Research Paper Engineering

A Study of Groundwater Level in Command Area of Machchhu-1 Dam, Morbi, Rajkot.

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ABSTRACT

The study is mapping of groundwater, seasonal and annual fluctuation and rainfall effect in semi-arid region Morbi, Rajkot District of Gujarat State. The collection of the number of well data at about 35 years water level data & rainfall data has taken as study period. The Establishing a mutual relationship of groundwater pre-monsoon and post-monsoon level has shown in graph, the graphical representation & discussion of pre-monsoon and post monsoon ground water level shows that the groundwater level follows a seasonal pattern of fluctuation. The variation of decadal average water level trend is increasing and average water level with time is decreasing for Rajkot district. Using Surfer, 3-D water surface level, contour map of pre and post monsoon water level are prepared to study fluctuation in water level (Seasonal study) for machchu-1 irrigation scheme.[3]

KEYWORDS rainfall, pre-monsoon, post-monsoon, Groundwater Level.

I.INTRODUCTION

Water resources are becoming scarce, due to growing population and changing lifestyles, increase in demands from industry, contamination of available water resources, resulting from human activities, etc. This thins out the allotment of water available for irrigation[3].

The primary water source is Ground Water for every human activities like domestic,drinking water, agriculture and industry; especially in those regions, which has limited annual precipitation. The rest portion of surface water become intermediate water and then after during percolating into the soil and finally meeting the required soil moisture deficiency,. This occurs at different locations below the earth's surface depending upon the physical properties of various formations that exist. Such as aquifer, unconfined aquifer, confined aquifer aquiclude,

aquitard, aquifuge etc. Groundwater which is used for domestic and industrial water supply and irrigation is vital to local people and industry arid areas like Matcucu-1 command area. In the last few decades, tremendous increase in the demand for fresh water due to the rapid growth of population and the accelerated pace of industrialization. Ground water condition of an area are mainly depends on abstraction, recharge, soil properties, hydrological characteristic of aquifer, storage capacity etc. The increase of ground water can be achieved by infiltration of rainfall, recharge by seepage, surface flow etc. With the increasing use of ground water for agricultural, municipal, industrial needs, the annual extraction of groundwater are far in excess of net average recharge from natural sources. The groundwater level fluctuation is controlled by recharge and draft of groundwater and the diverse influences on groundwater levels include meteorology, tidal phenomena, urbanization, earth- quakes and external loads Stress and strain in water level due to groundwater recharge, discharge and intensity of rainfall are reflected in groundwater level fluctuation with time. The lowering of groundwater levels has resulted in reduction in individual well yield, growth in well population, failure of bore wells, drying up of dug wells and increase in power consumption. The pre and post monsoon water levels indicate the degree of saturation in aquifer. Rainfall is the main source of recharge and the aquifers get saturated by infiltration process. The recharging conditions also vary according to the topography [3].

Objective: To study the trend of groundwater level and rainfall effect on groundwater level.

II.STUDY AREA

Location of Machchu-1 dam is on river Machchu near a Jalsika villagein Wakaner of Rajkot District, the distance is 57 km from the source of the river. The Wankanertownlies 22 km down-stream of Machhul dam. The Completion of Machchu-I damwas in the year 1958, the dam site catchment area is up to 735 km^2.The projected gross and live storage capacities of the dam are 72.7 Mm^3 and 70.8 Mm^3 respectively with FRL at 135.35 m[1].

TheMachchu-I dam has been designed as a reservoir impounding water for the purpose of irrigation.The command area of the task rests on the left bank of River Machhu in Wankaner and Morbi talks of Rajkot district. The cultivable command area is 104.09 Mm^2 and the gross command area of this project is 182.18 Mm^2.The whole of the catchment area gradually rises towards the source in the north eastern direction, i.e., Mandva hills from where the river holds its source.Away of the 735 km^2 of the catchment area at the dam site, 36.3 km2 have already been intercepted by a tank at area, 35.4 km upstream of the dam site.The reservoir is preconceived to provide irrigation water all the year round.Hence, a preparation for the evaporation and absorption losses that take place in the reservoir throughout the year has been caused. The spillway of the damwas designed to pass a flood of 2,595 cumecs with HFL at 137.46 m. In the river portion with water cushion a seller ended the fall weir of 487.68 m has been provided[].

2.2 Data Collection of Machchhu1 reservoirs.

Machchu-I reservoir Basin Map and data of the village were collected from *GWSSB-Gandhinagar and GWRDC- Rajkot.* Data required are annual rainfall, Ground water levels, Well location (latitude & longitude) of Machchhu-I reservoir.

