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GROUNDWATER ESTIMATION OF PIMPALGAON BASWANT VILLAGE, NIPHAD TALUKA, NASHIK, MAHARASHTRA, INDIA

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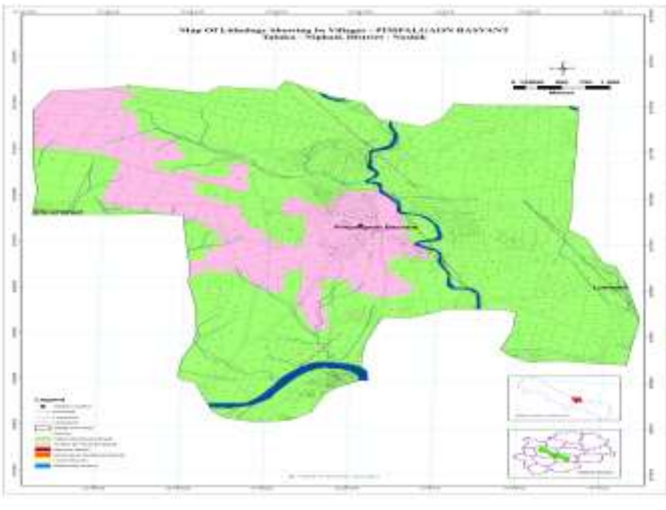
--ABSTRACT--
Estimating groundwater availability in a village can be a complex process, as it involves analysing various factors such as geological formations, rainfall patterns, land use, and hydrological data, existing water conservative structure data. Groundwater availability in a village is a crucial aspect of managing water resources effectively. Several methods can be used to estimate groundwater in a village. By using hydrological model in Pimpalgaon Baswant village can provide valuable insights into groundwater estimation by simulating the movement of water through the soil and aquifer systems. This model considers various parameters such as long-term rainfall trends, evapotranspiration, land use, and soil properties to estimate groundwater recharge and availability, assessing the sustainability of groundwater resources in a village. It is important to note that estimating groundwater availability is an ongoing process, as it needs to account for fluctuations in rainfall patterns, other environmental factors, multidisciplinary expertise and local knowledge to ensure accurate results. Regular monitoring and updating of data are essential for accurate estimations.

KEYWORDS: *Groundwater estimation, Run off estimation.*--

INTRODUCTION

The study area Pimpalgaon Baswant village is situated at Northen part which is left bank of Kadawa river, originated from Dindori taluka. Pimpalgaon Baswant is a town located in Niphad taluka, Nashik District of Maharashtra having coordinates 20.1654° Latitude and 73.9879° longitude. A small river naming Parashari is also passes through the village.



Geologically of the Pimpalgaon Baswant covers the various types of Deccan volcanic basalts (Cretaceous to lower Eocene age). showing Different types of weathering pattern in vesicular and compact Basalt.

Most part of the village is covered by the weathered basalt as shown in map. Sets of lineaments are also present in the study area. Map 1 showing lithology and administrative location of Pimpalgaon Baswant village.

Map 1: Pimpalgaon Baswant village lithology map

METHODOLOGY

In order to prepare the village groundwater estimation following information is collected through detailed field survey from the study area and various governmental agencies.

1) **Baseline survey**
   a) Demographic information
   b) Status of domestic water Supply
   c) Existing Water conservation structures information
2) **Hydrogeological Survey**
   a) Rainfall analysis: long term and daily rainfall of current/previous year of nearest rain gauge.
   b) Groundwater level trend analysis: long term trend analysis for nearest OBW readings
   c) Occurrence of groundwater in the area
3) **Village based Groundwater Estimation**
4) **Observations and conclusions.**

a. Demographic Information

1	Name of the village	Pimpalgaon Baswant (551291)		
2	Name of Gram Panchayat	Pimpalgaon Baswant		
3	Name of taluka	Niphad		
4	Name of District	Nashik		
5	Total area of all included village (in Ha)	1979.47		
6	Canal Command area (in Ha)	180		
7	Non-Command area (in Ha)	1799.47		
8	Total Cultivable area (in Ha)	836.47		
9	Total population (Human)	41559		
10	No. of Households	8187		
11	No. of Land Holder	2647		
12	Average land holding size per house hold	3 to 5 hac		
13	Total no. of Dug wells/Bore wells/Farm ponds	709	450	25
14	Total cattle population	10979		
15	Agriculture allied business, if any	Dairy, Goat farming, Poultry		

