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Comparative Analysis of Water Quality of Bore-Hole and Open Well in Olpad Region, Surat, Gujarat

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Abstract- *Groundwater is generally considered a safe source of drinking water because it is abstracted with low microbial load with little need for treatment before drinking. However, groundwater resources are commonly vulnerable to pollution, which may degrade their Quality. This study focused upon the determination of physical, chemical and biological properties, including metals, selected anions and coliform bacteria in drinking water samples from bore holes & open wells in the Olpad region, Surat city. The purpose was to assess the quality of water from these sources. Water samples were taken from two Bore holes & two Open wells i.e. four location were selected and samples were collected 4 times during the year 2015-16 and tested for physical, chemical & biological parameters like pH, Total Dissolved Solids(TDS), Turbidity, Total Hardness, Calcium, Magnesium, Chloride, Flouride, MPN of Total Coliform, MPN of Faecal Coliform, Free Residual Chlorine, etc. The results were compared with the World Health Organisation (WHO)'s permissible limits and analysis was carried out. The results showed that in both the open well stations, value of Total Coliform was higher. One selected bore hole had TDS, Nitrate, Flouride and Total Alkalinity value higher than WHO's limits while all the parameters of other bore hole were within the WHO's permissible limits. Suitable measures should be suggested for improving the quality of the water for drinking purpose.*

Key words: Water Quality, Ground Water, WHO, Bore Hole, Open Well

I. INTRODUCTION

Water is one of the most important components in nature but is also the most misused one. Earth is blue planet and fourth fifth of its surface is covered by water. The use of water by man and animals is universal. Without water there can be no life. Man can go nearly two months without food, but can live only 3-4 days without water. From the total amount of water on the earth, only 3% water is fresh water and rest is saline water. About 30.1 % of water from the fresh water is stored in the form of ground water.

Water is the most priceless human commodity. It can be both priceless and worthless, a blessing or curse depending on circumstances. Nothing can take place without water. Water serves more in fulfilling the human needs than does any other natural source. Water can be considered as the principal raw material from which most of our farm products are made. It is essential for growth of crops, animals and human being. On a global scale, ground water represents the world's largest and most important source of fresh potable water. Ground water provides potable water to an estimated 1.5 billion people worldwide daily and has proved to be the most reliable resource for meeting rural water demand.
In addition, human activities can alter the natural composition of groundwater through the disposal or dissemination of chemicals and microbial matter on the land surface and into soils, or through injection of wastes directly into groundwater. Industrial discharges, urban activities, agriculture, groundwater plumage and disposal of waste can affect groundwater quality. Pesticides and fertilizers applied to lawns and crops can accumulate and migrate to the water tables thus affecting both the physical, chemical and microbial quality of water.

Thus in this project, we are going to study and analyse the physical, chemical & microbial quality of water from bore holes & open well and compare it with the WORLD HEALTH ORGANISATION (WHO)'s Guideline for drinking water.

1.1 Objectives of the Study

The Following are the objectives of the study

1. To know the quality of water from Open well & Bore holes obtained within the proposed study area.
2. To study & compare the Physical, Chemical & Biological properties of ground water in open wells and bore holes.
3. To know whether the water is suitable for drinking purposes or not.
4. To recommend to government and the private individuals ways of improving the present situation.

II. STUDY AREA

The study area was located in Olpad taluka, Surat district. In the Olpad taluka, the two villages selected were Segvachhama and Barbodhan. Figure 1 shows the location of study area.Segvachamma is located at 21°13'45.31'' N and 72°44'15.78'' E. Barbodhan is located at 21°13'23.35'' N and 72°42'29.87'' E.

