ISSN: 2633-4828 Vol. 5 No.4, December, 2023

International Journal of Applied Engineering & Technology

NATURAL POTABILITY COMPETENCE OF GROUND WATER UNDER THE INFLUENCE OF DIFFERENT SOIL TYPES

[1]Abhilash N R and [2]Rumpa Sarkhel

[1,2]Assistant Professor, Civil Engineering Department, RNS Institute of Technology, Bengaluru, Karnataka, India

ABSTRACT

The project undertaken aims towards assessing the natural potability competence of ground waterwhich is influenced by the impartation of soil characteristics of different types like red soil, blackcotton soil, coastal Laterite soil, coastal alluvial soil, etc., which are vastly available in Karnatakastate. Each type of soil will have different composition and other factors that vary the characteristic ofground water which makes the local community to decide whether to use or not to use the ground waterdirectlywithoutanytreatment. This project gives a review on how each soil type has an impact on its ground water and gives acomparison on least affecting impact scale so as to know which soil type region is more naturallypotable.

Thetypesandconcentrationsofnaturalcontaminatesdependonthenatureofthegeologicalmaterialsthroughwhichthegroundwaterflowsandqualityoftherechargewater.Groundwater movingthroughsedimentaryrocksandsoilsmaypickupawiderangeofcompounds,suchas magnesium,calcium,andchloride,arsenic,fluoride,nitrate,andiron;thus,theeffectofthese natural contamination depends on their types and concentrations.

Keywords: Natural Potability, Ground water, Soil types.

INTRODUCTION

Water is an important natural resource for one's survival/sustainability. The rain or melting ice and snow results in the natural runoff and subsequent percolation into the soil gives rise to ground water. Groundwater accounts fornearly 95 % of the India's fresh water resources. It can stay underground thousands of years, or it can come to the surface and help fill ponds, lakes, rivers, streams or wetlands. Groundwater can also come to the surface as a spring or be pumped from a well. Bothofthesearecommonwayswegetgroundwaterto drink.

Nowadays the cheapest and more accessible source of drinking water is ground water and it is less vulnerable to pollution than surfacewater. Underground reservoircontains more water than capacity of all the surface reservoir. More than 60% of irrigatedagriculture and 85%ofdrinkingwatersuppliesaredependenton groundwater.Ground water Contamination- Polluted groundwater is less visible, but more difficult to clean up, than pollution in river and lakes.

OBJECTIVES

- Assessment of soils' character impartation in groundwater.
- Analysis of drinking water parameters and examine the permissible limits of the same as per the standards prescribed in IS 10500-2012.
- Investigate soil properties' impact on ground water potability at different depths.
- Assessing natural potability competence individual soil type by comparison.
- Proposition of locally available materials for low-cost treatments at individual sample site

STUDY AREA

Four regions of Karnataka state were selected for sampling of ground water at different soil types. They are; Bhalki, Bidar District; Manki Village, Honnavara Taluk, Uttara kannada District, Hosadu village, Kundapura Taluk, Udupi District and Sevanagar, Hassan District.

MATERIALS AND METHODOLOGY

- Identification of bore well points for different soil types in prior listed areas using geological maps from National Bureau of Soil Survey and Land Use Planning.
- The study area is compressed of Karnataka's state divided into regions of different soil availabilities.
- The samples had been tested and analyzed for different parameters.
- Investigation had been conducted on ground water samples to determine the natural potability competence under the influence of listed soil types.
- Explore locally available materials for suggesting low-cost treatment methods for local community.
- List of parameters and tests to be conducted.

Table: 1 Type of soil from different locations taken at different depths

Sl No	STUDY AREA	PLACE	SOIL	DEPTH (ft)	DEPTH (ft)
1	STUDY AREA 1	Bhalki	Black Cotton Soil	200	400
2	STUDY AREA 2	Manki	Laterite Soil	200	400
3	STUDY AREA 3	Hosadu	Clayey Laterite soil	200	400
4	STUDY AREA 4	Sevanagar	Sandy Loam soil	200	400

RESULTS AND DISCUSSIONS

Thefollowingparametersweretestedasfollows:pH,Turbidity,Alkalinity,Acidity,DissolvedOxygen,Chlorides, COD, Ironand TotalHardness

- **pH:-**

Table: 2-pHTest Results

SAMPLE	At 200ft depth	At 400ft	Avg. pH value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	6.49	7.3	6.89	1
2-Manki	6.2	6.4	6.30	0
3-Hosadu	6.35	7.1	6.72	1
4-Sevanagar	6.3	6.48	6.39	0

(allvalues areinmg/l)

