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CATCHMENT AREA TREATMENT PLAN

FOR

SHONGTONG-KARCHHAM HYDROELECTRIC PROJECT

(402 MW)

DISTRICT KINNAUR, HIMACHAL PRADESH

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PREFACE

The Catchment Area Treatment (CAT) Plan for Shongtong-Karchham HEP has been prepared on the basis of field survey in active association and consultation with field staff of the Kinnaur Forest Division. The list of participants in these interactions is appended as Annexure – VI. While doing this, basic objectives to stabilize the area and to reduce the silt load in the Catchment Area has been kept in view. Selection of areas to be treated has been done in consultation with the concerned filed staff. However, the detailed planning and micro-planning are required before actual execution of work in consultation with the local people/ communities/ committees to ensure participation in the entire process and eventual sustainability. Roles and responsibilities and time lines need to be mutually agreed by all stakeholders to the CAT Plan.

Figure P-1: Interaction with FLS at Shongtong

Figure P-2: Interaction with FLS at Akpa

Here it is worthwhile to mention that the preparation of a 'Comprehensive Catchment Area Treatment Plan for Sutlej Basin is nearing completion. The task is being accomplished by H.P. Forest Department by hiring a Consultant. The comprehensive CAT Plan is likely to be approved by the competent authority. The present CAT Plan of Shongtong Karchham HEP shall be a subset of the same and may be revised, if required, to make it fit into the same.

Need based changes in this CAT Plan (inter component or across the plan) can be made with the concurrence of Principal Chief Conservator of Forests, Himachal Pradesh. This, however, shall be within overall ceiling amount as marked for CAT Plan corresponding to overall project cost as per CAT Plan Guidelines- 2012 by Himachal Pradesh Forest Department.

The total catchment area of Shongtong - Karchham HEP CAT Plan, falling in Satluj basin above the point of intake is about 2999.87 sq.km out of which about 1302 sq.km area lies under permanent snow cover and another 242.45 sq.km area is totally barren & rocky which cannot sustain vegetation. In addition to this, about 1003.39 sq km area is under pasture/ meadows and about 26.12 Sq.km. area is covered by water-bodies. Thus, balance of 451.81 Sq.km. area is left for treatment in the total catchment area.

The scheme of arrangements like implementing authority & approving authority has been defined. Further to these arrangements, a provision for the flexibility in implementation of the CAT Plan is proposed so that the new inputs and lessons are incorporated.

The outlay of the CAT Plan is to the tune of Rs.60.40 Crores which is 2.5% of the proposed Project (HEP) cost of Rs. 2415.53 Crore (TEC Cost). However, Rs. 39.00 Crore is required to carry out activities as identified by CAT Plan proposals. The balance amount of Rs. 21.40 Crore against which no works have been proposed, may be used for funding Eco-Task Force in Satluj basin as also for the comprehensive CAT Plan of Satluj River basin.

BACKGROUND

The Shongtong-Karchham Hydroelectric Project (HEP) was allotted to Himachal Pradesh Power Corporation Limited (HPPCL) on 6th January, 2007 & accordingly DPR was prepared and submitted during May, 2007. The case for diversion of forest land was submitted to Government of India, Ministry of Environment & Forests during 28th August 2009 for according forest clearance for diversion of **63.5015 ha.** of Forest land and **13.8311 ha.** of private land for the project. Various factors affecting the erosion are soil characteristics, meteorological conditions such as; annual precipitation, snowfall, intensity of precipitation, wind velocity, exposure conditions such as; extent & type of vegetative cover & type of the catchment. In the present case Rainfall and snowfall are the prime factors responsible for erosion. Controlling one or more factors responsible for erosion as mentioned above can arrest the process of erosion. The catchment of Shongtong-Karchham is steep to very steep ground & the strata are loose with calcareous soil. The slopes being steep down below facilitate the mass movement of soil making land slide a very common phenomenon. Providing vegetal cover will have two fold effects in erosion control, the first is that it improves the soil matrix through reinforcing and second that it reduces the intensity of runoff. Breaking of slopes through the Bio engineering & civil works like construction of check walls, check dams, retaining walls & bench terracing etc. discontinue the slopes & prevent mass movement of soil. Though, various components proposed in the CAT Plan are likely to arrest the further increase in the silt load factor significantly, yet there is no guarantee for reduction in silt load factor in future because of factors mentioned below, over which the measures proposed in the CAT Plan have little effect & may lead to increased silt load in future:

(a) The climatic conditions prevalent in major portion of the catchment and the area covered in the CAT Plan are very hostile to any vegetation growth.

(b) Various natural & manmade factors upstream of HEP, like glacial erosion, flash floods, area being geologically very fragile & seismologically active, road construction, new Hydro Power Projects to be installed in near future & other development activities may lead to an increased silt generation. It is hoped that this CAT Plan will be able to address these issues so that the adverse impacts are mitigated to the extent possible.

INTRODUCTION

The Indian power sector is going through an exciting growth phase leading to capacity addition in generation, transmission, distribution and a stable regulatory environment coupled with a focus on rural electrification, nuclear and renewable sources of energy. India's demand for power is expected to 800 GW by 2032, which implies a six fold growth in the current capacities in about next 25 years. The Govt. of India has taken various steps to enable the growth in capacity. The planning commission has set a target to add 78 MW of capacity in the XI-Five year Plan for 2007-12. By March, 2009 there has been addition/ commissioning of 12467 MW. Given various constraints, the Govt. of India has envisaged in its Mission - **Power to all by 2012**. Achievement of this target requires development of power projects with large capacity. The energy policy also facilitates an environment conducive to sustainable private sector involvement. Accordingly, the states rich in 'Natural Resources' like Himachal Pradesh, Uttrakhand, Chhatisgarh & states in North East are tapping the hydro power potential to meet the power demand by involving the private sector.

Himachal Pradesh is a relatively young state, having been granted full statehood in 1971. It is a relatively small state both, in terms of population and size. With a population of 6.6 million, it represents well under 1 per cent of India's total population. About 90 per cent of the population resides in rural areas. Himachal Pradesh is largely mountainous with the exception of small pockets bordering Punjab and Haryana. The state comprises hilly terrain, perennial rivers, and significant forest cover. The state offers many opportunities, given its abundant water resources, hydropower, mineral resources, horticulture, agriculture, and potential for tourism. It is however, facing significant challenges arising from its elevation, topography, and ecological vulnerability. Since the 1990s, Himachal Pradesh has grown faster than the national average and is ahead in terms of most indicators of human development.

It is performing better than several more developed states in terms of social and economic progress. Supportive government policies have invested in infrastructure and given high priority to expenditures in the social sectors. Himachal Pradesh has achieved per capita social expenditures, which are approximately double of the all-states average for India. Investments in infrastructure is gradually creating a facilitating environment for growth, but much of the economy remains dependant on public spending financed by borrowing and central assistance. Employment opportunities outside the public

sector remain scarce in general and educated younger generation in the state in particular. Himachal Pradesh is one of eleven special category states with eligibility for special central assistance.

The state of Himachal Pradesh has four perennial rivers of Indus water system viz. Satluj, Beas, Chenab and Ravi and some tributaries of Yamuna basin. All these have significant potential for hydro power development. The Government of Himachal Pradesh has identified more than 20,000 MW of hydro power potential in the state. Out of which less than 7000 MW has been developed. The basin wise hydropower potential identified in the state is given as under:

Sl. No.	Basin	Hydro Power Potential (MW)
1	Beas	4564
2	Ravi	2305
3	Sutlej	9211
4	Yamuna	1011
5	Chenab	3287
6	Mini Micro Projects	530
	Total	**20908**
		[Source: HPSEB Website]

Hydroelectric Projects in Satluj Basin

The Sutlej basin alone accounts for 50% (approx.) of Hydro Power potential in the state. Some of HEPs like NJHEP, BASPA, Bhaba, Ganvi & Karchham Wangtoo, in Sutlej Basin, are already in operation. These have the total installed capacity of 3350.25 MW. Projects with installed capacity of 1880 MW are under execution and are likely to be commissioned in the near future. The remaining 4196.45 MW potential still remains to be developed/ harnessed. The BASPA-II 300 MW, NJHEP 1500 MW & 1000MW Karchham Wangtoo in Sutlej basin have been commissioned recently and are in full operation presently. The other major projects in the pipeline are: Kol Dam 800 MW, RHEP 437 MW, Shongtong Karchham 402 MW, Khab HEP 636 MW, Luhri HEP 465 MW, Thopan Powari 400 MW and Tidong-I HEP 100 MW.

The Development entails pressure on ecology. These HEPs relate to tracts associated with mass movement of soil, glacial erosion, monsoon related slides and large cloud bursts being common phenomenon. Any disturbance in ecological balance locally is bound to land up in more precarious situation. With the conservation perspective coming in to the frame over the past few

decades, these issues have become more important. The tract being geologically fragile and seismological active, it is, therefore, imperative to have a well designed plan to address these issues. Moreover, one of the essential requirements of Hydro Electric Power generation is the availability of water flow from a certain elevation/ head. Dams/ tunnels may be proposed with appropriate design to harness the energy of flow of water. The life of dam and long serviceability of turbines are directly affected by siltation. The siltation is primarily dependent on the physical and biological condition of the catchment area of the project. The more productive is the catchment area, the lesser will be the quantity of silt flowing into the dam/ tunnel site. The productivity of the catchment area is indicated by the land use pattern and extent of vegetation cover. Therefore, the forest plays the vital road in conserving the water resources.

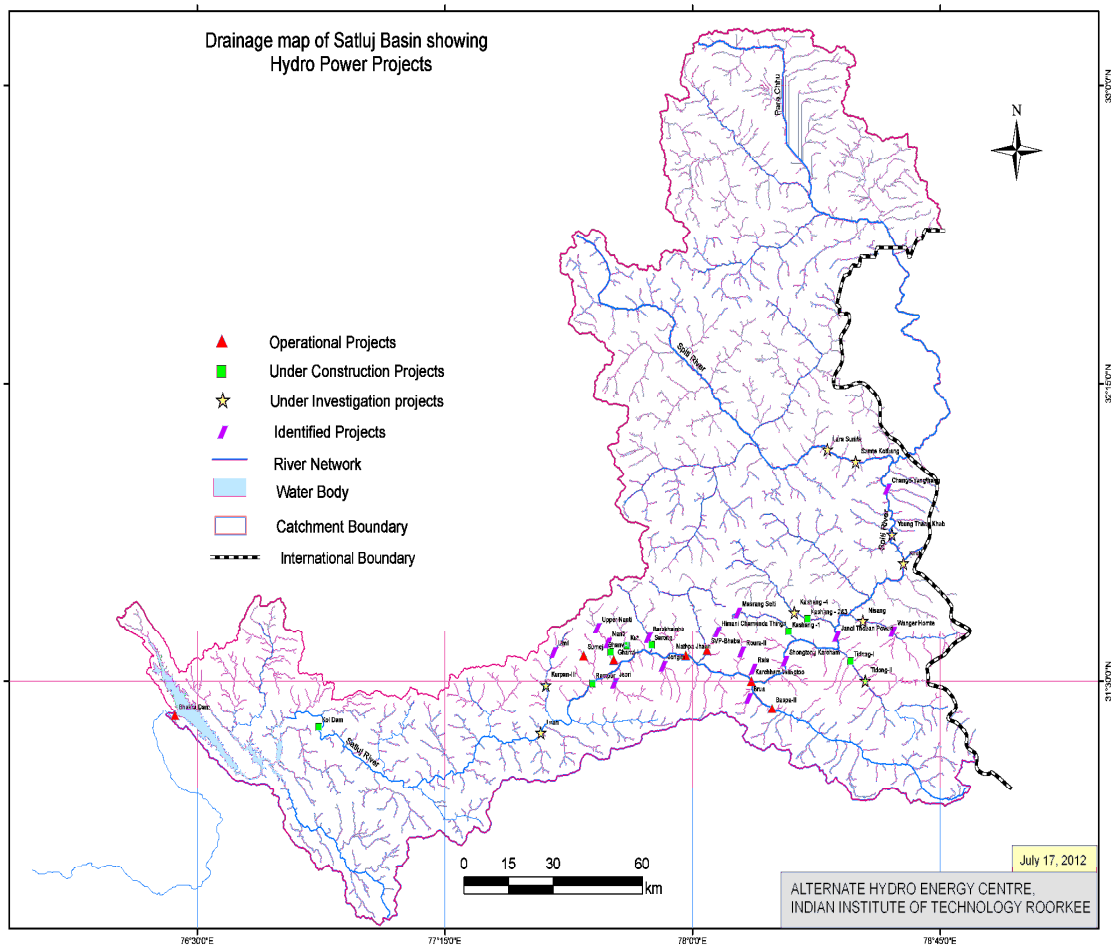

Figure I.1: Hydroelectric Projects in Satluj Basin

With an increase in population in the catchment area, pressure on the forest has also increased manifolds. Similarly, the cattle population has also increased many times and has affected the grazing grounds and forests badly.

Vast forest cover are being degraded due to excessive exercise of rights by the local people for meeting the demands of fuel wood, timber and also due to many other developmental activities like construction of roads, laying of transmission lines, irrigation line/ pipe, coming up of HEP etc. Improper land use and water management are also factors responsible for denudation. Lack of vegetal cover is the single largest factor contributing to the land degradation eventually leading to break down of the natural equilibrium of the fragile mountain ecosystem.

Hydro-electricity is a clean and renewable source of energy. At the same time it is essential that the catchment area be properly treated for stabilization of slopes and reduction of silt load in the river Satluj. Like many others developmental activities, these projects while providing planned benefits, have the potential to cause a variety of adverse environmental impacts. It is, therefore, essential to have proper management of environment to sustain and maintain the ecological balance in the tract. The Kinnaur valley is endowed with enchanting beauty in its picturesque snow clad peaks, traversing through meadows, where wide range of flora and fauna, clear blue sky, numerous tracking paths and rich cultural heritage of local people are visible. The catchment area of the project falls under dry & arid zone having typical climatic conditions.

A well designed CAT Plan is essential to ameliorate the adverse effects as a result of these HEPs in the Satluj Basin. It is with this in view that "**Himachal Pradesh Power Corporation Limited**" has formulated the CAT Plan for Shongtong-Karchham HEP in Kinnaur District of Himachal Pradesh through Himalayan Forest Research Institute, Panthaghati, Shimla. The major Nallas/ Khads namely Dubling, Nesang, Moorang, Tidong, Ribba and Purbani, on left bank and Siasso, Kanam, Kirang, Kashang and Pangi on right bank merge into the Satluj from Khab, the confluence of river Spiti with river Satluj, to village Powari in Kinnaur district from where the intake of water is proposed to be taken through a tunnel to underground power house near village Ralli.

The project developer through its consultants (HFRI) after thorough field visits and due consultation with the local forest officers have identified the activities to be carried out in CAT Plan over a period of 11 years. The areas of these activities fall on both the banks of river Satluj in the catchment area of the project and are depicted on the topo-sheet. The location map of the CAT Plan area is shown in **Figure I.2.**

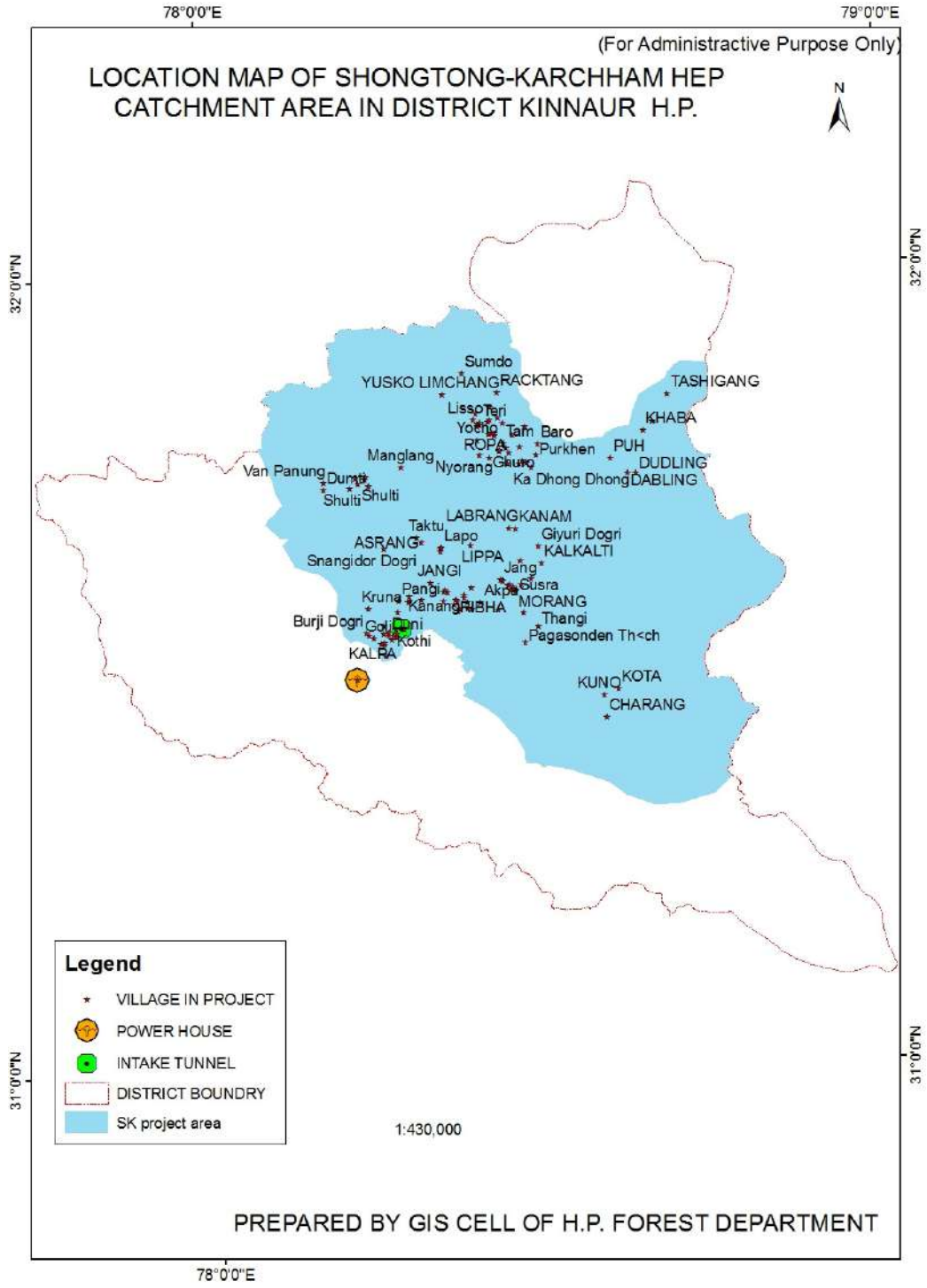

Figure I.2: Location Map of the CAT Plan Area

The scheme of arrangements like implementing authority & approving authority has been defined. Further to these arrangements, a provision for the flexibility in implementation of the CAT Plan is proposed so that the new inputs and lessons are incorporated.

1.1 Name and Location

In Himachal Pradesh many small, medium and large hydroelectric projects are being constructed to tap the hydroelectric potential of the state. It also provides excellent opportunities for power generation to bridge the gap between demand and supply of power in the state/ region. The electric power being a vital and essential infrastructure has a significant role to play in economic development and upliftment of people. The state has more than 20000 MW of identified hydroelectric potential, out of which 7000 MW potential had been harnessed so far. Himachal Pradesh has five river basins, which provide an ample scope for development of Hydro power potential. Out of these five basins, Satluj basin has the highest potential of about 9,211 MW of electricity.

This report deals with Catchment Area Treatment Plan for Shongtong-Karchham HEP in district Kinnaur (H.P.). The Shongtong-Karchham Hydro Electric Project has been envisaged with the purpose of exploiting the potential in the Satluj River between villages Powari and Ralli. The Shongtong-Karchham Hydro Electric Project is proposed to be commissioned on river Satluj in district Kinnaur of Himachal Pradesh. The project is envisaged as a run-of the river Scheme on Satluj River. The proposed barrage/ intake site is near village Powari and the power house is proposed to be located near village Ralli on left bank of river Satluj above the confluence of river Baspa with Satluj. The Shongtong-Karchham hydro-electric project is proposed to generate 402 MW of hydropower.

The Govt. of Himachal Pradesh has entrusted the task of implementing this hydroelectric project to Himachal Pradesh Power Corporation. The list of Ranges, Blocks & Beats of Kinnaur Forest Division constituting the CAT Plan area of the Shongtong-Karchham HEP are given as per Table 1.1. The breakup of the forest area is given as per Table 1.2.

Table 1.1: CAT Plan Area of the Shongtong-Karchham HEP

Sl. No.	Name of Range	Name of Block	Name of Beat
1	Kalpa	Shongtong	Tangling, Purbani
		Kalpa	Kalpa, Pangi, Reckong-Peo
2	Moorang	Jangi	Rarang, Jangi, Lippa
		Ribba	Ribba, Rispa, Moorang
3	Pooh	Kanam	Kanam, Sunam, Giabong
		Pooh	Pooh, Dubling

Table 1.2: Beat-wise Breakup of Forest Area under the CAT Plan

Name of Beat	DPF Area (in Ha.)
Tangling	825.95
Purbani	741.36
Rarang	1302.28
Jangi	562.51
Lippa	733.29
Ribba	864.51
Rispa	514.37
Moorang	226.61
Kanam	310.79
Sunam	276.40
Giabong	494.72
Pooh	0.00
Dubling	68.80
Kalpa	429.64
Pangi	692.83
Reckong-Peo	162.68
Total	**8206.74**

1.2 Situation

The Shongtong-Karchham HEP is a run of river scheme on Satluj River in Distt. Kinnaur, H.P. The project is to be located between Powari & Ralli villages on the left bank of Satluj. It is about 90 Kms. from Rampur Bushahr & 240 km from Shimla. The total length of the river up to intake near Powari is about 70 Kms. from the confluence of Satluj river with Spiti river at Khab and the catchment area at barrage/ intake axis is about 47132 Sq. Km. The total geographical area of District Kinnaur is 6401 Sq. km. The elevation at barrage site is 1935 Mt. above the mean sea level.

The entire catchment is sparsely populated. The Project, being tunnel based, is not likely to endanger the flora and fauna species in and around the area. Similarly least ecological disturbance or backlashes are anticipated that could upset the existing ecological balance in the project area. The ecosystem of the Satluj Valley above project site is fragile due to its geomorphologic and climatic features. The Demarcated Protected Forest area is 8206.74 ha. The remaining area is either barren/ rocky or having alpine pastures or snow covered peaks. The important villages coming in the Catchment Area are Kalpa, Pangi, Rarang, Jangi, Lippa-Asrang, Kanam, Sunam, Ropa Giabong & Pooh on right bank and Purbani, Ribba, Skibba, Thangi, Moorang, Dubling & Namgia on left bank of Satluj river. The catchment area of the proposed project falls under Kalpa & Pooh Sub Divisions of district Kinnaur.

As per the report of Choudhary Sarwan Kumar Himachal Pradesh Krishi Vishva Vidyalaya, (CSKHPKV) Palampur, the catchment area of Satluj basin above Wangtu has been divided into sub catchments. There are 24 Sub-catchments in all. Barring one sub-catchment, i.e. SC No. 19 falling in the jurisdiction of Spiti Sub- Division of Lahaul & Spiti district, remaining 23 SCs are in district Kinnaur. The 23 numbers of sub-catchments falling in district Kinnaur have heterogeneous type of land forms, varying altitude ranges, rock structures and composition with a result a great variety o

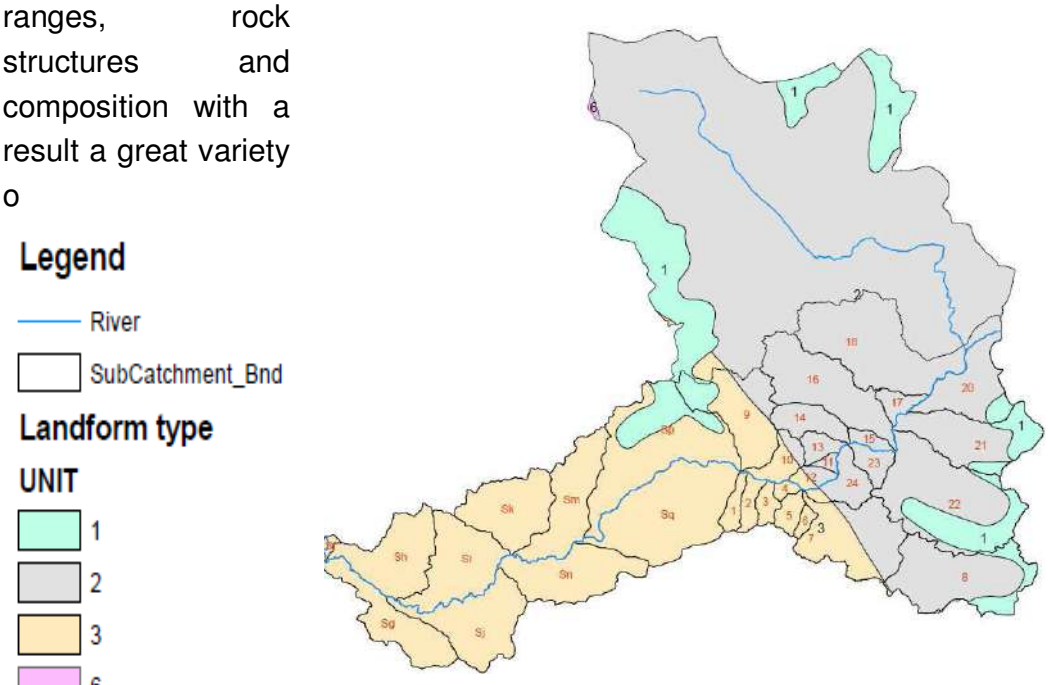

Figure 1.1: Map showing the sub-catchments & land form type in district Kinnaur beyond Wangtu

ms, forest types, rainfall pattern, agro-ecological zones and soil types. The catchment area of Shongtong-Karchham HEP falls under sub catchment Nos 11, 13, 14, 15, 16, 17 & 18 on right bank and sub catchment No 24 (part), 23, 22, 21 & 20 on the right bank of river Satluj.

The following Panchayats are covered under this Plan:

1 Kalpa, Duni, Khawangi, Shudarang, Tallangi, Kothi, Pangi, Rarang Thopan, Jangi, Akpa, Lippa-Asrang, Kanam, Sunam, Giabong, Ropa, Pooh etc on right bank, and

2 Powari, Purbani, Ribba, Skibba, Rispa, Thowarangi, Shilling, Lamber, Thangi, Kunu - Charang, Moorang, Nesang, Dubling & Namgia etc. on left bank.

1.3 General Description & Land Use Pattern

The general description & land use pattern which falls under sub catchments No.11, 13, 14, 15, 16, 17, 18, 24 (part), 23, 22, 21 & 20 of which the present CAT Plan is covered, is given in the Table 1.3. The figures are based on the figures in the comprehensive CAT Plan of Satluj.

Table 1.3: General Description & Land Use Pattern

Sub-catchment No.	Tehsil	Villages	Altitude (M)	Slope (in Degree)	No. of Households	Population (Numbers)	Forest Land (Ha.)	Waste Land (Ha.)	Other Land (Ha.)	Agriculture Land
11	Kalpa	Kalpa, Kothi, Duni, Khowangi, Yuwarangi	1900 - 5090	40 to 85	1395	6533	328	385	1186	402
13	Kalpa	Pangi	1960 - 5237	40 to 85	572	2069	724	1382	4008	86
14	Kalpa	Nil	2010 - 5806	40 to 85			217	408	12056	18
15	Moorang & Pooh	Rarang & Akpa	2225 - 4365	40 to 85	334	2367	1302	912	2017	169
16	Moorang & Pooh	Jangi, Lippa Asrang	2225 - 5848	35 to 90	541	3019	1234	2558	47455	553
17	Pooh	Spillo, Labrang, Kanam, Karra	2300 - 5092	40 to 90	470	2718	394	1758	3619	329
18	Pooh	Pooh, Ropa, Sunam, Shilla, Rushalang, Talling, Siasso	2365 - 5905	40 to 85	706	2940	693	15580	49613	514
24	Kalpa	Purbani, Tangling, Powari, Barang, Shongtong, Rally, Bawa	1720 - 6473	40 to 85	671	3661	Figures not available in CCP Satluj			
23	Moorang/ Pooh	Rispa, Ribba, Holding	2105 - 5712	30 to 85	500	2878	1374	2615	4406	205
22	Moorang/ Pooh	Moorang, Gramang, Thangi, Lambar, Kunnu, Charang	2225 - 6465	40 to 85	651	3010	Figures not available in CCP Satluj			
21	Moorang/ Pooh	Nesang	2259 - 6095	45 to 90	122	640	442	680	38993	85
20	Pooh	Dabling, Namgia, Khab, Tashigang	2534 - 5905	35 to 90	199	1183	199	17223	13331	147

(Figures are based on Comprehensive CAT Plan of Satluj)

1.4 Topography and Drainage

The terrain of the catchment area is mainly mountainous, which can be described as steep to very steep with precipitous slope. A flat U-shaped valley characterizes the area. It indicates the glacial movement along the valley. The whole area drains into river Satluj, which flows almost in the middle. Satluj enters the district from Northeast & leaves the district at its western end. There are also number of tributaries in the sub-catchments which drains into Satluj river carrying along a lot of silt. The terrain is mostly rocky with little rock exposure on both the bank of the river. There are few streams which are cutting the rocky terrain and the shapes are almost vertical (60°- 90°) at most of the places. In downstream the valley becomes narrow, at places, showing the cessation of the glacial movements.

1.5 Geology, Rock and Soil

The known geological formations in the tract are given in Table 1.4.

Table 1.4: Known Geological Formations

1.	Pre Cambrian	Schistis, gneisses, granites, quartzites (Vaikrita system)
2.	Late Pre Cambrian	Haimanta System-phyllites, quartzites conglomerates, shales and slates.
3.	Silurian	Coral limestone, Quartzites.
4.	Carboniferous	Quartzites and limestones.
5.	Triassic Rhaetic	Limestone, Shales, dolomites etc.
6.	Recent sub-recent	Soils.

The important rock formation in the forest areas are gneisses, schists, phyllites, granites and quartzite's metamorphosed schists occurring principally in the western portion of the Satluj valley. Among the members of schistose series micaceous-schists, talcose rocks, phyllites and gneisses are commonest & support good forests of Deodar, Kail & Fir. In the Wanger Gad, there is an outcrop of greenish quartzite which rapidly assumes a gneissic structure. Extensive outcrop of "Granitod gneiss" are seen beyond Wangtoo along the (old) Hindustan Tibet Road. To this rock type the name "Wangtoo Gneiss" is given. This type supports middle quality Kail crops. From near Pangi to some distance short of Jangi, the rocks exposed are mainly biotite granulites with extensive intrusions of

light coloured granite. Schists & soft-banded gneiss, which decompose more rapidly, tend to produce deeper soils than the hard fine-grained gneiss and quartzite. The soil produced by the former vary from clay to clay loam and are often heavy & retentive of moisture to a considerable degree conditions that are preferred by Kail & Silver Fir. The rapid weathering of granite in some localities, particularly in Kirang & Ropa valleys appears to be due to a very high proportion of feldspar, which rapidly disintegrates under the influence of frost action and extremes of temperature. Proterozonic rock of Jeori-Wangtoo and Banded Gneissic complex of Rampur, Chail and Jutogh Groups are found in the region. Tectonic place called Main Central Thrust is extensively developed throughout the region, though it is not encountered anywhere in the project area. Among the members of the schistose series micaceous-schists, talcose rocks, phyllites & gneisses are commonest and support good forests of Deodar, Kail and Fir.

The soil of the project area is skeletal mountain meadow and sub-mountain. It is thin on most hill sides of the district. Extreme South-Eastern part is covered with snow. The profile of the soils is well developed in dense forest and higher altitude. Soil is sandy to sandy loam with fragile strata, therefore, problem of slips and erosion is rather serious particularly where the land is not properly terraced. Generally speaking, on ridges, spurs, precipitous slopes & southern slopes the soil is shallow. On the other hand it is moderately deep on the cooler aspects and on gentle slopes. Soil over most of the area is formed in situ & is more or less loam to clay-loam.

As a result of the variations in altitude, relief, climate & parent rock of this region, the soil type differ. It is observed that the Kinnaur district has heterogeneous soil with different types of soil as given in the Figure 1.2.

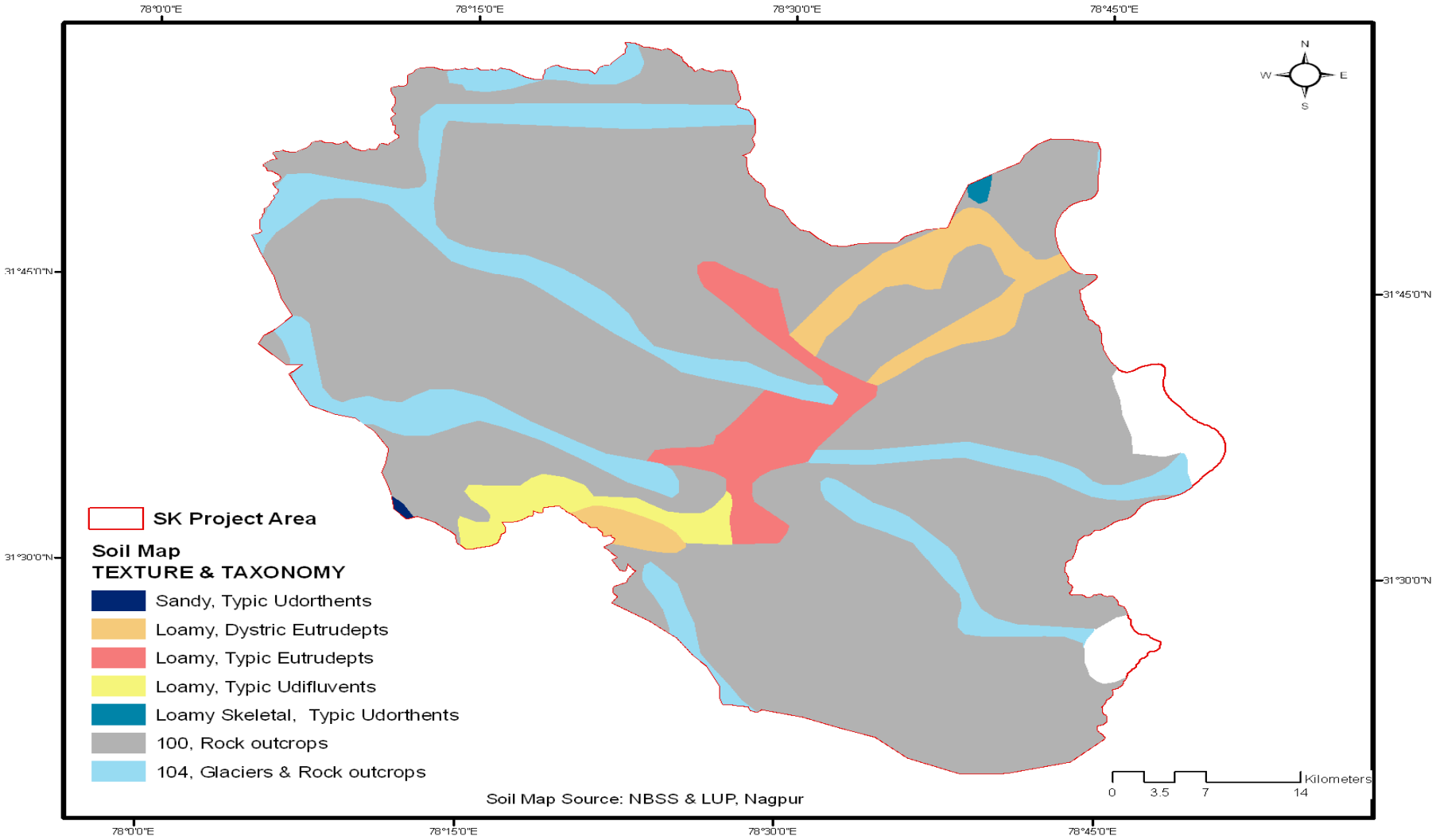

Figure 1.2: Soil Map of Shongtong-Karchham Project Area

1.6 Climate & Rainfall

By virtue of elevation, the tract may be said to have a temperate zone climate with winter from November to April & summer from May to October, which includes rainy season from July to September. The transition period from April to May and from September to October corresponds to spring & autumn seasons of the temperate zone. Broadly speaking three seasons viz., winter, summer & rainy are discernible in the tract.

