Literature Review of Dam Break Studies and Inundation Mapping Using Hydraulic Models and GIS

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Abstract – *In the present days, it is very much necessary to store water to fulfill the needs of human beings and for attenuating the flood to reduce inundation in the downstream reach of the river. It is also known that the damages caused by the dam failure incidents creates disaster in the vicinity area of downstream reach causing loss of human life and loss of properties to the tune of millions to billions. Hence dam break studies are to be carried out to study the behavior of the high flood generated from the dam break and to identify the area under inundation in this scenario. This will be useful in preparing emergency action plan for evacuation of human population and to minimize the loss of property. It is evident that the flood cannot be prevented but by adopting proper methods in evacuation, the losses can be minimized. In this paper various literature in the field of dam break studies carried out using various numerical models and inundation mapping using the results obtained from the numerical models are reviewed and some of the hydraulic models which are used for dam break study are also discussed.*

Key Words: Dam break study, HEC-RAS, MIKE 11, MIKE 21, Inundation Mapping

1. INTRODUCTION

Dams are the hydraulic structures constructed across the water to impound water in the upstream reservoir formed to supply water to irrigation, hydropower generation, domestic and industrial water supply, multi-purpose reservoir serves as flood control and drought mitigation structures and storage place for arresting the sediment (Hurdowar-Castro, et al., 2007). Change in land use and interrupting activities of human beings in the upstream catchment area, larger volume of soil erosion takes place and deposits in reservoir. The amount of siltation is increasing every year resulting in reduction of useful life of reservoir and decrease in storage capacity and when the high flood occurs, there is no enough space to attenuate the approaching flood and excess flood overflow over dam section leading to dam breach scenario resulting in generation of massive amount of flood wave inundating downstream reaches of dam.

In spite of many uses of the dams and reservoir, the disaster caused by the dam failure creates damages higher than the damages caused by the other disaster all together. Dam breaks can be described as partial or catastrophic failure leading to uncontrolled release of enormous flood to the downstream (Fread, 1993). Flood generated from the dam break is much higher than flood generated from the heavy precipitation. Causes for the dam break are seepage failure, failure due to overtopping, foundation failure, construction failures and failure due to bad quality materials. Failure of the dams may be gradual or instantaneous. Concrete dam generally fails by sudden failure due to overtopping and earthen dam fails due to erosion of material and piping action.

The high flood created by the dam break travel downstream of the dam creating damage to life of human beings and properties along the reach of flood wave (Katopodes & Strelkoff, 2002; Sakkas & Strelkoff, 2007). Additional problems created by the extreme flooding are socio-civil conflicts, environmental problems and economic losses (Ghimire, et al., 2015; Li & Shi, 2015; Aerts & Botzen , 2011).

Even though we have latest technologies in design methodologies and construction techniques, failure of dams still occurs. Study conducted on various failure of dams occurred in India and all over world indicated the hazard caused by the dam failures. Hence emphasis to be given on better management of the flood by preparing emergency action plan to minimize the hazards of the flood in the floodplain rather than prevention of the flood. It is necessary to analyse the behaviour flood before suggesting flood management measures, this can be done by analysing the flood based on the observed floods. Numerical models simulate the dam break and flood event based on the various parameters, hence numerical models are the very important tool to analyse the flood event.

2. LITERATURE REVIEW

Dam break study is the concern of the dam engineers since long time to minimize the hazards of flood. Dam rehabilitation and improvement project (DRIP) is envisaged for preparing guidelines for preparing emergency action plan covering flow charts, emergency situations, inundation maps, evaluation and classification of hazards and implementation methodologies are prepared. Dam break study includes detailed study on analyzing the reasons for cause of dam breach, studying the parameters responsible and study of high flood wave generated and impacts of flood wave on downstream reaches.

Literature review of the dam break studies carried out previous is carried in this paper to understand and analyze the latest methodologies adopted in the studies conducted by various author on various dams all over the world, this helps in choosing the suitable methodology and the numerical model to carry out the dam break study.

