एनटीपीसी
NTPC

NATIONAL THERMAL POWER CORPORATION LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

CATCHMENT AREA TREATMENT PLAN

FOR

KOLDAM HYDROELECTRIC PROJECT

HIMACHAL PRADESH

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CONTENTS

CHAPTER-1

CHAPTER-1

INTRODUCTION

1.1 Introduction

Proper utilization of natural resources is central to the steady progress of a country like India. Problems of scarcity of resources and associated degradation of the environment are common all through the country. It is the severity of such problems and the consequences, which vary from one region to the other depending upon the physical, biological and socio-economic attributes. In view of this variability, resource analysis at local, regional and national level becomes equally important. Himalayan region deserves special attention because of extreme physical constraints for production oriented land uses, poor communication, strong dependence of hill people on the natural resources and significant influence of the Himalayas on the adjacent Indo-Gangetic plains.

Relevant information on quality and quantity of natural resources thus becomes basic to development planning. Amongst a variety of natural resources, soil losses are the first and the foremost problem in the Himalayas, which causes siltation problems in the plains and cause reservoir sedimentation. The loss of productive substrata is both due to direct human development actions and indirect ecosystem changes. The direct human development action pertains to cultivation and development activities like road construction. The indirect human induced ecosystem changes like change in land use, excessive use of natural resources cause over the limits prescribed are causing erosive forces to erode most of the productive soil from the already depleted system.

1.2 Soil Erosion – Definition, Factors and Types

Erosion may be defined as the detachment and transportation of soil. Mainly water is responsible for this erosion. In many locations, winds, glaciers, etc. are also the agents causing soil erosion. In the catchment area of a hilly terrain being considered for this project, water erosion is the mostly prevalent and has been estimated. It is estimated that 53.3% of the total geographical area of the country is subject to various land degradation and erosion problems like saline alkali soil, waterlogged areas, marshy and gullied lands, area under shifting cultivation, desertification, etc.

Various types of water erosion are as described below:

1.2.1 Splash Erosion

When vegetative cover is stripped away, the soil surface is directly exposed to raindrop impact. If the soil is on a slope, gravity will cause the splashed particles to move downhill. When raindrops strike bare soil, the soil aggregates are broken up. Fine particles and organic matter are separated from heavier soil particles. This pounding action destroys the soil structure. Splash erosion is closely related to raindrop size, the impact increasing with the size of raindrops.

1.2.2 Sheet Erosion

Sheet erosion is caused by shallow sheets of water flowing over the soil surface. These very shallow moving sheets of water are seldom the detaching agents, but the flow transports soil particles that have been detached by raindrop impact.

1.2.3 Rill Erosion

Rill erosion begins when shallow surface flow starts to concentrate in low spots in the soil surface. The energy of this concentrated flow is able to detach and transport soil

particles. This action beings to cut tiny channels into rills. Rills are small but well-defined channels that are mostly a few inches deep.

1.2.4 Gully erosion

Gully formation is an advanced stage of rill erosion. It occurs on a bigger scale than rill erosion. The cross-sections of gullies frequently assume a V or a U shape. It usually occurs, either where runoff from a slope increases sufficiently in volume or velocity to cut deep incisions or where runoff from a slope increases sufficiently in volume or velocity to cut deep incisions.

1.2.5 Channel Erosion

Channel erosion occurs when bank vegetation is disturbed or when the volume or velocity of flow in a stream is increased. Common points where erosion occurs are at stream bends and at constrictions. Repair of eroded stream banks is difficult and costly.

1.3 Damages of Soil Erosion

The damages of soil erosion can be partitioned into costs on the site where soil erosion is taking place and off the site where sediment deposition takes place. Following are the major damages of soil erosion:

i) Loss in production potential

ii) Reduction in infiltration rates

iii) Reduction in water-holding capacity

iv) Loss of nutrients

v) Increase in tillage operation costs

vi) Reduced transport and storage capacity

vii) Reduction in water supply

viii) Depletion of wildlife, etc.

1.4 Catchment Area Treatment (CAT)

Assured water supply and electric power are the prime necessities for increasing farm production to meet the ever growing demand for food, fodder, fiber and many other commodities. As a result multipurpose river valley projects are still being emphasised in the development planning of the country. Such development projects, specifically those targeting magnificent production levels are accompanied by various problems of environmental degradation and may often negate the benefits accruing from the commissioning of such projects. The common environmental problems encountered during execution and operational phases of major hydroelectric projects include land degradation in the catchment area. Also, reduction in life and efficiency of impounded reservoirs and threat to life and property in downstream areas are the serious manifestations of the increased silt load.

Excessive erosion and sedimentation thus cause both environmental and economic impacts. Economic impacts may be more prominent and easier to assess, whereas environmental impacts build slowly for years, and may be irreversible.

Eroded soil contains nitrogen, phosphorus and other nutrients, which when carried into water bodies, promote algae growths that reduce water clarity, deplete oxygen, lead to fish kills, and create odours. Erosion removes the smaller and less dense constituents of topsoil, which are required for plant growth. The remaining sub-soil is often hard, rocky, infertile, and droughty. Thus, re-establishment of vegetation is difficult and the eroded soil produces less growth.

Preparation of Catchment Area Treatment (CAT) plan pertains to preparation of a management plan for the treatment of erosion prone areas in the catchment area of the proposed project. It has been observed from past experience that the life span of a reservoir is greatly reduced due to erosion in its catchment area. The costs of dredging and disposing of the sediment increases, whereas the storage capacity of the reservoir decreases. This effect is more prevalent in the Himalayas as the areas are generally unstable. Effective preventive measures have to be taken for the treatment of the catchment area so that the area is stabilized against future erosion. This is thus a prime concern for the project implementation authorities.

The areas, which are erosion prone, are also prone to natural disasters like landslides, rainfall runoff, washing away of crops due to excessive rainfall, etc. Construction and development activities also cause a large increase in erosion. CAT leads to the welfare of the people living in the catchment area and guides them about the agricultural and grazing practices to be followed for long term income and growth. Its effective implementation requires co-operation from the local people.

Erosion and sediment control measures add to the costs of land development. Control plans are prepared, which involve material and labour costs. Costs for various types of management and treatment are often hard to separate from other land development costs. If the treatment measures are preplanned, the erosion control costs can be minimal. The costs of these management measures represent the total costs to the developer, including labour, equipment, materials, maintenance, overhead, etc.

1.5 Need of the study

The Kol Dam Hydro-electric project proposed (4x200 MW) has been accorded approval by Central Electricity Authority, Government of India in August, 1988 and also by Ministry of Environment & Forests from environmental angle which has been transferred in NTPC's name from HPSEB. As per one of the conditions stipulated while according environmental clearance, a catchment area treatment plan was to be prepared which is to be undertaken with the primary objective of arresting soil losses and degradation of the area. NTPC entrusted this job to WAPCOS to prepare a phase wise CAT plan and cost estimates for undertaking various treatment measures. The primary objective is to ensure that effective erosion control and best management practices are adopted. A digital elevation model (DEM) of the directly draining catchment is shown in Fig 1.1

1.6 Scope of work

The broad scope of the study is to establish land use pattern through satellite data and boundaries of directly draining rivers, development of slope map of the area, collection and analysis of soil samples, preparation of drainage map, establishing soil erosion rate and identification of highly erodible areas, suggestion of soil conservation measures, like contour bunding and terracing, vegetated water ways, strip cropping, pasture development and protection, gully plugging, check dams and crop rotation, etc. Detailed scope of work is given below:

Methodology

The methodology to prepare the conceptual CAT plan for Kol dam project is briefly described in the following paragraphs. The following coverages are required for preparation of Catchment Area Treatment Plan as required by MoEF.

DIGITAL ELEVATION MODEL (DEM) OF THE DIRECTLY DRAINING CATCHMENT (KOL DAM PROJECT)

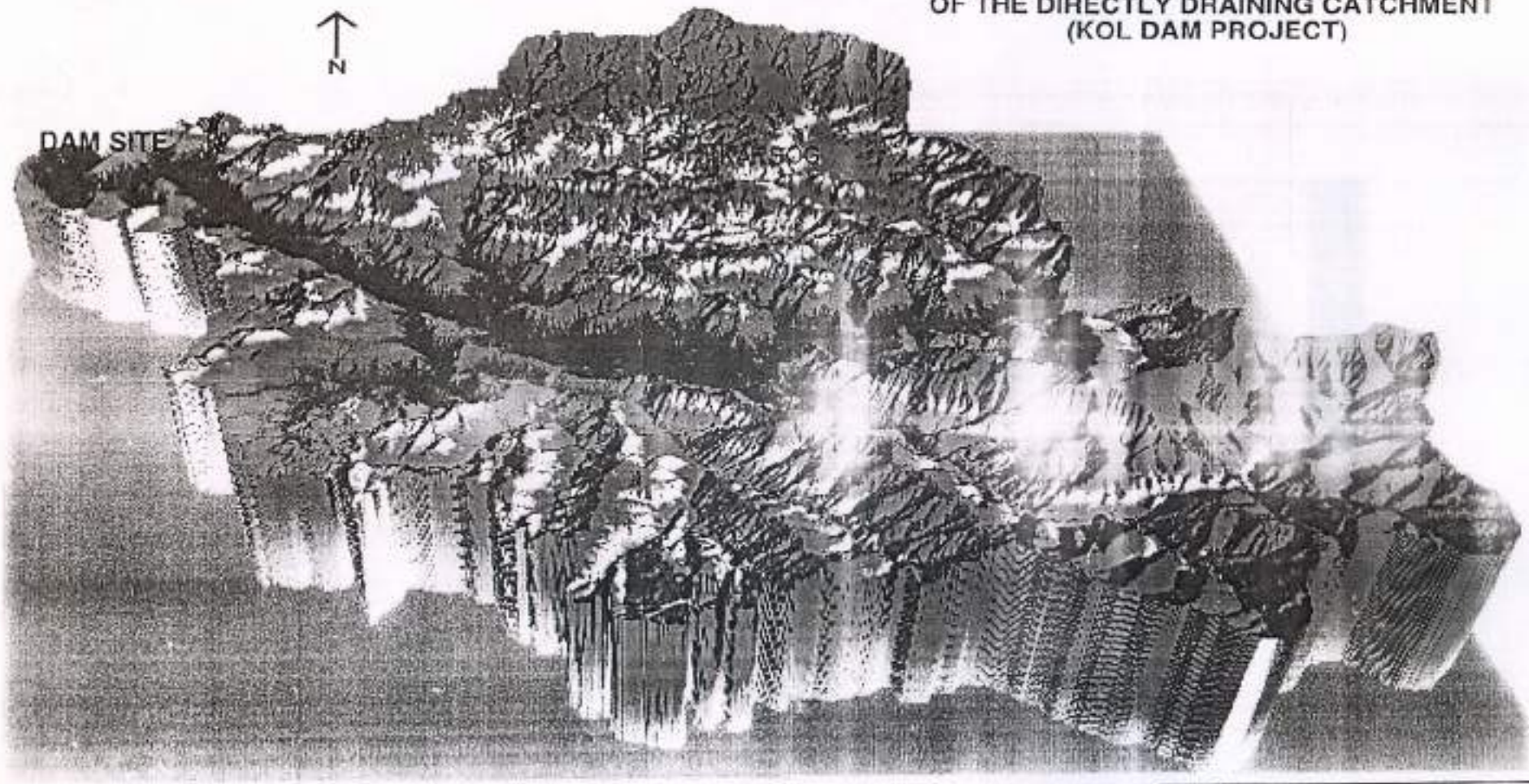


FIGURE - I-1

WAPCOS CENTRE FOR ENVIRONMENT

Landuse

Landuse pattern would be studied using the latest satellite imageries. The digital satellite data for IRS 1C/1D satellites would be procured for LISS-III and PAN sensors from National Remote Sensing Agency. The digital data from both the sensors would be merged to enhance the resolution and interpretability of the data. The catchment area boundaries of the directly draining rivers would be digitised from the toposheets which shall be arranged by NTPC. The catchment area boundaries would be digitized and superimposed over satellite imagery and the area of interest will be taken out. The enhanced image would be classified in different landuse categories using the signatures collected during the ground truth verifications.

The landuse map so prepared would be georeferenced in the real coordinates and area of different classes would be calculated. The landuse categories would include the following:

- Vegetation Density (Crown Cover <10%, 10-40%, >40%)
- Built up area
- Agricultural land
- Water bodies
- Barren land
- Any other specific/peculiar category.

The above exercise would be carried out inhouse using standard remote sensing and GIS softwares like ERDAS – Imagine, Arc/Info.

Slope map

A slope map would be generated using the digitised area of directly draining rivers. Contours falling in the catchment boundaries would be digitised at 100 m interval. The digitised coverage would be imported into Arc-View Spatial Analyst software to prepare slope map of the area.

Soil

To compute soil erodibility factor, minimum 40 soil samples would be collected from the catchment area and would be analyzed for texture (sand, silt & clay and X Ray where-ever applicable) and organic contents.

Drainage map

A drainage map of directly draining rivers would be prepared using the satellite imageries.

Soil Erosion Rates

The layers would be used to derive factors used in Universal Soil Loss Equation (USLE) to compute the soil loss from various landuse categories.

Based on the soil erosion rates, the directly draining catchment area would be classified based on the soil erodibility. The areas with high soil erodibility would be identified and prioritized. Based on the above estimates, various conservation measures like contour bunding and terracing, vegetated waterways, strip cropping, pasture development and protection, Gully plugging, Check dams, Crop rotation, afforestation, etc. would be worked out.

The Catchment Area Treatment Plan would be divided into various phases as per the priority based on the vulnerability to soil erosion. As a part of the study, the area to be

covered and the year-wise expenditure likely to be incurred for CAT in different phases would also be estimated.

1.7 Outline of the Report

The report comprises of the following Chapters:

Chapter 2 Project description

Chapter 3 Characteristics of the catchment

Chapter 4 Methodology for preparation for various thematic layers and soil loss modelling

Chapter 5 Watershed management – available techniques

Chapter 6 Identification and prioritization of watershed management

Chapter 7 Cost estimates

CHAPTER-2

CHAPTER 2

PROJECT DESCRIPTION

2.1 Brief Description of the Project

The Kol Dam Hydroelectric Project (4 x 200 MW) is located on Satluj river, 6 kms upstream of Dehar Power Station of B.S.L. Project in Bilaspur District of Himachal Pradesh . The project envisages utilisation of a drop of about 140 mtrs by constructing a 163 mtrs high rock fill dam and a dam toe power station with an installed capacity of 800 MW. Besides providing an annual energy generation of 3054 GWh, the Kol dam Project would enhance the life of the Bhakra Reservoir by about 18 years. A map depicting various hydro-electric projects on Satluj river has been shown in Fig 2.1

This project has been basically designed as a run-of-the river Hydro Power Development with advantage of additional storage for the first 30 years.

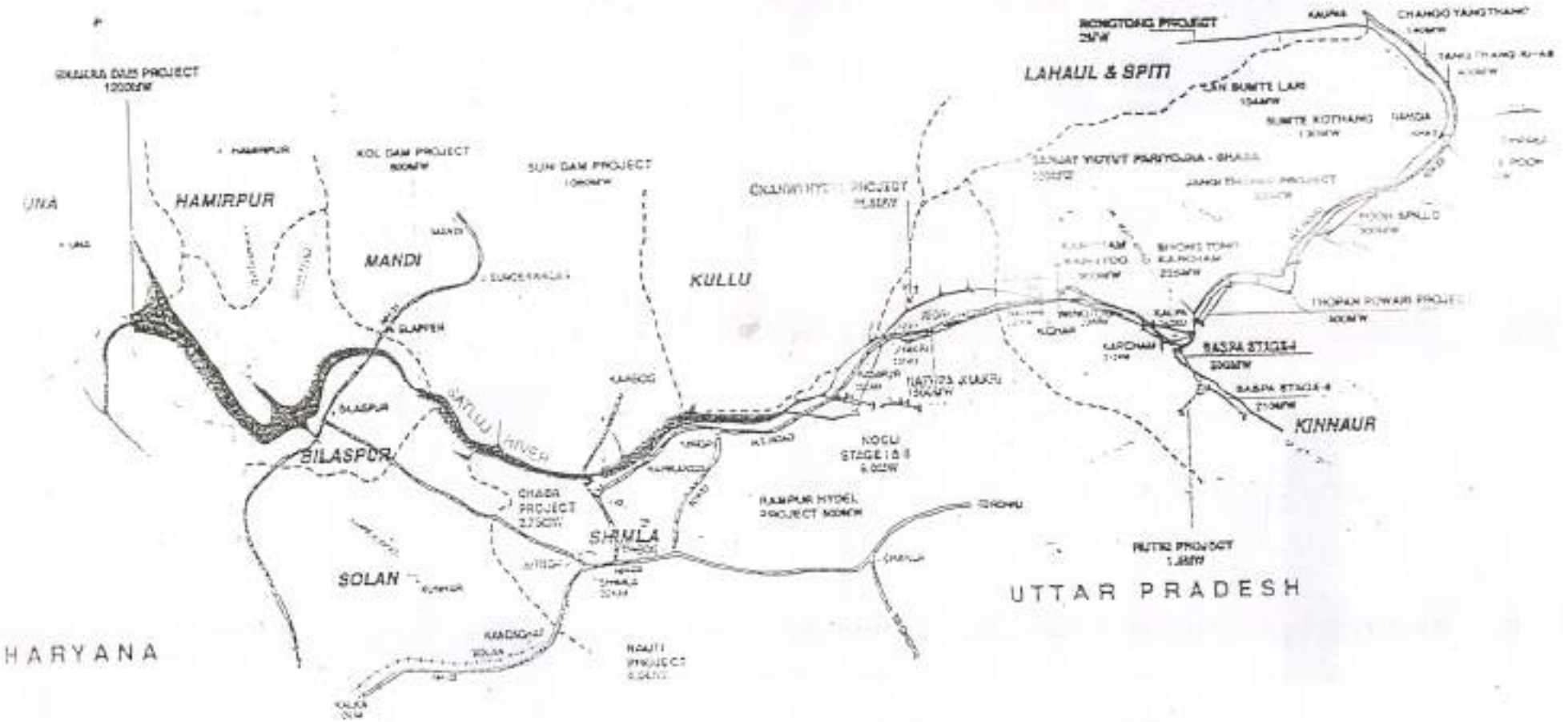
The Project has the distinct advantage of being located only 6 km from the National Highway-21 just upstream of the existing Dehar Power Plant which is having a very well developed infrastructure.

2.2 Project Features

Kol Dam Hydroelectric Project comprises of the following:

2.2.1 Rockfill Dam

A 163m high (above deepest foundation level) and 500m long (at crest) rock and gravel fill dam across river Satluj with impervious central clay core to provide a pondage of 9000 ha.m (90 M cum) between FRL 642m and MDDL 636 m. The pondage would reduce to 3350 ha m after 30 years of operation due to silting.



SATLUJ BASIN

PROJECT UNDER OPERATION	1338.75 MW
PROJECT UNDER CONSTRUCTION	1625.50 MW
OTHER PROJECTS	6966.50 MW
IDENTIFIED POWER POTENTIAL	9225.75 MW

WAPCOS
CENTRE FOR ENVIRONMENT

POWER POTENTIAL OF
SATLUJ BASIN

2.2.2 Spillway

A 420 m long chute spillway with a gated crest is proposed on left bank with a crest level of 625m. The spillway has been designed to pass a Probable Maximum Flood of 16,500 cumecs.

2.2.3 Diversion Structure

The river flow during the construction period is proposed to be diverted through 2 No. 14m finished dia horseshoe tunnels. The lengths of the tunnels are 870m and 910m respectively and these have a discharge carrying capacity of 6500 cumecs.

2.2.4 Desilting Arrangement

A covered desilting arrangement in the approach channel of the spillway within the body of the reservoir has been envisaged in order to eliminate all sediment particles of size 0.25mm and above.

2.2.5 Power House

A surface Power House is located at the toe of the dam and has 4 Nos. Francis type vertical axis Generating Units of 200 MW each. The Generating Units are being fed by independent 6.45 m dia. underground penstocks each having a carrying capacity of 196 cumecs.

2.2.6 Transmission

400 KV integrated transmission system has been evolved by Central Electricity Authority for evacuation of Power from Naptha Jhakri (1500 MW), Kol Dam (800 MW) and also from some of the other future projects likely to be constructed in the Satluj basin. This system of 1260 route Km length of line to evacuate the power from these projects to load

centres at Abdullapur (Delhi), Bawana, Bhiwani and Jaipur has been approved by Govt of India for execution as a separate project in the central sector.

A 50 Km long 220 KV D/C line from Kol Dam power house to Kunihar is proposed to meet the requirements within the state. The cost of this 50 Km line has not been included in the cost estimates.

2.3 Hydrology

The inflow data for Satluj river at Olinda (Bhakra) is available since 1909 (continuous from 1911). A gauging station was established at Kasol (catchment area 53,700 sq.km) near Kol dam site in the year 1966. Site specific data of Kasol for 34 year period (from 1966 to 1999) have been utilised to determine 10-daily inflow data. Though correlated data is available since 1911, the earlier data has not been utilised, because site specific data for 34 years is considered enough for project planning purposes.

The spillway has been designed for a standard project flood of 11400 cumecs and adequacy of free board has been checked for a PMF of 16500 cumecs. The design flood for river diversion during construction has been taken as 6500 m^3/sec. While accepting the PMF as proposed by HPSEB, CWC suggested that value adopted for PMF appears to be on higher side and further studies may be carried out at detailed design stage after collecting short interval rainfall and runoff data for storm studies to be carried by IMD considering catchment area upto Kol Dam only.

2.4 Cost

The cost of the project at March, 2000 price level is Rs. 2920.84 crores comprising Rs. 2373.26 crores on civil works Rs. 547.58 crores on Electrical works.

2.5 Benefits

Kol Dam Project with an installation of 800 MW will provide the much needed peaking capacity to the Northern grid and will generate on an average 3369 GWh during a year. The project will yield a average annual gross revenue of Rs. 237.56 crores (Incentives extra) with a tariff of Rs. 2.55 / kWh (with projected completion cost) at power house bus bars. The project will also increase the life of Bhakra Dam by about 18 years by trapping 0.46 MAF sediments in Kol Dam reservoir.

2.6 Construction Schedule

The project is programmed to be completed in a period of 8 years and 2 months comprising 2 years for pre-construction and 6 year and 2 months for the main project components.

2.7 Salient Features

The salient features of the project are given as follows:

SALIENT FEATURES

Location

i.	State	Himachal Pradesh
ii.	District	Bilaspur
Iii	Dam Site	On Satluj River about 6 kms. upstream of Dehar Power Plant of B.S.L. Project.

Hydrology

I	Catchment	53700 sq.kms.
Ii	Maximum annual rainfall in catchment	2450 mm
Iii	Minimum annual rainfall in catchment	570 mm
Iv	Design flood for	
	(a) Spillway Probable Maximum Flood	16,500 m^3/s
	(b) Design Flood for river diversion during construction (1 in 200 years return period)	6,500 m^3/s
	(c) Standard Project Flood	11,400 m^3/s
V	90% available discharge (without storage)	102 m^3/s

Dam and Diversion Structures

i)	**Dam**	
	(a) Type	Rock and gravel fill with impervious central clay core
	(b) Crest of Dam	El. 648 m
	(c) Height of dam above deepest foundation	163 m

	(d) Crest of length	500 m
	(e) Crest width	14 m
	(f) Upstream slope	2.25 H to 1.0 V
	(g) Downstream slope	2.0 H to 1.0 V
ii)	Spillway	
	a) Type	Chute, gated crest
	b) Crest level	El. 625 m
	c) Total width of crest	108.5 m
	d) No. of gate bays	Six each of 15.5 m clear span.
	e) Length of chute	420 m
	f) Type of gates	Radial (15.5 m wide x 17.3 m high)
iii)	Diversion structure	
	a) Diversion tunnel	2
	b) Finished diameter	14 m (horse shoe)
	c) Length of tunnels	T-1 = 870 m T-2 = 910 m
	d) Maximum velocity	20 m/sec
iv)	Coffer Dams	
	a) Type	Gravel fill with impervious core
	b) Height and crest elevation of upstream coffer dam (included in main dam fill)	60 m, El. 558 m
	c) Height and crest elevation of downstream coffer dam	25 m, El. 515 m

d) Slopes

Upstream coffer dam (including within main dam)	2.25 H : 1.0 V
- Upstream	1.5 H : 1.0 V
- Downstream	
Downstream coffer dam	1.5 H : 1.0 V
- Upstream	1.5 H : 1.0 V
- Downstream	

v) Desilting Arrangement

a) Type	Surface, within the body of the reservoir
b) Particle size removal	0.25 mm size
c) Size	14 Chambers each of 18 m width

vi) Reservoir

a) Top EL of dam	El. 648 m
b) Maximum reservoir level (MRL) corresponding to PMF	El. 646 m **El. 642 m**
c) Full reservoir level (FRL)	El. 636 m
d) Minimum draw down level (MDDL)	57,600 ha-m
e) Gross Capacity at FRL	48,600 ha-m
f) Dead storage capacity at MDDL	142 m
g) Maximum reservoir depth	About 3350 ha-m between El. 645 m & MDDL 636 m
h) Live storage after 30 years	

vii)	Power Intake	4 intake bays each equipped with 6.45 m x 6.45 m slide gates
viii)	Penstock Tunnels	
	a) **Type**	Circular steel lined
	b) No. of Penstock tunnels	4
	c) Maximum discharge through each penstock tunnel	196.0 m^3/s
	d) Diameter of penstock tunnels	6.45 m
	e) Max. velocity through penstock	6.0 m/s
	f) Total length of penstock tunnels	1600 m
ix)	Power Plant	
	a) **Type**	Surface
	b) Power house size	107 m x 48 m x 48 m
	c) No. of Units	4
	d) Type of turbines	Francis, vertical shaft
	e) Installed capacity	800 MW (4x200 MW)
	f) Firm Power at 100% load factor	101.9 MW
	g) Minimum gross head	127 m
	h) Maximum gross head	140 m
x)	Tailrace Channel	

	a) Type	Open channel
	b) Length	100 m
	c) Minimum tail water level	El. 503 m
	d) Maximum tail water level	El. 520 m ± 5 m (PMF)
xi)	Power Benefits	
	a) Increase in Firm Capacity	
	i) 90% year	101.9 MW continuous
	ii) 50% year	137.0 MW continuous
	b) Energy Generation	
	i) 90% year	3054 GWh
	ii) 50% year	3369 GWh
xii)	**Cost Estimate (March, 2000– Price Level)**	
	a) i) Unit I Civil works	Rs. 237326 lacs
	ii) Unit III G-Generation	Rs. 54758 lacs
	Total cost generation	Rs. 292084 lacs
	Cost per KW installed (Generation)	Rs. 36511
xiii)	**Construction Period**	
	2 Units on Line	7 years 10 months
	4 Units on Line	8 years 02 months
xiv)	**Financial Aspects**	
	Cost of energy generation with present day cost	Rs. 1.00 / kWh
	Cost of energy generation at projected completion cost	Rs. 1.40 / kWh

CHAPTER-3

CHAPTER-3

CHARACTERISTICS OF CATCHMENT

3.1 General

The directly draining catchment area extends over an area of 122,000 ha. The catchment area lies within coordinates 31^0 28' 54" to 31^0 5' 13" latitude and 76^0 51' 31" to 77^0 23' 57" longitude. It has a length of 42 km and width of 49 km. Due to variety of adverse biotic factors in the catchment area, the sediment production is on the increase within the catchment.

3.2 Physiography

The major physiographic divisions observed in the catchment area include :

- Outer Himalayas or Siwaliks
- Lesser Himalayas or Central zone
- River terraces
- Valleys
- Piedmont plains

The low hills of Siwaliks occupy the Western part of the catchment area. The southern slopes are scarped and dip gently to northern structural valleys. The structural valleys are known as 'Duns'. A sequential complex of 'Duns' and flattered siwalik hillocks together give an appearance of structural terraces in the western part of the catchment area. The landscape is likely to yield high runoff silt yield as source material is generally loose and argillaceous.

The Lesser Himalayas consist of various ranges. There is an abrupt rise in altitude in the northern portion. However, within the southern part of the catchment, the rise in altitude is gradual. Within the Lesser Himalayas, valleys are generally narrow and most of these valleys are dynamically active vis-à-vis erosion and sedimentation. Both cyclic and non-cyclic type of terraces are observed along many of the streams, which are generally well-protected. Runoff and erosion is slight to moderate, except at few locations, where improper management promotes serious degradations.

3.3 Geology

The formation in the area is represented by the tertiary and pre-tertiary rocks which are exposed on either side of the Main Boundary Fault with NNE-SSW trend between Sudarnagar and Mandi. The pre-tertiary rocks are exposed around Sundarnagar and its adjacent areas. The stratigraphical order of various rocks of the tract are as follows

Formation	Age
Shali formation	Upper proterozoic
Sundernargar	Upper proterozoic
Mandidaralan	Upper proterozoic
Salkhaca	1500 million year old

Salkhala formation

These formations comprise of quartz mica schist, gneiss and quartzite. The gneisses are light grey in colour, medium grained and well foliated. The quartzite colour varies from grey to pink, fine grained and contains magnitite at places. The other rock types are light to dark gray phyllite with inter bands of quartzite and limestone. This formation is highly foliated and water may penetrate along the foliation planes, leading to leaching and weathering.

Mandi Darala Volcanics

Isolated patches/bands of these rocks are exposed within the catchment area. They comprise vascular/non-vascular basic rock, i.e. basalt, which is filled with secondary zeolite and calcite. These rocks are rich in feldspar and contain ferro-magnesium minerals. As a result of its chemical composition these rocks on decomposition, produce calcium, aluminium, silicate and potassium/sodium calcium silicate weathering by products. These rocks are less resistant to weathering.

Sundernagar formation

These rocks are exposed in south Sundernagar area. They comprise of green dirty earth shales, dark grey shales, slate, phyllite and quartzite.

Shali formation

The major part of the Sundernagar area is occupied by the Shali formation.

3.4 Lithology

Lithology of the Sutlej catchment area comprises mainly alluvium, glacial deposits, metamorphic rocks clays, sandstone and conglomerate belonging to Miocene and Pliocene age. The Siwaliks are low foot hills with heights ranging from 1000-1300 m and extend 8-50 km in width and comprise of the following formations:

- Lower-argillaceous pink shales and sandstones predominated by shales, low collapsibility.
- Middle-comprising arenaceous gray sandstones with minor inclusions of gray shales, high collapsibility and low resistance to erosion.

- Loosely cemented conglomeration locally referred to as pseudo- conglomerates comprising poorly sorted, round to sub-round stones and boulders in a matrix of brown soil material. At places stones and boulders are replaced by pebbles and gravel, which are locally known as Bajari conglomerates.

The metamorphic rocks like phyllites, slates and schists yield moderately fine textured soils and have higher silt yields. Geologically, these ranges comprises of granite gneiss, quartzite and limestone, phyllite slates and schists. The conglomerates and sandstones have comparatively lesser silt yield.

3.5 Meteorology

The Sutlej catchment has sub-humid to mofderate type climate. The lower altitudes in general have a sub-humid type of climate, whereas higher altitudes have temperate climates. The duration of various seasons in the two zones is as under:

Season	Sub-humid	Temperate
Winter	Mid-November to mid-March	November to March
Summer	March to June	May to June
Rainy	Mid-July to mid-September	Mid-July to mid-September

The winter season is characterised by heavy post in lower hills and fairly heavy snow fall is observed in higher elevations. Within the valleys also, low temperatures are observed. Summers are quite hot in the lower belt, but pleasant in higher ridges. The mean annual temperature is 13.6°C and the difference between mean summer and winter temperatures exceeds 5°C (Refer Table-3.1). The annual precipitation is around 1480 mm. About 77% of the rainfall is received under the influence of monsoons during the months from June to September (Refer Table-3.1).

TABLE-3.1

Temperature and precipitation data of the catchment area

Month	Rainfall (mm)	Temperature (°C)		
		Maximum	Minimum	Average
January	65	8.5	1.9	5.2
February	48	10.3	3.0	6.7
March	58	14.4	6.8	110.6
April	68	19.2	11.8	15.2
May	54	23.4	15.0	19.2
June	147	24.3	16.2	20.3
July	414	21.0	15.0	18.0
August	385	20.8	15.2	18.0
September	195	20.0	13.8	16.9
October	45	17.9	10.8	14.3
November	7	15.0	7.3	11.2
December	24	11.3	4.2	7.7
Total	1480			
Average		17.1	10.1	13.6

3.6 Water resources

The river Satluj originates in the highlands of Tibet. After flowing for a distance of 400 km, almost parallel to the Indus and it cuts right through both the Zaskar range and the Great Himalayas. The river crosses the Indo-Tibetan border near Shipkhila, where it is joined by river Spiti. The river then flows in south-westerly direction in Himachal Pradesh and emerges from the mountains at the Bhakra gorge, where Govind Sagar is impounded behind the Bhakra dam. The Transhimalayan portion of the basis receives little rain. The upper catchment of about 50,140 km^2 is located above the permanent snowline at an elevation of about 45,000 m. The total catchment above Bhakra Dam in

Himachal Pradesh is about 20,200 km^2. It is anti cederant in nature has predominantly dendritic drainage pattern. The drainage pattern is controlled by folds, thrusts and joints. The average bed slope from its source upto Bilaspur is around 1 in 150. The Satluj river is perennial in nature and carries substantial flow even in summer season.

3.7 Soils

Generally, soil depth varies from shallow to moderately deep and very deep, pale yellow, yellowish brown, dark brown and very dark grey in colour. The texture varies from loamy sand to clay loam. Within the catchment area, both calcareous and non-calcareous soils are observed. In the limestone areas, only calcareous soils are observed.

Soils are broadly classified as Fluvents, Psmments, Orthents, Orhrepts, Udlfs, and Udolls. Amongst these, soils with moderately fine texture, shallow to moderately depth are most erosive. Soils of river terraces, valleys and peidmont plains are less erosive and contribute comparatively lesser silt yields.

Soils are under thick to medium forest cover, are dark brown to very dark grey in colour and have a thick layer of leaf litter and organic matter on the surface. These soils have developed grander and crumb structure in surface and sub-soils. The infiltration and percolation rates are high. These soils are less vulnerable to erosion, both by virtue of their vegetation cover and soil characteristics.

3.8 Landuse pattern

The satellite data for the project area was procurred from National Remote Sensing Agency, Hyderabad. Detailed ground truth studies were conducted to identify the various signatures. As a final step Supervised Classification was done to arrive at the landuse

pattern of the directly draining catchment area. The landuse pattern of the directly draining catchment area is summarized in Table-3.2.

TABLE-3.2

Landuse pattern of the directly draining catchment

S. No.	Landcover category	Area (ha)	Percentage of the total area
1.	Built up area	2879.2	2.36
2.	Water bodies	183	0.15
3.	Exposed rock	122	0.10
4.	Agricultural area	25010	20.50
5.	Dense vegetation	18910	15.50
6.	Open jungle	34245.4	28.08
7.	Scrubs	25254	20.70
8.	Barren	4404.2	3.61
9.	Grasslands	10980	9.00
	Total	122,000	100.00

It is clear from Table-3.2, that major landuse category in the directly draining catchment area is forest land which account for about 43.58% of the total directly draining catchment. Dense vegetation is observed in only 15.5% of the area under study and the balance, i.e. 28.08% is under open jungle. A common feature observed in the catchment area was that forest area adjacent to the settlements is generally open jungle, i.e., it has been degraded as a result of increased level of human interferences.

The land under agriculture is 25010 ha, which is about 20.5% of the directly draining catchment. Agriculture is the main occupation in the area. The land holdings are invariably small. The area under irrigation is insignificantly small and majority of the farmers are dependent on monsoons.

The area under scrubs and pastures account for about 20.70% and 9.00% of the total catchment. A small proportion of the land (3.61%) comes under the barren category.

3.9 Flora of the catchment area

The altitudinal differences of six hundred metres at the dam site and 2900 metres at Hatu peak coupled with aspect and biotic influences are responsible for a variety of vegetation varying from northern tropical dry deciduous forests to high level conifer forest. The distinct zones of temperatures on these mountains, which are sub-tropical at middle elevation and temperate at higher elevation result in the development of two distinct primary types of forests, i.e. Sub-tropical and Temperate.

Micro-climatic changes due to aspect and exposure of local changes of rocks and soils. however, often bring in vegetation inversion viz. association which otherwise occurs at higher elevations are found in the lower zone and vice versa. There is a great diversity in the vegetation of the tract starting with the riverain species like Dalbergia sissoo, Accacia catechu, and Mallotus phillipinenses, and ending with the Abies pindrow, Pinus wallichiana, Cidrus deodara, Picea smithiana, along with the associates such as Juglans regia, Aesculus indica, Quercus incana, Quercus dilatata, Rhododendron arborium are found scattered all over the forests within the catchment. The riverain species get replaced by the broad leaved species of northern dry mixed deciduous forests at places above the banks of Sutlej and are observed upto an elevation about 1800 m.

The Chil forests are scattered in the catchment area. Beyond elevation of about 2000 m, sub-tropical dry evergreen forests consisting of Ban Oak, Moru Oak, Oak scrub, Moist Deodar forest, moist temperate deciduous forest and low level blue pine forest are available. Upper west Himalayan temperate forest of high level Oaks and Oak fir mixed forests are found.

The details of forest types observed within the directly draining catchment are described in the following paragraphs.

3.9.1 Tropical dry deciduous forests

The tropical dry deciduous forests are observed below 1200 m elevation in the catchment area. They are confined along the right bank of Satluj river forming parts of the Karsog and Shimla Divisions. The width of the area under this type goes on decreasing with increase in elevation along the river. Lower parts of the tract represents this type. The major tree species observed in this forest type include Dalbergia sissoo, Acacia catechu, Mallotus phillippinensis, Salmalia malbaricum, Grewia oppositifolia, Bauhinia varigata, Albizzia lebbeck, Pistacia integerrima, Celtris australis, Emblica offcinalis and Ougeenia dalbergiodis, etc.

Undergrowth consists of Murrayakoenigii adha, Thoda vasica, Colebrookia opposotifolia, Carrissa opaca and Woodfordaia fruticosa. The common climbers found include Bauhinia vahilli, Bueraria tuberosa and Ceasal pinia sepiaria.

These forests have been badly degraded due to heavy grazing by large flocks of sheep and goats and also herds maintained by gujjars. These forests provide fodder, fuelwood and grass reserve for local inhabitants. The area being warm, the growth rate is high and also growing period longer. Presently the entire area is subjected to severe degradation as a result of human interferences.

3.9.2 Himalayan Chil pine forests

The Himalayan Chil pine forests are observed within an elevation of 1200 m to 1800 m, overlapping the dry deciduous forests at the lower elevation and temperate forests at higher altitudes. This forest type lies mainly along the river Satluj and its tributaries. Chil

forests are remarkably pure with practically no other tree species occurring in the top canopy. There is only sprinkling of other species representing second storey. The frequent fires and Chil needles prevent the development of shrubs except on rocky and very steep gradients. The broad leaved species observed include Cedrala serrata, Quercus incana, Pistacia interrigima, Grewia oppositifolia, Lyonia ovalifolia, Rhododendron arborium, Cornus capitata, Symplocus crateagoides, and Myrica sapida. The common shrubs forming the light under storey are Indigofera dosua Flemengia fruiticosa, Rubus ellipticus, Vibernum coriaceum, Leptodermis lanceolata, Principia utilis, Xanthoxylum alatum, Woodfordia fruiticosa, Berberis lycium, Sarcocca saligna, Urtica dioca, etc. The ground flora comprises mainly of Heteropogan concortus, Arundinaria intricata. Ferns in declivities are common. Climbers, however, are almost absent.

These forests are suffering from heavy mortality due to excessive grazing pressure and periodic fires. Deep channels made in Chil trees during resin extraction make the base weak and trees cannot withstand force as a result of strong winds. The trees of higher diameter classes have more channels and are subjected to maximum stress due to wind action. The resultant forests are mainly pole crops with medium density. Some regeneration is observed, but is inadequate in absence of proper protection measures.

3.9.3 Himalayan Sub-tropical Scrub

Large part of the area bordering the Chil zone and down to the mixed dry deciduous forests have been badly degraded due to destruction of forests for meeting fuel wood and timber requirements. The regeneration is further affected as a result of heavy grazing and fires. Most of undemarcated protected forests on lower elevation of the tract represents this type. The vegetation is mostly xerophytic, thorny, and non-palatable to livestock. The

continuous inadequate vegetation cover has also depleted the soil and soil nutrients resulting thereby in shallow and under-productive soils. The common shrubs observed in the Himalayan Sub-tropical scrub type of forest includes, Rhus parviflora, Plactranthus rugosus, Carrissa opaca, etc. There is immense scope to improve this forest type so as to make it more usable for generating fodder, timber and other valuable forest produce.

