and maintenance of all existing housing, infrastructures and equipments are essential for maintaining strict vigil in the area. The staffs that are posted in the remote areas still do not have basic amenities like a good residential accommodation and good approach road. The following infrastructure has been identified to construct, repair and maintained under the CAT plan.

- Construction of forest hut at Pankot
- Construction of BO offices at Patlikuhal
- Furnishing of Range Rest room at Patlikuhal
- Furnishing of Range office with Assistant room & record room

The provision of Rs 26 lacs has been allocated under the scheme in the cost estimation of CAT Plan Chapter-8.

5.2.8 Research, Training and capacity build up, publicity and awareness

a. Forest Research in the Area

The following studies and applied research will be conducted while implementing CAT plan. All these ground level researches will lead to education and awareness for improving and adopting those livelihood practices, which would help to sustain the project intervention in the long run. Different institutions having relevant expertise will be identified and short-listed for conducting the above studies and researches based on the technical competence. The issues and topics so far identified are as follows:

- Baseline studies of selected villages under CAT plan.

- In-situ improvement package & practices of local grasses.
- Studies on hydrological flow in the catchment area.
- Participatory research on gender empowerment for natural resource use.
- Applied research on improvement in traditional crops.
- Value addition of agriculture, horticulture and medicinal crops.
- Market research of traditional and high value crops in agriculture & horticulture.

b. General Awareness/Publicity

Mass awareness and education programme in the project area villages is a must to reduce anthropogenic pressure. Education and awareness generation programmes for garnering public support for biodiversity conservation is the need of the day. Community education and involvement is a crucial component of a biodiversity conservation strategy because the condition of the environment is reflected by the manner in which the communities treat and mange the natural resources.

Under this programme, various activities viz. trainings, publishing of research documents, pamphlets, brochures, hoardings, etc. shall be carried out during the implementation period of CAT plan. Training should be imparted to the school teachers in the area for introduction of environmental education among the school children and exchange of knowledge on environment and ecology between the monastic and village schools. The basic purpose of this is to create awareness among young generation and also among the local villagers so as to protect the wildlife for future generation.

Biodiversity education and community awareness will therefore be strengthened in a variety of ways to reach people of all sections. Activities like opening of biodiversity register in every village and promotion of traditional farming, advertisement of hazardous effect of fire through press, sign boards and public meetings will form the important activities under this component. The provisions for this activity have been considered in the estimation of outlay of CAT plan.

c. Training of Forest Officers/Officials And Community Members

The specialized training and study tours for forest officials/officers, who are executing the plan will be provided. The objective of this training component would be to provide the officers and the staff working in the project area to augment their skills, professional

knowledge, capacity building to be effective and efficient. The basic components of capacity building includes :

- Developing human resources through training and education
- Generate new information for better knowledge and understanding.
- Providing an adequate institutional framework and material support to enable acquired skills to be fully utilized.

Training for staff will be organized locally at the Division level or at various institutes in HP or in Wildlife Institute of India, Soil and Water Conservation Research Training Institute, Chandigarh and Dehradun

The provision for outlay of Rs 14.99 lacs has been allocated under the scheme in the Chapter-8

5.2.9 Monitoring and Evaluation

Monitoring and evaluation of CAT Plan progress work is yet another important and integral component for effective management and governance. The regular quarterly meeting/workshop will be conducted/ organized with the approval of the competent authority during the plan period.

A main committee shall monitor the works of the CAT Plan on annual basis so that objectives of the CAT Plan are achieved. The Monitoring committee would be constituted as below:-

1. Conservator of Forest Kullu-- Chairman,
2. DFO Kullu – Member Secretary
3. ACF Kullu division.
4. PRI Representatives one from each panchayats --- members.
5. One person from some reputed NGO or Autonomous bodies.
6. The Representative from Kanchanjunga Power Company Private Limited

This committee will decide about APOs and make any changes in it as and where required and also conduct yearly review of works carried out with sample field verification .The committee will further decide to outsource. The monitoring and evaluation work to reputed firms /NGO's as per their requirements.

A Subcommittee will also be formed for coordination of work at the field level. The committee will be constituted as below: -

1. DFO Kullu - Chairman

2. Range officer Patlikuhal – Member Secretary
3. PRI Representatives one from each panchayats
4. Representatives of Project

Meeting of this committee shall be convened at least twice in year or as and when required in emergency. The committee will monitor on half yearly basis the following:-

1. All activities undertaken during the period by the physical verification of atleast 50% of work.
2. Suggest any changes required in the activities or minor adjustments of budgetary provisions, to the Main committee for its decision.
3. Assessment of achievement of objectives of the previous work.
4. Photography monitoring will be done before the start of the work, during the progress of the work and after completion of work.

The committees shall strive to make the monitoring process transparent with due approval from members and higher authorities. All non official members shall be entitled to TA/DA as per rates approved and being followed by CF Kullu. All the expenditure incurred on these meetings shall be met from this head of Monitoring and Evaluation.

