Ground Water Quality Analysis of Part of MMR

Mrs. Pushpam K, V [1], Mrs. Chitra B. Iyer [2], Mr. Sayed Arshadul Quadri[3],
Mrs. Grace selvarani[4] Mrs. SharminShaikh[5]
Civil Engineering Dept., MH Saboo Siddik Polytechnic,
Byculla

Abstract—**Groundwater quality in the study area has been analysed in the present work. For this study, four regions (Mumbai, Thane-Kalyan, Vasai-Virar, and New Mumbai) of MumbaiMetropolitan Region were selected which covers almost the entire area. Thirty water samples, from various bore wells covering the study area during post monsoon season 2013 and pre monsoon season 2014 were collected to find out the concentration of various parameters in the groundwater. The tests for different parameters like pH., DO, Chloride, TSS, TS, TDS, MPN,Hardness, Sulphates, Iron, and Fluoride were performed in VJTI lab. Volumetric and instrumental techniques were adopted for systematic analysis of the water samples using Standard procedures. Water Quality Index (WQI) was also calculated by using 'weighted arithmetic index method'.On comparison with BIS standards TDS, MPN, Hardness are higher than permissible values and WQI of all locations are more than100. Hence the ground water is unfit for drinking in this area.**

Keywords—MMR-Mumbai metropolitan region, TSS-Total suspended solids. DO-Dissolved oxygen, TS-total solids, MPN-most probable number.

I. INTRODUCTION

Of the available global water supply, 97.2% is saline water in oceans. This water is unsuitable for drinking or agricultural uses. 2.14% is in ice caps and glaciers, 0.61% is groundwater. Much of this water is too deep for extraction. 0.009% is found in surface water. This is where most drinking water comes from.0.005% makes up soil moisture.0.001% of water is found in the atmosphere (United Nations 2012).Rapid urbanization, growing population and speedy industrialization have led to the pressure on demand for water. Groundwater is used for domestic, industrial and irrigation purposes all over the world. In the last few decades there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization ((Rijsberman 2006).Anthropogenic activities deteriorates the quality of groundwater. Water is a universal solvent and it dissolves the minerals from rocks in which it is stored and then chemical and physical attributes of groundwater depend on the geology of a particular area, rapid urbanization especially in developing countries like India has affected the availability and quality of groundwater (Burjia et al 1995). Intensively irrigated agricultural discharges into the ground water bring about considerable change in the ground water quality. The quality of groundwater is the resultant of all the processes and reactions that have acted on the water from the moment it condensed in the atmosphere to the time it is discharged by a well.

Therefore, the quality of ground water varies from place to place, with the depth of the water table, and from season to season and is primarily governed by the extent and composition of dissolved solids present in it (Ravikumar and Somashekar 2010). A vast majority of ground water quality problems are caused by contamination, over- exploitation, or combination of the two. The solutions are usually very expensive, time consuming and not always effective. The socioeconomic growth of a region is severely affected by unavailability of safe drinking water (Kumar and Ahamed 2003). Ground Water quality is slowly but surely declining everywhere. Groundwater pollution is intrinsically difficult to detect, since problems may well be concealed below the surface and monitoring is costly, time consuming. Precise classification and identification of groundwater quality is an essential task for meeting the goals of environmental management. The quality of groundwater is of great importance in determining the suitability of particular ground water for a certain use (public water supply, irrigation, toilet flushing, industrial applications, constructional use etc.).The wide range of contamination sources is one of the many factors contributing to the complexity of groundwater assessment. It is important to know the geochemistry of the chemical- soil-groundwater interactions in order to assess the fate and impact of pollutants discharged on to the ground. Pollutants move through several different hydrologic zones as they migrate through the soil to the water table. The serious implications of this problem necessitate an integrated approach in explicit terms to undertake groundwater pollution monitoring and abatement programs. (CPCB 2010) A major problem in urbanized areas is the collection and disposal of domestic wastes. Because a large volume of sewage is generated in a small area, the waste cannot be adequately disposed off by conventional septic tanks and cesspools. Therefore, special disposal sites are being used to collect and dispose of such wastes in densely populated areas. The leakages from the sewer pipes may join the groundwater later. The intensive use of natural resources and the large production of wastes in modern society often pose a threat to ground water quality and have

already resulted in many incidents of groundwater contamination. Solid waste from industrial units is being dumped near the factories, which is subjected to reaction with percolating rainwater and reaches the ground water level. The percolating water picks up a large amount of dissolved constituents and reaches the aquifer system and contaminates the groundwater. (D .Loganathan et al 20112)

Special Issue - 2021

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
NREST - 2021 Conference Proceedings

II   AIM OF STUDY

The objective behind this study is to understand an overall picture of ground water quality of the ' Part of Mumbai Metropolitan Region (MMR)To assess the ground water quality and its suitability for drinking and for flushing by comparing the results with quality standards. To find out the suitability of groundwater for domestic use, based on WQI.

