

OFFICE OF THE CHIEF ENGINEER, WATER RESOURCES
DEPARTMENT, RAJASTHAN, JAIPUR

No. /CE/TA(W)/659/86/Hatiyadeh/2446

Dated: 20-12-21

Chief Engineer,
Water Resources Zone,
Kota

No Tech 120221/2464

Date: 24-01-2022

Copy forwarded to CEWR - Div - III Baran JAS
Information avail N/A.

अधिसापी अभियंता एवं प्रावेो सहा
वास्ते:- अधीक्षण अभियंता जल
ससाधन वारो

F-129

Sub:- Regarding Catchment Area Treatment (CAT) Plan for Hatiyadeh Medium Irrigation Project across a local nallah in Village Karvari, Tehsil-Kishanganj Dist. Baran (Rajasthan).

Ref: - Your office letter no. CE/ WR/ Tech./ F-129/ 2021/ 12683 dated 22.11.2021.

Sir,

In connection to the above context, kindly refer your above cited letter vide which Catchment Area Treatment (CAT) Plan for Hatiyadeh Medium Irrigation Project across a local nallah in Village Karvari, Tehsil-Kishanganj Dist. Baran (Rajasthan) amounting to Rs. 204.52 Lakhs has been submitted for necessary action.

In this context, I am directed to convey the permission of Government to forward the Catchment Area Treatment (CAT) Plan to State Forest Department for necessary action.

This bears the approval of the competent authority vide MR. No. 63492/PS/SWR/SWRPD/IGN & ACAD dated 16.12.2021.

Encl: As Above

कार्य: ज.अ.ज.स.व.स. वारा

स्था. राजस्व
क. मंत्रालय
स. ज. वि. वि.
क. श. वि. वि.
स. टोर. वि. वि.

Yours sincerely

12/01/2022
प्रा.स. अ.प. अ.स.स.

(Harish Vasdani)

Superintending Engineer (Works)
to Chief Engineer, Water Resources,
Rajasthan Jaipur

No: CE/WR/Tech/F-129/2021/12683 Date: 23
Copy to SE WRC Baran

अधीक्षण अभियंता (जो मो.)

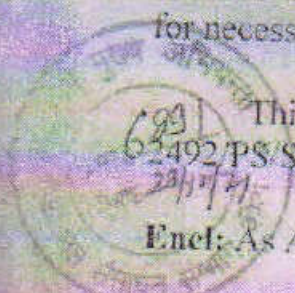


ABB
29/12

कार्यालय अधिशाषी अभियन्ता, जल संसाधन खण्ड (तृतीय) बारां

E-Mail : eewrdiv3baran@gmail.com - Phone No : 7453-237209

क्रमांक/अअ/तकनीकी/2021-22/3060

दिनांक/24/01/22

उप वन संरक्षक,
बारां।

विषय :- Diversion of 5.232 ha. forest land in favour of Water Resources Department for right main canal and minor of Ahamdi Minor Irrigation Project. (Proposal No. FP/RJ/IRRIG/23175/2016)

प्रसंग :- आपका पत्र क्रमांक ()/एफ.सी.ए./उ.व.स./2020-21/512 दिनांक 19.01.2022

महोदय,

उपरोक्त विषयान्तर्गत प्रासांगिक पत्र के क्रम में निवेदन है कि प्रकरण में प्रस्तावित गैर वन भूमि (CA Land) की KML File में आप द्वारा चाही गई आस-पास की घोषित वन क्षेत्र की सीमा को दर्शा दिया गया है।

अतः प्रस्तावित गैर वन भूमि CA Land की संशोधित KML File अग्रिम आवश्यक कार्यवाही हेतु प्रस्तुत है।

संलग्न :- उपरोक्तानुसार।



(पी.सी.मीणा)

अधिशाषी अभियन्ता

जल संसाधन खण्ड तृतीय, बारां

दिनांक/24/01/22

क्रमांक/अअ/तकनीकी/2021-22/3060-62

प्रतिलिपि :- निम्न को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रस्तुत/प्रेषित है।

1. श्रीमान् अधीक्षण अभियन्ता, जल संसाधन वृत्त, बारां।
2. सहायक अभियन्ता, जल संसाधन उपखण्ड तृतीय, भँवरगढ़।



अधिशाषी अभियन्ता

जल संसाधन खण्ड तृतीय, बारां

कार्यालय मुख्य अभियन्ता जल संसाधन सम्भाग कोटा

क्रमांक/मुअ/जस/तक./एफ-129/2021/12683 दिनांक :- 22/11/21

मुख्य अभियन्ता
जल संसाधन विभाग,
राजस्थान, जयपुर।

विषय:- हथियादेह मध्यम सिंचाई परियोजना के बाध निर्माण कार्य का CAT Plan अनुमोदन हेतु प्रस्तुत करने बाबत।

महोदय,

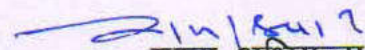
उपरोक्त विषयान्तर्गत हथियादेह मध्यम सिंचाई परियोजना के बाध निर्माण कार्य का CAT Plan राशि रू0 204.52 लाख का संलग्न कर आवश्यक कार्यवाही हेतु प्रस्तुत है।

संलग्न - उपरोक्तानुसार (दो प्रति)

(राजेन्द्र कुमार पारीक)
मुख्य अभियन्ता
जल संसाधन संभाग कोटा

क्रमांक/मुअ/जस/तक./एफ-129/2021/12684 दिनांक :- 22/11/21

प्रतिलिपि अधीक्षण अभियन्ता जल संसाधन वृत्त बारां को उनके पत्र क्रमांक 330 दिनांक 28.06.2021 के क्रम में सूचनार्थ प्रेषित है।


मुख्य अभियन्ता
जल संसाधन संभाग कोटा

GOVT. OF RAJASTHAN

WATER RESOURCES DEPARTMENT

**FOREST CLEARANCE PROPOSAL
FOR
HATYADEH MEDIUM IRRIGATION
PROJECT**

CAT Plan Report

**Executive Engineer
Water Resources Division-III Baran**

CATCHMENT AREA TREATMENT PLAN

1. Introduction

The study of erosion and sediment yield from catchment is of utmost importance as the deposition of sediment in reservoir reduces its capacity, thus affecting the water available 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 also adversely affects the agricultural production. Another important factor that adds to the sediment load and which contributes to soil degradation is grazing pressure. Many cattle, sheep, and goats graze the pastures continuously for about six months in a mountainous region.

The lack of proper vegetal cover is a factor to cause degradation and thereby results in severe run off/soil erosion, and subsequently premature siltation of the reservoir. Thus, a well-designed Catchment Area Treatment (CAT) Plan is essential to ameliorate the above-mentioned adverse cause and process of soil erosion. The catchment area treatment involves the understanding of the erosion characteristics of the terrain and suggesting remedial measures to reduce the erosion rate. For this reason, the catchment of the directly draining rivers, streams, tributaries, etc. are treated and the cost is included in the project cost.

The pre-requisite for a watershed management is the collection of multipronged data e.g., geology, geomorphology, topography, soil, land use/land cover, climate, hydrology, drainage pattern, etc. The multi-pronged data generated from various published sources and actual data collected from these watersheds on the above-mentioned parameters forms the basis of the Action Plan for Catchment Area Treatment is presented here.

Catchment Area Treatment (CAT) plans for the free draining catchment area of the proposed project has been prepared for areas with high soil erosion intensity. The CAT Plan targets towards overall improvement in the environmental conditions of the region. All the activities are aimed at treating the degraded and potential areas with severe soil erosion. The plan provides benefits due to biological and engineering measures and its utility in maintaining the ecosystem health. The plan with objectives addresses issues such as prevention of gully erosion, enhancing the forest cover for increasing soil holding capacity; and arresting total sediment flow in the reservoir and flowing waters.

2. Objectives

Integrated watershed management plan minimizes the sedimentation of reservoir. The main aim of the Catchment Area Treatment Plan is to rejuvenate various potential and degraded ecosystems in the catchment area for longevity of the reservoir storage capacity. For this purpose, the action plan has been prepared with the following objectives:

- 1 To facilitate the hydrological functioning of the catchment and to augment the quality of water of the river and its tributaries.
- 2 Conservation of soil cover and to arrest the soil erosion, floods and siltation of the river along with its tributaries and consequent reduction of siltation in the reservoir of the project.
- 3 Demarcation of the priority of watersheds for treatment based on soil erosion intensity in the catchment area.
- 4 Rehabilitation of degraded forest areas through afforestation and facilitating natural regeneration of plants.
- 5 Mitigation of landslide, landslip and rock falls.
- 6 Soil conservation through biological and engineering measures to reduce sediment load in river and tributaries, incidentally improving the quality of water.
- 7 Ecosystem conservation resulting from increased vegetal cover and water retaining properties of soil.
- 8 To meet the fuel and fodder requirements of local people.
- 9 Promotion of non-conventional energy device to reduce pressure on forest.
10. Employment generation through community participation and conservation.

3. Catchment Area

3.1 Free Draining Catchment

The total catchment area of Hatiyadeh Project up to the proposed site is 269.31 sq km (202.75 sq Km in Rajasthan & 66.56 Sq Km in M.P.) . The free catchment area at the Project Site is 202.75 sq km. the Catchment Area Treatment Plan shall be formulated for free catchment (202.75 sq km).

As per nomenclature contained in Water Atlas of India, Edition 1993, the free draining catchment under the study area lies in Water Resource Region-2 (River flowing into Bay of Bengal); basin-2D (Ganga), Catchment -2D2, sub-catchment 2D2A and covered in parts under 6 watershed. The free draining catchment has been further sub-divided into 12 sub-watersheds. The basin characteristics of different sub-watersheds are illustrated in Table 1,

the satellite imagery of the free draining catchment is presented in **Figure 1**, and the map of Free Catchment Area is shown in **Figure 2**.


4. Topography

The catchment is largely hilly terrain and has undulated topography and tracts of agriculture land and dry deciduous forest. The highest altitude in the basin free catchment is 504 M Mean Sea Level..The project area is located at 25°17'N, 76°43'E. At the project site, the river flows in I-shaped. The elevation of the catchment area varies from El. 504 M Mean Sea Level to El250 M Mean Sea Level near Project Site.. The drainage map of the catchment is shown in **Figure 3**.

Table 1: Basin Characteristics of Different Sub-watersheds

S.No.	Sub Catchment	WaterShed	Sub-Water Shed	Area in Sq KM
1	2D2A	2D2A6C	2D2A6C6	19.56
2		2D2A6H	2D2A6H4	9.23
3			2D2A6H5	28.02
4		2D2A6J	2D2A6J4 (1)	21.2
5			2D2A6J4 (2)	15.47
6			2D2A6J7	19.5
7		2D2A6K	2D2A6K2	29.38
8		2D2A6r	2D2A6r2 (1)	22.14
9			2D2A6r2 (2)	24.42
10			2D2A6r3	25.05
11			2D2A6r4	48.37
12		2D2A6t	2D2A6t5	6.97
			Total	269.31


