# **Report of the Water Supply Status in Bhoo Village**



# Unnat Maharashtra Abhiyan Cell - IIT Mumbai

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## **<u>1. Executive Summary:</u>**

Bhoo is a village located in Rajapur Taluka in Ratnagiri district of Maharashtra. The area of the village is 437 ha and the population of the village is 1210. Bhoo village consists of 11 Wadis, namely, Chinchpeth, Bhingewadi, Tambewadi, Mhadayewadi, Pimpalwadi, Brahmanwathar, Hardikarwathar, Madhaliwadi, Bauddhawadi, Kumbharwadi, Sarfarewadi. There are three main streams in the village.

The main river flows from east to west and all Wadis are located within 500 meters of distance from the river at an elevation of 60-90 meters above sea level. The northern part of the village is of higher altitude with the maximum elevation of 250 meters. Thus the village is composed of two main regions. The southern region with low elevation consists of the main rivers, habitations, agricultural patches and orchards whereas the northern region with higher elevation consists of forest patches, origin of sub streams, catchment areas and horticultural patches.

#### **Critical Sources:**

| No. | Name of the<br>Wadi | Populati<br>on | Critical<br>Sources | Key problems<br>identified  | Remarks/<br>Suggestions   |
|-----|---------------------|----------------|---------------------|---|---|
| 1)  | Bhingewadi          | 68             | Well                | Scarcity in Q4  | <ol> <li>Source strengthening<br/>required.</li> <li>Alternate source needed<br/>in Q2.</li> </ol>                |
| 2)  | Mhadayewadi         | 25             | Well                | Well not properly constructed.  | Needs proper construction of the well.  |
| 3)  | Sarfarewadi         | 76             | Well                | Water scarcity in Q4  | 1) Alternate source for<br>drinking water required  |
| 4)  | Pimpalwadi          | 31             | Well                | <ol> <li>Well not<br/>constructed properly</li> <li>Scarcity in Q3 and<br/>Q4</li> <li>Polluted water<br/>from river</li> </ol> | <ol> <li>Proper well construction<br/>is needed.</li> <li>Alternate source required<br/>for Q3 and Q4.</li> </ol> |

4 sources out of 9 sources are found to be critical.

## **Other Important Observations:**

- 1) Revival of the traditional Paat system is very important for groundwater recharge.
- 2) Brahmandev Zara and Talisakhal are the two important traditional water sources in the village which need to be protected.
- 3) There needs a survey of the catchment areas in the village and probable places for water conservation with reference to the new RCC bund recently constructed near Kumbharwadi.
- 4) Sarfarewadi bund needs repairing.
- 5) Option of permanent RCC bunds in place of traditional earthen bunds need to be checked.



#### 2. Introduction:

#### A) About the Project:

Jal Jeevan Mission (JJM) is a high-priority mission of the government and the district administration to provide household tap connections to every household by 2024. In the mission, "Source Sustainability for Drinking Water" is a central theme of the Jal Shakti Abhiyan 2023, as per the letter dated 24th February, 2023. The 15th Finance Commission (2021-22 to 2025-26), has allocated 60% of the total grants out of the total allocation in the form of 'tied grant' for water supply and sanitation services for Panchayats/Rural Local Bodies/RLBs. [1]

For the effective implementation of the scheme, village level primary data on the status of water supply is important. Under the Unnat Maharashtra program by IIT Bombay, this is an attempt to prepare a water supply status of Bhoo village. The report is an outcome of the pilot project of doing water supply status reports of 10 villages in Rajapur Taluka by the UMA-IITB team in collaboration with Ratnagiri Zilla Parishad.

Konkan is a region which is characterized by hilly surface, laterite plateaus, high rainfall and the coastline from the west. Unlike the deccan plateau, the problems and solutions in water supply in Konkan are more 'local' than 'regional'. Therefore, village level and Wadi studies of water supply are important. This report includes Wadi level data on the current status of water supply which will help the Gram Panchayat and local administrations to frame appropriate policies for the village.

