

ASSESSMENT OF GROUNDWATER QUALITY FOR DRINKING PURPOSE IN GUHLA BLOCK OF KAITHAL DISTRICT, HARYANA

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Abstract

Good quality water is important for living beings to avoid many health problems. But in the present time availability of good quality water especially groundwater is very scarce. The present study area Guhla block is located in Kaithal district of Haryana state. The geo-coordinates of the study area are latitudes 29.94° N to 30.19° N and longitudes 76.19° E to 76.47° E. The study area covers 372.48 sq. km area. Geologically alluvium and geomorphologically alluvial plain are present in the study area. The main objective was to assess groundwater quality for drinking purpose in the study area. In the study area nine groundwater samples were collected in 250 ml double capped plastic bottles. Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of nine groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board, Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids, fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine. Results of groundwater samples analysis were compared with BIS drinking water standards (IS 10500:2012) to know groundwater quality for drinking purpose. In the study area pH ranges 7.5 to 9, alkalinity 270 mg/l to 570 mg/l, hardness 130 mg/l to 420 mg/l, chloride 20 mg/l to 110 mg/l, TDS 672 mg/l to 1200 mg/l, fluoride nil to 2 mg/l, iron nil to 2 mg/l, ammonia nil to 1 mg/l, nitrite 0.2 mg/l to 0.5 mg/l, nitrate 45 mg/l to 150 mg/l, phosphate nil in all the nine groundwater samples and residual chlorine nil to 0.2 mg/l. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

Keywords: Groundwater, quality, drinking, Guhla, Kaithal, Haryana.

1. INTRODUCTION

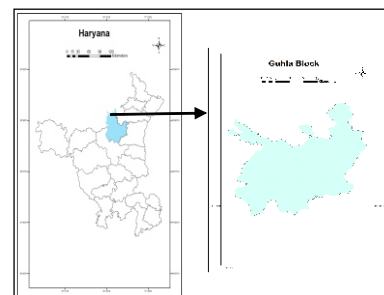
Water is important for living beings mainly for drinking, irrigation and industrial purposes. Good quality water is necessary for health to avoid many diseases. In the present time availability of good quality water is become very scarce due to anthropogenic pollution. Bunkar and Kumar (2019); Kaur et al. (2017), Khan and Jhariya (2017), Madhav et al. (2018), Nelly and Mutua (2016), Singh and Kumar (2014), Spanos et al. (2014), Vijaya Lalitha et al. (2016) had done work on groundwater quality assessment for drinking purpose in different areas.

2. STUDY AREA

Guhla block is located in Kaithal district of Haryana state

(Fig.1). The geo-coordinates of the study area are latitudes 29.94° N to 30.19° N and longitudes 76.19° E to 76.47° E. The study area covers 372.48 sq. km area. Geologically alluvium and geomorphologically alluvial plain are present in the study area.

Figure1: Location map of the study area



3. OBJECTIVE

The main objective of the study was to assess groundwater quality for drinking purpose in the study area.

4. MATERIALS AND METHODOLOGY

In the study area nine groundwater samples were collected in 250 ml double capped plastic bottles from tube wells (TW). Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of nine groundwater samples were done using Tamilnadu Water Supply and

Drainage (TWAD) Board, Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine (Table 1). Results of chemical analysis of groundwater samples were entered in excel software and prepared bar graphs for each chemical parameter. Results of groundwater samples analysis were compared with BIS (IS 10500:2012) drinking water standards (Table 2) to know groundwater quality for drinking purpose.

Table 1: Results of groundwater samples analysis in the study area.

