International Scholars Journals

African Journal of Ecology and Ecosystems ISSN: 9428-167X Vol. 5 (8), pp. 001-005, August, 2018. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Assessment of bore wells water quality in Gwagwalada town of FCT

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Accepted 18 April 2018

Bore wells water quality was carried out in Gwagwalada town of the Federal Capital Territory of Nigeria in December 2008. Acceptable standard method of sampling and analysis was used. Samples were collected from one bore well from the 11 part of the town. Wells were selected for the sample collections randomly. Sampling point locations and elevation were obtained using G.P.S. Analysis was carried out for Total Hardness, Turbidity, Sulphate, Calcium, Nitrate, Iron, PH, Chloride, Fluoride, TDS and Magnesium. Nitrate concentration was normal for all the samples points except for Ungwan Shanu and Ungwan Bassa. Turbidity, TDS and Magnesium for all the sampled wells are above the WHO permissible limit in all the location points. Hardness of water, Calcium and Chloride was found to be above the permissible level in Dagiri, Ungwan Dodo, Ungwan Shanu Ungwan Bassa, Kutunku, Abatoir and Ungwan Aguma. Other chemicals are found to be within the permissible limit.

Key words: Ground water, water quality, pollution, concentration.

INTRODUCTION

In many developing countries over the years, ground water remains one of the dependable sources of usable water in fast growing towns and villages where the supply of potable water is not consistent. Due to urbanization, industrialization and population increase, the demand for water has been at a maximum increase with a critical stress on ground water, most especially in the dry season when water from other source are not readily available (WHO, 2002).

Despite the fact that ground water is fundamental in global water balance, that substantial volume of water is stored underground from infiltrated water during the rainy season. In the dry and rain season today, ground water is used for many domestic and economic purpose such as irrigation and industrial activities, because it remains a primary source of fresh water in many town and rural areas, in developing countries. Due to vast anthropogenic activities, ground water quality is being lost causing extremely bad health problems to consumers of it as well as deteriorating the quality of soil, plants and other living organism that survive in the availability of qualitative ground water (WHO, 2002).

Gwagwalada is one of the fast growing and influential town in Federal Capital Territory (FCT) of Nigeria. Over the years the town is threatened by ground water pollution making the inhabitant vulnerable to health hazards associated with polluted ground water due to their high dependence on the ground water. The situation is likely to be exacerbated by poor economic situation of the inhabitant, poor planning system, high standard of living caused by proximity of the town to the Federal Capital City and being the University town of the FCT. Due to poor knowledge of ground water quality by the inhabitant of the town, this study was instigated.

STUDY AREA

This study concentrates on Gwagwalada town of the Federal Capital Territory of Nigeria. The town is about 45 km away from the Federal Capital City (FCC). It is one of the six Area Council headquarters of the FCT. The town lies in the downstream of River Usuma and located between latitude 8° 55' and 9° 00'N and longitudinal 7° 00'

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and 7° 05'E (Figure 1).The centrality of this town in relation to other Area Councils head quarters makes it influential and important in various Socio-economic activities. Climate of this town is not far fetched from that of the tropics having several climatic elements in common; most especially the wet and dry season, characteristic (Ishaya and Grace). The temperature of the area ranges from 30 - 37°C yearly, with the highest temperature experienced in the month of March and with mean total rainfall of rainfall approximately 1,650 mm per annum (Balogun, 2001). About 60% of this rain falls between the months of July to September.

MATERIALS AND METHODS

In this study acceptable standard method of sampling and analysis was used. Water samples were collected from one bore well from each part of the town; these areas are Dagiri, Ungwan Dodo, Ungwan Shanu, Ungwan Bassa, New Kutunku, Abattoir, Ungwan Aguma, Phase 1, Phase 2, Phase 3 and Kontogora Estate. The selected wells for the sample collection were done randomly to depict reliable and unbiased information. Sampling point locations were obtained using G.P.S to get the latitude and longitudes of points as well as elevation of sample points. The depths of wells were obtained using measuring tape. The water samples collected were stored in clean plastic bottles. (Table 1)

Analysis was done for Total Hardness, Turbidity, Sulphate, Calcium, Nitrate, Iron, PH, Chloride, Fluoride, TDS and Magnesium. ILWISS. Academic 3.2 was used to generate point's map of the Sites.

