PARTICIPATORY GROUND WATER MANAGEMENT & CROP PLANNING

Guidance: Prof. Anuradha Srinivasan Palanichamy

Presented By:

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ABOUT THE ORGANIZATION:VIKAS SAHAYOG KENDRA

- Sukha Mukti Abhiyan,90's
- Pani Chetna Manch(NGO)
- 1992-96, entire Palamu, partners(DA,PC)
- Now works in Palamu Commissionary

Mission: Enabling the vulnerable & voiceless communities to assert Rights & develop their capacity

Vision: Creation of a society based on justice & free from poverty and exploitation

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BACKGROUND:

Groundwater is the common pool resource, & is a “Local Public Good” , which it utmost necessary in case of both high & low rainfall;

Scope of Undertaking the Dissertation:

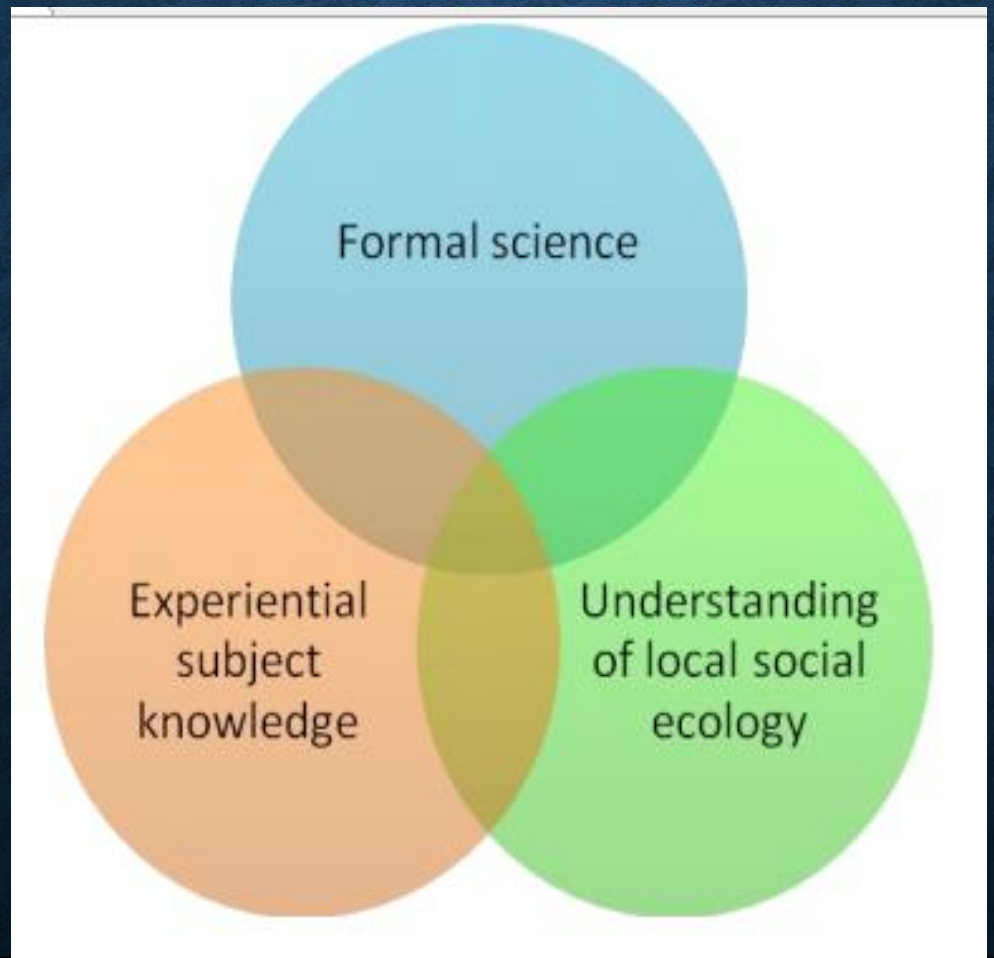
1. GWM is the first step to plan for improved availability of potable water, ensure sustainable agriculture, safeguard the environment and assure overall water security;

02. GWM, When linked to village level planning process it will ensure local drinking water security a reality;

03. Understand the knowledge on the total groundwater availability and promote the concept of innovation using technology & practices to ensure sustainability of ground water supply;

CULMINATION OF RESEARCH, FIELD & PRACTICE FOCUSSED KNOWLEDGE:

The methodology adopted to design & culminate the scope & focus of the dissertation encompassed study in the following spheres of existing resources



INTRODUCTION:

Groundwater is the common pool resource, a “Local Public Good” & is necessary in case of both high & low rainfall regions;

The “Generic Aspects” about “Ground Water Management” wrt the Geography are:

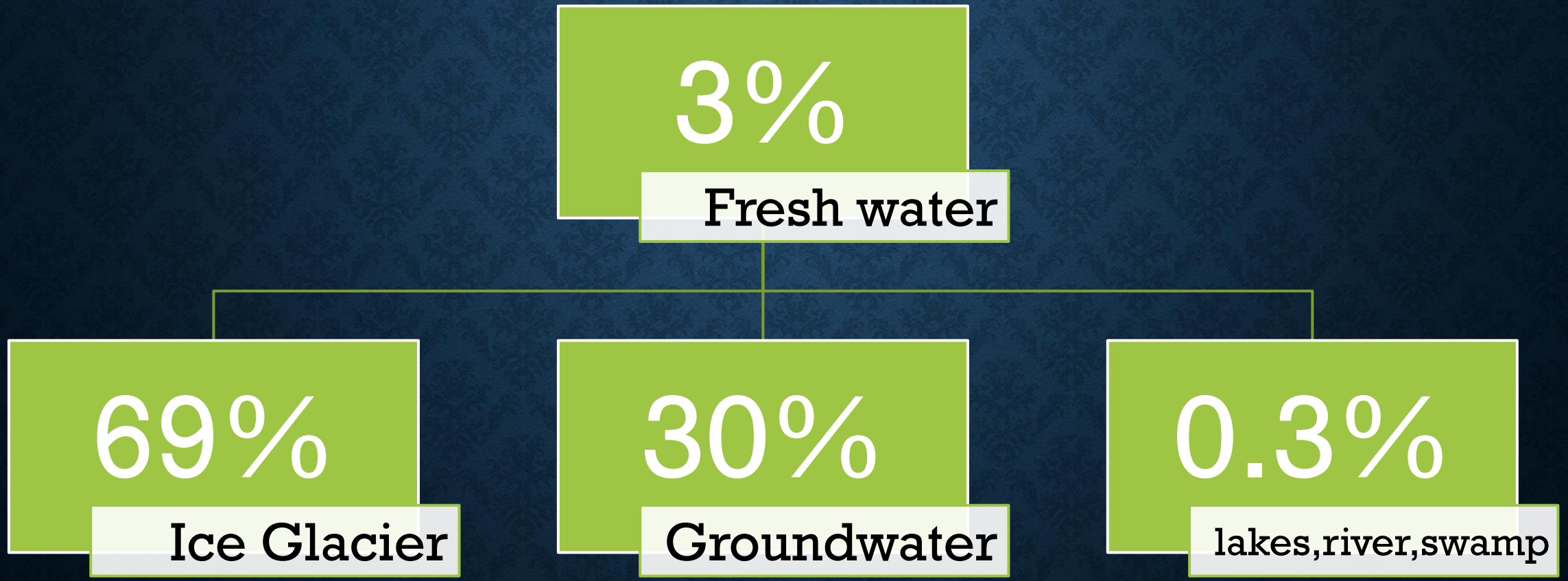
01. 90% of surface water is contaminated;
02. Unfit aquifers;
03. Shallow wells to distant pipelines;
04. Non- scientific recharge practices due to lack of geological knowledge & Aquifer receptivity;
05. No defined role of people, Govt., politicians, NGOs, CBOs and institution;
06. No effective audit procedures;