S. No.	Sample Location	Latitude	Longitude	Source	pH	Alkalinity	Hardness (mg/l)	Chloride (mg/l)	TDS (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Residual Chlorine (mg/l)(mg/l)
1	Kharondhi	30.01	76.29	TW	7.5	400	270	110	936	2	2	0.5	0.2	100	0	0.2
2	Baupur	30.11	76.38	TW	8	370	130	110	732	2	0.3	1	0.5	100	0	0.2
3	Cheeka	30.03	76.34	TW	8	330	200	30	672	2	0	0.5	0.5	75	0	0
4	Kangthali	29.97	76.35	TW	8	550	220	20	948	2	0	1	0.5	75	0	0
5	Malikpur	30.13	76.23	TW	7.5	450	420	50	1104	0	0	0.5	0.5	100	0	0
6	Balbehra	30.03	76.39	TW	8.5	570	400	30	1200	1	0	0.5	0.5	150	0	0
7	Bhagal	30.06	76.42	TW	7.5	270	280	50	720	1.5	0	0.5	0.5	100	0	0
8	Arnoli	30.17	76.40	TW	8	390	270	70	876	1.5	0	1	0.2	45	0	0
9	Peedal	29.99	76.36	TW	9	430	270	80	936	1.5	0	0	0.5	75	0	0

Table 2: BIS (10500:2012) Drinking Water Standards.

S. No.	Characteristics	Potable		Non-Potable
		Desirable	Permissible	
1.	pH	6.5-8.5	-	<6.5 and >8.5
2.	Alkalinity (mg/l)	200	200-600	>600
3.	Hardness (mg/l)	200	200-600	>600
4.	Chloride (mg/l)	250	250-1000	>1000
5.	Total Dissolved Solids (mg/l)	500	500-2000	>2000
6.	Fluoride (mg/l)	<1.0	1.0-1.5	>1.5
7.	Iron (mg/l)	<0.3	-	>0.3
8.	Ammonia (mg/l)	<0.5	-	>0.5
9.	Nitrite (mg/l)	<0.1	-	>1.0
10.	Nitrate (mg/l)	<45	-	>45
11.	Phosphate (mg/l)	<1.0	-	>1.0
12.	Residual Chlorine (mg/l)	<0.2	0.2-1.0	>1.0

5. RESULTS AND DISCUSSION

5.1. pH

In the study area pH ranges 7.5 to 9 (Table 1, Fig.2). As per BIS drinking water standards pH is desirable between 6.5 to 8.5 and non-potable if less than 6.5 and more 8.5 (Table 2). pH is desirable in eight groundwater samples (Kharondhi, Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli) and non-potable in one groundwater sample (Peedal (9)).

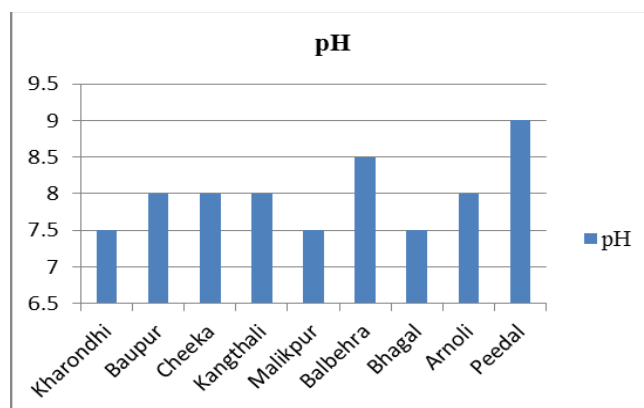


Figure 2: pH in groundwater samples.

5.2. Alkalinity

In the study area alkalinity ranges 270 mg/l to 570 mg/l (Table 1, Fig.3). As per BIS drinking water standards alkalinity is desirable if less than 200 mg/l, permissible between 200mg/l-600 mg/l and non-potable if more than 600 mg/l (Table 2). Alkalinity is permissible in all nine groundwater samples (Kharondhi, Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal).

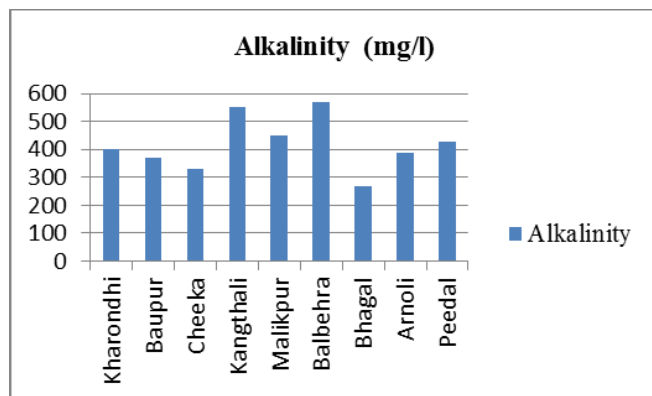


Figure 3: Alkalinity in groundwater samples.