 सहायक अभियन्ता
 जल संसाधन उपखण्ड चतुर्थ
 समरानियां, जिला बारां


 अधिशासी अभियन्ता
 जल संसाधन खण्ड III बारां

False Colour Composition (FCC)
MAP

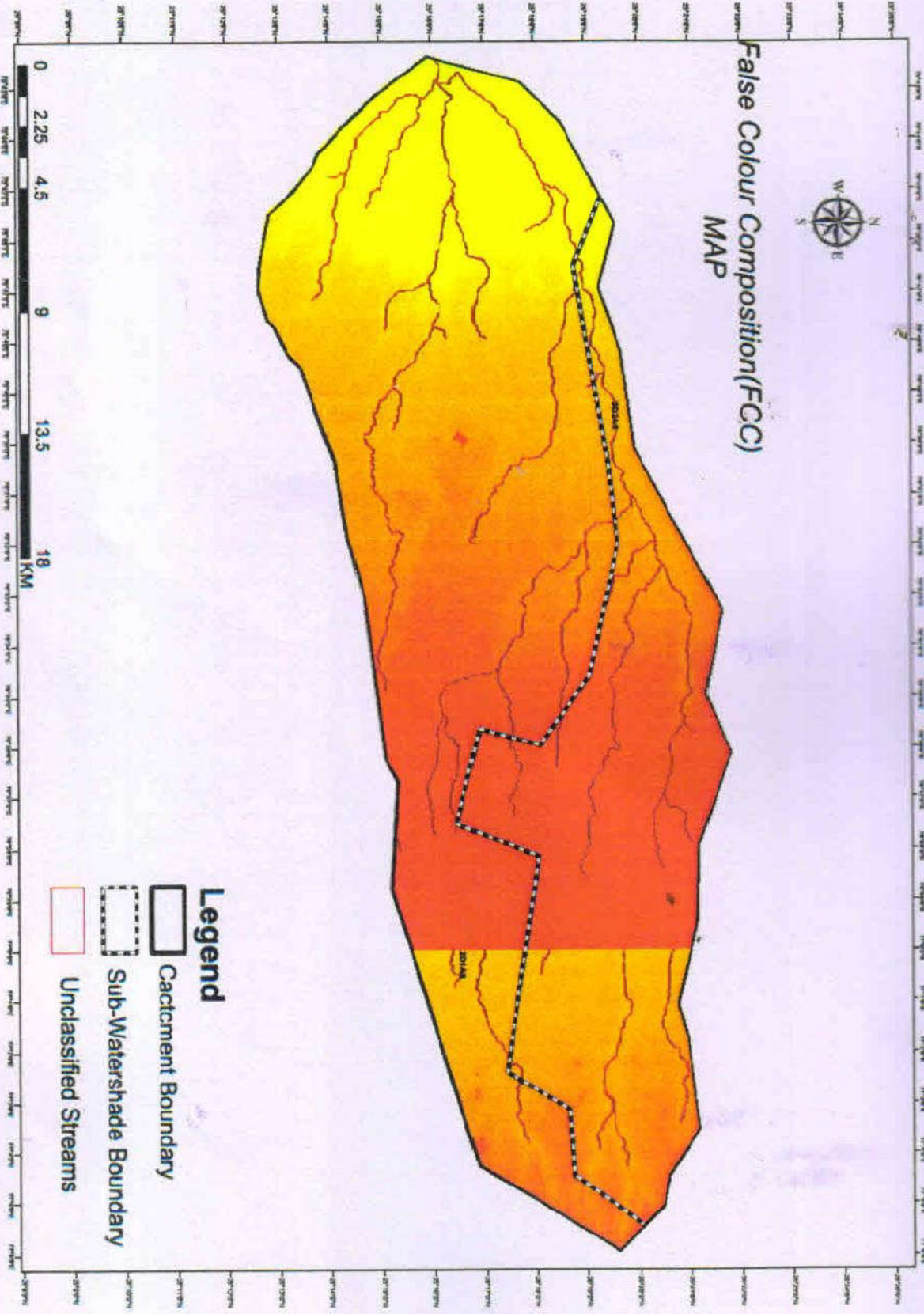


Fig. -1 FCC Map of Catchment Area

Prakash
सहायक अभियन्ता
पत्र सं. 10/2018/सपरखण्ड चतुर्थ
समनायिका, जिला कार्यालय

अ
अधिशाही अभियन्ता
पत्र सं. 10/2018/सपरखण्ड III कार्यालय

INDEX-MAP & CATCHMENT AREA PLAN OF HATHIADEN I.P.



Fig.-2 Fringe Catchment Area Plan Hayhiaden Dam

अधिकांक आभारता

अकल तलसलतल वलन, अलतल

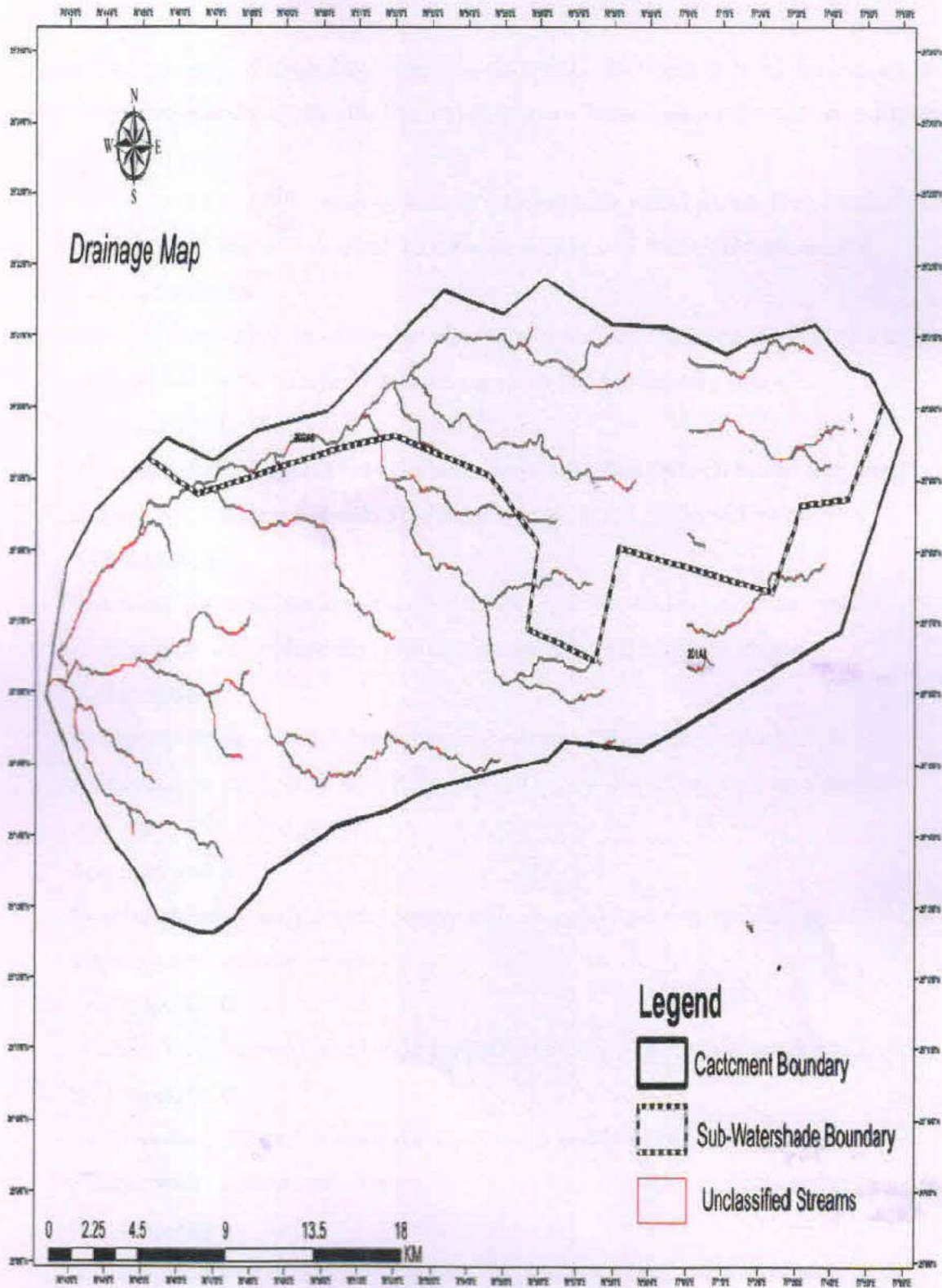


Figure 3: Drainage map of the catchment

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प्रकल्प संयोजन समिति, बारा

5 Soil

The soil resource map of Rajasthan from Bhuvan Portal has been used in the present study. The soil is predominantly sandy clay loam to clay soil. The soil map is presented in **Figure4**.

Soil map unit A

These pertain to gently sloping soils of residual hills with valleys. These soils are moderately deep, well-drained, calcareous clayey soil with moderate erosion.

Soil map unit B

These are very shallow somewhat excessively drained, loamy soils on gently sloping residual hills with valleys with severe erosion and moderately stony.

Soil map unit C

These are shallow excessively drained, clayey skeletal soils on moderately steep sloping with escarpment with very severe erosion and moderately stony.

Soil map unit D

These are very shallow excessively drained, loamy soils on moderately steep sloping hills with escarpment with severe erosion and moderately stony.

Soil map unit E

Extremely shallow somewhat excessively drained loamy skeletal soils on moderately steep sloping with hilly terrain (highly dissected) with very severe erosion.

Soil map unit F

Deep moderately well drained loamy soils on gently sloping undulating plateau with moderate erosion

Soil map unit G

Shallow well drained clayey soils on gently sloping plateau with moderate erosion

Soil map unit H\


Deep moderately well drained clayey soils on gently sloping undulating plateau with moderate erosion

Soil map unit I

Slightly deep well drained, clayey soils on gently sloping intervenial plateau with moderate e

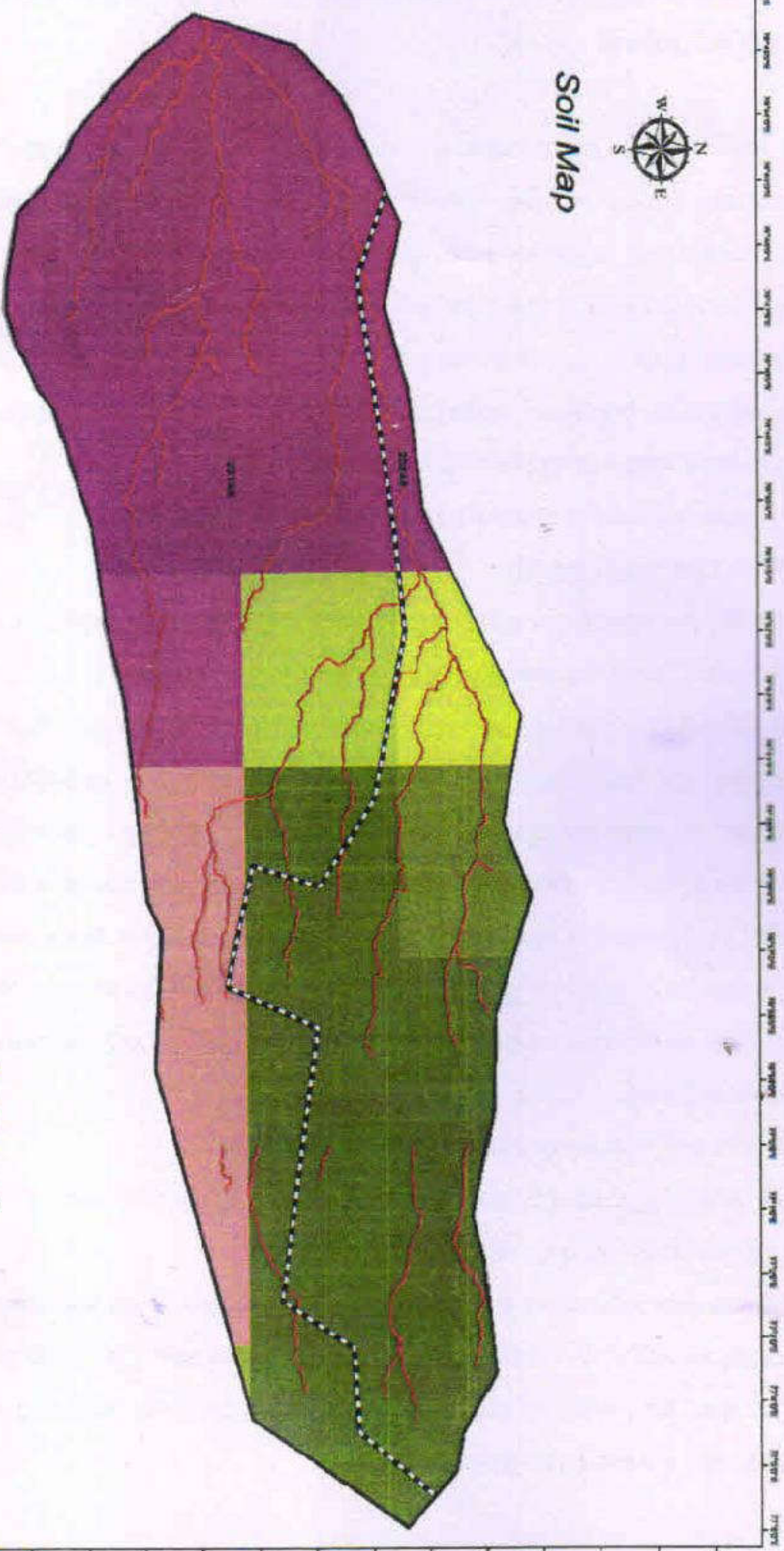


सहायक अभियंता
जल संसाधन विभाग
सम्राटनगर, जिला बरान


अधीक्षक अभियंता
जल संसाधन विभाग (बरान)

अभिषेक अभियन्ता
जल संसाधन विभाग, जिला बांसवाड़ा

Soil Map



- Legend**
- Catchment Boundary
 - Sub-Watershed Boundary
 - Unclassified Streams

0 2.25 4.5 13.5 18 KM

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6 Landuse

6.1 Land use-Land Cover Classification

Based on satellite data and topo-sheets, a land-use map has been prepared and verified in detail during ground surveys i.e. crosschecked with ground truths. The Land use/ Land-cover map of the catchment area is presented in **Figure 5** and its details are presented in **Table 2**.

