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REVISED
CATCHMENT AREA TREATMENT PLAN
OF
CHAMERA H.E. PROJECT, STAGE-II
(H.P.)

SUBMITTED BY:

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PREFACE

In order to maintain a desirable balance with resource production and resource utilisation and to fulfil the statutory requirement laid down for Hydroelectric Projects by Government of India the present Catchment Treatment Plan has been prepared jointly by National Hydroelectric Power Corporation and Forest Department (Chamba).

Latest 'State of the art' technique of Satellite Remote Sensing has been utilised to have an updated information on various parameters which characterize the Chamera-II catchment. Extensive field work has also been done jointly by NHPC and Forest Department Officers to validate the Satellite Image's interpretations done in respect of erosion intensity and feasibility of different mitigative measures.

While preparing the CAT plan various problem areas have been addressed keeping in mind the people's rights with regard to Forest Settlement Provisions and local aspiration. No development activity can reach its intended goal without the people's participation and as such it is planned to involve villagers and village headmen in suggesting the works, watch & ward etc.

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On completion of this arduous task of great environmental importance we are feeling a sense of satisfaction but the real sense of achievement could only be felt after its implementation.

The present plan envisages treatment of about 9890 ha facing moderate to severe erosion at a cost of Rs. 10.72 Crores within 5 years in the free draining catchment of Chamera-II project on Ravi river.

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CREDITS

Aurhors are highly indebted to Dr.(Mrs) usha Bhat, Manager (Environment) for continuous help and valuable suggestions rendered during the course of preparation of this treatment plan.

Authors also wish to place on record their sincere thanks to Sh. R.K. Kapur, C.F. Chamba, Shri S.K. Dodeja, General manager ,Chamera, Shri Parminder Singh and Sh. Vishvanathan, Chief Engineers Chamera-II project for providing all logistic support and keen interest.

Shri A.K. Gangopadhyay, Executive Director (Planning) Corporate Office, NHPC and Sh. V.K. Gupta, Chief Engineer, Planning Corporate Office have constantly been of immense help in inspiring. Authors wish to thankfully acknowledge their all out support during the preparation of this plan.

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1. INTRODUCTION:

Due to increase in population, pressure on land as well as on forests has increased manifold. Similarly livestock population has also increased many times and has affected the grazing grounds and forests badly. Vast forest areas are being denuded due to excessive exercise of rights by local people for meeting demands of fuelwood and timber. Improper Landuse and poor water management are also responsible for the poor state of forests. The increased run off through denuded mountain slopes with the melting snow during summer finds its way in Ravi river through a network of gullies and streams carrying huge amount of sediments. Gulley and stream bank erosions account for heavy sediment generation and transport.

With the coming up of Chamera Hydroelectric Project Stage-II it has become essential that the catchment area is properly treated so that the river Ravi does not lose its carrying capacity. Therefore proper gully and Nalla treatment and water harvesting structures/Bio-engineering works are required to be carried out in the free draining catchment of Chamera Stage-II Project.

This Catchment Treatment Plan for Chamera-II has been prepared to deal with the degradation of the catchment area, which directly or indirectly would benefit the local people as well as project authorities.

In hilly terrains, human and cattle population depend on forests, hence greater emphasis has been laid on undertaking afforestation, pasture development and soil conservation measures in the catchment.

1.1 Rights of the people

In almost all the forests rights exist for each demarcated and undemarcated forest. The forest settlement provides for free grazing to all animals of the right holders in their own Chaka and no ceiling has been fixed on the number of cattle that might be grazed. The graziers who avail summer grazing facilities in alpine pasture are not allowed to graze their animals outside their Chaka unless allowed at special concession or after paying grazing fee. Unlimited number of animals are being grazed in these forests which caused great damage to the vegetation as well as to the plantation. This right of grazing is also a factor that no more closures for plantation are being resorted to as the consent of local people has to be obtained before every such plantation venture.

1.1.1 Collection of fuelwood

People have the right to collect dry and fallen wood for their domestic use as per forest settlement right. In the Chamera-II project catchment, people depend on fuelwood for their day to day needs.

1.1.2 Timber

People have the right to get timber at nominal rates for the construction/ repair/maintenance of their houses. The concessional rates have been fixed at the time of Forest Settlement. No limit however, on the timber of trees to be sanctioned, has been fixed. Because of a very nominal fee charged from the right holders/Bartandarans, there is an increased tendency of wasteful use of timber.

1.1.3 Cutting of grass and lopping of trees

People have the rights to cut grass and lop trees for fodder purposes.

2. STATE FOREST POLICY

Forest is a concurrent list subject. The National Forest Policy, 1952 is also applicable to Himachal Pradesh. Para-34 of National Forest Policy, 1952 required enunciation of State Forest Policy within the frame work of National Policy to meet the peculiar forestry situation within the State. Consequent to this, a State Forest Policy under the ambit of National Forest Policy was enunciated by the Govt. of Himachal Pradesh in 1980.

2.1 Salient Features

- Settlement of two third of unden:arcated and unclassed forest by proper demarcation and settlement in 10 year.
- Game developmen: and preservation to be accorded high priority.
- People's participation in afforestation programme
- Attitudinal change in the forest personnel and guideline for posting and transfers.
- Mandatory field inspection by forest personnel.
- Control on felling as per working plan
- Rationalisation of provisions of rights and concessions and their codification.
- Discouraging agriculture on marginal lands
- Proper watershed management

3. LANDUSE/LAND COVER

Spatial information on present landusc is pre-requisite for analysing current problems of demand/supply and asse:sing sustainability of the area. In Himalayan terrain, the technique of rem·te sensing has maximum use especially when most of the area is inaccessible.

a) **Agricultural Land**

Agricultural land is predominant in interspur valleys, river terraces, hill slopes and valleys of rivers and streams. About 11% of agricultural land is single cropped and remaining is double cropped. The single cropped area represents showing of only one crop in a field in one year, whereas double cropped area indicates both Kharif and Rabi season crops. Agriculture is primarily dependent on rainfall, however very small area is under irrigation. Most of the single cropped areas are found upto altitude 2400 m. In these areas fields are sown in one season and kept fallow during the other season due to cooler climate and longer growing period.

The double cropped areas are spread upto altitude of 1800 m. In these areas Kharif crops are sown during April to June and harvested during August to October. Major Kharif crops are Maize, Paddy, wheat. Additionally cash crops like potatoes, tobacco, chilly and linseed are also grown. Vegetable include beans, brinjal and lady finger, which are grown in smaller fields near habitation. The Rabi crops are sown during Oct-Nov and reaped between April and June.

Wheat, barley, mustard and linseed are major crops. Vegetables include cabbage, cauliflower, peas, onion, turnip, carrot and raddish.

(b) Forest land

Forest lands show variation in species composition at different altitude.

The lower altitudional zone (1200 m to 1800 m) exhibited presence of mixed species composition with predominance of chir (Pinus roxburghii), cembal (Bombax malabaricum), shisham (Dalbergia sissoo) etc. Some patches of Pinus roxburghii were present between 1400 to 1800 m altitude. Above 1400 m altitude oak (Quercus in cana) made its presence at >50% slopes with varying aspect. Chir pine trees exhibited a comparatively lower dominance at this altitudes, due to unfavourable temperatures. Above the altitude of 1800 m forests of other temperate species viz. deodar (Cedrus deodara), Bluepine (Pinus wallichiana), (Rhododendron arboreum) also exhibited their presence and continued upto 3400 m. Fir (Abies webbiana) are also found above elevation of 2200 m.

(c) Scrub land

Scrub land is found mostly between altitude of 1800 m to 3400 m on south-eastern hill spoles. Major species are Indigofera habepetalos.

Spirala Sorbifolia, Salix. Spiraea bella, Aulux, elegans, potentilla fruticosa

(d) Grassland/Pastures

This category include the land covered with grasses alongwith scattered shrubs used for fodder to feed cattles and other animals. It is found in two ecological zones i.e.

i) Lower altitudinal grassland.

- It is mostly found along the crests, scarps and steep to very steep slopes of mountain. Ownership of this category is held by local cultivators and State Forest Department. The residents of the adjacent villages enjoy the rights to pasture sheep, goats and cattle and to cut grass for fodder. Pasture near villages are called Juh which are being utilised extensively.

ii) Alpine pastures:

This ca egory is present between treeline and snowline above the altitude of 3200 m. These areas are unsuitable for cultivation and constitu : habitat for domestic and wild animals.

(e) Lake/Reservoir

The natural lake are Lamdal, Nagdal, Nag chhatri dal, chhate dal and Dhuwardu dal etc. Refer Map No. 1 depicting landuse/land cover mapping done through Satellite Imagery of the study area and respective statistics.

4. GEOLOGY/GEOMORPHOLOGY

a) Geology

The free draining Catchment area is bounded by Chamba block in the west, Tissa in north, Shirmour in east and Bhatiyat in south west and Kangra district in the south. Ravi river is the major river system flowing through the middle of the area within the rocks of Chamba formation. There are mainly four different rock formations ranging from lower Palaeozoic to lower Permian in age. Dalhousie granite, Chamba formation, Minjir formation and Bharmour formation are the rock types repeated in this region. General geological formation has been collected from gazetteer of Chamba district and G.S.I.

Stratigraphy (After GSI)

Age	Formation	Lithology
Upper permian	Saluni Formation	Calcarous sandstone, arneceous shelly limestone


LANDUSE / LANDCOVER MAP
CHAMERA-II, H.P.
LEGEND
AGRICULTURAL LAND - I
AGRICULTURAL LAND - II
FALLOW LAND
OPEN SCRUB
DENSE SCRUB
DENSE FOREST - I
DENSE FOREST - II
WATER BODIES
SNOW/CLOUDS
DAM (Bagga)
NHPC / RRSSC-NOP
SCALE

MAP-1

GEOLOGICAL SURVEY OF INDIA

GEOLOGICAL MAP OF PARTS OF HIMACHAL PRADESH

SCALE

0 5 10 15 20 25 30 35 40 45 50 KILOMETRES

LEGEND

11	TRANS HIMALAYAN GRANITE & GNEISS.
10	LESSER HIMALAYAN GRANITE & GNEISS.
9	CENTRAL CRYSTALLINE JUTOGH & SALKHALA, SCHIST, GNEISS, LOW TO HIGH GRADE METAMORPHICS.
8	DEVONIAN QUARTZITE
7	CARBONIFEROUS SHALE, SLATE LIMESTONE, QUARTZITE SANDSTONE.
6	PERMO-CARBONIFEROUS PEBBLE & BOULDER SLATE. PERMIAN LIMESTONE SHALE / SLATE & QUARTZITE SANDSTONE.
5	LESSER HIMALAYAN VOLCANICS ALONG MURREE THRUST.
4	TRIASSIC LIMESTONE WITH MINOR SHALE.
3	LOWER SIWALIK SANDSTONE & SHALE.
2	MIDDLE SIWALIK SANDSTONE & SHALE.
1	UPPER SIWALIK CONGLOMERATE

GEOLOGY AFTER OFFICERS OF GEOLOGICAL SURVEY OF INDIA

MAP-2

Lower permian	Panjal volconics	Green massive amygdaloidal basic lava flows.
Vendian	Bharmour Formation	State, micaceous sandstone quartzite, silt stone
Vendian	Manjir Formation	Shale, slate, Lime- stone, Sandstone.
Vendian	Chamba Formation	Slate, phyllite, carbonaceous slate and quartzite.
Lower Palaeozic	Dalhousie Granite	Micaceous granites

Description of Formations

Dalhousie Formation

This rock is exposed in the area as lenticular band of rock sandwitched between Chamba formation in the north and Pindaru formation in the south. It comprises micaceous granite.

Chamba Formation

Chamba formation is in contat with Dalhousie granite in the south and overlying manjir formation in the north. The main lithotypes are slate, phyllites, carboniferous slates, subordinate quartzite. This formation is exposed in two part one in south west and another in the north eastern portion.

Manjir Formation

Manjir formation is running as thin band parallel to each other in the north west to south east direction. It is underlain by Bharmour formation, but in the central portion of the area it is in sharp contact with Panjal volconics. This formation comprises shale, sandstone, slate and limestone.

Bharmour Formation

Bharmour formation runs in the north west to south east direction and is underlain by Manjir formation and overlain by saluni formations. However, in the eastern most part the exposures is overlain by Manjir formation. The lithotype are dark grey slates, micaceous sandstone, quartzite, calcarious silt stone, dolomite and magnesite.

Panjal volcanics

Panjal volcanics comprises major soils exposed in the region and is in contact with Manjir formation in the north and with Saluni formation in the south.

Saluni formaion

Saluni formation also runs parallel to the north west to south east direction. It is overlain by Kalhel formation and is underlain by Bharmour formation. In the east it lies in close contact with Panjal volcanics and in the

west part of the region litho units are calcarious sandstone, arenaceous shelly limestone and slate.

Alluvium

These constitute the deposits of loose boulders, pebbles and gravels of granite, meta-sediments and gneisses etc along the river terraces and opon low lying valley. Refer General Geology map at MAP-2

b) Geomorphology

On the basis of interpretation of IRS LISS-II/LandSat TM images and further ground studies, the area has been divided into following geomorphic units.

Valley Fills

These are unconsolidated material partly or wholly filling a valley. The valleys have been formed along fractures or fault/zones and thus are structually controlled. Later on alluvial and colluvial material derived from the surrounding higher catchments have been deposited in the linear valleys. The valley fills consist of clays, pebbles, gravels etc.

River Terrace

They are formed by the deposition of river borne sediments. A river terrace marks the position of the flood plain which developed when the river flowed at a higher elevation. It usually consists of a bench on the side of the

valley, covered with the usual flood plain deposit clay, sand and gravel. Terraces may be developed by the rejuvenation of the river causing cutting through the existing flood plain and the development of a new one at lower level.

Flood Plain

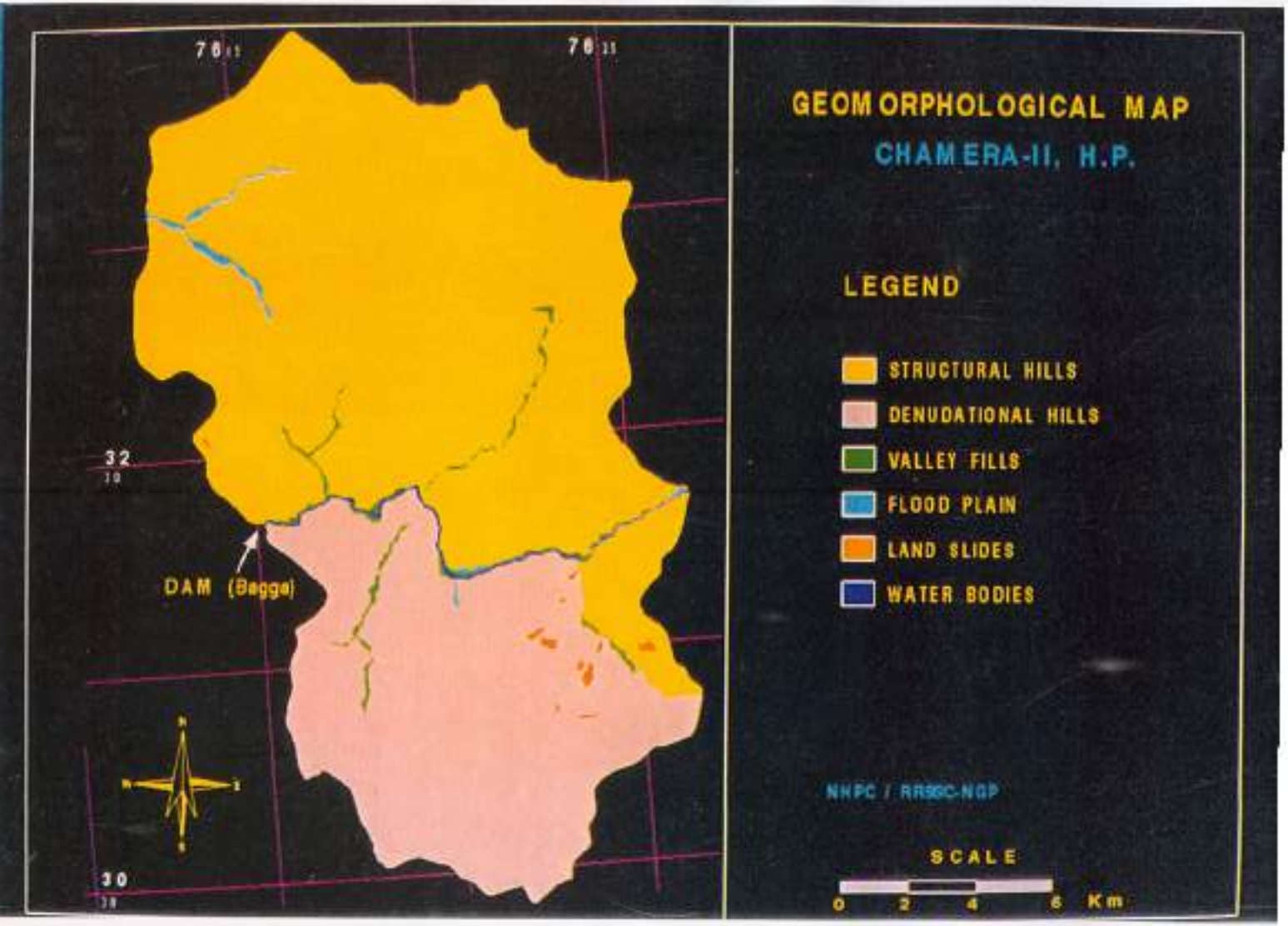
Recent deposits of fluvial sediments by the river along the river course, consists of unconsolidated sand, gravel and silt. These areas due to high permeability and perosity act as good recharge areas with subsurface waterflow.

Denundational Hills

These are the hills which have been formed by the denudational activity. These are moderate to steep sloping hills with inter-hill depressions. Generally these are considered high run off zones due to the steep slopes. These hills mainly comprise phyllites, schists and granites which are highly fractured and jointed.

Structural Hills

These hills mainly comprise sandstone, clays and siltstone of siwalics and are structurally controlled with moderate to steepy dipping beds resulting in the formation of linear hills with cuesta and flat iron structures.


GEOMORPHOLOGICAL MAP
CHAMERA-II, H.P.
LEGEND
STRUCTURAL HILLS
DENUDATIONAL HILLS
VALLEY FILLS
FLOOD PLAIN
LAND SLIDES
WATER BODIES
DAM (Bagga)
NHPC / RRSSC-NGP
SCALE
0 2 4 6 Km
76
32
30

MAP-3

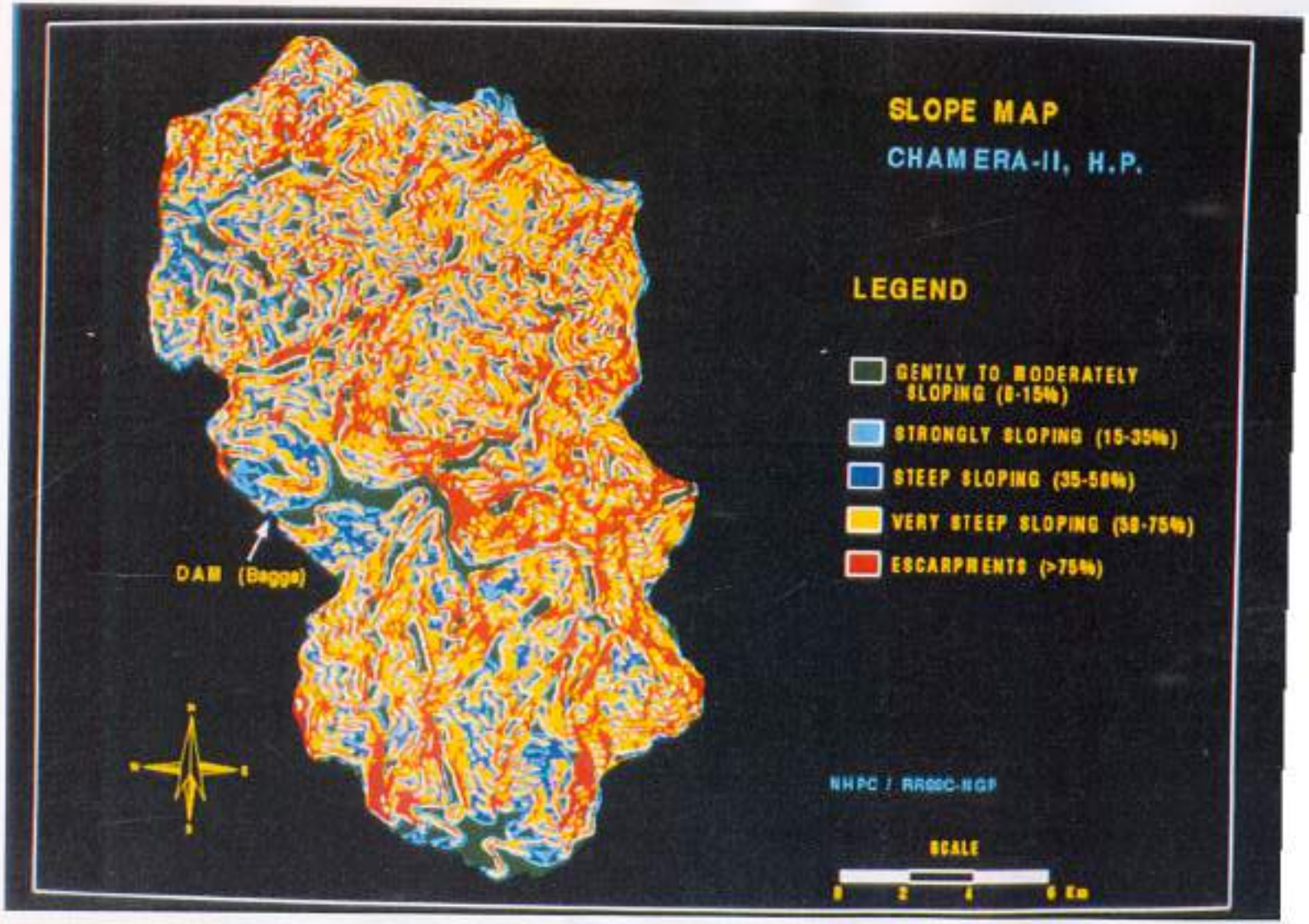
Structural Valleys

These are the linear or curvilinear valleys formed as a result of erosion along zones of intense folding or faulting in the terrain. These valleys generally comprise loose material from litho-units of the catchment area which after erosion were deposited along the valleys as valley fill deposits. (Refer Map No. 3).

5. SLOPE AND ASPECT

Slope and aspect of an area are vital parameters in deciding suitable land use for the area, as the degree and direction of the slope decide the landuse that the area can support. Slope is also very important while determining the land capability and has direct bearing on the runoff. In the present study area it has been observed that:-

- Area with more than 50% slopes are generally covered with thick forest cover. Areas having more than 50% slopes generally support open forest scrub and grass land at places. This slope category is present along the major ridge lines on the North, South and South eastern part of the study area.
- Areas having 35 to 50% slope generally support grass/scrub and forest in some places. These slope categories are located near Churi village


SLOPE MAP
CHAMERA-II, H.P.
LEGEND
GENTLY TO MODERATELY SLOPING (8-15%)
STRONGLY SLOPING (15-35%)
STEEP SLOPING (35-58%)
VERY STEEP SLOPING (58-75%)
ESCARPMENTS (>75%)
DAM (Bagga)
NHPC / RRSSC-NGP
SCALE
0 2 4 6 Km

MAP-4

as well as Chatrari villages and upper reaches of River valley.

- Areas having slopes of 15-35% are supporting valleys and terraces with good agriculture. These are observed along the lower reaches of Ravi river and the immediate right and left banks. Type area is near Churi and Chatrari village.

It has also been observed during the field survey that the aspect has a bearing on the landuse pattern. Northern, North-western and North-eastern aspects of slopes have thicker vegetation and support good forests when compared to slopes facing south. (Refer Map No. **4**)

6. SOILS

Soil is the function of soil forming factors like climate, vegetation, topography, parent material and time. All of these factors have influenced soil formation in this area. The two major distinct soil zones identified are:

Middle Himalayan Zone

Enjoys a cool, humid climate and invariably have soils with low base saturation percentage especially in areas having grass cover and forests.

In general, the study area is mountainous, with narrow valleys in which rivers and streams occasionally deposited the alluvium. The alluvial soils are generally deep to very deep, dark brown to dark yellowish brown, loamy with fluvial characteristics.