5.3. Hardness

In the study area hardness ranges 130 mg/l to 420 mg/l (Table 1, Fig.4). As per BIS drinking water standards hardness is desirable if less than 200 mg/l, permissible between 200mg/l-600 mg/l and non-potable if more than 600 mg/l (Table 2). Hardness is desirable in one groundwater sample (Baupur) and permissible in eight groundwater samples (Kharondhi, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal).

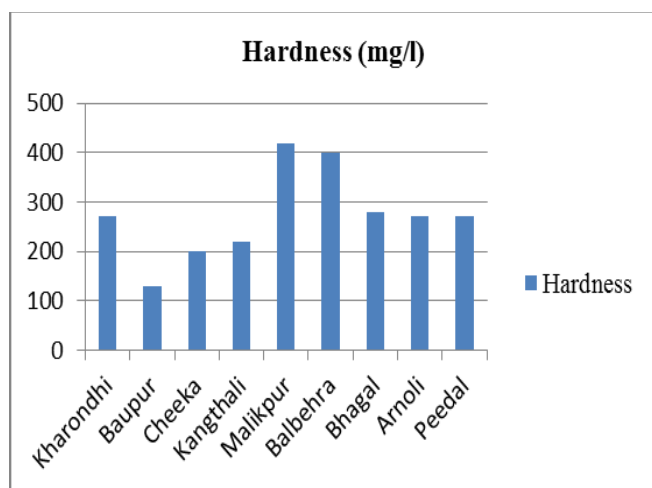


Figure 4: Hardness in groundwater samples.

5.4. Chloride

In the study area chloride ranges 20 mg/l to 110 mg/l (Table 1, Fig.5). As per BIS drinking water standards chloride is desirable if less than 250 mg/l, permissible between 250mg/l-1000 mg/l and non-potable if more than 1000 mg/l (Table 2). Chloride is desirable in all nine groundwater samples (Kharondhi, Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal).

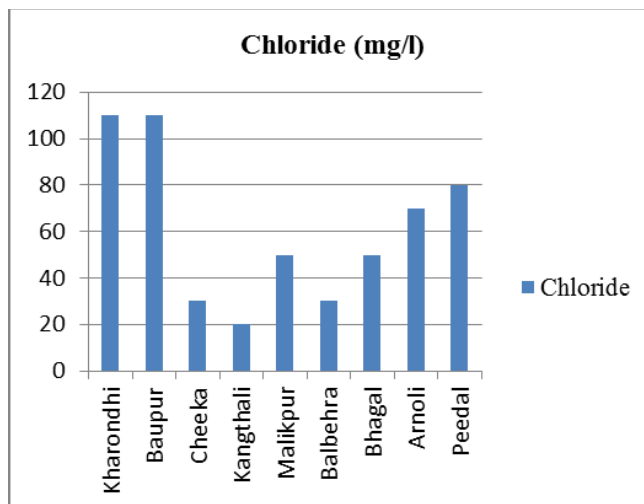


Figure 5: Chloride in groundwater samples.

5.5. Total Dissolved Solids (TDS)

In the study area TDS ranges 672 mg/l to 1200 mg/l (Table 1, Fig.6). As per BIS drinking water standards TDS is desirable if less than 500 mg/l, permissible between 500 mg/l-2000 mg/l and non-potable if more than 2000 mg/l (Table 2). TDS is permissible in all nine groundwater samples (Kharondhi, Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal).

