Abstract
Water is important for survival of living beings on the planet Earth. Drinking water quality should be as per drinking water standards to avoid the health effects. Anthropogenic activities have deteriorated the groundwater quality. In urban areas groundwater quality is more or less not suitable for drinking purpose. Shallow water table areas are more prone to water pollution due to anthropogenic activities. Rai block is located in Sonipat district of Haryana. The block covers an area of 280.49 sq.km. In the present study 20 groundwater samples in Rai block were collected in the month of January, 2019. The samples were analyzed using Field Water Testing Kit prepared by Tamil Nadu water Supply and Drainage Board, Chennai for twelve chemical parameters-pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrate, nitrite, ammonia, phosphate and residual chlorine. Chemical analysis of groundwater samples show that pH 6.5 to 9, alkalinity 100-2700 mg/l, hardness 130-920 mg/l, chloride 20 - 750 mg/l, TDS 828-3350 mg/l, fluoride 1-3 mg/l, iron nil to 5 mg/l, ammonia 0.5 - 1 mg/l, nitrite 0.2-1.0 mg/l, nitrate 45-100 mg/l, phosphate nil to 2 mg/l and residual chlorine nil to 0.2 mg/l. Groundwater is non-potable at Rasoi-2 (pH 9, alkalinity 860 mg/l, fluoride 2 mg/l, iron 5 mg/l, ammonia 1mg/l, nitrate 100mg/l), Rasoi-1 (alkalinity 2700 mg/l, TDS 3350 mg/l, fluoride 3 mg/l, nitrate 100 mg/l), Jakholi-3 (alkalinity 780 mg/l, nitrate 100 mg/l, Nurthupur (alkalinity 850 mg/l, fluoride 3 mg/l, ammonia 1 mg/l), Bahalgarh (Hardness 920 mg/l, TDS 2388 mg/l, fluoride 2 mg/l, ammonia 1mg/l/), Jatheri-1 (Hardness 700 mg/l), Liuaspur (Hardness 800 mg/l, TDS 2064 mg/l, ammonia 1 mg/l), Sabauti (fluoride 3 mg/l, nitrate 100 mg/l), Nagal Kalan (fluoride 3 mg/l, ammonia 1 mg/l, nitrate 75 mg/l), Patla-2 (iron 3mg/l, ammonia 1 mg/l), Jakholi-2 (iron 1 mg/l, nitrate 100 mg/l, phosphate 2 mg/l), Sewli-1(ammonia 1mg/l), Rai-1( ammonia 1 mg/l), Jat Joshi (ammonia 1 mg/l), Jat Joshi-2 (ammonia 1 mg/l). The study is highly useful for monitoring groundwater quality for drinking purpose in the study area.

INTRODUCTION
Water is important for survival of human beings and other living beings on the planet earth. In the present developmental activities water is polluted and not fit for drinking purposes. In industrial and high population density areas groundwater is polluted and not suitable for drinking purpose as per BIS drinking water standards. The need of the hour is to protect this precious natural resource for future generations. On various aspects of groundwater quality many workers have done good work Agrawal (2009), Ana et al. (2018), Balakrishnan, et al (2011), Das and Nag (2015), Durgadevagi, et al. (2016), Hussain and Prasad (2013), Jeihouni, et al. (2014), Mahadevswamy, et al. (2011), Okoye, et al. (2016), Pandian and Jeyachandran (2014),
Patel and Dhiman (2011), Rajesh, (2016), Sarkar, et al. (2012), Satyanarayana, et al. (2013), Saxena and Saxena (2015), Sengupta and Dalwani (2008), Shahida and Ummatul (2015), Sheikh and Kumari (2017), Sinha, et al. (2018), Subramani, et al. (2012), Thomas et al. (2015), Topper and Horn (2011), Vashisth (2017).

STUDY AREA
Rai block is located in Sonipat district of Haryana. The block covers 280.49 sq.km area. Geologically the block has soils of quaternary age. Rai is an industrial area with many types of industries working in the area. It is located on national highway adjacent to Delhi.

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

MATERIALS AND METHODS
Twenty groundwater samples were collected in plastic bottles from different parts of the Rai block in the month of January, 2019. Groundwater samples were analyzed using Field Water Testing Kit prepared by Tamil Nadu Water Supply and Drainage Board, Chennai for twelve chemical parameters- pH, alkalinity, hardness, chloride, total dissolved solids, fluoride, iron, ammonia, nitrate, nitrite, phosphate, residual chlorine. Chemical data entered in excel software and prepared the bar graphs of each parameter for all the sample location. Results were compared with BIS drinking water standards to know the pot-ability and non-potability of groundwater for drinking purpose.

