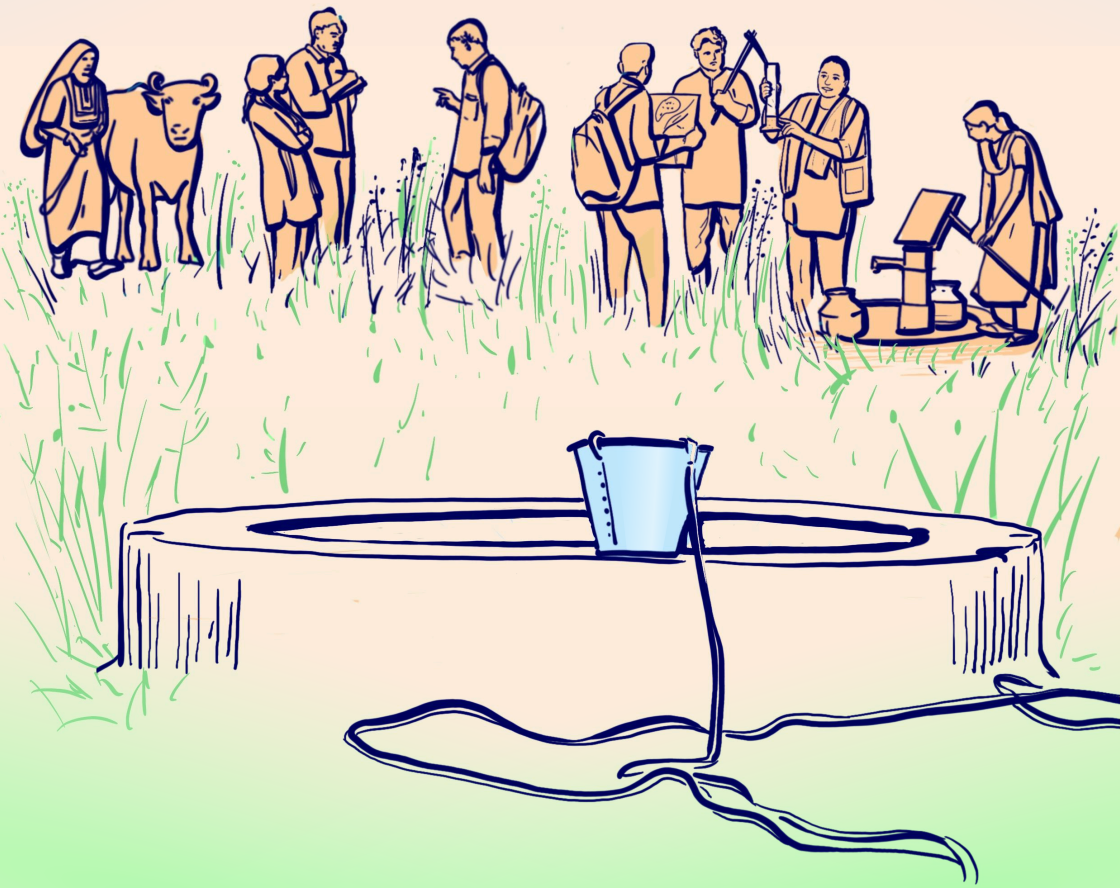
Community-led Water Management

Guide to a Sustainable Future



What need does the playbook address?

Large swaths of the country are facing severe water stress, largely due to over-exploitation of groundwater and surface water resources. Lower water availability leads to unequal distribution of water resources, lower crop yields during dry months, and issues of salinity and aridity of the soil. Addressing this issue requires community participation and behavioral change.

Rather than designing top-down schemes for agrarian water use, DSC emphasizes on community planning of water resources. The design of field assessments, community mobilisation, village-level water budgets, water recharge structures, monitoring and the participatory approach to water security planning best exemplify this.

Who can use this playbook?

Practitioners, Trainers, Community Resource Persons, Progressive Farmers, Subject Matter Specialists, Local Governance Representatives

This playbook is designed using the expertise of **Development Support Centre (DSC)**, which works on participatory water management and judicious use of water in Gujarat, Madhya Pradesh, Rajasthan and Maharashtra.

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These solutions by DSC have been designed and pioneered under the leadership of Anil Shah, founder chairman; Mohan Sharma, executive director; and Sachin Oza, former executive director. These community-empowering participatory technical and social processes in DSC`s 30-year journey led to the evolution of the approach to promoting community-led water security.

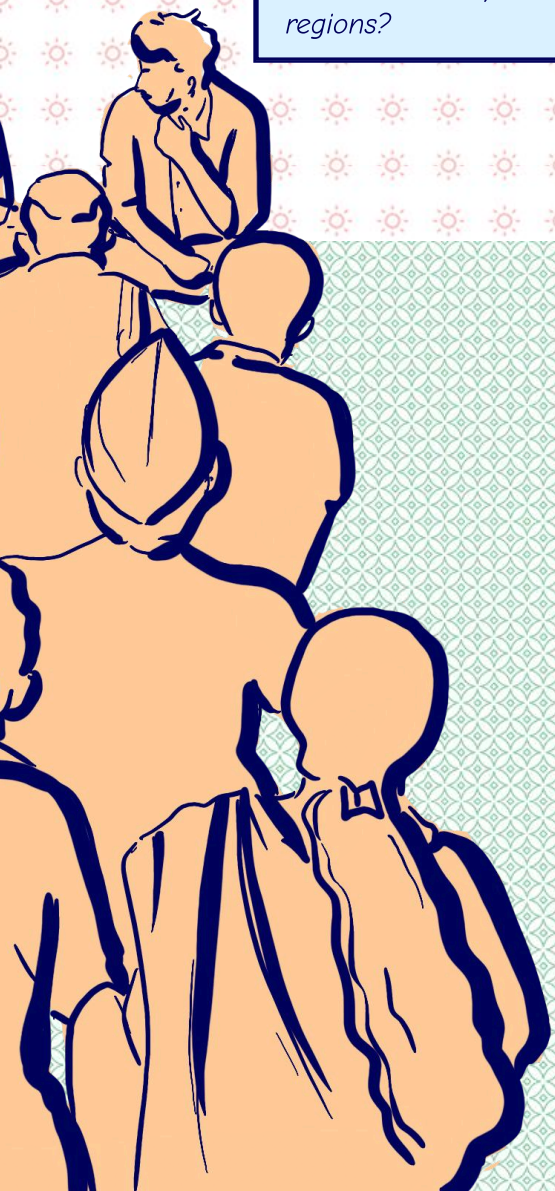
In this book you'll learn to

- Understand your village's water needs and resources
- Get involved in water management
- Prepare water budgets
- Plan for water security
- Replenish groundwater by building recharge shafts
- Monitor water resources
- Cooperatively manage irrigation


Today we have gathered to talk about the water situation in our village. Let's see how deep is the water.
How many of you had lower crop yields in this dry season?

Did any of you notice that the soil is getting arid because water is saline?

Did some of you feel you received less water than your neighbouring regions?



Did you know if we manage our water properly we can solve these problems of irregular water supply and quality? So, how do we do it?

1. **Understanding Your Village**

   We start by understanding the water resources available to the village, collective assessment of the issues like quality and access of water in our village.

2. **Getting Involved**

   People from the village are the best to manage their water situation. There are various roles you can take to participate in the process.

3. **Water Budgeting**

   The first step is to calculate our water supply and water needs to get an idea of the deficit that we need to plan for.

4. **Water Security and Planning**

   We then work to increase access to water and to reduce our agriculture demand to ensure there is parity in water supply and demand.

5. **Increasing Water Security**

To improve our water security we can build groundwater recharge shafts to direct excess rainfall towards replenishing groundwater levels. This is a climate smart technology.

