HIMACHAL PRADESH POWER CORPORATION LTD.

(A H.P. Govt. Under taking)

CATCHMENT AREA TREATMENT PLAN FOR SAINJ HEP (100 MW), DISTRICT KULLU, (H.P.)

लघु रत्न - MINI RATNA

WAPCOS LIMITED

(A GOVERNMENT OF INDIA UNDERTAKING)

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CATCHMENT AREA TREATMENT PLAN

CATCHMENT AREA TREATMENT PLAN

1. PROJECT DESCRIPTION

The Sainj hydroelectric project has been contemplated as run off the river scheme which envisages construction of barrage across river Sainj near village Niharani, located on the right bank of the river. The power house is proposed with two units of 50 MW each to be located near confluence of Jiwa Nallah and river Sainj, which is about 300 m upstream of the proposed power house of the Parbati Stage-II Hydro-electric Project. The energy generation of 399.57 GWh at 90% dependable year and 436.90 GWh at 50% mean year is envisaged as a result of commissioning of the project.

The salient features of project are briefly described as below:

- 24.5 m high Diversion gated barrage at an elevation of ±1733m, downstream of village Niharni on river Sainj. The FRL and MDDL is proposed at an elevation of ±1752 m and ±1738.50 m respectively, to attain a live storage of ± 38.41 ham to meet up diurnal peaking requirement during lean months.
- Two underground disilting tanks (145mx15mx7.5m) to exclude all silt particles down to 0.2 mm Size.
- A Head Race Tunnel (HRT) on the right bank of river Sainj, of abou ±6.3 km long with 3.76 m diameter designed to carry a discharge of 28.70 cumec.
- Two intermediate adits 320 m and 430 m long and 4 m D-shaped proposed at RD 930 m and 4750 m respectively to facilitate construction of HRT.
- An underground restricted orifice surge shaft at the end of HRT - adit to top elevation ±1766.5 m and another adit at Bottom Elevation +1672.37m is proposed to facilitate the construction of surge shaft
- An underground pressure shaft of ±2.75 m diameter, 550 in long to carry discharge into power house.
- An underground power house to be located on right bank of river Sainj near confluence of Jiwa Nallah and Sainj river, which will have two units of 50 MW each to provided total installed capacity of 100MW.
- A tail race tunnel (TRT) of 400 m long and 4.8 m D-shaped, will constructed for discharging the water back into river Sainj.

- Infrastructure works like construction of approach roads, bridge, colony office complex, school and hospital.

- Energy generation of 399.57 GWh and 436.90 GWh at 90% and 50% dependable years are envisaged as a result of commissioning of the project.

The total land requirement for the project is 56.763 ha. The project is proposed to be completed in about 4.5 years.

2. NEED FOR CATCHMENT AREA TREATMENT

It is a well-established fact that reservoirs formed by dams on rivers are subjected to sedimentation. The process of sedimentation embodies the sequential processes of erosion, entrainment, transportation, deposition and compaction of sediment. The study of erosion and sediment yield from catchments is of utmost importance as the deposition of sediment in reservoir reduces its capacity, and thus affecting the water availability for the designated use. The eroded sediment from catchment when deposited on streambeds and banks causes braiding of river reach. The removal of top fertile soil from catchment adversely affects the agricultural production. 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.

The Catchment Area Treatment (CAT) plan highlights the management techniques for to control erosion in the catchment area of a water resource project. The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive

measures are thus needed for the treatment of catchment for its stabilizat on against future erosion. The total catchment intercepted at barrage site is 39730 ha. The catchment area considered for treatment under the present project is 13234 ha which comes under very high and high erosion category. The sub-watershed in the catchment area considered for the present study is given in Figure-1.

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.

A detailed database on natural resources, terrain conditions, soil type of the catchment area, socio-economic status, etc. is a pre-requisite to prepare treatment plan keeping in view the concept of sustainable development. Various thematic maps have been used in preparation of the CAT plan. Due to the spatial variability of site parameters such as soils, topography, land use and rainfall, not all areas contribute equally to the erosion problem. Several techniques like manual overlay of spatially index-mapped data have been used to estimate soil erosion in complex landscapes.

Geographic Information System (GIS) is a computerized resource data base system, which is referenced to some geographic coordinate system. In the present study, real coordinate system has been used. The GIS is a tool to store, analyze and display various spatial data. In addition, GIS because of its special hardware and software characteristics, has a capacity to perform numerous functions and operations on the

various spatial data layers residing in the database. GIS provides the capability to analyze large amounts of data in relation to a set of established criteria.

In order to ensure that latest and accurate data is used for the analysis, satellite data has been used for deriving land use data and ground truth studies too have been conducted. The various steps covered in the study are as follows:

- Data acquisition
- Data preparation
- Output presentation

The above mentioned steps are briefly described in the following paragraphs.

2.1 Data Acquisition

The requirement of the study was first defined and the outputs expected were noted. The various data layers of the catchment area used for the study are as follows:

- Slope Map
- Soil Map
- Land use Classification Map
- Current Management Practices
- Catchment Area Map.

2.2 Data Preparation

The data available from various sources was collected. The ground maps, contour information, etc. were scanned, digitized and registered as per the requirement. Data was prepared depending on the level of accuracy required and any corrections required were made. All the layers were geo-referenced and brought to a common scale (real coordinates), so that overlay could be performed. A computer programme 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. The format of output was finalized. 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 and classification. The classified land use map of the catchment area considered for the study is shown as Figure- 2. The landuse pattern of the catchment area is summarized in Table-1.

TABLE-1

Landuse pattern of the catchment area

S. No.	Category	Area (ha)
1.	Dense vegetation	7121 (17.92)
2.	Open vegetation	3162 (7.96)
3.	Scrub	3000 (7.55)
4.	Agriculture	1204 (3.03)
5.	Barren lands	3397 (8.55)
6.	Water bodies	4773 (12.01)
7.	Snow cover	17004 (42.80)
8.	Settlements	69 (0.17)
	Total	**39730 (100.00)**

Note: Figure in brackets indicate percentage

Digitized contours from top sheets 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 top sheet were digitised (100 m interval). 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 their elevation). All this information was in real world coordinates (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 slope map is enclosed as Figure - 3. Various layers thus prepared were used for Modeling. Software was prepared to calculate the soil loss using input from all the layers.

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

The Silt Yield Index Model (SYI), considering sedimentation as product of erosivity, erodibility and areal 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. 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) Geomorphic 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 equation:

a. Silt Yield Index

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

where
Ai = Area of ith unit (EIMU)
Wi = Weightage value of ith mapping unit

n = No. of mapping units
Aw = Total area of sub-watershed.

The SYI values for classification of various categories of erosion intensity rates are given in Table-2.

TABLE- 2

Criteria for erosion intensity rate

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

4 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.

Following Engineering and Biological measures have been suggested for the catchment area treatment.

1. Engineering measures

- Step drain
- Contour bunding
- Check dams

2. Biological measures

- Afforestation /Plantation

- Replenishment afforestation / Gap plantation
- Fuel Wood and fodder development
- Pasture development
- Social forestry
- Development of nurseries

The description of various catchment area treatment measures recommended as a part of CAT Plan of the proposed Sainj hydroelectric project is given in the following paragraphs:

i) **Step Drain :** Step drain are recommended in the steep streams where soil erosion is high. The stepped drain can be concrete drain (2-3 ft. steps) or steps can be developed with sausage wall or combination of sausage walls and dry walls. The steps in the drain help in reducing the current of water which reduces the soil erosion.

ii) **Contour Bunding :** Contour bunding is a widely used soil conservation measure on agriculture land. It consists of constructing narrow trapezoidal embankments on contour to impound the runoff water behind them, so that impounded water is absorbed gradually into the soil profile for crop use.

iii) **Check dam :** The check dam will be provided with stone masonry and G.I. crate walls in the nalah where less vegetative cover and erosion is high.

iv) **Afforestation :** A well stocked forest plays a very important role in control of soil erosion. Thus, it is proposed to increase the vegetal cover in the area. For this purpose, barren areas, devoid of tree growth have been recommended to be brought under afforestation. As a part of the CAT Plan, two types of afforestation programmes have been recommended which are described in the following paragraphs:

a) **Afforestation of Degraded Areas** : As a part of the scheme, barren areas devoid of tree cover will be taken up for plantation. The tree species recommended for plantation include Deodar, Kail, Ban Oak, Ceder, Poplar, etc. About 1500 plants per hectare shall be planted.

b) **Replenishment Afforestation/ Gap plantation:** Many of the forest areas which have been depleted due to excessive pressure of local population for timber, fuelwood and fodder. The natural regeneration is absent as a result of increased human interferences. For such forest areas, it is proposed to increase the stocking by artificial regeneration. About 600 to 800 trees per ha are proposed to be planted as a part of this measure.

v) **Fuel wood and Fodder Development :** The dependence of local population on forest resources to meet fuel wood and fodder requirements leads to cutting of trees and clearance or grazing of pastures. This leads to increased soil erosion. Thus, as a landuse management strategy it is proposed to develop area under social forestry, fuelwood and fodder development to reduce the pressure on existing forest resources.

vi) **Pasture development :** Barren lands with slopes greater than 40% have been recommended to be treated by developing pastures over them. Fodder development has been recommended in vicinity to the villages within the catchment. This will reduce the pressure on pasture land being developed as a part of the catchment area treatment plan.

vii) **Social forestry** : The plantation under social forestry is recommended to control the tree felling near the settlement area.

viii) **Development of nursery** : Development of nursery is done to provide saplings for various plantation works. Nurseries have been recommended as a part

of the CAT Plan in various sub-watersheds covered as a part of the CAT Plan. The size of the nursery can be 1 to 1.5 ha and about 10,000 saplings can be planted in the nursery.

The basis of site selection for different biological and engineering treatment measures under CAT are given in Table -3.