6.2 Land use Categories and Erosion

The erosion acts differently in different land-use types. It is important to understand the nature of erosion in a land-use class to further plan for treatment.

6.2.1 Agricultural Land

Around 34.78 sq km area of the catchment constituting 12.92% of the total catchment comes under this category. Plain to Well-planned and developed terraces were seen at some places. In general, at places the sheet and rill type of soil erosion predominates with few gullies in early stage of its development. Very few or no measures are taken to conserve soil and tendency exists to interrupt the natural drainage due to faulty agricultural practices. Runoff often exceeds the safe velocity on long slope lengths. It is suggested to repair and better design the agricultural terraces, which follows the faulty agricultural practices.

Temporary and semi-permanent soil conservation structures like brushing dams, wiring woven and gabion check dams etc. shall be made for effective adaptive management.

6.2.2 Settlement (Built-Up Land)-

No area Under settlement category is present in the catchment.

6.2.3 Open Forest Land (Deciduous Broad leaf Forest)

Under open forest category, about 118.66 sq km, constituting 44.06% of the total catchment, is present. Forest crown density ranges from 0-40% or on average 20% crown density can be assumed present in the area. Soils have relatively good water holding capacity, humus, nutrient content and moderate to slight erosion rates on steeper slopes. Therefore, rill erosion predominates which in due course leads to scrub land formation with gullies. Afforestation is suggested so as increase the crown density by 20% in whole of the area to reduce erosion.

6.2.4 Dense Forest (Mixed Forest)


Dense forest covers about 68.15 sq. km area constituting 25.31% of the catchment with the forest crown density above 40%. Soils are very good in water holding capacity, humus and nutrients with no erosion but due to steeper slopes, some area requires soil conservation measures.

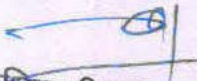
6.2.5 River / Water body

Around 4.19 sq km area constituting 1.56% of the catchment area is classified under water bodies. The category needs no treatment except that the unstable bank shall be provided stream bank stabilization through protection measures whenever required.

Table 2: Land use Details of Sub-watersheds in the Catchment

S.No.	Land Use Category	Area in Sq. Km	Land Use Area (Sq. Km)	Area (%)
1	CROP LAND	34.78	4.52	13.00
2	Fallow land	9.99	1.00	10.00
3	Water bodies	4.19	0.00	0.00
4	Shrubland	33.26	33.26	100.00
5	Deciduous Broad leaf Forest	118.66	11.29	9.51
6	Plantations	0.28	0.03	10.00
7	Mixed Forests	68.15	7.50	11.00
	Total	269.317	57.59	


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समरानियां, जिला बारों


अधिसाधी अभियन्ता
जल संसाधन खण्ड III बारों

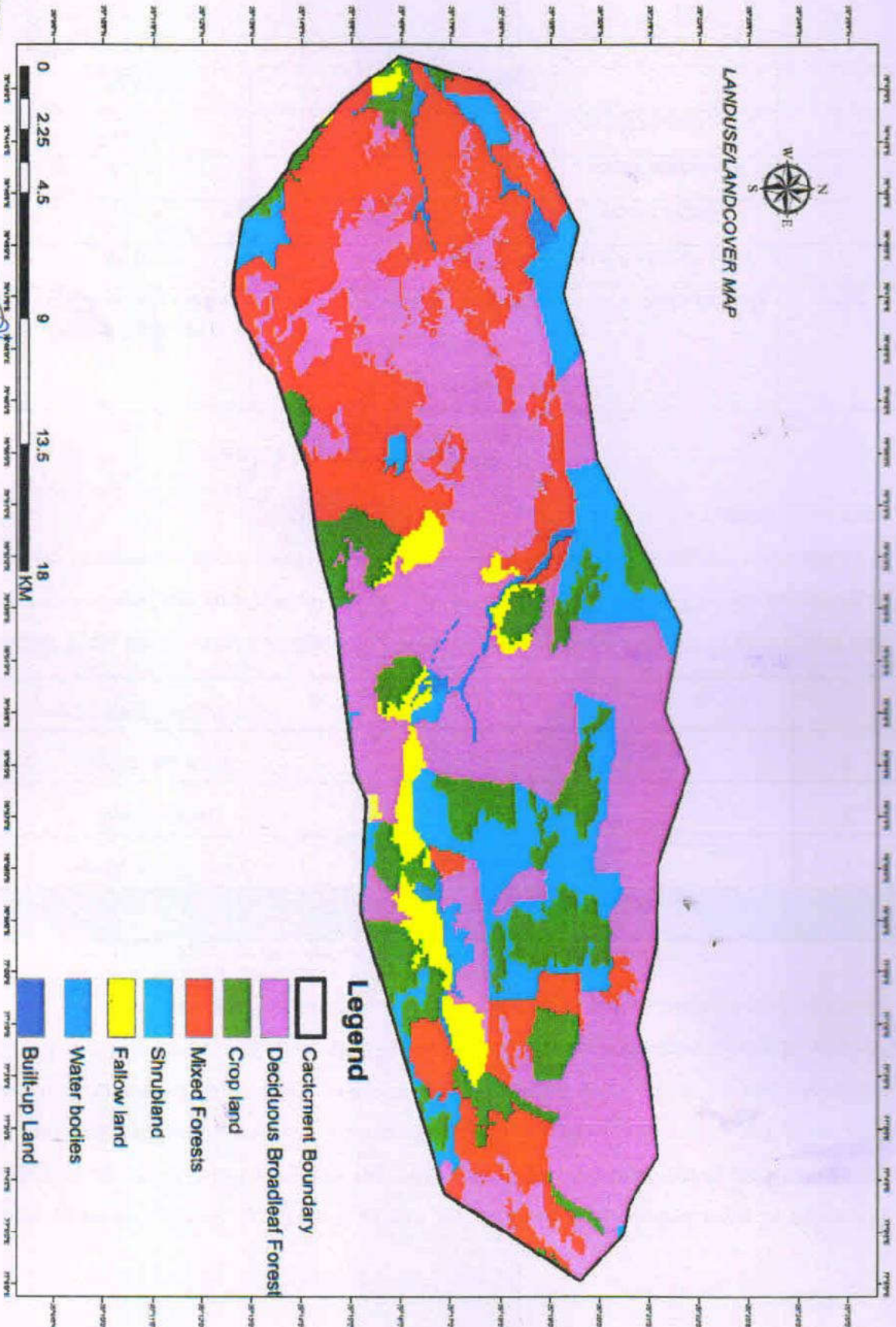


Figure 5: Landuse Map of Catchment Area

Praveen
अभियंता अभियन्ता

जल संसाधन विभाग, हरद्वार
समस्या, जिला कार्यालय

Praveen
अभियंता अभियन्ता

जल संसाधन विभाग, हरद्वार
समस्या, जिला कार्यालय

7 Slope

The slope of a watershed plays an important role in controlling the soil and water retention thereby affecting the land-use capability. The percentage of the slope in a watershed determines the soil erosion susceptibility and forms the basis for classifying different of the watershed into suitable classes for formulating effective soil erosion conservation measures. Broadly, the following slope classes and ranges (Table 3) as per norms of All India Soil & Land Use Survey were adopted to classify the slopes for the present study.

Table 3: Slope Ranges showing the intensity of catchment area

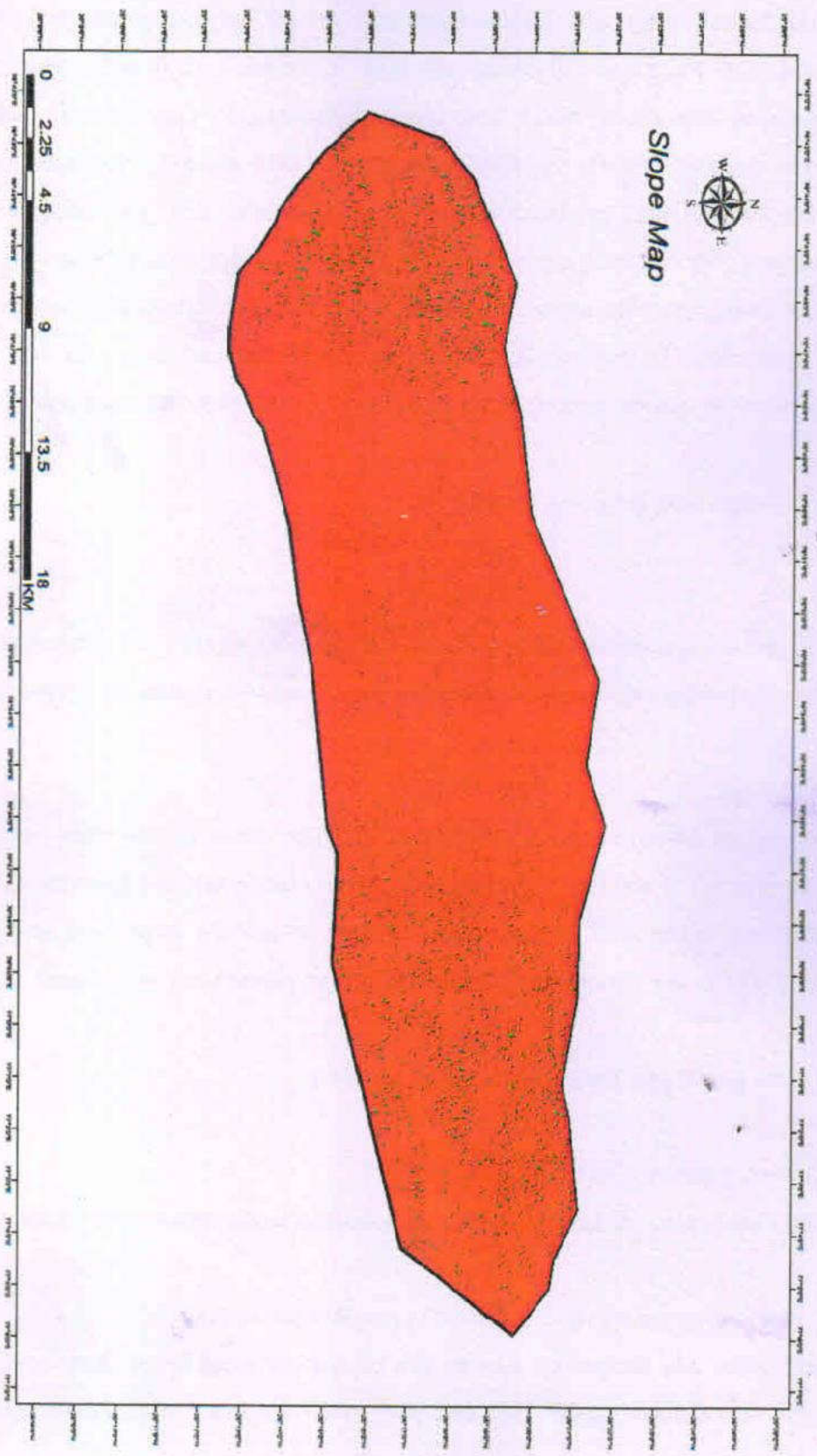
Sr. No	Slope Range (Degrees)	Description
1	0-2	Very Gentle Slope
2	2-5	Gentle Slope
3	5-10	Moderate Slope
4	10-18	Moderately Steep Slope

The Slope map of the free draining catchment is presented in Figure 6 and slope details are as presented under Table 4. The data shows that about 76.54% area lies between very gentle to gentle slope category of slope and balance 23.46% falls from moderate slope to moderately steep slope category.

Table 4: Slope Classes

S.No.	Description	Range of Slope	Area Under Diff Class (in Sq KM)	Area (%)
1	Very Gentle Slope	0-2	130.18	48.34
2	Gentle Slope	2-5	75.95	28.2
3	Moderate Slope	5-10	36.63	13.6
4	Moderately Steep	10-18	26.55	9.86
		Total Area	269.31	100.00


सहायक अभियन्ता
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समरानिया, जिला बारा



Birwal
 सहस्रक अभियन्ता
 जल संसाधन उपखण्ड कलुथ
 समरानिया, जिला बायाँ

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 अधिसाधी अभियन्ता
 जल संसाधन खण्ड III बायाँ

Figure 6: Slope Map of Catchment

8 Methodology Used for the Study

Superimposing topography, slope, soil and land use data/maps, a tentative estimation of erosion prone areas and landslides area in the catchment were made. The vulnerable and problematic areas were identified in different physiographic zones.

These data sets were used for preparation of the thematic maps, calculation of sediment yield index and Erosion Intensity Units.

