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Analysis of Water Quality of Saket by using Geophysical Logging Located in Saket, New Delhi

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ABSTRACT: Geophysical logging application was incorporated for the perusal of the groundwater analysis. The study area involves the parts of the Saket area, situated in the Indian capital Delhi. For the purpose of study VES(vertical electrical sounding) method was adopted to reach to desired analysis. The study carries the objective of an analysis of the condition of groundwater along with the investigation of the geological situation. Abem Terrameter SAS-300c system with the with Geomac II, ABEM SAS log200 system with Geomac III were used in the study to perform the VES of the Schlumberger configuration along with the tubewell geophysical logging. Lithological investigation of the tubewell depicts the presence of alluvial topsoil, Badarpur sand, fractured and weathered rock along with the sandy silt and silty sand for subsurface of soil. Also, the presence of four geoelectric layer found. In these layers the fourth layer that is observed at a depth range from 15 ft to 450 ft, were found with the aquifer and 50 to 2000 Ωm resistivity were observed for this layer consisting aquifer. Geophysical logging analysis depicts the observation results for total dissolved solid in aquifer as 430 ppm. the obtained limit of TDS is found to be in standard limits, as the standard limit is 500 ppm set for the potable water by standard organization of India. Ground water development is found to be feasible for the fourth layer, since the layer is observed as potential non-conductive zone in the study area.

KEYWORDS: Aquifer System, Geophysical Logging, Groundwater, Heath Issues.Water Quality Analysis.

1.0 INTRODUCTION

The survival of life on the earth is mainly dependent on the natural resources present on earth and the water is the most vital element out of all. The demand of water can be fulfilled by the rivers and lakes along with this most of urban demands are fulfilled by the subsurface water that is known as ground water. Except the desert areas the fresh surface water is readily available at most of the places. Besides the fact that the surface water is readily accessible at such places, this is found to be polluted at most of the times due to the anthropogenic activities. This phenomenon leads to the search of alternate option and ground water becomes practicable option to meet quality water requirements. Geophysical exploration techniques are used for the various exploration surveys viz. mineral exploration, environmental, archaeological, geotechnical etc. The electrical resistivity survey method is mostly adopted and old times method of exploration (Reynolds, 2011, Loke et al., 2013). Quality and quantity of the ground water along with its movement direction are sensed in the geophysical logging, for this the sensing devices are lowered in the boreholes (test-pits), such techniques are also able to detect the physical formation of the test pits. There are various logging techniques viz. Caliper, resistivity, temperature and radiation logging etc. The obtained data from these logging can be transmitted through tele techniques and also can be stored and digitized.

Subsurface investigations are employed for the ambient and detailed ground water study and feasible conditions. Whether the required data is for aquifer or for ground water, the subsurface investigations are employed for the quantitative data.

The use of geophysical logs for the analysis of systems of the ground water starts along with the preliminary environmental factors intellect, which are responsible for the responses of the geophysical-log. Along with this analysis needs knowledge of inter-relationship between geophysical-log responses and obtained data, such as models, properties of the rocks, equations that are derived experimentally and also the logging device response governing principles. For the analysis of freshwater aquifers and to allude interpretations which are based on the reliable empirical data, the established “oil-filed” geophysical-log interpretation methods were adopted. The user of these methods is required to be cognizant of variables and along with this the interrelation between the lithologic property and qualitative and quantitative geophysical log analysis. Geophysical log formation assessment is dependent on

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several assumptions, and without these proper assumptions the final interpretation cannot be better to reach ultimate conclusion. Geophysical logging is incorporated to achieve qualitative and quantitative data.

The objective of this work is to analyse the study area for geologic setting, also the condition of the groundwater is investigated to discern the formation of the subsurface and to depict the elements of the structure therein, these all acquired data will help to identify feasible groundwater development in area.

2.0 METHODOLGY AND MATERIALS

2.1 Geologic Condition and Location of the Study Area

The research area Saket lies in the Indian capital city Delhi, the coordinates of area is 28.5192°N 77.2134°E. The figure-1 below depicts the study area location. Most of the soil formation is alluvial along with the Yamuna flood plain deposits at the study area. Hard rock strata is found to be varying at different location, an average observation of strata is found approximately at 300 m (CGWB, New Delhi).

