Level and Quality of Ground Water in Deorukh Town: A Geographical Perspective

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Abstract

Ground water is one of the earth's important sources of drinking water. Groundwater is an economic source and more than 85 per cent water is obtained from well in the study region. For the present research work, the Deorukh town is selected as a study regionThe main objective of the present research is to assess the level and quality of ground water in the study region.

The study reveals that due to increasing exploitation of ground water for various purposes, the level of ground water is decreasing with the march of time. The average depth of the wells of the study region is 47.59 feet. However, the depth is varies from ward to ward. The seasonal variations are also found in the the depth of the water. It is observed that during summer season, few wells have no water at all. The quality of the water tested as per the standards of World Health Organization (WHO). The analysis reveals that the range of checked parameters of drinking water is within permissible range. Hence, water from both sources is potable and safe for drinking purpose.

KEYWORDS: Subsurface Water, Zone of Saturation, Geology, Hydrology, GPS, GIS, WHO, and Spectrometric Analysis

INTRODUCTION:

Ground water is one of the important sources of drinking water*(Santra, S. C. 2008).* The term ground water is usually used for subsurface water that occurs beneath the water table in the soil and geological formation that are fully saturated *(GautamMahajan).* Ground water becomes usable source when rocks in the zone of saturation are persistent. Ground water hydrology is regardless as specialized science that involves geology, hydrology and fluid mechanics *(R.K. Trivedi and P.K. Goel, 1986).* Study of ground water requires knowledge of basic principles of geography, chemistry, geology, physics and mathematics. Geography and Geology provide qualitative knowledge of framework of flow but chemistry provides tool for qualitative analysis of the same. Groundwater is an economic source and more than 85 per cent water supplyis obtained from well in the study region. Depth of water table below ground surface is governing factor in determining pollution. If water level approaches nearer ground surface, greater is the risk of contamination and vise-versa.

Now a day due to augmented human influence the level and quality of the ground water is decreasing with the march of time in the study region. In order to avoid future problem it is necessary to protect ground water sources from further contamination as well as enrich the ground water level. Hence, in the present research work an attempt is made to analyze the level and quality of ground water in the Deorukh town from geographical point of view.

THE STUDY REGION:

For the present research work Deorukh town is selected as a study region. The Deorukh town is the head quarter of Sangmeshwar Taluka and it is located on the plateau at the western offshoots of Sahyadri Mountain in the Konkan. Its latitudinal and longitudinal extent is 17^{O} 03' 13.92" north to 17^{O} 04' 27.43" north and 73^{O} 36' 55.12" east to 73^{O} 37' 51.57" east respectively. The average elevation of the Deorukh town from MSL is 160 meters.

The river Saptlingi, a tributary of River Bav, is flowing from the central part of the Deorukh town. The population of the Deorukh is 12, 353 persons, according to 2011 census.

OBJECTIVES:

The main objective of the present research work is to investigate the pattern of level and quality of the ground water in Deorukh town and to suggest wide-ranging plan for the sustainable development of the ground water resources in the study region.

Methods and Materials:

The present research work is basedon the primary as well as secondary data. However, the primary data is the main source to meet the objectives of the present research work. The primary data is collected through intensive fieldwork throughsystematic sample survey method.The team of the 20 students' surveyed 100 wells in the study region and collected data related to the deepness of the wells and the water. Water samples of 18wells and three tube-wells are collected by applying systematic sampling. Well purging*(Gopalan, R. and et. al., 2008)*is carried out before the collection of water samples. The Oregon 550 GPS is used to collect the spatial information of groundwater sources and schedule is used to collect the non-spatial information related to the same. The secondary data related to the groundwater sourcesiscollected from Nagar-panchyat office.

The collected data is processed, tabulated and presented in the form of charts, diagrams and maps. The GRAM ++ GIS software is used for the representation of spatial information. Water samples of eighteen wells and three and tube-wells are tested as per the WHO standards by using Spectrometric Analysis method.

RESULTS AND DISCUSSION:

PATTERN OF GROUND WATER LEVEL:

The ground water is principalsource of water, which have multipurpose uses (Santra, S. C. 2008, p. 210). In the Deorukh town, groundwater is the foremostsource of drinking water. During the field investigation, total544 wells were reportedin the study region and out of that, the students' surveyed 100 wells in October 2011 by using systematic sampling method. Ground water has secured quantity as well as quality as compared to the surface water and this is the cause that the study region has more worth to the ground water.

