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Analysis of Ground Water Quality in and Around Laggere, Banglore and their Effectiveness for Domestic Use

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***Abstract*: Due to human and industrial activities the water bodies are contaminated. This is the serious problem now a days. Thus the analysis of the water quality is very important to preserve the natural ecosystem. The assessment of the water quality is carried out in the different bore wells of LAGGERE, BENGALURU. The present work is aimed at assessing the waterquality index (WQI) for the ground water of LAGGERE. The ground water samples of all the selected bore wells were collected for a physiochemical and biological analysis. For calculating present water quality status by statistical evaluation and water quality index. Following 22 parameters have been considered Viz. pH, color, turbidity, TDS, conductivity, BOD, total hardness, calcium, chloride, zinc, sulphate, magnesium, alkalinity, fluoride, boron, copper, iron, COD, chromium, odor, nitrate, manganese, E-coli etc… The obtained results are compared with IS 10500:2012 and WHO. The study of physiochemical and biological characteristics of water samples suggests that the evaluation of water quality parameters as well as water quality management practices should be carried out to protect the water resources.**

***Keywords*: ground water**

1. Introduction

One of the major crises faced in the recent times is the strain on the potable water resources. Bangalore city originally met its water demand from the lakes and tanks which were constructed across the city in the 16th century. The lakes that were once a source of water for irrigation, drinking, fishing etc are now used as dumping sites for industrial effluents, domestic sewage, domestic solid waste etc .It is most important that the water which people drink and use for other purposes is clean water. This means that the water must be free of germs and chemicals and be clear (not cloudy).Water that is safe for drinking is called potable water. Disease-causing germs and chemicals can find their way into water supplies. When this happens the water becomes polluted or contaminated and when people drink it or come in contact with it in other ways they can become very sick. Water that is not safe to drink is said to be non-potable. Throughout history there have been many occasions when hundreds of thousands of people have died because disease-causing germs have been spread through a community by a polluted water supply.

One of the reasons this happens less frequently now is that people in many countries make sure drinking water supplies are potable. Water supplies are routinely checked for germs and chemicals which can pollute water. If the water is not safe to drink it is treated. All the action taken to make sure that drinking water is potable is called water treatment Industrial effluents were collected from three different stations during the year 2011 and 2012 for three different seasons and analyzed. COD concentration recorded was comparatively high during pre-monsoon season due to high temperatures and low dilution. The alkalinity of water was much higher than the Indian standard. Conceptual Design of a wastewater treatment plant for the Derabassi industrial estate, Punjab (2013) shows that overall goal of the project was to prevent the contamination of the aquifer. Studies on heavy metal contamination in Vrishabhavathi river water and groundwater of the surrounding river (2013) aims to assess the physicochemical parameter, extent of heavy metal content in Vrishabhavathi River and its surrounding ground water Toxic heavy metal analysis was done using atomic absorption spectrophotometer. Heavy metals Pb, Cr, Ni, Mn and Fe concentrations were found to be above permissible limit.

Table 1
Substance and types of problems

Substance	Types of Problems
Iron(Fe^{+2}, Fe^{+3})	Encrustation, staining of laundry and toilet fixtures
Manganese(Mn^{-2})	Encrustation, staining of laundry and toilet
Silica(So_2)	Encrustation
Chloride (Cl^-)	Portability, Corrosiveness
Fluoride (F^-)	Fluorosis
Nitrate (NO^3)	Methemoglobenemia
Sulphate (SO_4^{-2})	Portability
Dissolved Gases	Corrosiveness
Dissolves Oxygen	Corrosiveness
Hydrogen Sulphide (H_2S)	Corrosiveness
Carbon dioxide (CO_2)	Corrosiveness
Radio Nuclides	Portability
Mineral Constituents	Portability, Health aspects
Calcium and Magnesium (Ca^{2+}),(Mg^{2+})	Encrustation

WQI is an important technique for demarcating groundwater quality and its suitability for drinking purpose. It is computed to reduce the large amount of water quality data to a mere numerical value that express the overall water quality at a certain location and the time based on several water quality parameters. In this index a mathematical equation used to transform large number of water quality data in a single number which is simply and easy to understandable for decision makers about quality and possible uses of any water body. It serves as the understanding of water quality for the possible uses of any water body .it serves as the understanding of water quality for the possible uses by integrating complex data and generating a score that describes water quality status.

A. Ground water scenario

Ground water occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations (Fig. 3). The occurrence of Ground water movement and recharge to aquifers are controlled by various factors like fracture pattern, degree of weathering, geomorphological setup and amount of rainfall received. Generally the depth of weathering varies, being more in the valley, and often extending up to 30 m in the dug wells. However the yield in the bore well is dependent upon factors like degree of weathering, presence of joints and fractures and its connectivity and the presence of intrusive bodies. Granites and Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Laterites of Tertiary age occur as isolated patches capping crystalline rocks in Bangalore north taluk and ground water occur in phreatic condition. Alluvium of limited thickness and aerial extent of 20 to 25m thick occur along the river courses possessing substantial ground water potential. The highest with 1157mm and lowest for Anekal taluk with 890mm.