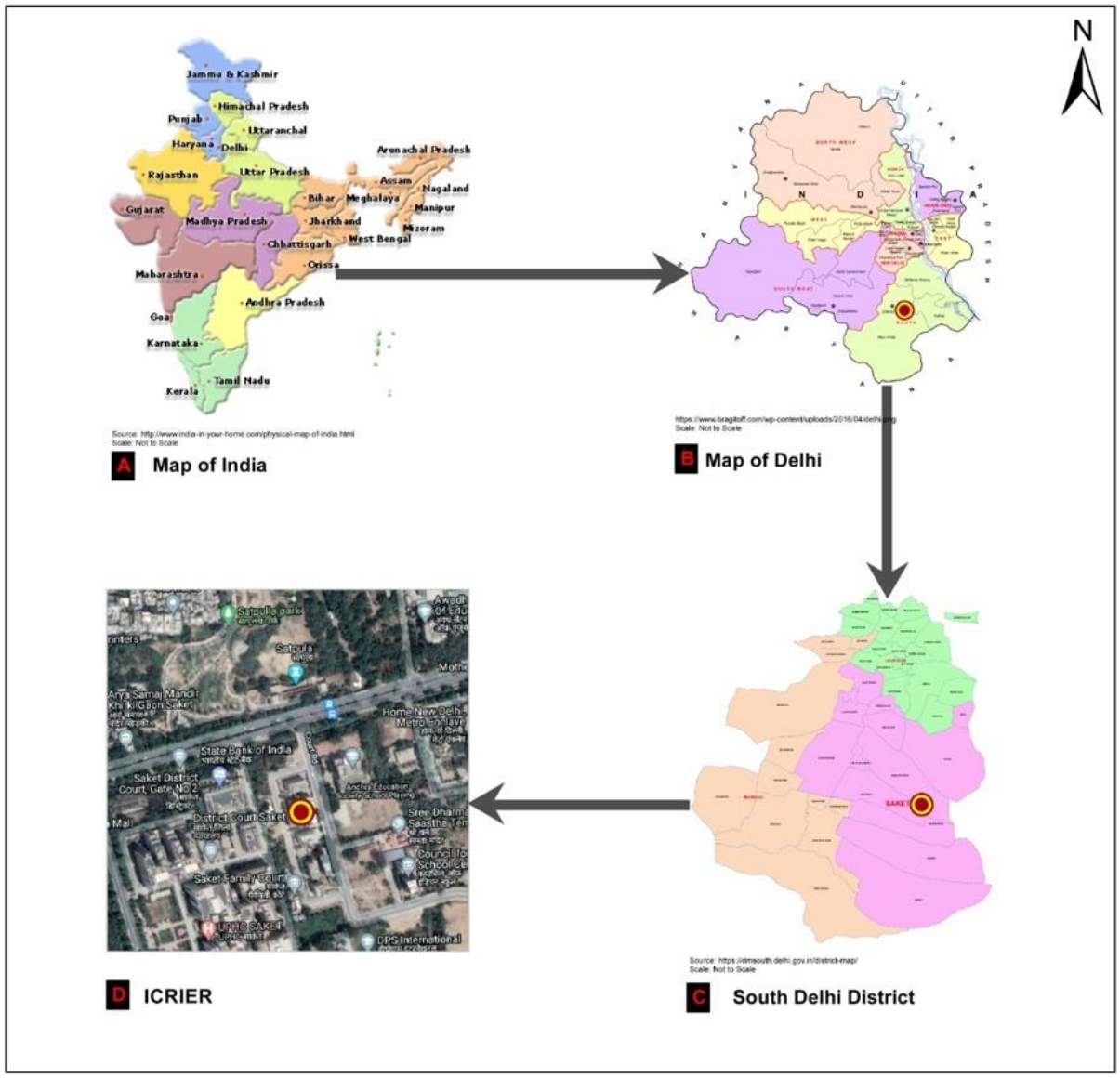

Figure-1: Location of Study Area

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3.0 RESULT AND DISCUSSION

The specimens of the rock water acquired from the study area by drilling a tubewell. The collection process is done at intervals to access the lithology, the interval kept as 40 ft and 80 ft. Terrameter connected logging probe is incorporated to investigate the drilled well for resistivity logging and subsurface Spontaneous potential (SP). Total dissolved solid and electrical conductivity data were used to interpret the ground water condition and data observed from logging were employed for the assessment of the subsurface geology.

Table-1 to 5 depicts the parameter wise results are within the permissible limit, and there is no significant variation in Physical and Chemical parameters. Figure-1 depicts that the physical and chemical parameters are above acceptable limits but below the permissible limits.