Mountainous soils

In general, these are slightly acidic to neutral in reaction except some forest soil which are moderately acidic in nature resulting into low exchangeable base and low to medium exchange capacity.

The soil composition in the area and its classification according to soil series is described as under. A texonomic soil mapping has been done with the help of satellite imagery. Refer Map No. 5 .

1. **Mohri Series (Loamy skeletal, shallow thermic)**

Mohri series is fairly good grassland soils, developed on moderate-steeply sloping mountain slopes in middle Himalayan region. These are moderately deep, dark brown, loamy skeletal, slightly acidic soils with granular to sub-angular blocky structures. These are well drained soils and suffer moderate to severe erosion. They have low productivity potential. At present they are being used as green/grazing lands.

2. **Pranvi Series (Coarse loamy, sl allow thermic)**

Pranvi soils are good agricultural soils developed over alluvium on moderately sloping river terraces along the Ravi river and its major tributaries. These are very deep brown to dark brown, coarse loamy, slightly acidic, well drained soils. The soils are well terraced and do

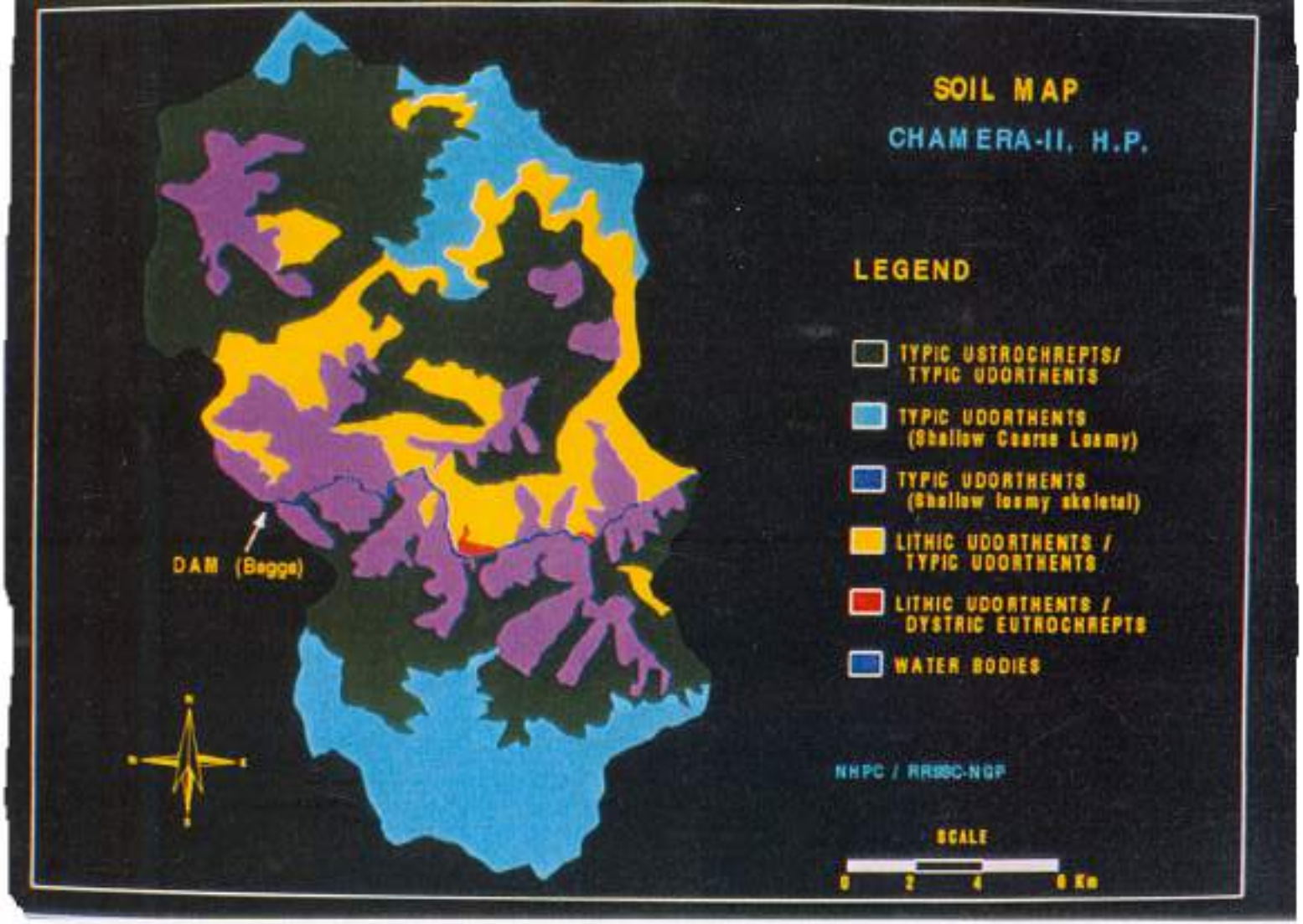
not have any problem of erosion. Application of Nitro-phosphatic fertilisers, and other improved agronomic practices are required. Slight land levelling is also required for efficient use of irrigation water. The soils are moderately productive and can be used for most of the climatically adopted crops as well as well suited for horticultural practice such as plums, khubani, almonds, apricot etc.

3. **Surkhigala Series (Coarse silty, shallw, thermic)**

Surkhigala series are fairly good lands, supporting moderately thick to thick forest. They occur on steep to very steeply sloping hills in middle himalayan zone of the study area. These soils are moderately deep, well drained, dark brown, gravelly coarse silty, strongly acidic. These soils have about 5-10 mm thick forest litter on surface and occasionally affected by slight erosion.

4. **Pukhari Series (Loamy, skeltetal, shallow)**

These soils are developed on moderately steep to steep hill slopes. They are shallow, dark brown in colour, loamy, skeletal, well drained soils with moderate to severe erosion. These soils have slightly acidic, low cation exchange capacity and low inherent fertility. At present these are under cultivation crops like maize, barley, mad and rajmah. Taxonomic classification of soils is given in Map--5---.


SOIL MAP
CHAMERA-II, H.P.
LEGEND
TYPIC USTROCHREPTS/ TYPIC UDORTHENTS
TYPIC UDORTHENTS (Shallow Coarse Loamy)
TYPIC UDORTHENTS (Shallow loamy skeletal)
LITHIC UDORTHENTS / TYPIC UDORTHENTS
LITHIC UDORTHENTS / DYSTRIC EUTROCHREPTS
WATER BODIES
DAM (Begga)
NHPC / RRSSC-NGP
SCALE
0 2 4 6 Km

MAP-5

7. BASIS FOR IDENTIFICATION OF EROSION INTENSITY CLASSES

As already stated the free draining catchment of Chamera-II is characterised with high and rugged relief and occupy unique physiographic location and forms the most fragile eco-system. Hill areas in general are vulnerable to all kinds of anthropogenic influences, through these areas are in isolation. Other constraints are wide variation in agro-climatic conditions poor infrastructure and availability of scarse arable lands.

The present attempt envisages watershed management which implies rational utilisation of land and water resources for optimum and sustained production with minimum hazard to natural resources and environment. It requires collection and analysis of information on physical relationship of vegetation-soil-water to Land Management which would also ensure economic and social upliftment of the region.

Land degradation due to soil erosion by natural processes or by human interference leads to excessive and premature siltation of reservoir of hydroelectric projects. Time-effort-cost proposition for landscaping of watersheds is a stupendous task. However, the observed silt load data in India indicates that all parts of watersheds do not erode equally and are not identical in hydrologic and sediment response variations. Therefore, it is

essential to locate critical source areas which have great potential for sediment field and run off and plan for their treatment on relative priority.

Remote sensing technique is now a viable tool which acts as an alternative and dependable support system in our conventional way of survey, investigation, planning, monitoring, modelling and decision making process. Concept of space and time dimension of water resources management are

- River basin-wise development
- Physical and hydro-dynamic resources information in river basin
- Time series analysis
- Management models

Resources Mapping in free draining catchment

Use of satellite remote sensing has provided applicable hydrological information in spatial and temporal scale. The synoptic coverage of Satellite Imagery has enabled fairly accurate identification of catchment boundary extent and broad physical features such as stream net work, landuse, soils, vegetation, surface water bodies etc.

Identification of Erosion prone area

Remote sensing technique has facilitated identification of existing and potential erosion prone areas. Method of erosion detection and assessment is based on tonal, texural and physiographic recognition of terrain features.

On Satellite False color composites (FCC) erosion is qualitatively apparent as

- Change in soil colour
- appearance of bare soil/bare rock
- accentriated dendritic drainage pattern
- erosion potential associated with changes in vegetation and litter

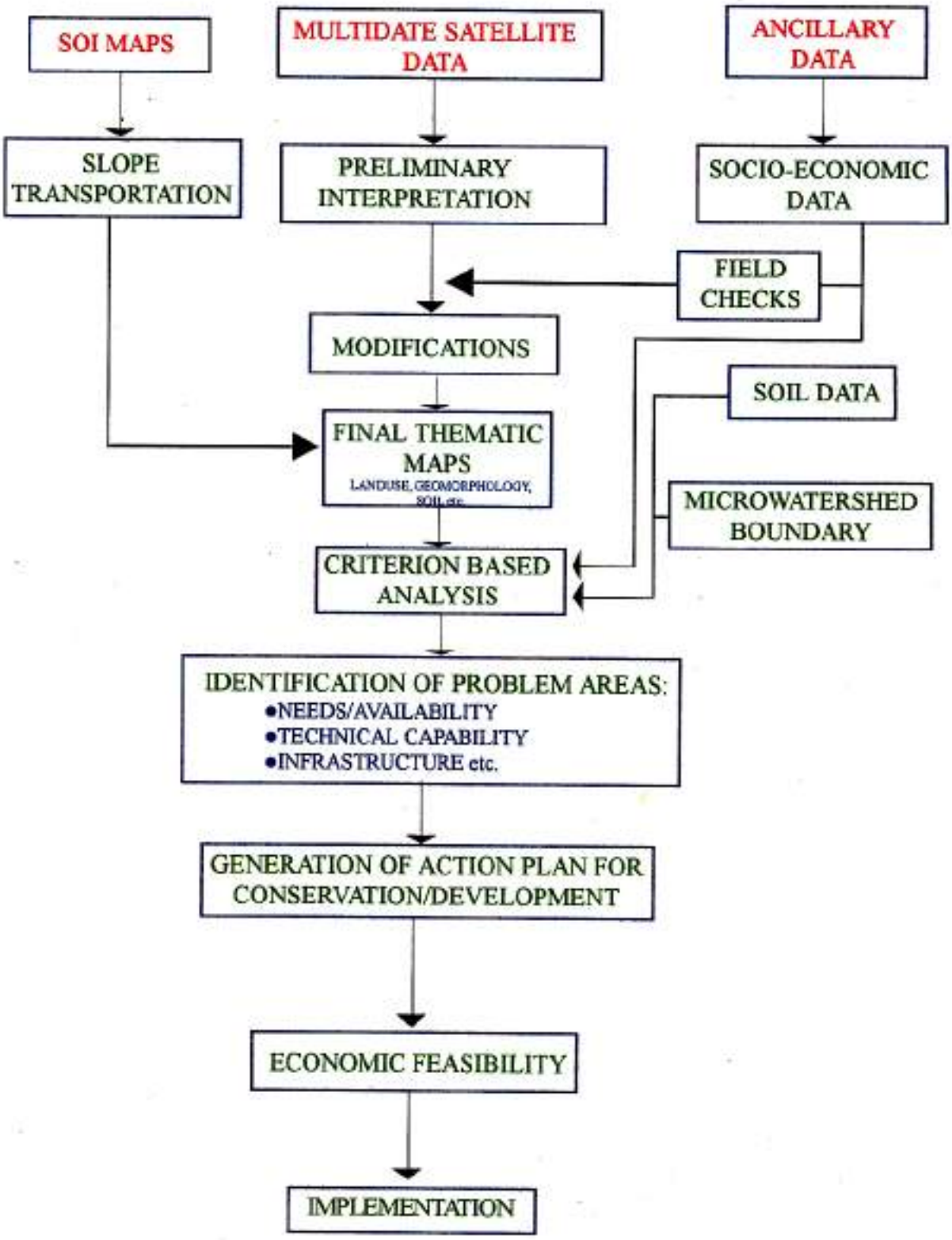
The conceptual flow chart showing steps as to how the erosion intensity classes of the study area has been delineated (Refer Flow Chart).

A number of sediment yield models, both empirical and conceptual are in use in India to address wide ranging soil and water management problems. These empirical models require input parameters in terms of spatial information on landuse, vegetation cover, soil, slope, drainage, density, besides runoff and rainfall intensity.

It was possible to interface this empirical model with remote sensing outputs. The traditional method followed in India for evaluating **sediment yield Index** (SYI) for prioritisation of watershed is as under.

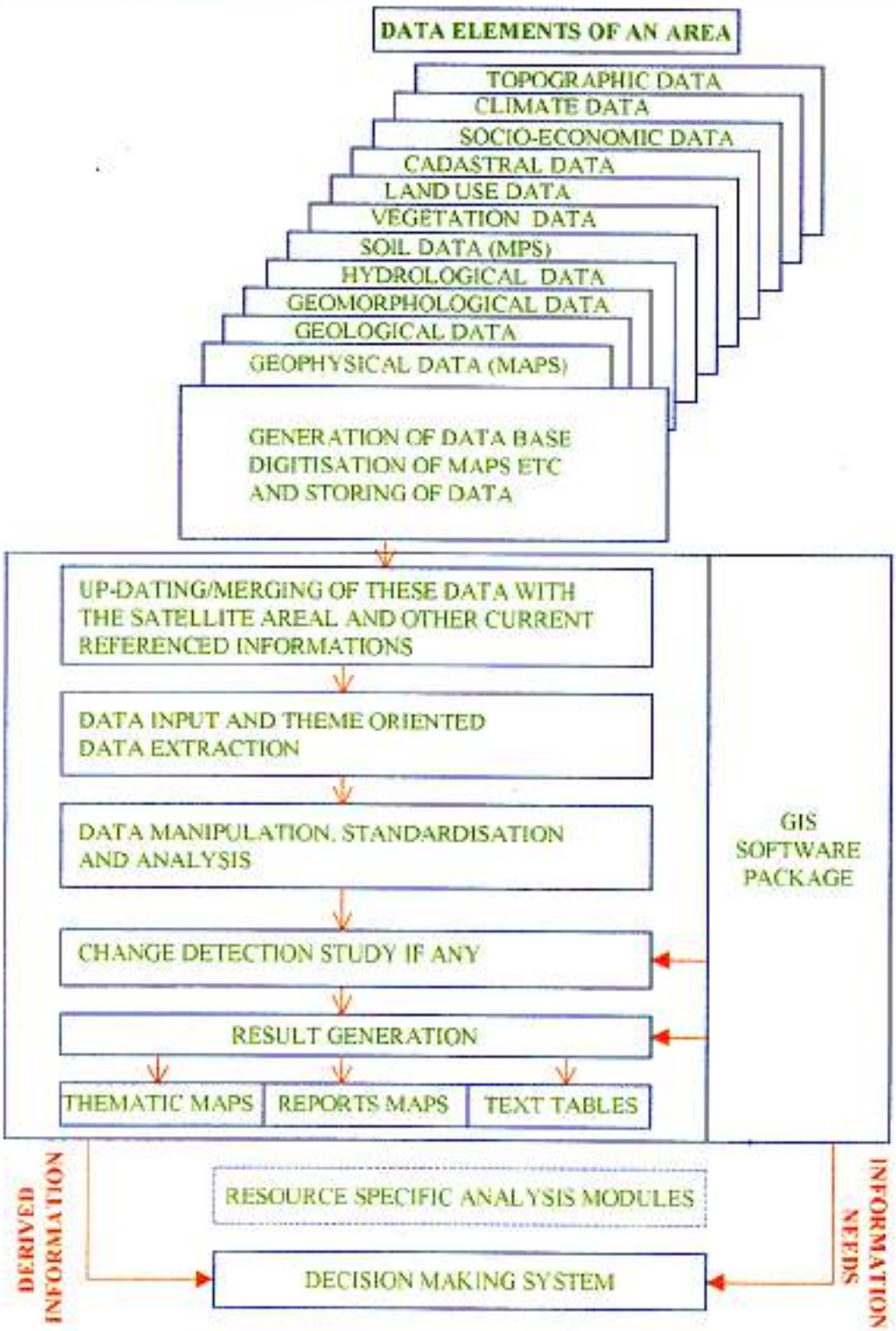
$$SYI = \frac{\text{Aeix Wei x Dr}}{\text{Aw}} \times 100$$

METHODOLOGY FLOW CHART FOR CATCHMENT AREA TREATMENT PLAN



FLOW CHART 2

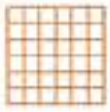
GEOGRAPHICAL INFORMATION SYSTEM AND DATA BASE MANAGEMENT SYSTEM



CONCEPTUAL COMPONENTS OF A GIS

GEOGRAPHIC DATA

SPATIAL LOCATIONAL DATA

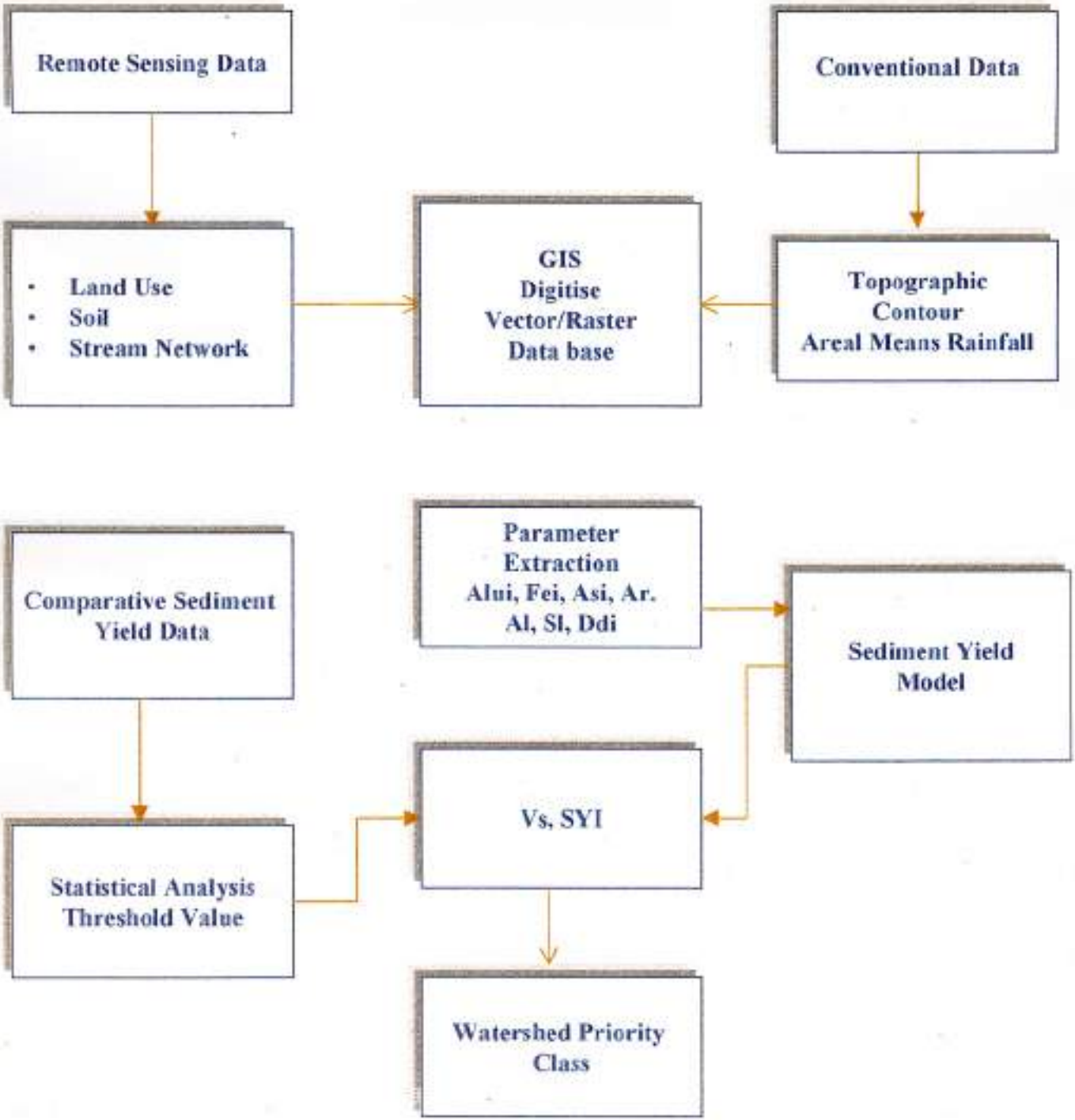
MEASURED X, Y LOCATION			TOPOLOGICAL LOCATION (RELATIONAL)	
POINT	LINE	POLYGON	GRID	NETWORKS
+				

ATTRIBUTE NON-LOCATIONAL DATA

VARIABLES	CLASSES	VALUES	NAMES
SOIL	1.		SAND
⋮	⋮	1.1 1.2 1.3	FINE MED. COARSE
		⋮	⋮

TEMPORAL DIMENSION

TIME 1 | TIME 2 | TIME 3



(Remote Sensing & GIS based sediment yield Model, Chakraborti, 1991 b)

Where Aei = Area of erosion intensity unit i.e. mapping unit

Wei = Weightage value assigned to erosion intensity unit

Dr. = Adjusted delivery ratio

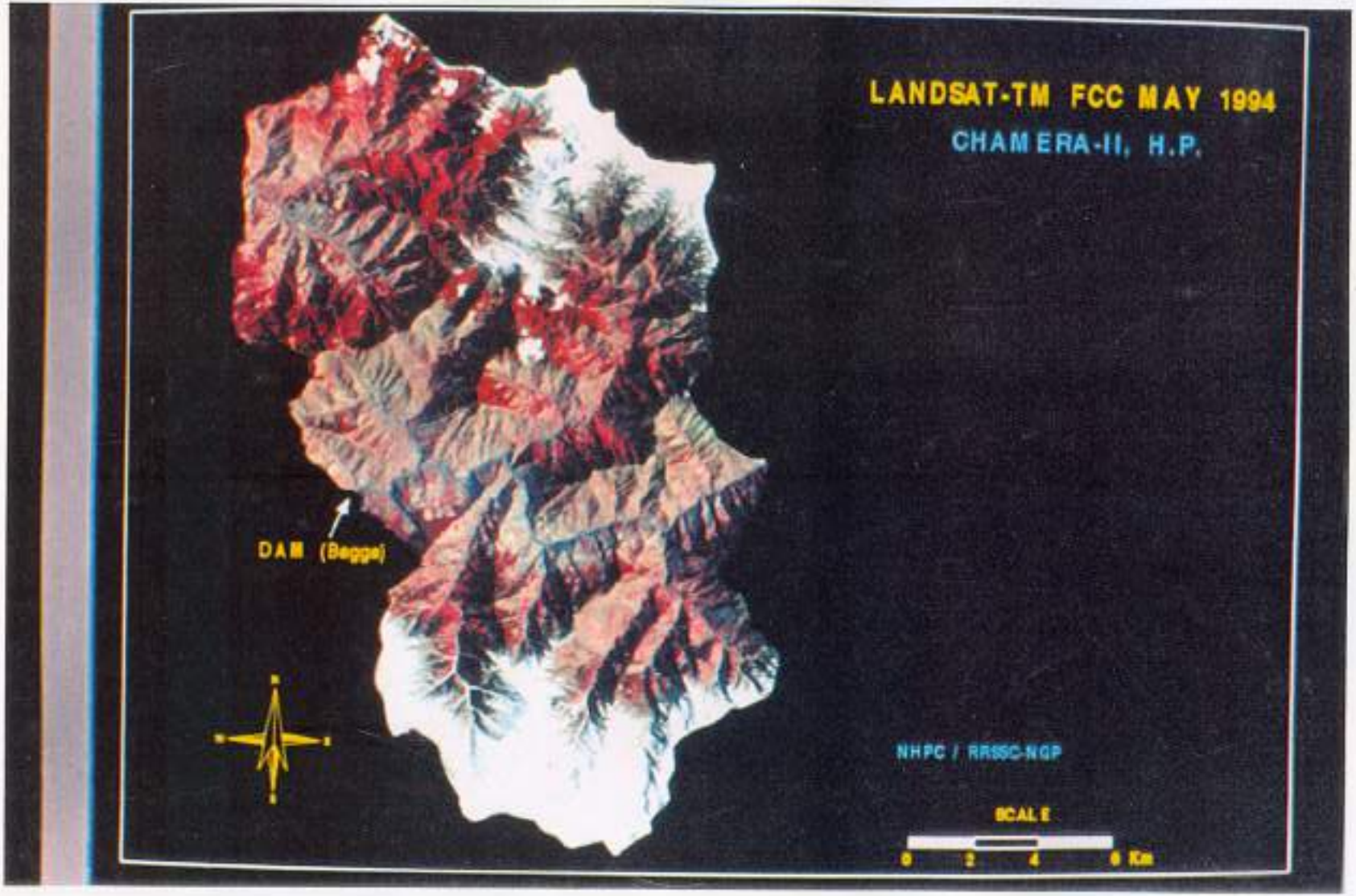
Aw = Area of subwatershed

An idea of the range of Aei has been gathered on the basis of detailed landuse and soil maps prepared through digital interpretation of Satellite Imagery. However SYI does not provide absolute value of soil loss from watershed nor sediment yield at outlet point, rather it has provided relative erodibility of free draining catchment for taking up treatment measures. (Refer Flow Charts 1-4)

All thematic layers pertaining to slope, geology, geomorphology, e.c. were also integrated in GIS environment to prepare the Erosion Intensity map. (Refer Flow Chart 1 and erosion intensity map No. 6).

