GROUNDWATER REPLENISHMENT IN AMBERNATH REGION

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Abstract – *The current water situation in the study region has been deteriorating each year with ever decreasing amount of water available to population and the exponential increase in the population in the study region in last two decades. Attributing to this mostly, all residential complexes resorted to extracting groundwater, following years of extraction has resulted in majority of the borewells drying up after monsoon season leading to complete dependency of city on Maharashtra Jeevan Pradhikaran and tanker services for water. Therefore, replenishing existing borewells seems to be a viable option to provide city with a steady source of water*

Key Words: **Groundwater, Borewell, Aquifer, Water scarcity, Replenishment.**

1. INTRODUCTION

Groundwater generally is the meteoric water from rain or snow which does not evaporate or run off and gets percolated into the ground. The properties of soil and the structure of ground determines the movement of the water under the ground and also the aquifer. On the earth, 97.24% water is in oceans, while 2.14% is in solid ice form, the largest source of accessible liquid fresh water is Groundwater at 0.61% [1]

These aquifers hold enormous amount of fresh water but even they are not limitless and in many parts around the globe are experiencing a decrease in the water level, so implementing proper measures to augment the rate of replenishment in the aquifer will negate the effect of the over exploitation of such aquifers.

This research paper will review and suggest some of such measures which should be implemented in the study region to help boost the water level in the existing borewell during the dry spells and would focus on measures which can be implemented at municipal level,

1.1 Scope of Work

a. Studying topography terrain and meteorological condition of the study region.
b. Based on the study determining the best technique for artificial recharge.

2. STUDY AREA [2]

Ambernath is part of Mumbai Metropolitan Region (MMR) in thane district of state of Maharashtra in India. It is Located on following co-ordinates 19.209N 73.186E. Area covered is 38 sq. Km by the study region and the average Elevation is 35m

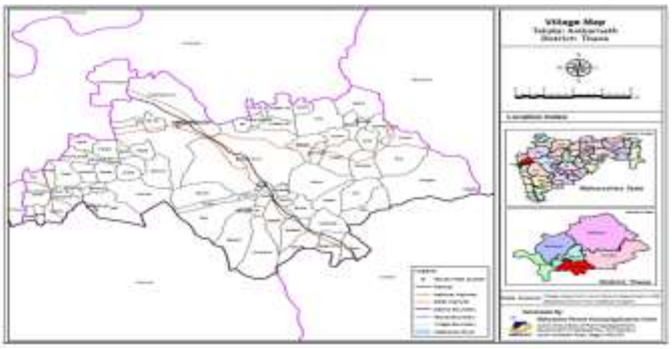

Fig -1: Map of Ambernath region

2.1 Population

Population statistics of Ambernath region is given below highlighting increasing trend of population from 1961 to 2011.

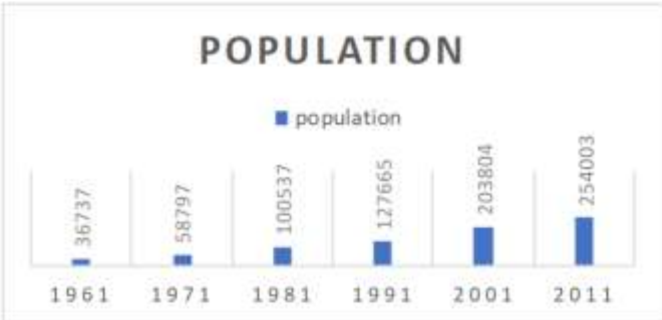

Fig -2: Graph on Population Index

2.2 Rainfall

Average Rainfall in thane district is 2576.4 mm [9] and the variation in annual rainfall from 2009 to 2014 are shown below.

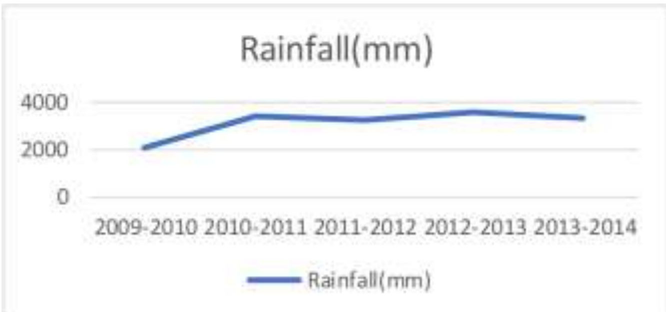

Fig -3: Variation in Rainfall with Respect to Year

2.3 Temperature

Temperature varies according to season. Average high during May can be observed as 32.48 °C and average low as 25.9 °C. During January month average high recorded as 29.4 °C and average low as 15.3 °C.

2.4 Soil

Soil found in Ambernath region is sand-loamy. Due to this rate of infiltration is low and salt and minerals are disintegrated/dissolved. Terrain of Ambernath is hilly and the soil is not swampy. Ambernath taluka mostly has sandy loam soil along with black colored soil and lighter colored soil in the villages surrounding the city.

2.5 Water supply

Daily water requirement of Ambernath region is - 62 MLD out of which Borewell supply - 0.12 MLD from 256 Municipality Dug borewells and Well supply-0.02 MLD from 17 Municipality Dug Wells. Private borewell registered with municipality are 60.

2.6 Physiography & Drainage [3]

The taluka can be broadly divided into two physiographic units i.e. undulating hilly tract of Western Ghats towards the south and east and the plain area towards the north and center. The foothills consist of Kondap and Malang gad. Topography is rugged and uneven characterized by high hills and steep valleys. The taluka is mainly drained by Ulhas river and its tributaries the digital elevation model of Ambernath taluka indicating the boundary of the taluka is shown in figure.