TABLE- 3

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
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.
Check dam	Stone masonry with cement mortar in 1:6 with concrete base 1:4:8 and G.I. crate walls on steep slopes, sliding surfaces, where less vegetative cover and silt erosion is high
Nursery	Centrally located points for better supervision of proposed afforestation, minimize cost of transportation of seedling and ensure better survival.

5 CATCHMENT AREA TREATMENT MEASURES

The total directly draining catchment area is 39,730 ha. The erosion category of various watershed in the catchment area as per a SYI index are given in Tables- 4 and 5. The details are shown in Figure-4.

TABLE- 4

Erosion intensity categorization as per SYI classification

Watershed number	Area (ha)	SYI values	Category
W1	1377	1216	High
W2	1285	1335	Very High
W3	1228	1217	High
W4	1693	1295	High
W5	753	1253	High
W6	912	1246	High
W7	852	1264	High
W8	793	1050	Medium
W9	1325	1285	High
W10	1414	1159	Medium
W11	1885	1155	Medium
W12	1255	1046	Medium
W13	1307	1208	High
W14	1330	1032	Low
W15	986	1030	Low
W16	1759	1126	Medium
W17	1247	1212	High
W18	1255	1240	High
W19	1242	1088	Low
W20	1139	1033	Low
W21	687	947	Very Low
W22	1758	969	Very Low
W23	1247	1003	Low
W24	827	1191	Medium
W25	707	1000	Low
W26	1146	932	Very Low
W27	712	1064	Medium
W28	2015	1126	Medium
W29	1375	933	Very Low
W30	1747	1005	Low
W31	1697	973	Very Low
W32	775	967	Very Low
Total	**39730**		

TABLE- 5

Area under various erosion categories

S. No.	Category	Area (ha)
1.	Very Low	7438 (18.7)
2.	Low	12207 (30.7)
3.	Medium	6851 (17.2)
4.	High	11949 (30.2)
5.	Very High	1285 (3.2)
	Total	**39730(100.00)**

Note: Figure in brackets indicate percentage

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 be treated at the project proponent cost. Hence, CAT plan has been suggested for very high and high erosion category, as a part of the present EIA study, the expenses of which have to be borne by project proponents. The area under very high and high erosion categories is 13,234 ha, which is about 33.4% of the total catchment area intercepted at the barrage site.

6 TREATMENT MEASURES

As a part of catchment area treatment plan, various biological as well as engineering treatment measures have been recommended. The details of the biological and engineering treatment measures recommended as a part of CAT plan are given in Tables- 6 and 7 respectively.

TABLE- 6

Details of biological treatment measures recommended as a part of CAT plan

S. No.	Treatment measures	Watershed No.	Area (ha)
1.	Afforestation (1500 trees/ha)	W1	25
		W2	18
		W3	20
		W5	17
		W6	21
	Total		**101**
2.	Replenishment Afforestation/ Gap Plantation (800 tree/ha)	W1	65
		W2	40
		W3	30
		W5	35
		W6	25
	Total		**195**
3.	Pastures Development	W1	20
		W2	20
		W3	20
		W5	20

S. No.	Treatment measures	Watershed No.	Area (ha)
		W6	20
		W7	20
		W9	20
		W13	10
	Total		**150**
4.	Fuel wood and Fodder development	W1	20
		W2	20
		W3	20
		W13	20
	Total		**80**
5.	Social forestry	W1	20
		W2	20
		W3	20
		W13	20
	Total		**80**

TABLE- 7

Details of Engineering measures recommended as a part of CAT plan

S.No.	Treatment measures	Watershed No.	Quantity
1.	Contour bunding	W1	104
		W2	81
		W3	63
		W5	58
		W6	95
	Total		**401 ha**
2.	Stepped drains	W1	2
		W2	1
		W3	1
		W5	1
		W6	1
		W9	1
	Total		**7 (105 Rmt)**
3.	Check Dam	W1	3
		W2	2
		W3	1
		W5	1
		W6	2
		W9	2
		W17	2
		W18	2
	Total		**15**

7 WILDLIFE IMPROVEMENT AND DEVELOPMENT

The catchment area is part of Great Himalayan National Park (GHNP) and the Sainj Wildlife sanctuary (SWLS) is about 2.5 km from the proposed barrage. The wildlife in the area is exposed to a lot of biotic interferences. The excessive cattle population also leads to significant pressure on vegetal cover. This results in disturbance of ecology and environment.The plant communities are representative of temperate and alpine regions. The forest area consists of extensive stands of Oak *(Quercus semecarpifolia)*, coniferous forests of Blue Pine *(Pinus wallichiana)*,- West Himalayan Silver Fir *(Abies pindrow)*, west Himalayan Spruce *(Picea smithiana)* and Himalayan Cedar *(Cedrus deodara)*. The broad-leaf forests contain *Aesculus indica, Rhododendron arboreum, Quercus leucotrichophora, Q.floribunda* at the lower altitude and pure patches of Birch *(Betula utillis)* at higher altitudes, Yew *(Taxus baccata)* is an important medicinal tree of the under storey. A rich variety of shrubs and patches of Ringal bamboo *(Arundinaria spathiflora)* are found as a dense under storey. The shrubs of *(Rhododendron campanulatum)* in the sub-alpine zone. Other shrubs that are found at an elevation above 3,700 m, are *Juniperus communis. J. pseudosabina, Lonicera, Berberis, Cotoneaster, Vibernum,* Rosa occur extensively above 3700 m. There are number of clearings in the forest areas which are locally known as 'thach'. These are grazing and camping ground for the migratory livestock including cattle, sheep and goats. The alpine flora occurring above 4,000 meters is characterized by species rich meadows with medicinal and economical values. They include *Aconitum violaceum, Salvia moorcraftiana, Viola serpens, Jurinea macrocephala, Rheum emodi, Berginia ciliata, Picrorhiza kurroo, Saussurea graminifolia* etc.

The catchment area is the part of Great Himalayan National Park (GHNP), supports an

extremely diverse wildlife population. It harbours one of the few known viable population of 'Western Tragopan' alongwith more than 300 species of birds and over 30 species of mammals.

The mammals reported in the catchment area include Serow *(Capricomis sumatraensis)*, Himalayan Tahr. Goral *(Nemorhaedus goral)*, BlueSheep (*Pseudols nayaur*), Himalayan Black Bear *(Selenarctos thibetanus)*, Himalayan Brown Bear *(Ursus- arctos)*, Himalayan Red Fox *(Vulpes vulpes)* and Musk Deer *(Moschus moschiferus)*. The Red Data Book, has listed Musk Deer as a vulnerable species. The GHNP has .recorded 183 bird species including 132 passerines and 51 non-passerines, Galliforms in GHNP constitute a very important and spectacular component of bio-diversity, The GHNP is one of two National Parks in the World with a population of endangered Western Tragopan *(Tragopan melanocephalus)*. Another endangered pheasant, Cheer (*Catreus wallichii)* is present on the steep, south-facing grassy slopes. Monal *(Lophphorus impegenus)*, and Koklas *(Pucrasia macrolopha)* are abundant in the temperate forest zone. Kaleej *(Lophura leucomelana)* occurs in small numbers below an elevation of 2,000 m. The sightings of Snow Partridge *(Lerwa lerva)*, Hill Partridge, *Arborophilatorqueola* and Himalayan Snow cock *(Tetragallus himalayana)* are few.

The communities of the project area generally occupy forest fringe region, they have lived in isolation but in harmony with the nature. They draw their sustenance largely from the forests for their day to day consumption and their livelihood. The needs of the people who live in the harmony with the forests also has to be considered. At the same time, it is essential that there is no adverse on the wildlife habitat and the delicate equilibrium between the two is maintained in future also. The need of the protection and promotion of the existing species of wildlife and education of people

about the harmonious coexistence with wildlife should be given proper importance in managing the forests.

7.1 Objective of wildlife management

The objectives of wildlife management are:

i) To maintain plant and animal bio-diversity in nature by establishing the viable, healthy and Productive population of wild life for conserving genetic resources.

ii) To identify the problems of wildlife in the area, this in turn will help formulating the guidelines for their development and improvement.

iii) To ensure collection of scientific data for the maintenance and development of viable population of flora and fauna for scientific, aesthetic and economic purposes.

iv) To manage the habitat of fauna by provided special food and ideal habitat.

7.2 Activities for wildlife improvement and development

The following activities are proposed to be carried out for wildlife improvement and development in the catchment area of Sainj hydroelectric project. Since the catchment area of the proposed project is the part of Great Himalayan National Park (GHNP), therefore the detailed action plan may be prepared by GHNP, who is responsible for the formulation and implementation of various conservation measures in the GHNP.

A. Wildlife Improvement

i) Survey and documentation of flora & fauna in the catchment area of Sainj hydroelectric project

ii) Incentive to local communities for fire prevention

iii) Incentive to local communities for protection of Wildlife.

iv) Incentive to community to regulate local and migratory gazers in Sainj WLS.