III   SCOPE

Fifteen locations have to be selected and a sanitary survey ofthe locations has to be done. After collecting the sample, the various chemical parameters and biological parameters (MPN) will be checked in the VJTI lab and the data will be checked with standards for suitability for drinking and for flushing.

1V   METHODOLOGY

- Literature survey.
- Deciding the sampling locations.
- The sanitary survey of water resources.
- 30 samples from 15 locations of MMR have to be collected representing different regions during post monsoon season 2013 and pre-monsoon season 2014.
- Conducting tests for pH, Chlorides, Hardness, Total Suspended Solids, TDS, MPN, Dissolved oxygen, Iron, Sulphate and fluorides in EnvironmentalEngineering laboratory of 'VJTI'.
- The data will be analyzed with reference to 'quality standards' to examine the suitability of groundwater for drinking and for flushing purposes.
- Finding out WQI for all the thirty samples by using the 'weighted arithmetic index' method.

V   EXPECTED OUTCOME

The project study is to check whether the water is safe in the study area for drinking, if not to inform the stakeholders suitably and also to classify the water on the basis of WQI, TDS and hardness. This study will enable us to know the change in concentration in various parameters from post- monsoon season 2013 to pre-monsoon season 2014.

V1   SAMPLING

Thirty water samples, 3000 ml each, were collected in polyethylene bottles from various bore wells covering the study area during post monsoon 2013and pre monsoon 2014. At the sampling points, the boreholes were pumped to purge the aquifer of stagnant water to acquire fresh samples for analysis (purging lasted for 5–10 minutes).Utmost care has to be taken during the collection of samples to avoid any kind of contamination. Water samples were examined immediately after collection that is within one hour after collection and in no case the time exceeded 24 hours. If they cannot be

analyzed within 24 hours, the samples were preserved in the fridge until analysis. No sample is fit for bacteriological analysis after 72 hours. Volumetric and instrumental techniques were adopted for systematic analysis of the water samples using Standard procedures. The water samples were analyzed in the VJTI laboratory.

VI1   STUDY AREA

For this study, the sampling sites representative of Mumbai Metropolitan Region is selected which covers almost the entire area. Greater Mumbai district is located on the western most periphery of the Maharashtra State. Arabian Sea lies on the southern and western side of the district while it borders Thane district on the north and eastern side.The coordinates of the study area are Virar on the north, Kalyan on north east and Panvel on south east.
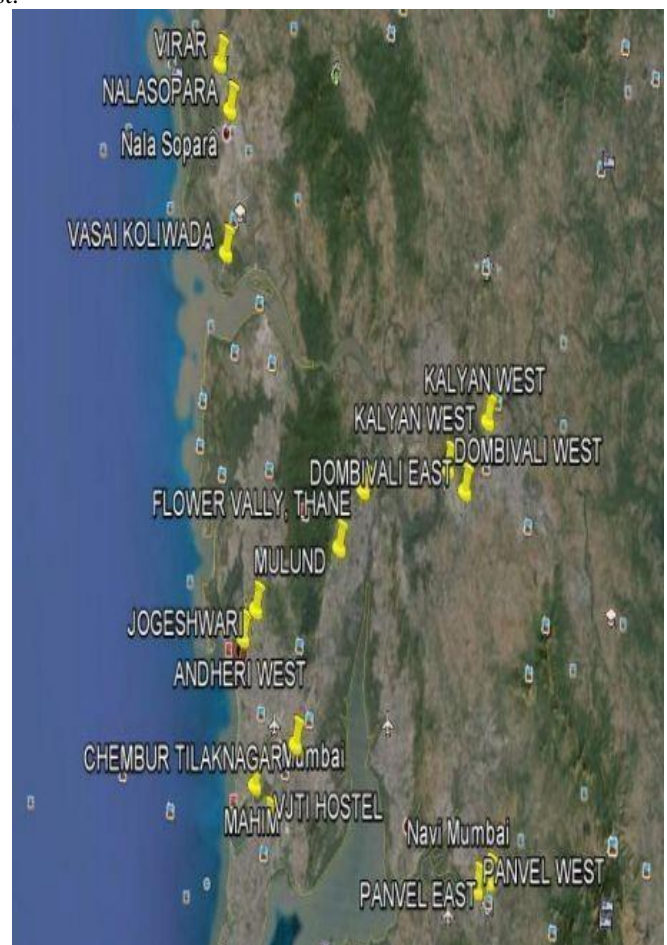

Fig.1

VIII   METHODS OF ANALYSIS

- pH by using a potentiometric method. (pH meters).
- Mohr's method followed to find out chloride content. Hardness of Water was found out by the EDTA titrimetric method.