INTRODUCTION:

Introduction: GW main component of human life (Irrigation, Drinking, Domestic, Industries);

Context & Rationale: Rapid expansion of Urban, Industries, Agriculture water Demand lead to water scarcity;

DATA:



NATURE REPORTS,2010:

80%	• With Water Threats
50%	• Use GW for Drinking
40%	• Irrigation by GW

Note: Since 1960, 300% over extraction

NEED & SCOPE OF PGWM:

"Towards adapting a scientific approach for rationale use of water with the collaboration of Community & NGO, other Institution"

LITERATURE REVIEWS:

- Participatory Groundwater Management: Lessons from Programmes Across India, Amritha kasturi rangan, January 27, 2016

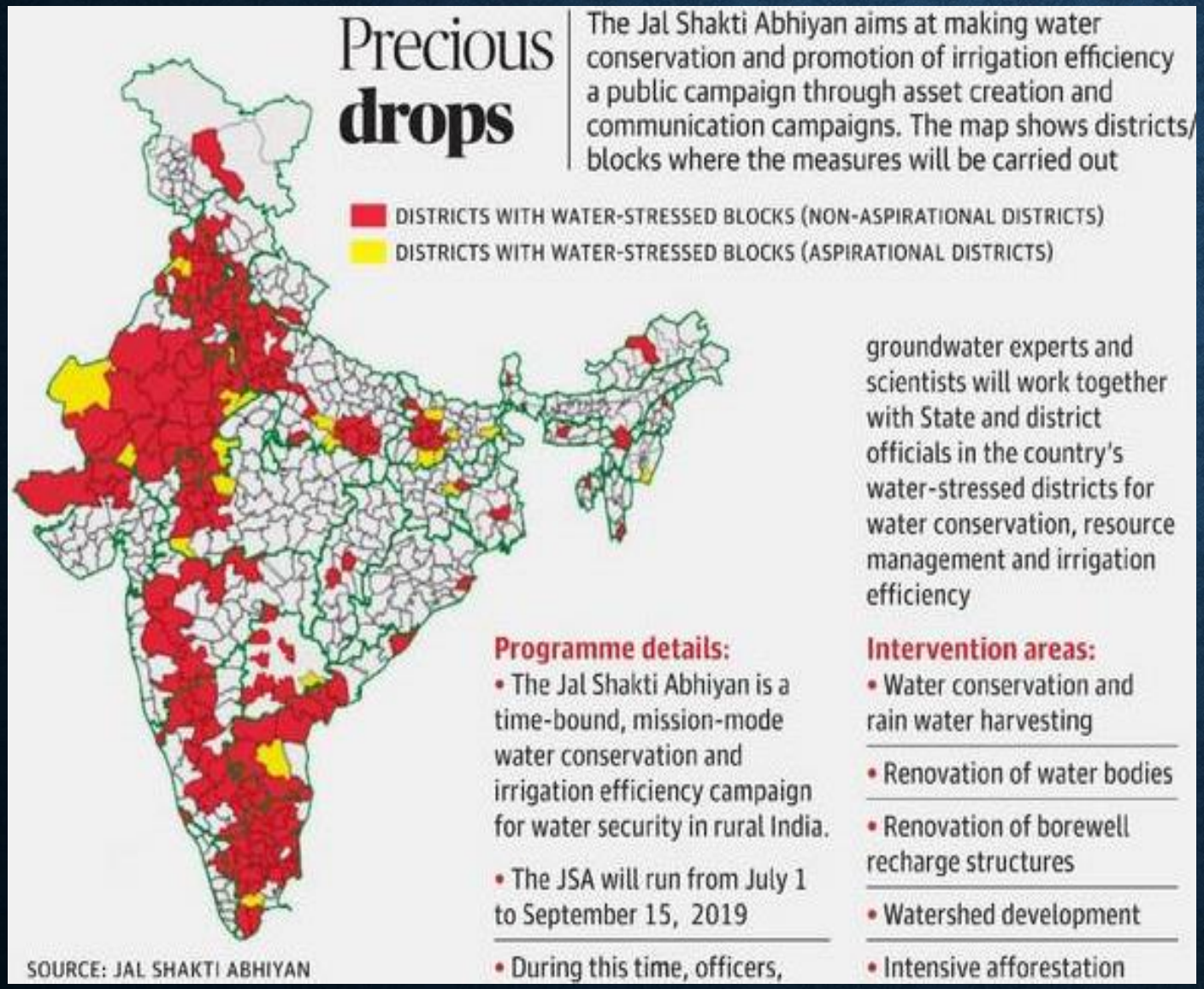
Findings:

01. Annual Extraction230 Cubic KM, largest ground water user(India);

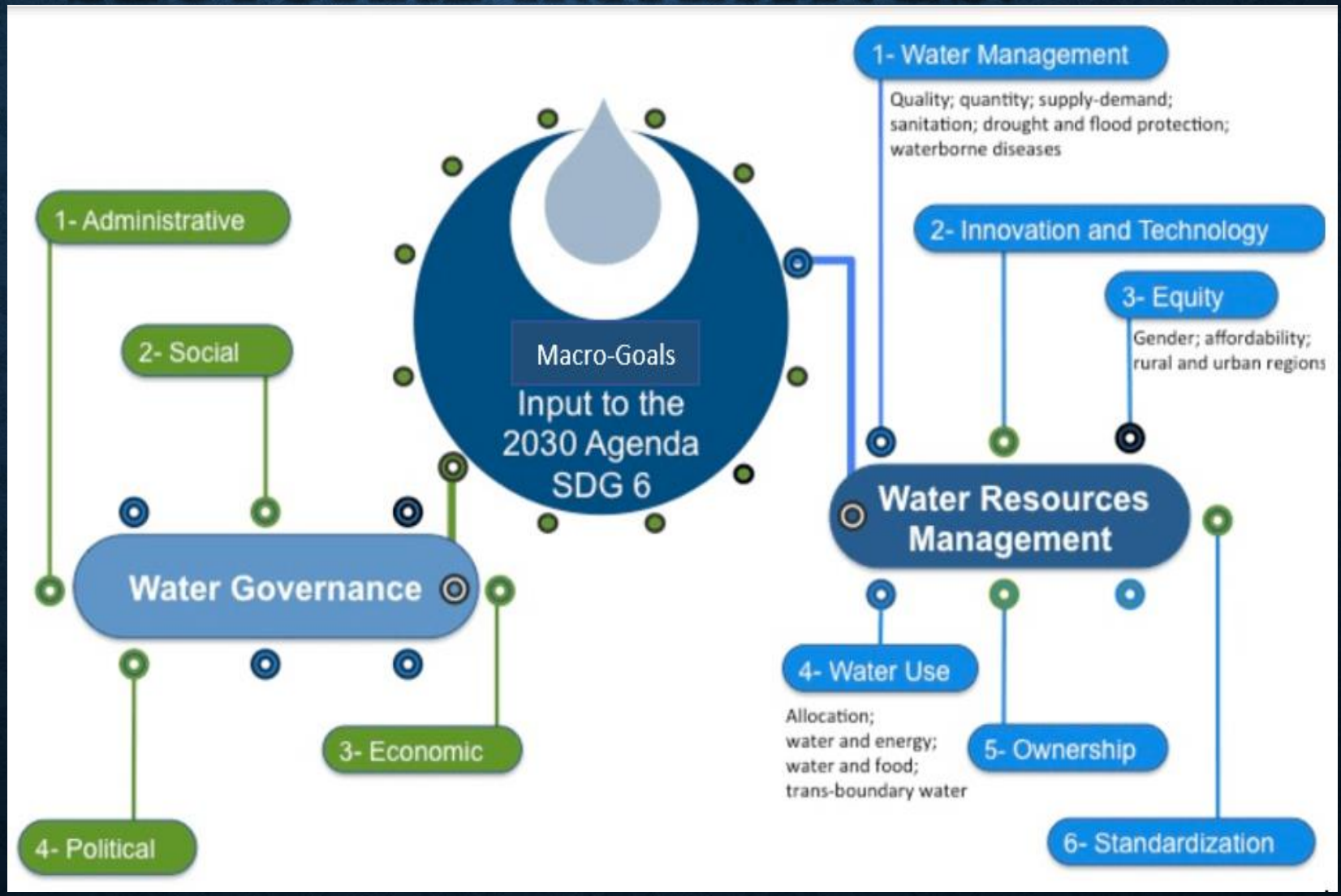
02. Unregulated water extraction led 60% districts affected by Scarcity or quality issue;

03. PGWM programme has been tested which increase the Ground water level, improved productivity;

LITERATURE REVIEWS:

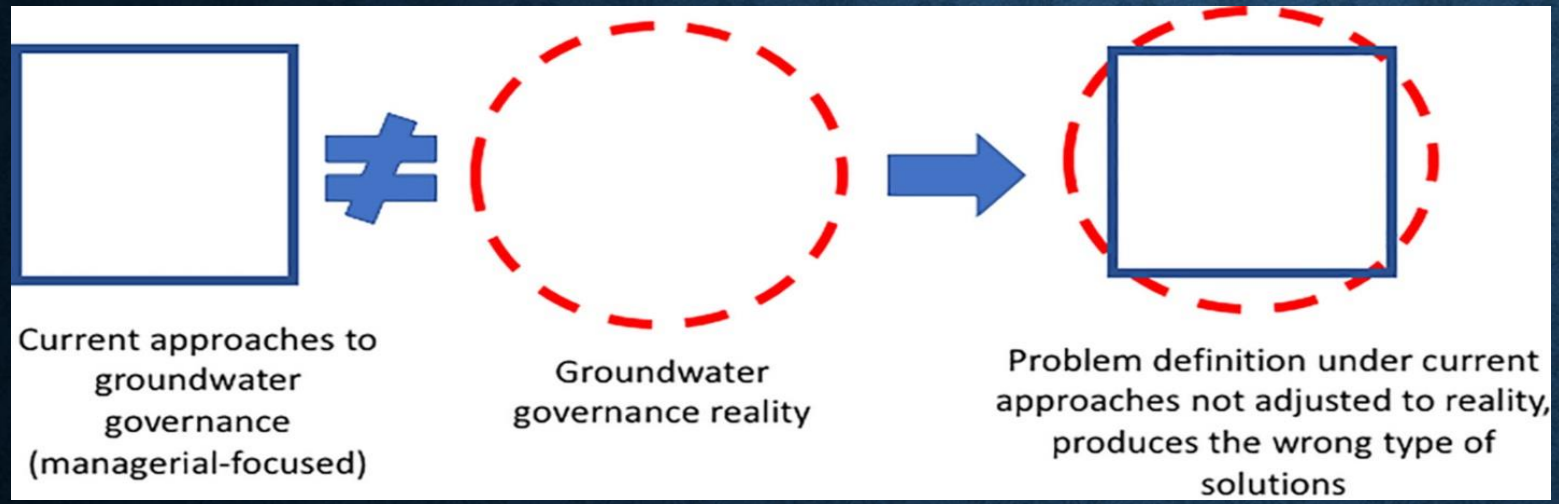


OUTLINE OF THE WATER RESOURCES MANAGEMENT / GOVERNANCE & MACRO SECTORAL INITIATIVES:



LITERATURE REVIEWS:

Conceptual Outline of the Policy & Practice on Water Governance / Management:



LITERATURE REVIEWS:

- Economic Impact of Participatory Groundwater Management: A Case Study on Andhra Pradesh Farmer Managed Groundwater Systems Project, Kolla Sravanthi, Stijn Speelman* and K B Umesh, December 2015

Findings:

1. Community-level institutions have become more assertive in the management of local resources;
2. has significantly increased on farm employment, but there is no significant impact on the net farm income, on crop diversification

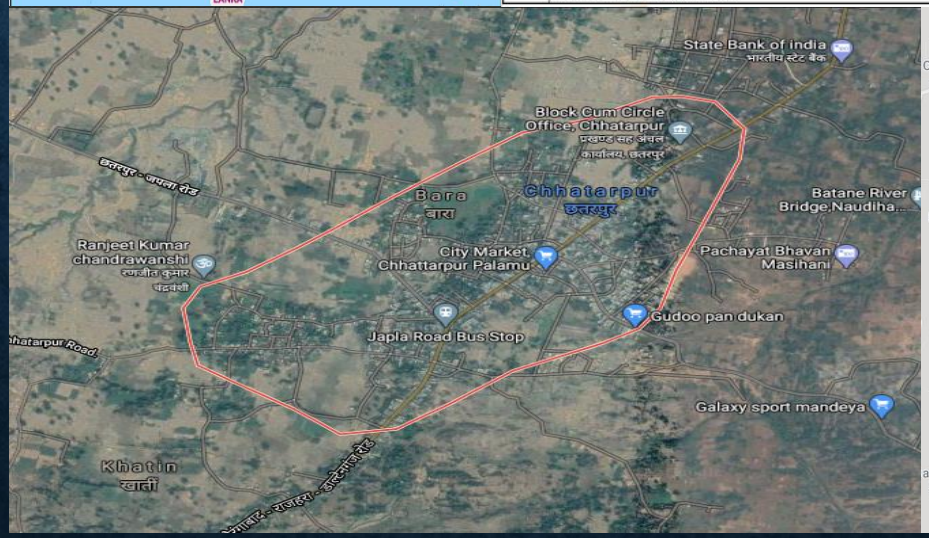
e;