B. Wildlife Development

a. Intensive Management of Wildlife

i. Habitat Improvement in Sainj WLS

ii. Wildlife Census

iii. Capacity building of staff and community

iv. Support for communication-mobile connectivity

v. Establishment of nursery with an area of 1 ha infrastructure for distribution of plants in public

vi. Maintenance of plants in nursery

vii. Soil and moisture conservation

viii. Monitoring, evaluation and impact assessment study

b. Eco-Development Activities

i) Support for vermi compost development.

ii) Support for introduction of LPG for poor house holds around project area and Sainj WLS

iii) Socio-economic survey around project area and in Sainj WLS

c. Ex-situ support for Himalayan Thar Breeding

A. WILDLIFE IMPROVEMENT

i) Survey and documentation of Flora and Fauna in the catchment

The existing boundary of the forest covering in the CAT Plan including Sainj WLS will be maintained with pillar. So that the areas are not encroached upon by the local inhabitants near their cultivations and at the same time the forests are also protected. Beside this survey for flora and fauna will also be carried out and recorded. An outlay of Rs.6.0 lakh has been kept for this purpose.

ii) Incentive to local communities for fire prevention

The local community of the plan area will be provided with incentives in order to prevent the area from fire and outlay of Rs. 2.0 lakh has been kept for this purpose.

iii) Incentive to local communities for protection of Wildlife

Reward / incentive to the informers are required for proper protection of the forest area against poaching and illicit felling. It is proposed to strengthen the Wildlife efforts of forest guard in controlling offences by associating the locals. They can be

rewarded and incentives be given by the forest department. It is necessary to make people aware about the biological, ecological hardship with the bio-diversity of the forest area is facing. Therefore, the people should be encouraged by providing them reward / incentive for giving information about the offender/culprits. It is also ensured that informer's name should not be disclosed publically or otherwise people will not dare to come forward on this issue. A provision of Rs.2.5 lakh has kept for this purpose.

iv) Incentive to community to regulate local and migratory gazers in Sainj Wildlife Sanctuary

Incentive will be provided to 1he local inhabitant to regulate the local and migratory gazers in the wildlife sanctuary areas in order to protect the area from complete depletion of the palatable grasses. Therefore an amount of Rs 2.5 lakh is proposed to meet this purpose during the plan period

B. DEVELOPMENT MEASURES

a. Intensive Management of Wildlife

i) Habitat Improvement in Sainj Wildlife Sanctuary

Since all wildlife in nature live in complex web of linkage with other organisms, the proper evaluation of habitat of each species followed by its proper management is very essential. The plant life provides a congenial habitat to wildlife. Thus, it is proposed to improve the wildlife habitat by undertaking planting and other works.

For this purpose bushy, shrubby and thick forests are to be maintained and no grass should be removed from the habitat of the wild life. In degraded forest areas, suitable species i.e. fodder and fruit bearing species will be carried out as per site location, the bank area in the forests especially in high reaches along ridge should be maintained as pasture land by sowing suitable local grasses for the benefit of wild animal. Besides this water pond/ hole should be constructed wherever these are

required. An outlay for Rs. 5.0 lakh has been proposed to be incurred during the plan period.

ii) Wildlife Census

It is proposed to carry out wildlife census every alternative year in key areas to assess the trends in population of growth of various species. The findings of the survey will help in assessment of various management measures and need for improvements, if any. An amount of Rs.10.0 lakh has been earmarked for this purpose.

iii) Capacity building of staff and community

The implementing staff and communities will be imparted with training and exposure visit in order to build their capacity for effective management and improvement of wildlife and wildlife sanctuary. An outlay of Rs. 3.0 lakh is proposed to be earmarked for this purpose.

iv) Support for communication

Mobile connectivity will be provided to the staff to have communication for effective protection of Flora and Fauna. An amount of Rs. 1.0 lakh is proposed to be earmarked for this purpose.

v) Establishment of nursery with infrastructure

An ideal nursery will be established with its infrastructure to provide healthy seedlings for distribution of plants in public. Rs. 5.0 lakh has been earmarked to establish this nursery.

vi) Maintenance of plant in nursery

The nursery will be maintained so as to provide sufficient planting stock in perpetuity for public distribution. An amount of Rs. 5.0 lakh has been kept for maintenance of nursery.

vii) Soil and moisture conservation

The tract is prone to soil erosion and in order to check and protect the area from further erosion, a provision for soil and moisture conservation interventions has been proposed. For this purpose an amount of Rs. 5.0 lakh has been earmarked.

viii) Monitoring, evaluation and impact assessment study

A study will be carried out for impact assessment, monitoring & evaluation and for this purpose an amount of Rs. 4.0 lakh has been earmarked.

b. Eco-development activities

i) Support for vermi compost development

Vermi composting is one of the alternative sources of income generation which is easy to adopt, home based and can bring fast income returns to the local people in an eco friendly manner. Forest department and horticulturist in Kullu district will be a potential buyer of all such compost for its vast network of Forest Nurseries. Woman organization of the area can adopt these activities as a part time without compromising with their day to day work. An outlay of Rs. 1.0 lakh has been kept under income generation activities.

ii) Support for introduction of LPG for poor house holds

In order to release pressure on existing forests to meet the demand of fuel in and around Sainj WLS a provision for introduction/ supply of LPG to the poor house holds has been made. An outlay of Rs. 1.0 lakh has been kept under this component

iii) Socio-economic survey

A survey will be conducted around Sainj Wildlife sanctuary to assess and study the socio-economic conditions. Funds to the tune of Rs. 1.0 lakh have been earmarked for conducting the socio-economic survey.

c. Ex-situ support for Himalayan Thar breeding of GHNP

The catchment area is the part of habitat of rare and important Himalayan Fauna. A provision has been made in the CAT Plan for its management including Ex-Situ Development/conservation. The habitat of these rare and important Himalayan Fauna species is in fact degrading causing their population to dwindle at a very fast pace. Therefore, in order to develop/manage the fauna found in the area, provision has been kept for development / management of wildlife to supplement in situ conservation with Ex-Situ conservation. The emphasis will be to conserve the gene pool of the endangered species so that they can breed in captivity, after which they can be released in the natural habitat of the area. A five year Ex-Situ conservation breeding project management plan will be prepared separately under the supervision of Central Zone Authority (CZA) of India under Wildlife Protection Act (1972). The proposed work will be executed on the basis of approved conservation captive breeding plan by the CZA New Delhi. The necessary infrastructure will be developed for Ex-Situ conservation breeding project as per approved plan and necessary provision will be made for human resource development by providing training to the staff in captive breeding and reintroduction programme. A total outlay of Rs.40.0 lakh has been proposed for this purpose.

7.3 BUDGET

A total provision of Rs.94.0 lakh has been estimated for implementation of various measures for Wildlife improvement and development. The details are given in Table-8.

TABLE-8

Details of cost required for wildlife improvement and development

S. No.	Activity	Cost (Rs. Lakh)
1.	Survey of flora and fauna in the catchment area	6.0
2.	Incentives to local communities for fire prevention	2.5
3.	Incentives to local communities for wildlife protection	2.0
4.	Incentives to community to regulate local and migratory grazers in Sainj Wildlife Sanctuary	2.5
5.	Habitat improvement in Sainj Wildlife Sanctuary	5.0
6.	Wildlife Census	10.0
7.	Capacity Building of staff and community	3.0
8.	Support for communication	1.0
9.	Establishment of nursery with infrastructure	5.0
10.	Maintenance of nursery	5.0
11.	Soil and moisture conservation	5.0
12.	Monitoring, evaluation & impact assessment study	4.0
13.	Support for vermin-compost development	1.0
14.	Support for introduction of LPG for poor household	1.0
15.	Socio-economic survey	1.0
16.	Ex-situ support for Himalayan Thar breeding/conservation of GHNP	40.0
	Total	**94.0**

8 Joint Forest Management Process

Joint Forest Management (JFM) is a concept of developing partnerships between fringe forest user groups and the Forest Department (FD) on the basis of mutual trust and jointly defined roles and responsibilities with regard to forest protection and development. In JFM, the local communities and the Forest Department manage the resource and share the cost equally. Joint management of forest lands is sharing of responsibilities, control, decision making authority and products over forest lands between Govt. and local user groups. The primary purpose of JFM is to create conditions at the local level, which enable improvements in forest conditions and productivity. A second goal is to support a more equitable distribution of forests products than is currently the case in most areas. It is a movement towards a more democratic management of natural resources founded on the principle of equity,

transparency and social justice, which aims to build collective community action deeply rooted in many rural communities. Joint forest management activities play an important role in the Catchment Area Treatment. Therefore, as a part of the JFM activities proposed for the Sainj H.E. Project, local communities will be motivated to identify themselves with the development and protection of the forests from which they derive benefits.

8.1 Objectives of Joint Forest Management (JFM)

The objective of the JFM is to review and study the technology and suitable silvicultural practices for increasing the productivity of degraded forests through participation of local communities. The communities are required to organize forest protection committees, village forest committees, village forest conservation and development societies, etc. Each of these bodies has an executive committee that manages its day-to-day affairs.

8.2 Policy Framework:

National forest policy 1988, envisages people's involvement in the development and protection of forests. Following the adoption of 1988 policy by the Govt. of India, several state governments including H.P. have decided to adopt the Joint Forest Management (JFM) approach with suitable modifications. Forest Protection Committees of West Bengal, Hill Resource Management Societies of Haryana, and village Forest Committees of Karnataka are few examples. In H.P. J.F.M. has been initiated in pursuance of Govt. Order No. Forest (C) 3-4/80- V dated 12 5.93. Implementation of JFM works shall be carried out as per the provisions of the Integrated Resource Management Plan (Micro Plan) and annual plan or operations finalised accordingly. Legal provisions, as amended from time to time, should be

included in the JFM strategies. The strategies for implementation are discussed as under.

8.3 Strategies for implementation:

Primacy of people:

Involvement of people is the foremost aspect in JFM. Joint management must be consciously based on people, their needs, their analysis of issues and their decisions. It also implies an explicit faith that people, whatever the condition *of* poverty and oppression, can progress, and transform their environment without the help *of* donation by external agencies.

In essence, JFM demands that local people move from being objects to becoming subjects of developmental process. It must be based on bottom up approach "Only through this approach can any people oriented progrramme attain any meaningful and lasting success. Thus, there is a need to bring in a change not only in their behavior but in attitude as well. The community awareness *of* the necessity and effectiveness *of* participation in their own development will ensure that progress shall continue even after the formalised programme ends. Till now, there is hardly any' example where people's participation has continued in a real sense even after the expiry of a particular programme / project. The programme's next purpose is to nurture the enthusiasm and capabilities *of* the user groups in order that they may attain self sufficiency. The group members will be encouraged to identify and utilise whatever resources, however meagre are available to them. Outside inputs shall be limited to the role *or* stimulants. Only assisting the groups in more effectively managing the own assets by using their knowledge. In no way shall the local community become dependent upon the programme itself for financial and bureaucratic survival. This will not only bridge the gap between officials and people

but also result in increased faith and confidence of people in Govt.