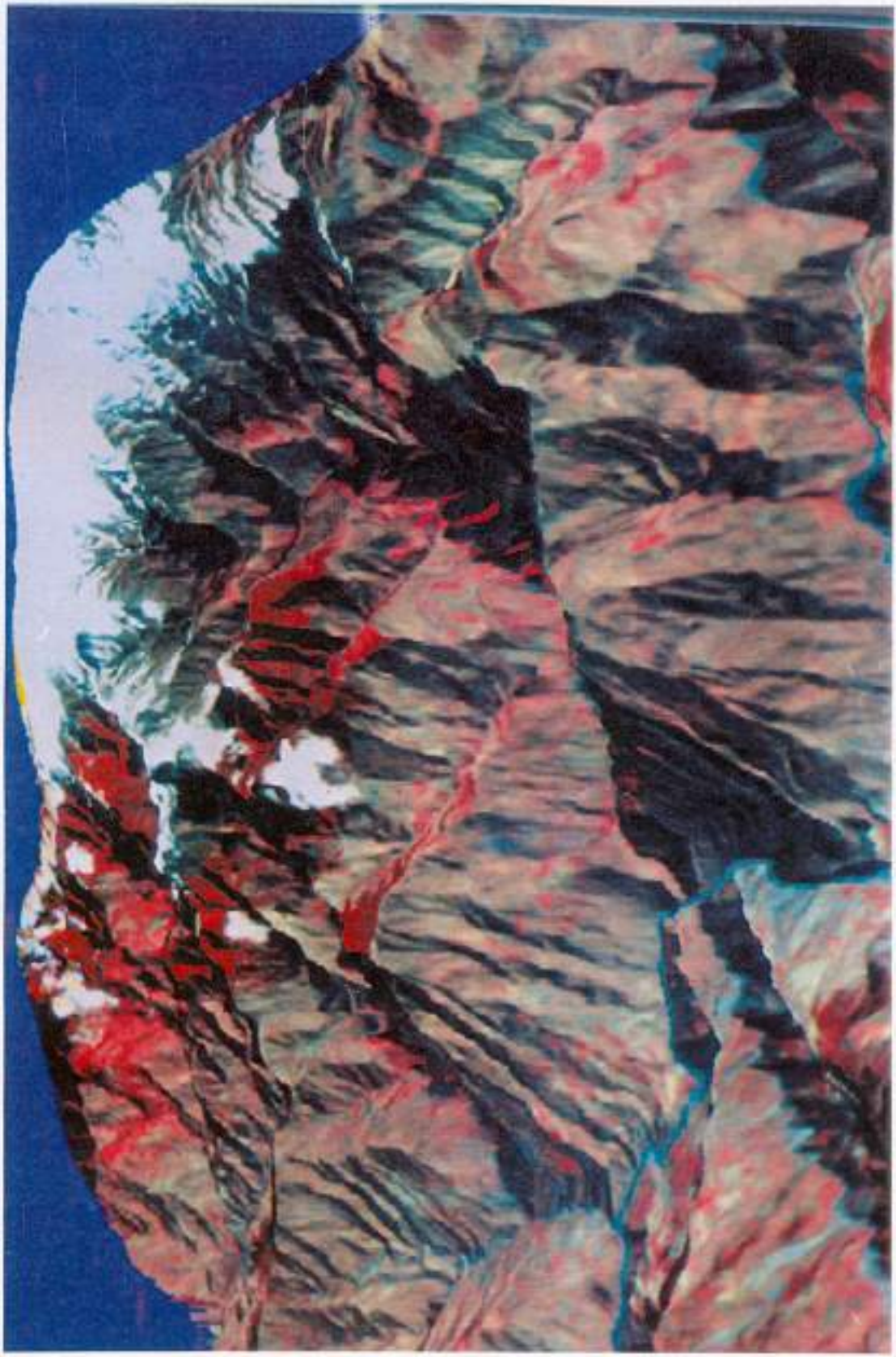
7.1 DATA USED

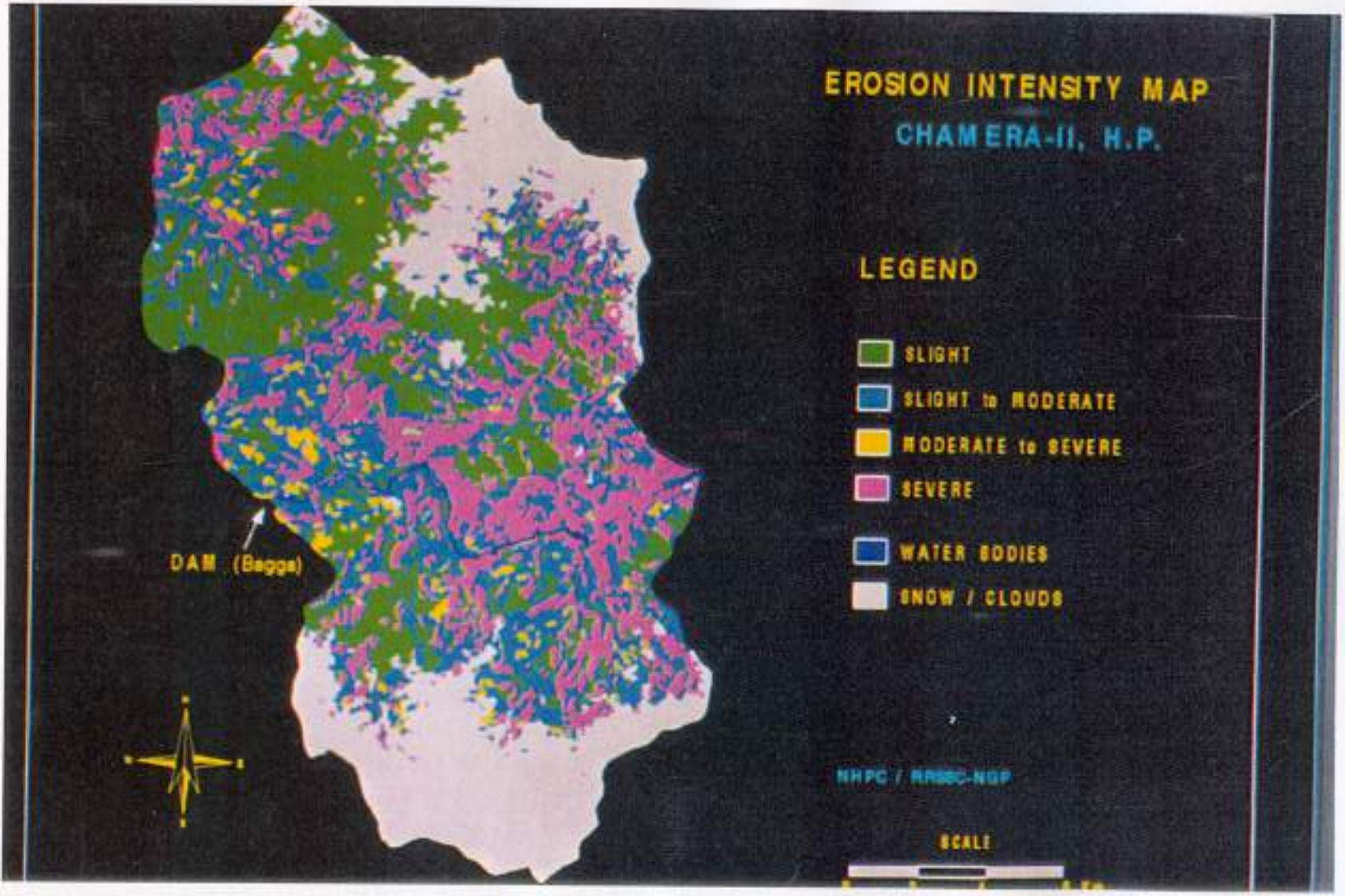
- IRS – 1A LISS-II False Colour Composite (FCC) images of path/row 31-44, 31-45 on 1:50,000 scale for two seasons, Landsat TM of May 1994.
- Survey of India topographical map 52 D/2, 3, 6, 7 on 1:50,000 scale.]


LANDSAT-TM FCC MAY 1994
CHAMERA-II, H.P.
DAM (Beggal)
NHPC / RRSSC-NGP
SCALE
0 2 4 6 Km

3-D PERCEPTION OF CATCHMENT

← N




EROSION INTENSITY MAP
CHAMERA-II, H.P.
LEGEND
SLIGHT
SLIGHT to MODERATE
MODERATE to SEVERE
SEVERE
WATER BODIES
SNOW / CLOUDS
DAM (Bagga)
NHPC / RRSSC-NGP
SCALE

MAP - 6

- Forest resources information from Divisional Forest Office Chamba.
- Geological map of District Chamba from GSI Chandigarh

7.2 Catchment Characterisation

a) Drainage System

The entire free draining catchment can be divided into 5 sub-watersheds viz-**Baleni Nallah** sub-watershed, **Balij ka nallah** sub-watershed, **Chirchind nallah** sub-watershed, **Braguna** sub-watershed and **Main Ravi** sub-watershed. Refer Map 1A to 5A

Baleni Nallah stream runs down south to north over the entire length of the sub-watershed and drains into Ravi at Dunali. The Baleni Nallah stream originates from Baleni Jot and passes down through Kathwada, Brehi and Sunnu villages.

Balij Ka Nallah stream originates from top of the watershed in the north at Malani village and flows right through the middle of the sub-watershed.

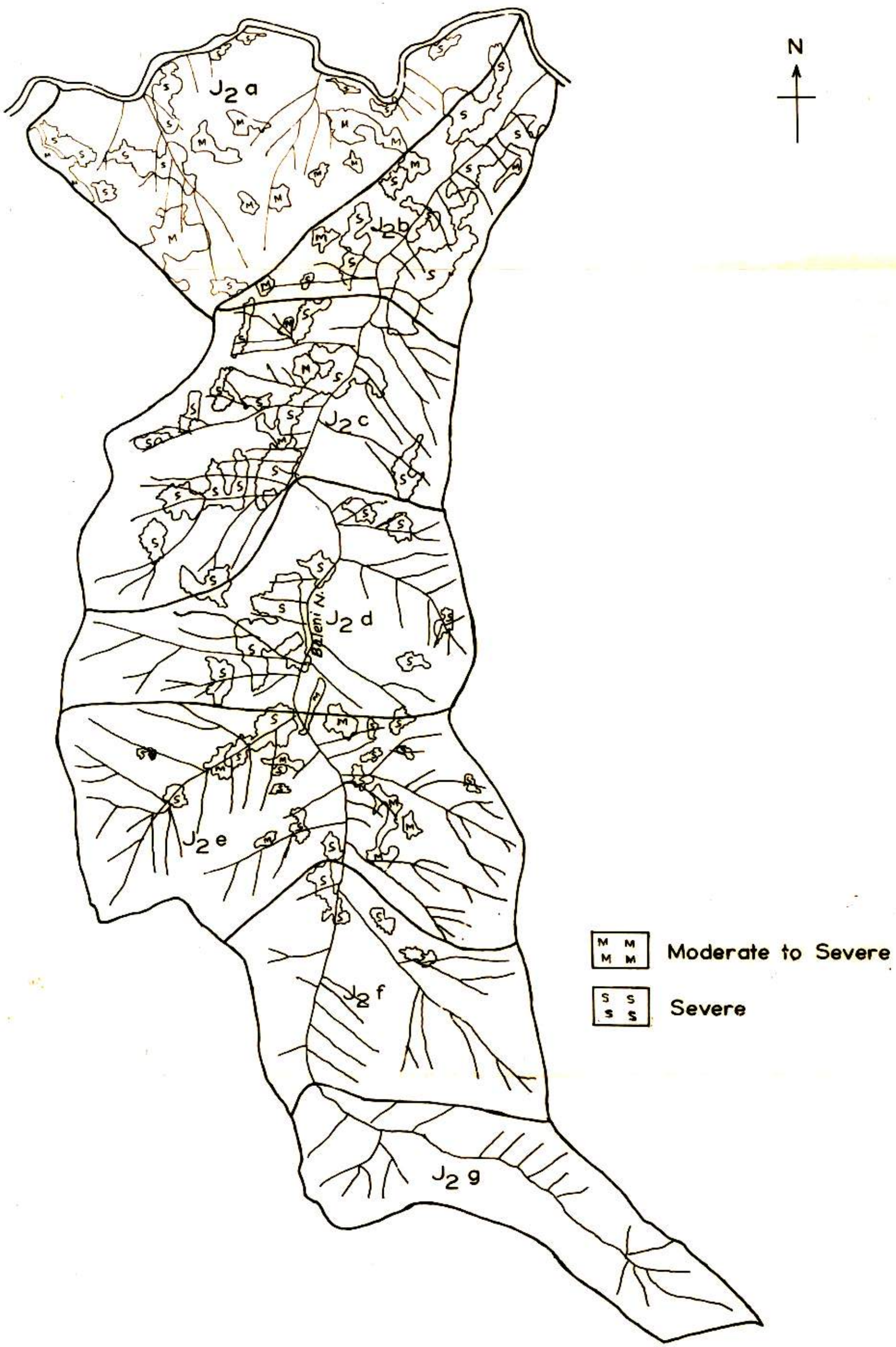
Chirchind Nallah stream drains the biggest sub watershed of the area with this principal nallah. It drains itself into Ravi River at Luna and is met by many streamlets on its way down from south to north. The main streams that join it on its way are Millar, Chirchind, Runukothi etc.

Drainage Map of Ravi Basin

MAP-7

Map - 1 A

Baleni Nallah Sub-Watershed & Micro Watersheds



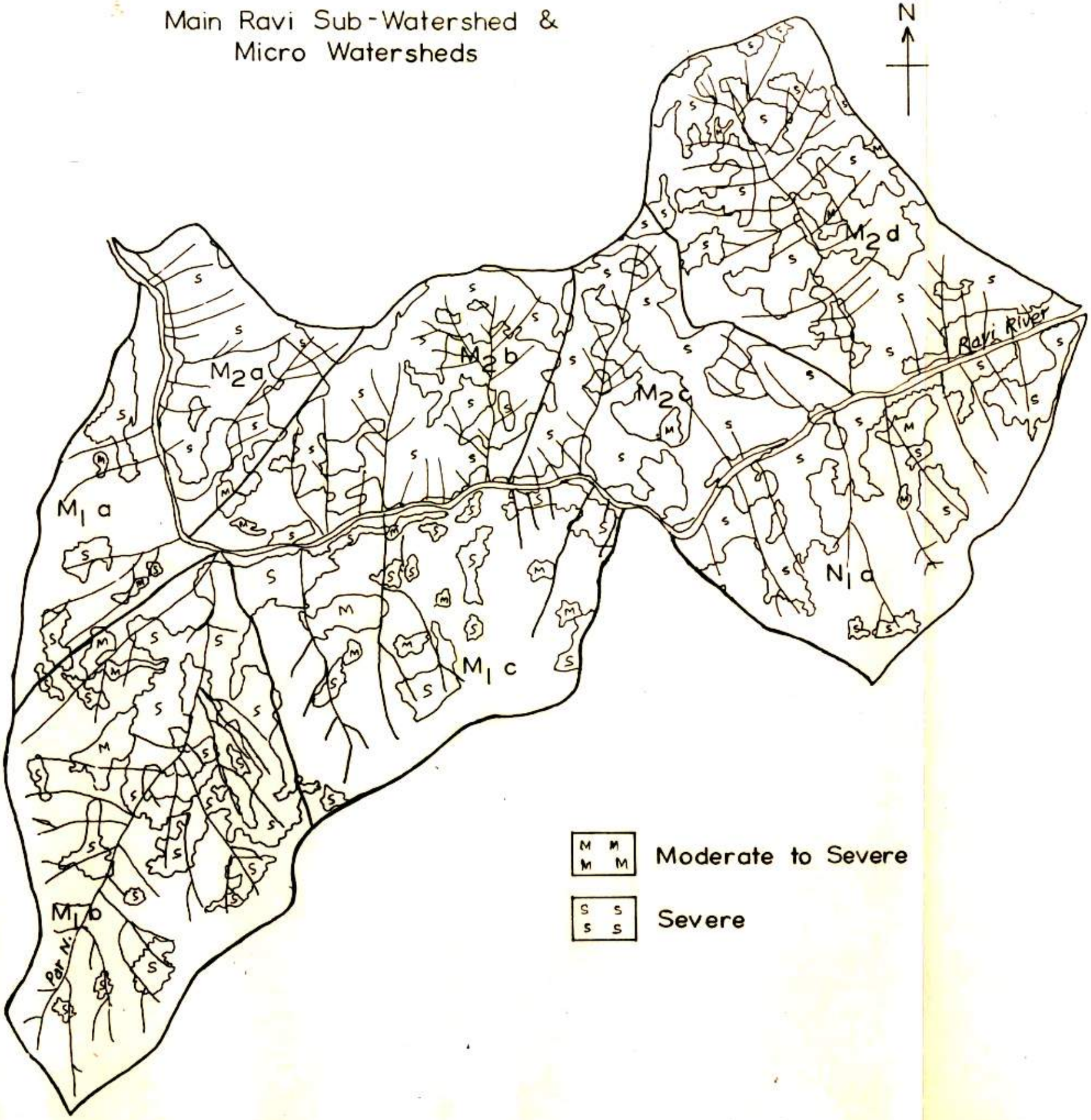
Braguna Sub-Watershed & Micro Watersheds
Main Ravi Tributary

Map - 3A

Balij Ka Nallah Sub-Watershed & Micro Watersheds

Map - 4A

Main Ravi Sub-Watershed & Micro Watersheds



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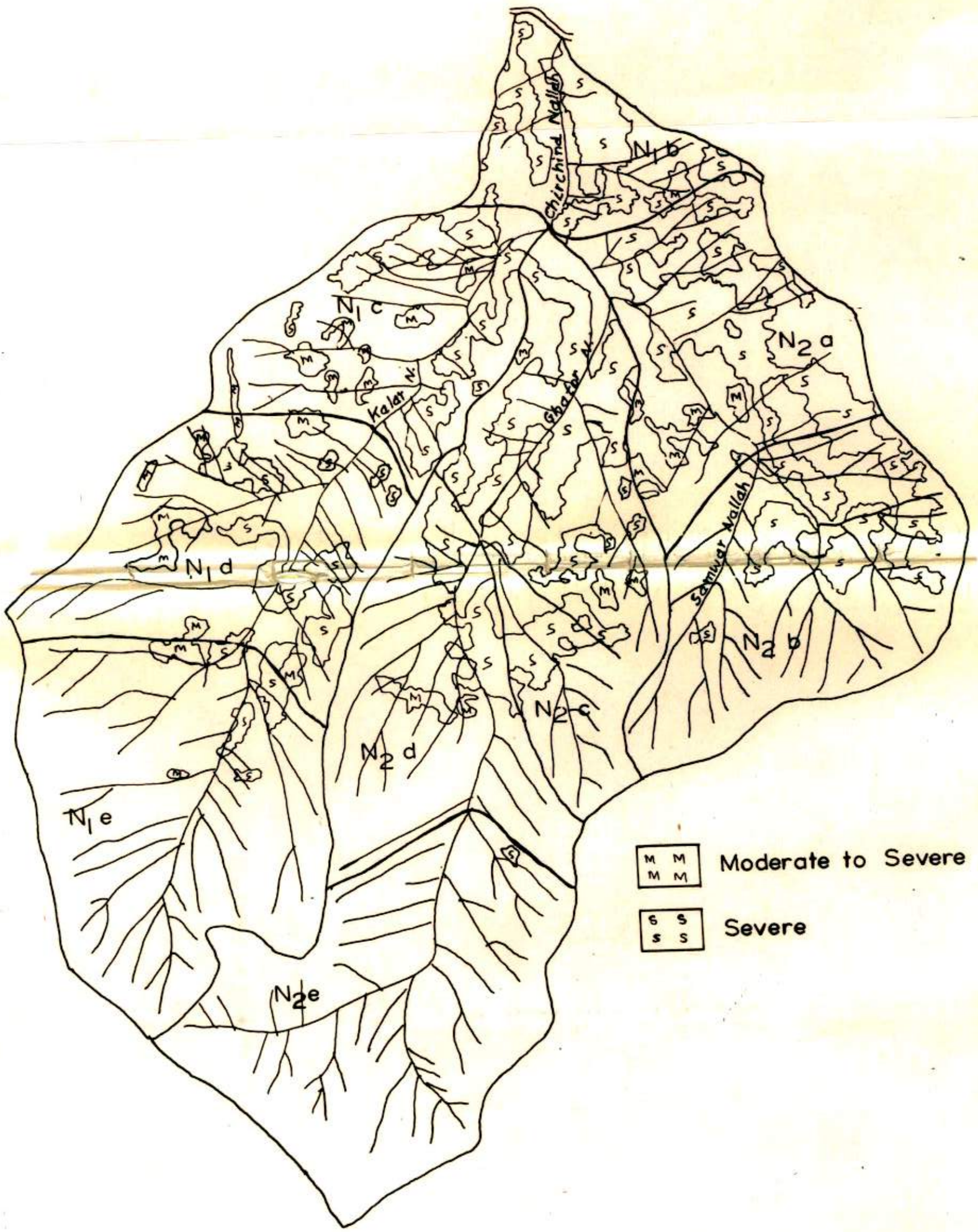
Chirchind Nallah Sub-Watershed & Micro Watersheds



Braguna Nallah sub watershed is yet another important portion which drain from north to south before meeting Ravi River in the NW portion of the entire free draining catchment.

The other microwatershed which have been delineated and which immediately drain into main Ravi collectively form main Ravi sub-watershed. Drainage map of Ravi Basin is at Map:7

b) **Relief**

The relief of the study area varies from precipitous in the upper reaches to moderately undulating in the lower areas. In upper steep mountain area, a rugged and rocky topography is observed. The elevation ranges from 1155 to more than 4500 m. This elevation range encompasses three major zones viz. upto 1800 mtrs (sub-tropical), 1800-3200 mtrs.(Humid temperate) and 3200- and above(Alpine).

c) **Aspect**

Aspect is the most important locality factor of any watershed as it dominantly determines the choice of the species which can be planted as also which can be sustained by it. The entire study area has two difirent aspects viz- North east and South west. However at microwatershed level these have modifications. Most of the North,

North-eastern aspected area are thickly vegetated whereas Southern aspect does not support thick vegetation. Refer Map No. 1

The total study area has an area of 552 sq. km. including Saho & Ravi Catchment. For treatment purposes only Ravi River free draining catchment with an area of 417 sq.km. has been taken up. In this area, two classes namely 'Moderate to Severe' and 'Severe' add up to about 98.90 sq.km. Hence 98.90 sq.km. area is considered degraded and treatment measure have been proposed. The Ravi free draining Catchment has been divided into 44 microwatersheds and proper codification has been made for the implementation and monitoring purposes. Each microwatershed is given componentwise treatment measure alongwith financial implications with yearly phasing. Refer Maps 8 and plates 1 to 39

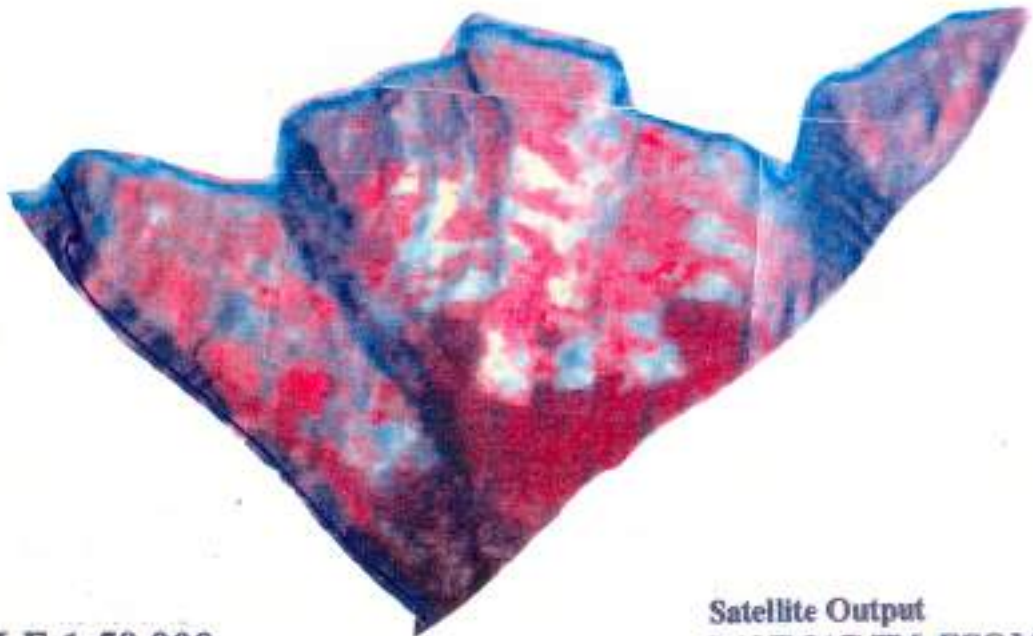
7.3 Problem Identification In Catchment Area:

Following major problems have been encountered while characterising the study area during the field work.

