"Rejoining of Streams & Rainwater Harvesting in Javagal Hobli" (A case Study)

Chethan R[1], Sandeep C[2]
[1]*Assistant Professor, Civil department, KNS Institute of Technology, Bengalore-560064*
[2]*Student, civil department, KNS Institute of Technology, Bengalore-560064*

***Abstract*- Water is precious and most commonly used resources and is one of the important natural resources available on this earth. The civilization flourished around water ways and rivers. Increases in population have led to increase in water demand which has led to exploitation of water hence depleting the resources. Due to the lack of availability of surface and subsurface water for the domestic industrial and irrigational use. In our study we have considered Javagal Hobli in which 60 percent of the people depend on the rain water due to lack of availability of surface water . Hence in our study we have made an attempt to conserve surface and subsurface water by rain water harvesting and by joining minor order streams into major streams or water bodies, which will recharge the ground water. From this overall water usage efficiency is increased.**

I. INTRODUCTION

Water is vital for human beings, animals and plants and one of the most important natural resources. Groundwater is the most wide spread and highly used resource. The rapid growth in population and further developmental activities has increased demand for water for domestic, industrial and irrigational needs. The continuous failure of monsoons and declining ground water levels call for immediate attention for augmentation of ground water resources. The occurrence and movement of ground water in a hard rock terrain (Karnataka) like crystalline rock formations is restricted to the zones of secondary porosity, which calls for adopting suitable techniques for mapping ground water prospective zones and suggest appropriate developmental plans. Many methods are being adopted to collect the basic data, which help to draw suitable action plan packages towards developmental activities. The details on lithology, lithologic contact zones, structures, landforms, drainage network, etc. form the most important basic data for exploration and exploitation of ground water resources. The geo-informatic technique which includes satellites, remote sensing and Geographic Information System plays an important role in exploration and exploitation of ground water. Satellite remote sensing techniques has become the most efficient tool for mapping of geological, structural and landform details due to its capability of synoptic coverage, availability of data in different spectral and spatial resolution with repetitive coverage. Geographic Information System (GIS) helps in integrating various spatial data derived from remote sensing technique as well as from field methods and narrow down the suitable areas for ground water development and management. The quality of groundwater varies as the occurrence and movement of the same is controlled by local lithologies as well as the path through which the water has moved. Hence the study of water-rock interaction plays significant role in understanding and managing the existing resources.

In the present study the potential rain water harvesting as been estimated. This is related to the demand and supply of water in the village whether the harvesting water can reduce the gap between two. There are no limit on use of ground water which is almost equivalent to be free and hence it is tapped as and when is required in desired quantity.

II.OBJECTIVES

- Preparation of different thematic maps which are controlling factors for groundwater occurrence using remote sensing technique supported by data collected through conventional methods.
- Quantification of water demand required by the users in the Javagal village and Identification of potential site for rain water harvesting.
- Augmentation of ground water table in the study area by roof Water harvesting methods.

- Study of geological characteristics of the study area to augment the existing water supply and to cut down the water supply cost.
- Approaching different methods to rejoining the minor streams into major one or Reservoirs.

III.METHODOLOGY FOLLOWED

- By basic surveying and investigation thematic maps are prepared for study area.
- Land use- Land cover, lithology, Landforms, Drinage networks, slope and Hydrological maps are prepared by using Arc View 3.2a, Map Info-7.5, ERDAS Imagine 8.7 software.
- A detailed qualitative and quantitative geomorphic study of the area will be carried out to relate the different geomorphic parameters with the hydro geological conditions.
- Available rainfall data will be collected and analyzed to understand the spatial and temporal variation of rainfall.
- Flow data of gauging stations in the basin will be collected and analyzed to calculate the major output from the basin.
- Water balance studies will be carried out to determine the quantity of groundwater availability.
- The seasonal water level fluctuations will be studied to prepare the ground water contour map.
- Ground water samples from different locations will be collected for chemical analysis.
- Principal component analysis (PCA) and factor analysis (F.A) will be applied to study the ground water chemistry and their geological controls.

A. Sources of Data and Research

Indian Remote Sensing satellite data, Survey of India topographical sheets, ground water samples, well inventory, published reports pertaining to the research work forms the basic data requirement for the study. The basic data available from Dept. of Mines and Geology, Government of Karnataka, CGWB, IMD, Bureau of Economics and Statistics; satellite data from KSRSAC / ISRO and toposheets from Survey of India will be obtained and will be used for the research work.