b. Status of Domestic Water Supply

1	No. of drinking water supply sources in all village	Dug Well	1
		Hand Pump	6
		PWS-DW	1
		PWS-BW	0
		Mini PWS (Dual pump)	0
2	Total Domestic water requirement for Human and cattle		
	Water requirement in Ham	**Per Day (in TCM)**	**Annual (in TCM)**
	Human (41559 × 365× 60 lpcd) as per GEC2015	2.49 **TCM**	910.14 **TCM**
	Cattle (10979× 365 × 30 lpcd)	0.329 **TCM**	120.22 **TCM**
	Total Domestic water requirement	**2.82 TCM**	**1030.36 TCM**
3	Groundwater Dependability (in %)	100%	
4	***Groundwater draft for domestic purposes (year 2022-23)***	**= 1030.36 TCM**	

b. Existing Water conservation structures information

SR. NO	Name of Structure	No.	Total storage Capacity (TCM)	No.of Fillings	Total annual run of arrested (annual storage) in TCM
1	CNB	5	16	2	32.00

c. Information of Existing Farm Ponds

SR. NO	Type of Farm Pond	Average Dimensions (m)	Unit storage Capacity (TCM)	No. of farm ponds	Total storage in TCM	Source of Filling
1	Unlined	30 x 30 x 3	2.1	25	52.5	Stream Water

2. Hydrogeological data analysis: (historical data analysis and field survey):

a. Rainfall analysis:

1	Name of nearest ***Taluka*** rain gauge station	Pimpalgaon Baswant
2	Name of the nearest ***Circle*** rain gauge station	Pimpalgaon Baswant
3	Normal Rainfall for the ***Taluka*** station in mm	518.10 mm
4	Monsoon RF for ***Taluka*** station in current year in mm (2021-22)	889.10 mm
5	75% dependable rainfall for ***Taluka*** station in mm	424.50 mm
6	Monsoon RF for ***Circle*** station in current year in mm (2021-22)	849.2 mm

b. Long term monsoon rainfall of Taluka rain gauge station and groundwater level trend analysis:

Long term monsoon rainfall over the study area is very much fluctuating and shows DPAP signatures although the normal annual rainfall is nearly 518.10 mm. Long term monsoon rainfall for this station shows slighty Raising trend.

Observation well (OBW) is at Pimpalgaon Baswant village, which is located at the North-East of the village. Long term pre monsoon (summer) Groundwater level shows the Rising trend (@ 0.3031 m/year) in the area, while post monsoon groundwater level shows Rising trend (@ 0.2424 m/year). This indicates large extraction of groundwater over annual ground water recharge.

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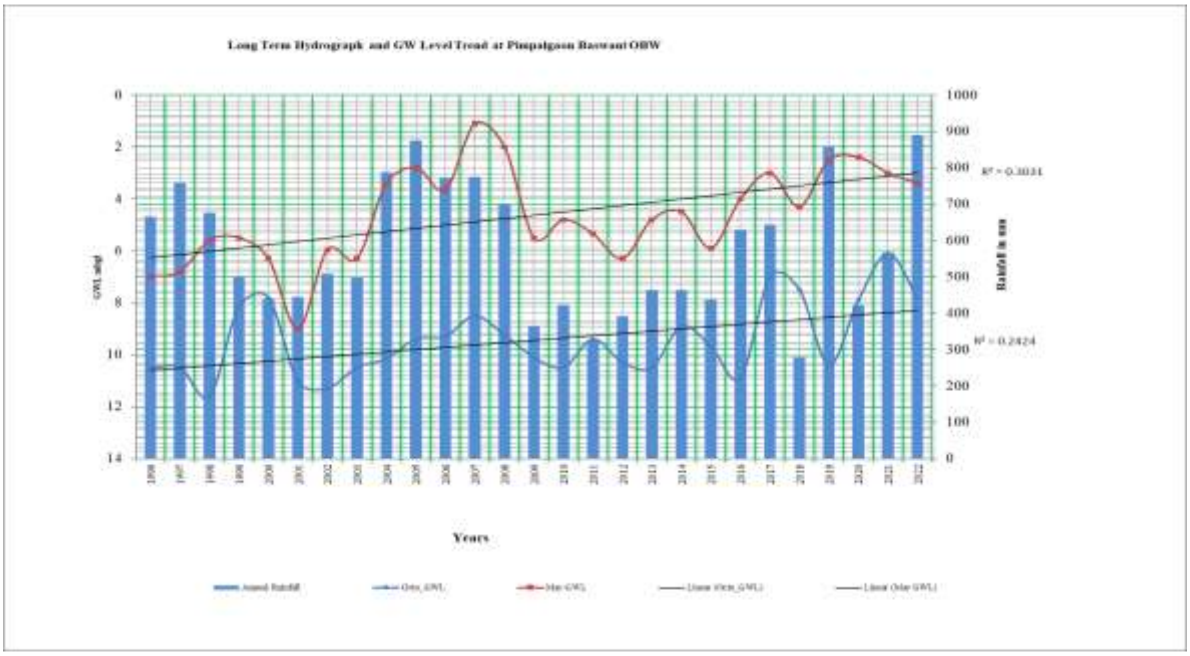

c. Run off estimates for the village

Geographical runoff estimation is the process of calculating the amount of water that flows as surface runoff from a specific area. It involves considering various factors such as precipitation, soil properties, vegetation cover, slope, and land use within the area. In the study area runoff estimation are driven by using run off coefficient method obtained from Strange's table.

