

## DEVELOPMENT OF IDENTIFIED WATERSHED IN PANCHAYAT SAMITI - DUDU, JAIPUR (RAJ.)

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**Abstract** - Surkhi Ghana Watershed is located 35km far from district head quarter on Sagar- Narsingpur National highway. The proposed Surkhi Ghana Watershed Project (SGWP) would include 1150.00ha of land covering Ghana, Patha and surkhi villages of sagar block of district. For the feasibility study, 1009.13ha of land area will be taken into consideration; of which 282.68 ha is from Patha, Ghana 236.08 ha and 425.37 ha in Surkhi village area has taken under project. Sagar district falls under the tropical climatic zone, with deteriorated natural resources, the water table is 100-300 feet's deep. The people of the SGWP area have ample potential of land and water conservation, but they face a problem of drinking water because only 15.28% of land is under irrigation. The livelihood of these villagers is dependent on agriculture. The problem is that the rain fails to meet villagers' agricultural requirements because it is erratic and unreliable. Also, the economy of the villages is based on rain-fed agriculture, and so it too suffers.

The watershed includes the villages are Ghana, patha and Surkhi. Both villages are dominated by the OBC and SC. The livelihood of these backward, poor people is based on simple rain fed agriculture, wage labour (agricultural and non-agricultural), and Bidi making. Most of the inhabitants of this area are indebted to money lenders who charge exorbitant rates of interest ranging from a minimum of 3% to a maximum of 15%. These people are in the clutch of moneylenders and contractors. As such, the socio economic condition of these people is very poor and the natural resources are left neglected and degraded, because watershed area fall in high rainfall zone where yearly rainfall is more than 1200mm but people facing drinking water problem in summer. In watershed area unavailability of soil and water conservation structure resultant low recharging of ground water, high degree of erosion reduce fertility of agriculture land as well as community land impact on production of crop and fodder.

**Keywords:** Agricultural, production, watershed.

### 1. INTRODUCTION

This Cluster Agricultural Competitiveness Plan (CACP) has prepared based on inputs collected through extensive Participatory Rural Appraisal (PRA) exercise in the 24 villages constituting the Project Area spread over 10,240 Hectares; Output of GIS & Remote Sensing (RS) technology based thematic layers; Data collected from concerned Government Departments; and inputs received from the concerned officials of Government of Rajasthan. The Common Guidelines issued by Government of India in year 2008 for developing and implementing watershed initiative were also referred.

The GIS/RS based thematic layers were prepared on basis of extensive DGPS field survey and high-resolution Cartosat-1 satellite imagery (with stereo-pair) obtained from the National Remote Sensing Agency (NRSA), ISRO, and Government of India. In these layers all relevant details are imbedded including

contours, slope, land-cover-land-uses, khasra details, drainages and water bodies, flow-accumulation estimation at various locations etc.

The relevant information culled out from these layers in various permutation & combinations utilised to identify and select proposed interventions/structures at appropriate locations. However, prior to recommending the interventions the GIS/RS based output was corroborated with the findings of PRA exercise and data analysis.

Effective harvesting of rainwater appears to be extremely critical for promoting socio-economic development of the Project Area. Better availability of water and improved land resources are likely to result in improved productivity of agriculture and allied sectors, thereby creating more livelihood opportunity for the poor including landless and marginal farmers. Findings of Water-Budgeting



exercise carried out for the Project Area suggests that the Total Surface Runoff in the watershed area is estimated to be 7640303 cum, out of which 4153776 cum (54.36%) is estimated to get stored in the existing water bodies situated in the project area. The remaining runoff amounting to 3486526 Cum is still available for consideration, out of which 1510197 Cums (19.76 % of total surface runoff) is proposed to be captured & stored in a range of new structures proposed to be constructed in the Project Area.