RESULT AND DISCUSSION

The detail of the findings is shown in Table 2. Results of sample of the parameters are shown along side WHO Permissible Standard. The finding shows that Nitrate concentration is normal for all the samples points except for Ungwan Shanu and Ungwan Bassa for which values are above the permissible WHO standard. The value ranges from 27 - 48. WHO standard permitted 45 as the acceptable limit. Nitrates are product of oxidation of organism nitrogen by bacteria present in the soils and in water. It can be introduced into the soil by the fertilizer, decayed vegetable, animal matter, domestic effluents, sewage sludge disposal to land and changes in land use give rise to nitrate concentration in groundwater. This is likely the reason for the high concentration of nitrate in the areas where they were found above the permissible limit. The exceeded concentrations of nitrate in water give rise to infertile methaemoglobiaemia, diarrhoea, and blue jaundice in children.

The Hardness of Water only in phase 1, phase 2, phase 3 and Kontagora Estate fall within the permissible limit of WHO (300). In areas like Dagiri, Ungwan Dodo, Ungwan Shanu, Ungwan Bassa, Kutunku, Abatoir and Ungwan Aguma tend to fall within the rejection level of WHO with all the values above 300. Cater and Knox (1986) observed a correlation between hardness of water and it role in heart diseases in the other hand Otta (1978) relate hardness of water to kidney and heart problems. Hardness of water causes disadvantages in domestic uses by producing poor lathering with soap, deterioration of cloths, scale forming skin irritation, boiled meat and food becomes poor in quality (Pragathiswaran, et al., 2008). Hardness of water caused by the presence of multivalent metallic cations and highly caused by calcium (Catt) and magnesium (MGtt iron) . Hard water is useful in the growth of children if within the permissible limit.

The Turbidity for all the sampled wells water is above the 5.0 WHO accepted standard. The lowest value of turbidity is 6.0 found in Phase 2 and the highest level of turbidity found Ungwan Dodo with value up to 14.0. Turbidity in water is the degradation in the clarity in water due to presence of particles such as silt, clay and other forms of living micro-organisms and non-living materials found in water (Rputheti et al., 2008).

The turbidity level found exceeds the WHO permissible level. Turbidity greater than the acceptable level of WHO makes water unsuitable for domestic uses.

Magnesium is considered as one of the available substance in natural waters. The availability of magnesium in natural water is not uniformly distributed it is based on human activities on the environment. The maximum permissible level accepted by the WHO is 50mg/c. The results of findings show the concentration of magnesium above the WHO permissible limit in all the location points.

The maximum acceptable limit if calcium in usable water by WHO is 75mg/l. The concentration of calcium from collected samples shows varied results, with high concentration around the unplanned area of the town (Dagiri, Ungwan Dodo, Ungwan Shanu, Ungwan Bassa, Kutunku, Abattoir and Ungwan Aguma) having calcium concentration above 75mg/l WHO acceptable limit. Less concentration are found in phase 1, phase 2, phase 3 and Kontogora Estate. Excess of calcium and magnesium contents in water will give rise to poor lathering and deterioration of cloths, (Pragathiswaran et al., 2008).

PH (hydrogen iron) in ground water within the town was within the accepted WHO limit. Natural water is expected to have PH value of between 6 and 8 (Ramesh Reddy, 1998., Chatter Jee et al., 2005). The lowest PH values were at 6.3 in Phase 2 and the highest value at 7.3 in Ungwan Aguma falling within the accepted WHO permissible limit.

In the town, Total Dissolved Solids was found in the ground water. High level of TDS was found in all the sample points within the town when compared with the WHO 500 mg/l permissible limit. TDS in excess quantity is responsible for the wide spread of gastric human system, produce undesirable taste, gastrointestinal irritation and corrosion (Pragathiswaran et al., 2008).

