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Identification and demarcation of ground water level with the help of horse power wise motor pumps in Bhokarbari irrigation project command area of Jalgaon district

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Abstract

Horse power of motor pumps installed on the wells is one of the significant indicators help to identify and demarcate groundwater levels. In the present paper an attempt is made to display village wise spatial distribution of horse power wise motor pumps to identify the depth of ground water levels. When depth of ground water level is deep, farmers prefer high HP motor pumps to irrigate the fields and vice a versa. In the Bhokarbari command area, MSEB office has supplied electric connections to 2029 agricultural wells, out of them 89.84% wells have supplied below than 3 HP connections. It is concluded that due to highest number of wells, utilization of groundwater is more; hence most of the farmers are suffering from insufficient supply of groundwater to irrigate their fields. It revealed that, in the central part Intensive irrigated area are observed in the command area of the project. The central part of the study area is having good amount of groundwater.

Keywords: Horse power, intensity, wells, groundwater, cropping pattern

1. Introduction

The command area of Bhokarbari irrigation project is a part of rain shadow zone, behavior of irregular rainfall, shortage of groundwater and imperforate irrigation facilities therefore most of farmers have constructed open wells as source of irrigation in agricultural field. Identification and demarcation of groundwater resources using various methods and techniques. To demarcate groundwater contours interpolation technique that uses accurate location of wells, observation and estimation of depth of wells and surface elevation. In the present work a try is made to demarcate the groundwater contours using interpolation, field observation and surveyed agricultural horse power wise motor pumps.

2. Objectives

The main objective of the present work is to assess the Impact of groundwater on irrigated land cover of the study region. To achieve this aim of the study, the following objectives are kept in mind.

1. To display the village wise agricultural horse power wise motor pumps.
2. To identify ground water level in association with horse power wise motor pumps installed on the wells.

