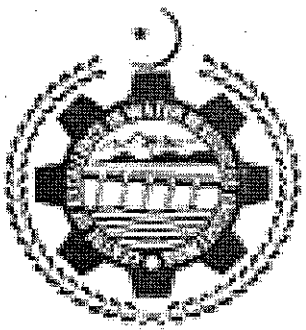
THESIS

ANALYSIS OF SEEPAGE PROBLEMS AND THEIR REMEDIAL MEASURES FOR LOWER GUGERA BRANCH CANAL (LGBC) FROM RD 13+000 TO RD 16+700



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2007-PG-WRE-16

For the Degree of

MASTER OF SCIENCE

IN

WATER RESOURCES ENGINEERING

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering and Technology, Lahore

2012

ABSTRACT

The Lower Chenab Canal (LCC) irrigates the land between Ravi and Chenab rivers. It was constructed in 1892 and originates from Khanki barrage. The Branch Canals off-taking from Lower Chenab Canal are the Jhang Branch, the Rakh Branch and the Lower Gugera Branch Canal. The Gugera Branch Canal irrigates Toba Tek Singh and Faisalabad Districts. It irrigates an area of 1.47 million acres (CCA) through a network of distributaries and minors. Water flows to the fields through outlet structures and the whole system works by gravity flow. The channels and the structures of Lower Gogera Branch canal are over stressed due to increasing demand of irrigation water. Deferred maintenance over a long period due to chronic paucity of funds has aggravated the situation.

The seepage through right bank of Lower Gugera Branch Canal increased from RD 13+000 to 16+700. In this area the crops were being damaged due to excessive seepage water. The minor problem was already there but its intensity had been increased since the construction of cross regulator at RD 16+500. There was no natural drainage of seeping water due to which underground water table raised up to the surface. This created water logged condition which adversely affected the crop yield and also created the environmental issues at site.

The main objectives of this study was to determine the causes of seepage from RD 13+000 to RD 16+700 and also to perform the seepage analysis of the problematic area by using SEEP/W. This study will be helpful in understanding the seepage problems of any selected reach. It will be utilized to minimize the loss of water and other issues related to seeping water.

Methodology adopted to find out the causes of seepage problem was collection of cross sectional drawings of canal of the study area. Peizometers were installed with the help of irrigation department. Peizometer readings were recorded at site. Phreatic line was established for the site. The samples for laboratory testing were collected from the site at four RDs i.e. 13+000, 15+800, 16+200, and 16+700. Permeability of soil was determined by laboratory testing. Flow lines and equipotential lines were drawn with the help of SEEP/W software. Ultimately flux through embankments was calculated.

During design of the canal embankments, it was considered that slope of HGL will not be flatter than 1 in 5 but installation of peizometers shows that the slope of HGL is 1 in 8. The observed slope of HGL is more flatter than it was actually designed. Grain size analysis shows that soil comprises of 12 % sand and 56% silt through which seepage is more as compared to clay contents. The bed level of canal is almost the same as of NSL outside the canal. It means canal is on fill material. From the study of L-section, it was clear that GWT is very near to the NSL and canal bed slope is 10000H: 1.4V.

Seepage analysis show that a heavy quantity of water seeps through the canal embankments and proper drainage is required. The phreatic line has been exposed as shown by peizometer installation as well as from the seepage analysis. The value of Gradient lies within the range of 0.4 to 0.5 which is less than critical value i.e 1. Therefore the embankments are safe and no risk of breaching. Flux is directly proportional to the Full Supply Level of the canal.

Proper drainage may be provided at site so that accumulated water could be drained off. The phreatic line should be covered at all points with an earth blanket, where it hits the NSL. In-place compaction of the canal banks and canal bottom can reduce the seepage flow considerably. The canal bank material can be improved by replacing soil contents to make it a well graded soil within the problematic area. An impermeable layer of clay can be provided in the embankment of the canal. Provision of geo-membrane in the canal bed can also be considered after financial implications.

Permeability test in the field should be performed so that more accurate value of soil permeability could be used for future studies. Bore holes for bore-logs study should be executed in the problematic area so that more informations regarding sub-soil strata be obtained from site and could be utilized in future. All the remedial measures are all theoretical solutions and separate studies should be carried out to evaluate each and every suggested solutions with respect to effectiveness and economical viability.