2. Literature review

A. Ramesh, B.S. Senior Environmental Officer, Karnataka State Pollution Control Board, Bangalore.

The study of underground contamination will be of immense help to researchers and environmental regulators to evolve and initiate mitigative measures. Penya Industrial Area, Bangalore, India is considered as to be one of the ldest and largest industrial area in south –east asia. studies have been carried out to identify the parameters of contamination and their distribution with the help of existing bore wells which have been analyzed for 20 parameters. The major general contaminants for exceeding standards are hardness and nitrates; whereas hexavalent chromium and lead are toxic elements found exceeding the drinking water limit in some bore wells. However, the bore wells containing the parameters exceeding the limits were found highly isolated spatially in the entire area except an isolated presence of chromium in one pocket, thus indicating that the situation is not serious and be tackled by the initiating measures to control local stretches. Combination of parameters exceeding limits varied from bore well to bore well.

A. Observation's drawn from the experimental observation

1. pH Ranges between 6.7 and 7.6. All samples are within permissible limit of 6.5-8.5.
2. Dissolved solids- Ranges between 730mg/L and 1090mg/. All samples are within the permissible limits of 2000mg/L.
3. Sulphates- Ranges between 30mg/L and 100mg/L. All samples are within the permissible limit of 400mg/L.
4. Chlorides- Ranges between 110mg/L and 200mg/L. All the samples are well within the permissible limit of 1000mg/L.
5. Cyanide- Not detected in any of the samples.
6. Copper- Ranges < 0.05. All the samples are well within the permissible limit of 1.5mg/L.
7. Hexavelent chromium- Ranges between < 0.05mg/L. All the samples are less than the acceptable limit of 0.05mg/L.
8. Zinc- Ranges between < 0.1mg/L. All the samples are well within the permissible limit of 15mg/L.
9. Manganese- It ranged between < 0.1 mg/L. All samples are exceeding the permissible limit of 0.3mg/L.
10. Iron- Ranges between 0.05mg/L and 0.15mg/L. All the samples are well within the permissible limit of 1mg/L.
11. Cadmium- Concentration of cadmium was observed to be below the detection limits.
12. Nitrate as NO3- Ranges between 5mg/L and 20mg/L. All the samples are well within the acceptable limit of 45mg/L.
13. Phenolic compounds- Not detected in any of the samples.
14. Hardness- Ranges between 300mg/L and 550mg/L. All the samples are well within the permissible limit of 600mg/L.
15. Clacium as Ca- Ranges between 90mg/L and 150mg/L. All the samples are well within the permissible limit of 200mg/L.
16. Magnesium as Mg- Ranges from 30mg/L and 50mg/L. All the samples are within the permissible limit f 100mg/L.
17. Fluoride- Ranges between 0.70mg/L and 0.90mg/L. All the samples are well within the permissible limit of 1.5mg/L.
18. Turbidity- Ranges between 0.3mg/L and 1mg/L. All the samples are well within the permissible limit of 5mg/L.
19. Alkalinity- Ranges between 250mg/L and 310mg/L. All are within the limits of 600mg/L.
20. MPN Coliform Bacteria/100ml- Not detectable in any of the samples.

It is generally observe that there is no contamination of ground water with respect to specific parameter in the entire

study area. As such presently there is no potential threat to the entire ground water, indicating that there are only a few pockets of contaminated ground water and these pockets are contaminated with respect to different types of contaminants. The sources of contamination are from different point sources and thus should be handled independently. Hence remedial approaches should be specified to the pocket and to the contaminants

Hardness is the single parameter exceeding the limits of 17 bore wells. Nitrates alone is exceeding permissible limits in 6 bore wells. While in 9 bore wells both hardness and nitrates are exceeding. By initiating remedial measures along with 24 non contaminated bore well, 67% of locations in ground water can be made suitable for human consumptions. The study area and its surrounding area lacks scientific sewage disposal facility, by addressing this issue, the contamination can further be prevented. Hexavalent chromium and lead are the only two toxic elements found in excess of permissible limits. This may due to improper historical disposal and /or industrial operations in the area. This problem is however only localized and can be handled by adopting suitable mitigative measures

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The rapidity of industrialization that has recently become the need of the hour, for a developing country like India has turned into a major source of ground water contamination. Huge inputs of pollutants from the industries have been taking the pollutants into the surface and groundwater sources from their activities do not strictly regulate their pollutant to safe limits. Many industries discharge their effluents without any project treatment into nearby open pits or pass them through unlined channel, which move towards the low lying depressions on land, resulting in the contamination of groundwater and surface water sources. The industrial effluents, if not treated to remove or bring pollutant concentration level below standards specified, can pollute and cause serious damage to the surface and ground water resources.The present study aims at evaluating the chemical characterization of surface and Ground water present in Peenya industrial area, Banglore city in India. Surface and Ground water sample from 40 district locations in the industrial area were collected. Analytical procedures as described in the Standard methods for the examination of water and waste water were implemented for chemical analysis of these samples and da results were compared with the Bureau of Indian Standards (IS 10500) guideline values for portable water, in order to evaluate the possibility of health hazards in the study area.The results reveal that most of the study area is highly polluted, because of excessive concentration of one or more water quality parameter such as pH, Total Hardness, Total Dissolved Solids, Dissolved Oxygen, Salinity, Alkalinity, Acidity and Electrical Conductivity. It is evident that more than 50% of water samples are non-potable as per Bureau of Indian standards (IS 10500).