3.9.4 Sub-tropical Euphorbia Scrub

This type of forest occurs upto an elevation of 1200 m, on the drier southern slopes of Kursog division. The soil is very shallow, and Euphorbia royleana is able to survive better than other species. There is heavy grazing pressure from livestock, which does not allow any other useful species to survive. On better protected areas with deep soils there are small patches of Bauhinia, Ficus and Mallotus and even Grewia oppositifolia.

3.9.5 Olea cuspidata Scrub Forests

Olea cuspidata occurs in pure patches scattered on flatter alluvial grounds and also on larger alluvial fans, in the tract. Patches of Olea cuspidata have been cleared up for cultivation and generally the area under this type is on the decline.

3.9.6 Ban Oak Forests (Quercus incana)

The Ban Oak forest type occurs between elevation 1500-2300 m and occupies large tracts in Shimla and Kursog divisions. Patches of this forest type are observed at other locations within the catchment. These forests overlap Chil in lower limits and are replaced by Deodar and Kail on the higher elevations. The other associates of Ban are the Rhododendron arboreum, Litsea umbrosa, Myrica sapida, Cornus capitata, and Lyonia ovefolia. Ruthless lopping of Ban Oak near habitations has made the trees stunted, malformed, poorly grown and under stocked. However the forests away from the

habitations are well stocked, tall and with clean boles. The undergrowth is generally dense and consists of species including Myrisine afficana, Indigofera pulchela, Gerardiana heterophylla, Rubus nivlus, Desmodium tiiliaefolium, Berberis aristata, Princepia utilitis, Sorcococa salgina, Rumex nepalensis, etc. The common climbers observed in this forest type are Hedra helix, Smilax parviflora, Vitis trifolia and Ficus foveolata.

3.9.7 Moru oak forests (Quercus incana)

This forest type is found as small patches in scattered forms in shady portions of deodar zone and also above the upper limits of Ban Oak. It occurs nearly in all ranges of the tract. Due to damp conditions and prolonged winter, the growth is very luxuriant. Moru is found in association with the Rhododendron, Litsea umbrosa, Euonymus and Ilex species. The undergrowth consists of Skimmia laureola, Sarcococa saligna, Vibernum faetens and Vibernum cotinifolium. The trees are generally tall, clean boled except near habitations, where they have been subjected to heavy lopping for leaf fodder.

3.9.8 Oak scrub

The Oak Scrub vegetation is met within areas near habitations and extends both in Ban and Moru oak zones. Heavy biotic pressure has reduced the Ban-Moru and its associates to stunted and poorly grown trees. The unpalatble varieties found include Rhododendrons arboreum and Lyonia ovalifolia. The hostile thorny bushes like Berberis princepia, Plectrantnus and Gerardiana are left as ground cover. The regeneration is sparse except of non-palatable species.

3.9.9 Moist deodar forest (Cedrus deodara)

This forest type is the most important from economical point of view. It includes the most valuable deodar forest which are found within an elevation ranging from 1800 to 2600 m. The forest are of almost pure deodar with some blue pine and a little spruce. The deodar forests occur on all geological formations but avoid badly drained heavy soils, however, well drained loams derived from mica schists and carboniferous shale support the best growth. Best stands of this type of formations occur in Kursog and Shimla divisions of the tract. In warmer places and also on areas which have suffered damage by fires, Kail is the major associate species. Spruce occurs in depressions and on comparatively cooler localities. Other associates are Quercus dilatata, Quercus incana, Populus cilata, Abies cindrow on higher limits and Pinus roxburghii on lower limits. Bush growth is low except in younger plantations, and in open patches. Common shrubs observed are Viburnum colinifolium, Indigofera pulchela, Gerardiana heterophylla, Loniserra augustofolia, Daphnia cannabina, Rosa moschata, Jasminium officianale, Clematis montana, Rubus niveus, Princepia utilitis, etc. Due to the proximity to the habitations, the areas are subjected to tremendous pressure as a result of livestock grazing. At places the excessive grazing has hampered the generation and vast areas have been rendered as open blanks. Fires have also badly damaged the Deodar and Chil forests in the past. Due to timber being valuable, the undemarcated areas have been degraded as a result of over-exploitation under the garb of private sales. Some of demarcated protected forests are well stocked with predominance of poles to middle aged classes. The forests being climatic, climax is regenerating well except, where biotic pressure is high. Artificial regeneration is also done to augment the natural regeneration

and to accelerate the stocking. With an effort to eliminate biotic pressure, the entire area is capable of regenerating naturally.

3.9.10 Western mixed coniferous forests

This type occurs above deodar forests i.e. above 2400 to 3000 m. These forests have varying mixture of coniferous trees such as Picea smithiana, Abies pindrow, Pinus excelsa and Cedrus deodara. Broad leaved species such as Aesculus indica, Acer caesium, Corylus colurna, Prunus paddum, Juglans regia, Betula alnoides, Populus ciliata, Taxus baccatta are also observed. Quercus semicarpifolia occurs along ridges on upper limits and Quercus dilitata in depression and shady areas. The undergrowth is moderate and consists of Vibernum sp., Skimmia laureola, Deutzia corymposa, Arundinaria falcate, Fragaria vessica, Viola serpens, Gerranium wallichianum, Rubus niveus, Anslia optera, Valiriana wallichii and Asparagus filicinus. The commonly observed climbers are Hedra helix and Vitis trifolium. The Abis pindrow and Picea smithiana were neglected species in the past due to less demand in the market. As a rule, Abies pindrow and Picea smithiana were allowed to be girdled in favour of other species. But now with demand for packing cases and other industrial uses; these species too have gained considerable commercial importance.

3.9.11 Moist temperate deciduous forests

Small patches of these forests occur in nallas and declivities within elevations ranging from 1800 m to 3000 m on gentler slopes. The extremely moist soil conditions have made these sites unfit for conifers. The common species found singly or mixed are Aesculus indica, Acer caesesium, Acer pictum, Betula alnoides, Cornus capitata, Juglans regia, Quercus dilitata, Prunus paddum, Corpinus viminea, Populus ciliata and Taxus baccata.

The undergrowth is very thick and consists of Strobilanthes atropurpureus, Spireae sorbifolia, Polygonum polygonatum, Rumex nepalenses, Impatiens and Anemone obtusiloba, etc. These broad leaved trees have gained special importance due to increasing demand of the wood for their various industrial uses. Patches of this type are found near Ha tu peak in Shimla Division of the tract.

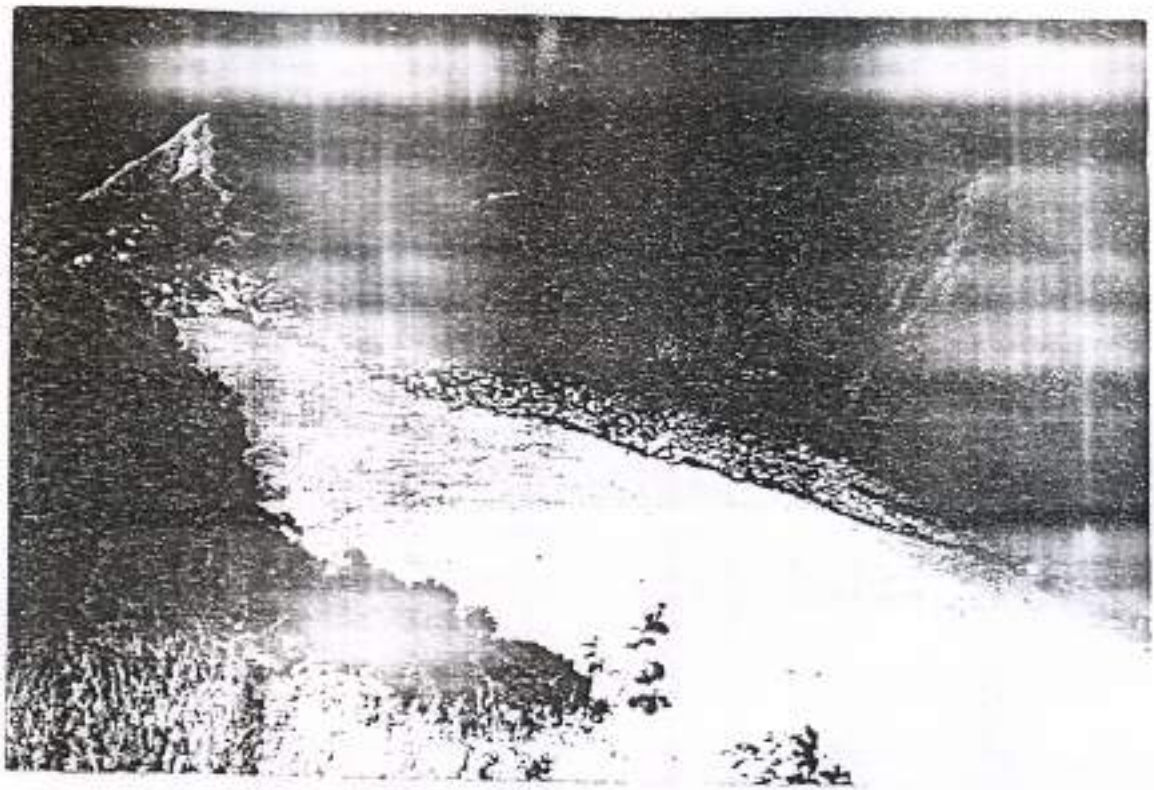
3.9.12 Low level blue pine forests

This serial type occupies the same altitudinal zone as Cedrus deodara. Pinus excelsa is the principal species. Being a pioneer colonist and a prolific seed bearer it is the first coniferous species to invade fire blanks, land slips, abandoned fields and grass lands. The growing stock is almost even aged in patches. The stocking is very good and the trees are tall with clean boles. The forests facing southern aspects when subjected to fires and lopping are badly damaged and ultimately attacked by Tremetes pini. These never attain maturity. Strict fire protection has caused some ecological progress and Pinus excelsa is being replaced by Cedrus deodara and even Picea smithiana in depressions. Other associates of Pinus excelsa in this forest type are Rhododendron arboreum, Quercus incana, Populus cilata. Commonly observed bush species are Viburnum cotinifolium, Lonicera angustifolia, Clematis montana and Rubus niveus.

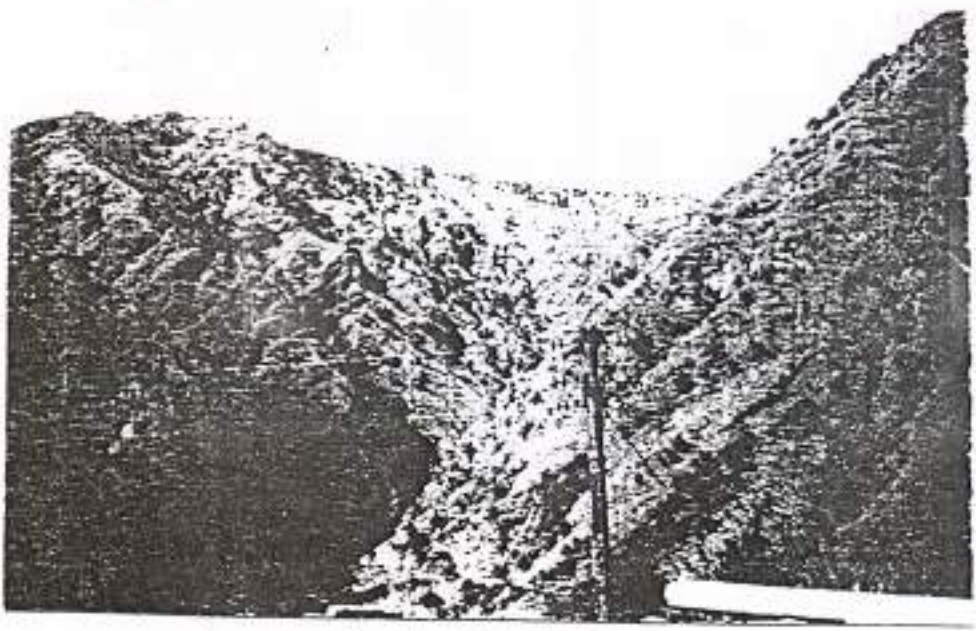
3.9.13 General description of the growing stock

Among the conifers, the most economic species is Cedrus deodara followed by Pinus wallichiana, Pinus roxburghii, Picea smithiana and Abis pindrow. The broad leaved species observed are Carpinus viminea followed by Betula utilitis, Juglans regia, Acer ceaseum, and Dalbergia sissoo. Generally these are quality forests. The Cedrus deodara of this tract is of Class I and II quality forests. The density varies from 0.3 to 0.8. The

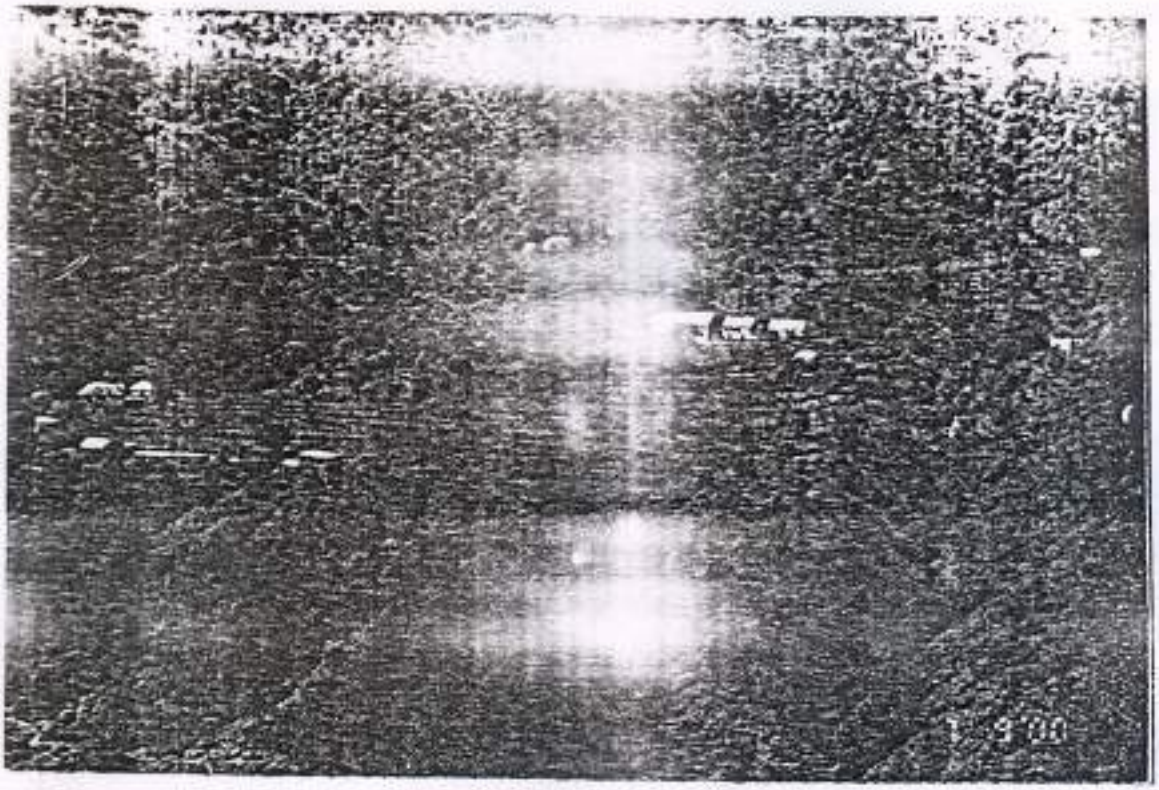
crop in the undemarcated protected forests is open to fair canopied and in the demarcated forests fair to close canopied. The forests are healthy and except Pinus wallichiana which is infected by Tremetes pini and also root fungus near habitations as a result of lopping and extraction of torch wood of southern aspect. At few places as in Sarain and Kujao forests, Cedrus deodara is also drying due to severe attack of Fomes annosus. The various species regenerating nature are Cedrus deodara, Pinus wallichiana and Pinus roxburghii. The regeneratoin of these species come in profusely with protection of area against grazing and fires. Picea smithiana also regenerates well at places, where the canopy has opened up leaving the soil exposed. The growth, however, depends upon the extent of protection against grazing. Abis pindrow regenerates only where there is less humus and bush growth. On gentle slopes, light grazing seems to be helpful for the regeneration as is noticed in Shilla, Sarao Nawni, Churath, mulno and lallon forests which are visited by the gujjars. The regeneration of broad leaved species except that of riverian species is absent. The age class distribution of the coniferous species is irregular, with middle age classes predominating. The mature classes predominate in the broad leaved species except the riverain species which are of all age classes. The growing stock of the coniferous species is degraded because of the heavy fellings in the past.



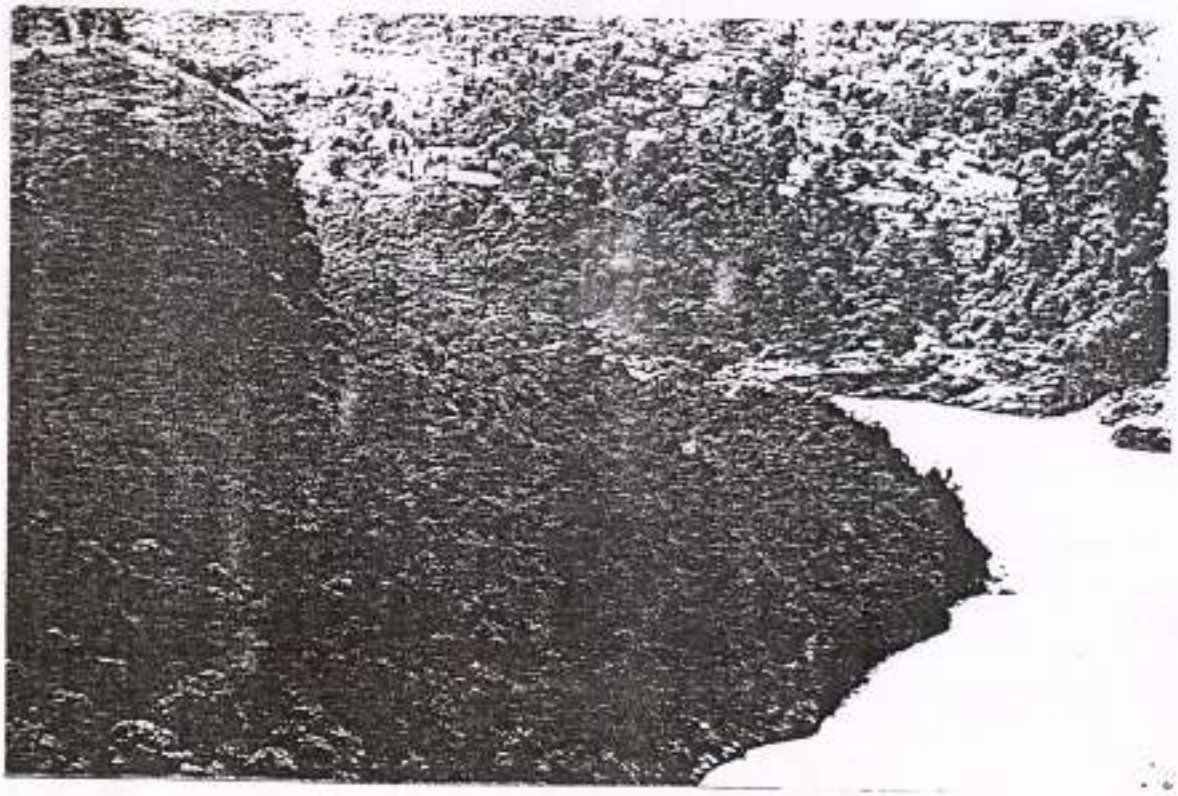
Dam Site – Kul Dam Hydro Electric Project



Grasslands in the Catchment



Agricultural Land in the Catchment



Ground Checks in the Catchment (Dense Vegetation)

CHAPTER-4

CHAPTER-4

METHODOLOGY

4.1 Methodology – Broad Outline/Steps Involved

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

Geographic Information systems (GIS) are computerised resource data base systems that are references to some geographic coordinate system (real coordinate system in this case). A GIS is primarily used to store, manipulate, analyze and display various spatial data. In addition, GIS combine special hardware and software to perform numerous functions and operations on the various spatial data layers residing in the data base. GIS provides the capability to analyze large amounts of data in relation to a set of established criteria.

In order to ensure that latest and accurate data is used for the analysis, satellite data has been used for deriving landuse data and ground sampling has been done to supplement the soil data acquired from All India Soil & Land Use Survey (AIS&LUS).

The study has been done using GIS/Remote Sensing (RS) analysis and interpretation techniques. The steps involved are as follows.

4.1.1 Definition of the Problem

The requirement of the study was first defined and the outputs expected were noted. As a Catchment Area Treatment Plan was to be prepared, all areas prone to erosion were identified using Modelling as detailed later. The various data layers of the catchment area required for the Modelling were identified as :-

i) Slope Map

ii) Soil Map

iii) Land use Classification Map

iv) Rainfall Erosivity Index

v) Current Management Practices

vi) Catchment Area Map

4.1.2 Data Acquisition and Preparation

The data available from various sources was collected. The ground maps, contour information, etc. were scanned, digitized and registered as per the requirement. Data was prepared depending on the level of accuracy required and any corrections required were made. Non-Spatial data, like soil texture was attached to spatial data, like soil map using GIS techniques. All the layers were georeferenced and brought to a common scale (real coordinates), so that overlay could be performed. Programming was done for the required Modelling to calculate the soil losses. The formats of outputs from each layer were firmed up to match the formats of inputs in the program. The grid size to be used was also decided to match the level of accuracy required, the data availability and the software and time limitations. The format of output was finalized. Ground Truthing and data collection was also included in the procedure. The soil samples collected from the

catchment were analysed. Satellite data was mosaiced and merged to form a seamless map of the project area.

4.1.3 Data Analysis

The input data was analysed for each layer as detailed later. Land use classification was done using Remote Sensing techniques. Digitized contours from toposheets were used for preparation of Digital Elevation Model (DEM) of the catchment area and to prepare a slope map. Data from All India Soil & Land Use Survey and ground sampling results were used for preparation of soil map, whereas data for Rainfall was collected from Indian Meteorological Department (IMD).

Various layers thus prepared were used for Modelling. A software was prepared to calculate the soil loss using input from all the layers. Universal Soil Loss Equation (USLE) was used in the Modelling. The catchment area was divided in grids. Each layers was divided in grids of 0.0002 degrees for the latitude as well as the longitude. The USLE was applied to each grid and soil loss in each grid was calculated.

4.1.4 Output/Presentation

The result of the Modelling was interpreted in pictorial form and was used to identify the erosion prone areas. This output and various other field and published data were used to prepare a management plan for the Catchment Area of the directly draining rivers.

4.2 Detailed methodology for preparation of various data layers

4.2.1 Land use classification

4.2.1.1 Acquiring the data

Digital satellite data was used for interpretation & classification. The choice of data is an important factor. NRSA is the sole distributor of satellite data in India. IRS-IC and IRS-ID satellites which are currently in operation have WiFS, LISS & PAN sensors. The

present application required high resolution Multispectral data. Hence, data of both LISS & PAN were acquired for the entire catchment area of Kol dam. LISS data is Multispectral data with 4 bands Bands 1 to 3 have a spatial resolution of 23.5 m and Band 4 (1.55 to 1.70 μ band width) has a spatial resolution of 70 m. PAN is a single visible band data with a resolution of 5.8 m. The field of view can be titled upto 26° to either side of the orbit path. Multispectral data is necessary for interpreting the land use classes on the ground. Various land use classes on the ground can be identified using varying reflections in different wavelengths and can be interpreted based on their reflectance in different bands. It is also possible to add, subtract, multiply and divide the pixel brightness from two bands of image data to form a new image. These are quite simple transformations to apply and can be used to highlight regions of change between two images of the same area.

For the purpose of ordering the satellite data, the primary requirement was catchment area map. The extremes of the catchment area were used as reference points for judiciously deciding the number of scenes required. The data received was corrected for atmospheric noise. The data is raster data i.e. the information is in form of pixels.

4.2.1.2 Referencing, Geocoding

i) Expressing image pixel addresses in terms of a map coordinate base is often referred to as geocoding. As various thematic layers were to be overlaid for this project, all the layers were georeferenced to real world coordinates.

An assumption to be made in this procedure is that a map of the region corresponding to the image is available, that is in the real world

coordinates (expressed in the form of Latitudes and Longitudes, oriented vertically in a north-south direction and to a geometric scale) A 1:50,000 toposheet can be used for the purpose of georeferencing. The two maps (satellite images and the reference map) are in two different cartesian coordinate systems and can be related via a pair of mapping functions. As these functions are known for standard georeferencing procedures (polynomials of first, second, third or higher degree), we could locate a point on the image knowing its position on the map. Unknown coefficients were estimated by identifying sets of features on the map (toposheet) that can also be identified on the image. These features, often referred to as ground control points (GCPS) are well defined and spatially small and could be road intersections, airport runway, bends in rivers, bridges, existing dams, etc. Enough of these were chosen so that the polynomial's coefficients can be estimated. The coefficients are evaluated using least square estimation.

ii) Resampling

Having determined the mapping polynomials explicitly by use of the GCPs, the next step is to find points in the image corresponding to each location in the pixel grid previously defined over the map. The spacing of the grid is chosen according to the pixel size required in the corrected image and need not be the same as that in the original image. The pixels are transferred to the appropriate locations on the destination grid (toposheet) to build up the rectified image. This process is known as

Resampling. A map projection system (real world) was also defined while resampling.

iii) Interpolation

Grid centres from the map registered to pixel grid will not usually project to exact pixel centre locations in the image, therefore a technique is used for deciding what pixel brightness value should be chosen for placement on the new grid.

Nearest neighbour resampling is the technique generally used for landuse application since the image is to be classified later. This technique simply chooses the actual pixel that has its centre nearest the point located in the image. The pixel is then transferred to the corresponding grid location on the toposheet. The original brightness value of the pixel is thus maintained.

iv) Choice of control points

Enough well defined control points must be chosen in rectifying an image to ensure that accurate mapping polynoimals are generated. However, care must also be given to the locations of the points. The distribution of control points should be around the edges of the image to be corrected with a scattering of the points over the entire image. This is necessary to avoid distortion of the image. Any control points that contain significant position errors either on the toposheet or on the image should also be avoided.

4.2.1.3 Image Enhancements

The quality of an image can be improved considerably using various enhancements techniques. Radiometric enhancements are generally applied to improve the visual quality of an image whereas geometric enhancements modify and enhance the geometric detail in an image.

Image analysis by photointerpretation is often facilitated when the radiometric nature of the image is enhanced to improve its visual impact. Specific differences in vegetation and soil types, for example may be brought out by increasing the contrast of an image. Similarly, subtle differences in brightness can be highlighted either by contrast modification or by assigning quite different colours. To improve interpretation during image analysis some of the radiometric & geometric enhancement techniques those were used in the current exercise are mentioned below:

- Image reduction & magnification.
- Linear and non-linear contrast enhancements.
- Histogram equalization.
- Density Slicing
- Edge detection & enhancements.
- Non-directional & Directional filters.
- Intensity, hue and saturation transformation.
- Band ratioing.
- Normalized Difference Vegetation Index (NDVI)
- Modified NDVI

4.2.1.4 Merging, mosaicing of the satellite data

The satellite data consisted of several adjacent maps that were digitally compiled into a mosaic to provide a seamless coverage of the project area. There is some overlapping area in adjacent scenes, and common points in this overlapping area are used as reference points to mosaic these scenes. The contrast of the adjacent scenes is matched and the two scenes are resampled and stitched together.

Merging of data of LISS & PAN sensors provides higher resolution & better interpretability. The scenes of the two sensors are georeferenced to form a merged product. This merged product then forms the map of the project area. A digitised map of the catchment area was used to cut the catchment area from this map.

4.2.1.5 Unsupervised classification

Prior to proceeding to the catchment area for ground truthing, the satellite data is often classified using unsupervised classification techniques. Unsupervised classification is a means by which pixels in an image are assigned to spectral classes without the user having prior knowledge of the existence or names of those classes. It is performed most often using clustering methods. These procedures can be used to determine the number and location of the spectral classes into which the data falls and to determine the spectral class of each pixel. The analyst then identifies those classes with aid of maps and information from ground visits. Some clusters may be meaningless because they represent mixed classes of Earth's Surface materials. The analyst should understand the spectral characteristics of the terrain well enough to label certain clusters. The

unsupervised classification for this project was only used as a guiding tool for the ground truthing.

4.2.1.6 Supervised classification

Supervised classification procedures are the essential analytical tools used for the extraction of quantitative information from remotely sensed image data. It is assumed in supervised classification that each spectral class can be described by a probability distribution in multispectral space. This is a multivariable distribution with as many variables as dimensions of the space. Such a distribution describes the chance of finding a pixel belonging to that class at any given location in multispectral space. Gaussian or Normal distribution is found to be the most appropriate for this. It gives rise to tractable mathematical descriptions of the supervised classification process, and is robust as classification accuracy is not too sensitive if the classes are not normal, as assumed.

A multidimensional normal distribution is described as a function of a vector location in multispectral space by –

$$P(x/w_i) = 1/(2\pi)^{N/2} \, |\Sigma|^{1/2} * \exp[-1/2(x - m_i)^t/\Sigma_i(x - m_i)]$$

where w_i are spectral classes, x is a vector location in the N dimensional pixel space, m is the mean position of the spectral class i.e. the position x at which a pixel from the class is most likely to be found, and Σ is the covariance matrix of the distribution, which describes its spread directionally in the pixel space.

As the multidimensional normal distribution is specified completely by its mean vector and its covariance matrix, if these are known, then it is possible to compute the set of probabilities that describe the relative likelihood of a pattern at a

particular location belonging to each of those classes. It can be considered as belonging to the class which indicates the highest probability.

This method, referred to as maximum likelihood classification, is the most common supervised classification method used with remote sensing image data. If m and Σ are known for every spectral class in an image, every pixel in the image can be examined and labelled corresponding to the most likely class on the basis of the probabilities computed for the particular location for a pixel. Before performing the classification however m and Σ are estimated for each class from a representative set of pixels called a training set. These are pixels which the analyst knows as coming from a particular spectral class. Estimation of m and Σ from training sets is referred to as supervised learning.

The essential practical steps followed for supervised classification were –

1. Decide the landuse classes into which the image is to be classified. For this particular project, the broad classes were eight.
2. Choose representative or prototype pixels from each set of classes. These pixels are said to form training data. This data was collected from site visits or ground truthing and maps, toposheets, photographs, etc. The no. of training sets required was judiciously chosen and spread over an area as described later.
3. Use the training data to define the parameters of the particular class, called its signature.
4. Using the training classifier, label or classify every pixel in the image into one of the desired landuse classification type. New classes may be

identified while ground truthing, or a few classes may have to be clubbed together based on ground verification and requirement of the project. The whole image area of interest was classified in appropriate landuse classes. The area under each landuse was computed.

5. Map compositions and tabular summary of the result was produced.

4.2.1.7 Training (Ground Truthing) site selection and statistics extraction

An analyst may select training sites within the image that are representative of the land-cover classes of interest after classification. The training data should be of value if the environment from which they were obtained is relatively homogenous. During the preliminary stages of a project, all significant environmental factors that contribute to confusions in classification of similar appearing ground data should be identified. There would be differences in rail type, water depth and clarity, crop species, unusual soil moisture conditions, etc. Such environmental conditions should be carefully annotated on the imagery and the selection of training sites made based on the geographic stratification of these data.

Once signature extension factors have been considered, the analyst selects representative training sites for each class and collects the spectral statistics for each pixel found within each training site. Each site is usually composed of many pixels. The general rule is that if training data are being extracted from n bands then >10 n pixels of training data are collected for each class. This is sufficient to compute the variance-covariance matrices required by some classification

algorithms especially maximum likelihood which is mostly used for landuse classification.

4.2.1.8 Reclassification:

After the supervised classification procedure, a landuse map was prepared and given to the team going for the next site visit. The landuse classification was verified by the team, and any errors or omissions were noted down. These were conveyed to the analyst who did a reclassification of the landuse categories implementing the details and corrections, if any. This reclassification normally gives the final land use classification map. This map after due verification was then composed and printed, as desired.

4.2.1.8 Output

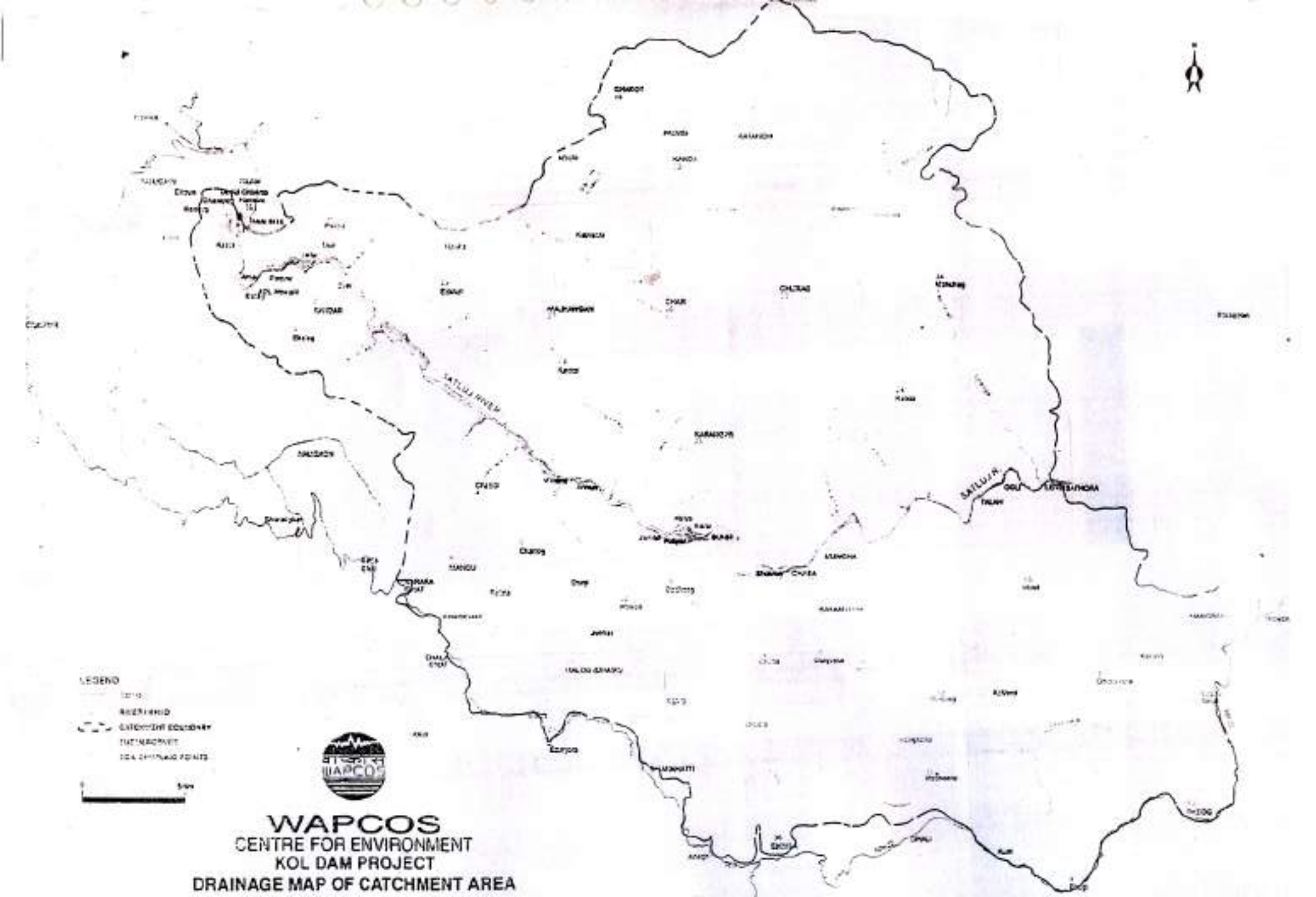
The area in each land use class was calculated and a table was prepared for the same. The land use classification map of the catchment area was prepared and important locations marked on it. This map was used for presentation purpose in the report.

For modelling purpose, however, this map was geo-referenced to real coordinates & converted to a vector layer and each landuse class was converted to a polygon in different layers with its land use class information attached to it.

The drainage map of the directly draining catchment has also been prepared and has been shown as Figure 4.1

4.2.2 SLOPE MAP PREPARATION

4.2.2.1 Slope : A measure of change in the value of altitudes over distance which can be expressed in degrees or as a percent for example, a rise of 2 m over a


LEGEND
WAPCOS
CENTRE FOR ENVIRONMENT
KOL DAM PROJECT
DRAINAGE MAP OF CATCHMENT AREA

distance of 100 m describes a 2% slope and has an angle which measures 1.15°. Mathematically, slope is referred to as the first derivative of the surface.

The first step in generation of slope map is to create surface using the elevation values stored in the forms of contours or points.

4.2.2.2 Surface: is a representation of geographic information as a set of continuous data in which the map features are not spatially discrete; that is, between any two locations, there are no clear or well defined breaks between possible values of the map feature. Surfaces can be represented by models, built from regularly or irregularly spaced sample points on the surface. A surface can be approximated by combining irregularly spaced points, lines and polygons, each having high information content. On the earth's surface, these point and feature correspond to peaks pits, passes, points of change in slope, ridges, stream channels and shorelines as features that define the frame of a surface. Thus, the TIN (triangulated irregular network) concept was devised as an alternative means for representing surfaces effectively. Irregularly spaced data is not limited to point data structures.

4.2.2.3 What is TIN

The tin data structure is based on two basic elements : points with x, y, z values, and a series of edges joining these points to form triangles. This triangular mosaic forms a continuous faceted surface much like a jewel. The tin triangular method satisfies the Delaunay criterion.

Delaunay triangulation is a proximal method that satisfies the requirement that a circle draw through the three nodes of a triangle will contain no other point.

Restated, this means that all sample points are connected with their two nearest neighbour to form triangle. Delaunay triangulation has several advantages over other triangulation method. The triangles are as equiangular as possible; thus reducing potential numerical precision problems created by long skinny triangles. Delaunay triangulation also ensures that any point on the surface is as close as possible to a node.

TIN : is a representation of a surface derived from irregularly spaced sample points and breakline features. Each sample point has an x, y coordinate and a surface or z value. These points are connected by edges to form a set of non-overlapping triangles that can be used to model the surface.

After converting the line and polygon vertical to points with x, y, z values, the features are developed into a series of connected triangles or facets. The nodes correspond to the irregularly spaced locations on the surface. Because the sample points can be located at optimum locations, it is possible for a tin to accurately represent a surface with less points than other data models.

Components of TIN

A tin data model is composed of nodes, edges, triangles, hull polygons and topology.

Nodes : Nodes are the fundamental building blocks of the tin. The nodes originate from the points and are vertices contained in the input data sources. Every node is incorporated in the tin triangulation. Every node in the tin surface model must have a z value.

Edges – Every node is joined with its nearest neighbours by edges to form triangles which satisfy the Delaunay criterion. Each edge has two nodes, but a node may have two or more edges. Because edges have a node with a z value at each end, it is possible to calculate a slope along the edge from one node to the other. Each feature in the input data sources used to build the tin is processed in accordance with its surface feature type.

Breakline features are always maintained as edges in the tin triangulation.

Triangles – Each triangular facets describes the behaviour of a portion of the tin's surface. The x,y,z coordinate values of a triangle's three nodes can be used to derive information about the facet, such as slope, aspect, surface area and surface length. Considering the entire set of triangles as a whole, it is possible to derive additional information about the surface including volume, surface profiles, visibility analysis, and surface views.

As each facet summarises a certain surface behaviour, it is important to ensure that the sample points are selected adaptively to give the best possible surface fit. A tin surface model can yield poor results if important regions of the surface are undersampled.

Hull – The hull of the tin is formed by one or more polygons containing the entire set of data points used to construct the tin. The hull polygons define the zone of interpolation of the tin. Inside or on the edge of the hull polygons, it is possible to interpolate surface z values, perform analysis, and generate surface displays.

The hull of a tin can be formed by one or more polygons which can be non-convex.

Topology – The topological structure of a tin is defined by maintaining information defining each triangle's nodes, edge numbers and type, and adjacency to other triangles.

For each triangle, TIN records –

1. The triangle number
2. The numbers of each adjacent triangle
3. The three nodes defining the triangle
4. The x, y coordinates of each node
5. The surface z value of each node.

