International Research Journal of Natural and Applied Sciences
ISSN: (2349-4077)
Impact Factor 5.46 Volume 7, Issue 02, February 2020
Website- www.aarf.asia, Email : editoraarf@gmail.com

A STUDY USING REMOTE SENSING AND GIS TECHNIQUES FOR GROUNDWATER SUPPLIES IN WESTERN INDIAN RIVER BASINS

[1]Devendra Kumar Singh, [2] Dr. Dahiwale Bhausahed Jagnnath

[1] Research Scholar of OPJS University, Churu, Rajasthan

[2]Associate Professor, OPJS University, Churu, Rajasthan

ABSTRACT

The main goal of the assessment is to represent potential groundwater areas. Groundwater is typically found in shallow debris and eroded bedrock because to the presence of a crystalline storm cellar in the area. Similarly, given the modest and continuing fall in water levels, as well as the haphazard exploitation of groundwater by drilling burrowed cum bore wells, it is unusual to have a thorough understanding of the hydro geological conditions that correlate to the area's groundwater potential. In locations with similar climate and terrain, such as the Western Indian River Basins, where genuine water causes non-appearance, the approach works similarly.

Keywords: groundwater potential, exploitation, water levels, river basins

INTRODUCTION

Groundwater, as we all know, is a significant source of water in the globe, and its use in water systems, industry, towns, and residential areas continue to expand. As a result, a greater emphasis is put on the anticipated and effective use of water resources. Surface water resources are unevenly distributed, as seen by asymmetrical rainfall circulation in both truth and fiction. As a consequence, there has been a greater emphasis on the expansion of groundwater resources. The simultaneous generation of groundwater, especially via burrowed wells and shallow cylinder wells, will lower the water level. In such a condition, a serious issue arises, with shallow wells drying up and the syphoning head for deeper wells and cylinder wells increasing. As a result, it is critical to produce water resources in a planned and efficient manner. A suitable water supply system must be established with planning based on the interconnection of surface and groundwater. The important task here will be to conduct a realistic evaluation of surface and groundwater resources and then arrange their usage to avoid excessive groundwater table depletion while meeting maximum harvest water needs. In a condition of dynamic equilibrium, the supply of groundwater must be sustained for a period of time, and changes in the water level must be kept within a particular range during rainstorms and monsoon seasons.

GROUNDWATER OCCURRENCE

Groundwater may be found in cracks, holes, and hard shakes that are connected together in the hard rock overlaying area. The surviving zone varies in thickness from location to place. It all depends on the geology and how long it lasts. The geology, structure, attitude, and geometry of the subsurface skyline affect the occurrence, creation, and availability of groundwater, which varies from one stone arrangement to another, location to place, and at various depths. The quantitative characteristics that regulate groundwater include surface geology, landforms, infiltration, energy systems, subsurface geological and geohydrological settings, and hydro-meteorological conditions. The investigation area includes granitic gneisses of varied origins, stones, late rites, dykes, quartz gravels, and pegmatite interruptions. The groundwater holding these stones in prolonged zones frames water wellsprings for families, agriculture, and businesses in this area, which has a tropical or subtropical environment.

WELLSPRING OF GROUNDWATER

Rainfall is the only source of groundwater. Rainfall falls on the field, some of it evaporates, some of it percolates into the soil as surface overflow, and some of it and more runs to energise the groundwater storing in the lasting and fractured sections of rocks. Groundwater events and development are restricted and monitored by the environment, which enables only a tiny portion of rainfall to provide energy to the groundwater, and the geological state.

Groundwater may be found in the enduring zone and perhaps in the cracked zone under semi-confined or unconfined conditions, depending on the status of the water table.

The existence and development of groundwater in hard rock locations is often difficult. A water-bearing resource made up of many sorts of rock. The presence and dispersion of groundwater varies depending on the rock type, structures, landforms, lithology, and energy conditions. Groundwater occurrences in granitic strata that have been experienced and cracked are exceedingly localized and may not be cohesive (Davis and Dewiest, 1966). Joint fractures and other structural features are important for groundwater circulation. The stone shapes are normally accepted to a depth of around 30 m in the inquiry area. Below the lasting field is the broken stone that lies beneath the massive bed rock. Groundwater occurs in enduring and fragmented regions under unconfined and semi-confined settings.

