

EXECUTIVE SUMMARY

UGC-Major Research Project

Title of the project:

Spatial Modelling of Hydrodynamic Regime of Saline Ingress at Lower Chandragiri River Basin, Kasaragod, Kerala: Towards Water Security

NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR:

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UGC APPROVAL NO. AND DATE: **No: F.NO.-43-375/2014(SR) Dated: 07.09.2015**

DATE OF IMPLEMENTATION: **21-10-2016**

TENURE OF THE PROJECT: **Three years**

TOTAL GRANT ALLOCATED: **Rs. 9,03,000/-**

TOTAL GRANT RECEIVED: **Rs.8,65,000/-**

FINAL EXPENDITURE: **Rs. 8,67,214/-**

OBJECTIVES OF THE PROJECT

The project aims to enhance the understanding of water resources management in lower Chandragiri river basin to meet the challenges of water scarcity. The objectives of this major research project are:

- To determine the physical and chemical factors of water quality of aquifers,
- To evaluate the LU/LC (land use/ land cover),
- Appraisal of saltwater-freshwater interface,
- GIS based analysis of saline water ingress, and

- To recommend the suitable water management strategy to ensure the safe water resources

The objectives were achieved successfully.

To understand the extent and severity of saline ingress in lower Chandargiri river basin, systematic scientific analysis was conducted. Land use land cover mapping were carried out. Analysis of physical and chemical parameters of water quality were carried out to identify the extent of saline water ingress. Saline interface and its seasonal variations were carried out using electrical resistivity surveys. Such vulnerable locations and affected areas were delineated. In addition to this, seasonal water quality dynamics were also considered with the recommendation of appropriate water resource development practice suitable for the area of study.

ACHIEVEMENTS FROM THE PROJECT

The areas affected by saline intrusion were spatially demarcated so that the vulnerable areas can be protected from further deterioration in lower Chandragiri river basin. The outcome of the study is helpful in arriving at strong knowledge on the terrain characteristics of water resources, particularly groundwater of this heterogeneous terrain in the lower Chandragiri river basin. The results provided the knowledge about the extent of influence of salt water ingress and the interface with fresh water at lower Chandragiri river basin.

This information is very crucial for the stakeholders in the construction of mitigation measures like regulatory structures which will check the flow of salt water due to tidal influences in lower Chandragiri river basin. The results help all the stake holders including common public for following sustainable water resources management practice, particularly in the use of groundwater.

SUMMARY OF THE FINDINGS

Chandragiri River is the one among the major river in the Kasaragod district. The river is tidal for a length of about 16 km from the sea mouth. Major part of the river is draining through peninsular gneissic complex in the study area followed by sandy and silty deposits. Chandragiri river basin is the major source of domestic and irrigation

water for major part of the city regions of Kasaragod district. During the peaks of summer (March, April and May months), saline water intrusion is a major problem in the river valley aquifers till near the Bavikkara region. During these periods, entire city region is supplied with salinity rich water. This extension of salinity varies from place to place as per the experiences of residents. To understand the extent and severity of this issue, a systematic scientific analysis was taken up in this work.

Land use and land cover analysis was carried out. Identification of saline water interface at different points and its seasonal variations were attempted using electrical resistivity survey. In addition to this, seasonal water quality dynamics are also considered to propose systematic water resource development practice in the area.

Water samples were taken from 42 locations along 10 profiles across the river basin. Turbidity, pH, Electrical conductivity, Acidity, Alkalinity, Total hardness, Calcium, Magnesium, Chloride, Fluoride, Iron, Nitrate, Sulphate, Sodium, Potassium and Bicarbonate were measured in pre-monsoon (May) and post-monsoon (October) seasons for two consecutive years in 2017 and 2018. For example, it was found that, maximum concentration of pH, EC, TH, Ca^+ , Mg^+ , Na^+ , K^+ , CO_3 , HCO_3 , Cl^- , SO_4^{2-} , NO_3^- , F^- and TDS in post-monsoon to pre-monsoon ranges from 8.41,1230, 250,76,18, 6, 2, 122, 0, 170, 129, 45, 0.00, 947 to 7.79, 1025, 560, 182, 75, 8, 4, 122, 0, 996, 19, 50, 0.00, 947 respectively for the year 2017, where ionic concentrations were given in mg/litre. During the pre-monsoon time, increase in the concentration of Calcium, Magnesium, Sodium, Potassium and Chloride were observed which can be attributed to the saline water incursion in to the river basin, Observation wells close to river banks showed higher concentration of these parameters than the one which is located away from the bank in the profiles taken.

Vertical electrical soundings were carried out for pre and post monsoon seasons at 53 points located close to observations wells considered for water chemistry. By making use of Schlumberger's electrode configuration up to a depth of 100m, surveys were carried out. Vertical profiles at each point showed different geo-electric layers with different thickness at each point. Data collected during pre-monsoon season at the points close to river bank and sea showed resistivity values less than 10-ohm meter at many points signifying saline water ingress. During post-monsoon, this trend has shown a shift towards river and sea representing recharge of fresh water in the aquifer and pulling

back of saline water from the aquifer close to river. On comparison of pseudo cross-sections generated across the river on either side of the river clearly indicates the shift in saline water presence from close to river to far from river in pre and post-monsoon data respectively.

The findings are vital for the preparation best groundwater management practice in the lower basin of Chandragiri river basin.

CONTRIBUTION TO THE SOCIETY

The output of the research will provide practical solution which helps all the stakeholders to employ the methods that help to alleviate the concerns of saline ingress in the region to provide safe water in the lower Chandragiri river basin. The outcome of this project helps the public at large in this place, and enable them to follow the best water resources management strategy. Areas which are vulnerable for saline water ingress has been delineated. This help the public focus the safe zone for groundwater management. Further, the outcome of the study will help the concerned stake holders in identifying the locations suitable for constructing the structures for checking the influence of saline water in the lower Chandragiri river basin. Water quality and subsurface geoelectrical properties of this region helps for capacity building of groundwater characterization this region..