Special Issue - 2021

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
NREST - 2021 Conference Proceedings

- A Winkler test was done to find out dissolved oxygen.
- Iron test was done by the Merck kit.
- TDS found out by calculation from TS and TSS and TSS by 'gravimetric after filtration' method .TS by 'gravimetric' method.
- Electrical conductivity was found out by dividingTotal dissolved solids (TDS) by a factor 0.65.
- MPN found out by 'multiple-tube fermentation technique' by using lauryl tryptose broth.
- Sulphate and Fluoride were analyzed by Merck kit.
- The data were analyzed with reference to'(BIS10600)' to examine the suitability of groundwater for drinking purposes.
- WQI by 'weighted arithmetic index' method.

.

1X   RESULTS AND DISCUSSION.

Groundwater quality in the study area has been analyzed in the present work. For this study, four regions (Mumbai, Thane-Kalyan, Vasai-Virar, and New Mumbai) of Mumbai Metropolitan Region were selected which covers almost the entire area. Thirty water samples, from various bore wells covering the study area during post monsoon season 2013 and pre monsoon season 2014 were collected to find out the concentration of various parameters in the groundwater. The tests for different parameters like pH, DO, Chloride, TSS,TS, TDS, MPN, Hardness, Sulphates, Iron and Fluoride were performed in VJTI lab. Water Quality Indices (WQI) were also calculated by using the 'weighted arithmetic index method'. The values of various parameters of water for drinking purposes were found out in the study area during post and pre monsoon seasons and compared with BIS standards and found that chloride, hardness, TDS, MPN and sulphates are exceeding the limits.

Thirty water samples, from various bore wells covering the study area during post monsoon season 2013 and pre monsoon season 2014 were collected to find out the concentration of various parameters in the groundwater. The tests for different parameters like pH, DO, Chloride, TSS, TS, TDS, MPN, Hardness, Sulphates, Iron and Fluoride were performed and the results are tabulated as under in table 1 and 2. Volumetric and instrumental techniques were adopted for systematic analysis of the water samples using Standard procedures.

Table 1 The values of various parameters in ground water samples in the study area during post monsoon2013

SR NO.	PLACE OF TUBEWELL	pH	DO (mg/l)	CHLORIDE(mg/l)	TSS(mg/l)	T.S(mg/l)	TDS(mg/l)	MPN per 100ml	HARDNESS(mg/l)	SULPHATES(mg/l)	IRON(mg/l)	FLUORIDES(mg/l)	EC µS/cm
1	MATUNGA	7.16	3.6	98	30	370	340	350	270	<200	0	0.15	523.1
2	JOGESWARI	6.69	4.3	100	70	530	260	23	235	<200	0	0.15	400.0
4	MULUND	7.5	4.2	52	30	290	260	140	187	<200	0	0.15	400.0
3	THANE	8.27	5.0	81	100	800	700	140	192	<200	0	0.30	1076.9
5	MAHIM	8.5	3.3	40	30	430	400	54.92	126	<200	0	0.15	615.4
6	NEW PANVEL	7.29	3.8	55	150	400	250	1600	118	<200	0	0.30	384.6
7	DOMBIVALI(west)	7.0	3.5	48	20	440	420	140	212	<200	0	0.15	646.2
8	CHEMBUR	7.2	5.0	240	40	860	820	540	198	<200	0	0.30	1261.5
9	ANDHERI	7.55	5.0	110	80	500	420	350	150	<200	0	0.15	646.2
10	KALYAN	7.2	3.2	42	30	730	700	>1600	199	<200	0	0.15	1076.9
11	VIRAR	7.21	4.2	345	180	1580	1120	17	649	>1600	0	0.30	1723.1
12	VASAI	7.5	2.0	43	150	840	690	51	384	>1600	0	0.30	1061.5
13	NALASAPORA	7.58	5.0	264	30	910	880	53	413	<200	0	0.15	1353.8
14	DOMBIVALI(east)	7.3	4.7	74	180	450	270	>1600	200	<200	0	0.15	415.4
15	OLD PANVEL	7.93	4.2	52	60	420	320	1600	197	<200	0	0.15	492.3

Table 2 The values of various parameters in groundwater samples in the study area during pre- monsoon 2014

