CATCHMENT AREA TREATMENT PLAN
PART OF UTTAR PRADESH
UNDER KANHAR IRRIGATION PROJECT

Prepared for:

Kanhar Irrigation Project,
Sonbhadra,
Uttar Pradesh Irrigation Department

Preparing by:

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Introduction

The Project

The Kanhar Irrigation project, in any case, is one of its kind in UP. Projected to serve more than 26,075 hectares of agriculture land the dam will serve through a network of 121.10 kilometres long main canal and another 150km of minor canals. Spanning over a length of nearly 3.24km the dam will have a maximum height of around 39.9 meters to store 0.160 million acres feet (MAF) of water which will flow through 16 gates having a dimension of 15.5x 14.5 meters.

Salient Features

The salient features of the proposed Kanhar Dam Project are given in Table 1.

Salient Features of of Kanhar Irrigation Project(U.P Part)	
Project Name	**Kanhar Irrigation Project**
Location (with layout plan)	**Barrage in Sonbhadra District**
Latitude	**24°7'21.29" N**
Longitude	**83°17'47.75" E**
Toposheet No.in U.P Part	**63 P/4 63P/7 & 63P/8**
Head Work Location	**Village:Amwar,Dudhi,Sonbhadra (U.P)**
Land use	**Forest,Irrigation & Cultivation Land**
Grass Command Area(GCA)	**37320Ha.**
Proposed Culturable Area	**26075Ha.**
Total Catchment Area	**4584SQM**
Catchment Area U.P Part	**324SQM**
Sources of water	**Kanhar River Tributary of Son**
Reservoir Maximum Water level(El-m)	**267.92**
Full Reservoir Level	**265.552**
Maximum Draw Down Level	**260.212**
Dead Storage Level	**260.212**
Maximum Hight Above G.L(M)	**Right Flank:39.9M and Left Flank:39.5M**
Nearest Railway station	**Dudhinagar 13KM**
Nearest state highway/national highway	
Nearest Airport	**Varanasi Airport 200 km**
Cost Of Project	**223934.64Lacs**

Table.1.0

NEED FOR CATCHMENT AREA TREATMENT

It is well- established fact that reservoirs formed by dams on rivers are subjected to sedimentation. The process of sedimentation embodies the sequential processes of erosion, entertainment, transportation, deposition and compaction of sediment. The study of erosion and sediment yield from

catchments is of utmost importance as the deposition of sediment in reservoir reduces its capacity, and thus affecting the water availability for the designated use. The eroded sediment from catchment when deposited on streambeds and banks causes braiding of river reach. The removal of top fertile soil from catchment adversely affects the agricultural production. Thus, a well-designed **Catchment Area Treatment (CAT) Plan** is essential to ameliorate the above-mentioned adverse process of soil erosion.

Soil erosion may be defined as the detachment and transportation of soil. Water is the major agent responsible for the erosion. In many locations, winds, glaciers etc. also causes soil erosion. As in the present case, erosion due to water is common phenomenon and the same has been studied as a part of the CAT Plan, Soil erosion leads to:

- Loss in production potential
- Reduction in infiltration rates
- Reduction in water-holding capacity
- Loss of Nutrients
- Increase in Tillage operation costs
- Reduction in water supply

The CAT Plan emphasizes the management techniques to control erosion in the catchment area of a water resource project. The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive measures are thus needed for the treatment of catchment for its stabilization against future erosion.

The total Catchment area at proposed in U.P, Chhattisgarh and Jharkhand Site is 4584sq. km. Catchment Area Part of UP is 324.0SQM
The catchment area considered for the present study is given in Figure 324 SQM As raw satellite imagery.

The catchment area treatment involves how to soil and water conservation in affected area by project by understanding of the erosion characteristics of the treatable area and suggesting remedial measures to reduce the erosion rate. Forest and environmental losses

APPROACH FOR THE STUDY

A detailed database on natural resources, terrain conditions, soil type of the catchment area, socio-economic status etc. is a perquisite to prepare treatment plan keeping in view the concept of sustainable development. Various thematic maps have been used in preparation of the CAT plan. Geographic information System (GIS) is a computerized resource data base system, which is

referenced to some geographic coordinate system. In the present study, real coordinate system has been used. The GIS is a tool to store, analyze and display various spatial data, in addition, GIS is a tool to store, analyze and display various spatial data. In addition, GIS, because of its special hardware & software characteristics, has a capacity to perform numerous functions and operations on the various spatial data layers residing in the database. GIS provides the capability to analyze large amounts of data in relation to a set of established criteria. In order to ensure that latest and accurate data is used for the analysis, satellite data has been used for deriving land use data. Ground truth studies, too, have been conducted.

The various steps, covered in the study, are as follows:

- Definition of the problem
- Data acquisition and preparation
- Output presentation