Horritt & Bates (2002) have tested both 1D and 2D flood hydraulics models such as HEC-RAS, LISFLOOD-FP and TELEMAC-2D on 60 km downstream reach of River Severn, U.K. The flood extent of year 1998 and 2000 are obtained from the radar remote sensing satellites and calibrated three numerical models using data obtained from floodplain and channel friction as independent parameters against observed flood depth from inundated area and discharge data in downstream river reach. Based on the results obtained from the study, they concluded that HEC-RAS and TELEMAC-2D numerical models can be calibrated with the observed inundated area and downstream reach data to obtain the reliable whereas the LISFLOOD-FP model needs to be calibrated against independent parameters of inundated area data to get acceptable results.

Meritt et al (2003) reviewed various Empertical, Conceptual and physical models which use explicit consideration of either sediment generation or transport process such as AGNPS, ANSWERS, CREAMS, EMSS, GUEST, HSPF, IQQM, HEC-RAS, LASCAM, LISEM, MIKE-11, PERFECT, SedNet, SWRRB/SWRRB-WQ, TOPOG and WEPP and suggested that emperical and simple conceptual models doesnot require large amount of input data and they are computationally simple, hence they can be used when the input data availablity is limited. Whereas, Physical models requires large amount of input data and these model are difficult to use. They also endorsed that, data requirements of the model often exceed the data availabality in the area are to be studied and there is lack of simplified and distributed process based model which can be applied in poor-data conditions.

Hicks & Peacock (2005) Conducted flood forecast study using two-step procedure, first step is flood routing is conducted using the hydrological model and resulting peak floods are converted to water level forecasts using hydraulic models. In this study, HEC-RAS steady flow model is used. It is very convenient to extend floodplain delineation in flood forecasting applications. Advantage of this is accuracy of flood forecasting can be improved and simplified into one step process hence savings in time can be achieved. The study concluded that HEC-RAS model can perform well without the need for calibration of Manning's n and it is still advised to investigate the sensitivity of the parameter. This study indicate that flood routing and flood level forecasting can be easily performed using HEC-RAS Model. Application of this model can save time in calibration of model and eliminating need to run a second model to determine corresponding flood level forecasts.

Yang et al (2006) Developed direct processing approach to river floodplain delineation on part of south nation river system in Ottawa, Ontario of Canada. Floodplain mapping is done by integrating geographic information system (GIS) with HEC-RAS. Numerical model simulations are performed to generate water surface profile for six different design storm events. Geo-referenced maps are integrated with digital elevation model (DEM) data to develop triangular irregular network (TIN) terrain model and floodplain zones for six design storm events were reproduced by overlaying the integrated terrain model with the corresponding water surface. Validation of the model is carried out using 100-year flood zone of Bear Brook sub-watershed. They concluded that HEC-RAS river network model provides upgraded simulations with better computational routine, supports import and export of GIS data and allows to view the river reach and cross-section data. This study focuses on integrating the hydraulic data with GIS map for inundation floodplain zones.

Yochum et al (2008) developed a one dimensional unsteady numerical model using HEC-RAS to simulate Big Bay dam embankment failure which happened on March 12, 2004 and to predict the behavior of floodwave generated caused by dam breach through the downstream valley. The model was developed using observed breach geometry and the HEC-RAS model gives relatively accurate result comparing with the water marks measured immediately after the failure. However, the random error in the projected peak water surface elevation from the model in comparison with the water marks measured indicates the geometry generated from 10m DEM will add small amount of error to the analysis and concluded that breach inundation studies can be carried out by gathering high resolution data using LiDAR or other advanced techniques to eliminate the errors.

Kalyanpu et al (2009) presented paper for assessing errors occurred by the use of LULC to estimate manning's roughness coefficient in hydrological model on watershed scale. They conducted study on 23km2 watershed and estimated manning's n using the National Land Cover Dataset and from the study found that 50% difference in manning's n is observed in 90% of study area. This study indicated the increasing trend deviation of hydrograph peak will increase the Manning's n deviation and concluded that the use of Manning's n values from NLCD datasets are acceptable for medium to large watershed.

