International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 9 No. 4 Dec. 2014, pp. 1818-1821
© 2014 Innovative Space of Scientific Research Journals
http://www.ijias.issr-journals.org/

IMPACT OF LINED/UNLINED CANAL ON GROUNDWATER RECHARGE IN THE LOWER BHAVANI BASIN

K. Mirudhula

Department of Civil Engineering,
Anna University, SNS College of Engineering,
Coimbatore, Tamil Nadu, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Bhavani basin is the fourth largest Sub Basin in the Cauvery basin. The entire command area of all three major canals that takes off from the Bhavani river falls within the Erode District i.e. Lower Bhavani Project (LBP), Kodiveri and Kalingarayan canals. The LBP canal is a major source of irrigation in Erode District. Many of these canals are unlined and leakage takes place from them. Thus the seepage from the canal helps in recharging the wells in the area, enabling to get adequate water supply for the crops when water was not released from Bhavanisagar Dam. In this study, the Groundwater recharge is determined by groundwater flow modeling using Visual MODFLOW model. For this purpose, three major natural sources of groundwater recharge are taken into consideration such as rainfall infiltration, canal seepage and return flow of irrigation. The model was run and ZONEBUDGET gives an idea about the amount of recharge from lined/unlined canal to the field. Unlined canal helps to recharge the groundwater about 20% more than the lined canal. The analysis reveals that the annual rainfall also has rapidly changed in this region. In the LBP canal Head reach meets their requirement with available quantity of water from the canal system. Tail end reach does not receive the required quantity of water because of seepage loss and conveyance loss. Hence the lined canal can be provided for full length of the main canal. Branch canals and minor distributaries are suggested to maintain the canals with unlined canal system.

KEYWORDS: Lower Bhavani basin, Erode, Groundwater flow modeling, Irrigation practice, Lined canal system.

1 INTRODUCTION

Reservoir is a natural or artificial place where water is collected in great amount and stored for use, especially for supplying a community, irrigating land, furnishing power, etc. Storage of water is released from the reservoir through canals for cultivation. Canals are man-made channels to divert or to distribute the available quantity of water to the farmlands. It is designed either lined canal or unlined canal. Lined canals and unlined canals both are manmade. The difference is that lined canal is lined with concrete, bricks or stone. Purpose is to avoid seepage of water through soil, where soil is made of sand. On the other hand unlined canal is used to recharge the ground water through the seepage. Groundwater is recharged from, and eventually flows to the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Hence the canal has an impact on the groundwater recharge.

Groundwater is underground water that completely fills the pores of an aquifer, following only by gravity forces. At present, groundwater is the major source of water supply for about half of the nations. Approximately 40% of the world's population uses groundwater and about 50% of the world's food production depends on irrigated agriculture linked to groundwater.

2 MATERIALS AND METHODS

2.1 STUDY AREA

The Bhavani basin is laid between 10°55’ N and 11°45’ N latitudes and 75°30’ E and 77°40’ E longitudes. The area is compressed of hilly regions and plain terrain with maximum and minimum altitudes of 1487 m and 215 m above mean sea level (MSL) respectively. The entire study area is situated in the state of Tamil Nadu spreading over the Erode District. The index map of the study area is shown in Fig 1.

The LBP Canal was originally designed for the ayacut area of 83.975 ha and the ayacut is spread over in Sathyamangalam, Gobi, Bhavani, Erode, Perundurai and Kangayam taluks. In addition to the above ayacut an extent of 1,012 hectare is also benefited in Karur district. The catchment area for this system is 4200 km^2. The main canal is having a length 124 miles irrigating a total ayacut of 83770 ha mostly lying in Gobi, Bhavani and Erode Taluk of Erode and Karur District. The main canal has three major distributaries taking off at 53 km, 101km and 119km, 69 distributaries, 196 minor distributaries and 118 sluices. Below the distributaries the water courses carry the water to the field channels, which directly irrigate lands. The canal is capable of carrying 2300 cusecs. This is the maximum required at peak period of irrigation. Irrigation period for ayacut under this scheme for the first turn is 15th August to 15th December, second turn 16th December to 15th March. The scheme contemplated dry crops. But the ayacut area under this system is prepared to raise paddy. In first turn, allowing supply of 24 TMC for wet crops is found to be optimal period for wet crops. In second turn for dry crops, with a total permissible quantity of 12 TMC water is supply