LITERATURE REVIEWS:

- Institutionalising Groundwater Management: A Tale of Three Participatory Models in Andhra Pradesh,M.Srinivasa Reddy, V. Ratna Reddy, R.V. Rama Mohan ,May, 2012
- Findings:
  1. the social regulation approach works better for sustainable groundwater management when compared to the knowledge intensive approach;
  2. Encouraging water sharing between well owners and others would result in achieving the twin objectives of conservation and [illegible]d access with equity;

STUDY AREA:

- Profile : Lat / Long
- 24.291703°, 84.231834°
- Tribal Population Prevalence: 97%
- Total : 609 people;
- HH : 110
- Area: 167 H land



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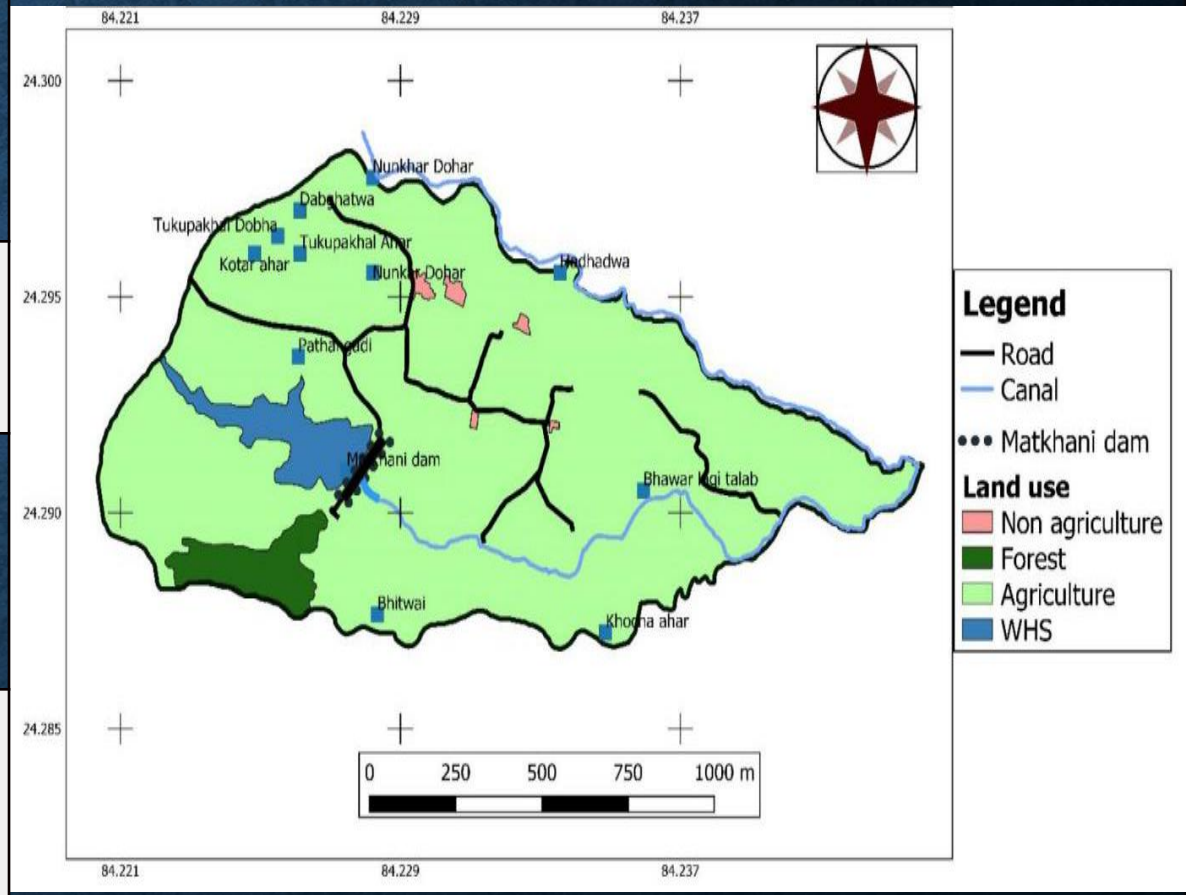
STUDY AREA:

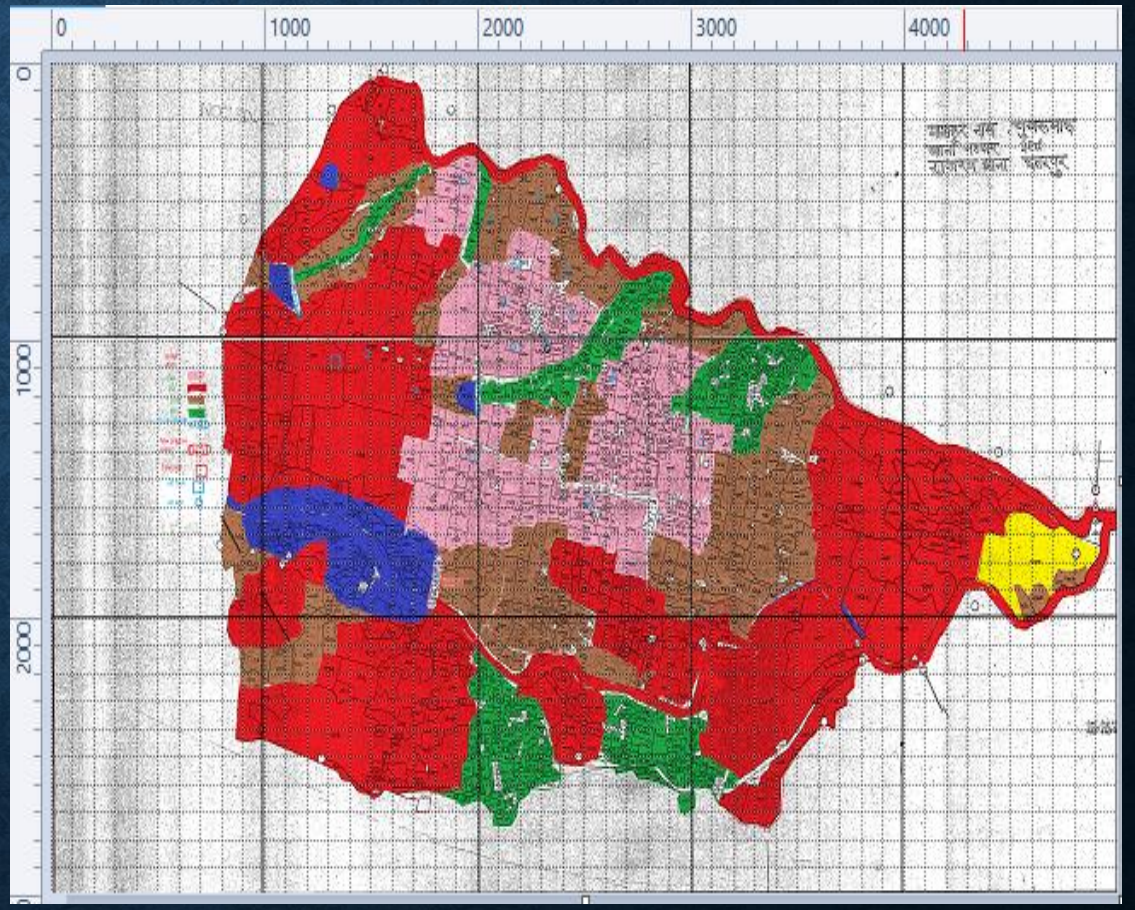
Land use/ land cover	Area (in Hectares)	Percentage (%) (Out of Total)	Hamlet (in which present majorly)	Remarks
Forest	11	6.5	Forest	Includes all land classes as forest.
Agriculture	149.9	89.8	All hamlets except forest and mountains	Includes the net sown area.
Non-Agriculture	6	3	Chuchrumanr Abadikhass	Includes all land occupied by the buildings, roads and water.



