



Village level assessment of Drinking Water Services for the village Savoi Verem

under the course

Technology and Society – Learning (TASLe) SL300

Muskan Jain (170010018)

Priyanka Arora (170020029)

Shikha Verma (160010007)

Faculty Advisors:

Prof. Milind Sohoni

Dr. Neha Karanjkar

Acknowledgement

- Thank You to Prof. Milind Sohoni , Dr. Neha Karanjkar and Prof. Ashish Bhateja for giving us the opportunity to be a part of this wonderful project and guiding us through the end.
- Special thanks to Dr. D B Desai of Savai Verem for helping us out during our field visits and being our mentor for the community survey.
- Thank You to Udhbhav, Miguel, Ashwin and Yashjeet for helping us out in the first phase of the project.
- Thank You to Sahil, Abhishek, Chaitanya, Yashraj, Hrishikesh for helping us in conducting community survey smoothly.
- Thank You to Transport IIT GOA, for helping us in reaching the village.

Abstract

The objective of Technology and Society learning (TASLe) is to work on regional problems of developmental interest.

According to census 2011, several villages of Goa face drinking water scarcity. The amount of treated tap water they receive annually is much less compared to the required amount. Despite the fact that Goa has huge forest land (34.63 percent of the total geographical land) and heavy rainfall, many villages of Goa face water scarcity. We identified four such villages after talking to the public water system authorities of Ponda Taluka. Out of those villages we chose **Savoi-Vernem** as our target village as the village to document the status of drinking water. The methodology adopted was to (i) conduct several field visits to understand the interplay of various factors, (ii) to prepare various maps and data-sets, and (iii) to conduct a community survey and analyse its outcomes.

This is a joint project of IIT Goa and Goa College of Engineering (GEC).

The study is based on three inter-connected systems namely (i) natural systems, (ii) engineering systems and (iii) the community. All the field visits were aimed at developing a better understanding of these systems.

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Chapter 1: Introduction

1.1 Objective

- To develop a basic understanding of the current water resources and services in Savoi-Verem.
- Document the demand and supply of drinking water in the village.
- Understand the interrelation between engineering systems (community wells and pipelines), natural resources (streams, lakes, reservoirs) and the community which uses these resources.

1.2 Savoi-Verem

Savoi-Verem is a village in Ponda Taluka in the North Goa district of Goa, India. It is situated at the banks of the Mandovi River, surrounded by villages of Keri, Betki, Volvoi and Querim on the same side of the river.

Latitude/Longitude - 15.480462°N 74.018991°E

Population - 3187 as on 01/04/2019 (source: census)

Area - 928 Ha.

Route from IIT GOA - 22 kms drive via Priol Road and SH 30

1.3 Stakeholders involved

- Villagers/Residents : The main stakeholders and beneficiaries of the scheme
- PWD : Department responsible for managing the water supply systems (pipes, wells and tanks).
- Gram Panchayat: Local government where villagers report their problems and which acts as an intermediate between the state administration and the residents.
- IIT Goa
- GEC

Chapter 2: Natural Systems

The total area of Savoi Verem is xxx hectares. More than 50% of the land of Savoi Verem is covered with forest. Besides this, there is much land devoted to plantations of areca nut, coconuts, cashew and mango. The village area is drained by one major stream and two minor streams. Hence, water bodies that serve the daily water needs of the people can be classified as natural resources like streams, springs, rivers, reservoirs.

We located three important natural resources in Savoi Verem.

1. Mandovi River :

The main river in Goa, Mandovi runs along the north-eastern edge of Savoi-Verem. Ferry services to Surla across the river are located in the adjacent village of Volvoi which is on the river. Water from the Mandovi river cannot be used for either drinking or for agriculture purpose directly because the water is saline. Upstream of Mandovi, on the river Khandepar, a fresh water weir and treatment plant called OPA is set up. This is 24.4 km from S.V. and caters to the drinking water needs of many towns and villages in North Goa Goa.