1.8.1 Soil Loss Using Silt Yield Index (SYI) Method

- The Silt Yield Index Model (SYI), considering sedimentation as product of erosivity, erodibility and aerial extent was conceptualized in the All India Soil and Land Use Survey (AISLUS) as early as 1969 and has been in operational use since then to meet the requirements of prioritization of smaller hydrologic units within river valley project catchment areas.
- Methodology for the calculation of sediment yield index developed by All India Soil & Land Use Survey (Development of Agriculture, Govt. of India) was followed in this study.

(i) Erosion Intensity and Delivery Ratio

- Determination of erosion intensity unit is primarily based upon the integrated information on soil characters, physiography, slope, land-use/land-cover, litho-logy and structure. This is achieved through super-imposition of different thematic map overlays. Based upon the field data collected during the field survey and published data, weight age value and delivery ration were assigned to each erosion intensity unit. The composite map for delineating different erosion intensity units was prepared through superimposition of the maps showing soil types, slope and land-use/land-cover. This thematic mapping of erosion intensity for entire catchment was done using the overlay and union techniques. Based on ground truth verification conducted during fieldwork and published data, weightage and delivery ratio was assigned to each erosion intensity units. The composite

erosion intensity map was then superimposed on the drainage map with sub-watershed boundaries to evolve CEIU for individual sub-watershed.

- Each element of erosion intensity unit is assigned a weightage value. The cumulative weightage values of the erosion intensity units represent approximately the relative comparative erosion intensity within the watersheds. A basic factor of $K=10$ was used in determining the cumulative weightage values. The value of 10 indicated an equilibrium condition between erosion and deposition. Any value of $K (10+X)$ is suggestive of erosion intensity in an ascending order whereas the value of $K (10-X)$ is suggestive of deposition intensity in descending order.
- The delivery ratios were calculated for each composite erosion intensity unit. The delivery ratio suggests the percentage of eroded material that finally finds entry into the reservoir or river/stream. Total area of different erosion intensity classes (composite erosion intensity unit) in each watershed was then calculated.
- The delivery ratio is generally governed by the type of material, soil erosion, relief length ratio, cover conditions, distance from the nearest stream, etc. However, in the present study the

delivery ratios to the erosion intensity units were assigned upon their distance from the nearest stream (being the most important factor responsible for delivery of the sediments) per the following scheme. The delivery ratio criteria adopted for the study is presented in Table 1.5.

Table 5: Delivery Ratio (DR) Criteria

Nearest Stream	Delivery Ratio (DR)
0-0.9 km	1.00
1.0-2.0 km	0.90
2.1-5.0 km	0.80
5.1-15.0 km	0.70
15.1-30.0 km	0.50

(ii) Sediment Yield Index & Prioritization of Sub-Watersheds

- The erosivity determinates are the climatic factors and soil and land attributes that have direct or reciprocal bearing on the units of the detached soil material. The relationship can be expressed as:
 - **Soil erosivity = f (Climate, physiography, slope, soil parameters land use/land cover, soil management)**

- The Silt Yield Index (SYI) is defined as the Yield per unit area and SYI value for hydrologic unit is obtained by taking the weightage arithmetic mean of the products of the weightage value and delivery ratio over the entire area of the hydrologic unit by using suitable empirical equation.
- Prioritization of smaller hydrological units within the vast catchments is based on the SYI of the smaller units. The boundary values of range of SYI values for different priority categories are arrived at by studying the frequency distribution of SYI values and locating the suitable breaking point. The watersheds/sub-watersheds is subsequently rated into various categories corresponding to their respective SYI values.
- The application of SYI model for prioritization of sub-watersheds in the catchment areas involves the evaluation of:
 - Climatic factors comprising total precipitation, its frequency and intensity
 - Geomorphic factors comprising land forms, physiography, slope and drainage characteristics
 - Surface cover factors governing the flow hydraulics
 - Management factors.
- The data on climatic factors can be obtained for different locations in the catchment area from the meteorological stations whereas the field investigations are required for estimating the other attributes.
- The various steps involved in the application of model are:
 - Preparation of a framework of sub-watershed through systematic delineation
 - Rapid reconnaissance surveys on 1:50,000 scale leading to the generation of a map indicating erosion-intensity mapping units.
 - Assignment of weightage values to various mapping units based on relative silt-yield potential.
 - Computing Silt Yield Index for individual watersheds/sub watersheds.
 - Grading of watersheds/sub-watersheds into very high, high medium, low and very low priority categories.
 - The area of each of the mapping units is computed and silt yield indices of individual sub-watersheds are calculated using the following equations:

Silt Yield Index

$$SYI = (A_i \times W_i \times D_i) \times 100/A_w; \quad \text{where } I = 1 \text{ to } n$$

Where

- A_i = Area of ith (EIMU)
 W_i = Weightage value of ith mapping unit
 D_i = Delivery ratio
 n = No. of mapping units
 A_w = Total area of sub-watershed

The SYI values for classification of various categories of erosion intensity rates were taken for the present study as:

	<u>Priority Category</u>	<u>SYI Values</u>
1.	Very High	>1300
2.	High	1200-1299
3.	Medium	1100-1199
4.	Low	1000-1099
5.	Very low	<1000

Accordingly, the sediment Yield Index has been calculated for sub-watersheds. The computation of SYI for each SWS is presented in **Table 6**.


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Table 6: SYI and Priority Rating as per Erosion Intensity

S.No.	Sub-watershed code	Erosion Intensity	Area* (ha) AI	Weightage WI	Area x weightage AI x WI	Delivery Ratio DI	Gross silt Yield	Sediment Yield Index SYI = (AI x WI x DI) x 100/Aw	Priority
1	2D2A6C6	Very Severe	0.31	18	5.58	0.8	4.46400	1174.52	High
		Severe	0.45	16	7.20	0.8	5.76		
		Moderate	13.64	14	190.90	0.9	171.8080227		
		Slight	3.28	12	39.36	0.8	31.488		
	Total	Negligible	1.58	10	15.80	0.8	12.64		
2	2D2A6H4	Very Severe	0.24	18	4.32	0.9	3.888	1022.90	Medium
		Severe	0.61	16	9.76	0.8	7.808		
		Moderate	3.48	14	48.67	0.85	41.36843625		
		Slight	2.25	11	24.75	0.8	19.8		
	Total	Negligible	2.51	10	25.10	0.8	20.08		
3	2D2A6H5	Very Severe	0.51	18	9.18	0.85	7.803	1029.64	Low
		Severe	0.78	16	12.48	0.8	9.984		
		Moderate	22.03	14	308.47	0.8	246.7794699		
		Slight	2.21	11	24.31	0.8	19.448		
	Total	Negligible	2.05	10	20.50	0	0		
4	2D2A6I4 (1)	Very Severe	0.26	18	4.68	0.9	4.212	1190.50	Medium
		Severe	0.31	16	4.96	0.85	4.216		
		Moderate	16.53	14	231.42	0.9	208.2783967		
		Slight	1.99	11	21.89	0.8	17.512		
	Total	Negligible	1.78	10	17.80	0.8	14.24		
5	2D2A6I4 (2)	Very Severe	0.21	18	3.78	0.8	3.024	1110.36	Medium
		Severe	0.38	16	6.08	0.8	4.864		
		Moderate	10.32	14	144.47	0.85	122.7986748		
		Slight	2.34	11	25.74	0.8	20.592		
	Total	Negligible	1.98	10	19.80	0.9	17.82		
	Total		15.23				169.10		

S.No.	Sub-watershed code	Erosion Intensity	Area* (ha)	Weightage WI	Area x Weightage X WI	Delivery Ratio Di	Gross silt yield	Sediment Yield Index SYI = (AI x WI x Di) x 100/Aw	Priority
6	2D2A6J7	Very Severe	0.11	18	1.98	0.8	1.584	1079.53	Low
		Severe	0.4	16	6.40	0.85	5.44		
		Moderate	15.39	14	215.41	0.8	172.3287017		
		Slight	1.85	11	20.35	0.8	16.28		
	Total	Negligible	1.45	10	14.50	0.8	11.6		
7	2D2A6K2	Very Severe	0.07	18	1.26	0.8	1.008	1212.26	High
		Severe	0.52	16	8.32	0.85	7.072		
		Moderate	23.68	14	331.56	0.9	298.4021895		
		Slight	2.54	11	27.94	0.9	25.146		
	Total	Negligible	2.11	10	21.10	0.9	18.99		
8	2D2A6r2 (1)	Very Severe	0.12	18	2.16	0.8	1.728	1157.12	Medium
		Severe	0.64	16	10.24	0.85	8.704		
		Moderate	18.14	14	253.90	0.85	215.8112696		
		Slight	1.45	11	15.95	0.9	14.355		
	Total	Negligible	1.45	10	14.50	0.8	11.6		
9	2D2A6r2 (2)	Very Severe	0.09	18	1.62	0.8	1.296	1100.73	Medium
		Severe	0.35	16	5.60	0.85	4.76		
		Moderate	21.38	14	299.32	0.8	239.4550326		
		Slight	1.68	11	18.48	0.8	14.784		
	Total	Negligible	0.54	10	5.40	0.8	4.32		
10	2D2A6r3	Very Severe	0.20	18	3.60	0.8	2.88	1233.56	High
		Severe	0.24	16	3.84	0.9	3.456		
		Moderate	21.99	14	307.86	0.9	277.0753603		
		Slight	1.55	11	17.05	0.9	15.345		
	Total	Negligible	0.68	10	6.80	0.8	5.44		
	Total		24.66				304.20		

S.No.	Sub-watershed code	Erosion Intensity	Area* (ha) Ai	Weightage WI	Area x weightage AI x WI	Delivery Ratio DI	Gross silt Yield	Sediment Yield Index SYI = (Ai x WI x DI) x 100/Aw	Priority
11	2D2A6r4	Very Severe	0.25	18	4.50	0.8	3.6	1240.73	High
		Severe	0.45	16	7.20	0.8	5.76		
		Moderate	43.92	14	614.84	0.9	553.3559967		
		Slight	2.15	11	23.65	0.9	21.285		
		Negligible	0.85	10	8.50	0.8	6.8		
Total			47.62				590.80		
12	2D2A6t5	Very Severe	0.11	18	1.98	0.8	1.584	1101.91	Medium
		Severe	0.13	16	2.08	0.85	1.768		
		Moderate	4.74	14	66.38	0.85	56.42402933		
		Slight	0.99	11	10.89	0.8	8.712		
		Negligible	0.89	10	8.90	0.8	7.12		
Total			6.86				75.61		


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9 Catchment Area Treatment Plan

There are mainly five categories of Land uses for which a proper treatment plan should be developed. First is the Agricultural Land, as this activity can never be eliminated, because the faulty practice results in heavy loss of fertile soil. Second, being open forestland for obvious conservation reasons. Third is scrub or degraded land, which contributes heavily to the silt load and possibilities exist to bring this area under pastures and other plantation to meet the local demand of fuel and fodder and thus decreasing the biotic pressure on the forests and leading to environment friendly approach of sustainable development. The fourth and most important category is Barren land because with practically no vegetal cover, the area produces huge amount of silt load. The fifth is dense forest land where in a few places soil conservation measures are required. For treatment of catchment area, the areas that require treatment have been delineated from the Composite Erosion Intensity Unit Map. The sum of weightages was reclassified as per the **Table 7** below to further subdivide the area as per the erosion intensity classes. The weightages for Land use, Slope & Soil were summed to get the Erosion Intensity Classes.

Table 7: Erosion Intensity & Weightages

Erosion Intensity Class	Sum of weightages
Very severe (E5)	12 to 14
Severe (E4)	9 to 11
Moderate (E3)	6 to 8
Slight (E2)	4 to 5
Negligible (E1)	0 to 3

After exclusion of rocks and inaccessible terrain, only those areas which fall under very severe and severe erosion intensity category would be taken up for conservation treatment measures in very high priority category micro-watersheds, whereas in the rest of micro-watersheds belonging to other priority categories, the area falling under very severe erosion intensity class shall be taken for treatment with biological and engineering measures under the CAT Plan.

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

The Erosion Intensity Map of the free draining catchment has been generated based on SYI data and is presented in **Figure 7** and the statistics are presented in **Table 8**.