The TIN also maintains a list of all the edges that form the tins hull and information defining the tin's projection and units of measure.

Interpolation of z values

Since it is impossible to store a z value for every location on the surface, TIN uses interpolation to calculate z values at surface locations where no samples have been taken.

Building TIN

Tin surface models can be build from a number of data sources like spot elevations, contours, photogrammetrically collected data, etc.

Slope map of the catchment area has been prepared using the elevation information for the area from contour heights. Toposheets of the scale 1:50,000 were collected for the entire catchment area. These toposheets were then manually pasted together to form a seamless mosaic of the area and the catchment boundary

for the proposed Kol Dam was marked on them. This was done for contours of upto the full reservoir level.

Once the catchment area was marked, all the contours on the toposheet were digitised (40 m interval). The output of the digitisation procedure were the contours as well as points contours in form of x, y & z points. (x, y location and their heights). All this information was in real world coordinates (latitude, longitude & ht. in meters above sea level).

A Digital Terrain Model (DTM) of the area was then prepared, which was used to derive a slope map. The slope was divided in classes of slope percentages.

4.2.2.4 Calculating slope angle and slope length

The catchment area is divided in grids of size 0.0002° in latitude and longitude, thus forming grids of length approximately 20 m X 20 m. The x, y, z for the midpoint of each grid is stored as an attribute. The coordinates x, y refer to the latitude and longitude of the point whereas z refers to the height of the point in meters (above sea level). This information was used to calculate the slope angle and the slope percentage for each grid.

The length of the slope, which is also required for calculation of a parameter in USLE, was calculated as follows:

Since the grid is of app. 20 m length and breadth, average of the minimum slope length (side of grid) and maximum slope length (diagonal of grid) was taken as the average slope length for all the grids.

For the purpose of making slope map of the area, the area was divided in 5 slope classifications as shown below:

0-10%

10-20%

20-30%

30-40%

> 40%

A slope map of the catchment area was prepared using ArcView Spatial Analyst software. It was observed that the catchment area mostly consists of areas of high slope.

4.2.3 SOIL MAP

Published data collected from All India Soil & Land use Survey (AIS&LUS) and ground sampling were used to derive the soil map of the catchment area.

For the preparation of the soil map of the area, AIS&LUS did systematic interpretation of aerial photographs. Soils information was inferred from the photo-elements and converging evidences. A tentative legend was formed as a result of photo-interpretation and traverses were planned for field checks. To begin with, field work was concentrated in the selected representative areas to establish correlation between photo elements and soils and to verify photo interpretation units with ground truth. Photo interpretation legend was consequently refined and finalised. This accomplished, random field checks were made throughout the catchment area to ascertain validity of the mapping units. On an average about 20% of the total surveyed area was subjected to ground checks. The available photographs in the scale of 1:15,000 were used for this purpose. Lack of photographs in the desired scale of 1:50,000 led to increase in the volume

of work. The soil maps obtained from AIS&LUS were mosaiced together manually and digitised. Catchment area was marked on these and the soil texture information was attached to each division of soil type.

The soil map obtained from them was verified by WAPCOS. 40 sampling locations were chosen which were well distributed in the catchment area. Soil samples for each of these locations were collected and analysed for grain size distribution and organic contents present in the soil. The map of the sampling locations was digitised and overlaid on the soil map procured from AIS&LUS. All the sampling locations were marked on the map and have been shown in Fig 4.1 The results of the analyses were used to verify the soil texture in the soil map and necessary corrections were made. The existing soil map was found to be mostly in conformity with the analyzed results. In addition to the analysis of soil samples from the catchment area, Petrography of four rivers sediments samples was also studied which is described below:

Microscopic pictures are shown in Fig 4.2. X-Ray graphs are also appended as Fig 4.3.

Grain size analysis of soil and sediments from the catchment area and organic carbon measured in soil samples are also given

PETROGRAPHY OF RIVER SEDIMENTS FROM KOL DAM PROJECT, HIMACHAL PRADESH

Sample S1

More than 35 mesh size fractions contain quartz, biotite, opaque and very less rock pieces.

a) >60 mesh size fraction contains mainly biotite, quartz, feldspar, rock pieces, and opaque in decreasing order of abundance. Rock pieces include mica gniess, mica schist, quartzite and greenschist (Fig a). Rock pieces and biotite are relatively more.

b) >120 mesh size fraction contains quartz, rock pieces, biotite, amphibole and opaque (Fig. b). The rock pieces include mica schist, mica gneiss, quartzite and greenschist. Rock pieces, quartz and opaque are more than biotite and amphibole

c) >230size fraction consists of quartz, rock pieces, tourmaline, kyanite, zircon, biotite, opaque and feldspar (Fig. c). Quartz and rock pieces are in equal amounts. Opaque and biotite are relatively less. However, heavy minerals are slightly more in this fraction.

d) >270 mesh size contains quartz, feldspar, hornblende, biotite, tourmaline, kyanite, apatite, opaque and rock pieces (Fig. d). Rock pieces and opaque are very less. The heavy and refractory minerals like tourmaline and kyanite are relatively more.

From the sediment petrography, the provenance appears to be from a metamorphic terrain consisting essentially of granite gneiss, mica schist and to some extent amphibolite. In the finer fractions, the heavy minerals are relatively in good amounts than the coarse fraction.

The X-ray analysis of untreated finer clay size fraction reveals the presence of mainly quartz with the possible presence of illite to some extent No other clay minerals are present in the untreated sample.

Sample S2

Sample S2

More than 35 mesh size fractions contain quartz, biotite, opaque and very less rock pieces.

a) >60 mesh size fraction contains mainly rock pieces, quartz, biotite and opaque in decreasing order. Rock pieces include mica gniess, mica schist, quartzite and greenschist (Fig. a). Rock pieces and quartz are relatively more than other minerals.

b) >120 mesh size fraction contains quartz, rock pieces, biotite, amphibole tourmaline and opaque. (Fig. b). The rock pieces include mica schist, mica gneiss, quartzite and greenschist. Rock pieces and quartz are more than other minerals.

c) >230size fraction consists of quartz, rock pieces, tourmaline, amphibole, biotite, opaque, zircon and feldspar (Fig. c). Quartz and rock pieces are in equal amounts. Opaque and biotite are relatively less. However, tourmaline and zircon are slightly more in this fraction.

d) >270 mesh size contains quartz, rock pieces, tourmaline, amphibole, biotite, zircon and opaque (Fig. d). Rock pieces and opaque are very less. The heavy and refractory minerals like tourmaline and zircon are relatively more.

From the sediment petrography, the provenance appears to be from a metamorphic terrain consisting essentially of granite gneiss, mica schist and to some extent amphibolite. In the finer fractions, the heavy minerals are relatively in good amounts than the coarse fraction.

The X-ray analysis of untreated finer clay size fraction reveals the presence of mainly quartz with the possible presence of illite to some extent . No other clay minerals are present in the untreated sample.

Sample S3

More than 35 mesh size fractions contain quartz, biotite, opaque and very less rock pieces.

a) >60 mesh size fraction contains mainly biotite, quartz, rock pieces and opaque in decreasing order of abundance. Rock pieces include mica gniess, mica schist, quartzite and greenschist (Fig. a). Rock pieces and biotite are relatively more.

b) >120 mesh size fraction contains rock pieces, quartz, biotite, tourmaline, amphibole and opaque (Fig. b). The rock pieces include mica schist, mica gneiss, quartzite and greenschist. Rock pieces and quartz are more than other minerals.

c) >230size fraction consists of quartz, rock pieces, tourmaline, kyanite, zircon, biotite, opaque and feldspar (Fig. c). Quartz and rock pieces are in equal amounts. Biotite is relatively less. However, heavy minerals are slightly more in this fraction.

d) >270 mesh size contains quartz, rock pieces, tourmaline, zircon, kyanite, amphibole, biotite and opaque (Fig. d). Rock pieces and opaque are very less. The heavy and refractory minerals like tourmaline, zircon and kyanite are relatively more.

From the sediment petrography, the provenance appears to be from a metamorphic terrain consisting essentially of granite gneiss, mica schist and to some extent amphibolite. In the finer fractions, the heavy minerals are relatively in good amounts than the coarse fraction.

The X-ray analysis of untreated finer clay size fraction reveals the presence of mainly quartz with the possible presence of illite to some extent . No other clay minerals are present in the untreated sample.

Sample S4

More than 35 mesh size fractions contain quartz, biotite, opaque and very less rock pieces.

a) >60 mesh size fraction contains mainly biotite, quartz, feldspar, rock pieces, and opaque in decreasing order of abundance. Rock pieces include mica gniess, mica schist, quartzite and greenschist (Fig a). Rock pieces and biotite are relatively more.

b) >120 mesh size fraction contains quartz, rock pieces, biotite, amphibole and opaque (Fig. b). The rock pieces include mica schist, mica gneiss, quartzite and greenschist. Rock pieces, quartz and opaque are more than biotite and amphibole

c) >230size fraction consists of quartz, rock pieces, tourmaline, kyanite, zircon, biotite, opaque and feldspar (Fig. c). Quartz and rock pieces are in equal amounts. Opaque and biotite are relatively less. However, heavy minerals are slightly more in this fraction.

d) >270 mesh size contains quartz, feldspar, hornblende, biotite, tourmaline, kyanite, apatite, opaque and rock pieces (Fig. d). Rock pieces and opaque are very less. The heavy and refractory minerals like tourmaline and kyanite are relatively more.

From the sediment petrography, the provenance appears to be from a metamorphic terrain consisting essentially of granite gneiss, mica schist and to some extent amphibolite. In the finer fractions, the heavy minerals are relatively in good amounts than the coarse fraction.

The X-ray analysis of untreated finer clay size fraction reveals the presence of mainly quartz with the possible presence of illite to some extent . No other clay minerals are present in the untreated sample.

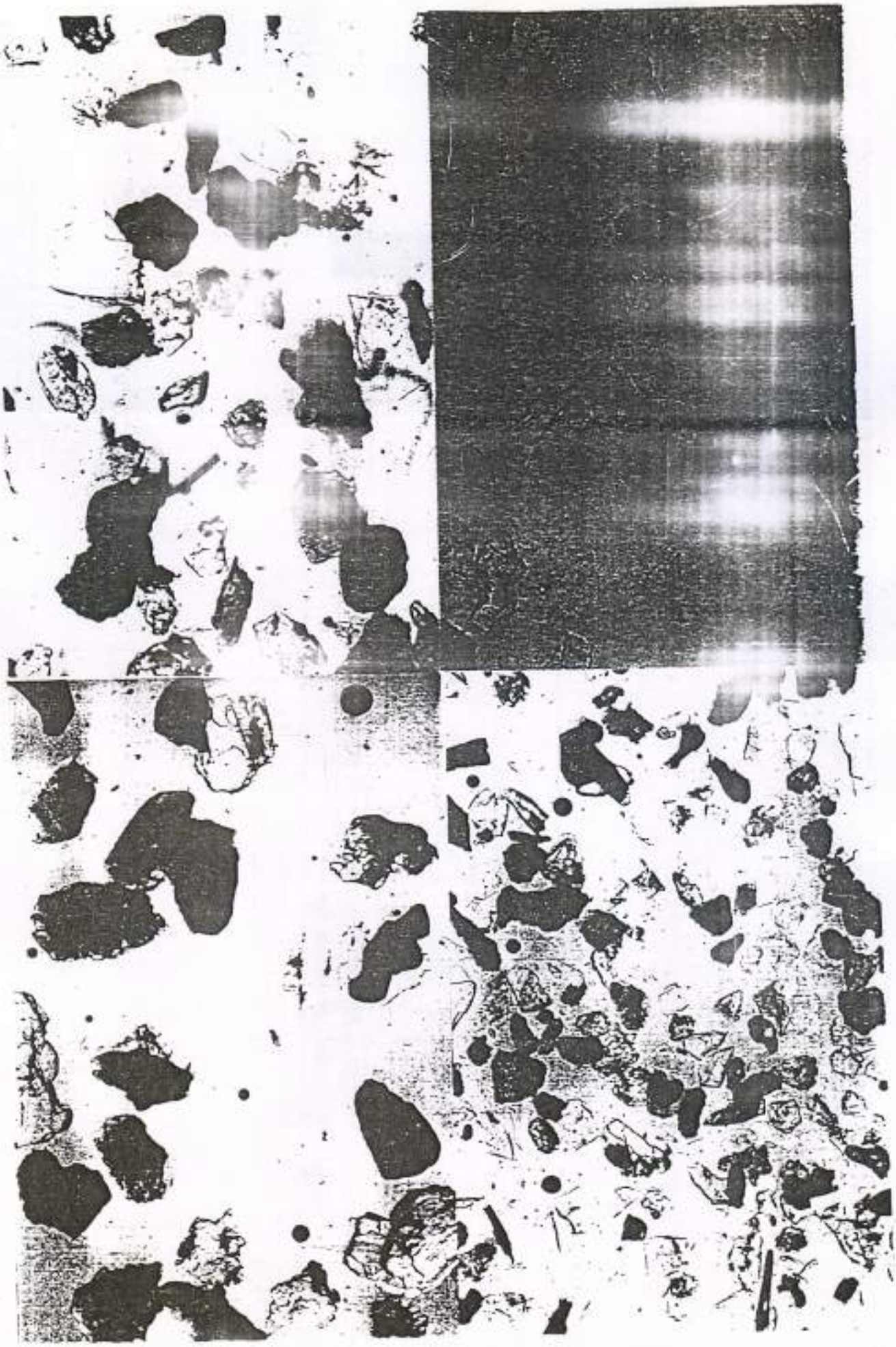


FIGURE – 4-2, 51

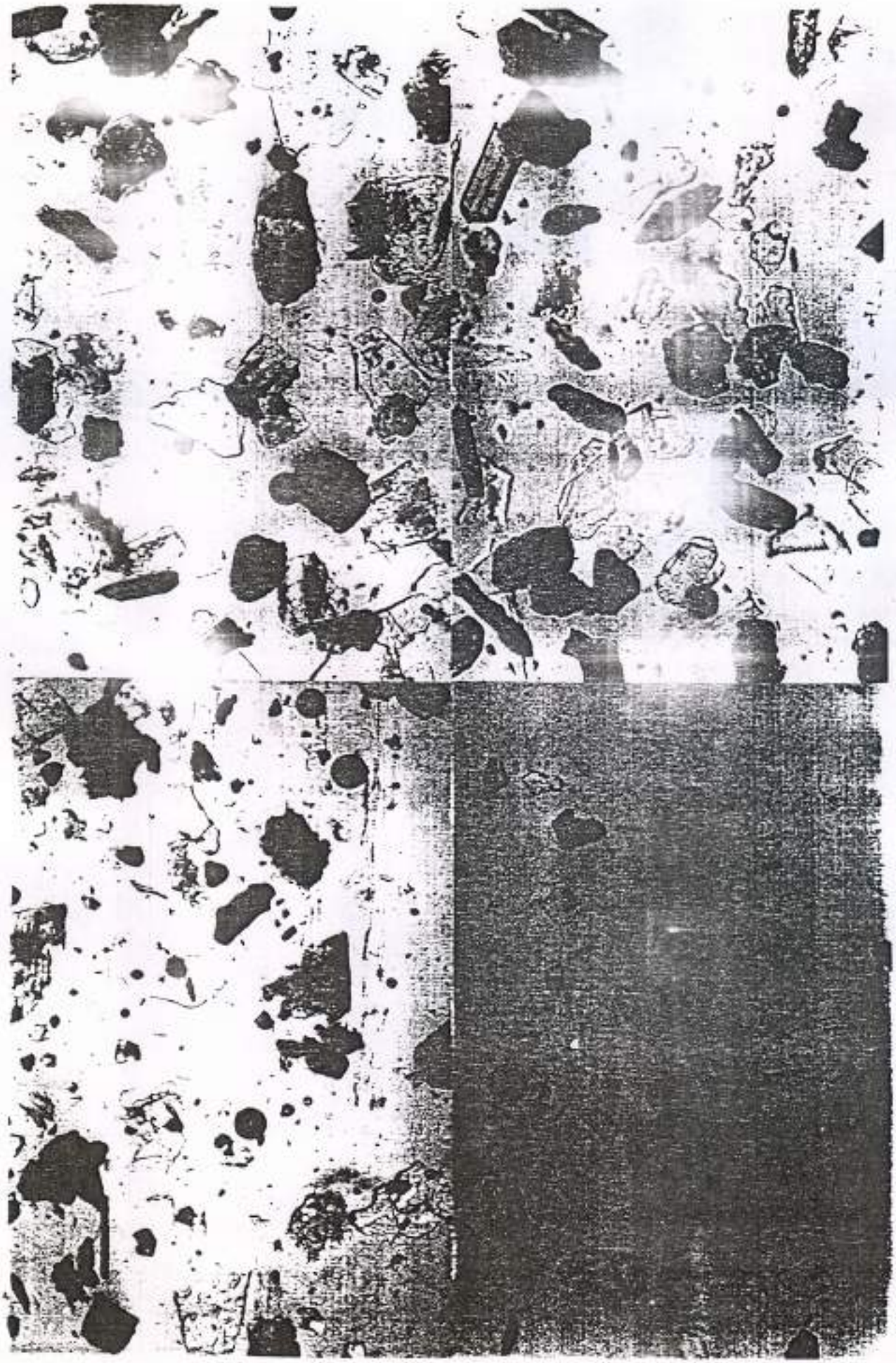
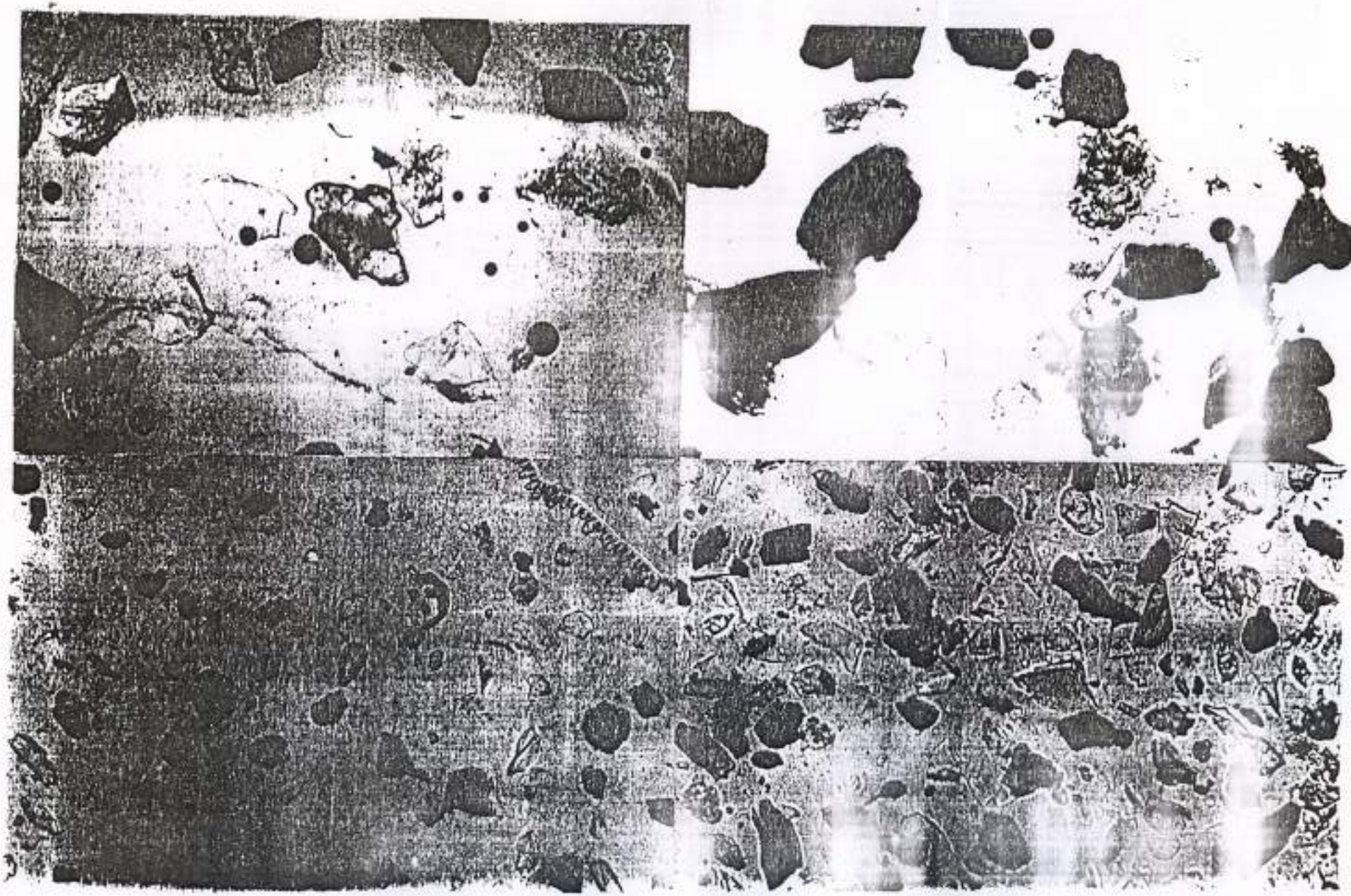


FIGURE - 4.2 a3



Grain Size Analysis of Soil and Sediments from Kol Dam Project, Himachal Pradesh

Grain Size (in Mesh and millimeter – weight in grams)								
Sample No.	10 Mesh 2.00 mm	18 Mesh 1.00 mm	35 Mesh 0.50 mm	60 Mesh 0.25 mm	120 Mesh 0.125 mm	230 Mesh 0.0625 mm	270 Mesh 0.053 mm	Pan < 0.053 mm
A. 1-40 Soil Samples								
1	27.4	19.3	12.4	13.2	12.7	7.3	0.2	7.5
2	28.3	20.9	13.2	14.3	15.7	6.6	0.5	0.5
3	10.6	14.5	16.0	22.4	17.5	9.7	1.3	8.0
4	10.2	15.1	16.1	23.2	17.3	11.0	0.2	6.9
5	9.2	15.1	14.7	18.6	17.5	17.9	3.4	3.3
6	17.3	24.5	18.5	16.7	11.5	5.1	0.3	6.1
7	19.8	19.2	18.8	17.5	14.4	6.5	0.5	6.3
8	28.6	21.8	13.4	14.6	9.8	7.3	1.1	3.4
9	13.5	20.3	20.4	22.4	12.0	4.4	0.2	6.8
10	12.3	12.5	9.9	11.2	16.0	23.4	1.2	13.5
11	17.5	12.2	8.6	7.6	16.5	20.5	0.2	16.9
12	20.5	25.7	16.2	16.3	12.2	7.1	1.5	2.5
13	17.3	28.9	19.0	0.2	25.2	6.7	0.2	2.5
14	26.9	17.4	11.9	12.4	12.4	9.2	0.9	8.9
15	16.9	16.6	14.5	17.6	12.5	10.7	0.3	10.9
16	16.3	15.5	12.1	16.3	14.4	10.2	0.3	14.9
17	15.7	16.4	13.4	2.4	29.8	9.2	0.5	12.6
18	13.5	15.8	13.1	17.7	14.5	14.8	1.2	9.4
19	25.8	19.1	11.9	14.8	14.4	12.4	0.6	1.0
20	18.0	19.3	13.8	4.6	25.8	9.4	1.9	7.2
21	25.1	20.5	12.6	14.7	12.4	11.3	2.0	1.4
22	19.9	15.4	10.4	15.7	17.0	13.9	3.3	4.4
23	23.1	18.7	13.4	7.9	20.7	7.3	0.2	8.7
24	24.8	21.8	15.9	15.9	10.4	8.5	1.3	1.4
25	26.9	15.0	9.5	0.4	27.1	12.0	2.3	6.8
26	22.7	17.4	15.4	19.3	12.6	6.4	0.1	6.1
27	19.4	17.7	15.0	10.6	23.4	6.7	0.1	7.1
28	19.1	19.8	17.0	16.8	12.3	6.5	0.2	8.3
29	20.0	23.3	18.3	16.9	9.4	8.5	0.2	3.4
30	22.0	18.7	14.9	1.1	27.9	7.4	0.5	7.5
31	31.3	15.7	10.5	12.1	12.4	14.6	2.1	1.3
32	20.4	22.7	15.2	2.7	23.0	5.9	0.2	9.9
33	16.3	29.2	18.0	1.2	25.2	7.5	0.2	2.4
34	13.8	20.3	21.3	21.1	11.1	5.4	0.1	6.9
35	18.8	18.1	17.9	16.4	15.5	6.5	0.6	6.2
36	10.2	16.1	17.0	20.3	18.3	11.0	0.2	6.9
37	17.1	21.5	20.3	1.2	27.7	6.4	0.4	5.4
38	22.8	19.0	16.1	13.4	15.4	7.5	0.5	5.3
39	13.2	16.4	19.4	28.2	17.8	4.3	0.2	0.5
40	16.0	19.3	12.8	8.0	23.8	11.0	1.8	7.3
B. Sediment Samples								
S1	---	---	0.1	8.4	54.6	28.9	0.1	7.9
S2	---	---	0.2	4.2	49.8	34.9	0.5	10.4
S3	---	---	0.2	4.6	48.8	34.6	1.4	10.4
S4	---	---	0.1	7.3	53.4	30.6	0.1	8.5

Soil Analysis

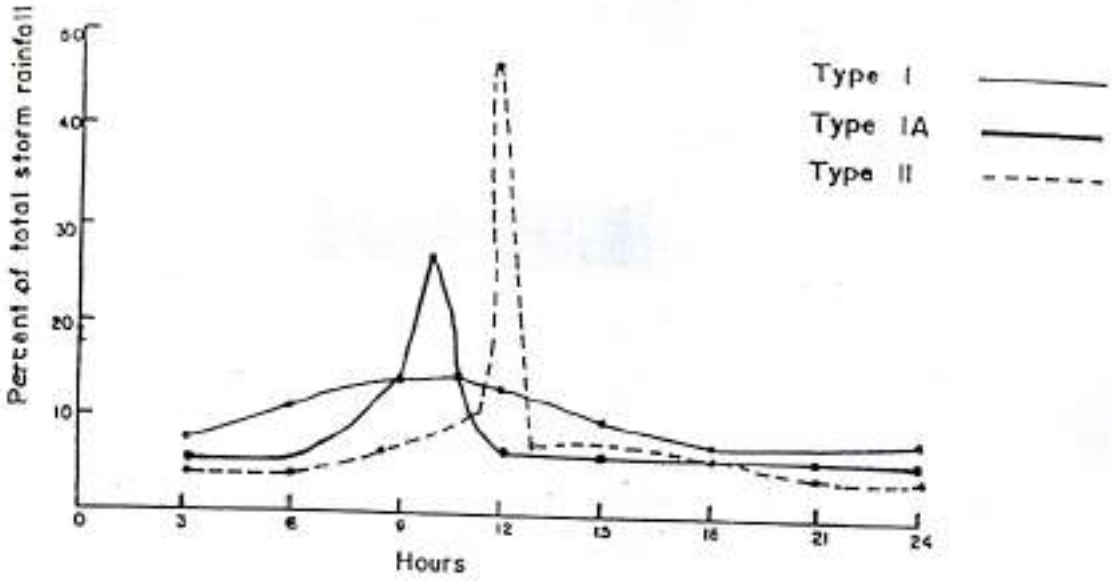
Sample No.	Organic matter
S1	2.23
S2	2.79
S3	2.44
S4	2.08
S5	2.5
S6	3.11
S7	2.93
S8	2.13
S9	3.19
S10	3.60
S11	2.81
S12	3.07
S13	2.12
S14	3.02
S15	3.84
S16	3.81
S17	2.59
S18	2.98
S19	2.82
S20	2.76
S21	1.55
S22	2.34
S23	2.45
S24	2.15
S25	2.77
S26	2.27
S27	3.11
S28	2.37
S29	3.68
S30	3.82
S31	1.01
S32	3.21
S33	2.0
S34	2.69
S35	3.69
S36	3.42
S37	3.35
S38	2.48
S39	2.9
S40	2.36

A corrected soil map was thus prepared. This map was in vector form with polygons having soil texture information attached to them.

4.2.4 Rainfall Erosion Index R

The Rainfall Erosion Index R is a measure of the erosive force and intensity of rain in a normal year. The two components of the factor are the total energy and the maximum 30-min intensity of storms. The rainfall erosion index is the sum of the product of all the major storms in an area during an average year. R should not be considered a precise factor for any given year or location. Its principal value, and that of the soil loss equation itself, is used as a predictive tool and risk evaluator. Construction activities in areas with high R values will require greater attention to erosion control practices than construction in areas with lower R values.

R was calculated by using rainfall data. Results of investigations show that R values could be approximated with reasonable accuracy by using 2 year, 6 hr rainfall data. Regression equations for three different storm types (I, IA and II) are used to calculate R values. A storm type is distinguished by the rainfall distribution within the storm. Type I and IA storms occur in maritime climate. Type II storms are characterised by gradually increasing rainfall followed by a strong peak in rainfall intensity that tapers off to low- intensity rain (refer fig 4.4) Type II storms are the one observed to be occuring in Himalayas.



Time distribution of rainfall within storm types FIGURE–4·4

The differences in peak intensity are reflected in the coefficients of the equations for the rainfall factor. The equation used for a type II storm is

$R = 0.029\ p^{2.2}$,

Where p is the 2 year, 6 hr. rainfall in millimeters.

When the rainfall time distribution curves and the corresponding R value equations are compared it is evident that the stronger the peak intensity of the typical storm, the higher the rainfall erosion index.

4.3 Estimating soil loss with the Universal Soil Loss Equation

Soil conditions are a principal factor in determining the erosion potential at a site. Soil Loss estimates are used for erosion control planning –

1. To identify erosion – prone areas on site
2. To compare the effectiveness of different erosion control practices.

Thus, by estimating soil loss, the erosion Catchment Area Treatment Planner will be able to avoid disturbing highly erodible areas and to select the most effective control measures for a site.

A number of methods for assessing soil loss have been developed. They vary from simple qualitative models to elaborate watershed simulations. Qualitative models rely on subjective evaluation of a series of criteria. Watershed simulation models, empirical models are best suited to estimating erosion from very large areas and lack accuracy for use on small sites such as construction sites.

The Universal Soil Loss Equation (USLE) is an empirical model developed by the U.S. Deptt. of Agriculture (USDA) to estimate sheet and rill erosion from agricultural lands. The equation has been tested worldwide in many countries. Some corrections and assumptions have been made for the various factors according to Indian conditions. Reference for this purpose has been taken from CWC's guidelines for sustainable water resources development & management.

USLE uses the USDA system for classifying the properties of soil. The USDA system of soil classification used by the U.S. soil Conservation Service (SCS) is directed at characteristics of soils important for agricultural uses, such as texture, organic matter and nutrient content. A particle size analyses is necessary before a soil can be classified by using the USDA system.

Four soil characteristics that are important to the use of the universal soil loss equation and that effect erodibility are :-

- Texture
- Organic matter content

- Structure
- Permeability

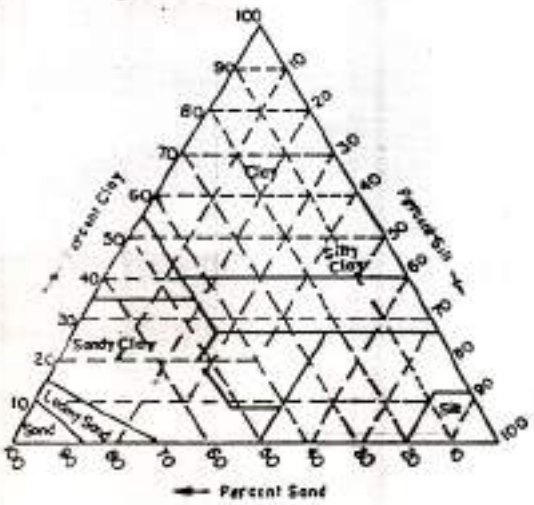
4.3.1 Soil Texture

Soil texture depends on the proportions by weight of sand, silt and clay in a soil, often referred to as the particle size distribution.

USDA Particle Size Classes

Particle Name	Size (mm)
Gravel	Greater than 2
Sand	2 – 0.1
Very fine sand	0.1 – 0.05
Silt	0.05 – 0.002
Clay	Less than 0.002

The above table lists the USDA particle size classes. A triangle is used to present the soil texture names according to particle size content (refer fig 4.5).



Textural classification of soils

FIGURE – 4.5

The percentages of sand, silt and clay in a soil add to 100. Sandy soils generally have a higher permeability than fine-textured soils have. The amount of runoff is lower and since the particles are relatively large, they are not carried far in any runoff that does occur. Sand particles will settle out of runoff at the bottom of a slope or in a channel with a gentle slope.

Silt is the most important particle size class when soil erodibility is evaluated. The higher the silt content, the more erodible a soil is, because silt-sized particles are small enough to reduce the permeability of a soil and are also easily carried by runoff. Control measures should be designed to prevent erosion of silt, or at least to contain it on site.

Clay is the smallest particle size class. A soil with a high clay content tends to be quite cohesive. Runoff does not pick up clay particles as easily as it does silt. However, once clays are suspended in runoff, they will not settle out until they reach a large, calm water body.

It is easiest to prevent erosion of sandy soils, silts are most susceptible to erosion, but they can be recaptured on site by applying control measures. Clays are the most difficult to trap once erosion has occurred, so control measures must focus on preventing their erosion in the first place.

Although, texture is a principal soil characteristic affecting erodibility, organic matter, soil structure and permeability also have a strong influence on erosion potential of soil.

4.3.2 Soil Permeability

Soil permeability refers to the ability of the soil to allow air and water to move through it. Soil texture, structure and organic matter all contribute to permeability. Sites with highly permeable soil absorb more rainfall, produce less runoff, are less susceptible to erosion and support plant growth more successfully.

4.3.3 Using the universal soil loss equation to estimate soil loss

The general form of the universal soil loss equation is

A = R x K x LS x C x P where

A = Soil loss, tons / (acre)/(year)

R = Rainfall erosion index, in 100 ft. tons/acre x in/hr

K = Soil erodibility factor, tons/acre per unit of R

LS = Slope length and steepness factor, dimensionless

P = Erosion control practice factor, dimensionless

The soil loss is an estimated annual average. The rainfall erosion index contains both an energy component and an intensity component. The LS, C and P factors are ratios of soil loss from the site to soil loss from a unit area of a standard plot with the following characteristics –

22.1 m long, 9% slope, tilled, bare soil

To calculate soil loss, each of the factors is assigned a numerical value. The five factors are then multiplied together to produce an estimate of soil eroded from the site in an average year.

Careful evaluation of site characteristics is important to obtain reasonable soil loss estimates. To produce the most accurate estimate of various factors controlling erosion, the entire catchment area has been divided into grids of 0.0002° in latitude as well as longitude.

The methodology used for evaluating these factors and the assumptions made are as follows :

4.3.3.1 Rainfall Erosion Index, R

The equations used to calculate R is –

$R = 0.0219\ p^{22}$ (assuming type II storm as explained earlier)

where p is the 2 – year 6 hr rainfall in mm

Rainfall Data has been collected from Indian Meteorological Department (IMD). The data is for 2 meteorological stations at Mandi and Shimla and is the average rainfall data for the last 40 years. The rainfall intensity has been estimated using the rainfall data averaged over the total number of actual rainy days. Average of the rainfall intensities for Shimla and Mandi has been used.

4.3.3.2 Soil Erodibility Factor, K

The soil erodibility factor K is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Texture is the main factor affecting K but soil structure, organic matter and permeability also contribute. K values range from 0.02 to 0.69.

For Indian conditions, an equation for calculating K value has been formulated in the CWC's guidelines for sustainable water resources development & management'. The equation, derived by using a Triangular Nomograph is as follows –

$$K = 0.07851\ (\%\ \text{sand})^{0.006} \times (\%\ \text{clay})^{-0.1183} \times (\%\ \text{silt})^{0.466}$$

The assumptions made in this equation are

- Content of very fine sands (0.05 to 0.1 mm ≤ 15%
- Organic matter in soil ≤ 2%
- Rock content (% of soil particles greater than 2 mm ≤ 15%)

For the present catchment area, soil testing results shows that these assumptions made are correct and no corrections need to be made in the equation for evaluating K.

4.3.3.3 Length Slope Factor (LS)

The slope length gradient factor LS describes the combined effect of slope length and slope gradient. It is the ratio of soil loss per unit area on a site to the corresponding loss from a 22.1 m long experimental plot with a 9 percent slope. The slope gradient is attached to each grid using the slope map of the catchment area, whereas the slope length for the grid of approx. 20 m length in vertical, as well as horizontal direction,

$$l = \frac{(1+\sqrt{2})20}{2},$$ taking the average slope length for each grid.

$$LS = \frac{65.41 * S^2}{(S^2 + 10{,}000)} + \frac{4.56 * S}{\sqrt{(S^2+10{,}000)}} + 0.065 \quad \frac{l}{72.5}$$

LS = slope length factor

l = slope length (m)

S = slope steepness (%)

m = exponent dependent upon slope steepness

m = 0.2 for slope < 1.0%

0.3 for slope 1-3%

0.4 for slope 3-5%

0.5 for slope >5%

4.3.3.4 Cover Factor C

The cover factor C is defined as the ratio of soil loss from land under specified crop or mulch conditions to the corresponding loss from tilled, bare soil. When the soil is bare, C is 1.0, whereas C for undisturbed native vegetation is assigned a value of 0.01. The value of C used for various landuse class is given as Table--.

Landuse class	Cover Factor,C
Barren land	1
Agricultural land	0.2
Dense vegetation	0.3
Grasslands	0.01
Open Jungle	0.4
Scrubs	0.45
Built-up Area	0.01
Exposed Rock	0.001
Water bodies	0.0001

Landuse class – C factor

- P factor depending on the slope

4.3.3.5 Erosion Control Practice Factor P

The erosion control practice factor P is defined as the ratio of soil loss with a given surface condition to soil loss with up-and-down hill plowing. Practices that reduce the velocity of runoff and the tendency of runoff to flow directly down slope reduce the P factor.

The agricultural land in the catchment area is under Terrace farming. The P factor for Terracing for varying slopes is as follows:

Practice	Land slope (S%)	P
Terracing	1.1-2.0	0.45
Terracing	2.1-7.0	0.40
Terracing	7.1-12.0	0.45
Terracing	12.1-18.0	0.60
Terracing	18.1-24.0	0.70

For non-agricultural lands, the value of P has been taken as 1 as no erosion control practice is being followed in the catchment generally.

Combined effects of LS, C and R factors of the five factors in the USLE, the R, LS and C factors have the widest range. Although R for a site is constant and K is essentially a constant slope length and gradient, cover, and, to a limited extent, surface condition can be manipulated. Slope length and vegetative cover are the most effective and easily implementable measures.

Thus the rate of soil loss for each grid was calculated using USLE. The rate of soil loss obtained has been attached to each grid. The map depicting sil loss in the catchment has been shown in Map 3. Thus knowing the soil erosion intensity, the areas susceptible at different degrees were identified and could aid in formulating the approximate mitigatory measures depending upon the degree of susceptibility to degradation as a part of comprehensive and detailed Catchment Area Treatment Plan for the proposed Kol Dam project. These have been elaborated in subsequent Chapters.

CHAPTER-5

CHAPTER-5

WATERSHED MANAGEMENT – AVAILABLE TECHNIQUES

5.1 Introduction

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

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

Watershed management is defined as the process of formulating and carrying out a course of action involving manipulation of natural, agricultural and human resources of a watershed to provide resource that are desired by and suitable to the watershed community, but under the condition that soil and water resources are not adversely attached.

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

- Engineering measures for erosion control in agricultural land.
- Erosion control measures for non-agricultural lands.

5.1.1 Engineering measures for erosion control in agricultural land

The various measures covered in their category are:

- Contour cultivation
- Contour bunding

- Graded bunding
- Vegetated waterways

Each of the above mentioned measures are explained in the following paragraphs:

5.1.1.1 Contour Cultivation

Cultivation is done across the slope, i.e. by keeping them on contour or nearly so. The contour farm so created would from a multitude of mini barriers across the flow path of the runoff which increase the detention storage in situ. This will in turn increase the opportunity time and hence, the infiltration of rain water into the soil profile, whereby reducing the quantity and velocity of runoff and hence, its erosive potential is greatly reduced. When the ploughing is done along the contour, the ridges alongwith the crops, prevent the movement of water and soil. In case of high rainfall, only a part of the water is conserved and the excess is drained with reduced erosive potential. The effectiveness of contour planting and tillage in erosion control varies with slope, crop cover and soil. Maximum effectiveness of contour cultivation is on medium slopes and on deep permeable soils which are either not prone to surface sealing effect or are protected with suitable cover from surface sealing. The relative effectiveness decreases on the land slopes belong very flat or very steep. The ratios of soil loss from contour cultivated plots to those from up and down cultivated plots on different slopes is given in Table-5.1.