Source: Document on NRM Planning Chuchrumanr

STUDY AREA:

S.No	Type of Land	Area in Hectare
1	Bari(Pink)	30.53
2	Tanr(Red color)	83.25
3	Chaur(Soily)	32.04
4	Jah(Green)	18.42



STUDY AREA:

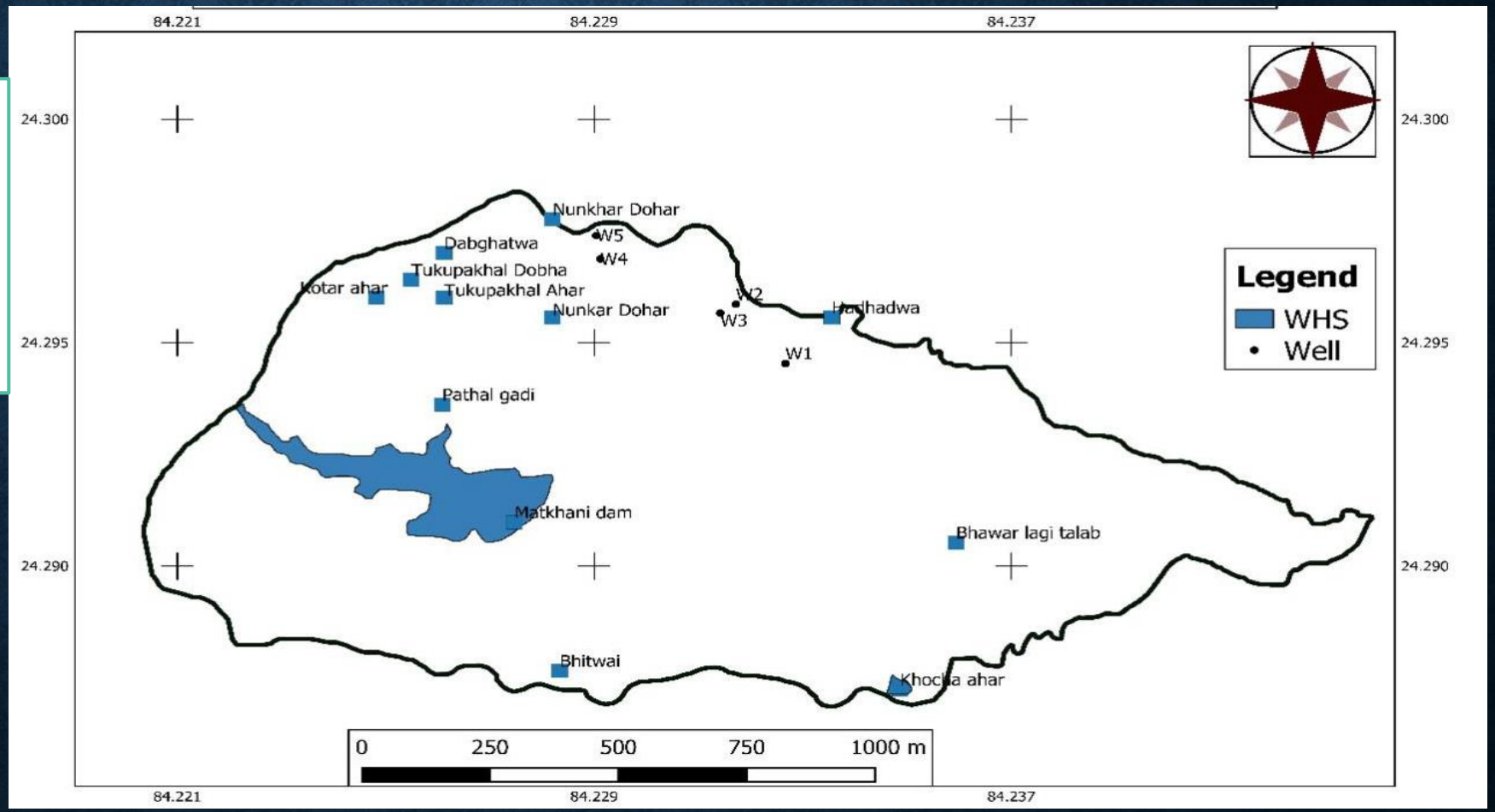
Water Harvesting Structures:

Sl. No.	Name of the Water Harvesting Structure	Latitude (° E)	Longitude (° N)	Remarks
1	Hadhadwa	24.295566	84.233556	All the structures except Matkhani dam were found to be completely dry at the time of visit. The structures retain water only during monsoon season;
2	Nunkhar Dohar	24.297767	84.228201	
3	Kotar ahar	24.296009	84.224822	
4	Dabghatwa	24.297008	84.226118	
5	Bhitwai	24.28765	84.228338	
6	Khocha ahar	24.287237	84.234864	
7	Bhawar lagi talab	24.290525	84.235942	
8	Pathal gadi	24.293619	84.226082	
9	Pathal gadi 2	24.226201	84.22429	
9	Tukupakhul Dobha	24.296407	84.22549	
10	Tukupakhul Ahar	24296009	84.226118	
11	Nunkar Dohar	24.295566	84.228201	
12	Matkhani	24.291060	84.227857	Has the largest water holding potential and was found to retain some quantity of water during visit;

MAIN WATER BODIES:

Blue:

Mathkhani Dam is the Main WHS



OBJECTIVE OF THE STUDY:

01. To estimate the water available in the Mathkhani Dam for surface water & in the wells for ground water;

02. To estimate the water budget of House Holds for irrigation, Drinking, Live-stocks, and other domestic uses;

03. In case of water deficit do the social advocacy to rational use water and change in crop pattern

RESEARCH OBJECTIVES / QUESTIONS:

- How the crops are irrigated in the post rainy season ?
- What all kinds of crops grown in the Chuchrumanr Village ?

