

# From PIM to Participatory Water, land & Agriculture Development in Command Areas of Irrigation Systems.

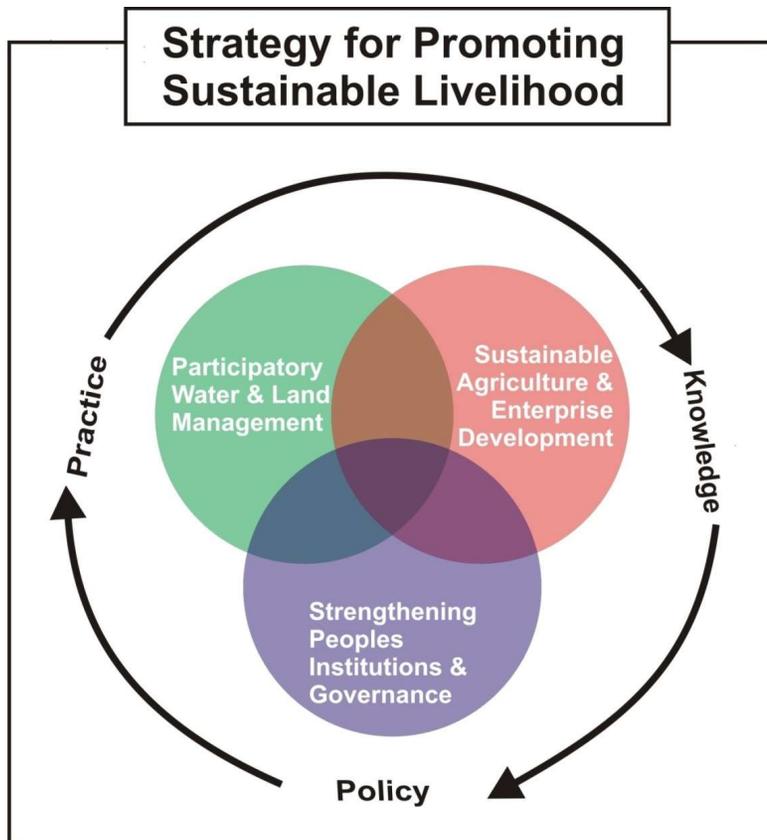
**-A Case Study of Conjunctive Use of Ground and Surface water in three Irrigation Schemes of North Gujarat**

**By Mohan Sharma- Development Support Centre, Ahmedabad**

**At National Conference, Ahmedabad**

**28<sup>th</sup> May, 2019**

# Genesis and Mission of DSC



- Setup in 1994 under Society and Trust Act
- Governed by a 12 member Board headed by Shri V B Patel, Ex. Chairman, CWC
- Works directly with more than 1.6 lakh households in 4 states of Western India
- Provides capacity building support to 7 states
- Best NGO-Water Education, 2019 by water Digest

## OUR MISSION

To provide knowledge based support to institutions involved in promoting sustainable livelihoods and participatory resource management

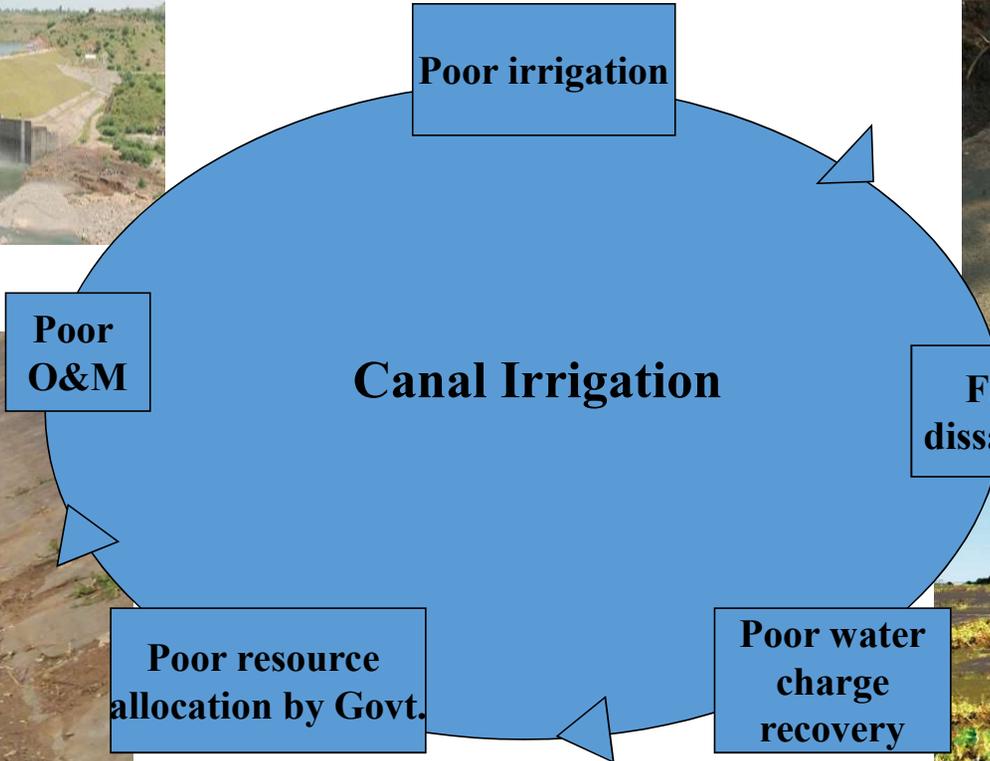
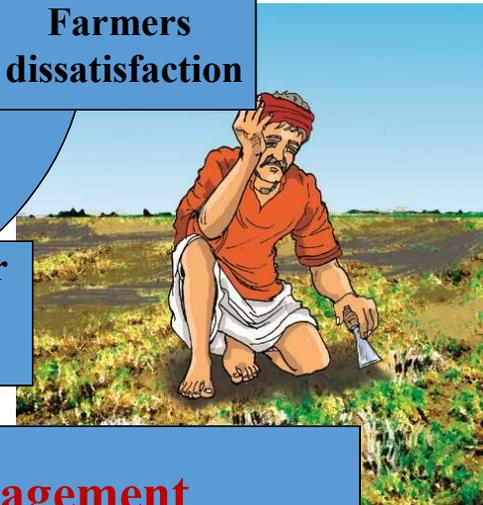
# Rationale for working in command areas

(App 40% of 14.2 crore ha.)

## Key Issues:

- High tail end deprivation
- Low water use efficiency
- Problems of seepage and high conveyance losses
- Mono cropping changing with time
- Stagnation of agri growth rate.