Patrol et al (2009) Presented a detailed review related to issues and limitations of hydrodynamic modelling of floods in data scarce countries with large flood prone rivers. In this study, a one-dimensional (1D) hydrodynamic model is used to study the river flow with limited available data in delta region of Mahanadi river. SRTM DEM was analyzed and compared with the elevation obtained from topo maps and actual river cross-section obtained from detailed survey. SRTM derived X-section are refined and used in hydrodynamic model. One dimensional model is developed and calibrated using the X-section obtained from SRTM DEM along with measured X-section, discharge and depth of water at different gauging stations in monsoon season of 2004 is considered for simulating the One-dimensional simulation of river. The values of discharge and water levels obtained from the model simulation are almost similar to the observed values. The study conducted demonstrates the use of X-section derived from SRTM DEM can be used in hydrodynamic modelling studies on data scarce regions.

Salajeghah et al (2009) conducted study on Polasjan river basin in Iran central plateu for floodplain analysis using HEC-RAS and GIS. They presented direct approach for processing output of HEC-RAS in ArcGIS platform and identified from the results obtained that GIS is an effective tool for floodplain mapping and analysis. Integrated HEC-RAS and ArcGIS acts as effective tool for floodplain mapping and analysis. The model developed by integrated HEC-RAS and ArcGIS has the many advantages such as user friendly, digital output, savings in resources. menu based software doesn't require much expertise in working in the software, digital output obtained can be compared with other digital data and covers many structures like infrastructures and buildings and this methodology saves time and resources in revising and updating the floodplain maps as and when changes in hydrologic and hydraulic conditions are observed.

Xiong (2011) conducted dam break study using HEC-RAS numerical model on 100 ft high and 1.3 mile length comprehensive flood control Foster Joseph Sayers dam situated cross Susquehanna river based on the available geometry data for 3 scenario such as "no dam break", "dam break" and "without dam" he advocated that the dam break is complicated & comprehensive process and actual failure mechanics are very hard to understood, neither physical model nor emperical models could fully depict the dam break scenarios and impacts of the dam break. In this study, it was observed that dam break due to piping increases the time period of high water surface elevation which increases duration of risk. On the other hand, dam break does not increase the downstream maximum water surface elevation and dam break increases the time period of higher water surface elevation and reduces the flood protection capacity of the dam and without dam shows greater risk on downstream reaches and He also carried out sensitivity analysis study, according to which changes in dam break parameters will not influence much on the downstream maximum water surface elevation and boundary conditions.

Timbadiya et al (2012) developed hydrodynamic model of lower Tapi river using HEC-RAS for Unsteady flow condition by using surveyed data for stream and appropriate downstream and upstream boundary condition. Observed and Simulated flood are compared with the stage hydrograph at different stations on the river and found that the simulated flood flows are relatively similar to observed flows. Hence validated the model developed for flood forecasting in lower Tapi river.

Qi & Altinakar (2012) Developed GIS based decision support system for dam break flood management for Sinclair dam in Milledgeville, Georgia state of USA based on the realistic two-dimensional flood simulations using classified remote sensing image. They used Monte-Carlo method to take into consideration uncertainties in various variables and parameters. The results obtained from the study are validated using HEC-RAS and HEC-FDA software showing the new system provides very versatile and reliable situation for estimating various flood damage and may enhance the decision making processes for future design of flood prevention.

Yerramilli (2012) developed hybrid hydrodynamic model to the city of Jackson, MS using HEC-RAS for identifying flood hazard and assessing the vulnerability of the region by integrating the numerical model with GIS. Combination of hydraulic model using HEC-RAS one-dimensional flood simulation model and GIS tool indicates the capability of simulating flood events and spatially depicting the degree of exposure or vulnerability of the region towards a hazard event in terms of inundation extent, water levels and depth. HEC-RAS model simulation results gave same result as that of the observed inundation depth record at that location.

Lai et al (2013) conducted a study on Yangtze river basin since it is experiencing rapid changes due to human activities and climate changes in the catchment. In their study, they developed coupled hydrodynamic assessment model for simulating large scale water system featured with complex river-lake interactions. In this study, unsteady one dimensional (1D) model and two dimensional (2D) hydrodynamic model using new algorithm suitable for large scale water systems is developed. This model is capable of reproducing satisfactorily the major physical processes involved in seasonal wetting and drying controlled by strong river-lake interactions.