RESULTS AND DISCUSSION
Results of twenty groundwater samples are given in Table 1 and BIS drinking water standards are given in Table 2. Parameter wise groundwater quality is given below:

Table 1: Results of chemical analysis of groundwater samples (in mg/l except pH).

| Sample Location | Latitude | Longitude | pH | Alkalinity | Hardness | Chl. | TDS | Fluo. | Iron | Amm | Nit | Nitrate | Phos | Residual Chlorine |
|-----------------|----------|-----------|----|------------|----------|------|-----|-------|------|-----|-----|---------|-----|------------------|
| Rasoi-2         | 28°54'25" | 77°6'45" | 9  | 860        | 570      | 20   | 1380| 2     | 5    | 1   | 1   | 100     | 0   | 0.2              |
| Rasoi-1         | 28°54'0"  | 77°6'44" | 7  | 2700       | 300      | 350  | 3350| 3     | 0    | 0.5 | 1   | 100     | 0   | 0                |
| Bahalgarh       | 28°57'29" | 77°5'36" | 7.5| 400        | 920      | 670  | 2388| 2     | 0    | 1   | 0.5 | 45      | 0   | 0                |
| Sewli-1         | 28°55'47" | 77°7'37" | 7.5| 600        | 600      | 50   | 1500| 1     | 0    | 1   | 0.5 | 45      | 0   | 0                |
| Rai-1           | 28°56'27" | 77°5'35" | 7.5| 350        | 430      | 550  | 1596| 1.5   | 0    | 1   | 0.5 | 45      | 0   | 0                |
| Jakholi-1       | 28°55'45" | 77°8'58" | 7  | 450        | 600      | 250  | 1560| 1.5   | 0    | 0.5 | 0.5 | 45      | 0   | 0                |
| Jatheri-1       | 28°55'19" | 77°4'24" | 7  | 600        | 700      | 350  | 1980| 1.5   | 0    | 0.5 | 0.5 | 45      | 0   | 0.2              |
| Sewli-2         | 28°55'20" | 77°7'33" | 7.5| 400        | 250      | 110  | 912 | 1     | 0    | 0.5 | 0.5 | 45      | 0   | 0                |
| Jakholi-2       | 28°55'58" | 77°8'29" | 7.5| 780        | 300      | 100  | 1416| 1     | 0    | 0.5 | 1   | 100     | 0   | 0.2              |
| Sewli-3         | 28°55'47" | 77°7'35" | 7.5| 380        | 250      | 60   | 828 | 1     | 0    | 0.5 | 0.5 | 45      | 0   | 0                |
| Pritampura      | 28°54'7"  | 77°5'54" | 6.5| 420        | 130      | 530  | 1296| 1.5   | 0    | 0.5 | 0.5 | 45      | 0   | 0.2              |
| Patla-2         | 28°55'21" | 77°8'26" | 7.5| 500        | 290      | 250  | 1248| 1     | 3    | 1   | 0.5 | 45      | 0   | 0                |
| Nathupur        | 28°54'6"  | 77°6'20" | 7.5| 850        | 370      | 190  | 1692| 3     | 0    | 1   | 1   | 100     | 0   | 0                |
| Jat Joshi       | 28°58'7"  | 77°4'7"  | 7.5| 370        | 360      | 280  | 1212| 1.5   | 0    | 1   | 0.5 | 45      | 1   | 0                |
| Jat Joshi-2     | 28°58'7"  | 77°4'29" | 7.5| 430        | 380      | 350  | 1392| 1.5   | 0    | 1   | 0.5 | 45      | 0.5 | 0                |
| Jakholi-3       | 28°55'30" | 77°8'55" | 6.5| 100        | 240      | 750  | 1308| 1.5   | 1    | 0.5 | 1   | 100     | 2   | 0.2              |
| Sabauli         | 28°53'23" | 77°5'42" | 7.5| 270        | 250      | 350  | 1044| 3     | 0    | 0.5 | 1   | 100     | 0   | 0                |
| Liwaspur        | 28°57'53" | 77°5'11" | 8.5| 520        | 800      | 400  | 2064| 1.5   | 0.3  | 1   | 0.5 | 45      | 0   | 0                |
| Patla           | 28°54'53" | 77°8'19" | 7  | 340        | 500      | 180  | 1224| 1     | 0    | 0.5 | 0.2 | 45      | 0   | 0                |
| Nangal Kalan-1  | 28°54'23" | 77°7'24" | 7.5| 240        | 450      | 80   | 924 | 3     | 0    | 1   | 1   | 75      | 1   | 0                |
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i. pH
pH is a measure of acidity or basicity of water. Water is potable between the range 6.5 to 8.5 and non-potable below 6.5 and above 8.5. pH ranges 6.5 to 9 in the study area. In the study area pH is desirable at nineteen sample locations and non-potable at Rasoi-2 sample location (pH 9). (Table 1, Table 2, Figure 1).

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

Table 2: Drinking water standards (IS 10500:2012).