OUTLINE OF THE RESEARCH DESIGN:

Qualitative Research Design : Aims to determine the relationship between collected data & observation based on the mathematical calculation (calculation of water in Mathkhani Dam & 23 numbers of wells);

RESEARCH METHOD FOR PRIMARY DATA:

S. No.	Types of Methods	Purposes
01.	Experimental	To calculate the water in the Mathkhani Dam & Wells arnd recharge and Discharge potential of the well
02.	Questionnairs	To know the crop pattern and use of watter source in off seasion
03.	Interview	To know the indigenous way of water use
04.	focus group discussion	To know the local solution of meeting the requirement of water deficit
05.	Observation	To know all the life line activities in the Chuchrumanr Village

FOR SECONDARY DATA:

- Use the Bhuvan Portal and Google earth Pro to calculate area;
- Access the administrative data-base of VSK office to analyse & understand previous interventions;
- Other open-source data;

CALCULATION OF WATER IN MATHKHANI DAM:

Step 01: Demarcation of boundary of Mathkhani Dam (yellow)

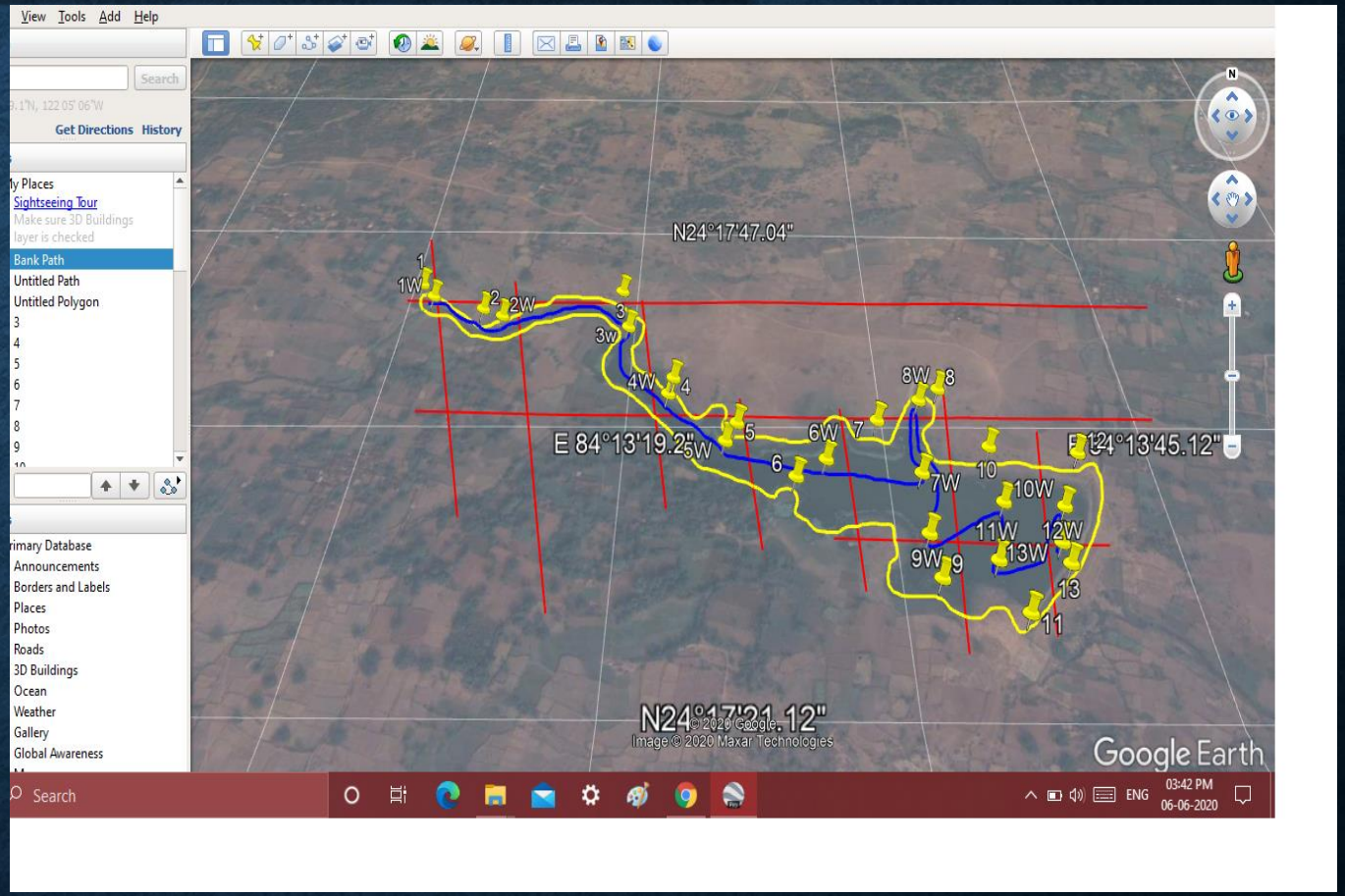
Step 02: Draw a elevation pate across the water(blue)

Step 03: Drop pins consecutive

Step 04: Calculate the hight on the bank and in water from the pins

Step 05:Calculate the Differnces

Step 06: Draw squares and grid taking screen shot in Paint



HEIGHT OF THE WATER ON THE BANK

No. of	Area in	Data on the Bank			
Sqaures	Hectare	PIN no.	Coordinate		Height from sea level
	1square=0.028 h		Latitude	Longitude	Sea level(integer)
2	0.056	1	24°17'42.23"N	84°13'6.71"E	316.2
13	0.364	2	24°17'40.59"N	84°13'10.48"E	315.25
30	0.84	3	24°17'41.79"N	84°13'18.19"E	314.12
12	0.336	4	24°17'36.14"N	84°13'21.35"E	315.3
20	0.56	5	24°17'33.51"N	84°13'24.66"E	316
65	1.82	6	24°17'30.64"N	84°13'27.48"E	318
85	2.38	7	24°17'33.70"N	84°13'31.71"E	314
5	0.14	8	24°17'35.45"N	84°13'35.05"E	315
25	0.7	9	24°17'26.02"N	84°13'33.69"E	315
60	1.68	10	24°17'32.29"N	84°13'37.05"E	314
70	1.96	11	24°17'24.62"N	84°13'37.25"E	313
25	0.7	12	24°17'31.96"N	84°13'41.33"E	313
15	0.42	13	24°17'26.73"N	84°13'39.58"E	312

HEIGHT IN ACROSS THE WATER

Data in the water					water in
PIN no.	Coordinate		Height from sea level	Height	hectare meter
	Latitude	Longitude	Sea level(integer)	Difference in meter	
1W	24°17'41.40"N	84°13'7.52"E	316	0.2	0.0112
2W	24°17'40.08"N	84°13'11.65"E	315	0.25	0.091
3W	24°17'39.41"N	84°13'18.72"E	314	0.12	0.1008
4W	24°17'35.18"N	84°13'21.13"E	315	0.3	0.1008
5W	24°17'32.51"N	84°13'24.08"E	315.5	0.5	0.28
6W	24°17'31.55"N	84°13'28.99"E	317	1	1.82
7W	24°17'30.90"N	84°13'33.55"E	313.3	0.7	1.666
8W	24°17'34.83"N	84°13'33.97"E	314	1	0.14
9W	24°17'27.97"N	84°13'33.43"E	314.6	0.4	0.28
10W	24°17'29.56"N	84°13'37.20"E	311	3	5.04
11W	24°17'26.86"N	84°13'36.37"E	312	1	1.96
12W	24°17'29.37"N	84°13'40.02"E	310	3	2.1
13W	24°17'27.68"N	84°13'39.44"E	311	1	0.42