Fluoride an important criterion for ground water quality with an acceptable limit of 0.5 mg/l. Findings shows that the highest fluoride content is at 0.5 which is the acceptable limit and the lowest is 0.2 mg/l. this shows that the

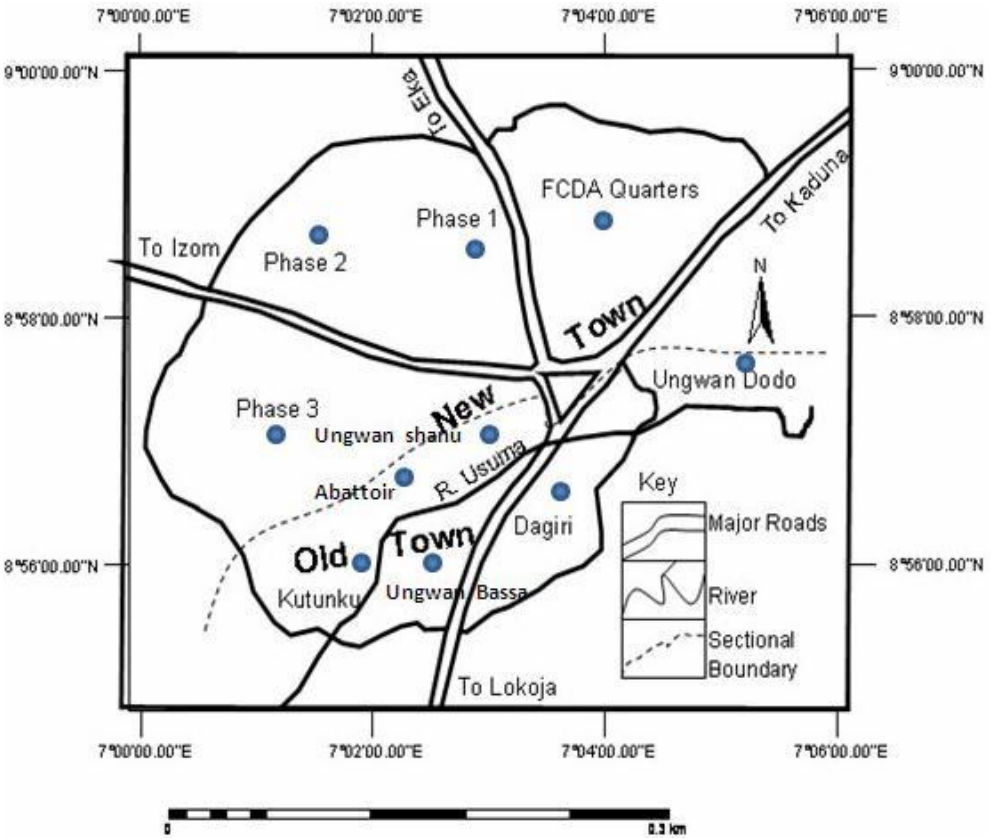

Figure 1. Map of Gwagwalada town showing points of sample collection.

Table 1. Showing locations, elevation and depth of wells.

S/N	Locality	Depth	Elevation	Latitude	Longitude
1	Dagiri	1.8 m	184 m	8° 55.977	7° 04.127
2	Ungwan Dodo	2.0 m	200 m	8° 57.384	7° 04.113
3	Ungwan Shanu	1.8 m	183 m	8° 56.404	7° 04.942
4	Ungwan Bassa	1.8 m	183 m	8° 56.265	7° 04.904
5	New kutunku	1.9 m	190 m	8°56.019	7° 01.369
6	Abattoir	1.7 m	179 m	8° 56.034	7° 04.855
7	Ungwan Aguma	1.7 m	181 m	8° 56.949	7° 04.951
8	Phase 1	2.3 m	210 m	8° 58.375	7° 02.145
9	Phase 2	2.1 m	201 m	8°58.113	7° 01.230
10	Phase 3	1.9 m	190 m	7° 57.431	7° 03.234
11	Kontogora Estates	2.0 m	200 m	8° 58.392	7° 03.167

fluoride content of the underground water is within the WHO permissible limit. Recent study shows that fluoride in bore well between the range of up to 0.5 mg/l is beneficial to human beings, but consumption of fluoride in above the prescribe WHO level for reasonable time lead to mottling of teeth and softening of bones, ossification of tendons and ligament. The high concentration of fluoride can cause dental and skeletal flourosis (Maiti, 2004).