Definition of the Problem

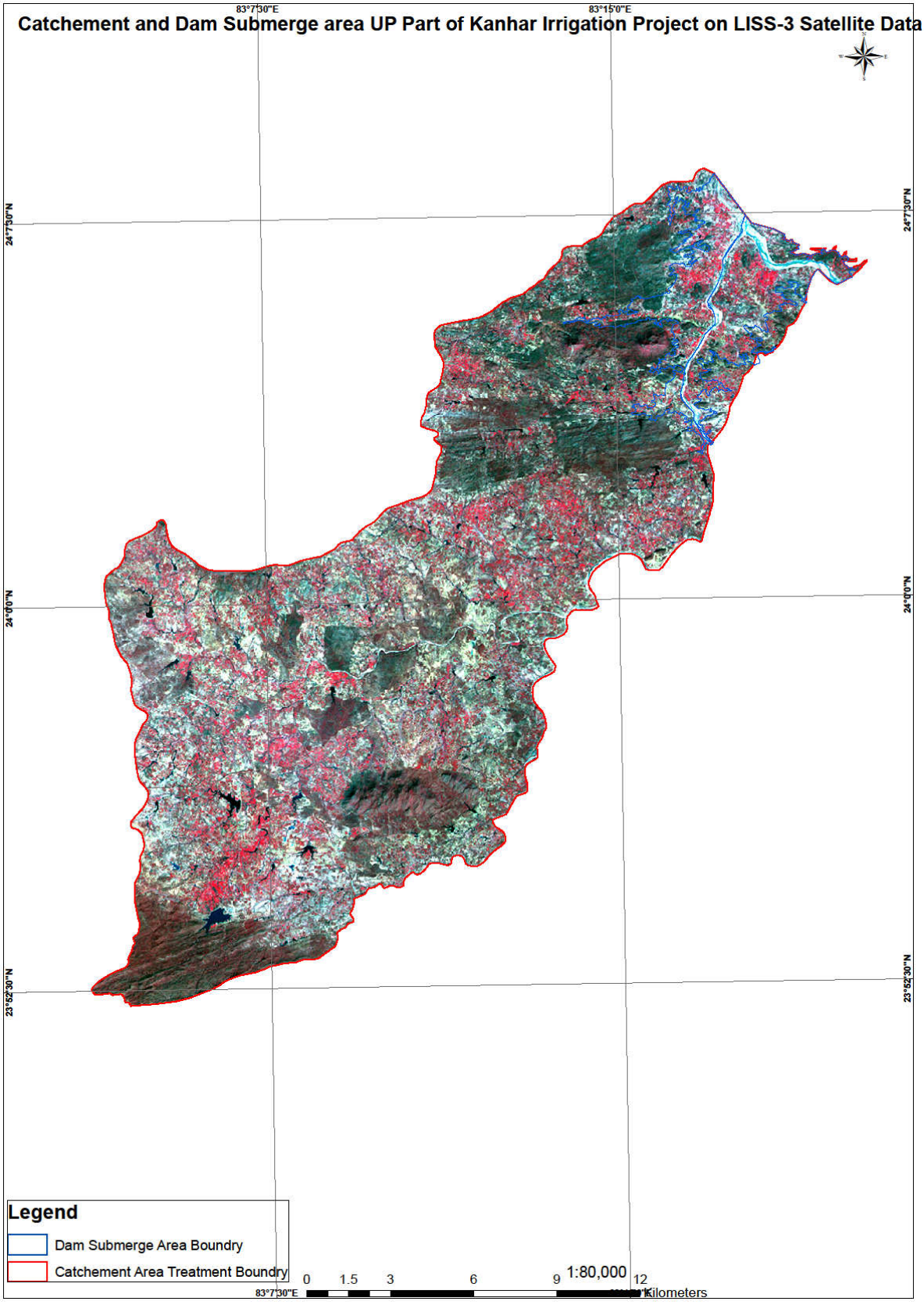
The requirements of the study were defined and the expected outputs were finalized. The various data layers of the catchment area to be used for the catchment area to be used for the study are as follows:

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

Data Acquisition and Preparation

The data available from various sources has been collected. The ground maps, contour information, etc. were scanned, digitized and registered as per the requirement. Data was prepared depending on the level of accuracy required and any corrections required were made. All the layers were geo-referenced and brought to a common scale (real co-ordinates), so that overlay could be performed. A computer program using standard modeling techniques was used to estimate the soil loss. The formats of outputs from each layer were firmed up to match the formats of inputs in the program. The grid size to be used was also decided to match the level of accuracy required, the data availability and the software and time limitations. Ground truthing and data collection was also including in the procedure.

For the present study, of proposed treatable area on IRS P6-LISS III Fig.1.0 digital satellite data was used for interpretation & classification. The data has been procured in raw digital format and has been geo-referenced using Survey of India topographical sheets with the help of standard data preparation techniques in standard image processing software. The interpretation of geo-referenced satellite data has been done using standard enhancement techniques, ground checks and experiences of qualified professionals. A detailed ground truth verification exercise has been undertaken as a part of field survey to enrich the image interpretation process.



Satellite Data

Source: From :Bhuvan Portal

Fig1.0

The classified land use map of the free draining catchment area, considered for the study, is shown as **Figure1.1**The land use pattern of the catchment area is summarized in **Table1.1**