Table-1 Tube well No.1 ICRIER Building Saket, New Delhi (Sample No.1 at 280 ft depth)

S. No.	PARAMETERS	RESULT (Mg/l)	FOLLOWED STANDARD (Mg/l)
			IS:10500-2012
CHEMICAL PARAMETERS			
1.*	Total Hardness	350	300-600
2.*	Ca-Hardness	200	
3.*	Mg-Hardness	150	
4	Alkalinity	300	600
5	Iron	0.3	0.3-1.0
6	Nitrate	13	15-50
7*	Sulphate	120	250 - 500
8*	T.D.S.	450	500-2000
9	TSS	NIL	
10	Oil	NIL	
11	Phenolic Compounds	Less than 0.001	0.001-0.002
12	Mercury	NIL	Not allowed
13	Cadmium	Less than 0.02	Not allowed
14	Selenium	NIL	Not allowed
15	Arsenic	NIL	Not allowed
16	Cyanide	NIL	Not allowed
17	Lead	Less than 0.05	Not allowed
18*	Chloride	300	250-1000
19	Zinc	Less than 0.05	15
PHYSICAL PARAMETERS			
1	Turbidity	2 N.T.U.	5.0 max
2	Taste	.....	Unobjectionable
3	Ph	8.4	6.5-8.2
4	Colour	Less than 5.0	5
5	Odour	Unobjectionable	Unobjectionable

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Table-2 Tube well No.1 ICRIER Building Saket, New Delhi (Sample No.2 at 320ft depth)

S. No.	PARAMETERS	RESULT (Mg/l)	FOLLOWED STANDARD (Mg/l)
			IS:10500
CHEMICAL PARAMETERS			
1.*	Total Hardness	350	300-600
2.*	Ca-Hardness	200	
3.*	Mg-Hardness	150	
4	Alkalinity	300	600
5	Iron	0.3	0.3-1.0
6	Nitrate	12	15-50
7*	Sulphate	110	250 - 500
8*	T.D.S.	440	500-2000
9	TSS	NIL	
10	Oil	NIL	
11	Phenolic Compounds	Less than 0.001	0.001-0.002
12	Mercury	NIL	No relaxation
13	Cadmium	Less than 0.02	No relaxation
14	Selenium	NIL	No relaxation
15	Arsenic	NIL	No relaxation
16	Cyanide	NIL	No relaxation
17	Chloride	290	250-1000
18*	Lead	Less than 0.05	No relaxation
19	Zinc	Less than 0.05	15
PHYSICAL PARAMETERS			
1	Turbidity	2 N.T.U.	5.0 max
2	Taste	.....	Unobjectionable
3	pH	8.3	6.5-8.2
4	Colour	Less than 5.0	5
5	Odour	Unobjectionable	Unobjectionable

Table-3 Tube well No.1 ICRIER Building Saket, New Delhi (Sample No.3 at 400 ft depth)

S. No.	PARAMETERS	RESULT (Mg/l)	FOLLOWED STANDARD (Mg/l)
			IS:10500
CHEMICAL PARAMETERS			
1.*	Total Hardness	350	300-600
2.*	Ca-Hardness	200	
3.*	Mg-Hardness	150	
4	Alkalinity	300	600
5	Iron	0.3	0.3-1.0

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S. No.	PARAMETERS	RESULT (Mg/l)	FOLLOWED STANDARD (Mg/l)
			IS:10500
6	Nitrate	11	15-50
7*	Sulphate	115	250 - 500
8*	T.D.S.	430	500-2000
9	TSS	NIL	
10	Oil	NIL	
11	Phenolic Compounds	Less than 0.001	0.001-0.002
12	Mercury	NIL	Not allowed
13	Cadmium	Less than 0.02	Not allowed
14	Selenium	NIL	Not allowed
15	Arsenic	NIL	Not allowed
16	Cyanide	NIL	Not allowed
17*	Chloride	280	250-1000
18	Lead	Less than 0.05	Not allowed
19	Zinc		15
PHYSICAL PARAMETERS			
1	Turbidity	2 N.T.U.	5.0 max
2	Taste	.....	Not objectionable
3	pH	8.3	6.5-8.2
4	Colour	Less than 5.0	5
5	Odour	Not objectionable	Not objectionable

Table-4 Tube well No.1 ICRIER Building Saket, New Delhi (Sample No.4 at 440 ft depth)