- The provisions for monitoring and evaluation activities have been allocated as Rs 14.50 lacs under this scheme of CAT plan in the Chapter-8.
- **Training of local youth for Tourism activities and Maintenance of local Temple & Cultural Heritage**: these activities are identified as per Eco tourism policy 2005 to enhance the skills of locals for tourism activities, so that they can generate income from this opportunity. An old temple that is a part of the local cultural heritage situated in the project area will be maintained from time to time. Locals can generate income by setting up camps/huts for tourists and can also identify and develop tourism activities in the area.
- Encouragement of local Handicrafts and Culture: Kullu district is famous for local handicrafts especially woolen shawls, clothes and works such as Kullu shawls, Kullu caps, loi/chaddar, pattoo, numdha, muffler, gudma, hand knit woolens, woolen socks, madri, patari/tokri, kilta, pullan. Development would enable locals to take advantage of modern technology that would further allow them to scale-up production and gain access to wider markets and establish the local handicraft industry. The provisions for this

activities have been allocated as Rs 2. lacs under this scheme of CAT plan in the Chapter-8.

Operational Support To Forest Department

The operational support will be in the form of Computer, GPS and transport facilities to meet the additional responsibilities of implementation of CAT Plan. The outlay of Rs 26.40 lacs has been allocated for operational support in Chapter 8 – Cost Estimates.

Details of Operational Support to Forest Department

Sn	Particulars	Quantity
1	Desktop Computer with furniture	4
2	GPS	6
3	Printer	2
4	Jeep/Vehicles	2
5	Maintenance of Forest Deptt vehicles	

5.2.10 Contingency/ Escalation

A provision of 10% to offset inflationary trends to absorb any escalation in the cost of plan proposals on account of increase in wage rate and material cost have been considered in Chapter 8 – Cost Estimates. The provision of Rs 42.03 lacs has been allocated towards this head in the CAT plan. This provision could be utilized to meet any unforeseen expenses in future, necessary for the achievement of the objectives of the CAT plan.

5.3 TOTAL EFFECTIVE AREA TO BE TREATED IN CAT PLAN

The total Catchment Area of proposed project is 47.46 sq. km. In the proposed CAT Plan various measures have been proposed to treat the Catchment Area. The area will be treated through biological and soil and conservation measures described in detail in Section 5.2 above.

The total area identified for plantation/ biological woks is 290 ha. The area identified for plantations has been wide spread in catchment area. Plantations and afforestation would be done in range of 20 Km from the weir site of the project and accordingly this plantation will affect 40-50 Sq. Km of surrounding catchment of the project. In addition, the provision for soil

conservation measures has been estimated which will treat the various adjoining Nallas and this will affect the complete catchment.

Furthermore the other activities proposed described in section 5.2 above such as Eco Tourism, Eco services, Protection of Wild Life, Management of Wild Life and protection of forest area will cover the entire catchment area.

Note: Depending on the site specific requirements, changes in activities, within and across components, can be made by the field agencies with prior approval of the Principal Chief Conservator of Forests, Himachal Pradesh.

CHAPTER-6

JOINT FOREST MANAGEMENT (JFM) IN THE CAT PLAN

6.1 INTRODUCTION

Forests are not just trees, but part of an ecosystem that underpins life, economies and societies. Forests provide a wide range of services which include prevention of soil erosion, floods, landslides, maintenance of soil fertility, and fixing carbon from the atmosphere as biomass and soil-organic carbon. A vast majority of the Indian population depends on forests for meeting basic needs of fuelwood, fodder, small timber for agricultural implements and house construction and even food and medicines in the form of Non-Timber Forest Products (NTFPs). Sale of fuelwood and NTFPs also generate vital cash income for many poor households.

The total forest cover of the country, as per the 2007 assessment, is 690,899 sq. km. which constitutes 21.05 per cent of the geographic area of the country. The very dense forest constitute 83,510 sq. km. (2.54%), moderately dense forest 319,012 sq. km. (9.71%) and open forest 288,377 sq. km. (8.77%) of the country's geographical area.(State Forest Report, 2009). India has the world's largest livestock population out of which about 25 %, i.e. over 100 million, graze on forest lands that have an estimated capacity to support only 31 million.

The destruction of natural forests for timber, cropland, fuelwood, pasture, urbanization have had an impact on many poor rural families who are dependent on forest resources for fuel, fodder, food, medicine, housing etc. The deterioration of forests has accelerated soil erosion, sedimntation of rivers, increased flooding, and over-taxed the land's capacity to regenerate and sustain.

The dense forests are losing their productivity and more than 40% of country's forest cover has degraded. Main cause of degradation is use of the forest resource beyond its carrying capacity and without much consideration to its sustainability. The trend of degradation of forests can be reversed only if this precious resource is managed sustainable with the involvement of local communities in its protection and management. All the stake holders need to be involved in the

protection and development of forest resources and Joint Forest Management Programme has come out as an important management intervention for sustainable forest management. Governments are opening number of opportunities for sustainable forest management and biodiversity conservation by decentralizing authority and responsibility for resource management in different parts of the world.

In India Joint Forest Management (JFM) has emerged as an important intervention in management of forest resources. In many parts of India, small village groups have started to protect and reclaim degraded forestlands through collective action. The Joint Forest Management Programme seeks to develop partnerships between local community institutions and state forest departments for sustainable management and joint benefit sharing of public forest lands. The primary objective of JFM is to ensure sustainable use of forests to meet local needs equitably while ensuring environmental sustainability. The central premise is that local women and men who are dependent on forests have the greatest stake in sustainable forest management.