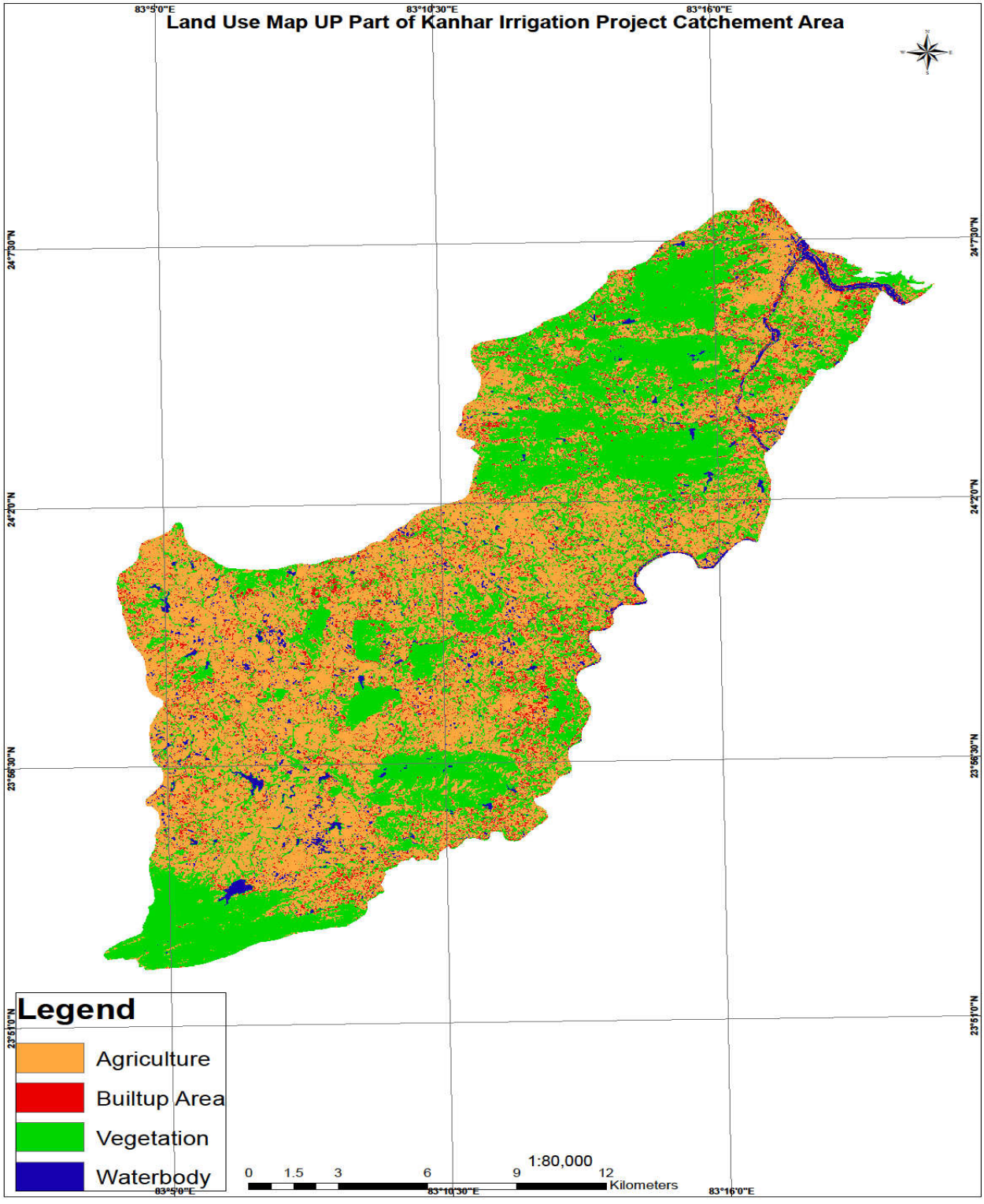


Fig.1,1

The first step in generation of slope map is to create surface using the elevation values stored in the form of contours or points. After marketing the catchment area, all the contours on the topographical

maps were derived. The output of the digitization procedure was the contours as points contours in form of x, y & z points.(x,y-location and z- their elevation). All this information was in real world co-ordinates (latitude, longitude and height in meters above sea level).

Table 2.1:Land use classification for free draining catchment at diversion site

Land use/Land cover	**Area(%)**	**Area(Ha)**
Agriculture Land	48.26	15631
Waterbody	2.88	928
Vegetation	41.24	13344
Builtup Area	7.62	2497
Total Area		32400Ha

Table1.1

A Digital Terrain Model (DTM) of the area was then prepared, which was used to derive a slope. The slope was divided in classes of slope percentages. The areas falling under various standard slope categories have been tabulated below in Table 1.2 The slope map is enclosed as Figure-…

Slope % in Treatable Area

Slope category (%)	**Area Under Slope %**
0 - 4.78%	
4.78%- 9.96%	
9.96% - 17.9%	
17.9% - 32.27%	
32.27% - 48.64%	