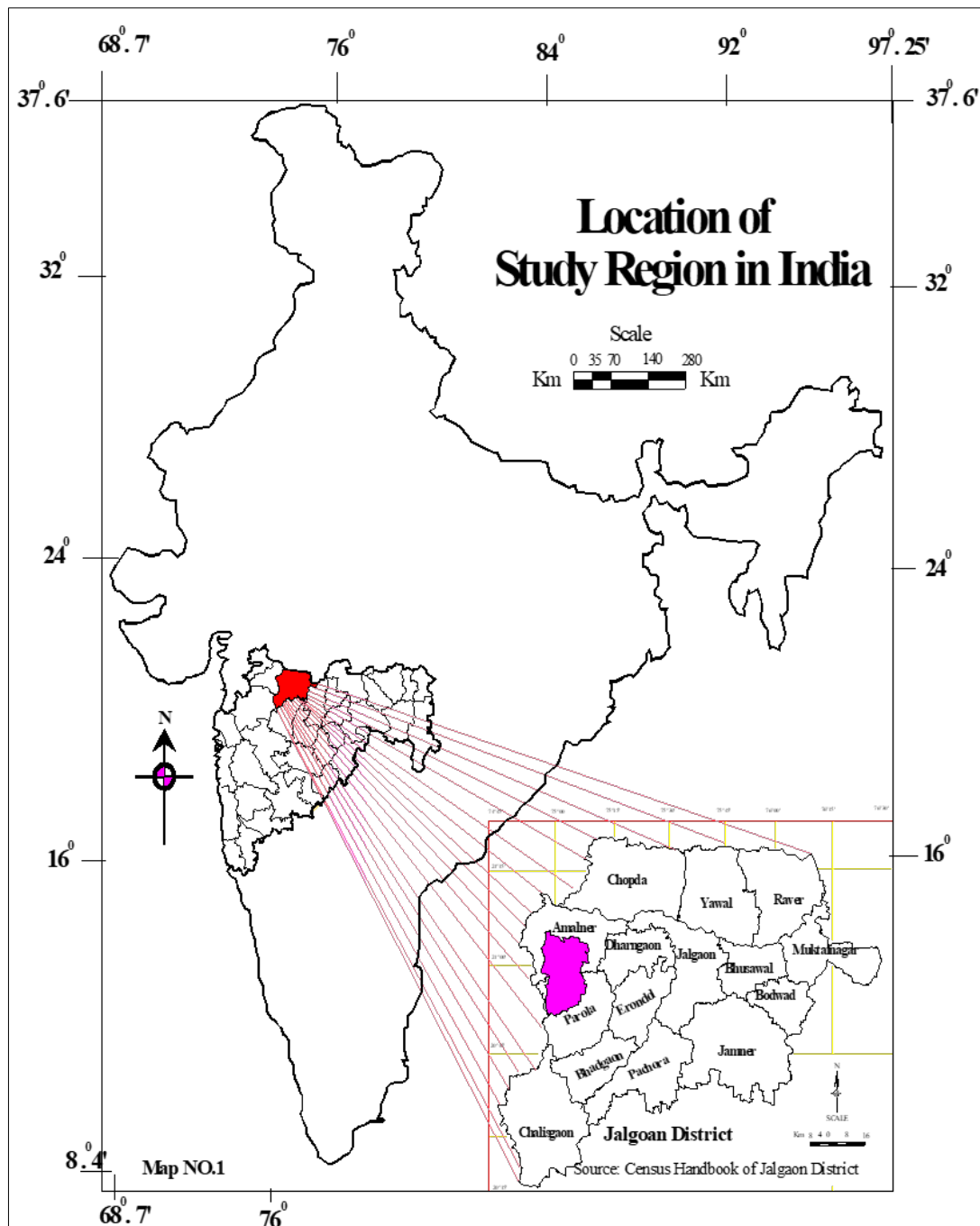
3. Study Region

The study region includes a small watershed of Bhokarbari irrigation project command area, which is a small part of Bori basin in Jalgaon district selected for detailed study. Bhokarbari irrigation project constructed on small watershed its tributaries of river Bori in Parola tehsil near bhokarbari village. The overflowing and excess water was released from the Girna irrigation project into the Girna River and then through the Jamada water project, water was diverted to the Jamada left bank canal which connected to the Parola branch canal; then the water reached the Mhaswa water project. From here, water received in the Bhokarbari dam. This extensive expedition of the water of 132 km has enriched the Bhokarbari projects.

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Command area of bhokarbari irrigation project is an upper part of Bori basin in eastern part of Jalgaon district bounded by $20^{\circ} 52' N$ and $21^{\circ} 00' N$ latitudes and $75^{\circ} 5' E$

and $75^{\circ} 10' E$ longitudes, covering 137.2300 sq km of land (13723.00 ha). This region includes 27 villages.



Map 1: Location of study region in India

4. Methodology

4.1 Data Base: The present work is based on primary and secondary data. Secondary data are collected from the Divisional Office of Maharashtra Electric Board, Jalgaon, village-wise and Horse Power wise agricultural motor pumps installed on of used wells, village-wise three HP motor pumps, five HP motors pumps, and 7.5 HP motor pumps and through the personal interviews of the farmers in rural areas

4.2 Data Analysis Techniques: This research work is entirely completed with the help of computer. Considering the nature of voluminous data, it is not possible to analyze such data manually.

1. Microsoft Excel software is used for the analysis of village wise data of cropping pattern. For data analysis “IF condition command”, “Advance filter command”, “Conditional formatting” commands are used.

4.3 Cartographic Techniques: Auto Desk Map software are used to prepare all maps. Considering the village wise boundary maps, all maps are prepared cited below:

1. Dot maps are prepared showing spatial distribution of all crops.
2. By considering the scale, per sq km grids are superimposed on dot maps.
3. Dots are then counted in each grid.
4. Counted numbers of dots are placed in respective grids.

5. With the help of these values of dots, isopleths are drawn.
6. According to the intensity of zones, hatching command is used to show the intensity zones of a particular crop. Thus, all maps are prepared showing intensity zones.

5. Discussion

There are number of methods to demarcate groundwater contours. Horse power of motor pumps installed on the wells is one of the significant indicators help to identify and demarcate groundwater levels. Out of them water lifting capacity of electric motor pumps installed on the wells determine the depth of ground water. Farmers prefer the horse power of electric pumps according to the depth of wells and water storage in the wells. Depth of wells is more to lift the water from high depth, farmers have installed high HP electric pumps on the Wells and low HP motor pumps have low capacity to lift the water. It is clear that horse power of motor pumps is one of the compounds to demarcate groundwater levels. Such village wise and HP wise trustworthy data of motor pumps is collected from MSEB DC office Jalgaon and prepare maps showing spatial distribution of HP wise motor pumps.

5.1 Distribution of Horse Power wise Motor Pumps Installed on Wells

In the Bhokarbari command area, MSEB office has supplied electric connections to 2029 agricultural wells, out of them 89.84% wells have supplied below than 3 HP connections. Table No 1 is showing that HP wise electric motor pumps installed on wells. This table displaying that 98.26% motor pumps installed on wells have less than 5 HP connections.

There are only 1.72% wells having more than 5 HP motor pumps. Generally low HP motor pumps have low capacity to lift the water, while high depth of wells require high HP motor pumps to lift the water.