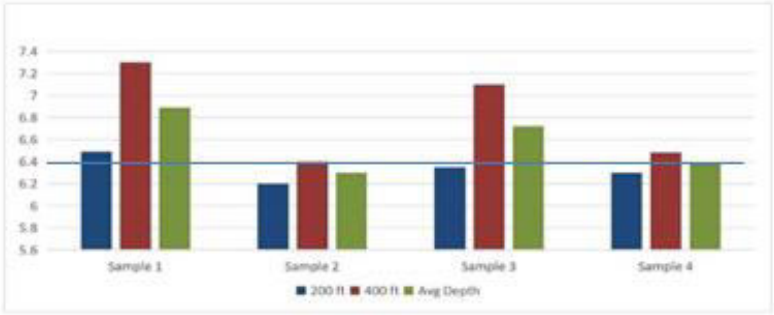

Fig: 1 - Graph of pH Test Results

- As per IS-10500-2012, pH should be between 6.5 to 8.5
- Itisobservedthatallthesamplesreachpotabilityvaluesof pHwithincreaseindepth.Atlesserdepthsitisobservedthatthesamples have anaffinitytowards acidic nature.
- Amongthe8samples,thefirstsamplestationprovestobethemostsuitablefordrinkingwithregardto pH.

➢ **Alkalinity:-**

Table: 3- AlkalinityTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. Alkalinity value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	214.66	230.45	222.55	0
2-Manki	150	164.23	157.11	1
3-Hosadu	90.56	183.65	137.10	1
4-Sevanagar	276.23	312.57	294.40	0

(**all values are in mg/l)

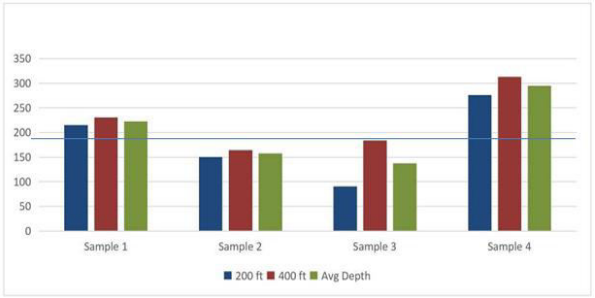

Fig: 2 - Graph of Alkalinity Test Results

- It is observed that alkalinity is very much near to the acceptable limit of 200mg/l as per IS-10500-2012 for samples 2 and 3 where as more in 1 and 4.
- The increase in alkalinity in eachsampleis increasingduetothepresenceofcarbonates andBi-carbonates inthesoil.

➢ **Total Hardness:-**

Table: 4- Total HardnessTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. Total hardness value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	92	80	86.00	1
2-Manki	78	71	74.50	1
3-Hosadu	56.6	25.33	40.96	1
4-Sevanagar	82	78	80.00	1

(**all values are in mg/l)

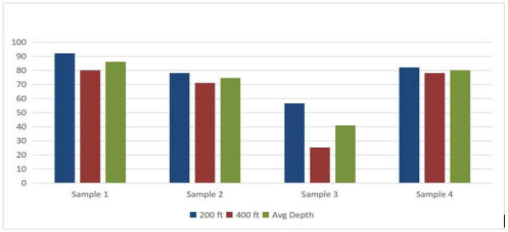

Fig: 3 - Graph of Total HardnessTest Results

- It is observed that Total Hardness of the 4 samples is well within 200mg/l as per IS-10500-2012.Sample 3 shows lesser hardness values than compared to others as the calcium content is less intherespectiveregion.
- Hence allthesamplesareeligible fordrinkingwithregard tototalhardness.

➢ **Dissolved Oxygen:-**

Table: 5- Dissolved oxygenTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. Dissolved oxygen value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	8	7.5	7.75	1
2-Manki	8.8	8.2	8.50	1
3-Hosadu	9	8.5	8.75	1
4-Sevanagar	6.8	6.2	6.5	1

(**all values are in mg/l)

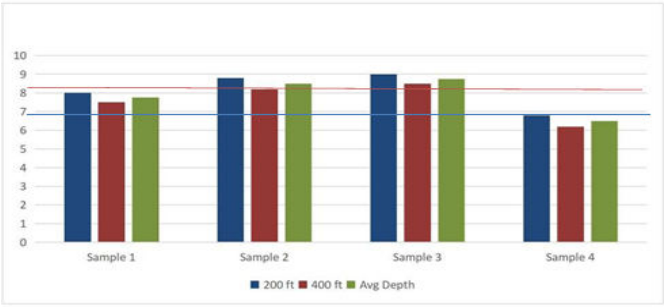

Fig: 4 - Graph ofDissolved oxygenTest Results

- ForahealthydrinkingwatertheDissolvedOxygenlevelsshouldbewithin4-8mg/l.
- Thetestedsamplesare wellwithin therange;hence itisdrinkable withregardto dissolvedoxygen.