Table-5.1

Effectiveness of contour cultivation on different soil groups

Slope groups (%)	Ratios of soil level of non-contour cultivation/up and down cultivation
<1	0.6
2-7	0.5
7-12	0.6
18-24	0.9

It can be observed from Table-5.1, that contour cultivation remains the most effective on the moderate slopes of 2 to 7%, wherein both on flat or steep slopes, the effectiveness is relatively less.

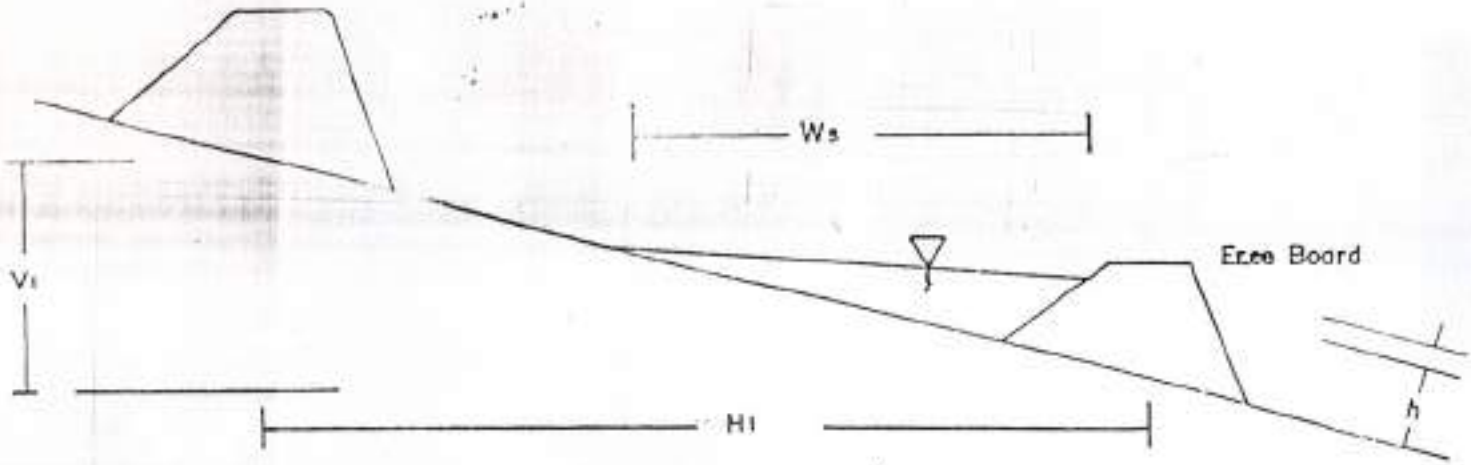
When the bunds are constructed along the contours, with some minor deviation to adopt to field/practical situation, they are termed as contour bunds. If the bunds are constructed with some slope, they are called as graded bund.

5.1.1.2 Contour Bunding

Contour bunding is one of the most popular conservation measure in the country. Studies have shown that contour bunding is useful for permeable soils to serve both as a water and soil conservation measure. This method is unsuitable for soil with poor internal drainage. This method comprises of construction of narrow based trapezoidal embankments on contours and the impounded water is allowed to gradually recharge into the soil profile for crop use. A typical layout of contour bund is given in Figure-5.1.

The planning of contour bunds should essentially consider the determination of spacing between bunds, cross-section of bunds and type and dimensions of surplus systems. The contour bunding is designed based on the empirical formulae. Spacing between bunds is an important factor. The bunds should be ideally spaced in such a way so as to intercept the erosive velocity. The basic philosophy involved in calculating the spacing between two bunds is to keep the velocity of runoff below the critical value.

In order to protect the contour bunds from breaching and also for avoiding damage to the dry land corps due to water stagnation, outlet structures are constructed to drain away the excess water. These structures are usually constructed in the lowest space in a land holding, where, due to the deviation of the contour bund to conform to field boundary,



SPACING OF CONTOUR BUNDS

FIGURE — 5·1

water stagnation occurs which has to be drained away rapidly. If the area to be drained by a proposed weir exceeds 3.5 – 4.0 ha, there is a need for construction of masonry weir in the bund.

Waste weir is located at depressions with the crest of their body walls constructed at 0.3 m above the contour. These are to be constructed in a staggered manner so that they will not cause gullying of field in between the waste weirs.

Various types of weirs are given as below:

Clear overfall weir : is made of masonry wall of a suitably designed length and with a crest of 0.3 m above the contour.

Channel weir : is constructed of a stone wall underground with one end of the bund pitched. It is located at one end of the bund to prevent the nose of the bund getting breached.

Pipe outlet : consists of a RCC or CI pipe of required diameter buried under the bund with downward slope. A vertical wall inlet of requisite height is provided on the upstream side.

Ramp cum waste weir : consists of an earthen bund, generally with its top 22.5 cm above the contour level. It has a very flat side slope of 10% on both upstream and downstream sides.

5.1.1.3 Graded bunding

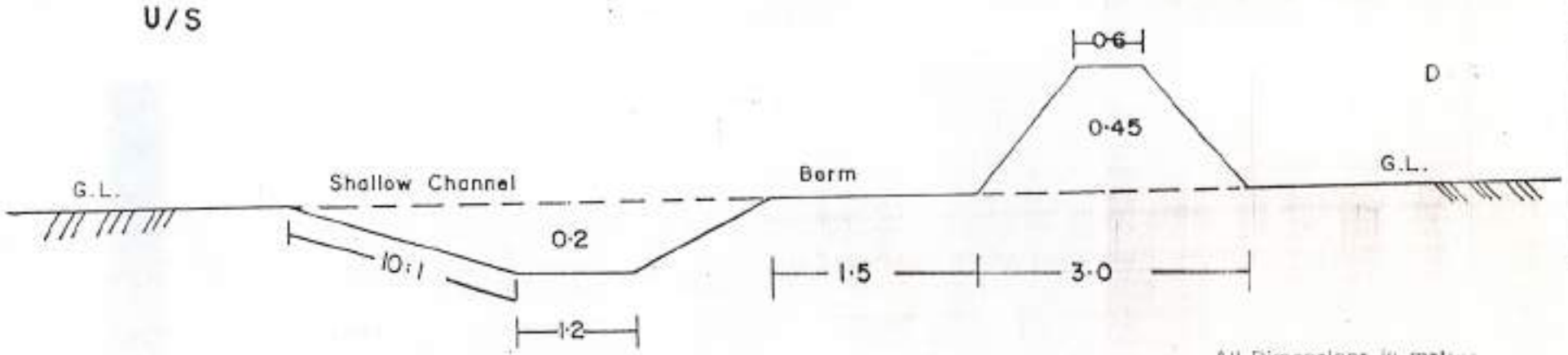
Graded bunding is suitable in relatively high rainfall areas, where the excess water is to be removed safely out of the fields to avoid water stagnation. These are narrow based version of the channel terraces. The objective is to divert the excess water from cropped lands, through suitable outlets which are required to safely remove the water so drained

into them. The excess water to be drained out requires a vegetated waterway for conveyance to a receiving water body. If natural water courses are not available or are located further apart, artificial courses need to be constructed and vegetated one or two seasons ahead of the actual construction of the terraces. If the condition are such that grasses and vegetation cannot to be easily established, or are not sufficient to handle large quantities of water, structural measures like drop structures are required. Drop structures too can be constructed in case of sudden drops in the channel elevation and where velocities of water would be too great to be handled by grass cover. A general layout of the graded bunding is shown in Figure-5.2.

5.1.1.4 Grassed Waterways

Grassed waterways are outlets for channel type of terraces to convey the collected or surface water safely into natural drainage courses without causing gully erosion. Grassed water ways need to be constructed in a natural depression or drainage line where the slope is the flattest in the watershed. Natural slope confines the flow in these natural depressions and moisture conditions are usually most favourable for vegetative growth. If natural grassed waterways are not available, they are artificially constructed and aligned so that they cause minimum obstruction to forum operations.

Normally, grassed waterways are constructed one or two season ahead of the construction of channel terraces and diversion so as to allow for growth of vegetation before the flow of water takes place. Grassed waterways can be constructed in three slopes, i.e. triangular, trapezoidal and parabolic. The parabolic shape is the most common as it is hydrologically most efficient and easy to construct.



CROSS-SECTION OF A TYPICAL GRADED BUND

FIGURE – 5·2

5.1.2 Erosion control measures for non-agricultural lands

The non-agricultural lands requiring implementation of erosion control measures include herbs & scrubs, and open vegetation. These would require the following control measures:

- Afforestation
- Gully control
- Pasture development

5.1.2.1 Afforestation

Afforestation is proposed to be done in open areas with moderate slope. If the area under plantation is gullied, and cut up with natural drainage channels, the planting has to be supplemented with engineering/vegetative works like gully plugging and check dam. The planting area should be closed for grazing, lopping, quarrying, etc. For proper protection, it is necessary that the area is fenced and the fence is maintained properly. It has been generally observed that after some time, these fences get damaged, with the result that plants get grazed and damaged leading to failures. Plants need to be protected till they attain a height, which is above grazing level.

Pits to be dug should be 30 cm x 30 cm x 30 cm size. Planting distance should be 2.5 m x 2.5 m. Preference should be given to fuel and fodder species especially when the planting area is in the vicinity of habitation. On exposed spurs, even Chil tree may also be desirable. Depending upon the locality factors, species suggested for afforestation are

Nursery development

The total area to be afforested as a part of catchment area treatment is quite large. About 1500 saplings are planted per hectare. Thus, a large number of seedlings are required. Many times, it is not possible to provide such a large number of saplings by the Forest Department. Thus, it is necessary to develop nurseries which can produce such a large number of seedlings. The nurseries can be developed and managed by the Forest Department.

Selection of species for planting

The species selected for afforestation should cater to the fodder/forage, fuel wood, timber, etc. The species should fit into the edaphic conditions, climatic conditions and socio-economic realities. In hilly catchments, where the aim is to get maximum yield of usable water in the streamflow, species with low transpiration rate should be selected. Species with leaves containing growth inhibiting substance should be avoided. Mixture of species at plantation site ensures natural resistance to insects, pests and fungi. Mixture of species would be able to fulfil fodder, forage, firewood, food and small timber demands of the community.

Selection of nursery site

The nursery site should be established on a slightly sloping fertile land. Growth of saplings in nursery requires continuous and sufficient source of water supply, hence, the nurseries should be located close to the perennial source of water. Natural or artificial fencing is needed for protection from stray cattle and others. If nursery is close to a road then transportation of seedlings to plantation site would be easy.

The following criteria should be kept in mind for selection of site for raising nursery:

- slightly sloping, fertile land;
- proximity to permanent source of water for irrigation;
- natural or artificial fencing;
- shadow trees in proximity;
- proximity to road for transportation, and
- closeness to plantation site.

Size of nursery

It is important to estimate the number of seedlings to be raised in a nursery. The nursery size can be accordingly estimated. The size of polythene container to be used should also be taken into account. With 25 x 17 cm polythene bags of 150 gauge, usually 1 ha nursery can support 200,000 seedlings.

Preparation of site

The nursery site should be cleaned in preceding winter. The whole nursery should be first ploughed and all stumps, roots, deeper grass roots and stones should be removed. This needs to be done at the end of the rainy season and the land can be kept fallow till the following season. In very light soil, deep working should not be done. Site which needs draining out in the beginning should not be selected. In hilly areas, such as that of the Kol dam catchment, Ridge-ditches are preferable. These are partly filled in trenches. Every species has an optimal spacing, which depends on numerous factors. Wider spacing is recommended for fast growing species. Wider spacing is also recommended when three tiers of vegetation providing fuel, fodder and timber is envisaged.

Soil preparation

The optimal mixture of soil, sand and manure in the nursery soil is 6:3:1 respectively. Use of chemical fertilizers should be as less as possible. Cheaper manures like leaf litter, animal dung and wood ash are also easier to obtain and are quite effective. A cheap nursery manure is made by piling alternate layers, 15-20 cm thick of soil, dung and vegetable matter and covered with a layer of soil 20 cm thick left for a year. When mixed with wood ash, this makes an excellent manure.

Preparation of seed germination beds

Seed beds are prepared just before sowing. Standard beds are of 1x10 m size, rectangular in shape. Sapling from one bed in nursery should be sufficient for plantation in 1 ha.

Time of sowing

Seeds of most species where potted plants are used for planting, are sown between January and March, and those where stumps are required, between May and June.

Transportation of seedlings

The modern nursery practices recommend planting the seedlings at site with ball of earth wrapped around the woodstock. The procedure of transplanting involves transferring of the germinated seedling from primary bed to a container, packed with good mixture of earth. The seedlings establish itself in the polythene bag nurtured by fertile soil and moisture. At appropriate time, the seedlings are transported to the planting site, where they are planted in the pits keeping the earthen ball undisturbed, after removing the polythene film.

Each seedling needs to be carefully separated from its neighbours. If its roots are crushed, or are too long, they are trimmed. The seedling is then placed in the centre of the polybag, already filled with soil and kept moist for some period. The root portion of the soil is gently placed in the hole and the soil is then lightly heaped around the seedling to cover the vacant spaces in the hole and then watered.

Weeding and soil working

The nursery area should be kept free of weeds from the time, the young plants appear till they are finally transplanted. As soon as the beds are full of seedlings, they should be thinned out so as to avoid competition.

Removing the plants from nursery for plantation

The stock is thoroughly watered 24 hours before transport. They are transported with bags, but bags are torn off before planting without disturbing the ball of earth.

5.1.2.2 Gully Control

Due to irregularities of the soil surface, the water is often forced to concentrate in small and shallow canals when rill erosion starts. The flowing water looses the soil particle and carries them away. Gullies are formed when many rills join, which will increase the volume and the erosive power of the water flow.

Gullies can have different shapes. U-shaped gullies are formed where the sub-soil erodes as easily as the top soil. On the other hand, V-shaped gullies are formed when the sub-soil is more resistant to erosion. A combination of both can be observed in soils with a very resistant layer below the surface. In that case, the trapezoidal shaped gully is formed.

In a totally degraded land, gullies can make up for a large part of the area. The objective of reclaiming these gullies is to prevent further erosion. Effective closures and afforestation promotes vegetational growth and retards further growth of gullies. To increase sedimentation to fill up the gully gradually, check dam may have to be constructed where even seasonal water flow is expected. Brushwood plugs and loose stones are some of the typical measures for reclamation of small gullies. There structures trap the sediments so as to gradually silt up the gully.

Larger gullies have to be treated to prevent further deepening and widening. The purpose of a check dam is to reduce the gradient and reduce the flow velocity. The water is guided safely from a higher elevation to a lower elevation without causing erosion at the gully/nallah bed and banks. The water pools behind the dam promotes the percolation into the soils.

The ideal spacing of check dam should be such that the bottom of the upper check dam is in level with the top of the next lower one. In steep areas, this is difficult to achieve, as it may require too many check dams. Check dam must be well anchored to prevent underscouring and scouring between the dam, and the banks. The flow is directed through a water or water spill in the centre of the dam, at the point of impact on the bed, a protective apron must be constructed to dissipate the energy. The various types of check dams recommended in the catchment area of the Kol dam are briefly described in the following paragraphs.

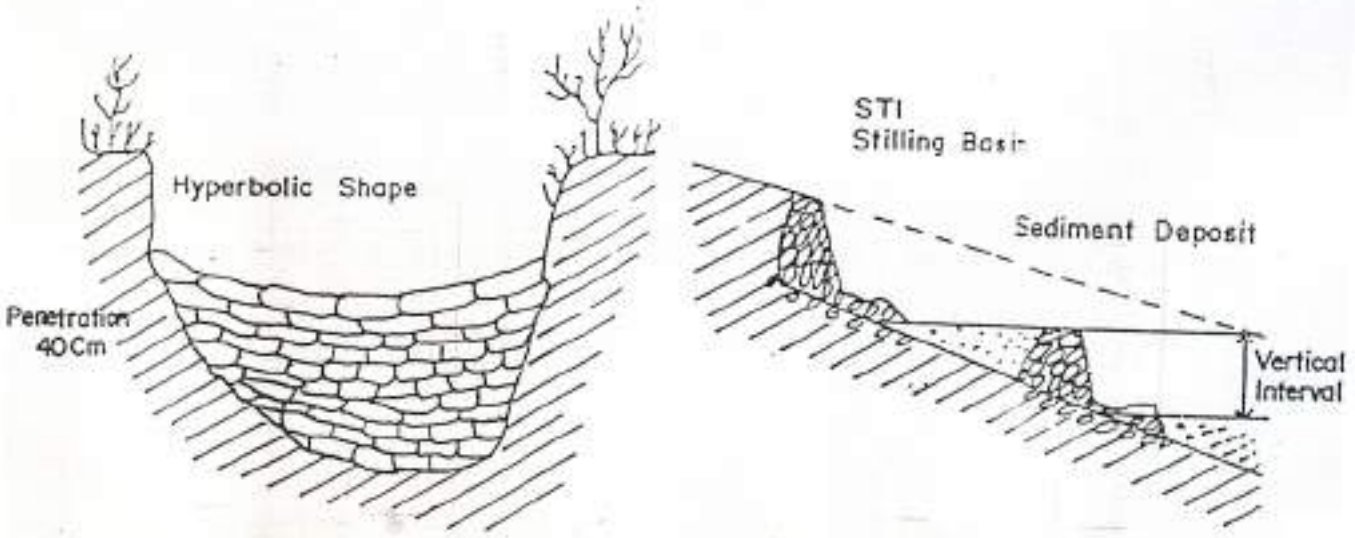
Masonry Check Dam: are the most commonly used structures both in case of larger gullies and small nallahs/stream. These are generally constructed in upper reaches of eroding nallahs to reduce the bed slope, stabilize the grade and check the bed scouring and retain silt, sand and pebbles. Layout of a typical checkdam is given in Fig. 5.3

The depth of the foundation may vary from 30-60 cm. Foundation should be dug across the nallah width extending well into the banks. The largest stones are placed in bottom layers. In every layer of stones, a step of 15 to 20 cm is left on the downstream side, so that the width is reduced from base to top. Two wing walls with appropriate foundations are often constructed at the upper side to force the flow into the water spill or notch and to prevent it from damaging the banks. The wing walls should form an angle of about 30° with the banks. Below the dam an apron has to be constructed with stones. On the upstream side, the dam has to get an earth fill for greater strength. The structure is supplemented by planting seedlings and cuttings of suitable species along the banks on the upstream side. The general layout of Loose stone Check dam and Dry stone dam is given in Fig. 5.4 and 5.5 respectively.

Solid Check dams: In boundary nallahs, the check dams may be constructed of gabion, masonary with matter or concrete. The construction material may vary with the field conditions.

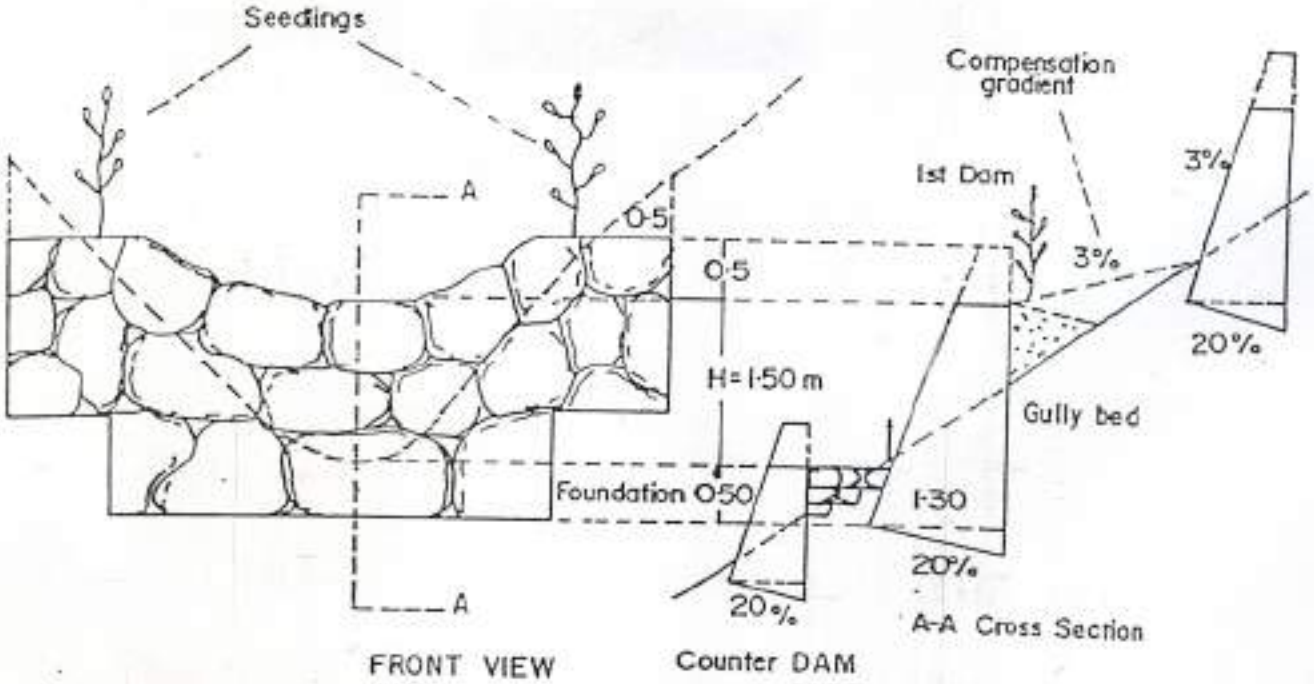
5.1.2.3 Pasture development

The role of grass plants in protecting the soil is based on their ability to prolong the hydrologic cycle from its inception as falling precipitation to its final disposal as runoff in streams. The grasses control water erosion through a three-tier action outlined as follows:



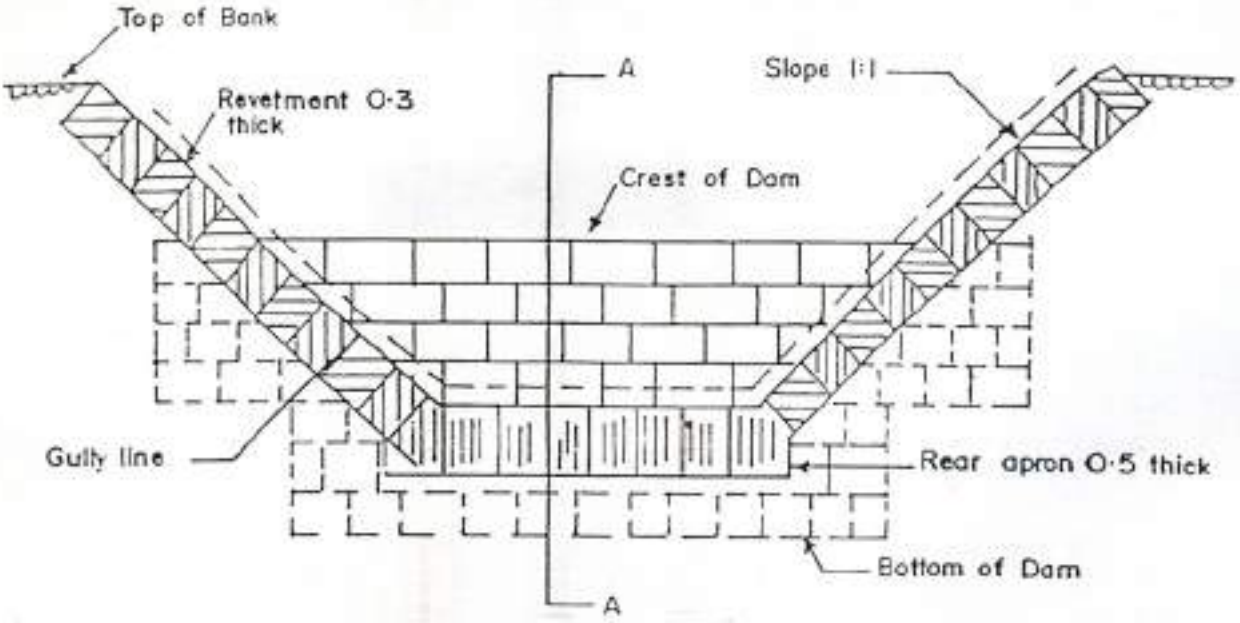
LAYOUT OF A TYPICAL CHECKDAM

FIGURE – 5·3

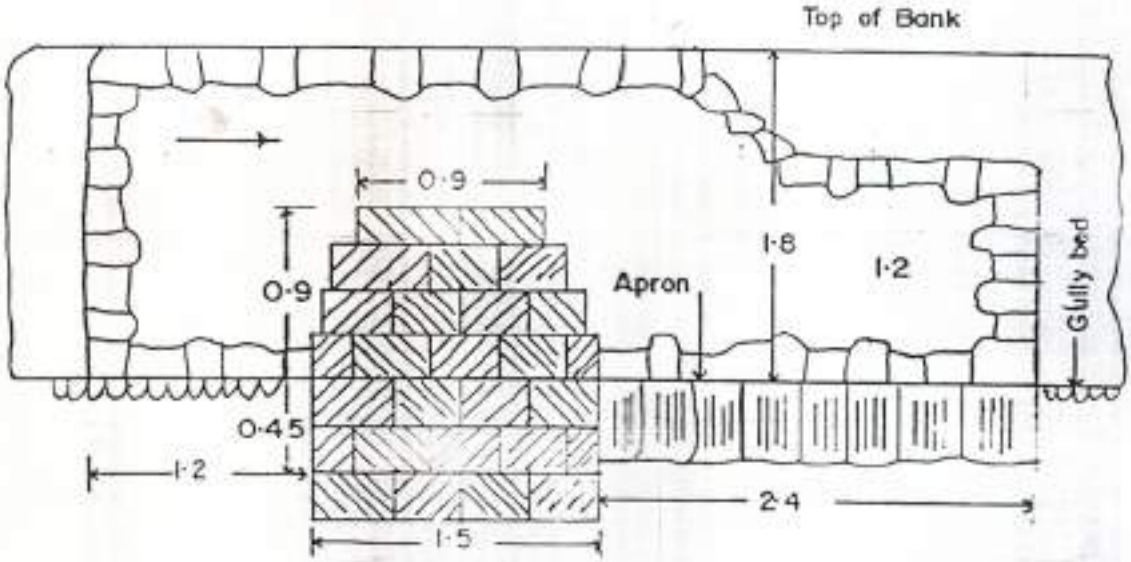


A LOOSE STONE CHECK DAM

FIGURE — 5·4



SECTION ELEVATION



SECTION A-A

DRY STONE DAM

FIGURE – 5·5

- Dense thatched roof action of the leaves and stems of grasses exposing innumerable little surfaces aggregating an area several times greater than that of the ground beneath.
- Grass provides resistance to erosion and runoff constituting mechanical resistance by plant clump, stolom or runners and the protective blanket of litter mass of leaves and fragments of stem in various shapes, stages of disintegration, performing double function of increased surface friction, which reduces volume and velocity of runoff and absorbing a part of water for deeper percolation.
- Knitting and binding effect of grass root and rhizome system protect the soil from detachment and washing. Grass holds the soil particles together and provides a mesh of reinforcement that both anchors the soil and resists the scouring action of water flowing over it.

Management of grasslands

The management of grass requires the use of the vegetation so as to preserve it in its highest state of protection and production. The other major objective of management is the harvesting of the products of the land. Grazing by animals, exerts three important influences, i.e. removal of herbage, dissemination of seed and trampling of soil. Under certain conditions, grazing has a stimulating effect on growth, and as a general rule, if the grazed plants are given sufficient opportunity to make substantial regrowth. Balancing numbers of animals with grazing capacity is probably the biggest and the most serious problem of grassland management.

Grazing capacity is defined as the ability of a grassland unit to give adequate support to a constant number of livestock for a stated period each year without deteriorating with respect to this and/or other proper land use. The effects of grazing will depend largely on the degree to which the forage is utilized. The quantity of herbage left after grazing will govern the growth and development of forage plant roots. The rate of root development depends on the availability of carbohydrates manufactured by plant and not needed immediately from top growth. Heavy grazing reduces surplus carbohydrate production. Those carbohydrates which are produced are primarily needed to replace the parts that have been cropped. The management of grasslands, and the balancing of numbers of animals with grazing capacity cannot be based on individual plants alone but on the aggregate of all the forage producing vegetation. Greater emphasis should be accorded to those species, which furnish a large part of the forage.

These plants should not be grazed beyond their safe limits even through there appears to be considerable ungrazed herbage remaining. Grazing capacity should not include heavy utilization of the less desirable plants because under such a practice, the more desirable and palatable plants will be overgrazed. Considerable herbage from ungrazed or partially grazed plants, left on the ground is important in maintaining or rebuilding good soil and watershed conditions.

In the beginning, before domestic livestock began using the grasslands, the vegetation is undoubtedly in a high stage of development. But with the beginning of grazing by livestock, the grasslands begins to deteriorate. The first impact is that the most palatable and most desirable plants are overgrazed, their growth becomes stunted, the root reserves

are depleted and the roots become shorter and smaller. With continued pressure these desirable plants die leaving some part of the ground surface unoccupied momentarily. This space is soon invaded by seedlings of less desirable types of plants. As the adverse practices continue, the next most desirable types of plants begin to be overgrazed and trampled and they too are forced to give up their places. At this point, and particularly in areas where the animals tend to concentrate, the cover may become insufficient to hold and erosion begins. As soon as the soil begins to move, the deterioration process becomes more rapid and more difficult to stop and soon the grassland is producing very little forage for livestock and is providing very little protection to the soil surface.

Soil conservation techniques in Grasslands

Overgrazing is the primary cause of degradation of grasslands in India. The introduction of proper grazing systems is essential to ensure higher sustained yields of grasses and better growth of animals.

Controlled grazing : is the direct utilization of grassland with livestock in a way that no degradation of vegetation and soil occurs. Controlled grazing can be continuous or in rotation. Continuous grazing needs careful decision on the number and type of livestock to be allowed to graze on a certain area. The maximum number allowed varies during the year, being highest after the rainy season when the soil is dry, but low during the rainy season and especially at the end of dry season. Therefore, additional fodder has to be produced through other sources to overcome shortages in periods of limited access to grassland.

All forms of controlled grazing help to prevent degradation of grassland, to conserve soil, water and vegetation and to provide for better animal feed in amount as well as in quality. Controlled grazing can be done by means of herders controlling livestock by fencing. In both cases, it has to be managed by the farmers.

Early vs deferred grazing: is postponing or delaying grazing, either completely for the entire growing season (early deferment) or for the later part of the growing season (rate department) to enable the vegetation to grow well, maintain its vigour and produce abundant seeds for regeneration of the pasture land. Grazing is allowed after seeding, but may have to be withdrawn to prevent overgrazing and exposure of soil after few months.

Rotational grazing : is the yearly grazing of blocks or compartments in rotation. The objective is to provide an opportunity for vegetation to grow and develop well. The simplest method is to divide the grazing land into two blocks and to allow grazing in alternate years in each block, while in the closed block range improvement is allowed.

Deferred-Rotational grazing : deferment of grazing till after the growing season in the poor and fair range lands is a must for effective recuperation of the vegetation. This method aims at achieving both objectives in one operation. In this system, the grazing area is divided into three blocks and all the blocks are used each year, changing the sequence of grazing in a way that each block is grazed for 1/3 year and protected for 2/3 year. Thus, each block gets deferment once in three years with equal grazing stress in all three blocks during the three year period.

CHAPTER-6

IDENTIFICATION OF AREAS AND TREATMENT MEASURES FOR CAT PLAN

6.1 General

Generally it is not possible to treat all the deteriorated areas in all the catchment simultaneously due to physical and financial constraints. Moreover, some of the deteriorated areas need relatively immediate attention as compared to others. Therefore, it becomes necessary to arrive at some kind of prioritization.

Prioritization of various portions of the catchment areas can be made through weightage to different parameters affecting sediment production and transport. Various parameters normally considered are:

- Areas of watershed.
- Drainage density
- Stream main truck length
- Discharge
- Slope
- Landuse/ land cover
- Sediment production rate
- Erosion intensity

In the present study, the weight to erosion intensity method has been used. A factor of soil erosion of more than 2.5 t/acre/year was considered to arrive at the following areas falling under various intensity zones. However, after discussions with Forest Department, H.P., the criteria for soil erosion was changed to more than 1 t/acre/year in order to bring more areas under CAT.

6.2 Land Use and Slope Analysis:

In order to identify the different measures for soil conservation, land use and slope of the area falling under soil erosion more than 1ton/acre/year have been analyzed. Table 6.1 shows the slope prevailing in the area. Table 6.2 shows the pattern of the land use. Area falling under open forests, barren land and scrubs is around 29,600 Ha. Grassland covers about 2,619 Ha. and agricultural land 1,958 Ha. Dense vegetation has an area of about 12,214 Ha.

Table 6.1: Area under Various Slope Categories for Soil Erosion >1 t/acre/year

Sl. No.	Slope	Area under various landuse categories (ha)	Area under scrubs (ha)
1	<30 deg.	16831	3974
2	30 deg. - 45 deg.	25094	3756
3	45 deg. - 70 deg.	2458	366
	>70 deg.	8	2

Table 6.2: Area under Various Land Use Categories

S. No.	Forest Division	Area under Directly Draining Catchment	Agricultural Land	Dense Vegetation	Open Forest	Barren Land	Scrubs	Grass-lands	Area with Soil Loss > 1t/ac/yr.
1	Bilaspur	2,316	10	241	183	188	119	0	798
2	Karsog	38,339	775	3477	3490	2,691	2,895	1,008	14336
3	Kunihar	13,252	96	1017	1,725	1,217	620	165	4840
4	Shimla	43,533	575	5098	4433	2,909	3,026	1,000	17041
5	Suket	15,910	428	1,613	749	2,424	950	324	6567
6	Nachan	1,325	10	337	183	77	55	24	665
7	Theog	7,293	64	431	464	769	433	98	2144
	TOTAL	**121,968**	**1,958**	**12,214**	**11,227**	**10,275**	**8,098**	**2,619**	**46,391**
			Total		**29600**				

6.3 CAT Measures:

As mentioned in 6.1, initially WAPCOS worked out the CAT Plan based on soil erosion rate of more than 2.5 t/acre/year. With this criteria, most of the directly draining catchment was under low erosion category, requiring no treatment. The area under moderate and high erosion rates were estimated as 3,987 ha and 188 ha respectively. The total treatment area covered was 4,175 ha (Table 6.3). However, after discussions with officials of Forest Department of Himachal Pradesh, the CAT Plan was reworked based on soil erosion rate of more than 1t/acre/year. It has been worked out that an area of 46,391 ha is falling under this modified criteria (Table 6.2).

Land use as shown in Table 6.2 has been considered while suggesting the type of treatment measures. Only the areas having dense vegetation have been excluded from treatment. Hence a Total Area of 34177 Ha. is to be treated out of which a total of 2000 Ha will be treated separately under Reservoir Rim Plantation. The area having open forests, barren land and scrubs amounting to about 29600 Ha. will be covered by afforestation, check dams and reservoir rim plantation. Grassland (2619 Ha.) and Agricultural land (1958 Ha.) as given in Table 6.2 have been considered for Pasture Development and Terracing / Soil and Moisture Conservation (Table 6.3) under CAT plan measures.

The vast experience of the Forest Department in implementation of CAT Plan was considered for catering to the overall requirement of conservation of soil. A total area of 32,177 ha was brought under the revised CAT measures. The detail of Treatment Measures are given in the Annexure I to V and are depicted in the Map – I.

In addition to the above, 20,000 check dams of various dimensions were considered. These check dams will be constructed based on appropriate technologies and availability of materials. The check dams will be constructed on the tributaries and sub-tributaries of Sutlej river. After detailed discussions with State Forest Department, it was decided that the location of the check dams will be chosen by the Forest Department based on their field experience.

The location of check dams will have to be selected in such a way that minimum area of catchment for each check dam will be at least 0.5 ha. for small dams, 1 ha. for medium dams and 2.5 ha. for big dams. Under this circumstances, the minimum area of catchment for 20,000 check dams from where the sediments will be arrested is about 16,000 Ha.

Table 6.3: Details of Areas under Various Treatment Measures

S. No.	Measures	Area (ha) considered under Soil erosion > 2.5 t/acre/yr	Area (ha) considered under Soil erosion > 1 t/acre/yr
1.	Afforestation	1,600	11,600
2.	Pasture Development	900	2,619
3.	Contour bunding	1,100	----
4.	Graded bunding	575	----
5.	Terracing / Soil and Moisture Conservation measures	----	1,958
	Total	4,175	16,177
6.	**No. of Check Dam**	10 Nos. (Large Size Dams)	20,000 Nos. (of various sizes, covering an area of 16,000 Ha.)
	Total Area Covered Under Treatment		**32,177 Ha.**
7.	Reservoir Rim Plantation*		2,000

* Reservoir Rim Plantation will be taken up separately.

The number of check dams is indicative and keeping the overall area of control under these check dams the number of big, medium and small dams may vary depending on the site requirement. The detail of Check Dams Division wise / Range wise are given in Table 6.11(a), 6.11(b), 6.11(c).

Originally, contour and graded bunding were also suggested as treatment measures. However, Forest Department opined that in Himachal Pradesh, these may not be preferred alternatives in view of the terrain conditions and therefore, graded and contour bunding have been deleted as treatment measures. Instead, terracing and Soil and moisture conservation has been proposed in agricultural area as per the site requirement.

The implementation of the CAT Plan by Forest Department, H.P. will take 6 years and the maintenance period will be spread over subsequent 5 years. It has been expressed by the Forest Department H.P. that action plan identifying the actual location for providing treatment and their prioritization will be undertaken by the Department itself depending on their experience in the field.

In order to ensure participation of local people in the implementation of CAT Plan and to strengthen the monitoring and evaluation mechanism, certain activities pertaining to Forest Infrastructure Development and Rural Infrastructure have been proposed. (Table 6.10, 7.2 and

Annexure IV and V). These activities are in addition to afforestation, pasture development, soil conservation works on forestland and terracing/ soil and moisture conservation on private land. All the proposed activities are based on site requirement in the catchment.

6.4 Prioritization

As explained in 6.3 above, the treatment measure are to be completed in six years. The area to be treated under each phase is given below in Table 6.4.

Table 6.4: Areas to be treated in Successive Years

Year	Area (ha)
I	4070
II	5984
III	8258
IV	5105
V	4380
VI	4380
Total	**32177**

In addition to the above, 2,000 Ha around the rim of the reservoir will be afforested separately. Hence, total area of treatment is considered as 34,177 Ha. Year-wise break-up of activities is given in Table 6.5. The areas to be treated under various treatment measures in different years are given in Table 6.6 to 6.11(a), 6.11(b), 6.11(c).

6.5 ECOLOGICAL ASSESSMENT OF FOREST AREAS UNDER KOL DAM HYDRO-ELECTRIC PROJECT

Plant communities are basically indicators of the total environment. They respond not only to one environmental factor but to interacting group of factors. Plant communities integrate these influences and react sensitively to change in balance of the environmental stresses being primary producers in the ecosystem. With time these plants communities bring lot of changes even in soil system. Plenty of awareness has been generated recently on the conservation of biodiversity because of the current decline of biodiversity, which is mainly due to the unplanned activities. Efforts therefore, are eventually required to conserve this biodiversity at all levels. Detailed knowledge of the diversity of the area will be helpful in managing the catchment properly by developing in situ and ex-situ conservation practices. Therefore ecological assessment of forest areas in the catchment has been proposed and Rs. 10 lacs have been earmarked for this purpose. Himalayan Forest Research Institute of India Council of Forestry Research and Education, Panthaghati (Shimla) is pioneer for such activities and is suggested for undertaking the proposed studies.