6. **Well Monitoring**

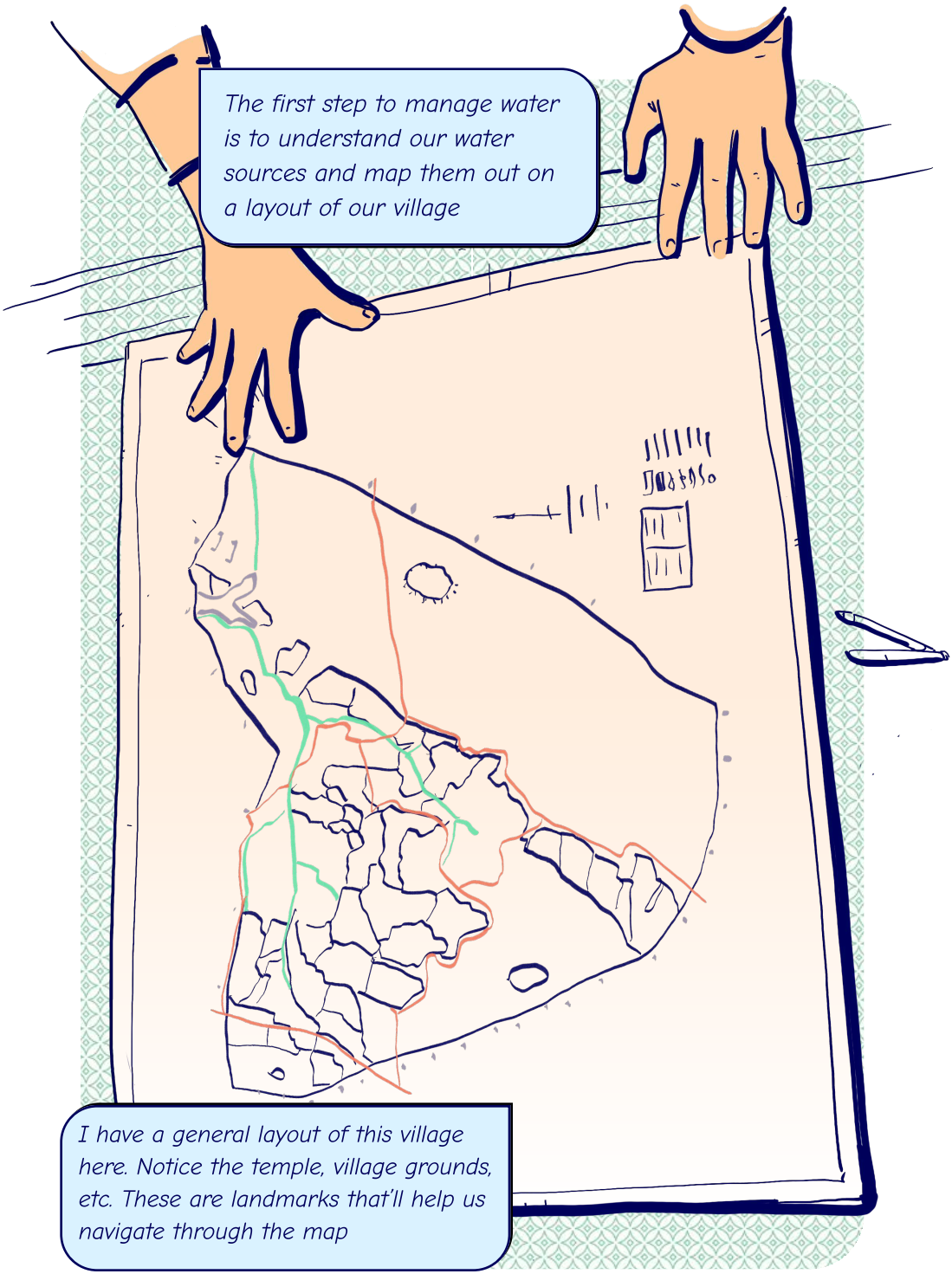
We need to keep monitoring the water levels and quality of our wells on a regular basis to be proactive in solving our water issues, and for response to emergencies.

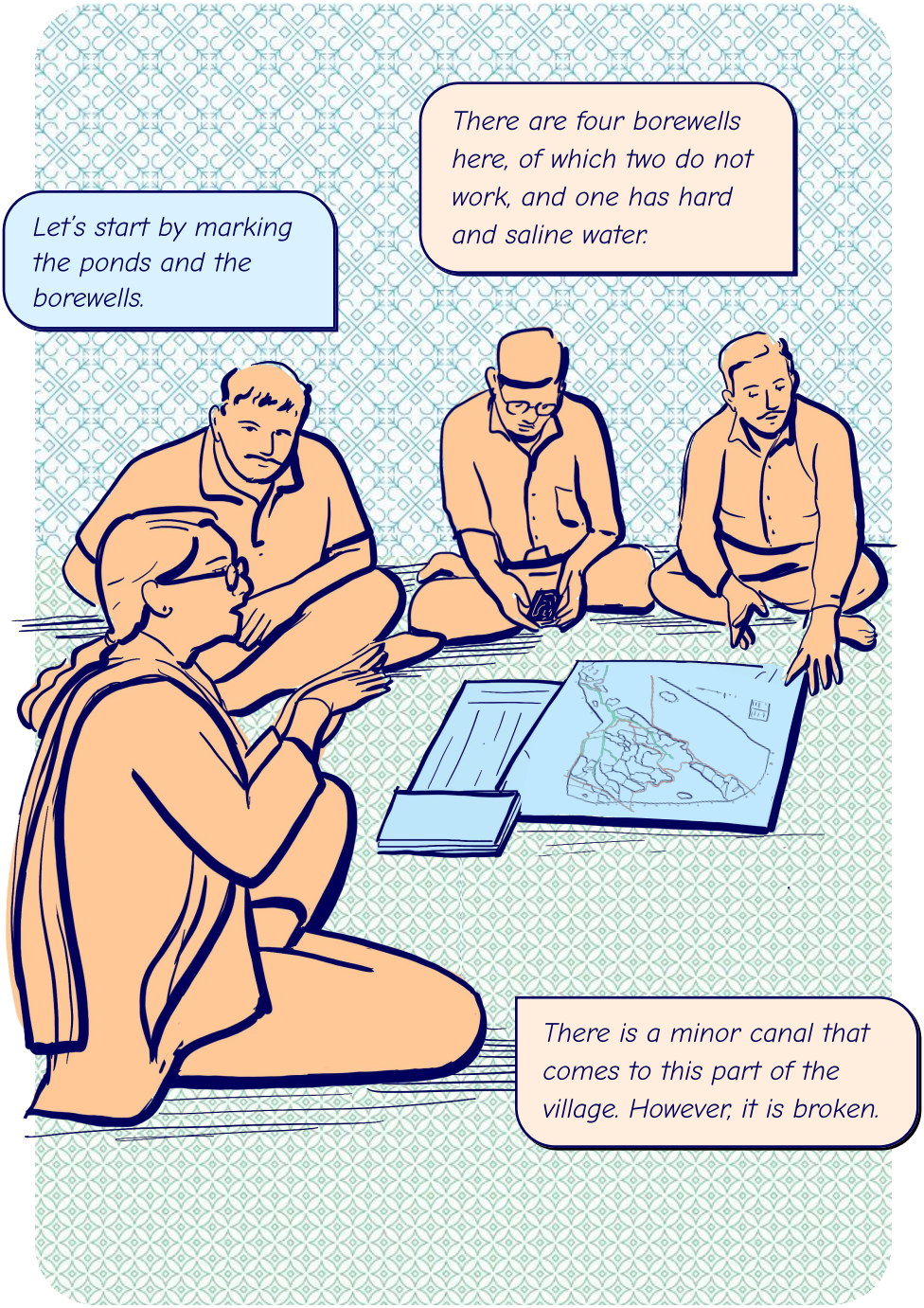
7. **Participatory Irrigation Management**

We need to ensure equitable distribution of water across the village in canal command areas.

1.

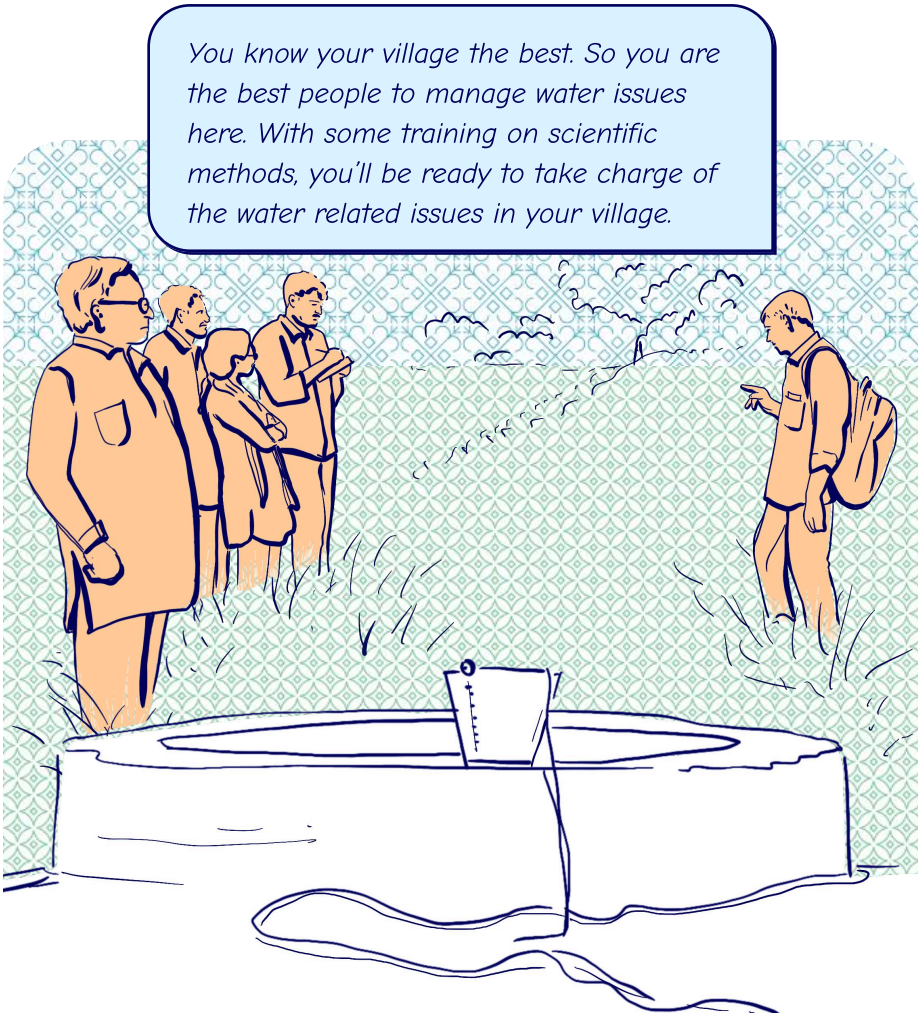
Understanding your Village


The first step to manage water is to understand our water sources and map them out on a layout of our village
I have a general layout of this village here. Notice the temple, village grounds, etc. These are landmarks that'll help us navigate through the map


There are four borewells here, of which two do not work, and one has hard and saline water.
Let's start by marking the ponds and the borewells.
There is a minor canal that comes to this part of the village. However, it is broken.