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Water as resource, basic amenity and the universal solvent is shared by pollutions. The physicochemical and biological quality study of Anekal Taluk has been taken up to evaluate its suitability for portable purpose. 1026 water samples were collected from bore well, hand pumps of 272 villages covering in Anekal Taluk. The quality of groundwater has been made through the analysis of pH, colour, electrical conductivity, turbidity, total dissolved solids, alkalinity, cholrides, total hardness, calcium, fluoride, nitrate, sulphate, iron and E.coli. The quality of groundwater assessed in the study area is discussed in detail. The physicochemical and biological results have been subjected to statistically analysis and given in the Table 1. The observed ranges of the samples were compared with Bureau of Indian Standards (BIS-10500: 1991). The samples collected showed considerable variations in the quality of groundwater. This might be due to irregular distribution of rocks or due to variation in the depth of sample points. A comparison of the depth of hand pump installation indicates that the deep installations are better than the shallow installations with respect to the groundwater quality, since shallow hand pumps draw water from the topmost water bearing structure, which is contaminated by various natural and anthropogenic sources percolating in the vicinity (Garg et al., 2003)

B. Objectives

- The objective of the study is to be analyses the ground water quality in the area LAGGARE, BENGALURU.
- To study effects caused due to water.

To suggest measures to be taken to prevent the pollution

3. Materials and methods

A. General

Several laboratory tests are conducted on water (raw as well as treated) to determine its characteristics and to determine the degree of treatment required to make it potable, as stated in the report. Usually at under graduate level, the following tests will be required to be performed in water testing laboratory.

B. List of physical and chemical tests and biological tests conducted in the laboratory

1. Ph
2. Color
3. Odor
4. Turbidity
5. Total dissolved solids
6. Total hardness
7. Chlorides
8. Total alkalinity
9. Sulphates
10. COD
11. BOD
12. Dissolved oxygen

Table 2
Sample and survey no.

Sample no.	Source	Latitude	Longitude	Depth (ft.)	Survey no.
Sample-1	Bore well	N13°0'36"	E77°31'33"	450	1
Sample-2	Bore well	N13°0'26"	E77°31'41"	160	2
Sample-3	Bore well	N12°57'53"	E77°30'21"	280	3
Sample-4	Bore well	N13°0'36"	E77°31'33"	380	4
Sample-5	Bore well	N13°0'32"	E77°31'20"	720	5
Sample-6	Bore well	N13°0'49"	E77°31'26"	600	6

13. phosphates
14. Temperature
15. Phenolic compound
16. Iron
17. Hexavalent Chromium
18. Coliform Bacteria

4. Results

Ground water is collected from places in BANGLORE. Its exact position on the map is on latitude 12°47'N and longitude 77°20'E. The sampling was considered at 6 spots to evaluate physio-chemical and biological characteristics of ground water.

The objective of sampling is to collect a portion of material, small enough in volume to be transported conveniently and handled in the laboratory the sampling details of water. In ground water before filling the sample the sample container, rinse it two or three with bore water to be collected for analysis of organic compound, and fill the container without the air bubbles. Every sample collected and identified is recorded on every container by attaching a Tag or a label. The data of collection, location are recorded. The sample was collected on 25-03-2018. During the period after sampling the analysis was carried out for 23 parameter as per Bureau of Indian Standards and the list of method are presented in appendix.

Table 3
Characteristics of ground water (Borewell 1 (450 ft.))

Tests	Results	Max desirable limits (mg/l)	Max permissible limits (mg/l)	Protocol IS-3025
Color, Hazen units	<5	5	25	IS-3025/Part-4
Odour	Agreeable	Agreeable	_	IS-3025/Part-5
Turbidity, NTU	0.5	1	5	IS-3025/Part-10
pH value	6.9	6.5-8.5	No relaxation	IS-3025/Part-11
Total hardness as Caco3,mg/l	410	200	600	IS-3025/Part-21
Calcium as Ca, mg/l	96	75	200	IS-3025/Part-40
Magnesium as Mg, mg/l	35	30	100	IS-3025/Part-46
Chloride as Cl,mg/l	141.8	250	1000	IS-3025/Part-32
Total dissolved solids, mg/l	880	500	2000	IS-3025/Part-16
Sulphate as SO4,mg/l	60	200	400	IS-3025/Part-24
Nitrate as NO3, mg/l	12	45	No relaxation	IS-3025/Part-34
Fluoride as F, mg/l	0.77	1.0	1.5	IS-3025/Part-60
Iron as Fe, mg/l	0.12	0.3	1	IS-3025/Part-53
Chromium as Cr, mg/l	<0.05	0.05	No relaxation	IS-3025/Part-52
Zinc as Zn, mg/l	<0.1	5.0	15	IS-3025/Part-49
Copper as Cu,mg/l	<0.05	0.05	1.5	IS-3025/Part-42
Boron as B, mg/l	<0.5	0.5	1	IS-3025/Part-57
Manganese as Mn, mg/l	<0.1	0.1	0.3	IS-3025/Part-59
Residual free Chlorine, mg/l	0.06	0.2	_	IS-3025/Part-26
Total alkalinity as Caco3, mg/l	263	200	600	IS-3025/Part-23
Micro biological test				
Parameter	**Limits**	**Results**	**Protocol**	**Method**
MPN Coliform Bacteria/ 100ml	Not detectable	Nil	IS 10500	3025