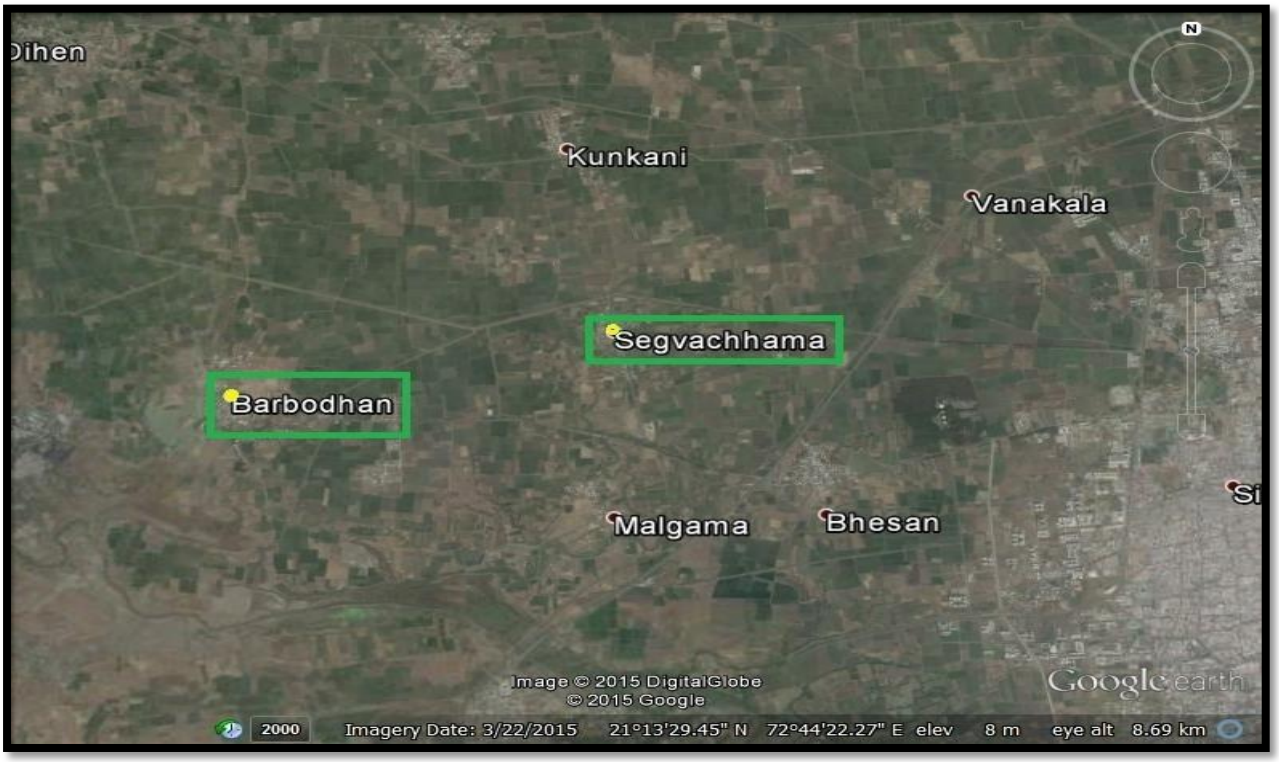


Figure 1: Location of Study Area

After the survey, one open well and one bore hole was selected from each of the villages of Segvachhama and Barbodhan respectively i.e. two open well and two bore holes were selected.

Table 1 Sample identification code and sample station

Sample Identification code	Sample Station
Open well 1 (OW1)	Segvachhama
Bore hole 1 (B1)	Segvachhama
Open Well 2 (OW2)	Barbodhan
Bore hole 2 (B2)	Barbodhan

The water sample from the sample stations for the Physical and Chemical testing was collected in the plastic bottles with tight screw-caps, while for the Biological (Bacterial) testing was collected in a Glass bottle provided by the Laboratory which was already sterilized in the Laboratory.
The bottles were labeled at the time of collecting water samples to avoid misidentification.
The samples were collected 4 times during the year 2015-16 for the physical, chemical and biological testing of the water from Open well and bore hole.

Table 2 Water sample collection date

Season	During monsoon		After monsoon	
Testing no.	1	2	3	4
Month	August	October	February	April
Date	25/08/2015	1/10/2015	28/02/2016	8/04/2016