Table 1: Proportion of HP wise Motor Pumps Installed on Wells

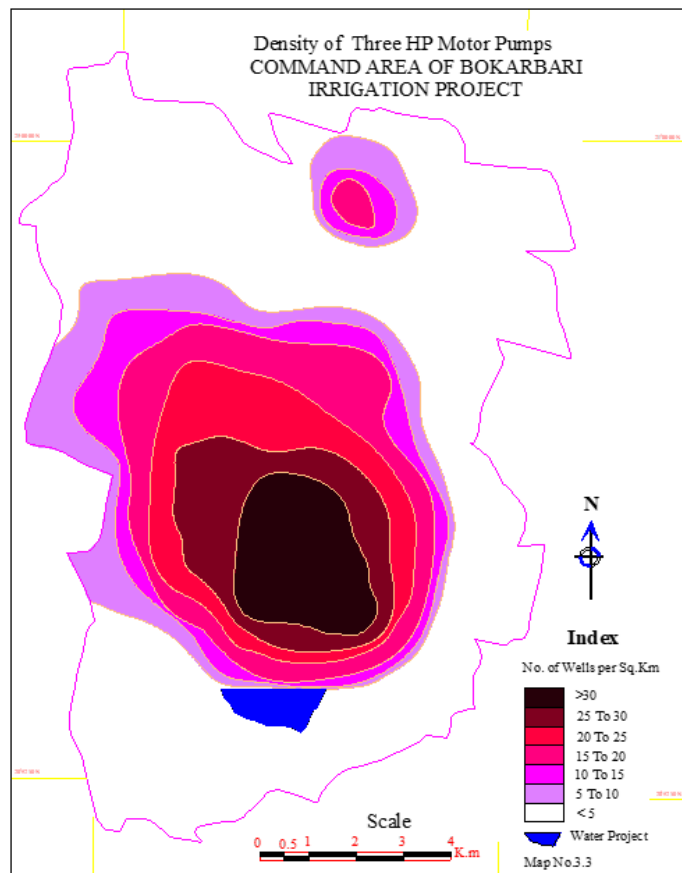
HP wise Electric Motor Pumps installed on wells	No of Electric Pumps	% To Total Connections	Average Depth of Wells Required (Feet)
Below 3 HP	1823	89.84	80 To 120
3 to 5 HP	171	8.42	120 To 160
5 to 7.5 HP	25	1.23	200 To 240
7.5 to 10 HP	10	0.49	>240
Total No of Connections	2029	100.00	

Source: MSEB DC Office Jalgaon

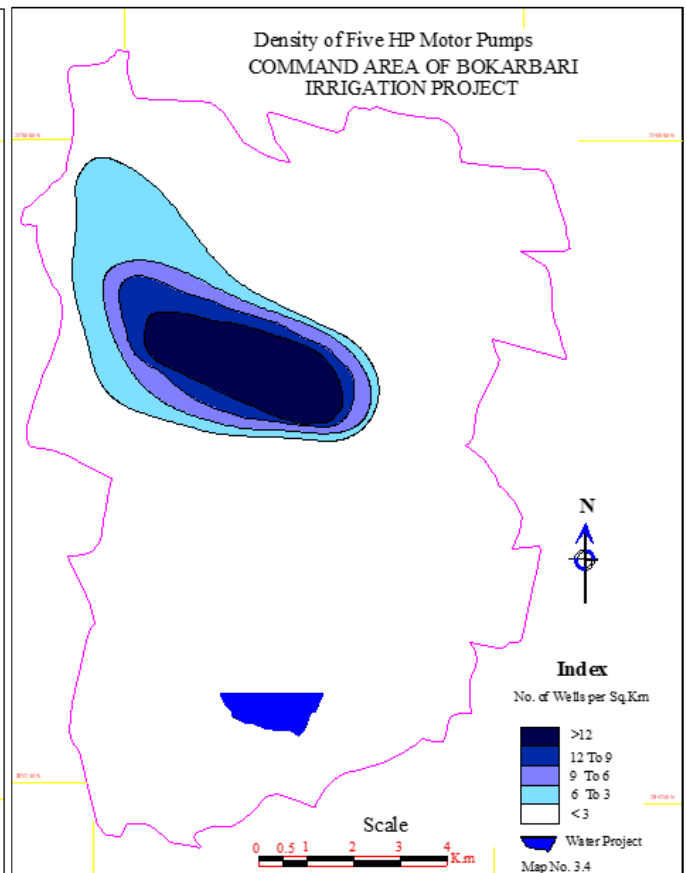
This table it is displaying that in the study region near about 90% wells have shallow depth ranging between 80 to 120 feet from the surface. While about 8.42% wells have 120 to 160 feet depth of water level. During the survey farmers have also reported that maximum depth of wells is about 150 feet. To correlate the HP wise motor pumps and depth of groundwater level, maps showing spatial distribution of 3 and 5 HP motor pumps are prepared.

5.2 Spatial Distribution of Wells having 3 HP Motor Pumps

Map No 2 is showing spatial distribution of 3 HP motor pumps. To prepare this dot map. Dot map is transformed into isopleths map and area of each intensity zones is measured. In this map two high intensity zones of three HP motor pumps are showing.