Table-1
The Deorukh Town
Depth of Wells (in feet)
October 2011

Sr. No.	Depth of Wells (in feet)	No. of Wells
1	< 30	05
2	31-40	20
3	41-50	38
4	51-60	18
5	61-70	16
6	71>	03
	Total	100

Source: Fieldwork (Sample Survey), October 2011

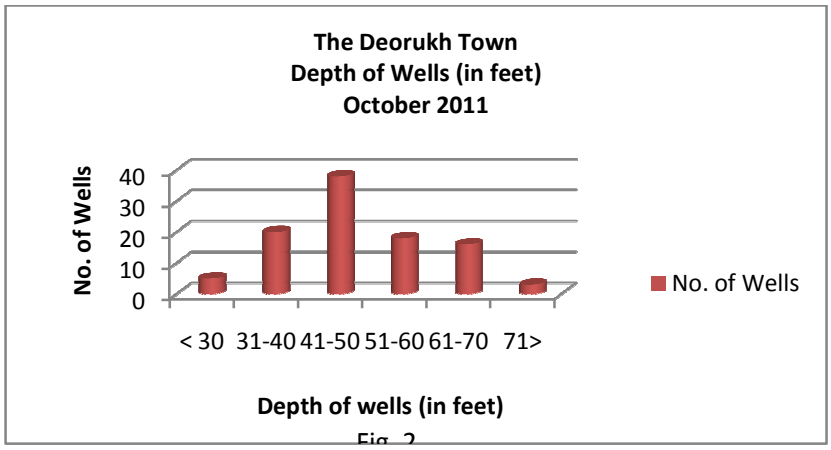

Fig. 2

Owing to increasing misuse and mismanagement of groundwater, the ground water level is declining with the march of time. The average depth of the wells of the study region is 47.59 feet. However, the depth is varies from region to region. It is interesting to note that out of 100 surveyed wells; only twenty-five wells have deepness less than forty feet and vice versa. The table-1 denotes the information of depth of wells and No. of wells in the study region.

Table- 2
The Deorukh Town
Depth of Water Available in Wells (in feet)
May- 2011

Sr. No.	Depth of Water (in feet)	No. of Wells
1	No water	16
2	</ = 03	64
3	04-06	16
4	07=/ >	04
	Total	100

Source: Fieldwork, May 2011.

It is clear from the table- 2 that out of 100 surveyed wells, sixteen wells have no water during summer especially in the month of May. Sixty-four wells have water level less than three feet.Sixteen wells reported the depth of water between four and six feet and only four wells reported the water level more than seven feet. The water level available in the well is depends upon the distance from the river Saptlingi, condition of rainy season and amount of rainfall received during rainy season. Thus, it is clear that due to over exploitation and mismanagement of the ground water, increased concretization and deforestation the level of ground water is decreasing since last few years especially after 1998 AD.

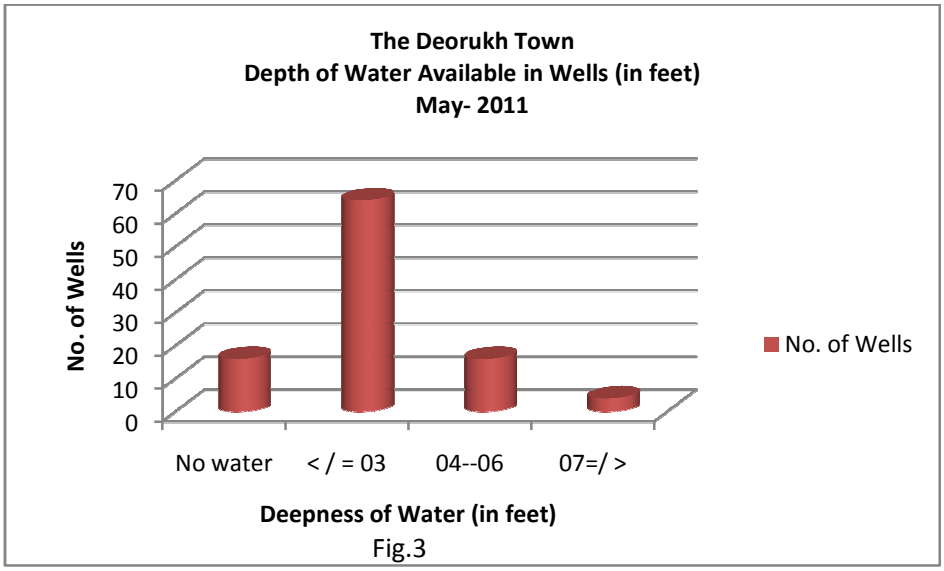

Fig.3

SPATIAL DISTRIBUTION OF WATER RESOURCES:

TheDeorukh is newly emerged town and it consist five wards. The study region has both surface and ground water resources. However, ground water is the main source of the drinking water and other uses in the study region. The study region has recorded 544 private wells, 19 public wells, 20 private tube wells, 16 public tube wells, 1747 private faucets and 36 public faucets.