#### **B)** Methodology:

Following methodology is used to prepare the water supply status report of Bhoo village:

- 1) Collection of the secondary data from govt portals such as JJM, Egramswaraj, CensusIndia, etc.
- 2) Visit to Gram Panchayat and collection of the data such as Wadi-wise households and population, major water sources, number of public and private wells, details of the recently implemented and newly proposed schemes, etc.
- Visiting each Wadi, meeting the Wadi Pramukh/reference persons from each wadi and getting information on the water supply system of the Wadi. Doing household surveys in each Wadi to calculate LPCD.
- 4) Taking GPS photographs of the important commonly used wells, tanks in each Wadi and locating them in the village map.
- 5) Preparing an excel sheet of the data collected from each Wadi which contains the main sources of water, well measurements, dependent population, ownership of the scheme, expenditure, key problems, etc.
- 6) Identifying the gaps between demand and supply in each Wadi and making recommendations towards source sustainability.

#### 3. About the village:

Bhoo is a village located in Rajapur Taluka in Ratnagiri district of Maharashtra. The area of the village is 437 ha and the population of the village is 1210 (as per 2011 census) [2] Gram Panchayat Bhoo includes only one revenue village i.e. Bhoo. The village is surrounded by Tervan in the south, Kotapur in the west, Khingini in the east and Pendkhale in the north. The village is about 45 km from the district place Ratnagiri and 15 km far from the Taluka place Rajapur. [3]



Fig 1. Location Map of Bhoo Village

## **<u>4. Field Observations:</u>**

## A) Wadi Level Survey:

Bhoo village consists of 11 habitations called as Wadis. Wadi level survey was done and the data is compiled in the excel sheet attached with this report. [4] The summary table of the level survey is as follows.

| Wadi<br>No. | Name of the<br>Wadi | Population<br>(GP data) | Major Water<br>Sources  | Access to the source   | PWS<br>Functional? | LPCD  | Key Problems<br>identified  | Remarks/<br>Suggestions   |
|-------------|---------------------|-------------------------|---|--|--------------------|-------|---|---|
| 1)          | Chinchpeth          | 68                      | 1) One common<br>well<br>2) 8-10<br>individual wells  | <ol> <li>No direct access to<br/>the common well</li> <li>Direct pump<br/>connections from<br/>individual wells</li> </ol> | No                 | NA    | No PWS<br>functional  | PWS needs to be functional.   |
| 2)          | Bhinge<br>wadi      | 89                      | One common<br>well  | PWS  | Yes                | 120   | Scarcity in Q4  | <ol> <li>Source<br/>strengthening<br/>required</li> <li>Alternate source<br/>needed in Q2.</li> </ol>                 |
| 3)          | Tambe<br>wadi       | 172                     | <ol> <li>1) One common<br/>well</li> <li>2) 3-4 individual<br/>wells</li> <li>3) Brahmandev<br/>Zara</li> </ol> | PWS  | Yes                | 78.26 | None  | Brahmandev Zara is<br>the major alternate<br>perennial source of<br>drinking water which<br>needs to be<br>conserved. |
| 4)          | Mhadaye<br>wadi     | 25                      | One common<br>well  | PWS  | Yes                | 83.33 | Well not<br>properly<br>constructed`                              | Needs proper<br>construction of the<br>well   |
| 5)          | Sarfare<br>wadi     | 76                      | 1) One common<br>well<br>2) 8-10  | 1) 6 standposts from<br>the common well<br>only for domestic use   | No                 | 75.5  | <ol> <li>No PWS<br/>functional</li> <li>Water scarcity</li> </ol> | <ol> <li>PWS needs to be<br/>functional.</li> <li>Alternate source of</li> </ol>                                      |

|     |                    |     | individual wells<br>3) Direct from<br>river                                     | 2) Gravity pipe direct<br>from river for<br>drinking purpose.   |     |       | in Q4   | drinking water required.  |
|-----|--------------------|-----|---|---|-----|-------|---|---|
| 6)  | Pimpal<br>wadi     | 31  | <ol> <li>1) One common<br/>well</li> <li>2) Direct from<br/>river</li> </ol>    | <ol> <li>PWS from the<br/>common well</li> <li>direct through<br/>pumping from the<br/>river</li> </ol> | Yes | 58.33 | <ol> <li>Well not<br/>constructed<br/>properly</li> <li>Scarcity in Q3<br/>and Q4</li> <li>Polluted water<br/>from river</li> </ol> | <ol> <li>Proper well<br/>construction is<br/>needed.</li> <li>Alternate source<br/>required for Q3 and<br/>Q4.</li> </ol> |
| 7)  | Hardikar<br>Wathar | 44  | Individual wells  | Individual pumps  | No  | 150   | None  | -   |
| 8)  | Brahmin<br>Wathar  | 40  | Individual wells  | Individual pumps  | No  | 200   | None  | -   |
| 9)  | Bauddha<br>Wadi    | 148 | One common<br>well  | PWS   | Yes | 200   | None  | -   |
| 10) | Madhali<br>Wadi    | 230 | One common<br>well  | PWS   | Yes | 90.63 | None  | -   |
| 11) | Kumbhar<br>Wadi    | 287 | <ol> <li>1) One common<br/>well</li> <li>2) 2-3 individual<br/>wells</li> </ol> | PWS   | Yes | 150   | None  | -   |

