

Abstract

The Sabarmati River is one of the major rivers in the western part of India. The present study is for a 160km reach in the Sabarmati river, from Dharoi Dam to Vasna Barrage. In this study, five hydrodynamic models are performed to analyze the behavior and processes governing the river using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software version 5.0.7. The computational models include: 1-D steady, 1-D unsteady, 2-D unsteady, sediment transport, and water quality simulations. Hydraulic structures such as dams, weirs, and bridges are included in the models as hypothetical characteristics to understand the behavior of the flow parameters near these structures. Before using HEC-RAS, a hydrologic model is performed initially by preparing a digital elevation model (DEM) for the basin in Arc-GIS software and the Soil & Water Assessment Tool (SWAT). Flow hydrographs are used as input parameters to run the hydraulic model (HEC-RAS). For 1-D steady flow simulations are performed to map the flood prone-zones along the reach for different return periods. For 1-D and 2-D unsteady flow simulations are performed to observe the flood wave propagations. Thus, evolution of flow depths and velocities along the river at different locations are computed. For sediment transport analysis, a reach of 21km is studied from Derol Bridge to Lakroda Weir. High rates of erosion are observed at 7km downstream of Derol Bridge (at Ged village) while high deposition rates are observed at 1km and 2.5km downstream of Ged village. For water quality analysis, nutrients such as ammonia-nitrogen, phosphate, and sulphate compounds with heavy metal ions such as Cu^{2+} , Fe^{2+} , and Pb^{2+} along with Total Dissolved Solids (TDS) are observed to have very high concentration further downstream of Ahmedabad City. One of the major limitations of the current simulations is that hypothetical sediment and water quality parameters are used as inputs.