Groundwater occurrence and hydrological parameter conduct in the study region are complicated and may change based on the hydrological circumstances at a short separation. The granitic and fractured layers are two distinct springs that have no link to one another (Radhakrishna, 1970). Groundwater output is regulated by lineaments, dolerite dykes, and quartz reefs. The lines act as conductors for the creation of groundwater. Groundwater production is hampered by dykes and quartz reefs. The yield of wells in this area is determined by sustaining force and joint separation.

2. FLUCTUATION IN THE LEVEL OF THE GROUNDWATER

The major cause of groundwater level fluctuation is anthropogenic; it is well known that removing groundwater from a spring causes a drop in water level, resulting in a cone of sadness, which is dependent on the spring hydrodynamic characteristics and geometry, among other factors. The fluctuation of groundwater in coastal springs is known to be influenced by sea tides (Marechal et al., 2002).

From 2001 to 2012, the typical water level in the investigated area fluctuated between 20.02 m bgl for premonsoons and 19.75 m bgl for postmonsoons. There are 16 observatory wells in the investigation field, the equivalent of which is managed by CGWB and the Department of Mines and Geology. These wells are seen many times during the year, in May (premonsoon), August, November (post monsoon), and January. The hydrographs' pattern lines indicate that the premonsoon water level drops and the postmonsoon water level rises. Natural water level changes are larger in the northern (Nandi Hills) and southern (Kannamagala) sections of the investigation area, and lower in the southern (Adugodi, Jayanagar, etc.) and center (Devanahalli) regions . The groundwater flow design is based on the topography slopes.

3. **EVALUATION SCALES FOR WATER RESOURCES**

In most cases, an accurate estimate of water supplies includes a rigorous traverse that can be measured with absolute certainty or assumed to be zero in both surface water and groundwater streams. The watershed of adjoining stream bowls to the sea outlet would be the longest measurement distance for a waterway bowl. In any case, experiments in the smaller sub-bowl regions will be carried out for this purpose. In any case, ongoing vigilance is essential when defining watershed limits, especially in geographic areas with large groundwater streams, since the degree of springs does not, of course, connect to bowl boundaries.

The main steps in completing the development of water supplies are shown in Figure 2. The key stage in every WRA to determine which of the procedures in Figure 2.1 prevails should be a substantial level catchment audit and should be focused on subsequent audits in this way. It is clear that this early assessment should be reviewed and replicated throughout the process to ensure that, in the light of aggregate knowledge and attempted breakdowns, the underlying assumptions are still valid.

The next stage is a large social reward and a collection of later hydrological data relevant to the target area reported and reported (e.g. catchment, stream bowl, groundwater system). This will involve precipitation, dispersion, waterway stream, surface stockpiling, groundwater and soil sogginess, and where possible, snowfields and ice masses.

Similarly, it is necessary to group and map sweeping subtleties in good systems on the physiographical characteristics of the bowl along with appropriate monetary and water-use details.

An summary to clarify the main relationships in the catchment and to confirm the core characteristics of both the current minute and the long-haul water balance is the following advance, gathering each of the subtleties. Typically, this would prompt the development of some sort of model, which may be a reasonably straightforward model of water balance month-to-month, but may be a much more complicated model, which ensures that countless enormous water changes within the catchment are reflected.

Any water quality evaluation should include them as well. After gaining a full grasp of how the catchment and its basic interactions work, this knowledge might be used to analyzing the bowl's display of water quality by implementing long-term awareness action courses. By merging long-haul records based on the present environment, it is possible to evaluate realistic predictions, such as return times and possibilities for distinct drought cycles and levels, even if the precise data structures that would cause them did not really occur throughout record time. These lengthy term plans might then be balanced to look at all parts of water supplies that affect future change, utilizing the most up-to-date information of how to modify the environment and diverse elements in the future.