The water supply system of Bhoo village is illustrated in the following map:



Fig. 2 - Major water sources of Bhoo village

#### Key Observations from Wadi-level Survey:

Following key observations can be drawn from the Wadi level survey excel sheet.

- 1) **MBGL** In Bhoo village, the average well depth of common wells is 8.81 meters while the average MBGL for the same (As in March 2023) is 5.58 meters.
- 2) Distance from river Among all common wells, the wells very close to the river (within 25 meters of distance) have an average MBGL of 3.24 meters while those which are comparatively far from the river (beyond 25 meters of distance) have an average MBGL of 8.5 meters. It clearly proves that the sources close to the river are more efficient.
- Ownership of wells Among the 11, there are Gram Panchayat wells for 5 wadis, namely, Chinchpeth, Tambewadi, Sarfarewadi, Bouddhawadi and Madhaliwadi. Other Wadis use private sources. [5]
- 4) **Storage capacity** Chinchpeth, Mhadayewadi and Pimpalwadi have comparatively low storage capacity (below 10,000 liters) while Bhingewadi, Bouddhawadi, Madhaliwadi and Kumbharwadi have comparatively high storage capacity (Above 10000 liters).
- 5) **PWS functionality -** PWS is functional in all Wadis except Chinchpeth and Sarfarewadi.
- 6) **GP intervention** In Bhingewadi, the entire water supply system is erected and managed by Wadi itself with no GP intervention. In other Wadis, there is some intervention by the GP, either partly or fully for the PWS scheme.
- 7) **Monthly expenditure** For PWS fed Wadis, the average monthly expenditure on the water supply system for each Wadi is Rs. 4,400, whereas the average monthly bill per household is Rs. 147.
- 8) **Daily water supply** For PWS fed Wadis, the average daily water supply time is 30 to 45 minutes. The average flow of water is 10LPM. Thus, within the given time, every household in Wadi gets around 300 to 450 liters of water everyday. (Provided that the difference in pressures is not counted.).

(Note:

1) Brahminwathar and Hardikarwathar are 100% dependent on individual wells. Hence they are not considered in the above analysis.

2) LPCD is not calculated for Chinpeth Wadi as it is not a residential area but the area occupied with commercial premises, schools, Gram Panchayat and administrative offices.)

#### **B)** Other Important Observations:

#### 1. Major Drainage of the village:

In Bhoo village, the east-west flow, which erects in Pendkhale and flows towards Bhalavali, is the main river of the village while its tributary, which flows south-north and meets the main river near Hardikarwathar is another important stream in the village. Both streams are located in the southern part of the village at the elevation of 60-90 meters above sea level while the maximum elevation in the village is 250 meters. The southern part of the village is of comparatively lower elevation i.e. below 150 meters while the northern part of the village is of comparatively higher elevation i.e. above 150 meters above sea level. All Wadis are situated within 500 meters of distance from the two streams. Another major stream in the village is 'Jaswandaparya' which flows south-north along the western border of the village. These three streams comprise the major drainage of the village. This drainage system can be observed in the map given above.

# 2. Traditional Paat System:

#### ii) Paat system in Bhoo village:

The unique characteristic of Bhoo village is the Paat system, i.e. the small diversion canals of about 0.5 to 1.5 kms of length, erected from the main stream by constructing bunds at specific points. Although the primary purpose of the Paats is to supply water to agriculture, they proved to be the important factor in groundwater recharge by scattering the main flow across a larger area. As per the field observations and interviews of the villagers, there were around 10 to 12 active Paats in the village, out of which, only 5 Paats are active as on today and others are not active. The Paat system of Bhoo is briefly outlined in the following freehand sketch. In the picture below, the Paats marked with red colour are inactive Paats since last few years whereas those marked in black colour are active as on today.



Fig. 3 - Paat



Fig. 4. Outline of the traditional Paat system in Bhoo village

## ii) Groundwater recharge due to Paats:

From the field observations it could be clearly seen that the wells located at the lower elevation got recharged because of the active Paat at the upper side.