Table 8: Erosion Intensity Categories in Sub-Watersheds (sq km)

S.No.	Sub-water-Shed	Very Severe	Severe	Moderate	Slight	Negligible	Waterbodies	Total Area (in Sq. KM)
1	2D2A6C6	0.31	0.45	13.64	3.28	1.58	0.30	19.56
2	2D2A6H4	0.24	0.61	3.48	2.25	2.51	0.14	9.23
3	2D2A6H5	0.51	0.78	22.03	2.21	2.05	0.44	28.02
4	2D2A6J4 (1)	0.26	0.31	16.53	1.99	1.78	0.33	21.2
5	2D2A6J4 (2)	0.21	0.38	10.32	2.34	1.98	0.24	15.47
6	2D2A6J7	0.11	0.4	15.39	1.85	1.45	0.30	19.5
7	2D2A6K2	0.07	0.52	23.68	2.54	2.11	0.46	29.38
8	2D2A6r2 (1)	0.12	0.64	18.14	1.45	1.45	0.34	22.14
9	2D2A6r2 (2)	0.09	0.35	21.38	1.68	0.54	0.38	24.42
10	2D2A6r3	0.20	0.24	21.99	1.55	0.68	0.39	25.05
11	2D2A6r4	0.25	0.45	43.92	2.15	0.85	0.75	48.37
12	2D2A6t5	0.11	0.13	4.74	0.99	0.89	0.11	6.97
	Total	2.48	5.26	215.23	24.28	17.87	4.19	269.31

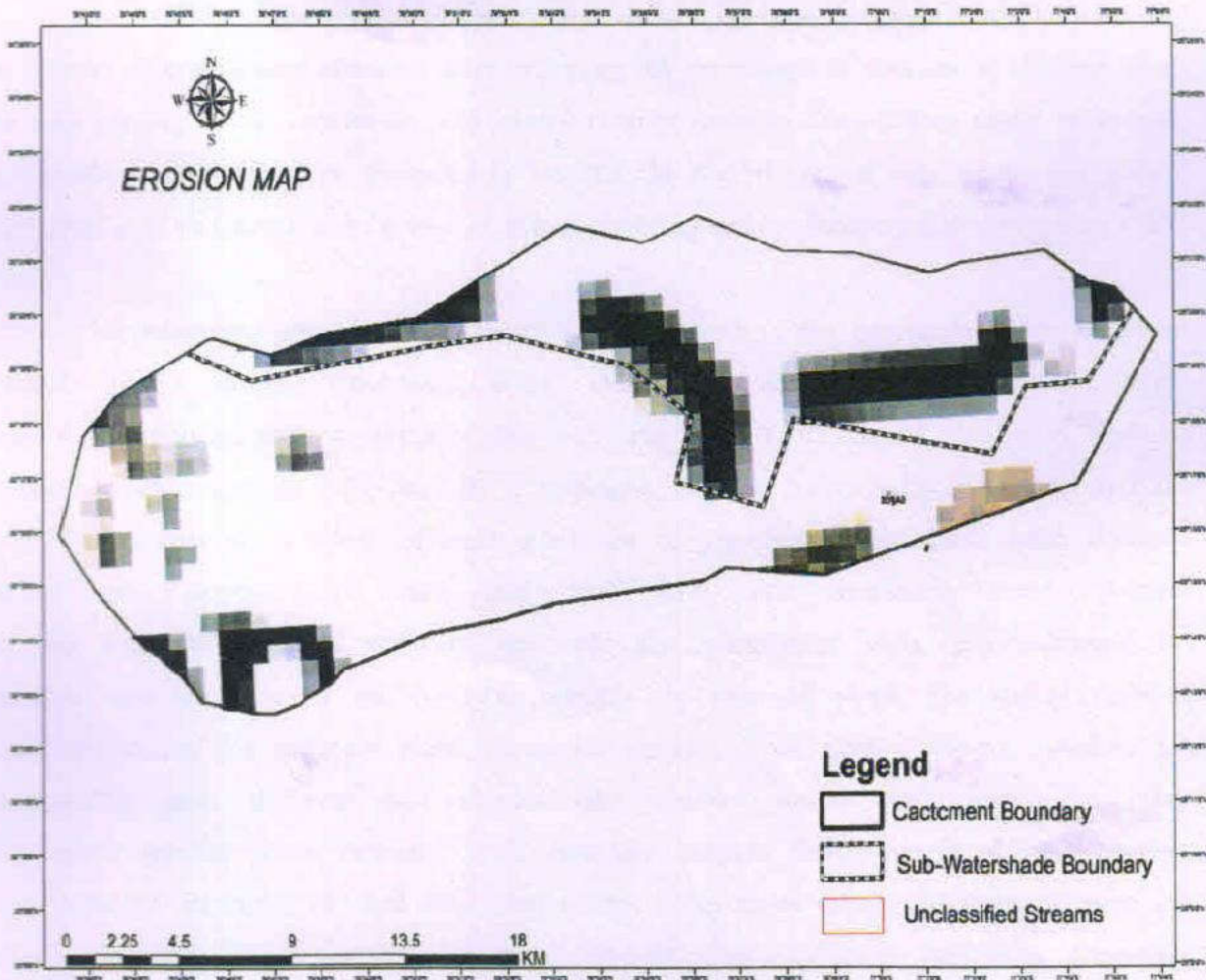


Figure 7: Erosion Intensity Map of Free Draining Catchment Area

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10. Treatment of Individual Sub-Watershed

There are mainly five categories of land uses for which a proper treatment plan should be developed. First is the agricultural land as this activity can never be eliminated. And, agriculture activities, if faulty, result in heavy loss of fertile soil. Second, is open forest land for conservation reasons Third is scrub or degraded land, which contributes heavily to silt load. Possibilities exist to bring this area under pastures and plantation to meet local demand of fuel and fodder and thus decreasing the biotic pressure on the forests leading to environment friendly approach of sustainable development. The fourth and most important category is barren land because with practically no vegetal cover the area produces huge amount of silt load. The fifth is dense forest land where a few places soil conservation measures are required.

Areas falling under very severe and severe erosion intensity category would be taken up for conservation treatment measures after excluding the percentage of area above 25° slope from the area coming under very severe and severe erosion intensity class falling under rocks and inaccessible terrain where no treatment is feasible, the rest of area of very severe and severe categories is to be treated with biological, bio-engineering and engineering measures under CAT Plan.


The prioritized areas in the different sub-watersheds of the free-draining of Hatiyadeh Project that require treatment were delineated and their areas calculated from the composite erosion intensity unit map. For this, a number of simple as well as complex spatial queries were run in a step-wise manner using GIS software (ArcGIS 9.0). These queries included different attributes of parameters that have been defined earlier viz. slope, soil depth and land use. For executing these queries all the thematic maps of different attributes and parameters were geo-referenced to maintain the accuracy of the resultant outputs. In case of slope, the spatial queries were undertaken for different slope categories ranging from gently sloping category to escarpments with different soil classes like shallow soils, deep soils, etc. The subsequent queries were executed with resultant outputs from the first level queries with different attributes of land use/ land cover. From these queries a thematic map of areas susceptible to erosion in the entire free-draining catchment area was prepared. From the thematic map of erosion intensity, areas that require treatment measures

were extracted with the help of further spatial queries. Areas which were classified as inaccessible, i.e. areas with more than 45° (100%) slope. After taking out the areas where it is not feasible to carry out treatment, the total area that will require treatment under this CAT plan is of the order of 121.65 Sq. KM. The total area earmarked for the treatment comprises more than 60% of the free-draining catchment area, and about 100 % of the total area under severe and very severe erosion intensity category & 72.225% of Moderate erosion intensity category, requiring for treatment measures

In the present case, an area of 121.65 Sq. KM has been proposed to be treated under the CAT plan. This area includes 97.32 ha area of catchment which shall be treated by biological measures.

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


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10. Activities to be Undertaken

Part - A - ENGINEERING MEASURES

10.1. Gully Control:

The gully(s) would be treated with the help of engineering/ mechanical as well as vegetative methods. Check dams would be constructed in some of the areas to promote growth of vegetation that will consequently lead to the stabilization of the slopes/area and prevention of further deepening of gully(s) and erosion. For controlling the gully(s), the erosive velocities are reduced by flattening out the steep gradient of the gully. This is achieved by constructing a series of check dams which transform the longitudinal gradient into a series of steps with low risers and long flat treads. Different types of check dams would be required for different conditions comprising different materials depending upon the site conditions and the easy availability of material at local level.

The following types are recommended for this area:

- i. Anicut
- ii. Check dam
- iii. Contour Bunding

In addition to the vegetative measures used for stabilization of gullies, temporary or permanent mechanical measures will be used as supplementary measures to prevent the washing away of young plantations by large volume of runoff. The gullies get stabilised over a period of time with the establishment and growth of vegetation cover. With the passage of time mechanical structures weaken and vegetative measures get strengthened.

PART - B - Biological Measures

10.2 Afforestation

In critically degraded areas, plantation of locally useful diverse and indigenous plant species such as timber plantation species, fodder species, fuel wood species, grasses, shrubs and legumes, medicinal and aromatic plants would be undertaken. The forestation will include rising of multi-tier mixed vegetation of suitable local species in the steep and sensitive catchment areas of rivers/streams with the objective of keeping such areas under permanent vegetative cover. Furthermore, degraded areas would also be brought under vegetation cover. Suitable trees of

economic value to local people shall be raised in the degraded forest areas near to villages with the objective of supplementing income of the villagers.

With a view to conserve and augment the state's rich medicinal plant resources in its natural habitat through adaptive and participatory management of the local people, cultivation of high priority medicinal plant species shall be undertaken. Thrust shall be given to organic cultivation of medicinal plants.

10.3. Treatment of Pasture

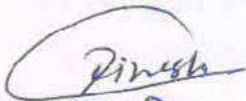
The restoration and management of degraded pasture is a vital objective, both to provide sufficient habitat for spatial movement of the spill over species outside and within catchment area and to provide biological resources to the local populace. The pastures have their own unique significance in the geophysical, environmental and socio-economic set-up of the region. They are the prime and continual source of herbage for the wild herbivores which are prey base for carnivores, cattle, sheep and goats. These pastures are extensively grazed by the live stocks of the local people. The large scale and indiscriminate grazing of these pasture over a prolong time has left these pastures ominously degraded. The palatable grasses are no more than a few inches tall and the other related pasture species have also started showing signs of stress. Because of continuous and heavy pressure of grazing, barren patches have developed over vast areas and soil erosion is rampant in these pastures. There is an imperative need to address this abysmal and alarming situation immediately before these pastures are brought to such a condition, where, their rejuvenation becomes impossible. Owing to traditional rights of the grazers, it is difficult to restrict the number of animals grazing there. Thus, the only alternative left is to increase the productivity of these pastures to cope with the grazing pressures. The situation warrants for a realistic survey and allied research in context of entire grazing issues and formulation of an action plan for corrective measures within the gambit of the state policy on the subject matter. Till such time the following recommendations are made for the management of pastures


- Assessment of the carrying capacity of the pastures through surveys so as to ascertain allowable size of live stocks.
- Periodical field checking of the size of the herds mentioned in the permits so as to avoid misuse by some permit holders.
 - Public awareness.

- . Periodical closure of areas in pastures for the proliferation of seeds of desirable grass species.
- Implementation of rotational deferred grazing system to derive the advantage of early nutritive growth and rest period during the growing season.
- Interaction with the local people and so that a sort of social fencing could be achieved.

10.4. Nursery Support

In order to meet the huge requirement of saplings required under biological / bio-engineering measures and reservoir rim treatment new nursery has to be developed along with support to the existing nurseries which shall also augment the supply of saplings for the works proposed.


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11. Cost Analysis of Different Works Under Engineering ,Biological Measures:-

Part - A - ENGINEERING MEASURES

11.1 **Gully Control:**

The Free Catchment of Hatiyadeh Medium Irrigation Project shall be treated by Various engineering measures. A few structures has been constructed by various govt. agency.

A Provisions for the Structures have been taken to treat the Free Catchment Area (60% of 202.75 Sq. Km = 121.65 Sq. Km) of Project as under-

1. Anicuts may have to be constructed for checking soil erosion & groundwater recharge at an average rate of 1 per 20 sq. km. area. The number may work out to be 6. There is no Anicut in the free catchment area of Rajasthan. Hence 6 New Anicut shall be proposed in this CAT plan. The Cost of One Anicut is worked out to be 11.05 Lakhs based on WRD BSR 2020 Baran. So the Cost of 6 Anicut is about 66.30 Lacs.

2. Check dams in the area 121.65 Ha. @ 1 No's/ 2 sq. km is proposed. Thus the number will be 61 Nos. . The Cost of One Check Dams is worked out to be 0.14 Lacs based on WRD BSR 2020 Baran. So the Cost of 61 Check Dam is about 8.54 Lacs.

3. Contour Banding shall be Constructed for holding Soil Erosion at an average rate of 1 per 5 Sq. Km area. Thus the number will be 24 Nos. The Cost of One Contour Banding is worked out to be 0.10 Lacs based on WRD BSR 2020 Baran. So the Cost of 24 Check Dam is about 2.40 Lacs.