The climate of the project area is characterized by the absence of monsoon rains during summer and resembles arid Tibetan type of climate for most part of catchment. It is sub humid in lower part of the Project site and semi arid to arid, further up. There is scanty monsoon and falls under climatic Zone-III, classified as arid mountain climate. The precipitation is mostly in form of snow during winter months which can be described as moderate to heavy depending on the altitude.

The rainy season starts with the advent of monsoon either towards the end June or early July and lasts till middle or sometimes in the end of September. The bulk of rainfall is received during this period in the wet zone. In the inner valley beyond Wangtoo, the rainfall shows progressive decline followed by an enhanced snowfall so much so that at Pooh, there is higher snowfall and absolutely no rains. After rainy seasons, the sky becomes clear & there is very little rains during Oct. & Nov. The monsoon clouds advancing from the plains are combed out by the outer ranges of the hills, where most of monsoon rain occurs, so that the inner valleys get a good deal of cloud but no steady precipitation. The snowfall is also heavier in the Himalayas than it is on the Tibetan plateau, but the zones of heavy snowfall includes the whole of Kinnaur and it is only beyond the Tibetan border and up in Spiti Valley that the snowfall shows any marked decline.

Climatically, the tract of Kinnaur district can be divided into three zones of fairly marked climatic characteristics. These may be called as Wet, Dry & Arid zones. The whole of Pooh sub Division falls under dry & arid zones. The Kalpa Sub-Division falls under dry & wet zones and the Nichar sub Division under wet zone. The whole catchment area of Project falls under dry & arid zone (in Kalpa & Pooh Civil Sub Divisions). The Drainage Map, Drainage Network (DEM), Aspect Map, Slope Map and FCC Map are given as Figures 1.3, 1.4, 1.5, 1.6 & 1.7. The average rainfall and snowfall experienced in the catchment are given in Tables - 1.5, 1.6 & 1.7.

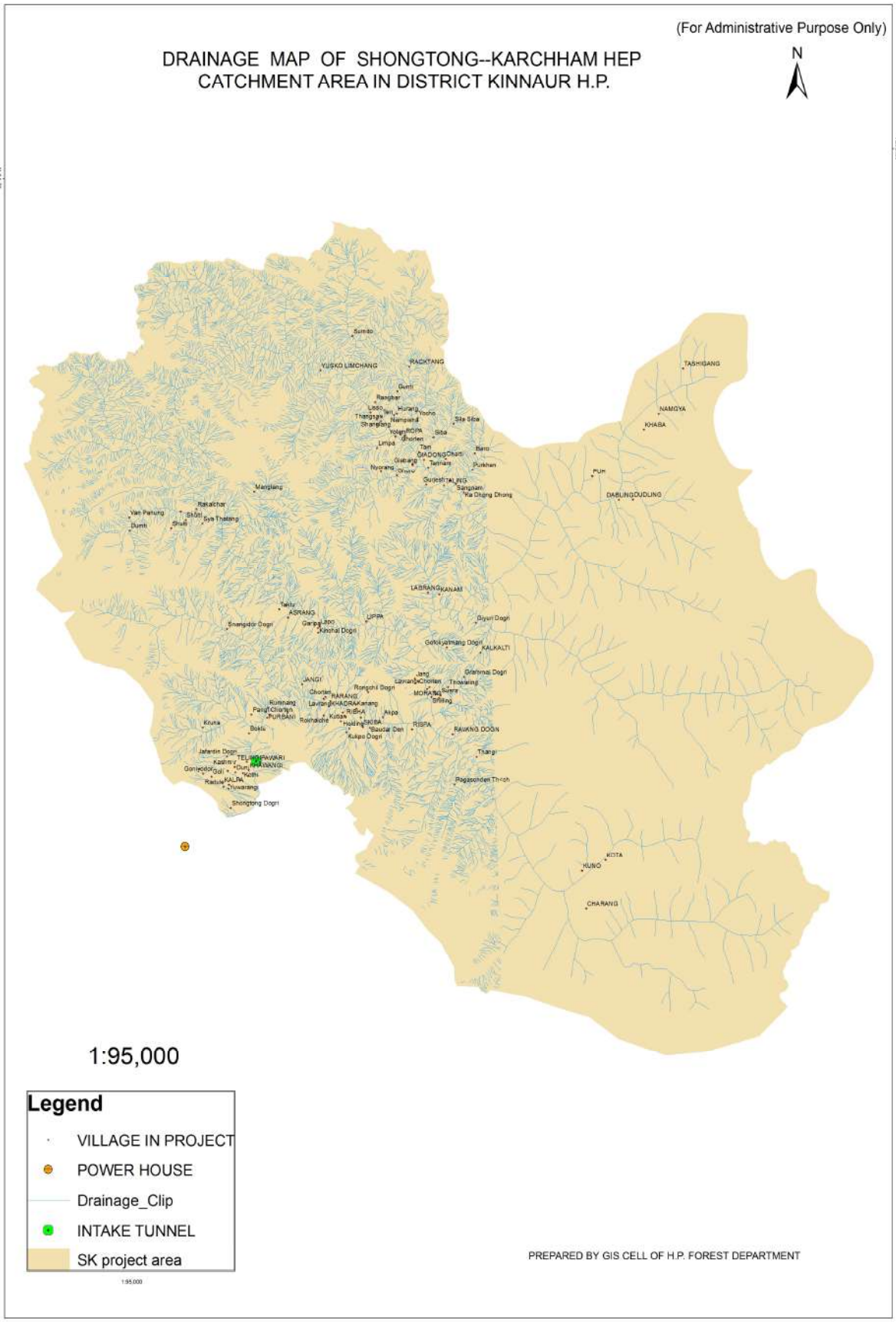

Figure 1.3: Drainage map of Shongtong-Karchham Project Area

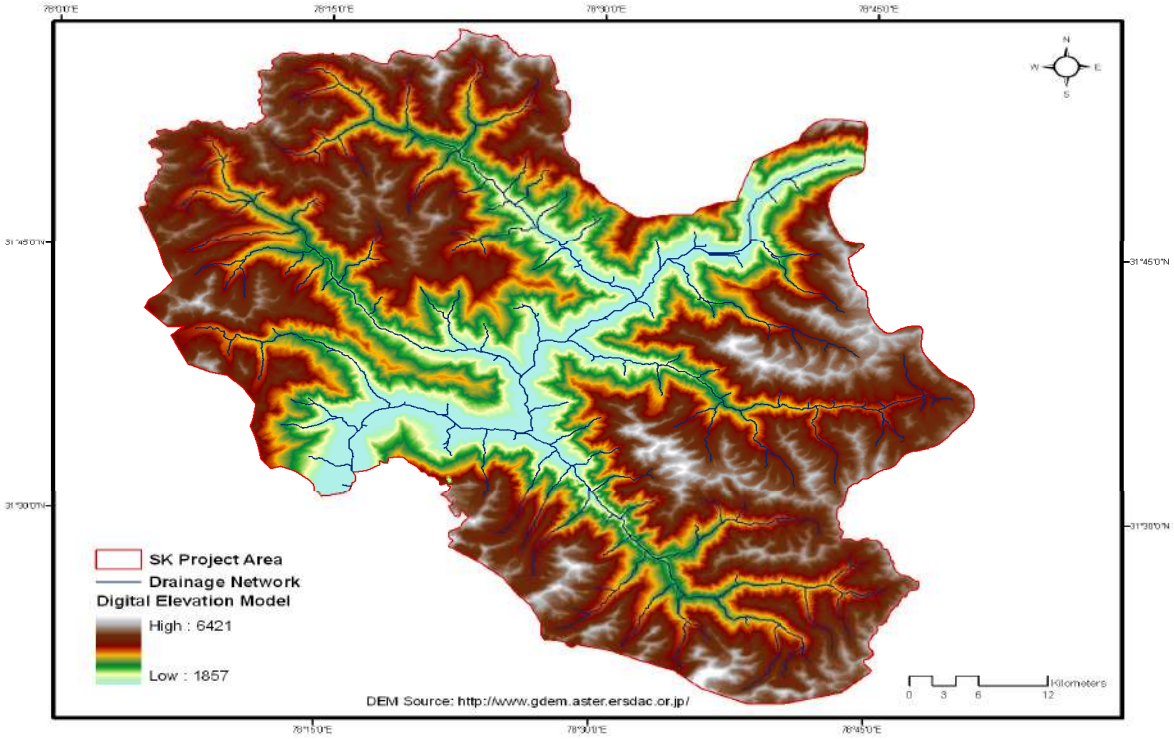

Figure 1.4: Drainage Network Digital Elevation Model

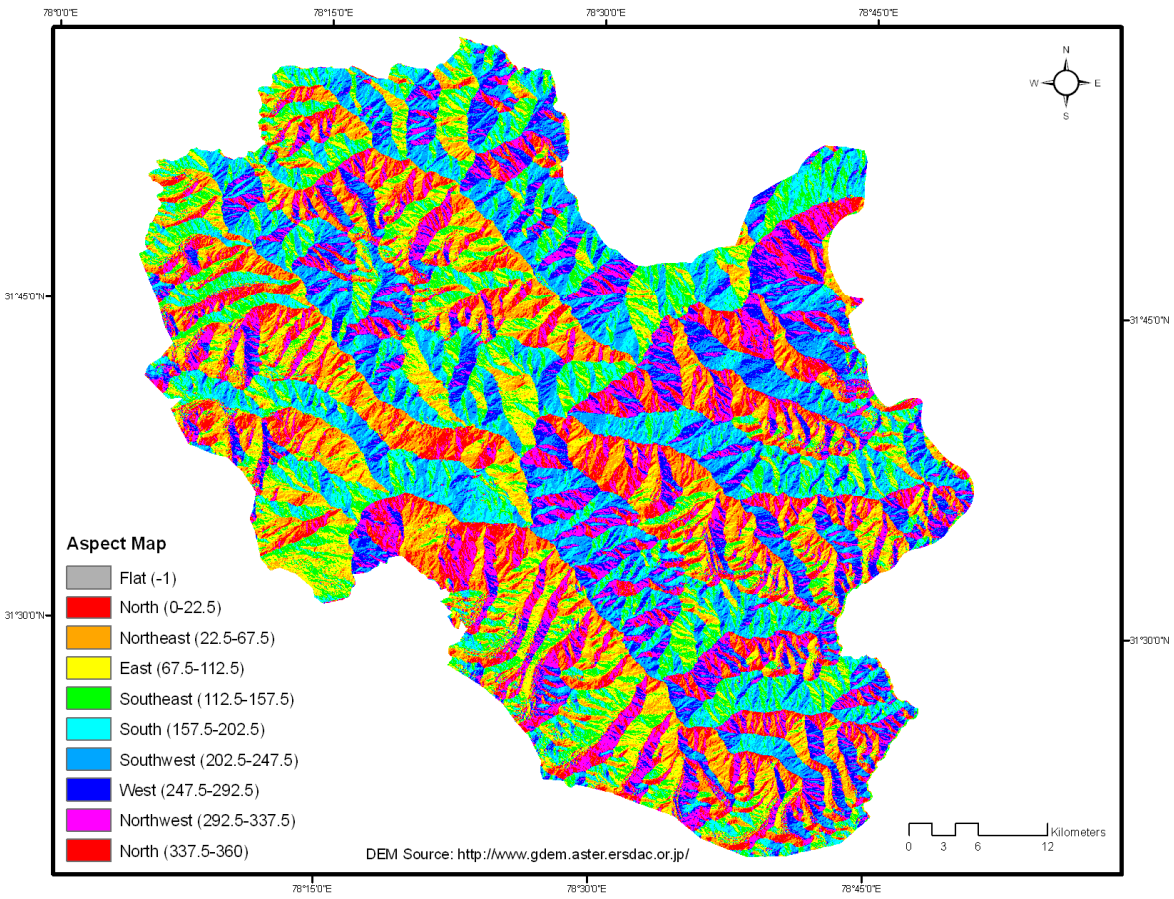

Figure 1.5: Aspect Map of Shongtong-Karchham Project Area

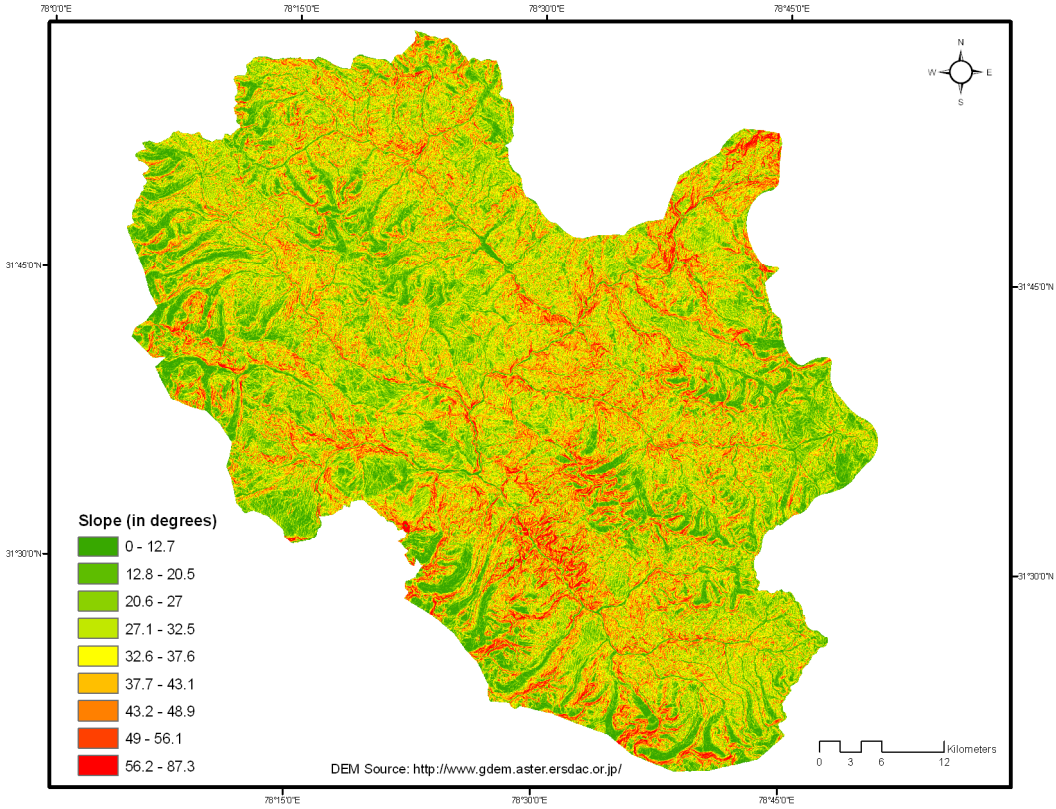

Figure 1.6: Slope Map of Shongtong-Karchham Project Area

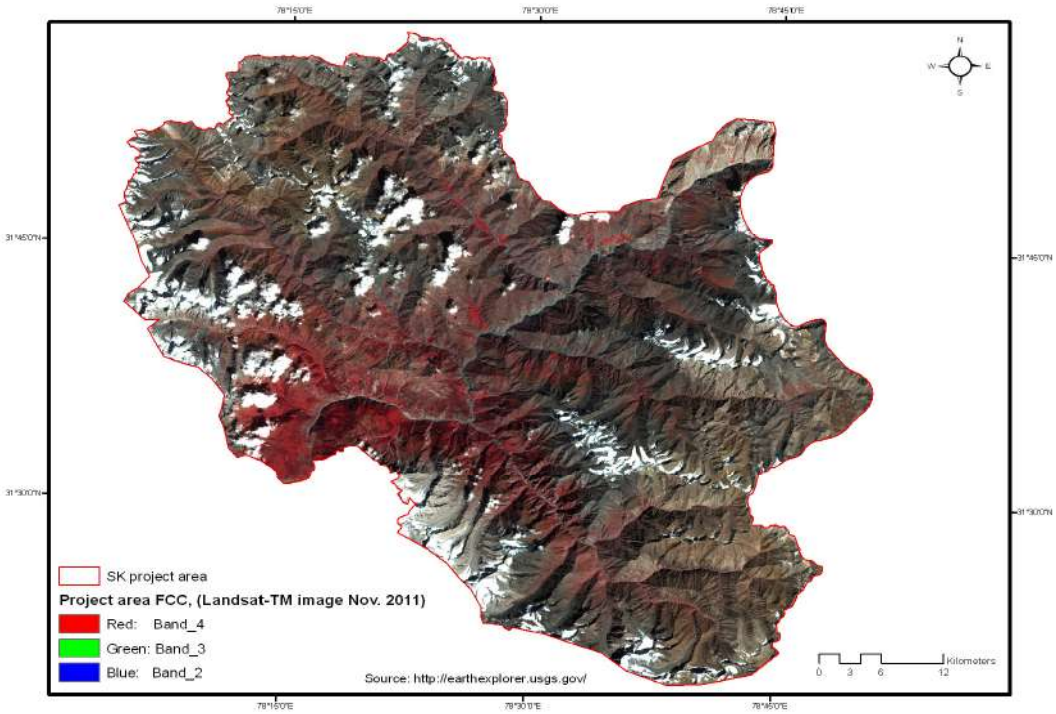

Figure 1.7: Satellite imagery from NRSC (False Colour Composite) Map of Shongtong-Karchham Project Area

Table 1.5: Yearly Rainfall Data

Sl. No.	Name of Station	Rain fall in mm									
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1.	Pooh	-	-	-	-	55.70	108.60	55.06	-	56.00	54.00
2.	Moorang	-	-	-	-	137.30	180.10	277.10	-	56.20	150.00
3.	Kalpa	69.00	29.12	54.29	352.40	-	286.70	451.90	-	282.93	435.90

Table 1.6: Monthly Rainfall Data for the Year 2009

Sl. No.	Name of Station	Rain fall in mm												
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1.	Pooh	-	7.00	-	3.00	-	-	-	6.0	30.00	1.00	2.00	5.00	**54.00**
2.	Moorang	6.00	7.00	-	73.00	-	-	7.00	6.00	32.00	-	13.00	6.00	**150.00**
3.	Kalpa	-	1.50	20.30	71.00	-	29.90	48.90	21.80	201.90	17.00	17.80	5.70	**435.90**

Table 1.7: Monthly Snowfall Data for the Year 2005

Sl. No.	Name of Station	Snowfall in mm											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	Pooh	323.00	220.00	-	-	-	-	-	-	-	-	-	-
2.	Moorang	125.90	108.30	23.20	-	-	-	-	-	-	-	-	-
3.	Kalpa	1428.00	1540.00	474.00	-	-	-	-	-	-	-	-	-

1.7 Temperature and Humidity

The temperature in the different parts of the tract varies according to the elevation. The temperature begins to rise rapidly from the end Feb. till June which is warmest month. The temperature remains high during July & August in arid zone because it lies beyond the reach of the monsoons. The weather is cool & pleasant in the summer season except in the deep valleys. With the onset of the South West monsoon by the end of June the temperature begins to decrease gradually. The drop in temperature is rapid only after October. January is the coldest month. Frost occurs from Oct. to May. The temperature varies between -2.9^0 C to 24.5^0 C and mean monthly relative humidity between 23 to 85% in a year. Table 1.8 gives average view of the Meteorological Condition in the area.

Table1.8: Average Meteorological Conditions in the Project Area

Month	Mean Temp. Daily (^{0}C)		Rainfall (mm)	Relative Humidity (%)	
	Maximum	Minimum		At 0830 Hrs	At 1730 Hrs
January			88.6	51.2	39.6
February	6.7	-2.5	121.9	54.2	45.4
March	10.7	0.2	208.7	49.6	42.4
April	17.6	4.9	60.2	44.6	37.6
May	21.7	7.9	36.3	51.6	42.6
June	22.6	10.9	42.3	67.6	54.2
July	23.0	13.3	41.2	81.4	64.2
August	22.3	12.9	39.7	83.8	68.6
September	21.1	9.5	33.6	72.0	60.8
October	19.7	5.0	2.5	45.6	40.2
November	14.7	1.9	63.2	40.4	35.4
December	10.0	-1.1	28.3	45.4	36.0
Average	16.4	5.1		57.3	47.3

Source: India Meteorological Department (IMD), Kalpa Station Average of 5 year data.

The data of temperature & humidity has been procured from India Meteorological Department (IMD), Kalpa station. The four seasons are well-defined;

The spring (Mid-March up to Mid June) is characterized by frequent showers.

The summer season may be described from mid June to mid September. Intense heat prevails along the banks of Satluj probably because of large bare rocks and vegetations. The temperature as well as humidity is moderate in the forest belt. The monsoon usually breaks up around mid July and continues up to mid-September.

The autumn (mid September to mid December) is very clear and fine, but dry winds are common with frost at height 7000 ft. elevation. Owing to increased aridity, the danger of fire is also increased. Snowfall may take place towards the end of the season.

The winters last from mid December to mid March. A lot of frost and heavy snowfalls occur which may descend down to Satluj but does not stay long. In the forest belt, the accumulation of snow is often great, but it quickly melts on southern aspects. By the end of April, all but the high forests are cleared off snow.

1.8 Land Use Pattern

No specific land use survey has been carried out in the catchment area. The land use as per the record available for Kinnaur District, has been shown in Table 1.9 and as interpreted from NRSC has been shown in Table 1.10

Table1.9: Land Use Pattern of Kinnaur District

Name of Area	Forest DPF (Ha)	Non-Cropped Land (Ha)	Alpine Pasture (Ha)	Fellow & Grassland (Ha)	Culturable Wasteland (Ha)	Miscellaneous Area (Ha)	Total Geographic Area (Ha)
District Kinnaur	22,259	7871	254389	3753	9803	253825	640100

Table1.10: Land Use Pattern of the Catchment Area as interpreted from NRSC

Land use Pattern of CAT Area as per Land use Map by NRSC.		
Sl. No.	Category Land Use	Area in Sq. Km.
1	Snow and Glaciers	1302.32
2	Grass land and alpine pastures	1003.39
3	Forest	82.07
4	Barren land/ Rocky area (Un-Culturable)	242.45
5	Barren land (Culturable)	250.00
6	Water Bodies	26.12
7	Agriculture & Horticulture	85.47
8	Rural & urban Built up Area	8.15
	Total	**2999.97**

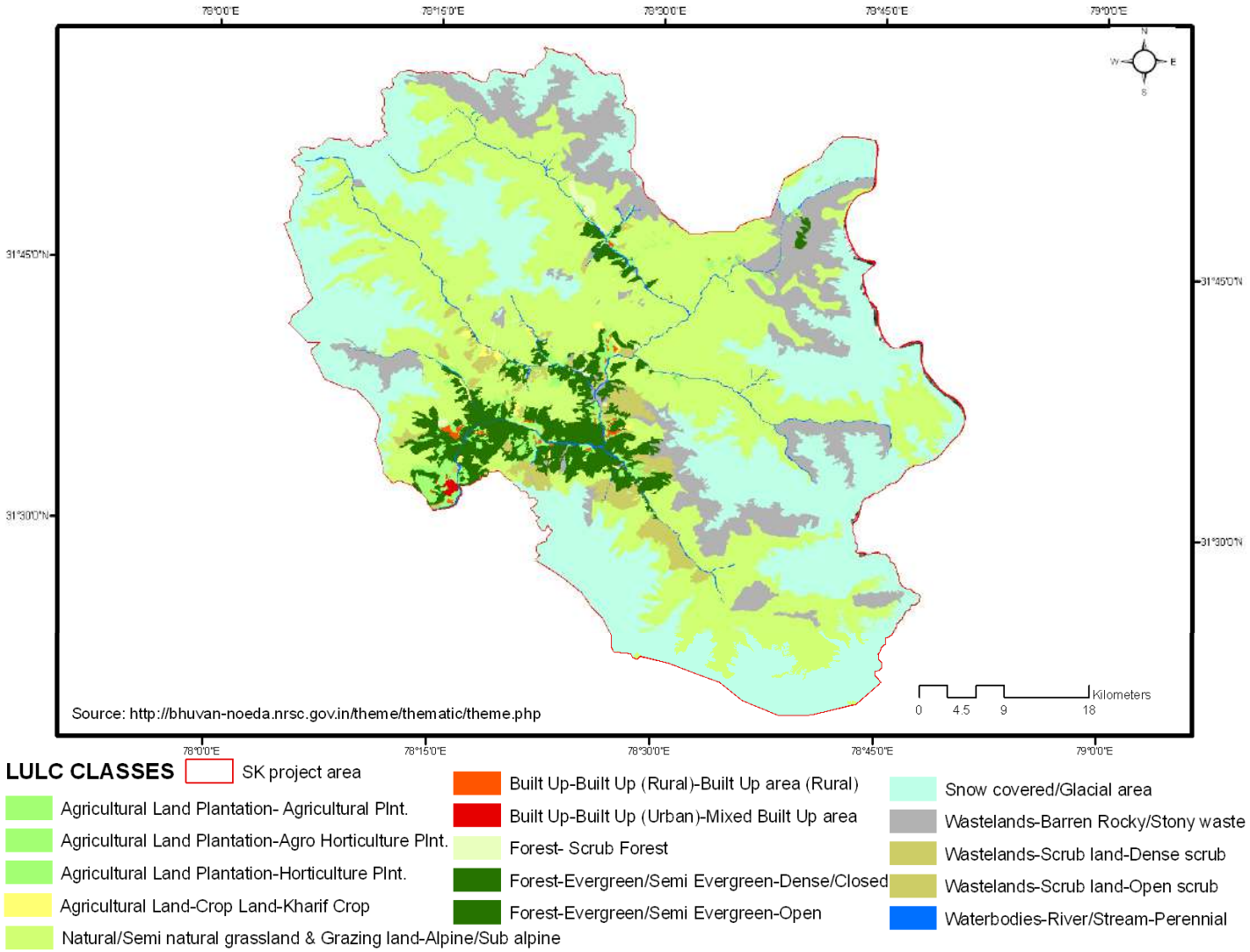

Figure 1.8: Map showing the land use pattern of the Catchment Area as drawn from NRSC

1.9 Socioeconomic Profile

According to the census report, year wise (1982, 1992 and 2003) breakup of live stock population is shown in Tables 1.12 to 1.14.

Table 1.11: Yearly (1982) Breakup of Livestock Population

Sl. No.	Name of Tehsil/ Sub- Tehsil	Cattle Population during the Year 1982					
		Cows & Oxen	Buffalos	Sheep	Goats	Others	Total
1.	Pooh	1454	-	5754	2945	1191	11344
2.	Moorang	2745	-	8088	2268	434	13535
3.	Kalpa	3436	-	6403	1632	355	11826
	TOTAL	**7635**	**0**	**20245**	**6845**	**1980**	**36705**

Table 1.12: Yearly (1992) Breakup of Livestock Population

Sl. No.	Name of Tehsil/ Sub- Tehsil	Cattle Population during the Year 1992					
		Cows & Oxen	Buffalos	Sheep	Goats	Others	Total
1.	Pooh	965	-	5905	2623	1726	11219
2.	Moorang	2057	-	10077	5546	897	18577
3.	Kalpa	2963	-	9663	5064	380	18070
	TOTAL	**5985**	**-**	**25645**	**13233**	**3003**	**47866**

Table 1.13: Yearly (2003) Breakup of Livestock Population

Sl. No.	Name of Tehsil/ Sub- Tehsil	Cattle Population during the Year 2003					
		Cows & Oxen	Buffalos	Sheep	Goats	Others	Total
1.	Pooh	1517	0	9064	4060	846	15487
2.	Moorang	2381	0	10556	4351	523	17811
3.	Kalpa	3214	9	7473	2171	529	13396
	TOTAL	**7112**	**9**	**27093**	**10582**	**1898**	**46694**

The total live stock population in the Cat Plan area as per latest census for the year 2003 as given in the above table is 46694 which works out to be 0.156 cattle density per ha. of the total Cat Plan area. This, however, doesn't depict the true picture of cattle impact as most of the cattle are confined to habitable areas (near to natural water sources) exerting heavy pressure of grazing and lopping on the adjoining forests.

1.10 Human Population and Livelihoods

According to the 2001 census of Kinnaur district, the total human population is 78334 with 42173 male and 36161 females and sex ratio is 857 female per 1000 males. The Population density is 12.23 per sq.km. The total area of the district being 6401 Sq. Km. There are 47 Nos. Gram Panchayats with 142 villages in and around the project area.

Table 1.14: Population data of Development Block in the Catchment Area of the Project

Sl. No.	Name of Development Block	Male Population (in Nos.)	Female Population (in Nos.)	Total	Sex Ratio
1	Kalpa	15636	13725	29361	878
2	Pooh	11665	10678	22343	915
Total		**27301**	**24403**	**51704**	894
Total for District Kinnaur		**42173**	**36161**	**78334**	**857**

Source: Economic and Statistical Department, District Kinnaur (H.P.)

Table 1.15: Data showing the Number of Families falling under Development Blocks in the Catchment Area of the Project

Sl. No.	Name of Development Block	Total Population (in Nos.)	No. of Households	No. of Villages
1	Kalpa	29361	6922	194
2	Pooh	22343	5178	278
Total		**27301**	**12100**	**472**
Total for District Kinnaur		**78334**	**18641**	**660**

There are 12100 families in Kalpa & Pooh Development Blocks. The low density can be attributed to difficult hilly terrain coupled with severe climatic conditions in the area. Agriculture, horticulture & sheep/ goat rearing are the chief sources of livelihood of the communities of the Cat Plan area. The occupation of more than 80% people in the area is Agriculture/ Horticulture. The other major agricultural product is potato, peas & cereals. But, the productivity of the arable land is very low owing to the prevalence of less remunerative and less intensive cropping system, with an overall poor level of management.

The animal population is 46694 numbers cow, ox, goat and sheep are kept by the local people for milk, ploughing, meat and wool purposes. The society of the project area comprises mostly of poor people and their main vocation is agriculture, horticulture, animal rearing etc. Horticultural activity is not encouraging due to non-accessibility to motorable road despite the fact that area being considered to be most suited for horticulture crops of apple and dry fruits. The livestock and livelihood of the people, to large extent, depend upon rich natural resources of the area. The road network has been gradually increasing of late.

The Shongtong-Karchham HEP project is being constructed on Satluj basin. The proposed project falls in Kalpa, & Pooh Community Block. Random sampling survey has been conducted to study a socio-economy of the catchment area. The secondary & primary Data collected during the field investigation revealed that the catchment area has general slope ranging from 35% to 85%. The farmers invariably practice mixed farming comprising of horticulture, agriculture, vegetable cultivation and animal husbandry. About less than 5% population of the catchment area has assured irrigation. Farming, therefore, is mostly rain fed. The manures, both chemical as well as organic are applied in insufficient quantities mainly due to lack of purchasing power of the farmers, non-availability of sufficient quantity of organic manure and insufficient soil moisture during the crop growth period.

Rainfall occurs during the monsoon season, therefore, efforts to conserve as much of water are essential. Organic manure & practicing organic farming, if adopted will go a long way in water conservation. This will improve the physical property of the soil thereby improving the water holding capacity of the soil which will result in more retention of rain water. This, in turn, would lead to reduction in run off loses and eventually reducing the silt load in the Satluj River.

It was also noticed during the field survey that the farmers are growing the field crops on sloppy land and cultivation is being done in some places across the contours having slope more than 35 to 40 degree. In order to conserve the rain water in situ, the terracing of agriculture land needs to be adopted. Farmers need to resort to conservation type of farming instead of soil depleting farming process.

The livestock population in the catchment is invariably very high which has put unbearable pressure on the land holding, pasture land and forest land.

The availability of fodder both green as well as dry is less than 50% which leads to pressure on grazing on forest land. The farmers while meeting the need of fodder from the adjoining forests invariably resort to indiscriminate lopping and felling of trees which has resulted in reduction of forest cover. Over grazing also leads to soil erosion in the tract it is, therefore, suggested to adopt stall feeding. The excessive population of livestock in the catchment area has led to under feeding, malnutrition and insufficient health care of animals. It has resulted into infertility in cattle and farmers abandoned such animals which are causing the stray cattle menace. It is, therefore, suggested that *Gosadans* may be established in consultation with groups of local Panchayats. This can be taken care of under Payment for Environment Services.

1.11 Demographic Profile of the Catchment

According to the 2001 census of Kinnaur district the total human population is 78334 with 42173 male and 36161 females and sex ratio is 857 female per 1000 males. The Population density is 12.23 per sq.km. The low density can be attributed to difficult hilly terrain coupled with severe climatic condition in the area.

Different Tables from Table No. 1.17 to Table No. 1.22 depict the demographic profile of the area.