Ward No. IV recorded highest No. of wells and it is 176 private and 5 public. Highest No. of faucets and lowest No. of wells are recorded in ward number V and it is 392and 66 respectively. Ward No. V records the lowest No. of wells because of the nearly absence of the ground water due to the geological structure of the region. It is observed that in the majority parts of the ward number V, the basalt rock attends at the depth of 25 to 40 feet.

The table 3and Fig. 4gives an idea about the spatial distribution of water resources in Deorukh town.

Table- III

The Deorukh Town

Spatial Distribution of Water Resources (2011)

Sr. No.	Ward No.	Area Consist	No. of Wells		No. of Tube Wells		No. of Faucets	
			Private	Public	Private	Public	Private	Public
1	I	Upper Lane,Teliwadi, Hasamwadi, Kolewadi, Morewadi, Shindewadi, Gelyewadi, Kumbharwadi, Tambalwadi, Bhorpavne	133	7	2	5	215	19
2	II	Hydro Colony, Middle Lane, Kanganewadi, Botkewadi	75	1	3	1	369	-
3	III	Bazarpeth, Lower Lane, Datt Nagar, Police Station,	99	1	5	4	355	1
4	IV	Bhayjewadi, Rohidasaali, Chavanwadi, Guravwadi, Bhandarwadi, Mohalla, Vanivathar	176	5	3	3	328	4
5	V	Kanjivara, Ghorpiwadi, Bagwadi, Parshuramwadi, Patharwadi, Mogravane, Mandavkarwadi, Boudhwadi	61	5	7	3	380	12
6	Total		544	19	20	16	1747	36

Source: *Nagar-panchayat Office, Deorukh*

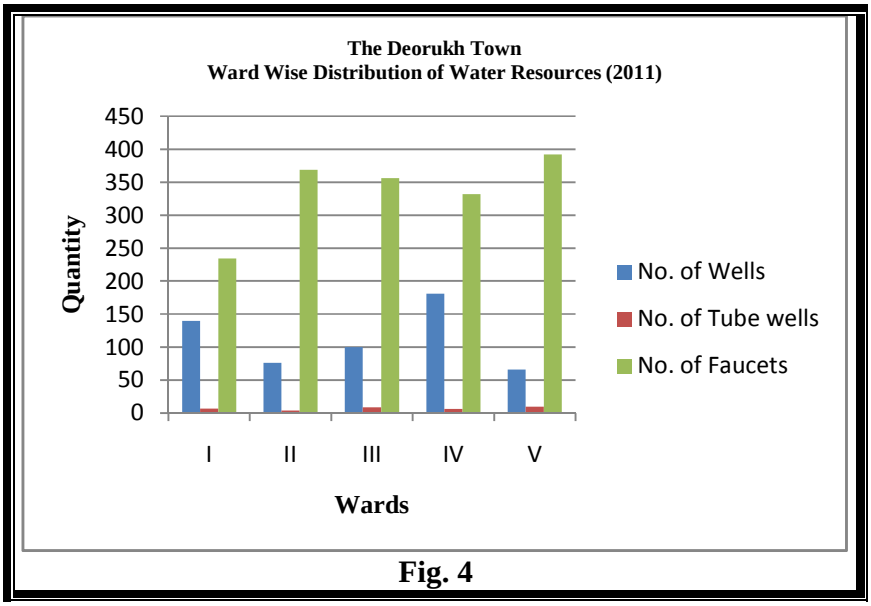

Fig. 4

PHYSICAL AND CHEMICAL ANALYSIS OF GROUND WATER WATER:

The wells and tube wells have pleasantodor and color of water. The average pH of well water and tube well water is 5.76 and 6.7 respectively. Thus, it is clear that the well water is acidic in nature. Total Solid (T. S.) of well water is 226.11 mg/lit while that of tube well water is 280 mg/ lit. Therefore, both the values are within permissible range but T. S. of tube well water is more than the well water. Total Dissolved Solids (TDS) of tube well water (193.33 mg/lit) is higher than the well water (150.27 mg/lit). Total hardness of tube well and well water is 102.66 mg/lit and 55.77 mg/lit, correspondingly. Calcium and magnesium hardness is also high in tube well water than well water. Therefore, tube well water is harder as compared to well water. Chlorides are also more in tube well water i.e. 193 mg/lit than well water i.e. 170.47 mg/lit. Alkalinity, $CO_2$and dissolve oxygen is in the satisfactory range (Table-5.6).