SR NO.	PLACE OF TUBEWELL	pH	DO (mg/l)	CHLORIDE(mg/l)	TSS(mg/l)	T.S(mg/l)	TDS(mg/l)	MPN per 100mL	HARDNESS(mg/l)	SULPHATES(mg/l)	IRON(mg/l)	FLUORIDES(mg/l)	EC µS/cm
1	MATUNGA	7.5	3.4	116	50	790	740	350	271	<200	0	0.15	1138.5
2	JOGESWARI	6.69	4.0	109	70	530	460	23	250	<200	0	0.15	707.7
4	MULUND	7.67	3.9	57	40	430	390	140	197	<200	0	0.15	600.0
3	THANE	8.5	4.5	113	20	780	760	140	305	<200	0	0.15	1169.2
5	MAHIM	8.5	3.0	43	30	500	470	54.92	184	<200	0	0.15	723.1
6	NEW PANVEL	7.5	3.5	67	50	440	390	1600	187	<200	0	0.30	600.0
7	DOMBIVALI(west)	7.17	3.3	49	10	480	470	140	244	<200	0	0.15	723.1
8	CHEMBUR	7.4	4.5	242	30	880	850	540	200	<200	0	0.30	1307.7
9	ANDHERI	7.8	4.5	113	50	490	440	350	164	<200	0	0.15	676.9
10	KALYAN	7.47	3.2	43	20	740	720	>1600	256	<200	0	0.15	1107.7
11	VIRAR	7.84	4.0	426	180	1580	1400	17	725	>1600	0	0.30	2153.8
12	VASAI	7.9	2.0	50	130	870	740	51	495	>1600	0	0.30	1138.5
13	NALASAPORA	7.8	4.5	268	210	1230	1020	53	641	<200	0	0.15	1569.2
14	DOMBIVALI(East)	7.5	4.5	83	40	370	330	>1600	464	<200	0	0.15	507.7
15	OLD PANVEL	8.2	4.0	57	60	880	360	1600	230	<200	0	0.15	553.8

Table 3.Classification of the water samples in the areaon the basis of TDS(c.w Fetter 1990)

Sr. no	Classification of ground water	TDS mg/l	No. of samples	
			Post monsoon	Pre monsoon season
1	Nonsaline	<1000	14	13
2	Slightly saline	1000-	01	02
3	Moderately saline	3000-	NIL	Nil
4	Very saline	>10000	NIL	Nil

Table 4.Classification of the water samples in the areaon the basis of Hardness.

SR	Description	Hardness mg/l	No of Samples (post monsoon season)
1	SOFT	0-60	NIL
2	MODERATELY HARD	61-120	NIL
3	HARD	121-180	3
4	VERY HARD	>180	12

Table 5.Comparison of ground water quality at the study area with the drinking water standards.BIS-10500

PARAMETR	MINIMUM	MAXIMUM	BIS-10500
pH	6.69	8.50	6.50-8.50
CHLORIDE(mg/l)	42	385	250
TDS(mg/l)	300	1260	500
MPN per 100ml	17	1600	0
HARDNESS(mg/l)	153	687	200
SULPHATES(mg/l)	<200	>1600	200
IRON(mg/l)	0	0	0.30
FLUORIDES(mg/l)	0.15	0.30	1

Special Issue - 2021

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
NREST - 2021 Conference Proceedings

X   WATER QUALITY INDEX

Table 6 .Classification of water on the basis of WQI(Brown et al 1972)

WQI	QUALITY OF WATER
0-24	EXCELLENT
25-49	GOOD
50-74	POOR
75-100	VERY POOR
>100	UNFIT FOR DRINKING

Water quality indexes of all locations are found out and tabulated as under. All the samples are unfit for drinking since the index of all the samples is above 100.
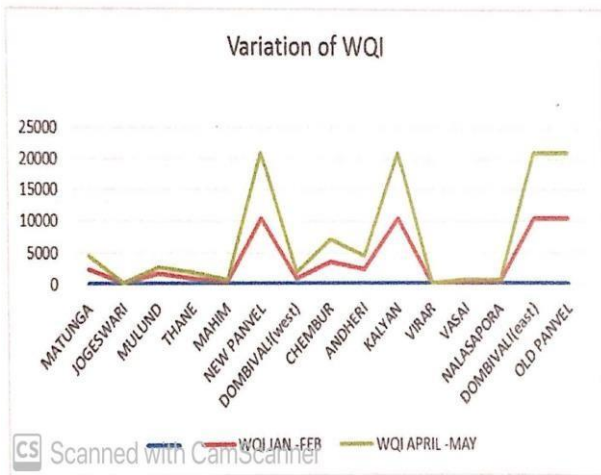
Fig.2 WQI Variations at various locations

Table 7. WQI of ground water in sampling locations.

Sr No.	Place of Tube well	WQI post monsoon 2013	WQI pre monsoon 2014
1	MATUNGA	2297	2298
2	JOGESWARI	143	143
4	MULUND	1704	915
3	THANE	920	916
5	MAHIM	357	358
6	NEW PANVEL	10533	10534
7	DOMBIVALI(west)	915	915
8	CHEMBUR	3552	3553
9	ANDHERI	2296	2297
10	KALYAN	10528	10528
11	VIRAR	111	112
12	VASAI	338	338
13	NALASAPORA	341	341
14	DOMBIVALI(east)	10527	10527
15	OLD PANVEL	10528	10529