Fig. 5 Well at the lower elevation gets recharged by active Paat at the upper side Well location: Near Hardikarwathar - Bhoo

## Video link:

https://drive.google.com/file/d/1ORIqU1jtVoZOmOlw82DwuEzxbHr\_Wnrp/view?usp=s haring

#### iii) Bunds for Paats:

To keep the Paat active throughout the dry season, the villagers have constructed temporary or permanent earthen bunds at the erection point of the Paats. This helps maintain a continuous flow of water till the next rainy season and eventually helps groundwater recharge. Field observations regarding the bunds are as follows:

## a) Temporary earthen bunds:

As per the data obtained from Gram Panchayat, total 15 temporary bunds are constructed every year for water retention on both the main streams irrespective of the erections points of the Paats. However, specifically for Paat activation, the bunds are constructed by villagers themselves. As per the data obtained from interviews, it requires 40 man days (20 persons x 2 days) to construct a temporary earthen bund.



Fig. 6. Temporary earthen bund constructed at the erection point of Karambelpaat near Hardikarwathar

## b) Permanent Small bunds:

Permanent small bunds at the erection points of the Paats is a better alternative to the temporary bunds to avoid every-year construction and prevent the leakage. As on today, 2 permanent bunds are found in Bhoo village.

**i) Bund at Deulpat:** In Bhoo village, a new small RCC bund is constructed in 2022-23 near Bouddhawadi which helps recharge Bouddhawadi well and activate two Paats - Deulpat flowing towards Kumbharwadi in the northern side and the one flowing towards Hardikarwathar in the southern side.

**ii)** Sarfarewadi bund: Sarfarewadi bund was constructed around 10-15 years ago which was important for Sarfarewadi Paat. However, due to no maintenance the dam is currently not in good condition. Water leaks out and Sarfarewadi Paat is not active.



Fig. 7. New RCC bund near Deulpat



fig. 8. Sarfarewadi bund damaged

### 3. Documentation of Traditional Water Sources:

Traditional water sources also form an important component of the village water system. In Bhoo village, there are two main natural streams which are at a higher elevation point and which are protected due to religious significance.

#### i) Brahmandev Zara:

Brahmandev zara is a perennial stream located near Tambewadi at the elevation of 187 meters above sea level. Whole Tambewadi was dependent on the stream when the PWS scheme was not made and even today the Wadi uses this source in Q1 and Q2. Water is brought to the Wadi through a pipe by gravitational force and supplied to the households through HH tap connections. This reduces the energy cost of pumping for 6 months. The villagers have constructed a small pond near the stream for water storage and another small pond for animals. Regular cleaning of the place is done by Tambewadi people.



Fig. 9. Brahmandev Zara near Tambewadi

#### ii) Talisakhal:

This area is near Kumbharwadi at the elevation of 170 meters above sea level. There is a small pond of around 2x3 feet in which water retains throughout the dry season. The surrounding area is of deciduous forest and due to religious significance it is not frequented by the people. This small pond is at the upper riparian part of 'Jaswandparya' a non-perennial stream that flows north-south in the western side of the village. Talisakhal pond is mainly used by wild animals and cattle for drinking water. However it is one of the points of groundwater recharge hence needs to be conserved.



Fig. 10. Talisakhal near Kumbharwadi

## 4. New Schemes for Source Sustainability:

Gram Panchayat has proposed some schemes for sustainability with a total budget of Rs. 1.24 cr. The new schemes include:

i) Bund near Kumbharwadi: A new bund is being constructed in the upper part of Kumbharwadi near Jaswandaparya at the elevation of 150 meters above sea level. This dam is in the catchment created by the hillops from three sides. The dam will create a water reservoir of about  $20 \times 4 \times 3$  meters dimension and help serve as a surface water source as well as help groundwater recharge.



Fig. 11 New dam under construction

**ii)** New well for Sarfarewadi: A new well is proposed for Sarfarewadi to supply drinking water through HH tap connections as not enough water is available in the existing well. However the location proposed for the well is right in the riverbed where there is hard rocky structure which needs blasting to dig 25-30 feet. Some of the villagers have raised an issue that blasting in the riverbed may adversely affect water supply to Karambelpaat as the erection point of the Paat is just 10 meters downstream to the proposed location. Therefore, the people who may be affected are demanding alternate location point for the well which will be outside the riverbed.



