

# CATCHMENT AREA TREATMENT-PLAN

## SAWRA-KUDDU H.E.P.-110MW

**PABBER VALLEY POWER CORPORATION LTD., ROHRU**

*(A Unit of Himachal Pradesh State Electricity Board)*

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# Abbreviations Used

ACF	Assistant Conservator of Forests
ADO	Agriculture Development Officer
Agri.	Agriculture
AIS&LUS	All India Soil and Land use Survey
APO	Annual Plan of Operation
CAT	Catchment Area Treatment
CGI	Corrugated galvanized Iron
Cm	Centimetre
Cum	Cubic metre
DA	Daily Allowance
DC	Deputy Commissioner
DFO	Divisional Forest Officer
Drg.No	Drawing Number
DRSM	Dry Rubble Stone Masonry
Fin.	Finance
FPR	Flood Prone Rivers
FRH	Forest Rest House
Gol	Government of India

Ha/ha	Hectare
HDO	Horticulture Development Officer
HEP	Hydro-Electric Project
HP	Himachal Pradesh
I/c	Including
kg	kilogram
L/S	Lump sum
LPG	Liquefied petroleum gas
M & E	Monitoring & Evaluation
MD	Managing Director
NGO	Non-governmental organization
No.	Number
NTFP	Non-Timber Forest Produce
PC	Personnel Computer
Phy.	Physical
PRI	Panchayati Raj Institution
PVPC	Pabbar Valley Power Corporation
Qtls.	Quintals
Qty.	Quantity
R & M	Repair and Maintenance

<b>Rm</b>	<b>Running metre</b>
<b>Rs.</b>	<b>Rupees</b>
<b>RVP</b>	<b>River Valley Projects</b>
<b>Spp</b>	<b>Species</b>
<b>Sq Km</b>	<b>Square Kilometres</b>
<b>TA</b>	<b>Travelling Allowance</b>

# 1. Introduction

## 1.1 Catchment Area

Pabbar river originating at Gangdari Dhar at an elevation of about 5,400 m drains a catchment of about 1034 Sq Km in Himachal Pradesh. The barrage site of the 110 MW Sawra-Kuddu Hydro-Electric Power project is proposed at Hatkoti. The total catchment of the project above the barrage is 968.30 Sq Km.

However, a total of five HEPs (Hydro-Electric Project) are envisaged on the main Pabbar River in HP. The uppermost being Tangnu-Romai, followed by Dhamwari-Sunda, Majhgaon-Chirgaon, Paudital-Lassa and Sawra-Kuddu. The last one being the lowermost in a cascading series as shown in Drawing No.1

## 1.2 Effective Sub-Catchment

Generation capacity of each of the above mentioned 5 HEPs exceeds 10 MW meaning thereby that each one would have its own CAT Plan (Catchment Area Treatment Plan) as per Gol

stipulations. Hence, the whole catchment of Pabbar in HP can be subdivided into six zones as there would be five sub-catchments above the barrage of each project extending up to the barrage site of immediate upstream one, which would be its effective sub-catchment. The top most project's effective sub-catchment would obviously extend right up to the ridge from where Pabbar river originates. The sixth zone or sub-catchment would consist of areas draining into Pabbar below the barrage site of lower most project (i.e. Sawra-Kuddu HEP at Hatkoti) in HP down to the tailrace outlet.

Accordingly, the effective sub-catchment of Sawra-Kuddu HEP is the area draining between the barrage site of immediate upstream project (i.e. Paudital - Lassa HEP) down to the barrage site (of Sawra-Kuddu HEP) at Hatkoti. The area of effective sub-catchment of this project is 197.3 Sq Km. The remaining catchment of Pabbar in HP below the barrage site at Hatkoti and above the tailrace outlet at Snail is 65.7 Sq Km, which has been referred above as the sixth zone/sub-catchment.

### 1.3 Extended Effective Sub-catchment

Experience has shown that river stretch downstream of barrage and upstream of tailrace outlet is impacted due to impounding and abstraction of river water. Besides, the aspiration of the people in the close vicinity of the project is also raised as they being users of the forestland diverted for the project find it difficult to comprehend that CAT Plan would not cover their areas. The catchment area of this stretch of the river when included with the effective sub-catchment becomes kind of extended effective sub-catchment. In this case the same measures up to 263 Sq km (i.e. 197.3 Sq Km + 65.7 Sq Km).

### 1.4 Treatable catchment area

The treatable catchment of Sawra-Kuddu HEP is the effective sub-catchment measuring 197.3 Sq Km as discussed in the foregoing. Although treatment of the extended part of the effective sub-catchment is not obligatory for the project yet keeping in view the impact of the project and aspirations of the

local people expressed by representatives of the PRIs during interactions with them, it has been included in the catchment area to be treated. Moreover, the concerned officers of the Forest department during similar interaction have also opined that the CAT-Plan should be practicable/feasible and after its implementation/execution, treatment becomes a model in the area. And last but not the least; the area of the extended portion is small and manageable.

But, during discussions with the concerned officers of the HP Forest Department, it was felt that a more rational approach has to be adopted in view of the fact that other four HEPs envisaged in this catchment are not coming up immediately though their sub-catchments also contributes to the silt flow of Pabbar river.

As such it was decided that, at least for the time being i.e. till other projects CAT Plans are not formulated, whole of the catchment of Pabbar river (i.e. total catchment of 1034 Sq Km) in HP should be treated by Sawra-Kuddu HEP with suitable apportioning of the CAT Plan funds. Accordingly, it was further decided that in no case share of the treatment cost for catchment

above the barrage site of Paudital-Lassa HEP should exceed 50 % of the total outlay for works component of the CAT Plan of this project. Treatment of effective sub-catchment and its downstream extension (total area = 263 Sq Km) would be given priority over other parts of the catchment.

## **2. Tributaries of Pabbar and its gradient**

The gradient of the river over the entire stretch ranges 15-40m/km, but reaches values up to 200m/km in the upper most regions. The river valley in upper region is very narrow and located between steep and high mountain ranges while along the lower stretches it is wider. The Pabbar river is joined by various Nallahs/khads in its course from its origin to Sawra (Hatkoti). Numerous tributaries known locally as Khads join Pabbar River in its course in HP up to the barrage site at Hatkoti. These are Supin khad, Sundru khad, Khargara khad, Andhra khad, Massrat khad, Shikdi khad (near Rohru), Dogri khad and last but not the least Biskalti khad (near Hatkoti), all from the right bank of the river; and Gumalti, Peja and Pakhal khads from the left bank.

### 3. Elevation zones in the catchment

The entire catchment of Pabbar in HP falls between elevation 1400 m to 5000m above the mean sea level (M.S.L). About 25 % of the area falls below 2000 m; 35 % between 2000 m to 3000 m; 39 % between 3000 m to 4500 m and only 1.11 % of the catchment is above 4500 m and above, which falls in the permanent snow line basin.

S.N.	Elevation range (in meters above MSL)	Percentage of Catchment
1	1400 m to 2000 m	25
2	2000 m to 3000 m	35
3	3000 m to 4500 m	39
4	4500 m and above	1
Total catchment 1400m and above		100

Around 87 Sq. km (8 %) of the catchment area lies at altitudes above 4000 m of which 13 % falls within 4,500 – 5,400 m altitudes.

## 4. Slope class zones in the catchment

The slope in the catchment varies greatly between extremes of gradients as tabulated below:-

S.No.	Classification of Slopes	Percentage of Catchment
1.	Very gently to gently sloping	1-10%
2.	Moderately steep to steep	15-33%
3.	Steep to very steep	15-33%
4.	Very steep to very very steep	> 33%

## 5. Land Use in the catchment

The land use classification and coverage in the catchment, as per the land use map (Source: Procured from NRSA, Hyderabad. Survey of India Topo-sheet and others) the built-up land, degraded or scrub land, evergreen/semi-evergreen forest, forest plantation, grass land/grazing land, agricultural land (kharif + rabi), land with or without scrub, plantations, snow covered/glacial area and Rocky unculturable wastes including

areas of steams & river beds is app. 0.15 %, 3.25 %, 20 %, 15 %, 10 %, 15 %, 30 %, 3 %, 2 % and 1.6 % respectively.

These have been worked out from the maps available (Drg.No. 2 & Drg. No. 2.1). For the ease of reading the same is tabulated below.

S.N.	Land Use	Percentage of Catchment
1	Built-up land	0.15
2	Degraded or scrub land	3.25
3	Evergreen/semi-evergreen forest	20.00
4	Forest plantation	15.00
5	Grass land/grazing land	10.00
6	Agricultural land (kharif + rabi)	15.00
7	Wasteland without scrub	30.00
8	Plantation	3.00
9	Snow covered/glacial area	2.00
10	Rocky unculturable wastes 1/c areas of steams & river beds	1.60
<b>Total</b>		<b>100</b>

## 6. Soil in the catchment

The soils of the area are derived from heterogeneous parent material i.e. gneiss, schist, sandstone and phyllite. The upper and mid mountainous portions that comprise this catchment area are characterized by shallow soils with coarse to medium texture and dark brown to very dark grayish brown color and have a thick layer of leaf and organic matter on the surface. The soil profiles met within the area (including the catchment area) are generally well developed with clear demarcation of horizons. The soils are brown podsols and transitional podsols. They have a fine texture akin to clays and clayey loams. Spruce and fir grow on a wide range of soil especially brown soils and podsols. Kail and Deodar generally thrive on brown soils. Large quantities of decomposing vegetative material enrich the forest soils with a good deal of humus. The following textures of soil generally of good depth are met within the area.

1. Loam or clayey loam in Jakhi, Khashdhar area.
2. Sandy loam in Kuddu and Batar forest areas
3. Loamy clays with black color as in oak bearing areas.

4. **Loamy soil with a cover of humus suited for Fir & Spruce.**

As in Larot, Guas and Chhachpur area, on ridges precipitous slopes and southern aspects, the soils tend to be shallow and dry. It is a common feature around villages because of frequent fires and excessive grazing.

Important physiographic units classification as per soil taxonomy together with their other important characteristics of soils of upper Yamuna catchment, which includes Pabbar catchment, as brought out in their Report on 'Demarcation of Priority sub-watersheds' in the catchment of upper Yamuna river by All India Soil and Landuse Survey Organization, Govt. of India (Report No. Agri.830) are furnished in Table No.:1&2. and Drawing No: 3, 3.1, 3.2 & 3.3

**Soil types and their coverage in the catchment**

S.N.	Soil Type	Percentage of Catchment
1	Sandy	20 %
2	Loamy	15 %
3	Coarse Loamy soil	25 %
4	Sandy to Coarse Loamy soil	35 %
5	Clayey	5 %
Total		100 %

## 7. Soil Erosion

Lack of proper soil and water conservation measures coupled with anthropogenic activities in the catchment leads to increase in silt flow in the Pabbar river. The increased run off from the denuded mountain slopes and others finds its way into the river through a network of gullies and streams carrying sediments with its flow. The most important sources of this sediment flow immediately entering into the rivers are gully and stream bank erosion. Another important factor that adds to sediment load and which contributes to soil degradation is the grazing pressure. A large number of animals graze the pastures, due to this pressure – the productivity of the pasture is also declining further. The lack of proper vegetal cover is a factor to cause degradation and thereby results in severe run-off/soil erosion and subsequently premature siltation of the reservoir. The path/road construction activities, frequent land slides and slips along the river also contribute to the huge debris in the beds of river and call for suitable control measures.

Thus, the soil erosion in the catchment would reduce the productivity of land, effect adversely the local water supplies, cause aridity in the climate and increase the frequency of land slides/slips beside contributing to sediment load to the reservoir. Instead of carrying of expensive and difficult operation of desilting of the reservoir, it is wise to treat the catchment of the river to reduce the silt inflow.

At present the sediment output of the catchment above the barrage site at Hatkoti is to the tune of about 35, 000 tonnes/year. The conditions obtaining in the catchment leading to the generation of silt are not static. The catchment is a dynamic entity bustling with human and non-human activities. As such the silt generation is greatly influenced by the scale of these activities.

## 8. Priority of treatment

For deciding the priority of area for treatment susceptibility to soil erosion has been taken as the sole basis. The AIS&LUS (All India Soil and Land Use Survey) Agriculture Report No. 830 has been adopted. This report categorizes Pabbar Watershed

catchment into various sub-watersheds. Priority of treatment has been assigned to each sub-watershed based on value obtained for run-off potential as tabulated ahead. Table-1 & Table-2.