The area is covered by black cotton soil (1 to 1.5 m) followed by high to moderate weathered basalt up to the depth of 10 to 12 m, with slope percent ranging from 1 to 1.2 % (Good sloping), thus as per Strange's categorization it comes under category of good catchment from run off point of view. As the annual rainfall is very fluctuating 75% dependable rainfall (return period of 1.32 years) which is the most reliable rainfall value, is considered for estimating the run off.

Normal rainfall for the area is 518.10 mm which has dependability of 50%, while 75 % dependable rainfall for the area is 424.50 mm. As per the Strange's table run- off coefficient for average catchment with rainfall of 581.5 mm is 11.0 % (0.11).

RUN OFF ESTIMATION		
1	Total catchment area of village in Ha	1979.47
2	Aquifer area in Ha	1979.47
3	non aquifer area in Ha	0.00
4	Average annual rainfall in mm	518.10
5	75% dependable rainfall in mm	424.50
6	Average slope Aquifer area in %	1 to 1.1
7	Run off coefficient Aquifer area in %	0.11
8	Run off yield Aquifer area in Ham	92.43
9	Run off yield Non worthy Area non aquifer area in Ham	0.00
10	Total Run off available from the catchment	92.43
11	Utilizable Run off for harvesting in Ham = 65% of Row 13 (35% left as riparian rights of the downstream)	60.08
12	No. of fillings assumed	2.00
13	Run off booked for existing WCS structures in Ham	1.60
14	Run off ultimately available for harvesting (12-14)	58.48
15	Approximate water storage capacity that can additionally be created (50% of 14)	29.24

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3. Groundwater estimation of village (2021-22):

	Groundwater Estimation	
Monsoon Recharge		**TCM**
1	Rainfall recharge during monsoon (by WTF) in TCM =(area × wtf × sy) (1979.47* 4 *0.0027)	209.95
2	Recharge from WCS during monsoon in Ham ?? (TCM) (9 CNB with 1TCM capacity) and Nala deepening	6.40
3	Recharge from groundwater irrigation during monsoon in TCM (considered 10 % of water applied)	77.36
4	Groundwater Draft during monsoon in TCM	773.64
5	Recharge from Surface water irrigation during monsoon in TCM	0
6	Total groundwater recharge during monsoon in TCM =(1+2+(4-3))	**912.63**
Non-Monsoon Recharge		
7	Recharge from WCS during non-monsoon in TCM	6.40
8	Recharge from canal in TCM	24
9	Recharge from Surface water irrigation during non-monsoon in TCM (10% of SW applied)	52
10	Recharge from Groundwater irrigation during non-monsoon in TCM (considered 10 % of water applied)	441.84
11	Recharge from Tanks and ponds in TCM (as per GEC norms)	10.5
12	Total groundwater recharge during non-monsoon in TCM (6+7+8+9+10)	**1447.36**
13	Gross groundwater recharge (6+12) in TCM	2359.99
14	Net groundwater availability in TCM (13-(10%0f 13)) by deducting base flow	2123.99
15	Gross groundwater draft for all uses (from earlier sections) in TCM (Domestic+ Irrigation) = 1030.36 + 519.20 = 1549.56 TCM	1549.56
16	Stage of groundwater extraction (15/14) × 100 in %	72.96
17	**Groundwater surplus (+)/deficit(-) = 14-15 in TCM**	**574.43**

4. Observations, Inferences and Recommendations:

a) Observations and Inferences:

1. With this estimation it is inferred that GW recharge percent w.r.t. rainfall is almost 8 % and there is no groundwater deficit in current scenario.
2. Rainfall pattern is very fluctuating and 1 to 2 dry spells in rainy season is very common.
3. Well density in the area is 35 wells per square Km, which is on very higher side of the safe limit of 8 wells per sq.km.
4. Yield of wells ranges 0.66 to 0.37 Ham per well, which is an average yield required for irrigating 3 to 4 Ha of land seasonally.

b) Recommendations

1. There should be annual GW budgeting on regular basis.
2. Application of Regulatory measures for not drilling Dug wells and bore wells.
3. Optimum planning of GW recharge and need to control the irrigation draft less than the recharge
4. Need to plan cropping as per GW availability
5. Optimum use of water saving practices.

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