3.1 Forest and Forestry in the Catchment Area

Forest (legal) in Himachal Pradesh covers an area of 37033 Sq.km. out of total geographical area of 55673 Sq. Km. The area under Green cover, however, is 16671 Sq. Km. (26.35%) as per SFR -2011 by Forest Survey of India (FSI). Due to wide range of altitudes and climatic conditions, several varieties of vegetations from Himalayan meadows to tropical shrubs and bamboo forests on low foothills are found in the state.

Forests, apart from being an important source of timber, have other, perhaps more important, function to perform viz.:

(i) Maintenance of ecological balance.
(ii) Maintaining the capacity of multi-purpose river valley projects & reservoirs leading to high electricity generation and increasing the life of project.
(iii) Production of fodder for the livestock.
(iv) Production of fuel wood for the use of local people.
(v) Improvement of water retention capacity leading to more water for drinking & irrigation during dry months.
(vi) Reduction of soil loss due to various types of erosion. Indirect reduction of crop losses in downstream areas due to flooding & silting.

As per FSI report 2009 although the presence of legal forests area in Kinnaur district is 79.6% of its geographical area but only 9.40% is under green cover as shown in the Table 3.1 below.

Table 3.1: Area statement District Kinnaur as per SFR - 2009

Sl. No.	Particulars	Area in Sq. Km.	Percentage to Geo Area
1	Total Geographical Area	6401	
2	Area under Forest (legal)	5093	79.6
3	Area under Dense Forest	82	
4	Area under Moderate Dense Forest	263	
5	Area under Open Forest	257	
	Total Forest Cover	**602**	**9.40**

According to the national Forest Policy, 66% area in the hills should be covered under forest. In the catchment area of the Project the forest cover is hardly 9%. The scope of afforestation are limited by the fact that the upper reaches of the catchment either remain under permanent snow or are under alpine pastures or rocky & other harsh topographical conditions.

However, in the areas where the forests have degraded in the past or where tree growth is possible, especially where there is possibility of providing irrigation to the plantations particularly in Pooh Sub Division, it has been proposed to carry out the plantation in such areas. Preference has also been given to polythene raised Chilgoza pine & Deodar plantations keeping in view the site conditions and suitability for raising these species.

3.2 Forest Types

With the variation in altitude and aspect; composition & condition of the forest varies a great deal giving rise to various forests types. The forests of catchment area of the project fall in climatic zone of dry & arid zone. The forests has been classified into different vegetation types according to "A revised survey of the forest type of India" by H G Champion and S K Seth, the following types are met within the catchment area as follows:-

Group-13: Himalayan Dry Temperate

C1 Dry broad leaved & coniferous forest. (*Quercus ilex, Pinus gerardiana*)

C-2 (a) Neoza pine forest (*Pinus gerardiana*)

C-2 (b) Dry Deodar Forest (Cedrus deodara)

C-4 West Himalayan high level dry blue pine forest.

Group-14: Sub Alpine Forest

C-I West Himalayan sub alpine Birch/ Fir Forest.

CI.a West Himalayan Sub-Alpine Fir Forest.

CI.b West Himalayan sub alpine Birch/ Fir Forest. Seral & degraded types of sub alpine forests.

I.SI *Hippophophae Myricaria*/

I.S2 Decidous sub alpine scrub

Group-15: Moist Alpine Scrub

C-1 Betula/ Rhododendron scrub forest

C-2 Deciduous alpine scrub.

C-3 Alpine pasture

Group-16: Dry Alpine Scrub

C-1 Dry alpine scrub

C.1 Dry alpine scrub

Type 13-C-1: Dry Broadleaved and Coniferous Forest (*Quercus ilex, P. gerardiana*)

This type occur between 2000 mtr to 2400 mtr extending 300 mtr lower on cooler aspects and 300 mtr high southerly exposures. Upper storey consists of *Pinus gerardiana, Cedrus deodara, Quercus ilex, Acer pentapomicum* etc. the common shrubs are *Artemisia maritime, A. vulgaris, Daphane oleoides & Lonicera angustifolia* etc.

Type 13-C-2a Neoza-Pine Forest (*P. gerardiana*)

Neoza-Pine replaces Chil-Pine near Wangtoo and continues along the Satluj as far as Kanam. Nearly pure crops locally mixed with some Deodar are seen. The forest being open a great deal of the surface is bare. These are much frequented by men for the collection of the Neoza seed which has got a ready market. Upper storey consists of *Pinus gerardiana* and occasional *Cedrus deodara*. In the second storey *Fraxinus xanthoxyloides* is common. Among the shrubs *Artemisia martima*, *Daphene oleoides, Ephedra gerardiana & Lonicera hypoleuca* are common.

Type 13-C-2b Dry Deodar Forest

This type of forest is confined to Kalpa and a part of Kilba Ranges. The forest lies between 2100 Mt. and 3250 Mt. elevation. A nearly pure Coniferous forest. Broadleaved trees being confined to the moist ravines. It varies from the close canopy forests to very open forests of low branching trees depending upon moisture factors. On drier localities it is found mixed with *Pinus gerardiana* but open mixed crops are common especially in the moist tracts where the pine extends higher up the slopes. Blue pine is frequently present and may occur pure over limited areas, especially at the higher elevations.

Type 13-C4 West Himalayan High Level Dry Blue Pine Forest

This type is met with on the higher altitudes of Kalpa & Kilba Ranges. The blue pine replaces both the Kharsu oak and Silver Fir as the typical high level tree of dry zone at high elevation of 3000 Mt. to 3600 Mt. It extends as far towards the arid Tibetan uplands as Deodar does. Below this level the Pine occurs quite frequently as companion of Deodar. Silviculturally and ecologically also, this high level Blue pine is different from the low level type. Important trees & shrubs species met with in this type are; *Betula utilis, Juniperous communis, Rhododendron campenulatum* etc. The common herbs are *Aconitum heterophyllum, Anaphalis, Anemone* etc.

Sub Alpine Forest

14C1a West Himalayan Dry Juniperous Forest

It is a very open xerophytic formation which is met with in the innermost Valley of the Satluj bordering the Tibetan border. The vegetation consists of dwarf trailing shrubs like J. *macropoda, Coragana, Ephedra & Artemesia* etc.

14 C1a West Himalayan Sub-alpine Forest

This type occurs not as continuous belt but in large irregular patches above 3050 Mt. Abies spectabilis is found pure or mixed with Betula utilis.

14C1b West Himalayan Sub-alpine Birch/ Fir Forest

This type occurs in large open and irregular patches above 3000 Mt. elevation or so. The predominant conifer is *Abies spectabilis* and occasionally a few Kail.

Type 15/C-3 Alpine Pasture

Extensive alpine pastures form a characteristic feature of the tract above the trees line. Locally these are called ***KANDA.*** The limit of their altitudinal distribution is between 3600 and 4550 Mt. with the upper limit extending even upto perpetual snowline. The slopes are usually gentle and bear a thick mat of alpine grasses. The large flocks of sheep and goats graze in these pastures from May to September. The area remains snow bound from November to mid April. The common herbs are ***Primula*** **spp.,** ***Anemone*** **spp.,** ***Gentiana*** **spp.,** ***Jurinea*** **spp.,** ***Aconitum heterophyllum*** **etc.** The common grasses are ***Agrophron spp., Brachypodium Sylyaticum, Bromus, B. japonicas, Poa*** **spp.,** ***Dactylis*** **spp.,** ***Millium effusum*** **etc.**

The ecological status of floral communities constituting these groups, forests and sub types is influenced by climate, geology, rock, soil, aspect, slope and altitude. These types overlap each other to a greater extent.

Broadly, the vegetation types of the State can be divided into tropical, sub-tropical, temperate, alpine vegetation and vegetation of cold desert. The main forests in the State are dominated by oak, deodar and pine and mixed type in some areas. **The Hon'ble Supreme Court of India in CWP No. 202/95 dated 28.03.2008 in 'T.N. Godavarman Thirumulpad versus Union of India & Others'** held that 16 major forest types have been classified by Champion and Seth with further grouping into 6 ecological classes depending upon their ecological functions as follows:

Eco-Class I Consisting of Tropical Wet Evergreen Forests, Tropical Semi Evergreen Forests and Tropical Moist Deciduous Forests.

Eco-Class II Consisting of Littoral and Swamp Forests.

Eco-Class III Consisting of Tropical Thorn Forests and Tropical Dry Evergreen Forests.

Eco-Class IV Consisting of Tropical Thorn Forests and Tropical Dry Evergreen Forests.

Eco-Class V Consisting of Sub-Tropical Broad Leaved Hill Forests, Sub-Tropical Pine Forests and Sub Tropical Dry Evergreen Forests.

Eco Class VI Consisting of Montane Wet Temperate Forests, Himalayan Moist Temperate Forests, Himalayan Dry Temperate Forests, Sub Alpine Forest, Moist Alpine Scrub and Dry Alpine Scrub.

Keeping in view the above classification of forests only **'Eco-Class VI'** falls in the catchment area of the Project.

3.3 Flora

The forest lies between the Elevation of 2000 to 3900 Mt. above main sea level.

The forest of the catchment comprises Deodar, Kail, Fir, Spruce, *Pinus gerardiana, Betula utilis*, Oaks, Alders, Rhododendrons, *Fraxinus xanthoxyloides, Olea ferruginea, Aesculas indica,* Birdcherry, Mapple, *Juglans regia*, *Pyrus* species, Wild Poplar, Salix, etc.

The undergrowth consists of *Indigofera, Desmodium, Rubus* spps. *Sarcococca saligna, Viburnum, Plectranthus, Salvia, Asperagus, Anemone, Anaphalis*, *Berberis* spp, *Prinsepia utilis*, *Prunus cornuta*, *Daphne, Artemesia*, *Caragana astralagus, Lonicera, Geranium*, *Nepta, Cotoneaster, Jurinea macrocephala* and medicinal herbs like Viola, Dhoop, Karu, Patish, Bankakri, Hathpanja, *Ephedra gerardiana,* Mushaqbala etc. are also found.

The extensive alpine pastures *'KANDA'* form a characteristic feature of the tract above tree line, the limit of their altitudinal distribution between 3600-4550 Mt. with upper limit extending even to permanent snow line. The

slopes are usually moderate and bear thick mat of alpine grasses. During summer months after snowmelt, graziers flock to these areas. Many of these are prone to soil erosion and nutrient depletion problems. Also, the continuous grazing has suppressed the growth & regeneration of palatable grass species. Pastures located at lower elevations, which are frequented by a large number of animals are more degraded than those located at higher elevations.

Figure: 3.1: Some Important Tree Species found in the Area

Pinus gerardiana

Fraxinus xanthoxyloides

Juniperus polycarpos

Quercus ilex

Prunus armeniaca

Betula utilis

Cedrus deodara

Juglens regia

Aesculus indica

3.4 Fauna

The main wildlife species found in the area are blue sheep, Musk deer Ghoral, Serrow, Himalayan Thar, Himalayan Black bear, common Leopard & other small mammals etc. Among birds, pheasants like Monal, Koklash & white crest Kaleej are found in the tract. In addition to these, a number of reptiles, amphibians and small birds are found. The wild life survey carried out by the wild life wing in the nearby sanctuaries has shown a rich population of herbivore & carnivores. Most of these species are also found in the catchment area, as the altitudinal zonation and other habitat are similar. However, the density of population is less compared to the sanctuary area. The important wildlife found in the catchment of the project area are:

Table 3.2: The main wildlife species found in the area

Mammals	**Herbivores**	**Carnivores**
	Musk Deer, Himalayan Thar, Goral, Bharal, Serrow etc.	Leopard, Himalayan Black Beer, Himalayan Fox, Jungle Cat etc.
Pheasants and Birds	Himalayan Monal, Kaleej, Chakor, Himalayan Partridge etc.	

In addition to these, a number of reptiles, amphibians and small birds are found in the tract.

The main wildlife species found in Lippa-Asrang Wildlife Sanctuary are; Snow Leopard (*Panthera uncia)*, Musk Deer (*Moschus moschiferus)*, Bharal (*Pseudois nayaur)*, Ibex (*Capra ibex)*, Himalayan Tahr (*Hemitragus jemlahicus*), Leopard Cat (*Felis bengalensis*), Himalayan Weasal (*Mustela sibirica*) etc.

Among birds main species are; Monal (*Lophophorus impyanus*), Snow-Cock (*Tetraogallus tibetanus*), Black Partridge (*Francolinus francolinus*), Chakor (*Alectoris graeca*), Jungle Crow (*Corvus macrorhynchos*), Eagle (*Aquila chryaetos*), Sparrow, Spotted Dove (*Striptopelia chinensis*), Blue Rock Pigeon (*Columba livia*), Himalayan Nut Cracker (*Nucifraga carvocatactes*), Golden Eagle (*Aquila chryaetos*), Himalayan Griffon Vulture (*Gyps himalayensis)*, Grey Tit (*Paras major*) and other smaller birds are also found.

3.5 Scope of the Study

The main objective of the present study is to plan measures for checking soil erosion thus decrease the silt load in the river channels and the reservoir of the proposed Shongtong-Karchham HEP on Satluj river. CAT Plan is an important document, which portrays the ecological health of the catchment area, sustainable use of natural resources, increasing production and protective functions of the existing forests. It proposes/ suggests various soil conservation measures and watershed management interventions required to arrest soil erosion. This is crucial for improving the soil and habitat conditions of drainage area and to rejuvenate the degraded ecosystems in the catchment.

In addition to this the scope of this study is also to address areas of concern that are indirectly responsible for soil erosion. These issues include fuel and fodder requirements of the local people in the project area. All these are reflected in a number of direct and indirect methods for treatment of the catchment to arrest soil erosion. The direct measures include engineering and biological methods while the indirect methods will facilitate gradual reduction of dependency of local people on natural resources for their daily needs.

3.6 General Condition, Density and Rights of the People

The composition and condition of the forests in the catchment of the project is not so good and varies considerably with the altitude and aspect. It is mainly due to high pressure of right holders and xeric/ arid conditions. The condition of the forest in the interior and away from habitations is fairly well stocked. In some of forests, there is hardly any tree growth. The status of regeneration in these forests is very poor because of heavy incidence of biotic pressures. The present condition is the cumulative result of heavy grazing, lopping & TD marking, etc. In the higher reaches, considerable damage is caused to the forest crop in the years of heavy snowfall and a good number of trees get uprooted.

3.6.1 Settlement Right

As per Bushahr Settlement a number of rights and concession have been admitted in the nearby forests to the local inhabitants. Some of these important rights are as under:

3.6.1.1 Grazing

Mostly grazing rights exist for each demarcated and un-demarcated forest in the Project Catchment Area. The field studies conducted indicated that 70% requirements of the fodder are met from the forest area. The settlement provides for free grazing to all animals by right holders in their own chaks without any ceiling on the number of cattle that might be grazed. The graziers availing summer grazing facilities in the alpine pastures are not allowed to graze their animals outside chaks unless allowed as a special concession or through the payment of certain grazing fee. With the result that a large number of cattle graze in these forests it has been causing great damages to vegetation as well as to plantations raised. The right of grazing also comes in the way of taking up more closure for raising plantations of different species as the consent of local people is to be obtained before the plantation work is to be undertaken and require closer notification under the Indian Forest Act, 1927.

3.6.1.2 Collection of Fuel Wood

People have the right to collect dry and fallen wood for their domestic use as per Forest Settlement Report. It is found that people in the catchment area are entirely dependent upon fuel wood for their day to day use. Annual consumption of fuel wood per house hold has been assessed to be 6.5 tones during the field survey.

3.6.1.3 Timber

The local people have the right to get timber at nominal rates (TD Rights) for construction/ repair/ maintenance of their house. After intervention by the Hon'ble High Court of Himachal Pradesh, these rights have been rationalized. TD from the Govt. forests is being given as per new mechanism. This has drastically reduced the intensity of timber removal.

3.6.1.4 Cutting of Grass and Lopping of Trees

People have the right to cut grass and lop trees for fodder purpose. Cutting of grass is being done as of present in the forests without paying any fees to the department of Forests.

3.6.1.5 Minor Forest Produce

The local people have rights to collect medicinal plants, herbs, roots, shrubs and other forest produce for bonafide domestic use and for sale to the traders as enshrined in the Bushahr Satluj Valley Forest Settlement Report, 1921 by H.M. Glover. The system of issuance of export permit has been made easier by delegating power to Pradhan Gram Panchayat concerned.

3.6.2 Rights as per the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

The President of India has given consent to FRA – 2006 on 29th December, 2006 which has been notified and published in the Gazette of India on 2nd February, 2007. This act recognized and vested the forest rights and occupation in forest land, in forest dwelling tribes and other traditional forest dwellers, who have been residing in such forests for generations but, whose rights could not be recorded; to provide for a framework for recording the forest rights so vested and the nature of evidence required for such recognition and vesting in respect of forest land. It includes the responsibilities and authority for sustainable use, conservation of biodiversity and maintenance of ecological balance and thereby strengthening the conservation regime of the forests, while ensuring the livelihood and food security of the forest dwelling tribes and other traditional forest dwellers. The following are some of the main rights vested with the tribesmen and other traditional forest dwellers as per this act:

(i) Right to hold and live in the forest land under the individual or common occupation for habitation or for self cultivation for livelihood by a member or members.

(ii) Community rights such as ***nistar***, by whatever name called, including those used in the erstwhile princely states, zamindari or intermediary regime.

(iii) Rights of ownership, access to collect, use and dispose of minor forest produce.

(iv) Other community rights of uses or entitlements such as fish and other products from water bodies, grazing etc.

(v) Right including community tenure of habitat and habitation for primitive tribal groups and pre-agricultural communities.

(vi) Right of conversion of Pattas or lease of grants issued by any local authority or any state govt. on forest land to title.

(vii) Right to *in-situ* rehabilitation and including alternative land in cases where the schedules tribes and other traditional forest dwellers have been illegally evacuated or displaced from forest land.

(viii) Notwithstanding anything contained in the Forest (Conservation) Act, 1980, the Central Government shall provide for diversion of forest land for the following facilities managed by the government which involves felling trees not exceeding 75 trees per ha. Namely; schools, dispensary or hospital, anganbari, fair price shops, electric and telecommunication line, tanks and other water body, drinking water supply and water pipe lines, water or rain harvesting structure, minor irrigation channels, non conventional sources of energy, traditional skills/ knowledge, roads, community centers etc.

Provided that such a diversion of forest lands shall be allowed only if the extent of forest land is less than 1 ha. in each case and further such development projects should have been recommended by the concerned Gram Panchayat.

The study area designed for the catchment area treatment is experiencing all the classic vagaries of the nature on large scale. The terrain and geology of the area is susceptible to high incidence of landslides, slips/ glaciers and water erosion. In Shongtong-Karchham Project catchment, a major portion of precipitation is in the form of snow or low intensity storm. Bulk of soil erosion takes place due to scouring action of water running off the surface during melting of snow. The runoff water first forms localized channels then forms bigger gullies leading to serious soil erosion problem in the area. In brief, the catchment area suffers from two major problems i.e. natural ecological and climatologically calamities such as heavy snowfall, avalanches, glaciers, landslides etc. and problems created and accelerated by human and live stock pressure. Every snow melt causes glaciers and avalanches which in turn gives rise to landslide erosion by way of slips and slides. Soil erosion is thus the major factor that contributes to heavy silt flow in the river Satluj.

4.1 Soil Erosion

Soil erosion may be defined as the dislodging and translocation of soil. Water is the major agent responsible for this erosion. In many locations, winds, glaciers, etc. also cause soil erosion. The catchment area of a hilly tract as the present one is, landslides/ glaciers and water erosion is a common phenomenon and the same has been studied as a part of the catchments area treatment (CAT) Plan. The problem has aggravated in last few years. The silt level in all the rivers and streams has gone up to alarming levels in Kinnaur District. This is causing great problems in the power generation and lowering the efficiency of turbines in various hydro-electric projects in the state. Following forms of erosion are prevalent in the area:-

4.1.1 Sheet Erosion

The whole region, especially cold desert region suffers from sheet erosion during snow melt. The cultivated land on steep to very steep slopes especially the Kanda lands are prone to sheet erosion in the form of splash & laminar erosion. The pastures also suffer from moderate to severe soil erosion due to raindrop and laminar erosion. In these regions loose, shallow top soil overlie the compact soil. Due to sheet erosion, uppermost layer of soil gets removed. Melting snow accelerates the erosion pressure. This region must be given an effective cover so as to minimize splash & run off on sloping lands.

4.1.2 Rill Erosion

The rill erosion removes the soil in localized small washes in defined channels with dimensions of few centimeters and depth not exceeding 15 - 25 cms. This further leads to gully formation.

4.1.3 Gully Erosion

Accelerated and unattended rill erosion leads to formation of gullies. Gully erosion is responsible for heavy sediment flow in streams and rivers as the eroded soil goes immediately & wholly into the streams owing to turbulence on steep gradients.

4.1.4 Stream and River Bank Erosion

A large no of rivulets & streams in this catchment bring large quantities of sediment into the river with frequent under cutting and resulting in slope failures. This phenomenon occurs all along the Satluj River. The problem is very acute in areas having loose strata. Many streams cascading down the hill sides, with uncontrolled fury during the peak months of snow melt eat away large chunks of land. Flood prone nallas/ streams have been identified.

4.1.5 Road Construction Erosion

Roads are the only means of land transport/ communication and are integral as important development activity in the region. Most of the roads are built along the stream/ river courses providing natural openings to different valleys. Road construction in the mountainous terrain requires a lot of blasting and cuttings in a zig-zag fashion leading to large scale devastation of landscape resulting in heavy silt load into the stream/ river.

Figure 4.1: Havoc due to road construction

4.1.6 Landslide Erosion

The region is quite prone to landslides/ slips that take a heavy toll on valuable lands, property and life besides aggravating the problem of siltation in the river. The overall geological formation in the region is unstable, very loose & fragile. Thin beds of clayey lime stones, shales, irregularly joined sedimentary beds and schists varieties in the region with deformities like steep dips, folds & faults are all pointers to the land slide problem. The area of such slides has been estimated and identified.

Figure 4.2: Unstable Geology

4.1.7 Glacial Erosion

Glacial erosion is quite predominant in the area. A large number of peaks are under perennial snow or remain under snow for most of the winter season. Whenever there is a movement of large mass of ice down the slopes, it brings along with it huge debris causing a lot of soil erosion and at times complete washing away of the vegetation on the way. Glacial action is characterized by furrowing, cutting, ploughing and scouring action on the landmass. The flash flood due to enormous snow melt transports the debris down to the river system after having inflicted a lot of damage to the bed and to the sides of gullies. Against the enormous force of glaciers, the protective measures including the encouragement of vegetation have virtually little effect. However, nallas to be treated and avalanche to be controlled have been identified. The treatment is likely to give some respite and improvement of the conditions.

4.1.8 Wind Erosion

In addition to erosion by water, wind erosion is also common in the area especially in the denuded areas and in arid zone. The problem is enormous below Khadra village and beyond Moorang upwards in the arid zone.

4.1.9 Manmade Factor

Certain problems of the region are attributable to human action and upcoming economic activities. The socio-economic pattern is also fast changing & transforming into modern society. Human aspirations are disturbing the natural balance. Changing life styles, construction activities especially roads and other related activities are devastating the nature.

4.1.10 Collection of Fuel Wood and Fodder

The local population depends on adjoining forest for their day to day requirement of fuel & fodder. They have right to collect dry and fallen wood for their domestic use and to lop tree for fodder. Often heavy lopping of trees is resorted to by the local population which has been denuding the existing forests.

4.2 Soil Erosion Leads to

- Loss in production potential.
- Reduction in (moisture) infiltration rates.
- Reduction in water holding capacity.
- Loss of nutrients.
- Increase in tillage operation costs.
- Reduced transport and storage capacity and
- Reduction in water availability
- Increased silt load in the stream/ river.

4.3 Problems Affecting the Catchment Area

1. Lack of vegetal cover is a contributing factor for accelerated soil erosion in the tract as also for environmental degradation. While ideally, dense tree cover would have been the best insurance against soil loss & environmental degradation, the conditions in the tract are otherwise. Large areas are either blank or bear very thin crop. The top most portions either support alpine pastures or are under snow for most part of the year and tree growth is not possible in these areas. Thus the natural conditions are a limiting factor in addressing the problems of soil erosion and environmental degradation. Nevertheless remedial measures can be taken to minimize their impacts to some extent.

2. Flash floods & cloud bursts cause landslips and bank cutting.

3. Drought (April-June & Oct.-Nov.) and xeric conditions also cause death in seedlings (both naturally & artificially regenerated) on warm aspects and where there is insufficient canopy density.
4. Heavy Snowfall & Avalanches clear strips of tree growth and land on their down ward movement.
5. The excessive live stock population is a great pressure on such lands, which is often beyond the carrying capacity with the result that neither the animals get sufficient fodder nor the lands are fully protected against the onslaught of rains on account of over grazing. This results into deterioration of the environment.
6. The age old Forest settlement, which recognized several rights of the people, has also become irrelevant in the present context. Any attempt to modify the rights and concessions, are met with stiff resistance from the people individually, collectively and even at other levels. The rights & concessions meant for meeting the legitimate needs of the individuals are often misused for obtaining more timber/ fuel fodder, grazing areas for cattle & collection of medicinal herbs.
7. Illegal encroachment on forest land is also common in the tract particularly where the Agricultural fields are adjoining/ near to the forests. The land for agriculture in Kinnaur is only- 2.52 % of the total area. Small farmers finding their holdings not viable to earn livelihood start making encroachments on lands otherwise not suitable for cultivation on long term basis. The farmers in Kinnaur District are entitled to have 20 bighas of land as Nautor & also by virtue of enactment of FRA (Forest Dwelling rights Act, 2006) as per detail given in Chapter-III Paragraph No. 3.5.(b). The revenue authority grants *Nautor* to landless people in the Government land. This activity not only reduces the forest areas but also contributes largely to soil erosion. Majority of the allotties try to encroach upon the forest lands adjoining to their allotted land. People also girdle trees in the adjoining forest which eventually dry up and are felled by the local populace to facilitate further encroachment to extend their cultivated fields and also get the dry tree for their requirement.
8. Land use and farm practices being adopted by the people are, at most of time, incompatible with physical conditions of the site. Steep gradient of the terrain and friable nature of soil, calls for improved farm practices on scientific lines to reduce the danger of soil loss as also to improve the productivity. But the farm practices & land use prevalent in the tract are obsolete.

4.4 Methodology for the Study of Soil Erosion

Main aim of study involves:

- To study erosion characteristics of the terrain.
- To evolve a proper plan to minimize the rate of erosion.

A comprehensive database on terrain conditions, different type of soil of the catchment, natural resources and socio-economic status etc. is essential to evolve a treatment plan. In high hills variability of site parameters such as topography, soils, land use, climate and rainfall matters. 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 topography.

In order to ensure that latest and accurate data is taken for the analysis satellite data has been used. Ground realities have also been taken into account. Geographic Information System (GIS) is a tool to store, analyze and display various spatial data. GIS is a computerized resource data base system and has a capacity to perform numerous function and operations.

4.4.1 Study of the Problem

The different data layers of the catchment area used for the study are as under:

- Land use classification map
- Correct management practices
- Catchment area map
- Soil map
- Slope map

4.4.2 Data Collection and Compilation

Ground maps, contour information were collected, digitized maps of slope, soil, land use, aspect drainage and aspect were procured as per requirement.

4.4.3 Estimation of Soil Loss

A computer programme was used to assess the soil loss. The grid size to be used was also decided to match the degree of accuracy required, the data availability and the software and time limitation.

Soil loss can be estimated using Silt Yield Index (SYI) method. The application of SYI method for prioritization of sub water sheds in catchment areas involves the evaluation of:

- Geomorphic factors comprising slope and drainage characteristics; landforms and physiographic.
- Surface covers factors governing the flow hydraulics.
- Climatic factors comprising total precipitation its frequency and intensity and
- Management factors

The area of each of the mapping units is arrived at and Silt Yield Index of individual sub-water sheds and computed using following equation: -

a) Silt Yield Index

$$SYI = \frac{\Sigma (Ai \times Wi) \times 100}{Aw}$$

Where
- i = 1 to n
- Ai = Area of ith (EIMU)
- Wi = Weightage value of ith unit
- n = Number of mapping units
- Aw = Total area of sub-water and

The SYI values for classification of various categories of erosion intensity rates are given in Table 4.1

Table 4.1: SYI values for classification of various categories of erosion intensity rates

Sl. No.	Category	SYI Values
1.	Very high	>1300
2.	High	1200-1299
3.	Medium	1100-1199
4.	Low	1000-1099
5.	Very Low	<1000

4.5 Watershed Management

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 programmes are to:

- Increase infiltration into soil;
- Control excessive runoff;
- Manage and utilize runoff for useful purpose

The watershed management measures have been classified under the following categories:

(a) Biological measures

(b) Bio-Engineering Measures

4.5.1 Biological Measures

The various measures covered in this category are: -

- Nursery Development.
- Normal afforestation.
- Enrichment planting.
- Conservation and Development of Chilgoza Pine (*Pinus gerardiana*)

4.5.2 Bio-Engineering Measures

- Stabilization of landslides/ slips
- Nallah stabilization
- Avalanche control
- River bank stabilization
- Water harvesting structures and Van Sarovars

4.6 Pressure on Forest Resources

The current problems being faced in forest conservation arises directly from the natural resource dependence of the people inhabiting in forested region in the Catchment. These dependencies are becoming immense

because of eco-system is going down from the use and over use of natural resources. Man is responsible for degrading the forest eco-system. As his number increased and culture and technology advanced, he modifies the natural eco-system into an artificial. As a result, many species of flora and fauna have become endangered. It is said that if the present course of environmental degradation is continued, then it will destroy the capability of our natural environment to support a civilized human society. The depletion of our Wild Life and also the hardships being faced by people dependence on natural resources is due to:-

(i) Progressive denudation of vegetation means that the land is less capable of sustaining human life.

(ii) Reduction of Biological diversity in forest Ecosystem.

(iii) Increasing biotic pressure.

(iv) Increasing demand of forest resources as per Forest Settlement Report, 1921 and Forest Rights Act, 2006.

(v) Illicit felling and poaching.

(vi) Encroachment on forest land.

(vii) Forest fires.

(viii) Cultural transition.

(ix) Collection of minor forest produces.

(x) Grant of Nautor land etc.

4.7 Strategy and Approach

The Two issues which need to be addressed by this CAT Plan are:

i. Silt load in river Satluj.

ii. Environmental degradation in the catchment & project area.

The two issues apparently, look different but in essence, they are intricately linked and have their genesis in common problems. Some of these problems owe their existence to the natural/ physical factors in the tract like topography, geology, climate, soil etc., while the other problems are either man made or aggravated by human actions. Very little can be done to change the natural factors except to limit their adverse impacts. But problems due to human actions can be reduced to large extent by taking suitable preventive as well as remedial measures.

It is clear from the analysis of the problems that traditional approach of afforestation or soil & water conservation undertaken in isolation, will not be enough as they concentrate on the symptoms of ecological degradation rather than on socio economic causes.

The immediate task is to check soil erosion in the area to ensure regular and sediment free water yields in the river system, which has direct bearing on successful running of hydro electric project. To achieve this, massive afforestation and soil conservation measures along with bio-engineering interventions, are to be done in the catchment area, which will help in soil & water conservation along with meeting the demands of fuel, fodder, timber etc of local people.

Intensive soil & water conservation measures along with bio-engineering interventions are proposed to be taken in the catchment area, ensuring sediment free yield of water in the river Satluj.

4.7.1 Prioritization

As described earlier there are 24 micro-watersheds/ sub-catchments in Satluj Catchment falling beyond Wangtu. 23 out of these fall in Kinnaur and one in Lahaul & Spiti District. 12 of these fall in the plan area. Priority of treatment for these sub-catchments has been adopted from Comprehensive CAT Plan of Satluj River Basin. This prioritization is based on the **'Resources-based approach'**. Under this approach different weightages are assigned to various resource parameters. These parameters (with weightage) have been; Forest Cover Density (10), Forest Area % (10), Wasteland % (10), Landslide Density (10), Drainage Density –Km/ Km^2 (5), Slope % (5), Population density (5) and Live stock density (5). The priority of treatment for various micro-watersheds/ sub-catchments is described as per Table 4.2:

Table 4.2: Priority treatment for various sub-catchments

Sl. No.	Number of Sub-Catchments	Priorities
1	11	First
2	13	Third
3	14	Fifth
4	15	Fifth
5	16	Fifth
6	17	Second
7	18	Third

Sl. No.	Number of Sub-Catchments	Priorities
8	20	First
9	21	Fourth
10	22	First
11	23	Fourth
12	24	Third

4.8 Grazing

Live stock practices in the tract are rather primitive. Incidence of grazing in the high lying alpine pastures as well as in the low lying pasture village pasture lands is very high and fodder resources are fast decreasing. Almost all the forests are burdened with the rights of local people to graze their cattle, without any ceiling to the number of cattle which may be allowed to be grazed under the provision of Forest Settlement Report, 1921. This open access to forests for grazing leads to great damage to vegetation, soil as well as to plantations etc. As a result that neither the animal gets sufficient fodder nor the land protected from the subsequent onslaught of the range on account of over grazing.

4.9 Management of Wildlife in and outside the Protected Area

The scientific Wild Life management is based on the biological characteristic of a species. Other considerations such as economic, political, social, humanitarian and sentimental are equally important. Our love for wild life has got religious sanctity behind it. Our sacred scriptures speak so eloquently about the protection & preservation of animal bird kingdom.

God is said to have created every being with definite purpose and function to maintain ecological balance Variety of wild life is found in the forest of the tract as a result of great variation in altitude, topography, climate and vegetation.

Since the exact number of various animals found in the tract is not known the fundamental need is to carry out a detailed survey and population census of species in the area. The causes for the depletion of fauna can be described as under:-

- Poaching, hunting, trapping and killing of Wild animals by local inhabitants.

- Biotic interference by man and his cattle especially near habitations coupled with clearing of forest land for agricultural purposes.
- Depletion in the food of herbivorous animals because of lopping of fodder trees by the graziers and local people.
- Natural calamities like drought, storms, heavy snow fall and repeated forest fires etc.
- Continuous predation has also caused the depletion of animals.

  This affects both herbivorous and carnivores in the Catchments area.