On a walk through the village...


They grow cotton and wheat in this land since the last two farming seasons. Next to this, the farmer grows marigold and groundnuts.


You know your village the best. So you are the best people to manage water issues here. With some training on scientific methods, you'll be ready to take charge of the water related issues in your village.

Building Rapport with Villagers as an Outsider

- Initial visits to the village should be informal to help villagers become familiar with us and our organization.
- Engage in general discussions, following up on any issues they mention, such as the canal system or irrigation.
- Understand the village's power structures and involve individuals from all communities in conversations.
- Approach the villagers as friends, avoid any sales-like tactics, and be patient as trust is built.

Participatory Rural Appraisal (PRA) Activities

- PRA includes various practices to gather information in rural areas and typically takes 2-3 hours.
- Schedule PRA activities at convenient times for villagers, and identify 3-4 proactive individuals to help invite others. On average, an activity will take 2-3 hours. If an activity is incomplete, it can be continued later.
- Choose a venue that accommodates atleast 30 people, ensuring it is not too open to avoid drawing a crowd and onlookers.

Making PRA Meetings more Inclusive

- Invite participants from all communities by selecting key individuals who can mobilize their peers.
- Include experienced farmers and village elders, both men and women.
- Aim for at least 15-20 participants representing different communities for activities like Focused Group Discussions (FGDs) and Mapping Exercises.

2.

Getting Involved

You can become part of your village's water management in several different ways

1. **Join the Village Water Committee**
   A committee of people who are actively involved in solving water issues in the village

2. **Become a *Jal Saathi***
   Jal Saathi are trained para professionals from the local community

3. **Volunteer**
   Volunteers support in creating awareness, monitoring water issues, and giving ideas to solve them

Village Committee

How to select members for the village committee?

- Committee size can be between 9 and 13 members
- Ensure equal representation of women in the committee
- Representatives from all major communities in the village should be included
- Include CBO representation like SHG members & Panchayat representatives
- Ensure representation from all hamlets/areas in the village
- No person with direct political affiliation should be taken

Jal Saathi

Are you enthusiastic to monitor water issues in your village?

Are you well-versed with the village?

Are you good at reading and writing?

Do you have education till 10th or 12th standard?

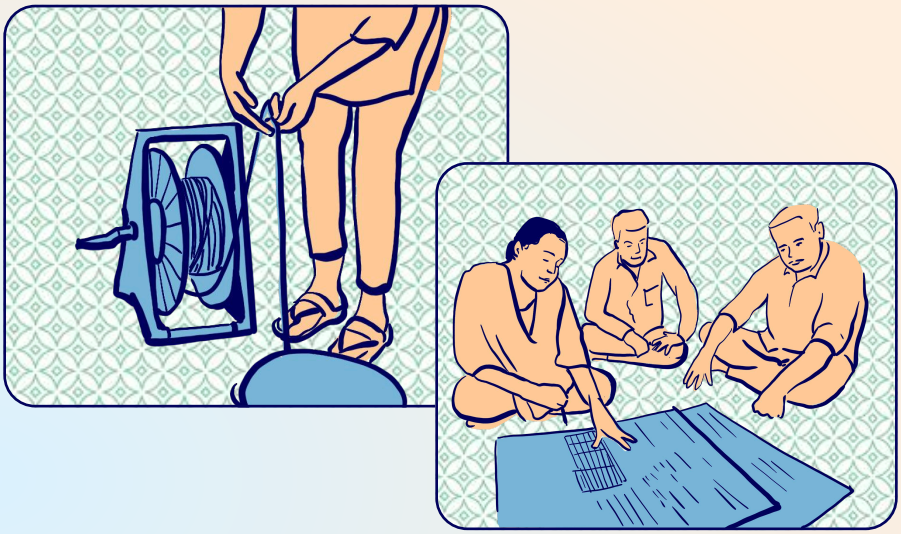
Are you below 40 years of age?

Apply to be a Jal Saathi *today and steer the water management of your village*

All genders encouraged to apply!

What you will get as a Jal Saathi

- Per-day honorarium to compensate for your time and efforts
- Training for 6 months to become a Jal Saathi
- Capacity building, skilling recognition and networking in social circles which helps in career growth
- Exposure to work with government departments and other stakeholders



What you will do as a Jal Saathi

- Gather and maintain data of water sources and consumption in a village
- Geo-tagging
- Monitor overexploitation of groundwater, pollution issues
- Monitor impact of salinity, hardness, alkalinity, acidity on agriculture and drinking water
- Present findings to the village committee
- Assist the organisation in other convergence activities with government departments and other stakeholders

Volunteer

Do you have ideas on how to solve water issues in your village?

Want to oversee the solutions for water management?

Volunteer with the Village committee

and help the village achieve our water goals!

3.

Water Budgeting

Why should we do water budgeting? Let me explain.

- *Water budgeting helps in **increasing awareness** of water needs in a village, by creating a baseline of water supply and demand in the village*
- *Water budgets can help in facilitating proposals to **attract developmental projects** through CSR, philanthropic initiatives, government aid, etc.*
- *A thorough assessment of water helps in **framing conservation initiatives***

When should we be doing it?

*The best time to do the water budgeting exercise is about two months before the annual panchayat plans are made. This way, any solution that arises from the discussion can be incorporated in the panchayat budgets for the year. Best time to make the budgets is between **February to June**, right after winter season. Water budgeting should be done every year.*

How much time does it take to do the exercise?

*On average, it can take **15 days to 1 month** to develop a water budget and present it to the committee. Hand-holding and mentoring of Jal Saathi through data collection and calculation phase is recommended.*

How do we get started?

Water budgeting is done in three steps:

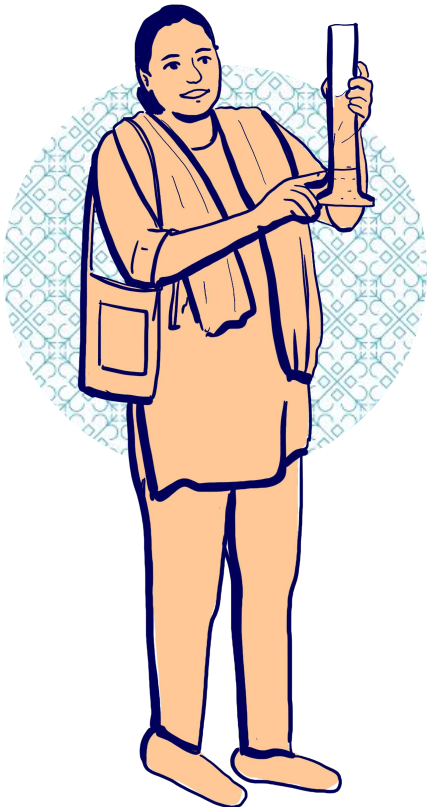
1. ***Collecting Data***
2. ***Calculating Supply***
3. ***Calculating Demand***

The Jal Saathi plays a crucial role in this activity

1. COLLECTING DATA

Jal Saathi goes around the village collecting the data below:

- Village inventory of tube-wells, bore-wells, open wells, ponds, check dams, recharge shafts
- Village demographic information
- Tabulating water sources

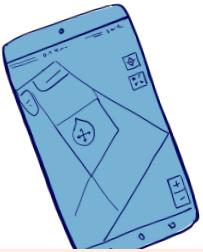


VILLAGE INVENTORY DATA

At a bore-well...

How deep did you drill that borewell? And do you get water throughout the year?

At a pond, using the Field Measurement App...

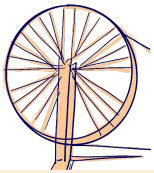


How deep is that pond and how many months of the year does it have water?

Hmm, if the pond is 10 feet in depth (3m), and my app is showing an area of 2.93 ha (29,300 sq.m.), then the volume of water it stores is around 8.79 lakh litres.

VILLAGE DEMOGRAPHIC DATA

At the Village Industry...

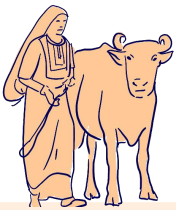


What is your annual water consumption for the year?

At the Panchayat Office...

Can you give me information on population, size of the village, crops sown, area of sowing, number of households, types of land?

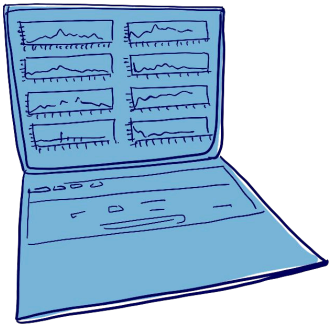
At the Animal husbandry...



How many livestocks do we have in the village? What kind of livestock do they own?

WATER RESOURCES DATA

At the Indian Meteorological department...



Indian Meteorological Dept. has annual rainfall data for upto 10 years for the region

At the Irrigation department...

How much water has been released into the minor canal in our village this year?

