

Assessment of the Status of Traditional Water Harvesting Systems (Kalyanis) in Suvarnamukhi Watershed, Tumkur District, Karnataka State Using Geospatial Technologies

Vijay UT and Usha N Murthy*

Department of Environmental Engineering, UVCE, Bangalore, Karnataka, India.

Research Article**Corresponding author***ABSTRACT**

The main objective of this paper is to ascertain the geo-hydrological and physical status of Kalyanis, the traditional water harvesting structures, which used to store rain water for domestic use in various villages comes under Suvarnamukhi watershed area of Tumkur District. Most of the Kalyanis have become dry and dump yards resulting into the decline in their potentials. In the context of the relevance of fostering Traditional Water Harvesting systems (TWHS), the assessment of existing these structures and revival is essential to enhance the storage capacity to address the water scarcity facing by an ever growing population. In most of the taluks in Tumkur district the ground water level has dropped to 700-800 feet. As the water level drops Fluoride contamination becomes greater. Fluoride contamination is found to be more in majority of the villages comes under this watershed region of the district. It is in this context, a detailed study has been undertaken to assess their physical, geo-hydrological status along with the assessment of water quality using Polysense Aqua sensor. The study concludes that, out of 40 Kalyanis selected for Survey, only 11 Kalyanis are in good condition and are under use. More than 18 Kalyanis are in bad condition without water. Around 5 Kalyanis are polluted with physical and chemical contaminants. Various scientific interventions have also been suggested to restore and rejuvenate these structures. The study would be a gateway for further exploration of surface and groundwater in the watershed area.

Keywords: Traditional Water Harvesting systems (TWHS), Geo-spatial technology, Rejuvenation, Polysense Aqua and Interventions

INTRODUCTION

Kalyanis are traditional tanks, which used to store rain water for domestic use such as drinking, bathing, washing. These are ponds paved with stones on the banks and gradually sloping towards the centre. The water is thus in contact with soil only for half its area. Kalyanis constructed near temples called Pushkaranis plays very important role in socio-religious and cultural activities of Indian tradition and as a storage reservoir to supply water for temples. Apart from the sanctity attached to them, these ponds helps to recharge the wells in and around the area. That was one of the reasons for the ancient rulers to allot funds for their maintenance.

Traditionally, where the rainfall was relatively low, every effort was made to retain all the water that fell on the ground through appropriate water retention and conservation strategies such as

Kalyanis, temple tanks and ponds. Traditionally, Kalyanis seem to have played three hydraulic roles:

- As a storage reservoir to store rain water for domestic use and as source of waters supply for houses and temples
 - As a storage, which acted as insurance against low rainfall periods and also recharges groundwater in the surrounding area,
 - As a flood control measure, preventing soil erosion and wastage of runoff water during the period of heavy rainfall, and
- As a device which was crucial to the overall eco-system.

Rampant exploitation of ground water, indiscriminate digging of bore wells and drying up of traditional water sources have led to a water crisis in this watershed area of Tumkur district. The water table is dipping a meter deeper with each passing year. On an average about 90% of rural population in the state is

dependent on ground water for their daily needs. According to Department of Mines and Geology, GOK around 85 taluks have been identified as ground water scarcity regions and Tumkur district is categorized as a dark zone in the state. It is in this context that the importance of Kalyanis, traditional water harvesting systems comes into play in the watershed area. Most of the Kalyanis have gone dry because of low rainfall and Ground water exploitation and also been neglected by the community.

OBJECTIVES

The primary objectives of this study are as follows:

- To survey and map the location of Kalyanis using GPS technology
- To create the digital database both spatial & non spatial database on various parameters and Geotag the present photographs using Geospatial technology.
- To Assess the present status and storage capacity
- To ascertain the water quality which involves the analysis of physio-chemical parameters of water quality for different uses
- To provide scientific remedial measures for rejuvenation based on its location, Physical status, quality and usage.