2. METHODOLOGY

Based on the topography and feasibility of various recharge techniques, it is suggested to implement following techniques at strategically decided locations based on the availability of the land, surplus water and the need of groundwater at selected locations. These recharge locations are expected to successfully recharge the aquifer not only to meet the current needs but also make sure to maintain sufficient water level during dry spells

Tab -1: Tentative locations of proposed artificial recharge methods

Sr.no	Area	Method	Co-ordinates
1	Manjarli Gaon	Injection Well	19.1809,73.24346
2	Vasant	Ditch & Furrow	19.22444,73.22999
3	Pashane	Injection Well	19.10675,73.3191
4	Kudsavare	Injection Well	19.11288,73.29615
5	Kamba Gaon	Percolation Tank	19.24483,73.20068
6	Ane Gaon	Stream channel modification	19.25005,73.22753

At Manjarli gaon, since the selected area in this region have no. of existing borewells and tube wells within 1km radius so it can be concluded that the aquifer beneath the borewells and tube wells is permeable enough to transmit the water, so it is suggested to tap and fill the water into aquifer by infiltration well and for future use this water can be extracted again by existing well. The efficiency of injection well is 40-80% depending on the water level, clogging of aquifer etc. The average yield of tube well is the 10TLD it is proposed to recharge 1 out of every 10 wells with at least 20TLD each under pressure. The wells selected for recharge must be fitted with assembly involving pumps to build pressure and must be provided with gravel screen to prevent the clogging of the well. The water required for the recharge can be lifted by the Ulhas river passing near the Manjarli village, the river has adequate surplus water to suffice the water required for injection wells. The wells selected for recharge depends on the location of each well and the proximity of the wells from each other, most of these wells are privately owned so willingness of the owner of the well to co-operate is another factor influencing the recharge.

Fig -4: Map showing Manjarli village

Similar condition is observed in the village of the Kudsavare and Pashane where upcoming new societies heavily rely on the groundwater. Each society is provided with tube well as this area is having inadequate supply of water. Number of borewells and tube well exists within 1 km radius and water from borewell and tube well is also utilised for the agricultural practise when the section of river dries out during summer. The average yield of the borewell shows fluctuation and some of the borewell and tube wells have dried out.so it is suggested to recharge these dried-out tube wells and bore well and those well which exhibit fluctuations along with the private bore well and tube wells of people who are willing to co-operate. Water required for recharge can be lifted from the Ulhas river when surplus water is available and from a lake Karav which is within close proximity.

The wells should be recharged to a maximum extend with at least 20TLD to be recharged in each well with some wells having higher yield should be recharged with upwards of 20TLD

Fig -5: Map showing village of Kudsavare and Pashane

Village of Vasant is situated near a bend on the Ulhas river and this bend can be utilized for the construction of the ditches and furrow. A weir is located on upstream side very close to the bend and this weir can be used to divert water through intake canal. These ditches and furrows can be constructed on a 36-hectare land with the length of the ditch anywhere from 1-2 km in length depending on the position whether it is near the apex or base. The width of the ditch can be between 0.3 m to 1.8 m depending on the length with at least 2-5m spacing between the ditches and furrows, total 100 such ditches and furrows can be prepared in this area. The transmissivity of the soil is around 40.80 to 50.52 m^2/day [15] which is considered enough infiltration of water. These ditches can be operated which there is flooding in the river during monsoon and post monsoon season but can't be efficient after February due to heavy evaporation losses. These ditches and furrow can hold 0.225-0.25 million litre water. The excess water can be carried back to the water throughout take canal. The depth of the ditches depends on the surface condition but it should be excavated till the depth is enough to efficiently percolate water.

Fig -6: Map showing village of Vasant

The area near Kamba is suitable for the percolation tank because this region is covered on 3 sides by hill and during monsoon the runoff from these hills can be collected in the low-lying area formed by these hills. The section of the Ulhas river also passes nearby which could provide the source of water for the percolation tank. Total area available for catchment is 1 km^2. Percolation tank is supposed to be provided with a gravity well so efficiently recharge the deep aquifer along with the vadose zone of the surface alluvial. The capacity of the percolation tank can be computed by using the dickens formula Q=CA

Where, Q= peak discharge
A=Area of catchment in km^2
C=Constant (22-25 for western India)

Here the maximum discharge is computed to be 22m^3/s. Therefore, the percolation tank should be designed for 950 million litres considering single filling. The water in the percolation tank are efficient for up to February before onset of the summer. The size of the percolation tank would depend upon the percolation capacity of the strata, if the percolation capacity is more than the tank could be made small for same capacity.

Stream channel modification of the Ulhas river at the Ane village along with the stream blasting along the bank of the river would increase the yield of the wells in the surrounding areas. For stream channel modification we need to construct a weir of about 125m in length over the Ulhas at the Ane village which should block at least 30% of the flow. Due to this weir the section of the river which goes dries during the summer also won't dry out and the stream blasting would widen the fractures in aquifer and increase yield.

Fig -7: Map showing village of Ane

3. CONCLUSION

In this project, few techniques have been suggested to replenish the aquifer system for Ambernath taluka. Dependency on Groundwater was on increasing trend as the water supplied by the municipal council was not proving sufficient enough for the most of the housing societies and most of these society had to depend on water tanker services or had to resort to groundwater as a source of staple domestic water. These suggestions were based completely on the suitability condition of land, usage of land, area available for recharge, cost of land and other such parameters. Being an isolated region not enough research was done before in this region and data required for the thorough suggestion was not available so few assumptions were made. If the above techniques are implemented properly it will aid in the recharge of the aquifer and help to curb the dipping of water level in the aquifer.

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AUTHOR

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