Figure 1: pH in groundwater samples

Figure 2: Alkalinity (mg/l) in groundwater samples

Figure 3: Hardness (mg/l) in groundwater samples.

ii. Alkalinity
Alkalinity is a measure of water’s ability to neutralize acids. In the study area alkalinity varies from 100 mg/l to 2700 mg/l. At one sample location (Jakholi) alkalinity 100 mg/l is desirable (<200mg/l), at fifteen sample locations alkalinity is permissible (200-600 mg/l) and at four sample locations alkalinity is non-potable (>600 mg/l) (Table 1, Table 2, Figure 2).

iii. Hardness
Hard water has high concentration of calcium and magnesium carbonates. In the study area hardness varies from 130 mg/l to 920 mg/l. Hardness is desirable at one sample location (Pritampura 130 mg/l), permissible at sixteen sample locations and non-potable at three sample locations (Table 1, Table 2, Figure 3).

iv. Chloride
Chloride is available in nature as salts of sodium (NaCl), potassium (KCl), and calcium (CaCl2). Chloride is an anion and formed when the element chlorine gains an electron or when a compound such as hydrogen chloride is dissolved in water or other polar solvents. In the study area, chloride varies from 20 mg/l to 750 mg/l. At eight sample locations chloride is desirable (<250 mg/l) and at twelve locations...
chloride is permissible (250-1000 mg/l) (Table 1, Table 2, Figure 4).

Figure 4: Chloride (mg/l) in groundwater samples.

1.5 mg/l) and six sample locations non-potable (>1.5 mg/l) (Table 1, Table 2, Figure 6).

Figure 6: Fluoride (mg/l) in groundwater samples.

Figure 7: Iron (mg/l) in groundwater samples.

vii. Iron
Iron is commonly found in nature in its oxides form and occurs in soils, sediments, and rocks. Iron is the second most abundant metal in the Earth’s crust. In the study area iron varies between nil to 5 mg/l. At seventeen sample locations iron is desirable (<0.3 mg/l) and three sample locations non-potable (>0.3 mg/l) (Table 1, Table 2, Figure 7).

Figure 8: Ammonia (mg/l) in groundwater samples.

viii. Ammonia
Ammonia is a compound contains nitrogen and hydrogen. In the study area, ammonia varies from 0.5 to 1 mg/l. At ten sample locations ammonia is desirable (<0.5 mg/l) and ten sample locations non-potable (> 0.5 mg/l) (Table 1, Table 2, Figure 8).

Figure 9: Nitrite (mg/l) in groundwater samples.

ix. Nitrite
Nitrite is ion having chemical formula NO2. In the study area,
nitrite varies from 0.2 mg/l to 1 mg/l. At all the twenty sample locations nitrite is desirable (<1 mg/l) (Table 1, Table 2, Figure 9).

xii. Residual Chlorine
Presence of residual chlorine in drinking water indicates that a sufficient amount of chlorine is added to the water to deactivate the bacteria and viruses that cause diarrhea. In the study area, residual chlorine varies from nil to 0.2 mg/l. At all the twenty sample locations residual chlorine is desirable (<0.2 mg/l) (Table 1, Table 2, Figure 12).

CONCLUSION
Groundwater is non-potable at fifteen sample locations viz. Rasoi-2 (pH 9, alkalinity 860 mg/l, fluoride 2 mg/l, iron 5 mg/l, ammonia 1 mg/l, nitrate 100 mg/l), Rasoi-1 (alkalinity 2700 mg/l, TDS 3350 mg/l, fluoride 3 mg/l, nitrate 100 mg/l), Jakholi-3 (alkalinity 780 mg/l, nitrate 100 mg/l), Nathupur (alkalinity 850 mg/l, fluoride 3 mg/l, ammonia 1 mg/l), Bahalgarh (Hardness 920 mg/l, TDS 2388 mg/l, fluoride 2 mg/l, ammonia 1 mg/l), Jatheri-1 (Hardness 700 mg/l), Liwaspur (Hardness 800 mg/l, TDS 2064 mg/l, ammonia 1 mg/l), Sabauli (fluoride 3 mg/l, nitrate 100 mg/l), Nangal Kalan (fluoride 3 mg/l, ammonia 1 mg/l, nitrate 75 mg/l), Pata-2 (iron 3 mg/l, ammonia 1 mg/l), Jakholi-2 (iron 1 mg/l, nitrate 100 mg/l, phosphate 2 mg/l), Sewli-1 (ammonia 1 mg/l), Jat Joshi (ammonia 1 mg/l), Jakholi-2 (ammonia 1 mg/l). Groundwater is potable at Patla, Pitampur, Sewli-2, Sewli-3 and Jakholi-1 sample locations. The study is highly useful for monitoring groundwater quality for drinking purpose in the study area.

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