STUDY AREA

The study area Suvarnamukhi watershed is in Tumkur district, located in the eastern belt of the southern half of the Karnataka state. The average annual rainfall in the district is 687.9 mm. Shimsha, Jayamangali and Suvarnamukhi are the important rivers of the district. There are about 450 Kalyanis in Tumkur district and around 125 kalyanies located in the study area as per the data received from Panchayat raj institutions. Around 40 Kalyanis were visited and surveyed physically in the watershed area. The Suvarnamukhi watershed has an area of 3, 22,400 Hectares and has been divided into 629 micro-watersheds. It lies within the Tunga Bhadra sub basin under Krishna basin.

METHODOLOGY

As part of assessing the status of surface water bodies in the watershed area, attempts have been made to study the present physical status of all Kalyanis in the area. Field survey was under taken by physically inspecting all Kalyanis in the watershed area using GPS and other instruments. The following methodology has been adopted to map the geographical location of these water bodies in GIS environment.

- Collection of secondary data on location of Kalyanis in the study area from Panchayath raj Institutions

- Physical visit of Kalyanis in the study area and interacting with locals to get details
- Collecting the primary data of Kalyanis such as its location, Structure details, Physical status, water availability
- Surveying and Capturing the geographical location of Kalyanis using GPS
- Mapping the location of Kalyanis in GIS environment
- Creation of digital database on both spatial and non spatial data of the Kalyanis
- Geo-tagging of photographs using Geospatial technologies as shown in figure no.1&2
- Linking, integration and Superimposition of different layers for Analysis- Drainage, Soil, Land use/Land cover, etc as shown in Fig nos 3,4,5 and 6.
- Tested the water quality of Kalyanis where there is water using Poly sense Aqua developed IIT, Bombay which measures p^H , TDS, Nitrate, Electrical conductivity, Iron and fluorides.
- Analysed and categorized the Kalyanis based on their physical status, functionality, type of usage and water availability as shown in fig no.7
- Analysed and categorized the Kalyanis based on water quality parameters on p^H , TDS, Nitrate, Iron, EC and Fluoride as shown in fig no.8
- Scientific remedial measures have been suggested based on the results obtained on physical status, water storage capacity, water availability and water quality

DATA USED

- Topographical Maps: 1:50,000 scale maps prepared by the Survey of India were collected from State NRDMS Centre, KSCST, Bangalore.
- Surface water bodies map with Road network maps from Survey of India and PWD, Bangalore
- Thematic maps like Soil, Slope, Geology, LU/LC, Hydrogeomorphology and Administrative boundary maps from District NRDMS centre, ZP Tumkur and State NRDMS Centre, KSCST, IISc, Bangalore.
- Statistical data collected from DSO Office, Tumkur and District NRDMS centre, ZP Tumkur.
- Ground water data from Mines and Geology, GOK.