Table 1.2

Slope Map of Treatable Area

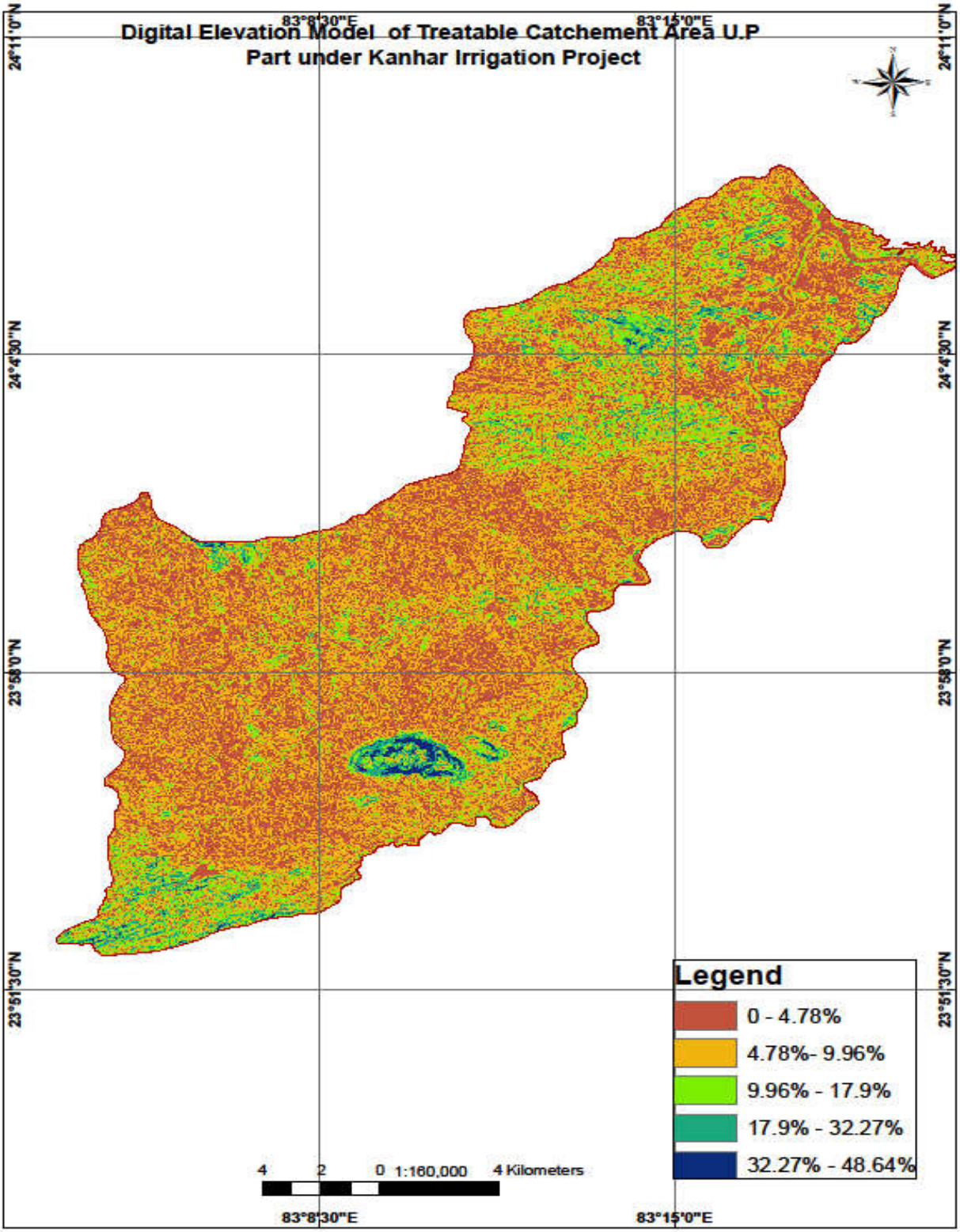


Fig 1.2

Aspect Map of Treatable Area

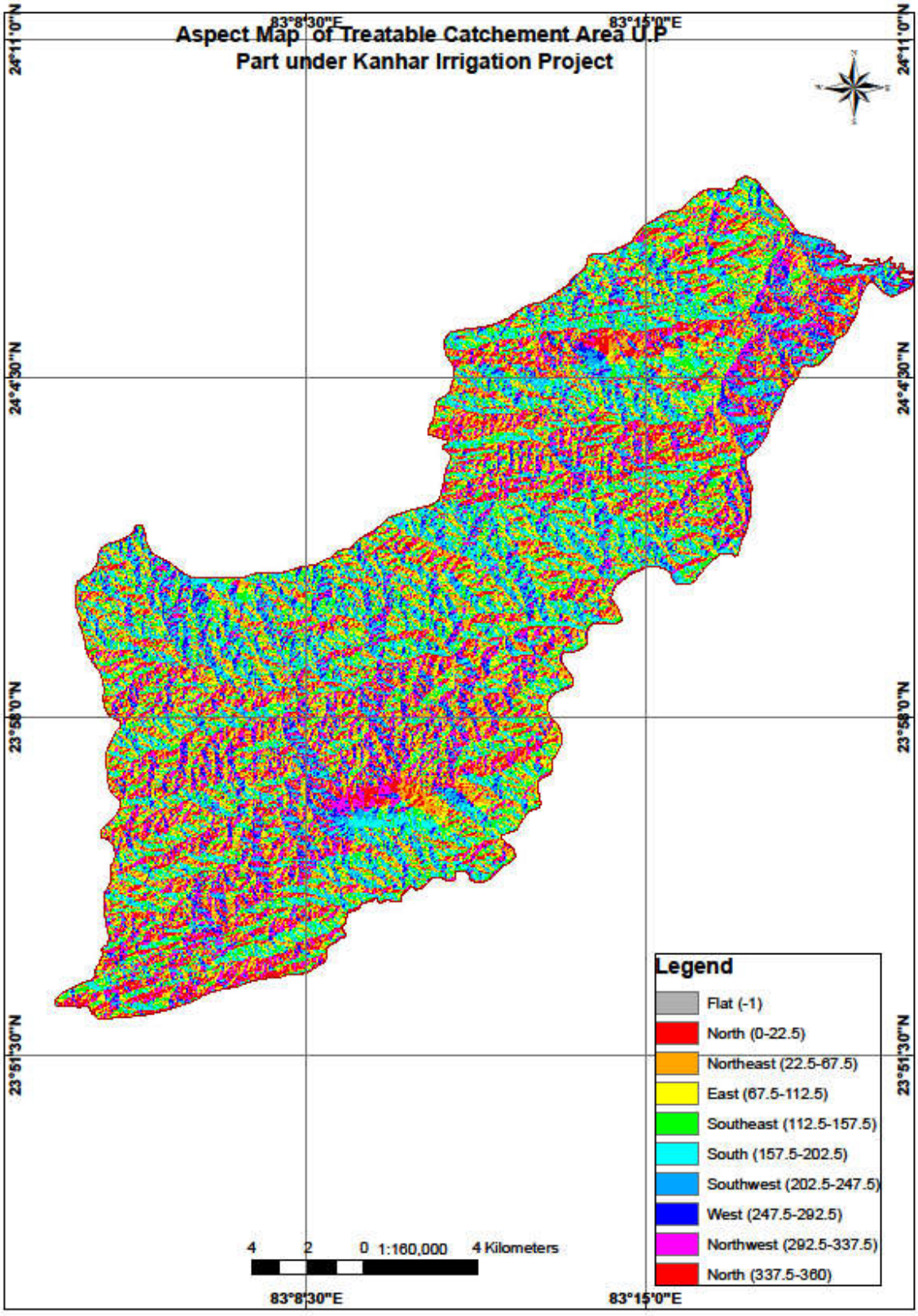


Fig 1.3

Type of Soil

Hill (3-5% slope)

11. Rock outcrops associated with moderately shallow loamy skeletal soils and severely eroded and moderate stoniness

Undulating Updates (1-3% slope)

12. Moderately shallow, loamy soils, severely eroded and moderately stoniness, associated with, loamy soils, moderately eroded and slight stoniness
13. Deep, fine soils, moderately eroded and slight stoniness

