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Numerical Modeling to Assist in Hydraulic Design of the Dharla Barrage and Ancillary Works

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Abstract

A barrage across the Dharla River in Bangladesh is envisaged as the main structural intervention needed for surface water irrigation development. Two-dimensional numerical modelling has been successfully applied to assist in hydraulic design of the barrage and ancillary works. A model covering a river stretch of about 36km has been developed. The model setup consists of curvilinear computational grid, open and closed boundaries and initial bathymetry based on bathymetric survey data. After calibration and validation the developed model has been applied for selection of appropriate layout of head and tail cut, barrage and river training works. Hydraulic design of the barrage and ancillary works has also been assessed by use of the model. This paper presents the results of the assessment in relevant terms.

Keywords: Barrage, Undersluice, Hydraulic Design, Design Discharge

1 Introduction

The Government of Bangladesh has formulated a project to bring the south western part of the Kurigram district under surface water irrigation for poverty alleviation and socio-economic development of this under-developed area. A barrage across the Dharla River is envisaged as the main structural intervention needed for intended surface water irrigation development. The selected location of the barrage is shown in Fig. **1**. Two dimensional numerical modelling of the Dharla River has been undertaken under "Consultancy Services for Detailed Engineering Design of Kurigram Irrigation Project (South Unit) in order to develop understanding of the physical processes of the river, planning of the barrage and associated works and assessing their hydraulic design and also assessing the effects of the barrage and river training works on river hydraulics and morphology in the upstream and downstream of the barrage in short and long-term. Incorporation of various barrage components to their dimensions in the two-dimensional model is indeed a challenging task. The hydraulics of barrage is essentially three-dimensional and thereby, cannot be accurately described through two-dimensional mathematical formulation. However, in case of gradually varied flow and relatively slow changes in river morphology two-dimensional model is capable of reproducing almost three-dimensional effects. The tool (MIKE21C) used in this study can reproduce three-dimensional effects of helical flow. The tool is also particularly suited for river morphological studies and includes modules to describe flow hydrodynamics, sediment transport, alluvial resistance, scour and deposition, bank erosion and plan form changes. The modules can run interactively, incorporating feedback from variations in the alluvial