Fig .6. Kalyanis superimposed on Types of Soil

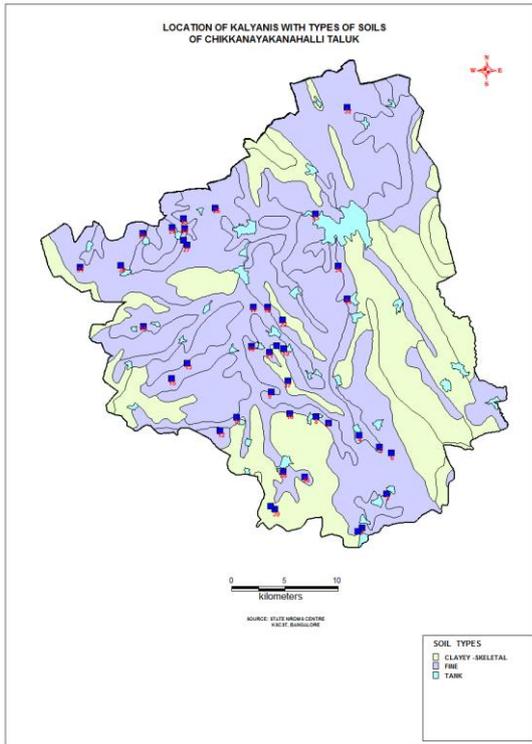


Fig .7. Physical status of Kalyanis

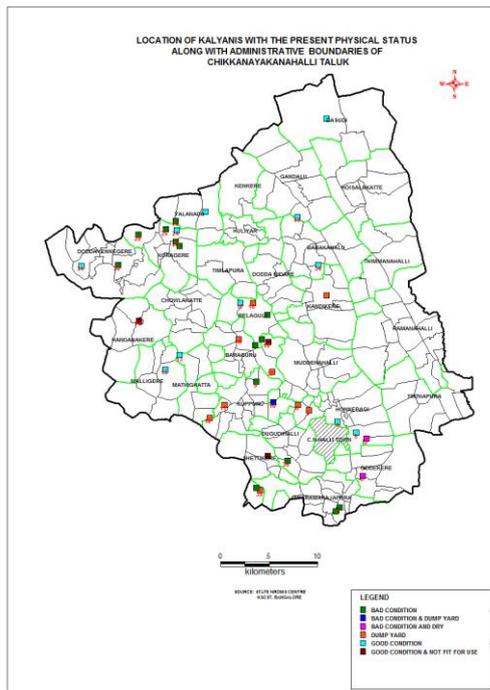


Fig .8. Distribution of pH

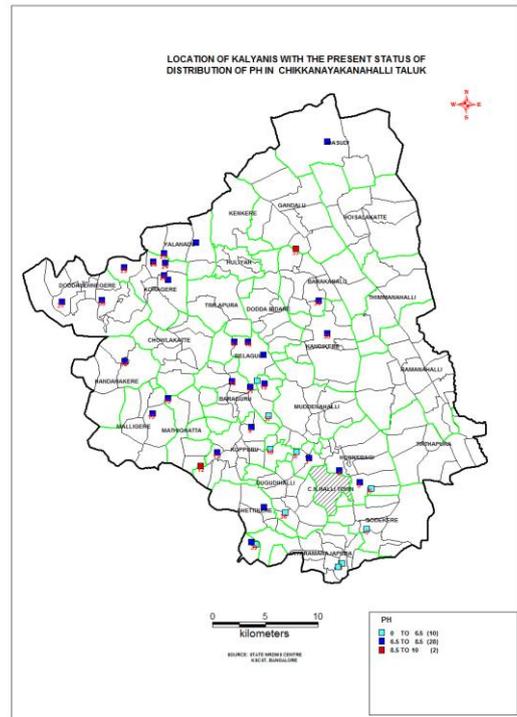


Fig.9: Physical survey of Kalyani



Fig.10: Water quality test using Polysense Aqua



RESULTS AND DISCUSSIONS

There are around 125 Kalyanis in the watershed area of which 40 major Kalyanis were selected for physical survey which are located in two different taluks namely Chikkanayakanahalli and Madugiri taluk comes under the watershed area.

The results obtained from this study are discussed in the following modules and the results of the Kalyanis obtained based on their physical status, functionality, type of usage and water availability along with water quality as per standards has been listed and shown in table no.1

PHYSICAL STATUS:

From the study it was found that, the status of more than 18 Kalyanis are really poor in both the taluks (Chikkanayakanahalli & Madugiri) and these Kalyanis are not properly maintained or cleaned periodically. More than 9 Kalyanis have become dump yard as they have been ignored by both community and Panchayath Raj Institutions. But there are few of the Kalyanis in Chikkanayakanahalli which are under proper use and maintained well. The water from these Kalyanis is mainly used for temple and domestic purpose as well as agriculture purpose.

STRUCTURE OF KALYANIS

From the study it was found that, the status and physical condition of the structure of these 18 Kalyanis is bad. Side walls have been collapsed, pitching of stones loosened and damaged. Most of the Kalyanis were built with stone pitching with gaps for water seepage and kept open the bottom for ground water percolation and seepage.

STATUS OF WATER & SILT DEPOSITION

It was found that, more than 10 Kalyanis are dry and there is no water in the body. It is also found that, all most all Kalyanis have been silted up and there is a need for desiltation of these structures.