III. METHODOLOGY

The following methodology were adopted in this study

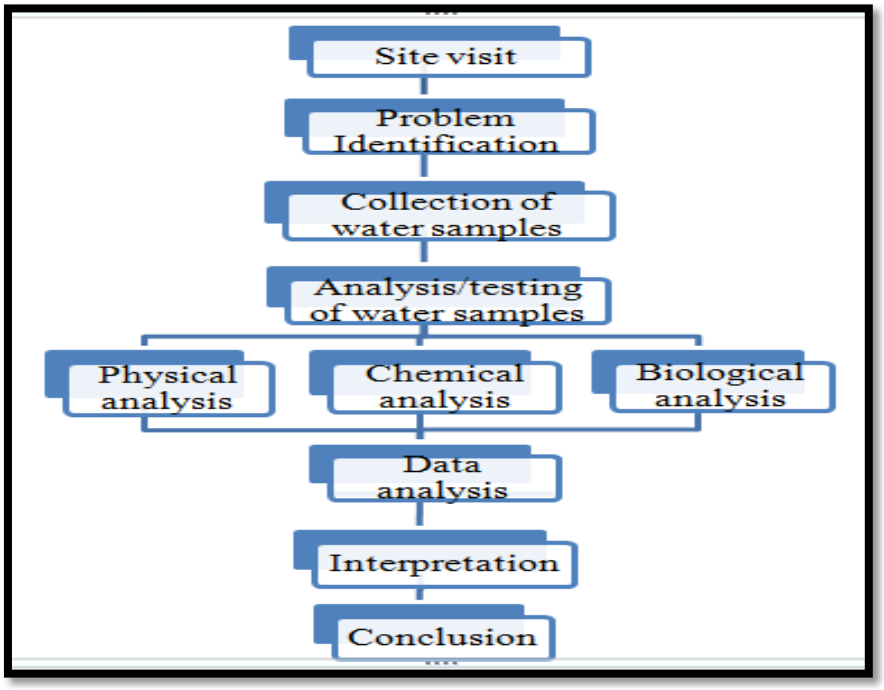


Figure 2 Flowchart of the methodology adopted

IV. RESULT AND DISCUSSION

The following results have been derived from the experiments

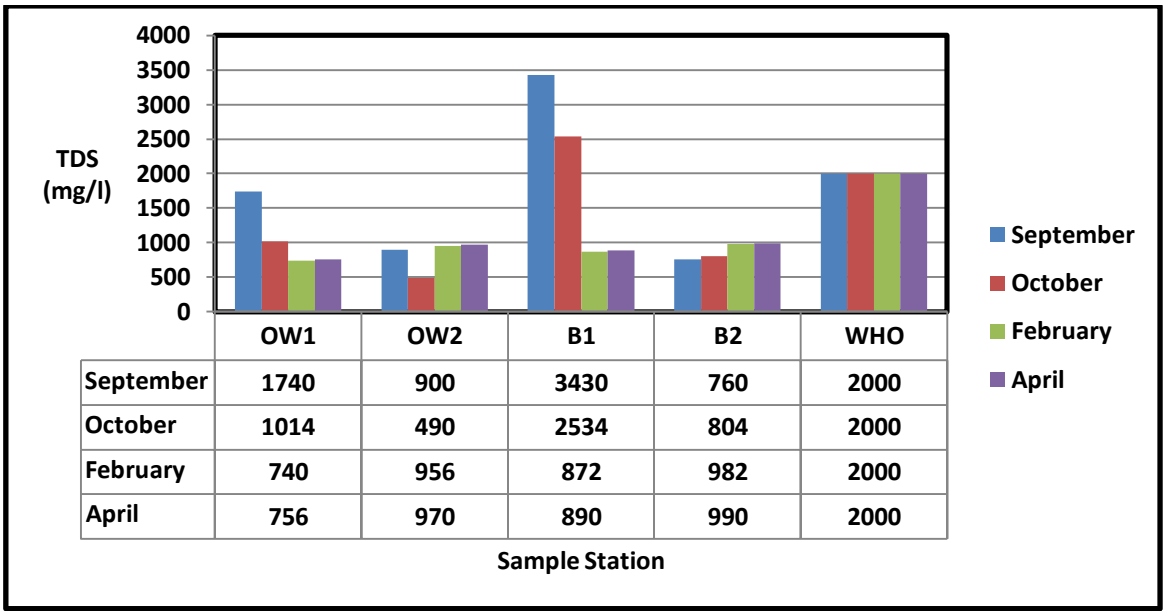
Open well 1 (OW1):
From the Data analysis and interpretation it is found that the quality of water of open well at Segvachhama village has color hazen unit, odour, Turbidity, TDS, TH, Ca, Mg, Cl, Sulphate, Nitrate, Flouride, Total alkalinity, i.e. all the physico-chemical properties were within the WHO's permissible limits. The Bacteriological parameters i.e. free residual chlorine, MPN of faecal coliform were within the permissible limits but the value of MPN of Total Coliform exceeds the permissible limits of WHO. Thus it indicates that the water is not fit for drinking purposes.

Open well 2 (OW2):
From the Data analysis and interpretation it is found that the quality of water of open well at Barbodhan village has color hazen unit, odour, Turbidity, TDS, TH, Ca, Mg, Cl, Sulphate, Nitrate, Flouride, Total alkalinity, i.e. all the physico-chemical properties were within the WHO's permissible limits. The Bacteriological parameters i.e. free residual chlorine, MPN of faecal coliform were within the permissible limits but the value of MPN of Total Coliform exceeds the permissible limits of WHO. Thus it indicates that the water is not fit for drinking purposes.