6.2 STATUS OF FOREST IN HIMACHAL PRADESH

The forests of the state are rich in biodiversity and play a vital role in preserving the fragile Himalayan ecosystem while also being a primary livelihood source for the rural population and prime source of fresh water for both urban and rural population. The major forest types represented are moist tropical, dry tropical, montane sub-tropical, montane temperate, sub-alpine and alpine scrub, comprising coniferous and miscellaneous broad-leaved tree species.

Although nearly 66% of the geographical area of the state is forest land as per records, the extent of actual forest cover on all categories of land in the state is only around 26%. Himachal Pradesh has more than 12% of its area under two National parks and thirty-two wildlife sanctuaries which are home to some rare and endangered faunal and floral species such as the snow leopard, musk deer, pheasants and Himalayan yew.

Forests are key to the livelihoods of most people in Himachal Pradesh. Rural people comprise around 90 percent of Himachal Pradesh's (HP) population, and most of them are dependent on forests for fuelwood, fodder, grazing, construction timber, non-timber forest products. Currently

forest resources tend to be used by local communities for subsistence needs, subject to restrictions. The HP Forestry Department (HPFD) has formal control of forest use and draws revenue from timber and resin production. However, there is also a high level of illicit extraction of produce often to distant markets. Rural people feel excluded from control of forests and, with no legitimate local organisational basis for resource use.

6.3 JOINT FOREST MANAGEMENT IN HIMACHAL PRADESH

The Governor of Himachal Pradesh launched the Sanjhi Van Yojna (SVY) Scheme, 2001 for sustainable management of forest resources in the State in collaboration with the local communities. The existing Sanjhi Van Yojna (SVY) Scheme, 1998, the Parisharam Hamara Van Hamara Scheme, 2000 and the Apna Van, Apna Dhan Scheme, which was to be launched during the year 2001 shall stand clubbed with the Sanjhi Van Yojna Scheme, 2001.

In many locations people's voluntary groups were engaged in protection of forests without any initiative from the Government. Subsequently, based on the experience, the process of institutionalizing people's participation in forest protection and regeneration began. This type of collective endeavour in protection and management of forests through people's involvement was later termed as Joint Forest Management. At present, the JFM committees are being registered under different names in various States as per the provisions contained in the resolutions. Memorandum of Understanding, with clearly defined roles and responsibilities for different work or areas should be separately assigned and signed between the State Governments and the committees. All adults of the village should be eligible to become members of the JFM Committees.

Special features of Sanjhi Van Yojna (SVY) Scheme, 2001

i) Involvement of grass root level institutions such as Gram Panchayats, Mahila Mandals, Yuvak Mandals, Ex-servicemen's bodies, Schools, Village Forest Development Societies (VFDSs), User groups, other Community Based Organisations (CBOs) and NGOs in sustainable management of forest resources;

ii) Grant of 100 % income from plantations to the VFDSs and Panchayats; Grant of total usufruct rights to the VFDSs;

iii) Regeneration of degraded forest areas and conservation & sustainable use of better forests through community involvement.

iv) Involvement of local communities in the choice of species to be planted under the scheme;

v) Creation and enhancement of social, physical and financial capital of the participating communities for poverty reduction;

vi) Special emphasis on involvement of women in the scheme;

vii) Address problem of rural unemployment by utilising degraded forest land for large scale plantations;

viii) Establish linkage between Food for Work Programme and the present scheme by making payments in the shape of food grains under the scheme;

ix) Increasing productivity of the Forest areas by improvement of nursery stock and adoption of mixed plantations.

x) Training of forest staff, VFDS members and CBOs/NGOs for facilitating and strengthening community participation.

xi) Gradually empower local communities and local level institutions to become more pro-active in sustainable forest management.

xii) To help VFDSs achieve financial viability and sustainability by introducing proper mix of short and long duration cropping patterns as a short and long term objective to ensure their continued participation in the scheme.

xiii) Gradually empower local communities and local level institutions to become more pro-active in sustainable forest management.

xiv) To help VFDSs achieve financial viability and sustainability by introducing proper mix of short and long duration cropping patterns as a short and long term objective to ensure their continued participation in the scheme.

6.4 IMPLEMENTATION STRATEGIES OF JOINT FOREST MANAGEMENT (MICRO-PLAN PREPARATION)

For the long-term success and the sustainability of the village level institutions, it is important that proper and adequate methods of community organisation and management are followed. Thus, normally in the first year major emphasis should be on the systematic and sequential formation of VFDSs, training of local communities, CBOs and community members. Towards the end of the first year, a well documented but simple and understandable micro-plan needs to be ready for implementation.

The micro plan should be prepared by the Forest Officers and Village Forest Protection Committees after detailed PRA exercise and should reflect the consumption and livelihood needs of the local communities as well as provisions for meeting the same sustainably. It should utilize locally available knowledge as well as aim to strengthen the local institutions. It should also take into account marketing linkages for better return of NTFPs to the gatherers and should also reflect the needs of local industries/ markets. This should be done with due regards to the environmental functions and productive potentials of the forests and their carrying capacity as also their conservation and biodiversity values.