Thereby, the untapped runoff of 1976329cum (25.86 % of total surface runoff) would still be flowing out of the watershed area wherein the Project Area is situated. To sum-up, following structures/interventions are proposed to be constructed at the suggested locations in the Project Area: Contour bund (987429 meters) with 158 nos. of Waste Weirs on Bunds suggested only for Marginal & Small Farmers; 1,002 numbers of Farm Ponds of Varying Storage Capacity to store(6,20,882 Cum.) majority (71%) of them are for Small Farmers; Masonry Water Harvesting Structure (1 no.); Waste Weirs on existing Structures (7 nos.); Development of Pasture Land Parcel at 7 locations (total area 228 Hectare) and Detailed Agriculture and Horticulture Plans are proposed for the project area. The Project area issituated closed to the National Highway.The Project Area has inherent strategic locational advantage in terms of better connectivity with big markets like Jaipur and Ajmer. However, this strength needs to be harness adequately by enabling the local population developing mass-production clusters. For instance, promising potential exists in the Project Area to develop several clusters focusing on organised production of pulses and value-added milk-products. To boost milk production, breed improvement needs to take up at massive scale and setting up fodder bank may also be considered.

### 1.1 Project Context:

The Project Management Unit (PMU) of the Rajasthan Agriculture Competitiveness Project (RACP) has identified rain-fed area of approximately 10,000 hectares (ha) in Dudu Panchayat Samiti of Jaipur District for developing on

watershed approach asa pilot. In this context PDCOR was assigned the responsibility of preparing Detailed Project Report (DPR) for development of the identified watershed which is located in Dudu Panchayat Samiti of Jaipur district.

### 1.2 About Rajasthan Agriculture Competitiveness Project (RACP):

Department of Agriculture, Government of Rajasthan (GoR) has been implementing the RACP with financial assistance from the World Bank. The broad objective of RACP includes demonstrating at scale feasibility of a range of distinct agricultural development approaches integrating technology, organization, institution and market innovations across selected regions of Rajasthan, capable of significantly increasing agricultural productivity and earnings of the farmer.

### 1.3 Water Scenario in the State:

Rajasthan has been historically prone to acute water scarcity and drought. The per capita annual water availability in the State is presently 780 cubic metres per person per year as against the internationally accepted norm of 1000 cubic metres per person per year. It is likely to reduce to 450 cubic metres per person per year by the year 2045.

Availability of water does not commensurate with the requirement in the State due to low operational efficiency of water resource systems as there is neither an incentive for saving of water nor any concerted effort for conservation of water. Especially, two major users of water, viz., domestic (drinking mainly) and irrigation sectors show avoidable losses. This is exacerbating the water situation in the State.

Public apathy to saving and conservation of water due to lack of ownership amongst the stakeholders is also one of the factors limiting availability of water. Though legislation for farmers' participation in water management is in place and a number of Water Users Associations (WUAs) have been formed for management of irrigation water but very few of them are active and progress in this regard is extremely slow. There are almost no WUAs or water user groups for groundwater management.

#### 1.4 Objectives of Watershed Management:

- To promote the socio-economic development of village community through optimum utilisation of natural resources of watershed.
- To conserve soil, rainwater and vegetation effectively and harvest surplus water to create surface water sources and to recharge groundwater.
- To promote sustainable farming and stabilise crop yields by adopting suitable crop management system. Thus increasing the production and yield per hectare.
- To cover the non-arable areas effectively through afforestation, horticulture and pastures based on land capability classification.
- To improve the economic and social conditions of the resource - poor and disadvantaged sections of the watershed community by employment generation and enhancing the income of individuals by adopting alternate enterprises.

#### 1.5 Need for Watershed Management in the State of Rajasthan:

Over 75 percent population of the State lives in rural areas depending on agriculture and livestock production for their livelihood and subsistence. Per capita income in rural areas is significantly below the national average, with 17 percent of rural population estimated as living below the poverty line.

The rural livelihoods are dependent on natural resources. In Rajasthan erratic rainfall, poor soil fertility, land degradation, lack of improved rain-fed varieties, poor knowledge base on improved technology, resource poor farmers, low farm productivity and income levels are the major problems. The challenge, therefore, is to improve the rural livelihoods and alleviate poverty by managing the natural resources along with supplementary rural agro-based income-generating schemes.