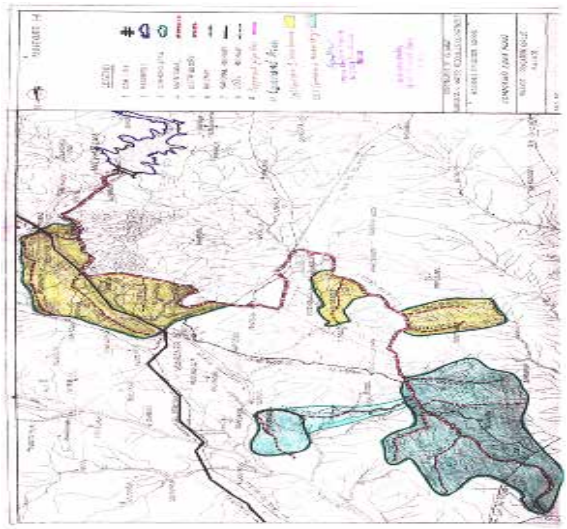

Fig.1 -Study area map of machchhu1 reservoir
Source: GWSSB (irrigation dept.) - Morbi.

III. METHODOLOGY

Pre-monsoon and Post-monsoon water level data of a number of wells have been collected from the GWRDC office-from the year 1978 to 2012 at an interval of 2-years. The annual rainfall data is collected From the GWSSB - Gandhinagar office. The study and analyses of seasonal groundwater fluctuation are done and established its relationship with rainfall[2].

Pre and post monsoonwater level graphshave found out fora period of 1978 to 2012.To analysis of water level for pre-monsoon & post-monsoon with reference to rainfall. Using Surfer 3-D, Water level contour map of pre and post-monsoon water level is prepared.

IV. RESULT AND DISCUSSION

The result obtained using surfer software shows increment on ground water level, pre and post monsoon graph shows water table is increase and decrease with reference of time. In the study area under Ground water level of different range, the variations are very less. Ground water levels have been plotted in form of contours in different ranges up to 115 m, indicated by different colours. It is interesting to note that redcolour zone which is of second number in hierarchy of reduced ground water levels, is showing maximum variation over the period of study. This is followed by yellow coloured zone. Lowest ground water level regions shows minimum variation these are indicated by green, light blue and dark blue colurs.

The plot of surfer map gives variation of GWT on yearly basis. There is lowest ground water table at Well No- RK011 as compared to all wells. RK-014 and RK-021 has high water table as compare other well; their comparison with nearer well RK-020 and RK-29 also have low ground water table. The 2-D maps water table scale shows minor variation, when correlating with pre-monsoon to post-monsoon.The difference of pre and post monsoon ground water levels although shows steady values in initial years 1978-81 and invers variation in 1995-96, 2003-04, 2005-06 and 2010-11by enlarge the overall variation follows similar trend. The graph of pre and post monsoon water levels with comparison of rainfall shown in Fig. 9.

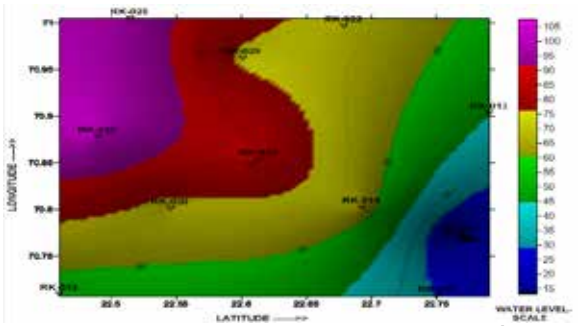

Fig.3- Groundwater Level 2-d contour May-1989(Sample graph

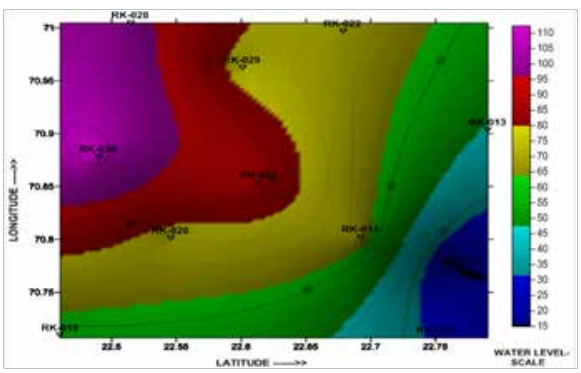

Fig.4Groond water level 2-D contour map Oct-1989(Sample graph)

