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Assessment of River Training Plans Using MIKE11 Model (Case Study: Zarineh River in Shahindezh City Conjunction)

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Abstract

1-Introduction

River training, flood control projects and every changing of river geometry will change the morphology conditions of the river and hydraulic characteristics of the flow in the river. In fact, the goal of river training plans can be found on the basis of the initial energy equilibrium of the river. In this study, the impact of river training on the hydrodynamic conditions of Zarrineh River in conjunction with Shahindezh city in different scenarios were investigated. Zarrineh River training project modeling, as a general objective, is the use of hydraulic simulations to create a river water surface based on new physical, civil, and hydrological properties of a given reach. The motivations for conducting such simulations are flood plain extent mapping based on current and new scenarios and the determination of water level along the study river reach. The objective of this project is to create maps before and after a new river training plan, all within the GIS and Autocad environment with georefrenced origin. Study of Zarrineh river project requires a thorough evaluation of the possible impacts that it may have, both upstream and downstream from the Vahdat Bridge on Zarineh River. Prediction of the operation, maintenance, and repair or

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replacement of the bridge, requirements of existing and proposed projects are other roles that river hydraulics simulations play in the planning and design processes. Zarineh River is a very wild river and every civil project highly needed to be evaluated from different aspects especially new geomorphological conditions. New liberalized areas beside the river for each scenario should be determined and evaluated for new land use utilizing particularly for Eco-Tourism usages. Sharifi and Pernoun (2017 p. 59) emphasized that the dynamical power of the river in the upstream and flow forces reduction in the downstream have a significant effect in the geometry formation of the rivers. Niranjan et al., (2010) showed that the MIKE11HD model has been able to accurately estimate and simulate water level in Berahmani river. The simulated river surface profile from MIKE11HD was used to simulate protective structures behavior in the river. The performance of the MIKE11 model in the simulation of hydrologic-hydrodynamic processes of rivers were confirmed in other studies such as Guang et al. (2017), Uleke et al. (2017), Tran et al. (2018) and Kha et al. (2018).

2- Methodology

MIKE11 was selected to simulate current and selected new river training scenarios that iteratively solves a one-dimensional energy balance to produce water elevations based on river geometry, channel roughness, flow rate and boundary conditions. MIKE11, developed by DHI, is a software package for simulating flows in rivers. The river geometry is provided in the form of channel cross-sections at regular intervals along the direction of flow. The number of cross sections that are taken varies with study requirements and stream characteristics. About 1 km reach of the upstream and downstream of existing Vahdat bridge with 14 cross sections under current situation (without bridges and without training), the bridge with 120 meters without training, the bridge with 120 m, 200 m and 300 m with bed and banks training. For the current and scenarios it is needed to predict stage, discharge, and velocity as functions of time anywhere on a river in different return periods such as 25 yr. To measure cross-sectional coordinates, previous topographic maps generated from field surveys performed with land surveying instruments were used. All

information to set up the Mike model, including input data files, simulation period, time step and the name of result files and also initial and boundary conditions have been determined and defined. Flow hydrographs for the project at the bridge location for all scenarios, extracted from hydraulically simulations from Mike11. For Hydrograph prediction the Saint-Venant approach with Finite Element method and Six-Point Algorithm of Abbott used to discretized temporal and spatial elements.

3- Results and discussion

Zarrineh river project consists of Vahdat Bridge that should be modelled and finally it should be cover reliability of new area liberalization without any impact to users of Shahindezh such as Municipality, regional water authority, Environmental protection agency and Ministry of Roads and City affairs. In river training scenario with widening bridge to 300 m, in addition of a liberalization of 90 ha areas on both sides of river banks, water level will be decreased about 65 cm and maximum flow capacity will be increased to 115000 m3. The calibration results indicate that the estimated error rate of flow volume (REV) and the relative error in the peak (REQP) for training scenario are 0.197 and 1.792% respectively that corresponding to current condition about 0.068 and 2.82 percent .This figures shows good agreement between modeled and observed values. Vahdat Bridge with 120 lengths with 1200 m3/sec (25 yr return flow) will overflow to adjacent areas. The modelling results show the high potential of river training on the flood transmitting and flood routing and also, the accuracy of the simulation of unsteady flow is one dimensional for the desired range by the MIKE11 mathematical model.

4- conclusion

The river training projects should be modelled, controlled, evaluated for overflow problem from sidewalls and also river bed and banks should be controlled that is not affected by water score problem. For secure hydrograph transmitting in the reach of Zarineh River and Shahindezh

city conjunction, the 300-meter bridge widening scenario is selected and the executive maps and detailed plans for the river training, bridge with a width of 300 meters, sidewalls and end sill structure (river bed stabilizing structure for preventing score) were provided.

Keywords: River training simulation, Zarineh River, Food water level, Direct bridge with deck