2. CALCULATING WATER SUPPLY

Jal Saathi presents, at the village committee meeting

After nearly one month of gathering data, I can present to you my findings. Let us start off with **water supply.**

Rainfall last year

750mm

Size of our village

1,072 hect

Total Water received = 750 x 1072

= 8,04,000 cubic meters *or* 16,08,000 tankers*

Now let us look at where does this water go

45%	20%	25%	10%
is lost to evaporation	runs off from our village in streams	is absorbed as the soil moisture	seeps through the soil and recharges our groundwater

If you look at this, it is clear that the water we can use in the village is whatever is absorbed by the soil and what is recharged. Which means, we can use

4,02,000 + 1,60,800 = 5,62,800 tankers

25% *of* 16,08,000 + 10% *of* 16,08,000

** 1 tanker = 5000 litres of water, read explanation for more details.*

We have **two ponds**, so let us calculate how much water is stored in each.

First pond is of an area of 0.22 hectare. It's depth is around 4 feet. But since water is not full in this pond throughout the year, we will consider the average capacity of 60% or, around 2.4 feet (which is 730mm). So our pond can store:

$$0.22 \text{ ha} \times 730 \text{ mm} \times 2^{*} = 351 \text{ tankers}$$

Similarly, the second pond stores: 236 tankers. We will add this to the water we get from the rain. So, in total, the village can get...

5.63 lakh tankers

** Read explanation*

Explanation for the calculations

CONVERTING TO TANKERS

For easy understanding, all volume measurements should be converted to tankers. In this case, DSC assumes 5000L per tanker, which is the most common form of water tanker in Gujarat. If the units for area is in hectares and for water is in litre (or mm when rainfall is measured), then, one has to multiple by 2 to get volume in tankers. e.g:

750 mm * 1,072 (ha) or 0.750 m * 1,07,20,000 sq.m. = 80,40,000 cubic meter

1 cubic meter = 1,000 litres & 1 tank = 5,000 litres. So, 1 cubic meters = 0.2 tanks

80,40,000 cubic meters = 16,08,000 tankers.

EVAPORATION AND OTHER LOSSES

This varies from region to region and should be calculated using secondary research. For instance, in hilly regions, 50% can be run-off, while less than 10% will be absorbed by the soil. These assumptions, research and calculation should be done by the technical staff in an organisation and then communicated to the *Jal Saathi* (Community Resource Person). In Gujarat, where DSC works, the soil is porous. Soil moisture absorption and recharge potential is very high here.

3. CALCULATING WATER DEMAND

Jal Saathi continues to present water demand to the committee..

Now, we'll calculate how much water **we need**

1. HOUSEHOLD

We have 3,770 people in the village, and each person consumes average of 80 litres of water daily.

3770 × 80 × 365 = 11,00,84,000 litres

If we have to divide this into 5,000 litres tankers, then we need 22,016 tankers of water.

2. INDUSTRY

We have three small scale industries and dairies. My enquiries show that they take holiday for just 2 days a year.

1st 270 litres × 363 = 98,010 litres 19.602 tankers

2nd 100 litres × 363 = 363000 litres 7.26 tankers

3rd 80 litres × 363 = 29040 litres 5.9 tankers

3. LIVESTOCK

The census of livestock was taken from the veterinary doctor in the village. Here, I have shown how much water is needed for each animal:

LIVESTOCK	WATER NEEDED PER DAY (LITRES)	TOTAL NO. OF ANIMALS	TOTAL REQUIREMENT. (LITRES)
Cow	50	806	40,300
Bull	60	625	37,500
Bullock	30	15	450
Horse	25	2	50
Camel	40	4	160
Goat	6	127	762
Total	**211**		**79,222**

Overall, our livestock need 79,222 litres per day.
For one year, we need 2.89 lakh litres *or* 5,783 tankers

Explanation for the calculations

HOUSEHOLD WATER DEMAND

For the number used by DSC is 80 litres, but this changes in regions. It could be less than 70 litres (in water stressed regions) to above 130 litres (in more prosperous regions).

Household surveys where water usage patterns are observed can give an approximate consumption of water.

LIVESTOCK WATER DEMAND

This again, depends on region, type of breed and animal husbandry practices. DSC makes these assumptions based on research by agriculture and veterinary researchers in Gujarat. A thorough literature review by technical team or subject matter experts can bring out approximate values of daily water consumption for different types of livestock. This information can be procured from the veterinary department and experts in other areas.

Now, we'll calculate how much water we need for **agriculture.** I have taken this information from the agriculture department and the gram panchayat. Here, we have a list of all crops in Kharif, Rabi and Zaid seasons, the approximate hectare that it is sown in, and water requirements in each hectare

CROP	HECTARES SOWN	WATER NEEDED PER HECTARE (litres per hectare as per Gujarat govt standard calculations)*	TOTAL WATER REQT. (L)	TOTAL WATER REQT. (M^3)
		KHARIF		
Cotton	100	500	50000	50
Castor	145	500	72,500	72.5
Vegetables	25	620	15,500	15.5
Fodder	50	350	17,500	17.5
		RABI		
Wheat	165	520	85,800	85.8
Mustard	70	350	24,500	24.5
Tobacco	2	630	1260	1.26
Vegetable	23	620	14,260	14.26
Potato	5	400	2000	2
		ZAID		
Bajra	70	650	45,500	45.5
Fodder	15	650	9,750	9.75
Jowar	30	650	18,500	18.5

As you can see, our calculations show that we need 7.41 lakh tankers of water just for agriculture. If we add household and livestock demand, we need at least 7.68 lakh tankers of water

**This data is available with all agricultural universities, KVKs, and agriculture dept. in your area*

Explanation for the calculations

AREA OF CROP SOWN

Through experience, DSC has found that there is often a mismatch between actual crop sowing area in a village and what is recorded by the agriculture department. It is good practice to verify the area of sowing through village committees.

AGRICULTURE WATER DEMAND

The water demand for crops and farmland varies widely between regions, and even between villages. It is dependent on soil types and farming methods. The kinds of seed varieties grown, use of pesticides and fertilisers, soil moisture content also play a role.

The calculations for crops and water use can be obtained through research by local state agriculture universities.

In subsequent years, *Bhujal Jankaars* and *Jal Saathis* can be trained in using flowmeters to calculate the water usage per season for a crop in selected farmlands in his village.

Jal Saathi concludes..

As you can see, our village receives around 5.63 lakh tankers of water every year; while, the demand is around 7.68 lakh tankers. This means we are ***falling short of 2.05 lakh tankers*** of water.

This tells us that we are over-exploiting the precious groundwater reserves available in our village!

4.

Water Security Planning

Why should we do water security planning? Let me explain.

- *Water Security Planning helps contribute towards **behavioural change** allowing for faster adoption of water sustainable practices*
- *It can also lead to **equal distribution of water** resources and increase agrarian incomes through better water use planning*

*A normal rain year is where the amount of rainfall received in that year is considered average or typical for a specific location, typically calculated over a period of 30 years.

This is quite shocking. I didn't know we are in so much of a deficit.

I thought washing dishes and household work consumes more water. But this is clearly showing that agriculture is the biggest consumer of water.

This is why groundwater levels are falling. We are extracting more water than is being recharged.

What should we do about this?

To ensure there is parity in water availability and demand, we can work on multiple programmes to increase supply of water and to optimise our agriculture water demand.

This is called ***Water Security Planning****.*

For instance, we can plan to build a recharge shaft or a check dam. We can also desilt ponds and create farm ponds to store water that would otherwise be running off to neighbouring villages.

We would need committee's help to identify the right spots to build these solutions

We can certainly help with finding ideal spots that will help a large number of farmers. We can also convince other villagers to help or follow-up with gram panchayat to execute this..

It is also important to reduce the water demand in agriculture.

You mean, drip irrigation? It is expensive to implement

Drip irrigation is a good way, but not the only solution. There are multiple ways one can save water in agricultural fields by using on-farm water management, like:

- *Straw Mulching,*
- *Alternate Furrow System,*
- *Developing Farmer Support for Change, and*
- *Planting low water requiring crops*

Straw Mulching

Cotton waste (that is, plant that are left over after harvest of cotton) or paddy straw can be dried and used as mulch.

Pile the dried waste around saplings. This reduces loss of soil moisture.

If done effectively along with alternative furrows, it can reduce water usage by more than 50%.

BENEFITS:

- Sustainable, low cost
- Reduced water usage
- Removes the need for disposal of agricultural waste
- Maintains and enriches soil health

Alternatives: Plastic mulch sheets (which are used for drip-irrigation systems) can also be used in case the farmer uses agricultural waste as fodder. However, its not an ecologically friendly model as the residues can lead to land degradation.

Alternative furrow system

In this system, a furrow is created in the spacing between rows. The mud removed is piled to create a raised bed that is about 1 feet in height above the furrows.

Water is let into every alternate furrow at a time (that is, in one watering, every alternate furrow is closed.)

Ideal for plants that require a wider spacing between rows of crop such as cotton or castor.

BENEFITS:

- Saves water usage by about 40%, without affecting yields.
- Prevents overwatering of the plants that can lead to crop-loss, soil erosion and increased soil salinity.
- Reduces pumping costs and can lead to lower fertiliser costs for farmers.
- Since furrows are shallow and wide, it can used effectively for cotton. cultivation which needs space for tractors to move between rows of the crop.

Developing farmer support for change

Demonstration plots can be made with the help of enthusiastic farmers. For each method of water conservation, create two plots: one with measures adopted (demonstration plot) and one without (called, a control plot)

Farmers can be trained in noting down measurements using a cutthroat flume. Measurements are noted for each irrigation cycle in demonstration plot and control plot.