Involvement of NGO' s

Undoubtedly NGOs have to play a significant role in creating awareness amongst people. NGOs should be involved particularly in documentation, training and community level organising and facilitation. High people, high sounding NGOs may be of limited use in HP, context as local NGOs like Mahila Mandals, Yuvak Mandals and awakened individuals are more conversant with local customs, traditions and needs of the people and such institutions are working effectively throughout Himachal Pradesh.

Training:

JFM. envisages frequent interaction with people on part of the staff of Forest Department. Training of staff is thus crucial for the success of JFM. programme. It requires extensive training and reorientation of the staff of Forest Department to function effectively in an extensive role and provide support to village management. Attitudinal changes are very important so that the forest offtcials do not view JFM. in total isolation nor consider it to be another Govt. 'Scheme'. It should not be viewed as an entry point activity and plantation! soil conservation activity only. The qualitative factors: whether the VFDC has clearly perceived its role in effectively and judiciously reducing the consumption tends to get lost. How to train officials so that critical evaluation of these qualitative factors becomes an integral part of this programme is the basic issue.

Till recently, forest officials have been depending on physical, resource and position. Use of physical power by way of policing and imposing authority, resource power by giving plethora of benefits in form of timber, fodder, MFP etc., (worth about Rs. 700 crore annually in Himachal Pradesh) and imposing ones own wisdom by virtue of

one's position/status has not resulted in establishing a strong link with the local people. It is, therefore imperative now to concentrate on the last two powers i.e. expert power and personal power. Expert power is the power that is vested in someone because of his acknowledged expertise and personal power resides in the person and in his personality, sometimes called charisma, sometimes personality. These two powers in an official would be developed through trainings; not only in professional activities but also in extension, communication, leadership qualities etc. so that he is able to motivate people.

An appropriate training programme would contain three components (1) Seminars to introduce field staff to concepts, goals, tools and the roles they are expected tpo play in JFM programmes. (2) Field practice in JFM and (3) Extended field visits to successful JFM projects. It will be quite pertinent to mention here that attitudinal changes are required not only at the level of field functionaries but also should include the highest management and planning level including the public representatives.

8.4 Activities In Joint Forest Management (JFM)

Major activities undertaken as part of joint forest management (JFM) in the catchment area of sainj H.E. Project, includes the following:

- Institutional
- Productivity
- Marketing
- Profit sharing

Institutional Arrangements

The primary objective of the JFM programme includes the rehabilitation of degraded forestlands, village resource development, micro watershed to improve the socio-

economic status of forest-dependant communities in order to reduce pressure on forests with peoples' organisations e.g. Village Forest Committees –(VFC). Hence, a VFC needs to be constituted for the implementation of JFM.

Productivity

In order to reduce pressure on forests and to provide incentives to communities for economic returns to sustain forest protection and management NTFPs like grasses, bamboo, fruits are being planted in blocks, forest blanks and along trenches, homesteads and agriculture bunds. Fuel wood is the most important commodity that people access from forest areas. Use of fuel-efficient devices like stoves and Biogas plants otherwise plantations through their agro-forestry and other plantation programmes can be implemented as a part of in JFM to reduce the pressure on the forest. Non-wood forest products (NWFPs) have a key role in JFM efforts. With the increasing awareness of their economic potential and growing concerns for the sustainability of the resources and the distribution of the benefits derived from them, various state governments have taken over control of a number of NWFPs. Some of the explicit objectives for state monopoly of NWFP trade are:

- to prevent unscrupulous intermediaries and their agents from exploiting NWFP collectors:
- to ensure fair wages to collectors:
- to enhance revenue for the state:
- to ensure quality;
- to maximize the collection of produce

Marketing

There are three types of products available to communities in JFM areas

(i) immediate products like NTFPs, grass, fuelwood available almost immediately or after a time period depending upon the state of degradation of the forest that is being managed jointly,

(ii) intermediate products from operations like thinning, other cultural operations, and

(iii) final products like timber from fellings. In majority of the States, however, JFM is still in the initial stages, and hence marketing has not emerged as an important issue for consideration.

The share of forest products to communities varies as per provisions in the various State orders for JFM. However, from the experience of different states it is evident that the VFC share is rather minimal in case of high revenue earning NTFPs. However, State agencies such as FD and FDCs do have a major role in the marketing of timber and fuelwood. Community involvement in NTFP management needs to be ensured in (i) technology for collection, preservation and regeneration; (ii) scientific harvesting and handling; and (iii) planned extraction and management based on an NTFP database. Among the important strategies that need to be adopted in JFM.

Benefit sharing

Forest-user communities, dependent on forests for fuelwood, fodder, small timber and NTFPs, have accessed forest products under different rights regimes. Under the JFM programme, residents of forest-fringe villages will be provided access to forest produce to meet their basic needs of fodder, fuel wood and NTFP. In lie of this, people are protecting and managing the forests with the FD. Social fencing is to be practised for forest protection by VFC's. Regular voluntary patrolling by villagers. The FD is therefore benefiting from reduced workload for forest protection and also reduced expenditure on protection measures. VFCs will be entitled to a share in the timber harvest in varying proportions

8.5 Budget

A provision of Rs. 20.0 lakh has been earmarked for implementation of awareness programs among locals, training of locals and forest officials, etc.

9 SILT OBSERVATORIES

It is recommended that in areas categorized under very high erosion categories, major streams and river Sainj be monitored. The monitoring shall cover silt content being carried in the river water. A provision of Rs. 40.0 lakh has been earmarked for this purpose.

10 COST ESTIMATE FOR ENGINEERING AND BIOLOGICAL TREATMENT MEASURES, WILDLIFE IMPROVEMENT AND DEVELOPMENT, JOINT FOREST MANAGEMENT (JFM) AND SILT OBSERVATORIES

The per ha cost for afforestation in degraded forest land and their maintenance and replenishment afforestaion/ gap plantation development is given in Table- 9 & 10 respectively.

TABLE – 9

Cost Model for Afforestation of Degraded Forest Land (1500 plant/ha)

(A) PLANTATION COST				
S.No.	**Particulars of Work**	**Quantity**	**Rate in Rs.**	**Amount in Rs. Area**
	Fencing			
1	Survey & demarcation of Plantation area	1 Ha.	67.33	67.33
2	Preparation/ purchage of RCC fence posts	60 Nos.	200 per post	12000.00
3	Carrige of RCC fence posts upto 2 mt. long over distance 2 km	60 Nos.	907.34 per hundred	544.40
4	Preparation/digging of holes 20-30 cm dia & 50 cm. deep	60 Nos.	604.51 per hundred	362.70
5	Fixing of Wooden fence posts including strutting	60 Nos.	477.34 per hundred	286.40
6	Carriage of Barbed wire over distance 2 Km.	0.90 Qtl	54.50 /Qtl/Km	98.10
7	Stretching & fixing of barbed wire in 4 stands.	720 Rmt	3.16 per mtr	2275.20

8	Preparation of inspection path 60 cm width	250 mtr.	7.24 per mtr	1810.00
9	Preparation of water retention mounds/treches.	L.S.		2000.00
10	Interlacing of thorny bushes along the fence.	180 Rmt	2.74 per mtr	493.20
	Total - Fencing cost			**19937.33**
	Planting			
1	Digging of pits 45x45x45 cm	600 Nos.	636.28 per hundred	3817.68
2	Digging of pits 30x30x30 cm	900 Nos.	318.22 per hundred	2863.98
3	Filling of pits 45x45x45 cm	600 Nos.	182.31 per hundred	1093.86
4	Filling of pits 30x30x30 cm	900 Nos.	127.22 per hundred	1144.98
5	Carriage of naked roots plants over distance 2 Km. uphil	600 Nos.	23.49 per hundred per Km	281.88
6	Carriage of plants in P/bags over distance 2 Km. uphil	900 Nos.	145.39 per hundred	2617.02
7	Planting of entire plant raised in P.bags	900 Nos.	145.49 per hundred	1309.41
8	Planting of naked roots plants	600 Nos.	122.66 per hundred	735.96
9	Planting of grass tufts/Preparation of strips including sowing in strips 100x30x5 cm for grass sowing along contour	500 Strips	613.33 per hundred	3066.65
	Total - Planting cost			**16931.42**
	Material			
1	Cost of barbed wire	0.90 Qtl.	7000 Per Qtl.	6300
	Nursery cost of plants			
1	Naked root plants	600 Nos.	6 per plant	3600
2	Polythin bags plants	900 Nos.	8 per plant	7200
	Total - Cost of Plants			**10800**
	Grand Total			**53968.75**
			Or Say	**54000.00**

(B) MAINTENANCE COST

Sl. No.	Particular of Work	Quantity	Rate in Rs.	Amount in Rs.
	1st year maintenance -30% mortality			
1	Re-digging of pits 45x45x45 cm.	180 Nos.	318.22 per hundred	572.79
2	Re-digging of pits 30x30x30 cm.	270 Nos.	159.07 per hundred	429.48
3	Filling of pits 45x45x45 cms.	180 Nos.	182.31 per hundred	328.15
4	Filling of pits 30x30x30 cms.	270 Nos.	127.22 per hundred	343.49
5	Planting of P. bag plants.	270 Nos.	145.49 per hundred	392.82
6	Planting of naked root plants	180 Nos.	122.66 per hundred	220.78
7	Planting of grass tufts/preparation strips I/C sowing in strips 100x35x5 cms for grass sowing	200 Strips	613.13 per hundred	1226.26
8	Carriage P. bags plants distance 2 km. Uphil	270 Nos.	145.39 per hundred	392.55
9	Carriage of naked roots plants over distance 2 km. Uphil	180 Nos.	23.49 per hundred	42.28