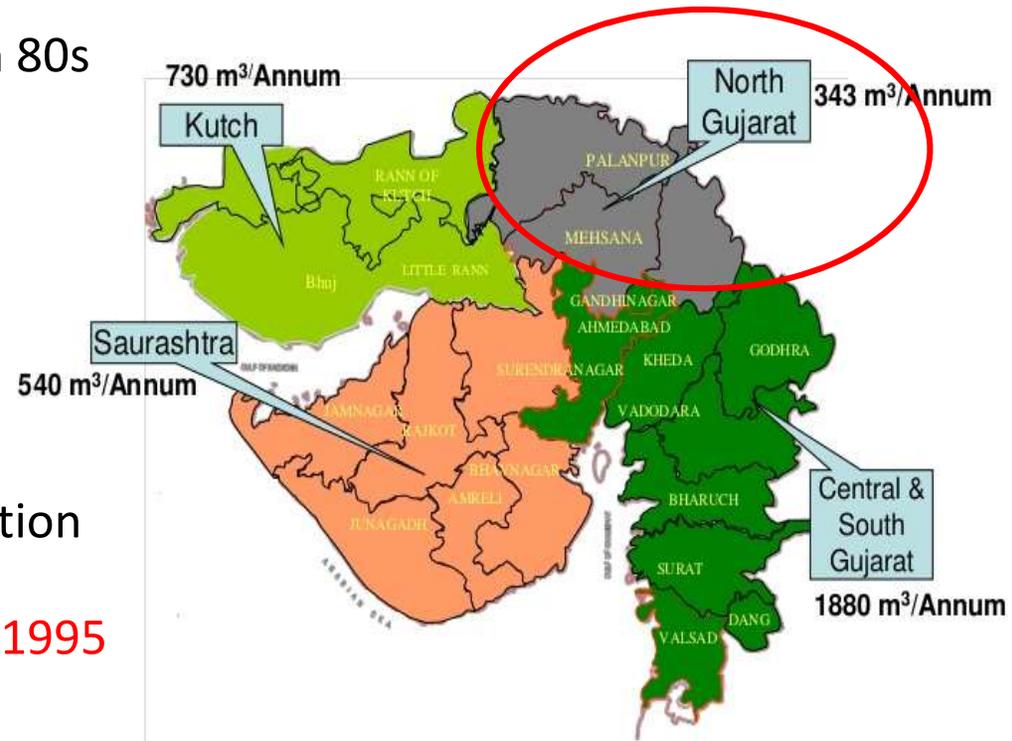




**Vicious Cycle of Canal Irrigation Management**

## A Case Study of North Gujarat

- Dharoi ,Guhai and Mazum schemes built in 80s
- Used to cover 172 villages .
- Desgined command area: about 46,300 ha
- Observed high tail end deprivation
- Wide gap between design and actual irrigation
- WRD and DSC piloted PIM with 1 village in 1995
- All schemes covered under PIM by 2012