The investigation shows that all the analyzed parameters are within permissible range, as per the WHO norms, except pH of well water. This is observed because of the pollution free areas at the surface, permeability of the rocks and deepness of the wells and tube wells. The table- 4, 5 and 6 gives comprehensive idea about the physical and chemical properties of the ground water in the study region.

Table- 4

WELL WATER SAMPLE ANALYSIS

2011

Sample No. / Parameters	Colour	pH	TS (mg/lit)	TDS(mg/lit)	Chlorides(mg/lit)	Alkalinity (mg/lit)	T. Hardness (mg/lit)	Ca++ (mg/lit)	Mg++(mg/lit)	DO (mg/lit)	CO2(mg/lit)	Residual Chlorine (mg/lit)	TSS (mg/lit)
W1	Clear	5.0	280	240	172.0	180.7	16	4.008	2.92	6.08	8.8	0.2	40
W2	Clear	6.2	200	120	167.5	180	84	25.65	14.25	6.68	4.4	0.3	80
W3	Clear	6.0	240	120	168	210.4	72	20.84	12.48	6.89	4.4	0.3	120
W4	Clear	5.4	200	167	178	198.4	39	22.90	7.45	6.05	4.2	0.2	90
W5	Clear	5.5	190	178	173	190.2	35	26.76	3.56	6.20	4.0	0.2	70
W6	Clear	6.3	260	143	177	216.4	65	19.44	13.55	6.94	4.5	0.3	60
W7	Clear	6.5	255	130	160	220	74	15.70	9.56	6.78	4.5	0.4	60
W8	Clear	5.8	270	120	169	190.9	85	18.34	12.43	6.34	8.8	0.2	100

Table Continued….

Sample No. / Parameters	Colour	pH	TS (mg/lit)	TDS(mg/lit)	Chlorides(mg/lit)	Alkalinity (mg/lit)	T Hardness (mg/lit)	Ca++ (mg/lit)	Mg++(mg/lit)	DO (mg/lit)	CO2(mg/lit)	Residual Chlorine (mg/lit)	TSS (mg/lit)
W9	Clear	6.0	220	138	168	189.3	67	27.42	10.53	6.56	5.5	0.3	60
W10	Clear	6.1	190	172	177	178.2	24	18.35	12.77	6.66	5.0	0.3	40
W11	Clear	5.3	180	168	179	196.3	40	22.80	6.45	6.05	4.3	0.4	80
W12	Clear	5.4	210	157	176	198.4	41	22.90	7.45	6.01	3.9	0.5	90
W13	Clear	5.8	200	154	165	192.4	37	27.66	3.56	6.72	4.2	0.6	70
W14	Clear	6.2	250	157	166	226.8	63	19.67	14.98	6.03	4.9	0.6	110
W15	Clear	5.3	265	137	169	220	84	16.10	8.96	6.98	3.9	0.3	70
W16	Clear	5.4	261	113	159	191.8	78	17.92	13.43	6.17	9.9	0.4	70
W17	Clear	6.5	210	129	178	199.3	77	26.43	9.54	7.01	5.3	0.1	50
W18	Clear	5.1	189	162	167	179.8	23	18.36	13.72	6.99	4.9	0.4	60

Source: *Calculated by the researchers*

Table- 5

TUBE WELL SAMPLE ANALYSIS

Sample No. / Parameters	TW1	TW2	TW3
Colour	clear	clear	clear
pH	6.8	6.9	6.4
TS (mg/lit)	160	240	440
TDS(mg/lit)	120	180	280
Chlorides(mg/lit)	187	194	198
Alkalinity (mg/lit)	220	180	200
T. Hardness (mg/lit)	124	64	120
Ca++ (mg/lit)	44.88	22.44	40.08
Mg++(mg/lit)	19.30	10.14	19.50
DO (mg/lit)	6.68	6.48	6.48
CO2(mg/lit)	-	-	4.4
Residual Chlorine (mg/lit)	0.4	0.3	0.28
TSS (mg/lit)	40	80	160