Thus the Total Estimation for **Engineering Means** is this proposal is **about 77.24 Lacs.**

PART – B - Biological Measures

11.2 Afforestation

Out of the total stock to be planted under afforestation, 20% species shall be tree species having medicinal values and 10% of fruit bearing wild species useful to wildlife shall also be planted. The cost analysis per hectare of afforestation with 100 plants/ha inclusive of maintenance for five years has been worked out as Rs. 0.59 lakh/ ha as per **Annex-4**. The rate analysis is as Based on NEREGA BSR, Kishanganj (Baran) & PWD BSR 2019.

Plantation under afforestation component shall be carried through identified user groups in catchment area. Plantations will be maintained for five years.

The cost of works under normal afforestation component encompassing the free draining catchment area of the project has been assessed as **Rs. 57.42 lakh** and is shown below table 10.

Table 10: Cost Estimate for Afforestation Measures

S.No.	Sub-water- Shed	Total Area (in Sq. KM)	Total Area (in Hact.)	Area Under Afforestation (in Hact.)	Cost @ 0.59 Lacs Per Hact.
1	2D2A6C6	19.56	1956	7.0684	4.17
2	2D2A6H4	9.23	923	3.3354	1.97
3	2D2A6H5	28.02	2802	10.1255	5.97
4	2D2A6J4 (1)	21.2	2120	7.6610	4.52
5	2D2A6J4 (2)	15.47	1547	5.5904	3.30
6	2D2A6J7	19.5	1950	7.0467	4.16
7	2D2A6K2	29.38	2938	10.6170	6.26
8	2D2A6r2 (1)	22.14	2214	8.0007	4.72
9	2D2A6r2 (2)	24.42	2442	8.8246	5.21
10	2D2A6r3	25.05	2505	9.0523	5.34
11	2D2A6r4	48.37	4837	17.4794	10.31
12	2D2A6t5	6.97	697	2.5187	1.49
	Total	269.31	26931	97.32	57.42

11.3 Pasture Reclamation

The pasture reclamation by rotational closure with live hedge fencing, sodding with local grass and legume plants inclusive of maintenance shall be carried out. The provision for cost of works under treatment of pastures for the SWS encompassing the free draining catchment area of the project has been taken as **Rs. 2.87 lakh** (5 % of Estimated cost of Afforestation).

11.4 Nursery Support

In the light of the fact that the CAT plan entails plantation over approximately 97.32 ha area, a huge requirement of saplings / plants is comprehended. Such requirement shall have to be met out from the existing nurseries which are too inadequate to meet the requirement. Being a mountainous area the suitable sites for developing new nurseries are not too many. Besides, the free of cost saplings shall be distributed to the JFM group for raising horticulture crops and private pasture development.

Availability of quality planting material well in time and near the areas where afforestation is to be undertaken, remains a major constraint in implementation of large scale afforestation. The proposed large scale afforestation in the area due to establishing of various hydroelectric projects, will certainly lead to establishment of decentralized nurseries through credit support.

The Cost Estimates for Implementing Nursery Support is taken as 2 % of Afforestation Cost that is 1.15 Lacs.

11.5 Fuel Wood Saving Devices


In order to reduce the pressure in the forest particularly for fuel wood exerted by villagers living near forest areas under the catchment, who are totally dependent upon the fuel wood for cooking purpose some alternate source of energy, is to be provided. It is proposed to provide LPG gas connection with cylinder at subsidized cost. Beneficiary under this component shall be the weaker section of society; families headed by women and scheduled caste/tribe households. The Principle for providing subsidy and cost sharing by the beneficiaries shall be as follows;


- (i) For Women Headed Households: 100% subsidy
For Schedule Cast/tribe 90% subsidy and 10% cost
(ii) Households: sharing

Identification of women headed households and Schedule Cast households should be backed by data available with Panchayat Secretary and with local NGOs. Besides LPG, the stakeholders in the catchment shall be provided solar pressure cooker and electricity saving device like LED. The break-up of cost under different non-conventional and fuel saving devices is shown in Table-11. An amount of Rs. 9.10 lakh is earmarked for this activity under the CAT Plan.

Table 11: The Break-up of Cost under Different Non-conventional and Fuel Saving Devices for Stake-holders

S. No.	Item	Quantity	Rate (Rs.)	Amount (Rs. in lakh)
1.	LPG Gas connection			
	a. At 100% subsidy	100	3000.00	3.00
	b. At 90% subsidy	100	2500.00	2.50
2.	Solar cooker @ 50% subsidy	200	1000.00	2.00
3.	LED bulbs@ 80% subsidy (500x2x2)	2000	80.00	1.60
	Total			9.10
	Say Rs.			9.10


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जल संसाधन उपखण्ड वसुंध
समस्तानिया, जिला बाराँ


अधिसापी अभियन्ता
जल संसाधन खण्ड III बाराँ

12 Cost of Other Components of Cat Plan

Apart from the forestry works and drainage line treatment in the catchment area there are other aspects of the CAT Plan to be addressed and their cost included in the overall cost estimate of the plan. The eco-restoration works, livelihood support works, social mobilization, documentation and publication, monitoring and evaluation and providing environmental services are some of the integral ingredients, which have to be considered and included while formulating the CAT plans.

12.1 Training and Extension Programme

There is a need to keep all members of the existing registered VFDCs and committees to be constituted in other villages and NGOs involved in programme implementation so that they can play an active role in implementation of the CAT plan by associating with the development work in their areas. For this purpose, people need to be trained in respect of different measures for habitat improvement by afforestation techniques, nursery development, pasture development, soil conservation and moisture retention works, horticulture development and agriculture practices in respect of land under the CAT plan with special thrust to local technique with the use of indigenous material without deteriorating ecology of the area. The technique of river-training work needs to be explained properly so that desired results are achieved. For this purpose, a training programme has to be properly devised and carried out at range office for which a provision of **Rs. 6.00 lakh** is being made.

12.2 Provision for Mobilizing User Groups

Based on the ground truth reality in each of the Village Forest Development Committee or Society falling under the different sub-watersheds, mobilizing the user groups will be of utmost importance to involve them in afforestation and other agreed activities of the CAT Plan. For this purpose, a provision of **Rs. 5.00 lakh** is being made.

12.3 Funds for Educational Activities related to Medicinal Plant Sector

A provision of **Rs. 8.00 lakhs** earmarked for various conservation and educational activities related to medicinal plant sector.

12.4 Development of Eco-tourism

Trekking routes with camping facilities can help to boost eco-tourism in the area. Concept of "Homesteads" can be promoted. Such host families who are enterprising and having reasonable traditional accommodation in the village en-route to good eco-treks can accommodate tourists on payment basis. Such financial support to rural people can boost the activity. Involvement of local youths can provide self-employment services like guides, porters, and making arrangements for boarding and lodging of eco-tourists. The poor families can earn wages by portering or other small works. Eco-tourism societies can be formulated under the overall control of the special purpose vehicle (SPV) arrangement for anchoring the eco-tourism activities. There exists scope for eco-tourism in the area where tourists can see its wild virgin and pristine glory and catching the everlasting enthralling moments in their mind while enjoying and learning the nature. Therefore, a provision of **Rs 10.00 lac** is made on this.

12.5 Provision for Floristic Survey and Forestry Research

Though a provision has been made in environment monitoring plan for ecosystem monitoring including environmental studies during construction and post constructional stages respectively, an additional provision of **Rs 10.00 lakh** is made for carrying out floristic survey of the area after complete implementation of CAT Plan, i.e., immediately after the fifth year of maintenance.

12.6 Provision for Forest Protection

The need for rigorous watch and ward of the forest covered under the catchment area becomes more imperative in view of proposed new plantation under the CAT plan and due to increased human activity in the form of labour, who shall be engaged for forestry works. Thus, fire protection measures including construction and maintenance of fire lines, construction of check-posts, watch towers have to be undertaken. Besides these construction / repair of forest boundary pillars shall also be carried out. The forest staff shall have to be properly equipped with modern utility gadgets like walky-talky, GPS and fire-fighting equipment's. For these a provision of **Rs. 8.00 lacs** are being earmarked

12.7 Capacity Building

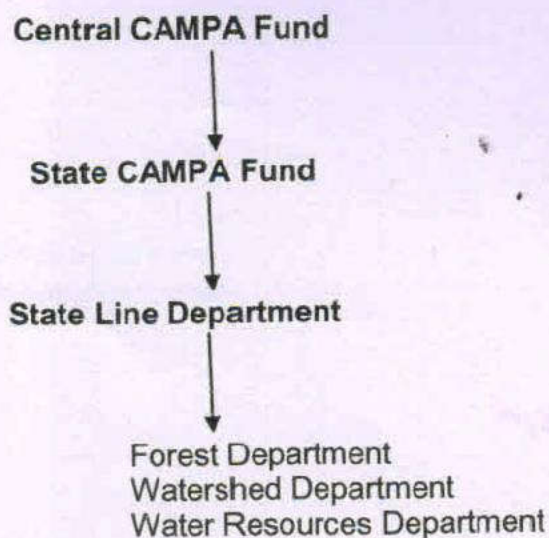
Since the effectiveness of the biological and engineering measures and their proper implementation will depend on the understanding and preparedness of the forest staff. It is important that the Forest Department makes efforts to sensitize the staff on implementation and management of plantation issues, soil conservation, flood protection works and also provide guidance and encourage them to build requisite capacities. Capacity building can be achieved through training programmes for which a provision of **Rs. 5.00 lakh** has been made in the plan.

13. Institutional Mechanism

13.1 Role of Project Proponent

The estimated plan cost will be deposited in central CAMPA fund. The funds for this CAT plan will be made available to Stat CAMPA funds on including these measures in States annual plan. The work will be executed through state Government line departments viz Watershed, Forest & Water Resources Department.

Funds Flow Chat



The treatment area covers agriculture land, pasture land, forest land. Works under non forest land will be executed by state watershed department & water resources department whereas works under forest land will be executed by State Forest Department.


13.2 CAT Implementation

The designated Officer of Water Resources Department, Rajasthan would coordinate with the forest department for the implementation of the proposed Plan. The designated Officer would evaluate/monitor financial aspects. The modalities of financial disbursement need to be worked out. The implementing agency shall submit completion certificate in the light of guidelines fixed by the Rajasthan Forest Department. The implementation of CAT Plan should have enough flexibility and should be subject to changes as per requirements of specific ecosystem and periodic gains. A monitoring committee as per the MoEF guidelines may be constituted for the project for administrative guidance and smooth realization of targets.

13.3 Project Monitoring and Reporting Procedures

Meetings would be held every three months to resolve problems arising in plan implementation. A Joint committee may be formed with Project Authority and State Forest Department; the team members must ensure implementation and monitoring of the CAT works and review the progress from time to time. Quarterly progress reports and completion certificates would be submitted to Project Proponent for evaluation and disbursement of finance. In addition, the work done should be published through public awareness campaigns. Visual and print media may be used to gain maximum benefit by beneficiaries. Such efforts would resolve conflicts which otherwise are potential sources for project delays.


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अतिशायी अभियन्ता
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14. Summary of Cost of Works

Table 12
Cost Estimate of CAT Plan for Hatiyadeh Medium Irrigation Project

S. No.	Particulars	Qty.	Unit	Rs in lac per Ha	Amount (Rs. In Lac)
Part - A					
1	Engineering Measure				
(a)	AniCut Structures (1 per 20 sq. km. area)	6	Nos.	11.05	66.3
(b)	Chack Dam (1 No.s/2 sq. km)	61	Nos.	0.14	8.54
(c)	Contour Bunding (1 per 5 Sq. Km area)	24	Nos.	0.10	2.4
	Total Amount of Engineering Measure- Part A (a to c)				77.24
Part - B					
2	Biological Measures & Others				
2.1	Habitat treatment works under free draining catchment				
(a)	Afforestation	97.32	Ha	0.59	57.42
(b)	Pasture reclamation (5% of Afforestation)	LS		5 % of (a)	2.87
(c)	Nursery support (2% of Afforestation)	LS		2% of (a)	1.15
2.2	Fuel wood saving devices	LS		9.1	9.1
2.3	Training and Extension Programme	LS		6	6
2.4	Mobilizing user groups	LS		5	5
2.5	Funds for Educational activities related to medicinal plant sector	LS		8	8
2.6	Development of Eco-tourism	LS		10	10
2.7	Provision for floristic survey and forestry research	LS		10	10
2.8	Forest Protection	LS		8	8
	Part - B Sub- total (2)- Biological Measures				117.54
	Grand Total				194.78
	Capacity building 5% of total amount				9.74
	Grand Total				204.52
	Say Rs.			in Lakhs	204.52


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अधिसाधी अभियन्ता अधीक्षण अभियन्ता
जल संसाधन खण्ड III बारण जल संसाधन वृत्त, बारण

