ASSESSMENT OF GROUND WATER POLLUTION USING DRASTIC MODEL

Umme Hamida* & Shivashankara G.P. **
**Lecturer in dept of civil engineering*
Ghousia College of engineering, Ramanagaram-571511
***professor in dept of civil engineering*
P.E.S College of engineering, Mandya-571401

ABSTRACT

DRASTIC model system methodology which is empirical assessment methodology helps in the assessment of vulnerability of ground water and can be used for preventive purposes through the prioritization of areas where ground water quality protection is critical. This system may also be used to identify areas where special attention or protection efforts are warranted. Maddur taluk of an area of 612.73 sq. Km, Mandya district, Karnataka state. A unique study has been made for Maddur taluk. The pollution potential of the study area is assessed by DRASTIC model system where in hydro-geological is given importance, beside each alphabet representing a parameter. DRASTIC index represents a relative measure of ground water pollution potential helps to planners and administrators in broadly screening areas for disposal sites. The moderately, highly and very highly vulnerable areas identified in Maddur taluk for ground water through the present investigation.
Key words: vulnerability; ground water; DRASTIC.

INTRODUCTION

Water is precious and most commonly used resource. Human life as well as animal and plant life on the planet is dependent on water. Ground water is the underground water that occurs in the saturated zone of variables thickness and depth, below the earth surface. Once the ground water is contaminated, its quality cannot be restored by stopping the pollutants from the source. It therefore becomes imperative to regularly monitor the quality of ground water and to device ways and means to protect it. Pollution potential index is one of the most effective tool to communicate information on the quality of water to the concerned citizens and policy makers. Thus it becomes an important parameter for the assessment and management of groundwater.
Ground water vulnerability cannot be measured directly and must be derived from information of various hydro-geological properties. The DRASTIC method [1] is a well-known vulnerability assessment method that can be implemented within a geographical information system framework.

The DRASTIC methodology has two major portions; the designation of mappable units, termed hydro-geologic settings and the application of a scheme for relative ranking of hydro-geologic parameter called DRASTIC which helps the user evaluate the relative ground water

pollution potential of any hydro-geologic setting. This methodology has been prepared using the concept of hydro-geologic settings. A hydro-geologic setting is a composite description of all the major geologic and hydro-geologic factors which affect and control ground water movement into, through and out of an area. It is defined as a mappable unit with common hydro-geologic characteristics and as a consequence, common vulnerability to contamination by introduced pollutants. From these factors it is possible to make generalizations about both ground water availability and ground water pollution potential[1]. Hence the main objective of this paper is to attempt to assess the ground water vulnerability to pollution using DRASTIC method. The concept of "Ground water vulnerability" was first pointed out by Marget of French in 1968. Generally speaking, the ground water environmental vulnerability refers to the sensitive degree of the problem brought by natural conditions change and human activities affection and concrete speaking, it is the difficulty degree of the soluble pollutants reaching the top of downward aquifer in no stagnation and response[3].

MATERIALS AND METHODOLOGY

Details of study area

Maddur taluk is geographically located between 12°36'0" N latitude and 77°4'0" E longitude. The map of Maddur taluk is shown in figure 1.The area of this taluk is 617.24sq.Km. The normal average rainfall of the taluk is 706.1mm. The soil in Maddur taluk is thin gravely and underlain with murram zone containing weathered rock.