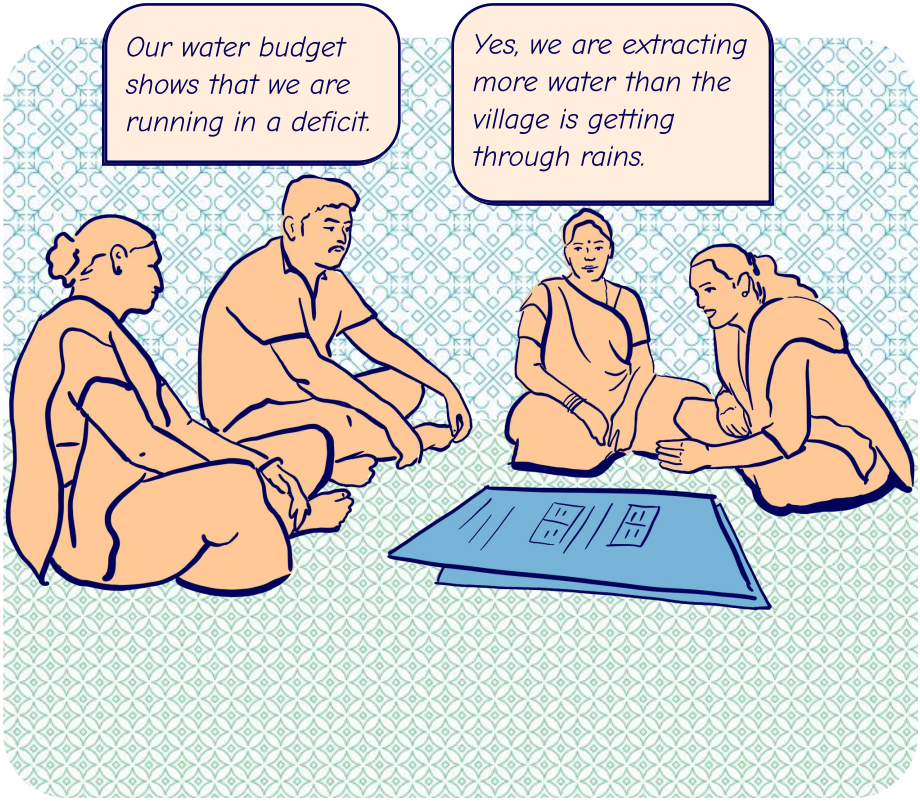
The average water consumption reduction for one crop during one season can be compared between the plots. This can be discussed with farmers and inculcated in the water budget for a village.

5.

Building Groundwater Recharge Structures

Why should we build groundwater recharge structures? Let me explain.

- *Groundwater Recharge structures can be a **sustainable way to replenish** falling groundwater levels*
- *It ensures **excess run-off** is directed into the sub-strata where it raises groundwater levels*
- ***Groundwater recharge shaft** is a new technology, which is climate efficient and best suited for community level interventions*


Our water budget shows that we are running in a deficit.
Yes, we are extracting more water than the village is getting through rains.

One way of lowering this deficit is to tap the rainwater run-off.

Right now, it is flowing out of the village, but we have to find a way to conserve water on surface or underground appropriately.

The area near the village pond always floods over in the monsoons, but borewells in the region dry up a few months after that.

We could build a recharge shaft there for underground recharge.

Yes, Recharge Shafts can be a sustainable way to replenish falling groundwater with many other benefits:

Direct excess rainfall towards recharging subsurface groundwater

Control inundation and water-logging in surrounding farms

Defunct wells nearby can also be replenished

Provide sufficient soil moisture and augments well and borewell levels during summer months, allowing farmers to reliably harvest crop even in other seasons

Improve the overall quality of water being extracted from bore-wells in the vicinity, leading to better crop yields and better soil health

We need to form a committee to build the recharge shafts. They will be responsible for the following tasks:

- *Finding suitable sites in the village*
- *Convincing other villagers to help*
- *Following-up with Gram Panchayat for execution*

We are excited to be part of the committee and steer the process of building recharge shafts in our village

SITE SELECTION

Finding a suitable recharge shaft site

JOINT SURVEY

Conduct a joint survey with geo-hydrologists, engineers, water committee members, farmers, water department officials, local NGOs working in the area.

IDENTIFY PLACES

Identify places where water accumulates during the rains: this could be ponds, big check dams or big depressions.

CHECK WATER AVAILABILITY

Amount of water and duration of water stored in a pond and check dams can be found through informal surveys with community members. Only ponds or check dams where water is typically available for atleast 6 months are considered to be ideal sites for recharge shaft.

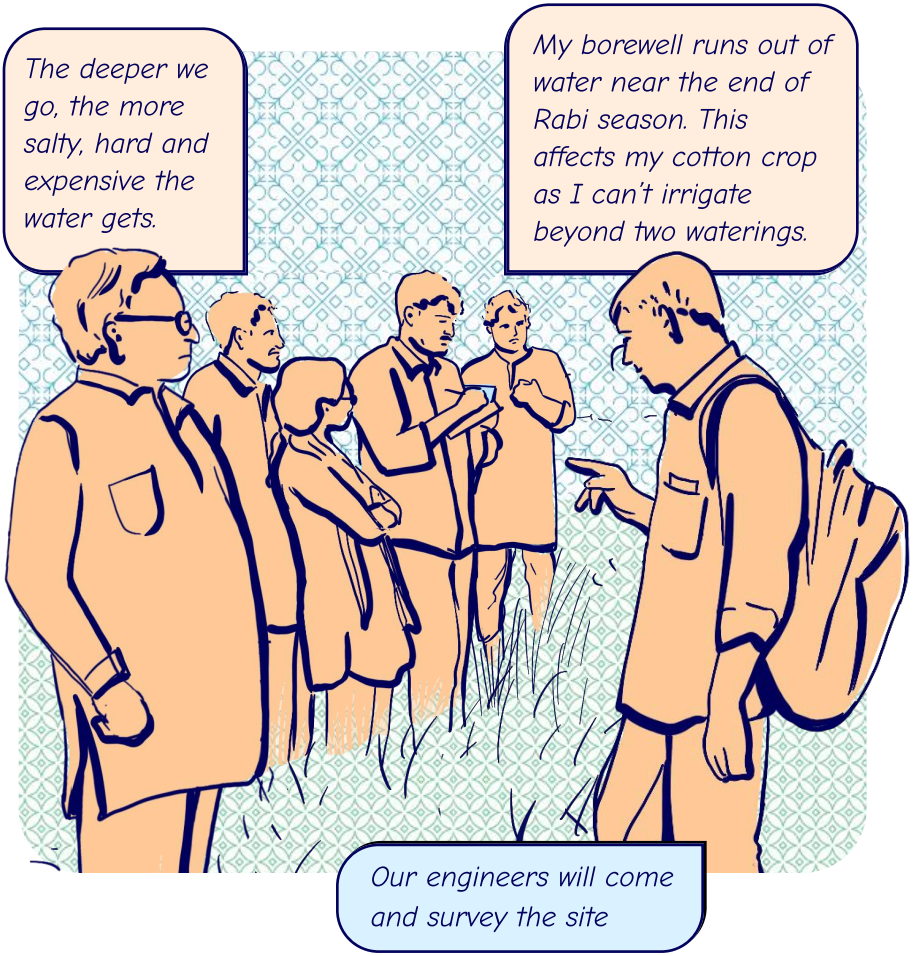
OPTIMISE FOR BENEFITS

If multiple places are chosen, then conduct a survey to find out how many borewells are within 1km radius. The place with the most number of borewells (defunct and active) and most farmers nearby will be ideal

Farmers can also be asked if their defunct borewell can be converted to a recharge shaft. This is low-cost and can be done in multiple places.

Where NOT to build a recharge shaft

- In ponds or tanks which are used for drinking water for villagers or livestock. The recharge shaft may cause this source of surface water to dwindle
- In places where water runs off quickly and does not stay stored there for long periods
- Close to oil wells or polluting industries
- In hilly areas or places where hard rock prevents deep tube well drilling


The deeper we go, the more salty, hard and expensive the water gets.
My borewell runs out of water near the end of Rabi season. This affects my cotton crop as I can't irrigate beyond two waterings.
Our engineers will come and survey the site

Technical analysis of recharge shaft site

There are numerous aspects for engineers and hydrologists to focus on when studying a field site:

METEOROLOGICAL CONDITIONS

HOW DOES WATER ENTER THE RECHARGE SITE?

- Rainfall pattern (Indian Meteorological Department data or state meteorological department)
- Evaporation losses from the area
- Surface (canal) network in the region (if any)
- Municipal or industrial wastewater flow to the village (if any)
- Chemical quality of water that will potentially enter the recharge site (includes a survey of nearby farms on the amount of fertiliser and pesticide used that could come in the run-off)

SOIL CONDITIONS

DOES THE SOIL/GEOLOGY ALLOW FOR RECHARGE?