2. Vijayadurga Temple stream and reservoir :

Vijaydurga Temple is located in Keri, a village adjacent(south east) to Savoi -Verem. A stream emanates from the surrounding thick forests and passes to the south of the temple, at its backside. Every November, i.e., after the monsoons, the stream is blocked by wooden planks to form a weir 3-4 meters high. This creates a reservoir about 250m long, 100m wide and about 4m deep. Water from the reservoir is not used for drinking purposes but is a very important water source for irrigating fields. The stream runs into Savoi-Verem , and is used by the farmers along the way. Water from the reservoir is stopped at various points. Bandharas or check dams are constructed on

the way so that the farmers can use the water for irrigating areca nut and coconut plantations by diverting water from these bandharas via small canals, no more than a foot wide. There are a total 7 bandharas on the stream as informed by the villagers residing nearby.

3. Ananta Temple stream :

It is located in the central, most populated, market area of Savoi-Verem. Ananta stream runs through streets and fields catering to the needs of people living in its neighborhood. People visit Ananta stream as a part of their recreation activities. The stream meets the Vijaydurga stream on its way.

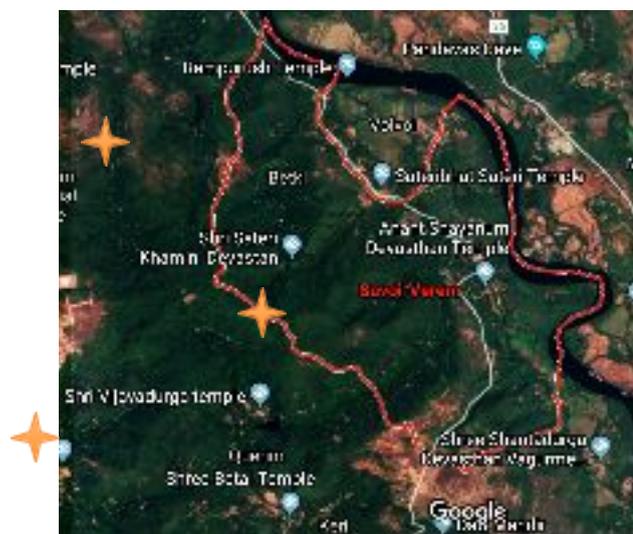


Figure 2.1 : Google map snippet showing the major natural resources



Figure 2.2 : Vijaydurga reservoir in August



Figure 2.3 : Ananta temple stream

Apart from these major natural resources, people in Savoi -Verem are blessed with a number of small streams frequently flowing at walking distances from their house. They go and fetch water from the streams. Sometimes the way to streams is through forested land. In dry months, specifically March, May and April, the level of water in the stream reduces. However, most streams do not dry out completely and are a very important source of water in the dry months.

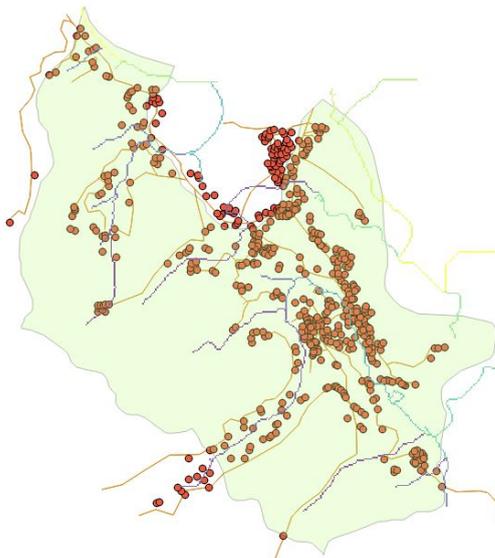


Figure 2.4 : Households in Savoi Verem are depicted by orange dots, whereas households outside the village boundary are marked in red. The blue lines depict the streams flowing and the red lines are major roads.

The streams are very near the households (as shown in the figure), hence it is easy for people to use the streams for their day-to-day needs.

