ABSTRACT

Sedimentation is a persistent challenge in the management of reservoirs and dams, significantly impacting their storage capacity, operational efficiency and life-span. Hydrodynamic model and sediment transport model has been carryout, to simulate water flow and for analysis of sediment deposition profile within the reservoir. Sediment transport and 1D hydrodynamics have been modeled using HEC RAS-6 software, version 6.4.1.

The Simulation of 1D sediment model is used to analyze the sediment deposition profile for 18 years. The study was carried out in the Dhamtari region of Chhattisgarh at the Ravishankar Sagar Reservoir, which is situated on the Mahanadi River near Gangrel township. The project site is about 13 km from Dhamtari town and about 81 km from the nearest railhead and airport, Raipur. Ravishankar Sagar dam site commissioned in 1979, has a 3670 km^2 catchment area in the Mahanadi river.

It is a multipurpose reservoir being used to meet the irrigation, municipal and industrial demands. Flow data over 2003 to 2021 is considered as for the Hydrodynamic model. Daily observed discharge and water levels at dam site are used for this study.

It is observed from the model that the sediment carrying capacity of the virgin river is adequate to carry its sediment load without any deposition on the bed. HEC-RAS is using Engelund-Hansen formula for sediment transport which shows a good agreement for analyzing sediment deposition profile in the reservoir. Current estimated reservoir capacity is 825.8 Mm^3, and the simulated water level extends around 25.5 km upstream of the dam at the Full Reservoir Level (FRL) of 348.7 m.

Assuming the reservoir is sediment-free at the start of the monsoon, the model was run using inflow data for a representative year. The volume of deposited sediment in the reservoir is 10.2 Mm^3 between July 1, 2018 and June 30, 2019, which is 1.24% of the reservoir's capacity (825 Mm^3). With a trap efficiency of 72.3%, the accumulated sediment volume reached 42.5 Mm^3 over 18 years, from July 1, 2003 to June 30, 2021, which is 5.15% of the reservoir's capacity (825 Mm^3).