4.10 Man-Wildlife Conflict

Man-Wildlife conflict is a result of gradual degradation of natural resources and the most sufferers are poor, marginalized communities living in an around the Forests of the Catchment area. The problems of animal damage, whether it is crop depredation, live stock depredation and human causalities is not as alarming as it is prevalent in other parts of the States or elsewhere in the country. The problem of livestock predation and killing by Leopard and Black Bear is gradually escalating and to some extent appropriate compensation is needed and also environmental awareness programmes for migratory graziers thus need to be developed. Concerted efforts in education, awareness, research, monitoring, policy, law and governance, habitat restoration and development of essentially needed infrastructure to tackle complex issues pertaining to the man animal conflict are required to be implemented on a priority basis.

4.11 Inadequate Scientific Information

Inventory of the flora and fauna of the catchment is yet to be prepared. The status of important habitat types and that of the threatened flora and fauna is not known. No information is available in this regard about the carrying capacity of the forests and alpine meadows in and around the Catchment area. Therefore, in the absence of reliable primary data on various aspects only general type of strategy and approach can be made as management and improvement of the catchment area by carrying out detailed survey of the catchment area. Thus a well designed catchment area treatment plan (CAT) plan is essential to ameliorate the abovementioned adverse process of depletion of biological diversity. An endeavor has been made in the present Plan to address the problem to some extent.

4.12 Harmful Practices by the Local People

The trees near habitations are lopped ruthlessly for the fuel wood and fodder. The grant of Govt. land to landless people is also putting the forests in danger. The forest is experiencing tremendous pressure of human and livestock. The cattle roam freely in the forest area tramping and grazing the forest. This results in increased rate of soil erosion and degradation of forests. These factors have caused following problems to the forests:

i) Excessive soil loss and increase in runoffs.

ii) Man and Wild Life conflict

iii) Fuel wood and fodder are becoming scarce.

iv) Unscientific collection of NTPF which is harmful to the Biodiversity of Catchments area.

v) Excess grazing.

4.13 Eco-Tourism Potential

The area being very interior and picturesque, there are very few income generation opportunities for the local people. The Kinnaur district as a whole is also a good potential of Eco-tourism and is still not explored for this purpose except Sangla Valley and Kalpa. There is overall deficiency of proper infrastructure for the growth of tourism in the area and basic facilities like FRH, Inspection Hut, hospitals, boarding & lodging, paths, well developed camping sites & public utility services etc. which further affects eco-tourism in the area. The local people are not aware of the vast potential of eco-tourism. They need basic training about eco-tourism vis-a-vis biodiversity conservation. It is one of the most important alternative income generation activities besides NTPF's etc.

4.14 Buildings, Paths and Communication Network

The existing buildings, I/Paths and B/Paths are in dilapidated conditions. Their abutments and wooden beams/planks are in worn-out conditions and needs replacement. In addition to these, there is need to construct and maintain new bridges and maintenance of existing I/Paths, B/Paths for effective patrolling/ touring in the catchment area. Not only it will provide facilities to the field functionaries but it will also helpful to local people. Also for better management of the Division, Ranges and Beats the conditions of existing I/Paths and B/Paths are to be improved on the priority basis. For

successful implementation of CAT Plan and better management of the catchment area, basic infrastructure in the catchment area needs to be improved.

4.15 Lack of Trained Staff in Wildlife Management

There is a lack of professional knowledge/ skills of management especially habitat improvement of Wild Animals, procedure for monitoring and evaluation in different events, vegetational changes and its relationship to changes in prey base species, collection of evidences and biological material, symptoms of important diseases, preventive measures and treatment assessment, techniques and methodologies and bio-diversity impacts etc. The staff is, therefore, left with no option but to undertake a protection job and implementation of various works in traditional ways. The training in wild life management to the front line staff outside the Protected Area Network is essential.

4.16 Lack of Concern about Conservation by the Local People

As the local population in majority is backward it is apparent that the people have little or no knowledge about the environmental conservation. The local people of the area do not seem to show any concern for the conservation of bio-diversity available in the area. There is no local concern voluntary organization willing to make conservation as a primary issue. Off late the government has realized that the effective implementation of various biodiversity conservation and environmental related programmes cannot be achieved their objectives without awareness and concerns of the tribal people. So, there is a need to initiate a dialogue with local people on the conservation of natural resources by formation of VFDS etc. at the village/ Panchayat level for conservation of bio- diversity.

4.17 Limited Employment and Income Generation Activities

The area was bereft of any road link till very recently, has been dependant only upon the subsistence economy. Most of the agriculture has been for internal consumption and no cash crops are grown in the Catchment area. The only cash crop has been the M.F.P. collection from the forests and sale to traders for supplementing their income under the provisions of the Settlement Report. Formation of society in each Panchayat of the catchment area for collection and sale of the NTFPs will certainly add in supplementing the income of the local people in an organized manner.

4.18 Lack of Appropriate Infrastructure Support:

The area is facing a lack of basic minimum infrastructure support in the field of housing, I/Hut, FRH, Office equipment i.e. Computer, GPS/PDA, Compass, Camping equipment, field equipment and vehicle etc. In the absence of this infrastructural support, the information flow is very slow and erratic in management.

4.19 Monitoring and Evaluation

Monitoring is an important and integral component for effective conservation and management as it provides a ways to track the status of various components of biological diversity and forest eco system over a period of time. The regular feed back through monitoring and evaluation allows better understanding, midway corrections and adoption of appropriate strategies. The desired success could not be achieved in this direction in the absence of adequate man power, scientific and professional knowledge, financial constraint, support from local institutions and participation of local communities. Regular review and evaluation meeting should be arranged to assess the results achieved and future strategies. All the agencies involved in the implementation of the CAT Plan should work in a coordinated effort regularly to evaluate the achievement of desired results.

5.1 Introduction

The state of Himachal Pradesh is embodiment of heaven on earth, replete as it is with lush green forests, high snow covered peaks, beautiful valleys, gushing streams and unpolluted rivers and waters, which is probably why it is the abode of god and goddess. The mountain terrain of Himalayas Ranges from 300 Mt. to 7000 Mt. and supports a variety of forests such as Sal, Pines, Deodar, Kail, Fir, Spruce, Rhododendrons, Oaks, Birch, etc. These forests are home to variety of wild flora and fauna, occupying different habitats and ecological niches. Himachal has 12.6% of its geographical area of 55,673 Sq. km. under the protected area network, an extremely high figure when compared to the national average of hardly 4.5%. With rationalization of Protected Area Network, its net area is likely to increase to 15% of total area. With protection measures there has been an increase in the number of wild flora and fauna not only within the protected areas but more so outside the protected area network.

Himachal Pradesh is rich in various faunal elements with reports of more than 107 species of mammals, 447 species of birds, 17 species of amphibian and 104 species of fish, There are carnivore species like leopard (*Panthara pardus*), leopard cat (*Prionailurus benghalensis*), jungle cat (*Felis chaus*), Asiatic black bear (*Ursus thibetanus)* and brown bear (Ursus arctos) in the State. The State of Himachal Pradesh is also a home to seven pheasant species out of the 17 found in the country (48 pheasant species found across the world). These seven species are Western tragopan (*Tragopan malenocephalus*) Himalayan monal (*Lophophorus impeyanus*), Koklas (*Pucrasia macrolopha*), White Crested Kaleej (*Lophura leucomelanos*), Cheer (*Catreus wallichii*) and Red Jungle Fowl (Gallus gallus). The Western tragopan is state bird of Himachal Pradesh and during 1993-94 Sarahan pheasantry witnessed first ever breeding of Western Tragopan in captivity, the World over.

Biodiversity conservation is on the national agenda which came into force on December 29, 1993 for nation/ states which are signatory to the Convention on Conservation of Biodiversity. It is well known that the conservation of Biodiversity involves conservation of ecosystem, species and population including conservation of genes. Biodiversity conservation

is essential not only for ecological and environmental rejuvenation but also for a sustainable development of forests. These forests regulate the water balance of the land around and influence the climate to a considerable extent. Apart from their ecological functions, they also serve as valuable gene pools.

The current problems being faced in wild life conservation arises directly from the natural resource dependence of the people residing in forested regions, impoverished population and development of HEPs in Satluj Basin. These dependencies are becoming critical due to fast degradation of Eco-System of Satluj valley on account of over use of natural resources. Therefore, the need for conservation, preservation and management of biological diversity has been strongly felt. In addition to this there have been regular conflicts between humans and wild life in the region. These conflicts may further increase as a result of project activities unless proper management practices are adopted. The likely project activities include road construction, blasting, excavation for tunnels, quarrying, dumping of excavated materials and human population pressure on land and biological resources. Looking into all these aspects a wildlife management plan has been prepared for the conservation and protection of biodiversity of the plan area.

5.2 Improvement and Development of Wildlife

For the improvement and development of wild life in the region various activities have been suggested in the plan. This will be achieved by way of plantation of trees of fodder and fruit species, fire protection measures, prevention of soil erosion and removal of exotic invasive plant species. Some patches of land may be developed exclusively as “green islands” in the project catchment area. These areas should be out of bound for any human intervention both for local people and domestic animals under the provision of Indian Forest Act, 1927. Such areas need to be developed as habitats or corridors for the wild life of the region. In view of the guidelines formulated and issued by the PCCF, Himachal Pradesh for the Wildlife Component in the CAT Plan, the following tasks are suggested.

- Planning
  - Planning perspective, approach and objectives
- Implementation
  - Implementation of developmental and income generation programme.
  - Management/ improvement and development of Wildlife inside & outside the Protected Area
  - Improvement of Lippa-Asrang Wildlife Sanctuary
  - Vaccination of domestic cattle
  - Carrying out of Wildlife Census outside PA & within PA
  - Anti-poaching measures.
- Extension Activities for Wildlife Awareness
  - Sign and Slogan Boards
  - Reward/ Incentives to Informers
- Other Interventions
- Support to *Ex-situ* Pheasant Conservation & Breeding Program at Sarahan
- Help to Resolve to Man–Animal Conflict
  - Compensation for damage by wild life as per prevalent rules in the state.
  - Purchase of equipments and medicine for management of wildlife
- Wildlife Habitat Management
  - Protection of unique wildlife habitat
  - Training
  - Research & Monitoring

5.3 Plantation of Indigenous Fodder and Fruit Plant Species

Planting of species to be carried out to cater to the needs of the fodder and fuel wood. Additionally it will include:

i) Provide much needed vegetation cover on the degraded and base land slopes.

ii) Increase the fodder and forage availability in the area

iii) Provide food in the wild to fauna.

iv) Provide nesting and roosting place in hill bamboo plantations.

5.4 Bio-engineering Measures

The detailed measures of soil conservation are given in the CAT Plan and the sufficient outlay has been proposed in the component of biological measures of CAT Plan.

5.5 Mitigation of Human Wildlife conflict

Eco-Development Activities by way of:

1. **Village Support Activities**
   - **a.** Repair of water bodies.
   - **b.** Construction of cattle pond.
   - **c.** Compensation against wild life damages.
   - **d.** Publicity and awareness generation
2. **Income Generation Activities**
   - **a.** Animal Husbandry support and dairy development.
   - **b.** Agriculture and Horticulture support.

5.6 Management of Biodiversity

During the construction period, a large numbers of imported labour is anticipated to come in the area. This will exert additional pressure on the natural resources in the catchment. Also, the noise and pollution levels will increase as a result of construction activities. To avoid and minimize the negative impacts during the construction period, project authorities are advised to prepare strict guidelines on the following lines.

(i) Strict monitoring of labour and associated workers for any activity related to endangering the life or habitat of wild animals and birds.

(ii) Strict restrictions will be imposed on the workers at project sites to ensure that they do not harvest any produce from the natural forests and cause any danger or harm to the animals and birds in the wild.

(iii) For fuel and heating purposes project labour will be provided free/ subsidized kerosene/ LPG from the depots being set up for this purpose to avoid forest degradation and the loss of animal habitats.

(iv) The interference of human population will be kept to a minimum and it would be ensured that the contractors do not set up labour colonies in the vicinity of forests and wilderness areas.

(v) A mix of incentives for the protection of wildlife and their habitats and strict regulatory framework will be put in place to implement the conservation effort.

(vi) The project authorities will be bound by the rules and regulations of the Wildlife Protection Acts or any such regulation of the State, which may exist or will be promulgated from time to time for the preservation of habitats and protection of wild animals/ biodiversity.

(vii) Minimum levels of noise during construction activities will be maintained and no activity will be carried out at night at a project site in the close vicinity of animals/ bird habitats.

(viii) It will be ensured that the noise levels in no case go above 80-100 dB in the project area. One of the measures that are proposed to be adopted is that the blasting is to be restricted during nights, early mornings and late afternoons, which are the feeding times of most of the fauna. Blasting will be resorted to only if extremely necessary. For this strict blasting regime, i.e. controlled blasting under constant and strict surveillance is to be followed. Some of the suggested methodologies for reduction and mitigation of noise so as to cause as little disturbance to the animals as possible are given below:

(a) Only well maintained/ new equipment that produces lesser noise would be installed at the work sites.

(b) The best way to control the noise is at source. Certain equipment that needs to be placed permanently at one place like generators, etc. would be housed in some enclosed structures to cut off the noise.

(c) The heavy equipment like rotating of impacting machines will be based on anti-vibration mountings.

(d) Wherever combustion engines are required they will be fitted with silencers.

(e) The traffic (trucks, etc.) used by the project works will be managed to produce a smooth flow instead of a noise producing stop and start flow. Necessary training/orientation will be provided to the traffic operators/ drivers. Sounding of loud horns, etc. in the forested areas will be banned.

(f) While clearing the land of vegetation for any project work, the project authorities will ensure that the work area has sufficient tree cover around it. It will act as an effective noise absorber. It will be desirable not to cut down or lop big trees around the periphery of the work site. The tree layer will act as noise and air pollution buffer. The tree cover is known to cut off noise by about 3-12 dB at a site depending on the density of vegetation.

These measures will be planned in advance and well before starting operation at any site. The project authorities will monitor the noise at critical sites from time to time.

6.1 Introduction

The state of Himachal Pradesh has traditionally been sensitive to the need of involving local people in the conservation and management of the forest resources. This is evident from the Forest Settlements carried out as early as the 19th Century when people were provided rights in the forests in lieu of their responsibilities and duties towards the forests. The Co- operative Societies of Kangra District are another testimony to this. The participatory approaches received a new impetus in the state with the launch of Social Forestry Umbrella project in mid 1980s as also with the adoption of the National Forest Policy 1988 which brought the people to centre stage. It was further strengthened by the constitutional delegation of power to the PRIs through the 73rd amendment. This brought about a paradigm shift in the objectives and management practices for forestry in the state through Participatory Forest Management (PFM).

Responding to these new developments, the Government of Himachal Pradesh has approved the new Forest Sector Policy on 02-05-2006. The Forest Sector Policy evolved through a dynamic and consultative process. An extensive evidence gathering process had been followed by primary and secondary sources through a range of stakeholder consultations with forest department, other line departments i.e. horticulture, agriculture, animal husbandry, rural development, research institutions, local communities, representatives of Panchayati Raj Institutions, NGOs, CBOs and people's representatives as well.

The new H.P. Forest Sector Policy, 2005 is remarkably different from the earlier State Forest Policy of 1980 as it is a response to the emerging needs and aspirations of the people of the state. The new policy has a unique mountain area focus where livelihood of communities and decentralization through Panchayati Raj Institutions in management of forests resources form the policy bedrock.

6.2 Date of Issue of Government Orders on JFM and Its Modification

i.	Government of India	1990
ii.	Himachal Pradesh introduced JFM	1992
iii.	Date of issuance of 1st JFM orders/ rules	12.05.1993
iv.	Date of amendment/ new orders/ rules	23.08.2001

6.3 JFM at a Glance in Himachal Pradesh

i. No. of JFM Committees 1749 covering an area of about 4246 Sq. Km

ii. Gender representation in JFM Committees

   a. Women 51.3%

   b. Men 48.7%

iii. Benefit sharing in JFM areas

iv. Approximate value of grass, fodder, fuel wood- 08.00 Crores

v. Employment Generation- 12.73 Crores

vi. Assets created (cumulative)- 62.37 Crores

6.4 JFM and Shongtong- Karchham HEP CAT Plan

i. The emphasis in the CAT PLAN is on enabling local people to prevent, arrest and reverse degradation of life support systems, particularly land and water, so as to produce biomass in a sustainable manner.

ii. Importance of micro planning on watershed basis with community participation will be operationalized during implementation of CAT Plan. Suitable institutional arrangements like Village Forest Development Societies (VFDS) representing various sections of village community need to be formed.

iii. Further, to ensure sustainability of interventions, cost sharing by stakeholders needs to be encouraged, to the extent possible. This establishes the roles and responsibilities of various stakeholders in the management of resources.

iv. Self Help Groups (SHGs) need to be formed from the identified IRDP/ BPL families so as to help the needy people with direct dependence on natural resources. Unless the biomass needs of the rural poor for fuel and fodder and small timber are satisfied, the forests and pastures improved/ developed under the plan would remain vulnerable and unsustainable. SHGs would provide an effective tool to involve the economical weaker sections of rural communities in the CAT Plan execution. This eventually would contribute towards sustainability of the interventions.

7. 1 Project Objectives

The objectives of the project are summarized as under

- To achieve Sustainable forest management, bio-diversity conservation and ecological rehabilitation in the project area leading to all round eco- development activities on sustainable basis.
- To initiate measure to rehabilitate the degraded habitat through afforestation of native species and assisting of natural regeneration.
- To improve alpine pasture land for augmenting grass and fodder availability and to solve the problem of graziers.
- To carry out soil conservation measure along with bio engineering interventions in the Catchments to ensure longevity of Shongtong-Karchham Hydel Project.
- To increase the potential/ production of the bio-mass in the area and to ensure longevity of Shongtong-Karchham Hydel Project.
- To provide employment to the local people by engaging them in project activities such as afforestation, fire protection, anti poaching, rural infrastructure and soil conservation works.
- To build the capacity of the Field front line staff in better Wildlife Management by their need based training.
- To strengthen and follow up activities of the forestry development, forest publicity and extension and motivation programme to the front line staff and communities.
- Initiation of research activities in better use and protection Natural resources on scientific basis.
- To strengthen the productive & protective functions of existing forests.
- To promote community participation by motivation/ awareness & training in adopting environmentally sustainable practices and to upgrade their skills in natural resource management.
- Thrust on sustainable development in the catchment area with adequate safeguards for protection and conservation of the local environment by active involvement of local communities through JFMCs.

- Emphasis on meeting with the economic needs of the local communities, greening of the region and strengthening the local wildlife management.
- Intergradation of all activities with a view to finally avoid soil erosion and decrease the silt load in Satluj River.
- Various mechanical and biological measures to treat the catchment area of the Project.

7.2. Plan Period (Project Period)

The CAT plan has been formulated for a period of eleven years including zero year with effect from 2013-14 to 2023-24. For the first two years of the plan not much of works have been prescribed and only establishment of nurseries will be done besides minor works and purchase of some equipments. However, from the second year onwards works will be done in full swing and will gradually taper off from the 7th year onwards to completion during the Plan period.

7.3. Cost of the Plan

The total CAT Plan outlay is Rs. 60.40 Crore and for implementation of this CAT plan is Rs. 39.00 Crore including contingencies, Monitoring & Evaluation, Payment for Environmental Services (PES), payment for Eco-Services to the Local Communities, other inflationary trends etc. The balance amount of Rs. 21.40 Crore will be expended for the Comprehensive CAT Plan being formulated for Satluj Basin and in other unforeseen eventualities within the Catchment area. The total cost of the CAT Plan has been deposited by the User Agency as per the H.P. Govt. directions/ guidelines in this regard.

With any increase in Project cost, outlay of CAT Plan may be revised accordingly, after review in accordance with latest guidelines issued by the H.P State Forest Department.

7.4. Plan Components

The CAT Plan has been designed in keeping with new guidelines issued by Himachal Pradesh Forest Department – 2012. Social, economic and environmental conditions of the Project Catchment area has been kept in focus while planning for the CAT Plan. The treatment measures emphasize on conservation of catchments through afforestation in blank/ degraded areas, bio engineering works in soil eroded areas, river banks

and Nallas. It also envisages an active participation of local community and providing them livelihood opportunities and boosts their economy. Apart from this, better wildlife management with habitat improvement, anti poaching measures, fire control measures coupled with bio engineering works will be undertaken in the catchments area. The important requirements of the CAT Plan for Shongtong-Karchham HEP as per latest guidelines are:

i. A good map of the CAT area on 1:15000 scale showing the contour lines at 3600, 3000, 2700, 2400, 2100, 1800 & 900 Mt., clearly depicting administrative and forest boundaries of Beats, Block, Range (s); drainage of the catchment and existing infrastructure etc. The Catchment Area being very large (approx. 3000 Sq. Km.) a single map on 1:15000 scale was not possible. Moreover, most of the SOI sheets are restricted and some of them were not available at all. **Activity Map** with available SOI sheets has been prepared in 1:95000 scale showing most of the CAT Plan Activities/ Treatment areas, land features, contours and appended to the Plan. **The Map duly folded is attached to this document at the end.**

ii. The prescriptions of the CAT Plan have been made based on the analyses of the current situation of the catchment after extensive field reconnaissance and consultation with local forest officials/ officers.

iii. The size of the CAT Plan is based on the actual extent of the work to be done in the catchment. Since the terrain and climatic condition have been the limiting factors entire 2.5% of the total project cost as provided for the CAT Plan w.r.t. guidelines may not utilized on activities.

iv. This CAT Plan has been designed keeping in view the ecological as well as social conditions prevailing in catchment area. The treatment measures emphasize on conservation of catchments through, enrichment plantation areas and bio engineering works in soil eroded areas and Nallas. It also envisages an active participation of local community in the catchments area.

The important activities identified and to be undertaken during the project period have been described in the following manner:

7.4.1 Biological Measures- Improvement of Tree Covers

i) Nursery development by Strengthening/ maintenance/ improvement of existing nurseries.

ii) Normal afforestation.

iii) Enrichment plantation.

iv) Conservation and Development of Chilgoza Pine (*Pinus gerardiana*)

7.4.2 Soil Conservation Works - Engineering & Bio-Engineering Measures:

- Stabilization of landslides/ slips by the way of bio-engineering and civil works.
- Drainage line treatment by the way of Bio-engineering and civil works.
- River Bank Stabilization
- Snow/ Avalanche/ Glacier control.
- Water Harvesting Structures and Van Sarovar.

7.4.3 Payment of Environmental Services (PES).

7.4.4 Research, Training, studies and Capacity Building.

7.4.5 Infrastructure Development

- Logistic support to forest staff
- Maintenance of existing buildings and forest paths
- Operational support to staff
- Silt monitoring in collaboration with SJVNL and stations established by them.

7.4.6 Forest Protection

- Forest Fire Protection
- Repair to boundary pillars and reward and incentives to informers
- Promotion of non – conventional energy devices, e.g. LPG, solar lights, induction heaters/ cookers etc.

7.4.7 Management of Wildlife in & outside the Protected Area

- Planning
- Planning perspective, approach and objectives:
- Implementation
- Implementation of Developmental and Income Generation Programme.
- Management/ Improvement and Development of wildlife Inside & Outside the Protected Area.
- Improvement in Lippa - Asrang WLS.
- Carrying out of Wildlife Census Outside PA & in PA.
- Anti-poaching measures.
- Support to *Ex-situ* Pheasant Conservation & Breeding Program at Sarahan
- Purchase of equipments and medicines for management of wildlife
- Wildlife Habitat Management & Protection of unique wildlife habitat
- Extension Activities for wildlife awareness
    - Signage/ slogan boards.
    - Reward/ Incentives to informers.
    - Other Interventions.
    - Help to resolve to **'MAN – ANIMAL'** conflict
    - Compensation and herd insurance scheme
    - Vaccination of domestic cattle
- Training, Research & Monitoring

7.4.8 Monitoring and Evaluation

7.4.9 Site Specific/ Micro Planning

7.4.10 Contingencies – for unforeseen expenditure

A description of activities in each component is as under:

7.5. Biological Measures - Improvement of Tree Covers

7.5.1 Nursery Development

To raise successful plantation it is essential to have a good & adequate planting stock in forest nurseries. The main thrust will be given on improved quality of nursery stock in the proposed Cat Plan nurseries so that sturdy nursery plants are available which can withstand the adverse site conditions. It is proposed to maintain and strengthen the existing forest nurseries. The nurseries shall be established in the zero year i.e. first year of the project period and will be further extended, developed and maintained till the completion of this Plan period. As far as possible the nursery need to be located within/ near to planting areas. The total amount of **Rs. 43 Lakh** has been kept for this purpose. This is expected to provide adequate and healthy planting stock. The detail of Nurseries is appended in Table 7.1.

Table 7.1: Nursery Development (Amount in Rs. Lakh)

Sl. No.	Sub-Ctmt.	Latitude/ Longitude	Name of Range	Name of Beat	Name of Nursery	Amt.
1	11	31^0 31' 39" 78^0 15' 30"	Kalpa	Reckong-Peo	Maintenance/ Improvement of Reckong-Peo Nursery	5.50
2	11	31^0 32' 19" 78^0 15' 13"	Kalpa	Kalpa	Maintenance/ improvement of Kalpa Nursery	6.00
3	13	31^0 35' 25" 78^0 15' 58"	Kalpa	Pangi	Maintenance/ improvement of Pangi Nursery	4.50
4	16	31^0 38' 54" 78^0 24' 34"	Moorang	Jangi	Maintenance/ improvement of Lippa Nursery	5.00
5	17	31^0 40' 31" 78^0 26' 55"	Pooh	Kanam	Maintenance/ improvement of Kanam/ Surpu Nursery	4.00
6	18	31^0 44' 32" 78^0 37' 55"	Pooh	Dubling	Maintenance /improvement of Dubling Nursery	2.50
7	24	31^0 35' 16" 78^0 18' 25"	Kalpa	Purbani	Maintenance/ improvement of Purbani Nursery	3.50
8	24	31^0 30' 59" 78^0 16' 03"	Kalpa	Shong-tong	Maintenance/ improvement of Shongtong Nursery	6.00
9	23	31^0 34' 42" 78^0 22' 46"	Moorang	Ribba	Maintenance/ improvement of Ribba/ Skibba Nursery	4.00
10	22	31^0 36' 19" 78^0 26' 25"	Moorang	Moorang	Maintenance/ improvement of Moorang Nursery	2.00
					Total	**43.00**

Figure 7.1: Some of the Forest Nurseries

Shongtong Nursery

Purbani Nursery

Pangi Nursery

7.5.2 Afforestation

Due to harsh & hostile conditions/ factors, the natural regeneration is scanty and almost absent in most of the CAT Areas. The best insurance against soil loss as well as for ecological rehabilitation is a well stocked forest. It is, therefore, proposed to increase the vegetation cover in the tract. For this purpose, the suitable areas, devoid of tree growth or the degraded forest lands with scanty vegetation but **having irrigation resources** shall be brought under afforestation.

The locality factors prevalent in the project area are very adverse to the establishment of plantations. The areas identified for the plantations are quite refractory. Their main characteristics are:

- Soil condition is poor.
- Rainfall is inadequate & erratic.
- Winter is harsh with high wind velocities.
- Presence of excessive/ heavy biotic interference.

Thus special and concerted efforts are needed to ensure success of afforestation work. Owing to the above enumerated factors the plantations need watering and added maintenance. The existing financial norms prevalent in the Forest department have been applied and detailed cost analysis for each plantation scheme has been done. This is in accordance with the site conditions and CAT plan objectives and also as per Sanctioned schedule of Labour and work rates for Rampur Forest Circle. These cost norms need to be applied for the Cat Plan activities. The afforestation activities will be carried out under the different schemes and as per latest guidelines.

7.5.2.1 Normal Afforestation

The aim of this CAT Plan is to conserve in-situ flora and fauna within the entire eco-system. Under this scheme blank areas and degraded forest areas are proposed to be planted. The choice of species will be mainly governed by the site suitability and invariably will be the natural species of the area. Accordingly proposed species to be planted have been listed against each area. Under this scheme 1100 number of tubed plants per ha. will be planted. A total of **40 ha.** area (34 Irrigated & 6 Un-irrigated)

has been identified as available for tackling under this scheme. Owing to heavy incidence of stray cattle, propensity fire and other biotic interference to which these areas are susceptible, proper care has to be provided to protect such plantation areas. Provision of watering for at least, five years has been provided in cost module to ensure the establishment of plantations. The expenditure for Normal plantation shall be **Rs. 34.85 Lakh** and is given in **Table-7.2.1/2** and the detail of areas identified Sub-Catchment-wise, Range-wise & Beat-wise is given in **Table-7.3** below:

Table 7.2.1: Expenditure of Afforestation for Normal Plantation (Irrigated)

Sl. No.	Particulars	Physical (Ha.)	Rate (Rs.)	Amount (In Lakh)
A	**New Plantation**			
1.	New	34	33,500	11.39
B	**Maintenance**			
1.	First Year Maintenance	34	25,500	8.67
2.	Second Year Maintenance	34	16,620	5.65
3.	Third Year Maintenance	34	8,880	3.02
4.	Fourth Year Maintenance	34	5,000	1.70
5.	Fifth Year Maintenance	34	5,000	1.70
	TOTAL			**20.74**
	G. Total	**A+B**		**32.13**

Table 7.2.2: Expenditure of Afforestation for Normal Plantation (Non-irrigated)

Sl. No.	Particulars	Physical (Ha.)	Rate (Rs.)	Amount (In Lakh.)
A	**New Plantation**			
1.	New	6	33,500	**2.01**
B	**Maintenance**			
1.	First Year Maintenance	6	5040	0.30
2.	Second Year Maintenance	6	3120	0.19
3.	Third Year Maintenance	6	1740	0.10
4.	Fourth Year Maintenance	6	1000	0.06
5.	Fifth Year Maintenance	6	1000	0.06
	TOTAL			**0.71**
	Grand Total	**A+B**		**2.72**

Table 7.3: List of Areas Identified for Carrying Out Normal Afforestation

Sl. No.	Sub-Ctmt. No.	Name of Range	Name of Beat	Name of Area/ Forest	Area in Ha.	Latitude Longitude	Species to be Planted	Name of Feeder Nursery	Remarks
1	13	Kalpa	Pangi	C-240	6	31^0 35' 06" 78^0 16' 07"	Chilgoza	Pangi Nursery	Above Pangi- Peo road, blank with scattered Neoza. Irrigation from Pangi Nala- 2.5 Kms by A/ Pipe
2	13	Kalpa	Pangi	C-235 **(Non - Irrigated)**	6	31^0 34' 56" 78^0 14' 17"	Chilgoza	Pangi Nursery	Adjoining to Pangi village, no scope of Irrigation.
3	15	Moorang	Rarang	UF Chenglen (Ht. **2920 Mts)**	5	31^0 36' 26" 78^0 21' 15"	Chilgoza & Deo	Lippa Nursery	Above Rarang village. Natural forest of Neoza & Deodar. Irrigation from Kashang Kuhal.
4	21	Moorang	Moorang	UF Nesang- 3120 Mt. (Somthane)	5	31^0 38' 37" 78^0 31' 05"	Deodar, Neoza & BL Spp.	Moorang Nursery	Above bus stand of Nesang village.
5	23	Moorang	Ribba	C-188 (2580 Mt.) Kurfu-Kanda	5	31^0 34' 25" 78^0 22' 0.5"	BL Spp.	Ribba/ Skibba Nursery	Top of the forest and irrigation available within the forest.
6	18	Pooh	Giabong	UF Tam	5	31^0 47' 08" 78^0 25' 46"	Deo & Chilgoza	Kanam/ Surpu/ Dubling Nursery	Above the right bank of Ropa Khad and opposite to Ropa village. Scattered trees of Deodar and Neoza. Irrigation from Yoling Khad.
7	18	Pooh	Sunam	UF Sunali (Barati Kanda)	8	31^0 44' 57" 78^0 27' 45"	Deodar, Neoza and BL Spp.	Dubling Nursery	Opposite Sonam village above right bank of Ropa Khad. Irrigation from Barati Nala. Open forest of Deodar and Neoza.
				Total	**40**				

7.5.2.2 Enrichment Plantation

Most of the regular forest areas within the project area have been depleted due to excessive pressure of local population for timber, fuel wood & fodder. The crop in these areas has become quite open and natural regeneration is scanty/ absent. It is, therefore, essential to restock such areas to their optimum productive potential so that their protective influence in the ameliorating the environment is utilized to the full.

There are some forests in the catchments area where in are present patches with poor crop density and ample blanks where planting could be done. In such areas planting of tubed plants with the norm of **800 seedlings** per hectare is expected to achieve full density of forest crop. Extent of such areas has been identified to be **86 ha.** with 15 ha. as irrigated and 71 ha. Non-irrigated. The estimated expenditure on such areas shall be **Rs. 39.87 Lakh** and is given in Table 7.4.1/2 below with detail of these areas Sub-Catchment-wise, Range-wise & Beat-wise as per Table-7.5 below:

Table 7.4.1: Expenditure for Enrichment Plantation (Irrigated)

Sl. No.	Particulars	Physical (Ha.)	Rate (Rs.)	Amount (in Lakh)
A	**New Plantation**			
1.	New	15	29000	**4.35**
B	**Maintenance**			
1.	First Year Maintenance	15	24456	3.67
2.	Second Year Maintenance	15	15924	2.39
3.	Third Year Maintenance	15	8358	1.25
4.	Fourth Year Maintenance	15	4000	0.60
5.	Fifth Year Maintenance	15	4000	0.60
	TOTAL			**8.51**
	G. Total	**A+B**		**12.86**

Table 7.4.2: Expenditure for Enrichment Plantation (Non-irrigated)

Sl. No.	Particulars	Physical (Ha.)	Rate (Rs.)	Amount (In Lakh)
A	**New Plantation**			
1.	New	71	29000	**20.59**
B	**Maintenance**			
1.	First Year Maintenance	71	3996	2.84
2.	Second Year Maintenance	71	2424	1.72
3.	Third Year Maintenance	71	1218	0.86
4.	Fourth Year Maintenance	71	700	0.50
5.	Fifth Year Maintenance	71	700	0.50
	TOTAL			**6.42**
	G. Total	**A+B**		**27.01**

Table 7.5: Area Identified for Carrying Out Enrichment Plantation

Sl. No.	Sub-Ctmt. No.	Name of Range	Name Beat	Name of Forest/ Area	Area (In Ha.)	Latitude Longitude	Species to be Planted	Name of Feeder Nry	Brief Description of the Area
1	2	3	4	5	6	7	8	9	10
1	11	Kalpa	Reckong-Peo	C-242	6	31^0 33' 20'' 78^0 15' 24''	Neoza & Deodar	Reckong-Peo & Kalpa Nursery	Near Shunati Dogri. Mixed forest of Neoza and Deodar with no irrigation facility.
2	11	Kalpa	Kalpa	C-239	8	31^0 33' 21'' 78^0 15' 35"	Deodar & Neoza	Kalpa Nursery	Above Kalpa Pangi road, a mixed forest of Neoza & Deodar with no irrigation.
3	11	Kalpa	Kalpa	C-243	6	31^0 33' 51'' 78^0 15' 35"	Deodar & Neoza	Kalpa Nursery	Above Rogi road near Military Post. A mixed forest of Neoza & Deodar with no irrigation.
4	11	Kalpa	Pangi	C-240 (b)	8	31^0 33' 57'' 78^0 15' 37"	Deodar & Neoza	Pangi Nursery	Above Kalpa Pangi Road. A mixed forest of Neoza & Deodar with no irrigation.
5	11	Kalpa	Pangi	C- 237	10	31^0 35' 47'' 78^0 15' 42''	Deodar & Neoza	Pangi Nursery	Above Pangi Nala before Pangi village. A mixed forest of Neoza & Deodar with no irrigation.
6	11	Kalpa	Kalpa	C- 241	8	31^0 32' 50'' 78^0 15' 21''	Deodar & Neoza	Kalpa Nursery	Above PWD rest house Kalpa. A mixed forest of Neoza & Deodar with no irrigation.
7	15	Moorang	Rarang	Dunang (2829 Mt.) **(Irrigated)**	5	31^0 35' 57'' 78^0 22' 40"	Neoza & Deodar	Akpa & Jangi Nursery	Between Akpa and Rarang villages. Natural forest of Neoza and Deodar. Irrigation from Kashang Khad.