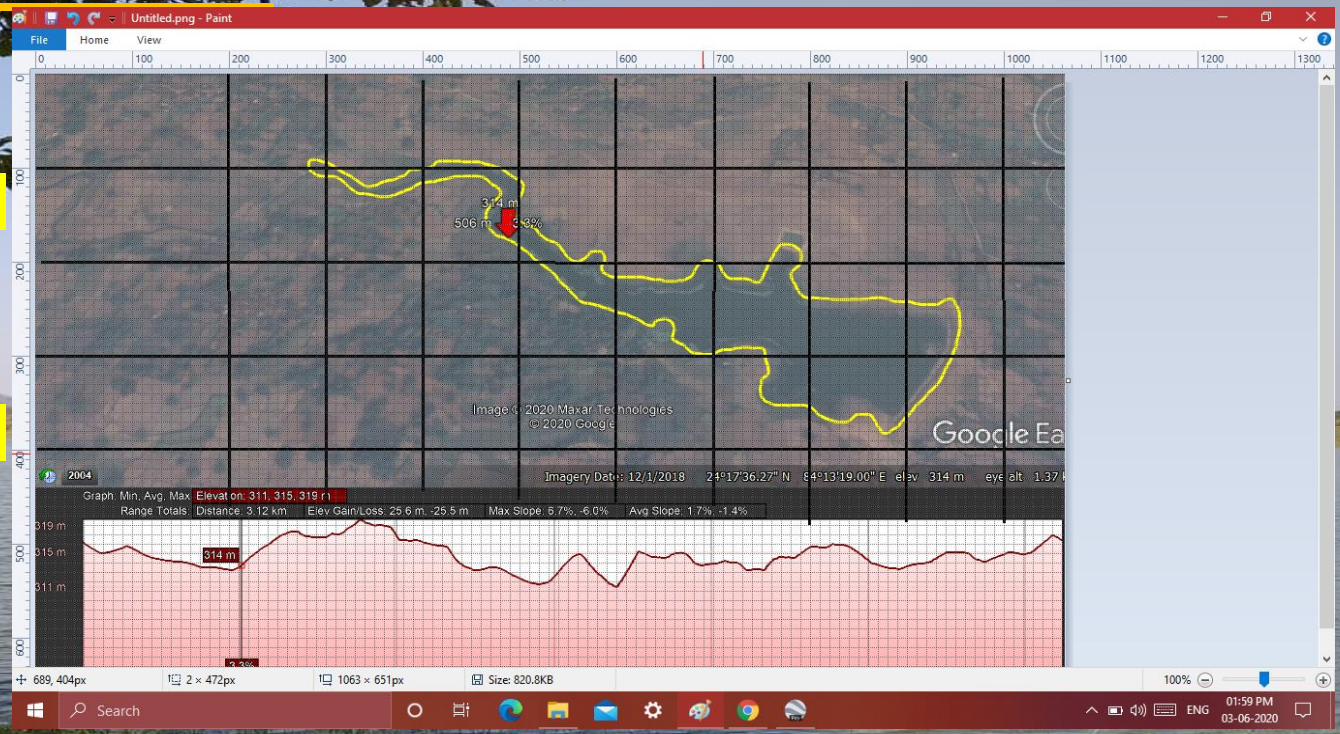
CALCULATION OF WATER IN MATHKHANI DAM:

Note: Total no of square= 345

Approx. area under Mathkhani Dam is =9.5 hectare

Value of 1 square is approx. = 0.028 Ha

In this way the water calculated is 14.0098 hectare meter



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CALCULATION OF WATER ACCORDING TO LISTED WELLS:

	Coordinate						
	Latitude N	Longitude E	water width	Well Radius	Circular area	Volume Cubic	Volume in
			in meter	in Meter	of the well(m*m)	meter	liter
Dhiri Singh	24.293207	84.234147	5.7912	1.524	7.29288864	42.23457669	42234.57669
Aklu Singh	24.291856	84.231943	1.6764	1.524	7.29288864	12.22579852	12225.79852
Harihar Singh	24.292394	84.231227	7.1628	1.2192	4.66744873	33.43200176	33432.00176
Basnt Singh	24.298696	84.234301	2.7432	1.524	7.29288864	20.00585212	20005.85212
Harender Pasvan	24.300064	84.231337	2.1336	1.524	7.29288864	15.5601072	15560.1072
Harigopal	24.295	84.233497	2.7686	2.286	16.40899944	45.42995585	45429.95585

CALCULATION OF WATER ACCORDING TO LISTED WELLS:

	Coordinate						
	Latitude N	LongitudeE	water width	Well Radius	Circular area	Volume Cubic	Volume in
			in meter	in Meter	of the well(m*m)	meter	liter
Brijmohan Uranv	24.296881	84.229221	2.159	2.286	16.40899944	35.42702979	35427.02979
Chhathu Uranv	24.297311	84.228978	2.5908	1.524	7.29288864	18.89441589	18894.41589

LIST OF THE WELLS:

Total Volume of the Water in the well: 603093.0836 liters;

Mithu Uranv	24.295983	84.229303	2.9718	1.524	7.29288864	21.67300646	21673.00646
Prabhu Uranv	24.295845	84.231383	3.6576	2.286	16.40899944	60.01755635	60017.55635
Nageshwar Uranv	24.289872	84.225015	2.8702	2.286	16.40899944	47.09711019	47097.11019
Dewbansh Singh	24.295594	84.226509	1.397	1.524	7.29288864	10.18816543	10188.16543
Madan Singh	24.299141	84.236277	2.4384	1.524	7.29288864	17.78297966	17782.97966
Birju Uranv	24.28983	84.225069	2.8448	1.524	7.29288864	20.7468096	20746.8096
lakhan uranv	24.295527	84.229928	2.5654	1.524	7.29288864	18.70917652	18709.17652
Jwala Uranv	24.29655	84.231449	2.7432	2.286	16.40899944	45.01316726	45013.16726
Puran Singh	24.288115	84.248129	0.6096	1.0668	3.573515434	2.178415008	2178.415008
Shivnath singh	24.293301	84.235831	0.6096	2.286	16.40899944	10.00292606	10002.92606
Kamta Singh	24.29308	84.22982	0.6096	1.0668	3.573515434	2.178415008	2178.415008

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RECHARGE & DISCHARGE POTENTIAL OF THE WELL:

Owner Name	Water volume	Start-Time	End-Time	Minutes/ Operational;
Aklu Singh	12236.92299	10:43	11:47	64
Basant Singh	20024.0558	13:40	15:49	129
Puran Singh	2180.397188	14:04	14:25	21

RECHARGE & DISCHARGE RATE:

Extraction(Lt.)/second	Extraction(l)/minutes	Time taken	Extra time taken	Water recharged in extra time	Rate of recharge liter/minute
3.33	199.8	61.24586082	2.754139181	550.2770085	8.598078257
3.75	225	88.99580357	40.00419643	9000.944196	69.77476121
6	360	6.056658854	14.94334115	5379.602812	256.1715625