**Table-1**

**Runoff Potential Mapping Unit Legend**

Mapping Symbol	Description	Approved Run off Potential Value
I <sub>1</sub>	Very gently to gently slopping (1-10%) river terraces : Cultivated, brown to very dark grayish brown and dark yellowish brown, moderately deep to very deep, coarse loamy soils; slight erosion.	50
M <sub>1</sub>	Moderately steep to steep (15-33%) mountain side slopes ,cultivated poorly terraced ; brown, shallow to moderately deep sandy to coarse loamy soils, moderate to severe erosion.	65
M <sub>2</sub>	Moderately steep to steep (15-33%) mountain side slopes; thin forest vegetation (mostly bushes) and grass lands; brown to dark grayish brown, shallow to moderately deep, sandy to coarse loamy soils ; 10-25% rock out crops; moderate to severe erosion with occasional land slips.	70

M <sub>3</sub>	Moderately steep to steep (15-33%) mountain side slopes, moderately thick forest, vegetation and grasslands; brown to dark grayish brown, shallow to moderately deep, sandy to coarse loamy soils; 10-25% rock out crops; moderate to severe erosion with occasional landslips.	65
P <sub>1</sub>	Very steep to very steep (more than 33%) mountain side slopes; grass lands and thin forest vegetation (mostly bushes) ; dark brown to dark grayish, brown and dark yellowish brown shallow to moderately deep, coarse loamy soils, 15-40% rock out crops; moderate to severe erosion with occasional land slides.	80
P <sub>2</sub>	Very steep to very very steep (more than 33%) mountain side slopes, moderately thick forest vegetation; brown to very dark grayish brown, shallow to moderately deep, coarse loamy soils; 15-40% rock out crops; moderate to severe erosion with occasional land slides.	75
U <sub>1</sub>	Very Steep to very-very steep (more than 33%) mountain slopes; snow bound for 5 to 8 months in a year; thin grassy cover; brown to dark grayish brown; very shallow to shallow, coarse loamy soils; 15-40% rock out crops; moderate to severe erosion with occasional land slides.	60
U <sub>2</sub>	Very steep to very-very steep (more than 33%) mountain slopes, glacier etc; permanent snow cover.	40

These indices have been and are still in vogue for deciding priority of treatment under RVP (River Valley Projects) and FPR (Flood Prone Rivers) schemes of the government of India Ministry of Agriculture. Although some of the watersheds may have been treated in the past yet as mentioned elsewhere in this report the situation in the catchment is dynamic and proneness to erosion keeps varying with time. Moreover, due to this scheme's own limitations entire watershed in many cases could not be treated as norms provided for hilly regions were kept at par or even below those of plain areas. Physical norms for number of plants per hectare of treated land were also reduced considerably to obviate incurring expenditure beyond the cost norms. For the same reasons barbed-wire fencing was not provided to the plantations and instead live hedge fencing was attempted. Effectiveness of live hedge fencing has been and is debatable in these regions as it was created in the same year as that of main species planting. Owing to slow growth rates in these colder climes the fencing has by and large remained ineffective. This seriously compromised the quality of treatment provided. Relative

Priority Index has been classified as per requirement of this CAT Plan and may be at variance with those followed in RVP/FPR scheme. Without passing any value judgement on the success or otherwise of the treatments done in the past, effort would again be made in this Plan to treat all sub-watersheds afresh with new initiatives to reduce silt flow which remains one of the objectives of this plan.

The priority classes vis-à-vis run off potential Index is given as under.

S.N.	Relative Priority Index class	Treatment Priority
1	> 80	Critical
2	56 - 80	Very High
3	46 - 55	High
4	31 - 45	Medium
5	< 30	Low

A word of caution needs to be added here that the AIS&LUS despite being the only authentic survey ever taken to cover all the sub-watersheds may have become dated for some areas in view of fast changing conditions in and dynamics of the catchments. As such some deviations may have to be made at the time of implementation. The implementing agency should use its own observation, experience and judgement while making

**departure from this prioritization of sub-watersheds for  
treatment.**

## Table - 2

### Characteristics of Yamuna basin - Pabbar Valley Sub-watersheds

S. No	Sub-Water-shed code	SYMBOL	Area in ha	Run off %	Product of area and Runoff	Runoff Potential Index (RPI)	Relative priority
1.	Ymlc	I1	25	50	1250		
		P1	425	80	34000		
		P2	2900	75	217500		
		Total		3350		252750	75
2.	Ym1g	I1	25	50	1250		
		M 1	500	65	32500		
		P1	1575	80	126000		
		P2	2475	75	185625		
		Total		4575		345375	75
3.	Ym1h	I1	25	50	1250		
		M 1	125	65	8125		
		M 2	25	70	1750		
		M 3	700	65	45500		
		P1	1250	80	100000		
		P2	900	75	67500		
		Total		3025		224125	74

4.	Ym1j	I1	600	50	30000		
		M	200	65	13000		
		1					
		M	150	70	10500		
		2					
		M	1450	65	94250		
		3					
		P1	425	80	34000		
		P2	1175	75	88125		
	<b>Total</b>		<b>4000</b>		<b>269875</b>	<b>67</b>	<b>84 (Critical)</b>
5.	Ym1k	I1	350	50	17500		
		M	50	70	350		
		2					
		M	200	65	13000		
		3					
		P1	825	80	66000		
		P2	1200	75	9000		
	<b>Total</b>		<b>2625</b>		<b>190000</b>	<b>72</b>	<b>62 (Very High)</b>
6.	Ym1n	I1	50	50	2500		
		M	25	65	1625		
		1					
		M	225	70	15750		
		2					
		M	850	65	55250		
		3					
		P1	1300	80	104000		
		P2	1950	75	146250		
	<b>Total</b>		<b>4400</b>		<b>325375</b>	<b>74</b>	<b>49 (High)</b>
7.	Ym2a	I1	25	50	1250		
		M	300	65	19500		



11	Ym2h	I1	200	50	10000		
		M1	1625	65	105625		
		M2	150	65	10500		
		P1	1500	80	120000		
		P2	450	75	33750		
	<b>Total</b>		<b>3925</b>		<b>279875</b>	<b>71</b>	<b>67 (Very High)</b>
12	Ym2j	I1	250	50	12500		
		M1	1175	65	76375		
		M2	600	65	42000		
		P1	2075	80	166000		
		P2	725	75	54375		
	<b>Total</b>		<b>4825</b>		<b>351250</b>	<b>73</b>	<b>54 (High)</b>
13	Ym2k	I1	325	50	16250		
		M1	300	65	19500		
		M2	25	70	1750		
		M3	575	65	37375		
		P1	275	80	22000		
		P2	125	75	9375		
	<b>Total</b>		<b>1625</b>		<b>106250</b>	<b>65</b>	<b>50 (High)</b>
14	Ym2m	I1	100	50	5000		
		M1	675	65	43875		

		M 2	175	70	12250		
		M 3	300	65	19500		
		P1	2100	80	168000		
		P2	375	75	28125		
	<b>Total</b>		<b>3725</b>		<b>276750</b>	<b>74</b>	<b>65 (Very High)</b>
15	Ym2n	I1	650	50	32500		
		M 1	375	65	24375		
		M 2	550	70	38500		
		M 3	450	65	29250		
		P1	1600	80	128000		
		P2	1475	75	110625		
	<b>Total</b>		<b>5100</b>		<b>363250</b>	<b>72</b>	<b>47 (High)</b>
16	Ym2p	I1	550	50	27500		
		M 1	825	65	53625		
		M 2	375	70	26250		
		M 3	575	65	37375		
		P1	1425	80	114000		
		P2	750	75	56250		
	<b>Total</b>		<b>4500</b>		<b>315000</b>	<b>70</b>	<b>52 (High)</b>
17	Ym2q	I1	200	50	10000		

		M 1	25	65	1625		
		M 3	200	65	13000		
		P1	625	80	50000		
		P2	100	75	7500		
	<b>Total</b>		<b>1150</b>		<b>82125</b>	<b>71</b>	<b>69 (Very High)</b>
<b>18</b>	<b>Ym2r</b>	<b>I1</b>	<b>475</b>	<b>50</b>	<b>23750</b>		
		M 1	100	65	6500		
		M 2	25	70	1750		
		M 3	1025	65	66625		
		P1	1550	80	124000		
		P2	875	75	65625		
	<b>Total</b>		<b>4050</b>		<b>288250</b>	<b>71</b>	<b>70 (Very High)</b>
<b>19</b>	<b>Ym2s</b>	<b>I1</b>	<b>375</b>	<b>50</b>	<b>18750</b>		
		M 1	50	65	3250		
		M 2	125	70	8750		
		M 3	200	65	13000		
		P1	1150	80	92000		
		P2	575	75	43125		
	<b>Total</b>		<b>2475</b>		<b>178875</b>	<b>72</b>	<b>63 (Very High)</b>
<b>20</b>	<b>Ym2t</b>	M 1	100	65	6500		

		P1	1450	80	116000		
		P2	1700	75	127500		
		U1	50	60	3000		
	<b>Total</b>		<b>3300</b>		<b>253000</b>	<b>77</b>	<b>5 (Low)</b>
21	Ym3a	I1	600	50	30000		
		M 1	125	65	8125		
		M 2	125	70	8750		
		M 3	775	65	50375		
		P1	575	80	46000		
		P2	1025	75	76875		
	<b>Total</b>		<b>3225</b>		<b>220125</b>	<b>68</b>	<b>50 (High)</b>
22	Ym3b	I1	350	50	17500		
		M 1	275	65	17875		
		M 2	250	70	17500		
		M 3	50	65	3250		
		P1	1025	80	82000		
		P2	1825	75	136875		
		U1	75	60	4500		
	<b>Total</b>		<b>3850</b>		<b>279500</b>	<b>73</b>	<b>63 Very High)</b>
23	Ym3c	I1	25	50	1250		
		M 1	25	65	1625		

		M 2	300	70	21000		
		P1	625	80	50000		
		P2	1225	75	91875		
		U1	400	60	24000		
	Total		2600		189750	73	60 (Very High)
24	Um3d	I1	75	50	3750		
		M 1	150	65	9750		
		M 2	350	70	24500		
		P1	1700	80	136000		
		P2	1125	75	84375		
		U1	1400	60	84000		
	Total		4800		342375	71	75 (Very High)
25	Ym3f	I1	50	50	2500		
		M 1	100	65	6500		
		M 2	25	70	1750		
		M 3	200	65	13000		
		P1	750	80	60000		
		P2	450	75	33750		
	Total		1575		117500	75	32 (Medium)
26	Ym3h	M 1	50	65	3250		
		M	375	70	26250		

		2					
		M	475	65	30875		
		3					
		P1	1750	80	140000		
		P2	1150	75	86250		
	Total		3800		286625	67	87 (Critical)
27	Ym3j	I1	150	50	7500		
		M	75	65	4875		
		1					
		M	125	70	8750		
		2					
		M	250	65	16250		
		3					
		P1	575	80	46000		
		P2	1200	75	90000		
	Total		2375		173375	73	57 (Very High)
28	Ym3k	I1	200	50	10000		
		M	25	65	1625		
		1					
		M	500	70	35000		
		2					
		M	250	65	16250		
		3					
		P1	1125	80	90000		
		P2	300	75	22500		
		U1	25	60	1500		
	Total		2425		176875	73	58 (Very High)
29	Ym3m	I1	825	50	41250		

		M 2	225	70	15750		
		P1	875	80	70000		
		P2	600	75	45000		
		U1	125	60	7500		
	Total		2650		179500	68	80 (Critical)
30	Ym3n	I1	25	50	1250		
		M 1	50	65	3250		
		P1	1450	80	116000		
		P2	1475	75	110625		
		U1	500	60	30000		
	Total		3500		261125	75	34 (Medlum)
31	Ym3p	P1	900	80	72000		
		P2	300	75	22500		
		U1	1425	60	85500		
	Total		2625		180000	69	74 (Very High)
32	Ym3q	I1	75	50	3750		
		P1	1825	80	146000		
		P2	500	75	37500		
		U1	2450	60	147000		
	Total		4850		134250	69	75 (Very High)
33	Ym3r	I1	150	50	7500		

		<b>M 3</b>	<b>50</b>	<b>65</b>	<b>3250</b>		
		<b>P1</b>	<b>1300</b>	<b>80</b>	<b>104000</b>		
		<b>P2</b>	<b>800</b>	<b>75</b>	<b>60000</b>		
		<b>U1</b>	<b>1775</b>	<b>60</b>	<b>106500</b>		
	<b>Total</b>		<b>4075</b>		<b>281250</b>	<b>69</b>	<b>76 (Very High)</b>
<b>34</b>	<b>Ym3s</b>	<b>P1</b>	<b>825</b>	<b>80</b>	<b>66000</b>		
		<b>P2</b>	<b>25</b>	<b>75</b>	<b>1875</b>		
		<b>U1</b>	<b>3200</b>	<b>60</b>	<b>192000</b>		
	<b>Total</b>		<b>4050</b>		<b>259875</b>	<b>64</b>	<b>91 (Critical)</b>

## 9. Objectives of the CAT Plan

The CAT Plan targets towards overall improvement in the environmental conditions of the region. All the activities are aimed at treating the degraded and potential areas of severe soil erosion. The plan provides benefits due to biological and engineering measures, and its utility in maintaining the ecosystem. It also aims to reduce fuel wood consumption at least during the interregnum till the time plantations become utilizable.

In consonance with the above, this CAT Plan has following objectives: -

- Reducing soil erosion and land degradation by taking up adequate and effective soil conservation measures in erosion prone area (severe and very severe).
- Rehabilitation of degraded forest areas through afforestation, treatment of pastureland and facilitating natural regeneration.
- Reduction/control of cultivation practices in the catchment area through suitable and appropriate alternatives acceptable to local residents.
- Demonstration of good practices in agriculture and horticulture land treatment.
- Saving and conservation of forest based fuel.
- Conservation and rehabilitation of riverine flora particularly in the river stretches between barrage and tailrace outlet.