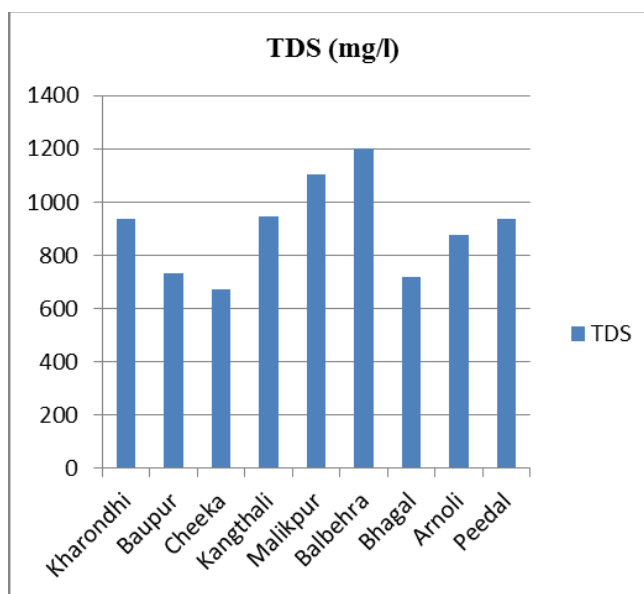


Figure 6: TDS in groundwater samples .

5.6. Fluoride

In the study area fluoride ranges nil to 2 mg/l (Table 1, Fig.7). As per BIS drinking water standards fluoride is desirable if less than 1.0 mg/l, permissible between 1.0 mg/l-1.5 mg/l and non-potable if more than 1.5 mg/l (Table 2). Fluoride is desirable in one groundwater sample (Malikpur), permissible in four groundwater samples (Balbehra, Bhagal, Arnoli, Peedal) and non-potable in four groundwater samples (Kharondhi (2 mg/l), Baupur (2 mg/l), Cheeka (2 mg/l), Kangthali (2 mg/l)).

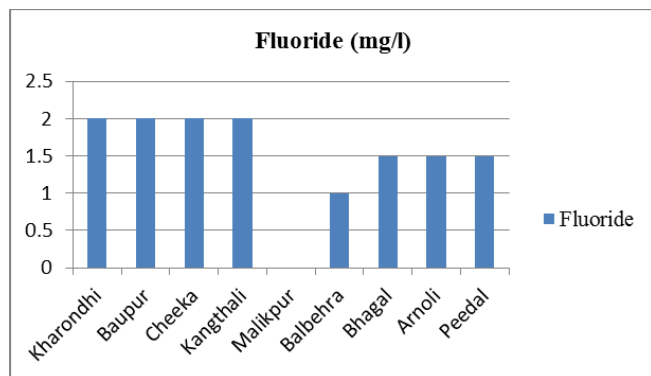


Figure 7: Fluoride in groundwater samples.

In the study area iron ranges nil to 2 mg/l (Table 1, Fig.8). As per BIS drinking water standards iron is desirable if less than 0.3 mg/l and non-potable if more than 0.3 mg/l (Table 2). Iron is desirable in eight groundwater samples (Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal) and non-potable in one groundwater sample (Kharondhi (2 mg/l)).

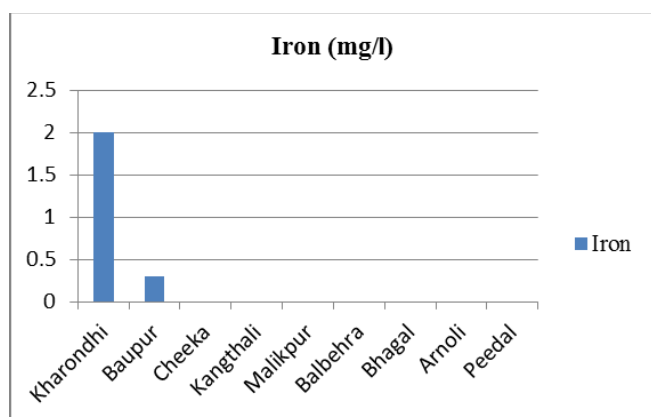


Figure 8: Iron in groundwater samples.

