

THESIS

**EFFICIENCY OF EMPIRICAL EQUATIONS IN ASSESSING THE SEEPAGE  
LOSSES FROM CONCRETE LINED IRRIGATION CHANNELS**



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## ABSTRACT

Water is a very precious natural resource. There are two types of major resources of water in Pakistan, natural and engineered. Natural resources include rainfall, rivers, glaciers, ponds, lakes, streams and wells etc. whereas engineered resources consist of the storage and movement of the stored water from rainfall and rivers, stored in dams and reservoirs. The water from these dams and reservoirs is not only used for irrigation and supplying water for daily consumption, but also used for hydroelectric power generation. When this precious resource moves through the canals certain part of the water is lost by seepage, evaporation etc. The correct estimation of conveyance water losses from an irrigation system is vital for the proper management of the system.

Seepage is the most dominant process by which water is lost in the canals. Thus, for the effective operational planning and management of an irrigation system, a dependable forecasting of the seepage is very important. Seepage rates are obtainable either by direct measurement or by estimation. This study investigated the efficiency of the equations of Mortiz and Davis-Wilson in estimating the seepage losses of concrete lined canals in Pakistan.

The study was conducted at Lakhuana Distributary. It off takes from Rakh Branch Canal at RD 229+496/L, near Gatwala Park, Faisalabad having total length of 18.05 kms. Its authorized discharge at head is 132 cusec. Its tail is at RD 59+205. Total No. of outlets of the Lakhuana Distributary are 47. There are also 4 No Minors off taking from Lakhuana Distributary. Mohalwala Minor, Dhudi Minor, Muhammadwala Minor and Rurana Minor. Lakhuana Distributary has been concrete lined/side protected from Head to tail under the remodeling project. Lakhuana

Distributary irrigates 29608 acres area of 29 villages of District Faisalabad. Ground water of the area commanded by Lakhuana Distributary & System is mostly brackish and irrigators use canal water for cultivating their lands as well as drinking purpose.

Seepage losses of the concrete-lined trapezoid canals of the Lakhuana Distributary of Faisalabad zone irrigation system were measured by the inflow-outflow method and the results were compared with the estimates of seepage losses given by the use of Mortiz and Davis-Wilson equation. Results showed, seepage losses measured by inflow outflow method were  $2.29 \text{ ls}^{-1}\text{m}^{-2}$  for 1<sup>st</sup> reach,  $2.56 \text{ ls}^{-1}\text{m}^{-2}$  for 2<sup>nd</sup> reach,  $6.18 \text{ ls}^{-1}\text{m}^{-2}$  for 3<sup>rd</sup> reach,  $9.79 \text{ ls}^{-1}\text{m}^{-2}$  for 4<sup>th</sup> reach and  $16.88 \text{ ls}^{-1}\text{m}^{-2}$  for 5<sup>th</sup> reach of the main canal. And seepage losses of secondary channels measured by inflow outflow method were  $9.07 \text{ ls}^{-1}\text{m}^{-2}$  for Mohwala minor,  $23.66 \text{ ls}^{-1}\text{m}^{-2}$  for Dhuddi minor,  $5.98 \text{ ls}^{-1}\text{m}^{-2}$  for Muhammadwala minor and  $13.29 \text{ ls}^{-1}\text{m}^{-2}$  for Rurana minor. Actual seepage losses from the main canal reaches and the minor channels were higher than the standard value, like USBR observed  $0.00002 \text{ ls}^{-1}\text{m}^{-2}$  and Kraatz (1977) observed about  $0.0003 \text{ ls}^{-1}\text{m}^{-2}$ . Since the seepage losses estimated by the Mortiz and Davis-Wilson equations were lower than the measured values, the use of these empirical equations in the estimation of seepage losses is not applicable, and these equations should be modified before using for concrete lined channels.