## Developing physical and social capital in the command areas under PIM



**Canal Rehabilitation by WUA**



**Irrigation Patrolling by Federation**

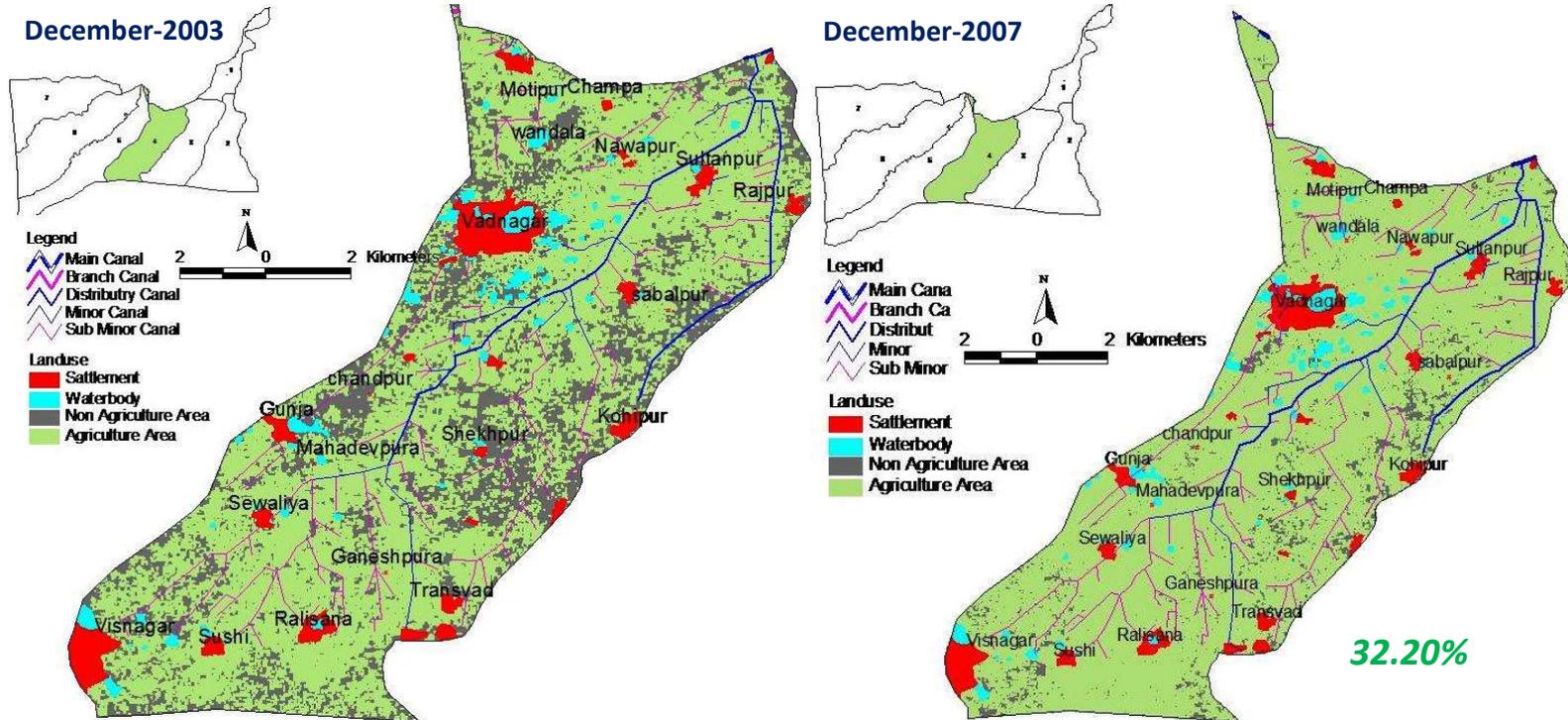


**Controlled supply of water by WUA**



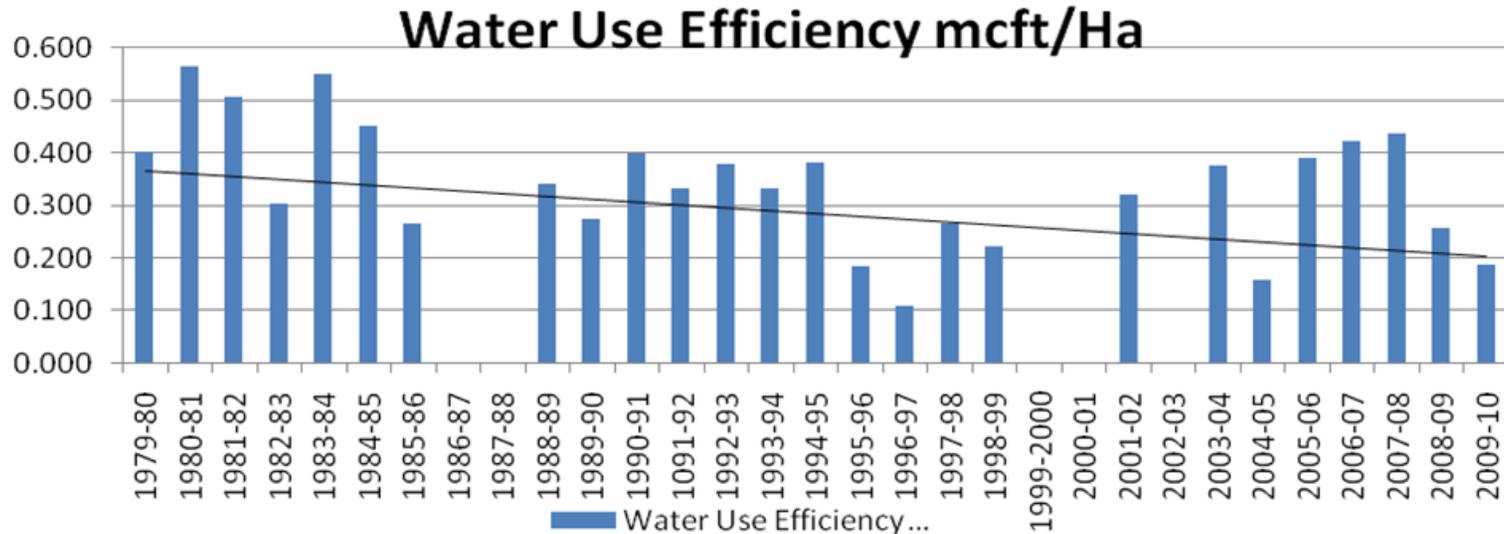
**Rabi Irrigation Review meet**

# Impact of PIM



| Block No.    | Irrigated Areas (Ha) |              | Difference (Ha) | Change (%)   |
|--------------|----------------------|--------------|-----------------|--------------|
|              | Year 2003-04         | Year 2007-08 |                 |              |
| 1            | 5551                 | 3537         | -2014           | -36.30       |
| 2            | 4964                 | 7940         | 2976            | 59.95        |
| 3            | 5351                 | 7753         | 2402            | 44.90        |
| 4            | 6646                 | 8785         | 2139            | 32.20        |
| <b>Total</b> | <b>22512</b>         | <b>36412</b> | <b>13900</b>    | <b>61.74</b> |

# Water Use Efficiency



| Duty              | MCFT/Ha      | Year               |
|-------------------|--------------|--------------------|
| Minimum           | 0.108        | 1996-97            |
| Maximum           | 0.565        | 1980-81            |
| PIM Impact        |              |                    |
| <b>Before PIM</b> | <b>0.340</b> | 1979-80 to 1994-95 |
| <b>After PIM</b>  | <b>0.232</b> | 1994-95 to 2010    |

## Developed effective canal water management by WUAs



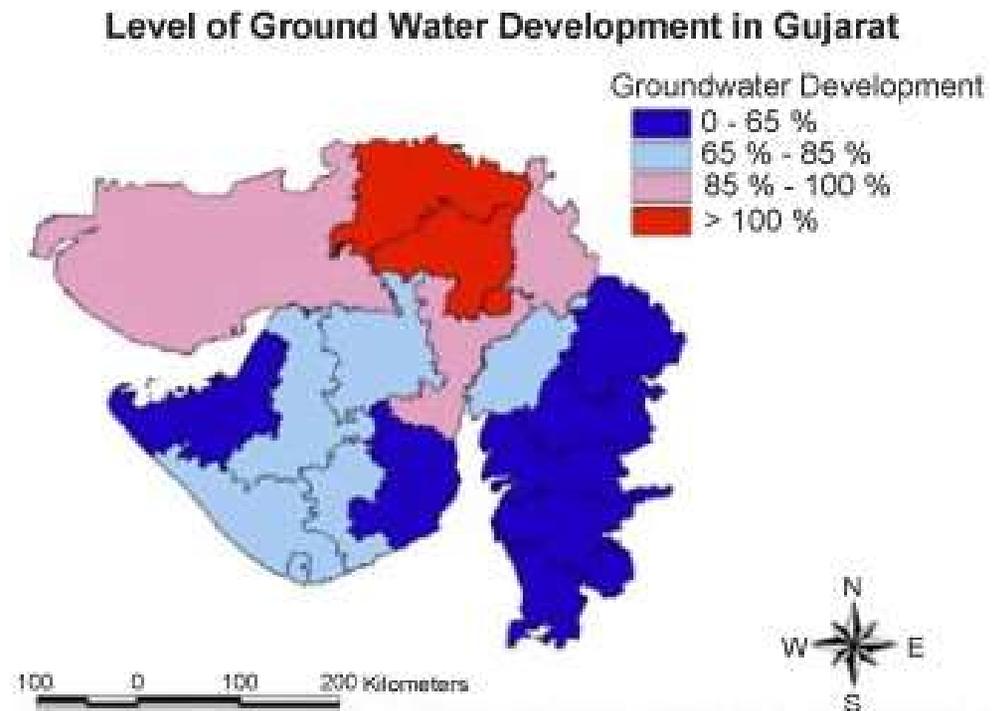
**Farmers paying water charges in WUA office**



**Improved Water Delivery**

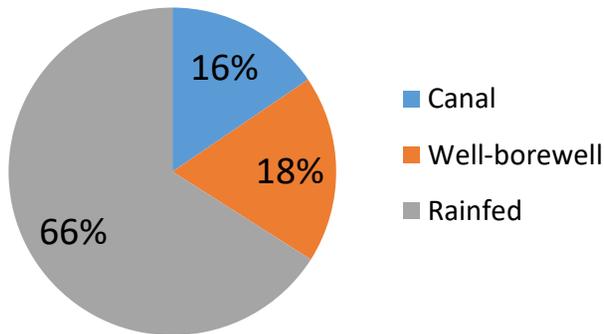
# Unintended Consequences of Irrigation development

- PIM increased access to water triggered **cropping intensity, change in cropping pattern**
- **Caused overexploitation of ground water**
- **Increase cost of irrigation**
- Sabarmati basin **Lowest per capita water availability** in the country
- The blocks declared as **dark zones**
- Poor land holding, **sandy soil with low fertility**
- **Increased cost of cultivation and reducing net incomes from farming and dairy**