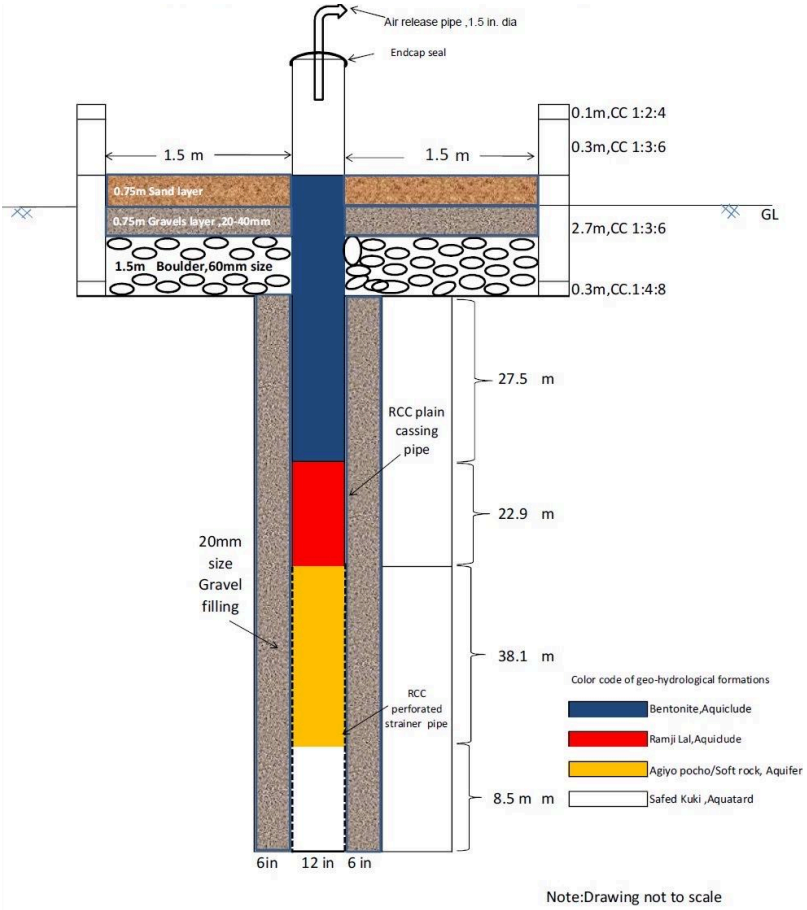
- Rate of soil infiltration (determined through cylinder or flood infiltrometers)
- Relation to the changes in the soil structure and the biological phenomena which take place when infiltration begins

SUB-SURFACE CONDITIONS

HOW DEEP SHOULD THE RECHARGE SHAFT BE?

- Regional hydro-geological maps, including water table contours if necessary
- Sub-surface hydro-geological units, their thickness and depth of occurrence (Geological Survey of India; Central Groundwater board data)
- Depths to the water table (DTW) for the periods of the maximum, minimum and mean annual position. This can be found by consulting with farmers and villagers who have borewells near the potential recharge site.

DESIGNING THE RECHARGE SHAFT



Design Diagram of Recharge Shaft in MALAI pond of village Dedhrota
Image source: Development Support Center

Depth of the recharge shaft can be estimated by surveying depths of nearby borewells and consultation with farmers on the type of rock where groundwater baseflow occurs. Depth of the shaft should penetrate the overlying low permeable layer. It is not necessary to reach the fissures that contain groundwater flow.

Above ground

CONCRETE WALL WITH MESH FENCING

This prevents trash from entering the recharge shaft. It also stops livestock, wild animals from entering and dirtying the recharge shaft.

FILTERING MEDIA

A series of layers of sand, grit and rock filter the water before it enters the recharge shaft. All materials should be locally sourced.

LAYERS

The first layer should be grit, followed by small rocks and then larger rocks in the final layer.

Layers can be 3 or more. The thickness and number of layers is determined by the silt in the incoming water. The muddier the water, the thicker the filtering medium

Below ground

RECHARGE SHAFT

Shallow shafts can be manually dug, with a maximum diameter of 2m.

If the soil caves in (that is, it is porous and unstable), then a lining should be made while digging it in.

For deeper aquifers, shafts can be drilled by direct rotary or reverse circulation method (just like normal tubewells). Diameter should not be more than 1m.

LINING

If manually dug or digging in soil that does not cave in, lining can be boulders/ cobble stone.

For deeper aquifers, the shaft is lined with RCC casing: plain casing at the top, and perforated casing in the bottom of the shaft to allow for water to trickle into the aquifer.

COMMUNITY INVOLVEMENT IN CONSTRUCTION AND MAINTENANCE

Village Water Management Committee

- The water management committee in the village supervises the construction of the recharge shaft.
- Water committee can allocate labour from within the village for construction of filter media and concrete wall.
- They should undertakes periodic cleaning of the lake, particularly removal of excess silt that may clog the recharge shaft

Beneficiary farmers

- A sub-committee of beneficiary farmers, who have borewells within 1km from the recharge site, is formed.
- A plan to take contributions from them for the construction of the recharge shaft can be made. For instance, on an average for the dimensions of 300mm diameter, depth of 200 ft - 450 ft (Varies with regional geography) and 10ft diameter, building a recharge shaft can cost anywhere between Rs. 2.5-4.5 Lakhs. In this case contributions from the 60-70 farmers around this site can be a total of Rs. 25,000.
- The sub-committee should also ensure the surroundings of the recharge is periodically cleaned.
- The filter media is to be removed and periodically cleaned before the rainy season. Organic mass (like moss or fungi or small plants) growing in it should be removed, the material soaked and cleaned in clean water and then replaced.

Bhujal Jaankar/ Jal Saathi

- Regular monitoring of water levels, Ph levels, TDS and Electrical conductivity in borewells from near the recharge shaft.
- Monitor and record increases in crop productivity, availability of water in lean season can be recorded through surveys of farmers. Success of the recharge shaft can be communicated to the wider community.
- A formal or informal agreement must be executed among the farmers for post construction equitable use and maintenance.

6.

Well monitoring

Why should we monitor the wells on a regular basis? Let me explain.

- *Well monitoring within villages can be a powerful tool to raise **awareness** about the lowering water quality in wells and monitoring groundwater levels*
- *By conducting these measurements in front of villagers and by involving them in discussions about water quality trends, organisations can set the stage for long-term behaviour change towards **sustainable irrigation practices***

Our water supply might change over years? How do we prepare ourselves better for our future needs?

We need to keep monitoring water levels and quality on a regular basis to identify and solve our water issues proactively.

That's right. Regular monitoring of wells helps us to be better prepared to manage out water situation

*It is important to create a **baseline** of water quality and levels in wells to measure and compare values. This helps us prioritise interventions and take decisions in time.*

For instance, if we notice the lowering or a rise in water levels or increase in salinity recorded in tube-wells, we can plan to construct recharge shafts and farm ponds or, if there is high concentration of nitrates in wells, we need to use start using fertilisers judiciously.

Well monitoring is an important step in the scientific analysis of a village's water situation using locally-generated water data

*I have spent over a month getting **technical training** on how to carry out well monitoring in our village. We had eight modules that covered several important topics including*

- *Mapping Water Resources*
- *Land and Water resource analysis*
- *Geo-hydrology*
- *Water balance analysis*
- *Groundwater Fluctuation Analysis*

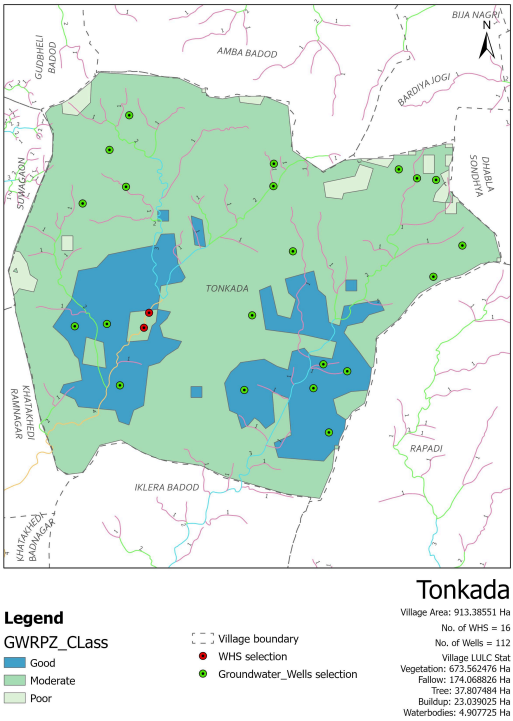
*And, I have received **water testing kits** which include:*

1. *Movable Rain Guage*
2. *Well-Measurement tape:*
    a. *30m tape for open wells*
    b. *Well-monitoring sounder* with sensor at the end of the tape and speaker near the head to announce water level.*
3. *TDS meter or Ph meter for water quality testing*
4. *Record Book for registering the numbers*
5. *Bucket for water sampling with rope*

** Sounder is an advanced and expensive device. The testing can be very well done with measuring tapes as well.*

Preparing a map of village wells

- A detailed study of village wells (open wells and borewells) is conducted.
- Wells are plotted on a maps of the village
- Approximate depth is noted based on interviews with well owner
- Layers of soil, stone and clay around the well or extracted during the drilling of the well should be noted on the map



Map designed by Kaushal, Development Support Center

Selecting wells for routine measurement

- After making the map, 4-5 wells are chosen for routine measurement.
- One well in each direction of the village (that is, one well in the north, south, each and west of the village) and one well in the centre of the village is chosen for measurement.
- Wells with different soil layers or uses are chosen, if possible
- Check dams, recharge shafts and other water interventions are also recorded and considered for routine measurements

Measurement of well levels

All readings are registered in a well water measurement sheet as well as submitted to the organisation through an online app.