5.7. Ammonia

In the study area ammonia ranges nil to 1 mg/l (Table 1, Fig.9). As per BIS drinking water standards ammonia is desirable if less than 0.5 mg/l and non-potable if more than 0.5 mg/l (Table 2). Ammonia is desirable in six groundwater samples (Kharondhi, Cheeka, Malikpur, Balbehra, Bhagal, Peedal) and non-potable in three groundwater samples (Baupur (1 mg/l), Kangthali (1 mg/l), Arnoli (1 mg/l)).

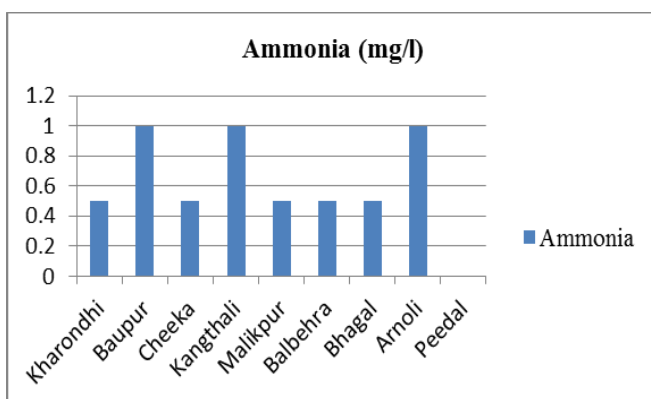


Figure 9: Ammonia in groundwater samples.

5.8. Nitrite

In the study area nitrite ranges 0.2 mg/l to 0.5 mg/l (Table 1, Fig.10). As per BIS drinking water standards nitrite is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Nitrite is desirable in all nine groundwater samples (Kharondhi, Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal).

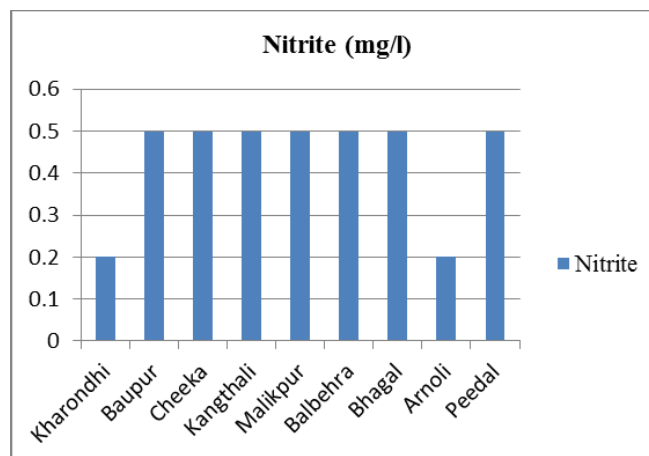


Figure 10: Nitrite in groundwater samples.

5.9. Nitrate

In the study area nitrate ranges 45 mg/l to 150 mg/l (Table 1, Fig.11). As per BIS drinking water standards nitrate is desirable if less than 45 mg/l and non-potable if more than 45 mg/l (Table 2). Nitrate is desirable in one groundwater sample (Arnoli) and non-potable in eight groundwater samples (Kharondhi (100 mg/l), Baupur (100 mg/l), Cheeka (100 mg/l), Kangthali (100 mg/l), Malikpur (100 mg/l), Balbehra (150 mg/l), Bhagal (100 mg/l), Peedal (100 mg/l)).

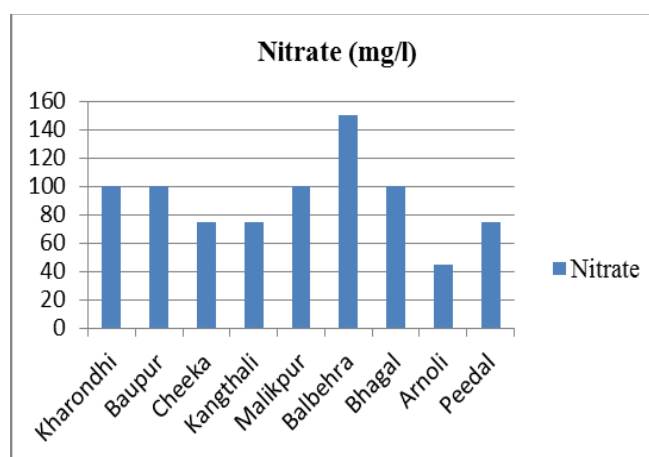


Figure 11: Nitrate in groundwater samples.