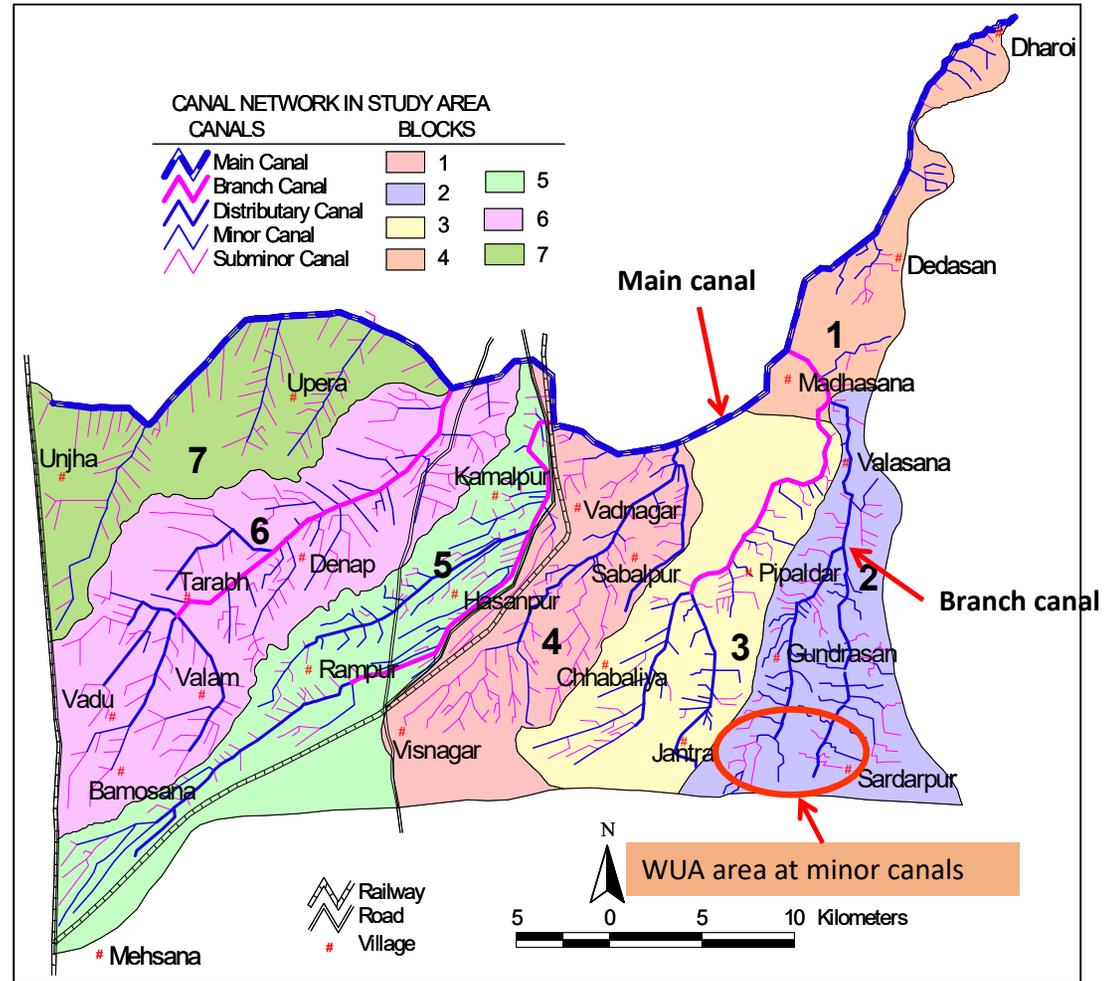


## Consequence, continue.....

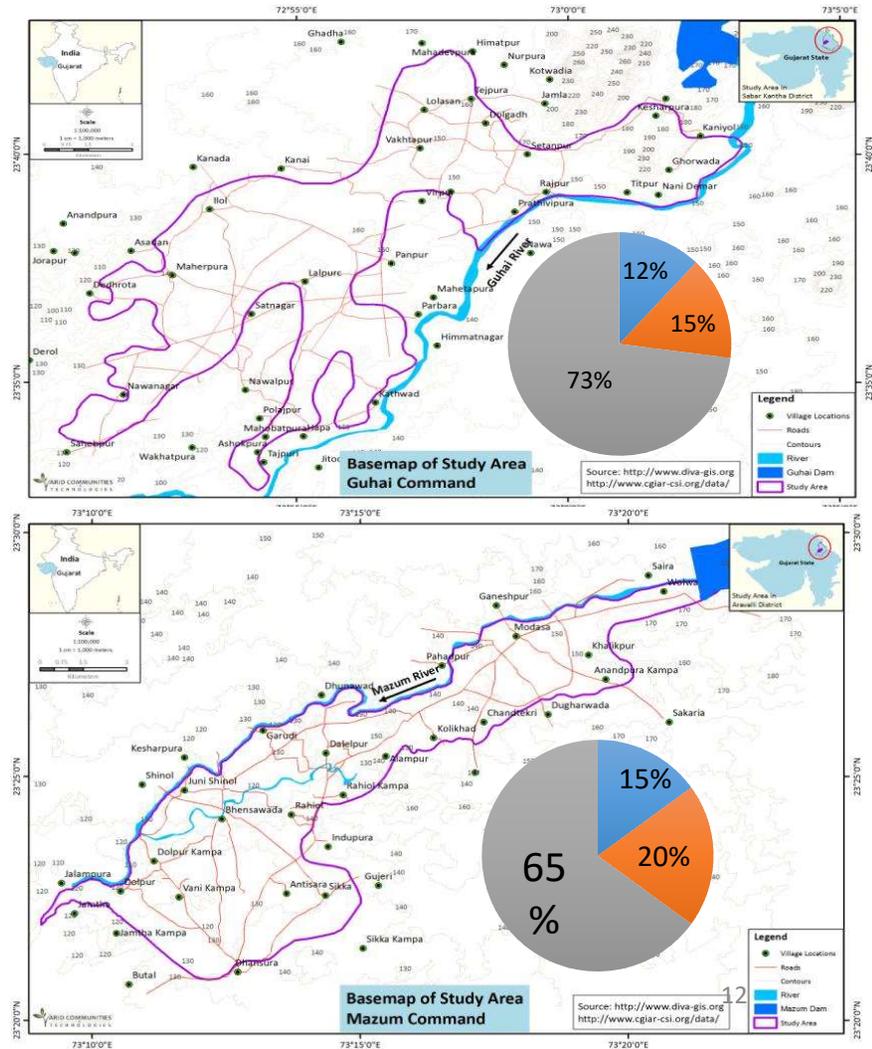
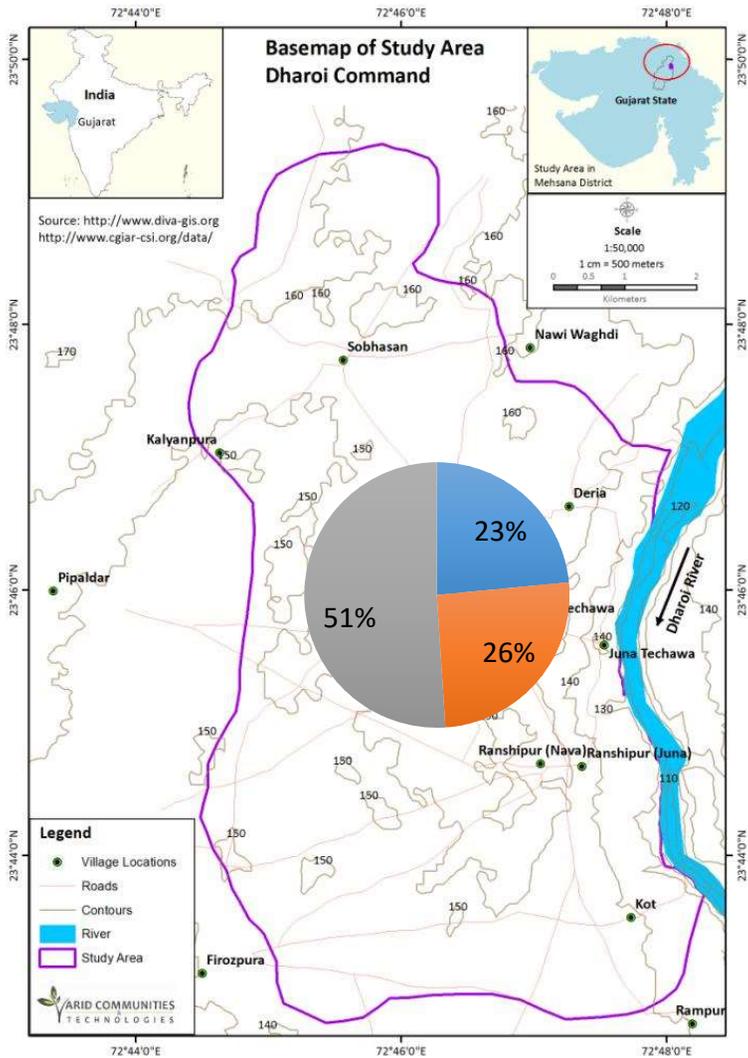
- **Inequity in water access** with in village and farmers; **Distortion in social fabric** with in village
- **Inefficient use of water** by those having access to water and **overexploitation of ground water** having no access to canal network