Fig. 12. Sarfarewadi new well location

#### iii) Tanks and PWS connections:

New tanks are proposed for Kumbharwadi, Bauddhawadi and Sarfarewadi. New PWS connection is proposed for Bauddhawadi.

#### **5.: Water demand for Horticultural Crops:**

Horticultural crops form a major sector of the economy of Bhoo village with 102.85 hectares of area under mango cultivation, 46.43 ha under cashew, 4.68 ha under arecanut and 2.34 ha under coconut as per the Fal-Ganana (census of fruit plants) 2021-22.

As per the information obtained from interviews, arecanut and coconut are the major water-intensive crops with the daily requirement of around 35 liters per tree per day for coconut and around 20 LPTD



for arecanut. Mango and cashew plantations also need water at least for the first three-five years. The area under horticulture plantation in the last 10 years shows an increasing trend as per the data obtained from the agricultural office. Pik Ganana (Crop census) is done after every 10 years. We obtained the data of plantation area in Bhoo village for the year 2010-11 and 2020-21 from Rajapur Taluka Agricultural Office. [6] It is shown in the following table.

| No. | Name of the<br>crop | Area Under Cultivation<br>(ha)<br>(2021-22) | Area under<br>cultivation (ha)<br>(2011-12) | % change in the<br>area |
|-----|---------------------|---|---|-------------------------|
| 1)  | Mango               | 88.85                                       | 102.85                                      | +15.76                  |
| 2)  | Cashew              | 36.43                                       | 46.43                                       | +27.45                  |
| 3)  | Arecanut            | 2.68  | 4.68  | +74.63                  |
| 4)  | Coconut             | 1.34  | 2.34  | +74.63                  |

It can be known from the above table that the area under cultivation of the four major horticultural crops shows an increasing trend. Therefore, the increasing requirement of water for horticulture and its impact on the available water sources needs to be assessed.

## **5. Conclusions and Recommendations:**

1) Bhoo village doesn't face severe water scarcity. The LPCD for the village is 100.33 which is 262.99% higher than the LPCD of 27.64 as recorded on the JJM website. The water related problems in the village are different from just the "availability per person per day"

2) Chinchpeth and Sarfarewadi don't have household tap connections. PWS scheme needs to be made functional in these two Wadis.

3) Proper construction of the well is needed for Pimpalwadi and Mhadayewadi.

4) Sources (Wells) in the proximity of the river are more reliable and sustainable than those at a distance.

5) Revival of traditional Paat system is very important not only to supply water to orchards but also for groundwater recharge. This may include the following measures:

ii) Geographical mapping of all Paats.

ii) Repairing of damaged bunds (e.g. Sarfarewadi)

iii) Construction of permanent RCC bunds at the erection points of the Paats.

6) There needs to be a rethinking on the proposed location of the Sarfarewadi well as it requires blasting right in the riverbed. Impact assessment of blasting is required.

7) Brahmandev Zara and Talisakhal are the two important traditional water sources in the village which need to be protected.

8) New RCC bund being constructed on the upper side of Kumbharwadi can serve as an example of creating water reservoirs in the proper catchment areas. Special survey of the catchment areas in the village and probable places for water conservation needs to be made with the participation of the villagers.

9) There needs to be careful assessment of the demand of water by growing horticultural plantations in the village and its impact on the drinking water sources.

10) Collective decision making by all GPs is very important while doing any major intervention on the source as Bhoo, Tervan, Pendkhale and Bhalavli village fall on the same riverbank.

## 6. References:

- 1] Jal Jeevan Mission https://jaljeevanmission.gov.in/
- 2] Census India 2011 <u>https://censusindia.gov.in/census.website/</u>
- 3] Bhoo village location <u>https://goo.gl/maps/mHNCaMz3otA4R8Rw5</u>

4] Wadi Level Survey Excel Sheet -

https://docs.google.com/spreadsheets/d/1RE5ePjQHuVnJGPmmyoDwKEhz7-MXUKxjk IbwzCDKoOw/edit?usp=sharing

5] Data Collected from Gram Panchayat -

https://drive.google.com/drive/folders/1e36Sno1BJQkqdhd4Qeq1mnEWij5QepKQ?usp= sharing

6] Data from Rajapur Agriculture Office -

https://drive.google.com/drive/folders/1jTWXmHGDOg3OlAgTUnNzmlcB5CQDDx75? usp=sharing

# **Photos:**









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