1. **Severe Soil Erosion:**

   This menace is mainly due to extensive degradation of hill slopes and valleys, intensive grazing, deforestation, slope cultivation and landslides (due to road construction and slope failures)

MICROWATERSHED (BAGGA-KUNDI)
CODE J2a



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LANDSAT TM FCC,MAY'94

BAGGA KUNDI MICROWATERSHED

Name of the microwatershed	:	**Bagga-Kundi**
Code	:	**J2a**
Area	:	**1140 Ha.** **(260 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**Northern-NW**
Land use	:	**Agriculture/Forest/Scrub**
Slope	:	**15-50% mod-steep**
Nullahs	:	**Rungri, Lothara, Churi**
Villages	:	**Bagga, Rungri, Dhimpu, Kundi, Churi, Darbhalla**

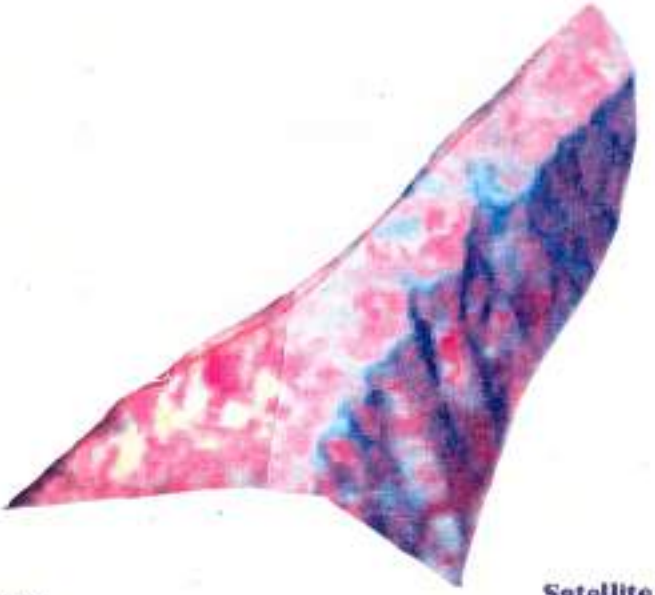
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	10 Ha.	Rs. 89600/-
Contour Bunding	20 Ha.	Rs. 112000/-
Afforestation	100 Ha.	Rs. 2031200/
Landslide Control	10 Ha.	Rs. 280000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 25 Nos. 35 Nos.	 Rs. 266875/- Rs. 42875/-
Gulley Control Model II	40 Ha.	Rs. 358400/-
Pasture Development	20 Ha.	Rs. 224000/-

Yearly Financial Outlay :

1st year	:	Rs. 700000
2nd year	:	Rs. 600000
3rd year	:	Rs. 600000
4th year	:	Rs. 650000
5th year	:	Rs. 854950
		Rs.3404950

MICROWATERSHED (BHATWARA)
CODE J2b



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BHATWARA MICROWATERSHED

Name of the microwatershed : **Bhatwara**

Code : **J2b**

Area : **700 Ha.**
(170Ha. Degraded)

Shape of the microwatershed : **Triangular**

Aspect : **Northern-NW**

Land use : **Agriculture/Forest**

Slope : **15-50% mod-steep**

Nullahs : **Baleni (Tributaries)**

Villages : **Hibra, Mundasa, Sunun, Kungairi, Kud**

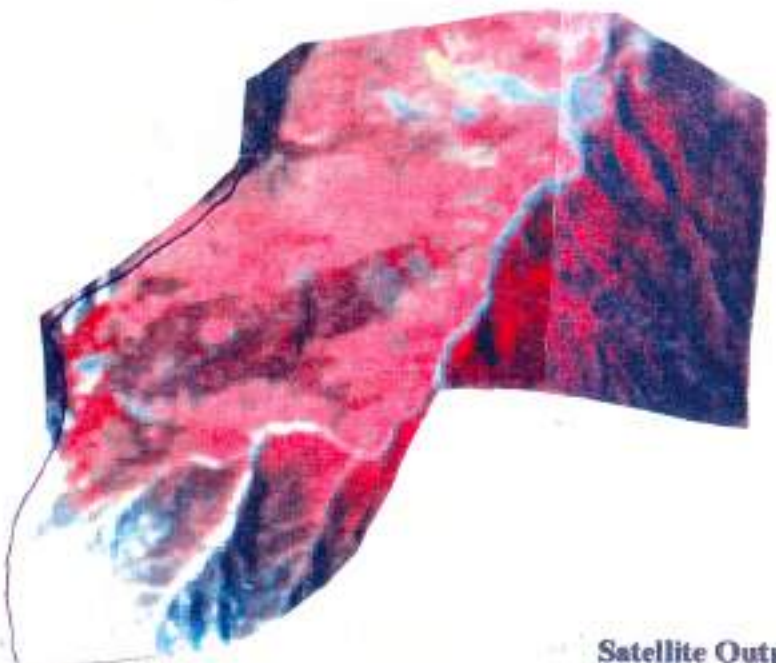
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	5 Ha.	Rs. 44800/-
Contour Bunding	10 Ha.	Rs. 56000/-
Afforestation	15 Ha.	Rs. 304680/-
Landslide Control	2 Ha.	Rs. 56000/-
Stream Bank Control		
- Wire Crate	15 Nos.	Rs. 160125/-
- Vegetative Spur	25 Nos.	Rs. 30625/-
Gulley Control Model II	20 Ha.	Rs. 179200/-
Pasture Development	15 Ha.	Rs. 168000/-

Yearly Financial Outlay :

1st year	:	Rs. 200000
2nd year	:	Rs. 180000
3rd year	:	Rs. 150000
4th year	:	Rs. 200000
5th year	:	Rs. 269430
		Rs.999430

MICROWATERSHED (NANI)
CODE J2c



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NANI MICROWATERSHED

Name of the microwatershed	:	**Nani**
Code	:	**J2c**
Area	:	**1262 Ha.** **(280 Ha. Degraded)**
Shape of the microwatershed	:	**Curvi-linear**
Aspect	:	**N.Eastern-Western**
Land use	:	**Dense Mix Jungle (Deodar), Agriculture, Scrub**
Slope	:	**15-50% mod-steep**
Nullahs	:	**Baleni (Tributaries)**
Villages	:	**Tappak, Kutwata, Sunau, Sadun, Nani**

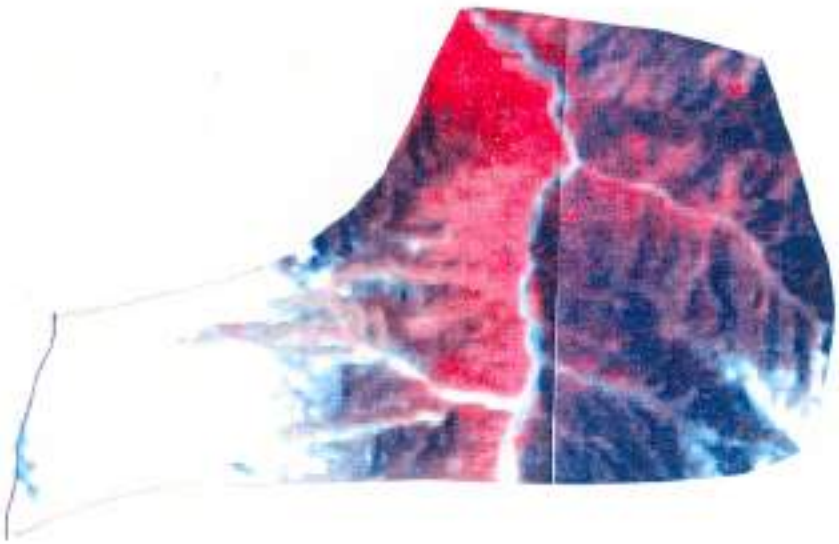
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	
Contour Bunding	18 Ha.	Rs. 100800/-
Afforestation	40 Ha.	Rs. 812480/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 35 Nos. 95 Nos.	 Rs. 373625/- Rs. 116375/-
Gulley Control Model I (25) Model II (25)	50 Ha.	Rs. 392750/-
Pasture Development	50 Ha.	Rs. 560000/-

Yearly Financial Outlay :

1st year	:	Rs. 450000
2nd year	:	Rs. 450000
3rd year	:	Rs. 450000
4th year	:	Rs. 450000
5th year	:	Rs. 556030
		Rs.2356030

MICROWATERSHED (DARKUND)
CODE J2d



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DARKUND MICROWATERSHED

Name of the microwatershed : **Darkund**

Code : **J2d**

Area : **1185 Ha.**
(200 Ha. Degraded)

Shape of the microwatershed : **Curvi-linear**

Aspect : **North-West-North-East**

Land use : **Dense, Deodar/Scrub**

Slope : **35-70%**

Nullahs : **Baleni (Tributaries)**

Villages : **Darkund**

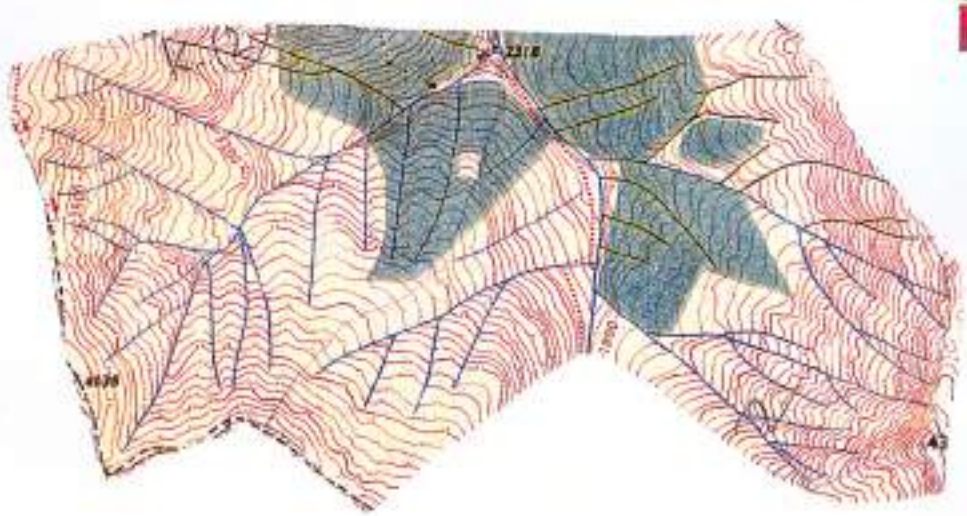
Total Physical Outlay :

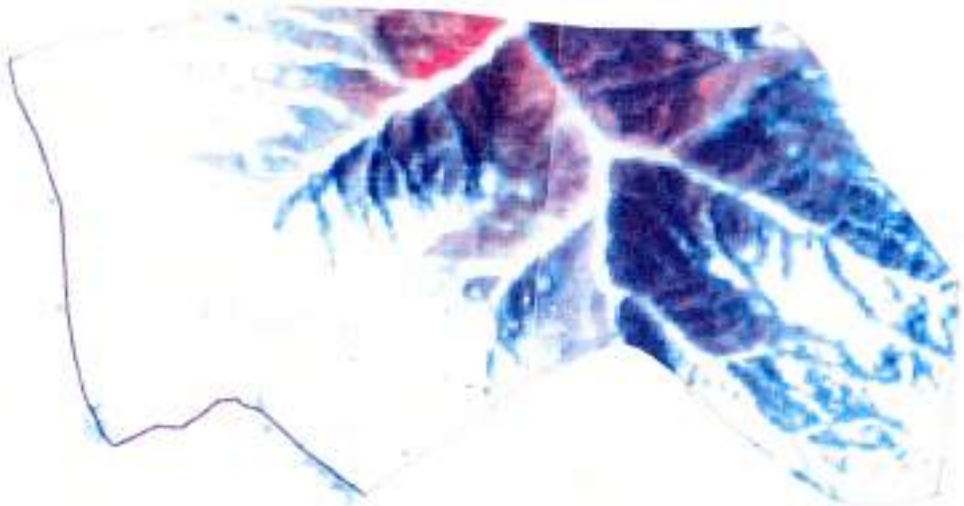
Components of Work	Quantity	Financial Outlay
Bench Terracing	--	
Contour Bunding	--	
Afforestation	40 Ha.	Rs. 812480/-
Landslide Control	2 Ha.	Rs. 56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 20 Nos. 30 Nos.	 Rs. 213500/- Rs. 36750/-
Gulley Control Model III	25 Ha.	Rs. 278300/-
Pasture Development	20 Ha.	Rs. 224000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 300000
3rd year	:	Rs. 350000
4th year	:	Rs. 300000
5th year	:	Rs. 371030
		Rs.1621030

MICROWATERSHED (SNOW)
CODE J2e





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SNOW MICROWATERSHED

Name of the microwatershed : Snow

Code : J2e

Area : 1530 Ha.
(160 Ha. Degraded)

Shape of the microwatershed : Irregular

Aspect : North-East/North-West

Land use : Forest/Scrub

Slope : 35-75%

Nullahs : Baleni (Tributaries)

Villages : Nil

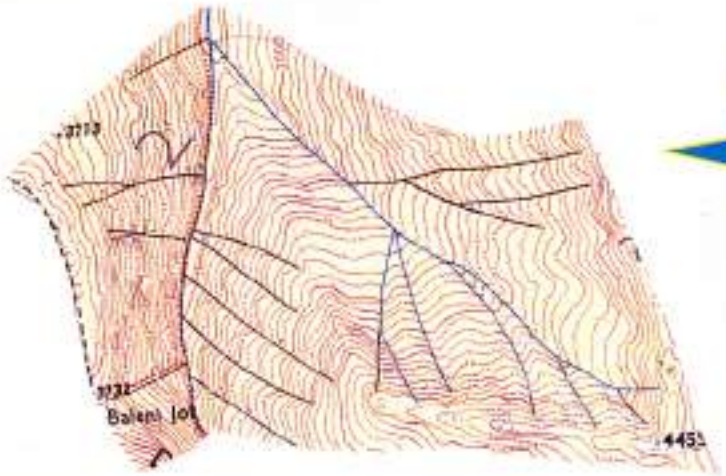
Total Physical Outlay :

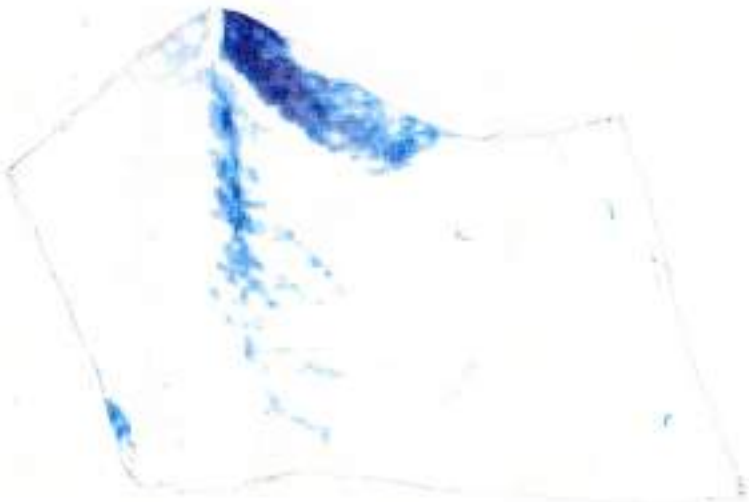
Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	50 Ha.	Rs. 1015600/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 -- --	 -- --
Gulley Control	--	--
Pasture Development	50 Ha.	Rs. 560000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 300000
3rd year	:	Rs. 300000
4th year	:	Rs. 300000
5th year	:	Rs. 375600
		Rs.1575600

MICROWATERSHED (BALANI JOT)
CODE J2f





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BALENI JOT MICROWATERSHED

Name of the microwatershed : **Baleni Jot**

Code : **J2f**

Area : **967 Ha.**
(40 Ha. Degraded)

Shape of the microwatershed : **Rectangular**

Aspect : **North-East/North-West**

Land use : **Pasture/Snowclad**

Slope : **35-75%**

Nullahs : **Baleni (Tributaries)**

Villages : **Nil**

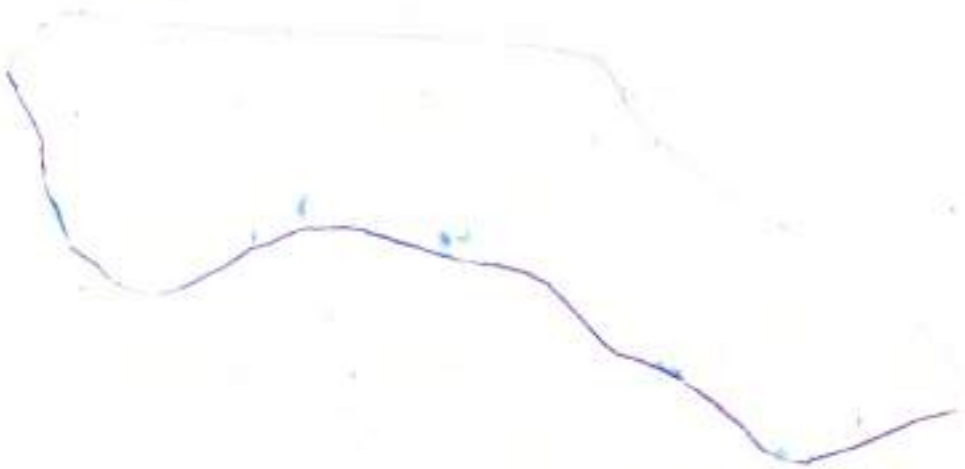
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	--	--
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 -- --	 -- --
Gulley Control	--	--
Pasture Development	50 Ha.	Rs. 560000/-

Yearly Financial Outlay :

1st year	:	Rs. 112000
2nd year	:	Rs. 112000
3rd year	:	Rs. 112000
4th year	:	Rs. 112000
5th year	:	Rs. 112000
		Rs. 560000

MICROWATERSHED (LAM-DAL)
CODE J2g



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LAM-DAL MICROWATERSHED

Name of the microwatershed : **Lam-Dal**

Code : **J2g**

Area : **875 Ha.**
(Snowclad Degraded)

Shape of the microwatershed : **Leafy**

Aspect : **Southern**

Land use : **Pasture/Snowclad**

Slope : **15-50% mod-steep**

Nullahs : **Baleni (Tributaries), Lam-Dal, Nag-Dal Lakes**

Villages : **Nil**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	
Contour Bunding	--	
Afforestation	--	
Landslide Control	--	
Stream Bank Control - Wire Crate - Vegetative Spur	 -- --	
Gulley Control	--	
Pasture Development	50 Ha.	Rs. 560000/-

Yearly Financial Outlay :

1st year	:	Rs. 112000
2nd year	:	Rs. 112000
3rd year	:	Rs. 112000
4th year	:	Rs. 112000
5th year	:	Rs. 112000
		Rs. 560000

MICROWATERSHED (DHANELI-NAL)
CODE K1a

SCALE 1:50,000

Satellite Output
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DHANELI MICROWATERSHED

Name of the microwatershed	:	**Dhaneli**
Code	:	**K1a**
Area	:	**775Ha.** **(161 Ha. Degraded)**
Shape of the microwatershed	:	**Leafy**
Aspect	:	**South-West**
Land use	:	**Agriculture/Scrub**
Slope	:	**15-50% mod-steep**
Nullahs	:	**Dhaneli (Tributaries)**
Villages	:	**Chanot, Guggi, Chandhel, Churi, Sunara**

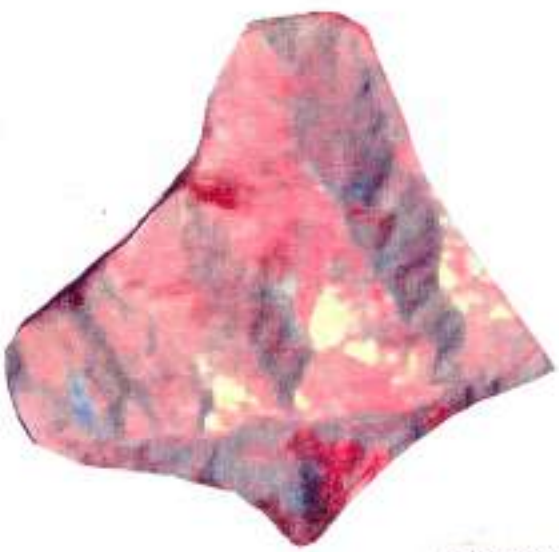
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	8 Ha.	Rs. 71680/-
Contour Bunding	15 Ha.	Rs. 84000/-
Afforestation	30 Ha.	Rs. 609360/-
Landslide Control	5 Ha.	Rs. 140000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 20 Nos. 35 Nos.	 Rs. 213500/- Rs. 42875/-
Gulley Control Model II	15 Ha.	Rs. 134400/-
Pasture Development	10 Ha.	Rs. 112000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 200000
3rd year	:	Rs. 250000
4th year	:	Rs. 250000
5th year	:	Rs. 407815
		Rs.1407815

MICROWATERSHED (DHALAUTA)
CODE K1b



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DHALAUTA MICROWATERSHED

Name of the microwatershed	:	**Dhalauta**
Code	:	**K1b**
Area	:	**787 Ha.** **(280 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**Southern**
Land use	:	**Agriculture, Scrub-Degraded Forest**
Slope	:	**strongly slopping 15-35%**
Nullahs	:	**Lith-khud (Tributaries)**
Villages	:	**Reil, Barthera, Dramman, Kather, Jhatka, Dhalauta**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	10 Ha.	Rs. 203120/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 25 Nos. 30 Nos.	 Rs. 266875/- Rs. 36750/-
Gulley Control Model I	25 Ha.	Rs. 168750/-
Pasture Development	15 Ha.	Rs. 168000/-

Yearly Financial Outlay :

1st year	:	Rs. 150000
2nd year	:	Rs. 150000
3rd year	:	Rs. 150000
4th year	:	Rs. 150000
5th year	:	Rs. 243495
		Rs. 843495

MICROWATERSHED (TIPRIARA)
CODE K1c

MICROWATERSHED (ANDHERA)
CODE K1d

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

TIPRIARA AND ANDHERA MICROWATERSHED

Name of the microwatershed	:	**Tipriara and Andhera**
Code	:	**K1c & K1d**
Area	:	**1182 Ha.** **(330 Ha. Degraded)**
Shape of the microwatershed	:	**Curvi-linear**
Aspect	:	**Southern**
Land use	:	**Agriculture**
Slope	:	**15-50% strongly-steep**
Nullahs	:	**Braguna (Tributaries)**
Villages	:	**Phebdi, Kalmala, Mauhri, Tipriara, Andhera**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	20 Ha.	Rs. 179200/-
Contour Bunding	30 Ha.	Rs. 168000/-
Afforestation	25 Ha.	Rs. 507800/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 40 Nos. 60 Nos.	 Rs. 427000/- Rs. 73500/-
Gulley Control Model III	20 Ha.	Rs. 222640/-
Pasture Development	30 Ha.	Rs. 336000/-