As mentioned elsewhere in this document, the catchment being dynamic and always under constant pressure of activities, both anthropogenic and other than anthropogenic, keeps generating silt of considerable proportions. A lot of silt load is

found right at the point where the river and its tributaries leave the glaciers. Complete stoppage of silt is therefore a utopian expectation, as it would also mean complete freezing of all activities at the base level/time. Hence, project proponent's bottom line in this respect is stabilization of silt flow so that it does not increase any further, if it can not effectively be reduced.

## **10. Proposed Treatment**

Proper gully treatment and water harvesting structures are required to be provided in the catchment area so as to reduce runoff and sediment flow. To check siltation, it is imperative that massive afforestation programme is also taken up in the area. Thus, the catchment treatment involve both biological and engineering measures for arresting the soil erosion process and controlling the sediment transfer to a certain extent. The Catchment Area Treatment (CAT) Plan envisages controlling the soil erosion process and subsequent sediment transfer to the reservoir.

The plan with objectives addresses issues such as prevention of gully erosion, enhancing the forest for increasing soil holding capacity; and arresting total sediment flow in the reservoir and flowing water.

## **10.1 Activities in the CAT Plan**

Considering the topographic factors, soil type, climate, hill slopes and land use in the catchment area following engineering and biological measures have been proposed to be undertaken with the aim to check the soil erosion, prevent/check siltation of reservoir and to maintain its storage capacity in the long run.

### **10.1.A. Engineering Measures**

#### **10.1.A.i Gully Control-Check Dams**

Gullies are mainly formed on account of physiography, soil type and heavy biotic interference in an area. The scouring of streams at their peak flows and sediment laden run off cause

**gullies. The gullies would be required to be treated with engineering/mechanical as well as vegetative methods. Check dams would be constructed in some of the areas to promote growth of vegetation that will consequently lead to the stabilization of slopes/area and prevention of further deepening of gullies and erosion. Different types of check dams would be required for different condition comprised of different materials depending upon the site conditions and the easy availability of material (stones) at local level and transport accessibility. An area of 920 ha shall be provided with this type of treatment. The types of check dam recommended for treatment are:**

- Model – I : Dry Rubble Stone Masonry (DRSM)**
- Model – II: Combination of DRSM and crate works, for moderate to deep gullies.**
- Model – III: Combination of DRSM walls, check dams, and crate walls.**

Rainfall pattern of the area, water seepage coupled with geological formation results in landslides under natural conditions. Human interference may also trigger it by disturbing the slopes like by digging and by earth cutting. Water plays an important role in triggering of landslides and mass wasting processes along with other factors such as slope and nature of soil/and cover/land use. However, most of the landslides are caused by human negligence. Road construction, overgrazing of hill slopes, felling of trees for timber, fuel and fodder and up slope extension of cultivation are some of main causes of landslides. The landslide prone areas of app. 985.00 ha would be taken up under following treatments.

#### 10.1.A.IV.a. Catch water Drains

Among the most effective, practical and least expensive measures of landslide hazard management is the construction of catch water drains for run-off and surface waters in the identified hazard-prone zone so that no or little water is able to infiltrate into the ground. All the streams and minor watercourses would

be diverted around the crown of the slide or the potentially hazardous area through catch water drains with an adequate gradient. The catch water drain when provided avoids the runoff to pass over such vulnerable areas and water is guided through these drains located on foothill or along the Katcha/Pucca roads. The ground surface of threatened area is leveled out to eliminate all depressions where water can accumulate. Area of 500.00 ha would be taken up under this category of treatment.

#### **10.1.A.iv.b Check dams/Retaining walls (R/W):**

Brush Wood check dams are useful in arresting further erosion of depressions, channels and gullies on the denuded landslides. In addition, retaining walls would be constructed to provide support at the base of threatened slopes. An area of 485.00ha would be taken up under this category treatment.

#### **10.1.A.iv.c Slope Modification by Stepping or terracing**

To avoid rolling down of the earth mass along landslide areas and to reduce the run off speed of rainwater, the slope is modified to increase its stability considerably by grading it. The construction of steps or terraces to reduce the slope gradient is one of the measures.

#### 10.1.A.IV.d Bench Terracing

The area under moderate to steep slopes would be subjected to bench terracing. The local people would be convinced to follow this type of terracing for comparatively better yield and with minimum threat to erosion. Moreover, in number of habitations in the catchment such practices are already visible. While making bench terraces, care will have to be taken not to disturb the topsoil by spreading earth from the lower terraces to higher terraces. The vertical intervals between terraces will not be more than 1.5 m and cutting depth may be kept at 50 cm. The minimum average width of the terrace would be kept from 4 to 5 m in order to enable usage of prolonged hinge. The shoulder bunds of 30 × 15 cm would also be provided. Staggered

channels will drain off the excess water from the terraces. An area of 125.00 ha will be covered under this plan.

## **10.1.B. Biological Measures**

### **10.1.B.1 Restoration of Degraded Areas**

In critically degraded areas, plantation of locally useful diverse and indigenous plant species such as timber species, fodder species, fuel wood species, grasses, shrubs, legumes, medicinal and aromatic plants would be undertaken. An area of 1855.00 ha is proposed to be taken up for various biological measures under this component during the CAT Plan implementation period. For raising plantation, suitably located two number (02 Nos.) nurseries would be developed in area for facilitating treatment in different pockets. The plantations done on forest land under this component shall be maintained for a period of seven years.

**Choice of species:**

In all the biological measures suggested for the forestland and pastureland treatment, in this Plan, local indigenous species shall be preferred and planting of exotics shall be avoided. NTFP shall also be planted in the afforestation areas besides being introduced as ground flora in the appropriate forest areas.

#### 10.1.B.1.a Afforestation

This will include raising of multi-tier mixed vegetation of suitable local species in the steep and sensitive catchment areas of rivers/streams with the objective of keeping such areas under permanent vegetative cover. It is proposed to bring an area of 300.00 ha under such plantation during the project construction period under this component. Further, more degraded areas would also be brought under some vegetation cover by way of timber plantation. The aim of raising afforestation need not be elaborated for it is too obvious. It would not only fulfill the purposes of silt reduction but also help the local populace to fulfill its needs. The plantations done under this component shall be maintained for a period of seven years. An area of 300.00 ha would be covered under this plan.

#### 10.1.B.1.b Timber plantation

The forests in the catchment are heavily burdened with rights of the local people including the right to concessional and free timber in the form of standing trees. With the increase in population as also increase in the incomes and living standards of the local people demand for house construction and also for other purposes has increased manifold leading to greater pressure on forests. This in turn leads to denudation and increased silt flow. Thus a need has been felt to make special efforts for raising exclusive plantations to meet the timber demand. Accordingly, an area of 325 ha would be developed as timber plantation.

#### 10.1.B.1.c Fodder plantation

Cattle population (that includes sheep and goats) almost equals the human population in the state and the position in the catchment is no different. Grazing and lopping for fodder are amongst the easily identifiable causes of degradation of vegetation. To help ameliorate the situation of scarce availability of fodder, it is proposed to bring a substantial area under fodder

plantation with suitable indigenous species. An area of 130.00 ha is proposed to be covered under this component.

#### 10.1.B.1.d NTFP plantations

A number of families supplement their income by collecting and selling NTFP (Non-Timber Forest Produce) including medicinal and aromatic species besides consuming some quantities for their own use. Over a period of time due to increased biotic pressure the availability and regeneration of the species of NTFP in demand is reducing. To sustain their growth and contribution to the economy, suitable plantations of appropriate local species of NTFP would be raised over an area of 250 ha.

#### 10.1.B.II Pasture Development

There are high altitude alpine pastures in the upper most parts of the catchment and temperate to sub-tropical pastures in the zones lower than alpine zone. The second type of pastures are owned separately by private individuals/families and

government. Under this component both alpine and lower zone pastures would be treated with suitable measures.

#### 10.1.B.II.a Alpine Pasture Development

As has been written elsewhere in this Plan, number of cattle, sheep and goats is very high and consequently the grazing pressure is also high. This causes degradation of pastures. There are two types of pastures in the catchment. One type is the permanent pasture of high altitude Alpine zone and the other is lower in altitude and is used as pasture for no other use is possible on this kind of land. The latter one is found nearer habitations. Both these types of pastures are subjected to grazing beyond their carrying capacities leading to varying degrees of degradation. Appropriate measures will be adopted to encourage development of healthy pasture areas for the use of cattle herders.

The Alpine zone pastures would be treated with grass sowing, grass slip/tuft planting in patches with soil and moisture conservation measures wherever needed. Medicinal herbs and

other NTFP species that grow in this zone would also be introduced. It is proposed to develop an area of 200 ha of alpine zone pastures.

#### 10.1. B.II.b Lower Zone Pasture Development

The lower zone pastures are owned separately by both government and private families/individuals. These pastures are nearer habitations and bear the brunt of excessive grazing through out the year. It is proposed to treat pastures under private holdings also besides the ones under government ownership. In the lower zone pastures a silvi-pasture model would be adopted and suitable species of grasses and tree fodder, and leguminous plant species shall be planted. Effective fencing would also be provided for protection of saplings in the government owned pastures. The owner of the pastures in private holding has to take the protection measures at his/her own convenience and cost.

Before any new area is taken up, eradication of weeds and unpalatable grass species is equally important. It is recommended that some parts of the pastures should be closed for seeding (

purpose only. It is proposed to cover an area of 300 ha (100 ha Privately owned + 200 ha government owned) under this component.

### 10.1. B.III Conservation and regeneration of riverine trees

As has been mentioned in the foregoing that impounding and abstraction of water from the river affect the river stretch downstream of the barrage site down to the tailrace outlet. It is apprehended that the riverine species growing along the banks and in the braided part of the channel may not be able to regenerate due to reduction in the flow (both volume and speed) of water. One such species is alder (kunjsh/kosh), which has a thick seed coat. The seed coat under natural conditions is broken due to soaking in water and by thrashing action of currents and waves. Therefore, to help the conservation and regeneration of the riverine species, this special component has been included in the CAT Plan. Similarly, other species of riverine succession also need assistance.

The two new nurseries that are provided in this Plan would cater primarily to the need of riverine flora conservation and extension. Plantation of riverine species like alders, willow etc would be carried out in linear strips along the riverbanks. Accordingly, higher norms for the same have been provided as linear strip plantation requires longer fencing and also may need watering in its inception.

#### 10.1. B.IV Private Land Treatment

It has been the experience elsewhere that erosion takes place from the privately owned land also. Silt contribution from the private holding is also significant. While change of land use is not the mandate of the CAT Plans yet it can help betterment of the current land uses and attempt to encourage better land management helping reduce silt flow. Therefore, it is proposed to provide treatment to private holdings for horticulture development. Agriculture development and also for pasture development. Fencing and also maintenance costs are not provided under this activity as these are to be the contribution of the land owners.

**10.1. B.IV.a            Plantation for horticultural and agricultural land development.**

Substantial parts of the catchment area is under private ownership and has the potential for development to increase land productivity and help enhance incomes of the individuals or families owning such lands. Under this treatment plan, suitable horticultural crop species like apple, plum, apricot and walnut etc shall be planted in select areas adjacent of the villages. The species listed here are only indicative and not conclusive. The treatment would also include soil and moisture conservation measures wherever needed. An area of 300 ha has been earmarked to be undertaken for this treatment. However, the owners as their share of the cost shall do fencing and maintenance.

**10.1. B.IV.b            Private Pasture Development**

As has been mentioned in the foregoing under the lower zone pasture development, the privately owned pastures would

also be treated with appropriate silvi-pasture model. Suitable species of grasses and tree fodder, and leguminous plant species shall be planted. No expenditure on account of fencing can be provided in case of private pastures, as the owner of the pastures in private holding has to take the protection measures at his/her own convenience and cost. Similarly, the maintenance costs, if any, shall be borne by the owners.

Before any new area is taken up, eradication of weeds and unpalatable grass species is equally important. It is recommended that some parts of the pastures should be closed for seeding purpose only. It is proposed to treat an area of 200 ha of privately owned pastures in this CAT Plan.

### **10.1.C. Fuel saving and alternate fuel devices**

The riverine trees are locally used primarily for two purposes i.e. fuel and fodder. Since their regeneration is likely to be adversely impacted and the new planting suggested in this Plan

are going to take time to reach harvesting age, it is necessary that devices be installed to reduce their requirement for fuel purposes.

Alder is particularly used for cremation of dead bodies as it is readily available nearer the cremation grounds invariably located on riverbeds or riverbanks. Therefore, construction of improved crematoria is provided in the CAT Plan. These are simple CGI sheet covered structures having open kilns made of fire clay bricks using fire clay cement mortar and are provided with side ventilation as also an iron grill for ventilation from below to facilitate quicker burning. Their design is now standardized and is already available with the forest department. All crematoria would be constructed at most suitable sites (suitable from all angles including from social/customary/religious angle) along the riverbanks to save them from floods. Small water channel to wash the ashes is also included in the cost estimate of each unit.

Similarly, other fuel saving devices are also sought to be introduced like LPG connections as one time non-recurring assistance to deserving families to reduce their dependence on forest trees besides reducing smoke and concomitant health risks.

This will be in the shape of one time non-recurring assistance. Provision for the same has been made in the cost estimates as lump sum.