Map 2: Density of three HP motor pumps command area of Bhokarbari irrigation project



Map 3: Density of five HP motor pumps command area of Bhokarbari irrigation project

1. Zone number one is observed in the central part of study region, near the north side of Bhokarbari irrigation project site. In this zone in this zone Bhokarbari, Ratnapimpri, Holpimpri, Dabapimpri, kankaraj, Bilali and Sadawan villages are included. In this zone groundwater level is shallow; hence farmers have installed 3 HP motor pumps on their wells. Farmers are uplifting sub soil groundwater recharged by Bhokarbari irrigation project dam and Bhokarbari canal.
2. Zone number two is found in the northern part of the study region near the north boundary In the Bhokarbari irrigation project command area. In this zone Radhavan, Rajure and western part of Ekrukhi village have more than 20 wells per sq. km.

With the help of above map showing isopleths of wells having 3 HP motor pumps, area covered by each intensity zone is measured and shown in the following table. Table No 2 is clearly showing that the area covered by high intensity of wells having 3 HP connections is very small (5.90%). The geographical area of this small pocket is 8.10 sq km in which more than 30 wells are constructed by the farmers.

Table 2: Distribution of 3 HP motor pumps installed on wells

Sr. No	No of Wells Per Sq km.	Geographical Area Sq.km	% To Total Area
1	> 30 wells	8.10	5.90
2	25 To 30	10.56	7.70
3	20 To 25	14.87	10.84
4	15 to 20	12.53	9.13
5	10 To 15	19.03	13.87
6	5 To 10	18.01	13.12
7	<5	54.13	39.44
	Total Area	137.23	100.00

Source: Calculated by researcher

While remaining near about 94% area is having less than 25 wells. It is clear that recharging capacity of small area is found more that's why more than 30 wells are found there.

5.3 Spatial Distribution of Wells having 5 HP Motor Pumps

Map No 3 is display intensity zones of 5 HP motor pumps installed on the agricultural wells. This map is clearly displaying that highest concentration of wells having 5 HP motor pumps is found in north-western part, east to west half of the region. In this intensity zone having highest concentration wells. This intensity zone is found near the north-western part of the region. Generally, this zone is tapering shape area of high concentration of wells having 5 HP motor pumps is near the Bori river. It is clear that Bori River recharging the groundwater, hence high concentration of wells is found there. The maximum capacity of 5 HP motor pump to lift the water is 30 to 40 meters while 3 HP motor pumps lift the water from the depth of 18 meters. Thus, map is showing the deep and shallow depth of groundwater contours. This map reveals that in the study region in north-western part east-west belt of medium to high concentration of 5 HP motor pumps is found in fish shape. There are pockets having highest concentration found in village Ratnapimpri, Kolpimri, Kanhere, Bilkhede, Fapore, Sadawan, where more than 10 to 12 wells per sq.km are constructed.

Table 3: Distribution of 5 HP motor pumps installed on wells

Sr. No	No of Wells Per Sq km.	Geographical Area Sq.km	% To Total Area
1	> 12 wells	5.98	4.36
2	12 To 19	9.51	6.93
3	9 To 6	13.6	9.91
4	6 to 3	22.24	16.21
5	<3	85.9	62.60
	Total Area	137.23	100.00

Source: Calculated by researcher

It is obvious to note that in the northern half of study region, depth of groundwater is 30 to 40 meters. While in the South, 3 HP motor pumps installed on wells are more, indicating that the depth of ground water is about 12 to 18 meters. With the help of Map, no 2 & table No 3. Is prepared. Area of intensity zones are measured and displayed in the table. This map clears that the area of high intensity zone, having more than 12 wells per sq.km is 4.36%; while area of medium concentration is having less than 9 wells per sq.km is estimated as 88.72%. It is clear that high concentration of wells is found small and low concentration is found high.

6. Conclusion

It is concluded that shallow depth of groundwater concentration of 3 HP motor pumps installed on the wells is taken into consideration. There are two zones, one is located in the neighborhood of Bhokarbari irrigation Project and another is found north part of the region. In this zone more than 30 wells per sq.km is observed. The depth of groundwater is less than 15 to 18 meters from the surface.

It is concluded that medium depth of ground water level, concentration of 5 HP motor pumps is considered. Water lifting capacity of 5 HP motor pumps to lift the water is about 30 meters. This belt is found is found in north-western part, east to west half of the region. In this intensity zone having highest concentration wells. This intensity zone is found near the north-western part of the region. It is clear that maximum depth of groundwater is found in the north-western part, while shallow depth of groundwater is found in the near of Bhokarbari irrigation Project and in the central part of study region.

It is concluded that due to highest number of wells, utilization of groundwater is more; hence most of the farmers are suffering from insufficient supply of groundwater to irrigate their fields.

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