Yearly Financial Outlay :

1st year	:	Rs. 400000
2nd year	:	Rs. 350000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 464140
		Rs.1914140

MICROWATERSHED (SALOI)
CODE K2a

(DHANDELA)
CODE K1e

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

DHANDELA AND SALOI MICROWATERSHED

Name of the microwatershed	:	**Dhandela and Saloi**
Code	:	**K1e & K2a**
Area	:	**1275 Ha.** **(280 Ha. Degraded)**
Shape of the microwatershed	:	**Curvi-linear**
Aspect	:	**Southern**
Land use	:	**Agriculture/Froest/Scrub**
Slope	:	**35->75% steep**
Nullahs	:	**Braguna (Tributaries)**
Villages	:	**Satain, Raina, Dhandela, Saloi, Barota**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	30 Ha.	Rs. 268800/-
Contour Bunding	40 Ha.	Rs. 224000/-
Afforestation	60 Ha.	Rs. 1218720/-
Landslide Control	6 Ha.	Rs. 168000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 40 Nos. 70 Nos.	 Rs. 427000/- Rs. 85750/-
Gulley Control Model II	40 Ha.	Rs. 358400/-
Pasture Development	50 Ha.	Rs. 560000/-

Yearly Financial Outlay :

1st year	:	Rs. 700000
2nd year	:	Rs. 650000
3rd year	:	Rs. 650000
4th year	:	Rs. 600000
5th year	:	Rs. 710670
		Rs.3310670

MICROWATERSHED (BRAGUNA)
CODE K2b

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

BRAGUNA MICROWATERSHED

Name of the microwatershed	:	**Braguna**
Code	:	**K2b**
Area	:	**807 Ha.** **(280 Ha. Degraded)**
Shape of the microwatershed	:	**Curvi-linear**
Aspect	:	**Southern**
Land use	:	**Forest(Deodar)/Agriculture/ Scrub**
Slope	:	**35->75% steep**
Nullahs	:	**Braguna (Tributaries)**
Villages	:	**Chhatkar, Sakraina, Dhangu**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	50 Ha.	Rs. 1015600/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 35 Nos. 45 Nos.	 Rs. 373625/- Rs. 55125/-
Gulley Control Model III	50 Ha.	Rs. 556600/-
Pasture Development	15 Ha.	Rs. 168000/-

Yearly Financial Outlay :

1st year	:	Rs. 400000
2nd year	:	Rs. 400000
3rd year	:	Rs. 400000
4th year	:	Rs. 400000
5th year	:	Rs. 568950
		Rs.2168950

MICROWATERSHED (DEGAIR-NAL)
CODE K2c

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

DEGAIR NAL MICROWATERSHED

Name of the microwatershed : Degair Nal

Code : K2c

Area : 1050 Ha.
(180 Ha. Degraded)

Shape of the microwatershed : Leafy

Aspect : North-East/North-West

Land use : Dense (Deodar)/Scrub

Slope : 35->75% steep

Nullahs : Degair (Tributaries)

Villages : Kega

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	25 Ha.	Rs. 507800/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 30 Nos. 30 Nos.	 Rs. 320250/- Rs. 36750/-
Gulley Control Model-I	20 Ha.	Rs. 135000/-
Pasture Development	25 Ha.	Rs. 280000/-

Yearly Financial Outlay :

1st year	:	Rs. 250000
2nd year	:	Rs. 250000
3rd year	:	Rs. 250000
4th year	:	Rs. 250000
5th year	:	Rs. 279800
		Rs.1279800

MICROWATERSHED (GANDHAR)
CODE L1a

MICROWATERSHED (MALLA)
CODE L1b

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

GANDHAR AND MALLA MICROWATERSHED

Name of the microwatershed : **Gandhar and Malla**

Code : **L1a & L1b**

Area : **630 Ha.**
(323 Ha. Degraded)

Shape of the microwatershed : **Triangular**

Aspect : **Southern**

Land use : **Agriculture/Scrub**

Slope : **35->75% steep-very steep**

Nullahs : **Balij Ka Nalla (Tributaries)**

Villages : **Gandhar, Kuddagi, Paddar, Malla, Guwar**

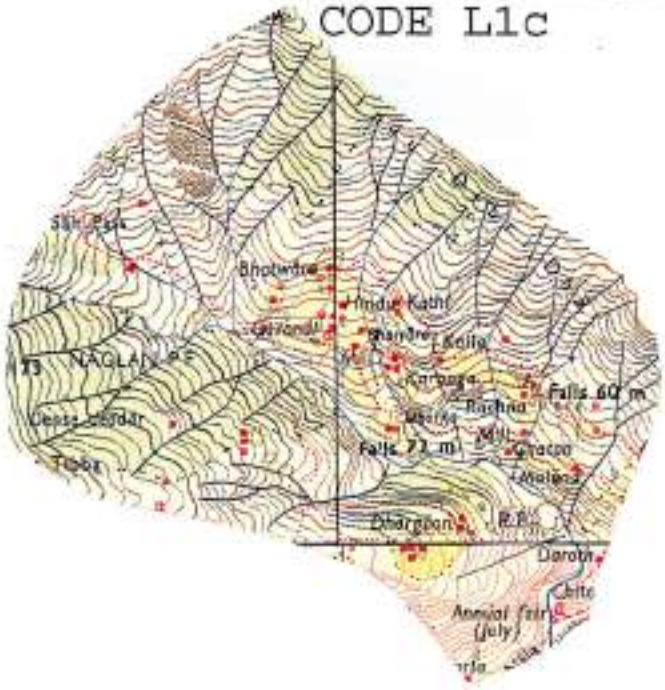
Total Physical Outlay :

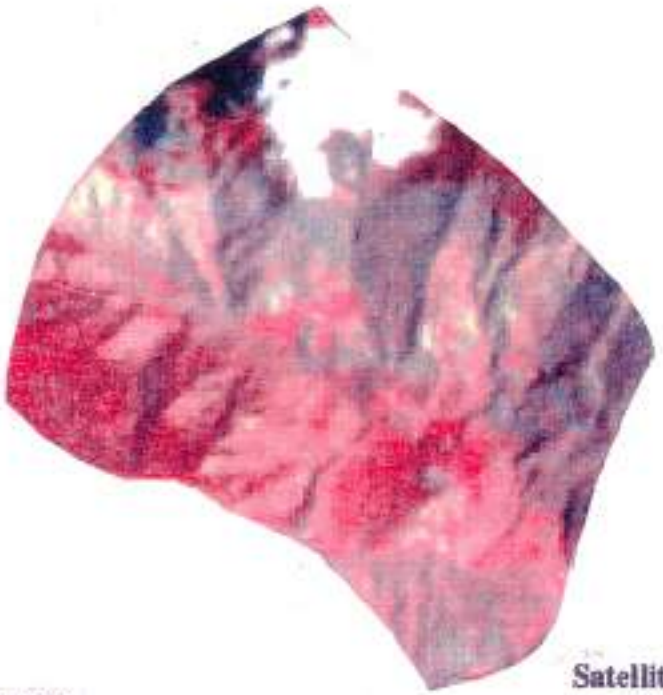
Components of Work	Quantity	Financial Outlay
Bench Terracing	5 Ha.	Rs. 44800/-
Contour Bunding	7 Ha.	Rs. 39200/-
Afforestation	30 Ha.	Rs. 609360/-
Landslide Control	5 Ha.	Rs. 140000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 12 Nos. 20 Nos.	 Rs. 128100/- Rs. 24500/-
Gulley Control Model I (20) Model II (15)	35 Ha.	Rs. 269400/-
Pasture Development	5 Ha.	Rs. 56000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 250000
3rd year	:	Rs. 250000
4th year	:	Rs. 200000
5th year	:	Rs. 311360
		Rs.1311360

MICROWATERSHED (GARANDI)
CODE L1c





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Satellite Output
LANDSAT TM FCC,MAY'94

GARANDI MICROWATERSHED

Name of the microwatershed	:	**Garandi**
Code	:	**L1c**
Area	:	**1225 Ha.** **(270 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**East/West**
Land use	:	**Forest (Deodar)/Agriculture**
Slope	:	**15-75% strongly-very steep**
Nullahs	:	**Balij Ka Nalla, Garandi (Tributaries)**
Villages	:	**Garandi, Karanga, Malund, Dhargaon**

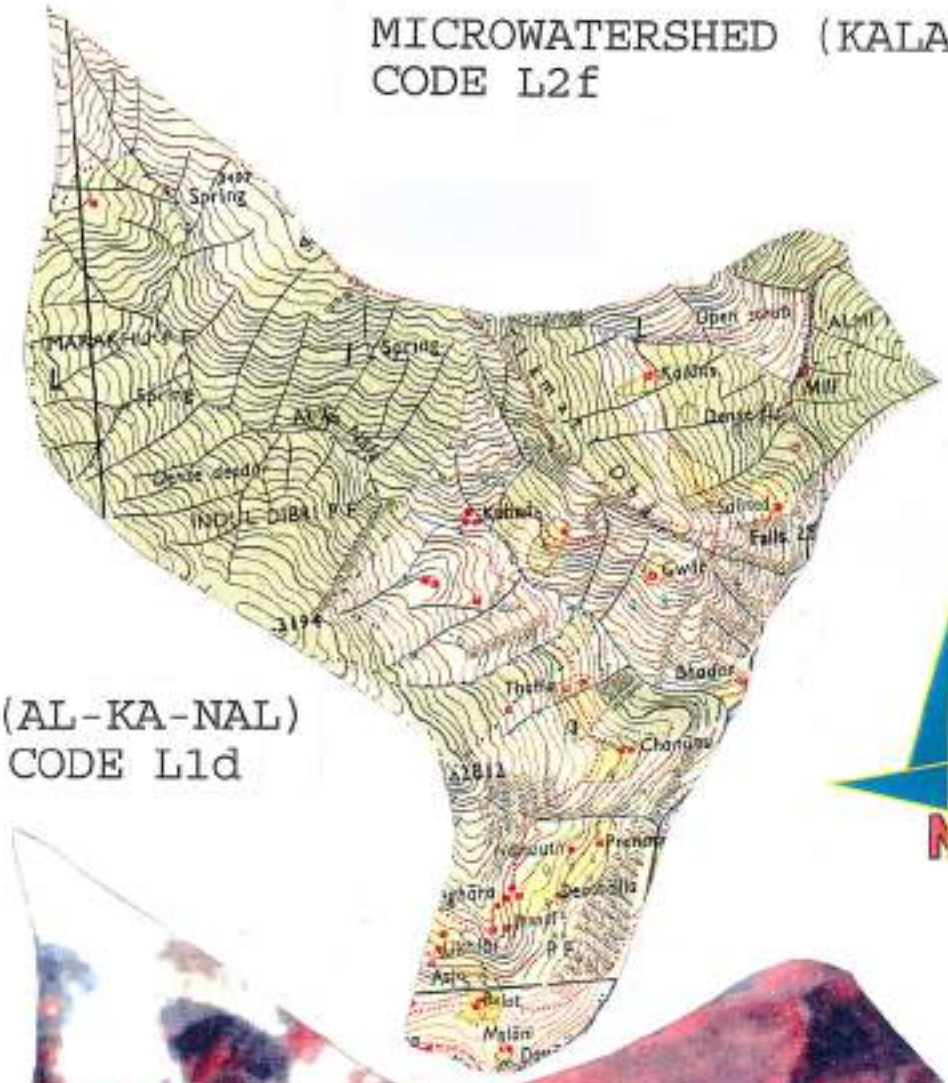
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	40 Ha.	Rs. 812480/-
Landslide Control	2 Ha.	Rs. 56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 25 Nos. 38 Nos.	 Rs. 266875/- Rs. 46550/-
Gulley Control Model-II	40 Ha.	Rs. 358400/-
Pasture Development	25 Ha.	Rs. 280000/-

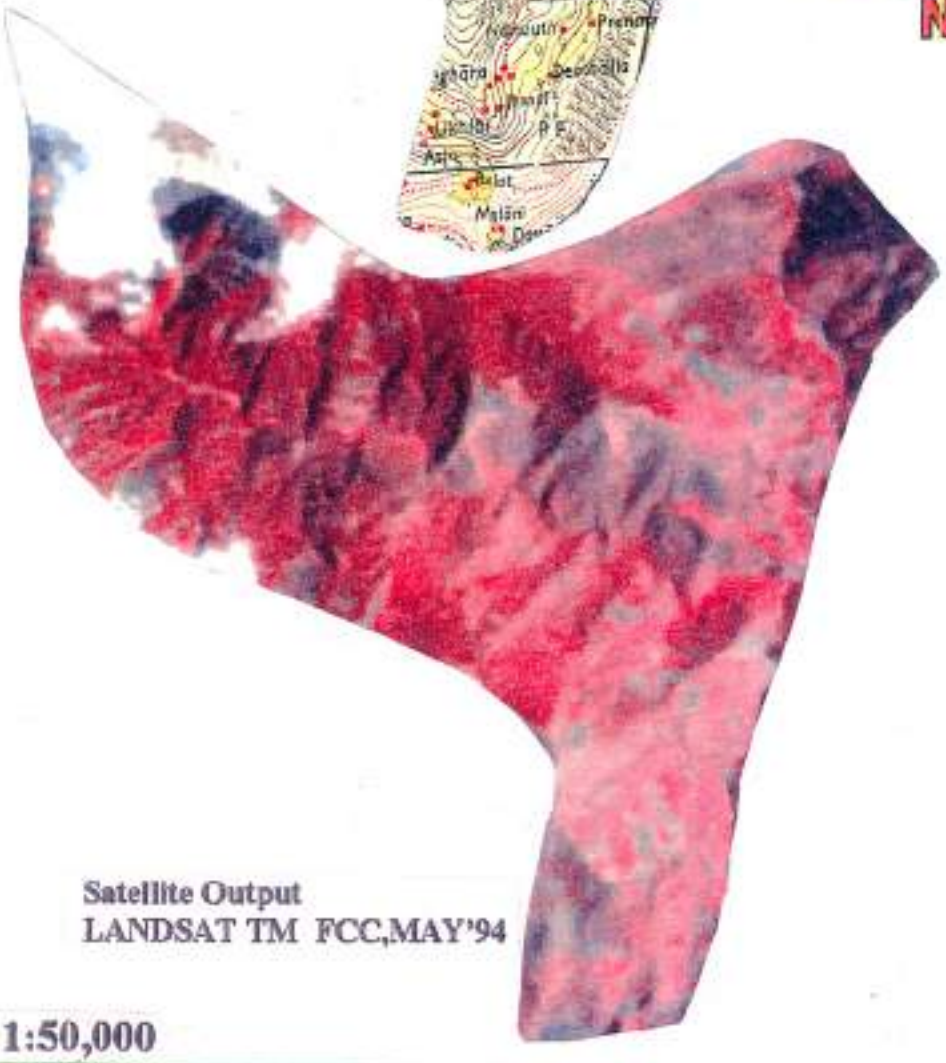
Yearly Financial Outlay :

1st year	:	Rs. 350000
2nd year	:	Rs. 350000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 420305
		Rs.1820305

MICROWATERSHED (KALANS)
CODE L2f



(AL-KA-NAL)
CODE L1d



Satellite Output
LANDSAT TM FCC,MAY'94

SCALE 1:50,000

ALKA NAL AND KALANS MICROWATERSHED

Name of the microwatershed : Alka Nal and Kalans

Code : L1d & L2f

Area : 2025 Ha.
(400 Ha. Degraded)

Shape of the microwatershed : Irregular

Aspect : Eastern

Land use : Dense (Deodar/Fir), Open Scrub/Agriculture

Slope : 15->75% strongly-Escap

Nullahs : Alka Nal (Tributaries)

Villages : Bhadar, Chanuna, Deothalla Malani, Kalans

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	100 Ha.	Rs. 2031200/-
Landslide Control	10 Ha.	Rs. 280000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 70 Nos. 95 Nos.	 Rs. 747250/- Rs. 116375/-
Gulley Control Model-I (35) Model-II (35)	70 Ha.	Rs. 549850/-
Pasture Development	30 Ha.	Rs. 336000/-

Yearly Financial Outlay :

1st year	:	Rs. 700000
2nd year	:	Rs. 700000
3rd year	:	Rs. 700000
4th year	:	Rs. 700000
5th year	:	Rs.1260675
		Rs.4060675

MICROWATERSHED (KHANDIL)
CODE L1e

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

KHANDIL MICROWATERSHED

Name of the microwatershed : **Khandil**

Code : **L1e**

Area : **1062 Ha.**
(292 Ha. Degraded)

Shape of the microwatershed : **Oblong**

Aspect : **North-West**

Land use : **Dense (Deodar/Fir)/**
Agriculture

Slope : **50-75% very steep-escarpment**

Nullahs : **Balij Ka Nalla (Tributaries)**

Villages : **Khandil, Khilla, Bhatlun**
Kanhetar, Gelu

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	10 Ha.	Rs. 56000/-
Afforestation	80 Ha.	Rs. 1624960/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 30 Nos. 50 Nos.	 Rs. 320250/- Rs. 61250/-
Gulley Control Model-III	40 Ha.	Rs. 445280/-
Pasture Development	10 Ha.	Rs. 112000/-

Yearly Financial Outlay :

1st year	:	Rs. 500000
2nd year	:	Rs. 500000
3rd year	:	Rs. 500000
4th year	:	Rs. 500000
5th year	:	Rs. 619740
		Rs.2619740

MICROWATERSHED (PARDEONA)
CODE L1f

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

PARDEONA MICROWATERSHED

Name of the microwatershed	:	**Pardeona**
Code	:	**L1f**
Area	:	**725 Ha.** **(180 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**North-West**
Land use	:	**Dense (Deodar)/ Agriculture/Scrub**
Slope	:	**<15-75% moderate-very step**
Nullahs	:	**Balij Ka Nalla (Tributaries)**
Villages	:	**Pardeona, Gotlu, Kuther, Gwar**

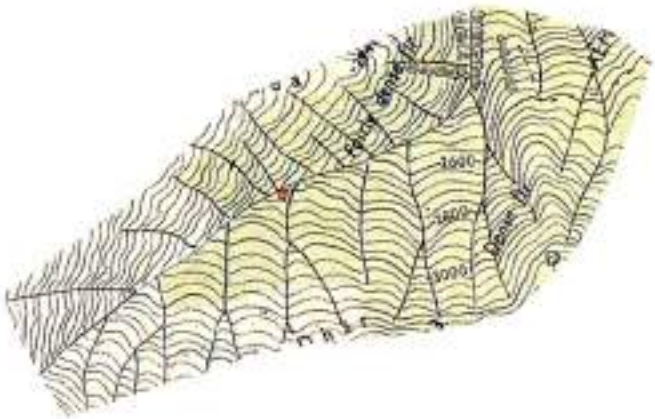
Total Physical Outlay :

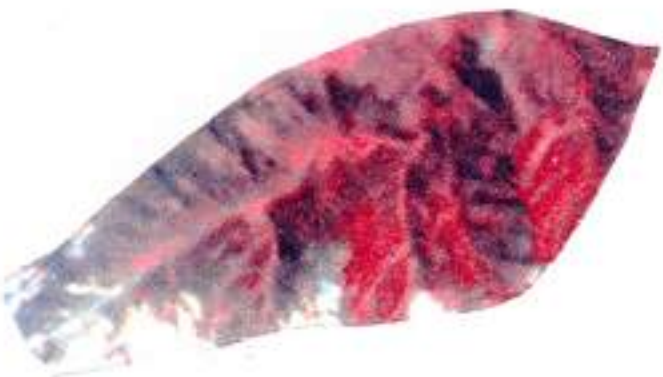
Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	40 Ha.	Rs. 812480/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 20 Nos. 30 Nos.	 Rs. 213500/- Rs. 36750/-
Gulley Control Model-II	40 Ha.	Rs. 358400/-
Pasture Development	30 Ha.	Rs. 336000/-

Yearly Financial Outlay :

1st year	:	Rs. 350000
2nd year	:	Rs. 350000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 357130
		Rs.1757130

MICROWATERSHED (BHADRA-LOWER)
CODE L2a





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Satellite Output
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BHADRA LOWER MICROWATERSHED

Name of the microwatershed	:	**Bhadra Lower**
Code	:	**L2a**
Area	:	**320 Ha.** **(100 Ha. Degraded)**
Shape of the microwatershed	:	**Leafy**
Aspect	:	**Northern**
Land use	:	**Forest (Fir), Open Scrub**
Slope	:	**35-50% steep**
Nullahs	:	**Bhadra (Tributaries)**
Villages	:	**Nil**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	15 Ha.	Rs. 304680/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 10 Nos. 12 Nos.	 Rs. 106750/- Rs. 14700/-
Gulley Control Model-I	10 Ha.	Rs. 67500/-
Pasture Development	20 Ha.	Rs. 224000/-

Yearly Financial Outlay :

1st year	:	Rs. 150000
2nd year	:	Rs. 150000
3rd year	:	Rs. 150000
4th year	:	Rs. 150000
5th year	:	Rs. 117630
		Rs. 717630

MICROWATERSHED (BHADRA)
CODE L2b

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

BHADRA MICROWATERSHED

Name of the microwatershed	:	**Bhadra**
Code	:	**L2b**
Area	:	**2140 Ha.** **(300 Ha. Degraded)**
Shape of the microwatershed	:	**Irreguiar**
Aspect	:	**North-West/North-East**
Land use	:	**Forest (Fir), Open Scrub**
Slope	:	**35-75% steep-very steep**
Nullahs	:	**Bhadra (Tributaries)**
Villages	:	**Aimi**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	80 Ha.	Rs. 1624960/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 35 Nos. 40 Nos.	 Rs. 373625/- Rs. 49000/-
Gulley Control Model-I (25) Model-II (25)	50 Ha.	Rs. 392750/-
Pasture Development	50 Ha.	Rs. 560000/-

Yearly Financial Outlay	:	**1st year**	: **Rs. 600000**
		2nd year	: **Rs. 600000**
		3rd year	: **Rs. 600000**
		4th year	: **Rs. 600000**
		5th year	: **Rs. 600335**
			Rs.3000335

MICROWATERSHED (NAINA-DHAR)
CODE L2c

N

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

NAINA DHAR MICROWATERSHED

Name of the microwatershed	:	**Naina Dhar**
Code	:	**L2c**
Area	:	**1150 Ha.** **(120 Ha. Degraded)**
Shape of the microwatershed	:	**Rectangular**
Aspect	:	**South-West**
Land use	:	**Scrub/Forest**
Slope	:	**35-75% steep-very steep**
Nullahs	:	**Bhadra (Tributaries)**
Villages	:	**Nil**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	30 Ha.	Rs. 609360/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 15 Nos. 32 Nos.	 Rs. 160125/- Rs. 39200/-
Gulley Control Model-I	35 Ha.	Rs. 236250/-
Pasture Development	35 Ha.	Rs. 392000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 250000
3rd year	:	Rs. 250000
4th year	:	Rs. 250000
5th year	:	Rs. 386935
		Rs.1436935

MICROWATERSHED (RESHAL)
CODE L2d

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

RESHAL MICROWATERSHED

Name of the microwatershed	:	**Reshal**
Code	:	**L2d**
Area	:	**1775 Ha.** **(280 Ha. Degraded)**
Shape of the microwatershed	:	**Linear**
Aspect	:	**South-West**
Land use	:	**Scrub/Dense (Fir)**
Slope	:	**35-75% steep-very steep**
Nullahs	:	**Reshal Nalla (Tributaries)**
Villages	:	**Nil**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	50 Ha.	Rs. 1015600/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 35 Nos. 65 Nos.	 Rs.373625/- Rs.79625/-
Gulley Control Model-I (15) Model-II (15)	30 Ha.	Rs.268230/-
Pasture Development	50 Ha.	Rs.560000/-

Yearly Financial Outlay :

1st year	:	Rs. 450000
2nd year	:	Rs. 450000
3rd year	:	Rs. 450000
4th year	:	Rs. 450000
5th year	:	Rs. 497080
		Rs.2297080

MICROWATERSHED (JOTO-KA-NAL)
CODE L2e

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

JOTU KA NAL MICROWATERSHED

Name of the microwatershed : **Jotu Ka Nal**

Code : **L2e**

Area : **1000 Ha.**
(410 Ha. Degraded)