Season-wise water samples will be collected and chemical analysis will be carried out in the laboratory. The chemical data of water samples will be used to prepare the iso-contour maps which will not only show the water quality but also help to understand the rock-water interaction and weathering processes in the study area.

Detailed study towards assessment of groundwater condition of the study area will be attempted and based on the same ground water development and management strategies will be suggested.

B Rain water harvesting

- Collected the rainfall data for previous years from the Municipal Office, Hassan.
- Site Survey has been carried out to identify the potential roof top catchments areas.
- Measurement of roof top catchments areas and location of rain water pipes has been done.
- The potential rainwater quantity to be harvested is estimated.
- Assessment of the quality of rainwater harvested is done based on the analysis of rain water from selected samples.
- Integral planning of rooftop rainwater harvesting system for domestic purpose on entire SRSR Polytechnic campus is done.
- The basic elements of rooftop rainwater harvesting system are designed.

C. Rejoining of minor Streams into Major Streams or water reservoirs.

- Various Topographical sheets of the study area collected.
- Topographical studies are made to trace land use and land cover by using geological methods.
- Software to be used Arc GIS, CADD, Map info. To digitize the contour and water shed and land use areas.
- Field survey is carried out to understand the soil and topographical conditions of the area.
- Methodology adopted for Planning and Designing of water structures to divert water to the reservoir site.

D. BENEFITS OF RAIN WATER HARVESTING

- Environment friendly and easy approach for water requirements.

- Rainwater harvesting is an ideal solution for water requirements in areas having inadequate water resources.
- Increases ground water level.
- Reduces the runoff, which otherwise flood storm water drains.
- Reduces flooding of roads and low-lying areas.
- Reduces soil erosion.
- Cost effective and easy to maintain.

IV.DATA COLLECTION

A. Study Area.

The Javagal hobli is located about 49 km from the central part of Hassan town, it is one of the well know historical place located in Hassan and lies between 13° 13´ and 13° 33´ North latitudes and 76° 05´ and 76º 38´ East longitude, javagal hobli has a total area of 682.15 Sq. Km. The hobli which has 69 villages. The geographic area of the hobli of javgal is 684 square kilometers. The population is 50000 and the average rainfall is about 800 mm annually. Black Pepper, Potato, Paddy and Sugarcane are the major agricultural crops.

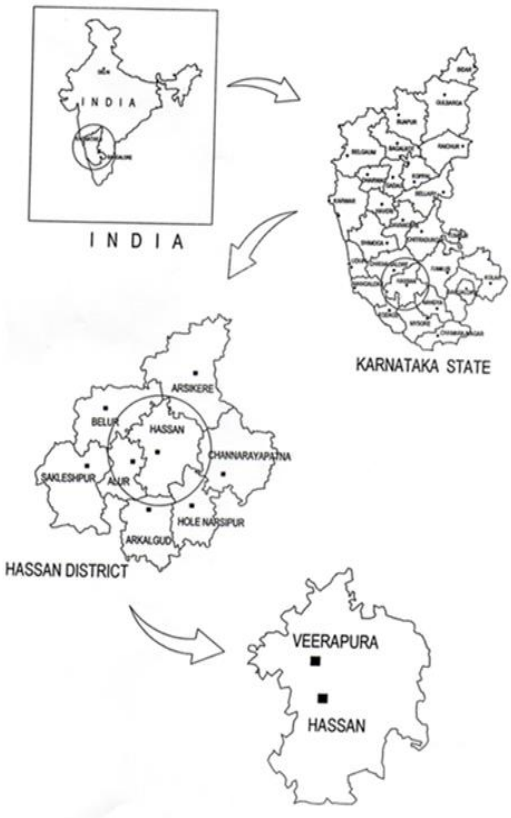


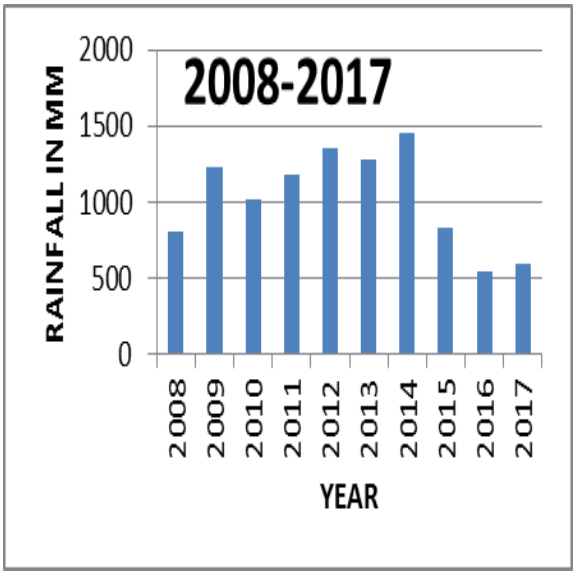
Fig. 1. Location Map of the Javagal Hobli.