If the existing working plans are in force (till their revision in future), for incorporation of micro plans in the working plans, a special order may be issued by the PCCFs for implementation of the microplan. In these areas, micro plan should aim at ensuring a multi product and more NTFP oriented approach. Without changing the basic principles of silviculture, deviations may be approved in the existing working plans if necessary. To ensure this, the concerned DFO and CF should dovetail the requirements of micro plans with the working plans.

The micro plan should also take into consideration and provide suitable advice for areas planted/ to be planted on community lands and other Government lands outside the notified forest areas Infrastructure/ Eco- development under micro plan should form a separate entity for funding it through concerned development agencies.

6.5 EXECUTION OF JOINT FOREST MANAGEMENT IN BARAGAON SHEP CAT PLAN

The works specified under the CAT plan will be executed based on this model of JFM. A total of Six Village Panchayats are falling in the Baragon HE project catchment area. They are as follows:-

1. Baragaon
2. Hallan-II
3. Pangan
4. Bari
5. Shigli
6. Riyara

All the plantation and soil conservation works identified, are falling in these Panchayats only. The local Panchayat specific VFDS will be formed which will supervise and carry out the works. The various activities planned in the JFM are given below:

Community Participation: Local people and committees will be engaged for the CAT Plan works such as plantation and maintenance etc. instead of hiring the labour. The wages will be met out from the provision incorporated in the norms. The engagement of Non Governmental Organisations (NGOs) and Community Bases Organisations (CBOs) would be encouraged for strengthening the JFM works. VFDC will be formed for this specific purpose besides this the active Mahila Mandals and Yuvak Mandals will be approached to carry out the various works of the CAT Plan.

Women Participation in JFM: Considering the immense potential and genuine need for women's participation in JFM programme, meaningful participation of women should be encouraged in JFM by forest department. Atleast 50% members of the JFM general body should be women. For the general body meeting, the presence of atleast 50% women members should be a prerequisite for holding the general body meeting.

Plantation in Degraded Forest Land: Provisions have been kept for plantations in the degraded and open forests and available non forest land and Bamboo/shrubs plantations. For plantations, however, the forest department shall continue to supply planting material to the VFDS on

demand, free of cost for three years including the year of plantation. Thereafter, for any more supply of plants price shall be charged from the VFDS.

Income Generation Activities (IGA): The major thrust of the CAT Plan is on Income Generation Activities (IGA). So that people get their livelihood without entering in the forests. In order to enhance the economic stake of rural communities in the conservation and sustainable utilisation of forest resources as well as to create means of income for the VFDS and its members, forestry related income generation activities should be promoted under JFM. Such activities may include water harvesting and its use for irrigation / drinking purposes. Introduction of improved grasses and development of village pastures, high-density fuelwood / fodder plantations. These examples are illustrative only and suitable income generation activities can be adopted as per the local populace requirement.

Non-Wood Forest Products including Medicinal and Aromatic Plants Plantation: Non Wood Forest Products (NWFP) are important source of supplementary incomes for rural households. Its sustainability and management are thus crucial to rural livelihoods. Medicinal and Aromatic Plants (MAPs) constitute an important aspect of NWFP management. *In-situ* or *Ex-situ* growing of medicinal plants of high economic value should be promoted within the selected areas or even on private lands.

Training, Workshop and Exposure Visit: The basic objective of the training is to develop the capacity of different stakeholders especially the forest staff, VFDS members and CBOs / NGOs and the villagers for facilitating and strengthening community participation. In terms of trainings, particular attention should be given to the ways in which issues of participation and organizational changes are dealt with. Trainings will be conducted after formulation of a concrete training plan in the initial stage of the micro plan.

Forest Fire Management: Forest fire cause irreparable damages to forests, biodiversity, wildlife, water sources and forest based livelihoods and well being. Participation of local communities should be encouraged in fire management including its prevention.

Control of Grazing- Grazing poses another significant impact on the forests. This can be resolved through a consultative mechanism with the involvement of the Gram Panchayat and the local community to address grazing issues will be evolved.

CHAPTER-7
MANAGEMENT OF WILDLIFE

7.1 INTRODUCTION

Human-wildlife conflict typically involves a direct and intense competition for resources resulting in real or perceived individualized harm to wildlife, humans or their property. Human-wildlife conflict may be characterized by instances of crop raiding, livestock depredation, destruction of property by wildlife, disease transmission, or killing of wildlife by people who experience or perceive actual or potential threats to themselves, their family or their property. The most serious conflicts are distinguished by to death humans and/or wildlife. According to the World Conservation Union (World Park Congress, 2003), it occurs when wildlife's requirements overlap with those of human populations, creating costs to residents and wild animals. Direct contact with wildlife occurs in both urban and rural areas, but it is generally more common inside and around protected areas, where wildlife population density is higher and animals often stray into adjacent cultivated fields or grazing areas.

The state of Himachal Pradesh has experienced escalation in the human wildlife conflict in the last one decade. Almost all protected areas in the State are surrounded by private land or other man-modified habitats where the presence of several wild animals, particularly predators i.e. leopard and black bear are intolerable. These species increasingly venture into human settlements and cultivated areas in search of food and cause loss of human lives or injuries, livestock predation or extensive damage to the horticulture and agriculture crops, and other private properties. The black bear, wild boar and monkey cause extensive damage to agriculture crops and bee keeping farming in the catchment. The various preventive measures such as use of barriers, guarding, and relocation of human habitation; and proper management of wastes generated from habitation etc. are important solutions to reduce the human-wildlife conflicts.