Table 6.5: Areas to be treated with Various Measures in Successive Years

Treatment Measures	Area (Hectare)						
	Year I	Year II	Year III	Year IV	Year V	Year VI	Total
Afforestation	1,600	1,900	2,100	2,000	2000	2000	**11,600**
Pasture Development	390	525	698	406	300	300	**2,619**
Terracing / Soil & Moisture Conservation measure	0	519	820	619	0	0	**1,958**
Check Dams							
Big Size (No.)	200	600	600	200	200	200	**2,000**
(area covered)	160	480	480	160	160	160	**1,600**
Medium Size (No.)	400	1200	1200	400	400	400	**4,000**
(area covered)	320	960	960	320	320	320	**3,200**
Small Size (No.)	2000	2000	4000	2000	2000	2000	**14,000**
(area covered)	1600	1600	3200	1600	1600	1600	**11,200**
Total area	**4,070**	**5,984**	**8,258**	**5,105**	**4,380**	**4,380**	**32,177**

6.6 DOWN STREAM TREATMENT

Eleven dumping sites have been identified by NTPC for dumping of excavated material. These are indicated on map enclosed as Annexure -VII. Eight dumping sites are upstream and on completion of the dam construction, these will form part of dead storage of the reservoir and the muck will not flow into the downstream of Satluj river. Therefore, no treatment is required for the upstream dumping sites except for the retaining structures and leveling etc., which will be carried out by NTPC. Three dumping sites identified in the downstream comprise of 2.8, 3.5 and 7.6 hac. area respectively. NTPC will under take all adequate rehabilitation measures to mitigate the adverse environmental effect as a result of dumping.

As per the approval of Ministry of Environment and Forests, Government of India conveyed vide letter No.3/84/79-HCT-Env.IA (copy enclosed as Annexure VI), the proposal of dumping has been approved subject to following conditions: -

1. Dumping site of excavated material should be rehabilitated by leveling, filling up of burrow pits, landscaping and properly afforested with suitable plantation.

2. A retaining wall should be provided at all the proposed emergency dumping sites, which are located in between road and river to prevent material going into the river.

To comply the above conditions, NTPC has earmarked Rs.50 Lacs for undertaking various rehabilitation measures including planting of dumping sites.

In addition to above, afforestation and soil conservation measures around the dumping sites have been proposed to counter the adverse effects of the project activities. The afforestation works has been proposed in the downstream up to National Highway-21. The detail of the

areas identified for afforestation are as under: -

Table 6.6 Down Stream Treatment Areas

Name of division	S. No	Name of area	Area (Ha)
Bilaspur	1	DPF Chamyon	20
	2	DPF Jamthal C-2(a)	18
	3	DPF Jamthal C-2(b)	12
	4	UPF Jamthal	15
		Total	**65**
Suket	1	DPF Dhawal	10
	2	UPP Dhawal	5
	3	DPF Sanali	10
	4	DPF Padhana	5
	5	UPF Padhana	5
		Total	**35**
	Down Stream Treatment Areas Total		**100**

The soil conservation works will also be restricted to the above areas as per the site requirement. The proposed afforestation and soil conservation works on account of Downstream Treatment in the CAT Plan have been shown in the Map-1 enclosed, the cost details amounting to Rs. 0.671 Crores are given in table 7.3(i) :-

Table 6.7: Division wise Areas for Afforestation in Successive Years

Forest Division	Area (Hectare)						
	Year I	Year II	Year III	Year IV	Year V	Year VI	Total
Karsog	411	544	703	921	410	462	3451
Theog	83	116	119	259	124	125	826
Nachan	0.00	33	47	55	55	0	190
Shimla	604	644	754	512	649	650	3813
Suket	325	249	262	87	406	407	1736
Bilaspur	13	28	16	26	26	26	135
Kunihar	164	286	199	140	330	330	1449
Total	**1600**	**1900**	**2100**	**2000**	**2000**	**2000**	**11600**

Table 6.8: Division wise Areas for Terracing / Soil and Moisture Conservation in Successive Years

Forest Division	Area (Hectare)						
	Year I	Year II	Year III	Year IV	Year V	Year VI	Total
Karsog	0.00	200	300	275	0.00	0.00	775
Theog	0.00	09	55	0.00	0.00	0.00	64
Nachan	0.00	0.00	0.00	10	0.00	0.00	10
Shimla	0.00	200	260	115	0.00	0.00	575
Suket	0.00	100	159	169	0.00	0.00	428
Bilaspur	0.00	0.00	0.00	10	0.00	0.00	10
Kunihar	0.00	10	46	40	0.00	0.00	96
Total	0.00	519	820	619	0.00	0.00	1958

Table 6.9: Division wise Areas for Pasture Development in Successive Years

Forest Division	Area (Hectare)						
	Year I	Year II	Year III	Year IV	Year V	Year VI	Total
Karsog	160	232	256	125	119	116	1008
Theog	0	36	13	27	11	11	98
Nachan	0	0	0	24	0	0	24
Shimla	150	163	318	125	121	123	1000
Suket	80	58	76	45	32	33	324
Bilaspur	0	0	0	0	0	0	0
Kunihar	0	36	35	60	17	17	165
Total	390	525	698	406	300	300	2619

Table 6.10: Division wise Expenditure of Rural and Forest infrastructure

Forest Division/ Circle	Cost in Crores Rs.						
	Year I	Year II	Year III	Year IV	Year V	Year VI	Total
Karsog	0.370	0.370	0.371	0.371	0.271	0.256	2.009
Theog	0.100	0.100	0.100	0.023	0.000	0.000	0.323
Nachan	0.000	0.015	0.000	0.000	0.000	0.000	0.015
Shimla	0.421	0.422	0.421	0.422	0.422	0.272	2.38
Suket	0.200	0.200	0.200	0.200	0.119	0.160	1.079
Bilaspur	0.000	0.063	0.000	0.000	0.000	0.000	0.063
Kunihar	0.148	0.148	0.148	0.148	0.147	0.147	0.886
Bilaspur Circle	0.150	0.000	0.000	0.000	0.000	0.000	0.150
Total	1.389	1.318	1.24	1.164	0.959	0.835	6.905

Table 6.11(a) : Nature of Check Dam

Name of Division	Nature of Check Dams (Nos.)			
	Big	Medium	Small	Total
Bilaspur	35	70	225	330
Shimla	730	1460	5110	7300
Kunihar	235	470	1650	2355
Nachan	15	30	115	160
Karsog	625	1250	4365	6240
Theog	105	210	735	1050
Suket	255	510	1800	2565
Total	**2000**	**4000**	**14000**	**20000**

Table 6.11(b) : Details of Check Dams Division wise

Forest Division	Area (Hectare)						
	Year I	Year II	Year III	Year IV	Year V	Year VI	Total
Karsog	811	1186	1810	811	811	811	**6240**
Theog	136	200	305	136	137	136	**1050**
Nachan	22	29	47	20	21	21	**160**
Shimla	949	1388	2117	948	949	949	**7300**
Suket	334	486	743	334	334	334	**2565**
Bilaspur	42	64	95	44	42	43	**330**
Kunihar	306	447	683	307	306	306	**2355**
Total	**2600**	**3800**	**5800**	**2600**	**2600**	**2600**	**20000**

Table 6.11(c): Detail of Check Dams Division and Range wise

		Big Dams							Medium Dams							Small Dams						
Division	Range	I-Year	II-Year	III- Year	IV-Year	V- Year	VI-Year	Total	I-Year	II-Year	III- Year	IV-Year	V- Year	VI-Year	Total	I-Year	II-Year	III- Year	IV-Year	V- Year	VI-Year	Total
Bilaspur	Sadar	3	11	10	4	3	4	35	7	21	21	7	7	7	70	32	32	64	33	32	32	225
Shimla	Mashobra	11	33	33	11	11	11	110	24	72	72	24	24	24	240	107	107	214	108	107	107	750
	Dhami	9.0	27.0	27.0	9.0	9.0	9.0	90.0	17.0	51.0	51.0	17.0	17	17	170	95	94	189	94	94	94	660
	Taradevi	9.0	27.0	27.0	9.0	9.0	9.0	90.0	17.0	51.0	51.0	17.0	17	17	170	100	100	200	99	100	100	699
	Bhajji	44.0	132.0	132.0	44.0	44.0	44.0	440.0	88.0	264.0	264.0	88.0	88	88	880	428	430	857	428	429	429	3001
	Total	73.0	219.0	219.0	73.0	73.0	73.0	730.0	146.0	438.0	438.0	146.0	146	146	1460	730	731	1460	729	730	730	5110
Kusihar	Darlaghat	23.0	70.0	71.0	24.0	24.0	23.0	235.0	47.0	141.0	141.0	47.0	47	47	470	235	236	471	236	235	236	1650
Nachan	Seraj	2.0	4.0	4.0	2.0	1.0	2.0	15.0	3.0	9.0	9.0	3.0	3	3	30	17	16	34	15	17	16	115
Karsog	Karsog	23.0	69.0	69.0	22.0	22.0	22.0	227.0	39.0	117.0	117.0	39.0	39	39	390	117	117	234	118	118	118	822
	Seri	14.0	44.0	45.0	14.0	15.0	14.0	146.0	32.0	98.0	98.0	33.0	33	33	327	196	196	392	195	194	195	1368
	Magru	8.0	20.0	20.0	8.0	8.0	8.0	72.0	9.0	26.0	26.0	9.0	9	9	88	36	37	73	36	36	36	254
	Pangna	18.0	54.0	54.0	18.0	18.0	18.0	180.0	45.0	134.0	134.0	44.0	44	44	445	274	274	548	275	275	275	1921
	Total	63.0	187.0	188.0	62.0	63.0	62.0	625.0	125.0	375.0	375.0	125.0	125	125	1250	623	624	1247	624	623	624	4365
Theog	Theog	10.0	32.0	32.0	10.0	11.0	10.0	105.0	21.0	63.0	63.0	21.0	21	21	210	105	105	210	105	105	105	735
Suket	Kangoo	12.0	35.0	35.0	12.0	12.0	12.0	118.0	24.0	72.0	72.0	24.0	24	24	240	118	161	200	118	118	118	833
	Zhungi	14.0	42.0	41.0	13.0	13.0	14.0	137.0	27.0	81.0	81.0	27.0	27	27	270	139	95	314	140	140	139	967
	Total	26.0	77.0	76.0	25.0	25.0	26.0	255.0	51.0	153.0	153.0	51.0	51	51	510	257	256	514	258	258	257	1800
G.Total		200.0	600.0	600.0	200.0	200.0	200.0	2000.0	400.0	1200.0	1200.0	400.0	400	400	4000	2000	2000	4000	2000	2000	2000	14000

CHAPTER-7

CHAPTER – 7

COST ESTIMATES

7.1 Total Expenditure

The total expenditure on Catchment Area Treatment is Rs. 65.23 crores including maintenance of plantations, over-head charges and development of wildlife, the details are given in Table 7.1.

The final cost of Rs. 65.23 crores has been arrived at after discussions with the Central and State Govt. Officials held at Mandi, Chandigarh and Shimla. The yearwise expenditure to be incurred for implementation of CAT Plan is shown in Table 7.2.

7.2 Maintenance and Administrative Charges :

The tentative period for implementation of CAT plan has been proposed for six years. Maintenance will continue thereafter for 5 years, especially for afforestation and pasture development. Unit rate for each activity for successive years has been calculated based on 6% increase over the unit rate for previous year.

For implementation of CAT measures, provisions for Vehicles, Computer, Fax and Xerox have also been made which are to be provided by the user agency from and through its budgetary mechanism. In addition to this, administrative charges @ 0.25 % on total capital expenditure have been provided. The details of the cost provisions under these heads have been presented in Table 7.1 and Table 7.2.

7.3 Division wise Expenditure

Expenditure for each division for implementing the CAT Plan has been worked out. It is found that highest areas fall in Shimla and Karsog Divisions and as such 20.564 and 19.153 Crore respectively have been allotted to them. Bilaspur and Nachan forest divisions will have the smallest areas falling in the Catchment and as such 0.696 and 0.685 Crores respectively have been allotted for them.

Year wise expenditure of each forest division for each activity under CAT measures have also been worked out and presented in Table 7.3.

Table 7.1 Cost for implementation of CAT Plan for Kol Dam Hydro-electric Power Project				
Revised CAT Plan for Area with Soil erosion > 1 T/acre/year				
	Treatment	**Area Ha.**	**Rate(Rs /Ha/ No.)**	**Cost Rs (Cr.)**
A	Afforestation	11600	17000-20250	23.051
B	Pasture Development	2619	8000-9530	2.396
C	Terracing/Soil and moisture conservation	1958	30000-33700	6.251
D	Check Dam-:- Big (No.)	2000	20000-23820	4.537
E	Check Dam Medium (No.)	4000	8000-9530	3.630
F	Check Dam-:- Small (No.)	14000	4000-4765	6.479
H	Otheractivities (infra Str. Forest and Rural)			6.905
I	Maint.:- Afforestation	11600	5985	6.943
J	Maint.:-Pasture	2619	2870	0.752
		Sub Total		**60.942**
K	Downstream treatment			
(i)	Afforestation	100	20250	0.203
(ii)	Maintenance	100	5985	0.060
(iii)	Soil conservation			0.408
		Sub. Total		**0.671**
L	Ecological Assessment of Plant Biodiversity			0.100
M	Vehicle 12 No.			0.600
N	Fax/Xerox/Computer			0.180
O	Maint Fax etc			0.140
P	Wildlife Development			2.000
Q	Wildlife maintenance			0.600
		Sub. Total		**3.620**
	Grand Total			**65.233**

Note:- (I) Infrastructures indicated above in column M and N will be provided by user aganecy from and through their budgetary mechanism

(ii) Budgetary provision for Wild Life Management and maintenance shown above in column P and Q will be utilized based on Management Plan to be prepared by wild life wing and approved by Pr CCF, HP

Table 7.2 Yearwise Expenditure for implementation of CAT Plan for Kol Dam Hydro-electric Power Project

	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	1600	17000	2.720	1900	18020	3.424	2100	19100	4.011	2000	20250	4.050	2000	21470	4.294	2000	22760	4.552	23.051
Pasture Development	390	8000	0.312	525	8480	0.445	698	8990	0.628	406	9530	0.387	300	10100	0.303	300	10700	0.321	2.396
Terracing/Soil and moisture conservation	0			519	30000	1.557	820	31800	2.608	619	33700	2.086	0	0	0.000	0	0	0.000	6.251
Check Dam-:- Big (NO)	200	20000	0.400	600	21200	1.272	600	22470	1.348	200	23820	0.476	200	25250	0.505	200	26770	0.535	4.537
Check Dam Medium (No)	400	8000	0.320	1200	8480	1.018	1200	8990	1.079	400	9530	0.381	400	10100	0.404	400	10710	0.428	3.630
Check Dam-:- Small (No)	2000	4000	0.800	2000	4240	0.848	4000	4495	1.798	2000	4765	0.953	2000	5050	1.010	2000	5350	1.070	6.479
Otheractivities (infra Str. Forest and Rural)	0		1.389			1.318			1.240			1.164			0.959			0.835	6.905
Maint.:- Afforestation	1600	5985	0.958	1900	5985	1.137	2100	5985	1.257	2000	5985	1.197	2000	5985	1.197	2000	5985	1.197	6.943
Maint.:-Pasture	390	2870	0.112	525	2870	0.151	698	2870	0.200	406	2870	0.117	300	2870	0.086	300	2870	0.086	0.752
Downstream treatment																			
Afforestation										100	20250	0.203							0.203
Maintenance										100	5985	0.060							0.060
Soil conservation		Lump Sum										0.408							0.408
Ecological Assessment of Plant Biodiversity		Lump Sum																	0.100
Vehicle 12 No.		12 Vehicles @ Rs 5,00,000/ per each (Will be provided by user agency from and through their budgetary provision)																	0.6000
Fax/Xerox/Computer		12 Sets @ 1,50,000/ per each (Will be provided by user agency from and through their budgetary provision)																	0.180
Maint Fax etc		7.5 % per year for 10 Years																	0.140
Wildlife Development		Management Plan will be prepared by Wild Life wing and approved by Pr CCF HP															Lum Sum		2.000
Wildlife maintenance		6% per year x 5 Years																	0.600
Grand Total																			65.233

Table 7.3 (a) Division wise and year wise expenditure on various activities of CAT PLAN

Division -; Bilaspur	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	13	17000	0.022	28	18020	0.050	16	19100	0.031	26	20250	0.053	26	21470	0.056	26	22760	0.059	0.271
Pasture Development	0	8000	0.000	0	8480	0.000	0	8990	0.000	0	9530	0.000	0	10100	0.000	0	10700	0.000	0.000
Terracing/Soil and moisture conservation	0		0.000	0	30000	0.000	0	31800	0.000	10	33700	0.034	0	0	0.000	0	0	0.000	0.034
Check Dam-:- Big (N0)	3	20000	0.006	11	21200	0.023	10	22470	0.022	4	23820	0.010	3	25250	0.008	4	26770	0.011	0.080
Check Dam Medium (No)	7	8000	0.006	21	8480	0.018	21	8990	0.019	7	9530	0.007	7	10100	0.007	7	10710	0.007	0.064
Check Dam-:- Small (No)	32	4000	0.013	32	4240	0.014	64	4495	0.029	33	4765	0.016	32	5050	0.016	32	5350	0.017	0.104
Check Dam Total	42		0.024	64		0.055	95		0.070	44		0.032	42		0.031	43		0.035	0.247
Otheractivities (infra Str. Forest and Rural)	0		0.000			0.063			0.000			0.000			0.000			0.000	0.063
Total			**0.047**			**0.168**			**0.101**			**0.118**			**0.087**			**0.095**	**0.615**
Maint.:- Afforestation	13	5985	0.008	28	5985	0.017	16	5985	0.010	26	5985	0.016	26	5985	0.016	26	5985	0.016	0.081
Maint.:-Pasture	0	2870	0.000	0	2870	0.000	0	2870	0.000	0	2870	0.000	0	2870	0.000	0	2870	0.000	0.000
Norms for maintenance		Afforestation :- Year						Pasture				Total			Total			Total	**0.696**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	IV	V	Total	IV	V	Total	
	2300	1500	815.00	685	685	5985	1160	630	400	340	340	2870	340	340	4230	340	340	5590	

Table 7.3 (b) Division wise and year wise expenditure on various activities of CAT PLAN

Division -; Shimla	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	604	17000	1.027	644	18020	1.160	754	19100	1.440	512	20250	1.037	649	21470	1.393	650	22760	1.479	7.537
Pasture Development	150	8000	0.120	163	8480	0.138	318	8990	0.286	125	9530	0.119	121	10100	0.122	123	10700	0.132	0.917
Terracing/Soil and moisture conservation				200	30000	0.600	260	31800	0.827	115	33700	0.388			0.000	0	0	0.000	1.814
Check Dam-:- Big (N0)	73	20000	0.146	219	21200	0.464	219	22470	0.492	73	23820	0.174	73	25250	0.184	73	26770	0.195	1.656
Check Dam Medium (No)	146	8000	0.117	438	8480	0.371	438	8990	0.394	146	9530	0.139	146	10100	0.147	146	10710	0.156	1.325
Check Dam-:- Small (No)	730	4000	0.292	731	4240	0.310	1460	4495	0.656	729	4765	0.347	730	5050	0.369	730	5350	0.391	2.365
Check Dam Total	949		0.555	1388		1.146	2117		1.542	948		0.660	949		0.700	949		0.742	
Otheractivities (infra Str. Forest and Rural)			0.421			0.422			0.421			0.422			0.422			0.272	2.380
Total			**2.123**			**3.466**			**4.516**			**2.626**			**2.638**			**2.625**	**17.994**
Maint.:- Afforestation	604	5985	0.361	645	5985	0.386	754	5985	0.451	512	5985	0.306	649	5985	0.388	650	5985	0.389	2.283
Maint.:-Pasture	150	2870	0.043	163	2870	0.047	318	2870	0.091	125	2870	0.036	121	2870	0.035	123	2870	0.035	0.287
Norms for maintenance		Afforestation :- Year						Pasture				**Total**		Pasture				**Total**	**20.564**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	I	II	III	IV	V	Total	
	2300	1500	815	685	685	5985	1160	630	400	340	340	2870	1160	630	400	340	340	2870	

Table 7.3 (c) Division wise and year wise expenditure on various activities of CAT PLAN

Division -; Kunihar	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	164	17000	0.279	286	18020	0.515	199	19100	0.380	140	20250	0.284	330	21470	0.709	330	22760	0.751	2.917
Pasture Development	0	8000	0.000	36	8480	0.031	35	8990	0.031	60	9530	0.057	17	10100	0.017	17	10700	0.018	0.155
Terracing/Soil and moisture conservation				10	30000	0.030	46	31800	0.146	40	33700	0.135		0	0.000	0	0	0.000	0.311
Check Dam-:- Big (N0)	23	20000	0.046	70	21200	0.148	71	22470	0.160	24	23820	0.057	24	25250	0.061	23	26770	0.062	0.533
Check Dam Medium (No)	47	8000	0.038	141	8480	0.120	141	8990	0.127	47	9530	0.045	47	10100	0.047	47	10710	0.050	0.427
Check Dam-:- Small (No)	236	4000	0.094	236	4240	0.100	471	4495	0.212	236	4765	0.112	235	5050	0.119	236	5350	0.126	0.764
Check Dam Total	306		0.178	447		0.368	683		0.498	307		0.214	306		1.000	306		0.238	2.497
Otheractivities (infra Str. Forest and Rural)	0		0.148			0.148			0.148			0.148			0.147		0	0.147	0.886
Total			**0.605**			**1.092**			**1.204**			**0.838**			**1.873**			**1.154**	**6.766**
Maint.:- Afforestation	164	5985	0.098	286	5985	0.171	199	5985	0.119	140	5985	0.084	330	5985	0.198	330	5985	0.198	0.867
Maint.:-Pasture	0	2870	0.000	36	2870	0.010	35	2870	0.010	60	2870	0.017	17	2870	0.005	17	2870	0.005	0.047
Norms for maintenance		Afforestation :- Year						Pasture				**Total**		Pasture				**Total**	**7.680**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	I	II	III	IV	V	Total	
	2300	1500	815	685	685	5985	1160	630	400	340	340	2870	1160	630	400	340	340	2870	

Table 7.3 (d) Division wise and year wise expenditure on various activities of CAT PLAN

Division -: Nachan	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	0	17000	0.000	33	18020	0.059	47	19100	0.090	55	20250	0.111	55	21470	0.118	0	22760	0.000	0.379
Pasture Development	0	8000	0.000	0	8480	0.000	0	8990	0.000	24	9530	0.023	0	10100	0.000	0	10700	0.000	0.023
Terracing/Soil and moisture conservation				0	30000	0.000	0	31800	0.000	10	33700	0.034		0	0.000	0	0	0.000	0.034
Check Dam-:- Big (N0)	2	20000	0.004	4	21200	0.008	4	22470	0.009	2	23820	0.005	1	25250	0.003	2	26770	0.005	0.034
Check Dam Medium (No)	3	8000	0.002	9	8480	0.008	9	8990	0.008	3	9530	0.003	3	10100	0.003	3	10710	0.003	0.027
Check Dam-:- Small (No)	17	4000	0.007	16	4240	0.007	34	4495	0.015	15	4765	0.007	17	5050	0.009	16	5350	0.009	0.053
Check Dam Total	22		0.013	29		0.023	47		0.032	20		0.015	21		0.014	21		0.017	0.116
Otheractivities (infra Str. Forest and Rural)			0.000			0.015			0.000			0.000			0.000			0.000	0.015
Total			**0.013**			**0.097**			**0.122**			**0.183**			**0.132**			**0.017**	**0.565**
Maint.:- Afforestation	0	5985	0.000	33	5985	0.020	47	5985	0.028	0	5985	0.000	55	5985	0.033	55	5985	0.033	0.114
Maint.:-Pasture	0	2870	0.000	0	2870	0.000	0	2870	0.000	24	2870	0.007	0	2870	0.000	0	2870	0.000	0.007
Norms for maintenance		Afforestation :- Year						Pasture				**Total**		Pasture				**Total**	**0.685**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	I	II	III	IV	V	Total	
	2300	1500	815	685	685	5985	1160	630	400	340	340	2870	1160	630	400	340	340	2870	

Table 7.3 (e) Division wise and year wise expenditure on various activities of CAT PLAN

Division -; Karsog	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	411	17000	0.699	544	18020	0.980	703	19100	1.343	921	28250	1.865	410	21470	0.880	462	22760	1.052	6.819
Pasture Development	160	8000	0.128	232	8480	0.197	256	8990	0.230	125	9530	0.119	119	10100	0.120	116	10700	0.124	0.918
Terracing/Soil and moisture conservation				200	30000	0.600	300	31800	0.954	275	33700	0.927		0	0.000	0	0	0.000	2.481
Check Dam-:- Big (N0)	63	20000	0.126	187	21200	0.396	188	22470	0.422	62	23820	0.148	63	25250	0.159	62	26770	0.166	1.418
Check Dam Medium (No)	125	8000	0.100	375	8480	0.318	375	8990	0.337	125	9530	0.119	125	10100	0.126	125	10710	0.134	1.134
Check Dam-:- Small (No)	623	4000	0.249	624	4240	0.265	1247	4495	0.561	624	4765	0.297	623	5050	0.315	624	5350	0.334	2.020
Check Dam Total	811		0.475	1186		0.979	1810		1.320	811		0.564	811		0.600	811		0.634	4.752
Otheractivities (infra Str. Forest and Rural)			0.370			0.370			0.371			0.371			0.271			0.256	2.009
Total			**1.672**			**3.126**			**4.218**			**3.846**			**1.871**			**2.065**	**16.799**
Maint.:- Afforestation	411	5985	0.246	544	5985	0.326	703	5985	0.421	976	5985	0.584	410	5985	0.245	407	5985	0.244	2.065
Maint.:-Pasture	160	2870	0.046	232	2870	0.067	256	2870	0.073	125	2870	0.036	119	2870	0.034	116	2870	0.033	0.289
Norms for maintenance		Afforestation :- Year						Pasture				**Total**		Pasture				**Total**	**19.153**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	I	II	III	IV	V	Total	
	2300	1500	815	685	685	5985	1160	630	400	340	340	2870	1160	630	400	340	340	2870	

Table 7.3 (f) Division wise and year wise expenditure on various activities of CAT PLAN

Division -: Theog	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	83	17000	0.141	116	18020	0.209	119	19100	0.227	259	20250	0.524	124	21470	0.266	125	22760	0.285	1.653
Pasture Development	0	8000	0.000	36	8480	0.031	13	8990	0.012	27	9530	0.026	11	10100	0.011	11	10700	0.012	0.091
Terracing/Soil and moisture conservation				9	30000	0.027	55	31800	0.175	0	33700	0.000	0	0	0.000	0	0	0.000	0.202
Check Dam-:- Big (N0)	10	20000	0.020	32	21200	0.068	32	22470	0.072	10	23820	0.024	11	25250	0.028	10	26770	0.027	0.238
Check Dam Medium (No)	21	8000	0.017	63	8480	0.053	63	8990	0.057	21	9530	0.020	21	10100	0.021	21	10710	0.022	0.191
Check Dam-:- Small (No)	105	4000	0.042	105	4240	0.045	210	4495	0.094	105	4765	0.050	105	5050	0.053	105	5350	0.056	0.340
Check Dam Total	136		0.079	200		0.166	305		0.223	136		0.094	137		0.102	136		0.105	0.769
Otheractivities (infra Str. Forest and Rural)			0.100			0.100			0.100			0.023			0.000			0.000	0.323
Total			**0.320**			**0.532**			**0.737**			**0.667**			**0.379**			**0.402**	**3.037**
Maint.:- Afforestation	83	5985	0.050	115	5985	0.069	119	5985	0.071	259	5985	0.155	124	5985	0.074	125	5985	0.075	0.494
Maint.:-Pasture	0	2870	0.000	36	2870	0.010	13	2870	0.004	27	2870	0.008	11	2870	0.003	11	2870	0.003	0.028
Norms for maintenance		Afforestation :- Year						Pasture				**Total**		Pasture				**Total**	**3.559**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	I	II	III	IV	V	Total	
	2300	1500	815	685	685	5985	1160	630	400	340	340	2870	1160	630	400	340	340	2870	

Table 7.3 (g) Division wise and year wise expenditure on various activities of CAT PLAN

Division -; Suket	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	325	17000	0.553	249	18020	0.449	262	19100	0.500	87	20250	0.176	406	21470	0.872	407	22760	0.926	3.476
Pasture Development	80	8000	0.064	58	8480	0.049	76	8990	0.068	45	9530	0.043	32	10100	0.032	33	10700	0.035	0.292
Terracing/Soil and moisture conservation				100	30000	0.300	159	31800	0.506	169	33700	0.570		0	0.000	0	0	0.000	1.375
Check Dam-:- Big (N0)	26	20000	0.052	77	21200	0.163	76	22470	0.171	25	23820	0.060	25	25250	0.063	26	26770	0.070	0.578
Check Dam Medium (No)	51	8000	0.041	153	8480	0.130	153	8990	0.138	51	9530	0.049	51	10100	0.052	51	10710	0.055	0.463
Check Dam-:- Small (No)	257	4000	0.103	256	4240	0.109	514	4495	0.231	258	4765	0.123	258	5050	0.130	257	5350	0.137	0.833
Check Dam Total	334		0.196	486		0.402	743		0.539	334		0.231	334		0.245	334		0.262	1.874
Otheractivities (infra Str. Forest and Rural)			0.200			0.200			0.200			0.200			0.119			0.160	1.079
Total			**1.012**			**1.399**			**1.814**			**1.220**			**1.268**			**1.383**	**8.096**
Maint.:- Afforestation	325	5985	0.195	249	5985	0.149	262	5985	0.157	87	5985	0.052	406	5985	0.243	407	5985	0.244	1.039
Maint.:-Pasture	80	2870	0.023	58	2870	0.017	76	2870	0.022	45	2870	0.013	32	2870	0.009	33	2870	0.009	0.093
Norms for maintenance	Afforestation :- Year						Pasture					**Total**		Pasture				**Total**	**9.228**
	I	II	III	IV	V	Total	I	II	III	IV	V	Total	I	II	III	IV	V	Total	
	2300	1500	815	685	685	5985	1160	630	400	340	340	2870	1160	630	400	340	340	2870	

Table 7.3 (h) Division wise and year wise expenditure on Down Stream Treatment of CAT PLAN

Division -; Bilaspur	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	0	17000	0.000	0	18020	0.000	0	19100	0.000	65	20250	0.132	0.000	21470	0.000	0.000	22760	0.000	0.132
Soil Conservation works	0	8000	0.000	0	8480	0.000	0	8990	0.000	0	L/S	0.288	0.000	10100	0.000	0.000	10700	0.000	0.288
Maintenance: Afforestation										65	5985	0.039	0.000	5985	0.000	0.000	5985	0.000	0.039
Total												0.45853	0			0			

Division -; Suket	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	0	17000	0.000	0	18020	0.000	0	19100	0.000	35	20250	0.071	0.000	21470	0.000	0.000	22760	0.000	0.071
Soil Conservation works	0	8000	0.000	0	8480	0.000	0	8990	0.000	0	L/S	0.120	0.000	10100	0.000	0.000	10700	0.000	0.120
Maintenance: Afforestation										35	5985	0.021	0.000	5985	0.000	0.000	5985	0.000	0.021
Total												0.21182							

	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites (Total)	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Afforestation	0	17000	0.000	0	18020	0.000	0	19100	0.000	100	20250	0.203	0.000	21470	0.000	0.000	22760	0.000	0.203
Soil Conservation works	0	8000	0.000	0	8480	0.000	0	8990	0.000	0	L/S	0.408	0.000	10100	0.000	0.000	10700	0.000	0.408
Maintenance: Afforestation										100	5985	0.060	0.000	5985	0.000	0.000	5985	0.000	0.060
Total												0.671							

Table 7.3 (i) Division wise and year wise expenditure on various activities of CAT PLAN

Bilaspur Circle	Year-I			Year-II			Year-III			Year-IV			Year-V			Year-VI			
Activites	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Area Ha	Rate Rs/ha	Cost Cr Rs	Total Cost
Otheractivities (infra Str. Forest)			0.150			0.000			0.000			0.000			0.000			0.000	0.150

Construction of conference hall at Bilaspur including furnishing and accessories

ANNEXURES

Annexure-I

List of areas proposed for Afforestation

Abstract	
Name of Division	**Area (Ha)**
Bilaspur	135
Shimla	3813
Kunihar	1449
Nachan	190
Karsog	3451
Theog	826
Suket	1736
Total	**11600**

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
Bilaspur	1	Chamyon 2a	60	3	Jamthal C1d	35
	2	Chamyon 2c	40		Total	135
Shimla	1	U-151 Mashobra	20	113	U 22 Palag	20
	2	D-70 Naldehra	20	114	U 60 Farianda	36
	3	D-72 Dhagog	5	115	U 61 Dyangol	20
	4	D-73 Mashobra	25	116	U 143 Kayar	25
	5	D-74 Kamhali	5	117	U 43 Berti	20
	6	D-80 Budfer	14	118	U 50 Shalli	40
	7	U-140 Dharti	10	119	D 26 Biru	65
	8	U-155 Jagyalru	5	120	U 53 Sarail	5
	9	U 152 Kalyanpur	15	121	D 24 Domehar	45
	10	U180 Annu	10	122	D 23 Chaprani	25
	11	U158 Oddu	15	123	D 22 Himri	25
	12	U 141 Kuni	20	124	D 21 Fulagalani	36
	13	D 81 Burmu	6	125	U 33 Seri	10
	14	D 75 Janlog	10	126	D2 Mahushaser	10
	15	D 62 Kufri	10	127	U 32 Bhargun	15
	16	D 66 Seepur	20	128	D 6 Neel	45
	17	D 65 Koti	10	129	U 577 Jaini nal	20
	18	D 77 Annu	5	130	U 578 Jood	10
	19	U 177 Nehari	10	131	U 579 Dhar	8
	20	U 159 Majhar	5	132	U 580 Paniyali	17
	21	U 163 Chaklu	5	133	U 31 Ghariyana	5
	22	U 174 Badfar	5	134	U 29 Reog	10
	23	U 176 Barmu	5	135	U 598 Naheot	12
	24	U 178 Ragi	5	136	U 599 Pahal	53
	25	U 179 Sharwag	5	137	U 23 Chowki	10
	26	U 181 Janog	10	138	U 24 Lunsumugna	30
	27	U 187 Pagog	4	139	D 25 Kadhar	45
	28	U 184 Shanan	8	140	U 144 Deothi	20
	29	D 71 Baragsheel	5	141	U 145 Mool Bhajji	20
	30	D 67 Paniali	10	142	U 59 Dhandi Bag	10
	31	D 63 Matiar	5	143	D 26 Biru	30
	32	D78 Sharwag	5	144	U 57 Bag	10
	33	U 148 Mool Koti	5	145	U 58 Deola	10
	34	U 149 Deothi	10	146	U 54 Gurthani	20
	35	U 154 Panihartu	5	147	U 20 Domehar	25
	36	U 156 Sawan Kair	10	148	U 19 Greon	25
	37	UF Baledi	11	149	U18 Chaprali	35
	38	UFBhankoo	5	150	U 17 Himiri	10
	39	DF Sanghech	7	151	U 15 Darnol	5
	40	DF Bagka Nal	9	152	U 16 Karyali	10
	41	DF Barli	2	153	D 10 Mugli	10
	42	DF Bara Pandash	9	154	U 11 Bagri Banuna	35

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
	43	UF Deola	4	155	U 9 Gulthai	15
	44	UF/ DF Badoo	13	156	U 5 Pabdoa	5
	45	UF Sedan	8	157	U 2 Aisha	10
	46	UF Bainsh	9	158	D23 Chaparni	5
	47	UF Medyan/Okhru	9	159	D 19 Dauka	5
	48	UF Bakhrail	4	160	D 12 Sal	15
	49	DF HiriKi Baishk	6	161	D 11 Mandor	13
	50	Uf Bathmana	2	162	D 15 Malwan	20
	51	UF Bohli	4	163	U 8 Golan	20
	52	UF Dhalaya	3	164	U 1 Annu Kialu	10
	53	UF Darkot	6	165	U 13 Ogli Summa	10
	54	DF Shahal	6	166	D20 Lamb ki Dhar	13
	55	UF Nahana	5	167	D 19 Darabla	10
	56	DF Salaun	5	168	UF Panera	10
	57	R 19 Doomi	10	169	U 39 Hiwan	20
	58	R 70 Ichhaser	10	170	U 38 Nagar	20
	59	GCL Kalot	5	171	G 40 Dadheog	20
	60	GCL Nanhail	5	172	U 592 Bohli	20
	61	D 208 Gadaug	12	173	U 586 Dishti	20
	62	R 27 Gadaug	12	174	D 32 Hiwan	20
	63	GCL Laharb	5	175	U 38 Nagar	15
	64	GCL Haro	5	176	U 593 Shalli Seri	7
	65	GCl Janal	5	177	D 1 Ratia	20
	66	GCL Rauri	10	178	D35 Goaln II	20
	67	GCl Larcchi	10	179	U 34 Ratia II	30
	68	GCL Beont	5	180	U 41 Chatyarh	110
	69	GCL Kaina	5	181	U 583 Sohal	65
	70	GCL Chewra	10	182	U 601 Nalag	50
	71	GCl Chaili	5	183	U 601 Nalag II	20
	72	GCl Chaili Kalaun	5	184	U 599 Pahal II	11
	73	R 26 Talgiri	10	185	D 260 Nalog	10
	74	GCl Neri	21	186	U 47 Jajher	80
	75	GCL Batol	9	187	U 23 Chowki	30
	76	GCL Bhakho	5	188	U 143 Kayar	35
	77	D205 Naugolcha	10	189	D 64 Thuila	15
	78	GCl Thud	10	190	U146 Chakyara	25
	79	GCl Jholu	10	191	U 48 Berti	20
	80	GCl Pancha	10	192	U 50 Shalli	30
	81	GCL Sheera	10	193	D 27 Kanled	80
	82	GCl Bugora	10	194	U 52 Bani Jalog	20
	83	D210 Girb	10	195	U 53 Sarail	20
	84	D203 Neri	5	196	U 56 Toloti	10
	85	GCl Dhar Ki Kufer	5	197	U 58 Deola	20
	86	GCl Kajail	5	198	U 59 Dhandi Bag	35
	87	GCl Sharog	5	199	D 12 Sal	15

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
	88	GCL Bhag	5	200	D 13 Aisha	20
	89	GCl; Doomi	3	201	D 14 Annu Kailu	12
	90	GCl Obna	8	202	D 15 Malawan	15
	91	GCl Bharech	5	203	D16 Biran	20
	92	GCl Dhanda	2	204	U 12 Gadahu	25
	93	R Mornala	15	205	U 14 Bhasara Drabla	35
	94	U 26 Basant pur	50	206	D 15 Dronl	10
	95	U44 Nadukhar	30	207	U 16 Karyali	35
	96	U 43 Embry	35	208	U 17 Himiri	35
	97	U 46 Mandialu	30	209	U 18 Chaprani	35
	98	U 34 Ratia	80	210	UF Showali	9
	99	U 35 Golan	50	211	U 37 Suni	5
	100	U 36 Madorh	45	212	U 34 Ratia	11
	101	U42 Neen	40	213	U 552 Bohli	10
	102	U 258 Bashchu	15	214	U 42 Neen	10
	103	U 581 Chanewag	10	215	U 27 Sunni Shakrori	10
	104	U 29 Reog	10	216	U 29 Reog	10
	105	U 27 Suni Shakrori	30	217	U 599 Pahal	10
	106	DPF Kaurpur	10	218	U 23 Chowki	9
	107	U 595 Chandli	20	219	U 22 Palag	2
	108	U 596 Bajhal	24	220	U47 Jajher	10
	109	U 597 Basol	9	221	U 147 Sharhi	20
	110	U 600 Sharog	16	222	U 145 Mool Bhajji	4
	111	U 47 Jajher	68	223	D 26 Biru	17
	112	U 25 Kadhair	60	224	D 19 Darabla	30
		Total	**1393**			**2420**
		Shimla			**Total**	**3813**
Kunihar	1	Bagga DPF	30	17	Behi UF	20
	2	Samitiyari DPF	15	18	Suni UF	80
	3	Bajnal DPF	80	19	Chainda	18
	4	Kathpal DPF	130	20	Beral UF	66
	5	Matrich DPF	15	21	Seharli UF	50
	6	Suin Masora DPF	45	22	Kandhar UF	74
	7	Sakor DPF	25	23	Sehanali UF	30
	8	Tarpt DPF	45	24	Dangail UF	10
	9	Banaula DPF	130	25	Matroh UF	75
	10	Seharli DPF	20	26	Sakor UF	135
	11	Samtiyari UF	55	27	Ghumar UF	25
	12	Baga Mangal UF	13	28	Jandoe UF	20
	13	Padiyar UF	30	29	Tun Badiyar UF	15
	14	Dhawta UF	20	30	Labrath UF	30
	15	Nal UF	58	31	Bir UF	20
	16	Kauli UF	70			0
		Total	**781**			**668**