There are also some abandoned lakes and water management systems as informed to us by Dr. D B Desai, a medical doctor practicing in the village and an eminent member of the environment conservation community in Savoi-Verem. One such example is “*Shitole*” near Bhoot Khamb on the road to Priol. It is a beautifully constructed historical structure that used to be a source of water for people around. However, it is currently abandoned and in poor condition.



Figure 2.4 Shitole landmark



Figure 2.5 Shitole structure

In the months of March and May , there is an acute shortage of water. Hence it will be better if we already identify the important streams and preserve them by not polluting and exploiting.

Chapter 3: Engineering Systems

Engineering system in Savoi Verem refers to the piped water supply systems constructed and managed by PWD piped. These water supply systems are sourced through community wells, and use pumps, pipelines and valves etc. to transfer water to various locations. Engineering systems play an important role in water supply analysis, as they determine both coverage, i.e, who are served, and seasonality and sustainability which depends on how they use natural resources.

3.1 Current Scenario:

- The whole engineering system is based on community wells.
- The water is supplied to the houses directly via pipelines.
- There is no overhead tank in Savoi-Verem for storing water and the pumps directly energise household taps.
- People rely directly on the supply water from the pipelines at assigned timings.
- There are no documents available with the Gram-Panchayat, like maps or details of wells, pipes and valves locations.

As a part of our study we located some community wells and tried to map the households they serve. We located 5 major wells which supply pipeline water.

- Sateri
- Chafewada/Saphebhat
- Kandaka
- Khamini
- Pali well



Figure 3.1 Wells marked on map

With the assistance of Mr. Premanand Shilkar, the well/scheme operator in the village, we visited the wells and tried to locate the pipes and valves.



Figure 3.2 Sateri Well



Figure 3.3 Pali well

Sateri Well is the well situated near the panchayat office. It is the main well of the village as it serves the people of three wards (out of total seven wards in the village). The level of water reduces significantly in the month of March causing trouble to people relying on it. There are different time slots of water pumping for different areas.

Although all the wells were in working condition, there were few problems highlighted by the villagers.

3.2 Problems Areas

- People who live near the well exploit these schemes by connecting small pipes (which disturbs the flow of the main pipeline).
- There is no fixed timing of water supply because of irregular electricity supply timings. Pumps, of course, cannot run without electricity.
- There is great variation in the elevations of pipes and they often burst because of high pressure. Pipes also burst due to irregular electricity timings causing return flow into pumps and water hammer.
- In the months of March to May, the water supply system fails to supply sufficient water. In that case, water tankers have to be called to serve some of the communities.

Tankers from OPA treatment plant arrive in the village on a weekly basis. They are free of cost for the residents and the cost is borne by PWD.

An over-head tank in the bazar area of capacity around 8 lakh is under construction.

Chapter 4 : Community Survey

Community survey plays an important role as to know the quality of service, the coping methods, and the point of view of people.

4.1 Objectives:

- To determine the distribution of water sources used by people.
- To understand actual problems faced by the people.
- To understand the cropping pattern for households having plantations.

There are 6 wards in Savoi-verem.

Savoi Verem Panchayat – Savoi Verem+ Vaghurme

Total no. of households in Savoi Verem = 1053

Percentage of households surveyed = 5%

Serial Number	Ward Names	Total Households	To be surveyed
1	Shilwada Savoi	256	13
2	Palwada	175	9
3	Amrai, Budruk,Chafewada	86	4
4	Madhlawada	290	14
5	Velas Khede	124	6
6	Kawangwada	122	6
	Total households	1053	52

Community Survey methodology:

1. Study ward data from the Gram panchayat office. In Savoi-Verem, ward data is documented in a register in the office.
2. Select roughly **5 percent** of the total households in each ward.
3. For each selected household, note down:
 - Name of House owner
 - Ward number
 - Address(including landmark)
4. Run the list of households from a senior and trusted resident of the village. For Savoi-Verem, we consulted with Dr. D B Desai.
5. Prepare a survey form suitable for the village scenario. Different survey forms have to be made for different categories of people, e.g., farm-holders, tanker-water households.
6. Divide the project team into different teams and finally conduct the survey.