Table 4
Characteristics of ground water (Borewell 2 (160 ft.))

Tests	Results	Max desirable limits (mg/l)	Max permissible limits (mg/l)	Protocol IS-3025
Color, Hazen units	<5	5	25	IS-3025/Part-4
Odour	Agreeable	Agreeable	_	IS-3025/Part-5
Turbidity, NTU	0.8	1	5	IS-3025/Part-10
pH value	6.7	6.5-8.5	No relaxation	IS-3025/Part-11
Total hardness as Caco3,mg/l	540	200	600	IS-3025/Part-21
Calcium as Ca, mg/l	148	75	200	IS-3025/Part-40
Magnesium as Mg, mg/l	47	30	100	IS-3025/Part-46
Chloride as Cl,mg/l	189.3	250	1000	IS-3025/Part-32
Total dissolved solids, mg/l	1090	500	2000	IS-3025/Part-16
Sulphate as SO4,mg/l	95	200	400	IS-3025/Part-24
Nitrate as NO3, mg/l	17	45	No relaxation	IS-3025/Part-34
Fluoride as F, mg/l	0.85	1.0	1.5	IS-3025/Part-60
Iron as Fe, mg/l	0.13	0.3	1	IS-3025/Part-53
Chromium as Cr, mg/l	<0.05	0.05	No relaxation	IS-3025/Part-52
Zinc as Zn, mg/l	<0.1	5.0	15	IS-3025/Part-49
Copper as Cu,mg/l	<0.05	0.05	1.5	IS-3025/Part-42
Boron as B, mg/l	<0.5	0.5	1	IS-3025/Part-57
Manganese as Mn, mg/l	<0.1	0.1	0.3	IS-3025/Part-59
Residual free Chlorine, mg/l	0.17	0.2	_	IS-3025/Part-26
Total alkalinity as Caco3, mg/l	268	200	600	IS-3025/Part-23
Micro biological test				
Parameter	**Limits**	**Results**	**Protocol**	**Method**
MPN Coliform Bacteria/ 100ml	Not detectable	Nil	IS 10500	3025

Table 5
Characteristics of ground water (Borewell 3 (280 ft.))

Tests	Results	Max desirable limits (mg/l)	Max permissible limits (mg/l)	Protocol IS-3025
Color, Hazen units	<5	5	25	IS-3025/Part-4
Odour	Agreeable	Agreeable	_	0
Turbidity, NTU	0.4	1	5	IS-3025/Part-10
pH value	702	6.5-8.5	No relaxation	IS-3025/Part-11
Total hardness as Caco3,mg/l	360	200	600	IS-3025/Part-21
Calcium as Ca, mg/l	85	75	200	IS-3025/Part-40
Magnesium as Mg, mg/l	32	30	100	IS-3025/Part-46
Chloride as Cl,mg/l	136.7	250	1000	IS-3025/Part-32
Total dissolved solids, mg/l	790	500	2000	IS-3025/Part-16
Sulphate as SO4,mg/l	40	200	400	IS-3025/Part-24
Nitrate as NO3, mg/l	10	45	No relaxation	IS-3025/Part-34
Fluoride as F, mg/l	0.73	1.0	1.5	IS-3025/Part-60
Iron as Fe, mg/l	0.08	0.3	1	IS-3025/Part-53
Chromium as Cr, mg/l	<0.05	0.05	No relaxation	IS-3025/Part-52
Zinc as Zn, mg/l	<0.1	5.0	15	IS-3025/Part-49
Copper as Cu,mg/l	<0.05	0.05	1.5	IS-3025/Part-42
Boron as B, mg/l	<0.5	0.5	1	IS-3025/Part-57
Manganese as Mn, mg/l	<0.1	0.1	0.3	IS-3025/Part-59
Residual free Chlorine, mg/l	0.06	0.2	_	IS-3025/Part-26
Total alkalinity as Caco3, mg/l	253	200	600	IS-3025/Part-23
Micro biological test				
Parameter	**Limits**	**Results**	**Protocol**	**Method**
MPN Coliform Bacteria/ 100ml	Not detectable	Nil	IS 10500	3025

Table 6
Characteristics of ground water (Borewell 4 (380 ft.))