Total household -12000



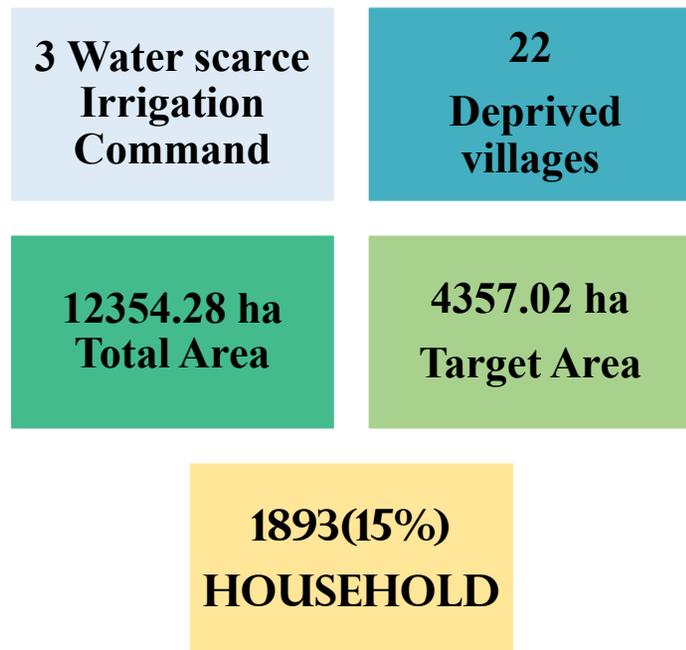
# Water for agriculture in three command areas in 2011-12



## PILOT PROJECT ON IWRM

**PARTNERS: DSC, HUF, RBS FOUNDATION AND ACT**

- **Inclusive representation – Water Users**  
**Association to village Sujal Samitee**
- Developing **local cadre** of para agri. professionals and para geo hydrologist –  
Bhujal Jankars
- Farmer collectivization – participatory way for behavior change - **Engaging individual farmers and farmer groups.**
- **Physical interventions for water harvesting and SWC.**



## Project Objectives

- To *Understand and monitor groundwater behavior* in 24 villages and build the capacities of the community on water budgeting
- To Build awareness of the community for conjunctive use *of surface and ground water.*
- To Demonstrate an *Inclusive Village Institute* which includes farmers/People from both command and out of command . *Viz. Land less ,women ,SC/ST and other*
- To Evolve *Processes , Techniques and Data* management for IWRM *at Village level.*
- To make the *Villages self sufficient* in Supply and Demand of *Water*
- To develop a *participatory plan for sustainable management* of soil, moisture and water conservation at the village level

## Key interventions

- ***Securing water availability*** (because canal reach was sub optimum & inefficient) through soil moisture conservation and water harvesting structures including repairs of old structures, de-silting etc
- ***Crops suitable for water availability*** : Introduction and scaling up adoption of short duration and less water consuming crop variety of wheat (GW451), cotton and castor GCH 7 in Gujarat
- ***Community collectives*** – WUAs ,Sujal samitees ,Farmer clubs and long term capacity building of local resource person
- ***Farming practices*** : Demonstration and Adoption of practices that help in water saving and giving high production SWI, mulching, application of organic inputs
- ***Farm-based technologies*** : Trainings for Crop and Water management , increasing adoption of Drip and Sprinkler Irrigation , Support for Post harvest Processing Machinery like Wheat cleaning and Grading Machine etc.

# Measuring impact of interventions on Ground water level

## Water depleted in 60% of state wells

Union Govt's Figures Show Fall In 2007-2016 Period

Ahmedabad: Figures released by the Union water resources ministry reveal that nearly 60% of wells in Gujarat have recorded water depletion over a decade.

According to the figures, Gujarat is among the top 16 states that have recorded a depletion in water levels in wells from 2007 to 2016. According to the information provided by the Union ministry in the Lok Sabha, the analysis of 789 wells in Gujarat conducted by the Central Ground Water Board (CGWB) suggested that 478 wells (60%) across the state had registered a depletion in water levels from 2007 to 2016. Moreover, the ministry said that only 20 wells have registered a rise in water levels, and the levels in 25 wells did not register any change

### DEPLETING LEVEL, RISING CONCERN

| State          | Wells | Wells with depletion | % of |
|----------------|-------|----------------------|------|
| Tamil Nadu     | 506   | 465                  | 92   |
| Punjab         | 243   | 198                  | 81   |
| Andhra Pradesh | 738   | 563                  | 76   |
| Uttar Pradesh  | 637   | 450                  | 71   |
| Gujarat        | 799   | 478                  | 59   |
| Kerala         | 136   | 95                   | 70   |
| Karnataka      | 143   | 96                   | 67   |
| Haryana        | 302   | 207                  | 69   |
| Odisha         | 1283  | 773                  | 60   |
| Maharashtra    | 1562  | 887                  | 57   |

In the period under review, Of the 25 blocks defined by the CGWB, 23 are over-exploited in the state. The worst affected areas are the districts in North Gujarat where depletion is more than 30% — meaning that more water is extracted from the ground than is replenished. Against the national average of 62% of groundwater resources used, Gujarat uses 72%. About 80% of this is used for irrigation. In Gujarat, the exploitation ranges from 30% to 100%.

The CGWB's ground water monitoring exercise is carried out four times a year on a regional scale through a

network of observation wells in the country. Comparisons and analysis of pre-monsoon (2007) water level data collected by the CGWB with the decadal average (2007-2016) indicates decline in ground water levels in about 61% of the wells. This may be due to the increase in population, rapid urbanisation and industrialisation, and other related factors, said the reply tabled before the Lok Sabha by Union minister Arjun Ram Meghwal.

Gujarat is one of the seven states covered under the National Groundwater Management Improvement Programme (NGMIP). Other states are Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh, Maharashtra, and Karnataka.

## A warning by Nirma, Cept researchers too

Paul.John@timesgroup.com

Ahmedabad: If Ahmedabad's depleting ground water aquifers are not alarmed you much, a recent study on ground water vulnerability by researchers from Nirma University and Cept University has warned that human activities is leading to higher concentration of minerals and accumulation of pollutants.

The study on Ahmedabad district's groundwater vulnerability — a term used to represent factors that determine the ease with which groundwater may be contaminated by human activities — has revealed the central and southern parts of the district with 46.4% of the area is under moderate vulnerability while 5.2% of area in the south-east of district is under high vulnerability.

The southern part of the district which covers 46.4% of area is under low vulnerability. The study was conducted by a team of researchers from Nirma University and Cept University, Jaipur.