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
		Kunihar		**Total**		**1449**
Nachan	1	Garignoo	29	3	Garignoo DPF	34
	2	Halsigad	42	4	Halsigad DPF	70
			71	5	Khudarsilh	15
						119
		Nachan		**Total**		**190**
Karsog	1	ND 12 Bhiyana	10	50	OD-183 Mahdev-Ki-Banoni. C.I.a	7
	2	ND 16 Chhattri Mandi	10	51	OD 193 Katach	7
	3	ND 20 Hunjinal	20	52	ND 198 Dhanyara I	20
	4	ND 72 Restadhar C III	20	53	N.D.199 Dhaniara-II	25
	5	OD 72 Restadhar CII(e)	30	54	OD 201 Aglidhar	20
	6	ND 73 Gharlol	40	55	ND 203 Thach C II	15
	7	OD 73 Gharlohal	30	56	ND 207 Gadhoi	80
	8	OD 73 GharlohalCII	25	57	ND 208 Majhod C II	65
	9	ND-74 Parwain	35	58	OD 211 Sinjh	20
	10	ND 74 Parvain	125	59	OD 213 Niharinal	85
	11	ND75 Chatkar	20	60	N.D 214 Jhunjan	99
	12	ND-76 Kapdyas	75	61	ND-219 Gannu C.II	50
	13	N.D-77 Gujrudhar	10	62	ND222 Pog C.III	10
	14	ND -80 Kanda	80	63	C.V	30
	15	ND 86Lochhar	75	64	ND 222 Pog	80
	16	ND 87 Saran	10	65	OD 228 Bhundashil	20
	17	ND 91 Bhalingi	10	66	ND 230 Thach	20
	18	ND 92 Sarour	25	67	OD 233 Richhani C I(b)	20
	19	ND 93 Thogi	30	68	OD 234 Sundru CIVa	15
	20	ND 94 Tattapani	20	69	OD 236 Pathrevi C Ivb	20
	21	ND 95 Jeuri	35	70	OD 236 Pathrevi CIVa	10
	22	ND 96 Sahaj	10	71	OD 237 KatandaCIb	15
	23	ND 99 Braker	20	72	OD 241 Kandloo CII (b)	20
	24	OD 100 Ghanger	65	73	OD 241 Kandhi C III©	20
	25	ND 101 Nando	138	74	OD 241 Kandhi C III(b)	45
	26	OD 102 Telehan	65	75	ND 242 Buna	20
	27	ND 103Telehan	85	76	ND 245 Hiru C I	10
	28	ND 104 Besta	99	77	ND 245 Hiru C II	10
	29	ND 105 Khadehan	80	78	ND 245 Firnoo	20
	30	ND 106Bhaura	80	79	ND 245 Jagol	20
	31	ND-107 Guma	80	80	ND 247 SarahanC I	10
	32	OD 124 KaLhouta	20	81	ND 247 SarahanC II	10
	33	ND 126 Kashot- III	30	82	ND 247 Sarahan C III	10
	34	OD 127 Kashot	35	83	O.D 249-Makra CIII a	20
	35	ND-128 Kashot-II	80	84	OD 249 Makra C III(a)	30
	36	ND 131 Parnot	35	85	ND 250 Bagridhar	20

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
	37	ND 133 Hiru	35	86	ND 251 Kaveri	20
	38	ND 133 Hiru	45	87	252 Nagnal	10
	39	ND 133 HIRU	35	88	ND 252 Naganal	20
	40	ND 134 Maghan	35	89	OD 255 Shagach C.VI	20
	41	ND 135 Fafan	95	90	ND 257 Jagol	15
	42	ND-136 Parlog	20	91	OD 259 Lotla C IV	20
	43	ND 136 Parlog	60	92	ND 264 Khattu	10
	44	OD 137 Nagaltha	30	93	ND 278 Nadoun	35
	45	OD 167 Baju C.III a	36	94	ND 279 Nadoun C II	25
	46	OD170 Tikkerkarsog C II(b)	30	95	ND 283 Raidhar	35
	47	O.D 173 Dopha C.II b	40	96	ND 289 Ghanidhar	15
	48	OD 174Dopha	15	97	ND 294 Danot	20
	49	OD175 Pehran	15	98	ND 297 Sarohi	20
			2148	99	NDKapdyas	40
						1303
		Karsog			**Total**	**3451**
Theog	1	D.29 Shalli Teer	20	41	D.28 Kaleri	10
	2	D.40 Narainty	10	42	U.62 Nal	20
	3	D.43 Narail	10	43	U.63 Kandi Bhaleoth	5
	4	D.52 Rohroo	10	44	U.66 Bhog Bhogra	20
	5	D.51 Bhalech	10	45	U.70 Gadla	10
	6	U.133 Khalashi	13	46	U.86 Shalri	15
	7	U.134 Chehar	10	47	U.93 Kathog	5
	8	U.137 Mithu Makhrol	11	48	U.98 Phadgula	10
	9	U.77 Gowas Kufta	10	49	D.50 Narguni	10
	10	U.97 Lanoo	10	50	D.58 Audh	10
	11	U.86 Shalvi	10	51	D.61 Sarog	5
	12	D.29 Shalli Teer	10	52	U.104 Bandroo	10
	13	D.30 Rachai	10	53	U.105 Ghikhar	10
	14	D.32 Khul	10	54	U.107 Pap Jadeog	15
	15	D.33 Rai Nala	10	55	U.108 Bhalech	10
	16	D.40 Narainty	5	56	U.109 Thanda	10
	17	D.39 Jhalaroo	10	57	U.117 Tunglu	10
	18	D.31 Bhaleoth	10	58	U.122 Tatal	15
	19	U.73 Gagan Ghatti	15	59	U.123 Sainj Kufta	20
	20	U.74 Bara Nal	10	60	U.124 Audh	10
	21	U.79 Sai	5	61	U.129 Manal Sarog	20
	22	U.85 Gadah Kufar	5	62	U.138 Khalashi	10
	23	U.99 Koti	5	63	U.135 Tikkar Chaura	10
	24	D.53 Bharyana	5	64	U.71 Ghatloo	10
	25	D.54 Tungla	10	65	U.72 Chilla	5
	26	D.55 Jugoo	5	66	U.78 Kiaral	10
	27	D.56 Tatal	10	67	U.87 Chalawag	10
	28	D.57 Sihloo	10	68	U.97 Lanoo	10

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
	29	U.102 Kathal	5	69	U.114 Chalawag	10
	30	U.103 Runkali	5	70	U.125 Bagri	10
	31	U.104 Bandroo	5	71	U.126 Kiary	10
	32	U.106 Gowai Sanana	10	72	U.131 Kandaghat	7
	33	U.102 Bhalech	10	73	U.132 Bagoti	5
	34	23 U.120 Keet	25	74	U.133 Khalashi	10
	35	U.137 Sithu Makhrol	20	75	U.137 Mithu Makrol	15
	36	U.138 Jahoo	10	76	U.136 Teer Mahasu	15
	37	U.134 Chehar	15	77	U118 Tikar	5
	38	D.40 Narainty	10	78	D51 Bhaleech	10
	39	D.29 Shalli Teer	10	79	U62 Nal	10
	40	D.35 Bagain	10			422
			404			
		Theog			**Total**	**826**
Suket	1	OD 248 Daint	41	28	D.P.F. Patta	50
	2	OD 242 Kathiuni	31	29	D.P.F. Jartoo	90
	3	OD 246 Manjhki	41	30	D.P.F. AhenSanvali	60
	4	OD 251 Shivshankar	16	31	D.P.F. AhenSanvali	70
	5	OD 256 Ranjhol	51	32	D.P.F. Soja	5
	6	OD 252 Baragodon	26	33	D.P.F. Behli	20
	7	OD 265 Salani	21	34	D.P.F. Katohar	10
	8	ND 268 Khoondhar	31	35	D.P.F. Karangal	50
	9	ND 264 Chanadbahan	21	36	D.P.F. Merad	50
	10	ND 269 Simoo	41	37	D.P.F. Bindlu	30
	11	ND 234 Chehar	16	38	D.P.F. Bhallan	5
	12	ND 235 Kharyana	16	39	D.P.F. Bragta	20
	13	ND 241 Kamrah	16	40	D.P.F. Hara	20
	14	ND 227 Marahara	51	41	D.P.F. Tahali	25
	15	ND 228 Marahara	41	42	D.P.F. Kahlind	20
	16	ND 232 Marahara	21	43	D.P.F. Thundhar	45
	17	ND 231 Marahara	10	44	D.P.F. Bharta	10
	18	ND 233 Barat	11	45	D.P.F. Jalah	15
	19	ND 230 Halanoo	11	46	D.P.F. Karla	15
	20	OD 222 Trechh	61	47	D.P.F. Cheuri	20
	21	ND 218 Supadhar	16	48	D.P.F. Deoli-I	30
	22	ND 217 Ropa	10	50	D.P.F. Deoli-II	15
	23	ND 212 Doghari	52	51	D.P.F. Chouri	90
	24	ND 204 Narchali	61	52	D.P.F. Chalan	39
	25	ND 203 Tarehari	52	53	D.P.F. Nehri Ropru	43
	26	UF Kathla	34			847
	27	DPF Geharoo	90			
			889			
		Suket			**Total**	**1736**
			Total			**11600**

Annexure-I

List of areas proposed for Afforestation

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
		Down Stream Treatment Areas				
Bilaspur	1	DPF Chamyon	20	3	DPF Jamthal C-2(b)	12
	2	DPF Jamthal C-2(a)	18	4	UPF Jamthal	15
			38			27
		Bilaspur		**Total**		**65**
Suket	1	DPF Dhawal	10	4	DPF Padhana	5
	2	UPP Dhawal	5	5	UPF Padhana	5
	3	DPF Sanali	10			
			25			10
		Suket		**Total**		**35**
		Down Stream Treatment Areas Total				**100**
		G. Total				**11700**

Annexure-II

List of areas proposed for Pasture evelopment

Abstract	
Name of Division	**Area (Ha)**
Bilaspur	0
Shimla	1000
Kunihar	165
Nachan	24
Karsog	1008
Theog	98
Suket	324
Total	**2619**

Annexure-II

List of areas proposed for pasture development

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
Bilaspur		**Nil**				
Shimla	1	Jug	9	39	D258 Basherhu	13
	2	Baldain	27	40	U27 Suni Shakrori	10
	3	Manju	31	41	U594 Kotla	13
	4	Shannel	34	42	U25 Kadharghat	15
	5	Saunl	36	43	U60 Farinda	10
	6	Charain	15	44	U48 Besti	10
	7	Kanda	15	45	U4 Gharaina	5
	8	Jagyalru	15	46	U44 Nadukhar	20
	9	Dhar	20	47	U593 Shalliseri	16
	10	Kamhalti	20	48	DPF Kaulpur	10
	11	Shaiser	10	49	U5 Pandoa	10
	12	UF Bakrail	15	50	U6 Dharogra	10
	13	DPF Penihana	31	51	U12 Gadahu	10
	14	UF Dhalaya	15	52	U19 Gram Jaishi	10
	15	DF Lahagkidhar	15	53	U24 Lunsu Mugna	45
	16	DPF Badoo	19	54	U295 Shalli	15
	17	UF Dhar	10	55	U45 Jander	20
	18	DPF Baledi	20	56	U577 Jaisunalli	15
	19	GCL Facthi	3	57	U31 Gharayana	15
	20	GCL Hiun	3	58	U594 Kotla	15
	21	R19 Doomi	8	59	U144 Deothi	20
	22	R20 Ichhaser	9	60	U51 Dhalana	20
	23	GCL Kalhot	4	61	U1 Annukailu	25
	24	GCL Neri	2	62	U7 Sandoa	25
	25	GCL Bharai	7	63	U13 Oglisuma	25
	26	GCL Panthi	3	64	U18 Chaprani	20
	27	GCL Dhainial	7	65	U11 BagiBanauna	10
	28	D207 Talgiri	5	66	U14 Bhararu	5
	29	GCL Sheera	12	67	U10 Malgi	5
	30	GCL Paneha	8	68	U61 Dhayangal	10
	31	GCL Sharag	3	69	U50 Shalli	10
	32	D211 Sharag	2	70	D28 Banitalag	5
	33	GCL Jablog	3	71	U145 Moolbhajji	3
	34	GCL Anji	2	72	U589 Mandri	5
	35	GCL Karondh	2	73	U578 Jood	5
	36	U26 Basantpur	37	74	U29 Reog	5
	37	U35 Galan	5	75	U594 Kotla	5
	38	D5 Nin	13	76	U47 Jajher	15
		Total	**495**			**505**
		Shimla		**Total**		**1000**
Kunihar	1	Bajrol DPF	30	6	Dhawta UF	10
	2	Kathpal DPF	30	7	Nal UF	10
	3	Banaula DPF	25	8	Kandhar UF	10
	4	Sakor UF	25	9	Bir UF	6
	5	Samtiyari UF	10	10	Bagga DPF	9
		Total	**120**			**45**

Annexure-II

List of areas proposed for pasture development

Name of division	S. No	Name of area	Area (Ha)	S. No	Name of area	Area (Ha)
		Kunihar			**Total**	**165**
Nachan		Garignoo DPF	14			
		Halsigad DPF	10			
		Total	24			
		Nachan			**Tatal**	**24**
Karsog	1	OD 73 Gharlol C I	20	24	ND 134 Magan	25
	2	ND 74 Parvain	65	25	ND 135 Fafan	15
	3	ND75 Chatkar	10	26	ND 136 Parlog	15
	4	ND 76 Kapdyas	35	27	OD 137 Nagaltha	30
	5	ND 80 Kanda	10	28	OD 138 Bagbakhari CIII	30
	6	ND 86 Lochher C II	10	29	ND 198 Dhanyara I	10
	7	ND 92 Sourur	20	30	ND 207 Godhoi C II	10
	8	ND 93 Thogi	10	31	OD 211 Sinjh	10
	9	ND 95 Jeuri	5	32	OD 213 Niharinal C III	35
	10	OD 100 Ghanger	10	33	ND 214 Jhunjan	55
	11	ND 101 Nandu	50	34	ND 222 Pog C III	10
	12	OD 102 Telehan C IV	10	35	ND 222 Pog C IV	10
	13	ND 103 Telehan	50	36	OD 233 Richhani C I(b)	8
	14	ND 104 Besta	40	37	OD 241 Kandlu C II(b)	10
	15	ND 105 Khadehan	20	38	ND 247 Sarahan C I	5
	16	ND 106 Bhoura	30	39	ND 247 Sarahan C II	5
	17	ND 107 Gumma	10	40	ND 247 Sarahan C III	10
	18	OD 124 Kalhouta C IV	10	41	ND 249 Makra C III(a)	5
	19	ND 126 Kashout III	45	42	ND 250 Bagridhar	10
	20	ND 128 Kashout II	20	43	OD 255 Sagach C IV	20
	21	ND 128 Kashout II	50	44	ND 278 Nadoun	40
	22	ND 131 Parnot	25	45	ND 283 Raidhar	20
	23	ND 133 Hiru	35	46	ND Pog V	30
			590			418
		Karsog			**Total**	**1008**
Theog	1	D.29 Shalli tees	10	5	U.93 Kathog	5
	2	D.40 Narainty	10	6	U.133 Khalashi	12
	3	U.133 Kalashi	30	7	U.136 Teer Mahasu	10
	4	U.133 Khalashi	21			27
			71			
		Theog			**Total**	**98**
Suket	1	ND 223 Mundli	7	8	D.P.F. Chori	48
	2	UF Kathla	32	9	N.D. Gehroo	30
	3	UF Hej	52	10	ND Pata	20
	4	UF Galtu	26	11	ND Ahansonali-I	5
	5	ND 247 Kanjihra	33	12	ND Ahensonali-II	9
	6	DPF Soja	5	13	Jartu	10
	7	D.P.F. Thongdhar	47			122
			202			
		Suket			**Total**	**324**

Annexure-III

Details of Terracing / Soil and Moisture Conservation - Private Land

Abstract	
Name of Division	**Area (Ha)**
Bilaspur	10
Shimla	575
Kunihar	96
Nachan	10
Karsog	775
Theog	64
Suket	428
Total	**1958**

Annexure III

Treatment of private areas

Name of Division	. Name of Panchayat	Name of village	Area in Ha	Name of Panchayat	Name of village	Area in Ha
1	2	3	4			
	A- Terracing					
Bilaspur	Harnora	Chamyon				
		Kasol				
	Bilaspur	**Total**				10
Shimla	Masobra	Chhabalri		Doomi	Makrainda	
	Masobra	Bagthal		Bhaunt	Tagiali	
	Moolkoti	Kanda		Bhaunt	Haron	
	Moolkoti	Purani Koti		Basantpur	Basantpur	
	Moolkoti	Moolkoti		Juni	Madorghat	
	Moolkoti	Deothi		Juni	Sanjari	
	Masobra	Kalayanpur		Juni	Anu	
	Masobra	Seapur		Basantpur	Jandal	
	Masobra	Bhog		Nehra	Paniyali	
	Chairi	Anu		Nehra	Nehra	
	Chairi	Bhawana		Nehra	Panohi	
	Chairi	Nehari		Nehra	Sohal	
	Bainsh	Bainsh		Gharyana	Gharayana	
	Bainsh	Dhanesar		Pahal	Pahal	
	Dhammi	Dagoh		Domehar	Ganvi	
	Jabari	Kangti		Domehar	Khob	
	Deonagar	Dalimu		Domehar	Palag	
	Deonagar	Dagoat		Domehar	Kadhar	
	Shakrah	Shakrah		Chebri	Mogna	
	Shakrah	Chalog		Majheor	Jajchar	
	Ghannati	Bagkanal		Theila	Chakyana	
	Ghannati	Mataina		Theila	Farinda	
	Jabari	Jabari		Theila	Dyangal	
	Deonagar	Neog		Khatnol	Khatnol	
	Deonagar	Khil		Theila	Deola	
	Deonagar	Balcdi		Khatnol	Bagh	
	Bainsh	Bakhrail		Khatnol	Dandibag	
	Bainsh	Dhanesar		Domehar	Domehar	
	Dhammi	Dagoh		Domehar	Navi	
	Dhammi	Jamog		Chebri	Padain	
	Jabari	Kangti		Himri	Gadahu	
	Deonagar	Narihana		Himri	Himri	
	Deonagar	Dochhi		Himri	Gadheri	
	Shakrah	Dhar		Bagh	Kayalu	
	Shakrah	Shaich		Basantpur	Ambry	
	Ghannati	Bagkanal		Basantpur	Nadukhar	

Annexure III

Treatment of private areas

Name of Division	Name of Panchayat	Name of village	Area in Ha	Name of Panchayat	Name of village	Area in Ha
1	2	3	4			
	Ghannati	Sarog		Shakrori	Shakrori	
	Deonagar	Khil		Juni	Kandula	
	Deonagar	Kolukikawali		Juni	Bhargan	
	Deonagar	Bari		Juni	Golan	
	Deonagar	Bhainkal		Juni	Seri	
	Jabari	Dhalaya		Juni	Jamog	
	Deonagar	Dalimu		Gehni	Dhar	
	Shakrah	Badu		Chanawag	Birkijayan	
	Ghannati	Sarog		Chanawag	Judloo	
	Chaili	Kiargiri		Reog	Reog	
	Chaili	Batol		Gharayana	Shil	
	Chaili	Garog		Thachi	Sharog	
	Chaili	Sarog		Chebri	Chowki	
	Chaili	Giry		Chebri	Mungna	
	Chaili	Chalili		Domehar	Khob	
	Doomi	Marhon		Majheor	Jajer	
	Doomi	Kamayna		Theila	Theila	
	Doomi	Sirdakhurd		Theila	Deothi	
	Doomi	Sirdakalan		Theila	Kayar	
	Doomi	Dudali		Theila	Runthal	
	Doomi	Obna		Majheor	Sharoh	
	Dhudalti	Panti		Majheor	Gulthani	
	Dhudalti	Kiana		Majheor	Belthi	
	Neri	Anji		Majheor	Sarail	
	Neri	Golcha		Karyali	Sal	
	Neri	Seri		Karyali	Drawl	
	Bhaunt	Bhaunt		Karyali	Karyali	
	Bhaunt	Beont		Karyali	Drahan	
	Bhaunt	Ragain		Himri	Nalah	
	Dhudalti	Rouri		Himri	Reog	
	Dhudalti	Bhroi		Dharogra	Sandoa	
	Dhudalti	Banoti		Dharogra	Dharogra	
	Neri	Neun		Bagh	Pancot	
	Neri	Hiun		Himri	Gadahu	
	Neri	Bhung		Ogli	Tharu	
	Neri	Chanu		Ogli	Talah	
	Neri	Karog		Basantpur	Kalvi	
	Doomi	Shahal		Juni	Sumi	
	Doomi	Doomi		Gehni	Chatyad	
	Doomi	Thud		Nehra	Paniyali	
	Bhaunt	Karechi		Gherana	Gherana	

Annexure III

Treatment of private areas

Name of Division	Name of Panchayat	Name of village	Area in Ha	Name of Panchayat	Name of village	Area in Ha
1	2	3	4			
	Bhaunt	Sanog		Gherana	Dwarsu	
	Bhaunt	Chewla		Pahal	Nehot	
	Bhaunt	Kawi		Chebri	Lunsu	
	Bhaunt	Karond		Domehar	Ganvi	
	Neri	Samri		Thaila	Moolbhajji	
	Neri	Dalan		Thaila	Sadohi	
	Neri	Dharkikuffar		Khatnol	Dalana	
	Neri	Peneha		Majheor	Majheor	
	Neri	Bhakho		Ogli	Malgi	
	Neri	Karond		Ogli	Kothi	
	Chaili	Kayar		Himri	Himri	
	Doomi	Beolidhar		Karyali	Mandap	
	Doomi	Beduti		Dharogra	Aisha	
	Shimla			**Total**		**575**
Kunihar	Barel	Score		Kander	Kander	
		Jandoi			Bhalog	
		Matrech			Baga	
		Siharli			Nuin	
		Beral			Padyar	
		Suinuprli and			Hawani	
		Nichli			Kol	
		Boi			Santyar	
		Barla Kayr				
		Kunihar		**Total**		**96**
Nachan	Janjhali	Balwar				
		Boong /Majhwal				
		Nachan		**Total**		**10**
Karsog	Sarahan	Firnu		Shakra	Shakra	
	Teban	Kot			Jedvi	
		Kotlu		Bindla	Bindla	
	Nanj	Nanj			Tallain	
		Tundal			Mangan	
		Choa		Thali	Thalli	
		Kehu		Tattapani	Randol	
	Khenol Bagra	Belu Dhank			Kidiya	
		Khryali			Tattapani	
		Shout			Thogi	

Annexure III

Treatment of private areas

Name of Division	Name of Panchayat	Name of village	Area in Ha	Name of Panchayat	Name of village	Area in Ha
1	2	3	4			
	Parlog	Parlog			Sarour	
		Bafan				
		Karsog		**Toatal**		775
Theog	Panchyat	Narainty		Kelvi	Shalvi	
	Shari Matiyana	Mater			Soc	
		Narel			Kathog	
		Lannu			Koti	
	Kathog	Dhanot		Kathog	Kathal	
		Kundli			Ronkali	
	Bharara	Bhalech		Sandhoo	Ronkali Diger	
		Tikkar			Bundo	
	Sandhoo	Khalashi			Gawai	
	Majhar	Chekar			Jadeog Sanana	
		Makrol			Bhalech-I	
	Satyan	Gawas			Bhalech-II	
		Bhog			Dancut	
	Bharara	Bhogra			Godhan	
	Dharampur	Manlog		Chikher	Bhariana	
		Chilla			Kundli	
		Rachhai		Bharara	Tungla	
		Khul			Balow	
		Mahla			Keet	
		Mhaleoth			Jugoo	
		Kandi			Silu	
		Jhalsu			Tikkar	
		Rauni		Kiartoo	Tatal.	
	Bharana	Majurana-1		Sarog	Audh	
		Bharana		Shatayan	Bithu	
		Bachloon-1			Makrol	
		Bachloon-II			Chchar	
		Majhrana-II		Majhar	Majhar	
		Rauni			Chohar	
		Banaraghati		Shatyan	Shatyan	
	Shari Matiyana	Gadaha-1			Jaku	
		Gadaha-II				
		Theog		**Total**		64
Suket	Batuara	Batwara		Shogha	Annu	
	Dhwal	Sanihan		Shogha	Srihan	
	Balag	Majholi		Jhungi	Barnog	

Annexure III

Treatment of private areas

Name of Division	Name of Panchayat	Name of village	Area in Ha	Name of Panchayat	Name of village	Area in Ha
1	2	3	4			
	Balag	Balag		Jhungi	Dharbar	
	Balag	Chauri		Gharot	Pandhar	
	Bandli	Dhamkoun		Nihri	Bara	
	Dhanyara	Dogri		Badhan	Kathachi	
	Haraboi	Bragta		Jhungi	Shendra	
	Shogha	Bhulahan		Jrol	Ghahar	
	Shogha	Balibatadi		Dhaniyara	Nihri Ropru	
	Bandli	Kinder		Balog	Pawo	
	Presi	Presi		Balog	Bunga	
	Badu	Badu		Balog	Sanchar	
	Jhungi	Jhungi		Balog	Kayri	
	Gharot	Brohkri		Bandli	Kumaru	
	Nihri	Nihri		Bandli	Phapna	
	Badayan	Badayan		Balog	D.P.F. Chauri	
	Jaral	Jaral		Dhanyara	Dhanyara	
	Batulara	Panjolth		Haraboi	Chalog	
	Dhaniyara	Samoul		Soja	Soja	
	Dhaniyara	Badu		Soja	Karngal	
	Bandli	D.P.F. Kuftu		Presi	Sharcha	
	Bandli	Kayr Kandi		Gharot	Kathuni	
	Bandli	Kyar Kandi II		Presi	Mahap	
	Bandli	Bandli		Gharot	Matyog	
	Bandli	Charog		Badahan	Mahreda	
	Haraboi	Boi		Jaal	Ropa	
	Haraboi	Batol		Jral	Manjhagan	
	Suket	**Total**				**428**

Annexure IV

Activities under Forest Infra - Structure

ABSTRACT	
Name of Division	Amount (Rs.)
Bilaspur	540000
Shimla	7495000
Kunihar	3602000
Nachan	0
Karsog	12233000
Theog	1300000
Suket	5393500
Bilaspur Circle	1500000
Total	32063500

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
Bilaspur	**A-Building**					
	Inspection hut	Chamyon	1	No	L/S	540000
	Bilaspur	**Total**				**540000**
Shimla	Repair of FRH	FRH Karyali	1	No.	100000	100000
	Repair of FRH	FRH Khatnol	1	No.	150000	150000
	Repair of FRH	FRH Sunni	1	No.	350000	350000
	Repair of I/Hut	Insp. Hut Sainj	1	No.	100000	100000
	Repair of I/Hut	Insp. Hut Thachi	1	No.	150000	150000
	Repair of	Range Office Sunni	1	No.	200000	200000
	Repair of	Range Room Badmain	1	No.	200000	200000
	Repair of	Store Range Office	1	No.		40000
	Repair of	Range Officer Office Totu	1	No.		25000
	Repair of	Range Clerk Residence	1	No.		15000
	Repair of	R.O. Residence	1	No.		25000
	Repair of	BO qtr Dhammi	1	No.	55000	55000
	Repair of	Mashobra	1	No.	85000	85000
	Repair of	BO qtr Ghannati	1	No.	30000	30000
	Repair of	BO Qtr Khatnol	1	No.	150000	150000
	Repair of	BO Qtr Sunni	1	No.	100000	100000
	Repair of	B.O Residence	1	No.		15000
	Const. Fgd hut	Bharari	1	No.	350000	350000
	Const. Fgd hut	Baldain	1	No.	350000	350000
	Maint. Of	Fgd hut Dhammi	1	No.	25000	25000
	Maint. Of	Fgd hut Kanhoi	1	No.	75000	75000
	Maint. Of	Fgd hut Solamile	1	No.	50000	50000
	Maint. Of	Fgd hut Sanog	1	No.	15000	15000
	Maint. Of	Fgd hut Ganeog	1	No.	15000	15000
	Maint. Of	Fgd hut Ghannati	1	No.	35000	35000
	Maint. Of	Fgd hut Kialu	1	No.	150000	150000
	Maint. Of	Fgd Hut Sandoa	1	No.	100000	100000
	Maint. Of	Fgd hut Basantpur	1	No.	150000	150000
	Maint. Of	Fgd hut Khatnol	1	No.	100000	100000
	Maint. Of	Fgd hut Chanaug	1	No.	90000	90000
	Maint. Of	Fgd Hut Mandhol	1	No.	90000	90000
	Maint. Of	Fgd hut Himri	1	No.	100000	100000
	Maint. Of	Fgd Hut Karyali	1	No.	100000	100000
	Maint. Of	Fgd hut Kadharghat	1	No.	100000	100000
	New Construction	Fgd Hut Bajhol	1	No.	400000	400000
	Maint. Of	Fgd Hut Gadaug	1	No.	20000	20000
	Maint. Of	Fgd. Hut Banoti	1	No.	20000	20000
	Maint. Of	Fgd. Hut Ghyamana	1	No.	15000	15000
	Maint. Of	Fgd. Hut Tal	1	No.	11000	11000
	Maint. Of	Mashobra	1	No.	80000	80000

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	Maint. Of	Chawakidar/ Peon Resi.	1	No.		15000
	Maint. Of	Mali Hut Mohranal	1	No.	70000	70000
	Maint. Of	Labour Hut Sunni	1	No.	60000	60000
	Maint. Of	Rain Shelter Gadaug	1	No.	LS	15000
	Maint. Of	Rain Shelter Banoti	1	No.	LS	15000
	Repair of water supply	Mandhol	1	No.	LS	80000
	Repair of water supply	Chawki	1	No.	LS	60000
	Repair of water supply	Palag	1	No.	LS	70000
	Maint. Of Forest roads	Mashobra to Dhanain	1	No.	44000	44000
	Maint. Of Forest roads	Craignaino to Sharai	1	No.	45000	45000
	Matelling of Road	FRH Sunni	1	No.	LS	50000
	Matelling of Road	Range Office	1	No.	LS	65000
	Repair of B/ Path	Bharari to Kelti	1.5	Km	12000	18000
	Repair of B/ Path	Bharari to Anu	3	Km	12000	36000
	Repair of B/ Path	Tilla to Badfar	3	Km	12000	36000
	Repair of B/ Path	Bharari to Chairi	4	Km	12000	48000
	Repair of B/ Path	Snowdon to Barmu	3	Km	12000	36000
	Repair of B/ Path	Mashobra to Shilroo	1	Km	12000	12000
	Repair of B/ Path	Panjali to Bakhrail	4	Km	8000	32000
	Repair of B/ Path	Kali Ghatti to Halog	5	Km	5000	25000
	Repair of B/ Path	Dhalaya to Kangti	3	Km	5000	15000
	Repair of B/ Path	Kanohoi to Jojavi	6	Km	5000	30000
	Repair of B/ Path	Bawri to Badu	3	Km	10000	30000
	Repair of B/ Path	Ghannati to Sanog	3	Km	5000	15000
	Repair of B/ Path	Baladi to Nehra	6	Km	5000	30000
	Repair of B/ Path	Chewta to Nehra	4	Km	5000	20000
	Repair of B/ Path	Ghannati to Moolbari	4	Km	5000	20000
	Repair of B/ Path	Nerti to Bains	2.5	Km	8000	20000
	Repair of B/ Path	Hiri ki Besak to Lahog	3	Km	5000	15000
	Repair of B/ Path	Jabri to Bohli	2	Km	7000	14000
	Repair of B/ Path	Gharog to Gaancog	4	Km	6000	24000
	Repair of B/ Path	Chhaundhar to Badu	2	Km	10000	20000
	Repair of B/ Path	Ghannati to Nayawag	5	Km	5000	25000
	Repair of B/ Path	Benkhal to Bhukhu	4	Km	5000	20000
	Repair of B/ Path	Ghannati to Lachhog	2.5	Km	6000	15000
	Repair of B/path	Basantpur to Himri	18	Km	7000	126000
	Repair of B/path	Nautikhad to Shalli	20	Km	7000	140000
	Repair of B/path	Malgi to Sandoa	9	Km	7000	63000
	Repair of B/path	Bagh to Kayalu	6	Km	7000	42000
	Repair of B/path	Malgi to Dhaugra	6	Km	7000	42000
	Repair of B/path	Himri to Shalli	10	Km	10000	100000
	Repair of B/path	Nehra to Chanaug	6	Km	7000	42000
	Repair of B/path	Basantpur to Badmain	8	Km	7000	56000
	Repair of B/path	Thaila to Shalli	18	Km	9000	162000

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	Repair of B/path	Karyali to Himri	10	Km	7000	70000
	Repair of B/path	Himri to Sandoa	15	Km	7000	105000
	Repair of B/path	Malgi to Gaganghatti	20	Km	9000	180000
	Repair of B/path	Bagh to Dharogra	14	Km	7000	98000
	Repair of B/path	Sal to Aishal	6	Km	7000	42000
	Repair of B/path	Jadova to Banuna	8	Km	9000	72000
	Repair of B/path	Palyal to Mandhol	10	Km	8000	80000
	Repair of B/path	Palyad to Devidhar	10	Km	8000	80000
	Repair of B/path	Palyad to Kamalpur	6	Km	7000	42000
	Repair of B/path	Palyad to Kandaula	6	Km	8000	48000
	Repair of B/path	Devidhar to Sarog	6	Km	8000	48000
	Repair of B/path	Khatnol to Dandibag	5	Km	10000	50000
	New Construction	Mali Hut at Sainj	1	Km	200000	200000
	Repair of Forest Road & Path	Pabo to Doomi	3	Km	LS	30000
	Repair of Forest Road & Path	Range Office to FRH	0.3	Km	LS	15000
	Repair of Forest Road & Path	R-11 Gadaug Totu	1.5	Km	LS	15000
	Repair of Forest Road & Path	R-20 Ichhaser Banoti	7	Km	LS	70000
	Repair of Forest Road & Path	R-10 Tallgiri Summerhill	1.5	Km	LS	15000
	Repair of Forest Road & Path	R-17 Marhon	1.5	Km	LS	10000
	Repair of Forest Road & Path	R-18 Pabo	2.1	Km	LS	20000
	Repair of Forest Road & Path	R-19 Dumi	0.07	Km	LS	6000
	Repair of Forest Road & Path	Totu to Sharog	5	Km	LS	50000
		Shimla			**Total**	**7495000**
Kunihar	Repair of path/road	Baga to Dangoil	20	Km	LS	40000
		Baga to Torti	20	Km	LS	40000
		Baga Ser Schanli	12	Km	LS	24000
		Devrdhar to Patta	16	Km	LS	32000
		Kandhar to Boi	32	Km	LS	64000
		Kandhar to Suin	36	Km	LS	72000
		Senahli to Nanihas	16	Km	LS	32000
		Kandher to Barel	40	Km	LS	80000
		Kandhar Ghatti to Banola.	60	Km	LS	120000
		Hira Mehta to Skore Skore	40	Km	LS	80000
		Shore to Barel	16	Km	LS	32000

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	New construction new buildings					
	Fgd Hut .	Labrath	1	No	LS	400000
	BO Qtr	Kandhar	1	No	LS	500000
	Fgd Hut .	Baga	1	No	LS	400000
	Const ofStore Baga	Baga	1	No	LS	150000
	Store at Labrath	Labrath	1	No	LS	150000
	Store at Kandhar	Kandhar	1	No	LS	150000
	Range Chowkidar	Darla	1	No	LS	200000
	Qtr at Darla.					
	Repair of Fgd Hut	Kandhar	1	No	LS	
	at Kandhar.					
✓	Addition/alteration of	Darlaghat	1	No	LS	436000
	FRH Darlaghat.					
	Inspection Hut	Kandhar	1	No	LS	600000
		Kunihar		**Total**		**3602000**
Nachan		**Nil**				
Karsog	Link road	Range officeSeri at Chauridhar	0.15	Km	L/S	90000
	Link road	inspection hut Katanda	0.2	Km	L/S	120000
	Link road	Inspection hut Tatta Pani	0.185	Km	L/S	111000
	Link road	FRH Mahun Nag	0.2	Km	L/S	120000
	Link road	Inspection hut Bagshad	0.25	Km	L/S	150000
	Link road	Range office Carson	0.5	Km	L/S	300000
	Link road	Forest Colony Chaura	0.1	Km	L/S	60000
	Link road	Divisional Office	0.15	Km	L/S	90000
	Link road	Divisional hut Sanarli	0.2	Km	L/S	120000
	Link road	Range office Pangna	0.065	Km	L/S	39000
	Bridle Path	Mumail to Kelodhar	5	Km	L/S	19000
	Bridle Path	Chhatri to Gattu Galla	8	Km	L/S	30400
	Bridle Path	Sapnot - Bagsiad	4	Km	L/S	15200
	Bridle Path	Khanuir to Santhal	14	Km	L/S	53200
	Bridle Path	Kelodhar to Mahog (Part)	20	Km	L/S	76000
	Bridle Path	Jong to Gariala	12	Km	L/S	45600
	Bridle Path	Chhatri to Bagra	12	Km	L/S	46600
	Bridle Path	Mahog to Shwad	10	Km	L/S	38000
	Bridle Path	Dharmor to Sandrahal	15	Km	L/S	57000
	Bridle Path	Bakhrot to Shivadehra	4	Km	L/S	15200
	Bridle Path	Shushan to Ashla	8	Km	L/S	30400
	Bridle Path	Bhanera - Saranda	8	Km	L/S	30400
	Bridle Path	Rajogara to Panyaru	7	Km	L/S	26600
	Bridle Path	Thalli to Talehan	12	Km	L/S	45600
	Bridle Path	Allsindi to Badyog	7	Km	L/S	26600

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	Bridle Path	Thensar to Seri Narain	12	Km	L/S	44200
	Forest Guard hut	Telehan	1	No.	L/S	300000
	B. Oquarter	Karsog	1	No.	L/S	400000
	Forest Guard hut	Karsog	1	No.	L/S	300000
	Forest Guard hut	Machhrot	1	No.	L/S	300000
	Out House T/panl	Tattapani	1	No.	L/S	300000
	Forest Guard hut	Chindi	1	No.	L/S	300000
	Forest Guard hut	Dopha	1	No.	L/S	300000
	Forest Guard hut	Parlog	1	No.	L/S	300000
	Forest Guard hut	Seri	1	No.	L/S	300000
	Inspection Hut	Asla	1	No.	L/S	300000
	Forest Guard hut	Lassi	1	No.	L/S	300000
	B.O. Quarter	Katwahachi	1	No.	L/S	400000
	B.O. Quarter	Chindi	1	No.	L/S	400000
	Forest Guard hut	Ghalaich	1	No.	L/S	300000
	Inspection Hut	Kandi	1	No.	L/S	300000
	B.O. Quarter	Bagshad	1	No.	L/S	400000
	Forest Guard hut	Nanj	1	No.	L/S	300000
	Forest Guard hut	Khadra	1	No.	L/S	300000
	Forest Guard hut	Richhani	1	No.	L/S	300000
	Forest Guard hut	Pokhi	1	No.	L/S	300000
	B.O. Quarter	Chaura	1	No.	L/S	400000
	Inspection Hut	Mangarh	1	No.	L/S	300000
	Forest Guard hut	Mehran	1	No.	L/S	300000
	Forest Guard hut	Kutwahachi	1	No.	L/S	300000
	Forest Guard hut	Kotkosh	1	No.	L/S	300000
	Forest Guard hut	Kathoundhar	1	No.	L/S	300000
	Forest Guard hut	Shagagi	1	No.	L/S	300000
	Forest Guard hut	Surahi	1	No.	L/S	20000
	Inspection Hut	Tattapani	1	No.	L/S	30000
	Forest Guard hut	Sarahan	1	No.	L/S	30000
	Forest Guard hut	Pathrevi	1	No.	L/S	50000
	B.O. Quarter	Mamail	1	No.	L/S	80000
	Inspection Hut	Sanarali	1	No.	L/S	100000
	Forest Guard hut	Mahog	1	No.	L/S	32400
	Forest Guard hut	Shalog	1	No.	L/S	30000
	Forest Guard hut	Karadal	1	No.	L/S	25000
	Seed Store	Chindi	1	No.	L/S	30000
	I/C Check Post	Tattaopani	1	No.	L/S	40000
	Forest Guard hut	Bagshad	1	No.	L/S	30000
	Forest Guard hut	Mahunag	1	No.	L/S	20000
	Rest House	Mahunag	1	No.	L/S	100000
	Inspection Hut	Bagshad	1	No.	L/S	100000
	Inspection Hut	Kotlu	1	No.	L/S	100000