10	Nursery cost of plants	375 Nos.	8 & 6 per plant	3240.00
11	Repair of fence	180 rmt	1.16/rmt	208.80
12	Repair of inspection path	L.S.		700.00
13	Moisture conservation works	L.S.		1000.00
	Total			9097.40
			Or say	**9100.00**
	2nd year maintenance -20% mortality			
1	Re-digging of pits 45x45x45 cm.	120 Nos.	318.22 per hundred	381.86
2	Re-digging of pits 30x30x30 cm.	180 Nos.	159.07 per hundred	286.32
3	Filling of pits 45x45x45 cms.	120 Nos.	182.31 per hundred	160.43
4	Filling of pits 30x30x30 cms.	180 Nos.	127.22 per hundred	167.93
5	Planting of P. bag plants.	192 Nos.	145.49 per hundred	279.34
6	Planting of naked root plants	108 Nos.	122.66 per hundred	132.47
7	Carriage P. bags plants distance 2 km. Uphil	192 Nos.	145.39 per hundred	556.8
8	Carriage of naked roots plants over distance 2 km. Uphil	108 Nos.	23.49 per hundred	50.74
9	Nursery cost of plants	300 Nos.	8 & 6 per plant	2184.00
10	Repair of fence	180 rmt	1.16/rmt	208.80
11	Repair of inspection path	L.S.		500.00
12	Moisture conservation works	L.S.		800.00
	Total			5708.69
			Or say	**5700.00**
	3rd year maintenance -10% mortality			
1	Re-digging of pits 45x45x45 cm.	60 Nos.	318.22 per hundred	190.93
2	Re-digging of pits 30x30x30 cm.	90 Nos.	159.07 per hundred	143.16
3	Filling of pits 45x45x45 cms.	60 Nos.	182.31 per hundred	109.39
4	Filling of pits 30x30x30 cms.	90 Nos.	127.22 per hundred	114.5
5	Planting of P. bag plants.	90 Nos.	145.49 per hundred	130.94
6	Planting of naked root plants	60 Nos.	122.66 per hundred	73.59
7	Carriage P. bags plants distance 2 km. Uphil	90 Nos.	145.39 per hundred	261.7
8	Carriage of naked roots plants over distance 2 km. Uphil	60 Nos.	23.49 per hundred	28.18
9	Nursery cost of plants	150 Nos.	8 & 6 per plant	1080.00
10	Repair of fence	200 rmt	1.16/rmt	232.00
11	Repair of inspection path	L.S.		400.00
12	Moisture conservation works	L.S.		800.00
	Total			3564.39
			Or say	**3600.00**
	4th year maintenance -10% mortality			
1	Re-digging of pits 45x45x45 cm.	60 Nos.	318.22 per hundred	190.93
2	Re-digging of pits 30x30x30 cm.	90 Nos.	159.07 per hundred	143.16
3	Filling of pits 45x45x45 cms.	60 Nos.	182.31 per hundred	109.39
4	Filling of pits 30x30x30 cms.	90 Nos.	127.22 per hundred	114.5
5	Planting of P. bag plants.	90 Nos.	145.49 per hundred	130.94
6	Planting of naked root plants	60 Nos.	122.66 per hundred	73.59
7	Carriage P. bags plants distance 2 km. Uphil	90 Nos.	145.39 per hundred	261.7
8	Carriage of naked roots plants over distance 2 km. Uphil	60 Nos.	23.49 per hundred	28.18

9	Nursery cost of plants	150 Nos.	8 & 6 per plant	1080.00
10	Repair of fence	200 rmt	1.16/rmt	232.00
11	Repair of inspection path	L.S.		300.00
12	Moisture conservation works	L.S.		700.00
	Total			3364.39
			Or say	**3400.00**
	5th year maintenance -10% mortality			
1	Re-digging of pits 45x45x45 cm.	60 Nos.	318.22 per hundred	190.93
2	Re-digging of pits 30x30x30 cm.	90 Nos.	159.07 per hundred	143.16
3	Filling of pits 45x45x45 cms.	60 Nos.	182.31 per hundred	109.39
4	Filling of pits 30x30x30 cms.	90 Nos.	127.22 per hundred	114.5
5	Planting of P. bag plants.	90 Nos.	145.49 per hundred	130.94
6	Planting of naked root plants	60 Nos.	122.66 per hundred	73.59
7	Carriage P. bags plants distance 2 km. Uphil	90 Nos.	145.39 per hundred	261.7
8	Carriage of naked roots plants over distance 2 km. Uphil	60 Nos.	23.49 per hundred	28.18
9	Nursery cost of plants	150 Nos.	8 & 6 per plant	1080.00
10	Repair of fence	200 rmt	1.16/rmt	232.00
11	Repair of inspection path	L.S.		300.00
12	Moisture conservation works	L.S.		500.00
	Total			3164.39
			Or say	**3200.00**
	ABSTRACT			
1	**New Plantation**	-		54000.00
2	**1st Year Maintenance**	-		9100.00
3	**2nd Year Maintenance**	-		5700.00
4	**3rd Year Maintenance**	-		3600.00
5	**4th Year Maintenance**	-		3400.00
6	**5th Year Maintenance**	-		3200.00
	GRAND TOTAL	-		**79000.00**

TABLE – 10

Cost Model for Replenishment/ Gap Plantation (800 tree/ha)

(A) PLANTATION COST				
S.No.	**Particulars of Work**	**Quantity**	**Rate in Rs.**	**Amount in Rs. Area**
	Fencing			
1	Survey & demarcation of Plantation area	1 Ha.	67.33	67.33
2	Preparation/ purchage of RCC fence posts	60 Nos.	200 per post	12000.00
3	Carrige of RCC fence posts upto 2 mt. long over distance 2 km	60 Nos.	907.34 per hundred	544.40
4	Preparation/digging of holes 20-30 cm dia & 50 cm. deep	60 Nos.	604.51 per hundred	362.70
5	Fixing of Wooden fence posts including strutting	60 Nos.	477.34 per hundred	286.40

6	Carriage of Barbed wire over distance 2 Km.	0.90 Qtl	54.50 /Qtl/Km	98.10
7	Stretching & fixing of barbed wire in 4 stands.	720 Rmt	3.16 per mtr	2275.20
8	Preparation of inspection path 60 cm width	250 mtr.	7.24 per mtr	1810.00
9	Preparation of water retention mounds/treches.	L.S.		2000.00
10	Interlacing of thorny bushes along the fence.	180 Rmt	2.74 per mtr	493.20
	Total - Fencing cost			**19937.33**
	Planting			
1	Digging of pits 45x45x45 cm	300 Nos.	636.28 per hundred	1908.84
2	Digging of pits 30x30x30 cm	500 Nos.	318.22 per hundred	1591.10
3	Filling of pits 45x45x45 cm	300 Nos.	182.31 per hundred	546.93
4	Filling of pits 30x30x30 cm	500 Nos.	127.22 per hundred	636.10
5	Carriage of naked roots plants over distance 2 Km. uphil	300 Nos.	23.49 per hundred per Km	140.94
6	Carriage of plants in P/bags over distance 2 Km. uphil	500 Nos.	145.39 per hundred	1453.90
7	Planting of entire plant raised in P.bags	500 Nos.	145.49 per hundred	727.45
8	Planting of naked roots plants	300 Nos.	122.66 per hundred	367.98
9	Planting of grass tufts/Preparation of strips including sowing in strips 100x30x5 cm for grass sowing along contour	500 Nos.	613.33 per hundred	3066.65
	Total - Planting cost			**10439.89**
	Material			
1	Cost of barbed wire	0.90 Qtl.	7000 Per Qtl.	**6300.00**
	Nursery cost of plants			
1	Naked root plants	300 Nos.	6 per plant	1800.00
2	Polythin bags plants	500 Nos.	8 per plant	4000.00
	Total - Cost of Plants			**5800.00**
	Grand Total			**42477.22**
			Or Say	**42500.00**

(B) MAINTENANCE COST

Sl. No.	Particular of Work	Quantity	Rate in Rs.	Amount in Rs.
	1st year maintenance -30% mortality			
1	Re-digging of pits 45x45x45 cm.	90 Nos.	318.22 per hundred	286.39
2	Re-digging of pits 30x30x30 cm.	150 Nos.	159.07 per hundred	238.60
3	Filling of pits 45x45x45 cms.	90 Nos.	182.31 per hundred	164.07
4	Filling of pits 30x30x30 cms.	150 Nos.	127.22 per hundred	190.83
5	Planting of P. bag plants.	150 Nos.	145.49 per hundred	218.23
6	Planting of naked root plants	90 Nos.	122.66 per hundred	110.39
7	Planting of grass tufts/preparation strips I/C sowing in strips 100x35x5 cms for grass sowing	200 Strips	613.13 per hundred	1226.26
8	Carriage P. bags plants distance 2 km. Uphil	150 Nos.	145.39 per hundred	218.08