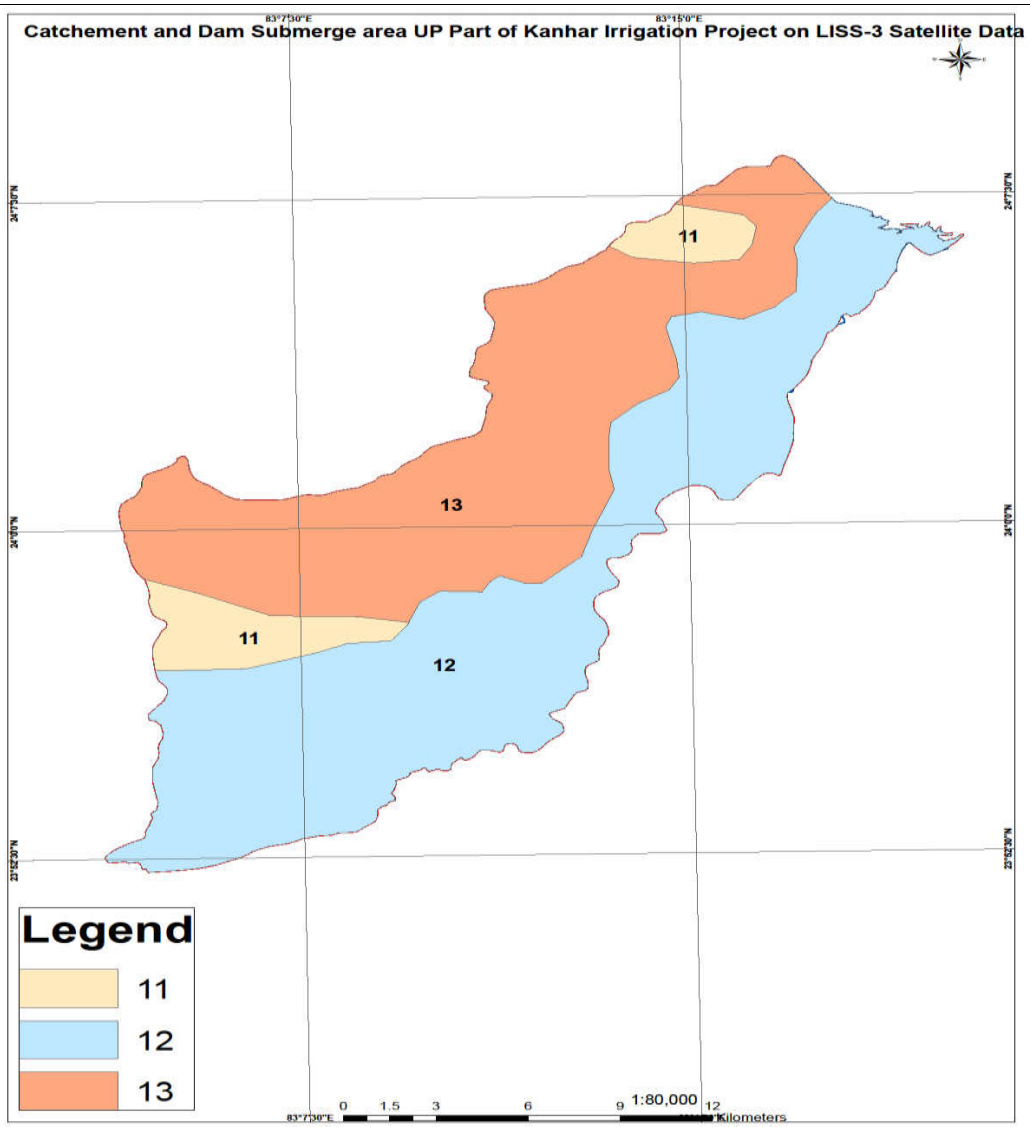


Fig. 1.4

Climate

Sonbhadra has a relatively subtropical climate with high variation between summer and winter temperatures. The average temperature is 30 ° C–46 ° C in the summer and 2 ° C–15 ° C in the winter. The weather is pleasant in rainy season from July to October.

Annual Railfall (mm)

Month	Annual Rainfall (mm)				
	Year				
	2012	2013	2014	2015	2016
January	25.7	1.5	35.9	41.9	21.1
February	13.5	47.7	29.7	3.8	0
March	10	11.7	23.5	26.2	30.3
April	11.4	29.4	1.5	10.5	0
May	1.5	2.1	10.3	20.5	14.1
June	38.3	160.3	53.8	111.8	74.3
July	303.2	289.9	156.5	208.5	526.4
August	221.8	303.1	272.2	245.3	484.9
September	422	65.8	66.3	9.7	234.1
October	0.3	110.8	39.8	25.4	34
November	7.4	0	0	1.4	0
December	11.4	0	2.7	4.6	0

Source: From the site of "India Meteorological Department". Table1.3

FIELD SURVEY

It was decided to carry out physical survey in the treatable catchment area in order to understand and analyze the site condition and based on site condition to suggest necessary remedial measures. Site visit also included collection of all necessary secondary data from forest department as well as irrigation department. A team of specialists from NRM Geomatics Pvt. Ltd. along with staff of forest and Irrigation department conducted the field survey on 11th and 12th May 2017. For the generation of base map of the study area i.e treatable catchment area extensive use of Google maps, GPS and GIS tools was made.

During field survey it was observed that the treatable catchment area is comprised of medium dense Plash, Sidha, and Mixed forests (having density 40-50%). In very few compartments found very dense mixed forest(having density >70%). Staff of forest department informed that some of the area available for plantation has already been earmarked for plantation under Japan International Corporation Agency(JICA) Scheme.

Sites Identified for Forest Enrichment Plantation

S.No.	Forest Block	Geographic Coordinates	Area to be Plantaed(Ha.)	Rate Rs/Ha	Total Cost(Rs.)
1	Chainpur-5	83°11'36.27"E 23°56'19.46"N	15	1,11,500	16,72,500
2	Pokhra	83°07' 08.82"E 23°57' 57.30"N	10	1,11,500	11,15,000
3	Chakdahiya-2	83°15'43.94"E 24° 06'45.12"N	20	1,11,500	22,30,000
4	Naudiha-2	83°11'42.37"E 24° 3'38.83"N	15	1,11,500	16,72,500
	Total				66,90,000

Table 1.4

Enrichment Plantation Sites

Trees/Plant Species found in the Treatable Catchment Area		
Sl. No.	**Plant Species/Scientific Name**	**Local Name**
TREES		
1	Acacia auriculiformis	Acacia
2	Ajan, ghorkara	Ailanthus excels
3	Am	Mengafera indica
4	Amaltas	Cassiafistula
5	Aonla	Emblica officinais
6	Arjun, Kahaua	Terminaliar arjuna
7	Babul	Acacia nilotica(L) Wild
8	Bahera	Terminelia belerica
9	Bans	Dendrocalmus strictus
10	Bansa	Albizzia odoratissima
11	Bargad, bar	Ficus bengalensis
12	Bel	Aegle marmelos
13	Ber	Zizyphus mauritiana
14	Bhaksi, harsingar, siharu	Nyctanthes arbortristis
15	Bhela, Bhelawan	Semecarpus, anacardium
16	Bheri	Cassaria elliptica
17	Bhoti	Eriolaena hooderiana