2.2 GROUNDWATER MODEL

A groundwater model was developed using geological and hydrogeological information obtained from PWD, WRD in Erode District. The numerical model was built using the software of Visual MODFLOW. The study area was discretized by a uniform quadratic grid size of 103000 x63000 by 1632.4 km^2. The boundary conditions for the model were: i) Bhavanisagar reservoir located in upper side of the topography used as constant head boundary ii) Bhavani river and Cauvery river, used as river boundaries and iii) LBP canal used as stream boundary. Groundwater recharge was estimated from the results of ZONEBUDGET. Data for the topography were obtained from Google Earth (Image LANDSAT), DATA SIO, NOAA, U.S., Navy, NGA, GEBCO.

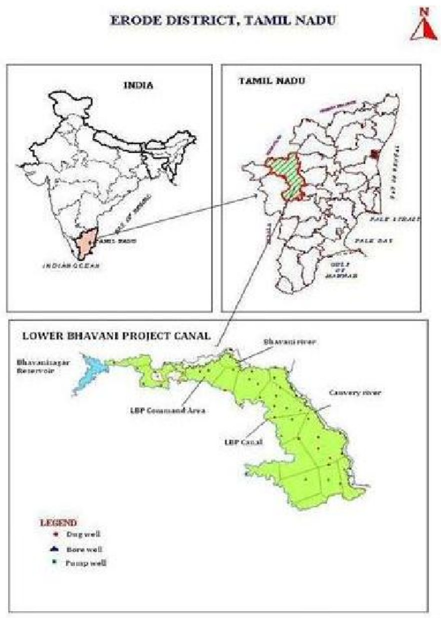

Fig 1. Study area of LBP canal

Totally 46 wells are located under the LBP command area. Out of 46 wells, 37 dug wells and 9 bore wells are selected and the details are collected from CWGB department in Erode. 46 wells are selected to calibrate the model by using Visual MODFLOW for 3 years. 6 layers are entered for 46 wells. 14 Pumping wells are selected and their details are entered in the model to find the recharge in command area. Using calibrated and validated model as well as pumping and recharge inputs, the results are attained as shown for LBP canal. Head calibration graph shown in Fig 2 & 3. Plot of observed vs. simulated values shows that they are in good agreement i.e., standard error of the estimates and correlation coefficients for the head and concentration are within the allowable limit.

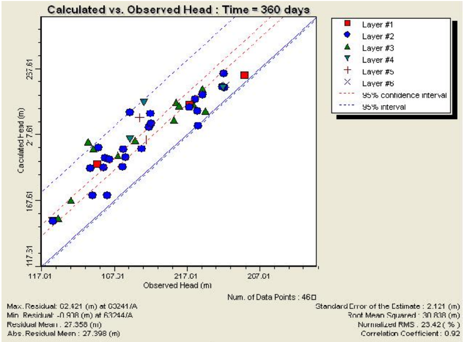

Fig 2. Head calibration for unlined canal

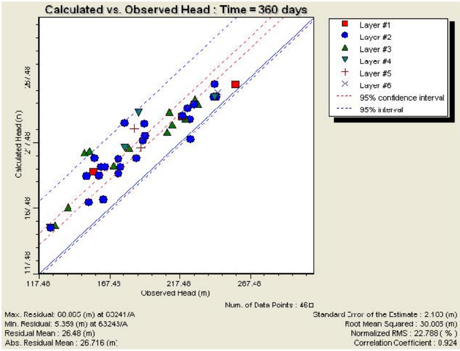

Fig 2. Head calibration for lined canal

3 RESULTS AND DISCUSSION

LBP canal is designed as an unlined canal. in the model domain it was assigned as a stream boundary. Due to the seepage loss groundwater recharged 39.54 % with the actual value of hydraulic conductivity of Erode District. When the canal is assumed to be a lined canal (by considering Concrete lining) seepage loss is arrested due to the cementing materials. The groundwater recharged 20 % by lined canal.

