Status Of Groundwater In The Part Of Godavari River Basin In Osmanabad District

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Abstract:-

Osmanabad is situated on the ridge line of two important river basins in Maharashtra i.e. Krishna and Godavari. The present study was undertaken to study the status of groundwater in the part of Manjara Sub-basin of Godavari river basin. Manjara sub-basin is mainly comprises of the most part of kallam taluka. This study is very important as it enables the availability of groundwater for the various purposes such as Domestic, Irrigation, Industrial and Livestock etc. Observation wells were selected in Kherda, Borda, Jawala (K), Borwanti and Ekurka villages of Kallam taluka. Observations of diameter of well, depth of well, static water level in the well were taken fortnightly with the help of tape, rope and stone. Initially the soil profile of the observation wells was studied to know about the type of aquifer underlying. Pumping tests were conducted on each well fortnightly during 15th November to 31st March. The readings of static water level, pumping water level, pumping time, recoupment time were recorded which helped to calculate draw down, well yield and specific capacity of each observation well. The rock profile comprises of basalt rock with horizontal and vertical fractures except Jawala (K) where semi-confiend aquifer was found. The average ground water level in the villages namely Borda, Kherda, Jawala (K), Borwanti and Ekurka were 5.1 m, 4.9 m, 9.7 m, 3.8 m and 3.42 m respectively. The average depth of water in the well, well yield and specific capacity were satisfactory till the month of January and gradually depleted from February to May.

Keywords: - River basin, Observation wells, Recoupment time, Well yield and Specific capacity.

Introduction:

Land-use intensification in India has progressed rapidly, especially over the last two decades. The increasing use of groundwater for agriculture and related activities has gone hand-in-hand with land-use intensification. The increase in water use has obviously affected both surface water and groundwater supplies to a large extent, and many areas of the country are clearly showing the signs of acute water crisis. The way out of this ever-increasing water crisis is simply to limit the extraction of water to a sustainable level first and to build a buffer for this sustainable level through augmenting groundwater recharge. Interflow is the water that moves towards a stream above the groundwater table, but underneath the soil water zone. The stream may recharge the groundwater during and after the storm. A dynamic relationship exists between the groundwater system and streams. For much of the year, groundwater table may support the flow in a stream but during periods of heavy precipitation following dry summers streams and rivers may provide water for groundwater recharge.

Rivers are of many uses to man and hence stream and river flows must not be excessively lowered through direct use or through overuse of groundwater which feeds them many times. In many areas, valuable surface water is lost during periods of high runoff because the local groundwater table is relatively high and river recharge to the ground is relatively minimal. The major problem is that rivers and surface storages contain water during and after the periods if rain when the groundwater table is high anyway and conditions are not ideal for inducing recharge artificially.

Groundwater is an important source for irrigated agriculture as it generally furnishes reliable and flexible inputs of water. To this extent, groundwater is instrumental in managing risk and optimizing food production in the rain fed areas. However, this reliance upon shallow aquifer systems for irrigation has turned to dependency. Depleting groundwater is a serious problem throughout Asia and more so in India as more than 22 million wells are operational in India supporting the economy. According to the report on the 3rd Census of Minor Irrigation schemes, the ultimate irrigation potential from groundwater source is 64.05 million ha, as compared to 46 million ha of land currently under groundwater irrigation. Groundwater, which is 38.5 % of the available water sources of the country, plays a major role in irrigation, rural and urban drinking water supply and industrial development. Groundwater meets nearly 55 % irrigation, 85 % of rural and 50 % of urban and industrial needs (Government of India, 2007). The use of groundwater in the agriculture sector has expanded rapidly because of the short gestation lags with which it can be developed, control over irrigation that it provides, free or subsidized availability of power in some states, water requirements for the crop production during critical growth stages caused due to erratic rainfall in dry land agriculture and paucity of surface irrigation.