Table 8.WQI calculations

PARAMETER	STD.VALUE Vs	IDEAL VALUE Vi	1/Vs	Wi=k*1/Vs	ACTUAL VALUE Va	Va-Vi	Vs-Vi	Qi=(Va-Vi)*100/(Vs-Vi)	Wi Qi	∑WiQi/∑Wi
pH	8.50	7.00	0.12	0.03	6.69	-0.31	1.50	-20.67	-0.53	
DO(mg/l)	5.00	7.81	0.20	0.04	4.30	-3.51	-2.81	124.91	5.40	
CHLORIDE(mg/l)	250.00	0.00	0.00	0.00	100.00	100.00	250.00	40.00	0.03	
TDS(mg/l)	500.00	0.00	0.00	0.00	260.00	260.00	500.00	52.00	0.02	
MPN per 100 ml	1.70	0.00	0.59	0.13	23.00	23.00	1.70	1352.94	171.90	
HARDNESS(mg/l)	200.00	0.00	0.01	0.00	235.00	235.00	200.00	117.50	0.13	
SULPHATES(mg/l)	200.00	0.00	0.01	0.00	32.13	32.13	200.00	16.07	0.02	
IRON (mg/l)	0.30	0.00	3.33	0.72	0.00	0.00	0.30	0.00	0.00	
FLUORIDES(mg/l)	1.00	0.50	1.00	0.22	0.15	-0.35	0.50	-70.00	-15.12	
TOTAL			5.26	1.14				1612.75	161.86	142.59

JOGESHWARI (POST MONSOON 2013)

1) MPN/100 ml <1.8 for Combinations of Positives 0, 0, 0 as per results when five tubes are used per dilution (10 mL, 1.0 mL, 0.1 mL) as per Table 9221.IV. (MPN Index and 95% Confidence Limits for Various Combinations of Positive) (Standard methods for the examination of water and wastewater, American public health association/American water works association/water environment federation, Washington DC, 19th edition,

2) Max Saturated DO (mg/l)7.81 at 28°c (source: water.epa.gov)

X   SUMMARY AND CONCLUSIONS

Groundwater quality in the study area has been analyzed in the present work. For this study, four regions (Mumbai, Thane-Kalyan, Vasai-Virar, and New Mumbai) of Mumbai Metropolitan Region were selected which covers almost the entire area. Thirty water samples, 3000 ml each, were collected in polyethylene bottles from various bore wells covering the study area during post monsoon season 2013 and pre monsoon season 2014 to find out the concentration of various parameters in the groundwater. The tests for different parameters like pH, DO, Chloride, TSS, TS, TDS, MPN, Hardness, Sulphates, Iron and Fluoride were performed in VJTI lab. Volumetric and instrumental techniques were adopted for systematic analysis of the water samples using Standard procedures. Water Quality Indices (WQI) were calculated by using 'weighted arithmetic index method'. Analysis for suitability for drinking was also done. In 'Mumbai region' during post monsoon and pre-monsoon season minimum pH was recorded (pH= 6.69) at Jogeshwari well and higher value was recorded (pH= 8.5) at Mahim well. All wells except one, showed alkaline pH. The TDS in the area during post-monsoon season varied from 260mg/l (Jogeshwari & Mulund) to 820mg/l (Chembur) and during pre monsoon it was 390-850mg/l (Mulund-Chembur). The Total hardness of groundwater in the area during post-monsoon season ranged from 126-270mg/l (Mahim- Matunga) and during pre monsoon it was 164-271mg/l (Andheri-Matunga). The variation of chloride concentration in the area during post-monsoon season ranged from 40- 240mg/l (Mahim and Chembur) and during pre-monsoon, it was 43-242 mg/l (Mahim and Chembur). In this area there was a slight increase in pH (Except in

2 places), Chloride, TDS and Hardness from post monsoon 2013 to pre monsoon 2014. The

DO in the area during post-monsoon season varied from 3.3-5.0mg/l (Mahim-Andheri and Chembur respectively) and during pre-monsoon, it was 3-4.5mg/l (Mahim- Andheri and Chembur respectively). In the Mumbai area MPN was found to be 23-540 mg/l (Jogeshwari- Chembur). In the present investigation sulphate concentration was ranged 0 - 200 mg/l which is within the permissible limit of 250 mg/l (BIS 10500). The fluoride concentration in groundwater of the area varies from 0.15 to 0.3 mg/lit. The concentration of iron in the groundwater of the area is below the detectable limit. 'Chloride' concentration varied from 42-241 mg/l and 'Sulphate' concentration was less than 200 mg/l which were within its permissible limits 500mg/l and 400mg/l respectively. 'Suspended solids' in the area was in the range of 30-70 mg/l (<2000mg/l). Hence the ground water in this region was found suitable for construction and can be used for flushing purposes. On comparison with BIS standards TDS (at Chembur during post monsoon season and at Matunga and Chembur during pre- monsoon season) MPN, Hardness, (Matunga and Jogeshwari during post-monsoon season and Matunga, Jogeshwari and Chembur during pre- monsoon season) are higher than permissible values and WQI of all locations are more than100. Hence the ground water is unfit for drinking in this area.