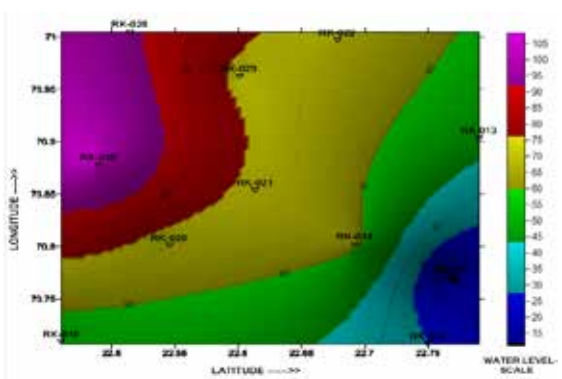

Fig.5- Groond water level 2-D contour map may-1992(Sample graph)

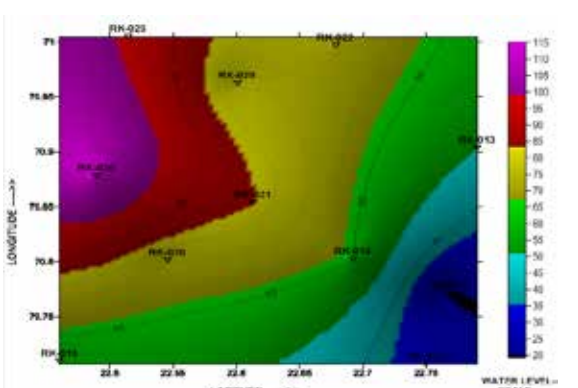

Fig.6- Groond water level 2-D contour map oct-1992(Sample graph)

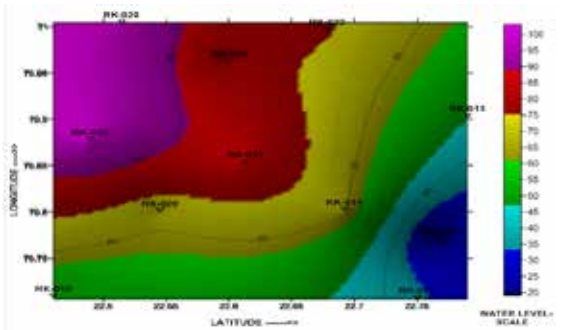

Fig.7- Groond water level 2-D contour map may-2008(Sample graph)

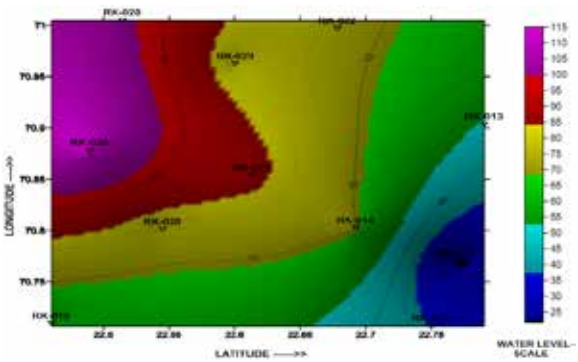

Fig.8- Groond water level 2-D contour map oct-2008(Sample graph)

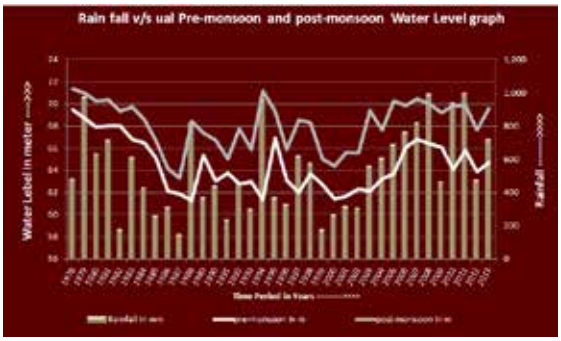

Fig.9-Rain Fall v/s annual Pre-monsoon and post-monsoon graph.

V. CONCLUSION

The study area is semiarid region with average rainfall around 500mm which is scattered distributed, amongst 35 years studied 7 years were having heavy rainfall and 6 years were having extremely less rainfall; majority of 22years were having annual rainfall of average magnitude. From the time series plot of pre and post monsoon GWL it is clear that the changes in ground water level follows almost similar trend of variation of rainfall. Mapping of GWL shows that over the period of study, red colourzone which is of second number in hierarchy of reduced ground water levels, is showing maximum variation followed by yellow coloured zone. Lowest ground water level regions (indicated by green, light blue and dark blue colurs) shows minimum variation.

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