4 CONCLUSION

In the LBP canal Head reach meets their requirement with available quantity of water from the canal system. Tail end reach does not receiving the required quantity of water because of seepage loss and conveyance loss. The annual rainfall also rapidly changed in this region. Results are denoted that the unlined canal is one of the sources for groundwater recharge. Lined canal helps 20% lesser than the unlined canal for groundwater recharge. Hence the lined canal can be provided for full length of the main canal. Branch canals and minor distributaries are suggested to maintain the canals with unlined canal system. It can also helps to recharge the groundwater by diverting the water to the field. While suggesting the lined canal system, it can change the seasonal application and also it will increase the ayacut area in tail end reach.

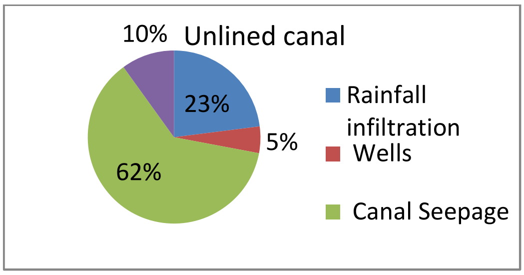

Fig 4. Contribution of groundwater recharge

REFERENCES

[1] M.Arshad, N.Ahmad, M.Usman and A.Sabbir, "*Comparison of water losses between unlined and lined watercources in Indus basin of Pakistan*" Journal of Agricultural Science – Pakistan.

[2] Fakhrealam and Rashid umar, "*Groundwater flow modelling of Hindon-Yamuna interfluves region Western Uttar Pradesh*", Journal geological society of India.

[3] A.G.Fernald and S.J.Guldan, "*Surface water-groundwater interactions between irrigation ditches, Alluvial aquifers and streams"* Fisheries science.

[4] F.E.Harvey and S.S.Sibray, "*Delineating ground water recharge from leaking irrigation canals only water chemistry and isotopes"* School of Natural resource sciences and conservation and survey division –Scottsbluff, Nebraska

[5] M.U.Igboekwe and Adindhuruth, "*Groundwater recharge through infiltration process: A case study of Umudlike, Southeastern Nigeria"* Journal of Water resource and protection – Nigeria

[6] Jose Luis Arumi, Diego river, Eduardo holzapfel, Peter Boochs, Max billib and Alexander fernald , "*Effect of the irrigation canal network on surface and groundwater interactions in the lower valley of the Cachapoal river, Chile*" Chilean journal of agricultural research – Chile.

[7] Kishansinghrawat, Anil kumarmishra and George paul, Rakeshkumar, "*Estimation of ground water resources in Shanergarh block of Allahabad (India) using remote sensing and statistical approach"* Global journal of science, engineering and technology-Allahabad

[8] Meijer, Karen and Boelee, Eline and Augustijn, Denie and Molenvander, Irna , "*Impacts of concrete lining canals on availability of water for domestic use in Southern Sri Lanka"* Elsevier Agricultural water management volume 83

[9] Mohammad Zare and Manfred Koch, "*3D Modeling of the effects of an irrigation/drainage network on ground water table fluctuations in the Miandarband plain, Iran"* Proceeding of 2013 IAHR World Congress

[10] Muhammad Arshad, Niaz Ahmad and M.Usmant, "*Simulating seepage from branch canal under crop, land and water relationship"* International journal of agriculture and biology- Pakistan

[11] G.N.Pradeepkumar and P.Srinivas, "*Estimation of ground water resources in a basin-a case study"* IGC – Hyderabad

[12] R.Rani and K.Elangovan, "*Impact of irrigation on groundwater case study: ParabikulamAliyar Project in Tamilnadu, India*" International journal of engineering research and applications – Kerala.