➢ **Turbidity:-**

Table: 6- TurbidityTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. Turbidity value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	5.2	4.8	5.00	1
2-Manki	15.2	14.1	14.65	0
3-Hosadu	20.7	19.8	20.25	0
4-Sevanagar	10	9.6	9.80	0

(**all values are in NTU)

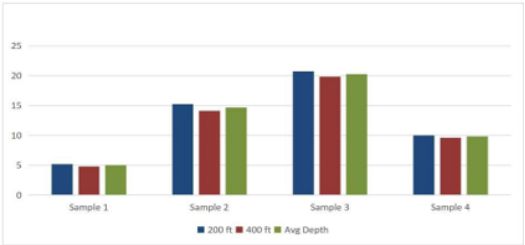

Fig: 5 - Graph of TurbidityTest Results

- AccordingtoIS-10500-2012thepermissiblelimitsofturbidityis1-5NTU.Itisobservedthattheturbidityis high in sample2,3,4and sample1shows values within thelimit.

➢ **Chloride:-**

Table: 7-ChlorideTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. Chloride value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	129.99	127.35	128.67	1
2-Manki	54.99	52.65	53.82	1
3-Hosadu	39.99	38.96	39.47	1
4-Sevanagar	141.99	140.8	141.39	1

(**all values are in mg/l)

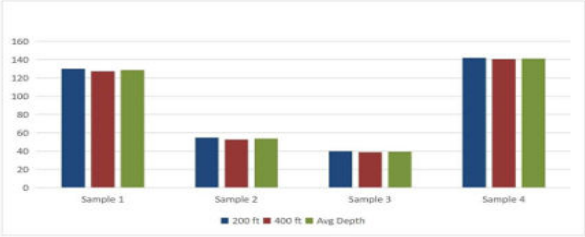

Fig: 6 - Graph of ChlorideTest Results

- Chlorideisfoundinvirtuallyallgroundwater.Chloridecanoccuringroundwaternaturally. According to IS 10500-2012, the Chloride content should be within 250mg/lt.
- Thetestedsamplesarewellwithintherange;henceitisdrinkable with regardtoChloride.

➢ **COD:-**

Table: 8- CODTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. COD value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	165.5	179.2	172.35	1
2-Manki	143.6	150.4	147.00	1
3-Hosadu	156.4	169.6	163.00	1
4-Sevanagar	149.3	163.2	156.25	1

(**all values are in mg/l)

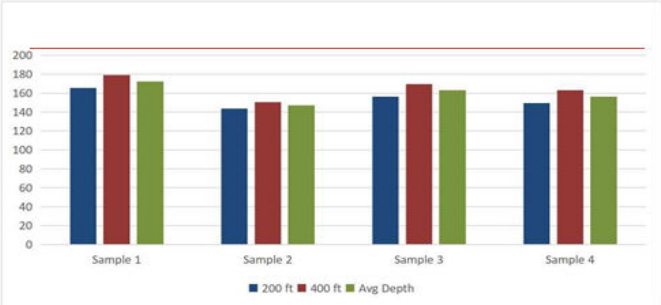

Fig: 7 - Graph of CODTest Results

- For a healthy drinking water the COD value should be within 200mg/lt.
- To understand thequantity of organic matter present in ground water and the results showed that there is lesscontaminationinallthefoursamplesandnoindustrialeffluentintrusioninto thegroundwater.

➢ **Iron:-**

Table: 9-IronTest Results

SAMPLE	At 200ft depth	At 400ft depth	Avg. Iron value from both the depths	Grading points [1 for suitable & 0 for not suitable for drinking]
1-Bhalki	0.52	0.59	0.55	0
2-Manki	0.20	0.41	0.30	1
3-Hosadu	0.48	0.50	0.49	0
4-Sevanagar	0.37	0.44	0.40	0

(**all values are in mg/l)

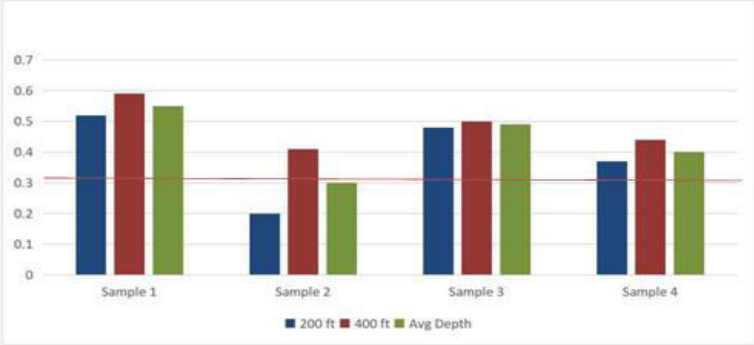

Fig: 8 - Graph of IronTest Results

- According to IS10500-2012, the iron content should be within 0.3 mg/lt. Itis observed that allthe samples show a trend of increasing in iron content along with increase in depth of soil as thegroundwaterpassesthroughdifferent strata.
- Sample 2 and 4 at depths of 200ft or less would be suitable for drinking directly without anytreatmentwith regard to Iron.