Tests	Results	Max desirable limits (mg/l)	Max permissible limits (mg/l)	Protocol IS-3025
Color, Hazen units	<5	5	25	IS-3025/Part-4
Odour	Agreeable	Agreeable	_	IS-3025/Part-5
Turbidity, NTU	0.8	1	5	IS-3025/Part-10
pH value	7.6	6.5-8.5	No relaxation	IS-3025/Part-11
Total hardness as Caco3,mg/l	320	200	600	IS-3025/Part-21
Calcium as Ca, mg/l	78	75	200	IS-3025/Part-40
Magnesium as Mg, mg/l	31.6	30	100	IS-3025/Part-46
Chloride as Cl,mg/l	116.5	250	1000	IS-3025/Part-32
Total dissolved solids, mg/l	730	500	2000	IS-3025/Part-16
Sulphate as SO4,mg/l	35	200	400	IS-3025/Part-24
Nitrate as NO3, mg/l	14	45	No relaxation	IS-3025/Part-34
Fluoride as F, mg/l	0.82	1.0	1.5	IS-3025/Part-60
Iron as Fe, mg/l	0.09	0.3	1	IS-3025/Part-53
Chromium as Cr, mg/l	<0.05	0.05	No relaxation	IS-3025/Part-52
Zinc as Zn, mg/l	<0.1	5.0	15	IS-3025/Part-49
Copper as Cu,mg/l	<0.05	0.05	1.5	IS-3025/Part-42
Boron as B, mg/l	<0.5	0.5	1	IS-3025/Part-57
Manganese as Mn, mg/l	<0.1	0.1	0.3	IS-3025/Part-59
Residual free Chlorine, mg/l	0.05	0.2	_	IS-3025/Part-26
Total alkalinity as Caco3, mg/l	258	200	600	IS-3025/Part-23
Micro biological test				
Parameter	**Limits**	**Results**	**Protocol**	**Method**
MPN Coliform Bacteria/ 100ml	Not detectable	Nil	IS 10500	3025

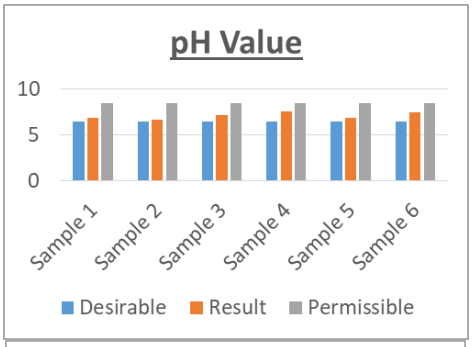
Table 7
Characteristics of ground water (Borewell 5 (720 ft.))

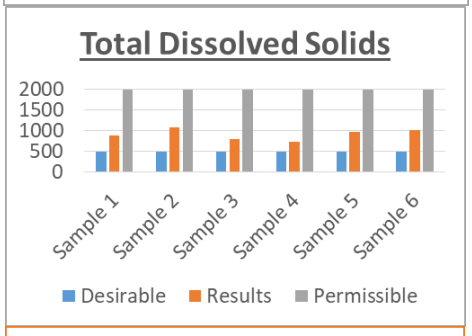
Tests	Results	Max desirable limits (mg/l)	Max permissible limits (mg/l)	Protocol IS-3025
Color, Hazen units	<5	5	25	IS-3025/Part-4
Odour	Agreeable	Agreeable	_	IS-3025/Part-5
Turbidity, NTU	0.5	1	5	IS-3025/Part-10
pH value	6.88	6.5-8.5	No relaxation	IS-3025/Part-11
Total hardness as Caco3,mg/l	430	200	600	IS-3025/Part-21
Calcium as Ca, mg/l	112	75	200	IS-3025/Part-40
Magnesium as Mg, mg/l	43	30	100	IS-3025/Part-46
Chloride as Cl,mg/l	160.35	250	1000	IS-3025/Part-32
Total dissolved solids, mg/l	960	500	2000	IS-3025/Part-16
Sulphate as SO4,mg/l	55	200	400	IS-3025/Part-24
Nitrate as NO3, mg/l	15.6	45	No relaxation	IS-3025/Part-34
Fluoride as F, mg/l	0.75	1.0	1.5	IS-3025/Part-60
Iron as Fe, mg/l	0.11	0.3	1	IS-3025/Part-53
Chromium as Cr, mg/l	<0.05	0.05	No relaxation	IS-3025/Part-52
Zinc as Zn, mg/l	<0.1	5.0	15	IS-3025/Part-49
Copper as Cu,mg/l	<0.05	0.05	1.5	IS-3025/Part-42
Boron as B, mg/l	<0.5	0.5	1	IS-3025/Part-57
Manganese as Mn, mg/l	<0.1	0.1	0.3	IS-3025/Part-59
Residual free Chlorine, mg/l	0.14	0.2	_	IS-3025/Part-26
Total alkalinity as Caco3, mg/l	286.7	200	600	IS-3025/Part-23
Micro biological test				
Parameter	**Limits**	**Results**	**Protocol**	**Method**
MPN Coliform Bacteria/ 100ml	Not detectable	Nil	IS 10500	3025