In 'Thane –Kalyan' region during post monsoon season, pH ranged from 7.0 to 8.27 (Dombivali (w)-Thane) and during pre-monsoon season it was found to be 7.17- 8.50 (Dombivali (w)-Thane). TDS in this region, during post monsoon season was 270-700mg/l (Dombivali (E) Thane-Kalyan) and during pre-monsoon season it was 330-760 mg/l ((Dombivali (E)-Thane). Hardness during post monsoon season was 192-212mg/l (Thane Dombivali (w)) and during pre-monsoon season was 236-464 mg/l (Kalyan - Dombivali (E)). In the region, during post monsoon season Chloride was 42-81mg/l (Kalyan – Thane) and during pre- monsoon season the same was 43-113 mg/l (Kalyan – Thane). In this area too there were slight increase of pH (except in two places), Chloride, TDS, and hardness from post monsoon 2013 to pre monsoon 2014. DO in the region, during post monsoon season was 3.2- 5.0mg/l (Kalyan – Thane) and during pre-monsoon season it was 3.2-4.5 mg/l (Kalyan –Thane & Dombivali E). MPN varied from 140 (Thane and Dombivali (w)) to more than1600 (Kalyan and Dombivali (E)). In the present investigation sulphate concentration was ranged from 0 - 200 mg/l which is within the permissible limit of 250 mg/l (BIS 10500). Fluoride content ranged from 0.15 mg/l to 0.3 mg/l. The concentration of iron in the groundwater of the area is below the detectable limit. Chloride concentration varied from 43- 97 mg/l and Sulphate concentration was less than 200

mg/l which were within its permissible limits 500mg/l and400mg/l respectively. Suspended solids in the area were in the range of 15-110 mg/l (<2000mg/l). Hence the ground water in this region was found suitable for construction and can be used for flushing purposes. While comparing different parameters with standards, it is found that, TDS (at Thane and Kalyan during post monsoon season and pre monsoon season), MPN, hardness (Dombivali(E), during post-monsoon season and Thane, Dombivali (W), Dombivali(E), and Kalyan during pre-monsoon season) are higher than the permissible values and WQI of all locations are more than 100. Hence the ground water is unfit for drinking in this area.

In 'Vasai-Virar' area pH was 7.21-7.58 during post monsoon season and during pre monsoon season it was 7.8-7.9 (Nalasopara- Vasai). TDS in Vasai-Virar region during post monsoon season was 690-1120mg/l (Vasai-Virar) and 740-1400mg/l during pre- monsoon (Vasai-Virar). The TDS was relatively high in Vasai- Virar area which may be due to influence of anthropogenic sources such as domestic sewage, septic tanks, agricultural activities and influence of rock-water interaction. The TDS slightly increased in pre monsoon season 2014 compared to post monsoon season 2013. Hardness In the region during post monsoon season was 384-649mg/l (Vasai-Virar) and during pre- monsoon it was 495-725mg/l (Vasai-Virar). In Vasai-Virar region Chloride was 43-345mg/l (Vasai-Virar) during post monsoon and 50- 426mg/l (Vasai-Virar) during pre- monsoon. In this region higher concentration of chloride is found (>250 mg/l), which could be dangerous from a health point of view. It might be due to proximity to sea. In this area too there were slight increase of pH, Chloride, TDS, and hardness from post monsoon 2013 to pre monsoon 2014.In the region 'DO' was 2-4.2mg/l (Vasai-Virar) & 2-4.0 mg/l (Vasai-Virar) during post monsoon and pre monsoon respectively. In the area MPN was 17-53. In this region it was comparatively low. In the present investigation sulphate concentration was ranged 0 - 1600 mg/l which is not within the permissible limit of 250 mg/l (BIS 10500). The fluoride concentration in groundwater of the area varies from 0.15 to 0.3 mg/l. The concentration of iron in the groundwater of the area is below the detectable limit. Chloride concentration varied from 47-386 mg/l (<500 mg/l). Sulphate concentration was in the range of <200 to >1600 which was not within its permissible limit (400 mg/l). Suspended solids in the area was in the range of 120- 180 mg/l (<2000mg/l). Since the sulphate concentration was exceeding its permissible limit, the groundwater in this region is unsuitable for construction activities but can be used for flushing purposes. In comparison with BIS standards Chloride (Virar and Vasai),

Special Issue - 2021

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
NREST - 2021 Conference Proceedings

TDS, MPN, Hardness and Sulphates (Virar and Vasai) are higher than permissible values and WQI of all locations are more than100. Hence the ground water is unfit for drinking in this area.