5.10. Phosphate

In the study area phosphate is nil in all the nine groundwater samples (Table 1, Fig.12). As per BIS drinking water standards phosphate is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Phosphate is desirable in all nine groundwater samples (Kharondhi, Baupur, Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Peedal).

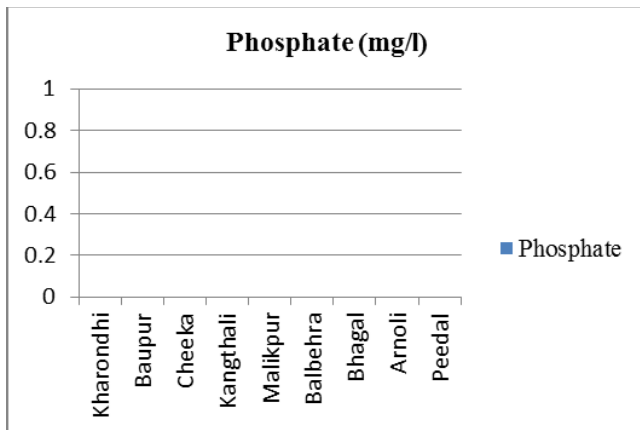


Figure 12: Phosphate in groundwater samples.

5.11. Residual Chlorine

In the study area residual chlorine ranges nil to 0.2 mg/l (Table 1, Fig.13). As per BIS drinking water standards residual chlorine is desirable if less than 0.2 mg/l, permissible between 0.2 mg/l-1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Residual Chlorine is desirable in seven groundwater samples (Cheeka, Kangthali, Malikpur, Balbehra, Bhagal, Arnoli, Peedal) and permissible in two groundwater samples (Kharondhi, Baupur).

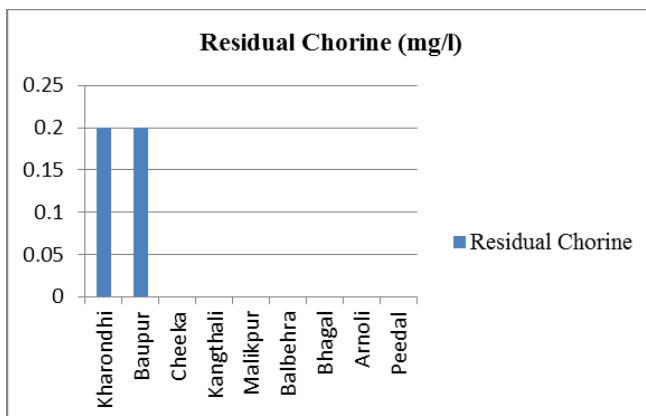


Figure 13: Residual Chlorine in groundwater samples

6. CONCLUSIONS

In the study area pH is desirable in eight groundwater samples and non-potable in one groundwater sample. Alkalinity and TDS are permissible in all nine groundwater samples. Hardness is desirable in one groundwater sample and permissible in eight groundwater samples. Chloride is desirable in all nine groundwater samples. Fluoride is desirable in one groundwater sample, permissible in four groundwater samples and non-potable in four groundwater samples. Iron is desirable in eight groundwater samples and non-potable in one groundwater sample. Ammonia is desirable in six groundwater samples and non-potable in three groundwater samples. Nitrite is desirable in all nine

groundwater samples. Nitrate is desirable in one groundwater sample and non-potable in eight groundwater samples. Phosphate is desirable in all nine groundwater samples. Residual Chlorine is desirable in seven groundwater samples and permissible in two groundwater samples. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

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