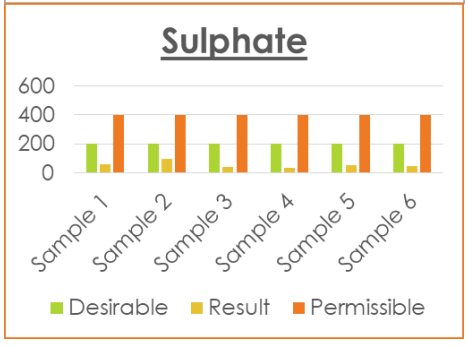
Table 8
Characteristics of ground water (Borewell 6 (600 ft.))

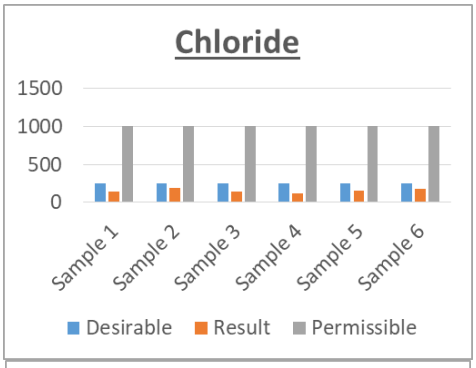
Tests	Results	Max desirable limits (mg/l)	Max permissible limits (mg/l)	Protocol IS-3025
Color, Hazen units	<5	5	25	IS-3025/Part-4
Odour	Agreeable	Agreeable	_	IS-3025/Part-5
Turbidity, NTU	0.7	1	5	IS-3025/Part-10
pH value	7.45	6.5-8.5	No relaxation	IS-3025/Part-11
Total hardness as Caco3,mg/l	480	200	600	IS-3025/Part-21
Calcium as Ca, mg/l	136	75	200	IS-3025/Part-40
Magnesium as Mg, mg/l	44.8	30	100	IS-3025/Part-46
Chloride as Cl,mg/l	177.35	250	1000	IS-3025/Part-32
Total dissolved solids, mg/l	1020	500	2000	IS-3025/Part-16
Sulphate as SO4,mg/l	50	200	400	IS-3025/Part-24
Nitrate as NO3, mg/l	13	45	No relaxation	IS-3025/Part-34
Fluoride as F, mg/l	0.8	1.0	1.5	IS-3025/Part-60
Iron as Fe, mg/l	0.06	0.3	1	IS-3025/Part-53
Chromium as Cr, mg/l	<0.05	0.05	No relaxation	IS-3025/Part-52
Zinc as Zn, mg/l	<0.1	5.0	15	IS-3025/Part-49
Copper as Cu,mg/l	<0.05	0.05	1.5	IS-3025/Part-42
Boron as B, mg/l	<0.5	0.5	1	IS-3025/Part-57
Manganese as Mn, mg/l	<0.1	0.1	0.3	IS-3025/Part-59
Residual free Chlorine, mg/l	0.18	0.2	_	IS-3025/Part-26
Total alkalinity as Caco3, mg/l	308.6	200	600	IS-3025/Part-23

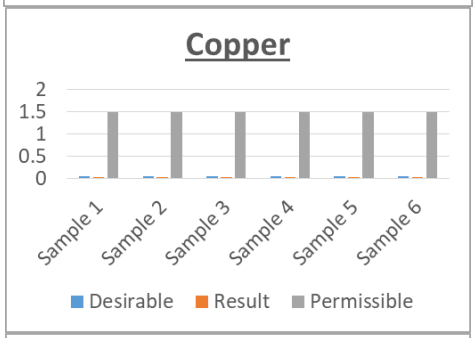
Micro biological test				
Parameter	**Limits**	**Results**	**Protocol**	**Method**
MPN Coliform Bacteria/ 100ml	Not detectable	Nil	IS 10500	3025