1	2	3	4	5	6	7	8	9	10
8	16	Moorang	Lippa	C -218 **(Irrigated)**	3	31^0 39' 35'' 78^0 20' 04"	Neoza & Deodar	Lippa Nursery	Before Asrang village. Natural forest of Kail, Deodar and Neoza. Irrigation from Jojrang Nala.
9	23	Moorang	Rispa	C-191 Holdo 2360 Mt. **(Irrigated)**	2	31^0 34' 41'' 78^0 24' 11"	Neoza & Deodar	Skibba	Neoza & Deodar Forest, Above Ribba-Rispa road and near to Holdo Kuhal.
10	17	Pooh	Kanam	C-212 (Kawa) **(Irrigated)**	5	31^0 41' 08'' 78^0 27' 05"	Deodar & Chilgoza	Kanam and Dubling Nursery	Above Kanam Village on the left bank of Kanam Khad with irrigation. Deodar and Chilgoza forest.
11	24	Kalpa	Purbani	C-184	5	31^0 35' 18" 78^0 18' 51"	Neoza & Deodar	Shongtong and Purbani Nursery	Near to Purbani village. A natural forest of Deodar and Neoza. No irrigation.
12	24	Kalpa	Purbani	UF Purbani	5	31^0 34' 50" 78^0 17' 42"	Neoza, Deodar and Kail	Shongtong and Purbani Nursery	Near to Purbani village. Above Shongtong – Purbani Road. A Natural forest of Deodar and Neoza.
13	24	Kalpa	Purbani	UF Kibbar	5	31^0 33' 10" 78^0 18' 35"	Neoza, Deodar and Kail	Purbani Nursery	Near Kibar dogri. A natural forest of Deodar and Neoza
14	24	Kalpa	Tangling	C-179	6	31^0 32' 40" 78^0 17' 26"	Neoza & Deodar	Shongtong Nursery	Near Talampi a natural forest of Deodar and Neoza. In three patches.
15	24	Kalpa	Tangling	C-180	4	31^0 32' 24" 78^0 17' 20"	Neoza, Deodar and Bray	Shongtong Nursery	A natural forest of Neoza and Deodar near Talampi Village.
				Total	**86**				

Figure 7.2: Some of the Areas for Enrichment Planting

C- 179

C-180

C- 191- Holdo

C-184

UF Kibber

7.5.3 CONSERVATION AND DEVELOPMENT OF CHILGOZA PINE (*Pinus gerardiana*)

INTRODUCTION

Chilgoza Pine is a very important tree species of semi-arid temperate region of the state mainly falling in Kinnaur and Chamba districts of Himachal Pradesh. It is an inhabitant of the temperate rocky dry landscape and forms the major tree element of the area which holds on to the thin layer of soil available in these areas, serving a very important ecological function. Also, it is very important from the socioeconomic perspective as it bears Chilgoza seeds of commerce (also known as 'Neoza' in trade) that fetches cash income to the local people to the tune of Rs. 18 Crore per year.

GENERAL CHARACTER OF VEGETATION

Chilgoza Pine is capable of growing on shallow soil or rocky crevices and on hillside etc. at altitudes between 1500-3300 m in dry zone region i.e. outside the scope of monsoons. The forests are depleted and bear little or no natural regeneration due to lack of seed as the cones are collected by right holders. Also unregulated and unrestricted grazing, eating of seeds by birds, rats, mice, and edaphic/ climate factors make it difficult to get regeneration in the area.

STRATEGY AND ACTION PLAN

Strategy and Action Plan for 5 years (2013-14 to 2017-18) has been prepared by CCF, Rampur to regenerate degraded and poorly stocked Chilgoza-Pine forests and the same is attached as **Annexure-VII** to this Plan.

THE PROJECT HIGHLIGHTS ARE AS UNDER

- Rehabilitation of 400 hectares of Chilgoza forests (Kinnaur = 320 ha., Chamba = 80 ha.).
- Raising of 7.50 lakh tall plant of Chilgoza for forest plantations and for public distribution.
- Conservation of genetic variability of Chilgoza through
    a) Establishment of 4 nos., Chilgoza Field Gene Banks (CFGBs) and
    b) Establishment of one Chilgoza Germplasm Bank (CGB).

- Promotion of non-destructive harvesting practices and local value addition methods.
- Promote Chilgoza as "Theme Tree" for Kinnaur and organize annual 'Chilgoza Festivals".
- Promote planting of Chilgoza on private and institutional lands @ 15,000 saplings per year.

PROJECT FUNDING:

The project area falls in the catchment of major river basins, where extensive hydro-electric projects are under implementation/ planned. As such the State CAMPA funds could be a potential source of project funding. Amount to the tune of Rs. 10.00 Crores have been proposed under the project proposal. Time frame of the project is 5 years (2013-14 to 2017-18). The required funds (Rs. 10 Crores) will be provided from Shongtong-Karchham CAT Plan. Detail of expenditure shall be worked out under Chilgoza Project by the implementing agency.

7.6. Soil Conservation Works - Engineering and Bio-Engineering Measures

Engineering and Bio-engineering measures are proposed to stabilize and protect the eroded soils to arrest further erosion. Bio-engineering technique offers the best way of blending slopes into the landscape and limiting damage to surrounding agricultural and forest land. They allow the restoration of something of the original vegetation and ecosystems, and particularly of tipping sites and spoil disposal areas. Through both implementation and later productivity, they offer social and economic benefits for poor and rural farmers.

In soil conservation, Bio-engineering refers to the use of live plants and plant parts to:

- Reinforce soil
- Act as erosion prevention barriers and
- Promote dewatering of water laden soils.

Bio-engineering is the use of vegetation, either alone or in conjunction with civil engineering structures, to reduce instability and erosion on slopes. Bio-engineering has the advantage over other measures as:

i. It provides the best way to armour slopes against erosion:
ii. It is relatively low in cost, it uses local material and skills, and provides livelihood benefits (i.e. economically useful products)
iii. It is simply part of wise and sustainable asset management.
iv. Plants reduce the supply of debris from degrading slopes.
v. It is an “appropriate” way of enhancing civil engineering structures to increase stability as far as possible;
vi. Vegetative structures are also flexible, being capable of absorbing movement and recovering from damage.

Traditional methods of checking stream flow and erosion rely on structural practices like staggered/ continuous contour walls/ trenches, Dry stone/ masonry/ CC/ RCC works in check walls, check dams, silt detention structures, sheet piles etc. These are often expensive and invariably demand specific skills. Both structural practices and live vegetation are used to provide erosion protection for hill slopes and stream banks.

Some of the vegetative techniques are

1. **Cutting, Pollarding and Sodding**

   The species selected for bio-engineering should be available locally suitable for that zone. Cuttings and rooted plants are only to be used during the winter months (dormant season) and sodding techniques to be used during the (summer season) vegetation season. Various methods are available for hillside and slope stabilization. Methods of seeding are dry-seeding and hydro-seeding. On exposed areas the seed is to be protected with straw in combination with meshes of jute and wire. After seeding, the stabilization can be increased through transplanting of stump sprouting deciduous shrubs or tree species.

2. **Brush/ Hedge Layer**

   With different type of brush layering, loose rock slopes can be stabilized. If the plants are rooted, they are called hedge layer. If they are un-rooted, they are called brush layer.

3. **Palisades**

   For treating small gullies with sprouting poles well packed to the soil and held in line across the gully by a pair of waste wood poles.

4. **Fascines**

   These are bundle of sticks packed in between poles of sprouting species.

5. **Bamboo/ wooden Crib Walls**

   Use of bamboo or other wooden members, as per availability on site. The inter spaces are to be planted with suitable cuttings and hedge plants for stabilizing wider areas of the slope.

As per the latest instructions issued from the PCCF (HP), the budget for soil and water conservation needs to be utilized as under:

- 50% For Small Engineering works.
- 50% For Bioengineering afforestation works.
- 50% of the outlay of Bio Engineering for raising nursery plants.

- And balance 50% of the outlay of Bio Engineering for carrying out actual a forestation/ related bioengineering interventions in the affected area.

Due to limitations of climatic and arid factors there is limited scope for use of vegetative measures in the CAT Plan Area. Concept, approach and techniques of Bio-engineering measures have been described and attached as Annexure - IV.

7.6.1 Landslides/ Slips Control Measures

Landslides are caused by the downhill movements of weathered rock mass, boulders, soil etc. There are various factors natural and manmade, which contribute directly or indirectly in producing land slide. The identified areas as per the CAT Plan are to be stabilized through various control measures which would depend upon the size, extent and location of the slip of the area. Some of the sites in the catchment are in the active process of slides and are rapidly extending to engulf bulk of forest land. However, in general the following measures shall be applied depending upon the situation in the site/ field.

i) Construction of diversion channel on the top of the slip to prevent water from flowing to the slip.

ii) Construction of Fascines, Palisades and Wooden Cribs within the slip gullies.

iii) Mulching and seeding of the exposed surfaces with jute netting and grassed with planting of deep rooted species in between in the slip area.

iv) Construction of Toe wall at the bottom of the slips with crate wire/ gabion structures.

v) A mixture of engineering structures from dry stone, cement mortar, cement concrete to RCC type as per need in between the vegetative measures.

A total 20 Nos. of sites/ locations requiring treatment/ stabilization have been identified, and described in the plan. These have given in **Table 7.6.**

Table 7.6: List of Landslides/ Slips Identified for Treatment

Sl. No.	Sub-Ctmt. No.	Name of Range	Name of Beat	Name of Slide/ Slip	Latitude Longitude	Brief Description	Approx. Amt. (Rs. In Lakh)
1	11	Kalpa	Reckong-Peo	Khawangi slip 1994 Mt.	31^0 32' 58" 78^0 16' 47"	Above NH 22 near GREF temple	20.00
2	11	Kalpa	Reckong-Peo	Powari slip 1981 Mt.	31^0 33' 11" 78^0 16' 45"	Above NH 22 near GREF temple	25.00
3	11	Kalpa	Pangi	Pangi Nala Slip	31^0 33' 54" 78^0 16' 35"	Above NH 22 near Pangi village	12.00
4	11	Kalpa	Reckong-Peo	Telangi Dakho Slip 2144 Mt.	31^0 33' 53" 78^0 16' 31"	Above Peo to Pooh road (old) below Telangi cultivation	20.00
5	11	Kalpa	Pangi	Ragura Nala Slip	31^0 35' 45" 78^0 17' 41"	Above Project road to Kashang P/House	10.00
6	24	Kalpa	Purbani	Purbani Jhula Slip 2085 Mt.	31^0 35' 47" 78^0 18' 14"	Below Purbani village and opposite to Kashang P/ House	8.00
7	15	Moorang	Rarang	Gurchenden Slip (2867mts)	31^0 36' 43" 78^0 19' 10"	Above Thopan village, slope moderate to steep.	10.00
8	14	Moorang	Rarang	C-232 Kashang slip (near bridge) (2495mts)	31^0 36' 30" 78^0 18' 02"	Near to bridge over Kashang on Pangi Rarang road on Right bank. Moderate to steep slope	5.50
9	18	Pooh	Giabong	Yollingdhar to Dharang Chokten top slip	31^0 47' 15" 78^0 26' 29"	On top of Thorpa Village. Moderate to steep with small Nallas	25.00
10	18	Pooh	Giabong	Brelling Dhar slip	31^0 48' 10" 78^0 24' 41"	Opposite to Thorpa village on the right bank of Ropa Khad.	12.00
11	18	Pooh	Giabong	Holdhani Nala top slip	31^0 47' 57" 78^0 25' 16"	In between Ropa and Thorpa villages	20.00
12	18	Pooh	Giabong	Ropa Khaas Slip (Shakdhama Garden)	31^0 44' 20" 78^0 28' 55"	On the top of Base Camp of Army. Moderate to steep slope	15.00

13	18	Pooh	Sunam	Gialba Pangche Lungfa	31^0 29' 46" 78^0 29' 36"	Near to FG Hut Sunam and top of Rushkalang village. Moderate to steep slope.	5.00
14	18	Pooh	Pooh	Pooh slip-III 3353 Mt. on lower side	31^0 46' 46" 78^0 34' 19"	Near Pooh village in Pooh Nala	9.00
15	20	Pooh	Namgia	Tashingang slip-II 3456 Mt.	31^0 49' 46.7" 78^0 42' 53.6"	Near to Tashingang Village Temple.	10.00
16	20	Pooh	Namgia	Slip above Namgia-II 2898 Mt.	31^0 48' 31" 78^0 39' 26"	Above Nagia village	7.00
17	17	Pooh	Kanam	Sanipang Slip (6 km) 2825 Mt. (middle)	31^0 40' 07" 78^0 26' 11"	In front of Karla village, moderate to steep and dry slip.	15.00
18	17	Pooh	Kanam	Gonfo Shalama Slip 2710 Mt. (middle)	31^0 39' 41" 78^0 26' 20"	On top of Spillow village and below link road to Kanam village.	10.00
19	17	Pooh	Kanam	Sprang Lungfa Slip 2674 Mt. (Middle)	31^0 39' 21" 78^0 26' 11"	Adjoining to Gonfa Shalma slip.	10.00
20	17	Pooh	Kanam	Angkalang Murti Slip 2694 Mt. (middle)	31^0 39' 03" 78^0 26' 29"	On top of GREF Camp Spillow village.	11.00
					Total		**259.50**

The provision for each site has been made in lump sum on the basis of rough/ preliminary estimation in the field. However, detailed estimates need to be prepared at the time of execution of actual works as per site requirement in each case. The costing will include raising of local bio-species in the nurseries and planting/ biological intervention in the location/ site. The actuals of expenditure are likely to vary as per the site requirements at the time of execution.

Figure 7.3: Some of the Landslides/ Slips Proposed for Treatment

Khawangi Slip

Namgia Slip

Pooh Slip

Powari Khwangi Slip

Purbani Jhula Slip

Tashigang Slip

7.6.2 Nala Stabilization:

The list of Nallas requiring treatments in the catchment area has been identified and listed below. 57 Nallas have been identified for treatment depending upon the site conditions and workability in the catchment area. The basic objective of treatment of these Nallas will be to check the flow velocity, prevention of cutting of banks & detention of silt. The treatment will include bio-engineering measures like check dams, protection walls, silt detention dams, vegetative shrub barriers brush wood check dams etc. The planting of grasses, shrubs and trees will also be done on the banks where feasible. The provision for treatment of each Nala has been done on the basis of rough estimation but the actual work will be done after preparing detailed estimates and treatment plan of each Nala as per spot requirement.

The identified areas are given in the CAT Plan shall be stabilized through controlled measures which will depend upon the size, extent and location of the Nallas of the field.

a) Construction of check dams with protection wall with crate wire to regulate and check/ reduce the speed of flow.

b) The eroded and effected banks of Nallas will be channelized and protected by the crate wire of toe/ check walls in vulnerable lengths.

c) Live hedge vegetative spurs along the Nallas shall be put up after one or two years, when the Nallas will be filled by the silt. Local species which are good soil binders like Salix, *Alnus nitida*, *Ailanthus*, Nirgal, Kashmal, Bekhal, Seabuckthorn*, Rosa* spp., *Rubus, Debreggessia, Desmodium & Spiraea* species to be planted.

d) The cost includes raising of local bio-species in the nurseries and planting/ other biological interventions in the location/ site.

Table-7.7: List of Nala Identified for Treatment

Sl. No.	Sub-Ctmt. No.	Name of Range	Name of Beat	Name of Nala	Latitude Longitude	Brief Description	Approx. Amt. (in Lakh)
1	2	3	4	5	7	8	9
1	11	Kalpa	Kalpa	Gonang Nala	31^0 33' 02" & 78^0 16' 32"	Below Kashmir/ Khwangi villages, seasonal with steep slope.	10.00
2	13	Kalpa	Pangi	Meber Nala 2550 Mt.	31^0 35' 20" & 78^0 15' 52"	Before Pangi village and a perennial Nala.	15.00
3	16	Moorang	Jangi	Honden Nala 2250 Mt.	31^0 37' 14" & 78^0 25' 35"	In between Jangi and Lippa, Above Jangi Lippa road with moderate to steep,seasonal	20.00
4	16	Moorang	Lippa	Chamarka Nala 2569 Mt.	31^0 39' 16" & 78^0 23' 11"	Right bank of Kirang Khad and Opposite Lippa village, seasonal	15.00
5	16	Moorang	Lippa	Fotenden Nala 2661 Mt.	31^0 39' 28" & 78^0 22' 54"	Right bank of Pagger Khad near Lippa village, seasonal.	8.00
6	16	Moorang	Lippa	Onchalang Nala 2698 Mt.	31^0 39' 33.7" & 78^0 23' 15.3"	Left side of village Lippa, seasonal, drains into Kirang Khad.	5.00
7	15	Moorang	Rarang	Romshuna Nala 2510 mts	31^0 36' 32" & 78^0 19' 37"	Near Thopan Dogri, seasonal, slope moderate top steep.	5.00
8	15	Moorang	Rarang	Chhandoring Nala 2510mts	31^0 36' 36" & 78^0 19' 25"	Adjoining to Romshuna Nala near Thopan village. It is seasonal.	4.50
9	15	Moorang	Rarang	Godang Nala 2885 mts	31^0 36' 44" & 78^0 19' 11"	Above Thopan village, seasonal, slope moderate to steep.	5.50
10	15	Moorang	Rarang	Shingkin Nala 2885 mts	31^0 36' 31" & 78^0 20' 13"	Between Thopan and Rarang villages, seasonal, moderate to steep.	5.50
11	15	Moorang	Rarang	Chhugalen Nala 2920 mts	31^0 36' 16" & 78^0 22' 43"	Above Aknam Dogri and is seasonal.	4.50
12	15	Moorang	Rarang	Rangthunpa Nala 2638 mts	31^0 35' 47" & 78^0 22' 31"	Above Khadra village, seasonal, moderate to steep.	6.00
13	15	Moorang	Rarang	Tichen Nala 2454 mts	31^0 35' 20" & 78^0 23' 02"	Near Akpa Dogri, seasonal, moderate to steep	4.50

1	2	3	4	5	7	8	9
14	23	Moorang	Rispa	Khonkung Nala 2727 Mt.	31^0 34' 21" & 78^0 25' 14"	Above Rispa village and near to C-191 (Dhar Gompa Ptn.), seasonal.	6.50
15	23	Moorang	Rispa	Holdo Nala 2357 Mt.	31^0 34' 38" & 78^0 24' 15"	It originates from the top of Rispa Kanda with Glacial origin.	7.50
16	23	Moorang	Rispa/ Moorang	Duwa Nala 2498 Mt.	31^0 33' 01" & 78^0 27' 14"	On left side of Pibbar village draining into Tidong Khad. It is perennial with Glacial origin.	25.00
17	23	Moorang	Ribba	Partupain Nala 2581 Mt.	31^0 33' 29" & 78^0 22' 03"	Adjoining to Raldang Khad and Ribba village, perennial with Glacial origin.	5.00
18	23	Moorang	Ribba	Gottang Nala 2586 Mt.	31^0 33' 12" & 78^0 22' 15"	A tributary of Raldang Khad, adjoining to Ribba village, perennial with Glacial origin.	8.50
19	23	Moorang	Rispa	Ti Nala 2314 Mt.	31^0 34' 22" & 78^0 26' 51"	Near Tidong Project, a perennial Nala	10.50
20	23	Moorang	Moorang	Shurting/ Lalanti Nala – 3436 Mt.	31^0 26' 02" & 78^0 33' 39"	Near ITBP Camp Charang, a perennial Nala	25.00
21	23	Moorang	Moorang	Changkakte Nala 3583 Mt.	31^0 25' 01" & 78^0 34' 08"	Near to Bebgya. Dogri of Charang village and with perennial flow	15.00
22	21	Moorang	Moorang	Tabaldan Nala 2856 Mt.	31^0 39' 41" & 78^0 29' 32"	A seasonal Nala draining into Nasang Khad.	5.50
23	21	Moorang	Moorang	Tashnoang Nala 2580 Mt.	31^0 36' 13" & 78^0 27' 24"	Beyond Moorang near Vetrinary Hospital	5.50
24	21	Moorang	Moorang	Khopa Nala 2530 Mt.	31^0 35' 22" & 78^0 27' 10"	Seasonal Nala near to Khopa village	6.50
25	21	Moorang	Moorang	Domangti Nala 2530 Mt.	31^0 36' 49" & 78^0 26' 32"	Beyond Lalan village opposite to Jangi.	7.00
26	21	Moorang	Moorang	Nemcheng Nala 3161 Mt.	31^0 38' 30" & 78^0 31' 10"	Seasonal Nala above Nesang Village.	20.00
27	21	Moorang	Moorang	Chelneng – Nala 3175 Mt.	31^0 38' 12" & 78^0 31' 53"	Above Nesang village near to GHS and is seasonal	9.50

1	2	3	4	5	7	8	9
28	22	Moorang	Moorang	Mazrang Nala 3480 Mt.	31^0 27' 38" & 78^0 33' 49"	Beyond Shurting camp and before Kuno Village.	15.00
29	22	Moorang	Moorang	Grangbal Nala 3300 Mt.	31^0 33' 46" & 78^0 29' 29"	Before Thangi Village	15.00
30	22	Moorang	Moorang	Nungkriyeng Nala 3095 Mt.	31^0 33' 55" & 78^0 28' 31"	Near to Thangi village and Rowang Village	18.00
31	22	Moorang	Moorang	Tugrun Nala 3249 Mt.	31^0 29' 56" & 78^0 31' 40"	Near Parvati Dhank before Lumber	10.00
32	22	Moorang	Moorang	Khokho Nala 2945 Mt.	31^0 36' 27" & 78^0 28' 13"	Seasonal Nala on top of Morang village	6.00
33	22	Moorang	Moorang	Tungpa Nala 3090 Mt.	31^0 25' 14" & 78^0 36' 33"	Below Charang village with perennial flow	15.00
34	22	Moorang	Moorang	Rangrik Khad 3653 Mt.	31^0 26' 23" & 78^0 36' 35"	Beyong Charang village with Rangrik Temple.	25.00
35	22	Moorang	Moorang	Bepgaya Khad 3464 Mt.	31^0 34' 55" & 78^0 33' 05"	Seasonal Nala above ITBP post at Shurting.	25.00
36	18	Pooh	Sunam	Petangla Nala (Sunam kanda)	31^0 46' 44" & 78^0 30' 29"	Top of Sunam Nala in Kanda area. Seasonal.	15.50
37	18	Pooh	Sunam	Baro Hungshati Nala	31^0 47' 14" & 78^0 29' 24"	Near to Baro Hungshati Nala. Dry and seasonal.	16.00
38	18	Pooh	Pooh	Gujungna Nala 2800 Mt. at base	31^0 45' 50" & 78^0 35' 44"	Above Pooh Hospital	7.00
39	18	Pooh	Pooh	Pooh Nala-III 3358 Mt.	31^0 46' 48" & 78^0 34' 41"	Opposite Facing Pooh Slip near Pooh village	6.50
40	17	Pooh	Kanam	Labrang Nala	31^0 40' 30" & 78^0 26' 12"	On top of Labrang village	11.00
41	17	Pooh	Kanam	Kawa Nala	31^0 41' 27" & 78^0 27' 18"	On the Left bank of Kanam Khad near Kawa Dogri	10.50
42	17	Pooh	Kanam	Hurlling Nala	31^0 41' 47" & 78^0 26' 59"	On the left bank of Kanam Khad beyond Surpu Nry	9.50

1	2	3	4	5	7	8	9
43	20	Pooh	Namgia	Namgia Futang Nala – 3114 Mt.	31^0 48' 10.5" & 78^0 39' 19.9"	Above Namgia Bus stand	25.00
44	20	Pooh	Namgia	Namgia Nala – 2991- 3255 Mt.	31^0 48' 24.7" & 78^0 39' 25.9"	Adjoining Namgia village	30.00
45	20	Pooh	Namgia	Tashingang Nala-I – 3506 Mt.	31^0 50' 51" & 78^0 41' 23"	Above Tashingang village	9.00
46	20	Pooh	Namgia	Tashingang Nala- II 3171 Mt.	31^0 50' 49" & 78^0 40' 45"	Near Tashingang dogri	8.50
47	20	Pooh	Dubling	Mangrang Nala -II 2955 Mt.	31^0 44' 38" & 78^0 36' 14"	Opposite Army TCP.	6.50
48	20	Pooh	Dubling	Yukyur Nala Dabling-I 2907Mt.	31^0 40' 13" & 78^0 37' 03"	Near to Dabling village on left bank of Satluj	5.50
49	20	Pooh	Dubling	Yukyur Nala Dabling-II 2932 Mt.	31^0 43' 35" & 78^0 36' 52"	Near to Yukyur Nala above	5.50
50	20	Pooh	Dubling	Puwak Nala – Dubling – 2886 Mt.	31^0 45' 01" & 78^0 37' 32"	On left side Dubling village on Left bank of Satluj	7.50
51	20	Pooh	Dubling	Shmulung Nala Dubling – 3244 Mt.	34^0 44' 43" & 78^0 38' 35"	Above Dubling Bus stand	10.50
52	24	Kalpa	Tangling	Pirang Santhang Nala - 2277 Mt.	31^0 33' 53" & 78^0 17' 03"	Above Purbani link road near to Powari Village, seasonal	10.00
53	24	Kalpa	Tangling	Kananki -1st Nala 2574 Mt.	31^0 32' 59" & 78^0 17' 20"	Above Powari village, a seasonal Nala	6.00
54	24	Kalpa	Tangling	Kananki -2nd Nala 2574 Mt.	31^0 32' 54" & 78^0 17' 19	Above Powari village, a seasonal Nala	5.00
55	24	Kalpa	Tangling	Shuna Nala 2518 Mt.	31^0 33' 06" & 78^0 17' 36"	Above Powari village, seasonal	5.00
56	24	Kalpa	Tangling	Balgor Nala 2554 Mt.	31^0 33' 20" & 78^0 17' 37"	Above Powari village, seasonal	5.00
57	24	Kalpa	Tangling	Phyala Nala 2560 Mt.	31^0 33' 35" & 78^0 17' 35"	Above Powari village from C-179, seasonal	5.00
						Total	**614.50**

Figure 7.4: Some of the Nallas Proposed for Treatment

Kananki-I & II

Namgia Nalla

Pirang-Santhang Nalla

Tashiganag I - II

Yokyor I - II

7.6.3 River Bank Stabilization

River cutting by Satluj River & its tributaries has been identified for stabilization. The basic purpose for the treatment of the river will be to check the erosion of river side and to stream line the flow of river. The treatment will include bio engineering measures & by way of constructing appropriate engineering structures, spur etc. Besides this planting of grasses, shrubs and trees will also be done on the banks where ever feasible. Provision for treatment of each river have been made on the basis of rough estimation but actual work will be done after preparing actual detailed estimate & treatment plan as per spot requirement. A total amount of Rs. 50 Lakh has been provided for this component. The indicative list for treatment of River bank stabilization & as per requirement is given in the table below:

Table 7.8: Indicative list for treatment of River bank stabilization

Sl. No.	Sub Ctmt. No.	Name of Range	Name of Beat	Name of Area & Brief Description	Latitude Longitude	App. Amt. (in Lakh)
1	17	Pooh	Kanam	River bank near GREF Camp below Spillow village.	31^0 39'13' 78^0 26'33"	30.00
2	23	Moorang	Rispa	Left Bank of Satluj below Krispa village. Ht. 2272 Mt.	31^0 34'53" 78^0 25'42"	20.00
		Total				**50.00**

7.6.4 Snow/ Avalanche Control

The glacial erosion is quite predominant in the area. Snow/ avalanches are active geological agents of erosion and have been a source of natural disasters since time immemorial. A common feature of mountainous terrain throughout the temperate and arctic regions of the earth, they may fall wherever snow is deposited on slopes steeper than 30 degrees. Small avalanches, or sluffs, run down many times each winter, while the large avalanches spreading miles apart with millions of tons of snowfall may gush down, frequently causing havoc to life and property on the way with wiping out everything. Avalanches find their genesis in snow cover structural weaknesses which are often induced by internal changes. A large overburden of snow alone may not result in avalanching if it is anchored to a solid under layer. On the other hand, even a shallow snow layer can slide from the mountainside, if poorly bonded.

A large number of peaks are under perennial snow or remain under snow for most of time during winter months. Whenever, there is a movement of large mass of ice down the slopes, it brings along with it huge debris causing a lot of soil erosion. Glacial erosion is characterized by furrowing, cutting, ploughing and scouring action on the land mass. The flash floods are caused due to enormous snow melt which transports the debris down to the river system after having inflicting damage to the bed and to the side of gullies. The protective measures including the enhancement of vegetation have virtually little effect against the enormous force of glaciers. The avalanche hazard can be mitigated or eliminated by the application of operational and engineering techniques. There are two fundamental methods of avalanche control:

- Modification of terrain &
- Modification of the snow cover.

7.6.4.1 Modification of Terrain

The terrain modification may deflect the sliding snow away from fixed facilities to be protected or may actually prevent the Avalanche release. In formidable terrain the snow may be rested by snow dam in the catchment basin. Actual Avalanches defense by terrain modification is achieved with supporting structures in Avalanche release zone. There are large walls, trenches that retain the snow and prevent Avalanche from falling. Their size and spacing are designed to:

- Terrace the mountain side into discrete zones so that each has snow deposited to a slope less than mean.
- Break the continuity of the snow surface and prevent slab motion.
- Support snow on mountain side in small manageable sections.

7.6.4.2 Modification of the Snow Cover

Avalanche control by snow modification doesn't give high degree of protection afforded by varying modification but is cheaper. It is commonly used to reduce the hazard to mobile entities; such as skiers or high way traffic, which may be reduced during the period danger. The commonest method is artificial release, which brings the Avalanche down at a chosen safe time and inhibits formation of large Avalanche by releasing slope of their snow burden in piece meal in smaller sizes.

Avalanches are also arrested in the outrun or transition zone of their paths by breaking conical earthen or masonry mounds of four meters or more height which are arranged in a pattern to break up the flowing snow into crosscurrents which internally dissipate its kinetic energy. The avalanche prone Nallas/ sites has been identified & an approximate amount of **Rs. 228 Lakh** has been kept for their control. These have been given in **Table 7.9.** Execution of these Works shall be subject to proper estimates.

Figure 7.5: Some of the Areas for Avalanche Control Measures

Khatung Nalla (near Village Rispa)

Prutikanda 1,2 & 3 (above Village Kanam)

Tinku Nalla on NH-22 (before Pooh)

Table 7.9: Table Showing Avalanche Control

Sl. No.	Sub Ctmt. No.	Name of Range	Name of Beat	Name of Nallas/ Avalanche Area	Latitude Longitude	Brief Description	Approx. Amt. (Rs. in Lakh)
1	2	3	4	5	6	7	8
1	23	Moorang	Moorang	Kharba Nala (Charag)	31^0 24' 28" & 78^0 31' 45"	Near Charang village	18.00
2	23	Moorang	Ribba	Permiti Nala	31^0 28' 32" & 78^0 30' 42"	Opposite to Parvati nala	11.00
3	23	Moorang	Moorang	Charang Nala	31^0 25' 33" & 78^0 34' 52"	Near Charang village	9.50
4	23	Moorang	Moorang	Garangba Nala	31^0 28' 37" & 78^0 32' 06"	Near to Shurting/ Kalimiti	10.00
5	23	Moorang	Moorang	Ganungti Nala (Pibbar)	31^0 27' 45" & 78^0 34' 10"	Opposite to Thangi village and near to Pibber village	10.00
6	23	Moorang	Moorang	Gujugo Nala (Thangi)	31^0 30' 32" & 78^0 25' 18"	Above Thangi village	8.00
7	23	Moorang	Moorang	Tulling Nala (Lumber)	31^0 29' 34" & 78^0 31' 44"	Near Lumber village	6.50
8	23	Moorang	Rispa	Khatung Nala 2663 Mt.	31^0 34' 08.5" & 78^0 25' 29.7"	Adjoining to Rispa village, perennial with Glacial origin.	15.00

1	2	3	4	5	6	7	8
9	16	Moorang	Jangi	Chhapan- Shalma slip (3710mts)	31^0 38' 50" 78^0 22' 55"	Above Chhappan Dogri. In front of Lippa Village. Dry slip.	25.00
10	17	Pooh	Kanam	Pruti-kanda -1st	31^0 41' 21" 78^0 27' 30"	On the top of Kanam village	10.00
11	17	Pooh	Kanam	Pruti-kanda– 2nd	31^0 41' 08" 78^0 27' 30"	On the top of Kanam village	10.00
12	17	Pooh	Kanam	Prutikanda– 3rd	31^0 40' 59" 78^0 27' 36"	On the top of Kanam village	10.00
13	17	Pooh	Kanam	Tapangkanda	31^0 41' 48" 78^0 27' 30"	On top of Kawa Dogri	15.00
14	18	Pooh	Pooh	Tinku Nala 2600 Mt.	31^0 45' 17" & 78^0 34' 44"	Just before Pooh Cantonment above NH 22	45.00
15	18	Pooh	Sunam	Talling Dhar	31^0 46' 45" 78^0 30' 29"	At the right bank of Chhiaso Khad on top Talling village	25.00
				Total			**228.00**

7.6.5 Soil and Water Harvesting Structure - Construction of Van Sarovar

The demand on the water resources of the state has been increasing with every passing year. The state is faced with a situation of water stress i.e. manifested by apparent moisture stress in vegetation and forest. Keeping in view of these facts the Hon'ble Forest Minister during the CF's Meeting on 7th & 8th July 2009 stressed upon the Forest Department to construct Van Sarovar in the forest area to conserve and augment water resources of the forest in the State of Himachal Pradesh. The basic idea of the Van Sarovar scheme is to trap rain water on hill sides, increase percolation and to build water retaining structures to store the excess water runoff in streams. The component and design of the scheme is to be followed as direction given by the department time to time as per availability and requirement of the site. A lump sum provision of **Rs. 25.00 Lakh** has been made in the CAT Plan for construction of three Van Sarovars, one in each Range. The sites need to be identified during implementation/ Micro-planning subsequently.