9	Carriage of naked roots plants over distance 2 km. Uphil	90 Nos.	23.49 per hundred	21.14
10	Nursery cost of plants	240 Nos.	8 & 6 per plant	1620.00
11	Repair of fence	180 rmt	1.16/rmt	208.80
12	Repair of inspection path	L.S.		700.00
13	Moisture conservation works	L.S.		1000.00
	Total			6202.79
			Or say	**6200.00**
	2nd year maintenance -20% mortality			
1	Re-digging of pits 45x45x45 cm.	60 Nos.	318.22 per hundred	190.93
2	Re-digging of pits 30x30x30 cm.	100 Nos.	159.07 per hundred	159.07
3	Filling of pits 45x45x45 cms.	60 Nos.	182.31 per hundred	109.386
4	Filling of pits 30x30x30 cms.	100 Nos.	127.22 per hundred	127.22
5	Planting of P. bag plants.	192 Nos.	145.49 per hundred	279.34
6	Planting of naked root plants	60 Nos.	122.66 per hundred	73.60
7	Carriage P. bags plants distance 2 km. Uphil	150 Nos.	145.39 per hundred	218.08
8	Carriage of naked roots plants over distance 2 km. Uphil	60 Nos.	23.49 per hundred	28.19
9	Nursery cost of plants	160 Nos.	8 & 6 per plant	1080.00
10	Repair of fence	180 rmt	1.16/rmt	208.80
11	Repair of inspection path	L.S.		500.00
12	Moisture conservation works	L.S.		800.00
	Total			3774.616
			Or say	**3800.00**
	3rd year maintenance -10% mortality			
1	Re-digging of pits 45x45x45 cm.	30 Nos.	318.22 per hundred	95.47
2	Re-digging of pits 30x30x30 cm.	50 Nos.	159.07 per hundred	79.535
3	Filling of pits 45x45x45 cms.	30 Nos.	182.31 per hundred	54.69
4	Filling of pits 30x30x30 cms.	50 Nos.	127.22 per hundred	63.61
5	Planting of P. bag plants.	50 Nos.	145.49 per hundred	72.74
6	Planting of naked root plants	30 Nos.	122.66 per hundred	36.79
7	Carriage P. bags plants distance 2 km. Uphil	50 Nos.	145.39 per hundred	72.69
8	Carriage of naked roots plants over distance 2 km. Uphil	30 Nos.	23.49 per hundred	14.09
9	Nursery cost of plants	80 Nos.	8 & 6 per plant	540.00
10	Repair of fence	200 rmt	1.16/rmt	232.00
11	Repair of inspection path	L.S.		400.00
12	Moisture conservation works	L.S.		800.00
	Total			2461.615
			Or say	**2500.00**
	4th year maintenance -10% mortality			
1	Re-digging of pits 45x45x45 cm.	30 Nos.	318.22 per hundred	95.46
2	Re-digging of pits 30x30x30 cm.	50 Nos.	159.07 per hundred	79.535
3	Filling of pits 45x45x45 cms.	30 Nos.	182.31 per hundred	54.69
4	Filling of pits 30x30x30 cms.	50 Nos.	127.22 per hundred	63.61
5	Planting of P. bag plants.	50 Nos.	145.49 per hundred	72.74
6	Planting of naked root plants	30 Nos.	122.66 per hundred	36.79
7	Carriage P. bags plants distance 2 km. Uphil	50 Nos.	145.39 per hundred	72.69

8	Carriage of naked roots plants over distance 2 km. Uphil	30 Nos.	23.49 per hundred	14.09
9	Nursery cost of plants	80 Nos.	8 & 6 per plant	540.00
10	Repair of fence	200 rmt	1.16/rmt	232.00
11	Repair of inspection path	L.S.		300.00
12	Moisture conservation works	L.S.		700.00
	Total			2261.605
			Or say	**2300.00**
	5th year maintenance -10% mortality			
1	Re-digging of pits 45x45x45 cm.	30 Nos.	318.22 per hundred	95.46
2	Re-digging of pits 30x30x30 cm.	50 Nos.	159.07 per hundred	79.535
3	Filling of pits 45x45x45 cms.	30 Nos.	182.31 per hundred	54.69
4	Filling of pits 30x30x30 cms.	50 Nos.	127.22 per hundred	63.61
5	Planting of P. bag plants.	50 Nos.	145.49 per hundred	72.74
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9	Nursery cost of plants	80 Nos.	8 & 6 per plant	540.00
10	Repair of fence	200 rmt	1.16/rmt	232.00
11	Repair of inspection path	L.S.		300.00
12	Moisture conservation works	L.S.		700.00
	Total			2261.605
			Or say	**2300.00**
	ABSTRACT			
1	**New Plantation**	-		42500.00
2	**1st Year Maintenance**	-		6200.00
3	**2nd Year Maintenance**	-		3800.00
4	**3rd Year Maintenance**	-		2500.00
5	**4th Year Maintenance**	-		2300.00
6	**5th Year Maintenance**	-		2300.00
	GRAND TOTAL	-		**59600.00**

The details of cost required for implementation of biological treatment measures and engineering treatment measures, wildlife improvement and development, joint forest department and silt observatories are given in Tables - 11 & 12. The details are given in Figure-5.

TABLE- 11

Cost estimate for Catchment Area Treatment - Biological Measures

S. No.	Item	Rate (Rs.)	Target	
			Physical	Financial (Rs. lakh)
1.	Afforestation (1500 plants/ha)	79,000/ha	101 ha	79.79
2.	Replenishment Afforestation/ Gap plantation(800 plants/ha)	59,600/ha	195 ha	116.22
3	Pasture Development	11,800/ha	150 ha	17.70
4.	Fuel wood plantation	59,600/ha	40 ha	23.84
5.	Fodder (Silvipasture)	59,600/ha	40 ha	23.84
6.	Social forestry	59,600/ha	90 ha	53.64
7.	Establishment of New Nurseries	200,000/no	5	10.00
	Total			**325.03**

TABLE- 12

Cost estimate for Catchment Area Treatment - Engineering Measures

S. No.	Item	Rate (Rs.)	Unit	Qty (No.)	Target	
					Physical	Financial (Rs. Lakh)
1.	Contour bunding	25,000/ha	ha	401	401	100.25
2.	Step drain	25,000	Rmt	7	105	26.25
3.	Check dams	200,000	No.	15	15	30.00
	Total					**156.50**

TABLE- 13

Details of cost required for wildlife improvement and development ,joint forest management & silt observatories

S. No.	Activity	Cost (Rs. Lakh)
1.	Survey of flora and fauna in the catchment area	6.0
2.	Incentives to local communities for fire prevention	2.5
3.	Incentives to local communities for wildlife protection	2.0
4.	Incentives to community to regulate local and migratory grazers in Sainj Wildlife Sanctuary	2.5
5.	Habitat improvement in Sainj Wildlife Sanctuary	5.0
6.	Wildlife Census	10.0
7.	Capacity Building of staff and community	3.0
8.	Support for communication	1.0
9.	Establishment of nursery with infrastructure	5.0
10.	Maintenance of nursery	5.0
11.	Soil and moisture conservation	5.0
12.	Monitoring, evaluation & impact assessment study	4.0
13.	Support for vermi-compost development	1.0

14.	Support for introduction of LPG for poor household	1.0
15.	Socio-economic survey	1.0
16.	Ex-situ support for Himalayan Thar breeding/conservation of GHNP	40.0
17	Joint Forest Management, training and awareness	20.0
18	Silt observatories	40.0
	Total	**154.0**

Total cost for Biological and Engineering measures, Wildlife improvement & Development, JFM and Establishment of Silt observatories (A) = **Rs.635.53 Lakh**

Departmental Charges @ 17.5 % (B) = **Rs.111.22 Lakh**

Total Cost of Work (A+B) = **Rs.746.75 Lakh**

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11. PROMOTION OF ECO-TOURISM

The area is known for its scenic beauty and splendour and is frequented by a large number of tourists every year. Keeping in view this the existing path of GHNP will be maintained. Beside this other tourist attraction spots will also be maintained/ developed in the area. An amount of Rs. 7.47 lakh has been kept for this purpose.

12. ECOLOGICAL TASK FORCE

Ecological Task Forces (ETFs) Scheme was initiated by the Ministry of Defence in1980 with a view to involve ex-servicemen in afforestation and eco-development schemes in remote and difficult areas to undertake restoration of degraded ecosystems through afforestation, soil conservation and water resource management techniques.

The scheme of Eco-Development Forces is based on two objectives of ecological restoration and employment generation for able bodied ex-servicemen. Under this scheme, the establishment and operational expenditure on Eco-Task Force (ETF) Battalion raised by Ministry of Defence (MoD) is reimbursed by Ministry while the input like sapling fencing etc. as also the professional and managerial guidance is

provided by the State Forest Departments {Source- http://envfor.nic.in/naep/sch/etf.pdf (15.07.08) & http://india.gov.in/sectors/ environment/ national_board.php (15.07.08)}. The scheme is in operation for last four Five Year Plans.

At present there are 4 (Four) Eco-Task Force Battalions raised with the Regular and Territorial Army Personnel. These are as follows:

S. No.	TA Bn. Id No.	Year of Raising	Location
1.	127 Inf Bns	1981	Shivalik Hills
2.	128 Inf Bns	1981	Rajasthan Canal (Bajju)
3.	130 Inf Bns	1988	State of J&K
4.	130 Inf Bn	1994	Pithoragarh (Uttranchal)

The progress of the Eco-Task Force (ETF) Battalions is being closely reviewed jointly by Ministry of Defence and Ministry of Environment and Forests. A proposal for establishment of new ETF Battalions in Assam, Jharkhand and Karnataka is also being examined.

The state has already raised an Territorial Army (TA) infantry battalion 133 infantry battalion Dogra Ecological Force in March 2006 in Satluj basin. The Himachal Pradesh government has made a proposal to the Defence Ministry for raising two more Territorial Army battalions of eco-task force for Ravi and Beas catchment areas with a view to preserve the flora and fauna of the state. All CAT Plans of all Hydel projects of the basin are supposed to pool in resources to support the ETF. The reimbursed expenditure by Ministry should be re-invested in the ecological restoration works in the basin. There are number of project in Beas basin of which CAT Plan either under preparation or implementation. Some of these such major projects are given below:-

- Larji Hydro Electric Project
- Parbati stage II & III Hydro Electric Project
- Malana stage II Hydro Electric Project
- Allan dhuhan Hydro Electric Project
- Khauli stage II Hydro Electric Project
- Fozal Hydro Electric Project
- Baragaon Hydro Electric Project
- Lanbaduck Hydro Electric Project
- Uhal stage III Hydro Electric Project
- Neogal Hydro Electric Project
- Khili Bahal Hydro Electric Project
- Sanj Hydro Electric Project 100MW
- Patikari Hydro Electric Project
- Dhaula sidh Hydro Electric Project

There may be other smaller project which may require preparation and implementation of the CAT Plan.

The fragile ecology of the lower Himalayas, especially in Himachal Pradesh, is more prone to flash floods and cloud bursts which cause massive damage to public and private properties and infrastructure as well. People of, Kullu and Mandi districts have suffered heavy losses due to floods in Beas which affected normal life of the people living on banks.

Budget

Keeping the above view a provision of Rs 150 lakhs has been made for the same in the CAT Plan of Sainj Hydro Electric Project.

