2.1 Sample Sites: The samples were collected from 10 different stations of Phulambri region.

Sample sites from Phulambri area

1. Wahegaon
2. Sanjul
3. Hiwra
4. Aland
5. Wadod Bazar
6. Gewrai Gungi
7. Pirbawda
8. Wanegaon
9. Ranjangaon
10. Girsawali

Sample sites from Area

2.2 Sampling of Water: Plastic bottles of one liter capacity were used to collect the samples. Care was taken that no bubble should appear during the sampling. Whenever we sample bore well water the first portion of water was rejected. The bottles were rinsed with same water and then samples were collected. It was also taken into consideration that there should not be empty space remain so that the dissolve oxygen should not get altered. The temperature was recorded at the time of sampling on the spot and the rest of the
parameters were analyzed in the laboratory. Throughout the experiment following chemicals were used.

**2.3 Chemicals and Instruments:** Potassium dichromate (Sd fine chem Ltd), Ferrous Ammonium Sulphate (Reidel), Ferroin (Qualigens), Sulphuric Acid (Sd fine chem Ltd), Mercuric Sulphate (Reidel), Silver sulphate (Universal lab), Brucine Sulphate (Loba Chemcials), Sulfanilic Acid (Sd fine chem Ltd), Sodium Chloride (Loba Chemicals), Sodium Arsenite ((Sd fine chem Ltd)), Potassium nitrate (Sd fine chem Ltd), Copper Sulphate ((Sd fine chem Ltd)), Potassium Sulphate (Sd fine chem Ltd), Sodium Hydroxide (MERCK), Hydrochloric Acid (MERCK), Boric Acid (MERCK), Boromocresol Green (Sd fine chem Ltd), Methyl Red (Qualigens), Phenolphthalein (Sd fine chem Ltd), Ammonium Molybdate (MERCK), Stannous Chloride (Loba Chemicals), Nitric Acid (Sd fine chem Ltd), Barium Chloride (MERCK), Silver Nitrate (Fluka), Glycerol (SDFCL), Isopropyl Alcohol (Sd fine chem Ltd), Sodium Sulphate (Qualigens), Potassium Chromate (Thomas Baker), EDTA (Sd fine chem Ltd), Ammonium Chloride (MERCK), Ammonium Hydroxide (Sd fine chem Ltd), Magnesium Sulphate (Sd fine chem Ltd), Solochorme Balck T (Sd fine chem Ltd), Sodium Sulphide (Fiescher), Potassium Chloride (Fiescher), Potassium Hydrogen Phosphate (Qualigens), Murexide (Sd fine chem Ltd).

For the present work all chemicals were used of analytical reagent grade and used without further purification. Glass double distilled water was prepared by distilling water using pinch of KMnO₄ and KOH.
The procedure involved for determination of different physico-chemical parameters are described in the following paragraphs. These are taken from various practical books and lab manuals.

2.4 Methods:

1) pH: The pH of sample water was determined using pH meter of Elico make (model LI 120). A combined glass electrode was used. The pH meter was first calibrated using buffer solutions of pH 4 & 9.2. The pH meter reading accuracy was ± 0.1 pH.

2) Electrical Conductivity: Conductivity is a measure of ability of solution to carry electric current. The conductivity depends on presence of ions, the total concentration, and mobility, oxidation state of metal ion and on the temperature of measurement. The conductance of water was measured by using conductivity meter Elico make (model CM 180). The cell constant was calculated by measuring the conductance of 0.1 N KCl and 0.02 N KCl solutions and it used for conductivity measurement. Each measurement was carried out for three times with a time interval of five minute and average was recorded.

3) Total Dissolved Solid: The filterable solids can be determined from the difference of the total solids and the total suspended solids. To an evaporating dish 250 ml sample was added and evaporated on a water bath and calculated the weight of solids. Similarly to pre weighed evaporating dish 250 ml of the
filtered sample was added and evaporated to dryness and calculated the weight of the solids.

4) Turbidity: Prepared calibration curves of Hydrazine sulfate and hexamethylenetetramine from 0 to 400 units. And turbidity was determined by comparison with dilute standards. The sample was thoroughly shaked and kept for some time to remove the air bubble. Sample was filled in the sample holder of the Nephelometer and recorded the turbidity.