4. IRRIGATION

The amount of water utilized in water systems is determined by the area being drained, the crops being produced, the trimming designs, the meteorological circumstances, and the kind of water system construction. Climate change and generational pressures may lead to greater interest, therefore extensions to watered areas will need to be assessed. Future changes in yield or processes are difficult to predict, but predictions should be included into future water supply. Changes in the atmosphere that affect precipitation or evapotranspiration should be considered when assessing water resources. It may be possible to comprehend ever more powerful water system frameworks wherever water is expected to grow scarcer or more pricey. For example, inefficient growing water frameworks are going to be replaced by progressively distinctive water applications and lowered frameworks for stream water frameworks. In the long run, closely regulated hydroponic systems in high water pressure places might be developed to reduce water usage per generating unit.

5. AGRICUTURE

Agriculture is thought to account for 70–80 percent of world water use. Varying crops and forms of agriculture would have different evapotranspiration rates and water demand levels as a result. many instances of water needs for various yields.

Serious stock leveling will need a greater amount of water than minor nibbling, and the move from grassland to arable land will almost always increase water requirement. Furthermore, the rate of overflow and penetration may be affected by different growth practices.

The usage of fertilizers and pesticides across the board has an impact on the uniformity of surface overflow from agricultural land and groundwater quality. Water is utilized to either replenish or poison excess. Water variations in the Missouri and Arkansas River basins that need different harvests from downstream tests may become unfit for most uses or may only be useable after extremely expensive treatment.

6. WATERSHED PRIORITIZATION

Prioritization of any watershed relies on its precise delineation and plays an important role in deciding the directions of stream flow and the areas that contribute. It is important to measure the compound parameter values and also rate them for sub watershed prioritization. The first priority will be given to the sub watershed with the lowest compound parameter value. The lowest value means that the region is subjected to possibility of further soil erosion, so that the appropriate soil conservative steps have to be taken (Umair Ali &Syed Ahmad Ali 2014).

The prioritization of the North Pennar Basin sub-watersheds with an integrated approach using Remote Sensing, GIS and socio-economic data was analysed by Srinivasa Vittala et al. (2008). The study covers an area of 570 km2 that forms part of the hard rock terrain in the Pavagada area, Tumkur District, Karnataka, and a small portion in Ananthpur District, Andhra Pradesh, India. The drainage network displays a dendritic to sub-dendritic pattern, and in nature it is non-perennial. In conjunction with the rise in groundwater exploitation, recurrent drought contributes to a decrease in the level of groundwater. Prioritization on the basis of accessible natural resources derived from satellite images and socio-economic conditions has been taken up in the sub-watershed study area. The sub watersheds were grouped into three groups, such as high, medium and low, on the basis of the importance and weighting assigned to each thematic map. The results of the prioritization show that the sub watersheds of Nagalamadike, Maddalenahalli and Dalavayihalli rate the highest on the basis of weighting and are considered to be of high importance. These sub-watersheds can be taken up immediately with creation and management strategies for the protection of natural resources on a sustainable basis, eventually contributing to soil and water conservation.

4. FINDINGS

Agriculture

In the technological industry, farming is a crucial function. Because of the monsoonal climatic circumstances and storm-supported cutting structure, a bigger amount of land under a single example collects throughout the Kharif (June-September) season. The northern areas of the review district (Kharif and Rabi, Oct-Feb) indicate a twofold yield pattern.

Woods The majority of the forest zones are found in the NW1, NW2, and EW watersheds, which are located in the northern and eastern parts of the research region. Degraded timberland includes areas described in the backwoods demonstration and lands with various types of forest spread with a vegetation spread of less than 10%. This category encompasses the majority of the timberland area. The Godavari hills are classified as wooded plantations.

Wasteland

Wasteland refers to degraded terrain that can be reclaimed with modest effort and replanted. These lands are now unprofitable owing to a variety of issues. The majority of the wastelands may be found in the north and northwest regions of the investigation area, beneath hilly districts.

Land that has been developed

This category comprises places with heavy land usage where engineered systems and avenues safeguard a large portion of the land. Residential, commercial, retail, transportation, communications, services, and entertainment are all included. In the present urban area research, Bangalore (SW2) and southern Bangalore, for example, have been considerably distinguished.