## 2. APPROACH & METHODOLOGY

### 2.1 Overview

The approach adopted for preparing this Detailed Project Report is broadly based on the Common Guidelines for Watershed

Development Projects 2008 prescribed by Government of India. The basic data collection and its analysis were carried out following scientific approach as well as taking inputs from the community by carrying out the PRA exercise. The entire project area constitutes of a set of seven geo-hydrological units, popularly known as micro watersheds. These seven micro watersheds fall into two larger units called macro watersheds.

### 2.2 Participatory Rural Appraisal (PRA):

While preparing the DPR an extensive exercise of Participatory Rural Appraisal (PRA) was carried out in each of the villages falling under the project area. A team of experts visited all twenty four (24) villages identified under the Project Area and organised detailed discussions with the villagers. Each and every village visited by a team of experts spent about two days in each village. Secondary data received from various sources including Panchayat Samiti Dudu Office, Department of Agriculture, GoR, Department of Water Resources, GoR were utilized to prepare the DPR.

Focused Group discussions (FGDs) as well as one-to-one talks were also performed in each Project village. These FGDs were also forming an integral part of the data collection exercise. Ample opportunity was given to the villagers to explain the difficulties faced by them and also motivate them to resolve the issues. All the needs relating to soil and water conservation activities, support required for agriculture, livelihood support, capacity building of the water committees, user groups etc. expressed by village community are included in the DPR. Based on the discussions with the community and feedback received from them, the DPR is prepared incorporating all relevant inputs/suggestions to the extent feasible and validating the proposed interventions with the outcome generated through GIS maps based scientific analysis.

### 2.3 Process Followed for Preparation of GIS/RS Based Thematic Layers:

The Common Guidelines issued by Government of India for development of watershed projects envisage extensive usages of various high-end scientific tools at various stages of watershed



development which also include GIS-based Thematic Layers (Maps) to be prepared on basis of NRSA Satellite Imagery. In these GIS based layers/maps the macro and micro watershed boundaries, village and Gram Panchayat boundaries are also demarcated.

Major transport network of rail, roads etc; settlements, key landmarks and points-of-interest are also indicated in the map. These Maps also highlight the main drainage lines and water bodies; geo-referenced and vectorized Khasra land parcel layer. Land-Use and Land-Cover (LU/LC) layer for two seasons i.e. Rabi and Kharif (based on satellite imagery) is also depicted along with Flow-accumulation layer required for Water budgeting and to identify proposed interventions.

While planning the soil and moisture conservation activities to be executed in the cluster, the ridge to valley approach has to be followed. So accordingly in Mokhampura cluster the ridge to valley approach has been adopted and the thematic layers have been prepared for better planning towards the

preparation Detailed Project Report (DPR) of effective implementation of the watershed development project in an integrated manner.

Definitions of the terminology used in this document in context of GIS/RS based thematic layers are given below which is followed by description of the approach & methodology followed to prepare these thematic layers.

**Theme:** A theme is a distinct set of geographic features, such as states, roads, and villages, along with the attributes for those features. It represents geographic objects using three basic

**shapes:** points, lines and polygons. A single theme cannot have features of different types.

**Layer:** Layer corresponds to a theme. Layer is an alias name for a theme.

**Map:** A map is a theme or group of themes relating to a region or a geographic area.

**Shape file:** A shape file is a file-based vector data storage format for storing the location, shape, and attributes of geographic features without topology.

