3DModelling of Arunavati Reservoir and Preparation Of Proposal For Diversion Of Flood Flow Through Artificial Channel- A Remedy For Two Towns Subjected To Flood Disaster

R. D. Rathod

Assistant Professor, Jagadambha College of Engineering and Technology, Yavatmal,
Maharastra State, India

ABSTRACT: *Due to sedimentation, growth of vegetation and other environmental effects   the morphology in the Arunavati Reservoir Basin have been changed considerably after construction of dam across Arunavati River. Computer modeling of catchment of Arunavati Reservoir Basin located near DigrasTahsil in Yavatmal District of Maharashtra State, India, will be done to simulate hydrological processes and to carry out flood forecasting. A diversion channel will be modeled, morphological computations will be done and effect of diversion on flow regime will be studied. Based on the results a proposal will be prepared to construct artificial channels at Digras (on upstream) and at Arni on downstream of the dam as a remedy for controlling flood disaster and in view of Aesthetics and Landscape energy that benefit the locality.*
Keywords :*channel, diversion, flood,hydrological,sedimentation, simulation etc.*

I.   INTRODUCTION

Due to sedimentation,growth of vegetation and other environmental effects the morphology in the reservoir basin have been changed considerably after construction of dams across alluvial rivers. The dynamic effect of large flows from main river causes slit deposition at the mouth of the reservoir that the results in delta formation extending towards upstream.

   The locality in the upstream experiences heavy floods every year. In counteraction the spillway gates are opened suddenly which results in floods downstream creating tremendous disaster. This is the known problem and occurring mostly.

One of the most effective and economic way of flood control is diversion of the part of flood discharge through artificial channel. The diverted flow can pass through an artificial channel and part of it may join the lake and the excess diverted water joins the main river downstream of the dam. The flood stage can be effectively reduced by constructing a diversion channel of sufficient length so that backwater effect is less.

With the advent of computers, it is now possible to prepare a model of the reservoir basin to study the effect of flow on the regime of the main channel and to prepare a proposal for diversion of flood flow through artificial channel. It is intended to conduct this research on Arunawati Reservoir Project, (in Yavatmal District of State of Maharashtra, India) in order to control floods in towns in Digras and Arni on upstream and downstream of the dam respectively.

Computer modeling of catchment of Arunavati Reservoir Basin located near DigrasTahsil in Yavatmal District of Maharastra State, India, (Figure1) will be done to simulate hydrological processes and to carry out flood forecasting using computational fluid dynamics program SSIIM (Sediment Simulations In Intakes with Multiblock option). A diversion channel will be modeled, morphological computations will be done and effect of diversion on flow regime will be studied. Based on the results a proposal will be prepared to construct artificial channels at Digras (on upstream) and at Arni (on downstream) of the dam.

II. REVIEW OF LITERATURE

Diversion of flood flows through artificial channel was never considered as remedy for flood control at the time of initiation of Reservoir Project. The problem of flooding on upstream and downstream

side of a dam is now regarded as environmental effect of reservoir, a new study developed after its growing awareness.

Optimum reservoir operation based on the flood forecast was considered a remedy for flood control on upstream and downstream of the dam. Accurate flood discharge prediction is an important information for the real-time management of river basins as well as storage reservoir operations. Because of sedimentation, growth of vegetation and other environmental effects morphologies in the reservoir basins have changed considerably after construction of dams. Hence flood forecasting done with previous morphologies results in faulty reservoir operation by unaware engineers. Hence reservoirs can not be optimally operated to prevent flood disaster as the accurate rainfall prediction is impossible.

Many researches done in that direction of flood forecasting and optimum reservoir operation resulted wasteful as they are unable to provide better solution to flood control on upstream and downstream of a dam. Hence new trend of removing dams is started in U.S.A. More than 500 dams were removed considering losses surpassed their benefits. It is the need of the day to devise the remedy of diversion of excess floods through artificial channels.