POTENTIAL ZONES FOR GROUNDWATER

On the basis of overlay testing, a groundwater map was created, which is separated into four territories: low to none, small to medium, moderate, and wide probable groundwater regions. Low potential areas are found in the examination zone's northern, western, and southeastern regions, whereas gneissic rocks are found at shallow depths. A crucial component of the research zone is referred to as a medium-potential district. Along the stream's course, high potential zones may be found in the northwest, southeast, and a few other locations where the overburden thickness is typically high. High and medium potential areas in the survey region are attractive organized regions for future groundwater study and development

CONCLUSION

The research on GIS and remote sensing were conducted. Landforms, lineaments, geology, slope, landuse/landcover, soil, and longitudinal conductance maps, among other topics, were developed with the help of the programming projects ArcGIS 9.3, ERDAS 9.2, and Map Info 10. In addition, all of the topical layers/parameters were systematically included in a continuous development in GIS condition, resulting in the delineation of the groundwater potential zone map for all of the watersheds.

The subject of groundwater science is discussed. More than a dozen distinct samples were collected in the examination region in both pre- and post-monsoon seasons from diverse places in the study area in order to better understand groundwater quality and diversity. Groundwater hardness, sodium hazards, residual sodium carbonate, list of base trade, and destructiveness ratio are some of the metrics that have been determined. Seasonal variations of iso-concentration maps have been prepared, and anomalous zones in GIS conditions for several chemical components have been demarked. The groundwater in the study region was evaluated using a variety of categorization schemes in order to determine its use for local, agricultural, and industrial reasons. Tables and graphs are used to present the findings.

The consequences on the environment are investigated. This is concerned with the examination of the origins and causes of groundwater contamination, as well as remedial approaches to address the issue. Overexploitation and the effects of a dry period are also discussed.

REFERENCES

1. Choubey, V. K. and Subramanian, V., (1992). "Estimation of suspended solids using Indian Remote Sensing Satellite-1A :A case study from Central India", Int1.Jou. Rem. Sen, vol.(13) No.8, pp 1473 - 1485.

2. Ghulam et al. (2004). "Satellite remote sensing of groundwater: quantitative modelling and uncertainty reduction using 6S atmospheric simulations" Itl. Jou. Rem.Sensing, (25) No. 23, pp. 5509-5524.

3. Collier, C.G., (2000): Precipitation. Chapter in: Remote Sensing in Hydrology and Water Management (G.A. Schultz and T. Engman, eds). Springer Verlag, 111–132.

4. Goodison, B.E. and A.E. Walker, (1995): Canadian development and use of snow cover information from passive microwave satellite data. In: Passive Microwave Remote Sensing of Land-Atmosphere Interactions (B.J. Choudhury, Y.H. Kerr, E.G. Njoku and P. Pampaloni, eds). VSP, Utrecht, The Netherlands, 245–262.

5. Gyananath, G.; Islam, S.R.; Shewdikar, S.V, (2001). Assessment of Environmental Parameter on ground water quality. Indian Journal of Environmental Protection. 2001, 21, 289-294.

6. Renji Remesan and R.K Panda, (2008). Remote sensing and GIS application for groundwater quality and risk mapping. 3rd International Conference on Water Resources and Arid Environments and the 1st Arab Water Forum.

7. Dams et al. (2014). "Predicting land-use change and its impact on the groundwater system of the Kleine Nete catchment, Belgium", Hydrol. Earth Syst. Sci., (12) pp. 1369-1385.

8. Elbersen, G.W.W et al. (1988). "Small scale soil survey and automated land evaluation", ITC Journal 1988-1, pp 51— 59.

9. Kayak, K and lnana, S., (2002). "Enhancement facilities of SPOT XS imagery in remote sensing geology: an example from the Sivas Tertiary Basin (central Anatolia/Turkey)", Intliou. of Remote sensing, Vol.23, NO.4, pp 701 — 710.

10. Reddy et al. (2004a). GIS and Remote Sensing applications in prioritization of river sub-basins using morphometric and USLE parameters-A case study. Asian Journal ofGeoinformatics, 4(4): 35-48.

11. Chaudhury, B.J., 1997: Global pattern of potential evaporation calculated from the Penman-Monteith equation using satellite and assimilated data. Remote Sensing of the Environment, 61:64–81.