7.7 Payment of Environmental Services (PES)

It is a new concept as a reward for good conservation behavior by upstream community living in the catchment areas of the project. The PES will be based mainly on the result of monitoring of the following aspects and effectiveness of conservation measures between communities.

- Silt load (total, seasonal and average assessment).
- Survival % of plantation.
- Freezing land use.
- Better Agriculture, Horticulture and Animal Husbandry practices in the catchments area.

Procedure for implementing PES is yet to be evolved. However, following works are suggested under PES:

- Distribution of fruit plants.
- Value addition facilities for the local raw materials.

- Span for carriage of commodity/ local produce.
- Maintenance/ improvement of village paths.
- Maintenance/ improvement of water sources.
- Protection of Forests from all types of Forest offences.
- Incentivisation for rotational grazing in pastures.
- Incentivisation of establishment of Gosadans in a cluster of Panchayats
- Incentivisation for bench terracing of Agriculture land to individuals.
- Eco-tourism activities.
- Provision for the JFMC for assisting forest staff in protection measures.
- Agriculture, horticulture and animal husbandry support.
- Income generating activities.
- Soil Conservation works in the private land to be treated through the individuals.
- Distribution of Alkathene Pipes for carriage of irrigation water form nearest source.

Details and mechanism of these activities has not been prescribed because it will depend on the degree of support provided by the local people in implementation of CAT plan and providing environmental support. However, the tentative approximate amount has been kept in the year wise phasing. As the CAT Plan progresses, these activities may be decided/ changed/ amended and executed accordingly. It is, proposed, that the activities may be implemented through the representative of concerned Panchayat/ JFMCs/ SHGs. The overall record will be maintained by the staff of implementing Division.

Catchment specific study will be made to identify proposals and activities to be undertaken under PES and once these activities are approved by the Forest Department, these will be implemented with the amount kept under PES. The provision for the PES has been worked out @ 10% of the CAT Plan outlay which works out to be Rs. 604.00 Lakh. However, the tentative funds requirement for activities defined above will be less. Therefore, **Rs. 200 Lakh** has been kept for this purpose and will be expended sub catchment wise for the activities listed above.

7.8 Research, Studies & Training

In order to tackle the ecological problems, publicity, motivation, education & confidence building extension programme have to be evolved for local population and also for the graziers dependent on the pasture eco-system. The extension workers & field staff need to be trained in joint forest management & extension methodologies. Focus on social & institutional aspects need a substantial re-orientation in vision, thought process, work culture & ethics and attitudinal behavior across the stakeholders at all levels. The methodologies need to be mutually evolved with roles and responsibilities defined and adopted earnestly.

Local villagers will also be made aware of the importance of soil conservation and encouraged/ assisted and trained in adopting improved agricultural, horticultural & animal husbandry practices in their private lands. They, being the important stake holders in the environmental rehabilitation of the tract, need to be sensitized & made partners in the maintenance of assets & interventions made through this CAT Plan to ensure sustainability. Towards this objective necessary provision has been made in the plan.

The forest area falling in the catchment area is unique and rich in biodiversity due to diverse physiographic and climatic conditions. Whereas, the prominent indigenous woody component includes Deodar, Kail, Fir, Spruce, Juniperous, Neoza etc., the grassland are mainly composed of a large variety of grasses and herbaceous plants which have immense medicinal value. However, not much is known about the floral diversity and its ecological and environmental impact in the area due to absence of comprehensive work on the subject either conducted or published. It is utmost important that a base line information about the floral diversity, ecological studies and composition is generated to guide future conservation action. Funds will be allotted to implementing agency, who will determine the study areas with focus on present scenario during the plan period. The implementing agency needs to identify the appropriate agency/ institution to conduct the research activities. First preference may be given to those, who have knowledge and expertise in forestry, wildlife management and conservation. Indicative list of such institutions is; ICFRE through HFRI Shimla, WII Dehradun and any recognized university in India. Priority may be given to undertake research studies in the following subject:

(a) Socio-economic Studies of the villages dependent on the forest resources.

(b) Environmental Impact Assessment (EIA) of grazing and biotic interference.

(c) Identification of habitat for pheasants.

(d) Sites specific / issue specific research/ study.

(e) Training and capacity building needs of the staff and communities.

(f) Information dissemination.

A lump-sum provision of **Rs. 100 Lakh** has been made for this component. Year wise allocation shown in the schedule is only indicative and funds may be used as per actual requirements of research activity proposals/ plans, submitted by the agency/ institution and after approval by the component authority.

Training of Front Line staff, communities and officers is also required in soil & water conservation, extension and participatory development methodologies. These trainings need to have both on the site and institutional (designated) components. The objective of this training component would be to provide the people & staff working in the plan area to enhance their existing skills, build partnerships and offer experience sharing to achieve the overall plan objectives of ecological development, silt reduction and soil conservation. Annual allocations are only indicative & actual funds required may be sought annually after finalization of activities for that year as per need.

7.9 Infrastructure Build-up

7.9.1 Buildings

For the optimum management of Forest resources of the tract, it is essential that the field infrastructure of the Forest Department is adequately developed. The forest path/ bridle path and buildings are the important lines of communication in these difficult terrains and to keep them in serviceable condition it is highly desirable. Due to paucity of funds many existing paths are in a State of neglect & require repairs to facilitate efficient forest management. Similarly is the case with Forest buildings which require maintenance/ repair. The list of buildings which need maintenance/ repair are given in Table 7.9.1 with lump sum financial provisions.

Table 7.9.1 – Buildings

Sl. No.	Sub Ctmt. No.	Name of Range	Name of Beat	Name of Building	Approx. Amt. (Rs. in Lakh)
1	11	Kalpa	Kalpa	Repair/ maintenance of Range Office-cum Residence at Kalpa	6.00
2	11	Kalpa	Reckong-Peo	Repair/ maintenance of Division Office, DFO Residence, Staff Quarters (7 nos.)	55.00
3	11	Kalpa	Reckong-Peo	Maintenance of FG Reckong-Peo	1.00
4	11	Kalpa	Kalpa	Maintenance of BO Quarter Kalpa	1.50
5	11	Kalpa	Kalpa	Maintenance of FG Hut Kalpa	0.75
6	11	Kalpa	Kalpa	Maintenance of Type- II (Double story Quarter) at Kalpa	2.00
7	11	Kalpa	Kalpa	Maintenance of Mali Hut Kalpa	0.75
8	11	Kalpa	Kalpa & Reckong-Peo	Maintenance/ augmentation of water supply to Forest Colony Kalpa and Reckong-Peo	6.00
9	11	Kalpa	Reckong-Peo	Construction of Recreation room at Reckong-Peo	15.00
10	13	Kalpa	Pangi	Maintenance of FG Hut Pangi	1.00
11	15	Moorang	Rarang	Construction of Out- Houses at Akpa	7.50
12	17	Pooh	Kanam	Maintenance of FG/ Hut Kanam	1.00
13	18	Pooh	Pooh	Maintenance of FRH Pooh	3.00
14	18	Pooh	Giyabung	Maintenance of I/Hut Giyabung	2.50
15	23	Moorang	Ribba	Maintenance of BO Quarter at Ribba	1.00
16	23	Moorang	Ribba	Maintenance of FG Hut at Ribba	1.00
17	23	Moorang	Rispa	Maintenance of Bo Quarter at Rispa	0.75
18	24	Kalpa	Barang	Maintenance of FG Hut Shongtong	1.00
19	24	Kalpa	Barang	Maintenance of BO Quarter Shongtong	1.25
20	24	Kalpa	Tangling	Maintenance of FG Hut Tangling	1.00
21	24	Kalpa	Barang	Special repair Inspection Hut at Anodan	7.50
22	24	Kalpa	Purbani	Maintenance of FG Hut Purbani	1.25
23	24	Kalpa	Pubani	Special Repair to Kitchen of FRH Purbani	4.00
					121.75

7.9.2 Maintenance of Paths

The condition of the existing Paths in the Catchments area is not good and requires maintenance/ upkeep. The approximate length of these paths to be repaired/ maintained is 66 Km. These are given in **Table 7.9.2** with lump sum financial proposals.

Table 7.9.2 Paths:

Sl. No.	Sub Ctmt. No.	Name of Range	Name of Beat	Name of Path	Length (in Km)	Approx. Amt. (Rs. in Lakh)
1	11	Kalpa	Kalpa	Repair/ maintenance of I/ Path from C-243 to C-244	5	3.50
2	13	Kalpa	Pangi	Repair/ maintenance of I/ Path From C-238 to Pangi Nala	8	4.50
3	13 -16	Kalpa, Moorang	Pangi, Rarang, Jangi & Lippa-Asrang	Repair/ maintenance of I/Path From Pangi to Asrang	25	20.00
4	22/ 23	Moorang	Rispa/ Moorang	Maintenance of Bridle path from Holdo to Tidong.	7	4.00
5	24	Kalpa/ Ribba	Tangling, Ribba & Purbani	Kibbar Kanda to Tangling, Purbani and Ribba	10	6.50
6	24	Kalpa	Tangling	Powari to Talampi (B. Path)	3	1.25
7	24	Kalpa	Tangling	Talampi to Kinner Kailash	8	9.00
				Total	**66**	**48.75**

7.9.3 Vehicles and Operational Support

A provision has been made in the CAT Plan to provide support to the implementing agency in the form of establishment charges, office expenses, operational vehicles and amenities to staff and labour for better implementation of CAT Plan. **The vehicles and office equipments are to be provided by purchase** have been listed in Tables 7.9.3-(i), 7.9.3 (ii) & 7.9.3 (iii).

Table 7.9.3 (i) - Operational Support

Sl. No.	Particulars	Quantity	Rate	Amount (Rs. in Lakh)
1	Mahindra (Xylo)	3 Nos.	L/s	30.00
2	Bolero Camper (GLX)	1 No.	L/s	10.00
3	MUV	1 No.	L/s	12.00
			Total	**52.00**

Table 7.9.3 (ii) – Office Support

Sl. No.	Particulars	Approx. Amt. (Rs. in Lakh)
1	Establishment Cost (Refund of Salary of CAT Plan Division to Government)	100.00
2	Establishment Cost (contractual Emoluments)	50.00
3	Office Expenses	46.00
4	Motor Vehicle & POL I/c Hiring of Vehicles for Front Line Staff	100.00
5	Amenities to Staff and Labour	20.00
6	Travelling Expenses	55.00
7	Miscellaneous Expenditures	25.00
	Total	**396.00**

Table 7.9.3 (iii) Office Equipment

Sl. No.	Particulars	Quantity	Rate	Amount (Rs. in Lakh)
1	Computer with accessories	6 Nos.	L/s	4.00
2	Digital Camera- DSC more than 12 MP	6 Nos.	L/s	1.00
3	GPS	12 Nos.	L/s	3.00
4	Xerox Machine	1 Nos.	L/s	1.00
			Total	**9.00**

7.9.4 Silt Monitoring

Whereas no new silt observatory posts have been proposed in the catchment area it is suggested that the activity may be planned by the implementing agency for efficacy. Collaboration with other agencies may be explored. A lump sum provision of **Rs. 55.00 Lakh** is made under the component.

7.10 Forest Protection

Under this sub component following activities are proposed:

7.10.1 Construction/ Repair of existing boundary/ chak pillars and Engagement of Fire Watchers

For protection of protected areas from encroachments near the cultivations, the existing boundary pillars are to be repaired and new intermediate pillar/ chak pillars are to be constructed on the boundary separating cultivated land and forest areas. An outlay for **Rs. 16.50 Lakh** is proposed to be incurred during the plan period as per table 7.10.1

Table 7.10.1 – Forest Protection

Sl. No.	Particulars	Approx. Amt. (Rs. in Lakh)
1.	As per triennial programme for the checking (construction/ repair) of boundary pillar in Kalpa (Kalpa & Shongtong block of Kalpa range), Moorang and Pooh Forest Range prescribed under working plan for Kinnaur forest division.	6.50
2.	Engagement of fire watcher/ fire fighting squad for six months in Kalpa (Kalpa & Shongtong block of Kalpa range), Moorang and Pooh Forest Range	10.00
	TOTAL	**16.50**

7.10.2 Distribution of Non-conventional Energy and Fuel Saving Devices

In order to reduce the pressure on forest resources in and around the catchments of the project area, it is proposed to provide alternative sources like LPG Cylinders on subsidized rate (50% cost to be borne by the beneficiaries) to poor local people, construction of crematoria along with fuel wood store and distribution of solar lights etc. in each villages falling in the catchment area. The non-conventional energy and fuel saving devices shall be distributed to the identified families/ beneficiaries as per list supplied by the concerned Panchayats. Proper record for the same needs to be maintained by the frontline staff of the forest department in consultation with Panchayats. It will, however, be one time investment.

Table 7.10.2 : Non-conventional Energy and Fuel Saving Devices

Sl. No.	Particulars	Remarks & Financial Allocation
1	Distribution of LPG Cylinders	The numbers of non-conventional energy and fuel saving devices shall be ascertained and distributed to the identified families/ beneficiaries for which proper record needs to be maintained both by the concerned Forest Department and Panchayat/ JFMC. The amount of **Rs. 5.00 Lakh** kept is approximate and may be expended accordingly.
2	Distribution of Solar lights	
3	Distribution of Induction Heater & Cookers	

7.10.3 Sign and Slogan Boards

It is desirable that the sign and slogan boards are put up at selected sites. All these sign and slogan boards need to be in Hindi and English Languages in the form of an appeal to the local people to make them aware of the importance of Wildlife conservation under the provision of Wildlife (Protection) Act, 1972, Indian Forest Act, 1927 & Forest Conservation Act, 1980 etc. All such development works which are taking place in the project area must be properly displayed at the site of execution e.g. plantation work, nursery, pasture development, soil conservation works etc. An amount of **Rs. 2.00 Lakh** has been proposed for this purpose during the plan period.

7.10.4 Reward/ Incentives to Informers

Reward/ incentive to informers for control of illegal trade/ illicit felling of trees is required for proper protection of forest and wildlife. Without help or association of the local people, forest guards alone may be helpless to protect/ detect the forest and wildlife offences. It is necessary to make people aware about the biological and ecological hardships which the fauna of the tract is facing. The people need to be encouraged by way of suitable rewards/ incentives for giving information about the offender/ culprits. An outlay for **Rs. 2.00 Lakh** is proposed to be incurred during the plan period.

7.11 Management of Wildlife in & outside the Protected Areas

Himalayas are the youngest and fragile mountain formation and supports varied forms of life and unique eco-system with moderate to steep slopes, forests, snow clad peaks, glaciers and alpine meadows. The Himalayas have rich reserve of life forms/ biodiversity.

7.11.1 Protected Areas

In the Plan area, is situated *Lippa-Asrang Wild Life Sanctuary* which is under the administrative control of Divisional Forest Officer, Sarahan (Wild Life) and is about 1.5 Km upstream of Lippa village in the upper Catchment of Kirang Khad. The area falls in the Western Himalayan zone of Himalayas. The area of the sanctuary is about 30.89 Sq.km. The altitude ranges from 3000 to 5122 Mts. There are three villages along the lower boundary of the sanctuary. These are Lippa, Asrang and Tokto. The prominent species available in the sanctuary includes Snow leopard, Bharal, Ibex, Brown Bear, Musk Deer, Snow Partridge, Snowcock etc. The Sanctuary is devoid of tree growth. The vegetation is representative of alpine shrubs and juniperous bushes. The zone on the lower altitude and cooler aspect has few trees of Deodar, Chilgoza, Kail, juniper, Salix and *Alnus* species. The sanctuary has vast stretches of alpine pastures which serve the store house of important medicinal herbs like Dhoop, Karoo, Patish and Kuth. A brief description of the Lippa-Asrang Wildlife Sanctuary is given as under:

7.11.1.1 Name and Location

The Lippa-Asrang Wildlife Sanctuary falls in Moorang Tehsil of Pooh Sub-Division in Kinnaur district. It was notified as a sanctuary first in 1962 and then re-notified in March, 1974 vide Himachal Pradesh Government Notification No. 5-11/70-SF dated 27-03-1974. The Lippa-Asrang Wildlife Sanctuary is situated between 31° 39' 30.1" North Latitude and 78° 22' 80.03" East Longitude. It is under the administrative control of Sangla Wildlife Range, which is a part of Sarahan Wildlife Division. Sarahan is about 140 km. away from the sanctuary. The nearest town is Reckong-Peo, which is also headquarters of the Kinnaur district. Nearest Rail Head and Airport is at Shimla.

7.11.1.2 Boundaries

As per the Government of Himachal Pradesh Notification No. 5-11/70-SF dated 27-03-1974 the boundaries of the Lippa-Asrang Wildlife Sanctuary are as under:

North: Taiti Gad/ stream.

West: Precipitous ridge to the West of Balinaren and Nagach Thatches extending between Taiti Gad and Moltha Thong Dhar.

South: Moltha Thong Dhar

West: Drimbling Dhar

The area of the sanctuary is 30.89 Sq. Km.

7.11.1.3 Geology and Terrain

The Himalayas are the youngest geological formations in the world and are still in the stage of morphological evolution. The important rock formations are gneiss, granites, quartzite and schist. The area is very dry, mountainous and ecologically fragile. Between Asrang and Lippa to the North of Taiti Khad, the strata mainly consist of granite and gneisses, which are altered with the consequent formation of China clay. The rapid weathering of granite in the sanctuary appears due to high frequency of frost action and extreme temperatures. It gives rise to sandy soil. Schist and gneisses produce clay and granite produces loam. Therefore, sandy-clay soil type is most prominent in the sanctuary. The humus layer is not very thick. The soil depth is also not much due to precipitous slopes, high altitude and negligible tree growth. On steep slopes the erosion due to snow, sliding of glaciers is very high and consequently the fertility of the soil is low. In the buffer zone area, however, soil depth and humus layer is sufficient to sustain tree growth.

7.11.1.4 Climate and Rainfall

The area has extremes of temperature, harsh climate with average to very heavy snowfall and scanty rainfall. The temperature ranges from -10^{o}C to 25^{o}C. Winter season is fairly prolonged from mid November to end of March or early April. Summer is of short duration up to May and rains start in June, which lasts till September. During this period snowfall is also occurs on higher reaches.

7.11.1.5 Water Sources

Higher snow clad mountains are mainly the source of water. Taiti stream is the main source of water beside Kochi which being equally important, are the main source of water. When the snow starts melting, water is diverted through small check dams to small irrigation channels. Skillfully constructed wooden siphons are used for direction of water, which reduce the loss of water in transect. As the rainfall is less, snow fed streams play an important role in the water regime of the area.

7.11.1.6 Flora of the Sanctuary

The vegetation of the sanctuary is represented by *Juniperous* shrubs and alpine pastures. There are hardly any trees in the sanctuary area. Eighty seven medicinal plant species have been reported, out of which fifteen are threatened. In the proposed buffer zone, trees of Deodar, Chilgoza and Kail with few broadleaves are present. Based on the eco-system classification of forests by Champion and Seth following forest types are representative of the area;

i) Himalayan Dry Temperate Forests

Type 13/C-IIa Neoza Pine Forests (*Pinus gerardiana*)

Type 13/C-IIb Dry Deodar Forests

ii) Moist Alpine Scrub

15/C-3 Alpine Pastures

iii) Alpine Scrub

Type-16/C-I Dry Alpine Scrub

Type-16/E-I Dwarf Juniper Scrub

7.11.1.7 Fauna of the Sanctuary

The main wildlife species found in Lippa-Asrang Wildlife Sanctuary are Snow Leopard (*Panthera uncia)*, Musk Deer (*Moschus moschiferus)*, Bharal (*Pseudois nayaur)*, Ibex (*Capra ibex)*, Himalayan Tahr (*Hemitragus jemlahicus*), Leopard Cat (*Felis bengalensis*), Himalayan Weasal (*Mustela sibirica*) etc. Among birds, main species are namely, Monal (*Lophophorus impyanus*), Snow-Cock (*Tetraogallus tibetanus*), Black Partridge (*Francolinus francolinus*), Chakor (*Alectoris graeca*), Jungle Crow (*Corvus macrorhynchos*), Eagle (*Aquila chryaetos*), Sparrow Hawk, Spotted Dove (*Striptopelia chinensis*), Blue Rock Pigeon, (*Columba livia*) Himalayan Nut Cracker (*Nucifraga carvocatactes*), Golden Eagle (*Aquila chryaetos*), Himalayan Griffon Vulture (*Gyps himalayensis)*, Grey Tit (*Paras major*) and other smaller birds are also found. Brief description about main species of the sanctuary and their habitat is as under;

1. **Snow Leopard (*Panthera uncia*)**

This animal is of yellow grey colour with dark spots all over the body with long bushy tail. This is the main predator found in the Lippa-Asrang Wildlife Sanctuary up to 5500 Mt. It is nocturnal. It is distinctive in the shortness of its muzzle, high forehead and vertical chin. The spots are unbroken on head and lower parts of the limbs but break up into rosettes on the body. It usually resides above the tree line i.e. 12000 - 13000 feet above sea level. It prays upon Sheep, Goats, Ibex, Blue-Sheep, rodents and is known to follow the movement of grazing herds. Recently its number has been dwindling in wild. There have been instances where snow leopard has attacked domestic animals, causing considerable loss and thereby is in direct conflict with man. It needs urgent attention to protect the species and its habitat. Habitat improvement and protection for its conservation is of utmost importance so as to improve prey base for long-term survival.

2. **Musk Deer (*Moschus moschiferus*)**

Locally this animal is known as “Musbapha”. In the past, it has been hunted for its precious “Musk-Pod”, which in fact an abdominal gland is found only in the male animal. Musk deer holds a place between the deer and the antelope and is regarded as the underdeveloped form of the deer. It is hornless and has a gall bladder. A solitary and secretive animal, it is found between 2900-4000 Mt. elevation in the sanctuary. No systematic and detailed wildlife survey has been carried out for this species in the past. There are few trees in the sanctuary area, necessary for refuge of the animals. However, direct and indirect evidence of the animal in the sanctuary has been reported. It feeds on grass, lichens, leaves and flowers.

3. **Bharal (*Pseudois nayaur*)**

This Himalayan Blue Sheep is seen mostly above 3000 Mt. In structure it holds a place intermediate between sheep and goat. It grazes like sheep on open grassy undulating slopes and like goat can climb to precipitous cliffs, inaccessible mountains when disturbed. It prefers undulating ground and is a splendid climber on

stiff rocky terrain with considerable speed. Between trees and snowline, the Bharal find their food in the occasional patches of coarse grass, moss and dwarf shrubs. It may occur in small group to big flock numbering up to two hundred occasionally.

4. **Ibex (*Capra ibex*)**

This is common animal of the Pin Valley National Park and does crossover to the Sanctuary. The locals call it Kin or Tangrol. An ibex is heavily built sturdy Goat with large horns. It occurs in the higher elevation above the tree line. The Ibex is distributed in the mountain ranges of Central Asia and Western Himalayas. The Himalayan Ibex inhabits the Western Himalayas on both sides of the main Himalayan Range. Its eastern limits are set by the upper reaches of the Satluj River as it does not occur beyond this. The favourable ground of Ibex lies in the higher elevations above the tree-line. In spring, they are found low below the snow-line, grazing early in the morning and again in the evening. Above grazing ground they have the shelter and security of precipitous cliffs and ridges. It is found in herds and is hunted for soft woolly under fur.

5. **Brown Bear (*Ursus arctos*)**

It is heavier built with brown coat as distinct from the Black Bear. The coat is dark rich brown during summer and luxuriant before the onset of winter. It inhabits bare open peaks high above and along the tree-line. During early summer, they graze on newly grown grass and hunt voles and marmots. They also kill Sheep, Goat and Ponies during summer. During fruiting season, it feeds on berries and wild fruits. It hibernates during winter.

6. **Thar (*Hemitragus jemlahicus*):**

These heavily build wild Goat with short curving horns inhabit steep cliffs in the forest terrain. Locally, it is known as Meshi. Thar is found in the most inaccessible grounds in the Himalayas. It inhabits precipitous terrain along towering cliff, rocks and dense scrub. Found in herds, its number in the wild is declining and urgent protection measures are required.

7. Leopard Cat (*Felis bengalensis*)

It is about the size of a domestic cat but rather having longer legs. It looks like a miniature panther. There are four distinct bands running from the crown over the neck. They have a pair of horizontal check strips. It is nocturnal and prays on small birds and animals. Hollows in the tree are its favorite shelter. It preys upon small birds and animals. Instances of its inbreeding with domestic cat have been observed.

8. The Himalayan Weasal (*Mustela sibirica*)

It has been seen several times in thatches all over the sanctuary. It mostly inhabits stonewalls raised by shepherds to protect their Sheep and Goats. These small animals, 60 cms in size are known for inflicting damage on the pheasants. In the Himalayas it lives in temperate and alpine pastures up to 16000 feet showing remarkable adaptability.

7.11.1.8 Socio-economic Analysis

Villagers have right of grazing, fuel-wood collection, timber, minor forest produce collection, etc. Excessive pressure on the natural resources has lead to the degradation of the area in many parts of the sanctuary. Lippa, Asrang and Toktu villages are situated along the lower boundary of the sanctuary. Porang Dogri, a place situated within the sanctuary area, to where people of these villages migrate seasonally. Agriculture and sheep-goat rearing are the main sources of livelihood of the communities in Lippa-Asrang. They usually get only one crop in a year, due to high altitude and harsh winter. They grow barley, wheat and vegetables. The farmers have to make the living out of infertile, shallow and stony land holdings.

At the onset of winter, they move down to lower elevations to sell some of their indigenous items like wool, which add to their source of livelihood. They also grow Kuth, Peas and other vegetables as a cash crop. Chilgoza Pine (*Pinus gerardiana*) seeds are highly valued and add to the economy. The hostile terrain and unfriendly climatic conditions restrict developmental activities and living is generally harsh under these conditions.

7.11.1.9 Financial Outlay

The Wildlife Management, Development and Biodiversity Plan for Lippa-Asrang Wildlife Sanctuary as prepared by the Divisional Forest Officer (Wildlife), Sarahan may be followed. In addition to this eco-development activities in ECO- ZONE may also be taken up to reduce pressure on the Sanctuary. Need based addition alteration may also be addressed and activities modified with approval of competent authority. A lump-sum outlay of **Rs. 50.00 Lakh** has been kept to chip into the Management plan.

7.11.2 Management Initiatives outside Protected Areas

Biotic pressure and habitat destruction are main threats to the wildlife conservation in the sensitive Himalayan region. The domestic animals compete with the dwindling wild population of the Himalayan species in alpine pastures resulting overgrazing. This has been leading to the degradation of these pastures. Biotic pressure coupled with less precipitation and inhospitable terrain, the free migration of the wild species is restricted to the pockets in the Himalayas leading to inbreeding. Rehabilitation of the degraded areas, habitat improvement and corridor protection will also lead to the enrichment of biodiversity of the region.

In view of the guidelines issued by the PCCF, Himachal Pradesh, vide letter dated 12-03-2012 regarding standardization of norms for the wildlife component in the CAT Plan of the HEP, the following sub-components are proposed for implementation in the CAT Plan.

1. Planning

1.1 Planning Perspective, Approach and Objectives

The wildlife activities in the plan area will be planned in order to preserve and conserve the wildlife. The main objective shall be to work with the local communities to reduce/ mitigate their dependencies on natural resources and focus and to work out strategy for co-existence i.e. wildlife and humans. Micro-plan synergies with CBOs/ SHGs need to be evolved. For this purpose an outlay of **Rs. 1.00 Lakh** is kept in the Plan.

2. Implementation

2.1.1 Management and Improvement of Wildlife

The tribal communities of this project area generally occupy the forest fringe region where for a long period in their history, they have lived in isolation but in harmony with the nature. They draw their sustenance largely from the forests for their livelihood. Tribal life is connected one way or the other with the forest & wild life right from birth to death. We can't deny the needs of tribal people who live in harmony with the forests. At the same time, it is essential that there is no adverse impact on the wild life 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 wild life and education of people about the harmonious co-existence with wild life should be given proper importance in managing the forests & wildlife.

The need for conservation, preservation and management of biological diversity arises because of threats to natural terrestrial and aquatic ecosystems due to various anthropogenic activities. In order to achieve these objectives & reduce the pressure on the forests & wild life as also to maintain the ecological balance, the following activities are proposed to be carried out under this CAT Plan.

- The area heavily degraded will be closed with physical barriers and will be planted with bamboo, fruit trees, fruit bearing shrubs or shrubs with fodder values, herbs and grasses depending upon the site to be planted so far as practical.
- Increase biomass production especially on degraded common lands adjoining to villages by planting grass/ broad leaved trees. The species to be planted need to be local and indigenous as exotic species have long term negative impacts on the environment.
- The vegetative measures need to be supported by minor soil conservation works. For this purpose bushes, shrubs & herbs are to be maintained and no grass should be removed from the home range of the wildlife so that habitat of wildlife could be preserved & protected.

- The blank area in the forests in high reaches along ridge should be maintained as pasture land by sowing suitable indigenous grasses for the need of wild herbivores which are prey base for the carnivores. The detailed plantation programme has already been given in the component of Biological Measures, i.e. under Afforestation Scheme to reduce the pressure from the forest area.

A lump sum provision of **Rs. 15.00 Lakh** is kept for this purpose.

2.1.2 Implementation of Developmental and Income Generation Activities

In order to address the better livelihood priorities of the local people and to facilitate the biodiversity conservation of the plan area and management / improvement/ development of wildlife outside the protected area necessary support for income generation programme is proposed.

This includes support for Vermi-compost development. Vermi-composting is one of the alternative source of income and is easy to adopt. It is home based and can bring fast cash returns the communities in an eco-friendly manner. The Forest and Horticulture Departments in Kinnaur district may be the potential buyers for this organic compost. Women CBOs in the area can easily adopt these activities being part-time in addition to their routine working. Other activities, found effective to the area may be adopted. An outlay of **Rs. 5.00 Lakh** is kept for this activity on cost sharing basis.

2.1.3 Vaccination of Domestic Cattle

Common use of water holes/ ponds and grazing areas by the domestic as well as wild live stock in the forests may lead the wild animals to contract diseases common to domestic live stock. Therefore, an effective vaccination programme is recommended for foot and mouth disease in sheep, goats and other cattle adjoining to the Sanctuary areas. The migratory herds need to be vaccinated before they enter the catchment area. The veterinary department needs to be associated for this purpose. The staff should be trained in pathological problems and collection of samples. An amount of **Rs. 5.00 Lakh** has been kept for this purpose during the plan period.

2.1.4 Anti-Poaching Measures

The forest area is required to be guarded against poaching throughout the year. In order to curb the nefarious activities of the poachers, anti-poaching measures like joint patrolling is to be organized by engaging ex-servicemen/ local unemployed youth. Necessary provision to engage locals to keep close eye on the poaching of wildlife in the catchment area as well as in the Lippa-Asrang sanctuary, has been made. These local youth are to be trained to give assistance to field staff and prior information regarding likely poaching in a project/ sanctuary area. A forest guard will have two wild life watchers while going on patrolling in the forests. These wild life watchers are to be engaged seasonally and for a short duration as per need. These wild life watchers will also act as local informers. An amount of **Rs. 5.00 Lakh** is proposed to meet this purpose during the plan period.

2.1.5 Reward/ Incentives to Informers

Lump-sum provision of **Rs. 2.5 Lakh** has been kept for reward and incentives to informers who actively associate with the Forest Department in protecting the forest area against poaching and illicit felling.

2.1.6 Extension Activities for Wildlife Awareness

A provision for formation of street theatre of local community may be effective for protection of wildlife and forest. Bands of 10-12 village youth may perform a play about wildlife and forest conservation with nature based local songs and Nati from village to village. It is therefore essential to make the people, school children aware about the importance for success of wildlife management. Therefore, to protect the wildlife in the catchment area wide publicity through '*Nukkar Natak'*, posters, print and electronic mass media will be arranged. For this purpose lump-sum **Rs. 10.00 Lakh** is proposed and kept in the Plan.

2.1.7 Sign and Slogan Boards

Sign and slogan boards will be displayed in strategic locations which will be written in Hindi language in the form of an appeal to the locals telling about the wildlife conservation and provision of

wildlife protection act, 1972, Indian Forest Act, 1927 and Forest conservation act, 1980. Similarly, all the activities be carried out in the catchment area under the CAT Plan will also be displayed at the respective sites. A lump-sum provision of **Rs. 2.00 Lakh** has been kept in the plan.

2.1.8 Carrying out of Wildlife Census

To maintain plant and animal biodiversity and conserving genetic resources in nature it is essential to establish a viable, healthy and productive population of wildlife. Therefore, it is suggested to carryout wildlife census every third year in the key area of the catchment as well as in the protected area so as to assess the density of the species. This will facilitate better management for their improvement and development. A lump-sum provision of **Rs 6.00 Lakh** has been kept for this purpose.

2.1.9 Support to *Ex-situ* Pheasant Conservation & Breeding Program at Sarahan

Some species are on verge of extinction and for protecting them *ex-situ* efforts are required. A pheasantry, to support conservation and breeding of Western Tragopan, has been established at wildlife division headquarters at Sarahan. There the birds are being bred in captivity for ultimately releasing them in natural habitat for establishing viable populations in the wild. Other rare and endangered species can be taken up for captive conservation and breeding program on priority basis for which funds, in addition to the existing conservation efforts, are proposed under this plan. The Sarahan Pheasantry is being extended at Gopalpur for which necessary provision has been made in the Plan.