Chloride was found to be above the permissible limit (200 mg/l) in Dagiri, Ungwan Dodo, Ungwan Shanu Ungwan Bassa, Kutunku, Abatoir and Ungwan Aguma (Slums areas of the town), while areas that results falls within the permissible limit are Phase1 , phase 2, phase 3 and kotongora Estate.

The values of Iron for all the sample points were within the permissible level which is 0.3 mg/l. The highest value

Table 2. WHO standard chemical parameter of water and samples results.

S/N	Parameters	WHO	Dagiri	Ungwan Dodo	Ungwan Bassa	Kutunku	Abatoir	Ungwan Aguma	Phase 1	Phase 2	Phase 3	Kontogora	Ungwan Shanu
1	Nitrate	45	27	33	48	26	23	30	18	19	18	18	47
2	Turbidity	5.0	13.0	14.0	10.0	9.0	12.0	13.0	8.0	6.0	8.0	10.0	16.0
3	Magnesium	50	80	90	90	80	70	100	60	70	70	60	100
4	Total hardness	300	320	310	330	320	310	320	280	290	270	280	340
5	Iron	0.30	0.16	0.17	0.18	0.20	0.10	0.07	0.03	0.04	0.10	0.05	0.13
6	TDS	500	950	1000	1100	900	850	900	600	700	600	650	1050
7	PH	8.0	7.1	7.0	7.1	7.2	7.1	7.3	6.4	6.3	7.0	6.4	6.4
8	Calcium	75	120	100	160	110	100	100	65	70	70	60	110
9	Chloride	200	210	220	230	200	210	230	190	180	200	190	210
10	Sulphate (SO_4)	200	103	84	73	71	85	90	68	72	7.2	78	83
11	Flouride	0.5	0.3	0.4	0.3	03	0.5	0.4	0.5	0.4	0.2	0.5	0.3

recorded was 0.18 mg/l at Ungwan Bassa and the lowest value at 0.03 mg/l at phase 1. This is likely due to elevation of these areas when compared with the elevation of other parts of the town (Dagiri, Ungwan Dodo, Ungwan Shanu, Ungwan Aguma, Ungwan Bassa, Kutunku, and Abattoir tend to have higher concentration of iron compared with the planned area of the town (Phase 1, Phase 2 and Kontogora Estate where the elevations are higher). Result also shows that Sulphate content is within the permissible limit which is 0.5mg/l as WHO standard. The highest recorded values was in Dagiri (103 mg/l), and the lowest value was in phase 1 (68 mg/l).

Though chemical characteristic and quality of ground water depend on the chemical composition of the rocks through which the ground water move and also the resident time; inorganic pollutants derived from urban and industrial generated waste also exacerbate the concentration (Chatterjee et al., 2005).

Conclusion

Findings of this study depict that quality of bore wells water varies from place to place and based on the nature of human activities and human structural concentration. In the unplanned areas of the town (Dagiri, Ungwan Dodo, Ungwan Shanu, Ungwan Aguma, Ungwan Bassa, Kutunku, and Abattoir). Hardness of water, Calcium and Chloride were found to be above the permissible level in Dagiri, Ungwan Dodo, Ungwan Shanu Ungwan Bassa, Kutunku, Abatoir and Ungwan Aguma. Nitrate concentration was normal for all the samples points except for Ungwan Shanu and Ungwan Bassa. PH (hydrogen iron) in ground water within the town was within the accepted WHO limit. The values of Iron for all the sample points were within the permissible level which is 0.3mg/l. Sulphate content is within the permissible limit which is 0.5 mg/l as WHO standard. Fluoride in ground water falls within the acceptable limit of 0.5 mg/l of WHO

The concentration of some heavy metals above The accepted WHO standard makes water unpalatable for human consumption if not purified and affect the suitability of the water for other form of domestic use.

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