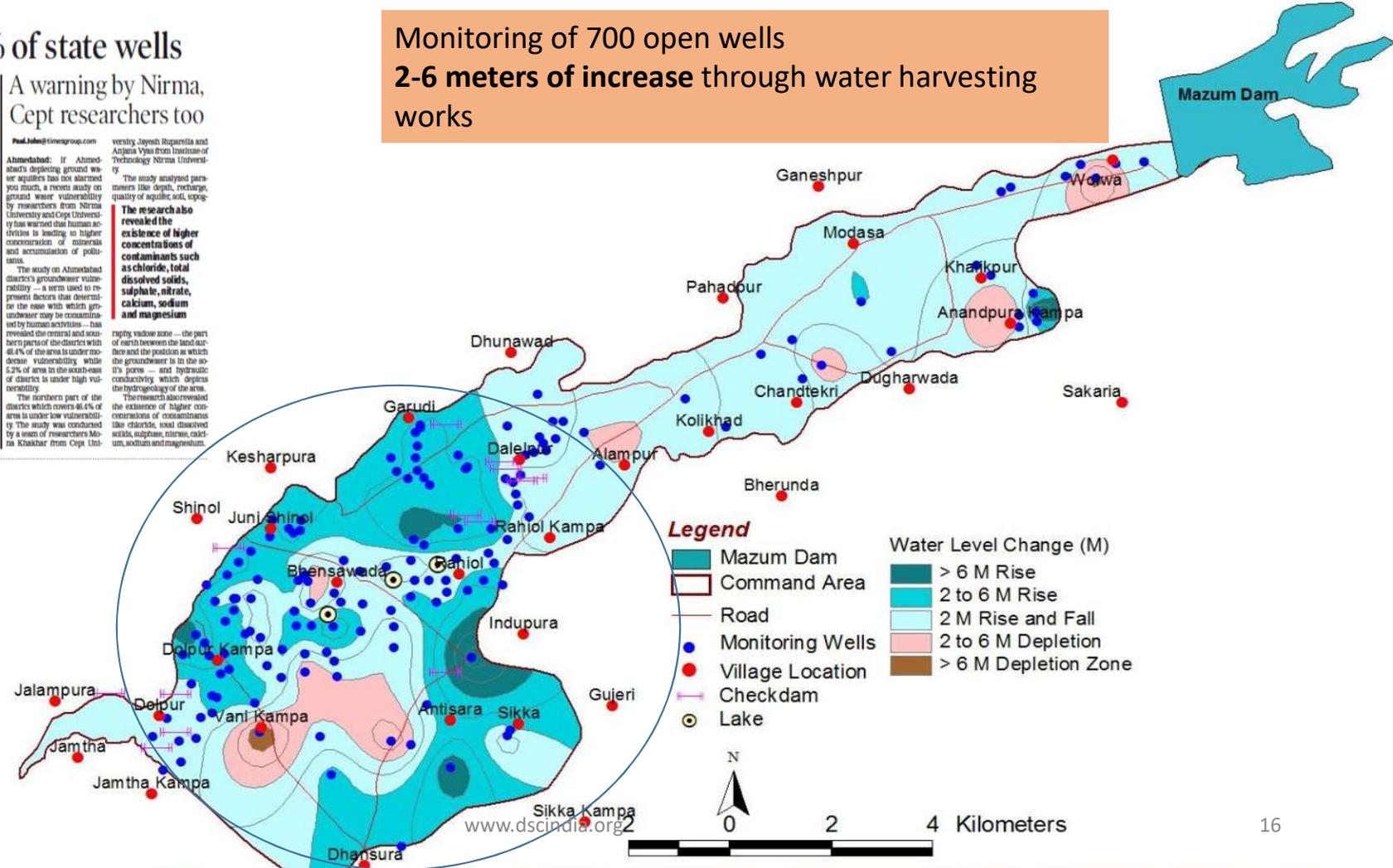
Jayesh Ruparelia and Anjana Vyas from Institute of Technology Nirma University.

The study analyzed parameters like depth, recharge, quality of aquifer, soil, topography, vadose zone — the part of earth between the land surface and the position at which the groundwater is in the soil's pores — and hydraulic conductivity which depicts the hydrogeology of the area.

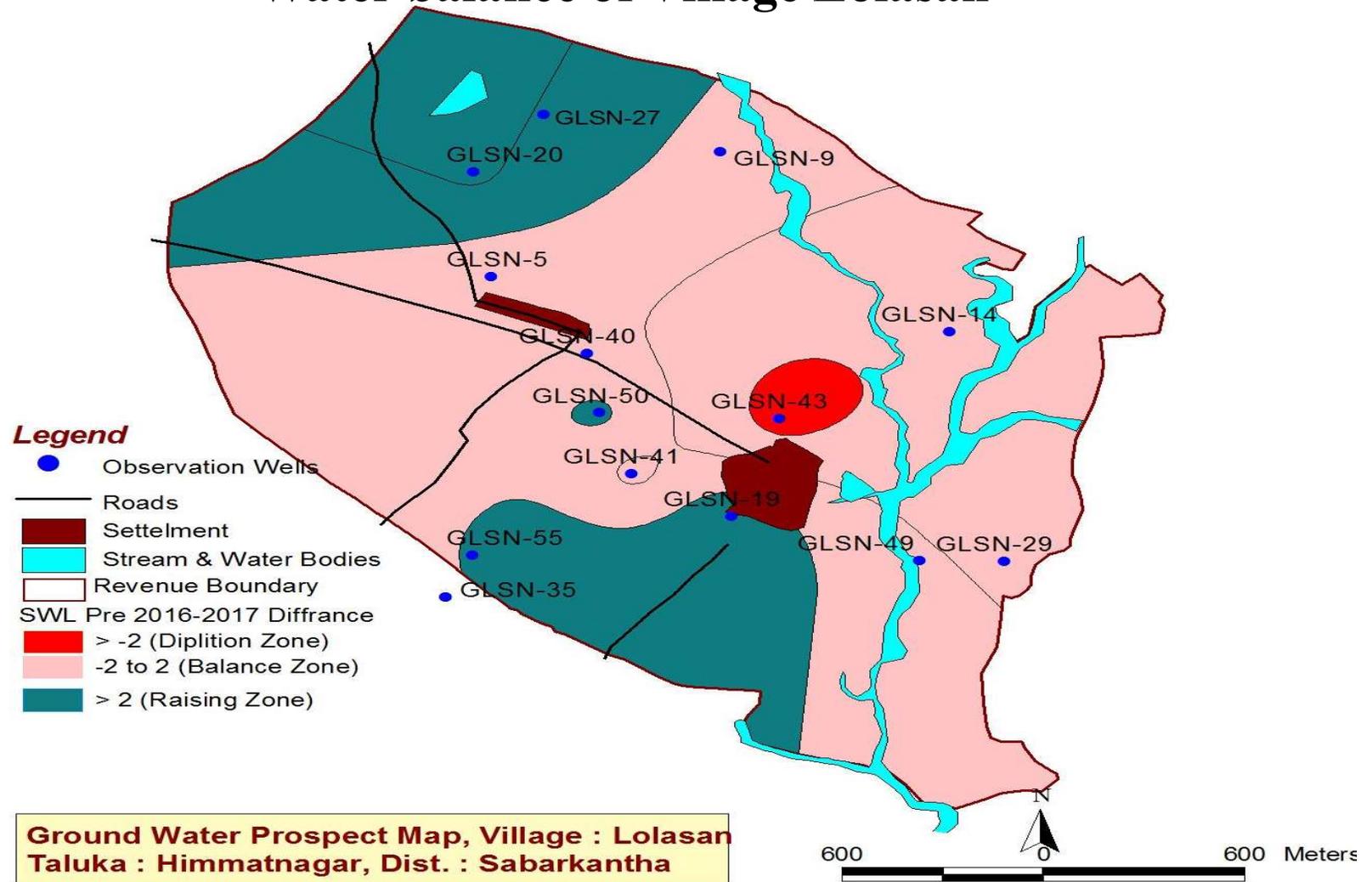
The research also revealed the existence of higher concentrations of contaminants like chloride, total dissolved solids, sulphate, nitrate, calcium, sodium and magnesium.

The research also revealed the existence of higher concentrations of contaminants like chloride, total dissolved solids, sulphate, nitrate, calcium, sodium and magnesium.

Monitoring of 700 open wells  
2-6 meters of increase through water harvesting works



# Water balance of Village Lolasan



## Community Volunteers

Bhujal Jankaar and increasing role and acceptance over the period with farmers and with government :

- Chauhan Ajay P. a Bhujal Jankar (para-Hydrogeologist) of Lolasan village of Guhai command had got trainings on Water resource management and basic knowledge of Hydro geology and better agricultural practices .
- He had Prepared 5 thematic Maps of His village and presented in front of village institutions for validations
- He had done well inventory of Lolasan village under guidance of DSC. Now he is monthly monitoring water level and quality fluctuations of 19 selected wells and sharing results to villagers
- Became famous in his village for Water and Agriculture related information
- Gram Panchayat has started taking his services for surveys on soil-water management and other information related to agriculture.