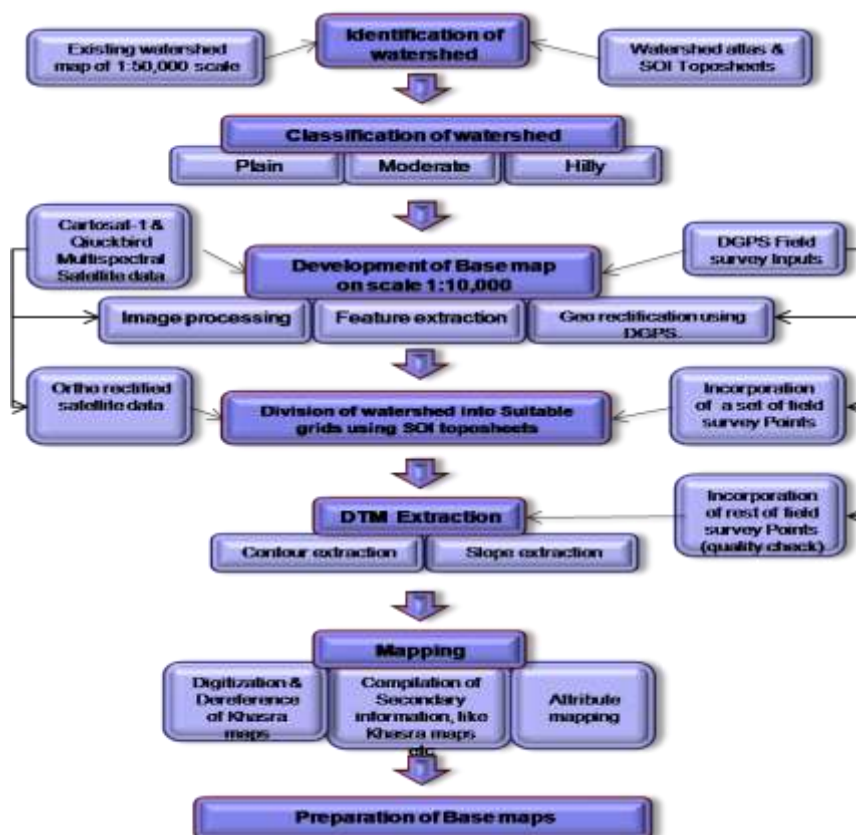


Figure – 1 Composite Methodology Framework for Preparation of Thematic Layer Maps



### 3.4 Creation of Land-Use-Land-Cover (LULC) Map:

For LU/LC mapping LISS IV MX 5.8 Mt. Resolution data latest as available was procured for two seasons; kharif& rabi seasons. This data provided the land use & land cover profile including vegetation status, surface water availability etc. The satellite data as processed using ERDAS Imagine software supported with ground checks and ground truth verification. Area and distance calculations were carried out

using GIS software. The LU/ LC output is in 1:10,000 scales.

### Database Repository

The database repository contained spatial information of the project area like Land-Use/Land-Cover, Drainage, Infrastructure, Topographical & Administrative units and non-spatial information like socio-economic data as per the Standard Document of GoR's Watershed Program.

The framework for the same can be understood from the following diagram:

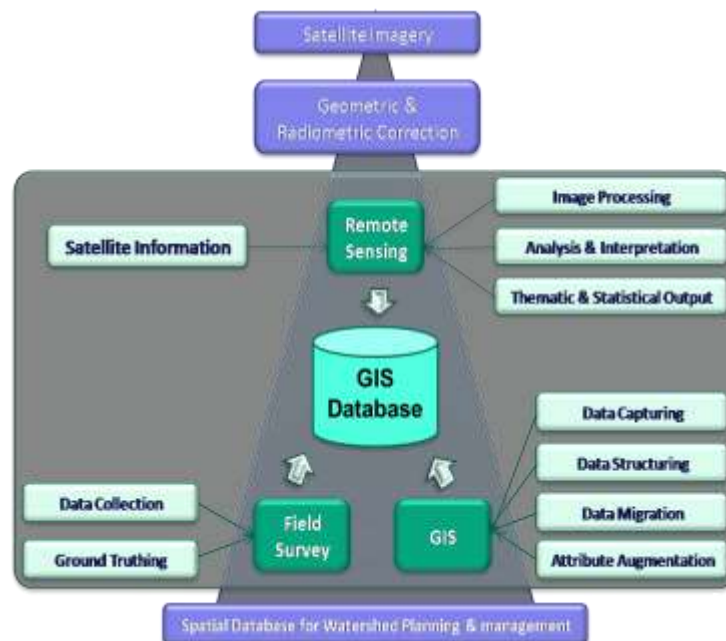


Figure – 2 Preparation of GIS based Database

## 3. WATER BUDGETING & PROPOSED INTERVENTIONS

### 3.1 Ground Water Scenario in Dudu Block:

Hydrogeologically, the major parts of Dudu & Surrounding blocks are occupied by gneiss, schist, granite, quartzite, phyllite, and limestone belonging to Bhilwara and Delhi Supergroup of rocks of Archaean to Proterozoic age.

Majority of ionic and non-ionic constituents are falling within desirable limit except fluoride. Fluoride concentration in shallow aquifer of this area ranges between 0.35 to 14 mg/l whereas in deeper aquifer ranges between 0.7 to 9.3 mg/l while Bureau of Indian Standards (BIS, 1991) and World Health Organization (WHO, 1984) recommends

1.0 mg/l as the desirable limit and 1.5 mg/l as the maximum permissible limit.

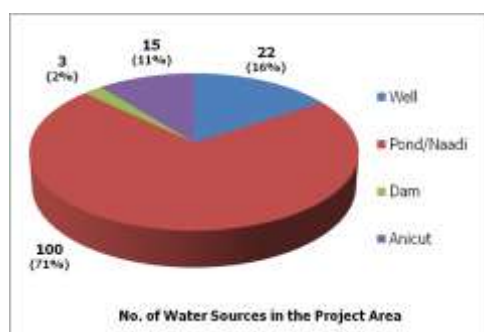
Approx. 68% of open wells and 33% of bore wells in the area have fluoride concentration beyond the maximum permissible limit. Fluoride concentration in excess of permissible limit in drinking water causes dental and skeletal fluorosis.

With regard to quality of groundwater in the Project Area, the data available with Central Ground Water Board (CGWB), State Ground Water Department (GWD), and discussions held with people living in the project villages suggest that in most of the project-villages groundwater is not fit either for drinking or for irrigation purposes mainly due to high salinity and high fluoride and nitrate contents. According to the information

available with the State Groundwater Department, 97 villages of Dudu block are having high fluoride content while 88 villages have high nitrate content. Also, electrical conductivity (EC) is reported in the groundwater in 94 villages.

### 3.2 Surface Water Scenario:

It was reported by the villagers during the PRA exercise that the Project Area has several ponds, naadis, rainwater drainages and other structures as sources of surface water. In last two-three years the Project Area has received good rainfall resulting in relatively better availability of water in these structures. However, due to high salinity in groundwater in many villages the surface water resources also acquire salinity in six-eight months of rain.



**Figure – 3 Number & Percentage of Different Water Sources in the Project Area**

Source: PRA Exercise with the villagers

### 3.3 Drinking Water Scenario:

As per the information received during the PRA exercise the surface water resources (ponds, naadis etc) and hand pumps as the sources of drinking water for the

inhabitants of the Project Area. Beside this, the project villages are now connected with the Bisalpur Water Supply Scheme under which each village has five-six water points and each of the water-points is generally used by a group of 20-25 households.

### 3.4 Water Budgeting for the Project Area - Calculations:

**Classification of Project Area based on inputs received from Revenue Record, GIS layers, and PRA exercise:**

The entire Project Area categorised based on the nature and characteristics of the area based on the criteria given below.

**Good Catchment** – where maximum runoff & minimum infiltration like hillocks, plateau etc.

**Average Catchment**—cultivated land, forest land with vegetation

**Bad Catchment**— where runoff is minimum and infiltration is maximum e.g. Sandy soil

Accordingly, the Project Area was categorised on the basis of the information available in the land record.