#### **10.1.D. Administrative/Infrastructure support**

Implementation of CAT Plan places responsibility and additional workload on the executing agency. In this case the executing agency is the forest department of the state. In case of the Compensatory Afforestation there is a levy of 17.5 % Departmental Charges as this work has been viewed as an additional work carried out on behalf of the project. Similarly, for implementing the CAT Plan, the executing agency needs infrastructure support as also administrative cost and has expressed the same during the interaction. Accordingly, provision has been made in the CAT Plan to purchase office equipments (Computers, photocopiers & fax machines) and vehicles, fund construction of one new and repair 8 old Forest Rest Houses in the catchment. Detailed costing has been dealt under the cost norms.

### **10.1.E. Publicity and Awareness**

Creating awareness and doing publicity of the works being done under the CAT Plan are also important as these show the correct picture to the masses. Besides, it also reflects on the environmental responsibilities being discharged by the Sawra-Kuddu. Hence, supporting publicity and awareness about the activities of the CAT Plan in particular has also been identified as one of the activities in the CAT Plan.

To support monitoring of works, it is also proposed to provide sign board/hoarding for each work done in the field. The cost for the same would also be met from this component. However, it has been depicted under the Administrative and Infrastructure costs as it is to be carried out by the CAT Plan executing agency.

### **10.1.F. Monitoring & Evaluation**

Effective monitoring of the Implementation of the CAT Plan is equally important and need not be emphasized. Further, during the interaction with local PRI representatives (some of whom were accompanied by local residents) expressed to be associated not only in the monitoring process but also in the approval of the annual plan of activities for the CAT Plan. A separate paragraph has been devoted on the Implementation mechanism as also on monitoring aspects.

The funds being allocated under this head are meant for carrying out mid-term and end of the term appraisal by hiring professional individual/agency. However, the expenditure incurred on the meeting of two committees as prescribed in this Plan shall also be met with from the funds being provided under Monitoring and Evaluation.

## **10.2 Cost Analysis – Economic and Financial Aspects**

The costs for the proposed schemes comprise of capital investments, annual recurring & maintenance costs. The

construction of nursery, and vehicles form the capital cost. Annual recurring costs include purchase of seed, manure, salary and wages, and miscellaneous expenditure. The plantations done on forestlands under this Plan shall be maintained for a period of seven years. The unit costs are used to determine total cost. Capital costs other than the nursery are taken in Lump Sum. Recurring costs are determined on annual basis. The unit costs are determined for three models of check dams for gully control measures, and secondly wire crates and vegetative spurs for stream bank protection. In case of other engineering measures such as bench terracing, contour stagger trenching, catchment drains and slope modification rates from previous plans have been considered with adjustments considering 12% increase. For biological measures, costs of plantation were determined based on rates per ha from forest department. Administrative and infrastructure costs include expenses of vehicles, equipment, computer, tools etc. It also includes cost of constructing a new Forest Rest House (FRH) besides maintaining 8 older ones. Unforeseen expenditure shall be met from the savings from unutilized amount after meeting the physical targets.

## 10.3. Determination of Unit Costs

### 10.3.A. Engineering measures

#### 10.3.A.1. Cost Estimate for Gully Control Measures

Three models of DRSM Check Dams are prescribed for implementation.

#### Model – I

Conditions: DRSM Check dams in gullies that are shallow to moderate, where stones are available at site. Considering an area of 5 ha, the unit costs are determined.

Check Dams to be erected = 8 Nos.

Average Dimension = 8 m × 1.5m × 2m = 24 cum

Cost @ Rs. 240/- cum =  $24 \times 240 = \text{Rs. } 5,760/-$  per no.

Cost for 8 No.s of check dams = Rs. 46,080/-

Cost per ha. = Rs. 46,080/5

= Rs. 9216/- per ha.

Say Rs 9250/-

## Model – II

Conditions: DRSM check dams in side gullies along with main gully create walls, where stones are available at site. Considering an area of 20 ha, the unit costs are determined.

### [A] Gully Crate Walls

Gully Crates to be erected = 9 Nos.

Average Dimension = 8m × 1.5m × 2 m = 24 cum

Total stones required = 216 cum (24 cum × 9 No.s)

Crate wire required = 9 quintals

[1] Cost of crate wire = Rs. 3,200 × 9 = Rs.  
28,800/-

[2] Transport, weaving etc. = Rs. 4,500/-

[3] Cost of crate with local stones

= Rs. 240/- × 216 = 51,840/-

Total cost [1] + [2] + [3] = Rs.85,140/-

[B] Check dams for Side Nala

Check Dams to be erected = 40 Nos.  
 Average Dimension = 8 m × 1.5m × 1m = 12 cum  
 Total Stones required = 12 cum × 40 = 480 cum  
 Cost @ Rs. 200/- cum = 480 × 240 = Rs.  
 1,15,200/-

**[C] Check Dams for Main Nala**

Check Dams to be erected = 9 Nos.  
 Average Dimension = 8 m × 1.5m × 2m = 24 cum  
 Total stones required = 24 cum × 9 = 216 cum  
 Cost @ Rs. 200/- per cum = Rs.240/- × 216cum  
 = Rs. 51,840/-

Therefore, Total Cost for 20 ha = [A] + [B] + [C]  
 = (Rs.85,140/- + Rs.1,15,200/- + Rs.  
 43,200/-)

= Rs. 2,52,180/-

Hence, cost per ha = Rs. 2,52,180/20 ha  
 = Rs. 12,609/- per ha

Say Rs 12,650/-

## Model – III

Conditions: Combination of DRSM Check Walls, DRSM check dams and Crate works in areas with eroding slopes. Considering an area of 20 ha, the unit costs are determined.

### [A] Gully Crate Walls

Gully Crates to be erected = 9 Nos.

Average Dimension =  $8\text{m} \times 1.5\text{m} \times 2\text{m} = 24\text{ cum}$

Total stones required =  $216\text{ cum} (24\text{ cum} \times 9\text{ nos.})$

Crate wire required = 9 quintals

[1] cost of crate wire =  $3,200/- \times 9 = \text{Rs. } 28,800/-$

[2] Transport, weaving etc. = Rs. 4,500/-

[3] Cost of crate with local stones

=  $\text{Rs. } 240/- \times 216 = 51,840/-$

Total cost [1] + [2] + [3] = Rs. 85,140/-

### [B] Check walls

Check walls to be erected = 50 Nos.

Average Dimension = 10 m × 0.8m × 0.5 m = 4 cum  
Total stones required = 200 cum (4 cum × 50 nos)  
Construction of check walls = Rs. 240/- × 200 cum  
= Rs. 48,000/-

### [C] Check Dams

Check Dams to be erected = 30 Nos.  
Average Dimension = 8 m × 1.5m × 1m = 12 cum  
Total Stones required = 12 cum × 30 = 360 cum  
Cost @ Rs. 200/- cum = 360 × 240 = Rs. 86,400/-

Therefore, Total Cost for 20 ha = [A] + [B] + [C]  
= Rs. 85,140/- + Rs. 48,000/- + Rs. 86,400/-  
= Rs. 2,19,540/-

Hence, cost per ha  
= Rs. 2,19,540/20 ha  
= Rs. 10,977/- per ha  
Say Rs. 11,000/-

### 10.3. A.II. Cost Estimate for Stream Bank Protection

No.	Item	Unit	Qty.	Rate	Amount
<b>Wire Crates (2m x 2m x 15m)</b>					
1	Crate Wire	M	60	95	5700
2	Labour Charges	Man days cum	60	96	5760
3	Stone Collection, fill & tie	Man days cum	60	96	5760

**Total = 17,220/-**

#### Vegetative spur

1	Supply of brushwood material with 40 bundles in two layers	Per bundle	40	18	720
2	Cost of wooden poles 6' x 6' and 6' dia	Numbers	12	30	360
3	Supply	Man days	4	94	376

**Total = Rs.1456/-**

**Note: -**

- i) Bench terracing and Contour stagger trenching rates are taken Rs9,500/- & Rs.4,000/- per ha.respectively with prior experiences which may be analyzed by executing agency for execution.
- ii) Catch water drains rate is taken Rs.1000/- per ha. with prior experiences which may be analyzed by executing agency for execution.

## 10.3.B. Biological Measures

### 10.3.B.1. Afforestation Cost Model

PER HA. COST MODEL FOR AFFORESTATION OF DEGRADED FOREST LANDS, CALCULATIONS BASED ON AVERAGE OF 5 ha PLOT OF 250 × 200 MTRS.

(CALCULATED AT WAGE RATE OF RS. 65/-)

Sr. No.	Particulars of works	Qty.	Rate <u>(in Rs.)</u>	Amount (in Rs)for Non tribal Areas
1.	Survey and demarcation of plantation area including marking of sections, path and Preparation of map.	1 ha.	44.36 per ha	44.36
2.	Cutting and preparation of wooden post 1.80 m. Long and 8 to 10 cm dia including debarking and fastening the top 15 cm in conical shape	60 Nos.	561.36 per hundred	336.81
3.	Carriage of fence post up to 2 m long and 8 to 10 cm dia over distance 1 km.	60 Nos.	295.41 per hundred per Km.	177.24
4.	Preparation/digging of holes 20-30 cm dia and 45 cm deep.	60 Nos.	393.02 per hundred	235.81
5.	Fixing of wooden	60	301.64 per	180.98

	posts including strutting.	Nos.	hundred	
6.	Carriage of B/wire over average distance of 1 km. Up hills.	1 qtls	73.93 per Qtls per Km	73.93
7.	Stretching and fixing of barbed wire with U-staples in case strand (3 stands)	540 Rm.	2.05 per Rm.	1107.00
8.	Bush Cutting in the plantation site	1 ha	517.00 per ha	517.00
9.	Interlacing of thorny bushes in B/wire obtained from planting site	180 Rm	1.78 per Rm	320.40
10.	Preparation of inspection path 60 cm wide.	250R m	4.71 per Rm	1177.50
11.	Layout of pits over.	1ha	73.82	73.82
12.	Digging of pits 45 × 45 × 45 cm (40% of total)	440 No.	413.60 per hundred	1819.84
13.	Digging of pits 30 × 30 × 30 cm (60% of total)	660 No.	206.85 per hundred	1365.21
14.	Filling of pits 45 × 45 × 45 cm.	440 No.	118.51 per hundred	521.44
15.	Filling of pits 30 × 30 × 30 cm	660 No.	82.70 per hundred	545.82
16.	Carriage of naked root plants over distance 2 km. Up hills (BL as well as conifers)	400 No.	15.27 per hundred/Km	122.16
17.	Carriage of plants in P/bags over distance 2 km. Up hills	700 No.	94.51 per hundred	1323.14
18.	Planting of entire plants raised in P/bags	700 No.	94.57 per hundred	661.99

19.	Planting of Naked root plants.	400 No.	79.73 per hundred	318.92
20.	Nursery cost of plants	1100 Nos.	4.00 per plants	4400.00
21.	Sub-Total (1)			15323.37
22.	Soil and moisture conservation work up to (25% of initial planting cost at serial number 21)	1ha	25% of initial planting cost	3830.75
23.	Sub-Total (2)			19154.12
24.	Add cost of B/wire including cost of U Nails.	45kg	2300	1785.00
25.	Total for new planting			20879.12
26.	Or Say			20800.00
	<b>MAINTENANCE COST</b>			
M.	1 <sup>st</sup> year maintenance 1 25% mortality			
a	Re-digging of pits 45 × 45 × 45 cm	110 No.	206.85 per hundred	227.53
b	Re-digging of pits 30 × 30 × 30 cm.	165 No.	103.40 per hundred	170.61
c	Filling of Pits 45 × 45 × 45 cm	110 No.	118.51 per hundred	130.36
d	Filling of pits 30 × 30 × 30 cm	165 No.	82.70 per hundred	136.45
e	Planting of Polythene bags plants	175 No.	94.57 per hundred	165.49
f	Planting of Naked root plants	100 No.	79.73 per hundred	79.73
g	Carriage of Polythene bags plants over a distance of 2 km. Up hills	175 No.	94.51 per hundred	330.78
h	Carriage of Naked	100	15.27 per	30.54

	root plants over a distance of 2 Km up hills	No.	hundred	
i	Nursery cost of plants	275 Nos.	4.00 per hundred	1100.00
j	Repair of fence	180 Rm.	0.70 per	126.00
k	Repair of Inspection path		L/S	300.00
l	Repair of soil and moisture conservation works		L/S	400.00
m	Sub-Total (3)			3197.49
	Or Say			3200.00
M. 2	2nd year maintenance 20% mortality			
a	Re-digging of pits 45 × 45 × 45 cm	88 No	266.85 per hundred	182.02
b	Re-digging of pits 30 × 30 × 30 cm	132 No	103.40 per Hundred	136.48
c	Filling of Pits 45 × 45 × 45 cm	88 No	118.51 per hundred	104.28
d	Filling of pits 30 × 30 × 30 cm	132 No.	84.70 per Hundred	109.16
e	Planting of Polythene bags plants	140 No.	91.57 per Hundred	132.39
f	Planting of Naked root plants	80 No.	79.73 per Hundred	63.78
g	Carriage of Polythene bags plants over a distance of 2 km up hills	140 No.	91.51 per Hundred	264.62
h	Carriage of Naked root plants over a distance of 2 km up hills	80 No.	15.27 per Hundred	24.42
i	Nursery cost of plants	220 No.	4.00 per plant	880.00
j	Repair of fence	180R	0.70 per	126.00