The influx of outside laborers and people for project will increase the human activity and the impacts in the area. This poses a serious danger to the wildlife in the catchment area and influence zone of the project. The natural habitats of flora and fauna may get affected due to heavy disturbance, increase on the exploitation of the natural resources of project people and the biggest threat is poaching of wildlife in the area. The human wild life conflicts may also increase due to habitat degradation, decrease the natural food, and attracting wild animals to human settlements for searching food. To avoid these circumstances following measures are proposed to minimize the human wildlife conflicts and for wildlife protection in the CAT Plan.

7.3 STRATEGIES TO MITIGATE HUMAN WILDLIFE CONFLICTS

7.3.1 Vaccination of Domestic Cattle

The local people have grazing rights in and around the protected area. It is therefore necessary to immunize the domestic cattle against contagious disease like foot and mouth etc. Medication for domestic cattle is necessary against contagious disease like foot and mouth etc. Amount of Rs 2 lacs has been allocated for approximately 1500 cattle in the vicinity in cost estimation CAT Plan Chapert-8.

7.3.2 Conservation Education for Local Population

Education and training activities at different levels would have the objective of disseminating innovative techniques, building local capacity in conflict resolution and increasing public understanding of human wildlife conflicts. Educating rural villagers in practical skills would help them to deal with dangerous wild animal species and to acquire and develop new tools for defending their crops and livestock. In an optimistic scenario, education and training would promote commitment towards conservation, raise awareness on the essential role of wildlife in the ecosystem functioning and its ethical and economic value, as well as its recreational and aesthetic importance. Efforts should be made to involve local people in conservation and protection of wild life. The detailed implementation of this scheme has been described in Chapter -6. The provision has been made in the outlay of the plan described in the Chapter-8 under the head of Research, Training and capacity build up, publicity and awareness.

7.3.3 Research and Survey related to threaten WL

The research on human-wildlife conflicts should address the question of what mitigation measures work and under what circumstances. Priority areas for human-wildlife conflict include focus on community-level response to collective management of risk, and how benefits from conservation can be linked to conflict mitigation measures. The provision of Rs 4 lacs has been made towards the outlay under this scheme and described in the Chapter-8.

7.3.4 Rescue operation and human wild life conflict support

The human wildlife conflict carries significant economic costs to humans and compensation is a measure which aims to alleviate conflict by reimbursing people for their losses. The provision for meeting such expenses are provided by the Govt under their nominal budget. However, provision has been made in the CAT plan to organize rescue operation and a part of this can be utilized for procurement of basic equipment for the purpose. The provision of Rs 3.25 lacs has been made towards the outlay under this scheme and described in the Chapter-8.

CHAPTER-8

COST ESTIMATE

The cost required for Catchment Area Treatment is **Rs. 420.28 lakh**. Provision of 10% per year to offset inflationary trends (contingencies) has been kept in costing. The details are given in Tables -8.1.

Table- 8.1

Abstract of Cost estimate for Catchment Area Treatment of Baragaon S. H E Project

Sn	Item	Area (Ha)	Unit	Target Financial (Rs Lacs)	% of Total Outlay
1	Nursery development & Raising of the plants in nursery (Patlikuhal & Shila)			33.93	8.07%
2	Afforestation Including 20% medicinal trees & 10% fruit trees	140	Ha	49.14	11.69%
3	Enrichment planting (incl.thorny bush wood protection guard)	140	Ha	25.90	6.16%
4	Energy Plantations (incl.wooden fence 5 strand barbed wire fencing with live hedge fence)	65	Ha	46.22	11.00%
5	Maintenance of afforestation (with the help of user group)			10.52	2.50%
6	Soil Conservation & Bio engineering measures			57.10	13.59%
7	Payment of Eco Services			45.81	10.90%
8	Eco-Tourism Development			5.00	1.19%
9	Research, Training and capacity build up, publicity and awareness			14.99	3.57%
10	Protection of Forests (Incl. Boundary Pillars & JMFC and User Groups)			13.50	3.21%
11	Development and Management of Wildlife			9.25	2.20%
12	Forest Infrastructure Development			26.00	6.19%
13	Operational support to Forest Deptt			26.40	6.28%
14	Monitoring and evaluation & studies			14.50	3.45%
15	**Total Outlay**			**378.25**	**90.00%**
16	Contingency/ cost escalation @ 10% of Total Outlay			42.03	10.00%
17	**Grand Total Outlay for CAT Plan**			**420,28**	**100%**
18	Preparation of site specific detailed plan over the said outlay			4.00	

Total Project Cost as per TEC 16811

Provision for CAT as per notification (2.5% of the Project cost) 420.28

Addl:- Preparation of site specific detailed Plan - 4.00

Total CAT Plan 424.28

Note: The detailed estimation has been worked out based on the prevailing rate of year 2010-11

Total Project Cost as per TEC Rs 16811 lacs

Provision for CAT as per notification (2.5% of the Project cost) Rs 420.28 lacs

The detailed estimation has been worked out based on the prevailing rate of year 2010-11

The year wise physical and financial targets are given in Table-8.2 and detailed estimate of outlay for CAT plan has been given in Table 8.3.