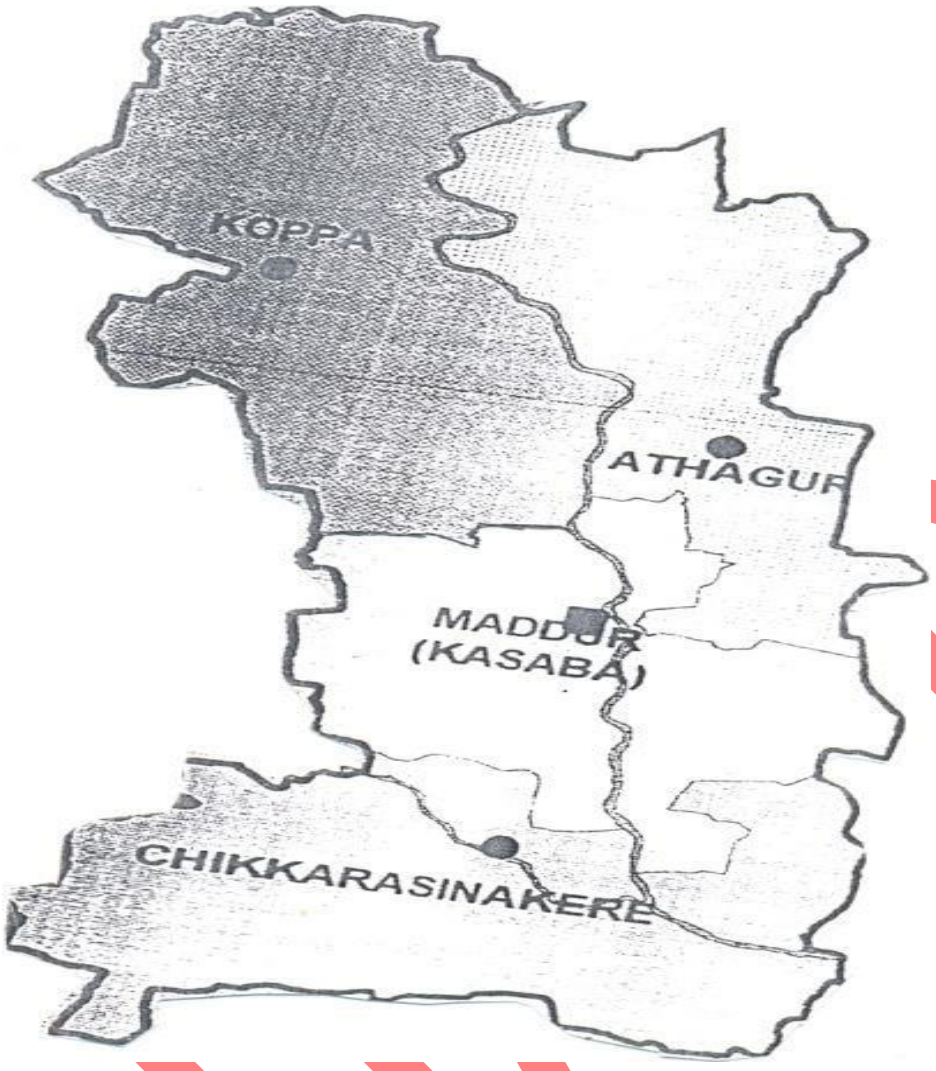

Fig.1 Showing study area of Maddur taluk, Karnataka

Methodology

DRASTIC, a ground water pollution vulnerability assessment spatial determination model. DRASTIC uses a set of seven hydro-geologic key parameters to classify the vulnerability or pollution potential aquifer has developed [1]. DRASTIC parameters are Depth of ground water, Recharge due to rainfall, Aquifer media, Soil media, Topography, Impact of vadose zone and Hydraulic conductivity.

$$DRASTICindex=D_RD_W+R_RR_W+A_RA_W+S_RS_W+T_RT_W+I_RI_W+C_RC_W \quad (1)$$

In the Eq. (1) $_R$ is rating of the parameter of the hydro-geologic setting and $_W$ is weight of the parameter

DRASTIC are developed based on few assumptions they are the contaminant is introduced by the surface of the earth, contaminant is flushed into the ground water by precipitation,the

contaminant has mobility of water and the area is evaluated to about 0.4Km^2 . The weight of DRASTIC parameters used in this study is shown in table 1.

Table 1.Depth, recharge and hydraulic conductivity of Maddur taluk

Place	Depth		Recharge (inch)	Hydraulic conductivity (gal/day/ft^2)
	Monsoon season (m)	Non-monsoon season(m)		
Maddur	0.4	0.3	190.20	1.4
Koppa	0.4	0.1	171.18	1.7
Athagur	1.05	0.2	634	1.34
Chikkarasinkere	0.11	1.05X10^{-3}	1255.3	1.62

Depth (m) (D_W=5)		Recharge (inch) (R_W=4)		Aquifer media (C_W=3)			Soil media (S_W=2)		Topography(% slope) (T_W=1)		Impact of vadose zone (I_W=5)		Hydraulic conductivity (C_W=3)		DRASTIC index		
Range	Rating	Range	Rating		Range	Rating	Range	Rating	Range	Ratings	Range	Ratings	Range	Ratings			
0-1.5	10	0-2	-	shale	1-3	-	Gravel	10	0-2	10	Clay	3	1-100		>120<130	moderate	-
1.5- 4.6	-	2- 4	1	Metamorphic/Igneous	2-5	3	aggregated clay	7	2-6	9	clayed mixed sand and gravel with significant silt &clay	6	100-300	-	>130<140	moderately high	

4.6-9.1	-	4-7	-	Weathered metamorphic (Igneous)	3-5	-	Non aggregated clay	1	6-12	-	granetic gneiss	5	300-700	-	>140<150	High	142.1
9.1-15.2	-	7-10	-	Glacial fill	4-6	clay oam	1	3	12-18	-	Karst lime stone	10	700-1000	-	>150<160	very high	-

Table2.Range, rating and DRASTIC index of Maddur taluk

RESULT AND DISCUSSION

For the current study, the bore-logs and published report from department of Mines and geology are used. The water table is the expression of the surface below the ground level where all the pore spaces are filled with water and air. The table 1 shows the depth of ground water table of the observation well of Maddur taluk; the range and rating of parameter are compared in table 2. The depth to water is important primarily because it determines the depth of material through which a contaminant must travel before reaching the aquifer. In this study, the depth of ground water table is having rating 10 and 9 with a weight of 5. Though this it can be seen that it is a shallow aquifer. The ground water recharge was estimated using water table fluctuations method, which was recommended by the Ground water Estimation Committee in 1982. Recently, CGWB has published the guidelines and norms for assessing the quantum of ground water in 1997. This method is based on the water level fluctuations of the observation wells, network setup for the purpose where water levels are measured regularly every month. The rating for the recharge is 1 and weight is 4. The area is not with a heavy rainfall. The geologic and hydrogeomorphology maps (using satellite data) prepared by mines and geology are been used to determine the aquifer media. The soil maps where obtained from National Bureau of Land use and Soil Survey (NBLSS) Bangalore and mines and geology. The soil maps has rating 10 , 7, 1, 3 and weight is 2. Slope map were prepared using survey of India toposheet on 1:50,000 scale that gives the information on contour at 20m interval used to determine topography of Maddur taluk The aquifer and soil media is studied and range is assigned in study ofimpactofvadosezone.Itcanbeseenfromtable2thatacombinationofgeology,

hydrogeology and human activities across the Maddur region generates significant regional variability in ground water vulnerability. This area is found to be high vulnerable area.

CONCLUSIONS

The ground water vulnerability evaluation is the basis of reasonable exploitation and protection of ground water and the important technical measures to prevent ground water pollution. For its operability the DRASTIC evaluation method proposed by US Environmental Protection Agency(USEPA) becomes an effective tool of ground water vulnerability assessment and has been widely used. From all these results, it can be concluded that pollution is high at Maddur taluk as when used the DRASTIC to analysis the quantitative parameter.

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