A Well water measurement record sheet consists of two parts:

- One time Record: Records condition of the well and its ownership which includes the dimension, rock strata of the well.
- Continuous Record: Records water level on the dates measured.

S.NO

VILLAGE

OWNER NAME

LOCATION (LONGITUDE/LATITUDE)

TYPE OF WELL

DIAMETER (M)

HEIGHT OF MEASUREMENT POINT

DEPTH OF WELL (MBMP)

DEPTH OF WATER LEVEL

MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER

Measuring water levels

The Bhujal Jankaar or Jal Saathi lowers their measuring tape from the edge of the well (for open wells) or lowers the ringer tape from the cap of the borewell. Distance between start of the tape and ground level is measured.

Image source: Development Support Center

Subtracting the depth of the water level and the height of the edge of the well, can give the depth reading in meters below the ground.

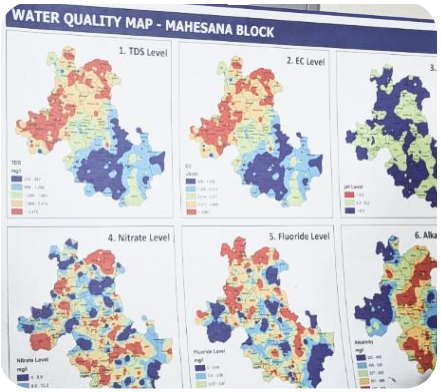
Monitoring water quality

A sample of water is taken by tying a cup/mug to a thread and lowering it till the water level (for open well) or by running the borewell and collecting it from its spout. This is then placed in the cup of the water quality reader, and values of Ph, TDS and Electrical Conductivity (EC) are noted down in the register.

Mapping water levels and quality

Water data collected over the years is plotted as graphs that capture trends in water levels and quality. This can be used to identify places where TDS or OH exceeds suitability for agriculture

TDS: <2000 suitable for agriculture
TDS: < 550 for drinking
Ph: 6.5-8.5 is suitable for agriculture
EC: <4000 is suitable for agriculture
EC: <1,100 for drinking



** This information is based on the agro-climatic region. Please consult your local agronomist for this*

Why are water levels falling in certain wells?

If the water table has declined, it can be for two reasons: Insufficient rainfall has reduced recharge or groundwater withdrawal has increased or continued.

What about the water quality? We can see it is falling down in certain wells.

This can either be due to increased local use of fertiliser and pesticides or higher withdrawal of groundwater or presence of underground mines.

These readings must be incorporated in the annual water budget. And we need to continue to monitor recharge shafts, earthen dams, and check dams to measure the success of these structures.

To help us plan better, once a year, water samples from monitored wells can be sent to labs for fluoride and nitrate analysis. This, combined with monthly, well-monitoring results can yield trends over the field areas. This also helps in determining the water holding/storage capacity of the aquifer.

We can analyse areas that require immediate focus and interventions and we can analyse impact of interventions, including recharge shafts, farm ponds, earthen dams and check dams

7.

Participatory Irrigation Management in Canal Command Areas

Why do we need to learn about participatory irrigation management? Let me explain.

Despite heavy investment in large-scale irrigation projects, ***equitable water distribution*** *remains a challenge.*

Farmers at the tail-end of minor canals rarely get their share of water, leading to lower agriculture yields. On the other hand, unscientific practises are leading to cultivation of water intensive crops or increasing salinity due to water logging.

Rather than design top-down schemes for equitable agrarian water use, DSC emphasises on community planning of water resources. Involving the community in solving irrigation issues ensures:

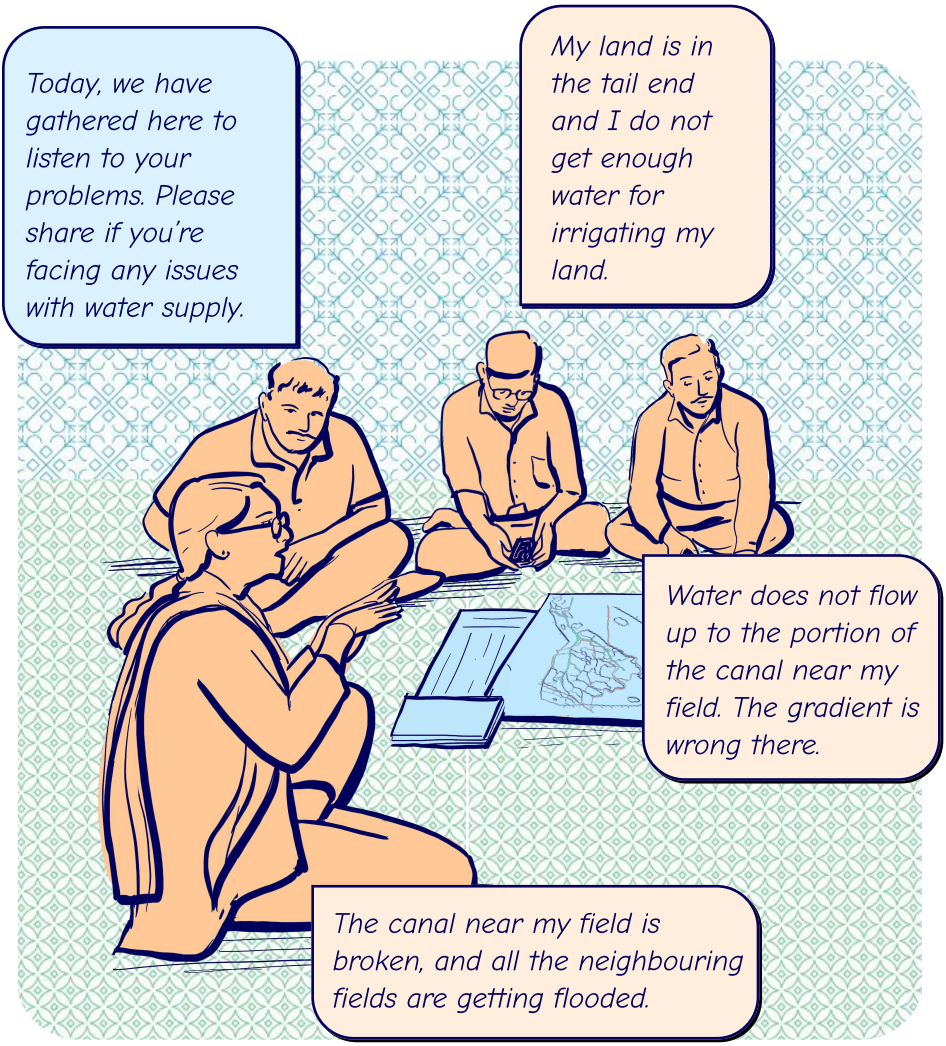
- *Equal distribution of water resources through* ***a cooperative approach*** *between farmers*
- *Increased agrarian incomes through* ***better water use*** *planning and rotation*
- *Increased incomes through* ***better crop planning*** *based on available water*
- *Efficient use of water resources to* ***lower dependence on groundwater*** *and other depleting water sources*
- *Better maintenance and use of* ***public structures*** *such as canals and pumps*

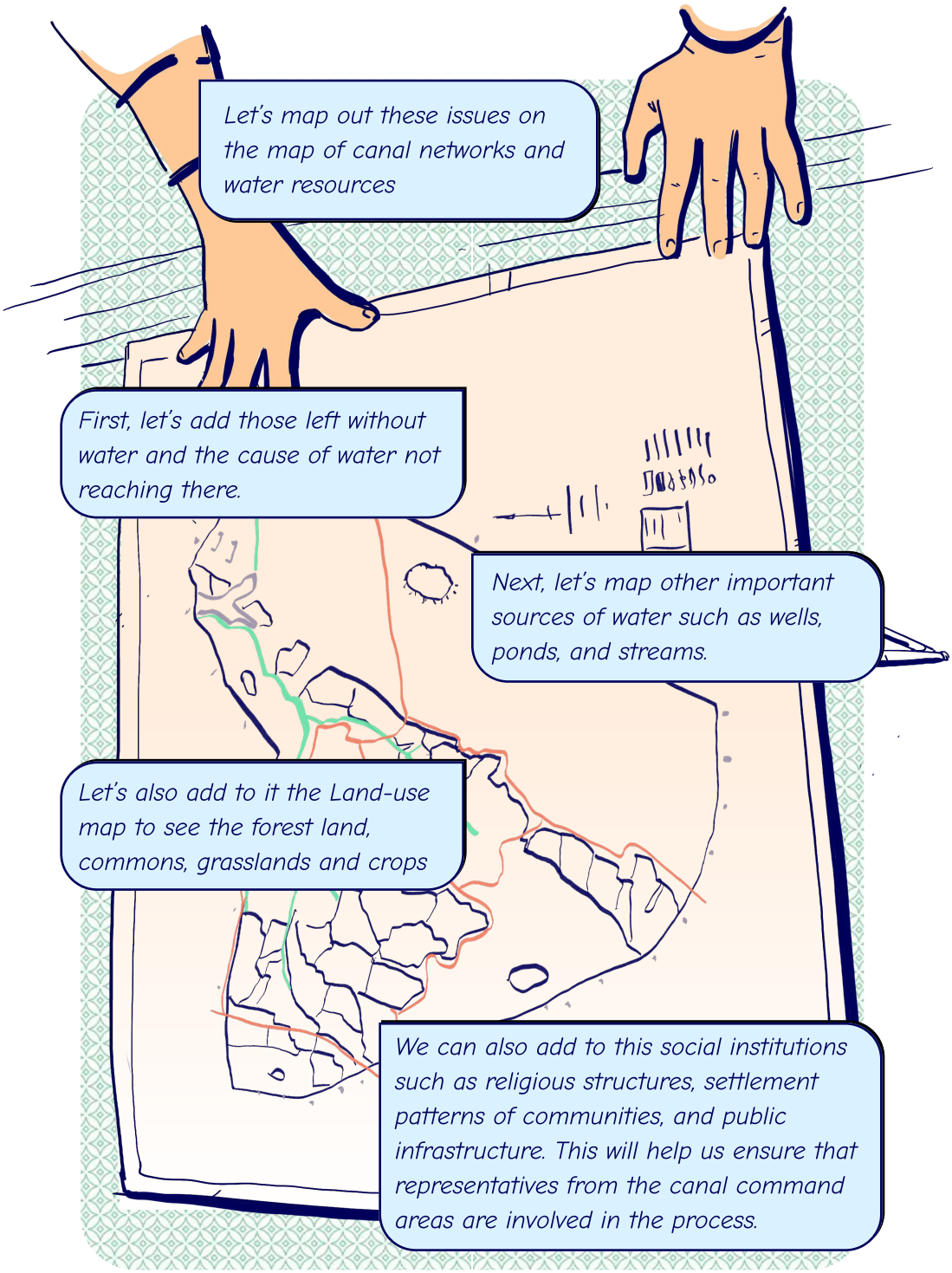
PIM programmes have demonstrated that many problems related to water access and management in canal command areas can be reduced with the active participation of farmers. There are two important stakeholders in the PIM process