		m	Rm.	
k	Repair of Inspection path		L/S	300.00
l	Repair of soil and moisture conservation works		L/S	400.00
m	Sub-Total (4)			2723.15
	Or Say			2800.00
M. 3	Third year maintenance mortality 15%			
a	Re-digging of pits 45 x 45 x 45 cm	66 No.	206.85 per Hundred	136.52
b	Re-digging of pits 30 x 30 x 30 cm	99 No.	103.40 per Hundred	102.36
c	Filling of Pits 45 x 45 x 45 cm	66 No.	118.51 per Hundred	78.21
d	Filling of pits 30 x 30 x 30 cm	99 No.	82.70 per Hundred	81.87
e	Planting of Polythene bags plants	105 No.	94.57 per Hundred	99.29
f	Planting of Naked root plants	60 No.	79.73 per Hundred	47.83
g	Carriage of Polythene bags plants over a distance of 2 km up hills	105 No.	94.51 per Hundred	198.46
h	Carriage of Naked root plants over a distance of 2 km up hills	60 No.	15.27 per Hundred	18.32
i	Nursery cost of plants	165 No.	4.00 per plant	660.00
j	Repair of fence	200 Rm	0.70 per Rm	140.00
k	Repair of Inspection path		L/S	300.00
l	Repair of soil and moisture conservation		L/S	400.00

	works			
m	Sub-Total (5)			2262.86
	Or Say			2300.00
M. 4	Fourth year maintenance 15% mortality			
a	Re-digging of pits 45 x 45 x 45 cm	66 No.	206.85 per Hundred	136.52
b	Re-digging of pits 30 x 30 x 30 cm	99 No.	103.40 per Hundred	102.36
c	Filling of Pits 45 x 45 x 45 cm	66 No.	118.51 per Hundred	78.21
d	Filling of pits 30 x 30 x 30 cm	99 No.	82.70 per Hundred	81.87
e	Planting of Polythene bags plants	105 No.	94.57 per Hundred	88.29
f	Planting of Naked root plants	60 No.	79.73 per Hundred	47.83
g	Carriage of Polythene bags plants over a distance of 2 km up hills	105 No.	94.51 per Hundred	198.47
h	Carriage of Naked root plants over a distance of 2 km up hills	60 No.	15.27 per Hundred	18.32
i	Nursery cost of plants	165 No.	4.00 per plant	660.00
j	Repair of fence	200 Rm	0.70 per Rm.	140.00
k	Repair of Inspection path		L/S	200.00
l	Repair of soil and moisture conservation works		L/S	200.00
m	Sub-Total (6)			1962.87
	Or Say			2000.00
M. 5	Fifth year maintenance 10%			

	mortality			
a	Re-digging of pits 45 × 45 × 45 cm	44 No.	206.85 per hundred	91.01
b	Re-digging of pits 30 × 30 × 30 cm	66 No.	103.40 per hundred	68.24
c	Filling of pits 45 × 45 × 45 cm.	44 No.	118.51 per hundred	52.14
d	Filling of pits 30 × 30 × 30 cm.	66 No.	82.70 per hundred	54.58
e	Planting of Polythene bags plants	70 No.	94.57 per hundred	66.19
f	Planting of Naked root plants	40 No.	79.73 per hundred	31.89
g	Carriage of Polythene bags plants over a distance of 2 km up hills	70 No.	94.51 per hundred	132.31
h	Carriage of Naked root plants over a distance of 2 km up hills	40 No.	15.27 per hundred	12.21
i	Nursery cost of plants	110 Nos.	4.00 per plant	440.00
j	Repair of fence	200 Rm.	0.70n per Rm	140.00
k	Repair of Inspection path		L/S	200.00
l	Repair of soil and moisture conservation works		L/S	200.00
m	Sub-Total (7)			1488.57
	Or Say			1500.00
M. 6	Sixth year maintenance 10% mortality			
a	Re-digging of pits 45 × 45 × 45 cm.	44 No.	206.85 per hundred	91.01

b	Re-digging of pits 30 x 30 x 30 cm	66 No.	103.40 per hundred	68.24
c	Filling of Pits 45 x 45 x 45 cm	44 No.	118.51 per hundred	52.14
d	Filling of pits 30 x 30 x 30 cm	66 No.	82.70 per hundred	54.58
e	Planting of Polythene bags plants	70 No.	94.57 per hundred	66.19
f	Planting of Naked root plants	40 No.	79.73 per hundred	31.89
g	Carriage of Polythene bags plants over a distance of 2 km up hills	70 No.	94.51 per hundred	132.31
h	Carriage of Naked root plants over a distance of 2 km up hills	40 No.	15.27 per hundred	12.21
i	Nursery cost of plants	110 Nos.	4.00 per plant	440.00
j	Repair of fence	150 Rm	0.70 per Rm	105.00
k	Repair of Inspection path		L/S	100.00
l	Repair of soil and moisture conservation works		L/S	100.00
m	Sub-Total (8) Or Say			1253.57 1250.00
M. 7	Seventh year maintenance mortality 10%			
a	Re-digging of pits 45 x 45 x 45 cm	44 No.	206.85 per hundred	91.01
b	Re-digging of pits 30 x 30 x 30 cm	66 No.	103.40 per hundred	68.24
c	Filling of Pits 45 x 45 x 45 cm.	44 No.	118.51 per hundred	52.14
d	Filling of pits	66	82.70 per	54.58

	<b>30 × 30 × 30 cm.</b>	<b>No.</b>	<b>hundred</b>	
<b>e</b>	<b>Planting of Polythene bags plants</b>	<b>70 No.</b>	<b>94.57 per hundred</b>	<b>66.19</b>
<b>f</b>	<b>Planting of Naked root plants</b>	<b>40 No.</b>	<b>79.73 per hundred</b>	<b>31.89</b>
<b>g</b>	<b>Carriage of Polythene bags plants over a distance of 2 km up hills.</b>	<b>70 No.</b>	<b>94.51 per hundred</b>	<b>132.31</b>
<b>h</b>	<b>Carriage of Naked root plants over a distance of 2 km up hills</b>	<b>40 No.</b>	<b>15.27 per hundred</b>	<b>12.21</b>
<b>i</b>	<b>Nursery cost of plants</b>	<b>110 Nos.</b>	<b>4.00 per plant</b>	<b>440.00</b>
<b>j</b>	<b>Repair of fence</b>	<b>150 Rm.</b>	<b>0.70 per Rm.</b>	<b>105.00</b>
<b>k</b>	<b>Repair of Inspection path</b>		<b>L/S</b>	<b>100.00</b>
<b>l</b>	<b>Repair of soil and moisture conservation works</b>		<b>L/S</b>	<b>100.00</b>
<b>m</b>	<b>Sub-Total (9)</b>			<b>1253.57</b>
	<b>Or Say</b>			<b>1250.00</b>
<b>27</b>	<b>Grand Total Initial cost of 7 years maintenance</b>			<b>35100.00</b>
<b>28</b>	<b>Contingencies (5% of total cost)</b>			<b>1755.00</b>
<b>29</b>	<b>Grand Total</b>			<b>36855.00</b>
<b>30</b>	<b>Or Say</b>			<b>36800.00</b>

**10.3.B.I. Linear strip planting Cost Model for riverine tree spp  
• conservation**

In addition to the above cost model for afforestation, the linear strip planting along watercourse mainly of the Pabbar River would require costs on account of carriage of material within the plantation area and also would entail higher costs for fencing. The perimeter of fencing in this model would be much longer as compared to the traditional afforestation model. As such its initial planting cost is taken as Rs 26,000/- per ha as opposed to the per ha cost of Rs 20,800/- per ha for afforestation model for initial planting. Similarly, the maintenance cost is also higher at Rs 15,000 per ha in case of this model.

### **10.3.C. Maintenance:**

Provision of maintenance is proposed for the works to be executed under CAT-Plan after its completion @ 5%, upto 7 years, of all items taken under Engineering & Biological measures in which maintenance cost is not included.

The executing agency may bifurcate the amount of maintenance as per the requirement and unutilized amount may be diverted to other treatment works in the catchment with proper codal formalities. Amount may be seen in the Table:3

<b>10.3.D. Machinery &amp; Equipment</b>				
<b>S. No.</b>	<b>Items</b>	<b>Qty.</b>	<b>Rate (Rs. In lacs)</b>	<b>Amount (In lacs.)</b>
1	Trucks	1	8.00	8.00
2	Bolero	1	6.00	6.00
	Sub total	-	-	14.00
3	Fax	2	0.15	0.30
4 (i)	Desktop Pentium 4 PC's complete with assessories, and 1 laser printer	6	0.50	3.00
(ii)	Photo copiers	2	1.0	2.00
	Sub total		<b>5.30 Lacs</b>	
5	R & M of Vehicle for 5years	L/S.		<b>10.00 Lacs</b>

<b>10.3.E Buildings/FRHs^</b>				
<b>S. No.</b>	<b>Items</b>	<b>Qty.</b>	<b>Rate (Rs.)</b>	<b>Amount (In lacs.)</b>
1	Repair & furnishing of old FRH's			
(i)	At Rohru	01 No.	L.S.	2.00
(ii)	At Khadda Pather	01 No	L/S	5.00
(iii)	At Dodra	01 No	L/S	5.00
(iv)	At Tikker	01 No	L/S	2.00
(v)	At Biswani	01 No	L/S	2.00
(vi)	At Dalgaa	01 No	L/S	2.00
(vii)	At Basla	01 No	L/S	4.00
(viii)	At Gowas	01 No	L/S	4.00
	Sub total C			<b>26.00</b>
2	New FRH Construction I/c furnishing	01 No	L/S	<b>25.00</b>

^ Detailed estimates to be prepared by the executing agency. However, executing agency shall be at liberty to approve any variation of cost estimates between FRHs but remaining within the overall cost of Rs 26.00 lakh.

10.3.F	Publicity and Awareness	-	L.S.	9.00
<p>Besides expenditure on awareness campaigns and other publicity measures, the cost under this component would also include cost of providing sign boards for each work done in the field under this Plan.</p>				

### 10.3.G. Fuel Saving Devices: - (Cost Model)

#### 10.3.G.i. The alternate fuel in the form of LPG connection

LPG gas connections (cylinder along with stove) to be distributed to the effected permanent residents of the area. One time assistance as Non-recurring cost.

Approximately 2000 connections @ Rs.1500/- to be released over a span of 5years.

Hence, total amount = 2000 No. @ RS. 1500/- = Rs 3,00,000/-

(Rupees Thirty Lacs only)

#### 10.3.G.ii. Crematoria

**Crematoria -4.00 No @ \*Rs.4,00,000/- = Rs.16,00,000/-**

**It includes the cost of water channel, site selection etc. for complete job in all respect.**

**\* The detailed estimate to be prepared by the executing agency through competent professionals.**

## **11. Total Cost of CAT Plan**

**The total cost of implementing this CAT Plan is Rs 731.08/- lakhs. Details of Cost for five years Plan can be viewed at a glance in Table-3, which also provides the component-wise break up. The implementing agency may adjust inter-component costs depending upon the need and savings from any one component without increasing the over cost of the CAT Plan. Similarly, it may vary the year-wise cost also.**

### **11.1. Cost apportioning between sub-catchments**

**As elaborated under Introduction the cost of this CAT Plan has to be apportioned appropriately since there are four more HEPs on main Pabbar river coming up shortly. It was duly**

deliberated with the concerned officers of the forest department and it was decided that till such time other projects' CAT Plans are not formulated, the Sawra-Kuddu HEP should treat the whole catchment. However, in view of the upcoming other HEPs it was also decided that the total cost should be apportioned half-half between treatable catchment area (263 Sq Km) and the remainder of the total catchment (i.e. 1034 Sq Km - 263 Sq Km =) 771 Sq Km area. This arrangement will come to an end the day any other HEP's CAT Plan on main Pabbar river is formulated.

## **12. Implementing agency**

The implementing agency of this CAT Plan shall be the HP Forest Department as per GOI stipulations being followed elsewhere too. The forest department has the requisite expertise and experience of formulation and implementation of CAT Plans. Extensive and intensive consultation with them has been done while preparing this Plan. Some of the components the implementing agency has desired to be provided to it in kind, the cost of which shall be borne from this Plan. All such components

shall accordingly be shown in the funds release statements of PVPC and also of funds received statements of the HP Forest Department. The Pabbar Valley Power Corporation (PVPC) shall be associated in the APO (Annual Plan of Operation) approval and also in the subsequent monitoring of activities. Details are provided in the following paragraphs.

### **13. Institutional Mechanisms for implementation**

The HP Forest Department would implement this Catchment Area Treatment Plan. The Forest Department would be at liberty to sub-contract relevant components.

The soil conservation and afforestation programme would evolve employment opportunities; thus, people's participation should be encouraged and would involve mobilization of manpower for such activities. As such, wherever feasible and where people show interest as per state's PFM rules, CAT Plan activities should be planned and executed in accordance with the

same. Experts and professionals competent enough in operationalizing the plan may be consulted from time to time.