Shape of the microwatershed : **Triangular**

Aspect : **North-West**

Land use : **Scrub/Forest (Fir)**

Slope : **35-75% steep-very steep**

Nullahs : **Jotu Ka Nal (Tributaries)**

Villages : **Khirkil, Girar**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	30 Ha.	Rs. 609360/-
Landslide Control	1.5 Ha.	Rs. 42000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 27 Nos. 45 Nos.	 Rs. 288225/- Rs. 55125/-
Gulley Control Model-I	15 Ha.	Rs. 101250/-
Pasture Development	25 Ha.	Rs. 280000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 250000
3rd year	:	Rs. 250000
4th year	:	Rs. 250000
5th year	:	Rs. 325960
		Rs.1375960

MICROWATERSHED (KANN)
CODE M1a

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

KANN MICROWATERSHED

Name of the microwatershed	:	Kann
Code	:	M1a
Area	:	457 Ha. (100 Ha. Degraded)
Shape of the microwatershed	:	Triangular
Aspect	:	North-East
Land use	:	Agriculture/Forest
Slope	:	<15-35% mod-strongly
Nullahs	:	Loharada (Tributaries)
Villages	:	Lungwani, Malantha, Loharada, Bhatwara

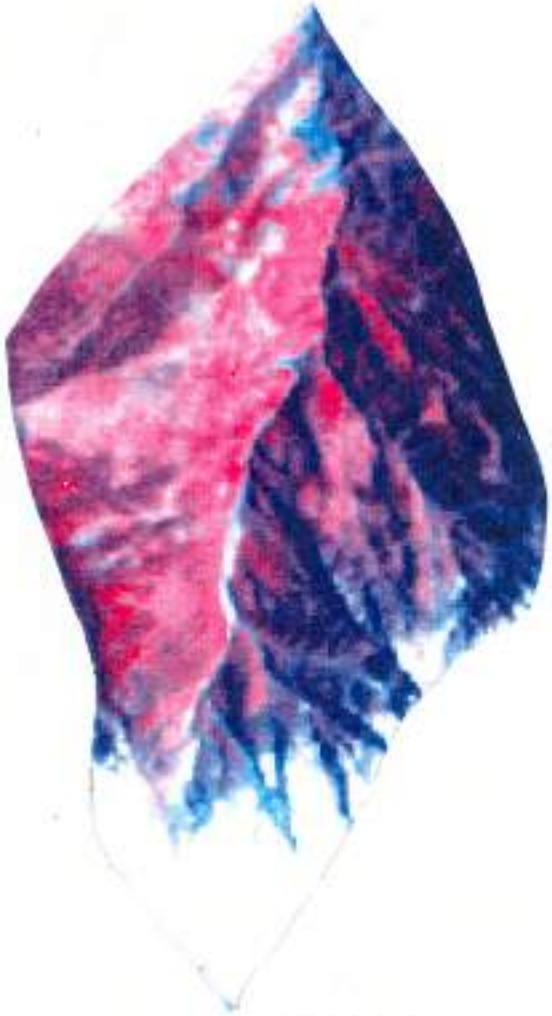
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	5 Ha.	Rs. 44800/-
Contour Bunding	10 Ha.	Rs. 56000/-
Afforestation	25 Ha.	Rs. 507800/-
Landslide Control	12 Ha.	Rs. 336000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 18 Nos. 25 Nos.	 Rs. 192150/- Rs. 30625/-
Gulley Control model - II	15 Ha.	Rs. 134400/-
Pasture Development	--	--

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 250000
3rd year	:	Rs. 250000
4th year	:	Rs. 300000
5th year	:	Rs. 201775
		Rs.1301775

MICROWATERSHED (PAR)
CODE M1b



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Satellite Output
LANDSAT TM FCC,MAY'94

PAR MICROWATERSHED

Name of the microwatershed	:	**Par**
Code	:	**M1b**
Area	:	**1455 Ha.** **(510 Ha. Degraded)**
Shape of the microwatershed	:	**Leafy**
Aspect	:	**North-East/North-West**
Land use	:	**Forest /Agriculture/Scrub**
Slope	:	**15-75% mod-very steep**
Nullahs	:	**Par Nalla (Tributaries)**
Villages	:	**Gumrara, Nakan, Khuddon, Pharkajhikla**

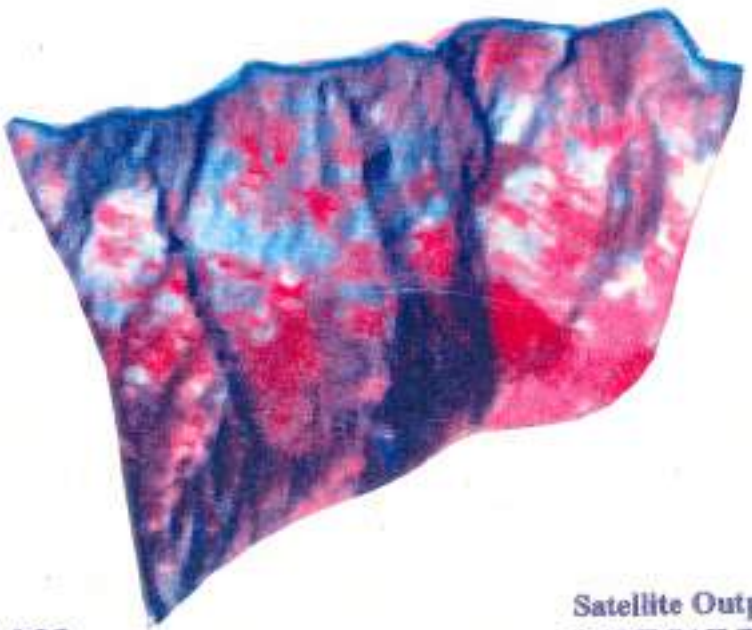
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	20 Ha.	Rs. 179200/-
Contour Bunding	25 Ha.	Rs. 140000/-
Afforestation	60 Ha.	Rs. 1218720/-
Landslide Control	2.5 Ha.	Rs. 70000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 35 Nos. 58 Nos.	 Rs. 373625/- Rs. 71050/-
Gulley Control Model-II (20) Model-III (20)	40 Ha.	Rs. 401840/-
Pasture Development	60 Ha.	Rs. 672000/-

Yearly Financial Outlay :

1st year	:	Rs. 700000
2nd year	:	Rs. 750000
3rd year	:	Rs. 750000
4th year	:	Rs. 550000
5th year	:	Rs. 376435
		Rs.3126435

MICROWATERSHED (CHATRARI)
CODE M1c



SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

CHATRARI MICROWATERSHED

Name of the microwatershed : Chatrari

Code : M1c

Area : 1112 Ha.
(270 Ha. Degraded)

Shape of the microwatershed : Rectangular

Aspect : Northern

Land use : Forest (Mix Deodar), Agriculture

Slope : 15-50% mod-steep

Nullahs : Ravi (Tributaries), Chatrari Badhor

Villages : Lanota, Rakhwara, Chatrari, Sungrer, Maraur

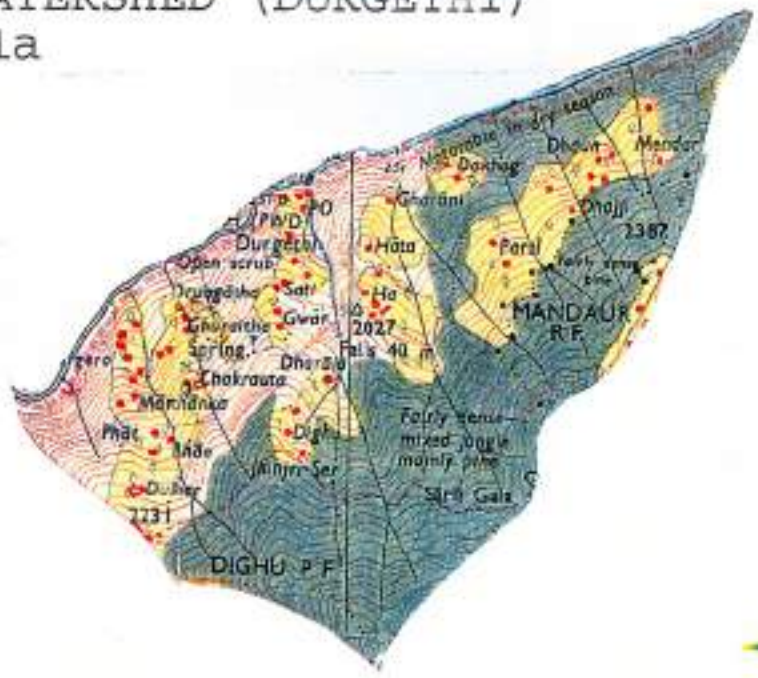
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	32 Ha.	Rs. 286720/-
Contour Bunding	50 Ha.	Rs. 280000/-
Afforestation	60 Ha.	Rs. 1218720/-
Landslide Control	10 Ha.	Rs. 280000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 25 Nos. 30 Nos.	 Rs. 352275/- Rs. 73500/-
Gulley Control Model-III	30 Ha.	Rs. 333960/-
Pasture Development	20 Ha.	Rs. 224000/-

Yearly Financial Outlay :

1st year	:	Rs. 700000
2nd year	:	Rs. 700000
3rd year	:	Rs. 550000
4th year	:	Rs. 600000
5th year	:	Rs. 499175
		Rs.3049175

MICROWATERSHED (DURGETHI)
CODE N1a



SCALE 1:50,000

Satellite Output
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DURGETHI MICROWATERSHED

Name of the microwatershed	:	Durgethi
Code	:	N1a
Area	:	1000 Ha. (310 Ha. Degraded)
Shape of the microwatershed	:	Triangular
Aspect	:	North-West
Land use	:	Forest (Pine), Agriculture
Slope	:	15-50% strongly steep
Nullahs	:	Ravi (Tributaries), Durgethi Gharani
Villages	:	Durgethi, Chakrauta, Sati, Hata, Parol, Dighu

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	25 Ha.	Rs. 224000/-
Contour Bunding	35 Ha.	Rs. 196000/-
Afforestation	100 Ha.	Rs. 2031200/-
Landslide Control	10 Ha.	Rs. 280000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 25 Nos. 80 Nos.	 Rs. 266875/- Rs. 98000/-
Gulley Control Model-I (20) Model-II (60)	80 Ha.	Rs. 706350/-
Pasture Development	40 Ha.	Rs. 448000/-

Yearly Financial Outlay :

1st year	:	Rs. 850000
2nd year	:	Rs. 850000
3rd year	:	Rs. 850000
4th year	:	Rs. 850000
5th year	:	Rs. 850425
		Rs.4250425

MICROWATERSHED (DUNDHELI)
CODE N1b

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

DUNDHELI MICROWATERSHED

Name of the microwatershed	:	**Dundheli**
Code	:	**N1b**
Area	:	**462 Ha.** **(160 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**Northern**
Land use	:	**Agriculture/Scrub**
Slope	:	**15-50% strongly steep**
Nullahs	:	**Ravi (Tributaries), Chirchind**
Villages	:	**Chandanpat, Dundheli,** **Thakula, Masor**

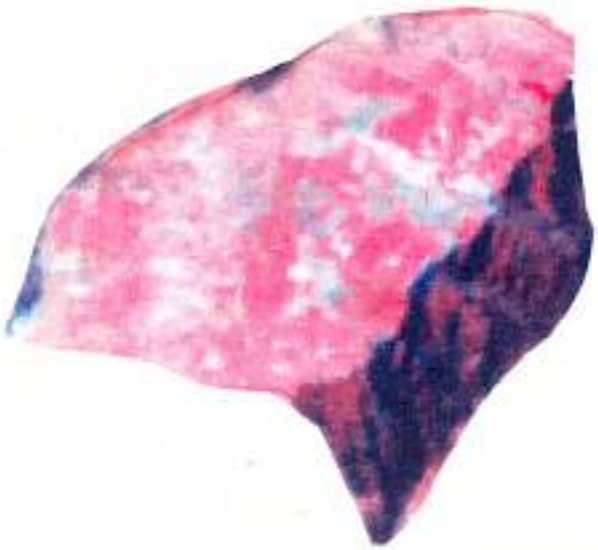
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	25 Ha.	Rs. 224000/-
Contour Bunding	35 Ha.	Rs. 196000/-
Afforestation	30 Ha.	Rs. 609360/-
Landslide Control	2 Ha.	Rs. 56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 35 Nos. 50 Nos.	 Rs. 373625/- Rs. 61250/-
Gulley Control Model-I	10 Ha.	Rs. 67500/-
Pasture Development	10 Ha.	Rs. 112000/-

Yearly Financial Outlay :

1st year	:	Rs. 350000
2nd year	:	Rs. 350000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 299735
		Rs.1699735

MICROWATERSHED (JANTRA)
CODE N1c



SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

JANTRA MICROWATERSHED

Name of the microwatershed	:	**Jantra**
Code	:	**N1c**
Area	:	**815 Ha.** **(270 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**North-East**
Land use	:	**Agriculture/Scrub/Forest**
Slope	:	**15-50% mod-steep**
Nullahs	:	**Klunr (Tributaries),**
Villages	:	**Khalan, Jantra, Bhaga, Kalangaon**

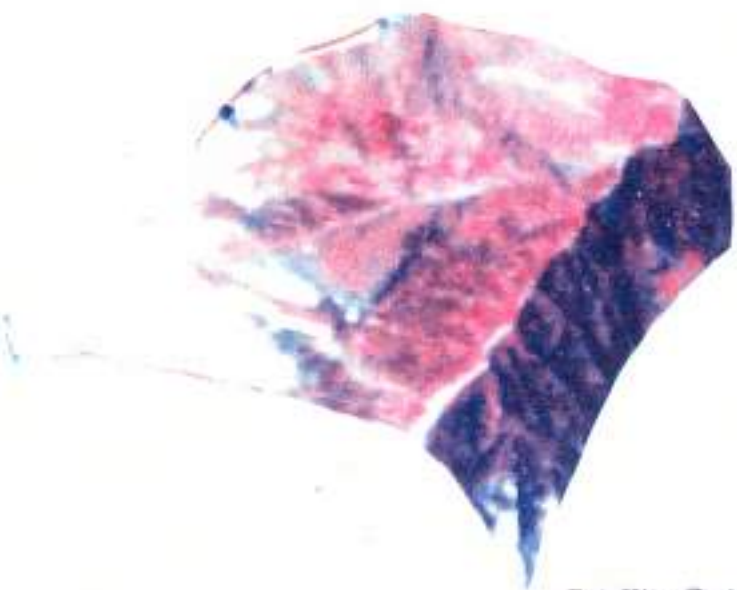
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	10 Ha.	Rs. 56000/-
Afforestation	20 Ha.	Rs. 406240/-
Landslide Control	5 Ha.	Rs. 140000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 30 Nos. 40 Nos.	 Rs. 320250/- Rs. 49000/-
Gulley Control Model-I	40 Ha.	Rs. 270000/-
Pasture Development	40 Ha.	Rs. 448000/-

Yearly Financial Outlay :

1st year	:	Rs. 350000
2nd year	:	Rs. 300000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 339490
		Rs.1689490

MICROWATERSHED (KANJRALA-GOT)
CODE N1d



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LANDSAT TM FCC,MAY'94

KANJRALA GOT MICROWATERSHED

Name of the microwatershed : Kanjrala Got

Code : N1d

Area : 1027 Ha.
(150 Ha. Degraded)

Shape of the microwatershed : Semi-circular

Aspect : North-East

Land use : Forest (Deodar)/Scrub

Slope : 15-75% strongly-very steep

Nullahs : Klunr (Tributaries),

Villages : Bhagnir

Total Physical Outlay :

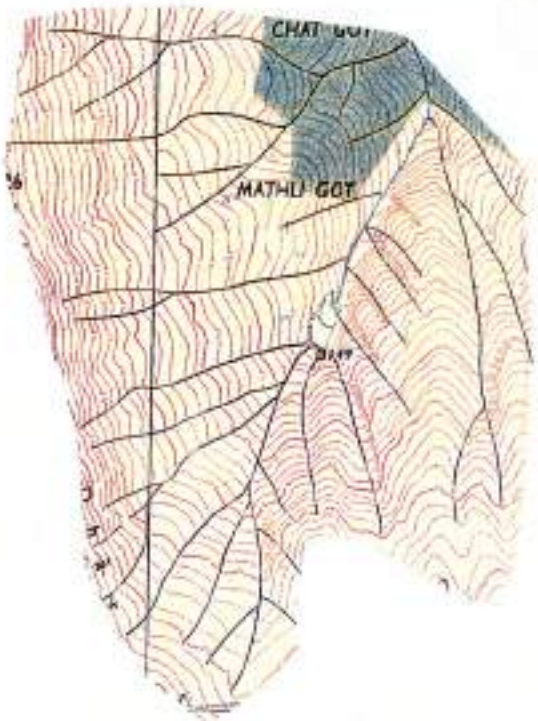
Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	35 Ha.	Rs. 710920/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 12 Nos. 18 Nos.	 Rs. 128100/- Rs. 22050/-
Gulley Control Model-I	20 Ha.	Rs. 135000/-
Pasture Development	20 Ha.	Rs. 224000/-

Yearly Financial Outlay :

1st year	:	Rs. 250000
2nd year	:	Rs. 250000
3rd year	:	Rs. 250000
4th year	:	Rs. 250000
5th year	:	Rs. 220070
		Rs.1220070

MICROWATERSHED (MATHLI-GOT)

CODE N1e



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MATHLI GOT MICROWATERSHED

Name of the microwatershed : **Mathli Got**

Code : **N1e**

Area : **1332 Ha.**
(Snoclad Degraded)

Shape of the microwatershed : **Rectangular**

Aspect : **North-East**

Land use : **Forest (Deodar)/Scrub/ Snow**

Slope : **15-75% strongly-very steep**

Nullahs : **Klunr (Tributaries),**

Villages : **Nil**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	10 Ha.	Rs. 203120/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 10 Nos. 15 Nos.	 Rs.106750/- Rs.18375/-
Gulley Control Model-I	30 Ha.	Rs.202500/-
Pasture Development	70 Ha.	Rs.784000/-

Yearly Financial Outlay :

1st year	:	Rs. 300000
2nd year	:	Rs. 200000
3rd year	:	Rs. 200000
4th year	:	Rs. 250000
5th year	:	Rs. 364745
		Rs.1314745

MICROWATERSHED (BUDHERA)
CODE N2a

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Satellite Output
LANDSAT TM FCC.MAY'94

BUDHERA MICROWATERSHED

Name of the microwatershed : **Budhera**

Code : **N2a**

Area : **890 Ha.**
(310 Ha. Degraded)

Shape of the microwatershed : **Rectangular**

Aspect : **North-West**

Land use : **Scrub/Agriculture/Forest**

Slope : **15-50% strongly-steep**

Nullahs : **Chirchind (Tributaries),**

Villages : **Bhatera, Kuther, Maglun, Langauta, Jagat**

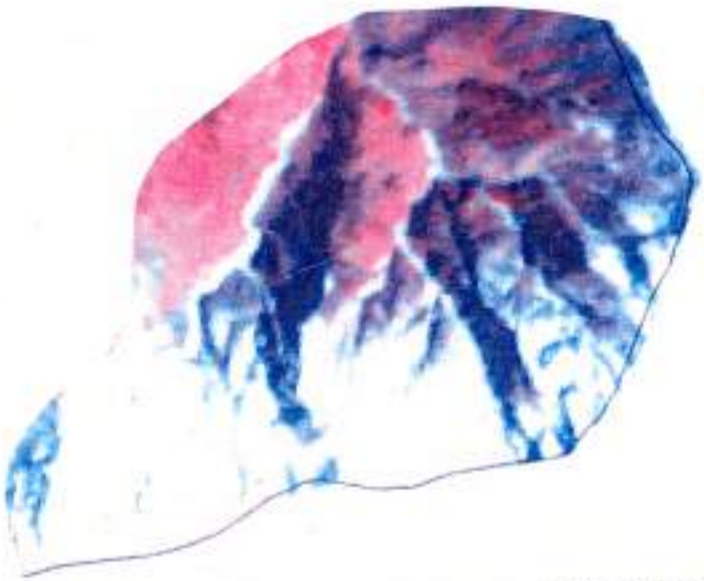
Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	5 Ha	Rs. 44800/-
Contour Bunding	20 Ha.	Rs. 112000/-
Afforestation	20 Ha.	Rs.406240/-
Landslide Control	2 Ha.	Rs.56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 30 Nos. 75 Nos.	 Rs.320250/- Rs.91875/-
Gulley Control Model-II	45 Ha.	Rs.403200/-
Pasture Development	35 Ha.	Rs.392000/-

Yearly Financial Outlay :

1st year	:	Rs. 350000
2nd year	:	Rs. 350000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 426365
		Rs.1826365

MICROWATERSHED (SAMWAR)
CODE N2b



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SAMWAR MICROWATERSHED

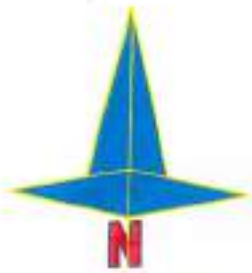
Name of the microwatershed	:	**Samwar**
Code	:	**N2b**
Area	:	**1132 Ha.** **(260 Ha. Degraded)**
Shape of the microwatershed	:	**Leafy**
Aspect	:	**North-West**
Land use	:	**Scrub/Forest/Agriculture**
Slope	:	**35->75% steep-escap**
Nullahs	:	**Samwar (Tributaries),**
Villages	:	**Kareri**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Bench Terracing	5 Ha.	Rs. 44800/-
Contour Bunding	15 Ha.	Rs.84000/-
Afforestation	30 Ha.	Rs.609360/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 18 Nos. 30 Nos.	 Rs.192150/- Rs.36750/-
Gulley Control Model-I (15) Model-III (30)	45 Ha.	Rs. 435210/-
Pasture Development	40 Ha.	Rs. 448000/-

Yearly Financial Outlay :

1st year	:	Rs. 400000
2nd year	:	Rs. 350000
3rd year	:	Rs. 350000
4th year	:	Rs. 400000
5th year	:	Rs. 350270
		Rs.1850270

MICROWATERSHED (GHATOR)
CODE N2c



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LANDSAT TM FCC,MAY'94

GHATOR MICROWATERSHED

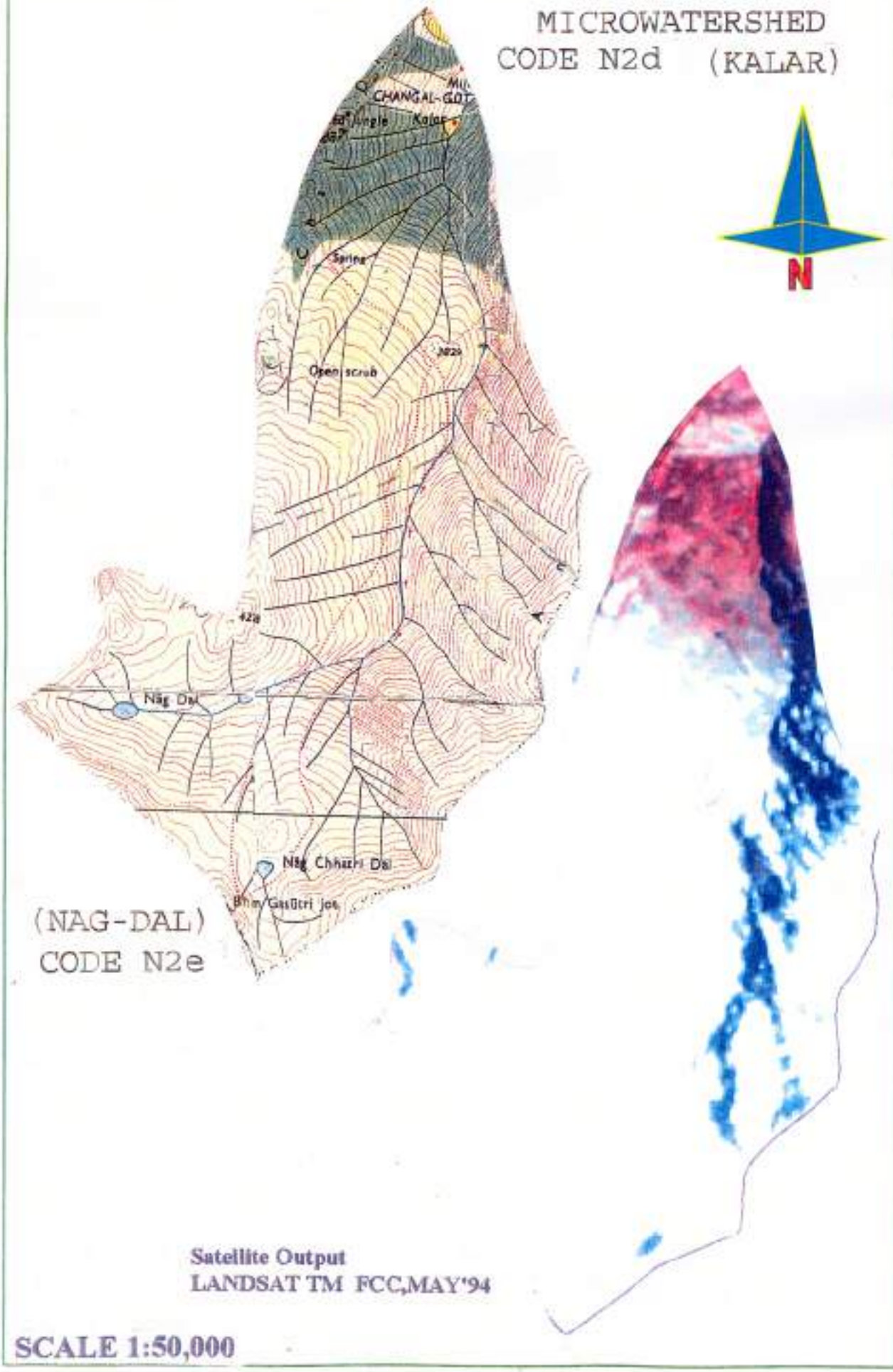
Name of the microwatershed	:	**Ghator**
Code	:	**N2c**
Area	:	**1115 Ha.** **(500 Ha. Degraded)**
Shape of the microwatershed	:	**Linear**
Aspect	:	**Northern**
Land use	:	**Forest (Mix Fir)/Scrub/ Agriculture**
Slope	:	**15-75% strongly-very steep**
Nullahs	:	**Ghator (Tributaries),**
Villages	:	**Khan, Urei, Panjbhog, Chalau**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	5 Ha.	Rs.44800/-
Contour Bunding	10 Ha.	Rs.56000/-
Afforestation	40 Ha.	Rs.812480/-
Landslide Control	2 Ha.	Rs.56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 55 Nos. 75 Nos.	 Rs.587125/- Rs.91875/-
Gulley Control Model-I (15) Model-II (30)	45 Ha.	Rs.370050/-
Pasture Development	50 Ha.	Rs.560000/-