The Sarahan Pheasantry was established during the year 1987-88 comprising total area of Pheasantry about 11-12-37 ha. and is located near the Nalati Stadium about half km. from the famous “MAA BHIMAKALI” Temple at Sarahan. It was initially setup as rescue and rehabilitation centre for the Wild Western Himalayan fauna driven from the habitations for food due to snow fall at higher reaches. It was only where the captive breeding of Western red listed Pheasants was added during the year 1990-

91 and construction of enclosure was taken up with special attention to pan, hygiene and feed etc. During the year 1993-94 Sarahan Pheasantry witnessed the first ever breeding of Western Tragopan in captivity in the World. It is the only Sarahan Pheasantry in the World where this rare endangered species kept and bred in captivity under the guidelines of IUCN.

The Hon'ble Chief Minister of Himachal Pradesh has decided in the meeting held on 10.08.2007 that an alternative site for conservation breeding of Western Tragapon at Gopalpur may be setup to avoid any out breaking disease. Therefore, a provision of **Rs 25 Lakh** has been made for this purpose during the plan period and funds will be utilized as per direction of PCCF (Wild Life) cum – Chief Wild Life Warden Himachal Pradesh.

2.2 Help to Resolve Man-Animal Conflict

The communities of this project area largely occupies forestry region where for a long period in their history, 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. Their life is connected one way or the other with forest and wildlife, right from birth to death. We cannot deny the needs of the society as the local people who live in harmony with the forests; environment and ecologically they cannot be disregarded. Mitigation of Wildlife problems in hilly area is very complicated and therefore there is urgent need for development of livelihood approach that can minimize or reduce the man Wildlife conflict to tolerable level.

2.2.1 Compensation against Damage by Wild Life

Man-Wildlife conflict is a result of gradual degradation of natural resources and the most sufferers are poor and marginalized communities living in an around the Forests of the Catchment area. The problems of animal damage whether it is crop depredation, livestock depredation and human causalities are not as alarming as it is prevalent in other parts of the States or elsewhere in the country. The problem of livestock predation and killing by Leopard and Black Bear is gradually escalating. The state government has fixed the compensation rates on account

of damage to animal and human life. Sometimes funds to meet these exigencies are inappropriate. This needs to be strengthened by the CAT Plan allocation to this effect. In addition to this environmental awareness programmes for migratory glaziers need to be developed and disseminated. Concerted efforts by way of education, awareness, research, monitoring, policy, law and governance, habitat restoration and development of essentially needed infrastructure to tackle complex issues pertaining to the man animal conflict are required to be implemented on a priority basis.

Wildlife damages to human life and property is a major cause of alienation of local communities from wildlife conservation. Timely payment of compensation against the depredation of wildlife goes a long way in eliciting local support.

A provision of **Rs. 25 Lak**h is proposed and kept for this purpose during the plan period.

2.2.2 Support to Monkey Sterilization Programme

The wild life wing of HPFD has launched monkey sterilization programme to tackle the 'MONKEY MENACE'. It is proposed to support/ supplement the same under the CAT Plan with a lump-sum provision of **Rs. 30 Lakh.**

2.2.3 Purchase of equipments and medicine for management of wildlife

The rich and unique bio-diversity of catchment area is under tremendous pressures and stress due to ever increasing demographic pressure. Increasing conflicts between Wildlife and local communities is a major factor that leads to antagonism among the people and discourage the forest official to appropriately enforce the existing laws.

The State of Himachal Pradesh has experienced escalation in the human-wildlife conflict in the last one decade. Almost all PAs 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 Beer is 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/agriculture crops and other private properties. The escalation in the human-wild life conflict is an outcome of shrinkage, fragmentation and degradation of habitats. Special field training/ workshop on wildlife damage control with emphasis on use and handling of animal repellants, deterrents, snares, traps, capture devices nets and accessories and power fencing etc. need to be organized. Besides above staff should be well equipped with all necessary capture traps and squeeze cages and immobilizing equipments required for capture and handling of problem of Leopard. The equipment will help in capturing of such animals and release them in their natural habitat or zoo under the provision of Wildlife (P) Act, 1972.

Purchase of equipments like capture cages, traps, immobilizing gun, darts, drug, GPS, Compass and medicines will be required for the management of Wildlife.

The following field equipment and medicine will be purchased:

- Physical capture cages/ traps, immobilizing gun, darts, drugs, animal rescue, translocation/ transportation, capture devices net and accessories etc.
- Field measurement - GPS/ PDA, altimeter, pedometer, compass, Handy cam, Census equipments, Binoculars and spotting scope etc.

Therefore, a lump-sum of **Rs. 35 Lakh** has been made in the Plan to meet this purpose during the Plan period.

2.3 Wildlife Habitat Management

The natural vegetation communities, population of large ungulates, carnivores and pheasants will be maintained and protected in the Plan area.

2.3.1 Protection of Unique Wildlife Habitat

The catchment area seems to have lot of unique wildlife habitats such as gorges and hidden valleys which are houses to many such species like amphibians, reptiles, birds etc. There is need to

identify such unique habitats to protect them from activities like blasting and degradation. This is also true for the nesting site of vultures and gali form etc. (cliffs and ledges). The mapping of such critical and unique area is required to be done and necessary provision to the tune of **Rs. 15 Lakh** for the same has been kept.

3. Training:

Development competence based training programme including monkey and wildlife trapping for the forest staff and local communities, Gun license holder is proposed. For this purpose a lump-sum provision of **Rs. 10.00 Lakh** is made in the Plan.

4. Research and Monitoring

Research will also be required to uplift the socio-economic condition of the local population for harmony between man and nature.

Himalayan biodiversity is not well studied at present and require research efforts to gain information and knowledge on the species found in the Catchment area. Research parameters are to be prioritized to study the habitat preferences of the species found and accordingly devise and apply the management practices. Research and monitoring is an important part of natural resource management. It has become more significant today as more species are being added to the endangered list.

Biodiversity as we move up the Himalayas go down both in richness and numbers considerably. The uniqueness of the area is that it falls in cold desert of trans-Himalayas. Combinations of climatic and edaphic factors strongly influence the biodiversity of the area. Recent study by the HFRI showed that the area supports some of the vanishing floral species. Due to the impact of global warming, the vegetation line, insect biodiversity is going to be altered influencing the distribution and type of wild animals found in the area. The wildlife species such as, Snow Leopard, Blue-Sheep and Ibex could move further up to the higher altitude for which regular monitoring and evaluating trends in the wild population are proposed.

The area falls in the higher Himalayan region and melting of snow is a main source of water in the cold areas. The small water channels spread all over contribute as a water collecting system in the pastures and are also a source of water to the animals. In water-stress areas after proper identification and monitoring, waterholes as per requirement will be built for even utilization of habitat by the wild animals. The Arid Zone Field Research Station to be established under Integrated Kashang Hydroelectric Project CAT Plan, will also cater to the wildlife research operations/ activities in the field.

Research and Monitoring may include the following parameters:

- Habitat analysis viz., food, shelter, availability of water, etc.
- Wildlife census and trends.
- Periodic survey for wild animal diseases.
- Monitoring the cattle influx into the sanctuary.
- Resources evaluation.
- Monitoring and evaluation results to support management intervention in the Sanctuary.
- Survey and study of Griffon Vulture species, i.e. *Gypus himalayensis, Gypus fulvus, Neophron percnopterus, Gypaetus barbatus* (Bearded Vulture or Lammergier) and other high altitude Birds of Prey spp.

A mechanism to monitor and evaluate the objectives proposed under the plan will be established in the beginning for effective implementation. Monitoring wildlife population trends, Non-Timber Forest Produce shall be taken up on priority. An Implementation and monitoring committee is proposed to be constituted for implementation, monitoring and evaluation of the project component under the chairmanship of Chief Conservator of Forests, Rampur Circle with DFO, Kinnaur (Wild Life Warden) as member and DFO Wild Life Sarahan (Wildlife Warden) as Member Secretary. The committee shall have local Panchayat Pradhans, two reputed NGOs with wild life expertise, representatives of Women CBOs and Youth clubs as members. The committee will meet once in each quarter in the sanctuary area.

In order to provide for Research & Monitoring a provision of **Rs. 10 lakh** is proposed.

5. Contingencies and other Interventions

To meet with unforeseen/ new initiatives during the plan period a contingency amount of **10 Lakh** is proposed for management of Wild Life outside the Protected Areas.

7.12 Monitoring and Evaluation

A need is also being felt to put a multi-tier monitoring mechanism to high light the achievements & shortcomings of the impact of catchment area treatment plan in state. Therefore, as per guidelines, a three tier monitoring system has been put in place for effective supervision, guidance & bringing transparency in implementation of CAT PLAN works. Under this system the first two tiers of monitoring will be in house while the third tier would involve connected state Universities & institutions (HPU, UHF Nauni & CSKHPKVV Palampur & IHBT Palampur, HFRI, FSI & in their absent approved and empanelled vendors.

7.12.1 The first tier of monitoring (in-house) would be done by the field functionaries up to the level of CCF Rampur and will be a physical monitoring exercise. The percentage of checking will be the same which is applicable in the Forest department for checking of plantations under the existing system of Mandatory Field Inspections.

The regular in house quarterly monitoring will be conducted/ organized during the plan period in addition to third party monitoring. The Internal Monitoring Committee would be constituted as below:

- Chief Conservator of Forests, Rampur Circle, Chairman.
- DFO Sarahan (Wild Life), Member.
- A.C.F. Kinnaur, Member
- Representative of PRI, Member
- Representative of user agency, Member
- Range Officer Kalpa, Moorang & Pooh, Members
- D.F.O. Kinnaur, Member Secretary

The committee would need to ensure the implementation and monitoring of the catchment area works and review progress from time to time. The implementing agency upon its approval will provide a copy

of the approved APO giving details such as list of areas along with the works to be taken up and their costs to each member of the committee. The committee shall strive to make the monitoring process transparent. Meeting of this committee shall be convened at least thrice in a year or as and when required in emergency with due approval from members and competent authority. All non official members shall be entitled to TA/DA as per rates approved and being followed by D.C. Kinnaur.

7.12.2 The second tier of in- house monitoring would be done by the teams of officers from direction office & shall **serve as mentoring exercise** along with performance monitoring. The teams will be monitoring to the extent of 2% of all the works in the following manners:

- The teams will monitor 1% of the works already monitored & reported.
- The teams will monitor 1% of the works not monitored.
- The teams will inspect the areas in October-November of the following year & submit their reports by 30th November.

7.12.3 Third party monitoring will be a sort of impact monitoring will be carried out through institutions/ entities in the state like the Universities & Forest Research Institutes; in their absence by approved/ empanelled consultants, after calling bids from the qualified consulting firms on the ToR, duly approved by the H.P. Forest Department. The indicator for monitoring impact of the CAT Plan will include:-

- Change in silt load
- Survival of plantations
- Changes in the water discharge in natural springs
- Change in land use (private holdings)
- Changes in man animal conflicts
- Status & functioning of User groups
- Trend of fire incidences in vulnerable areas.

The results of all the three types of monitoring processes/ exercises will be placed/ posted on the website of the department to share them with the public and user agencies.

All the expenditure incurred on this shall be met from this head of Monitoring and Evaluation. 6% of the cost of CAT Plan has been kept reserved for this purpose. Therefore, an outlay for **Rs. 76 Lakh** is proposed to be incurred under the scheme during the plan period.

7.13 Site Specific Micro Planning

In the CAT Plan, activities are component wise and area specific. Further site specific Micro Planning will be required at the time of execution of CAT Plan in close consultation/ involvement of JFMCs. Moreover, if certain new techniques/ innovations occur in due course of time, these can be taken up as per requirement of site and particular location. The site specific micro plans will be prepared to address specific natural resource base livelihood needs of the local communities. The emphasis will be laid on strengthening of the natural resource base of the area by promoting indigenous flora. Micro- level disaster mitigating measures will be identified and promoted under this activity. Therefore an outlay amounting to **Rs. 85 Lakh** is proposed for this purpose during the plan period.

7.14 Contingencies:

The outlay for the various components has been worked out on the prevalent wage rate of Rs. 130/- with 25% increase for tribal area & market rates of the materials prevailing as of today i.e. July, 2012. Since the CAT Plan is to be implemented over a period of eleven years, hence to absorb any future escalation and to make for any unforeseen situation/ activities beyond plan proposals, 5% contingencies have been provided under this component. A provision of **Rs. 175 Lakh** has been kept for the purpose.

As per report of Himachal Pradesh Krishi Vishva Vidyalaya, (CSK HPKV) Palampur, the catchment area of Satluj basin above Wangtoo has been divided into sub catchments. There are 24 sub catchments in all with only one sub catchment i.e. SC No.19 falling in the jurisdiction of Spiti Sub Division of Distt. Lahaul & Spiti and the remaining 23 SCs in district Kinnaur. It is given in Figure 1.1 of Chapter of this document. The catchment area of Shongtong-Karchham HEP falls under sub catchment No. 11,13,14,15,16,17 &18 on right bank and sub catchment No 24 (part), 23, 22, 21 & 20 on the right bank of river Satluj. The brief description of all the Sub-Catchments falling under this CAT Plan is given here as under:

8.1 Sub Catchment No. 11

The sub catchment is situated between Latitude 31^0 32', to 31^0 35' and Longitude 78^0 11' to 78^0 17'. The Sub-Catchment area is bound by Peo-Kalpa-Burcha Dogri & Rakchora-Ridge running down to Satluj from Talangi/ Bokto PF.

Figure 8.1: A Panoramic View of Sub-Catchment No. 11

The total area of this Sub Catchment is 2300 ha.. The altitude varies from 1900 Mt. to 5090 Mt. and the slope varies from about 40^0 to 85^0. The Soil texture is Sandy Loam. The other details of Sub-Catchment are given in **Tables 8.1 to 8.4.**

Table 8.1: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Kalpa	Kalpa	Kalpa/ Reckong-Peo	Kalpa	Kalpa & Khawangi

Table 8.2: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture) (in ha.)	Waste land (in ha.)	Other land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
328	402	385	1185	2300	1395	6533	3104

Table 8.3: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Spruce, Walnut, Kunish, Chilgoza, Poplus etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigofera, Berbaris, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Nepeta, Lonicera, Deutizia* etc.	Ratanjot, Guchhi, Kala Zira, *Diascoria* etc.

Table 8.4: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & Others Small Mammals	Chakor & Other Birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchments still require treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.5: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakh)
I	**Biological Measure**			
(A)	Nursery Development			
1		Reckong-Peo Nursery	1 No.	5.50
2		Kalpa Nursery	1 No.	6.00
		Total	**2 Nos.**	**11.50**
(B)	Normal Afforestation	Nil	-	
(C)	Enrichment Plantation			
1		C-242	6 Ha.	
2		C-239	8 Ha.	
3		C-243	6 Ha.	
4		C-240(B)	8 Ha.	
5		C-237	10 Ha.	
6		C-241	8 Ha.	
		Total	**46 Ha.**	**17.50**
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	As given in Chapter-7	**5 Nos.**	**87.00**
(B)	Nalla stabilization	Gonang Nalla	1 No.	**10.00**
(C)	River Bank	Nil	-	-
(D)	Snow & avalanche	Nil	-	-
(E)	Van Sarovar	Kalpa Range	1 No.	**8.00**
III	**Infrastructure Build-Up & Forest Protection**			
(A)	**Buildings**	As given in Chapter-7	9 Nos.	**88.00**
(B)	**Paths**	Repair/ maintenance of I/ Path from C-243 to C-244**-**	**-**	**-**
		Total	3.5 kms	**3.50**
		Grand Total		**225.50**

8.2 Brief Description of Sub Catchment No. 13

The sub-catchment is situated between Latitude 31^0 32', to 31^0 38' and Longitude 78^0 11' to 78^0 19'. The sub catchment is bound by Boktu - Talangi PF & ridge running from Rachora-Pangso Sakarishul glacier down to Satluj at the confluence of Kashang Khad with Satluj River. The total area of this Sub Catchment is 6200 ha. The Altitude varies from 1960 Mt. to 5237 Mt. and the slope varies from about 40^0 to 85^0. The Soil texture is Sandy Loam.

Figure 8.2: A Panoramic View of Sub-Catchment No. 13

The administrative units covered under this sub-catchment are as under:

Table 8.6: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Kalpa	Kalpa	Pangi		Pangi

Table 8.7: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture)	Wasteland (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
724	86	1382	4008	6200	572	2069	3562

Table 8.8: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Fir, Kail, Deodar, Walnut, Kunish, Chilgoza, Poplus etc.	*Rosa , Rubus, Cotoneaster, Desomodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigo Fera, Berbaris, Daphne, Lonicera, Spiraea, Artimesia, Lonicera, Deutizia, Nepeta* etc.	Ratanjot, Guchhi, Kala Zira, Diascoria, etc.

Table 8.9: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.10: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development			
1.		Pangi Nursery	1 No.	**4.50**
(B)	Normal Afforestation			
1.		C-240	6 Ha.	5.67
2.		C-235	6 Ha.	2.72
		Total	12 Ha.	**8.39**
(C)	Enrichment Plantation	-	-	-

II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	-	-	-
(B)	Nalla stabilization	Meber Nalla	1 No.	**15.00**
(C)	River Bank	-	-	-
(D)	Snow & avalanche	-	-	-
(E)	Van Sarovar	-	-	-
III	**Infrastructure Build-Up & Forest Protection**			
	Buildings	As given in Chapter-7	1 No.	**1.00**
IV	**Paths**	Repair/ maintenance of I/ Path from C-238 to Pangi Nalla	8 Kms	**4.50**
	Grand Total			**33.39**

8.3 Brief Description of Sub Catchment No. 14

The sub catchment is situated in between Latitude 31^0 36' to 31^0 42' and Longitude 78^0 19' to 78^0 08'. The catchment area is bound in between Boktu-Telangi PF extending from Rakchora-Pangso Kranti glacier & further running down to the confluence of river Satluj with Kashang Khad. Total area of this Sub Catchment 12700 ha. The Altitude varies from 2010 Mt. to 5806 Mt. and slope between 40^0 to 85^0. The Soil texture is Loam/ Sandy loam.

Figure 8.3: A Panoramic View of Sub-Catchment No. 14

The administrative units covered under this sub catchment are as under:

Table 8.11: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Kalpa (Part) & Moorang	Kalpa & Jangi	Pangi (Part) & Rarang	Kalpa (Part) & Pooh	Pangi & Rarang

Table 8.12: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture)	Wasteland (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
217	18	408	12057	12700	4		

Table 8.13: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Fir, Kail, Deodar, Walnut, Kunish, Chilgoza, Poplus etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigo Fera, Berbaris, Daphne, Lonicera, Spiraea, Artimesia, Lonicera, Deutizia, Nepeta* etc.	Ratanjot, Guchhi, Kala Zira, Diascoria, etc.

Table 8.14: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Kashang HEPs CAT Plans. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.15: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	-	-	-
(B)	Normal Afforestation	-	-	-
(C)	Enrichment Plantation	-	-	-
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	C-232	Kashang Slip	**5.50**
(B)	Nalla stabilization	-	-	-
(C)	River Bank	-	-	-
(D)	Snow & avalanche	-	-	-
(E)	Van Sarovar	-	-	-
III	**Infrastructure Build-Up & Forest Protection**		-	-
(A)	**Buildings**		-	-
(B)	**Paths**	Repair/ maintenance of I/ Path from Pangi to Asrang	5 Kms	**5.00**
		Grand Total		**10.50**

8.4 Brief Description of Sub-Catchment No. 15

The total area of this Sub Catchment is 4400 ha. and is situated between Latitude 31'34, to 31'39' and Longitude 78'18' to78’ 27’ The catchment area is bounded by Satluj at confluence of Kashang Khad near Thopan – Talchiku - Urang Laridge downward to Jangi PF & down to Satluj in front of Tidong Khad. The Altitude varies from 2225 m to 4365 m and the slope is about 40^0 to 85^0. The Soil texture is Sandy Loam.

Figure 8.4: A Panoramic View of Sub-Catchment No. 15

The administrative units covered under this sub catchment are as under

Table 8.16: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Moorang	Jangi	Rarang	Pooh	Rarang

Table 8.17: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture)	Wasteland (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
1302	169	912	2017	4400	334	2367	2742

Table 8.18: Details of Flora found in the Sub-Catchment

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Poplus, *Fraxinus xanthoxyloides, Juniperous Communis*, etc.	*Rosa, Rubus Orientale, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigo Fera, Berbaris, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Deutizia, Nepeta, Ephedra Gerardiana* etc.	Ratanjot, Guchhi, Kala Zira, Diascoria etc.

Table 8.19: Details of Fauna found in the Sub-Catchment

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.20: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	-	-	-
(B)	Normal Afforestation	UF Chenglen	5 Ha.	**4.73**
(C)	Enrichment Plantation	Dunang	5 Ha.	**4.29**
II	**Soil & Moisture Conservation**			**-**
(A)	Landslides & slips	Gurchenden Slip	1 No.	**10.00**
(B)	Nalla stabilization	As given in Chapter-7		**35.50**
(C)	River bank	-	-	-
(D)	Snow & avalanche	-	-	-
(E)	Van Sarovar	-	-	-
III	**Infrastructure Build-Up & Forest Protection**			-
	Buildings	Construction of Outhouse at Akpa		**7.50**
IV	**Paths**	Repair/ maintenance of I/ Path from Pangi to Asrang	5 Kms	**5.00**
		Grand Total		**67.01**

Previously this sub catchment has been treated under Karchham – Wangtoo HEP CAT Plan. However, the sub catchment still requires treatment and after carrying out the detailed field survey, works are proposed for stabilization of sub catchment under the component mentioned under Chapter–7. The component and area wise detail is given as under:

8.5 Brief Description of Sub Catchment No. 16

The total area of this Sub Catchment is 51800 ha. and is situated between Latitudes 31^0 35' to 31^0 52' and Longitudes 78^0 04' to 78^0 27'. The sub catchment is bound by ridge in front of Tidong Khad-Jangi PF-Urang La-Talchiku-Khyore Hawe-Nibling ridge towards Larba way pass- Sutigarang way ridge towards Temcho down to Babar Dogri-Satluj at confluence of Kirang Khad. The Altitude varies from 2225 Mt. to 5848 Mt. and the slope is about 35^0 to 90^0. Soil texture is Sandy Loam.

Figure 8.5: A Panoramic View of Sub-Catchment No. 16

The administrative units covered under this sub catchment are as under:

Table 8.21: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Moorang	Jangi	Jangi & Lippa	Pooh	Asrang, Jangi & Lippa

Table 8.22: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture) (in ha.)	Wasteland (in ha.)	Other Land (in Ha.)	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
1234	553	2558	47455	51800	541	3019	5589

Table 8.23: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	*Fraxinus, xanthoxyloides*, Kail, Deodar, Walnut, Kunish, Chilgoza, Juniperous, Poplus etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigofera, Berbaris, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Deutizia, Thymus, Caragna, Nepeta, Ephedra gerardiana* etc.	Ratanjot, Guchhi, Kala Zira, Diascoria, Karoo, Patish, Bankasha, Jangli Onion, Saxiferga, Chukri etc.

Table 8.24: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black bear, leopard, bharal & others small mammal	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.25: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	Lippa Nursery	1 No.	**5.00**
(B)	Normal Afforestation	-	-	
(C)	Enrichment Plantation	C-218	3 Ha.	**2.57**
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	-	-	
(B)	Nalla stabilization	As given in Chapter-7	4 Nos.	48.00
(C)	River bank	-	-	
(D)	Snow & avalanche	As given in Chapter-7	1 Nos.	25.00
(E)	Van Sarovar	Moorang Range	1 No.	8.00
III	**Infrastructure Build-Up & Forest Protection**			
	Buildings			
IV	**Paths**	Repair/ maintenance of I/ Path from Pangi to Asrang (Part)	5 Kms	**10.00**
	Grand Total			**98.57**

8.6 Brief Description of Sub Catchment No. 17

The total area of this Sub Catchment is 6100 ha. It is situated between Latitudes 31^0 37' to 31^0 44' and Longitudes 78^0 23' to 78^0 32'. The sub catchment area is bound by Satluj at confluence of Kirang Khad-Ridge upward Babar Dogri-Thimcho-Runangway-Ridge running down to Satluj at confluence of Chhiaso (Ropa) Khad. The Altitude varies from 2300 Mt. to 5092 Mt. and slope is from 40^0 to 90^0. The Soil texture is Clay Loam/ Dry & Gritty.

Figure 8.6: A Panoramic View of Sub-Catchment No. 17

The administrative units covered under this sub catchments are as under:

Table 8.26: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Pooh	Kanam	Kanam	Pooh	Spillo, Kanam and Labrang

Table 8.27: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture) (in ha.)	Wasteland (in ha.)	Other Land (in Ha.)	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
394	329	1758	3619	6100	470	2718	4138

Table 8.28: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Juniperous, Poplus, *Fraxinus xanthoxyloides* etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Caragana, Ephedra, Nepeta, Thalictrum, Plectranthus, Salvia, Indigofera, Berbaris, Daphne, Lonicera, Astralagus, Juniperus Communis, Spiraea, Artimesia, Deutizia, Thymus, Balsom, Seabuckthorn*, etc.	Ratanjot, Guchhi, Kala Zira, Diascoria etc.

Table 8.29: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & other small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.30: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	Kanam	1 No.	**4.00**
(B)	Normal Afforestation	-	-	
(C)	Enrichment Plantation	C-212	5 Ha.	**4.29**
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	As given in Chapter-7	4 Nos.	**46.00**
(B)	Nalla stabilization	As given in Chapter-7	3 Nos.	**31.00**
(C)	River Bank	As given in Chapter-7	1 No.	**30.00**
(D)	Snow & avalanche	As given in Chapter-7	4 Nos.	**45.00**
(E)	Van Sarovar			

III	**Infrastructure Build-Up & Forest Protection**			
(A)	**Buildings**		1 No.	**1.00**
(B)	**Paths**			
		Grand Total		**161.29**

8.7 Brief Description of Sub Catchment No. 18

The total area of this Sub Catchment is 66400 ha. The sub-catchment area is bound by Satluj at confluence of Siasoo Khad -ridge upward Runangway-Tamcho-complete catchment boundary of Siasoo Khad-ridge at top of Pooh area-Ridge down to Satluj opposite Khab.

Figure 8.7: A Panoramic View of Sub-Catchment No.18

The Altitude varies from 2365 Mt. to 5905 Mt. and the slope varies from 40^0 to 85^0. The Soil texture is Sandy Loam/ Dry. The administrative units covered under this sub catchment are as under:

Table 8.31: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Pooh	Pooh & Kanam	Pooh, Sunam & Giabang	Pooh	Pooh, Ropa, Giabang & Sunam

Table 8.32: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture) (in ha.)	Wasteland (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
693	514	15580	49613	66400	706	2940	14956

Table 8.33: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Juniperous, Poplus, Seabuckthorn, etc.	*Rosa cebbiana, Verbascum, Inula, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigo Fera, Berbaris, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Caragana, Ephedra, Nepeta, Deutizia, Thymus, Balsom, Seabuckthorn, Arundo donax, Agrophron Longearistatum, Agrostis, Alba* etc.	Ratanjot, Guchhi, Kala Zira etc.

Table 8.34: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Bear, Leopard, Bharal, & others small mammals	Chakur & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.35: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	Dubling Nursery	1 No.	2.50
(B)	Normal Afforestation	As given in Chapter-7	13 Ha.	12.29
(C)	Enrichment Plantation	-	-	
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	As given in Chapter-7	6 Nos.	86.00
(B)	Nalla stabilization	As given in Chapter-7	4 Nos.	45.00
(C)	River Bank	-	-	
(D)	Snow & avalanche	As given in Chapter-7	2 Nos.	70.00
(E)	Van Sarovar	Pooh Range	1 No.	9.00
III	**Infrastructure Build-Up & Forest Protection**			
	Buildings	As given in Chapter-7	2 Nos.	**5.50**
IV	**Paths**	-	-	
		Grand Total		**230.29**

8.8 Brief Description of Sub Catchment No. 20

The total area of this Sub-Catchment is 30900 ha. The sub catchment area is bound by Khab-Tashigang top ridge-catchment of Satluj towards Shipkila-Jaskar mountain - Top Ridge running towards Gangtang, La-Gangcha-Lamchichi-Leychichi-Gyanrbuk-Bablu-down to Satluj at confluence of Tagla (Nesang) Khad.

Figure 8.8: A panoramic view of Sub-Catchment No. 20

The Altitude varies from 2534 Mt. to 5905 Mt. and the slope varies from about 30^0 to 90^0. The Soil texture Sandy-Loam & Calcarious. The administrative units covered under this sub catchments are as under:

Table 8.36: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Pooh	Pooh	Dubling & Namgia	Pooh	Pooh & Namgia

Table 8.37: Land Use and Demographical Features

DPF	UPF	Private Land (Agriculture & Horticulture) (in ha.)	Wasteland (in ha.)	Other Land (In Ha.)	Total (in ha.)	No. of House-hold (in No.)	Human Population (in No.)	Livestock Population (in No.)
69	130	147	17223	13331	30900	199	1183	1447

Table 8.38: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Juniperous, Fraxinus etc.	*Rosa , Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigofera, Berberis, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Caragana, Ephedra, Colutea, Thymus, Seabuckthorn* etc.	Ratanjot, Kala Zira, Diascoria etc.

Table 8.39: Details of Fauna Found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.40: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	-	-	-
(B)	Normal Afforestation	-	-	-
(C)	Enrichment Plantation	-	-	-
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	As given in Chapter-7	2 Nos.	17.00
(B)	Nalla stabilization	As given in Chapter-7	9 Nos.	108.00
(C)	River Bank	-	-	-
(D)	Snow & avalanche	-	-	-
(E)	Van Sarovar	-	-	-
III	**Infrastructure Build-Up & Forest Protection**			
	Buildings	-	-	-
IV	**Paths**	-	-	-
	Grand Total			**125.00**

8.9 Brief Description of Sub Catchment No. 21

The total area of this Sub Catchment is 40200 ha. It is situated between Latitudes 31^0 31' to 31^0 41' and Longitudes 78^0 25' to 78^0 58'. The sub-catchment is bound by Satluj at confluence of Tagla (Nesang) khad- Bablu- Gyanrbuk- Leychichi- Lenchichi- Gangchho- Gangtang La-Top ridge of Nesang Khad running via Sesarang-Gramong-Shurangmang-down to Satluj in front of Srimatti Dhank.

Figure 8.9: A Panoramic View of Sub-Catchment No. 21

The Altitudes vary from 2259 Mt. to 6095 Mt. and the slope varies from about 45^0 to 90^0. The Soil texture Clay-Loam/ Shallow. The administrative units covered under this sub catchments are as under:

Table 8.41: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Moorang	Ribba	Moorang	Pooh	Nesang

Table 8.42: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture) (in ha.)	Wastel and (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
442	85	680	38993	40200	122	640	2805

Table 8.43: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Juniperous, Poplus, *Fraxinus xanthoxylum* etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigo Fera, Berbaris, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Thymus*, Seabuckthorn, etc.	Ratanjot, Kala Zira etc.

Table 8.44: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Snow Leopard, Bharal, & others small mammals	Chakur & other birds

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.45: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	-	-	
(B)	Normal Afforestation	UF Nesang (Somthane)	5 Ha.	**4.73**
(C)	Enrichment Plantation	-	-	
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	-	-	
(B)	Nalla stabilization	As given in Chapter-7	6 No.	**54.00**
(C)	River Bank	-	-	
(D)	Snow & avalanche	-	-	
(E)	Van Sarovar			
III	**Infrastructure Build-Up & Forest Protection**			
(A)	**Buildings**	-	-	
(B)	**Paths**	-	-	
	Grand Total			**58.73**

8.10 Brief Description of Sub Catchment No. 22

The total area of this Sub Catchment is 80500 ha. It is situated between Latitudes 31^0 20' 38" and Longitudes 78^0 24' 60". The sub- catchment is bound by the Ridge in front of Srimati Dhank-Shurangmang-Gramang-Sesarang-Top ridge of Tidong Khad-Shimang pass-Khimokul La-Ridge running towards Mangsu La-Charang Ghati-Daboling-Jorkandan-down to Satlej at confluence of Tidong near Rispa.

Figure 8.10: A Panoramic View of Sub-Catchment No. 22

The Altitudes vary from 2225 Mt. to 6465 Mt. and the slope varies from about 40^0 to 85^0. The Soil texture is Loam to Clay-Loam. The administrative units covered under this sub catchment are as under:

Table 8.46: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Mooang	Ribba	Moorang	Pooh	Moorang, Thangi & Kunu Charang

Table 8.47: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture)	Wasteland (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
	-	-		80500	651	3010	3504

Table 8.48: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Juniperous, Betula, Poplus etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Plectranthus, Salvia, Indigo Fera, Berberis, Daphne, Lonicera, Viburnum, Juniperus Communis, Caragena, Spiraea, Fraxinus xanthoxyloides, Artimesia, Lonicera, Deutizia, Thymus* etc.	Ratanjot, Guchhi, Kala Zira, Diascoria Etc.

Table 8.49: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Tidong HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However,

component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.50: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	Moorang Nursery	1 No.	2.00
(B)	Normal Afforestation	-	-	
(C)	Enrichment Plantation	-	-	
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	-	-	
(B)	Nalla stabilization		8 Nos.	129.00
(C)	River bank	-	-	
(D)	Snow & avalanche	-	-	
(E)	Van Sarovar	-	-	
III	**Infrastructure Build-Up & Forest Protection**			
(A)	**Buildings**	-	-	
(B)	**Paths**	Holdo to Tidong (Part)	4 Kms	2.00
	Grand Total			**133.00**

8.11 Brief Description of Sub Catchment No. 23:

The total area of this Sub Catchment is 8600 ha. The sub catchment area is bounded by river Satluj in confluence of Tidong Khad near Rispa-Ridge running upwards to Jarkandon-Kailash-Jastangrang-downwards to Satluj in front of Kashang Khad. The Altitude varies from 2105 Mt. to 5712 Mt. and the slope varies from about 30^0 to 85^0. The Soil texture is Loam/ Clay Loam.

Figure 8.11: A panoramic view of Sub-Catchment No. 23

The administrative units covered under this sub catchment are as under:

Table 8.51: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Moorang	Ribba	Ribba, Rispa	Pooh	Ribba, Rispa

Table 8.52: Land Use and Demographical Features

DPF (in ha.)	Private Land (Agriculture & Horticulture) (in ha.)	Wasteland (in ha.)	Other Land	Total (in ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
1374	205	2615	4406	8600	500	2878	3820

Table 8.53: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Kail, Deodar, Walnut, Kunish, Chilgoza, Poplus etc.	*Rosa, Rubus, Cotoneaster, Desmodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigo, Fera, Berbaris, Daphne, Lonicera, Caragana, Artemesia, Nepeta, Dianthus, Spiraea, Artimesia, Deutizia, Thymus, Balsom*, Seabuckthorn etc.	Ratanjot, Guchhi, Kala Zira, Diascoria etc.