Sn	Measures	Unit	Rate	Year I		Year II		Year III		Year IV		Year V		Year VI		Year VII		Year VIII		Year IX		Year X		Total	
				Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)
a	Vaccination of Domestic Cattle (around 1500 cattles)	LS			0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		2.00
b	Research and Survey related to threaten Wil.	LS			2.00				2.00																4.00
c	Rescue operation and human wild life conflict support	LS			2.00				1.25																3.25
d	Sub - total (a+b+c)				4.20		0.20		3.45		0.20		0.20		0.20		0.20		0.20		0.20		0.20		9.25
12	**Forest Infrastructure Development**																								
a	Construction of forest hut at Pankot	LS					5.00																		5.00
b	Construction of BO offices at Patlikuhal	LS					5.00																		5.00
c	Furnishing of Range Rest room at Patlikuhal	LS					5.00																		5.00
d	Furnishing of Range office with Assistant room & record room	LS			8.00																				8.00
e	Sub - total (a+b+c+d)				8.00		15.00																		23.00
13	**Operational support to Forest Deptt**																								
a	Desktop Computer complete with furniture	No		4	1.60																				1.60
b	G.P.S.	No		6	0.60																				0.60
c	Printer	No		3	0.20																				0.20
d	Jeep/Vehicles	No				2	14.00																		14.00
e	Maintenance of vehicles	LS			1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		10.00
f	Sub - total (a+b+c+d+e)				3.40		15.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		26.40
14	**Monitoring and evaluation & Studies**				1.50		1.50		1.50		1.50		1.50		1.50		1.50		1.50		1.50		1.00		14.50
15	**Total Outlay for CAT Plan**				**58.27**		**95.51**		**49.03**		**38.72**		**36.72**		**37.43**		**35.00**		**16.75**		**15.33**		**7.04**		**379.25**

Note : The tree cost not involved in aforestation, energy planting and enrichment because plantation cost already taken in nursery component (raising plants).

16. Add: Contingency / Contingencies @ 10% of Total outlay. → 42.43

17. GRAND TOTAL OUTPLAY OF CATPLAN → 421.68

18. Add: Preparation of 10 year working detailed Plan over the said outlay. → 4.00

TOTAL PROVISION FOR CATPLAN → 425.68

Sn	Measures	Unit	Rate	Year I		Year II		Year III		Year IV		Year V		Year VI		Year VII		Year VIII		Year IX		Year X		Total	
				Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)
7	**Payment of Eco Services**																								
a	Agriculture Improvement, Horticulture (floriculture) &Vegetable Farming	LS			2.00		2.00		1.00		1.00														6.00
b	Animal Husbandry & Dairy Development including provision for mangier for grazing	LS			1.50		1.50		1.31																4.31
c	Encouragement of local Handicrafts and culture	LS			1.00		2.00		1.00		1.00														5.00
d	Training of Local Youths for Tourism Activity	LS			0.50		0.50		0.50		0.50														2.00
e	Maintenance of Local Temples & Cultural heritage - in kind	LS			1.00		2.50		1.00																4.50
f	Fuel saving device (in kind)																								
i	Distribution of L.P.G. to local people	No		50	2.50	50	2.50																		5.00
ii	Pressure Cookers to local people	No		30	0.75	30	0.75																		1.50
iii	Pressure Solar Cookers to local people	No		50	3.75	50	3.75																		7.50
iv	Distribution of solar light - in kind	No		20	4.00	20	4.00																		8.00
v	Distribution CFL - in kind	LS			1.00		1.00																		2.00
c	Sub - total (a+b+c+d+e+f)				16.00		20.50		4.31		2.50														43.31
8	**Eco Tourism** -Repair of Forest Path from Dwara Village to Baragarh Fort via Nagoni	LS							5.00																5.00
9	**Research, Training and capacity build up, publicity and awareness**																								
a	Research and Studies	LS			4.00		1.00																		5.00
b	Publicity, Nature Awareness Camp, Exposer Visit, Training of CBO's & Extension Programme/Workshop & Meeting/Evaluation Expenses and capacity building	LS			0.50		0.50		0.50		0.50				0.20		0.20		0.20		0.20		0.18		2.98
c	Providing Training & Infrastructure support to local youths	LS			0.50		0.50		0.50		0.25		0.26												2.01
d	Training of Forest Officers/Officials	LS			0.50		0.50		0.50		0.50		0.50		0.50		0.50		0.50		0.50		0.50		5.00
e	Sub - total (a+b+c+d)				5.50		2.50		1.50		1.25		0.76		0.70		0.70		0.70		0.70		0.68		14.99
10	**Protection of Forest**																								
a	Const./Repair of Boundary Pillars and fire line	LS			1.00		1.00		1.00		1.00		1.00		1.00		0.50		0.50		0.50		0.50		8.00
b	JFM & User Group				0.30		0.30		0.30		0.30		0.30		0.30		0.30		0.30		0.30		0.30		3.00
c	Forest Protection in view of outside workers -- providing LPG/Kerosene	LS		--	1.00		1.00		0.50		--				--		--		--		--		--		2.50
d	Sub - total (a+b+c)				2.30		2.30		1.80		1.30		1.30		1.30		0.80		0.80		0.80		0.80		13.50
11	**Development and Management of Wildlife**																								