18	Bhurkul	Hymenodictyon exelsum
19	Bichhula	Grewia specias
20	Bijaisal, Biya	Pterocarpus marsupium
21	Chamraor	Ehretia laevis
22	Chilbil, Kanju	Holoptelea integrifelia
23	Dhak, palas, paras	Butea monosperma
24	Dhaura, Dhau	Aongeissus latifolia
25	Dhauri, Sidha	Lagerstrema, parviflora
26	Dhobin	Dalbergia paniculata
27	Dudhi	Wrightia toemtosa
28	Galgal	Cochlospermum religiosum
29	Ghamhar, Khamhar	Gmelina arborea
30	Ghanta	Schrebera swietenioides
31	Ghorkara, ajan	Ailanthus excelsa
32	Gular	Ficus recemosa
33	Gurhi, phaldu	Mitragyan paryifolia
34	Haldu, Karam	Haldina cardifolia
35	Hardi	Dalbergia lanceolaria
36	Harra	Terminalia chebula
37	Harua, haura	Erythrina suberosa
38	Imli	Tamarindus indica
39	Jamun	Syzyzium cumini
40	Jhigan, Jigna	Lanerea coromandelica
41	Jolgudala	Steroulia
42	Kachnar	Bauhin roxburghiana
43	Kadam	Anthoceophalus cadamba
44	Kahua, kawa, arjun	Terminalia arjuna
45	Kaitha	Limonia acdissima
46	Kakor	Zizibhus Glaberrima
47	Kala siris, bansa	Albizzia odoratissima
48	Kanju, chilbil	Holoptelea integrifolia
49	Karam, Haldu	Adina cordifolia
50	Karoha	Cleistanthus collinus
51	Kari	Miliusa tomentosa
52	Kataila, katia	Flacourtia indica
53	Kath Jamun	Eugenia heyneane
54	Kathmuhuli	Bauhinia racemosa
55	Kekar	Garuga pinnata
56	Khair	Acacia indica
57	Khaja	Bridelia squamosa
58	Khajur	Phoenix humilis
59	Kharhar	Gardenia- tugida
60	Lasora	Cordia dichotoma
61	Mahuja	Madhuca longifolia
62	Neem	Azadirechta indica
63	Pakar	Ficus lucescens

64	Palas, paras, dhak	Butea monosperma
65	Piyar	Buohonabia Lanzan
66	Reonja	Acacia Leucophloea
67	Rohina	Soymida febrifuga
68	Safed siris	Albezzia procera
69	Sagon, teak	Tectona grandis
70	Sal, Shaku, Shakhua	Shorea robusta
71	Sandan	Qugenia oojeinensis
72	Sehur, sendh	Euphorbia niyulis
73	Shisham	Dalbergia sissoo
74	Tendu	Diospyros exsculpta
SHRUBS AND HERBS		
75	Chakunda, Chakwar	Cassia, occidentalis
76	Dhaki	Antidesam diandrum
77	Dhawai	Woodfordia fruticosa
78	Jharberi	Zizyphus nummularia
79	Karaunda	Carissa spinarum
80	Lantana, phulwari	Lanatana camara
81	Marori, Marorphal	Helicteres isora
82	Pedar	Randia uliginosa
83	Satawar	Asparagus recamosa
CLIMBERS		
84	Dudhi bel	Cryptolepts buchanani
85	Gurch	Tinospora sinensis
86	Kewanch, kaunch	Mucuna prurita
87	Malkakni, malkangni	Celestrus paniculata
88	Puraina	Cissampelos pareira
89	Rataru	Combretum albidun
BAMBOOS		
90	Bans	Dendrocalamus strictus
91	Kagzi, bans	Dendrocalamus hamiltoni
92	Kanta (Kantila)	Bambusa arundinacea
EPIPHYTES AND PARASITES		
93	Akash bel	Cuscuta reflexa
94	Amar bel	Cassythafilliformis
95	Banda	Dendrophhoe falcata
GRASSES		
96	Anjana	Cenchrus ciliaris
97	Bargai, Sabai	Eulalicpsis binata
98	Bhanjura, Patpatawan	Apluda mutica
99	Bhorhi, guner	Themeda guearivelvis
100	Chhota, parua, Lappa	Aristida hystrix
101	Chikania	Chyrysopogon fulyus
102	Dub	Cynodon dactylon

Table 1.5

As per data collected and interaction with staff of forest department spotted Deer, Monkey, Langur, sambhal, cheetal, Indian Fox etc. are found in the tratable catchment area. Out of these, spotted Deer, Monkey and Indian Fox were sighted during field survey. A list of mammalian species found in the tratable catchment area is given in Table ..Ponds & Check dams constructed by forest & some other development departments under various govt. schemes. These ponds & Check dams are constructed mainly to provide drinking water for animals & conservation of soil.

Mammalian Species found in the Treatable Catchment Area		
Sl. No.	**Common Name**	**Order/Scientific Name**
1	**Bandar**	**Macaea Mulatta**
2	**Langur**	**Prisbytis entollus**
3	**Tendua**	**Panthera pardus**
4	**Jangallibilli**	**Felis chaus**
5	**Bhalu**	**Melursus usinus**
6	**Bheria**	**Canis lupus**
7	**Gidar**	**Canis aurous**
8	**Lomri**	**Vulpes bengalensis**
9	**Neola**	**Herpestes adwardsi**
10	**Bijjoo**	**Melivora indica**
11	**Sambhar**	**Cervus unicolor**
12	**Cheetal**	**Axis axis**
13	**Chinkara**	**Gazella gazella**
14	**Kala hiran**	**Antilope cervicapra**
15	**Nilgai**	**Boselphus tragocamelus**
16	**Sahi**	**Hystrix**
17	**Chooha**	**Bandicota indica**
18	**Gilehri**	**Funambulus pennanti**