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	Seed Store	Kotlu	1	No.	L/S	30000
	Forest Guard hut	Chaura	1	No.	L/S	23200
	Forest Guard hut	Thanser	1	No.	L/S	30000
	Forest Guard hut	Shorshan	1	No.	L/S	25000
	Forest Guard hut	Belar	1	No.	L/S	25000
	Forest Guard hut	Sapnot	1	No.	L/S	20000
	Forest Guard hut	Sanaril	1	No.	L/S	20000
	Forest Guard hut	Mamail	1	No.	L/S	30000
	Range Office	Karsog	1	No.	L/S	90000
	Resident Quarter	Chaura	1	No.	L/S	400000
	B.O.Quarter	Kotlu	1	No.	L/S	16200
	Forest Guard hut	Niharinal	1	No.	L/S	30000
	Forest Guard hut	Dhamoon	1	No.	L/S	30000
	Forest Guard hut	Chauridhar	1	No.	L/S	30000
	B.O. Quarter	Chauridhar	1	No.	L/S	25000
	Range Office	Chauridhar	1	No.	L/S	80000
	Inspection Hut	Katanda	1	No.	L/S	50000
	Forest Guard hut	Gowalpur	1	No.	L/S	61200
	Karsog	**Total**				**12233000**
Theog	Jeepable road	Theog	1.4	Km	L/S	300000
	Repair of FG Hut	Sarog	1	No	L/S	150000
	Repair of FG Hut	Kuphri	1	No	L/S	150000
	Repair of FG Hut	Godah	1	No	L/S	100000
	Repair of FG Hut	Raghighat	1	No	L/S	200000
	Repair of FG Hut	Bakelthi	1	No	L/S	200000
	I/ hut	Dharampur Dibba	1	No	L/S	100000
	Office Campound	Theog	3	No	L/S	100000
	Theog		**Total**			**1300000**
		Roads and Paths				
Suket	Repair of Bridle Path	1. Pandar - Fesidhar	10	Km	L/S	50000
	Repair of Bridle Path	2. Barokri - Kanjira	10	Km	L/S	50000
	Repair of Bridle Path	3. Nandi Gah- Doban	10	Km	L/S	50000
	Repair of Bridle Path	4. Bandi Gali - Jayog	3	Km	L/S	15000
	Repair of Bridle Path	5. Shandra - Nandi	3	Km	L/S	15000
	Repair of Bridle Path	6. Jhungi - Jhachh	3	Km	L/S	15000
	Repair of Bridle Path	7. Baduli - Kanda	3	Km	L/S	15000
	Repair of Bridle Path	8. Gadog - Gangoti	3	Km	L/S	15000
	Repair of Bridle Path	9. Jhungi - Galtu	12	Km	L/S	80000
	Repair of Bridle Path	10. Gadog - Darbar	10	Km	L/S	30000
	Repair of Bridle Path	11. Chakral - Sarol	3	Km	L/S	15000
	Repair of Bridle Path	12. Mahap - Barog	4	Km	L/S	20000
	Repair of Bridle Path	13. Banthal - Sarcha	12	Km	L/S	60000
	Repair of Bridle Path	14. Batoh Gali - Jablilloo	10	Km	L/S	50000

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	Repair of Bridle Path	15. Dwarloo Dehra - Bhaka	5	Km	L/S	25000
	Repair of Bridle Path	16. Bider - Chirl	3	Km	L/S	15000
	Repair of Bridle Path	17. Sural - Sashan	10	Km	L/S	50000
	Repair of Bridle Path	18. Badyan - Regi	5	Km	L/S	25000
	Repair of Bridle Path	19. Jaral - Gali	5	Km	L/S	25000
	Repair of Bridle Path	20. Ropa - Manjhangan	10	Km	L/S	50000
	Repair of Bridle Path	21. Sheri - Kriya	5	Km	L/S	25000
	Repair of Bridle Path	22. Bandli - Mundlidhar	10	Km	L/S	50000
	Repair of Bridle Path	23. Bandli-Kumaroo	5	Km	L/S	50000
	Repair of Bridle Path	24. Bandli - Chorog	5	Km	L/S	25000
	Repair of Bridle Path	25. Kinder - Sojha	10	Km	L/S	50000
	Repair of Bridle Path	26. Kinder - Kayar	5	Km	L/S	25000
	Repair of Bridle Path	27. Kinder - Narili	5	Km	L/S	25000
	Repair of Bridle Path	28. Charog - Jendrer	5	Km	L/S	25000
	Repair of Bridle Path	29. Dhanu-Kathla	5	Km	L/S	25000
	Repair of Bridle Path	30. Jogan - Banas	3	Km	L/S	15000
	Repair of Bridle Path	31. Koophato-Kumaroo	3	Km	L/S	15000
	Repair of Bridle Path	32. Dharbar - Gohata	5	Km	L/S	25000
	Repair of Bridle Path	33. Barnog - Fesi Dhar	5	Km	L/S	25000
	Repair of Bridle Path	34. Shandra - Shaya	3	Km	L/S	15000
	Repair of Bridle Path	35. Kutachi - Jhungi	4	Km	L/S	20000
	Repair of Bridle Path	36. Matyog - Ropa	20	Km	L/S	100000
	Repair of Bridle Path	37. Pandar - Kamronag	25	Km	L/S	78955
	Repair of Bridle Path	38. Behli - Saror	8	Km	L/S	60000
	Repair of Bridle Path	39. Behli - Annu	6	Km	L/S	40000
	Repair of Bridle Path	40. Chandikar - Rondi	5	Km	L/S	40000
	Repair of Bridle Path	41. Boi- Tali	8	Km	L/S	70000
	Repair of Bridle Path	42. Neri Khad - Badoh	5	Km	L/S	32360
	Repair of Bridle Path	43. Mahala - Batari	3	Km	L/S	30000
	Repair of Bridle Path	44. Dogri - Cheori	8	Km	L/S	65000
	Repair of Bridle Path	45. Karla - Neri Khad	2.5	Km	L/S	14000
	Repair of Bridle Path	46. Dogri - Kumaru	9	Km	L/S	60000
	Repair of Bridle Path	47. Hara boi - Dogri	7	Km	L/S	50000
	Repair of Bridle Path	48. Neri - Balag	12	Km	L/S	80000
	Repair of Bridle Path	49. Badoh - Bakhal	4	Km	L/S	39633
	Repair of Bridle Path	50. Kol - Fafna	8	Km	L/S	80000
	Repair of Bridle Path	51. Kol - Balag	6	Km	L/S	50000
	Repair of Bridle Path	52. Bali - Bindlu	3	Km	L/S	25000
	Repair of Bridle Path	53. Bali - Mared	4	Km	L/S	40000
	Repair of Bridle Path	54. Bhalan - Peluenı	2	Km	L/S	20000
	Repair of Bridle Path	55. Batol - Bragta	4	Km	L/S	30000
	Repair of Bridle Path	56. Badu - Chori	10	Km	L/S	70000
	Repair of Bridle Path	57. Fafna - Ghan	8	Km	L/S	51700

Annexure IV

Activities under Forest infrastructure development

Name of Division	Activity	Location	Quantity	Unit	Rate	Amount (Rs)
1	2	3	4		5	6
	Repair of Bridle Path	58. Ahain-Sanihan	4	Km	L/S	35000
	Repair of Bridle Path	59. Sanihan - Dhar	4	Km	L/S	35000
	Repair of Bridle Path	60. Ropa - Batwara	5	Km	L/S	40000
	Repair of Bridle Path	61. Dohru - Senihan	2	Km	L/S	20000
	Repair of Bridle Path	62. Ropa - Kandhi	12	Km	L/S	80000
	Repair of Bridle Path	63. Batwara - Jartu	6	Km	L/S	50000
	Const of J/Road	64. Behli - Jadiun	6	Km	L/S	224300
			Total			**2695948**
	ii) Repair of Buiding	1. Fgd hut Kathuni	1	No	L/S	20000
		2. Fgd Dharwar	1	No	L/S	20000
		3. Range Store Jhungi	1	No	L/S	20000
		4. Fgd Hut Salani	1	No	L/S	20000
		5. Fgd Hut Nihri	1	No	L/S	40000
		6. FRH Nihri	1	No	L/S	60000
		7. Fgd Hut Kanas	1	No	L/S	50000
		8. Seed Store Jhungi	1	No	L/S	13925
		9. Fgd Hut Bandli	1	No	L/S	20000
		10. Fgd Behli	1	No	L/S	40000
		11. B O Quater Behli	1	No	L/S	60000
		12. FRH Behli	1	No	L/S	60000
		13. Fgd Hut Hara Boi	1	No	L/S	40000
		14. Fgd Hut Badu	1	No	L/S	20000
		15. Fgd Hut Dogri	1	No	L/S	80000
		16. FRH Har Boi	1	No	L/S	60000
		17. FRH Batwara	1	No	L/S	80000
		Total				703925
	ii) Construction of Building	1. Fgd hut Batwara ✔	1	No	L/S	450000
		2. Fgd hut Gehroo ✔	1	No	L/S	543627
	-do-	3. B.O. Quater Trachh	1	No	L/S	600000
	-do-	4. B.O. Quater Pandar ✔	1	No	L/S	400000
		Total				1993627
		Suket	**Total**			**5393500**

Bilaspur Circle	Construction of Conference hall at Bilaspur including furnishing and accessries required for the conference hall.

Annexure V

Activities under Rural Infra - Structure

ABSTRACT	
Name of Division	Amount (Rs.)
Bilaspur	90000
Shimla	16295000
Kunihar	5258000
Nachan	150000
Karsog	7859400
Theog	1930000
Suket	5393500
Total	36975900

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
Bilaspur		**A-Village path**					
	Hamora	Kasol	Repair of path	4	Km	L/S	30000
		B- Village ponds/Tank/other water sources					
		Kasol	Repair of ponds	1	No	L/S	20000
		Chamyon	Repair of ponds	2	No	L/S	20000
		Panali	Repair of ponds	2	No	L/S	20000
		Bilaspur	**Total**				**90000**
		A-Village path					
Shimla	Dhammi	Halog to Kaiaribag	V.Path(Mint)	2	Km	12500	25000
	Shakaraha	Sedan	V.Path(Mint)	2	Km	15000	30000
	Shakaraha	Badu	V.Path(Mint)	2	Km	15000	30000
	Ghannati	Kufri Dhar	Pakka Path (Maint.)	0.5	Km	50000	25000
	Mashobra	Seapur	Road (Maint)	1.5	Km	LS	50000
	Mashobra	Gharshi	V.Path (Mint.)	3	Km	10000	30000
	Mashobra	Shuilla	V.Path (Mint.)	4	Km	10000	40000
	Mashobra	Shawahal	V.Path (Mint.)	3	Km	10000	30000
	Mashobra	Kalayanpur	V.Path (Mint.)	4	Km	10000	40000
	Mashobra	Phagala	V.Path (Mint.)	3	Km	10000	30000
	Mashobra	Kanola	V.Path (Mint.)	3	Km	10000	30000
	Mashobra	Deothi	V.Path (Mint.)	4	Km	10000	40000
	Mashobra	Gumma	V.Path (Mint.)	6	Km	10000	60000
	Mashobra	Bagthal	V.Path (Mint.)	4	Km	10000	40000
	Dhalli	Chaivan	V.Path (Mint.)	3	Km	10000	30000
	Dhalli	Badfer	V.Path (Mint.)	3	Km	10000	30000
	Dhalli	Ajdhar	V.Path (Mint.)	3	Km	10000	30000
	Dhalli	Lindidhar	V.Path (Mint.)	2	Km	10000	20000
	Dhalli	Kamahali	V.Path (Mint.)	4	Km	10000	40000
	Dhalli	Masech	V.Path (Mint.)	3	Km	10000	30000
	Moolkoti	Kanda	V.Path (Mint.)	4	Km	10000	40000
	Moolkoti	Rachhol	V.Path (Mint.)	3	Km	10000	30000
	Moolkoti	Chanari	V.Path (Mint.)	3	Km	10000	30000
	Moolkoti	Moolkoti	V.Path (Mint.)	4	Km	10000	40000
	Moolkoti	Flogi	V.Path (Mint.)	2	Km	10000	20000
	Baldain	Dhar	V.Path (Mint.)	3	Km	10000	30000
	Baldain	Jagyalru	V.Path (Mint.)	2	Km	10000	20000
	Baldain	Bhagijubbar	V.Path (Mint.)	3	Km	10000	30000
	Naldehra	Oddu	V.Path (Mint.)	3	Km	10000	30000
	Naldehra	Kogi	V.Path (Mint.)	2	Km	10000	20000
	Naldehra	Swankayar	V.Path (Mint.)	2	Km	10000	20000
	Naldehra	Saunthal	V.Path (Mint.)	3	Km	10000	30000
	Chairi	Bhawana	V.Path (Mint.)	5	Km	10000	50000
	Chairi	Bhatiyar	V.Path (Mint.)	3	Km	10000	30000
	Chairi	Anu	V.Path (Mint.)	3	Km	10000	30000
	Chairi	Nehari	V.Path (Mint.)	2	Km	10000	20000
	Pagog	Pagog	V.Path (Mint.)	3	Km	10000	30000
	Pagog	Badash	V.Path (Mint.)	3	Km	10000	30000
	Gharyana	PalyartoReog	Const of foot Path	5	Km	LS	100000
	Pahal	Palyar to Nalag	Const of foot Path	4	Km	LS	80000
	Majhiwar	Jajehar to Majailu	Const of foot Path	4	Km	LS	100000
	Juni	Sainjari to Madhor	Const of foot Path	3	Km	LS	60000
	Juni	Madhor to Golan	Const of foot Path	3	Km	LS	30000
	Himri	Galou to Gadheri	Const of foot Path	6	Km	LS	100000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Himri	Gudheri to Reog	Const of foot Path	2	Km	LS	30000
	Dharogra	Dharogra to Eog	Const of foot Path	7	Km	LS	70000
	Majhiwar	Guma to Romahan	Const of foot Path	4	Km	LS	40000
	Chanawag	Bir ki Jain toJhunkari	Const of foot Path	3	Km	LS	60000
	Chanawag	Chanawag to Harshingh dhar	Const of foot Path	9	Km	LS	200000
	Domahar	Navi to Shara	Const of foot Path	4	Km	LS	50000
	Himri	Navi to Himri	Const of foot Path	9	Km	LS	70000
	Gharyana	Gha ryana to Kamalpur	Const of foot Path	6	Km	LS	100000
	Majhiwar	Jajhar to Matlod	Const of foot Path	10	Km	LS	50000
	Majhiwar	Hajal to Thuru Temple	Const of foot Path	3	Km	LS	30000
	Chanawag	Chanawag to Dawaru	Const of foot Path	4	Km	LS	40000
	Domehar	Kadhar	Kadhar to Gunvi (Maint)	3	Km	10000	30000
	Domehar	Palag	Kadhar to Chebri	6	Km	10000	60000
	Basantpur	Basantpur	Basantpur to Panera	2	Km	10000	20000
	Majhiwar	Jajer	Jajer to Malaun	5	Km	10000	50000
	Domehar	Domehar	Kadhar to Domehar ghat	8	Km	10000	80000
	Pahal	Kotla	Kotla to Nalag	4	Km	15000	60000
	Ghaini	Ghaini	Ghaini to 18/2	4	Km	10000	40000
	Bagh	Pandoa	Pandoa to Paneot	5	Km	10000	50000
	Ghaini	Ghaini	Devidhar to Ghaini	5	Km	10000	50000
	Reog	Reog	Suni to Devidhar	8	Km	10000	80000
	Gagh	Bathora	Bathora to Paneot	4	Km	10000	40000
	Gharayana	Kamalpur	Surni to Kamalpur	4	Km	10000	40000
	Chaily	Dall to anji	Repair of Vill. Paths	2	Km	LS	30000
	Chaily	Tall To Manyar	Repair of Vill. Paths	3	Km	LS	30000
	Doomi	Doomi to Sheera	Repair of Vill. Paths	4	Km	LS	40000
	Doomi	Ghyamana TO Bhoant	Repair of Vill. Paths	2	Km	LS	30000
	Chaily	Gadaug to Kair	Repair of Vill. Paths	2	Km	LS	30000
	Chaily	Dhanda to Sharog	Repair of Vill. Paths	2	Km	LS	30000
	Dhudalti	Bhonti to fiharoie	Repair of Vill. Paths	2	Km	LS	30000
	Dhudalti	Dhudalti to Beont	Repair of Vill. Paths	3	Km	LS	34000
		B Village Ponds/ Tank/Other sources					
	Bainsh	Nerti	Water Pond	1	No	50000	50000
	Bainsh	Bainsh	Water Pond	1	No	50000	50000
	Bainsh	Bakhrail	Farm Pond	1	No	45000	45000
	Dhammi	Bagh	Farm Pond	1	No	50000	50000
	Jabri	Kangti	Farm Pond	1	No	50000	50000
	Deonagar	Salong	Water Pond	1	No	75000	75000
	Jabri	Neoli	Bauri	1	No	50000	50000
	Deonagar	Narihana	Bauri	1	No	50000	50000
	Deonagar	Kalvi	Bauri	1	No	50000	50000
	Deonagar	Deola	Bauri	1	No	50000	50000
	Shakaraha	Badu	Water Source	1	No	50000	50000
	Ghannati	Kufri Dhar	water supply	1	No	100000	100000
	Mashobra	Seapur	Bauri	2	No	25000	50000
	Chairi	Chairi	Bauri	1	No	25000	25000
	Chairi	Nehari	Bauri	1	No	25000	25000
	Chairi	Anu	Bauri	1	No	25000	25000
	Chairi	Badash	Bauri	1	No	25000	25000
	Pagog	Pagog	Bauri	1	No	25000	25000
	Naldehra	Saunthal	Bauri	1	No	25000	25000
	Naldehra	Kogi	Bauri	1	No	25000	25000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Mashobra	Seapur	Water Tank	1	No	80000	80000
	Chairi	Anu	Farm Pond	1	No	60000	60000
	Pagog	Badash	Farm Pond	1	No	60000	60000
	Dhalli	Badfer	Farm Pond	1	No	60000	60000
	Naldehra	Oddu	Farm Pond	1	No	60000	60000
	Baldain	Bag	Farm Pond	1	No	60000	60000
	Moolkoti	Gharaich	Farm Pond	1	No	60000	60000
	Shakrori	Shakrori	Repair W/tank	1	No	LS	50000
	Majhiwar	Jajhehar	Repair W/tank	2	No	LS	80000
	Dharogra	Sandhoa	Repair W/tank	1	No	LS	100000
	Juni	Seri	Repair W/tank	1	No	LS	40000
	Basantpur	Mohara Nala	New w/Tank	1	No	LS	150000
	Dharogra	Sandhoa	New w/Tank	1	No	LS	100000
	Chanawag	Manjali jain	New w/Tank	1	No	LS	100000
	Chanawag	Jood/Jodllo	New w/Tank	1	No	LS	100000
	Juni	Bhargan	New w/Tank	1	No	LS	100000
	Majhiwar	Jajhehar	New w/Tank	1	No	LS	100000
	Khatnol	Shalli	New w/Tank	1	No	LS	200000
	Shakrori	Shakrori	Repair Bawari	1	No	LS	20000
	Juni	Kandoula	Repair Bawari	1	No	LS	20000
	Gharyana	Gharyna	Repair Bawari	1	No	LS	20000
	Gharyana	Dawarasu	Repair Bawari	1	No	LS	25000
	Pahal	Sharog	Repair Bawari	1	No	LS	20000
	Juni	Madhor	Repair Bawari	1	No	LS	20000
	Juni	Seri	Repair Bawari	1	No	LS	20000
	Khatnol	Khatnol	Repair Bawari	1	No	LS	20000
	Khatnol	Bag	Repair Bawari	1	No	LS	20000
	Gharyana	Gharyna	Repair Big Bawari	1	No	LS	35000
	Juni	Golan	Const of Farm Pond	1	No	LS	80000
	Dharogra	Dharogra	Const of Farm Pond	1	No	LS	80000
	Khatnol	Taloti	Repair of Spring	1	No	LS	20000
	Himri	Gadheri	Repair of Spring	2	No	LS	30000
	Dharogra	Dharogra	Repair of Spring	4	No	LS	60000
	Majhiwar	Ramahan	Repair of Kuhal	3	Km	LS	60000
	Juni	Jamog	Repair of Kuhal	4	Km	LS	40000
	Karali	Jaishi Bharara	Repair of Kuhal	5	Km	LS	60000
	Ogli	Ogali Kohti	Repair of Kuhal	4	Km	LS	50000
	Khatnol	Khatnol	Water Storage Tank	1	No	LS	100000
	Deola	Deola	Water Storage Tank	1	No	LS	100000
	Majhiwar	Jubbar	Water Storage Tank	1	No	LS	100000
	Domehar	Kadhar	Water Storage Tank	1	No	LS	100000
	Chebri	Chawki	Water Storage Tank	1	No	LS	100000
	Himri	Gadahu	Water Storage Tank	1	No	LS	100000
	Dharogra	Aeog	Water Storage Tank	1	No	LS	100000
	Bagh	Aisha	Water Storage Tank	1	No	LS	100000
	Basantpur	Naltu	Water Storage Tank	1	No	LS	100000
	Neen	Chatyar	Water Storage Tank	1	No	LS	100000
	Thachi	Kotla	Water Storage Tank	1	No	LS	100000
	Karali	Jaishi	Water Storage Tank	1	No	LS	100000
	Karali	Bharada	Water Storage Tank	1	No	LS	100000
	Chaily	Gadaug	Const of Ponds	1	No	LS	15000
	Chaily	Girb	Const of Ponds	1	No	LS	15000
	Chaily	Kiar	Const of Ponds	1	No	LS	15000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Chaily	Dhar Ki Kuffer	Const of Ponds	1	No	LS	15000
	Neri	Anji	Const of Ponds	1	No	LS	15000
	Doomi	Obna	Const of Ponds	1	No	LS	15000
	Doomi	Pabo	Const of Ponds	1	No	LS	15000
	Chaily	Gadoug	Repair of Baswaries & W/S	1	No	LS	15000
	Chaily	Rehai	Do	1	No	LS	15000
	Neri	Neri	Do	1	No	LS	15000
	Chaily	Kiar	Do	1	No	LS	15000
	Chaily	Anji	Do	1	No	LS	18000
	Chaily	Chaily	Do	1	No	LS	15000
	Neri	Dhar Ki Kuffer	Do	1	No	LS	15000
	Bhanot	Bhaont	Do	1	No	LS	10000
	Doomi	Pabo	Do	1	No	LS	10000
	Doomi	Obna	Do	1	No	LS	10000
	Bainsh	Bainsh	Checkdams	30	No	LS	300000
	Deonagar	Saltu	Checkdams	9	No	LS	150000
	Sakraha	Badunala	Checkdams	15	No	LS	200000
	Deonagar	Bledi	WHS	1	No	100000	100000
	Deonagar	Sagech	WHS	1	No	100000	100000
	Shakaraha	Sedan	WHS	1	No	100000	100000
	Ghannati	Bagh ka nal	WHS	1	No	100000	100000
	Chairi	Bhawana	WHS	1	No	75000	75000
	Pagog	Parechi	WHS	1	No	75000	75000
	Dhalli	Barmu	WHS	1	No	75000	75000
	Moolkoti	Deothi	WHS	1	No	75000	75000
	Moolkoti	Moolkoti	WHS	1	No	75000	75000
	Baldain	Kanda	WHS	1	No	75000	75000
	Naldehra	Kogi	WHS	1	No	75000	75000
	Mashobra	Jabbal	Checkdams	15	No	LS	150000
	Naldehra	Saunthal	Checkdams	10	No	LS	100000
	Moolkoti	Naroti	Checkdams	10	No	LS	100000
	Pagog	Pagog	Checkdams	10	No	LS	100000
	Ogli	Malgi	Const of Har.Struc.	1	No	LS	200000
	Juni	Jamog	Const of Har.Struc.	1	No	LS	200000
	Nehara	Dirshti	Const of Har.Struc.	1	No	LS	200000
	Deola	Shadi	Const of WHS	1	No	LS	200000
	Khatnol	Gaida	Const of WHS	1	No	LS	200000
	Domehar	Domehar	Const of WHS	1	No	LS	200000
	Karali	Nalah	Const of WHS	1	No	LS	200000
	Himri	Gadahu	Const of WHS	1	No	LS	200000
	Dharogra	Palger Nalla	Const of WHS	1	No	LS	200000
	Bagh	Bagain	Const of WHS	1	No	LS	200000
	Basantpur	Kadog	Const of WHS	1	No	LS	200000
	Sunni	Gharat Nalla	Const of WHS	1	No	LS	200000
	Neen	Panchal	Const of WHS	1	No	LS	200000
	Chanawag	Macharyana	Medium	10	No	LS	80000
	Nehara	Panohi	Big	4	No	LS	80000
	Thachi	Thachi	Big	3	No	LS	60000
	Thachi	Thachi	Medium	5	No	LS	40000
	Thachi	Bajhol	Small	10	No	LS	40000
	Chaily	Sharog	Const of Harvesting Str.	1	No	LS	60000
	Chaily	Gadaug	Const of Harvesting Str.	1	No	LS	60000
	Neri	Neri	Do	1	No	LS	60000

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Neri	Niun	Do	1	No	LS	60000
	Doomi	Doomi	Do	1	No	LS	60000
	Bhaont	Bhaont	Do	1	No	LS	60000
	Doomi	Pabo	Const of Big Check Dam	4	No	LS	80000
	Neri	Naughalca	Do	4	No	LS	80000
	Chaily	Niun	Do	4	No	LS	80000
	Chaily	Sharog/ Girb	Do	4	No	LS	80000
	Doomi	Pabo	Do	8	No	LS	64000
	Neri	Naughalca	Const of Medium Check Dam	8	No	LS	64000
	Chaily	Niun	Do	8	No	LS	64000
	Chaily	Sharog/ Girb	Do	7	No	LS	56000
	Nin	Nin	Repair of Cremoteria	1	No	LS	40000
	Majhiwar	Rilli/Gumma	Const of Cremoteria	1	No	LS	100000
	Majhiwar	Majailu	Const of Cremoteria	1	No	LS	100000
	Chanawag	Sainj/Khud	Const of Cremoteria	1	No	LS	100000
	Majhiwar	Jajher	Repair of temple	1	No	LS	100000
	Sunni	Sunni	Const. Of Community Hall	1	No	LS	150000
	Majhiwar	Hajal	Const. Of Community Hall	1	No	LS	100000
	Majhiwar	Berty	Repair of Bauri	3	No	LS	80000
	Majhiwar	Najas	Const. Of Foot Bridge	1	No	LS	150000
	Majhiwar	Majhiwar	Const of Foot Bridge	1	No	LS	150000
	Khatnol	Sadoh	Const of Foot Bridge	1	No	LS	150000
	Dharogra	Palger	Const of Foot Bridge	1	No	LS	150000
	Bagh	Bagh	Const of Foot Bridge	1	No	LS	150000
	Gharaina	Kamalpur	Community Centre	1	No	LS	125000
	Karali	Karali	Community Centre	1	No	LS	125000
	Juni	Madhorghat	Community Centre	1	No	LS	125000
	Sunni	Sunni	Community Centre	1	No	LS	125000
		Bridges					
	Majhiwar	Majailu Khad	Const of Foot Bridge	1	No	LS	200000
	Chanawag	Sainj Khad	Repair of Foot Bridge	1	No	LS	50000
	Majhiwar	Guma Khad	Const of Foot Bridge	1	No	LS	200000
			Shimla		**Total**		**16295000**
		A Village paths					
Kunihar	Beral	Matrech	Const. Of Pucca path	500	Mtr	LS	150000
		Matrech	Pucca path Hira Mehta	500	Mtr	LS	150000
		Sakore	Const. Of Pucca path	750	Mtr	LS	225000
		Seharli	Const. Of Pucca path	750	Mtr	Ls	225000
		Beral	Const. Of Pucca path	750	Mtr	LS	225000
		Parla Kayar	Const. Of Pucca path	500	Mtr	LS	150000
		Bohi	Const. Of Pucca path	1	KM	LS	300000
		Soin	Const. Of Pucca path	1	KM	LS	300000
	Kandhar	Samtiyari	Const. Of Pucca path	1	KM	LS	300000
		Nanihas	Const. Of Pucca path	667	Rmt	LS	200000
		Darwarlo &	Const. Of Pucca path	667	Rmt	LS	200000
		Chandia					
		Baga	Const. Of Pucca path	460	Rmt	LS	138000
		Baga	Const of Pucca path Hawani to Towti	667	Rmt.	LS	200000
	Beral	Beral	Const of Kacha path Suin to Beral	1	No	LS	150000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
		Beral	Kacha path Chainda	1	No	LS	150000
			to Suin via Beral.				
		Matrech	Kacha path Bani Ka	1	No	LS	100000
			Nal to Surgdawari.				
		Matrech	Kacha path Hira Mehta	1	No	LS	400000
			to Kathfol.				
	Kandhar	Kandhar	Kacha path	1	No	LS	300000
		B Village Ponds/ Tank/Other water sources					
	Beral	Matrech	Water tank at Bir	1	No	LS	100000
		Seharli	Water tank.	1	No	LS	100000
	Kandhar	Baga	water tank.	1	No	LS	100000
	Beral	Seharli	Water pond (Harvest-	1	No	LS	300000
			ing structure) at Bang				
			Ka Nala.				
	Kandhar	Santyari	Foot bridge.	2	Nos	LS	220000
	Beral	Jaldoi	New Kuhal	1	No	LS	205000
		Matrech	Kuhal	1	No	LS	150000
	Kandhar	Torti (Baga)	Kuhal	1	No	LS	220000
			Kunihar	**Total**			**5258000**
Nachan		**B Village Ponds/ Tank/Other water sources**					
	Janjhali	Bhalwar	Const of pond near Girigangoo	1	No	LS	50000
		Bhalwar	Const of pond near Mangroogarh	1	No	LS	50000
		Boong Majhwal	Const of pond	1	No	LS	50000
			Nachan	**Total**			**150000**
Karsog		**A Village paths**					
	Karsog	Sanarli-Jhakhroo - Khanora	Repair to Village Paths	2	KM	5000	10000
	Karsog	Sarkol - Santhal	Repair to Village Paths	4	KM	5000	20000
	Karsog	Kashaul to Kandi	Repair to Village Paths	5	KM	5000	25000
	Karsog	Falindi to Shongi	Repair to Village Paths	6	KM	5000	30000
	Seri	Manshana to Sihanj	Repair to Village Paths	8	KM	5000	40000
	Seri	Ashla to Tebban	Repair to Village Paths	6	KM	5000	30000
	Seri	Katol to Kotlu	Repair to Village Paths	5	KM	5000	25000
	Seri	Manshana to Sihanj	Repair to Village Paths	6	KM	5000	30000
	Seri	Dhamoon to Mahasudhar	Repair to Village Paths	5	KM	5000	25000
	Seri	Naglog to Mahavan	Repair to Village Paths	3	KM	5000	15000
	Pagna	Thali to Sawindhar	Repair to Village Paths	6	KM	5000	30000
	Pagna	Thali to Jamoodhar	Repair to Village Paths	7	KM	5000	35000
	Pagna	Thali Suni	Repair to Village Paths	3	KM	5000	15000
	Pagna	Shongi to Talehan	Repair to Village Paths	6	KM	5000	30000
	Pagna	Jamoodhar to Tellehan	Repair to Village Paths	10	KM	5000	50000
	Seri	Chekhwa to Sarahan	Repair to Village Paths	6	KM	5000	30000
	Seri	Sarahan to Phanyota	Repair to Village Paths	3	KM	5000	15000
	Seri	Ashla to Koti	Repair to Village Paths	4	KM	5000	20000
	Seri	Shaledi Khad to Jai	Repair to Village Paths	3	KM	5000	15000
	Seri	Chekhwa Naftan	Repair to Village Paths	10	KM	5000	50000
	Seri	Jai tp Shill	Repair to Village Paths	10	KM	5000	50000
	Seri	Khaneol bagra - Mendi	Repair to Village Paths	8	KM	5000	40000
	Seri	Belu to Kurna	Repair to Village Paths	5	KM	5000	25000
	Seri	Belu to Belludhank	Repair to Village Paths	12	KM	5000	60000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Seri	Belu dhank to Beludhank-II	Repair to Village Paths	8	KM	5000	40000
	Seri	Nanj to Sianj	Repair to Village Paths	10	KM	5000	50000
	Seri	Nanj to Khaneol Bagra	Repair to Village Paths	12	KM	5000	60000
	Seri	Nanj to Trimbll	Repair to Village Paths	6	KM	5000	30000
	Seri	Jai to Ashla	Repair to Village Paths	6	KM	5000	30000
	Karsog	Gadar to Besta	Repair to Village Paths	5	KM	5000	25000
	Karsog	Bagsiad - Kund via Gadari	Repair to Village Paths	12	KM	5000	60000
	Karsog	Bagsiad to Mahran	Repair to Village Paths	6	KM	5000	30000
	Karsog	Bagsiad to Badyog	Repair to Village Paths	12	KM	5000	60000
	Karsog	Bagsiad to Kashapari	Repair to Village Paths	7	KM	5000	35000
	Karsog	Mahunag to Bagsiad	Repair to Village Paths	6	KM	5000	30000
	Karsog	Mahunag to Sans - Jhungroo	Repair to Village Paths	8	KM	5000	40000
	Karsog	Mahunag to Seri	Repair to Village Paths	5	KM	5000	25000
	Karsog	Mahunag to Sartoyala	Repair to Village Paths	10	KM	5000	50000
	Karsog	Garyala to Thanali	Repair to Village Paths	6	KM	5000	30000
	Pangna	Tattapani to Sahaj	Repair to Village Paths	5	KM	5000	25000
	Pangna	Tattapani to Thogi	Repair to Village Paths	2	KM	5000	10000
	Pangna	Kot to Ropri	Repair to Village Paths	3	KM	5000	15000
	Pangna	Mahot to jassal	Repair to Village Paths	4	KM	5000	20000
	Pangna	Shakra to Dwaroo	Repair to Village Paths	8	KM	5000	40000
	Pangna	Shakra to Bindla	Repair to Village Paths	6	KM	5000	30000
	Pangna	Shakra to Talehan	Repair to Village Paths	8	KM	5000	40000
	Pangna	Subot to Badyog	Repair to Village Paths	11	KM	5000	55000
	Pangna	Bindla to Magan	Repair to Village Paths	9	KM	5000	45000
	Pangna	Kujonal to Chindi	Repair to Village Paths	5	KM	5000	25000
	Magru	Jhared to Chared	Repair to Village Paths	8	KM	5000	40000
	Magru	Navidhar to Shakehlar	Repair to Village Paths	8	KM	5000	40000
	Magru	Seri to Luathan	Repair to Village Paths	4	KM	5000	20000
	Magru	Seri Katanda to Bagoond	Repair to Village Paths	5	KM	5000	25000
	Karsog	Kashaul to mendi	Repair to Village Paths	7	KM	5000	35000
	Karsog	Banthal to Bahan Gadhiman	Repair to Village Paths	5	KM	5000	25000
	Karsog	Dabrot to Phinoo	Repair to Village Paths	6	KM	5000	30000
	Karsog	Gothra to Naswar	Repair to Village Paths	3	KM	5000	15000
	Karsog	Sartyola to Magan	Repair to Village Paths	8	KM	5000	40000
	Karsog	Sartoyala to Manju	Repair to Village Paths	6	KM	5000	30000
	Karsog	Punni to Bhanach	Repair to Village Paths	2	KM	5000	10000
	Karsog	Parlog to Sartoyola	Repair to Village Paths	8	KM	5000	40000
	Karsog	Sartoyala to Magan	Repair to Village Paths	8	KM	5000	40000
	Karsog	Dhartha to Kanda	Repair to Village Paths	4	KM	5000	20000
	Karsog	Durkanoo to Pandli	Repair to Village Paths	8	KM	5000	40000
	Karsog	Makree to Kashmir	Repair to Village Paths	3	KM	5000	15000
	Karsog	Bag to Tikkari	Repair to Village Paths	2	KM	5000	10000
	Karsog	Bagshaid to Aliyad	Repair to Village Paths	4	KM	5000	20000
	Karsog	Garyala - Jong	Repair to Village Paths	6	KM	5000	30000
	Karsog	Kao to Dabrot	Repair to Village Paths	5	KM	5000	25000
	Karsog	Dhanara to Kashol	Repair to Village Paths	4	KM	5000	20000
	Karsog	Shalani to Kashol	Repair to Village Paths	3	KM	5000	15000
	Seri	Jua - Shill	Repair to Village Paths	8	KM	5000	40000
	Seri	Shaloa to Pokhi	Repair to Village Paths	10	KM	5000	50000
	Seri	Kevi to Shill	Repair to Village Paths	8	KM	5000	40000
	Seri	Kevi to Shill	Repair to Village Paths	7	KM	5000	35000
	Seri	Kevi to Shalla	Repair to Village Paths	2	KM	5000	10000
	Seri	Tundal to Purvi seri	Repair to Village Paths	3	KM	5000	15000

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Seri	Phayota to Swin	Repair to Village Paths	6	KM	5000	30000
	Seri	Dhamoon to Ganna	Repair to Village Paths	8	KM	5000	40000
	Seri	Sianj to Kumarla	Repair to Village Paths	6	KM	5000	30000
	Seri	Gannu to Tundal	Repair to Village Paths	10	KM	5000	50000
	Seri	Gwalpur to Tuman	Repair to Village Paths	8	KM	5000	40000
	Seri	Dhamoon to jong	Repair to Village Paths	6	KM	5000	30000
	Seri	Bahot to Sihanj	Repair to Village Paths	6	KM	5000	30000
	Seri	Bour to Belu	Repair to Village Paths	9	KM	5000	45000
	Seri	Khaneoul to Jogi	Repair to Village Paths	11	KM	5000	55000
	Seri	Rashog to Ashala	Repair to Village Paths	6	KM	5000	30000
	Seri	Rashog to Kotlu	Repair to Village Paths	6	KM	5000	30000
	Seri	Tuman to Paloh	Repair to Village Paths	5	KM	5000	25000
	Seri	Jai to Teban	Repair to Village Paths	4	KM	5000	20000
	Seri	Pokhi to Shill	Repair to Village Paths	6	KM	5000	30000
	Seri	Sarahan to Phirnoo	Repair to Village Paths	4	KM	5000	20000
	Seri	Shushan to Gowalpur	Repair to Village Paths	4	KM	5000	20000
	Seri	Shushan to Ashla	Repair to Village Paths	4	KM	5000	20000
	Seri	Tebban to Phirnoo Garari	Repair to Village Paths	7	KM	5000	35000
	Seri	Bhurti to Chedu	Repair to Village Paths	3	KM	5000	15000
	Seri	Phirnoo to Dabroot	Repair to Village Paths	4	KM	5000	20000
	Seri	Naganee to Dhanira	Repair to Village Paths	3	KM	5000	15000
	Seri	Raksaludhar - Barshol	Repair to Village Paths	4	KM	5000	20000
	Seri	Charkupari to Dhawas	Repair to Village Paths	4	KM	5000	20000
	Seri	Sanarli Khad to Tikkar Madh	Repair to Village Paths	4	KM	5000	20000
	Seri	Jhahar to Talehan	Repair to Village Paths	2	KM	5000	10000
	Pangna	Thalli to Telehan	Repair to Village Paths	12	KM	5000	60000
	Pangna	Kanda to Mohru	Repair to Village Paths	3	KM	5000	15000
	Pangna	Kanda to Restadhar	Repair to Village Paths	4	KM	5000	20000
	Pangna	Kanda to Shegli	Repair to Village Paths	4	KM	5000	20000
	Pangna	Kanda to Alsindi	Repair to Village Paths	6	KM	5000	30000
	Pangna	Balindi to Restadhar	Repair to Village Paths	5	KM	5000	25000
	Pangna	Jeori to Sahaj	Repair to Village Paths	6	KM	5000	30000
	Pangna	Sahaj to Sawindhar	Repair to Village Paths	6	KM	5000	30000
	Pangna	Jamodhar to Jassal	Repair to Village Paths	5	KM	5000	25000
	Pangna	Sawindhar - Jassal	Repair to Village Paths	6	KM	5000	30000
	Pangna	Raandol - Kiria - Tatapani	Repair to Village Paths	5	KM	5000	25000
	Pangna	Thali - Barod	Repair to Village Paths	4	KM	5000	20000
	Pangna	Thali to Kharedi	Repair to Village Paths	4	KM	5000	20000
	Pangna	Thalli to Bag	Repair to Village Paths	3	KM	5000	15000
	Pangna	Thogi to Sawindhar	Repair to Village Paths	3	KM	5000	15000
	Pangna	Pangna to Ghangli	Repair to Village Paths	2	KM	5000	10000
	Pangna	Shorshan to Mashog	Repair to Village Paths	6	KM	5000	30000
	Pangna	Belar to Mashog	Repair to Village Paths	6	KM	5000	30000
	Pangna	Baju - Chowaridhar - Galand	Repair to Village Paths	4	KM	5000	20000
	Pangna	Sorta to Pangna	Repair to Village Paths	5	KM	5000	25000
	Pangna	Thandapani to Chitadhartu	Repair to Village Paths	4	KM	5000	20000
	Pangna	Pangna to Ghangli	Repair to Village Paths	2	KM	5000	10000
	Pangna	Pargagali to Restadhar	Repair to Village Paths	5	KM	5000	25000
	Pangna	Chindi to Mahog	Repair to Village Paths	2	KM	5000	10000
	Pangna	Durkan to Dachhar	Repair to Village Paths	4	KM	5000	20000
	Pangna	Dachhar to Majhagan	Repair to Village Paths	6	KM	5000	30000
	Pangna	Bakhloohi to Bakhrot	Repair to Village Paths	4	KM	5000	20000
	Pangna	Bakhloohi to Thandapani	Repair to Village Paths	5	KM	5000	25000