WATER QUALITY

Water quality analysis for pH, Nitrate, EC, TDS, Iron and Fluoride parameters has been carried out for Kalyanis those having water and it was found that some kalyanis polluted with chemical components having more than permissible limits. The categorization has been carried out based on their status and shown in table no.2

The status of Kalyanis based on their physical condition, usage, water availability with quality have been categorized and listed and shown in table no.1

Table 1: Categorization of Kalyanis based on the status

No	Details of Observations/Analysis	No. of Kalyanis	Suggestions made
1	Bad Condition (side walls collapsed)	18	Restoration of side walls, Desilting, cleaning
2	Used as Dump yards	9	Cleaning, weed removal and de-silting
3	No water /Dry	10	Cleaning, de-silting and RWH
4	Good condition/ Under use	11	Cleaning and de-silting
5	Water quality - pH High (>8.5)	1	Add Buffer solution
6	Water quality - TDS High(>500 ppm)	3	Distillation, RO, De-ionization
7	Water quality - EC High(1000 µs/cm)	3	RO
8	Water quality - Nitrate High(>50 ppm)	2	Distillation, RO
9	Water quality - Iron High (>0.5 ppm)	3	De-ionization , RO
10	Water quality - Fluoride High(>1.5ppm)	3	De-fluoridation Units

CONCLUSIONS

From the survey and assessment it concludes that, out of 40 Kalyanis selected for Survey, only 11 Kalyanis are in good condition and are under use. More than 18 Kalyanis are not under use and they are

in bad condition without water and more than 5 Kalyanis are polluted with physical and chemical components having more than permissible limits which require proper measures for restoration.

Based on the conclusions drawn on the status of Kalyanis in the area, some of the following scientific remedial measures have been suggested based on their physical status and quality of water.

- Clean the inlet and outlet channels and bail out contaminated water
- Remove the weeds, Alga, garbage, bushes and slush formed in Kalyanis
- De-silting, spreading of clay and sand in the bottom of Kalyanis
- Repairing of steps, side walls, side pitching and parapet wall wherever necessary based on its physical status as mentioned in the table
- Rearing of fish in some Kalyanis to enhance the aquaculture
- Community should start using the water for domestic use, secondary purposes in order to avoid the stagnation of water in the body
- Regular maintenance and cleaning of the water body is important to realize the importance of traditional water harvesting system
- Since most of Kalyanis have become dry due to depletion of ground water table provision should be made to allow the runoff and surface water flow during rainy season to these water bodies
- Rain water harvesting system should be adopted to fill these water bodies
- Panchayath Raj Institutions and community should own up the Kalyanis for proper maintenance and security

REFERENCES

1. M.G.M. Delvi and C.V.Rangaswamy, "Ground water investigation in Madhugiri taluk, Tumkur District" Dept of Mines and Geology, GOK, Bangalore.
2. N.R.D.M.S Centre, "District Profile and Resource Atlas of Tumkur District" Zilla Panchayath, Tumkur.
3. Rural Development Department "Renovation of Traditional Village Ponds" Government of Tamil Nadu.
4. Madhavi Ganesan "The Temple Tanks of Madras city, India; Rehabilitation of Ancient Technique for multipurpose water storage" Centre of Water Resources, College of Engg, Guindy, Chennai, India.
5. B.K. Das, IAS, "Tumkur District Census handbook" Series 9 Karnataka-Director of census operations, Karnataka.
6. Centre for Water Resources 'Rehabilitation of an ancient technique for multipurpose water storage - The Temple tanks of Madras, India' College of Engineering, Chennai.
7. Keshab Das 'Traditional water harvesting for domestic use - Potential and Relevance of village ponds in Gujarat' Gujarat Institute of Development & Research, Ahmedabad.

8. K. Amaranarayana 'Ancient water harvesting system and its relevance today increasing ground water' - A success story of Chitradurga city.
9. Peter. A. Burrough and Rachael A. McDonald "Principles of Geographical Information System"