S. No	Catchment	Area in Ha
1	Good Catchment	7783.082
2	Average Catchment	1668.572
3	Bad Catchment	789.213
	<b>Total</b>	<b>10240.867</b>

**Average Annual Rainfall:** 557 mm (Data provide by Jr. Engineer, Watershed Department, Government of Rajasthan)

### Calculation of Runoff (Expected Yield) based on the “Strange-Table”

Rating of the Catchment	Characteristics	Coefficient in the strange table (Cum/Ha) [1]	Area (in Hectare) [2]	Expected Yield (in Cum) [1 x 2]
Good	Runoff is maximum & infiltration is minimum like hillocks, plateau etc.	725.286	7783.082	5644961
Average	Runoff is medium like cultivated land, forest land with vegetation	967.120	1668.572	1613710
Bad	Runoff is minimum and infiltration is Maximum e.g. Sandy soil	483.560	789.213	381631.9
<b>Total</b>			<b>10240.867</b>	<b>7640302.9</b>

### Estimation of water-storage in existing water harvesting structures situated in Project Area

Type of Structure	Storage Capacity (In Cum)	Storage Capacity (% of Total Surface Runoff)
Tank/Talab/Nadi/anicut/WHS/Local Depression/Pond	4153777	54.36 %

**Note: Detailed calculation for the above is given at Annexure – 17 Calculation of the Balance Runoff:**

**Balance Runoff** = Expected Yield (iii) – Present Storage Capacity (iv)

**Balanced Runoff** = 7640303cum - 4153777 cum = 3486526 Cum

**Proposed Project Activities/Structures:**

The activities/interventions given below are selected and proposed based on the outcomes of (i) the PRA exercise carried out in each project village (ii) Water budgeting carried out for the watershed (iii) Information gathered through DGPRS survey and GIS based thematic layers.

S. No.	Type of Structure	Unit	Total Storage Capacity (Cum)	Cost (Rs. in Lakh)
1	Water Harvesting Structure	1 No.	149731	4
2	Waste Weir for Existing Water Harvesting Structure	7 Nos.		20.8
3	Farm Pond	1002 Nos.	620882	973.88
4	Contour Bund	987429 Mtr	739584	957.80
5	Waste weir for Contour Bund	158 Nos.	--	9.48
	Pasture Land Development	228 Ha.		134.52
	<b>Total</b>		1510197	<b>2100.48</b>

**Note: Details for each project structure in terms of size and cost are given at Annexure – 18**

**Estimated Collective Storage Capacity of the Proposed Structures =**

1510197Cum (which is 19.76 % of Total Surface Runoff)

**Remaining (still untapped) Runoff** = (v) - (vii) = 1976329Cum (which is 25.86 % of Total Surface Runoff)

Expected Yield of Water	Present storage capacity	Balance Runoff to be utilised	Estimated Collective Storage Capacity of the Proposed Structures	Remaining Runoff (Still Untapped)
<b>1</b>	<b>2</b>	<b>3 = 1 - 2</b>	<b>4</b>	<b>5 = 3 - 4</b>
7640302 Cum	4153777 Cum	3486526 Cum	1510197Cum	1976329Cum
<b>100%</b>	<b>54.36%</b>	<b>45.64%</b>	<b>19.76%</b>	<b>25.86%</b>

#### 4. CONCLUSION

- The stakeholders provided the following information with respect of historical transect:
- Villages in the Project Area are more than 500 years old.
- There is no forest lands in the entire Project Area except small piece of forest land (28 ha) in Keriya village of Mokhampura Gram Panchayat.
- Cremation grounds in most of the villages are located near naadi/pond/talai.

- Education level has increased in last decades. More and more schools have opened in recent years compared to what were there in last 50-60 years.
- More than 60 percent of the dwellings are now pucca construction as compared to houses that were mainly kuchcha structures about 50 years ago.
- Main communities in these villages are Gujar and Jat. 16.18percent of the population belong to the Scheduled Castes and 2.3 percent of Scheduled Tribescategories.

- Mainly due to lesser rainfall and non-availability of groundwater, agricultural productivity has gone down in recent years.
- Animal Husbandry is one the major sources for livelihood for the villagers. Though the number of cattle has reduced in recent years nevertheless numbers of dairies/milk collection centres have increased.

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