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Pangna	Nagra to Pangna	Repair to Village Paths	6	KM	5000	30000
	Magroo	Seri Katanda to Chhayora	Repair to Village Paths	6	KM	5000	30000
	Magroo	Navidhar to Baidarh	Repair to Village Paths	5	KM	5000	25000
	Magroo	Magroo Seri to Chatri	Repair to Village Paths	7	KM	5000	35000
	Magroo	Kakradhar to Chhatri	Repair to Village Paths	5	KM	5000	25000
	Magroo	Chhatri to Lassi	Repair to Village Paths	4	KM	5000	20000
	Magroo	Chhatri to Gattu	Repair to Village Paths	4	KM	5000	20000
	Magroo	Lassi to Ruhmani	Repair to Village Paths	5	KM	5000	25000
	Seri	Seri to Manshana	Repair to Village Paths	6	KM	5000	30000
	Seri	Seri to Paindu	Repair to Village Paths	6	KM	5000	30000
	Seri	Khaneri to Rathiala	Repair to Village Paths	3	KM	5000	15000
	Seri	Pendu to Dharal	Repair to Village Paths	3	KM	5000	15000
	Seri	Bhurti to Seri	Repair to Village Paths	4	KM	5000	20000
	Seri	Bahal to Seri	Repair to Village Paths	6	KM	5000	30000
	Seri	Dhurmoo to Pokhi	Repair to Village Paths	8	KM	5000	40000
	Seri	Ashla to Swin	Repair to Village Paths	13	KM	5000	65000
	Seri	Bagridhar to Paloh	Repair to Village Paths	6	KM	5000	30000
	Seri	Ashla to Rashog	Repair to Village Paths	10	KM	5000	50000
	Seri	Gwalpur to Shakehar	Repair to Village Paths	6	KM	5000	30000
	Pangna	Chamanpur to Pangna	Repair to Village Paths	7	KM	5000	35000
	Pangna	Mahota to Jamnoo	Repair to Village Paths	12	KM	5000	60000
	Pangna	Mahota to Gujrodhar	Repair to Village Paths	5	KM	5000	25000
	Pangna	Jeori to Badyogi	Repair to Village Paths	15	KM	5000	75000
	Magru	Sinj to Maghach	Repair to Village Paths	5	KM	5000	25000
	Magru	Mahog - Shwad	Repair to Village Paths	7	KM	5000	35000
	Magru	Navidhar to Bag	Repair to Village Paths	4	KM	5000	20000
	Magru	Bag to Gopalpur	Repair to Village Paths	6	KM	5000	30000
	Magru	Gatu to Bagrathach	Repair to Village Paths	8	KM	5000	40000
	Magru	Mahog to Pokhi	Repair to Village Paths	8	KM	5000	40000
	Magru	Bethwan to Dhawar	Repair to Village Paths	7	KM	5000	35000
		B Village Ponds/ Tank/Other water sources					
	Pokhi	Pokhi	Village Ponds & Tanks	1	No.	L/S	10000
	Pokhi	Sihanj	Village Ponds & Tanks	1	No.	L/S	10000
	Sarahan	Ashala	Village Ponds & Tanks	1	No.	L/S	10000
	Sarahan	Chakhwa	Village Ponds & Tanks	1	No.	L/S	10000
	Sarahan	Sarahan	Village Ponds & Tanks	1	No.	L/S	10000
	Tebban	Tebban	Village Ponds & Tanks	1	No.	L/S	10000
	Tebban	Sarail	Village Ponds & Tanks	1	No.	L/S	10000
	Tebban	Jai	Village Ponds & Tanks	1	No.	L/S	10000
	Nanj	Urboo	Village Ponds & Tanks	1	No.	L/S	10000
	Nanj	Nanj	Village Ponds & Tanks	1	No.	L/S	10000
	Khaneol Bagra	Shahot	Village Ponds & Tanks	1	No.	L/S	10000
	Khaneol Bagra	Khamarla	Village Ponds & Tanks	1	No.	L/S	10000
	Parlog	Parlog	Village Ponds & Tanks	1	No.	L/S	10000
	Parlog	Beludhank	Village Ponds & Tanks	1	No.	L/S	10000
	Satyola	Satyola	Village Ponds & Tanks	1	No.	L/S	10000
	Satyola	Magan	Village Ponds & Tanks	1	No.	L/S	10000
	Bindla	Bindla	Village Ponds & Tanks	1	No.	L/S	10000
	Shakra	Shakra	Village Ponds & Tanks	1	No.	L/S	10000
	Shakra	Jadvi	Village Ponds & Tanks	1	No.	L/S	10000
	Shakra	Dawaroo	Village Ponds & Tanks	1	No.	L/S	10000
	Thalli	Thalli	Village Ponds & Tanks	1	No.	L/S	10000
	Thalli	Do-Gaon	Village Ponds & Tanks	1	No.	L/S	10000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Tattapani	Subot	Village Ponds & Tanks	1	No.	L/S	10000
	Tattapani	Jeori	Village Ponds & Tanks	1	No.	L/S	10000
	Kahnu	Kahnu	Village Ponds & Tanks	1	No.	L/S	10000
	Kahnu	Dachhaher	Village Ponds & Tanks	1	No.	L/S	10000
	Mashog	Dhar	Village Ponds & Tanks	1	No.	L/S	10000
	Mashog	Belar	Village Ponds & Tanks	1	No.	L/S	10000
	Bahlidhar	Sainj	Village Ponds & Tanks	1	No.	L/S	10000
	Bahlidhar	Paridhar	Village Ponds & Tanks	1	No.	L/S	10000
	Chouridhar	Narash	Village Ponds & Tanks	1	No.	L/S	10000
	Chouridhar	Mahasudhar	Village Ponds & Tanks	1	No.	L/S	10000
	Mehandi	Gajeha	Village Ponds & Tanks	1	No.	L/S	10000
	Mehandi	Serti	Village Ponds & Tanks	1	No.	L/S	10000
	Bagela	Bagela	Village Ponds & Tanks	1	No.	L/S	10000
	Bagela	Sawan	Village Ponds & Tanks	1	No.	L/S	10000
	Bhanera	Khaduhan	Village Ponds & Tanks	1	No.	L/S	10000
	Mahunag	Shehandal	Village Ponds & Tanks	1	No.	L/S	10000
	Mahunag	Ghani	Village Ponds & Tanks	1	No.	L/S	10000
	Sapnot	Dharkandloo	Village Ponds & Tanks	1	No.	L/S	10000
	Mehran	Mehran	Village Ponds & Tanks	1	No.	L/S	10000
	Mehran	Kakanu	Village Ponds & Tanks	1	No.	L/S	10000
	Bagshad	Kund	Village Ponds & Tanks	1	No.	L/S	10000
	Sahaj	Kot	Village Ponds & Tanks	1	No.	L/S	10000
	Sawidhar	Sawidhar	Village Ponds & Tanks	1	No.	L/S	10000
	Sawidhar	Jammu	Village Ponds & Tanks	1	No.	L/S	10000
	Kanda	Kanda	Village Ponds & Tanks	1	No.	L/S	10000
	Balindi	Segali	Village Ponds & Tanks	1	No.	L/S	10000
	Balindi	Balindi	Village Ponds & Tanks	1	No.	L/S	10000
	Mamail	Mamail	Village Ponds & Tanks	1	No.	L/S	10000
	Mamail	Mandlah	Village Ponds & Tanks	1	No.	L/S	10000
	Upper Carson	Khanora	Village Ponds & Tanks	1	No.	L/S	10000
	Upper Carson	Nawa	Village Ponds & Tanks	1	No.	L/S	10000
	Upper Carson	Doghari	Village Ponds & Tanks	1	No.	L/S	10000
	Lower Carson	Lalog	Village Ponds & Tanks	1	No.	L/S	10000
	Matehal	Kulthanu	Village Ponds & Tanks	1	No.	L/S	10000
	Matehal	Metehal	Village Ponds & Tanks	1	No.	L/S	10000
	Churag	Manola	Village Ponds & Tanks	1	No.	L/S	10000
	Churag	Karadal	Village Ponds & Tanks	1	No.	L/S	10000
	Kheel	Kheel	Village Ponds & Tanks	1	No.	L/S	10000
	Mahog	Navidhar	Village Ponds & Tanks	1	No.	L/S	10000
	Mahog	Bag	Village Ponds & Tanks	1	No.	L/S	10000
	Kuther	Seri Katanda	Village Ponds & Tanks	1	No.	L/S	10000
	Kuther	Shilhiseri	Village Ponds & Tanks	1	No.	L/S	10000
	Gowalpur	Bagridhar	Village Ponds & Tanks	1	No.	L/S	10000
	Gowalpur	Shanog	Village Ponds & Tanks	1	No.	L/S	10000
	Bhanthal	Rikki	Village Ponds & Tanks	1	No.	L/S	10000
	Bhanthal	Rehdi	Village Ponds & Tanks	1	No.	L/S	10000
	Bakhrot	Chindi	Village Ponds & Tanks	1	No.	L/S	10000
	Bakhrot	Neut	Village Ponds & Tanks	1	No.	L/S	10000
	Sorta	Madidhar	Village Ponds & Tanks	1	No.	L/S	10000
	Pangna	Godan	Village Ponds & Tanks	1	No.	L/S	10000
	Pangna	Suin	Village Ponds & Tanks	1	No.	L/S	10000
	Mangarh	Seri	Village Ponds & Tanks	1	No.	L/S	10000
	Mangarh	Bihani	Village Ponds & Tanks	1	No.	L/S	10000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Jharehd	Thua	Village Ponds & Tanks	1	No.	L/S	10000
	Gattu	Gattu	Village Ponds & Tanks	1	No.	L/S	10000
	Dabrot	Khashoul	Village Ponds & Tanks	1	No.	L/S	10000
	Dabrot	Kandi	Village Ponds & Tanks	1	No.	L/S	10000
	Seri	Seri	Village Ponds & Tanks	1	No.	L/S	10000
	Seri	Jua	Village Ponds & Tanks	1	No.	L/S	10000
	Thakurthana	Kamehrl	Village Ponds & Tanks	1	No.	L/S	10000
	Thakurthana	Delag	Village Ponds & Tanks	1	No.	L/S	10000
	Jatha	Pathrevi	Village Ponds & Tanks	1	No.	L/S	10000
	Jatha	Richhani	Village Ponds & Tanks	1	No.	L/S	10000
	Kelodhar	Pendu	Village Ponds & Tanks	1	No.	L/S	10000
	Kelodhar	Kelodhar	Village Ponds & Tanks	1	No.	L/S	10000
	Surahi	Luchhadhar	Village Ponds & Tanks	1	No.	L/S	10000
	Chattri	Karsai	Village Ponds & Tanks	1	No.	L/S	10000
	Bareugi	Gagan	Village Ponds & Tanks	1	No.	L/S	10000
	Bareugi	Mahorti	Village Ponds & Tanks	1	No.	L/S	10000
	Kakradhar	Khattu	Village Ponds & Tanks	1	No.	L/S	10000
	Kalashan	Kalashan	Village Ponds & Tanks	1	No.	L/S	10000
	Kalashan	Kaneri	Village Ponds & Tanks	1	No.	L/S	10000
	Pokhi	Kutlanal	Village Ponds & Tanks	1	No.	L/S	10000
	Sarahan	Phirnoo	Village Ponds & Tanks	1	No.	L/S	10000
	Sarahan	Phaneota	Village Ponds & Tanks	1	No.	L/S	10000
	Tebban	Rashog	Village Ponds & Tanks	1	No.	L/S	10000
	Nanj	Galu	Village Ponds & Tanks	1	No.	L/S	10000
	Nanj	Purana	Village Ponds & Tanks	1	No.	L/S	10000
	Khaneol Bagra	Sainjli	Village Ponds & Tanks	1	No.	L/S	10000
	Khaneol Bagra	Niran	Village Ponds & Tanks	1	No.	L/S	10000
	Parlog	Parlog II	Village Ponds & Tanks	1	No.	L/S	10000
	Sartyola	Manju	Village Ponds & Tanks	1	No.	L/S	10000
	Bindla	Talehan	Village Ponds & Tanks	1	No.	L/S	10000
	Shakra	Jedvi-II	Village Ponds & Tanks	1	No.	L/S	10000
	Thalli	Thali-II	Village Ponds & Tanks	1	No.	L/S	10000
	Thalli	Barod	Village Ponds & Tanks	1	No.	L/S	10000
	Tattapani	Tattapani	Village Ponds & Tanks	1	No.	L/S	10000
	Tattapani	Kiria	Village Ponds & Tanks	1	No.	L/S	10000
	Kahnu	Jamnoo	Village Ponds & Tanks	1	No.	L/S	10000
	Mashog	Khadoon	Village Ponds & Tanks	1	No.	L/S	10000
	Bahlidhar	Mahavan	Village Ponds & Tanks	1	No.	L/S	10000
	Chauridhar	Bhunda	Village Ponds & Tanks	1	No.	L/S	10000
	Mehandi	Kot	Village Ponds & Tanks	1	No.	L/S	10000
	Mehandi	Garyala	Village Ponds & Tanks	1	No.	L/S	10000
	Bagela	Kanda	Village Ponds & Tanks	1	No.	L/S	10000
	Bhanera	Bagain	Village Ponds & Tanks	1	No.	L/S	10000
	Mahunag	Bukhari	Village Ponds & Tanks	1	No.	L/S	10000
	Sapnot	Bago	Village Ponds & Tanks	1	No.	L/S	10000
	Sapnot	Jingle	Village Ponds & Tanks	1	No.	L/S	10000
	Mehran	Kandi	Village Ponds & Tanks	1	No.	L/S	10000
	Bagshad	Gadari	Village Ponds & Tanks	1	No.	L/S	10000
	Sahaj	Gujarodhar	Village Ponds & Tanks	1	No.	L/S	10000
	Sahaj	Chanyana	Village Ponds & Tanks	1	No.	L/S	10000
	Sawidhar	Kalangar	Village Ponds & Tanks	1	No.	L/S	10000
	Kanda	Dhaun	Village Ponds & Tanks	1	No.	L/S	10000
	Balindi	Kot	Village Ponds & Tanks	1	No.	L/S	10000

Annexure-V

Activity under Rural Infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Mamail	Btalabahal	Village Ponds & Tanks	1	No.	L/S	10000
	Upper Karsog	Nayara	Village Ponds & Tanks	1	No.	L/S	10000
	Upper Karsog	Pathron	Village Ponds & Tanks	1	No.	L/S	10000
	Lower Karsog	Chalalru	Village Ponds & Tanks	1	No.	L/S	10000
	Churag	Churag	Village Ponds & Tanks	1	No.	L/S	10000
	Kheel	Dharmour	Village Ponds & Tanks	1	No.	L/S	10000
	Mahog	Shamehar	Village Ponds & Tanks	1	No.	L/S	10000
	Kuther	Thani Nala	Village Ponds & Tanks	1	No.	L/S	10000
	Gowalpur	Gawalpur	Village Ponds & Tanks	1	No.	L/S	10000
	Bhanthal	Nehra	Village Ponds & Tanks	1	No.	L/S	10000
	Bakhrot	Bajho	Village Ponds & Tanks	1	No.	L/S	10000
	Sorta	Begli	Village Ponds & Tanks	1	No.	L/S	10000
	Pangna	Nagron	Village Ponds & Tanks	1	No.	L/S	10000
	Mangarh	Behli	Village Ponds & Tanks	1	No.	L/S	10000
	Jharehd	Mohini	Village Ponds & Tanks	1	No.	L/S	10000
	Jharehd	Hall	Village Ponds & Tanks	1	No.	L/S	10000
	Gattu	Chapland	Village Ponds & Tanks	1	No.	L/S	10000
	Dabrot	Ghaniara	Village Ponds & Tanks	1	No.	L/S	10000
	Seri	Khaneri	Village Ponds & Tanks	1	No.	L/S	10000
	Thakurthana	Thakurthana	Village Ponds & Tanks	1	No.	L/S	10000
	Jatha	Jatho	Village Ponds & Tanks	1	No.	L/S	10000
	Kelodhar	Kwagla	Village Ponds & Tanks	1	No.	L/S	10000
	Surahi	Bahl	Village Ponds & Tanks	1	No.	L/S	10000
	Chhattri	Lassi	Village Ponds & Tanks	1	No.	L/S	10000
	Bareugi	Baryogi	Village Ponds & Tanks	1	No.	L/S	10000
	Kakradhar	Kandi	Village Ponds & Tanks	1	No.	L/S	10000
	Kalashan	Kapdyas	Village Ponds & Tanks	1	No.	L/S	10000
	Pokhi	Katanda	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pokhi	Badar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sarahan	Koti	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sarahan	Chekhwa	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sarahan	Sarahan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tebban	Kotlu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tebban	Sarail	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tebban	Jai	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Nanj	Dateha	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Nanj	Nanj	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Nanj	Tundal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Khaneol Bagra	Dawawal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Khaneol Bagra	Khamarla	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Khaneol Bagra	Bagail	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Parlog	Parlog I	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Parlog	Beludhank II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sartyola	Sartyola	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sartyola	Magan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bindla	Bhaura	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bindla	Marola	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Shakra	Khadyan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Shakra	Jadvi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Shakra	Dawaroo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thalli	Thalli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thalli	Do-Gaon	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thalli	Deol	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tattapani	Subot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tattapani	Randol	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tattapani	Jeori	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kahnu	Kahnu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kahnu	Durkanu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kahnu	Dachhaher	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mashog	Mashogla	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mashog	Belar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bahlidhar	Sainj	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bahlidhar	Paidhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bahlidhar	Bhamala	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chouridhar	Kotlu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chouridhar	Mahasudhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Chouridhar	Katol	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehandi	Mahandi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehandi	Gajeha	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehandi	Thanali	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagela	Bagela	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagela	Kukanoo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagela	Sawan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanera	Bhanera	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanera	Kubshan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Kalbouta	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Seri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Shehandal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Ghani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sapnot	Thanger	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sapnot	Dharkandloo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehran	Mehran	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehran	Kakanu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagshad	Kund	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagshad	Shungi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagshad	Bagshad	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sahaj	Mahouta	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sahaj	Sahaj	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sahaj	Kot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sawidhar	Jammu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sawidhar	Panetu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sawidhar	Kanda	Repair of Spring Buwaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Kanda	Kot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Balindi	Bah	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Balindi	Segali	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Balindi	Balindi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mamail	Mamail	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mamail	Mandlah	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mamail	Kani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Upper KARSOG	Khanora	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Upper KARSOG	Nawa	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Upper KARSOG	Johar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Lower KARSOG	Lalag	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Lower KARSOG	Shopa	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Matehal	Kulthanu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Matehal	Matehal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Churag	Manola	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Churag	Dhawas	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Churag	Karadal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kheel	Kheel	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kheel	Jamorda	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahog	Navidhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahog	Bag	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahog	Bauta	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kuther	Garjoob	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kuther	Shilhiseri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kuther	Chowki	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gowalpur	Bagridhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Gowalpur	Shanog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gowalpur	Tuman	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gowalpur	Tharmi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanthal	Rikki	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanthal	Puni	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanthal	Rehdi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bakhrot	Chindi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bakhrot	Neut	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bakhrot	Dalag	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sorta	Sorta	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sorta	Madidhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pangna	Godan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pangna	Suin	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mangarh	Seri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mangarh	Bihani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jharehd	Thua	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jharehd	Doghari	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gattu	Gattu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gattu	Shavan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gattu	Karganu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Dabrot	Khashoul	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Dabrot	Kandi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Dabrot	Chlhani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Seri	Seri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Seri	Jua	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thakurthana	Kamehri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Thakurthana	Delag	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jatha	Pathrevi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jatha	Richhani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kelodhar	Pendu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kelodhar	Kelodhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Surahi	Surahi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Surahi	Luchhadhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chhattri	Karsai	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chhattri	Raidhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bareugi	Gagan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bareugi	Mahorti	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kakradhar	Khattu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kakradhar	Laharishil	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kalashan	Kalashan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kalashan	Kaneri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kalashan	Bhanol	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pokhi	Gadaran	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pokhi	Khaneog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sarahan	Phirnoo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sarahan	Chalaha	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sarahan	Chberi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tebban	Cheberi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tebban	Porla	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tebban	Narahan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Nenj	Kehu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Nenj	Purana	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Nenj	Rauti	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Khaneol Bagra	Sainjli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Khaneol Bagra	Biran	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Khaneol Bagra	Kurna	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Parlog	Parlog II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Parlog	Beludhank II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sartyola	Manju	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sartyola	Chimootir	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bindla	Talehan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bindla	Talehan - II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Shakra	Jedvi - II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Shakra	Shakra - II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thalli	Thali-II	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thalli	Barod	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tattapani	Tattapani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Tattapani	Kiria	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kehnu	Jamnoo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kehnu	Padli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mashog	Khadoon	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mashog	Mashog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bahlidhar	Trmbli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bahlidhar	Mahavan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bahlidhar	Mambli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chouridhar	Naglog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chouridhar	Makneri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chouridhar	Bhunda	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Mehandi	Kot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehandi	Jong	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehandi	Garyala	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagela	Kanda	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagela	Saned	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagela	Chalaha	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanera	Bagain	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanera	Kao	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Bukhari	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Ragan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Sans	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahunag	Jhungroo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sapnot	Blasso	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sapnot	Jingle	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehran	Kandi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mehran	Jhunjar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagshad	Gadari	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagshad	Khadeol	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bagshad	Thaltoo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sahaj	Gujarodhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sahaj	Chanyana	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sahaj	Kapdyas	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Swidhar	Kalangar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Swidhar	Alias	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Swidhar	Dhudhan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kanda	Bhanias	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Balindi	Kot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Balindi	Samlot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Balindi	Alsindi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mamail	Btalabahal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mamail	Sursi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mamail	Bag Shalana	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Upper Karsog	Nayara	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Upper Karsog	Bhadamu	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Upper Karsog	Pathron	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Lower Karsog	Chalalru	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Lower Karsog	Panjrat	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Matehal	Shirgal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Matehal	Batheri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Churag	Kot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Churag	Churag	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Churag	Narash	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kheel	Dharmour	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kheel	Ajot	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahog	Shamehar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahog	Khair	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mahog	Bhandal	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kuther	Thani Nala	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kuther	Rashog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kuther	Lotla	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gowalpur	Gowalpur	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gowalpur	Shushan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Gowalpur	Kaneog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gowalpur	Naur	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanthal	Nehra	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanthal	Loharli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bhanthal	Naganzan	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bakhrot	Bajho	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bakhrot	Bakhras	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sorta	Begli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Sorta	Badar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pangna	Nagron	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pangna	Pangna	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mangarh	Behli	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Mangarh	Jhmach	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jharehd	Mohini	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jharehd	Hall	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gattu	Chapland	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Gattu	Bethwa	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Dabrot	Finoo	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Dabrot	Ghaniara	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Dabrot	Chamog	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Seri	Khaneri	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Seri	Manshana	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thakarthana	Thakarthana	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Thakarthana	Shanahar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Jatho	Jatho	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kelodhar	Kwagla	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Kelodhar	Ghaliach	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Surahi	Bahi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chhattri	Chaura	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Chhattri	Lassi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bareugi	Baryogi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Bareugi	Ruhmani	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kakradhar	Kandi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kakradhar	Kadradhar	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kakradhar	Kapas	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Kakradhar	Jharandi	Repair of Spring Bawaries and other water sources	1	No.	L/S	4200
	Pokhl	Kandal	Construction of foot bridge	1	No.	75000	75000
	Karsog	Repair to F/B Khanora	Construction of foot bridge	1	No.	75000	75000
	Pokhl	Dhurmoo	Construction of foot bridge	1	No.	L/S	100000
	Mamail	Repair to Foot Bridge Mama	Construction of foot bridge	1	No.	50000	50000
	Gattu	Seri Mangarh	Construction of foot bridge	1	No.	50000	50000
	Karsog	Nayara Chhodoo	Construction of foot bridge	1	No.	L/S	150000
	Karsog		**Total**				**7859400**
Theog		**A Village Paths**					
	Kathog	Laphughati	Repair of vilage path	3	Km	L/S	100000
	Shateyam	Lambidhar Dak Bunglow		3	Km	L/S	100000
	Shateyam	Tikkar		2	Km	L/S	100000
	Shateyam	Bithu		2	Km	L/S	100000
	Bharara	Kundli/ Karyal		2	Km	L/S	100000
		B Village Ponds/ Tank/Other water sources					
	Shateyam	Khali Baun	Const of village tank	1	No	L/S	100000
	Bharanj	Gawas Kuphta	Const of village Pond	2	No	L/S	60000
	Bharara	Kundli	Const of village tank	3	No	L/S	100000
	Shateyam	Bithu	Const of village tank	4	No	L/S	100000
		C Soilconservation works					
	Bharara	Bharyana Nala	Soil works	2	Km	L/S	1070000
		Theog		**Total**			**1930000**
		A- Village Paths					
Suket	Garot	Pandar Mathyog	vi) Const. of Village Path	18	Km	L/S	88800
	Badan	Barta - Kheel	-do-	8	Km	L/S	88800
	Bandli	Bandli Recol	-do-	5	Km	L/S	55500
		Kinder Bhalath	-do-	4	Km	L/S	44400
	Jhungi	Chadog - Shandra	-do-	4	Km	L/S	44400
		Jhungi - Shandra	-do-	4	Km	L/S	24400
		Jhungi - Bamog	-do-	6	Km	L/S	37170
	Batwara	Dol - Gehgroo	-do-	6	Km	L/S	50000
		Rohal - Panjolth	-do-	5	Km	L/S	40000

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
		Panjolth - Suin	-do-	4	Km	L/S	35000
		Balag - Kathla	-do-	6	Km	L/S	50000
		Preni - Galu	-do-	5	Km	L/S	40000
		Jarat - Galu	-do-	4	Km	L/S	35000
		Gehroo- Jindri Dhar	-do-	6	Km	L/S	50000
		Jindri- Prali	-do-	5	Km	L/S	40000
		B Village Ponds/ Tank/Other water sources					
Gharot		1. Galandi Kufar	**i) Const. of Village Pond**	1	No	L/S	69000
Badan		2. Mundli	-do-	1	No	L/S	69000
Bandli		3. Dalala Kufar	-do-	1	No	L/S	69000
Jaral		4. Kandidhar	-do-	1	No	L/S	69000
Jhungi		5. Kathabai	-do-	1	No	L/S	69000
Bandli		6. Devidhar	-do-	1	No	L/S	69000
Presi		7. Salani	-do-	1	No	L/S	91570
Batwara		8. Dalali Dhar	-do-	1	No	L/S	20000
		9. Sanihan	-do-	1	No	L/S	80000
		10. Batwara	-do-	1	No	L/S	50000
		11. Batwara II	-do-	1	No	L/S	80000
Batwara		1. Drog	iii) Const. of Water Tank/W.H.S.	1	No	L/S	50000
		2. Reoch	-do-	1	No	L/S	75000
		3. Jabal	-do-	1	No	L/S	75000
		4. Batwara	-do-	1	No	L/S	75000
Soja		Plueni & Roundi	iv) Repair of Bouries	2	No	L/S	4724
Barot		Glassi, dharli, Shendra, Jyog, Tikri, Pandar, Mathar, Tehta.	-do-	8	No	L/S	80000
Jhungi		Shandra-II, Shandra-III, Chadog, Khobla, Jadu, Dharmchar.	-do-	6	No	L/S	57451
Bandli		Kinder, Rakol, Bandli, Villages.	-do-	18	No	L/S	128119
Jaral		Jaral, Ropa, Janol	-do-	3	No	L/S	30000
Nihri		Bhuti Nala, Upper Nihri, Gharla, Chirl.	-do-	4	No	L/S	40000
Badan		Kolta, Ghar, Berelli	-do-	3	No	L/S	30000
Badu		Sharcha, Banthal, Badu, Salani, Charkri	-do-	5	No	L/S	50000
Presi		Presi, Bansotla, Bajarthi, Srehi part.	-do-	4	No	L/S	40000
Balag		Kathla, Fafna, Tikker, Balag, Khoun.	-do-	5	No	L/S	50000
			v) Const. of Foot Bridge				
Jhungi		Shandra Naal	Foot Bridge	1	No	L/S	111490
Garot		Ahal	-do-	1	No	L/S	111490
Mandli		Shari Khad	-do-	1	No	L/S	111490
Jaral		Ropa Khad	-do-	1	No	L/S	111490
Nihri		Kamrot Nala	-do-	1	No	L/S	59610
Danhera		Badu Khad	-do-	1	No	L/S	250000
Batwara		Suin	-do-	1	No	L/S	400000
		C Const. of Soil & Water Conservation Structure					
Gharot		1. WHS Brokri Nala	Soil works	1	No	L/S	920000

Annexure-V

Activity under Rural infrastructure Development

Division	Name of Panchayat	Village	Activity	Quantity	Unit	Rate	Amount Rs
1	2	3	4	5	6	7	8
	Badan	2. Kot Nala	-do-	1	No	L/S	92000
	Nihri	3. Dulah Nala	-do-	1	No	L/S	92000
	Jhungi	4. Barnog Nala	-do-	1	No	L/S	92000
	Bandli	5. Kumaroo Nala	-do-	1	No	L/S	62000
	Jhungi	6. Jhungi Nala	-do-	1	No	L/S	75570
	Dhanyara	Stererenthening of badu path	-do-	3	No.		120870
	Soja	Stererenthening of Bari path	-do-	3	Kms		120888
		Path in Bhalan Village		1.8	Kms		20000
		Devlopment of Neri-Badhu J/Road.		4	Kms		600000
	Jhungi	Development of Kanda - Chanad Road	-do-	1	Kms		126430
	Dhanyara	i. Dharot	vii) Repair/Const.of Kuhal	1	Kms		50000
		ii. Badu		1.5	Kms		70000
		iii. Badnu		1	Kms		50000
	Soja	iv. Mared	-do-	1	Kms		36700
		v. Mahla		1	Kms		31700
	Batwar	vi. Reoch	-do	2	Kms		87146
		vii. Kandhi		2	Kms		87146
		viii. Suin		2	Kms		87146
		Suket	Total				5393500

तार :
Telegram : PARYAVARAN,
NEW DELHI
दूरभाष :
Telephone : 436 2827
टेलेक्स :
Telex : W-66385 DOE IN
FAX : 4360678

भारत सरकार
पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS
पर्यावरण भवन, सी. जी. ओ. कॉम्प्लेक्स
PARYAVARAN BHAVAN, C.G.O. COMPLEX
लोधी रोड, नई दिल्ली-110003
LODHI ROAD, NEW DELHI-110003

No.3/84/79-HCT-Env.IA

May 15, 2002.

Shri M.H. Rao
Dy. Gen. Manager(Env.Engg)
NTPC
Engineering Office Complex
Plot No. A-88, Sector-24
Post Box No. 13
NOIDA-201301.

Subject:- Kol dam Hydroelectric Project – Dumping of excavated material regarding.

Sir,

This has reference to your letter No.CC/EAC/5501/2002/GEN/12D dated 9th May, 2002 on the subject. It is noted that the area identified for disposal of excavated material coming out from diversion tunnel, is located at an elevation of 530 m which is 9 mt above than maximum flood level of 521 m. It is also noted that after the construction of dam is completed the muck disposal sites will form a part of the dead storage of the reservoir and will not flow into the river. Temporary dumping area for emergency dumping, identified between road and river, will be provided with a masonry wall, if required , to prevent material going into the river.

In view of the above we have no objection for the proposed dumping sites subject to the condition that –

i) Dumping sites of excavated materials should be rehabilitated by levelling, filling up of burrow pits, landscaping and properly afforested with suitable plantation.

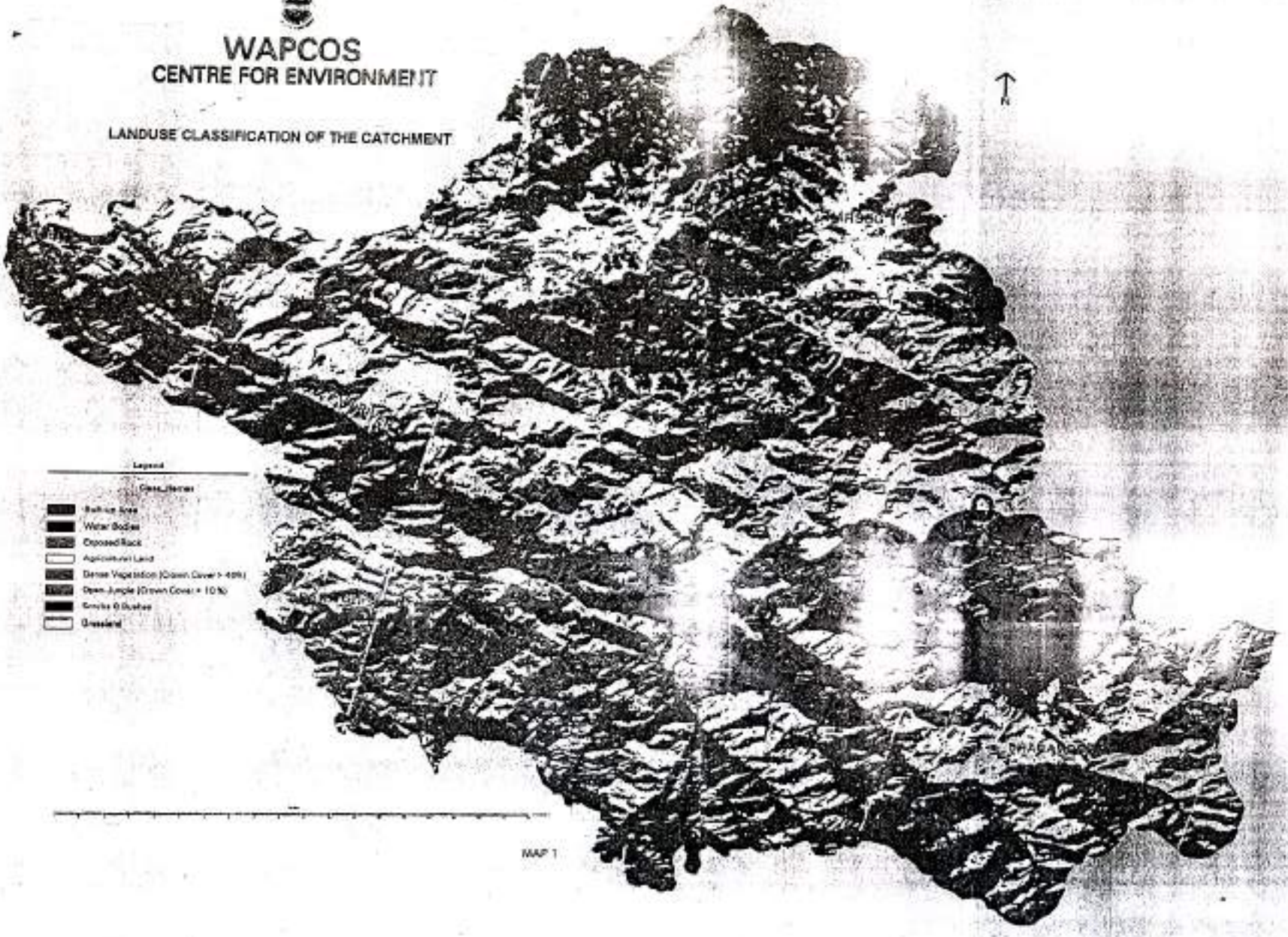
ii) A retaining wall should be provided at all the proposed emergency dumping sites which are located in between road and river to prevent material going into the river.

Yours faithfully,

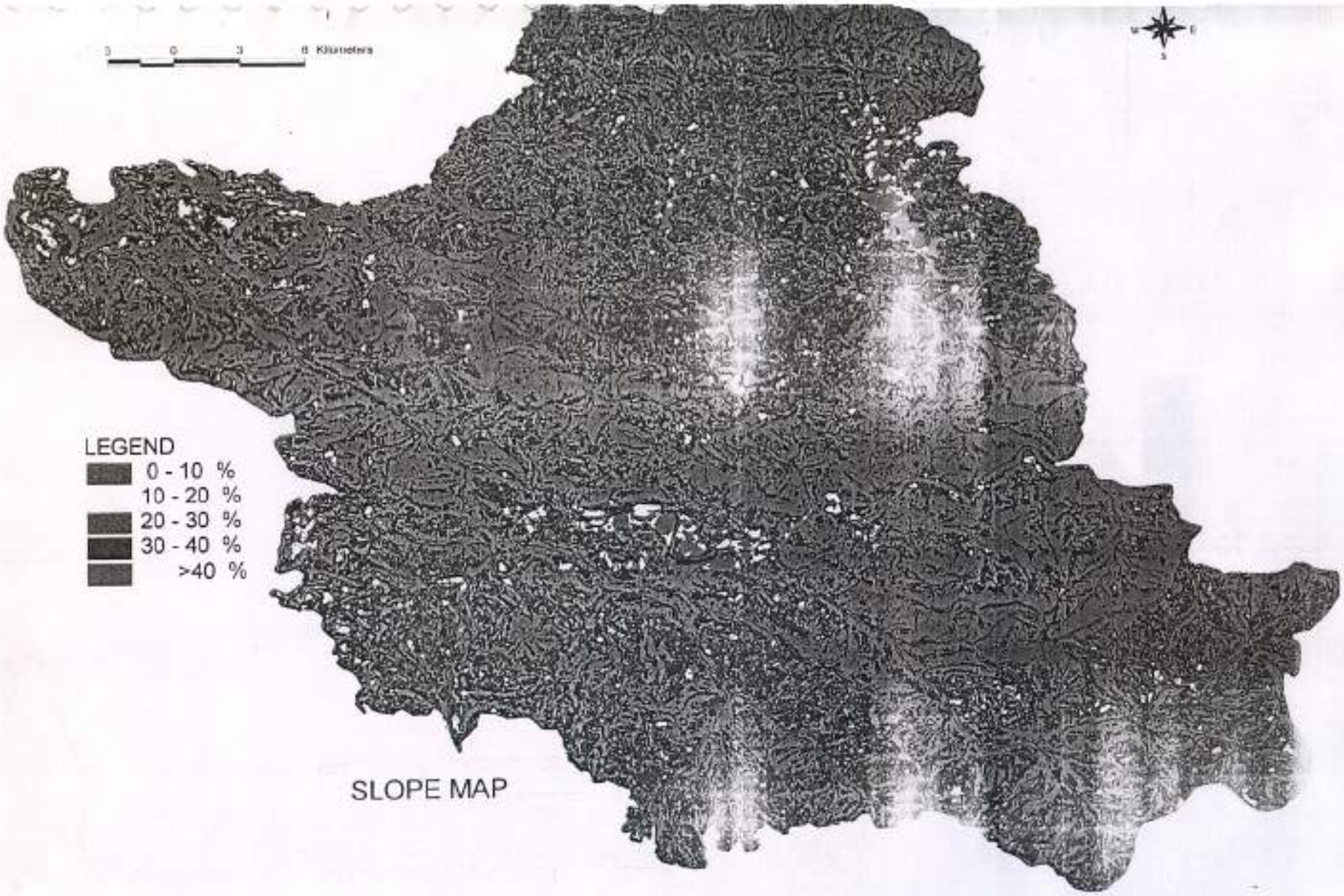
(Dr. S. Bhowmik)
Additional Director

WAPCOS
CENTRE FOR ENVIRONMENT

LANDUSE CLASSIFICATION OF THE CATCHMENT



MAP 1



SLOPE MAP