B. Topography and Geology

Physiographically the study area consists of hilly terrain in the west and gently sloping topography in the east. Hassan District is covered by metamorphic and igneous rocks, viz., peninsular gneisses close pet granites and Bababudan group scheists. Red loamy, sandy and black mix red soil constitute crust zone. 8.9% of the geographical area is covered by forests. Geologically, the area mainly consists of rock types belonging to the Peninsular Gneissic Complex (PGC), Schistose rocks of Sargur group and Dharwar super group Younger intrusives (basic dykes) and in thin patches of Quaternary gravels. The Schistose rocks occupy the NW to SE in the central portion of the area. Granites and granitic gneisses occupy the North and Southern part of the area.

C. Rain fall data

The rainfall data is collected from the Municipal Office, Hassan. Also visited the rain gauge stations located in Javagal Hobli. Recorded the rain fall data for current year by visiting the rain gauge stations periodically. From our observations concluded that the maximum rainfall was recorded 1400 mms in 2014 and the average annual rainfall is about 800 mm.



D. Land use and Land cover data.

The geographic area of the hobli of Javgal is 684 square kilometers. Out of 684 Square kilometers around 320 square kilometers area is under irrigation. But most of them are defended on rain water for irrigation purpose.

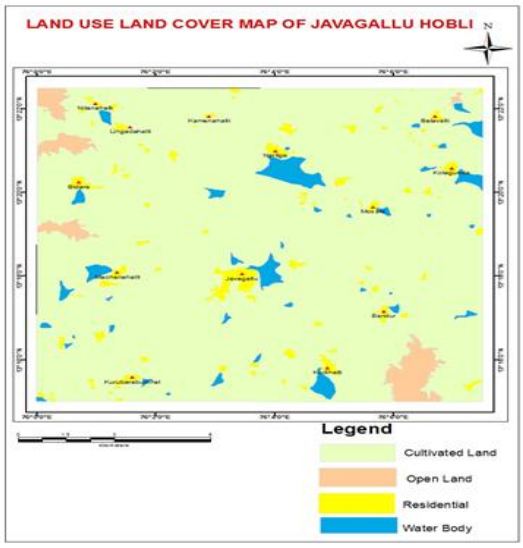


FIG 2 Land use land cover of the Javagal Hobli

V.PLANNING AND DESIGNING OF WATER HARVESTING STRUCTURES

A. Feasiblity system.

In order to increase the natural supply of ground water, we made an attempt to artificially recharge ground water basins. It includes augmenting the natural movement of the surface water into underground formation by some method of construction, by spreading of water, or by artificially changing natural conditions.

The initial step in planning and developing a rain water roof catchment system involves an appraisal of the feasibility of the system. To achieve feasibility of the system we carried the survey on technical feasibility, economical feasibility and social feasibility.

B. Recharge Pit.

By using various designing methods area is calculated to implementation of rain water harvesting.

A pit excavated into a permeable formation serves as an ideal facility for ground water recharge. Because the cost of excavation and removal of material is high, use of abandoned excavations, such as gravel pits, is most economic. And followed the below procedure for Construction.

- A well 1.5m diameter and 3m depth is dug around the bore.
- The well is lined cement rings as in the conventional system.
- The casing pipe is cut just above the gravel layer and the pump and casing pipe are removed.
- A section of the casing pipe, equal to the height of the V-wire screen is cut and the screen fitted to the pipe.
- The casing pipe with the V-wire screen is fitted back to the section of the casing pipe at the bottom of the well.
- A perforated reinforced concrete slab is placed at the level of the third ring from the top and then filled with sand, charcoal and crushed stone.
- The empty space between the third ring and the bottom allows the water to collect and also increase the pressure with which it enters the bore through the V-wire screen.

FIG 3 Constructed Recharge fit at SVSR Building.

Rejoining of minor streams into major streams/reservoirs.

The experiment involved excavation of trenches and divert rainwater from minor streams to the reservoirs or lakes in a watershed.