13. PAYMENT OF ENVIRONMENTAL SERVICES (PES)

It is a new concept as a reward for good conservation behaviour by upstream community leaving in the catchment area of the project. Incidentally there are only three villages in the catchment area of Sainj Hydro Electric Project.

The PES will be based on the result of monitoring of the following aspects and effectiveness of conservation measures between communities:

- silt load (total, seasonal and average assessment)
- Plantation survival rate in social forestry,
- Freezing land use
- Better Agriculture practices in the catchment area.

A committee would decide the quantum PES to be paid to the upstream considering the above. An amount of Rs. 60.00 Lakh has been earmarked for the same in the catchment area treatment plan of Sainj Hydro Electric Project.

The mechanism of payment:-

The payment will be made through Villages Forest Development Society (VFDS) / Panchayat. A Monitoring Committee has been suggested, comprising one member from each i.e. User Agency, Forest Department, Pollution Control Board (PCB) & Environment Department and Agriculture /Horticulture Department under the chairmanship of District Commissioner. The committee will monitor /review the status and progress of the work and determine the quantum of payment of Environmental Services. The year wise allocation of funds made in the CAT Plan is indicative. The committee may decide to release the payment in different ratio for each year with in the overall outlay for the Environmental Services in the CAT Plan of Sainj Hydro Electric Project.

14. MONITORING

The main objective of the study will be the assessment of impact monitoring and evaluation of the intervention provided in CAT Plan under green India scheme by the Government of India &/ or State Government of Himachal Pradesh. The monitoring will be carried out by independent agency for which a provision of Rs. 28.93 Lakh has been made in the CAT Plan of Sainj Hydro Electric Project. The result will be shared by the User agency.

15. BUDGET FOR CATCHMENT AREA TREATMENT PLAN

The total budget estimated for implementation of CAT Plan is **Rs. 993.15 Lakh**. The abstract of cost is given in table no. 14. The year-wise physical and financial target given in table no. 15

TABLE-14

Abstract of cost for Catchment Area Treatment Plan for Sainj HEP (100 MW)					
S.N.	**Activity**	**Unit**	**Rate (in Rupees)**	**Phy**	**Financial (Rs. in Lakh)**
I	**WORKS**				
A	**Biological Measures**				
1	Afforestation	ha	79000	101	79.79
2	Gap Plantation	ha	59600	195	116.22
3	Pasture Development	ha	11800	150	17.70
4	Fuelwood Plantation	ha	59600	40	23.84
5	Fodder (Silvipasture)	ha	59600	40	23.84
6	Social Forestry	ha	59600	90	53.64
7	Establishment of New Nurseries	No.	200000	5	10.00
i	***Sub-Total (1) Biological Measures***	-	-	***621***	***325.03***
B	**Enginerring Measures**				
1	Contour Bunding	ha	25000	401	100.25
2	Stepped drain	Rmt	25000	105	26.25
3	Check dams	No.	200000	15	30.00
iii	***Su-total (2) Engineering Measures***	-	-	-	***156.50***
C	**Wildlife Improvement & Development**			-	94.00
D	**JFM, Training, Awareness**	L/S	-	-	20.00
E	**Silt Observatory**			-	40.00
iii	***Sub-Total (3) Works (A to E)***				***635.53***
F	**Departmental Charges @ 17.5 %**	-	-	-	111.22
iv	***Total Works (I) Component (4)***	-	-	-	***746.75***
II	**SERVICES**				
G	**Eco-Tourism @ 1 % of iv**	-	-	-	7.47
H	**Payment of Environmental Services^**	L/S	-	-	60.00
I	**Eco-task force (Physical 100 ha min.)**	Ha.	-	-	150.00
v	**Total cost of (II) Services**	-	-	-	***217.47***
vi	**Total of Works + Services (I+II)**				***964.22***
J	**Monitoring & Evaluation @ 3 % of vi**	-	-	-	28.93
	Grand Total (A-J)	-	-	-	***993.14***
				Rupees in Crores	**9.931**

Rates are inclusive of Maintenance for 5 years
***Payment of Environmental Services^** = To be paid to communities for conservation behaviour related to various parameters.*

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Great Himalayan National Park,
Shamshi, Kullu (H.P.)
WAPCOS Centre for Environment

Assistant Conservator of Forests
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Shamshi—175126 (Kullu)

Sr. Manager
Sainj Const. Division No. II
H.P.P.C.L. Larji

TABLE-15

Year-wise Physical and Financial Target for Catchment Area Treatment Plan Sainj Hydroelectric Project (100 MW)

S.N.	Activity	Financial Outlay for the CAT Plan Period	Unit	Total Phy. Outlay for CAT Plan Period	0 Yr		1 Yr		2 Yr		3 Yr		4 Yr		5 Yr		Total		Remarks
					Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	
I	**WORKS**																		
A	**Biological Measures**																		
1	Afforestation	79.79	ha	101	11	8.69	30	23.7	30	23.7	30	23.7	0	0	0	0	101	79.79	Rate of work to be applied in field while executing works shall be as per notified norms excluding maintenance and departmental charges. Maintenance as per norms notified are to be segregated by Executing Agency
2	Gap Plantation	116.22	ha	195	15	8.94	60	35.76	60	35.76	60	35.76	0	0	0	0	195	116.22	
3	Pasture Development	17.70	ha	150	10	1.18	60	7.08	60	7.08	20	2.36	0	0	0	0	150	17.7	
4	Fuelwood Plantation	23.84	ha	40	10	5.96	10	5.96	10	5.96	10	5.96	0	0	0	0	40	23.84	
5	Fodder (Silvipasture)	23.84	ha	40	10	5.96	10	5.96	10	5.96	10	5.96	0	0	0	0	40	23.84	
6	Social Forestry	53.64	ha	90	15	8.94	25	14.9	25	14.9	25	14.9	0	0	0	0	90	53.64	
7	Establishment of New Nurseries	10.00	No.	5	5	10	0	0	0	0	0	0	0	0	0	0	5	10	
i	*Sub-Total (1) Biological Measures*	*325.03*	-	*621*	*76*	*49.67*	*195*	*93.36*	*195*	*93.36*	*155*	*88.64*	-	-	-	-	*621*	*325.03*	
B	**Engineering Measures**																		
1	Contour Bunding	100.25	ha	401	101	25.25	100	25.00	100	25.00	100	25.00	0	0.00	0	0.00	401	100.25	Rate of work to be applied in field shall be as given in abstract of costs excluding departmental charges
2	Stepped drain	26.25	Rmt	105	15	3.75	45	11.25	25	6.25	20	5.00	0	0.00	0	0.00	105	26.25	
3	Check dams	30.00	No.	15	2	4	8	16.00	3	6.00	2	4.00	0	0.00	0	0.00	15	30.00	
ii	*Su-total (2) Engineering Measures*	*156.50*	-	-	-	*33*	-	*52.25*	-	*37.25*	-	*34.00*	-	*0.00*	-	*0.00*	-	*156.50*	
C	Wildlife Improvement & Development	94.00	-	-	-	32.9	-	23.5	-	23.5	-	14.1	-	0	-	0	-	94.00	Ref-Table No.8
D	JFM, Training, Awareness	20.00	L/S	-	-	7	-	5	-	5	-	3	-	0	-	0	-	20.00	
E	Silt Observatory	40.00	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-	40.00	
iii	*Sub-Total (3) Works (A to E)*	*635.53*	-	-	-	*122.57*	-	*174.11*	-	*159.11*	-	*139.74*	-	*0*	-	*0*	-	*635.53*	
F	Departmental Charges @ 17.5 %	111.22	-	-	-	21.45	-	30.47	-	27.84	-	24.45	-	0.00	-	0.00	-	111.22	
iv	*Total Works (i) Component (4)*	746.75	-	-	-	144.02	-	204.58	-	186.95	-	164.19	-	0.00	-	0.00	-	746.75	
II	SERVICES																		
G	Eco-Tourism @ 1 % of iv	7.47	-	-	-	-	-	1.87	-	1.87	-	1.87	-	1.87	-	-	-	7.47	
H	Payment of Environmental Services*	60.00	L/S	-	-	-	-	15.00	-	15.00	-	15.00	-	15.00	-	-	-	60.00	
I	Eco-task force	150.00	Ha.	-	-	-	-	37.50	-	37.50	-	37.50	-	37.50	-	-	-	150.00	Phy. 100 ha min.
v	Total cost of (II) Services	217.47	-	-	-	0.00	-	54.37	-	54.37	-	54.37	-	54.37	-	-	-	217.47	
vi	Total of Works + Services (I+II)	964.22		-	-	144.02	-	258.95	-	241.32	-	218.56	-	54.37	-	0.00	-	964.22	
J	Monitoring & Evaluation @ 3 % of iv	28.93	-	-	-	-	-	-	-	4.34	-	5.79	-	8.68	-	10.12	-	28.93	
	Grand Total (A-J)	*993.14*	-	-	-	*144.02*	-	*258.95*	-	*245.66*	-	*224.35*	-	*63.05*	-	*10.12*	-	*993.14*	

Phy = Physical; Fin. = Financial;
Financial Amount = Total is inclusive of Maintenance for 5 years including on Soil & Moisture Conservation Works
Rates to be applied each Year = as per notified norms for executing the works
This Phasing is mainly for physical works phasing and release of money by the User Agency. Since financial amount each year includes maintenance, the break up to be done by Executing Agency.

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Shamshi, Kullu (H.P.)