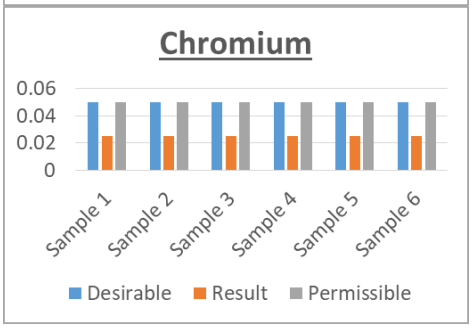


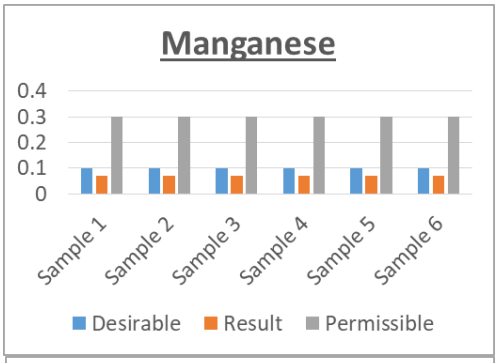


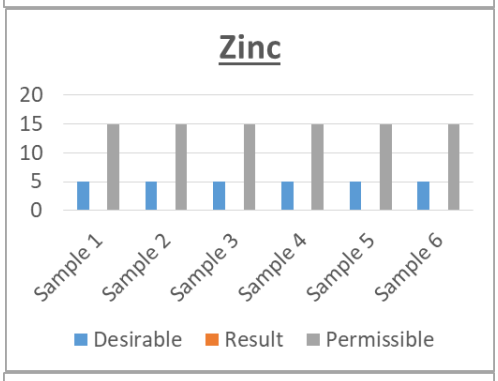


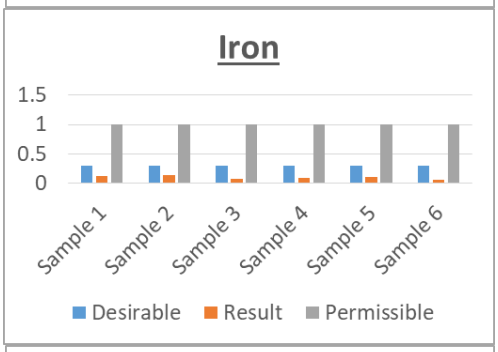


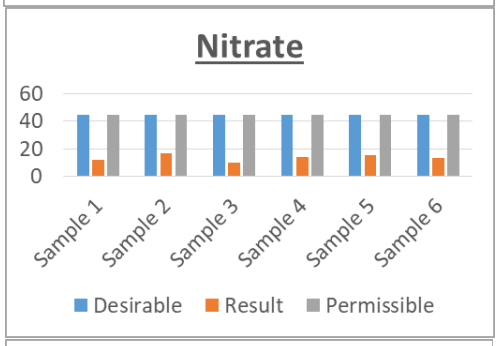


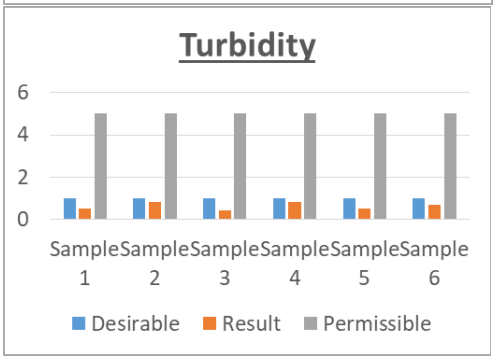


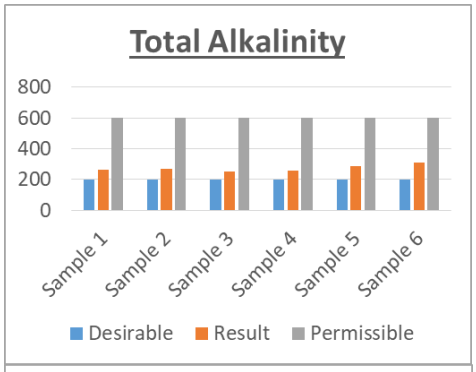

Manganese
0.4
0.3
0.2
0.1
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible

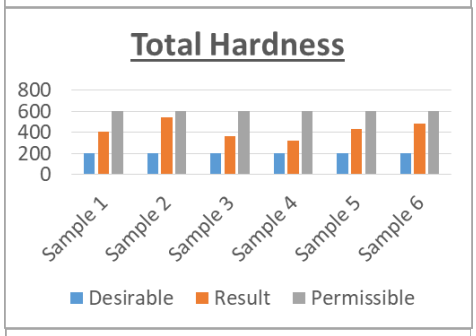

Zinc
20
15
10
5
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible

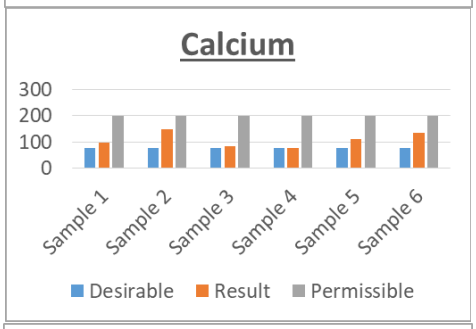

Iron
1.5
1
0.5
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible

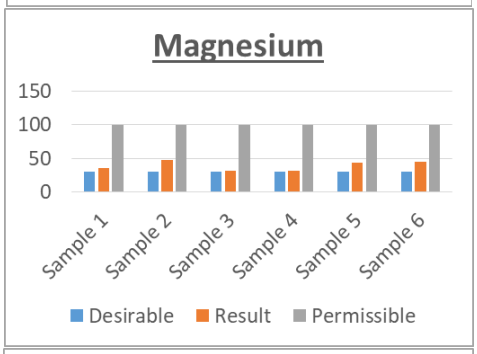

Nitrate
60
40
20
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible

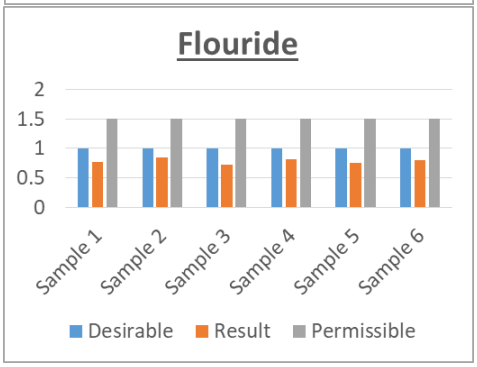

Turbidity
6
4
2
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible


Total Alkalinity
800
600
400
200
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible


Total Hardness
800
600
400
200
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible


Calcium
300
200
100
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible


Magnesium
150
100
50
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible


Flouride
2
1.5
1
0.5
0
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6
Desirable
Result
Permissible




Collection of bore water (Laggere, Bangalore)

5. Conclusion

pH: It is –ve logarithm to base 10 of hydrogen ion concentration. For pure water pH is 7.If this value will increases their reduction in the hydrogen ions concentration. As per our study pH value of all the samples such as lake water, bore well water, well water lies between 6.5-8.5 (Max. acceptable limits).
Turbidity: It is caused due to the wide variety of suspended matters which ranges in size from colloidal to coarse dispersion. Turbidity for drinking water must be less than 1 NTU but as per results all collected water samples crosses their limit.
Total dissolved solids: Higher concentration may make appearance of water dull and water may give salty taste and unpleasant odor. Water with lower TDS may corrosive and leak toxic metal such as copper lead etc. According to our studies all the sources of samples crosses the maximum acceptable limis(500mg/l).
Total hardness: It is the property of water which prevents the lathering of soap. It is caused due to carbonates, sulphates of calcium and magnesium ion.If hardness is greater than 200 it is hard water. As per our tests results total hardness of all the samples is more than the acceptable limits. Hence some softening methods are required.
Chlorides: The presence of chloride is due to the presence of saline water and sewage water. Excess of chloride is dangerous and unfit for use. Chloride content of all the samples is lies within the acceptable limits(250mg/l).Hence safe.
Total alkalinity: Alkalinity of water is its capacity to neutralize an acid. The presence of carbonates, bicarbonates and hydroxides decreases H+ ions and increases pH value of water. Results shows all the samples crosses their acceptable limits.
SULPHATE: The concentration of sulphate in water less than 200mg/l is an indicate that water is fresh and unpolluted. As per results of samples sulphate content shows less than acceptable limits. Hence safe.
COD: It is the important water quality parameter. Higher COD level mean a greater amount of oxidizable organic materials in the sample which will reduce DO level, reduced DO lead anaerobic condition which is deleterious higher aquatic life. Test results shows COD in lake water is more whereas bore well water and well water is less than the acceptable limits. Hence Lake water is not safe.
BOD: Bio chemical oxygen demand is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic materials given water sample at certain temperature over a specified time period. Lower the BOD indicates the water is of good quality and higher the BOD indicates water is polluted. As per our studies BOD in lake water is more whereas bore well water and well water is less than the acceptable limits. Hence Lake water is not safe.
Temperature: Temperature is one of the physical parameter. Temperature above 26℃ is undesirable and above 35℃ is not potable. As per our test results temperature of all the samples is ≤ 26℃. Hence ok.
Iron: If these are present less than 0.3ppm, it is not objectionable, but if it exceeds 0.3ppm the water is not suitable for domestic usage. As per test results none of the sample shows more than 0.3ppm. Hence safe.

Water is one of the precious gifts of nature, precious because of its reusability. It is essential for the substance and propagation of life on earth. A world without water cannot even be visualized. Its importance is readily recognized when it becomes scare or when it gets polluted. Per capita consumption of water doubtlessly serves as an index of civilization. A country's prosperity solely depends on its farm output which inturn depends on good quality water and fertile soil. Uncontrolled growths of population augmentation of agricultural activities and so have put considerably strain on surface and sub-surface water resources.

Global distribution of water is highly variable of the earth's total volume of 1386Mkm^3 of the water available only 0.91mkm^3(0.06%) is available as fresh water lakes. Of these water resources nearly 90% is available in Canada (Great Lake) the remaining 10% is distributed all over the world. Of this fresh surface water bodies some have been contaminated due to the inputs of polluted water through their tributaries. Techniques in selection of site, design of structure, etc. For construction of artificial recharge structure.

Mass awareness programmes should be conducted in rural areas to educate the farmers regarding the ground water management to update their knowledge

Training for local government functionaries, NGOs, voluntary organizations in watershed management activities needs to be imparted on the scientific

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[6] S. Chandra, A. Singh and P. K"Physico chemical, "Analysis of Water from Various Sources and Their Comparative Studies."(Jul. - Aug. 2013).