Source: *Calculated by the researchers*

Table- 6

AVERAGE COMPARISON

Sample Type / Parameters	Well water	Tube well water
pH	5.77	6.70
TS(mg/lit)	226.11	280.00
TDS(mg/lit)	150.28	193.33
Alkalinity(mg/lit)	197.74	200.00
Total Hardness (mg/lit)	55.78	102.67
Chlorides (mg/lit)	170.47	193.00
DO (mg/lit)	6.51	6.55
CO2 (mg/lit)	5.30	4.40
Residual Chlorine (mg/lit)	0.33	0.33
Ca++ Hardness (mg/lit)	20.62	35.80
Mg++ Hardness (mg/lit)	9.87	16.31
TSS (mg/lit)	73.33	93.33

Source: *Calculated by the researchers*

CONCLUSION:

Due to increasing misuse and mismanagement of ground water, the ground water level is declining with the march of time. The average deepness of the wells of the study region is 47.59 feet. However, the depth is varies from region to region. The deepness of the water also changes from season to season. Especially during summer season, few wells have no water at all. The quality of the ground water is tested as per the standards of World

Health Organization (WHO) by using spectrometric analysis method. The analysis reveals that the range of checked parameters of drinking water is within permissible range, except pH. Hence, water from both sources is potable and safe for drinking purpose. It is observed during the investigation that water level in the well is affected by thethe distance from the river Saptlingi, geological structure, condition of rainy season and amount of rainfall received during rainy season.

SUGGESTIONS:

Groundwater is an economic source and more than 85 per cent water supply is obtained from well in the study region. Thus, ground water has more relevance and it need to protect from over exploitation. However, for the sustainable development of the groundwater in the study region, followings are the some of the remedial measures suggested by the researcher by taking into account its feasibility.

1. It is essentialto recharge the ground using rainwater and wastewater through excavating the fleapits in the campus of every individual and at community level.
2. The concretization should have ban and instead of concretization, spreading of rock pieces should applied. It helps to natural recharge of ground water and ultimately helps to increase the ground water level
3. The Loo tanks should be far away from the well and/or tube well.
4. The reuse of wastewater for the other functionsshould be practiced. It will help to protect the ground as well as surface water and will reduce the impact of wastewater on ground water.
5. Maximum plantation should be done on open spaces that it could help to natural recharge of ground water and to protect the soil erosion.
6. The Integrated Watershed Management should be practiced for the sustainable development of the groundwater and protection of soil.

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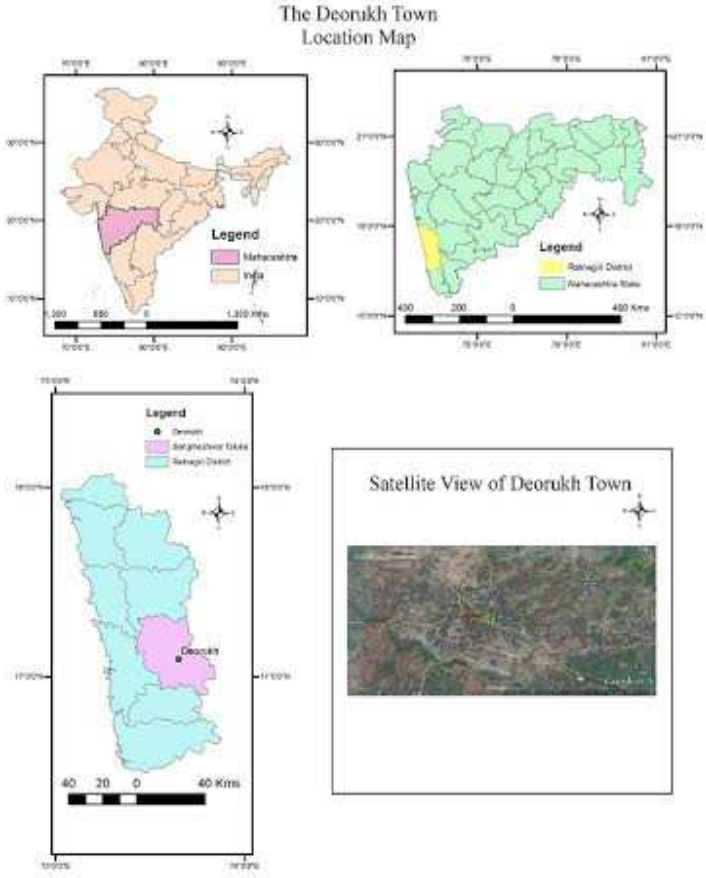
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Satellite View of Deorukh Town