## 14. Role of PVPC and other Agencies

There would be four more CAT Plan of other four HEPs on the main Pabbar river soon taking the total number of CAT Plans to five in this valley in HP to be implemented by Rohru Forest Division. Therefore, it may be prudent to have a common society for implementing all the five CAT Plans in the valley. Forming a Pabbar Valley CAT Plan Society at the earliest is advisable.

The suggested society should inter alia have members from all the user agencies like Pabbar Valley Power Corporation. Representatives of the PRIs should also be enlisted as members. NGOs, if any, working in the area should also be involved.

However, till the time such an entity comes into being and starts functioning, an interim arrangement has been devised and is described in the subsequent paragraphs. There would be two committees; one for approval of the APO and the other for monitoring of works of CAT Plan. Even in areas where PFM

mode is adopted for implementation this mechanism shall remain in force and shall not be overruled.

#### **14.1. APO Approval Committee**

Till the time the suggested Pabbar Valley CAT Plan Society does not come into being and is not operationalized, as an interim arrangement a committee shall approve the activities on an annual basis. This committee shall be called APO Approval Committee of Sawra-Kuddu HEP CAT Plan.

Following shall be the constitution of the committee, which shall be notified by the Conservator of Forests, Shimla.

1. Chairman - Conservator of Forest, Shimla.
2. Block Development Officer Rohru
3. Block Development Officer Jubbal
4. ADO, Agriculture Department.
5. HDO, Horticulture Department.
6. Technical Officer, Animal Husbandry Department.
7. PRI (Panchayat Raj Institution) representative of the affected twelve Panchayats namely – Barada, Ranwl,

**Bhollar, Thanda, Mandhal, Jhagtan, Jhalta, Giltari, Antl, Sarswati-Nagar, Kuddu and Patsari.**

- 8. Any other four PRI representatives from the remaining catchment nominated by Conservator of Forests, Shimla.**
- 9. Representative of M.D, Pabbar Valley Power Corporation (P.V.P.C) Limited.**
- 10. D.F.O. Rohru Forest Division - Member Secretary.**

**The Range Officers concerned shall assist the member secretary in the meeting.**

**Right in the beginning of the financial year or even up to two months before, this committee shall approve the APO of that particular year which is to be treated. The implementing agency will clearly list the areas (with name and location) along with the works to be taken up and their costs in the agenda note for the committee. The report/proceeding of the Monitoring Committee as available would also placed before this committee. A copy of the proceedings along with a copy of the agenda note would be sent to members of the Monitoring Committee also for their information.**

This committee will meet once a year. A quorum of 50 % of the members would suffice to hold a meeting and approve the APO and other items of agenda. All non-official members shall be entitled to TA/DA as per rates approved and being followed by DC Shimla. All the expenditure on the conduct of the meetings of this committee would be met from the funds of Monitoring & Evaluation head.

## **15. Monitoring and evaluation**

### **15.1. Monitoring Committee for CAT Plan Works**

As in the case of APO approval, till such time the suggested Pabbar Valley CAT Plan Society does not come into being and does not have proper monitoring mechanism, as an interim arrangement a committee shall monitor the works of this CAT Plan on an annual basis.

The monitoring committee would be constituted as furnished below: -

1. Chairman, Conservator of Forests, Shimla

2. A.C.F, Rohru.
3. PRI (Panchyati Raj Institution) representatives – Any 5 (Five) Pardhans of the affected Panchyats to be nominated by CH Shimla in rotation as per convenience.
4. Any other four PRI representatives from the remaining catchment nominated by Conservator of Forests, Shimla.
5. Representative of M.D, PVPC.
6. D.F.O, Rohru – Member Secretary.

Chairman may co-opt any other members for a period as felt necessary by him. However, total co-opted members would not be more than five at any time.

The committee would need to ensure the implementation and monitoring of the catchment area treatment works and review the progress from time to time. The implementing agency will, immediately upon its approval, provide a copy of the approved APO giving details such as list of areas (with name and location) along with the works to be taken up and their costs to

each member of the committee right in the beginning of the year. The report/proceeding of the Approval Committee as available would also be placed before this committee. Annual progress report would be submitted to PVPC also.

The Committee shall strive to make the monitoring process as transparent as possible. The members of the PRI representatives would be responsible for sharing information in their areas, as also with other representatives of PRIs and who in turn are to share the information in their respective areas.

Meeting of this Committee would be held at least once in a year. A quorum of 50 % of the members would suffice to hold a meeting. All non-official members shall be entitled to TA/DA as per rates approved and being followed by DC Shimla. All the expenditure on the conduct of the meetings of this committee would be met from the funds of Monitoring & Evaluation head.

## **15.2. Monitoring & Evaluation by Professional Agency**

Services of a professional monitoring expert as individual or as an agency (group/firm/company) would be required for supplementing the monitoring efforts of the monitoring committee and also for preparing a well documented monitoring report. The CF Shimla is fully authorized to hire a competent agency/individual for this purpose and order release of payment for the same from the funds allocated for monitoring & evaluation. However, the report shall be tabled before the monitoring committee for its approval.

### **15.3. Public Awareness and information**

In addition, the works should be published through public awareness campaigns. Visual and print media need to be used to embark on maximum benefit by direct and indirect beneficiaries. Such efforts would resolve conflicts which otherwise are potential sources for increasing project gestation. Publishing the list of areas treated in a particular year would be the most appropriate strategy for public information of the works done.

## 16. Release of funds

The PVPC would release the funds as per year-wise phasing given in **Table-3** and during year five, it would release all the remaining funds. Whatever mechanism is adopted for implementing the CAT Plan, whether a society or a committee, representative of the Managing Director of PVPC would be associated in approval of the APOs and also in the subsequent monitoring of works.

## 17. Other Recommendations

Besides above, following recommendations are being made for smooth implementation of the CAT Plan.

1. The implementing agency i.e. HP Forest department should give priority to the project-affected families and local population while employing labor in CAT Plan activities and also in the selection of beneficiaries under alternate fuel devices.

2. Project authorities should ensure frequent meetings with the forest department's CAT Plan implementation officials and executing team members to enable smooth implementation of the CAT and ensure financial flow.
3. Sub-contracting of appropriate activities of the CAT Plan through local people/agencies should be encouraged.
4. Adequate emphasis on NTFP introduction and propagation would help the local population in the short term.
5. Display of Information boards at the work sites showing name of work/component, scope & extent of work, cost involved and year of completion as also name of the funding agency would help in public information.

CAT Plan - Sawra-Kuddu Hydro-electric Project

TABLE No.3 :

Physical and financial Details of CAT Plan

S.N.	Description of the Item	Phy. Qty	Unit	Fin. unit cost in Rs.	Zeroth Year		1st Year		2nd Year		3rd Year		4th Year		5th Year		Total		
					Phy.	in Lacs	Phy.	in Lacs	Phy.	in Lacs	Phy.	in Lacs	Phy.	in Lacs	Phy.	in Lacs	Phy.	in Lacs	Phy.
<b>A. Engineering Measures/Soil &amp; Moisture Conservation</b>																			
1. Gully Control :-																			
1.	Mode I	400	ha	92500			8000	7.40	8000	7.40	8000	7.40	8000	7.40	8000	7.40	40000	37.00	
2.	Mode II	300	ha	126500			6000	7.59	6000	7.59	6000	7.59	6000	7.59	6000	7.59	30000	37.95	
3.	Mode III	220	ha	110000			4400	4.84	4400	4.84	4400	4.84	4400	4.84	4400	4.84	22000	24.20	
2. Stream bank protection																			
1.	Wire Crates	200	No	172200			4000	6.89	4000	6.89	4000	6.89	4000	6.89	4000	6.89	20000	34.44	
2.	Vegetative spurs	400	No	145600			8000	1.16	8000	1.16	8000	1.16	8000	1.16	8000	1.16	40000	5.82	
3.	Bank terracing	125	ha	950000			2500	2.38	2500	2.38	2500	2.38	2500	2.38	2500	2.38	125000	11.88	
4.	Contour stagger trenching	100	ha	400000			2000	0.80	2000	0.80	2000	0.80	2000	0.80	2000	0.80	100000	4.00	
3. Landslides Control:-																			
1.	Catchwater drains	500	ha	100000			10000	1.00	10000	1.00	10000	1.00	10000	1.00	10000	1.00	50000	5.00	
2.	R.W. check dams etc	455	ha	1100000			9700	10.67	9700	10.67	9700	10.67	9700	10.67	9700	10.67	485000	53.35	
<b>Total (A)</b>								<b>42.73</b>		<b>213.64</b>									
<b>B. Biological Measures</b>																			
1. Afforestation - 300 ha @ Rs.20,800/- (\$800+12000)																			
1.	Advance work	300	ha	58000			60	5.28	60	5.28	60	5.28	60	5.28	60	5.28	30000	26.40	
2.	Plantation Completion	300	ha	120000			6000	7.20	6000	7.20	6000	7.20	6000	7.20	6000	7.20	300000	36.00	
2. Timber plantation 325 ha @ Rs.12600/- (\$780+\$820)																			
1.	Advance work	325	ha	378000			65	2.46	65	2.46	65	2.46	65	2.46	65	2.46	325000	12.29	
2.	Plantation Completion	325	ha	882000			6500	5.73	6500	5.73	6500	5.73	6500	5.73	6500	5.73	3250000	28.67	
3. Exotic plantation 130 ha @ Rs.12600/-																			
1.	Advance work	130	ha	378000			26	0.98	26	0.98	26	0.98	26	0.98	26	0.98	130000	4.91	
2.	Plantation Completion	130	ha	882000			2600	2.29	2600	2.29	2600	2.29	2600	2.29	2600	2.29	1300000	11.47	
4. NTFP plantation 250 ha @ 12600/-																			
1.	Advance work	250	ha	378000			50	1.89	50	1.89	50	1.89	50	1.89	50	1.89	250000	9.45	
2.	Plantation Completion	250	ha	882000			5000	4.41	5000	4.41	5000	4.41	5000	4.41	5000	4.41	2500000	22.05	

S.N.	Description of the Item	Qty.	Unit	Fin. unit cost in Rs	Zeroth Year		First Year		2nd Year		3rd Year		4th Year		5th Year		Total		
					Phy.	Fin	Phy.	Fin	Phy.	Fin	Phy.	Fin	Phy.	Fin	Phy.	Fin	Phy.	Fin	Phy.
e	Pasture development 300 ha @ Rs 8250-(2475+5775)																		
i)	Advance work.	300	ha.	2475.0	60	1.49	60	1.49	60	1.49	60	1.49	60	1.49					
ii)	Plantation Completion	300	ha.	5775.0		3.47	60.00	3.47	60.00	3.47	60.00	3.47	60.00	3.47	50.00	3.47	300.00	7.43	300.00
	Sub-Total (B-4)	1305				12.85		35.20		35.20		35.20		35.20		23.18			175.98
5	Conservation & Regeneration of riverine tree spp.																		
a	New nurseries development	2	No.	500000			2.0	10.00											
b	Maintenance of nurseries	2	No.	500000				1.00		1.00		1.00		1.00		1.00	2.00	2.00	10.00
																			5.00
c	Linear strip planting	50	ha.	25000.0			10.00	2.60	10.00	2.60	10.00	2.60	10.00	2.60	10.00	2.60	50.00		13.00
	Sub-Total (B-5)							13.60		3.60		3.60		3.60		3.60			28.00
6	Maintenance																		
6 a	Engineering Structures	2730	% of A	3.0															
6 b	Afforestation (4 a above)	300	per ha	14300.0															
6 c	Other Plantations (4 b to 4 e)	1005	% of B	20.0															
6 d	Riverine strip planting	50	per ha	15000.0															
	Sub-Total (B-6)																		
	Total (B)		All Biological Measures																283.51
C.	Administrative / Infrastructure Expenses:-																		
7	Vehicles/Machinery and Equipments:-																		
a	Boleto-1, Mazda Carter-1	2	No.	US			2	14.00											14.00
b	Maintenance of machines			US				2.00	2.00					2.00					10.00
c	Computer-5, Photo-copier-2, Fax-2			US			10	5.30											5.30
8	Buildings:-																		
a	Maintenance (Repair/furnishing) of old FRHs-8 at diff. Locations	8	No.	US				26.00											26.00
b	New Forest Rest-House (FRH)-Const./Furnishing	1	No.	US			1	25.00											25.00
9	Awareness, Publicity & Other charges			US				2.50	2.00					1.5					9.00
	Total (C)							100.8	4.00					3.50					115.30
D.	Private Land Treatment																		
10	Pasture development @ Rs. 8250/-																		
i)	Advance work	200.0	ha.	2475.0	40	2.99	40	0.99	40	0.99	40	0.99	40	0.99					200.00
ii)	Plantation Completion	200.0	ha.	5775.0			40.00	2.31	40.00	2.31	40.00	2.31	40.00	2.31	40.00	2.31	200.00		11.55
	Sub-Total (D)																		
11	Horti./Agriculture and development @ 12600/-																		

to be apportioned each year as per previous year's actual physical achievement for 7 Year  
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S.N.	Description of the Item	Phy. Qty	Unit	Fin. unit cost in Rs	Zero(0) Year		First Year		2nd Year		3rd Year		4th Year		5th Year		Total		
					Phy.	Fin in Lacs	Phy.	Fin in Lacs	Phy.	Fin in Lacs	Phy.	Fin in Lacs	Phy.	Fin in Lacs	Phy.	Fin in Lacs	Phy.	Fin in Lacs	Phy.
i)	Advance work	300.0	ha.	3780.0	60	2.27	60	2.27	60	2.27	60	2.27	50.0	2.27			300.00	11.34	
ii)	Plantation Completion	300.0	ha.	8820.0			60.0	5.29	60.0	5.29	60.0	5.29	50.0	5.29	60.0	5.29	300.00	26.46	
	<b>Total (D)</b>					3.26		10.9		10.86		10.86		6.00		7.50		54.30	
<b>E. Fuel Conservation Measures.</b>																			
12	Alternate Fuel							6.00		6.00						6.00		30.00	
13	Fuel saving devices - Crematorias	5	No.	400000/-			3	12.00	2.00	3.00								20.00	
	<b>Total (E)</b>							18.00		14.00				6.00		6.50		50.00	
<b>F. Monitoring &amp; Evaluation</b>																			
14	Meetings & Evaluation Expenses by Independent Valuator/Agency @ 2% of Totals (A+B+C+D+E)							2.87		2.87						2.87		14.33	
	<b>Total (F)</b>							2.87		2.87						2.87		14.33	
<b>GRAND TOTAL = (A+B+C+D+E+F+G+H) Rs (in Lacs)</b>																<b>731.08</b>			

**Or Say Rs (in Lacs)**

\*This Percentage excludes maintenance of Afforestation areas of 4 a

  
 Manoj Kumar  
 Sr. Executive Engineer,  
 PV.C, Khalini  
 Shimla-2 (H.P.)