To encourage insitu harvesting of rainwater for promotion of sustainable dry land farming systems following activities are undertaken.

Preliminary survey is carried out to understand the actual slope of the Javagal watershed; same thing was analyzed with contour map which is derived from the toposheet.

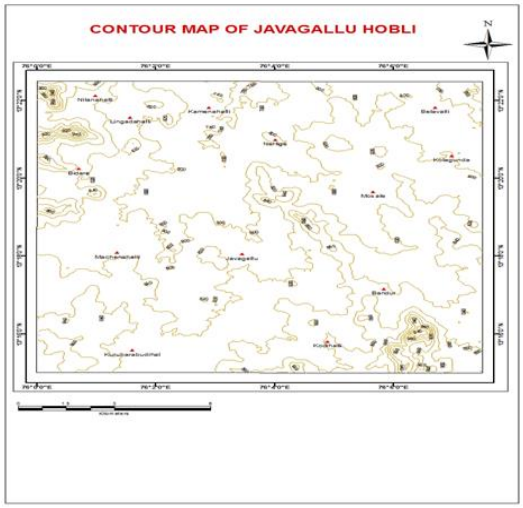


FIG 4 Slope map of the Javagal Hobli.

For our project work watershed map is very essential thing. To determine actual stream length, density, basin area we delineated the toposheet Using ARC-GIS and Map-Info Software's.

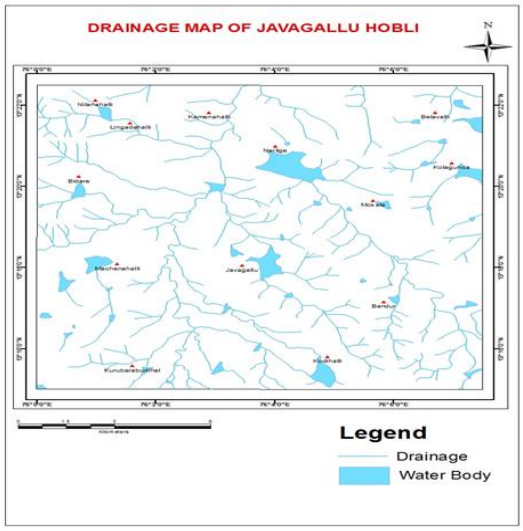


Fig. 5.Projected Drainage map of the Javagal Hobli.

Located the particular ponds for every two to three ha of catchment which were drain from lack of inlets and which are easily accessible for Irrigation. These ponds are located in such a way that the field trench act as conducting channels for excess water from each pond to be conducted to the next pond in the same contour.

Formation of trench cum bund across the slope. The trench cum bund formed helps to retain silt and water. It is joined to the located water reservoirs, Ponds and lakes. Once a pond is filled with rainwater the excess water flows to the next pond through the channels. Cautions are taken that the ponds are not lined with any impervious material. Instead the ponds are regularly desalted for encouraging maximum percolation. The trench cum bund formed is used for plantation of mixed species of forestry trees.

VII.CONCLUSION

Rejoining of minor streams into major streams/reservoirs. In the present study the potential of roof top rain water harvesting as been estimated. This is related to the demand and supply of water in the campus whether the harvesting water can reduce the gap between two. There are no limit on use of ground water which is almost equivalent to be free and hence it is tapped as and when is required in desired quantity. Though the need for rain water harvesting is not felt as much but for sustainability, the technique of rain water harvesting is needed. The harvested rain water would only substitute a small portion of the demand but it is essential.

- The rain water that can be harvested is calculated to be 900 m3 for 6 months from surface Area of 1544.12 m2.
- The area receives heavy rainfall (1450 mm) therefore the roof water harvesting can be made with ease.
- Based on available roof water, pump capacity and pipe diameter, storage tank and filter design has been made.
- To recharge the ground water table recharge pit method, well recharge method and point recharge structures for bore well has been proposed.

VIII.ACKNOWLEDGMENT

The completion of this undertaking could not have been possible without the participation and assistance of so many people whose names may not all be enumerated. Their contributions are sincerely appreciated and gratefully acknowledged. However, I would like to express their deep appreciation and indebtedness.

Mrs. Sudha PS, HOD of Civil dept, KNSIT for their endless support, kind and understanding spirit during the work.

To all my colleagues, friends and others who in one way or another shared their support, either morally, financially and physically, thank you.
Above all, to the great almighty, the author of knowledge and wisdom, for his countless love.

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