

## Assessing the Channel Design of the Eco-Friendly 'Falaj' Water System in Meeting the Optimal Water Demand: A Case Study of Falaj Al-Khatmain, Sultanate of Oman

**Authors :** Omer Al-Kaabi, Ahmed Nasr, Abdullah Al-Ghafri, Mohammed Abdelfattah

**Abstract :** The Falaj system, derived from natural water sources, is a man-made canal system designed to supply communities of farmers with water for domestic and agricultural purposes. For thousands of years, Falaj has served communities by harnessing the force of gravity; it persists as a vital water management system in numerous regions across the Sultanate of Oman. Remarkably, predates the establishment of many fundamental hydraulic principles used today. Al-Khatmain Falaj, with its accessibility and historical significance spanning over 2000 years, was chosen as the focal point of this study. The research aimed to investigate the efficiency of Al-Khatmain Falaj in meeting specific water demands. The HEC-RAS model was utilized to visualize water flow dynamics within the Falaj channels, accompanied by graphical representations of pertinent variables. The application of HEC-RAS helped to measure different water flow scenarios within the channel, enabling a clear comparison with the demand area catchment. The cultivated land of Al-Khatmain is 723,124 m<sup>2</sup> and consists of 16,873 palm trees representing 91% of the total area and the remaining 9% is mixed types of trees counted 3,920 trees. The study revealed a total demand of 8,244 m<sup>3</sup> is required to irrigate the cultivated land. Through rigorous analysis, the study has proven that the Falaj system in Al-Khatmain operates with high efficiency, as the average annual water supply is 9676.8 m<sup>3</sup>/day. Additionally, the channel designed at 0.6m width x 0.3m height efficiently holds the optimal water supply, with an average flow depth of 0.21m. Also, the system includes an overflow drainage channel to mitigate floods and prevent crop damage based on seasonal requirements. This research holds promise for examining diverse hydrological conditions and devising effective strategies to manage scenarios of both high and low flow rates.

**Keywords :** Al-Khatmain, sustainability, Falaj, HEC-RAS, water management system

**Conference Title :** ICEMST 2024 : International Conference on Environmental Management, Science and Technology

**Conference Location :** Vienna, Austria

**Conference Dates :** June 20-21, 2024