Yearly Financial Outlay :

1st year	:	Rs. 500000
2nd year	:	Rs. 500000
3rd year	:	Rs. 550000
4th year	:	Rs. 550000
5th year	:	Rs. 478330
		Rs.2578330


MICROWATERSHED
CODE N2d (KALAR)
CHANGAL-GOT
Kalar
Spring
Open scrub
N2e
N2d
Nag Dal
Nag Chhazri Dal
Bhim Gasotri jee
(NAG-DAL)
CODE N2e
N
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KALAR AND NAG DAL MICROWATERSHED

Name of the microwatershed : **Kalar and Nag Dal**

Code : **N2d & N2e**

Area : **2240 Ha.**
(160 Ha. Degraded)

Shape of the microwatershed : **Linear (Leafy)**

Aspect : **Northern**

Land use : **Forest/Scrub**

Slope : **35-75% steep-very steep**

Nullahs : **Ghator (Tributaries),**

Villages : **Kalar**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	--	--
Contour Bunding	--	--
Afforestation	25 Ha.	Rs.507800/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 -- --	 -- --
Gulley Control	--	--
Pasture Development	140 Ha.	Rs. 1568000/-

Yearly Financial Outlay :

1st year	:	Rs. 400000
2nd year	:	Rs. 400000
3rd year	:	Rs. 450000
4th year	:	Rs. 450000
5th year	:	Rs. 375800
		Rs.2075800

DUNALI MICROWATERSHED

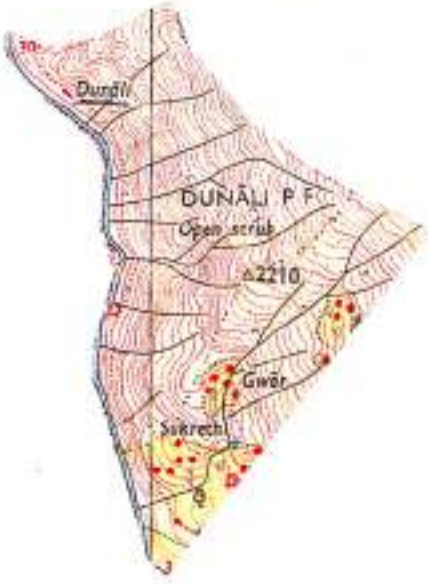
Name of the microwatershed	:	**Dunali**
Code	:	**M2a**
Area	:	**447 Ha.** **(290 Ha. Degraded)**
Shape of the microwatershed	:	**Triangular**
Aspect	:	**West**
Land use	:	**Scrub/Agriculture**
Slope	:	**35->75% steep-escap**
Nullahs	:	**Gwar Nalla (Tributaries),**
Villages	:	**Gwar, Dunali, Sukrethi**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Beach Terracing	5 Ha.	Rs.44800/-
Contour Bunding	9 Ha.	Rs.50400/-
Afforestation	50 Ha.	Rs.1015600/-
Landslide Control	--	--
Stream Bank Control - Wire Crate - Vegetative Spur	 25 Nos. 40 Nos.	 Rs.266875/- Rs.49000/-
Gulley Control Model-I (35) Model-II (35)	70 Ha.	Rs.549850/-
Pasture Development	40 Ha.	Rs.448000/-

Yearly Financial Outlay :

1st year	:	Rs. 500000
2nd year	:	Rs. 400000
3rd year	:	Rs. 400000
4th year	:	Rs. 450000
5th year	:	Rs. 674525
		Rs.2424525

MICROWATERSHED (DUNALI)
CODE M2a



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MICROWATERSHED (LECH)
CODE M2b

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

LECH MICROWATERSHED

Name of the microwatershed : **Lech**

Code : **M2b**

Area : **780 Ha.**
(470 Ha. Degraded)

Shape of the microwatershed : **Triangular**

Aspect : **Southern**

Land use : **Agriculture/Scrub**

Slope : **15-75% strongly-very steep**

Nullahs : **Salli Nalla (Tributaries),**

Villages : **Lech, Sindhwa, Sunkar, Kurog**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	20 Ha.	Rs.179200/-
Contour Bunding	50 Ha.	Rs.280000/-
Afforestation	20 Ha.	Rs.406240/-
Landslide Control	2 Ha.	Rs.56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 30 Nos. 75 Nos.	 Rs.320250/- Rs.91875/-
Gulley Control Model-I (15) Model-II (15)	30 Ha.	Rs.235650/-
Pasture Development	65 Ha.	Rs.728000/-

Yearly Financial Outlay :

1st year	:	Rs. 400000
2nd year	:	Rs. 400000
3rd year	:	Rs. 400000
4th year	:	Rs. 400000
5th year	:	Rs. 697215
		Rs.2297215

MICROWATERSHED (LUNA)
CODE M2c

SCALE 1:50,000

Satellite Output
LANDSAT TM FCC,MAY'94

LUNA MICROWATERSHED

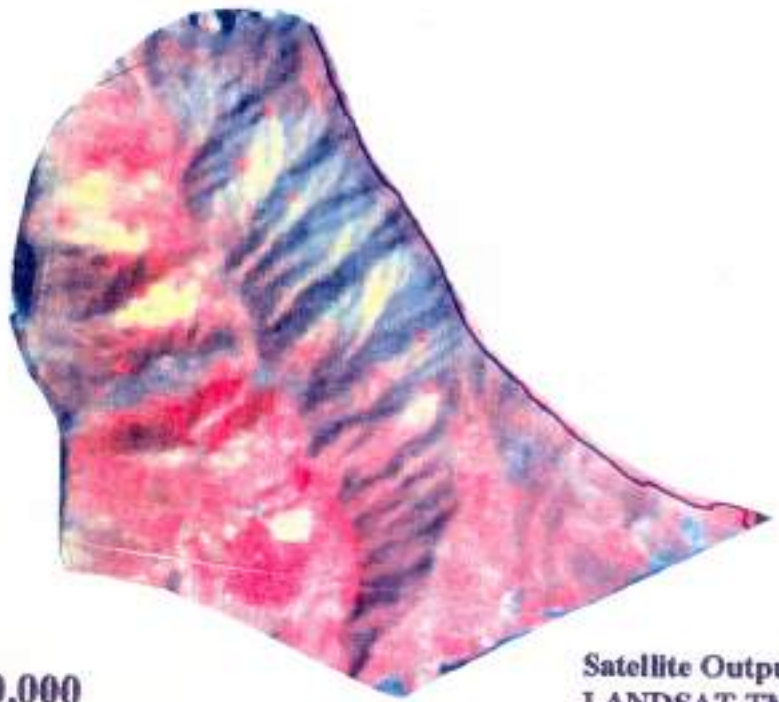
Name of the microwatershed	:	**Luna**
Code	:	**M2c**
Area	:	**705 Ha.** **(282 Ha. Degraded)**
Shape of the microwatershed	:	**Leafy**
Aspect	:	**Southern**
Land use	:	**Scrub/Agriculture**
Slope	:	**15-75% strongly-very steep**
Nullahs	:	**Juthar Nalla (Tributaries),**
Villages	:	**Kulhaur, Phaili, Luna, Bag**
Total Physical Outlay	:	

Components of Work	Quantity	Financial Outlay
Bench Terracing	10 Ha.	Rs.89600/-
Contour Bunding	15 Ha.	Rs.84000/
Afforestation	20 Ha.	Rs.406240/-
Landslide Control	2 Ha.	Rs.56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 30 Nos. 45 Nos.	 Rs.320250/- Rs.55125/-
Gulley Control Model-II	30 Ha.	Rs.268800/-
Pasture Development	50 Ha.	Rs.560000/-

Yearly Financial Outlay :

1st year	:	Rs. 400000
2nd year	:	Rs. 300000
3rd year	:	Rs. 350000
4th year	:	Rs. 350000
5th year	:	Rs. 440015
		Rs.1840015

MICROWATERSHED (KHARONTU) CODE M2d



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KHARONTU MICROWATERSHED

Name of the microwatershed : **Kharontu**

Code : **M2d**

Area : **1165 Ha.**
(380 Ha. Degraded)

Shape of the microwatershed : **Leafy**

Aspect : **North-East**

Land use : **Scrub/Forest/Agriculture**

Slope : **35-75% steep-escap**

Nullahs : **Ravi (Tributaries),**

Villages : **Kharontu, Latan, Chhatran, Adwar, Sin**

Total Physical Outlay :

Components of Work	Quantity	Financial Outlay
Bench Terracing	15 Ha.	Rs.134400/-
Contour Bunding	65 Ha.	Rs.364000/-
Afforestation	70 Ha.	Rs.1421840/-
Landslide Control	2 Ha.	Rs.56000/-
Stream Bank Control - Wire Crate - Vegetative Spur	 50 Nos. 90 Nos.	 Rs.533750/- Rs.110250/-
Gulley Control Model-II (30) Model-III (30)	60 Ha.	Rs.602760/-
Pasture Development	40 Ha.	Rs.448000/-

Yearly Financial Outlay :

1st year	:	Rs. 700000
2nd year	:	Rs. 700000
3rd year	:	Rs. 750000
4th year	:	Rs. 750000
5th year	:	Rs. 771000
		Rs.3671000

2. **Scarcity of fodder and fuel:**

Due to overall degradation of forests, grassland and scrub.

3. **Low agricultural yield:**

Due to faulty agricultural practices and lack of resources

4. **Overgrazing of Alpine Pastures:**

The entire study area has been divided into three distinct ecological units for the purpose of suggesting eco-restoration through Catchment Area Development Refer Plate 10

Zone I Sub tropical Zone (1200-1800 m)

This zone experiences moderately hot summer with temperature ranging between 35-40o winters are cool with temperature 8-20o, widespread monsoon with plenty of rainfall, averaging annually about 250-270 cm which is scanty during winter. Healthy vegetative growth of natural flora in expected in monsoon (i.e. July-Sept.)

Zone-II Humid temperate zone(1800-3200 m)

In this zone summers are comparatively cooler having temperature between 20-25 C wherein winters are cold having temperature between 5-15 C. Rainfall is good in monsoon as also the area in experiencing moderate to heavy snowfall during winter months on mountain

Zone-3 - Alpine Zone (above 3200)

This zone extends upto an elevation of 4800 m summers are cool with heavy snow fall during winter which keeps the mountain peaks snow clad most of the year. The area remain under snow from December to April and vegetative grants predominantly pastures start only after snow melt during summer i.e. May-August.

8. CATCHMENT AREA TREATMENT:

The present Catchment Area Treatment Plan has been prepared keeping the unique characteristics of the study area in view as also the local needs in respect to availability of fuel, fodder and timber.

Afforestation: The study area is hilly region and a large portion of population depends on Forest resources to meet their requirements. Zone specific afforestation programme is envisaged.

Elevation 1800-3200 mtrs

These areas are good locations for plantation of mixed species. The species which the area could sustain are listed as below:

- *Grewia oppositifolia (biul)*
- *Bombax ceiba (Simbal)*
- *Albizia chinensis (ohi)*

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- *Grewia oppositifolia (biul)*
- *Bombax ceiba (Simbal)*
- *Albizia chinensis (ohi)*

- *Prunus sp. (Tahli)*
- *Grevillea robusta (silver oak)*
- *Myrica age (Kaphal)*
- *Bauhinia variegata (kachnar)*
- *Dalbergia sissoo (Shisham)*
- *Ficus (wild fig)*
- *Ulmus wallichiana (Kwish)*
- *Quercus dilatata (moru)*
- *Populus ciliata (Himalayan poplar)*
- *Taxus baccata (Taxus)*
- *Prunus armeniaca (apricot)*
- *Dendrocalamus hamiltonii (bamboo, at moist sites)*

Plantation of deodar can also be attempted at sites of elevation more than 1800 m. However this zone will have to be kept under monoculture as we do not expect growth of associate species in the vicinity of cedrus deodara.

The zone also offers potential for agrihorticulture practices over areas > 1800 m. The fruit bearing trees shall be planted on the bunds of agricultural fields and over marginal lands. The following fruit bearing tree species could be sustained on terraced slopes.

- Peach
- Apricot
- Walnut
- Chestnut
- Plum
- Apple
- Cherry
- Olive
- Grapes

Silipasture: The zone also has patches where degraded community land is present. This area is envisaged to be developed by planting multipurpose trees, grasses and legumes. The recommended species upto 1800 m are as follows

A Grasses

Setaria anceps (Golden timothy)

This species is tolerant to cold and remains that green throughtout the year. The grasses can be harvested 3-4 times. With a yield potential of 900-1200 quintal/ha.

Panicum maximum (Green panic)

This species can also be harvested 2-3 times during one season with yield potential of 400-500 quintal/ha.

Avena Sativa (Oat)

and *Sorghum* (Jowar)

These species are drought and cold tolerant.

Chloris gayana (Rhodes grass)

This species is a known soil binder.

Cynodon dactylon (Doob)

This species remains green from April to November with creeping habit, deep roots and drought tolerant. The species also has medicinal value for use in chronic diarrohea.

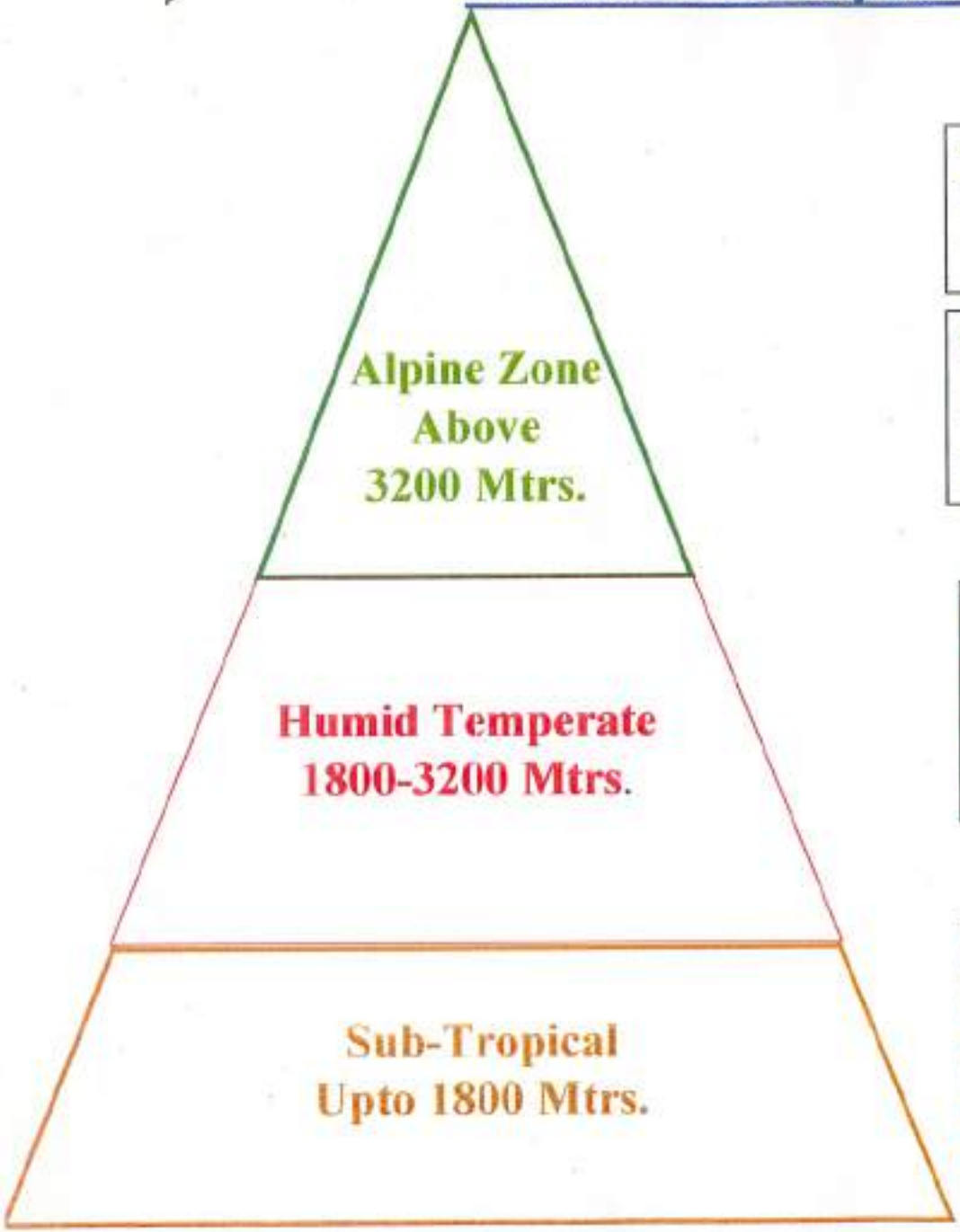
Vetiveria zizanioides (Vetiver grass)

This species is Runner having roots of aromatic value, a known soil binder.

B. Lagume

- *Trifolium spp.*
- *Medicago sativa*
- *Field bean*
- *Phaseybean*

Suitable Plant species (altitude wise)



Grasses
- *Phleum pratense (Timothy grass)*
- *Phalaris sp. (Red canary grass)*
- *Lolium perenne (Rye grass)*

Legumes
- *Trifolium pratense (red clover)*
- *Trifolium repens (white clover)*
- *Medicago sativa (lucerne)*
- *Melilotus sp.*

Shrubs
- *Desmodium sp.*
- *Robinia pseudoacacia*
- *Plectranthus sp.*
- *Prinsepia utilis*
- *Indigofera sp.*

Medicinal and Aromatic
- *Dioscorea deltoidea*
- *Plerorrhiza Kurra*
- *Podophyllum hexandrum*
- *Lavandula officinalis*
- *Valeriana wallichi*

Mixed Plants
Grewia oppositifolia (Biul)
Dendrocalamus hamiltonii (Bamboo)
Bombax Ceiba (Simbal)
Albizia Chinencis (ohi)
Prunus Sp. (Tahli)
Dalbergia Sissoo (Shisham)
Populus Ciliata (Himalayan Poplar)

Fruit Bearing
Peach
Apricot
Walnut
Chestnut
Plum
Apple
Cherry
Olive
Grapes

Grasses
(Setaria anceps)
Green panic
(Panicum maximum)
Oat & Baira
(Avena Sativa Sorghum)
Rhodes grass
(Chloris gayana)
Doob
(Cynodon dactylon)

Legume
Trifolium Sp.
Medicago Sative
Field bean
Velvet bean

Shrubs
Leucaena leucocephala
Salvadora Sp.
Calliandra Sp.

Medicinal/Aromatic
Abies Webbiana
Atropa accuminata
Datura Stramonium

- *Valvet bean*

All these species are very good Nitrogen fixer.

C. Shrubs:

Leucaena lencocephala

This species is for multipurpose use, nitrogen fixer. Adaptive to zerophytic and merophytic conditions.

Salvadora spp. (Fodder & fuel)

Calliandra spp (Fodder and nitrogen fixer)

D. Medicinal and Aromatic Plants

The following species are suggested

- *Abies webbiana*
- *Atropa accuminata*
- *Datura stramonium*

8.1 Codification Of Microwatersheds:

According to watershed Atlas of India, 1990 of All India Soil and Landuse Survey organisation, the free draining Catchment of the project falls in one distinct watershed viz. 1C1C3. The study area is a part of Water Resource Region No.1 and corresponds to Ravi River Basin (designated by second character in Codification : C corresponds to Ravi).

Further categorisation of watershed has been done as suggested in Integrated Mission on Sustainable Development Technical guidelines, 1995. The lower units of division has been done into sub-watershed, mini watershed and microwatershed levels. Refer Map. 8

Watershed sub-classification according to IMSD Technical Guidelines

Watershed	Sub-watershed	Mini watershed	Microwatershed	Stream Name
1C1C3	J	J2	J2a J2b J2c J2d J2e J2f J2g	Baleni Nallah
	K	K1	K1a K1b K1c K1d K1e	Main Ravi Tributary
		K2	K2a K2b K2c	Main Ravi Tributary
	L	L1	L1a L1b L1c L1d L1e L1f	Balij Ka Nallah
	L	L2	L2a L2b L2c	Reshal-Bhadra Nallah

			L2d L2e L2f	
	M	M1	M1a M1b M1c	Main Ravi Tributary
	M	M2	M2a M2b M2c M2d	Main Ravi Tributary
	N	N1	N1a N1b N1c N1d N1e	Chichind Nallah
	N	N2	N2a N2b N2c N2d N2e	Chichind Nallah

MICROWATERSHED AND EROSION CLASSES (AREA-WISE)

S.No.	Code	Microwatershed	Total Area of Microwatershed	"Moderate to Severe" and "Severe" Erosion class area sq.km
1.	J2a	Bagga-Kundi	11.40	2.6
2.	J2b	Bhatwara	7.00	1.7
3.	J2c	Nani	12.62	2.8
4.	J2d	Darkund	11.85	2.0
5.	J2e	Snow	15.30	1.6
6.	J2f	Baleni Jot	9.67	0.4
7.	J2g	Lam-Dal	8.75	0.50
8.	K1a	Dhaneli	7.75	1.61
9.	K1b	Dhalauta	7.87	2.80
10.	K1c	Tipriara	11.82	3.3
11.	K1d	Andhera		
12.	K1e	Dhandela	12.75	2.8
13.	K2a	Saloi		
14.	K2b	Braguna	8.07	2.8
15.	K2c	Degair Nal	10.50	1.8
16.	L1a	Gandhar	4.05	2.0
17.	L1b	Malla	2.25	1.23
18.	L1c	Garandi	12.25	2.7
19.	L1d	Al-Ka-Nal	16.25	3.0
20.	L1e	Khandil	10.62	2.92
21.	L1f	Pardeona	7.25	1.80
22.	L2a	Bhadra Lower	24.60	4.0
23.	L2b	Bhadra		
24.	L2c	Naina Dhar	11.50	1.2
25.	L2d	Reshal	17.75	2.80
26.	L2e	Jotu Ka Nal	10.00	4.1
27.	L2f	Kalans	4.00	1.0
28.	M1a	Kann	4.57	1.00
29.	M1b	Par	14.55	5.1
30.	M1c	Chatrari	11.12	2.7
31.	M2a	Dunali	4.47	2.9
32.	M2b	Lech	7.80	4.7

33.	M2c	Lune	7.05	2.82
34.	M2d	Kharantu	11.65	3.80
35.	N1a	Durgethi	10.00	3.1
36.	N1b	Dundheli	4.62	1.6
37.	N1c	Jantra	8.15	2.7
38.	N1d	Kanjrala Got	10.27	1.5
39.	N1e	Maidi Got	13.32	1.25
40.	N2a	Budhera	8.90	3.1
41.	N2b	Samwar	11.32	2.6
42.	N2c	Ghator	11.15	5.0
43.	N2d	Kalar	22.40	1.60
44.	N2e	Nag Dal		
		Total	417.21	98.93

8.2 Soil Conservation Measures:

Engineerig Measures

Contour bunding on farm lands:

In the project area, the rainfall is quite heavy and causes considerable soil losses in run off. Therefore the agricultural lands under 6% slope shall be brought under contour bunds so that the surplus run off can flow gently off the arable land at non-erosive velocity. This would mean raising of earthen bunds along the contour at appropriate intervals. It is proposes to treat 500 ha of land under the programme.