6) Total Hardness: Hardness in water is due to the presence of calcium, magnesium salts of carbonate and bicarbonates. It is a measure of the capacity of water to precipitate soap. When hardness numerically is greater than the sum of carbonate and bicarbonate alkalinity that amount of hardness equivalent to alkalinity is called carbonate hardness and amount of hardness in excess of this called non-carbonate hardness. When hardness numerically equal to or less than carbonate and bicarbonate alkalinity all hardness is carbonate hardness and non-carbonate hardness is absent.

EDTA solution of its disodium salt was prepared in distilled water, it was standardize by using Zinc ion solution at pH 10 and using soluchrome black T indicator. A definite amount of sample water was taken in conical flask. It was buffered to pH 10. Few drops of indicator soluchrome Blak T was added and titrated against standard EDTA Solution.

7) Calcium Hardness: EDTA solution of its disodium salt was prepared in distilled water, it was standardize by using Zinc ion solution at pH 10 and using
using soluchrome black T indicator. A definite amount of sample water was taken in conical flask. It was buffered to at higher pH. Few drops of indicator Murexide was added and titrated against standard EDTA Solution.

8) Magnesium Hardness: It is determined by subtracting the value of calcium hardness from total hardness.

9) Sodium: Sodium was determined by using flame photometer Toshniwal Pvt. Ltd. (model TMF-45). Standard solution containing 100 ppm sodium ion was prepared by dissolving appropriate amount of NaCl in 500 ml of water. This solution was used to prepare a series of solution with different concentration. The calibration curve was plotted. All the samples were aspirated one by one through the flame and double distilled water aspirated in between them. The concentration of sodium in the sample water was determined from calibration curve.

10) Potassium: Potassium was determined by using flame photometer Toshniwal Pvt. Ltd. (model TMF-45). Standard solution containing 100 ppm potassium ion was prepared by dissolving appropriate amount of KCl in 500 ml of water. This solution was used to prepare a series of solution with different concentration. All solutions were aspirated in the flame one by one and the corresponding readings were noted down. The calibration curve was plotted. The concentration of potassium in the sample water was determined from calibration curve.
11) **Iron:** To a suitable aliquot added 2 ml of conc. HCl followed by 1 ml Hydroxylamine Hydrochloride solution. Boiled for few minutes to ensure dissolution of iron. After cooling, added ammonium acetate buffer and 1,10-phenanthroline solution. Diluted to 100 ml and compared with blank.

12) **Total Alkalinity:** It is determined by titrating a suitable aliquot with a known concentration of sulphuric acid using phenolphthalein and methyl orange indicator.

13) **Chloride:** A Mohr’s method was used for the estimation of chloride. A known volume of sample was taken in a conical flask $K_2CrO_4$ was added as indicator and titrated against standard $AgNO_3$ solution till a brick red precipitate obtained.

14) **Fluoride:** Under acid condition fluorides (HF) react with zirconium SPANDS solution and the ‘lake’ (coour of SAPNDS reagent) gets bleached due to formation of ZrF$_6$. Since bleaching is a function of fluoride ions, it is directly proportional to concentration of fluoride. It obeys Beers’ law in reverse manner.

To estimate Fluoride a calibration curve was prepared in the range 0.0 to 1.4 mg/L by diluting appropriate volume of standard Fluoride solution to 50 ml in Nessler tubes. Added 10 ml acid zirconyl-SPANDS reagent to all samples, mix well and read optical density of bleached colour at 570 nm using reference solution for setting zero absorbance. Similarly water sample was processed and from calibration curve amount of fluoride is obtained.
15) **Nitrate-Nitrogen:** The nitrate concentration was determined by using UV-Visible spectrophotometer Elico make (model SL-159) at 220 nm and 275 nm. Since dissolved organic matter absorbed at 220 nm and NO$_3$ does not absorb at 275 nm. The following formula was used to calculated NO$_3$ from groundwater

$$= \text{O.D. at 220 nm} - (2 \times \text{O.D. at 275 nm})$$

16) **Sulphate:** A UV-Visible spectrophotometer Elico make (model SL-159) was used for determination of sulphate content. Sulphate ion is precipitated in the form of BaSO$_4$ by adding BaCl$_2$ in acidic medium. The amount of sulphate was determined from the calibration curve prepared from 0-100 ppm of sulphate.
Reference:


2. D.S. Ramteke & C.A. Moghe, Water & Wastewater analysis, National Environmental Engineering Research Institute, Nagpur,