S. No.	PARAMETERS	RESULT (Mg/l)	FOLLOWED STANDARD (Mg/l)
			IS:10500
CHEMICAL PARAMETERS			
1.*	Total Hardness	350	300-600
2.*	Ca-Hardness	200	
3.*	Mg-Hardness	150	
4	Alkalinity	300	600
5	Iron	0.3	0.3-1.0
6	Nitrate	11	15-50
7*	Sulphate	110	250 - 500
8*	T.D.S.	440	500-2000
9	TSS	NIL	
10	Oil	NIL	
11	Phenolic Compounds	Less than 0.001	0.001-0.002
12	Mercury	NIL	Not allowed

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S. No.	PARAMETERS	RESULT (Mg/l)	FOLLOWED STANDARD (Mg/l)
			IS:10500
13	Cadmium	Less than 0.02	Not allowed
14	Selenium	NIL	Not allowed
15	Arsenic	NIL	Not allowed
16	Cyanide	NIL	Not allowed
17*	Chloride	260	250-1000
18	Lead	Less than 0.05	Not allowed
19	Zinc	Less than 0.05	15
PHYSICAL PARAMETERS			
1	Turbidity	2 N.T.U.	5.0 max
2	Taste	.....	Not objectionable
3	pH	8.2	6.5-8.2
4	Colour	Less than 5.0	5
5	Odour	Not objectionable	Not objectionable

Table-5 Tube well No.1 ICRIER Building Saket, New Delhi (Sample No.5 at 480 ft dept)

S. No.	PARAMETERS	RESULT (Mg/l)	PROTOCOL FOLLOWED (Mg/l)
			IS:10500
CHEMICAL PARAMETERS			
1.*	Total Hardness	350	300-600
2.*	Ca-Hardness	200	
3.*	Mg-Hardness	150	
4	Alkalinity	300	600
5	Iron	0.3	0.3-1.0
6	Nitrate	12	15-50
7*	Sulphate	100	250 - 500
8*	T.D.S.	440	500-2000
9	TSS	NIL	
10	Oil	NIL	
11	Phenolic Compounds	Less than 0.001	0.001-0.002
12	Mercury	NIL	Not allowed
13	Cadmium	Less than 0.02	Not allowed
14	Selenium	NIL	Not allowed
15	Arsenic	NIL	Not allowed
16	Cyanide	NIL	Not allowed
17*	Chloride	250	250-1000 Mg/l

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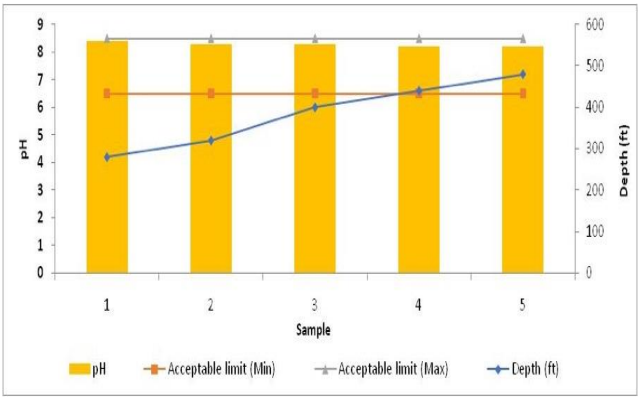
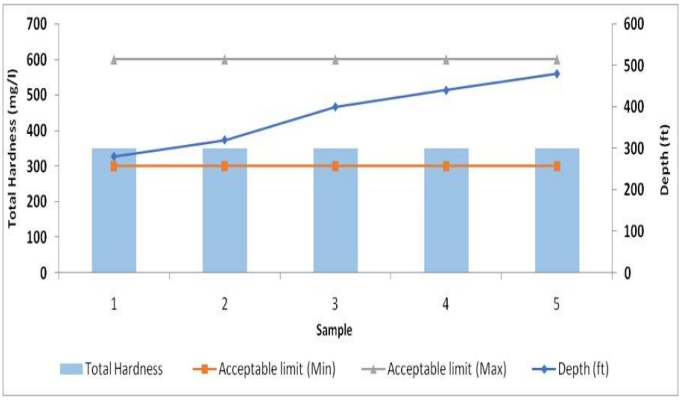
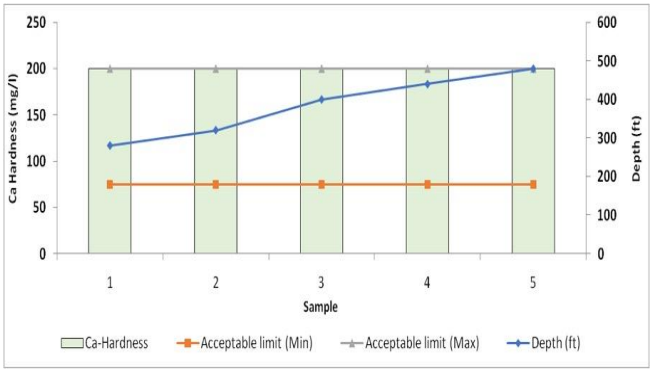
18	Lead	Less than 0.05	Not allowed
19	Zinc	Less than 0.05	15
PHYSICAL PARAMETERS			
1	Turbidity	2 N.T.U.	5.0 max
2	Taste	.....	Not objectionable
3	pH	8.2	6.5-8.2
4	Colour	Less than 5	5
5	Odour	Not objectionable	Not objectionable