WATER BUDGETING:

Agriculture(crops landwise Upper/ Middle / Lower)

Upperland

Total Upperland is 83.25(Tanr) hectares and the average water deficit approx 400mm(Taking average of water deficits)

Name of crop	Water requirement	Growing Period	Water fulfillment due to RF	Water Deficit
Lentil (Masur)	425mm	125-130	51.43	373.57
Maize	525 mm	120	51.43	473.57
Arhar	420	150-200	51.43	368.57
Kulthi	420	120	51.43	368.57

MIDDLE LAND:

Total Middle land (Bari) is 30.53 hectares and the average water deficit is 440 mm.(taking Average of water Deficits);

Wheat	500mm	90	51.43	448.57
Gram-	400mm	130-135	51.43	348.57
Mustard	400mm	90	51.43	348.57

Rice	1250mm	110	51.43	1198.57
Brinjal(Sept-Jan)	486mm	150	51.43	434.57
sPea(Oct-Feb)	440mm	150	51.43	388.57
Chilli(July -Nov)	600 mm	180	51.43	548.57
Potato (Oct -Dec)	400 mm	90	51.43	348.57

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Chilli(July - Nov)	600 mm	180	51.43	548.57
Potato (Oct - Dec)	400 mm	0	51.43	348.57
Tomato(Oct -Dec)	425 mm	90	51.43	373.57
Cauliflower(Oct-Jan)	400 mm	120	51.43	348.57
Cabbage(Oct-Jan)	400 mm	120	51.43	348.57
Pumpkin(June-Oct)	350 mm	155	51.43	298.57
OnionDec- Mar)	400mm	90	51.43	348.57
	00mm	120	51.43	348.57

TOTAL WATER REQUIREMENT IN AGRICULTURE:

- Upper-land+ middle-land , (83.25+30.53)=108.78
- Water deficits: (400+440)/2= 420 mm
- Water deficits 108.78*420=45,687.6 hectare-mm

WATER BUDGETING:

Livestocks Water Requirement

Total no of livestocks is=400and the water requirement in a day 155 liters a day
Total water requirement by 400 livestocks 400x155=62000liters

No of H/H	Animal	No of Animals	Water requirement in Litres
45	Ox	124	38
62	Cow	28	41
5	Buffalo	5	65
64	Goat	63	7
15	Pig	20	4.5
40	Poultry	160	.250

WATER BUDGETING:

House-hold Water Requirement:

Water requirement in a day by all number of human
609x117=71,253liters

Total no.of human	Wate requirement (lpcd)
609	117

WATER BUDGETING:

Overall Water Requirement:

S. No	Sectors in need	Requirement	
01.	Irrigation	108.78x420 hectare-mm	45,687.6 Hectare-mm
02.	Livestocks	400x155=62000liters	Total in liter 133,253
03.	HH	609x117=71,253liters	

COMPARISON BETWEEN WATER AVAILABILITY & WATER REQUIREMENT:

Water Available in Mathkhani Dam	Water requirement in irrigation
14.0098Hectare-meter or 14.0098x100x100=140098 Hectare-mm	45,687.6 Hectare-mm

Water available in well for domestic use	Water requirement
603093.0836 liters	133,253 liters

COMPARISON BETWEEN WATER AVAILABILITY & WATER REQUIREMENT:

- While it is evident, that 70-80% of gross water requirement is fulfilled by ground water. Hence, the effective solution should be focused towards planning at micro level through water budgeting which will lead to water security, in the coming decades;
- The main objective of water budgeting exercise is to encourage the community to prepare their localized water budget for attaining water security & sustainable development;
- Redefined role and responsibility with clear guidance for capacity building at grass root level, towards conserving natural resources;
- Water reserves planning on long term basis towards ensuring sustainability through recharge
- & supply from surface sources at the time of water shortages.

FINDINGS:

- Only the Mathkhani Dam is the source of surface water for irrigation in the off rainy season;
- In case of Horticulture the wells' water is used for irrigation;
- Mainly the Rainfed crops are sown as farmers have less facilities to lift the water from the Mathkhani Dam and their well (like solar pump and diesel Pumps);
- Deficit of water for irrigation but sufficient for drinking purposes;

RECOMMENDATIONS:

Categories:	Developmental Problems:	Field Based Solutions:
Agriculture	1. Siltation in existing structure 2. Few no. of well for irrigation 3. lack of canal structure to lift water from Mathkhani	1. Improving WHS (Includes pond renovation) 2. New pons & wells can be constructed 3. Canal construction
Livestock	1. Scarcity of drinking water during dry season 2. -Lack of availability of fodder due to water scarcity;	1. One or two Panchayat well or Mathkhani can be used
House hold	1. The well get dries and contaminated in rainy searson, & in stormy days	1. Well should be maintained well

RECOMMENDATIONS:

Categories	Problems	Solutions
Agriculture		
Paddy (Oryza sativa) **Maize (Zea mays)** **Arhar (Cajanus cajan)** **Vegetables**	- The existing water harvesting structures have decreased in depth due to excess siltation, causing drastic reduction in the potential water holding capacity of the structures. Thus, these don't suffice the irrigation demand of the community; - There are very few number of wells, used for irrigation, in the village; - Due to lack of proper canal structural intervention the water from the water harvesting structures, particularly Matkhani Dam to Gohdi Ahra to Dhan ki ber (canal of 1200ft) does not reach many agricultural fields in the village and does not benefit the villagers at its potential;	- Improving water harvesting structures (Includes pond renovation); - New farm ponds and new wells can be constructed to conserve rainwater and also for improving ground water; - Canal renovation and extension of 1200ft additionally can irrigate additional 20-30 % (approx..) of the agricultural area of the village.
Livestock		
Large Ruminants (Cows/Buffaloes) **Small Ruminants (Goats)**	- Scarcity of drinking water during dry season; - Lack of availability of fodder due to water scarcity;	- One or two sources of water, such as panchayat well and Matkhani dam can be used for fulfilling the livestock's' water demand; - Fodder plantations can be carried out to meet the fodder demand during lean season.

RECOMMENDATIONS:

Net Agriculture Sown Area (m^2)	Water Required for Irrigation (m)	Volume of Water Presently Required (m^3)
14,99,000	0.127	5,71,119

Policy & Implementation Perspectives for Achieving Sustainability Include:

(a) The Enabling Environment: Policies towards setting goals for water use, protection & conservation;

(b) Institutional Roles: Towards creating an organizational framework – forms & functions, institutional capacity building – developing human resources, community partnership models;

(a) Management Instruments: Promoting Innovative Partnerships, including Field & Functions;

CONCLUSION:

1. Mathkhani Dam is Alive Reservoir for off season has about 14 H-M and water deficit is about 45 H-M;
2. Water requirement in HH use and for Animal is comparatively lesser, so to fulfill requirement wells water can be used along with new construction;
3. Rationale use of water;

PICTURES DURING FIELD VISITS

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THANK-YOU