Table 8.54: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.55: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development	Ribba Nursery	1 No.	4.00
(B)	Normal Afforestation	C-188	5 Ha.	4.73
(C)	Enrichment Plantation	C-181	2 Ha.	1.71
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	-	-	
(B)	Nalla stabilization	As given in Chapter	8 Nos.	103.00
(C)	River Bank	As given in Chapter	1 Nos.	20.00
(D)	Snow & avalanche	As given in Chapter-7	8 Nos.	88.00
(E)	Van Sarovar			
III	**Infrastructure Build-Up & Forest Protection**			
(A)	**Buildings**	As given in Chapter-7	3 Nos.	2.75
(B)	**Paths**	Holdo to Tidong	3 Kms	2.00
	Grand Total			**226.19**

8.12 Brief Description of Sub Catchment No. 24

The total area of this Sub Catchment is 17800 ha. It is situated between Latitudes 31^0 11' to 31^0 26' and Longitudes 78^0 27' to 78^0 36'. The sub catchment area is bound by Ridge in front of Kashang Khad-upwards Jostonggarang-Kailash-Jorkandan-Top Ridge of Tangling Khad-downward to Raldang-Baldharang-Harang Ghati & downwards to Satlej at confluence of Baspa river. The Altitudes varies from 1720 Mt. to 6473 Mt. and the slope varies from about 40^0 to 85^0. The Soil texture Loam/ sandy loam.

Figure 8.12: A Panoramic View of Sub-Catchment No. 24

The administrative units covered under this sub catchment are as under:

Table 8.56: Administrative Units Covered under the Sub-Catchment

Forest Division	Forest Range	Forest Block	Forest Beats	Name of Development Block	Name of the Panchayats
Kinnaur	Kalpa & Part of Kilba	Shongtong & Part of Karchham	Purbani, Tangaling, Barang & Ralli	Kalpa (Part) & Pooh (Part)	Purbani, Powari, Tangaling, Barang & Mebar Ralli

Table 8.57: Land Use and Demographical Features

DPF (in Ha.)	Private Land (Agriculture & Horticulture)	Waste land (in Ha.)	Other Land	Total (in Ha.)	No. of Household (in No.)	Human Population (in No.)	Livestock Population (in No.)
-	-	-	-	17800	671	3661	2143

Table 8.58: Details of Flora found in the Sub-Catchment:

Sl. No.	Trees	Shrubs & Herbs	Medicinal Herbs
1.	Fir, Spruce, Kail, Deodar, Walnut, Kunish, Chilgoza, Poplus, Quercus Ilex, Bird Cherry, Alders, *Juniperous, recurva*, Salix etc.	*Rosa, Rubus, Cotoneaster, Desdomodium, Viola, Polygonum, Frageria, Thalictrum, Plectranthus, Salvia, Indigofera, Berbaris, Daphne, Lonicera, Juniperus Communis, Spiraea, Artimesia, Deutizia, Viburnum, Geranium, Nepta, Astralagus, Gnaphalium, Caragana, Aaron's Rod, Thymus, Balsom, Seabuckthorn* etc.	Ratanjot, Guchhi, Kala Zira, Diascoria, Dhoop, Karu, Patish, Chukri, Chora, etc.

Table 8.59: Details of Fauna found in the Sub-Catchment:

Sl. No.	Animals	Birds / Pheasants
1.	Black Bear, Leopard, Bharal, & others small mammals	Chakor & other birds etc.

During the past, this sub-catchment has been treated under different Departmental Schemes and also under Karchham-Wangtu HEP CAT Plan. However, the sub-catchment still requires treatment. After carrying out the detailed field survey/ reconnaissance of the sub-catchment, the following areas are proposed and identified for treatment under different components. The area/ site-wise brief description of works to be undertaken has been described under Chapter-7. However, component-wise list of areas identified in this Sub-Catchment is appended as under:

Table 8.60: Component-wise list of areas identified in the Sub-Catchment

Sl. No.	Name of Component	Name of Area	No./ Area (Ha.)	Approximate Amount (In Lakhs)
I	**Biological Measure**			
(A)	Nursery Development			
1		Purbani	1 No.	**3.50**
2		Shongtong	1 No.	**6.00**
(B)	Normal Afforestation	-	-	-
(C)	Enrichment Plantation	-	-	-
1		C-184	5 Ha.	1.90
2		UF-Purbani	5 Ha.	1.90
3		UF-Kibber	5 Ha.	1.90
4		C-179	6 Ha.	2.28
5		C-180	4 Ha.	1.52
		Total	**25 Ha.**	**9.51**
II	**Soil & Moisture Conservation**			
(A)	Landslides & slips	-	1 No-	**8.00**
(B)	Nalla stabilization	As given in Chapter-7	6 Nos.	**36.00**
(C)	River Bank	-	-	0
(D)	Snow & avalanche	-	-	0
(E)	Van Sarovar	-	-	0
III	**Infrastructure Build-Up & Forest Protection**			0
(A)	**Buildings**	As given in Chapter-7	6 Nos.	**16.00**
(B)	**Paths**			
1		Kibbar Kanda to Tangling, Purbani and Ribba	10 Kms	6.50
2		Powari to Talampi	3 Kms	1.25
3		Talampi to Kinner Kailash	8 Kms	9.00
		Total		**16.75**
		Grand Total		**95.76**

An abstract of all these activities in various catchments is given in Table 8.61 Below:

Table 8.61 – Table showing abstract of Activities in various Sub-Catchments under the CAT Plan

Abstract of Expenditure in Various Catchments as per Identified Activities in the Tables (Rs. in Lakh)																					
Catchment No.	Nursery Development		Normal Planting		Enrichment Planting		Slip Treatment		Nalla Treatment		River Bank Treatment		Avalanche Control		Buildings		Paths		Van Sarovar		Total Amount
	No	Amt	Ha.	Amt	Ha.	Amt	No	Amt	No	Amt	No	Amt	No	Amt	No	Amt	No	Amt	No	Amt	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
11	2	11.50			46	17.50	5	87.00	1	10.00					9	88.00	1	3.50	1	8.00	**225.50**
13	1	4.50	12	8.39					1	15.00					1	1.00	1	4.50			**33.39**
14							1	5.50									1	5.00			**10.50**
15			5	4.73	5	4.29	1	10.00	7	35.50					1	7.50	1	5.00			**67.01**
16	1	5.00			3	2.57			4	48.00			1	25.00			1	10.00	1	8.00	**98.57**
17	1	4.00			5	4.29	4	46.00	3	31.00	1	30.00	4	45.00	1	1.00					**161.29**
18	1	2.50	13	12.29			6	86.00	4	45.00			2	70.00	2	5.50			1	9.00	**230.29**
20							2	17.00	9	108.00											**125.00**
21			5	4.73					6	54.00											**58.73**
22	1	2.00							8	129.00							1	2.00			**133.00**
23	1	4.00	5	4.73	2	1.71			8	103.00	1	20.00	8	88.00	3	2.75	1	2.00			**226.19**
24	2	9.50			25	9.51	1	8.00	6	36.00					6	16.00	3	16.75			**95.76**
Total	**10**	**43.00**	**40**	**34.85**	**86**	**39.87**	**20**	**259.50**	**57**	**614.50**	**2**	**50.00**	**15**	**228.00**	**23**	**121.75**	**10**	**48.75**	**3**	**25.00**	**1465.22**

Besides above activities as specific to sub-catchments there are common activities under Wild Life Management, Conservation and Development of Chilgoza Pine, PES, M&E, Micro-planning, contingencies etc. which will be available to each sub-catchment.

9.1 Site Conditions

The physiography of the plan area is rather tough and gradient steep. The soil is mostly calcareous, sandy to sandy-loam with fragile strata. Therefore, the problem of landslides/ slips and incidence of erosion is quite high, particularly where the land is not properly terraced. Regeneration is scanty and plant growth is retarded due to lack of moisture and assured irrigation. The alpine pastures are degraded.

9.2 Species

The choice of species depends upon the climatic and edaphic factors and requirement of the communities. A list of the species that supports the area is given in the following Table.

Table 9.1: List of species suggested for plantation

Sl. No.	Name of the Species		Value
	Local	Scientific	
1.	Deodar	*Cedrus deodara*	Timber
2.	Kail	*Pinus wallichiana*	Timber
3.	Chilgoza	*Pinus gerardiana*	Edible Fruit/ Fuel-wood
4.	Rai	*Picea smithiana*	Timber
5.	Tosh	*Abies pindrow*	Timber
6.	Kosh	*Alnus nitida*	Nitrogen fixing/ soil binder
7.	Bhoj-Patra	*Betula utilis*	Bark used as paper for writing religious text and is regarded as Sacred tree. It is also utilized by the locals for thatching of roof.
8.	Sharu	*Cupressus sempervirens*	Timber/ ornamental plant
9.	Ash	*Fraxinus xanthoxyloides*	Fuel-wood and soil binder
10.	Robinia	*Robinia pseudacacia*	Fuel-wood and fodder
11.	Poplar	*Populus ciliata*	Fuel-wood and timber
12.	Chuli	*Prunus armeniaca*	Edible and medicinal
13.	Beuns	*Salix alba*	Fuel-wood and soil binder
14.	Bray	*Quercus ilex*	Fuel-wood and fodder
15.	Akhrot	*Juglens regia*	Furniture, timber, dye
16.	Google Dhoop	*Juniperus macropoda*	Dhoop

9.3 Afforestation

In the forests, where the stocking and density is poor and in blank areas, rehabilitation will be carried out through afforestation and enrichment planting with sturdy nursery raised seedlings in polythene bags only. The Chilgoza plantations will be established on suitable sites. Its natural regeneration has been a problem as there remains hardly any seed due to ruthless extraction of Chilgoza cones by communities as per their rights. A Project for **'Conservation and Development of Chilgoza Pine'** has been incorporated within this CAT Plan to address this issue.

To address the issue of high incidence grazing, all the plantations need to be fenced. The fencing needs to be supplemented with live hedge of local species. Provision for irrigated through alkathene pipes and by Kuhl has been made in the work schedule with maintenance for five years.

9.4 Soil Conservation

It is proposed to adopt various engineering and suitable biological interventions for preventing the soil erosion in the nallas, river banks, landslides/ slips, etc. The details of interventions required for the treatment of these nallas/ slips has been given against each. However, in general, the following measures shall be applied.

i) Construction of masonry check-walls/ gabion check-dams in mixture with vegetative measures.
ii) Planting of bio-engineering species on level portions above civil structures, wherever required/ feasible to provide stability.
iii) Broadcasting of suitable seeds of indigenous species found in the plan area in slips with other measures.
iv) Planting of grasses, shrubs, fast growing, other soil binding species, etc.
v) Erection of live-hedge vegetative spurs where the flow of water is slow and not torrential.
vi) The bio-species selected need to be locally available for that zone.
vii) The cuttings/ rooted plants need to be used during winter months and sodding done during summer season.
viii) Exposed areas need is to be protected by sowing and covering with straw in combination with jute mats and wire mesh.

In brief the main Criteria for choice of species need to be:

- Natural plant species of the locality.
- Easy availability.
- Easy propagation.
- High tolerance for refractory soil conditions.
- Non-palatable or less grazed/ browsed species.
- Soil binder species like, Salix, Alnus, Ailanthus, Nirgal, Kashmal, Bekhal, Seabuckthorn, Rosa & Rubus spp., etc.

9.5 Avalanche Control

Coupled with soil conservation works, check-walls/ protection-walls, pillars, moulds and bench-terracing, snow traps etc. will be adopted/ constructed in the avalanche prone areas.

9.6 Van Sarovars

In order to conserve and augment water resources in the forest area, Van Sarovars are proposed to trap rain water on hill sides and to increase percolation and to build water retaining structures to store the excess runoff water in streams. The Van Sarovars will be established as per design of the scheme vis-à-vis site requirements.

This CAT Plan will be implemented by the H.P. Forest Department through the Chief Conservator of Forests, Rampur Circle. At the field level the actual implementation will be done through DFO, Kinnaur, having territorial jurisdiction over the areas covered under this Plan. The DFO, Kinnaur will be assisted by the regular staff posted under them and in case of need may also hire local consultants on short term basis for implementation of the CAT Plan. Wild life management works in the protected area of Lippa-Asrang Wildlife sanctuary and in Sarahan Pheasantry shall be done by DFO Wildlife Sarahan.

In compliance of Hon'ble Supreme Court of India, an agency called "CAMPA" compensatory afforestation fund management and planning authority has been created on the recommendations of the Central Empowered Committee (CEC) for examining the issues pertaining to compensatory afforestation, net present value of diverted forest land and other money recoverable/ received to be utilized for carrying out the above works.

The Government of India, Ministry of Environment and Forests, have notified Governing Body and Executive Body for the functioning of CAMPA. Bill has been introduced in the Lok-Sabha (Parliament) to lay down the CAMPA (Compensatory Afforestation Fund Management and Planning Authority) Rules. The money on account of the CA, NPV and CAT Plan are now to be deposited in the above fund and spent in the manner provided by the MOEF. In compliance to the instructions contained in Ministry of Environment and Forests, Government of India's letter No. 1-58/09-MoS(I/c)-E&F dated 15th July 2009, the Governor of Himachal Pradesh is pleased to reconstitute "State Compensatory Afforestation Fund Management and Planning Authority (hereinafter referred to as State CAMPA) vide H.P. Govt. Notification no FFE-B-F(2)-72/2004-Pt-II intended as an instrument to accelerate activities for compensatory afforestation, forest resource management, preservation of natural forests, management of wildlife, infrastructure development in the sector and allied works.

State CAMPA would provide an integrated framework for utilizing multiple sources of funding and activities relating to protection and management of forests and wildlife. Its prime task would be regenerating natural forests and building up the infrastructure engaged in this work. The State Forest Department would be modernized to protect and regenerate the forests and wildlife habitat.

The functions of State CAMPA shall include funding, overseeing and promoting compensatory afforestation done in lieu of diversion of forest land for non-forestry use under the Forest (Conservation) Act, 1980 and also the execution of Catchment Area Treatment plans. The State CAMPA shall function through a Governing Body, Steering Committee and an Executive Committee. The Governing Body shall lay down the broad policy framework for the functioning of State level CAMPA and review its working from time to time. The Steering Committee shall monitor the progress of the utilization of funds released by the State CAMPA and approve the Annual Plan of Operation (APO) prepared by the Executive Committee. The State level Executive Committee shall take all steps for giving effect to the State CAMPA and overarching objectives and core principles, in accordance with the rules and procedures approved by the Steering Committee and the approved APO. The State Level Executive Committee shall supervise the works being implemented in the State out of the funds released from the State CAMPA and be responsible for proper auditing of both receipt and expenditure of funds. An independent system for concurrent monitoring and evaluation of the works implemented from the State CAMPA funds shall be evolved and implemented to ensure effective and proper utilization of funds.

The works will be executed strictly in accordance with the State CAMPA Notification dated 03.08.2009 through the (Chief) Conservator of Forests-cum-Project Director. The implementation at field level will be by the DFO Kinnaur having jurisdiction over the area under the plan in Kinnaur Forest Division and by DFO Sarahan (Wild Life) for Lippa- Asrang Sanctuary and Sarahan Pheasantry. The limit of execution of work will be Forest Beats/ Forest Blocks in Kalpa, Moorang & Pooh territorial Forest Ranges.

The works will be carried out as per the Annual Plan Operations to be prepared on the basis of year wise phasing of the physical & financial targets. The APOs will be got approved from the State CAMPA through the Pr. CCF as envisaged in the CAMPA Notification.

Since multi disciplinary approach is to be adopted in this project, as such, involvement of local communities in close liaison with departments of Agriculture, Rural Development, Panchayati Raj, Animal Husbandry and PWD shall be the endeavour. The Shongtong-Karchham HEP Authorities (HPPCL) will also be associated in implementation of this Plan and during the monitoring and evaluation process.

10.1 Implementation Staff

The existing staff of Kinnaur Forest Division and Sarahan Forest Division (Wildlife) for Wildlife Sanctuary & Pheasantry will be involved for the implementation of CAT Plan works in addition to their own duties. However, for proper execution of works and utilization of the money for the treatment of the catchments area DFO will be authorized to engage staff on contract basis with the approval of State CAMPA.

10.2 Cost Escalation

The present cost projections are based on the prevailing wage rates of Rs. 130/- per day. The cost of the project will escalate as and when wage rates are hiked by the H.P. Government (from time to time). The cost for proportionate increase in the cost of material and wages will be met by the implementing agency from the component of *'Contingencies'* during the plan period. The overall CAT Plan outlay shall remain fixed. The funding agency (HPPCL) has already deposited the entire amount of 61.45 Crore in one go on 1-10-2012.

11.1 Mandatory Requirement for Submission of CAT Plan

The Shongtong-Karchham HEP involves diversion of 63.5015 ha. of forest land lying in Kalpa Forest Range within the jurisdiction of Kinnaur Forest Division and under the administrative control of Chief Conservator of Forests, Rampur Circle. In view of the provision made under Forest (Conservation) Act, 1980 vide Ministry of Environment & Forests No. 11-14/94-FC dated 1.11.2001, it has been made mandatory for the project proponents to prepare the CAT Plan for Hydroelectric Project while submitting the proposal for diversion of forest land for non-forestry purpose.

As per Techno-Economic Clearance (TEC) accorded by the HPSEB vide their letter dated 22.6.2006 the total cost of the project is Rs. 2415.53 Crores (copy attached as Annexure: VII). In accordance with the guidelines, the CAT Plan size works out to be Rs. 60.40 Crore. The project proponent (HPPCL) has assigned the work for preparation of CAT Plan for Shongtong-Karchham HEP to Himalayan Forest Research Institute, Shimla (HFRI). The HFRI has prepared an elaborate CAT Plan as per the latest guidelines issued by the Himachal Pradesh Forest Department after having carried out the detailed field survey, consultation with local forest officials/ officers and having accessed data like remote sensing, soil survey, slope survey etc. costing to **Rs. 39.00 Crore**. The balance amount may be pooled in for the treatment under Comprehensive CAT Plan for Sutlej Basin as and when completed/ approved and to meet unforeseen eventualities and new interventions deemed fit during the plan period. The abstract of cost of components of CAT Plan are shown in the Table 11.1.

With increase in the project cost and other need based additions and alterations, the outlay of CAT Plan may be revised/ reviewed every two years. Consequent changes may be made in this CAT Plan (inter component or across the plan) with the concurrence of Principal Chief Conservator of Forests, Himachal Pradesh. This, however, shall be within overall ceiling amount as marked for CAT Plan corresponding to overall project cost as per CAT Plan Guidelines- 2012 by Himachal Pradesh Forest Department.

Table -11.1: The component-wise abstract of CAT Plan Cost

Sl. No.	Name of Component	%age Outlay of total CAT Plan Cost	Total Cost (Rs. in Lakh)			Difference (Rs. in Lakh)
			As per guidelines	As per Actual	% age	
1	**Afforestation Measures**	25	1510.00	1117.72	28.66	392.28
2	**Soil & Water Conservation Endeavors**	25	1510.00	1177.00	30.18	333.00
3	**Payment for Environmental Services**	10	604.00	200.00	5.13	404.00
4	**Research, Training & Capacity build up, Publicity & Awareness, Documentation**	5	302.00	100.00	2.56	202.00
5	**Infrastructure built up & Forest Protection**	15	906.00	708.00	18.15	198.00
6	**Wild Life Measures**	6	362.40	261.50	6.70	100.90
7	**Monitoring & Evaluation**	6	362.40	76.00	1.95	286.40
8	**Site Specific Work Plan (Micro Planning)**	3	181.20	85.00	2.18	96.20
9	**Contingencies**	5	302.00	175.00	4.49	127.00
	G. Total of CAT PLAN Activities		**6040**	**3900.22**	**100**	**2139.78**
	Total Rounded up in Rs. Crore			**3900.00**	**0.65**	
	The balance amount of Rs. 21.40 Crore against which no works have been proposed, may be used for funding Eco-Task Force in Satluj basin as also for the comprehensive CAT Plan of Satluj River basin.			**2140.00**	**0.35**	
	G. Total		**6040**	**6040.00**		

The CAT Plan has been prepared as per site-specific requirements and in accordance with guidelines laid down by the H.P. Forest Department.

11.2 Total Project Cost

Cost of the various components has been worked out on sanctioned schedule rates for Rampur Forest Circle of H.P. Forest Department for the year 2012-13. The detail of expenditure for various components has been shown in the respective chapter. Total project cost for 11 years will be as under:-

Table -11.2: Yearly Break up of Cost

Year	Amount (Rs. In Lakhs)
Zero Year	209.75
First Year	341.60
Second Year	646.51
Third Year	835.61
Forth Year	801.46
Fifth Year	428.40
Sixth Year	162.90
Seventh Year	195.50
Eighth Year	119.52
Ninth Year	91.72
Tenth Year	67.25
Grand Total Cost of CAT Plan	**3900.22**
Or Say	**3900.00**

11.3 Annual Phasing

Annual phasing of works to be carried out under Shongtong-Karchham HEP CAT Plan is attached along with cost modules, year wise phasing of Physical & Financial activities & Activity wise %age of Financial Outlay vide Annexures I, II, & III respectively.

Table 1.16: Human Population of the Catchment Area

Sl. No.	Tehsil/ Development Block	Panchayat	No. of Villages	No. of Household	Human Population		Human Population			Grand Total
					Male	Female	SC	ST	Others	
1	Kalpa	Kalpa	5	659	1403	1263	72	2219	375	2666
2		Shudrang	3	388	855	681	79	1026	431	1536
3		Duni	4	262	572	515	82	869	133	1084
4		Kothi	3	717	1487	1151	426	1365	847	2638
5		Pangi	5	458	1070	1079	7	2066	76	2149
6		Khawangi	2	838	1773	1195	326	1326	1316	2968
7		Telangi	4	245	534	462	67	816	113	996
8		Purbani	3	91	219	233	0	441	11	452
9		Powari	3	245	615	502	18	906	193	1117
10	Pooh	Namgia	3	155	342	269	33	465	113	611
11		Pooh	6	580	1228	876	313	1173	618	2104
12		Sunum	4	189	458	459	169	620	128	917
13		Giabong	4	242	602	526	380	547	201	1128
14		Ropa	3	146	313	290	173	311	119	603

Sl. No.	Tehsil/ Development Block	Panchayat	No. of Villages	No. of Household	Human Population		Human Population			Grand Total
					Male	Female	SC	ST	Others	
15	Pooh	Nesang	2	124	246	234	1	340	139	480
16		Spillo	2	182	484	348	31	454	347	832
17		Kanam	3	174	524	474	191	733	74	998
18		Labrang	2	147	332	373	-	639	66	705
19		Murang	7	435	987	929	161	1380	375	1916
20		Thangi	4	154	326	340	-	629	37	666
21		Charang	2	73	115	178	-	293	-	293
22		Rispa	4	196	478	371	20	629	200	849
23		Ribba	7	405	973	898	12	1596	275	1871
24		Rarang	5	419	942	885	23	1395	409	1827
25		Jangi	2	183	421	399	61	567	192	820
26		Lippa	2	234	537	582	28	1060	31	1119
27		Asrang	3	109	294	248	20	456	66	542
		Total	**97**	**8050**	**18130**	**15760**	**164**	**24321**	**1173**	**33887**

Table 1.17: Literacy Profile – Kinnaur District

Sl. No.	Tehsil/ Development Block	Total Population Above 0-6 years			Literacy Population			Literacy Percentage		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
1.	Kalpa	13907	12006	25913	12091	8109	20200	86.94	67.54	77.95
2.	Pooh	10353	9425	19778	8222	5714	13936	79.42	60.63	70.46
	Total	**24260**	**21431**	**45691**	**20313**	**13823**	**34136**	**83.18**	**64.85**	**74.20**
3.	**Total for District Kinnaur**	**37472**	**31558**	**69030**	**31589**	**20324**	**51913**	**84.30**	**64.40**	**75.20**

Source: Census Report for the Year 2001

Table 1.18: Development Block-wise Workers Population and Percentage with respect to Total Population in the Catchment Area

Sl. No.	Name of Development Block	Total Population	Workers Population			Percentage of Workers w.r.t. the total Population
			Male	Female	Total	Total
1	Kalpa	29361	9925	6885	16810	57.25
2	Pooh	22343	8103	6636	14739	65.97

Source: Census Report for the Year 2001

Table 1.19: Development Block-wise Non-Workers Population and Percentage with respect to Total Population in the Catchment Area

Sl. No.	Name of Development Block	Total Population	Non- Workers Population			Percentage of Non-Workers w.r.t. total Population
			Male	Female	Total	Total
1	Kalpa	29361	5711	6840	12551	42.75
2	Pooh	22343	3562	4042	7604	34.03

Source: Census Report for the Year 2001

Table 1.20: Development Block-wise Main-Workers Population and Percentage with respect to Total Population in the Catchment Area

Sl. No.	Name of Development Block	Total Population	Main-Workers Population			Percentage of Main Workers w.r.t. total Population
			Male	Female	Total	Total
1	Kalpa	29361	8841	5017	13858	47.20
2	Pooh	22343	6987	5085	1272	54.03

Table 1.21: Development Block-wise Marginal-Workers Population and Percentage with respect to Total Population in the Catchment Area

Sl. No.	Name of Development Block	Total Population	Marginal-Workers Population			Percentage of Marginal Workers w.r.t. total Population
			Male	Female	Total	Total
1	Kalpa	29361	1084	1868	2952	10.05
2	Pooh	22343	1116	1551	2667	11.94

2.1 Project Details - GENERAL

The project envisages the construction of:

- Diversion barrage, intake structure with 4 intake bays with gates and four intake tunnels passing through four sedimentation chambers.
- Head Race Tunnel 8.02 km long culminating in open surface surge shaft.
- Three circular steel lined underground pressure shafts to convey water to 3 Francis turbines to generate (3 x 134 MW) 402 MW of power in an underground power house.
- Tail Race Tunnel of 10.0 m dia and 90 m length to discharge flow into river Sutlej near village Ralli.
- The salient features of the project are given in Table-1. The layout plan is enclosed as shown in Figure 2.1.

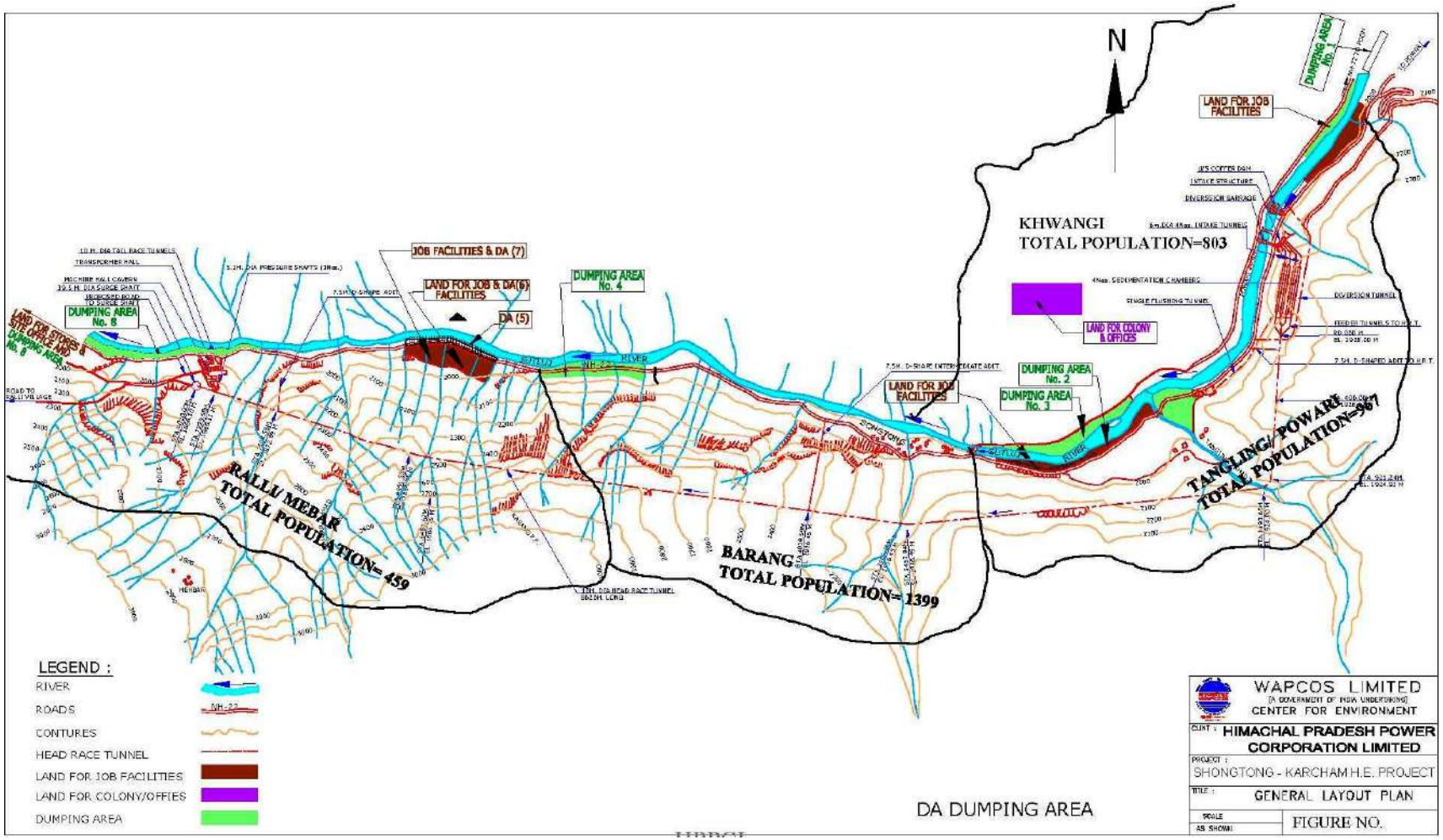

Figure 2.1: Project location and lay-out plan with village boundary map (Source: HPPCL)

Table 2.1: Salient Features of Shongtong-Karchham Hydroelectric Project

Location	
State	Himachal Pradesh
District	Kinnaur
River	Sutlej
Location	Diversion barrage site near village Powari
Powerhouse Site	
Near Village Ralli on NH-22 about 200 km from Shimla	
Hydrology	
Catchment area at barrage axis	47132 sq.km.
Maximum observed average 10 Daily discharge	1666 cumec
Design flood	4050 cumec
Average runoff (90% dependable Year)	59862 Mm^3
Average runoff (50% mean year)	87253 Mm^3
Firm discharge for 90% availability	71.72 cumec
50% availability	130 cumec
Diversion Barrage	
Type	Sloping Glacis
Size	241.5 m (L) and 102.5 m (W)
Water Bay	102.5 m
Top level of Barrage	El. 1958.00 m
Full Reservoir Level (FRL)	El. 1956.00 m
Maximum Pond Level	El. 1956.00 m
Mean Draw Down Level (MDDL)	El. 1945.50 m
Crest level	El. 1936.50 m
Live storage	400 ha.m.
Peaking	3.70 hrs
River Bed Level at Barrage axis	$\pm$ El. 1936.000 m
Length of stilling basin	60.00 m

Diversion Tunnel	
Type	Circular concrete lined
Size	10.0 m dia
Length	1187 m
Bed Slope	1: 593
Intake Structure	
No. of intake bays	4
Width of each bay	10.00 m
Discharge through each bay	116 cumec
Crest level	1938.00 m
Minimum water level u/s	El. 1945.50 m
No. of Intake Gates	5
Size	5.00 m x 4.25 m
Intake Tunnels	
No. of Intake Tunnels	4
Type	Modified horse shoe
Size	5.00 m
Design discharge	464 cumec
Velocity	4.10 m/sec
Sedimentation Chambers	
No. of sedimentation chambers	4
Width	14 m
Depth	25 m
Length	300 m
Particle size to be settled	+0.25 mm
Design discharge	464 cumec
Flow through velocity	0.3 m/s
Silt Flushing Tunnels	
No. of tunnels from the sedimentation	4
Chambers connected with main silt Flushing tunnel	
Type	Circular
Diameter	2.25 m
Length	70 m

Main Silt Flushing Tunnel

Type	Circular concrete lined
Diameter	5.00 m
Length	450.00 m
Design discharge	93 cumec

Head Race Tunnel

Type	Circular concrete lined
Diameter	10.00 m finished
Length	8020 m
Design discharge	371 cumec
Bed slope	1:303
Velocity	4.77 m/sec

Adits

No. of Adits	4
Type	D-shaped
Size	7.5 m
Length	210.00 m

Surge Shaft

No.	One
Type	Restricted Orifice (Underground)
Diameter	39.50 m
Orifice Dia.	5.54
Elevation of centre line of HRT	1871.11 m
Elevation at invert of surge shaft	1865.11 m
Top elevation	1988.00 m
Maximum upsurge level	1978.00 m
Minimum down surge level	1919.34 m

Pressure Shaft

No.	3
Type	Circular steel lined (Underground)
Diameter	5.10 m (Finished)
Length	211.00 m each

Power House/ Transformer Hall Cavity

Type	Underground
Installed capacity	402 MW (3 x 134 MW)
Size of machine Hall	90 m (L) x 20 m (W) x 51 m (H)
Size of transformer Hall	72 m (L) x 15.5 m (W) x 25 m (H)
Approach adit to machine hall	8.5 m D-shaped 88 m long
Average gross head	146.00 m
Net head at 371 cumecs tunnel discharge	125.00 m

Tail Race Tunnel

Size & Type	10.00 m dia. Circular shape
Length	90 m
Invert level of tail race tunnel at outfall	1808.00 m
Normal tail water level	1810.00 m
Maximum tail water level	1816.25 m

Power Generation

Installed capacity	402 MW
Annual generation:	
- 90% dependable Year	1735.46 GWh
- 50% dependable year	1817.26 GWh
Project Cost	**Rs. 2415.53 Crores**

The project is expected to provide annual energy generation of about 1735.5 MU in a 90% dependable year. The project shall also provide peaking capacity benefits of 402 MW for about 4 hours per day during lean season. The project will be constructed in a period of 6 years.

The power generated will be fed into the northern region grid through a 220 KV transmission system. The project is proposed to be operated as a peaking station for power absorption in the grid.