CONCLUSION

In this study, the natural potability competence of ground water under the influence of differentsoil types was investigated. From the results and gradings of the present work, it can be said thatthe ground water from regions having black cotton soil (Bhalki Tq., Bidar Dist.) , Laterite soil(MankiVillage,HonnavaraTq.,UttarakannadaDist.)andClayeyLateritesoil(Hosadu,Kundapura Tq., Udupi Dist.) is more naturally suitable for drinking than the redsoil. Thisconclusion is drawn by considering the parameters like pH, Alkalinity, Turbidity, Total Hardness,Chloride, COD, Dissolved oxygen and Iron. The 4th sample station i.e Sevanagar, Hassan Dist.,also shows good quality in Total hardness, chloride, COD and dissolved oxygen, whereasdisplayspoorerresults forpH,alkalinity,turbidityandiron.

SCOPE OF FUTURE WORK

- The current project is based on only 4 types of soil types considered, the project regarding sandy soil, clayey soil, loamy soil and forest soil can also be considered for a precise conclusion.

- The depths of sampling ground water can be taken deeper than 400 ft for every increase in 100 ft.
- The increase in depths gives a scope in studying the soil strata and the sub strata discharges of its characters into the ground water.
- With prior information about the heavy metal presence in the regions can be taken intoconsideration for an exclusive study.
- The project can also be analyzed for samples whichare being influenced with the neighboring water sources such as ponds, lakes, rivers, sea and ocean and assess the potential impacts on the ground water.

REFERENCES

[1] Joe-Asare, T., Peprah, M. S., Opoku, M. M. (2018), "Assessment of the Potability of Underground Water from aSmall Scale Underground Mine: A Case Study",University of Mines and Technology, Tarkwa, Ghana, Ghana Mining Journal, Vol. 18, No. 2, pp. 61 - 67.

[2] Veena Chaudhary & S. Satheeshkumar (2018), "assessment of ground water quality for drinking and irrigation purpose in arid area of Rajasthan, India", Department of Chemistry,C.S.S.S. PG College, Machhra, Meerut, UP, India,doi:10.1007, pp. 01-17

[3] Abdul Khayum, N. Nandini , J.S. Chandrashekar and R. Durgesh(2011), "Assessment of drinking water quality of Bangalore, west zone, India: a case study",Department of Environmental Science, Bangalore University, Bangalore, pp.114-121

[4] Baoli Xu, Dongguo Shao, , Xuezhi Tan , Xia Yang, Wenquan Gu, Haoxin Li(2017), "Evaluation of soil water percolation use different irrigation practice, antecedent moisture and ground water depth in paddy field",State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, PR China, pp.1-5

[5] Yi Dong,Changfu Wei,and Ning Lu(2020),"Identifying soil adsorptive water by soil water density",Journal of Geotechnical and Geoenvironmental Engineering,DOI: 10.1061, pp.1

[6] Adriana babau, V. MICLE & I. M. SUR(2016) ,"Research on underground water quality from Almasu mare area",Technical University, Faculty of Materials and Environmental Engineering, 400641, Cluj-Napoca, pp.269-274

[7] Adel A. Banana, Al-Gheethi AA , Efaq AN , Mohamed RM(2017), "Quality of Underground Water and Environment Adjacent to Petrochemical Industry Zone in Libya ",Environment Engineering Department, Subrata College, University of Zawia, Libya,pp.1-4

[8] M.G. Patil, P. Tiwary,D. K. Pal, T. Bhattacharyya, Dipak Sarkar, C. Mandal, D. K. Mandal, P.

[9] Chandran, S. K. Ray, Jagdish Prasad, Mrunmayee Lokhande, and Vishakha Dongre(2013),"Soil Water Retention Characteristics of Black Soils of India and Pedotransfer Functions Using Different Approaches in the country",American Society of Civil Engineers, pp.1-13.

[10] D.J.Lapworth,G.Krishan,A.M.MacDonald&M.S.Rao(2017),"Groundwaterqualityinthe alluvial aquifer system of northwest India: New evidence of the extent of anthropogenic andgeogeniccontamination",BritishGeologicalSurvey,MacleanBuilding,Wallingford,UK,NationalInstituteof Hydrology,Roorkee,Uttarakhand,India,,BritishGeologicalSurvey, LyellCentre,Edinburgh, UK,pp.1434-144.

[11] L Kalpana and L Elango (2013),"Assessment of Groundwater Quality for Drinking and Irrigation Purposes in Pambar River Sub-Basin, Tamil Nadu." anna university , department of geology, chennai ,pp 1-8