[www.dscindia.org](http://www.dscindia.org)

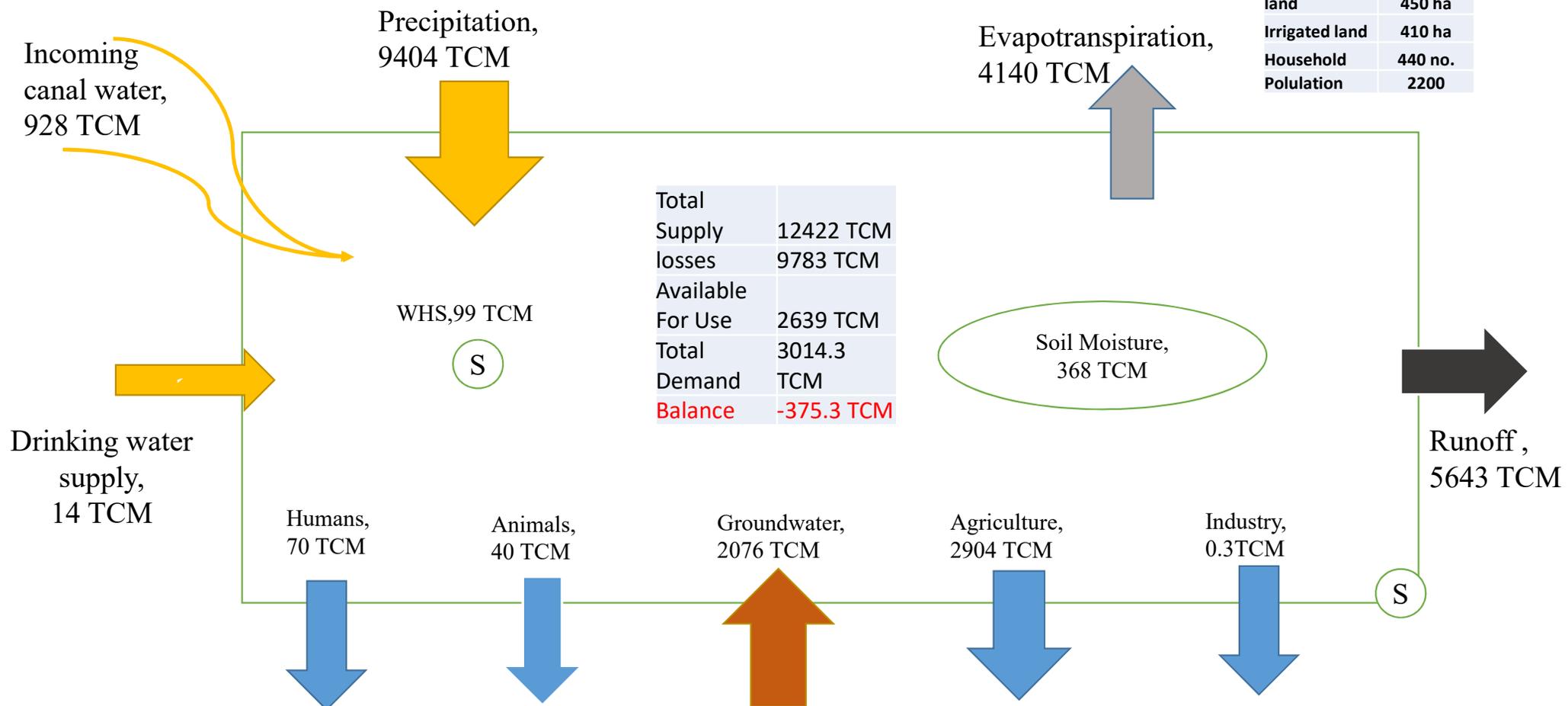




## Demystifying Science of GW

# Sample Water Balance

| Demographic Detail   |        |
|----------------------|--------|
| Village Area         | 546 ha |
| Cultivated land      | 450 ha |
| Irrigated land       | 410 ha |
| Household Population | 2200   |



# Key interventions-Soil and Moisture Conservation



Gully Plugs Holding Back Precious Silt



[www.uscinda.org](http://www.uscinda.org)

# On Farm Water Management & Soil Health management



## Adoption by farmers

- Narankaka has totally shifted to organic farming since last 3 years , now learning hub for organic farming in Sabarkantha district, Role model in nearby villages , also president of Organic farming committee of Sabarkantha district.
- Ashokbhai is producing more than 75 ton of vermicompst annually and has net income of Rs. 2.5 lakh
- Lalabhai ,a marginal farmer had increased his cultivable land through gradual leveling and adopted Mix cropping approach.



## Community Institution:

- Sujal Samitee of Javanpura,Dalilpur village had created new water resources for deprived and needy farmers.
- Sujal samitee of Dethrota and Lolasan are liasoning with Gram panchayat and Jilla Panchayat for creating and conserving Water resources and Demanding rain water recharge through Artificial recharge Technologies like Recharge shaft .
- Women SHGs of Garudi and Farmer clubs of Kolikhad and Rahiyol villages are Awarded as “best institution” by ATMA ,Aravalli district
- Sujal samitees and farmer clubs of Navalpur, Bhenshavda ,Rahiyol ,Ranshipur ,sobhashan had motivated more than 166 farmer members who had Adopted Drip irrigation in 298.38 hectares and Saved 4.39 MCM water through adopting set of water saving agricultural practice .



- 35 farmer clubs are preparing and using bio inputs vis. Jivamrut ,bio pesticide and Vermi-compost on their own.

# Behaviour change adoption

## Measurement



**Community Volunteers**

**40 Para Agri Workers  
and Bhujal Jaankar**

## Influencing



**Community Institution**

**22 Sujal Samittee**

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## Farmer to Farmer learning



**150 – lead farmers**

**89% (1684) farmer  
adopted direct  
interventions**

# What changed

## Water Security



**Water Supply – 22.35 Bl. Liters**  
**Water savings – 24.47 Bl. Liter**  
**1472.73 ha. added to command area**

**1470 farmers benefitted across 22 villages**

## Agriculture production



**Increase in production > 40 % in Cotton, Castor and Ground nut**  
**Change in on-farm practices**

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## Farmer led Agri. Enterprise



**Improved quality of produce**  
**Additional price realization – 1.2 Cr in 22 villages**  
**Farmer collectives, cleaning and grading of wheat, groundnut.**