Bore hole 1 (B1):
From the Data analysis and interpretation it is found that the quality of water of Bore hole at Segvachhama village has color hazen unit, odour, Turbidity, TH, Ca, Mg, Cl, Sulphate, i.e. these physico-chemical properties were within the WHO's permissible limits. But the value of parameters like TDS, Nitrate, Flouride & Total Alkalinity exceeds the WHO's permissible limits during the monsoon season. The value of Bacteriological parameters i.e. free residual chlorine, MPN of faecal coliform and MPN of Total Coliform were within the WHO's permissible limits. Thus it indicates the water is not fit for drinking purposes.

Bore hole 2 (B2):
From the Data analysis and interpretation it is found that the quality of water of Bore hole at Barbodhan village has color hazen unit, odour, Turbidity, TDS, TH, Ca, Mg, Cl, Sulphate, Nitrate, Flouride, Total alkalinity, i.e. all the physico-chemical properties were within the WHO's permissible limits.The value of Bacteriological parameters i.e. free residual chlorine, MPN of faecal coliform and MPN of Total Coliform were within the WHO's permissible limits. Thus it indicates the water is not fit for drinking purposes.

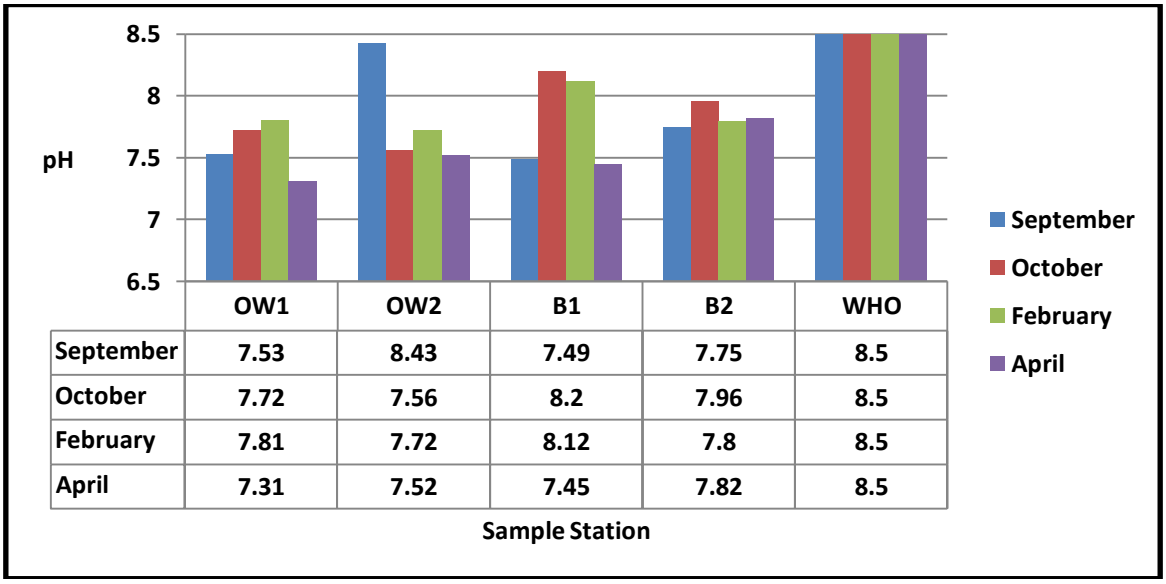
The Figure 3 shows the value of Total Dissolved Solids (TDS) for various stations. The WHO's permissible limits for TDS in Drinking water is 2000mg/l.
The Bore hole at Segvachhama (B1) has value of TDS value greater than the WHO's permissible limits in the month September & October i.e. during the monsoon season while the value of TDS in all other stations (OW1, OW2 & B2) lies within the permissible limits.