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 PV.C, Khalini  
 Shimla-2 (H.P.)



# ENVIRONMENTAL ATLAS

## SHIMLA DISTRICT

### LANDUSE MAP

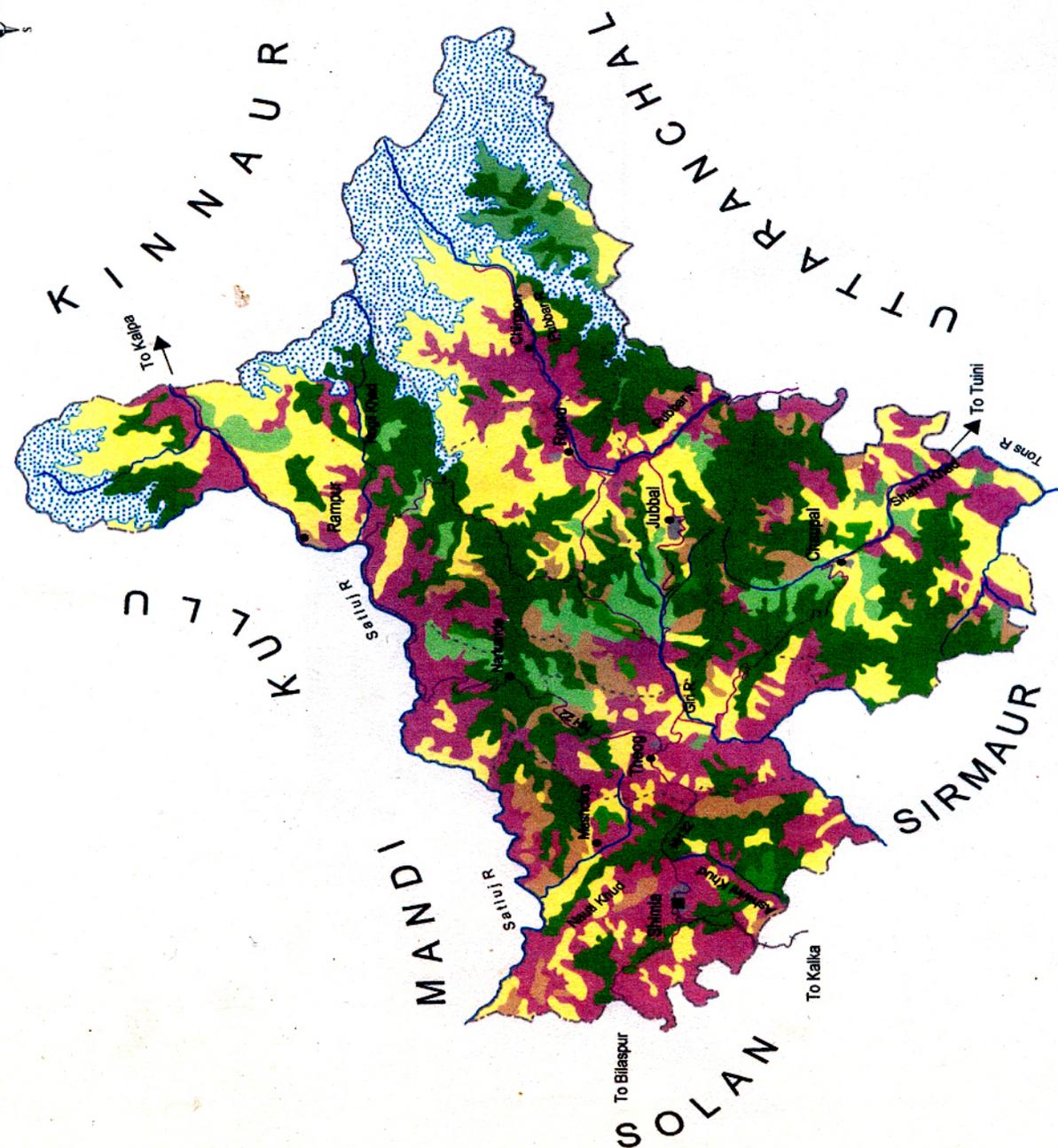
Legend

- State Boundary
- District Boundary
- Block Boundary
- Major Roads
- Railway Line
- Drainage
- Block HQ
- District HQ
- BUILT-UP LAND
- DEGRADED OR SCRUB LAND
- EVERGREEN/SEMI-EVERGREEN FOREST
- FOREST PLANTATION
- GRASS LAND/GRAZING LAND
- KHARIF-RABI
- LAND WITH OR WITHOUT SCRUB PLANTATION
- SNOW COVERED/GLACIAL AREA

Source: Procured from NRSA, Hyderabad  
Survey of India Toposheets



Dr. No: 2.



# PUBBAR VALLEY SHIMLA DISTRICT

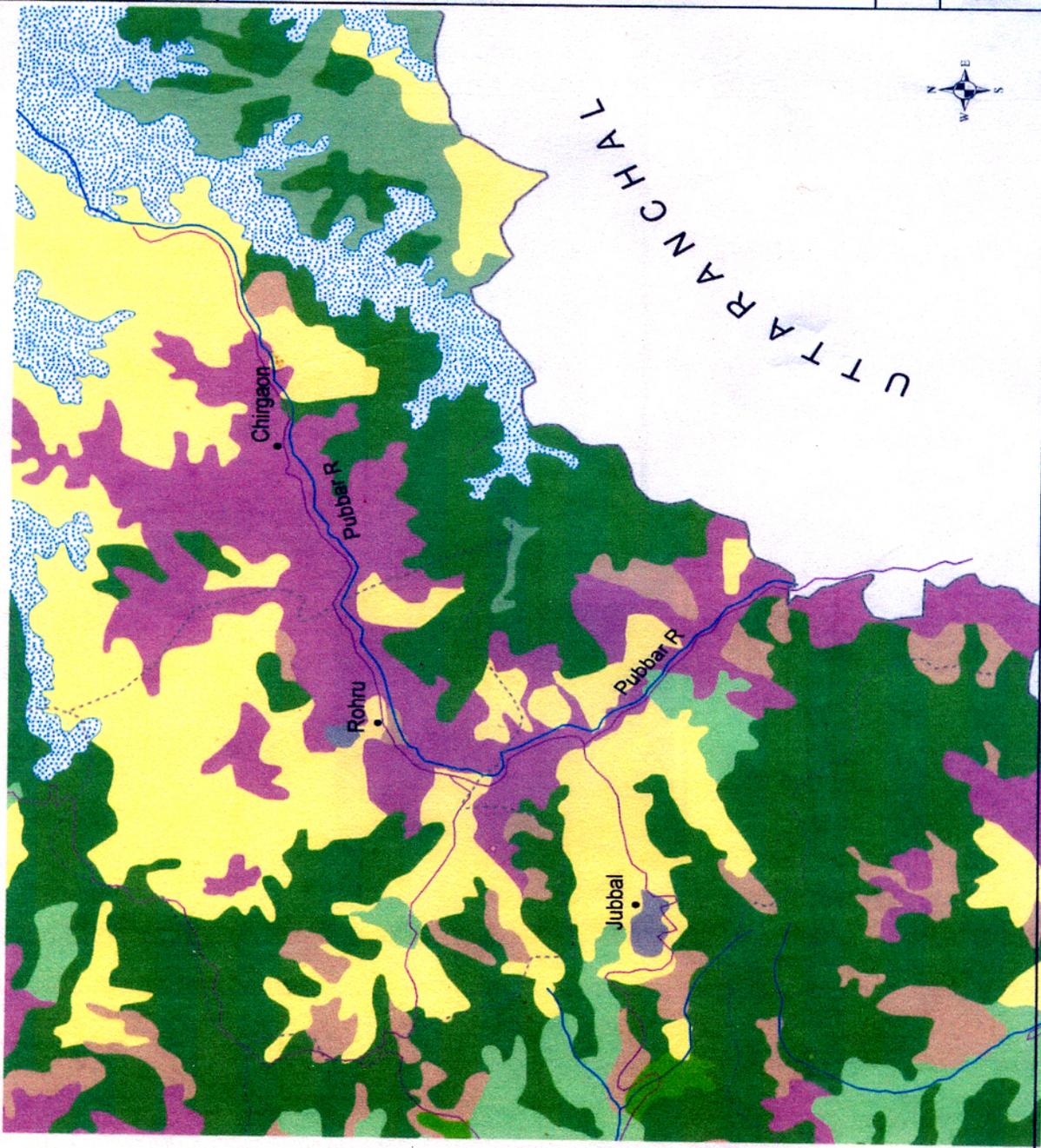
## LANDUSE MAP

- Legend
- State Boundary
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  - - - Block Boundary
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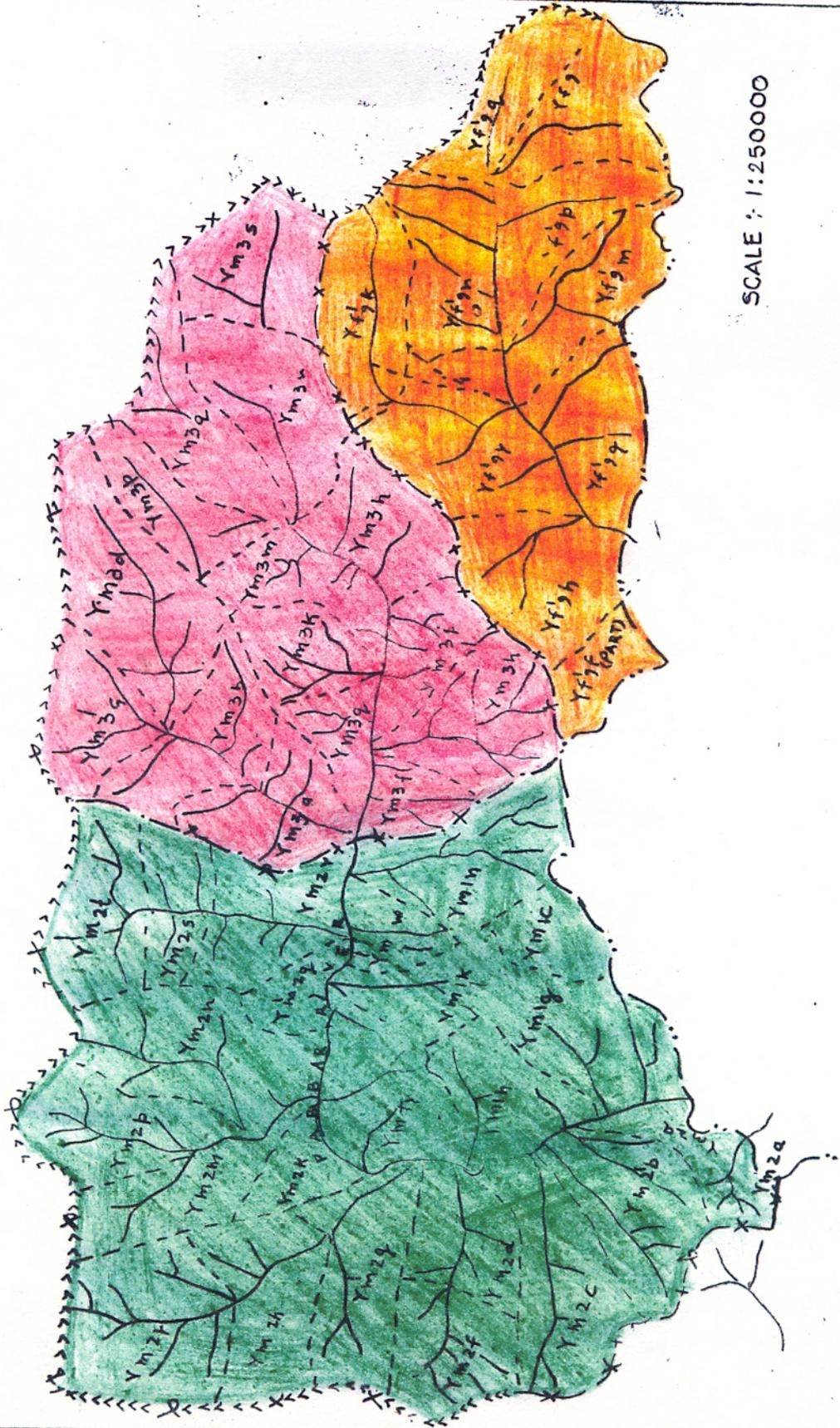
Dr# No: 2.1



# CATCHMENT AREA MICRO-WATER-SHEDS WITH CODE

SOURCE : AGRICULTURE REPORT NO. 830 . A.I.S. & L.U.S. G.I. MOA, NEW DELHI.