Survey:

We conducted survey by visiting various wards and interviewing people about their water needs and supply.

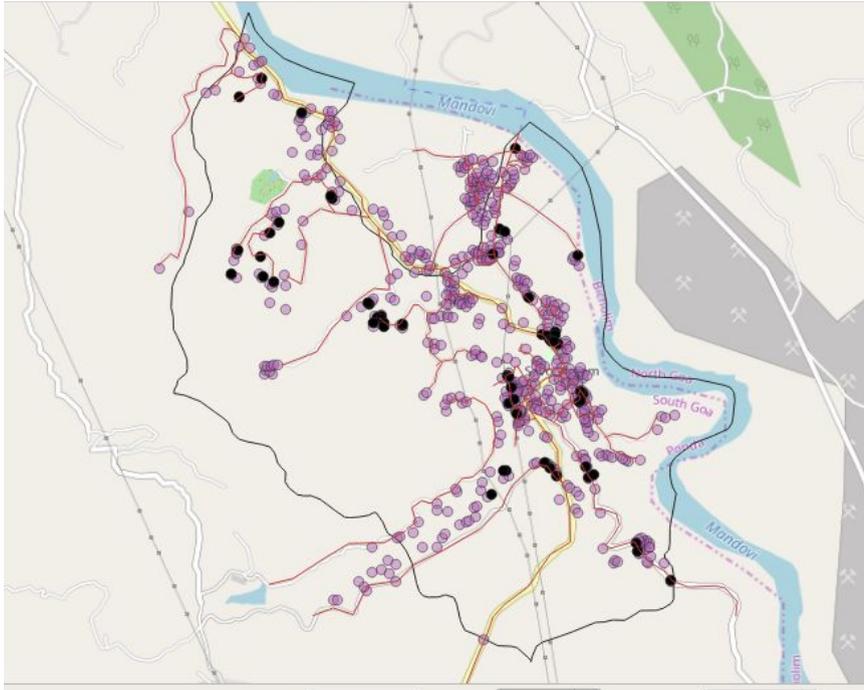
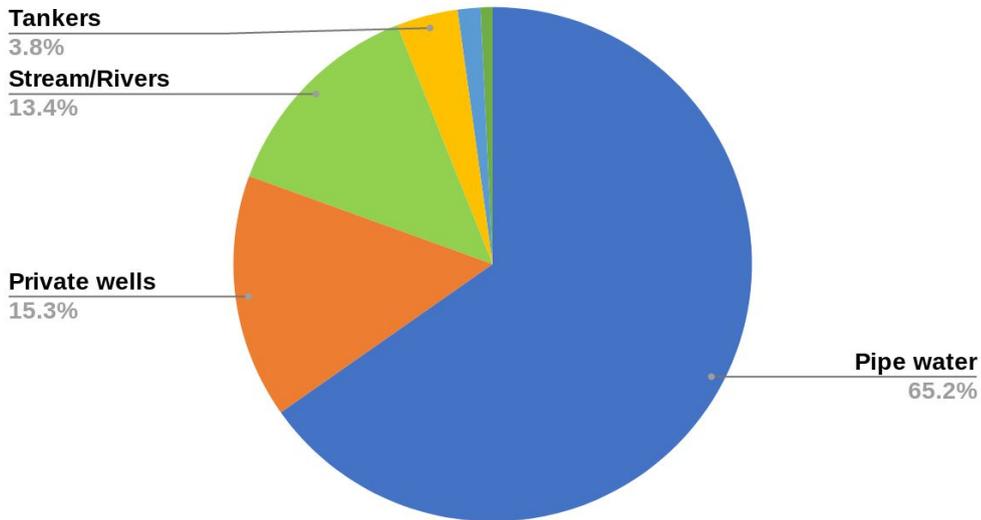


Figure 4.1 Total households are marked by violet points whereas households surveyed are marked with black points.