Assistant Conservator of Forests,
Great Himalayan National Park,
Shamshi

Sainj Const. Division No. II
H.P.P.C.L. Larji

FIGURES

77°26' 77°30' 77°35' 77°40' 77°45'

31°50'

31°45'

N

W1 W2 W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 W13 W14 W15 W16 W17 W18 W19 W20 W21 W22 W23 W24 W25 W26 W27 W28 W29 W30 W31 W32

Dam Site

Dam site
River
Tributary
Sub Watershed Boundary

3 0 3 6 Kilometers

WATERSHED AREA MAP OF SAINJ H.E. PROJECT

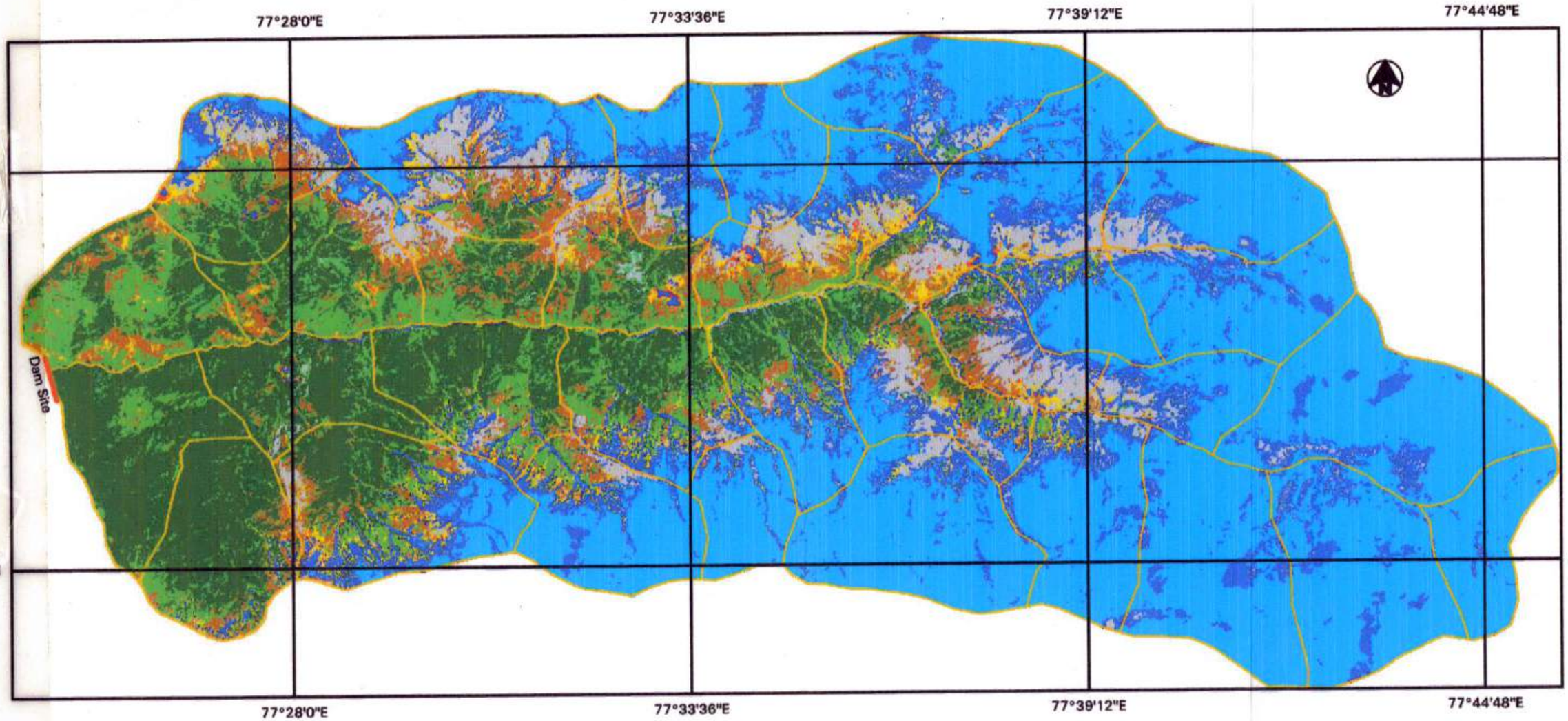
Figure : 1

Range Officer
Wild Life Range
Jiwanal

Assistant Conservator of Forests
Great Himalayan National Park,
Shamshi (Kullu)

Conservator of Forests
Great Himalayan National Park,
Shamshi (H.P.)

Sr Executive Engineer
Sainj Const Division No -II
HPSEB Larji Distt Kullu (H.P)



Legend

Class_Names

- Dense Vegetation
- Open Vegetation
- Degraded Vegetation/ Scrubs
- Water Body
- Snow Cover
- Barren Hills
- Agriculture Land
- Settlements/Exposed Rocks

Scale

2 0 2 4 6 Kilometers

Range Officer
Wild Life Range
Jiwanal

Assistant Conservator of Forest
Great Himalayan National Park
Shamshi - 175126 (Kullu)

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HPSEB Larji Distt Kullu (H.P.)

LAND USE CLASSIFICATION OF THE CATCHMENT AREA

Figure : 2

77°25' 77°30' 77°35' 77°40' 77°45'

31°50'

31°45'

N
W E
S

Dam Site

Tributary
River
Slope in percentage
0 - 10
10 - 20
20 - 30
30 - 40
>40

2 0 2 4 Miles

Range Officer
Wild Life Range
Jiwanal

Assistant Conservator of Forest
Great Himalayan National Pa
Shamshi - 175126 (Kullu

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SLOPE MAP OF THE CATCHMENT AREA OF SAINJ H.E.PROJECT

Figure : 3

77°25 77°30 77°35 77°40 77°45

31°50 31°45

W1 W2 W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 W13 W14 W15 W16 W17 W18 W19 W20 W21 W22 W23 W24 W25 W26 W27 W28 W29 W30 W31 W32

Dam Site

River

SYI Values

<100

1000 - 1100

1100 - 1200

1200 - 1300

>1300

Range Officer
Wild Life Range
Jiwenal

Assistant Conservator of Forests
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Shamshi - 175126 (Kullu)

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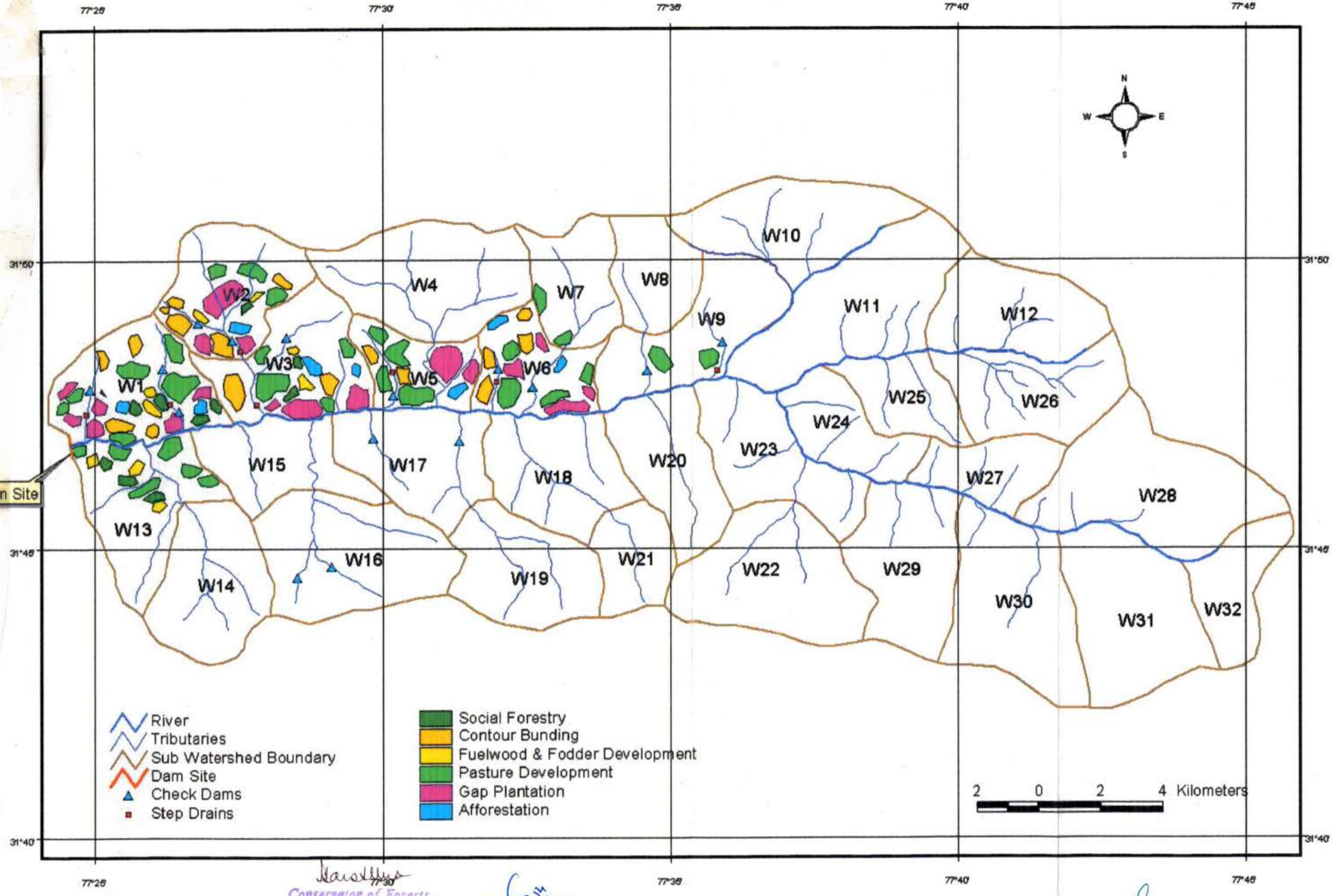
HPSEB Larji Distt Kullu (H.P.)

PRIORITISATION OF DIFFERENT WATERSHEDS IN THE CATCHMENT AREA

Figure : 4



Conservator of Forests.
Shamshi Kullu (H.P.)

Range Officer
Wild Life Range
Jiwanal

Sr Executive Engineer
Sainj Const Division No.-II
HPSEB Larji Dist

PROPOSED CATCHMENT AREA TREATMENT MEASURES FOR SAINJ H.E.PROJECT

Figure : 5