In 'New Mumbai' area pH was 7.29-7.93 (New Panvel and Old Panvel) during post – monsoon season and was 7.5-8.2 (New Panvel and Old Panvel) during pre- monsoon season. In the region during post monsoon season TDS was 250- 320mg/l (New Panvel-Old Panvel) and during pre-monsoon season it was 360-390mg/l (Old Panvel and New Panvel). In the area during post monsoon season hardness was 118- 197mg/l (New Panvel-Old Panvel) and during pre-monsoon season it was187- 230mg/l (Old Panvel and New Panvel). The Hardness slightly increased in May 2014 compared to Jan 2014. In the region Chloride was 52-55mg/l during post monsoon season and 52-67 mg/l during pre-monsoon season at Old Panvel and New Panvel respectively. In this area too there were slight increases of pH, Chloride, TDS and hardness from post monsoon 2013 to pre monsoon 2014. DO in 'New Mumbai' region was 3.80-4.20mg/l and 3.50- 4.0mg/l (New Panvel and Old Panvel) during post monsoon and pre monsoon respectively. MPN in the New Bombay area (in Old and New Panvel) was 1600. In the present investigation sulphate concentration was ranged 0 - 200 mg/l which is within the permissible limit of 250 mg/l (BIS 10500). The concentration of iron in the groundwater of the area   is below detectable limits .The fluoride concentration in groundwater of the area varies from 0.15 to 0.3 mg/l. Chloride concentration varied from 52-61 mg/l and Sulphate concentration was less than 200 mg/l which were within its permissible limits 500mg/l and 400mg/l respectively. Inorganic matter found to be in the range of 340-350 mg/l and Organic matter was in the range of 50-80 which were also well within its permissible limits 3000 mg/l and 200 mg/l respectively. Suspended solids in the area was in the range of 60-100 mg/l (<2000mg/l). Hence the ground water in this region was found suitable for construction. and can be used for flushing purposes. In comparison with BIS standards Hardness and MPN are higher than the permissible values and WQI of all locations are more than100. Hence the ground water is unfit for drinking in this area. There was a slight increase in the study area in the concentration of pH, hardness, TDS and chloride in pre- monsoon season 2014 compared to post-monsoon season 2013. In the fourteen locations of the study area 'TDS' fall under 'non-saline' category (<1000mg/l), and 'one' falls under 'slightly saline' (1000-3000mg/l) category. Total Hardness in 'twelve' samples falls under 'very hard category 'and the remaining 'three' samples in the

'moderately hard' category. The residents of Mahim, Virar,

Vasai, Nalasapora, New-Panvel and Old-Panvel are using the ground water under study for domestic purposes especially for drinking and bathing where, the values of the various parameters like MPN of the groundwater are found exceeding the acceptable limits of drinking. Hence the concerned residents will have to be informed about the consequences to enable them to take the precautionary measures.

X1   REFERENCES

[1] Annie Rompre, Pierre Servais, Julia Baudart, Marie-Rene e de-Roubin, Patrick Laurent"Detection and enumeration of coliforms in drinking water: current methods and emerging approaches", Journal of Microbiological Methods49 (2002) 31–54.

[2] A.Gibrilla E.K.P. Bam Adomako S. Ganyaglo S. Osae T.T. Akiti S. Kebede E. AchoriboE. Ahialey G. Ayanu E.K. Agyeman "Application of Water Quality Index (WQI) andMultivariate Analysis for Groundwater Quality Assessment of the Birimian and CapeCoast Granitoid Complex: Densu River Basin of Ghana". Water Qual Expo Health(2011) 3:63–78 DOI 10.1007/s12403-011-0044-9.

[3] BIS, Indian standards specifications for drinking water, Bureau of Indian Standards, IS:10500, (2012).

[4] Burjia, J.S.; Romani, S."Groundwater Development–Present Scenario and FutureNeeds". Indian J. Pub. Adm. 2003, XLIX (3), 301. CPCB, Water Quality, Parries, 1995,1(4), 6.

[5] Central Zonal Office Central Pollution Control Board Bhopal. "Status of Groundwater WaterQuality in Chhattisgarh, 2010".

[6] CPHEEO Manual on Water supply and treatment, 3rd edition, Ministry of Urban|Development, New Delhi, May 1999.

[7] D.Loganathan 1, S Kamatchiammal2, R. Ramanibai1, D.Jayakar Santhosh2, V.Saroja 2 and S.Indumathi 2, "Statusof Groundwater at Chennai City, India". Indian Journal ofScience and Technology .volume 4,issue 5,may 2011

[8] Durfor,C.N.and Becker,E.,(1964)"Public water supplies of the 100 largest cities in the United States' ', In Geological Survey Water-Supply, U.S. Government Printing Office, Washington, Paper No. 1812, pp. 364. 9.echo2.Epfl.Ch/Vicaire/Mod_2/Chapt_2/Main.Htm

[9] Groundwater Quality Series: Gwqs/ 09/2006-2007 Central Pollution Control Board(Ministry Of Environment and Forests),"Status Of Groundwater Quality In India-Part1".cpcb.nic.in/EnvironmentalPlanning/Ground/Chapter 1.Pdf P2-3.