	OW1	OW2	B1	B2	WHO
September	1740	900	3430	760	2000
October	1014	490	2534	804	2000
February	740	956	872	982	2000
April	756	970	890	990	2000

Figure 3 Comparison of Total Dissolved Solids with WHO's permissible limits

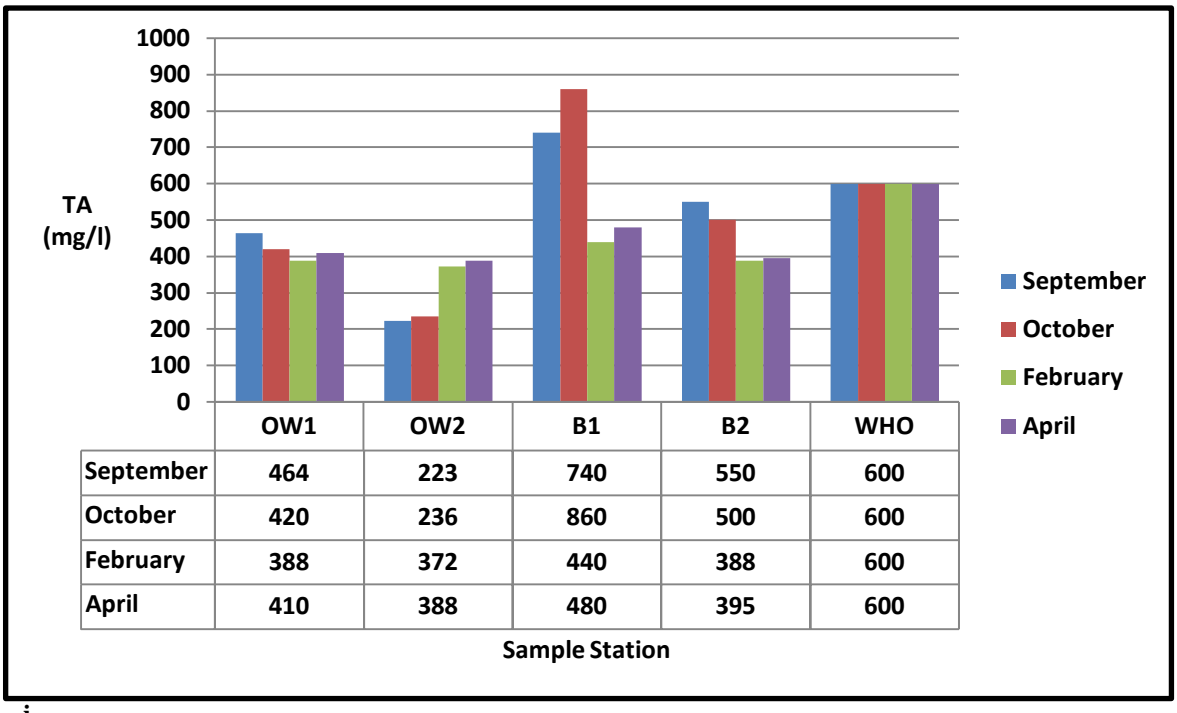
The figure 4 shows the value of pH for various stations during. The WHO's permissible limits for pH in Drinking water between 6.5 – 8.5.
The value of pH for all the stations lies within the permissible limits.



	OW1	OW2	B1	B2	WHO
September	7.53	8.43	7.49	7.75	8.5
October	7.72	7.56	8.2	7.96	8.5
February	7.81	7.72	8.12	7.8	8.5
April	7.31	7.52	7.45	7.82	8.5