The over-exploitation of groundwater in ten years (1995-2004) increased by more than 4.5 times, making groundwater use a matter of serious concern. The over-exploitation of groundwater in six states (Gujarat, Haryana, Punjab, Rajasthan and Tamil Nadu) is 54% against a national average of 28%.The prime cause of over-exploitation of groundwater is the rising demand from agriculture and rapid growth in urbanization and industrialization. In many groundwater irrigated areas, the decisions on cropping pattern and cropping intensity are being taken largely independent of the groundwater availability. Thus water intensive crops have tended to be grown in the face of scarcity of water. Such distortions occur partly due to the legal/regulatory regime governing groundwater . In many states, groundwater extraction has exceeded annual recharge and water tables have gone down (Batchelor et al. 2000). The groundwater management rather than development is the major challenge facing the water resources, particularly in the dry land areas. Therefore, a focus on the development activities must be balanced by integrated management mechanism to achieve a sustainable utilization of groundwater resources, which is an important driver for the management of watersheds for sustainable development in the dry land areas. Groundwater is an invisible and endangered open or common access resource. Overexploitation of the groundwater beyond the sustainability limits in several parts of the country has resulted in widespread and progressive depletion of its levels in selected pockets of 370 (61%) out of 603 districts in the country (MOWR, 2005). In 15% of the blocks, the annual extraction of groundwater exceeds the annual recharge and in 4% of the blocks it is more than 90% of the recharge (CGWB, 2006).

About the Study Area:

The groundwater represents large reserves of the water source that is little affected by the irregularities from year to year. So, the study of groundwater is too much important. The present study is undertaken in 2010-2011 in the part of Kallamb taluka which, falls under the catchment area of GODAVARI river basin. The study area comprises of Borda, Kherda, Jawala(K), Ekurka and Borwanti villages. Kallam taluka lies between 18^{o}20'25" N Latitude and 76^{o}04'42" E Longitude. The study area is situated in Balaghat region. Manjara river, a tributary of Godavari river basin mainly comprises of the most part of Kallamb taluka. Manjara river basin is located at an altitude of 823m from mean sea level. Total area of Godavari river basin is 172 lakh ha. Nearly 39440 ha of area of Kallamb taluka falls under Godavari river basin. As far as arid region is considered, groundwater is a primary source of water to fulfill the domestic, agricultural and industrial needs.

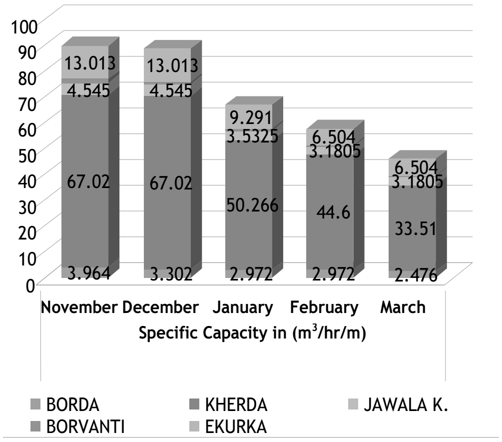
Methodology:

The present study was carried out to study the ground water level as well as to determine the yield and specific capacity of the observation wells in the study area. The rock profile of all the wells was studied during the non availability of water in the wells. To meet the objectives, the subsurface investigation of groundwater was done. The shape, size, depth of observation wells were observed. The static water level and pumping water levels were taken at fortnightly interval. Pumping tests of all the wells were conducted to determine the well yield and specific capacity. All these observations were taken with the help of tape, rope and stone. An electric water-level sounder was used for deeper wells. The time for pumping and recoupement time were observed with the help of watch. The study was started in July 2010 but it was not possible to take the observations from July to October 2010 as the water levels in all the observation wells were at ground level. The observations were taken during November to March at fortnightly interval. Drawdown was calculated by using the static water level and the pumping water level. The well yields were calculated using the volume of water coming into the well and its corresponding recoupement time. The specific capacity was calculated using the yield of well and drawdown.

Results and Discussions:

The study of rock profile was useful in determining the type of aquifer tapped by the observation wells. The unconfined aquifers were tapped in Kherda, Jawala(K), Borwanti and Ekurka while a semi-confined aquifer was observed in Borda village. In the study area the fractured basalt rock was found which showed high transmissivity and at the bottom an impermeable layer was found which showed high storativity. The geology permits the construction of storage tanks in Borda and Borvanti villages, while it permits the construction of percolation tanks in Kherda, Jawala(K) and Ekurka villages.