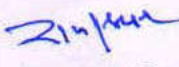

मुख्य अभियन्ता
जल संसाधन सभाग, कोटा

TABLE - 13 YEAR WISE IMPLEMENTATION SCHEDULE

Sn	Part	Agency	Capacity building	Cost of works (in Lacs)	Total Cost of works (in Lacs)	Amount in Rs Lacs					Total Amount
						2021-22	2022-23	2023-24	2024-25	2025-26	
						10% works Amount	20% works Amount	20% works Amount	20% works Amount	30% works Amount	
1	A	Watershed & Water resources Department	0	77.24	77.240	7.724	15.448	15.448	15.448	23.172	77.24
2	B	Forest Department	9.74	117.54	127.279	12.728	25.456	25.456	25.456	38.184	127.279
		Total		194.78	204.52	20.45	40.90	40.90	40.90	61.36	204.52


अभियन्ता
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समरामियां, जिला बारौ


अधिसाधी अभियन्ता
जल संसाधन खण्ड III बारौ

लागत अनुमान पक्के एनिकट के निर्माणकार्य

Annexure-1

ABSTRACT OF COST


Name of work:- Construction of water harvesting structure across local Nalla in Catchment area of Hatlyadeh Project

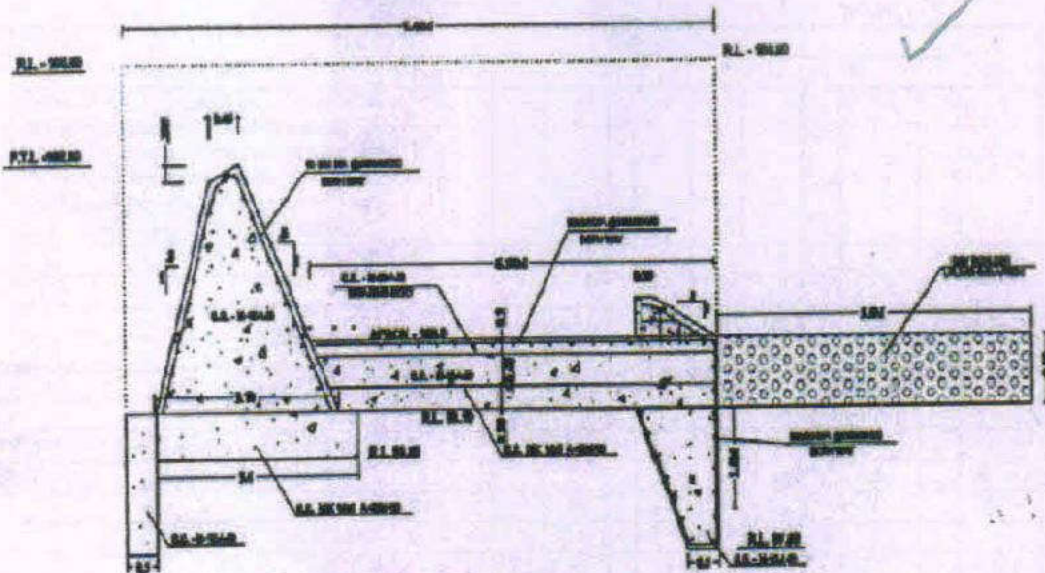
BSR-2020, Baran (WRD)

SN	WRD Baran BSR Item	Description	Quantity	Rate	P. Unit	Amount
1	Ch-V 1.c	Excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50 m. and lift up to 1.5m. in dry or moist including dressing of excavated area, dewatering wherever required complete in all respect.				
a		Hard Soil mixes with kanker / boulders, Morrur	137	87	/Cum	11919.00
2	Ch-V 2.a	Excavation including loading, unloading, disposal and dressing of excavated rock within initial lead of 50 m. and lift up to 1.5m. in dry or moist including dressing of excavated area, dewatering wherever required complete in all respect.				
a		Soft / disintegrated rock	319	118	/Cum	37642.00
3	Ch-IX -8.d	Providing and Laying in position of Cement concrete Nominal mix(1:3:6) including leads of all construction materials, curing, compaction and finishing with rendering in cement sand mortar 1:3 (1 cement : 3 coarse sand) and making good the joints excluding the cost of centering, shuttering and reinforcement. Well graded crusher broken stone aggregate of maximum size upto 20 mm	29	4134	/Cum	119886.00
4	Ch-IX -7	Providing and Laying in position of Cement concrete Nominal mix (1:2:4) including leads of all construction materials, curing, compaction and finishing with rendering in cement sand mortar 1:3 (1 cement : 3 coarse sand) and making good the joints excluding the cost of centering, shuttering and reinforcement. Well graded crusher broken stone aggregate of maximum size upto : 20 mm	154	4574	/Cum	704396.00
5	Ch-IX -8	Providing and Laying in position of Cement concrete Nominal mix (1:1.5:3) including leads of all construction materials, curing, compaction and finishing with rendering in cement sand mortar 1:3 (1 cement : 3 coarse sand) and making good the joints excluding the cost of centering, shuttering and reinforcement. Well graded crusher broken stone aggregate of maximum size upto:20 mm	7	4928	/Cum	34496.00
6	Ch-X- 12	Extra labour charges for RCC due to obstruction in laying and placing the reinforced cement concrete due to reinforcement.				0.00
	Ch-X- 12.a	in foundation rafts, beams, columns bases slilling basins, buckets, aprons etc. (non suspended horizontally laid mass concrete)				11919.00

A			4	124	/Cum	
	Ch-X-12.b	Columns, slabs, cantilevers projections staircases, lintels, beams, chajjas, Retaining walls, piers, abutments, galleries, arch covers, bed plates, sluice capstan bases etc				11919.00
b			16	175	/Cum	
7		Side shuttering including propping etc. Complete (to achieve finish F2) for :-				
a	Ch-X-1.a	Block joint of foundation stilling basins buckets, aprons etc. (non- suspended horizontally laid mass concrete.	26	127	/Sqm	3302.00
b	Ch-X-2	Retaining wall, counterfort, abutment, wing walls up stream or downstream slope facings of dams and open faces of construction joints etc	389	173	/Sqm	67297.00
c	Ch-X-3	Curved edges or sides or special shapes like baffle or chute blocks, end sills, Basin Block, projected copings, extended sills, curved surfaces arches, circular ducts etc	14	280	/Sqm	3920.00
8	Ch-X-9.c. ii	Supply & fixing 6 mm thick PVC water seal of approved quality in construction/contraction joint as per drawing complete in all respect. (ii)305 mm wide	13	700	/RM	9100.00
9	Ch-X-11.b	Supplying of m.s. reinforcement including labour charges for bending binding and placing in position all reinforcement as per drawing including cost of binding wire and all leads and lifts using.	723	72	/Kg	52056.00
10	Ch-V-8.b	Retaining of excavated material including loading and unloading and dressing within initial lead of 50 m and lift of 1.5 m with cost of dewatering wherever required and all applicable taxes and levies etc. complete in all respect, for (V) Mixed strata muck	137	80	/Cum	10960.00
11	Ch-V-9.a	Extra charges for disposal of excavated/retained material in required profile laid in uniform layers and given side slopes well dressed having layer thickness including loading and unloading wherever required with cost of dewatering wherever required complete in all respect, Not exceeding 15 cm	137	8	/Cum	1096.00
12	Ch-V-11	Add Extra charges for disposal of excavated material above initial lift of 1.5 m and for every additional lift of 1.5 m or part there of including required loading and unloading wherever required				
a		Mixed strata				
i		1st extra Lift	213	8	/Cum	1704.00
ii		2nd extra Lift	107	16	/Cum	1712.00
					TOTAL	1083324.00
					Add 2 % for contingencies	21666.48
					G.TOTAL	1104990.48
					Say	11.05
					Lacs	


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DETAILS OF WEIR HEAD WALL


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Detailed Estimate

Name of work:- Construction of water harvesting structure across local Nalla in Catchment area of Hatiyadeh Project

Length :- 7 M

SN	Description	Measurement								Qty.	Unit	
		No	L	B			H					
1	Excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50 m. and lift up to 1.5m. in dry or moist including dressing of excavated area, dewatering wherever required											
	Head wall	1	2	2.12			3.9	+	3.4	/2	15.48	
		1	4	2.12			3.4	+	1.5	/2	20.78	
		1	4	2.12			1.5	+	1.58	/2	13.06	
		1	2	2.12			1.58	+	3.85	/2	11.51	
	U/s Cutoff	1	7	0.5					0.9		3.15	
	Apron	1	7	3			3.3	+	2.8	/2	64.05	
	D/s Cutoff	1	7	0.5	+	1.3	/2		1.5		9.45	
	W/walls	2	6	3.4					3.9		159.12	
	U/s R/walls	2	3	3.4					3.9		79.56	
	D/s R/walls	2	3	3.4					3.9		79.56	
											455.71	Cum
b	Hard Soil mixes with kanker / boulders, Morrum											
	30 % of Total Excavation										136.71	
										Say	137	Cum
2	Excavation including loading, unloading, disposal and dressing of excavated rock within initial lead of 50 m. and lift up to 1.5m. in dry or moist including dressing of excavated area, dewatering wherever required complete in all respect.											
a	Soft / disintegrated rock											
	70 % of Total Excavation										319	
										Say	319	Cum
3	Providing and Laying in position of Cement concrete Nominal mix(1:3:6) including leads of all construction materials, curing, compaction and finishing with rendering in cement sand mortar 1:3 (1 cement : 3 coarse sand) and making good the joints excluding the cost of centering, shuttering and reinforcement. Well graded crusher broken stone aggregate of maximum size upto 20 mm											
	Head wall	1	7	2.12					0.3		4.45	
	Apron	1	7	3	+	3	/2		0.3		6.3	
	W/walls	2	6	2.6					0.3		9.36	
	U/s R/walls	2	3	2.6					0.3		4.58	

	D/s R/walls	2	3		2.6					0.3		4.68	
												29.47	Cum
											Say	29	Cum
4	Providing and Laying in position of Cement concrete Nominal mix (1:2:4) including leads of all construction materials, curing, compaction and finishing with rendering in cement sand mortar 1:3 (1 cement : 3 coarse sand) and making good the joints excluding the cost of centering, shuttering and reinforcement. Well graded crusher broken stone aggregate of maximum size upto : 20 mm												
	Head wall	1	7		1.82	+	0.45	/2			1.575	12.51	
		1	7		1.82	+	1.82	/2			0.9	11.47	
		1	7		0.45	X	0.23	/2				0.35	
	U/s Cutoff	1	7		0.5						1.5	5.25	
	D/s cutoff	1	7		0.5	+	1.3	/2			1.5	9.45	
	W/walls	2	6		2.3	+	0.6	/2			3.3	57.42	
	U/s R/walls	2	3	+	3	/2	2.3	+	0.6	/2	3.3	28.71	
	D/s R/walls	2	3	+	3	/2	2.3	+	0.6	/2	3.3	28.71	
												153.87	Cum
											Say	154	Cum
5	Providing and Laying in position of Cement concrete Nominal mix (1:1.5:3) including leads of all construction materials, curing, compaction and finishing with rendering in cement sand mortar 1:3 (1 cement : 3 coarse sand) and making good the joints excluding the cost of centering, shuttering and reinforcement. Well graded crusher broken stone aggregate of maximum size upto:20 mm												
	Apron	1	7		3	+	3	/2			0.2	4.2	
	End Sill	1	7		0.3	+	1.3	/2			0.5	2.8	
												7	Cum
											Say	7	Cum
6	Extra labour charges for RCC due to obstruction in laying and placing the reinforced cement concrete due to reinforcement.												
a	In foundation rafts, beams, columns bases stilling basins, buckets, aprons etc. (non suspended horizontally laid mass concrete)												
	Qty of Apron											4.2	
												4.2	Cum
											Say	4	Cum

	Qty of Item No: 11												137	Cum
12	Add Extra charges for disposal of excavated material above initial lift of 1.5 m and for every additional lift of 1.5 m or part there of including required loading and unloading wherever required													
a	Mixed strata													
i	Ist extra Lift													
	Head wall	1	2	3.4				1.5	+	1.5	/2		10.2	
		1	4	3.4				1.5	+	0	/2		10.2	
		1	4	3.4				0	+	0.08	/2		0.54	
		1	2	3.4				0.08	+	1.5	/2		5.37	
	Apron	1	4	5.75				1.5	+	1.3	/2		32.2	
		1	4	5.75				1.3	+	0	/2		14.95	
		1	4	5.75				0	+	1.5	/2		17.25	
	W/walls	2	6	3.4						1.5			61.2	
	U/s R/walls	2	3	3.4						1.5			30.6	
	D/s R/walls	2	3	3.4						1.5			30.6	
													213.12	Cum
													Say	213
														Cum
ii	IInd extra Lift													
	Head wall	1	4	3.4				0.9	+	0.4	/2		8.84	
		1	4	3.4				0.4	+	0	/2		2.72	
		1	4	3.4				0	+	0.85	/2		5.78	
	Apron	1	4	3				0.3	+	0	/2		1.8	
		1	4	3				0	+	0.25	/2		1.5	
	U/s cutoff	1	7	0.5						0.9			3.15	
	D/s cutoff	1	7	0.5			+ 1.3	/2					1.5	
	W/walls	2	6	3.4						0.9			36.72	
	U/s R/walls	2	3	3.4						0.9			18.36	
	D/s R/walls	2	3	3.4						0.9			18.36	
													106.68	Cum
													Say	107
														Cum


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 अधिशाही अभियन्ता
 जल संसाधन खण्ड III बाराँ

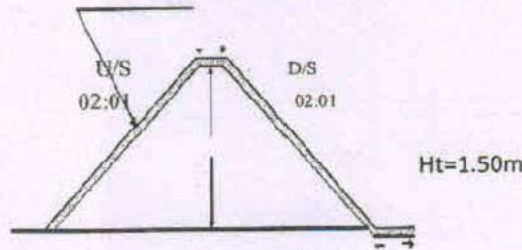
Abstract of Cost & Qty.