Figure 4 Comparison of pH with WHO's permissible limits

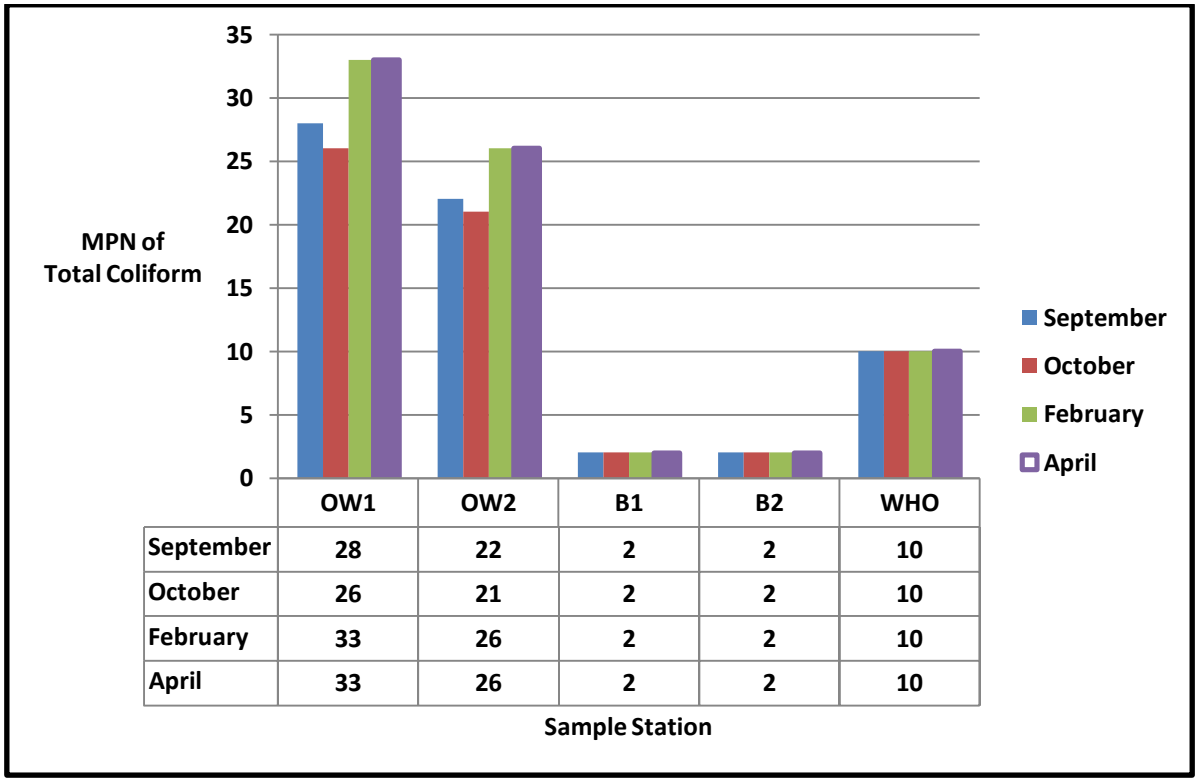
The figure 5 shows the value of Total Alkalinity (TA) for various stations. The WHO's permissible limits for TA in Drinking water is 600mg/l.
The Bore hole at Segvachhama (B1) has value of TA value greater than the WHO's permissible limits in the month September and October i.e. during monsoon while the value of TA in all other stations (OW1, OW2 & B2) lies within the permissible limits



	OW1	OW2	B1	B2	WHO
September	464	223	740	550	600
October	420	236	860	500	600
February	388	372	440	388	600
April	410	388	480	395	600

i
gure 5 Comparison of Total Alkalinity with WHO's permissible limits

The figure 6 shows the value of MPN of Total Coliform for various stations. The WHO's permissible limits for Total Coliform in Drinking water is less than 10 per 100 ml.
The Open Well stations (OW1 & OW2) has value of Total Coliform value greater than the WHO's permissible limits while the value of Bore hole stations (B1& B2) lies within the permissible limits.



	OW1	OW2	B1	B2	WHO
September	28	22	2	2	10
October	26	21	2	2	10
February	33	26	2	2	10
April	33	26	2	2	10

Figure 6 Comparison of MPN of Total Coliform with WHO's permissible limits

V. CONCLUSION AND RECOMMENDATION

From the present study following conclusions and recommendations were drawn:

Conclusions:

From this study, it can be concluded that in both the Open well at Segvachhama and Barbodhan, the physico-chemical parameters lie within the WHO's permissible limits but the value of bacteriological parameter MPN of Total Coliform exceeds the permissible limits of WHO. Thus it indicates that the water is not fit for drinking purposes. For this parameter, both the open wells are at critical stage and suitable measures should be adopted for treatment of the water for drinking purposes.

It can be also concluded that in Bore hole at Segvachhama (B1), the bacteriological and some of the physico-chemical parameters lies within the WHO's permissible limits but the value of parameters like TDS, Nitrate, Flouride & Total Alkalinity exceeds the WHO's permissible limits during the monsoon season. Thus it indicates the water is not fit for drinking purposes. For these parameters, B1 is at most critical stage and suitable measures should be adopted for treatment of water for drinking purposes.While in Bore Hole at Barbodhan(B2), all the physical, chemical and bacteriological parameters lies within the WHO's permissible limits. Thus it indicates that the water is safe for drinking purposes and no treatment should be done.

Recommendations:

- ✓ For the treatment of water for TOTAL COLIFORM, it is recommended to use any of the Chlorination, Ultra-violet and Distillation & Iodination process.
- ✓ For the treatment of water for TDS, it is recommended to use Reverse osmosis process.
- ✓ For the treatment of water for NITRATE, it is recommended to use any of the Reverse osmosis & Distillation process.
- ✓ For the treatment of water for FLOURIDE, it is recommended to use any of the Distillation & Activated Alumina process.
- ✓ For the treatment of water for TOTAL ALKALINITY, it is recommended to use Neutralising agent process.

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