[10] Ground water scenario in major cities of India, Ministry Of Water Resources Govt. OfIndia cgwb.gov.in/documents/Gw-Senarioin%20cities-May2011. Pdf 135-140.

[11] Ground Water Information Greater Mumbai, Central GroundWaterBoard,cgwb.gov.in/DistrictProfile/Maharashtra/Greater%20mumbai.Pdf, Page1-5.

[12] Http://water.usgs.gov/owq/FieldManual/chapte/htmlents.html

[13] Http://Www.Nptel.Iitm.Ac.In/Courses/Iit,madras/Enivironmental_Chemistry_Analysis/Pdfs/2_1.Pdf

[14] I.S 456(Fourth Revision ICS 91.100.30 to IS-456-2000 clause: 5:4)

[15] Kumar, D.; Ahamed, S. Current Sci., 2003, 84(2), 188- Ravikumar., P. And Somashekar.R. K., "Multivariate Analysis To Evaluate Geochemistry Of Groundwater In VarahiRiver Basin Of Udupi In Karnataka (India)," The Ecoscan, 4 (2&3): 153-162, 2010.

[16] Moore, C.V. "Iron in Modern Nutrition in Health and Disease, Philadelphia, Lea andFebiger", P.2. 1973 18.mbmggwic.Mtech.Edu/Sqlserver/V11/Help/Reports/Wqc onstituents.Asp

[17] Rajgopal. "Groundwater quality assessment for public policy in India", 1st Annualreport, Department of Geography, IOWA University, 10-11, (1984).

[18] Ramesh. K., Soorya Vennila 'Hydrochemical Analysis and Evaluation of Groundwater Quality in and around Hosur, Krishnagiri District, Tamil Nadu, India' International Journal of Research in Chemistry and Environment.Vol. 2 Issue 3 July 2012(113-122) ISSN 2248-9649.

Special Issue - 2021

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
NREST - 2021 Conference Proceedings

[19] Ravi Kumar., P. and Somashekar., R. K., "Multivariate analysis to evaluate geochemistry of groundwater in Varahi river basin of Udupi in Karnataka (India)", The, 4 (2&3): 153-162, 2010

[20] Richards L.A(1954):"Diagnosis and Improvement of Saline and Alkali Soils", agriculture Handbook 60, US Department of Agriculture, Washington, DC, P. 160

[21] Rijsberman, F. R. "Agricultural Water Management", 2006, 80(1-3), 5. R.M.Brown,N.J.Mcclelland, R.A.Deininger, M.F.A.O'connor, "Water quality index- crossing the physical barrier", Proc. Int. Conf. on water pollution research, Jerusalem, 1972, 6, 787-797.

[22] Sarala C, Ravi Babu P ''Assessment of Groundwater Quality Parameters in and Around Jawaharnagar, Hyderabad ''. International Journal of Scientific and Research Publications, Volume 2, Issue 10, October 2012 1.Issn 2250-3153 .(www.Ijsrp.Org.)

[23] Schroeder H. A., "Relations between hardness of water and death rates from certain chronic and degenerative diseases in the United States", J. Crohn's disease, 12, 586- 591,(1960)

[24] Segun M. A. Adelana & Alan M. MacDonald "Groundwater Research Issues In Africa" Geology Department, University Of Ilorin, Pmb 1515, Ilorin, Nigeria, Adelana@Gmx.Net,BritishGeological Survey,West Mains Rd, Edinburgh, Eh9 3la,Uk, Amm@Bgs.Ac.Uk .

[25] Standard Methods for the Examination of Water and Wastewater, American Public Health Association/American Water Works Association/Water Environment Federation, Washington DC, 19th edition, 1995

[26] Sunitha, Reddy B, Rajeswara, Reddy M, Ramakrishna."Groundwater Quality Evaluation With Special Reference To Fluoride And Nitrate pollution In Uravakonda, Anantapur District, Andhra Pradesh– A Case Study". International Journal of Research in Chemistry and Environment.Vol. 2 Issue 1 January 2012(88-96) ISSN 2248-9649.

[27] Tijani M.N., "Hydrochemical assessment of groundwater in Moro area, Kwara State, Nigeria", Environ Geol, 24,194–202, (1994)

[28] United Nation (2012). UN News Centre – 2012 World Water Day: Target 7.C of the Mdgs Met Before the 2015 Deadline; Ensuring Access to Water for Agriculture Vital For a Sustainable Future. Un Web Services Section Department Of Public Information, UnitedNations©2010.

[29] WHO. Guidelines for drinking-water quality, health criteria and other supporting information, IV.th edition2011, (World Health Organization, Geneva).

[30] Www.learner.org/courses/envsci/unit/pdfs/unit8.pdf