4.2 Observations :

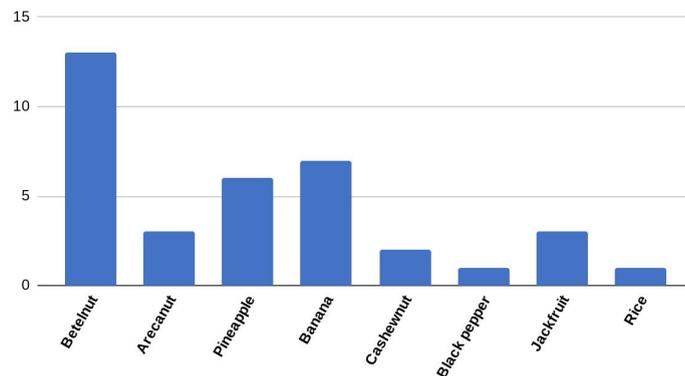
Water resources used by the villagers can be classified into four main parts namely tankers, streams, private wells and piped water. Below is the distribution of water sources.

Distribution by Primary Source of water



- 74.1 percent of households we surveyed have pipe water connection.
- In the rainy season pipes from community wells supply water for around 2 hours per day.
- In non rainy season (March - May) piped water supply comes for only around 15-20 minutes.
- 39.2 percent of people rely on tankers in the non-rainy season. These tankers arrive twice a week on average and people have to store water.
- 43.1 percent of total households we surveyed have farming lands and they produce different crops like areca nuts, pineapple etc. Below is a plot showing the distribution

Distribution of Crops grown



for the same.

Chapter 5 : Summary and Conclusions

5.1 Current Scenario : Conclusion

- People who use piped-water and live far away from streams face a lot of problems in non-rainy seasons.
- People who live near the streams do not face much problems because they can fetch water flexibly (any amount and anytime). Only issue is the drudgery of walking to the stream in case there is no pumping facility.

5.2 Towards the solution

No centralized solution is feasible due to varying altitudes and scattered households.

Moreover, some people do not seem to have any problems regarding availability of drinking water (as per the survey conducted) and may not participate in a community-wide solution.

As stated in the section of engineering systems, a new overhead tank is to be constructed in the main area of the village. But a better solution could be locating small tanks near the existing wells and filling these in the non rainy season. This will utilize the existing pipeline network instead of laying down new pipelines and making the whole system more complicated. Most people in the village have pipelines connected to the public wells, so if the well does not dry out and the level of water is sufficient enough to serve the people then the crisis of drinking water availability would be solved. Also, those who do not have pipelines live at a high elevation and use local streams as water resources. Although the level of water is reduced in non-rainy season, the streams do not dry out and continue to act as a source of water.

5.3 Future Work

- Analysing the discharge of streams at different locations in different seasons.
- Study of Community wells.

Chapter 6: Appendix

6.1 Contacts from the village

Name	Identification	Contact No.
Madan Desai	Junior Engineer, Ponda	9423812719
Mahesh Shilkar	Panch S.V	7798897888
Rupa Naik	UPA sarpanch S.V	8554057898
Manjhila	Agriculture Diploma student, S.V.	8007677568
Manjusha	Manjhila's sister	
Dr. D B Desai	Doctor	9370382775 9423882072
Premanand	Water scheme operator	7798754359
Paandu	Water scheme Plumber	9420766193
Prasad Naik	V.P. Secretary	95271 95801
Sadanand Naik	V.P. Clerk	99235 94578
Satish Kedekar	House in orchid near bandh 2	9637884002
Gaurav Naik	Private wells	8007361415
Vishnu Sattarkar	Plantation owner	9764564265
Digamber	Worker Asst. PWD	9890757788