Annexure-2

Estimation of Earthen Check Dam for Hatiyadeh Project											
लम्बाई 10 मीटर, ऊंचाई 1.5 मीटर											
S.No.	Item No.	Item	No.	L	B	H	Qty	Unit	Rate	Amount	
1	XVIII .8.a	Dag belling 5 cm to 7.5 cm deep	2	10			20	m	0.70	14.00	
2	Ch- XVII I-1. a	Cutting & clearance of jungle, bushes, shrubs Ankra/Ipomoea, Julifloratypna etc. on canal and bunds in dry/moist/slushy conditions including disposal as per instructions of the Engineer-in-charge. Cost of wood has been deducted from rates and thus will be property of contractor after cutting. Ordinary	1	10	7		70	Per Sqm	1.25	87.5	
3	Ch-V- 16	Earth work in rough (borrow area) excavation for embankment in hard soil, Morrum or highly weathered strata dry or moist, including laying in 20 cm layers (before compaction) and breaking of clods, sorting of grass, pebbles etc. and dressing when compacted manually or by plain roller with initial lead of 250 m and lift up to 1.5m (excluding charges for compaction and watering), including loading and un-loading wherever required complete in all respect.	1	10	4	1.5	60	Cum	83.00	4980.00	
4	Ch-V- 36	Rip rap stone laying in required profile properly hand packed using stone of specified size including all lead & lifts 25 cm thickness (± 5 % thickness tolerance)	1	10	3	0.2	6.9	Cum	1311.00	9045.90	
Total										14127.4	
Add 2 % for contingencies										282.548	
G. Total Amount (Rs.)										14409.95	
										Say	0.14

Lacs

20CM TO 23CM THICK STONE PITCHING




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 समरानियां, जिला बारां

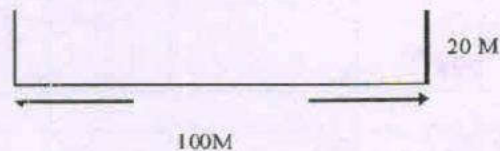
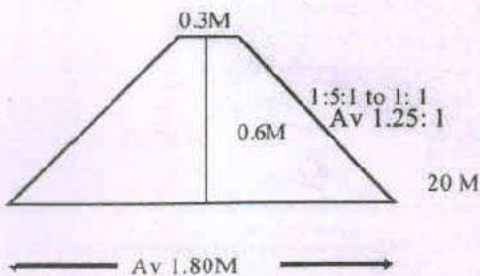

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Contour/Field Bunding with Waste Weir on Pasture/ Agriculture Land

Estimation of Contour Bunding for Hatiyadeh Project									
Based on WRD BSR Baran Distt 2020									
S.No.	Item	No.	L	B	H	Qty	Unit	Rate	Amount
1	Ch- XVII I.8.a								
	Dag belling 5 cm to 7.5 cm deep	2	100			200.00	m	0.70	140.00
3	Ch-V- 16	1	100	1.05	0.6	63.00	Cum	83.00	5229.00
	Earth work in rough (borrow area) excavation for embankment in hard soil, Morrum or highly weathered strata dry or moist, including laying in 20 cm layers (before compaction) and breaking of clods, sorting of grass, pebbles etc. and dressing when compacted manually or by plain roller with initial lead of 250 m and lift up to 1.5m (excluding charges for compaction and watering), including loading and unloading wherever required complete in all respect.								
4	Ch-V- 36	1	10	1.5	0.2	3.50	Cum	1311.00	4588.5
	Rip rap stone laying in required profile properly hand packed using stone of specified size including all lead & lifts 23 cm thickness ($\pm 5\%$ thickness tolerance) West Weir - 10M								
	Total								9957.50
	Add 2 % for contingencies								199.15
	G.Total (Rs.)								10156.65
								₹	0.10

Lacs

Cross-Section of Contour/Field Bund



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जल संसाधन उपखण्ड चतुर्थ
समरानियां, जिला वाराँ

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अधिशापी अभियन्ता
जल संसाधन खण्ड III वाराँ

Cost analysis Per Ha. of Plantation for Afforestation

First Year Plantation Work

Annex-4

A. Labour orientation Work


Based on NREGA BSR, 2020 Kishanganj (Baran)

S.No.	Refrence	Work	Unit	Qty.	Rate	Amount
1	Narega BSR 2020 Itms 157B	Digging Pits 45x45x45cm	Nos.	100	14.29	1429
2	Narega BSR 2020 Itms 158b	Plantation 1st Year	Nos.	100	7.67	767
3	Narega BSR 2020 Itm 160	Watering in 1st Year(15liters Water Per Plant) 12 Times	Nos.	1200	3.7	4440
4	Narega BSR 2020 item 161	Plantation's Nerai and gudai(3 Times)	Nos.	300	2.56	768
5	forest BSR 3-A-3	sowing balls of grass seeds by FYM and sowing it in field by hand rakers	per 6kg aggrega te materia	4	90.41	361.64
Total Labour Cost (A)						7765.64

B. Material orientation Work

S.No.	Refrence	Work	Unit	Qty.	Rate	Amount
1	PWD H.4.1.C	Loading & unloading of plants from Deptt Nursery to site 150 Per Km.	Per 1000 Plants	100	4.5	450
		30	km			
2	PWD H1.1.1	Supply of dry manure including loading unloading transportation & stacking at site :	cum	3	720	2160
3	PWD H1.2.1	Supply of Chemical Fertilizers at store in bags weighing not less than 50 Kg each including loading unloading & transportation	Per 50Kg	3	400	1200
4	PWD H1.4.5	Supply of Insecticides & Pesticides at store in dust / liquid form complete :	lit	3	430	1290
5	Ls	Plants Rate				
		1st Year (Forestry)	Nos.	100	45	4500
Total Labour Cost (B)						9600


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 Adishashi
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Cost analysis Per Ha. of Plantation for Afforestation

Second Year Plantation Work

A. Labour orientation Work

S.No.	Refrence	Work	Unit	Qty.	Rate	Amount
2	Narega BSR 2020 Itms 158b	Plantation IInd Year(10% of 1st Year)	Nos.	10	7.67	76.7
3	Narega BSR 2020 Itm 160	Watering in IInd Year(15liters Water Per Plant) 12 Times	Nos.	1200	3.7	4440
4	Narega BSR 2020 item 161	Plantation's Nerai and gudai(3 Times)	Nos.	300	2.56	768
5	forest BSR 3-A-3	sowing balls of grass seeds by FYM and sowing it in field by hand rakers	per 6kg aggregate materia	4	90.41	361.64
Total Labour Cost (A)						5646.34

B. Material orientation Work

S.No.	Refrence	Work	Unit	Qty.	Rate	Amount
1	PWD H.4.1.C	Loading & unloading of plants from Deptt Nursery to site Per Km. (150/km)	Per 1000 Plants	10	4.5	45
		30	km			
2	PWD H1.1.1	Supply of dry manure including loading unloading transportation & stacking at site :	cum	3	720	2160
3	PWD H1.2.1	Supply of Chemical Fertilizers at store in bags weighing not less than 50 Kg each including loading unloading & transportation	kg	3	400	1200
4	PWD H1.4.5	Supply of Insecticides & Pesticides at store in dust / liquid form complete :	lit	3	430	1290
5		Plants Rate				
		Ist Year (Forestry)	Nos.	10	20	200
Total Labour Cost (B)						4895

Dinesh
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जल संसाधन खण्ड III बारां

Cost analysis Per Ha. of Plantation for Afforestation

Third Year Plantation Work

A. Labour orientation Work

S.No.	Refrence	Work	Unit	Qnty.	Rate	Amount
3	Narega BSR 2020 Itm 160	Watering in Illrd Year(15liters Water Per Plant) 12 Times	Nos.	1200	3.7	4440
4	Narega BSR 2020 item 161	Plantation's Nerai and gudal(3 Times)	Nos.	300	2.56	768
5	forest BSR 3-A-3	sowing balls of grass seeds by FYM and sowing it in field by hand rakers	per 6kg aggrega te materia l	4	90.41	361.64
Total Labour Cost (A)						5569.64

B. Material orientation Work

S.No.	Refrence	Work	Unit	Qnty.	Rate	Amount
2	PWD H1.1.1	Supply of dry manure including loading unloading transportation & stacking at site :	cum	3	720	2160
3	PWD H1.2.1	Supply of Chemical Fertilizers at store in bags weighing not less than 50 Kg each including loading unloading & transportation	kg	3	400	1200
4	PWD H1.4.5	Supply of Insecticides & Pesticides at store in dust / liquid form complete :	lit	3	430	1290
Total Labour Cost (B)						4650



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जल संसाधन खण्ड III बाराँ

Cost analysis Per Ha. of Plantation for Afforestation

Fourth Year Plantation Work

A. Labour orientation Work

S.No.	Reference	Work	Unit	Qty.	Rate	Amount
3	Narega BSR 2020 itm 160	Watering in IVth Year(15liters Water Per Plant) 12 Times	Nos.	1200	3.7	4440
4	Narega BSR 2020 Item 161	plantation's Nerai and gudai(3 Tim	Nos.	300	2.56	768
5	forest BSR 3-A-3	sowing balls of grass seeds by FYM and sowing it in field by hand rakers	per 6kg aggrega te materia	4	90.41	361.64
Total Labour Cost (A)						5569.64

B. Material orientation Work

S.No.	Reference	Work	Unit	Qty.	Rate	Amount
2	PWD H1.1.1	Supply of dry manure including loading unloading transportation & stacking at site :	cum	3	720	2160
3	PWD H1.2.1	Supply of Chemical Fertilizers at store in bags weighing not less than 50 Kg each including loading unloading & transportation	kg	3	400	1200
4	PWD H1.4.5	Supply of Insecticides & Pesticides at store in dust / liquid form complete :	lit	3	430	1290
Total Labour Cost (B)						4650

Pineer
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जल संसाधन खण्ड III बाराँ

Cost analysis Per Ha. of Plantation for Afforestation

Fifth Year Plantation Work

A. Labour orientation Work

S.No.	Reference	Work	Unit	Qty.	Rate	Amount
3	Narega BSR 2020 itm 160	Watering in Vth Year(15liters Water Per Plant) 12 Times	Nos.	1200	3.7	4440
4	Narega BSR 2020 item 161	Plantation's Nerai and gudai(3 Times)	Nos.	300	2.56	768
5	forest BSR 3-A-3	sowing balls of grass seeds by FYM and sowing it in field by hand rakers	per 5kg aggrega te materia	4	90.41	361.64
Total Labour Cost (A)						5569.64

B. Material orientation Work

S.No.	Reference	Work	Unit	Qty.	Rate	Amount
2	PWD H1.1.1	Supply of dry manure including loading unloading transportation & stacking at site :	cum	3	720	2160
3	PWD H1.2.1	Supply of Chemical Fertilizers at store in bags weighing not less than 50 Kg each including loading unloading & transportation	kg	3	400	1200
4	PWD H1.4.5	Supply of Insecticides & Pesticides at store in dust / liquid form complete :	lit	3	430	1290
Total Labour Cost (B)						4650

Abstract of Cost

Sr. No.	Year	Labour orientation Work (A)	Material orientatio n Work (B)	
1	Ist Year	7765.64	9600	17365.64
2	IInd Year	5646.34	4895	10541.34
3	IIIrd Year	5569.64	4650	10219.64
4	IVth Year	5569.64	4650	10219.64
5	IVth Year	5569.64	4650	10219.64
Total Cost for 100 plant in 1 Hact. Area				58566

Say 0.59 Lacs


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