DRG. NO. 3



SCALE : 1:250000

# CATCHMENT AREA MICRO-WATER-SHEDS WITH CODE

SOURCE :- AGRICULTURE REPORT NO 330 A.I.S. & LUS.G.I.MOA,NEW DELHI.

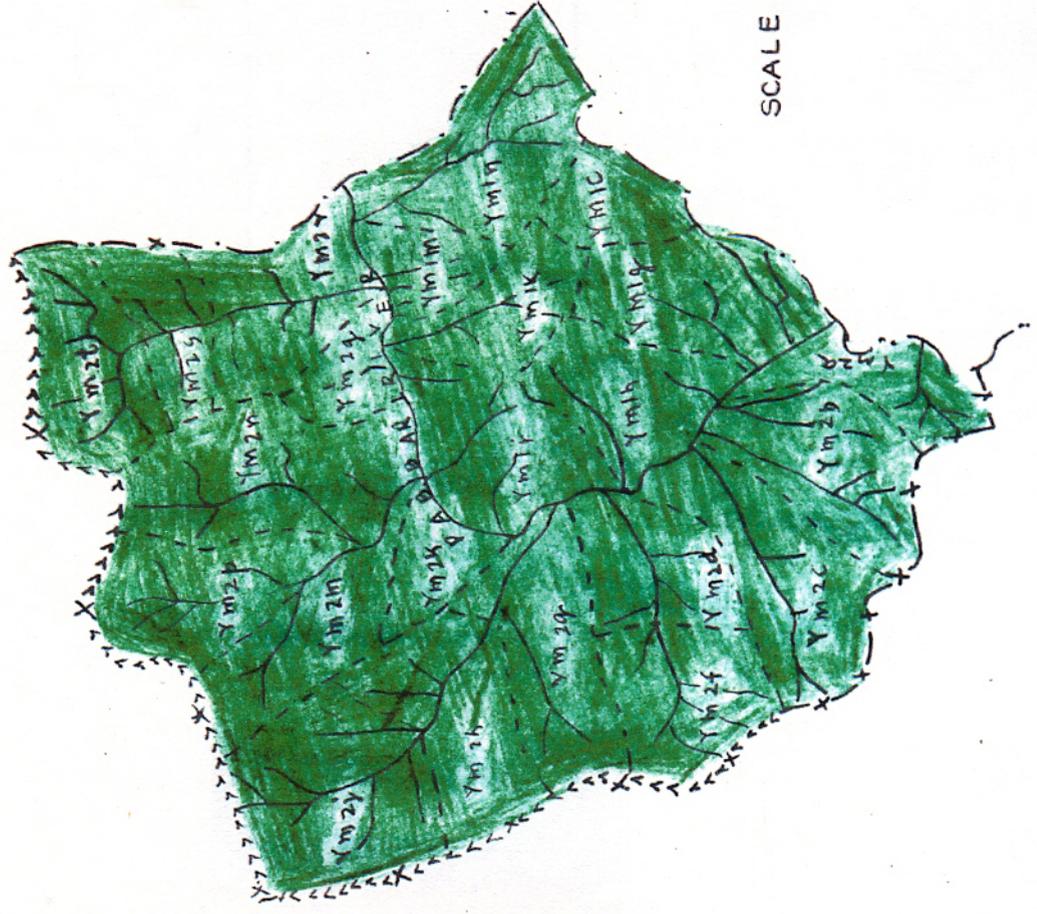


SCALE :- 1:250000

# CATCHMENT AREA MICRO-WATER-SHEDS WITH CODE

DRG. NO. 3.3

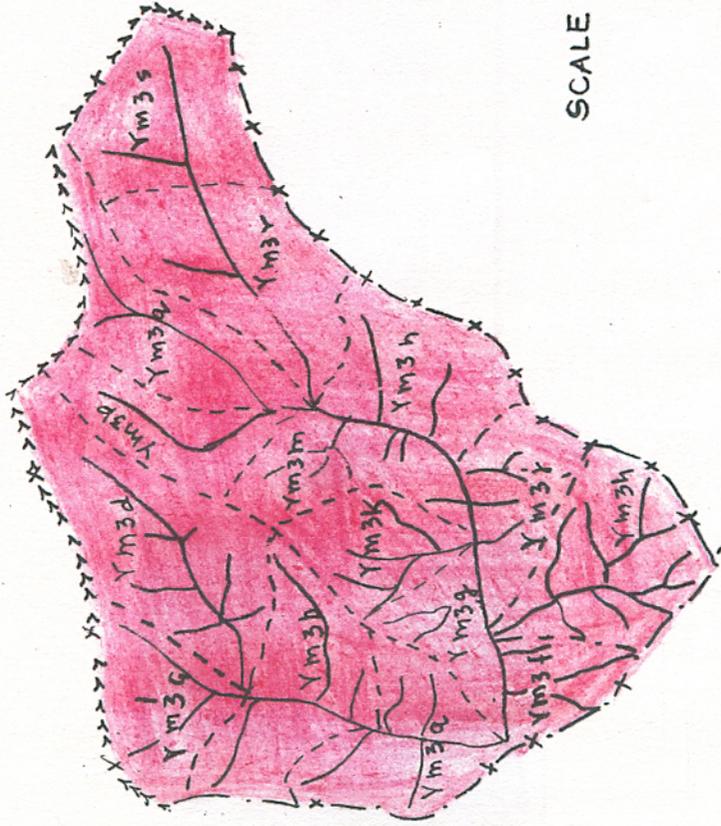
SOURCE : AGRICULTURE REPORT NO 830. A.I.S. & L.U.S. G.I. MOA NEW DEHLI.



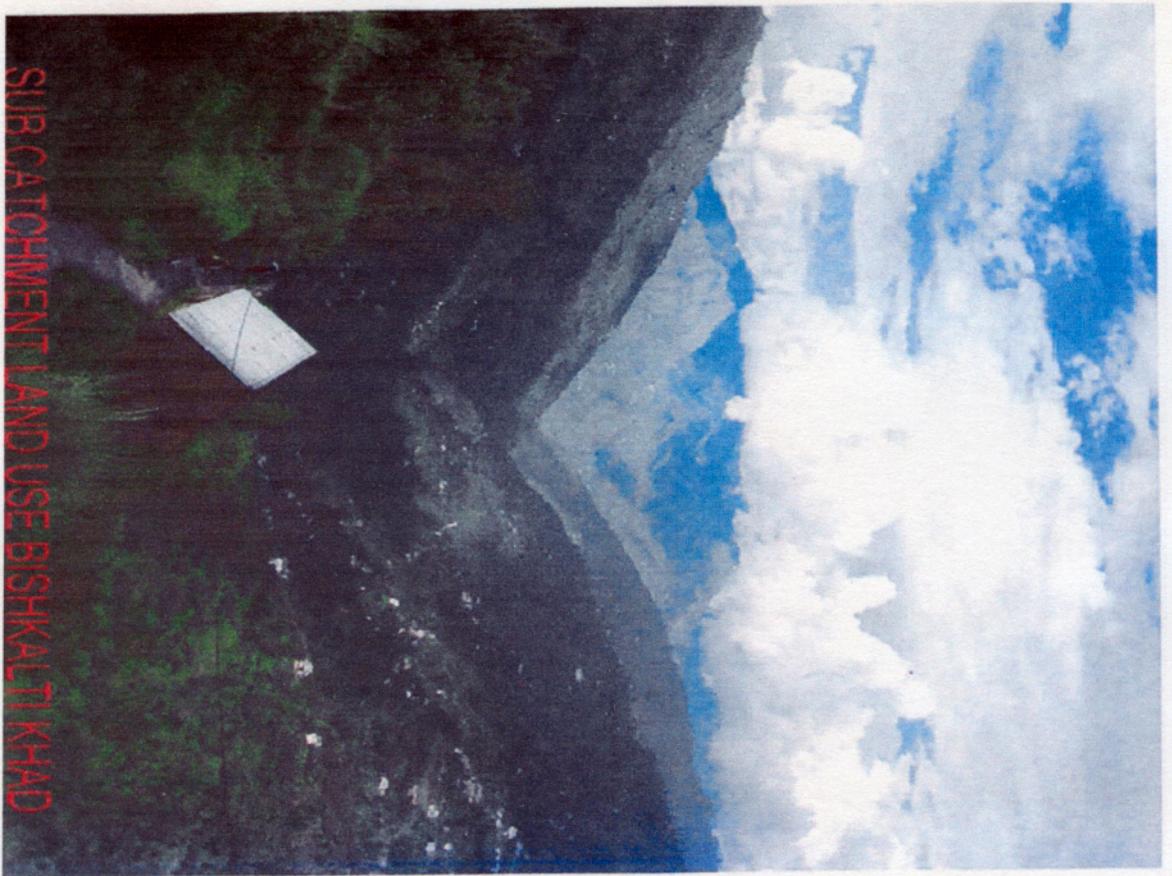
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# CATCHMENT AREA MICRO-WATER - SHEDS WITH CODE

SOURCE: AGRICULTURE REPORT NO 830, A.I.S & L.U.S. G.I MOA NEW DEHLI



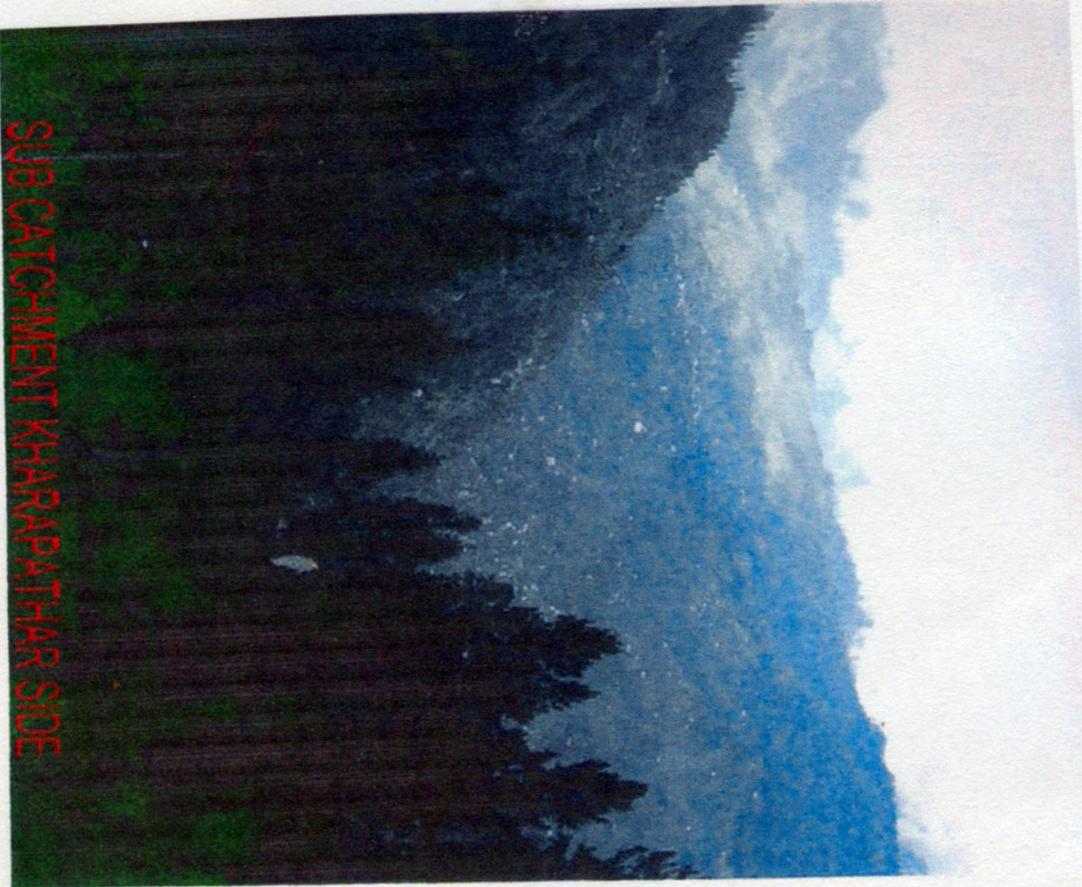
SCALE : 1:250000



SUB CATCHMENT LAND USE BISHKALTI KHAD



SUB CATCHMENT LAND USE



SUB CATCHMENT KHARAPATHAR SIDE



SUB CATCHMENT FORESTS