Table 1.6

Drainage Map of Treatable Area

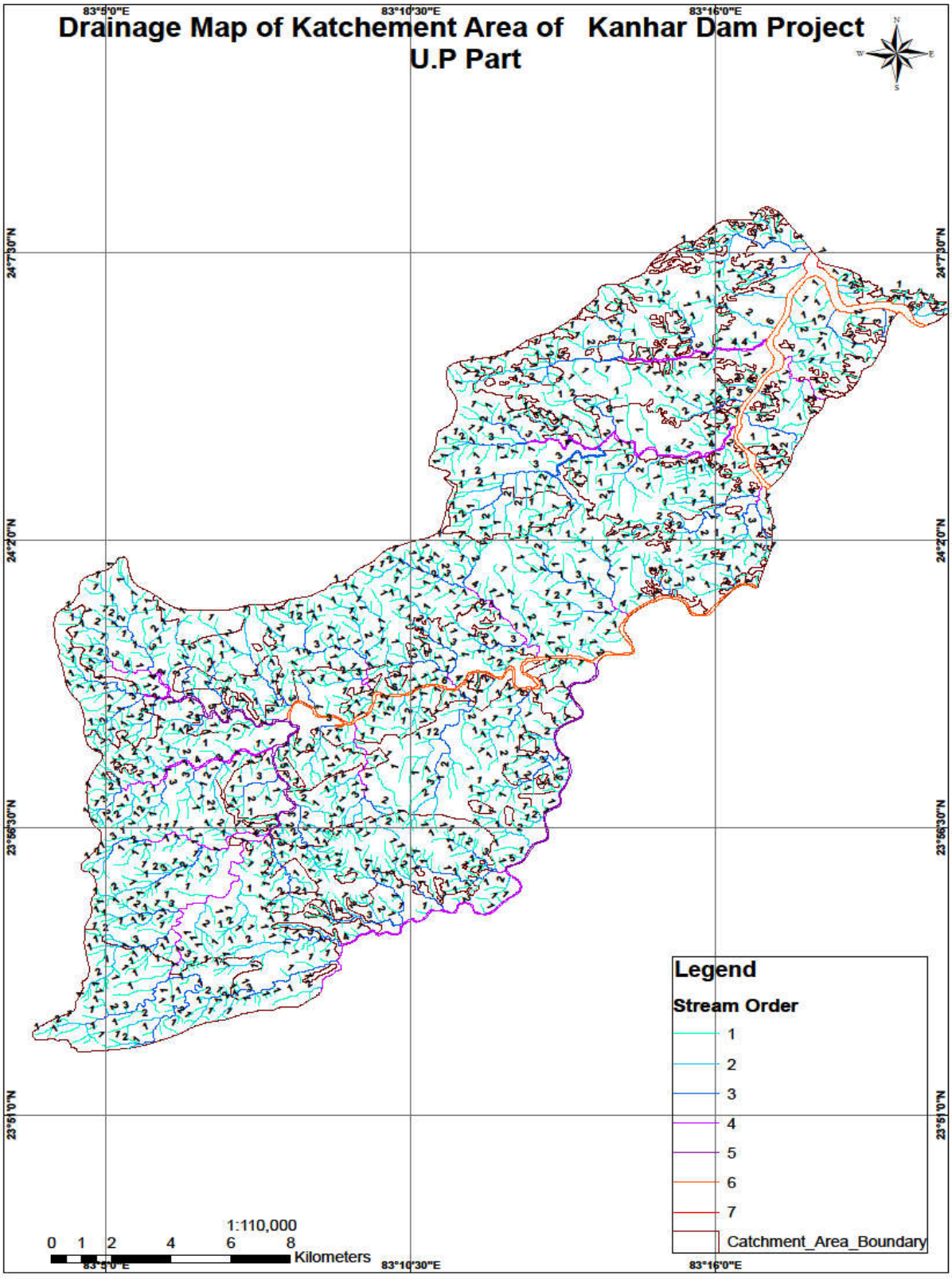


Fig 1.5

Map of Proposed Sites Check Dams in Proposed Treatable Area

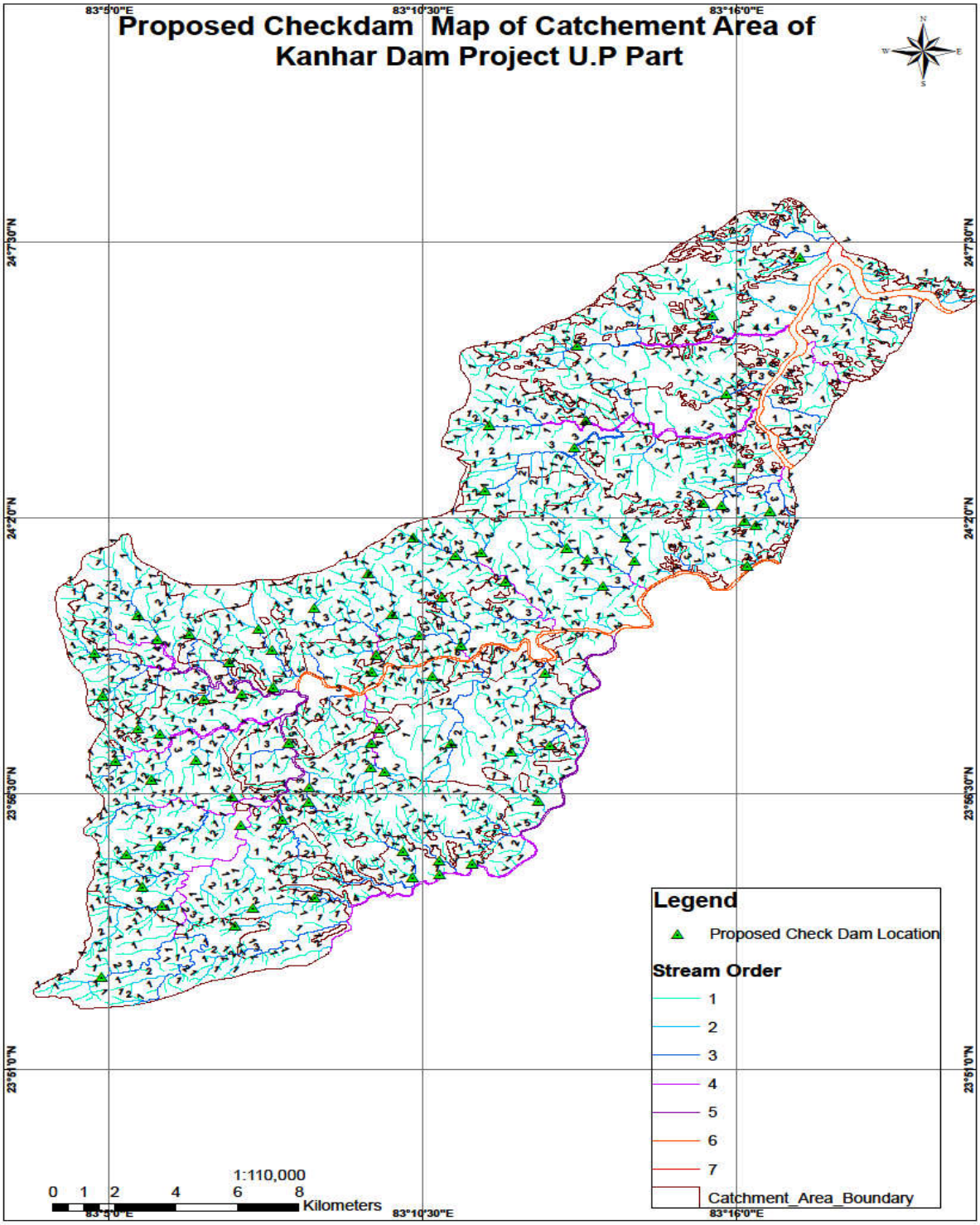


Fig1.6

Watershwd Map of Treatable Area

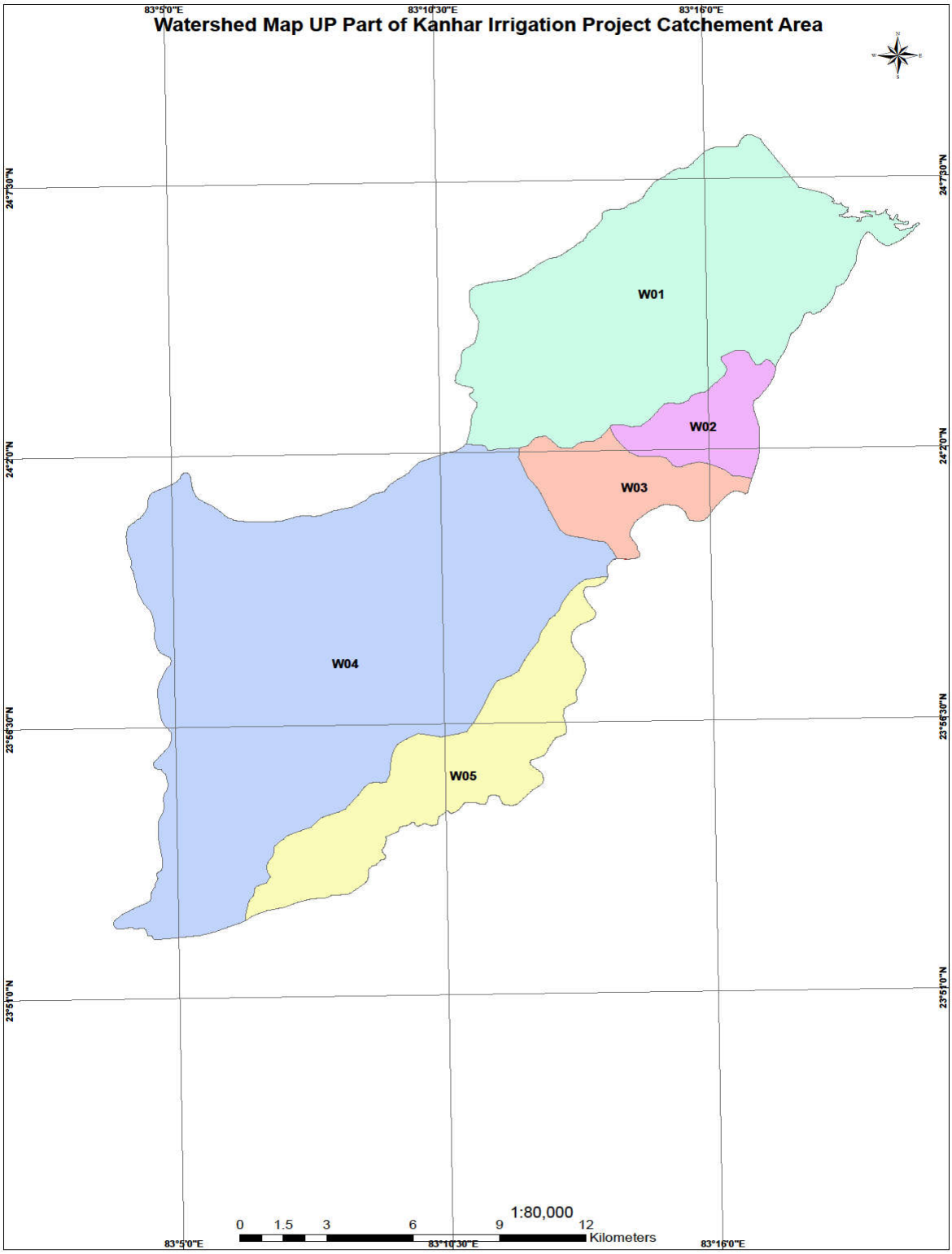


Fig1.7

Estimated cost of Catchment Area Treatment Plan U.P-Part Implementation (Kanhar Irrigation Project)					
Sl. No.	Item	Rate (first year) (Rs.)	Unit	Target	
				Physical	Financial (Rs.)
I	**Biological Measures**				
1	Afforestation(including maintenance for 10 years				38564299
2	Enrichment(including maintenance for 10 years	111500/Ha	Ha	60	6690000
3	Nursery Development	LS			2500000
4	Maintenance of Nursery	LS			1250000
5	Vegetative Fencing	LS			1000000
6	Watch & Ward for 5 years @10/person	4500/man/month	man/month	60	2700000
	Sub Total I (1+2+3+4+5+6)				**52704299**
II	**Engineering Measures**				
7	Water Pond	5000/pond	no.	200	1000000
8	Check Dams	250000/dam	no.	77	19250000
9	Contour Tranching	40000/Ha	Ha	30	1200000
	Sub Total I (7+8+9)				**21450000**
A	**Treatment Cost (Sub Total I+II)**				**74154299**
III	**Administrative Measures**				
10	Government Expenditure 5% of Treatment cost(Including O&M)				3707714.00
11	Establishment cost 8% of Treatment cost				5932343.00
12	Provision for forestry reasearch in the area @5% of Treatment cost				3707714.00
13	Provision for monitoring & evaluation @5% Treatment cost				3707714.00
14	Provision for forest protection measures				1000000.00

15	Provision for eco-services to local communities @5% of Treatment cost				3707714.00
16	Provision for training for forest staff and sensitization of local communities @2.5% of Treatment cost				1853857.00
17	Provision for energy saving devices				700000.00
18	Contingency Fund @5% of Treatment cost				3707714.00
B	**Sub Total III**				**28024776.00**
Total CAT Plan Cost (A + B)					**102179075**

प्रभागीय वनाधिकारी
ओबरा वन प्रभाग
ओबरा सोनभद्र

अधिशासी अभियन्ता
कनहर निर्माण खण्ड-3
पिपरी-सोनभद्र

प्रभागीय वनाधिकारी
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