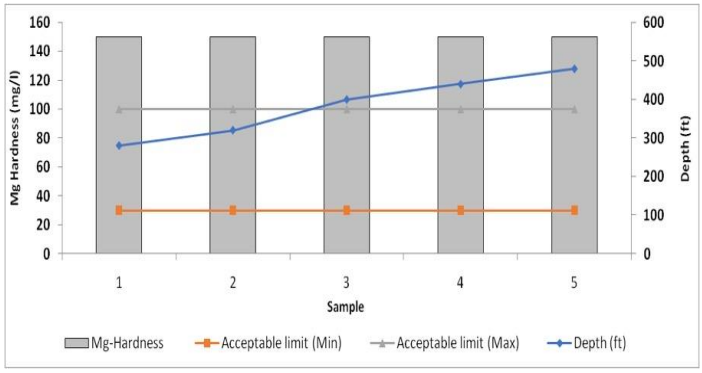
(a) Relation between pH and depth



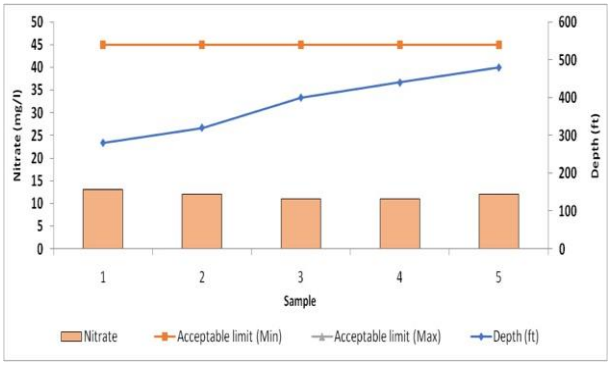
(b) Relation total hardness and depth



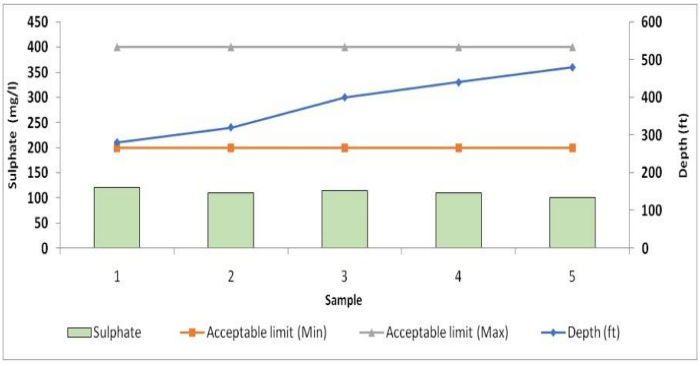
(c) Relation total Ca hardness and depth



(d) Relation total Mg hardness and depth



(e) Relation Nitrate and depth



(f) Relation Sulphate and depth

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3.0 CONCLUSION AND RECOMMENDATION

The area is predominantly occupied by the Alluvial Soil with generally Weathered Formation. It indicates that the area may be a part of Flood Plain zone. The promising zone with respect to the depth indicated by spontaneous potential logging may be considered for slotted/ perforated areas. The water quality is Moderately Hard and Alkaline in reaction.

For the investigation of groundwater condition along with the geological setting, the geophysical logging and vertical electrical sounding surveys were performed. Computer iteration were incorporated to interpret the data of vertical electrical sounding, along with this the well cutting and down-hole logging were also analyzed and evaluated.

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