III. AIMS AND OBJECTIVE OF RESEARCH WORK

With the advent of computers and development of computational fluid dynamics programs it is possible to do 3d modeling and computations of sediment flow, its deposition flood routing etc. the objectives of this research are,

- To investigate the environmental effects of the reservoir project, in terms of sedimentation, vegetal growth and other environmental effects responsible for flood disaster on upstream and downstream of a dam.
- To investigate flood routing pattern due to change in river morphologies on upstream and down stream of a dam.
- To verify the problems in optimum reservoir operation.
- To verify the feasibility of different methods of flood control on upstream and downstream od a dam.
- To verify the suitability of artificial flood diversion channel not to select an economical plan.
- To prepare a proposal for diversion of excess flow through artificial channel to lake and or to main stream on downstream.

Figure 1. Google Map Showing Reservoir And Two Towns Digras and Arni

IV. OUTLINE OF PROPOSED RESEARCH WORK

i) Data Collection :
- To undertake a case study to investigate environmental effects of reservoir, a reconnaissance survey.
- To collect topographic maps, aerial photographs, satellite imageries of the catchment area of the reservoir basin.
- To identify various problems in optimum reservoir operation by conducting actual interviews of the people.
- To collect various catchment geometry and hydrological simulation models and to select a suitable one for case study.

ii) Catchment Modelling :-
- To carryout catchment modeling for flood routing, sedimentation analysis and computation using SSIIM1 and SSIIM2 program.
- To investigate and to compute feasibility of different methods of flood control on upstream and downstream of a dam.
- To investigate and to compute suitability of diversion channel in view of economy and to select a suitable plan.

iii) To prepare a proposal :-
- To prepare a proposal for diversion of flood flow through artificial channel to be sent to the appropriate authority for its consideration.

V. CONCLUSION

Use of Computational fluid dynamics programs have changed the ways of studies and becoming very useful in planning and design of hydraulic structures. SSIIM1 and SSIIM2 programs are becoming more popular due to their ease and availability. Most of the work is over and author intend to present the results in the international conference.

VI. ACKNOWLEDGEMENT

I am thankful to Hon'ble Secretary ShriShitalWatile and Hon'ble Director ShriPawanWatileSir for encouraging me to undertake this research and helping me in all ways.

REFERENCES

JournalPapers :

[1] "Case Study: Dealyed Sedimentation Response to inflow and operation at Sanmenxia Dam", Baosheng Wu, GuangqianWang and JunqiangXia ,*Journal of Hydrulic Engineering ASCE/ May 2007*.

[2] "Effects On The Upstream Flood Inundation Caused From The Operation Of Chos Phraya Dam", SuthamVisutimeteegorn, KanchitLikitdecharote and SuphatVongvisessomjai, Songklanakarin*J.Sci. Technol., Vol.29.No.6.Nov.Dec.2006.*

[3] Modeling of Sedimentation upstream of NyumbaMungu Reservoir in Pangani River Basin Preksedis Marco NDOMBA, University of Dar esSalaam(UDSM), Tanzania, *Nile Basin Water Science and Engineering Journal, Vol.3, issue No.2, 2010.*

[4] Experimental Study of Hydraulic Sediment properties on deltaic sedimentation in reservoir., J. Mammizadeh, S.A.AyyoubZadeh, M.A.,Banikasemi, *Int Res. Appl.Basic Sci. Vol.3(4) 810-817, 2012*.

Books :

[5] " Mechanics of sediment Transport and alluvial stream Problems", R.J.Garde and K.G.RangaRaju, *Wiley Eastern Limited, Second Edition July 1985.*

[6] " Remote Sensing Based Study on Channel changes and Wetland Ecosystem Dynamics of Bramhaputra River in India", Nayam Sharma, OinasmMakimchandra and BikashRanjanParida, *Department of Water Resources Development and Management, Indian Institute of Technology, Roorkee-247667.*

[7] "Sedimentation in Storage Reservoirs", *Department of Environment Transport and Regions Final Report 2001*www.halcrow.com