1. ***The Government**, which has constructed the canal.*
2. ***Farmers and citizens** of the village, for whom the canals have been constructed and whose responsibility it is to use it judiciously.*

The role of both these parties is equally important. It has been observed that water usage has become 6-7% cheaper than private water extraction sources through farmers' organisations promoted under the PIM process. Collective action is the key to make the best use of canal water possible.

Some of the best examples and practices of farmer-managed canal irrigation systems can be seen in the Dharoi, Guhai, and Majham water user associations in Gujarat. These associations can serve as valuable references for learning more about this process.


Today, we have gathered here to listen to your problems. Please share if you're facing any issues with water supply.
My land is in the tail end and I do not get enough water for irrigating my land.
Water does not flow up to the portion of the canal near my field. The gradient is wrong there.
The canal near my field is broken, and all the neighbouring fields are getting flooded.


Let's map out these issues on the map of canal networks and water resources
First, let's add those left without water and the cause of water not reaching there.
Next, let's map other important sources of water such as wells, ponds, and streams.
Let's also add to it the Land-use map to see the forest land, commons, grasslands and crops
We can also add to this social institutions such as religious structures, settlement patterns of communities, and public infrastructure. This will help us ensure that representatives from the canal command areas are involved in the process.

After spending months on understanding the canal irrigation problems, we are in a good place to start thinking of solutions. We all need to work together towards these solutions. This is called ***Participatory Irrigation Management.***

We need to start a ***Water User Association*** *(WUA) of command area farmers to cooperatively work towards solutions around the minor canal areas in the village.*

The WUA will also deal with government departments such as irrigation and water resource departments, facilitate legal processes, and manage the canal water distribution and management in the village.

There are 3 stages every WUA has to undergo in its evolution:

1. ***Formation****: understanding the PIM act and rules, objectives and functions of the WUA and its resources*
2. ***Planning & Execution of Canal rehabilitation****: Understanding the canal system, Resource mobilisation, construction management*
3. ***Regular irrigation management****: Rotational Water supply, crop water relation, water charge collection*

** Note: All these provisions are based on the Gujarat PIM Act and Rules. These provisions vary from state to state.*

1. FORMATION

We need people to be part of a WUA committee and oversee issues of irrigation.

We are ready to start a WUA and find more members to look after these issues.

Forming the Water User Associations (WUA)

Water User Association is formed under the rules of the Irrigation Department for the state. Often, it is registered as an irrigation cooperative. These rules defer from state to state and need to be thoroughly understood

- A general meeting is held to decide on the rate per acre as well as membership rate for the WUA. The rate has to be agreeable to most farmers present.
- Many states insist that the Water User Association should have 51% of farmers in the command areas as members. Community leaders are engaged to expedite this process by talking to farmers and getting a nominal membership fee from them.
- Rules insist that farmers should own land in the command area to become a member. This may see women being excluded from the committee. It is advisable to appoint women farmers as “nominee members” and accord them equal rights.
- WUA consists of sub-committees for various tasks: conflict resolution, construction, acc and audits, and water distribution.

2. PLANNING & EXECUTION OF CANAL REHABILITATION

Getting the cooperative registered can be difficult. The file will be sent back and forth between government departments, and some new rule or missing document will be pointed out.

Hmm, farmers can get easily dissuaded and lose interest in the process. It will be important to keep farmers motivated.

Right, the process to complete the registration of the cooperative can take up to 9 months. In that time, the process of rehabilitation and repair of canals can take place.

Process of Canal Rehabilitation Work

- Signing of MoU between farmers, the non-profit organisation and government signalling handover of canals after maintenance is completed
- Joint survey between farmers and irrigation department officials to resolve issues relating to the canal
- Approval of estimates by irrigation department and collection of contributory costs from farmers

Cooperative laws of some states require that farmers contribute a share of the amount to repair the canal: which is usually around 10% of the cost.

This may confuse farmers who think that they have already paid a membership fee and share capital.

Yes, we will need to organise more trainings, meetings and exposure visits to clear these misconceptions. Farmers can be shown that they will benefit more than the amount they give as a contribution

Receiving Government Grants for Repair Work

If the cooperative is not registered even at the start of construction, the organisation can receive the grant from the irrigation department. Farmers need to be included in every decision and to oversee work.

In many states, Water User Associations are given the option of receiving government money to conduct the repair work, instead of work being done through the irrigation department. This is a better option as work can be supervised directly by association and farmers.

Working of The WUA and role of the organisation

MEETINGS

- Executive Committee meets once a month
- AGM (Annual General Meeting) happens once a year to decide on a budget

SALARIES

- Secretary: fixed rate work for 3-4 months of the year
- Canal Operator: Rs. 300-400 per day, during the irrigation season

IRRIGATION PLANNING BY THE COOPERATIVE

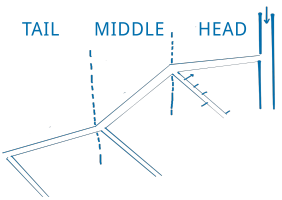
- Chairman is called to a meeting with irrigation department on amount of water to be released during a season. Government also fixes a rate for the water
- Chairman discusses the irrigation plan within committee to ensure water is accessible to all members. This meeting will decide on area of land that can be irrigation for each farmer, suggest crop to be cultivated depending on water availability
- AGM decides on expenses for water distribution, cleaning the canal, the secretary's salary, salary of canal operator and payment of water taxes.
- Water rates charged by cooperative will be above the government rates (around 20-25% more). This will help in meeting expenses of cooperative

Organisations can play a role in continuous handholding of WUA for the first 2-3 years. This includes:

1. *Training of Chairman and cooperative members in water distribution and financial matters;*
2. *Training of cooperative on involvement of women in decision-making; and,*
3. *Training for canal operator on calculation of time to irrigate agriculture fields, crops and soil types.*

Training of canal operators for equitable distribution of water

This shows a rough schematic of the minor canal passing through the village. The canal is divided into Head, Middle and Tail sections. Subsidiary canals go outwards from the minor canal and outlets here lead to fields of farmers.



- Water is released first to the Head section and only after irrigation is done here, is water released to the middle and then tail sections.
- Water is always released to each section through the last subsidiary canal of each section. And once, it is released through the subsidiary canal, the last outlet is always is irrigated first (in the illustration, the timing of the outlet is shown as 1,2,3,4 and final)
- Canal operator has to be in touch with farmers and coordinate based on their needs. When irrigation of the field is nearly finished, the next farmer in line can be contacted over phone to be ready.

This system prevents wastage, damage to the canal system due to strong flow, and flooding of middle fields. It also saves time for farmers who need not wait for hours until their turn

Water sharing rules within the WUA

1. Membership is open to those who have land in the command.
2. Farmers are eligible for getting water for irrigation only if they fill up the membership form.
3. Women farmers who are single will receive water during the day time.
4. Farmers can receive water only after receiving the gate pass from the operator.
5. During the rotation of water, if the farmer is caught taking water two times then s/he will be penalised a sum of Rs.400. The penal amount will be doubled if the farmer is also a committee member.
6. Cost of damage to the canal infrastructure will be recovered from the farmer who does the damage.
7. Farmers who are caught wasting water will have to thereafter abide by the decision of the justice committee on this matter.
8. Before the initiation of irrigation, an Annual General Meeting (AGM) of the members of the irrigation cooperative will be organised.
9. The secretary will draw a salary based on the repairing work undertaken by the society.

Efforts for Institutional health

- Annual Self-appraisal of the WUA is essential. This is based on the criteria of equity, financial viability and review of conflict resolution.
- The WUA can also review water access in the canal command annually.

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