Groundwater Quality Assessment of Nanded District For Drinking And Irrigation Purpose

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Abstract : Groundwater is almost globally important for human consumption as well as for the support of habitat and for maintaining the river's base-flow. It is usually of excellent quality. Being naturally filtered in their passage through the ground, they are usually clear, colorless, and free from microbial contamination and require minimal treatment. Water quality with respect to path length and abundance of soluble ingredient can be very different in various regions. Quality assessment of groundwater for drinking and irrigation was evaluated in parts of Nanded district of Maharashtra state, India. The overall groundwater quality and the suitability to drinking and irrigation were evaluated by hydrochemical analysis of groundwater samples. The water quality parameters were compared with that of the limits set by World Health Organisation (WHO) and Bureau of Indian Standards (BIS). The Bureau of Indian Standard (BIS, 2009) has been considered to assess the suitability of groundwater for drinking purposes and irrigation purposes. Anthropogenic activities are influencing the groundwater quality of the study area.The present study is helpful in proper planning and management of available water resource for drinking purpose. Evaluation of groundwater quality is an important issue to assure from its safe and stable use. However, describing quality conditions is generally difficult considering spatial variability of pollutants and a wide range of indicators (biological, physical and chemical substances) which can be measured.

***IndexTerms* – Groundwater quality, Nanded District, Assessment.**

I. INTRODUCTION

A groundwater threat is now posed by an ever increasing number of soluble chemicals from urban and industrial activities and from modern agricultural practices. Nevertheless, landslides, fires and other surface processes that increase or decrease infiltration or that expose or blanket rock and soil surfaces interacting with downward-moving surface water, may also affect the quality of shallow groundwater. Chemical composition of groundwater is measured to determine its suitability as a source for human use and animal consumption, irrigation, industrial purposes and the others. Water quality refers to the physical, chemical, and biological characteristics that are required for water uses. Therefore, water quality monitoring is important because clean water is essential for human health and integrity of aquatic ecosystems. Also quality evaluation will be clear vision to specialists and managers of groundwater quality trends and risk of contamination of water resources.

There are several methods to determine water quality, the most common method to assess water quality for drinking purpose. Ground water is a very valuable natural resource for the economic development and secure provision of potable water supply in both urban and rural environments (Foster et al. 2002; Ghezelsofloo and Ardalan, 2012; Wakode et al. 2014). Nowadays groundwater pollution has become one of the most serious problems throughout the world. Urbanization, industrialization and agricultural activity affecting groundwater quantity and quality (Jat et al. 2009; Tiwari et al. 2015; Rubia and Jhariya, 2015; Khan and Jhariya, 2016). Water pollution threats human health, economic development and social success (Milovanovic 2007; Wakode et al. 2014; Tiwari et al. 2015) Groundwater is a valuable natural resource that accounts for over 97% of all the freshwater available on Earth, excluding glaciers and ice caps.

It needs to be monitored and protected from chemical and organic pollutants, not only because groundwater is used as drinking water but also because it is an important resource for industry and agriculture and has recreational uses and environmental value. Due to the fact that groundwater moves through the subsurface slowly, the impact of human activities may last for decades, and pollution events that occurred in previous years will probably continue to threaten us for several generations.

II. STUDY AREA

Nanded District lies between 18°16' to 19°55' North latitude and 76°56' and 78°19' east longitude in the eastern part of Marathwada Region, which corresponds to Aurangabad Division of Maharashtra. The district is bounded by Nizamabad, Medak and Adilabad districts of Andhra Pradesh on the east, by Bidar District of Karnataka on the south, by Parbhani and Latur districts of Marathwada on the west, and Yavatmal District of Vidarbha region on the north. The geographical area of the district is 10502 sq km.

According to 2001 census the population of the district is 33.71 lakhs. Administratively, the district is subdivided into three revenue sub-divisions, namely Nanded, Deglur and Kinwat. These three subdivisions together comprise of 16 talukas. There are total 1580 village out of which 1515 are unhabitated and the rest emhabitated and 13 urban center in the district .Nanded is district headquarter and other important town are Dharmabad, Biloli, Duglur, Mukhed, Kandhar, Hadgaon, Kiwat, Umri, Mudkahed and Loha etc.

The total area under forest in the district is 91916 hectares. The soil of the district are black and fertile . The district has got net cultivable area of 7,80,600 ha. Food grains are grown in 62.74 % of the area and the main cash crops are cotton, banana and sugarcane. The gross irrigated area is 47,455 ha and the net irrigated area is 38,317 ha. Out of this surface water and ground water irrigated area is 8,883 and 29,434 ha (1994- 95) respectively.

III. CLIMATE AND RAINFALL

The climate of the district is generally dry except in monsoon season. The district gets 89% of the rain from south west monsoon. The rainfall increases from west to east. Average annual rainfall is in the range of 767 to 1285 mm with an average of 47 rainy days. The mean daily maximum and maximum temperatures are 13.1°C and 42° during December and during May respectively. The relative humidity is high during SW monsoon season when it ranges between 60% and 80%. Winds are generally light during October to March and they get strength in the later half of the summer and south west monsoon season. Thunderstorms occur in summer and monsoon months. Their frequency being higher in June and September. Dust raising winds are common during summer afternoons.