(Ls-6.2

'wise target (physical and financial) for Catchment Area

opment Plan

Measures	Unit	Rate			Year I		Year II		Year III		Year IV		Year V		Year VI		Year VII		Year VIII		Year IX		Year X		Total	
					Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)	Physical	Financial (Rs.lakhs)
Nursery																										
Nursery development & Maintenance inc. all activity					1	4.29		0.25		0.25		0.25		0.25		0.25		0.25		0.25		0.25		0.25		6.50
Rawing of Plants						3.02		3.28		3.78		3.78		3.78		4.70										
Maintenance of the plants - 1st yrs								0.28		0.35		0.50		0.50		0.50		0.47								
- 2nd year										0.18		0.25		0.25		0.33		0.33		0.31						
- 3rd year												0.09		0.12		0.17		0.17		0.17		0.16				27.43
Total outlay for raising the plants Inc. Maintenance (1To III)						3.02		3.53		4.29		4.59		4.70		5.70		0.96		0.48		0.16				
Sub - total (a+b)						7.27		3.78		4.54		4.83		4.95		5.95		1.21		0.73		0.41		0.25		33.93
Afforestation																									140	46.14
Afforestation (1100 plants/Ha) (20% Medicinal Trees+10% forest fruit)	Ha	38100	Rs/Ha				20	7.02	35	8.78	35	8.78	25	8.78	35	8.78	30	7.02								
Maintenance of afforestation									20	0.72	45	1.40	70	1.83	75	1.88	75	1.88	70	1.70	45	0.88	20	0.28	400	10.52
Rate - 1st yr 3800 Rs./Ha 2nd yr 2500 Rs/Ha 3rd yr - 1400 Rs/Ha																										
Sub - total (a+b)								7.02		9.50		10.18		10.60		10.66		8.90		1.70		0.88		0.28		56.66
Enrichment Plantations																										
Enrichment Plantations (800 plant/Ha)	Ha	14300	Rs/Ha								20	2.86	20	2.86	20	2.86	25	3.58	30	4.29	25	3.58			140	20.02
Thorny brush wood protection guard for each plant (as per schedule) rate)			7	Rs/plant								0.84		0.84		0.84		1.05		1.26		1.05				5.88
Sub - total (a+b)												3.70		3.70		3.70		4.63		5.55		4.63			65	25.90
Energy Plantations (5000 plant/Ha) (Incl. wooden fence post & stand, babwool wire, live hedge fencing)	Ha	71130	Rs/Ha				10	7.11	10	7.11	10	7.11	10	7.11	10	7.11	15	10.67								46.23
Total Area for Afforestation and plantations							30		35		55		55		55		60								345	
Soil Conservation / Bio Engineering																										
Bio-Engineering Measures																										
Rawing of of Bio engineering plants	No	2.5	Rs/unit	75000	1.88	56000	0.84	50000	1.25	50000	1.25	50000	1.25	50000	1.25	50000	1.25	50000	1.25	50000	1.25	25000	0.63		12.13
Planting of Bio engineering plants	No	3.5	Rs/unit	75000	2.63	35000	1.23	50000	1.75	50000	1.75	50000	1.75	50000	1.75	50000	1.75	50000	1.75	50000	1.75	25000	0.88		16.96
Soil Conservation works																										
Vegetative Structures - Jaschrea,brush-wood check dams, bamboo pits etc	No	650	Rs/unit	100	0.65	100	0.65	50	0.33	100	0.65	100	0.65	50	0.33	100	0.65	90	0.59	100	0.65	50	0.33	900	5.20
Civil structure																										
- Gryotme small	No	5000	Rs/unit	5	0.25	10	0.50	10	0.50	10	0.50					5	0.25			10	0.50	10	0.50	65	3.25
- Gryotme medium	No	10000	Rs/unit	5	0.50	10	1.00	10	1.00	2	0.20					5	0.50	5	0.50	5	0.50			47	4.70
- Crate wire structure-medium	No	15000	Rs/unit	5	0.75	5	0.75	10	1.50	2	0.30	3	0.45	5	0.75	5	0.75			4	0.60			39	5.85
- Crate wire structure-large	No	25000	Rs/unit	5	1.25	5	1.25	10	2.50			2	0.50					2	0.50			2	0.50	26	6.50
- Water harvesting structure-medium	No	50000	Rs/unit			2	1.00			1	0.50			1	0.50	1	0.50							5	2.50
Sub - total (a+b)					7.90		7.29		8.83		5.15		4.60		5.33		5.40		4.58		5.35		2.83	1	97.10

Afforestation cost/Ha of plantation including maintenance

A) Plantation including Fencing:

S.No	Description	Unit	Rate	Cost(Rs)
1.	Survey & demarcation of plantation & area I/C marking of seditions, path preparation of maps	1Ha	80.80	80.80
2.	Cutting & preparation of wooden fence posts2 mtr & 8 to 10Cm diameter I/C debarking & fashioning the top 15Cms in conical shape	60 No	1036.02 per%	621.61
3.	Carriage of fence posts upto 2mtr long & 8 to 10cm diameter over a distance of 2Kms	60 No	272.20 /%/Km	326.64
4.	Charring & coal tarring of the ends of the fence posts	60No	223.60/%	134.16
5.	Preparation & digging of holes 20-30 cm dia. & 45cm deep	60 No	725.41/%	435.25
6.	Fixing of wooden posts I/C strutting	60 No	572.80	343.68
7.	Carriage of B.wire bundles uphill over an average distance of 2Km	0.7Qtl.	65.40./Qtl/Km	91.56
8.	Stretching & fixing of barbed wire with U- stapple in 3 strand	540 Rmt.	3.80	2052.00
9.	Interlacing of thorny bushes with barbed wire obtained from planting site	180 Rmt.	3.30	594.00
10	Preparation of Live hedge Fencing (Two Rows)	160 Rmt (Each).	10.60/Rmt	3816.00
10.	Preparation of inspection path60cm wide	250 Rmt.	8.70	2175.00
11.	Preparation of water retention mounds/trenches	L/S	L/S	2200.00
12.	Digging of pits(30x30x30) cm	660No	381.86/%	2520.30
13	Digging of pits(45x45x45) cm	440 No	763.53/%	3359.55
14	Filling of pits(30x30x30) cm	660No	152.66/%	1007.58
15	Filling of pits(45x45x45) cm	440 No	218.77/%	962.59
16	Carriage of plants in P.Bags from nursery site over an average distance of 2Km uphill	1100 No	174.46/%/Km	3838.12
17	Planting of plants raised in P. Bags	1100	174.58/%	1920.40
18	Planting of grass tufts/preparation of strips I/C sowing in strips 100x30x5cms for grass sowing	500 strips	735.99/%	3679.98
19	Cost of B. Wire/U- nail	0.70Qtl	7000	4900.00
21	G.Total			35059.22
22	Or Say			35100.00
	B) Nursery Cost of Plants	**1100**	**3.50/plant**	**3850.00**

C) Maintenance:

1st Year Maintenance	3600.00
2nd Year Maintenance	2500.00
3rd Year Maintenance	1400.00
G.Total Maintenance	**7500.00**

GRAND TOTAL (New & Maintenance) **46450**

Energy Plantation cost/Ha of plantation (No Maintenance)

A) Plantation including Fencing:

S.No	Description	Unit	Rate	Cost(Rs)
1.	Survey & demarcation of plantation & area I/C marking of seditions, path preparation of maps	1Ha	80.80	80.80
2.	Layout of pits/patches per Ha	1Ha	81.78	81.78
3.	Cutting & preparation of wooden fence posts2 mtr & 8 to 10Cm diameter I/C debarking & fashioning the top 15Cms in conical shape	60 No	1036.02 per%	621.61
4.	Carriage of fence posts upto 2mtr long & 8 to 10cm diameter over a distance of 2Kms	60 No	272.20 /%/Km	326.64
5.	Charring & coal tarring of the ends of the fence posts	60No	223.60/%	134.16
6.	Preparation & digging of holes 20-30 cm dia. & 45cm deep	60 No	725.41/%	435.25
7	Fixing of wooden posts I/C strutting	60 No	572.80	343.68
8	Carriage of B.wire bundles uphill over an average distance of 2Km	1.17.Qtl.	65.40/Qtl/Km	153.04
9.	Stretching & fixing of barbed wire with U- stapple in 5 strand	900 Rmt.	3.80	3420.00
10.	Interlacing of thorny bushes with barbed wire obtained from planting site.	180 Rmt.	3.30	594.00
11	Preparation of Live hedge Fencing(Two Rows)	180 Rmt (Each)	10.60/Rmt	3816.00
12.	Digging of pits(30x30x30) cm	5000No	381.86/%	19093.00
13	Carriage of plants in P.Bags from nursery site over an average distance of 2Km uphill	5000 No	174.46/%/Km	17446.00
14	Planting of plants raised in P. Bags	5000 No	174.58/%	8729.00
15	Filling of pits(30x30x30) cm	5000No	152.66/%	7633.00
16	Cost of B. Wire/U- nail	1.17.Qtl	7000	8190.00
17	G.Total			71097.96
18	Or Say			71100.00

B) Nursery Cost of Plants — 5000 — 3.50/plant — 17500.00

GRAND TOTAL — 88600.00

Per Hactare Cost of Enrichment planting

A) Plantation with Thorny brushwood guard protection around individual plant (No Fencing& maintenance):

S.No	Description	Unit	Rate	Cost(Rs)
1.	Digging of pits(45x45x45) cm	600 No	763.53/%	4581.18
2.	Filling of pits(45x45x45) cm	600 No	216.77/%	1312.62
3.	Carriage of plants in P.Bags from nursery site over an average distance of 3Km uphill	600 No	174.46/%/Km	3140.28
4.	Planting of plants raised in P. Bags(Tall plants)	600	174.58/%	1047.48
5.	Thorny brushwood guard protection around individual plant	600	7.00	4200.00
21	Total			14281.56
22	Or Say			14300.00
B) Nursery Cost of Plants		600	3.50/plant	2100.00

GRAND TOTAL 16400