



M.Sc. Thesis

NUMERICAL SIMULATION FOR THE HYDRAULIC ANALYSIS OF
CANAL (A CASE STUDY OF SELECTED CANAL)



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ABSTRACT

Pakistan has one of the world's most effective irrigation systems which comprised of canal network. These canals are mostly unlined and are designed mainly either on Lacey or Kennedy design methodologies. Design of irrigation channel is based on the concept of non-silting, non-scouring approach, which is known as regime condition. The irrigation channel should be designed by considering the sediment concentration in the system and silt carrying capacity should be estimate by using the different sediment transport formulae.

Irrigation canals take water from rivers which carried varying amount silt throughout the year. If canal geometry is not properly designed, then flowing water can cause scouring or deposition of silt, which results in the form of canal capacity reduction. To maintain a canal system, heavy expenses are incurred to keep the canal in operative condition. Present study focused on the point that an unlined canal system should be designed which conveys water along with the associated silt so that at the end canal should be in regime after some period. Since from the construction till now, most of unlined canals are operational some of these canals are facing siltation and scouring problem. HEC-RAS was used for sediment simulation of Pakpattan canal.

Pakpattan canal would design for 6,594 cusecs it off takes from head regulator based on the right flank of Suleimanki Barrage. Pakpattan Canal irrigates Okara, Pakpattan, Vehari, and Lohdran districts of Punjab province. This canal is facing sedimentation problem at different reaches as the results, the canal efficiency is not up to the design criteria. The study was carried out to evaluate the regime of canal, sediment simulation and to assess the sediment carrying capacity of designed channel by using different sediment transport functions.

Hydraulic, sediment & hydrographic survey data was collected from International Sediment Research Institute of Pakistan (ISRIP) of Water and Power Development Authority (WAPDA).

Comparison of designed and existing parameters of Pakpatten canal showed that canal is not in regime conditions. Sediment deposition and degradation occurred quite unusually, and its ranges from minimum half feet to maximum two feet. There was quite less sediment deposition in some reaches while high scouring in most of the reaches. This situation for longer period can cause heavy damages to the canal prism & hydraulic structures. On the other hand HEC-RAS reveals 0.5 feet canal bed scoured.

Further, assessment of sediment carrying capacity was done by SHARC (Sediment & Hydraulic Analysis for Rehabilitation of Canals) model. Analysis showed that minimum 221 ppm and maximum 1847 ppm sediment concentration observed in Pakpattan canal. In Pakpattan canal 477 ppm average suspended sediment concentration was observed. Sediment concentration variation ranges from 16% to 91%, such high variation in sediment concentration is because of the heavy rain at time of observation and other flow conditions.