Pumping tests of all the wells were conducted to determine the well yield and specific capacity. The observations were taken during November to March at fortnightly interval. In Borda village, the well yields were observed to be 19.82, 16.51, 14.86, 14.86 and 12.38 m^3/ hr in November, December, January, February and March respectively with an average well yield of 16.286 m^3/ hr by maintaining the drawdown of 5m in each pumping test in Borda. The specific capacity of 3.964, 3.302, 2.972, 2.972 and 2.476 m^3/ hr/m were observed in the respective months with an average of 3.371 m^3/ hr/m. The well yield and specific capacity of the observation well in Borda village were gradually decreased from November to March. For the recoupement of 5m drawdown the well had taken 15 hours in November and gradually increased to 24 hours in March.



Graph 1: Monthly Specific Capacity of observation wells in the study Area

The well yields in Kherda village were observed to be 201.06, 201.06, 150.80, 133.80 and 100.53 m^3/ hr in November, December, January, February and March respectively with an average well yield of 157.45 m^3/ hr by maintaining the drawdown of 3 m in each pumping test. The specific capacity of 67.02, 67.02, 50.26, 44.60 and 33.51 m^3/ hr/m were observed in the respective months with an average of 52.482 m^3/ hr/m. The well yield and specific capacity of the observation well in Kherda village were constant in November and December while gradually decreased from January to March. For the recoupement of 3m drawdown the well had taken only 3 hours in November and gradually increased to 6 hours in March.

Sr. No.	Village	Well Yield in (m3/hr)					Average Well Yield in (m3/hr)
		November	December	January	February	March	
1	BORDA	19.82	16.51	14.86	14.86	12.38	15.686
2	KHERDA	201.06	201.06	150.8	133.8	100.53	157.45
3	JAWALA K.	9.33	9.33	7.775	6.997	6.997	8.086
4	BORVANTI	2.52	1.68	1.68	0.841	0.841	1.512
5	EKURKA	29.93	29.93	21.37	14.959	14.959	22.23

Table 1. Monthly Well Yields of observation wells in the study Area

The well yields in Jawala Khurd village were observed to be10, 10, 7.77, 6.997 and 6.997 m^3/ hr in November, December, January, February and March respectively with an average well yield of 8.35 m^3/ hr by maintaining the drawdown of 2.2 m in each pumping test. The specific capacity of 4.545,4.545, 3.532, 3.18 and 3.18 m^3/ hr/m were observed in the respective months with an average of 3.796 m^3/ hr/m. The well yield and specific capacity of the observation well in Jawala Khurd village were constant in November and December while gradually decreased from January to March. The recoupement of 2.2 m drawdown in the well had taken only 15 hours in November and gradually increased to 20 hours in March.

The well yields in Borwanti village were observed to be 2.52, 1.68, 1.68, 0.841 and 0.841 m^3/ hr in November, December, January, February and March respectively with an average well yield of 1.512 m^3/ hr by maintaining the drawdown of 1.7 m in each pumping test. The specific capacity of 1.482, 0.988, 0.988, 0.495 and 0.495m^3/ hr/m were observed in the respective months with an average of 0.8896 m^3/ hr/m. The well yield and specific capacity of the observation well in Borwanti village were highest in November and decreased to 1.68 m^3/ hr in December and January while maintained a value of 0.841 m^3/ hr in February and March. The recoupement of 1.7 m drawdown in the well had taken 16 hours in November and gradually increased to 48 hours in March.

The well yields in Ekurka village were observed to be 29.93, 29.93, 21.37, 14.959 and 14.959 m^3/ hr in November, December, January, February and March respectively with an average well yield of 22.22 m^3/ hr by maintaining the drawdown of 2.3 m in each pumping test. The specific capacity of 13.01, 13.01 9.291, 6.504 and 6.504 m^3/ hr/m were observed in the respective months with an average of 9.663 m3/ hr/m. The well yield and specific capacity of the observation well in Borwanti village were highest in November and December decreased to 21.37 m^3/ hr and 9.291 m^3/ hr/m in January while maintained a value of 0.841 m^3/ hr and 6.504 m^3/ hr/m in February and March. The recoupement of 2.3 m drawdown in the well had taken 5 hours in November and December and gradually increased upto 7 hours, 10 hours and 10 hours in January, February and March respectively.

For all the villages it was observed that the static water level increased gradually in the post monsoon season while the well yields and specific capacities of the observation wells were gradually decreased in the study period. It was also observed that the pumping time was less than or equal to the recoupement time during November December and January while the recoupement time was more than the pumping time due to the reduced well yields during February and March.

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