6.2 Field-Trips:

1. Field Visit-1

1.1. Location : Savoi-Verem

1.2. Date: 15/08/19

1.3. Objective: To get basic idea of the problem at hand.

1.4. Members: Prof Milind Sohoni, Prof Neha Karanjkar, Muskan Jain, Priyanka Arora and GEC students.

1.5. Meeting set with: Mrs. Rupa Naik, Mr. Mahesh Shilkar, Mr. Satyawan shilkar.

1.6. Observations and Information received:

- Savoi-Verem doesn't have an overhead tank. Its pipeline system is
- based on wells.
- These wells dry out in the months of April, May and June.
- Villagers rely on tankers and nearby streams in non-rainy season.
- The gram panchayat suggested to work on a local and de-centralised solution as it is more feasible due to the inconsistent altitude variation.
- Ananta temple, the one village is based around has a water reservoir which is used for cultivation and not for drinking purposes.
- Vijaya Durga temple's streams come down to Savoi-Verem.



Figure :Ananta Temple



Figure : Vijaydurga temple

2. Field Visit-2

2.1. Location: Savoi-Verem

2.2. Date: 25/08/19

2.3. Objective: To understand the water problem from villager's perspective and to track the pipeline wells

2.4. Members: Prof. Milind Sohoni, Prof Neha Karanjkar, Muskan Jain, Priyanka Arora and Shikha Verma.

2.6. Meeting set with: Dr. DB Desai , Manjila , Mr. Premanand Shilkar.

2.6. Observations and Information received:

- We Visited 3 Wells named Kandaka, Sateri and Chafewada.
- Villagers living on high altitude need to walk around 1km in a dense forest to fetch drinking water despite having a pipeline supply.
- The paddy fields near Sateri well are not cultivated which could be one of the reasons behind reduced ground-water level.
- There were several small pipelines in Chafewada well which disturbs the flow of the main pipeline.
- Due to the salinity of river mandovi nearby wells are built on a high altitude.
- There are many abandoned water resources like "chittore".
- Deforestation is one of the reasons behind reduced ground-water level.



Figure : Kandaka well



Figure : Dr. DB Desai House

3. Field visit-3

3.1. Location: Savoi-Verem

3.2. Date: 28/08/19

3.3. Objective: To locate the other wells of PWS.

3.4. Members: GEC students

3.5. Meeting set with: Mr. Premanand Shilkar

3.6. Observation and Information received:

- Two more PWS wells were located.
- One well is situated in Panchebhat and the other one is situated in Bodheya.
- There was a smaller capacity well in Panchebhat, but it gets replenished by a nearby spring.
- The Bodheya well has a lake built nearby to refill it in the dry months. This solution can be implemented for the other wells too.



Figure : Stream near well #3



Figure : Well situated at Bodeya

4. Field Visit-4

4.1. Location: Savoi-Verem

4.2. Date: 10/09/19

4.3. Objective: To understand the working of Ananta temple reservoir

4.4 Members: Prof. Milind Sohoni, Muskan Jain, Priyanka Arora and GEC students.

4.5. Meeting set with: Dr. DB Desai.

4.6. Observations and Information received:

- Bandharas are mini-dams which are constructed using mud.
- Man Made bandharas are put on the streams post monsoon season.
- These bandharas are used for irrigation purposes.



Figure: Bandhara on VijayaDurga stream



Figure: Bandhara on VijayaDurga stream

5. Field Visit-5

5.1. Location: Querim

5.2. Date: 02/10/19

5.3. Objective: To meet an environmentalist and develop a deeper understanding of the current scenario.

5.4. Members: Prof. Milind Sohoni, Shikha Verma and GEC students.

5.5. Observations and Information received:

- Government had carried out a study of water resources which could be of use.

6. Field Visit - 6, 7,8

6.1 Location: Savoi-verem

6.2 Dates: 04/11/2019 , 03/11/2019 , 22/10/2019

6.3 Objective: Community Survey



Figure: Interviewing a Person



Figure: A women Fetching water from a stream nearby

6.3 Documents and web resources cited :

- Digital Elevation Model for stream generation <https://search.asf.alaska.edu/>
- Habitation profile <https://ejalshakti.gov.in>
- Gram Panchayat ward register used for community survey