***Cadre of Bhujal  
Jankars***





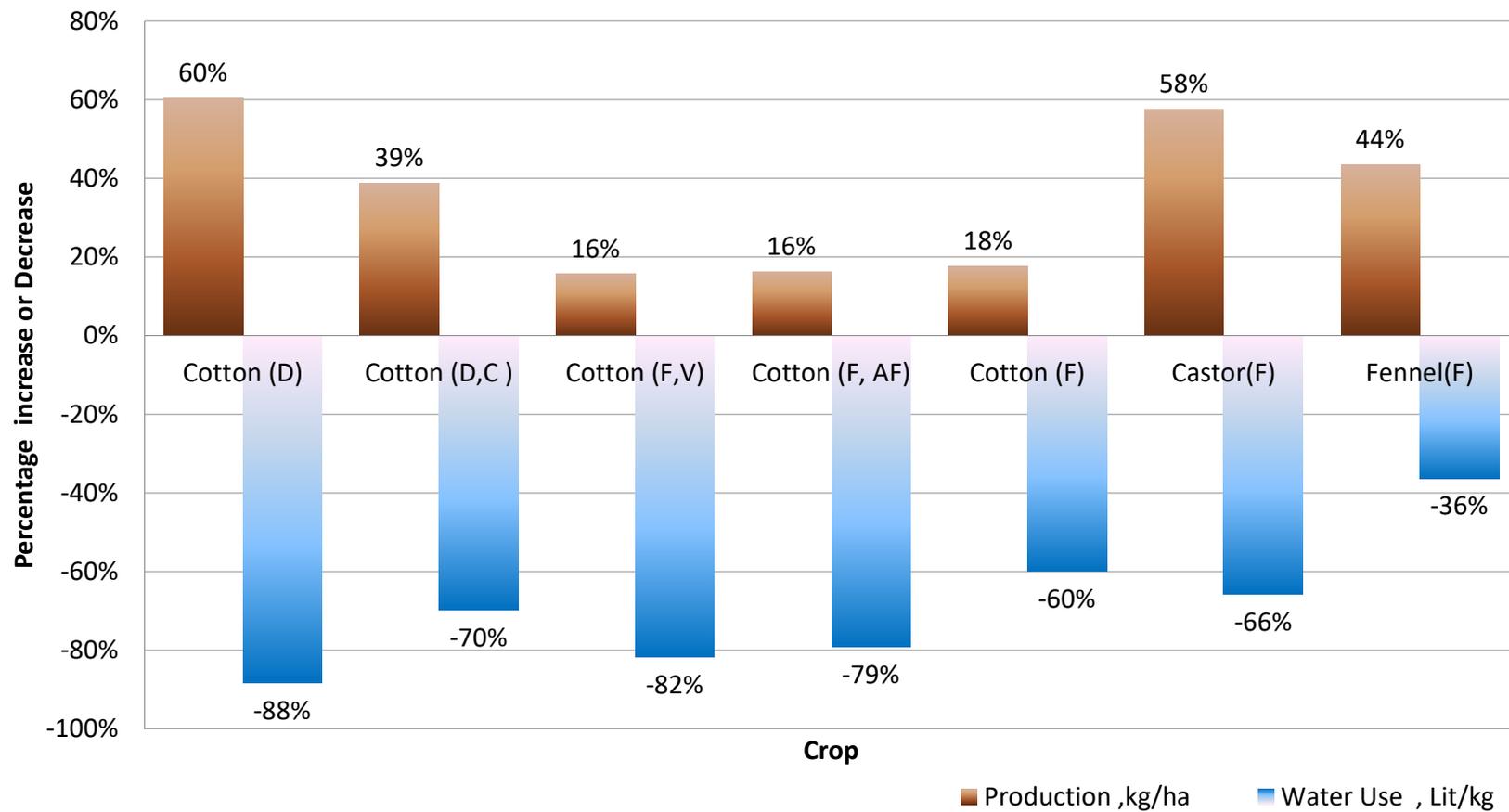
**Gujpro Agribusiness Consortium Producer Co. Ltd.**



**FAREMR COLLECTIVES FOR AGRICULTURE ENTERPRISE INCREASED PRICE REALISATION TO FARMERS**

| Water   | Agri   | No of farmers   | Quality of impact  |
|---|--|---|--|
| <ul style="list-style-type: none"> <li>• <b>29.75 MCM saved</b> through Demand side interventions</li> <li>• Average Reduced water use per Ha <ul style="list-style-type: none"> <li><b>Cotton :31.29%</b></li> <li><b>Castor :37.56%</b></li> <li><b>Ground nut:40.09%</b></li> <li><b>Fennel :26.38%</b></li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>8418.52 tons</b> increased production through Demand side interventions</li> <li>• Average increased production per Ha <ul style="list-style-type: none"> <li><b>Cotton :48.49%</b></li> <li><b>Castor :43.58%</b></li> <li><b>Ground nut:48.17%</b></li> <li><b>Fennel :29.39%</b></li> </ul> </li> </ul>                                 | <p>1893 farmers in the project area intended for coverage</p>                             | <p>Social capital-</p> <ul style="list-style-type: none"> <li>• 22 Sujal Samitee Conscious for all source of water</li> <li>• 20 Bhujal jankar</li> <li>• More than <b>150 Progressive farmers</b> acting as a resource for other farmers</li> <li>• More than <b>960 farmers</b> have new set of Knowledge</li> </ul> |
| <ul style="list-style-type: none"> <li>• <b>30.04 MCM saved</b> through <b>Supply side</b> interventions</li> </ul> <p><b>Average 12 ft and 7 ft increase in ground water level</b> in project villages of Mazum and Dhaori command area respectively</p>   | <p><b>More than 1600 farmers</b> adopted set of Good Agricultural Practices Viz.</p> <ul style="list-style-type: none"> <li>• For Irrigation :Combination of Drip, furrow ,short furrow ,alternate furrow for Irrigation</li> <li>• For soil moisture and fertility : use of vermi compost , FYM, Cultures</li> <li>• For crop : High yielding and short duration varieties</li> </ul> | <p>89%(1684)farmers adopting interventions from the base of total farmers in the area</p> | <p>Institutions and their role –</p> <ul style="list-style-type: none"> <li>• Prioritizing Women and marginal farmer during planning and execution of work by Inclusive Sujal samitees</li> <li>• Improved Water literacy</li> <li>• Under standing about Buffer water for future</li> </ul>                           |
| <ul style="list-style-type: none"> <li>• <b>1556 HA.</b> additional Command Area Developed due to water harvesting works.</li> <li>• <b>Increased canal reach in 4 villages</b> of Guhai command area</li> </ul> <p>Approx. 350 ha brought under canal Irrigation in last 3 year.</p>   | <ul style="list-style-type: none"> <li>• Improved quality of produce helped farmers to realize premium market price.</li> <li>• <b>Premium price of Rs.1 to 7 per kg</b> due to Adoption of post harvest technology Viz. grading in wheat</li> <li>• Increased milk production</li> </ul>  |   | <ul style="list-style-type: none"> <li>• Shift of Understanding form Individual water resources to collective</li> <li>• Increased Understanding that “Water is Limited Commodity “ and it requires conservation and management round the year</li> </ul>  |

### Average Change in Production and Irrigation Water use in Himmatnagar Cluster,



# Conclusion

- Public irrigation systems have their own limitations in terms of water supply and timeliness which often is not in tune with the requirement of farmers. Thus, the system needs to align and complement other water resources such as groundwater and surface water bodies in order to meet the requirement of farmers.
- The WUA cannot solely rely on transported water from the reservoir which is reducing. Thus they have to develop and manage local water resources to meet the increasing demand for irrigation.
- Since WUAs have only farmers from the command area as its members, they often alienate other farmers in the village. Thus, there is a need to have a more inclusive Water Users Association.

## **Moving Forward >>**

- *The **project model is replicable** for water scarce Rainfed and command areas in the country under CAWDM*
- *Designed process and implementation of tools – **Linking Surface and Ground Water** with availability and use for **community led change are available***
- ***Cadre of community resource persons** – Agri and Ground water- Cooperative for providing services to other departments and CBOs*
- *Adding value by **Backward-Forward Market linkages** to ensure **better water productivity** - Develop short and long value chain of agri commodities*
- *The NGOs and CSRs can be involved by creating multi-stakeholder platforms*



शाश्वत खेती-खुशहाल परिवार

*Thank you*



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