Bench terracing:

The area under moderate to steep slopes will be bench

terraced. Bench terracing is used for raising agriculture crops. While making bench terraces, care will be taken not to disturb the top soil, by spreading earth from the lower terraces to higher terraces. Vertical intervals of the terraces will not be more than 1.5 m & cutting depth will be 50 cms. 4 to 5 m should be the average width of the terrace in order to enable usage of bullock carts for ploughing. Shoulder bunds of 30 x 15 cms 1:1 side slope will be provided. The excess water from the terraces will be drained off by staggered channels. An area of 250 ha. will be covered during the plan period in project area.

Gulley Control:

Gulleys are mainly formed on account of physiography, soil type, and heavy biotic interferences in an area. Scouring of streams at their peak flows and sediment laden run off causes gulleys. The gulleys in the croplands would be treated with engineering and vegetative methods. Check dams would be constructed in the area to promote growth of vegetation & consequent stabilization of the area. The check dams will be made of different materials depending upon the site conditions and the material easily available.

The following types are recommended:

Model-I : DRSM check dams with stone available at site.

Model-II : Combination of DRSM and crate works (Moderate to deep gullies) with Stones available at site.

Model-III : Combination of DRSM checkdams, DRSM check walls & crate work in areas with eroding hill slopes.

Landslide control:

Rainfall pattern in the area, water seepage coupled with geological formations result in landslides. The landslide control works would include provisions for subsurface drainage, afforestation, and engineering works. The works would include:

a) Check walls/retaining walls

b) Gabions

c) Fascine works

d) Stepping or terraces

e) Vegetative methods

Under these operations an area of 95 ha would be treated.

Trenching & other measures:

In very badly eroded areas, minor engineering works would be carried out before planting. Continuous trenching would be done to trap the silt and run off. This would be done to build up a fertile base for plantation to establish. Gulley plugging works & check damming in the uplands will also help stabilize the slopes. Similarly, the check walls of stones & crate work will be done to keep eroding materials from sliding downhill.

Physical and Financial targets:

The physical and financial targets of the engineering measures are detailed in the appendices.

The abstract of costs is as under:

i)	Bench Terracing	250 ha	22.40 lac
ii)	Contour Bunding	499 ha	27.94 lac
iii)	Stream Bank Protection		
	- Wire Crates	1000 Nos.	106.75 lac
	- Veg. Spur	1658 Nos.	20.31 lac
iv)	Land Slide Control	95 ha.	26.60 lac
v)	Gulley Control	1265 ha.	108.84 lac
		Total:	312.84 lac

Biological Measures:

a) Afforestation

Areas have been specified for afforestation in each microwatershed. These areas will be fenced with RCC posts & wooden fence posts.

Choice of species:

Species that will act as soil binders and water conservers would be planted. These would include Robinia, Aesculus, Prunus, Ulmus, Celtis, Alnus and other species. However by far the most important species will be Robinia considering the degraded condition of the area.

Planting and after care:

Four most important conditions can be identified for achieving successful plantations. These are:

a) Right type of species

b) Right type of soil working technique.

c) Right type of time of planting

d) Tending and after care

The species selection has already been referred earlier. Indigenous species will be preferred over the exotic.

Soil working technique is another consideration which has been found largely determining the success or failure of plantations. The underlying principle for soil working is that the project area should achieve `in-situ' moisture conservation.

Two planting seasons are winter and early spring. The planting work need to be planned in a systematic manner so as to confine planting at an optimum level.

No planting programme will be successful unless it accounts for its tending and after care. Most of the plantations which are initially successful die away because these are not looked after. This is particularly true in the areas, where pits and trenches have to be attended to make them functional for moisture conservation because in such cases the silt and gravel carried into these pits and trenches by the rains make them useless for moisture concervation. Addition of Farm Yard Manure would be used to give an initial boost to young plants. Similarly effective protection against biotic interference wil be done.

Inspection paths

The inspection paths are necessary for inspections and tending works and need be provided.

Nurseries

For raising the planting materials, the nursery network in the project area will be created. For the establishment of nurseries, care will be taken that these are accessible. Nursery at Karian and Bagga will also be utilised for the purpose.

Physical & Financial Targets

The physical and financial targets under the forestry sector have been detailed in the appendices to the report.

The abstract of costs is as under:

i)	Afforestation	1555 ha	315.85 lac
ii)	Maintenance of plantation	1555 ha	109.72 lac

			Total: 425.57 lac
			---

b) Pasture and fodder development

Present Status

Considering the area available for grazing, the cattle population of the area is very high. The domestic, poor bred, diseased and malfed animals are kept in large numbers and the numbers are ever increasing. Additionally, some of the 'Bahaks' in uplands are visited by and large herds of nomadic animals.

Closure and Paddock cultivation/Demarcation

Degraded pasture areas in both agro-climatic zones would be closed in a system of deferred and rotational grazing, for which the areas would be divided into convenient paddocks. This would help the natural vegetation to recover and simultaneously regulate the grazing.

Seed Production

For speedy improvement of degraded grazing from areas, introduction of quality legumes has to be made, but the availability of legume seeds is negligible. The slot of emphasis would be laid on production of legumes, seeds of red and white clover. This would mean establishment of seed production farms

Weed eradication

Infestation of unpalatable herbs and poisonous grasses is always on the increase in overgrazing areas that spoils the grazing potential of an area. Mechanical, Chemical and biological measures would be taken to eradicate weeds.

Forage conservation

Latest techniques of hay and pillage production would be adopted. Hay stands and silage pits would be constructed adjacent to grazing areas at a number of places for demonstrations.

Silvi-pasture

During the slack periods, when the forage is not available, it is proposed to raise fodder trees and bushes in combination with suitable legumes and grasses, which would be lopped for fodder during the scarcity periods. Raising of red clover, white clover and orchards grass in apple orchards can be tried with advantage in the project area.

Peoples participation

For selection of the species and sharing of the produce, the peoples participation will be ensured. The concessionists of the project area will obviously have no restriction on collecting the dead wood, branches and fallen material from the area and in return will help in the protection of the area. The villagers would also be encouraged to raise plants and other vegetation on the boundaries of their crop lands.

In case of village woodlots, at the time of first major harvest after establishment, direct costs will be recovered or accounted for from the sale of produce while the rest would be given to the Panchayat which would utilise the same for the development of the village or finance the establishment of more village woodlots. The villagers would be allowed to collect fallen wood and tree choppings from the village woodlots and strip plantations.

Physical and financial targets

The physical and financial targets under the pasture and fodder development sector is given in the appendices. The abstract is as under:

i) Pasture and fodder development: @ Rs.11,200/ha.for 1400 ha.

(Total Cost = **Rs.156.80 lacs)**

9. ADMINISTRATIVE SET-UP

The total estimated cost of the project under administration is Rs. 176.64 lakhs. **The project involves intensive and highly technical operations, which require posting of exclusive and expert technical personnel on the job. It has therefore, been decided to create a small compact and competent project staff, who shall be directly responsible for the execution of the project under technical guidance of H.P. Forest department.**

9.1 Staff Requirement

For the implementation of the scheme the following staff would be required.

Sl. No.	Post	Salary	No. of post	Total (annual)
1.	Forest officer	15000	1	180000
2.	Junior Engineer	12000	1	144000
3.	Range Officer	12000	2	288000
4.	Deputy Ranger	8000	2	192000

5.	Forest Guards	6000	8	576000
6.	Sr.Assistant	8000	1	96000
7.	Jr. Assistant	6000	2	144000
8.	Driver	5000	2	120000
9.	Peon/Khalasi	4000	4	192000
				1932000

Machinery and equipment

One office building and one inspection hut would be constructed, planting tools and other equipment would also be purchased. Similarly one Gypsy, one truck and one computer would also be purchased.

S.No.	Item	No.	Amount
1.	Gypsy	One	350000
2.	Truck	One	850000
3.	Computer	One	100000
4.	Tools	L.S.	50000
5.	Misc.	L.S.	50000
			1400000

10. OTHER OPERATIONS

Public awareness and publicity

In order to ensure proper participation of the people it is proposed to set up a committee on the project level and subwatershed levels. The

Committees would include local people, the representatives from the Chamera-II Project authorities and other sister Departments working in the area. The committees will discuss implementation of works, problems of the management & peoples demands. It will also ensure peoples cooperation and participation. Publicity material including both print a visual media (video film etc.) would be made to highlight the effect. A provision of Rs.10.0 lacs has been kept for the purpose.

Celebrations on World Environment Day and other National Festivals.

A provision of Rs. 5 lacs has been kept for the purpose wherein Chamera CAT Project & NHPC would jointly celebrate World Environment Day on 5th June, every year. Voluntary Plantation, essay competitions, lectures, would be organised jointly to mark the occasion.

11. TOTAL COST AND PHASING :

The total cost of the CAT plan is Rs.10.72 crores. Sectorwise yearly physical and financial breakup is given in Annexure(1, 2, 3).

12. SCHEDULE AND MODE OF PAYMENTS FOR CAT WORKS AND MONITORING ASPECTS

NHPC will be responsible for maintaining the scheduled release of funds for the CAT works subject to following conditions which are in practice in other similar projects.

Annex - I

YEARWISE PHYSICAL AND FINANCIAL TARGET

SOIL CONSERVATION SECTOR

Sl.No.	Item of Work	Unit	Unit Cost in Rupees	TARGET											
				1st Year		2nd Year		3rd Year		4th Year		5th Year		Total	
				Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial
I.	Contour Bunding	Ha.	5600	100	560000	100	560000	100	560000	100	560000	99	554400	499	2794400
II.	Benching Terracing	Ha.	8960	50	448000	50	448000	50	448000	50	448000	50	448000	250	2240000
III.	Gulley Control														
	Model I	Ha.	6750	86	580500	86	580500	86	580500	86	580500	86	580500	430	2902500
	Model II	Ha.	8960	121	1084160	121	1084160	121	1084160	121	1084160	121	1084160	605	5420800
	Model III	Ha.	11132	46	512072	46	512072	46	512072	46	512072	46	512072	230	2560360
IV.	Land Slide Control	Ha.	28000	19	532000	19	532000	19	532000	19	532000	19	532000	95	2660000
V.	Stream Bank Protection														
	a) Wire Crates	No.	10675	200	2135000	200	2135000	200	2135000	200	2135000	200	2135000	1000	10675000
	b) Vegetative Spur	No.	1225	331	405475	331	405475	331	405475	331	405475	334	409150	1658	2031050
					6257207		6257207		6257207		6257207		6255282		31284110

Annex - 2

FORESTRY SECTOR

Sl.No.	Item of Work	Unit	Unit Cost in Rupees	TARGET											
				1st Year		2nd Year		3rd Year		4th Year		5th Year		Total	
				Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial
1	Afforestation including raising of nurseries, planting, fencing and construction of inspection paths	Ha.	20312	311	6317032	311	6317032	311	6317032	311	6317032	311	6317032	1555	31585160
2	Pasture Development	Ha.	11200	280	3136000	280	3136000	280	3136000	280	3136000	280	3136000	1400	15680000
					9453032		9453032		9453032		9453032		9453032		47265160

3 Maitenance of Plantation

Year	Unit	Area	Rate Per Ha.	Amount in Rupees
1st Year	Ha.	1555	2240	3483200
2nd Year	Ha.	1555	1792	2786560
3rd Year	Ha.	1555	1344	2089920
4th Year	Ha.	1555	1008	1567440
5th Year	Ha.	1555	672	1044960
				10972080

Annex - 3

ADMINISTRATION

Sl.No.	Item of Work	Unit	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
1	Staff	-	1952000	2125000	2338000	2571000	2828000	11814000
2	Office Expenses	-	50000	50000	50000	50000	50000	250000
3	Buildings	-	800000	400000	-	-	-	1200000
4	Vehicles	-	1200000	-	-	-	-	1200000
5	Equipment	-	120000	30000	25000	15000	10000	200000
6	Publicity & Awareness	-	200000	200000	200000	200000	200000	1000000
7	Contingencies	-	200000	200000	200000	200000	200000	1000000
8	Unforeseen Expenditure	-	100000	100000	100000	100000	100000	500000
9	Celebration of World Environment Day and other National Festivals	-	100000	100000	100000	100000	100000	500000
			4722000	3205000	3013000	3236000	3488000	17664000

ABSTRACT OF COST (Total CAT Plan)

Soil Conservation	31284110
Forestry (Including Pasture)	47265160
Maintenance of Plantation	10972080
Administration	17664000
Total	107185350

Say Rs. 10.72 Crores

Once the yearly requirement of funds is established in the proposed CAT plan, the instalments will be thrice in a year to be released by NHPC by bank draft after deducting bank charges.

The CAT Plan implementation will be subject to monitoring of the joint inspection committee who will see to it that the treatment work progress is satisfactory.

The joint inspection committee will include

1) Project Officer, Chamera CAT Project (Forest Department)
2) AM/DM (Environment) from NHPC

In addition to the above, yearly progress and expenditure details will be submitted by Forest Department to NHPC.

As per the provisions of MOEF guidelines the monitoring committee constituted for overall monitoring of the Environmental works for Chamera-II project will also monitor the CAT Plan.

All efforts will be made by NHPC and Chamera II CAT project (Forest Department) to publicise the work done by public awareness through visual and print media so that maximum benefit can be accrued to direct or indirect beneficiaries of this ambitious ecological restoration project.

As there are many right holders in the area a situation may arise where they do not give consent to put enclosures and the identified location of mitigative measures is changed. In these eventualities the new location will be discussed and only after mutually agreed upon by NHPC, Forest Department, and MOEF the changed location will be utilised for afforestation or for any other suggested measures.

BARREN DEGRADED AREAS NEEDING PLANTATION

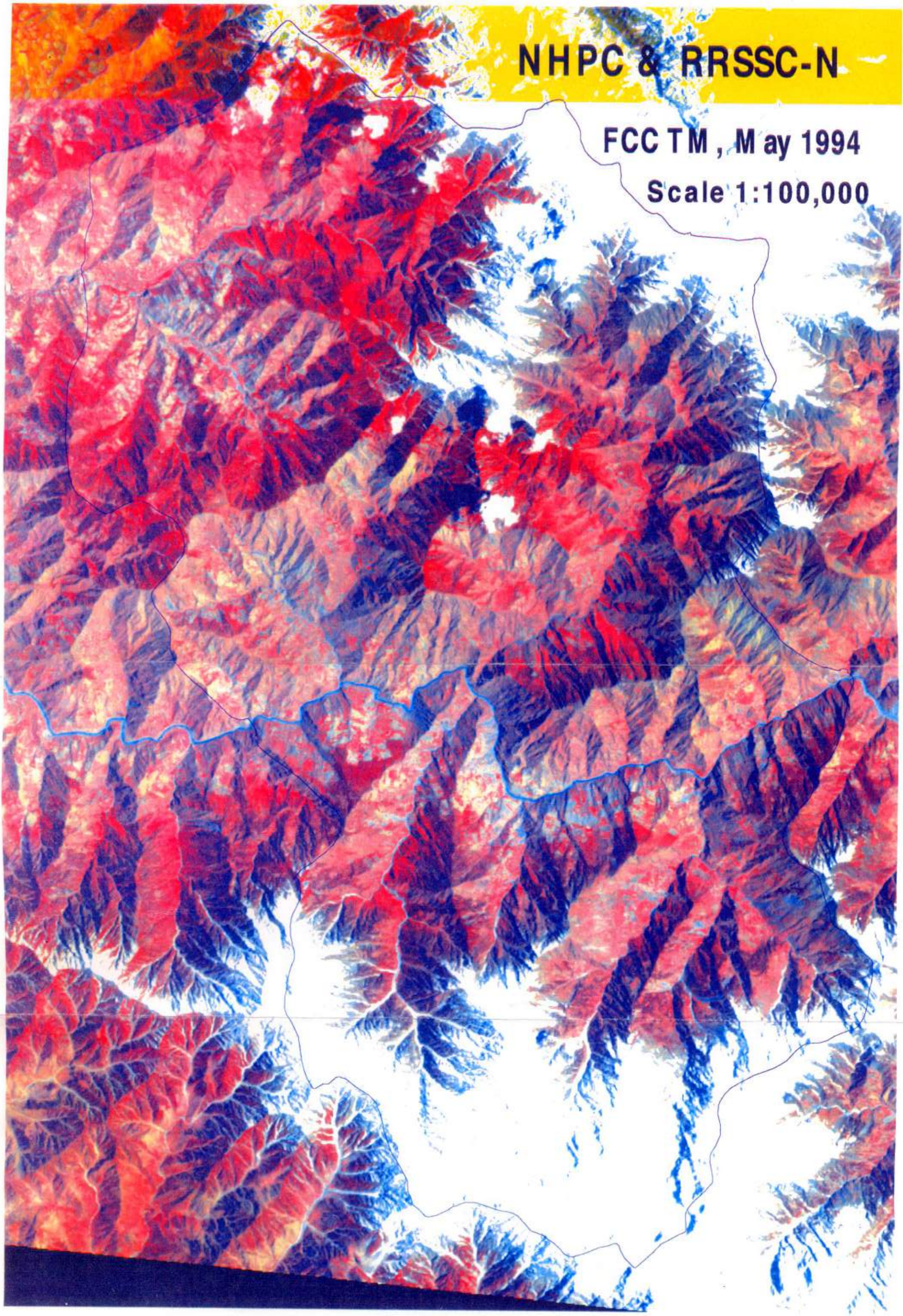
HIGHLY DEGRADED FORESTS

THE STEEPLY CUT RIVER BANKS SHOWING MULTIPLE RILL EROSION

SEVERELY ERODED AREA OF CATCHMENT

LAND SLIDE PROBLEM ALONG THE BAGGA-BHARMOUR ROAD IN THE CATCHMENT AREA

QUARRYING PROBLEM


NHPC & RRSSC-N
FCC TM , May 1994
Scale 1:100,000

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Unit cost of check dams and check walls (per ha)

Model-I

Conditions: DRSM Checm dams in gullies shallow to moderate. Stones available at site.

Details worked for a unit area of 5 ha

No. of check dams to be erected		8 Nos.
Average dimension		24 cum (8x1.5x2) = 24m x156.25 (Rate HPSR) = 3750.00
Constt. of check dams with locally available stones to be collected and extracted	=	Rs 30,000 (for 8 Nos)
Therefore cost per ha	=	Rs 30000 --- 5
	=	**Rs 6750/- per ha.**

Unit cost of check daming/gully plugging works (per Ha)

Model-II

Conditions: Main gully-crate and DRSM
Side gullies-check dams (DRSM)
Stones available at site (Extracted and collected to be locally)

Details worked for a unit area of 20 ha

i)	No. of crates to be erected	=	9
	Average dimension	=	24 cum (8x1.5x2m)
	Total stones required	=	216 cum (24x9)
	Cost of crate wire for 9 qtls at Rs 2300/-qut	=	Rs 20,700/-
	Carriage, weaving etc.	=	Rs 03,000/-
	Cost of crate with local stones available incl. T.work	=	Rs 29,250/-
	Total cost	=	Rs 52,950/
ii)	Total No. of check dams Inside gullies	=	40 Nos.
	Average dimension	=	12 cum(5x1.5x1.5m)
	Total stones required	=	480 cum (40x12)
	Constt. of check dams with local stones available incl. T work	=	Rs 75,000/- (at Rs 156.25/cum)

iii) No. of check dams in main nalla = 9 Nos.

Average dimension = 24 cum(8x1.5x2)

Total stones required = 216 cum (24x9)

Constt. of check dams with local stones available incl. T.work = Rs 33,750/- (at Rs 156.25/cum)

Therefore total cost = (i+ii+iii)=Rs 1,61,700

Cost per ha = $\frac{\text{Rs } 1,61,700}{20}$ = Rs 8085/-

Say Rs 8000+12.5% = Rs.8960/-

Unit cost of check dams, check wall and Crate works (Per ha)

Model-III

Conditions : Combination of DRSK check walls, DRSM check dams and crate work in areas with eroding hill slopes.

Details worked for a unit area of 20 ha.

i)	No. of check walls to be erected	=	50 Nos (10x0.80x0.50)
	Average dimension	=	4 cum (10x8x5m)
	Total stones required	=	200 cum (4x50)
	Consit. of check walls with locally available stones to be extracted and collected.	=	Rs 35,156/-
	No. of check dams to be erected	=	30 Nos.
	Consit. of check walls with locally available stones to be extracted and collected.	=	Rs 1,26,562/-
iii)	No. of crates to be erected		9
	Average dimension	=	24 cum(8x1.5x2)
	Total stones required	=	216 cum (24x9)

Cost of crate wire for 9 qtls at Rs 2300/-qutl	=	Rs 20,700/-
Carriage, weaving etc	=	Rs 2250/-
Cost of crate with local stones available incl. T work	=	Rs 37,969/-
Total cost	=	Rs 60,919/-
Therefore total cost (i+ii+iii)	=	Rs 2,22,637
Cost per ha	=	Rs 2,22,637 / 20 = Rs 11,132

Say Rs 11,132/-

Stream Bank Protection

Wire Crates (2 m x 2 m x 15 m)

	Unit	Unit cost	Quantity	Amount
Crate wire	Cum	75	60	Rs 4500.00
Labour site preparation	Mandays/ cum	51.45	60	Rs 3087.00
Rock collection, Fill & Tie	-do-	51.45	60	Rs 3087.00
				Rs.10674.00

Cost per structure Rs 10,675.00/-

Vegetative Spur

i) Supply of brushweed material with 40 bundles in two layers @ Rs 10/- per bundle	per bundle	15	40	Rs 600.00
2. Cost of wooden poles 6x6 and 6 diam	Nos	25	16	Rs 400.00
3. Labour charges for laying for brushwood in spur and fixing of spur	Mazdoors	56.25	04	Rs 225.00
				Rs1225.00

Total Rs 1225/- per structure.

Break up of cost per hactare of plantation (1500 plants per ha)

Wage Component

S.No.	Item of work	Cost
1.	Bush cutting @ 409.00 per ha	409.00
2.	Construction of inspection path 60 cm wide approx.200 m	522.00
3.	Digging of pits (45 cm x 45 cmx45cm)	4912.00
4.	Refilling of pits 45x45x45 cm @ 93.60/100 Nos pits	1404.00
5.	Planting of plants @ 68.60/100 Nos	1029.00
6.	Weeding and heoing once @ 28.06/- 100 Nos	421.00
7.	Carriage of plants from nursery to site over an average of 4.00 km @ 86.90/- and 12.15) 50% each average 49.55 per 100 plants per km	2973.00
8.	Cost of raising seedings in nursery @ 225/- per 100	3375.00
9.	Cutting and preparation of fence pots 80 Nos @ 444.48 per 100	355.59
10.	Coal tarring of the fence posts @ Rs 95.90/100 Nos.	76.72
11.	Carriage of fence post over a distance of 2 km @ 233.94/100 per km	374.30
12.	Digging of 45 cm deep holes per fixing of fence posts 80 Nos @ Rs 311.17/100 Nos.	248.94
13.	Fixing of fence posts @ 238.89/ 100 Nos.	191.11
14.	Stretching and fixing of B. wire in 4 strands total 960 rent @ Rs 1.45/per m	1566.00
	Total cost of wage component	17857.66

Cost of material

1.	Cost of B. wire approx 80 kg.	2200.00
2.	Carriage of B wire upto site over an average distance of 1 km @ 5/qtl/km	204.00
3.	Cost of U-nails	50.00
4.	Total cost of material	2454.00
	Total cost of plantation	
	Total cost of plantation per ha (1500 plants per ha)	
	Total of wage component	17,858.00
	Total of material	2,454.00
	Total:	20,312.00