IV. Water Level Scenario

The depth to water level data from 41 National Hydrograph Network Stations (NNHS) in the district four times a year i.e. January, May (Pre monsoon), August and November (Post monsoon). It is observed that premonsoon water level (May 2011) varies from 2.93 m at Unkeshwar to 13.98 at Jamb Buzurg.

Depth to water level between 10-15mbgl are observed in major part of the district. Water level between 5-10m is observed in the southern part of the district and also as isolated patches. Shallow water level between 2- 5mbgl are observed in the northern most part of the district.

Post monsoon depth to water level varies between 1.9 Unkeshwar and 7.93 at Dhawari Buzurg in the district. Water level in the range of 2-5 are observed in major parts of the district. Water level between 5-10mbgl are observed in the central and north eastern parts whereas, water level of less than 2 mbgl is observed as small patch in the south western parts of the district.

V. GROUND WATER RESOURCES

As per the estimation the net annual ground water availability is 1386.92 MCM. The gross draft for all uses is estimated at 418.36 MCM with irrigation sector being the major consumer having a draft of 391.81 MCM. The domestic and industrial water requirements for the year 2025 are worked at 53.10 MCM.

The net ground water availability for future irrigation is estimated at 942.01 MCM. Stage of ground water development varies from 18.61% (Kinwat) to 65.72% (Ardhapur). The overall stage of ground water development for the district is 30.16%. In general, the level of ground water development in the district is quite low and all the talukas fall in "Safe" Category.

VI. AQUIFER PARAMETERS

Ground water abstraction structures commonly observed in the district are mainly of two types i.e. dug well and bore well tapping shallow and deeper aquifer respectively.

There are 41977 irrigation dug wells in the district out of which 64187 are electric pump and 1675 diesel pumps where as 445 wells are not in use.

Out of total 63 bore well , 37 bore wells are high discharge yielding (>3lps discharge) and their discharge ranges from 11250 lph to 70776 lph. Ground Water Survey and Development Agency (GSDA) Govt. of Maharashtra has also drilled 7804 bore wells (Up to March 1997) under the Rural Water Supply Scheme out of which 5993 bore wells are successful and 883 bore wells are high yielding having a discharge more then 5000 lph.

VII. RESEARCH METHODOLOGY

A total of 10 numbers groundwater samples were collected from various locations of the study area for sampling and assessment from 10 monitoring wells. The water samples after collection were immediately subjected to the analysis of various parameters in the Regional Chemical Laboratory.

The parameters analyzed include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO3) and Fluoride (F). The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being.

The standards proposed by the Bureau of Indian Standards (BIS) for drinking water were used to decide the suitability of ground water.

VIII. RESULTS AND DISCUSSION

The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TH, NO3 and F prescribed in the standards as given in the table.

Table-1: Classification of Ground Water Samples for Drinking based on BIS Drinking Water Standards (IS-10500-91, Revised 2003)

Parameters	DL	MPL	Samples with conc.<DL	Samples with conc. DL-MPL	Samples with conc. >MPL
TH(mg/L)	300	600	1	7	2
NO_3(mg/L)	45	No Relaxation	1	-	9
F(mg/L)	1.0	1.5	8	1	1

The table shows that the concentrations of all the parameters except nitrate in most of the samples are the maximum permissible limit of the within BIS standards.

The potability of ground water in the wells is mainly affected due to the Nitrate (NO3) as its concentration exceeds more than MPL in 90% of samples. Overall, it can be concluded that the ground water quality in the wells monitored in the district is affected because of high NO_3 concentrations.

8.1 Electrical Conductivity

Electrical Conductivity (EC) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation. The classification of water for irrigation based on the EC values is as follows.

Low Salinity Water (EC: 100-250 µS/cm): This water can be used for irrigation with most crops on most soils with little likelihood that salinity will develop.

Medium Salinity Water (EC: 250 – 750 µS/cm): This water can be used if moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

High Salinity Water (EC: 750 – 2250 µS/cm): This water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

Very High Salinity Water (EC: >2250 µS/cm): This water is not suitable for irrigation under ordinary condition. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

The classification of ground water samples collected from monitoring wells for was carried out irrigation purpose and given below in Table-2.

Table-2: Classification of Ground Water for Irrigation based on EC.

Type	EC(µS/cm)	No. of Samples	% of Samples
Low Salinity Water	<250	Nil	Nil
Medium Salinity Water	250-750	1	10
High Salinity Water	750-2250	9	90
Very High Salinity Water	>2250	-	-
Total		10	100

It is clear from the Table-2 that maximum number of samples (90%) falls under the category of high salinity water while nearly 10% of samples fall in medium salinity water category. This shows that the ground water in the pre-monsoon season from shallow aquifer in the district should be used for irrigation with proper soil and crop management practices.

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