ShahiriParsa et al (2013) Carried out a study to simulate the flood zoning on Kota Tinggi district of Johor state in Malaysia using HEC-RAS one-dimensional model by adopting various flood return periods and with different roughness coefficients. They carried out sensitivity analysis of the model to improve the flood zoning results obtained from the numerical model. The sensitivity analysis is carried out by varying the roughness coefficient, the coefficient of narrowing and opening and the energy slope and water surface profile is generated by varying the roughness coefficient and from the research conducted they concluded that, the reservoir water volume and upstream surface runoff area, stream flood conditions and physical characteristics of the area are the responsible factors governing the severity and recurrence of the flood.

Asnaashari et al (2014) developed two hypothetical dam breach studies on Pinaus Lake dam near Vernon and Cold Spring Creek dam in Fairmont, Canada using HEC-RAS numerical model in combination with GIS tool. The study was conducted to estimate dam break outflow hydrograph, routing the dam break hydrograph through the downstream river reach and floodplain and to calculate the inundation water depth and time and the maps were plotted for worst case scenario to show largest area that could be inundated and subsequently incremental consequence analysis were conducted to assess hazard and dam classification and this study can be used to improve the dam breach analysis.

Benjankar et al (2014) conducted study on three central Idaho river systems namely South fork boise river, Bear Velley creek and Lower deadwood river in USA by both 1D hydrodynamic model and 2D hydrodynamic model using MIKE 11 and MIKE 21 developed by DHI and they validated that better results of hydraulic variables such as Water Depth, Water Surface Elevation, Velocity and bed Shear Stress can be obtained in 1D model when finer cross-section (say 5m) is adopted compared to 2D model, whereas when coarser cross-section is taken for the study, hydraulic variables will vary both longitudinally and transversally in 2D modelling whereas they remain same for entire cross-section in 1D modelling.

Piper (2014) conducted study on Lower Thames flood risk management strategy which gives ideas about balancing flood risk and development in the flood plain. His study is carried out on the basis of severe flood experienced by mainland Europe in 2000 and policy developed by the UK government with aim of delivering greatest environment, social and economic benefit for sustainable development. The policy covers largest risk developed and undefended flood plain in England having 21000 properties and 50000 human beings with more than 0.5% annual exceedance probability flood risk. Consequences of flood is very severe leaving the flood upto two weeks, causing disruption in highways and disturbing drinking water supply in London. Climate change impacts are worsening the situation by doubling the flood damages. The Lower Thames Strategy's main aim is to identify the sustainable solution to reduce the flood risk to properties and human being. This is achieved by minimizing disruption to infrastructure, safeguarding the location of nature conservation and biodiversity and maintaining quality and sediment level of rivers.

Dottori et al (2016) have developed high resolution flood hazard models which is suitable at continental and global scale level helping the developing countries and data scarce regions to increase their preparedness to flood event and reduce the flood impacts. They developed model using long term datasets of daily river discharges from hydrological model simulations of Global Flood Awareness System (GloFAS), and the dates are rationalized to high resolution river network and this provides input to flood inundation simulations performed in two-dimensional hydrodynamic model. Flood prone areas are identified and flood hazard maps for different return period are generated for lesser resolution and the authors evaluated the performances of the methodology in several river basins across the globe by comparing the simulated flood maps with official flood hazard maps generated by using the satellite images. The sensitivity of the flood models to several parameters, strengths, limitations and improvements of the methodology are also studied in this paper.

Zope et al (2016) Have carried out investigations on the impacts of land use-land cover change on the urbanization floods of Oshiwara River in Mumbai, India using HEC-HMS hydrological integrating with HEC-GeoHMS GIS module. For this purpose, land use change in the years 1966, 2001 and 2006 are carried out using topographic map and satellite images. The study reveals that built up area is increased by 74.84% and open space is decreased by 42.80%. The impact of change in land use on flood hydrograph for different return period is calculated using hydrological model and it shows that for 100 year return period increase in peak runoff and runoff volume is increased by 3.0% and 4.45% and 10.4% and 12.2% for 2 year return period respectively. Flood hazard analysis shows that area in highly hazardous zone area is increased by 64.29% and less hazardous zone is decreased by 32.14% and overall increase of flood hazard area is 22.27%. The authors suggested that the result obtained from the model can be used in preparing flood mitigation and early evacuation management plan and can also be used as criteria for insurance to the property by insurance organizations.

Khattak et al (2016) Have carried out floodplain mapping study for part of Kabul river in Pakistan using HEC-RAS hydraulic model. They conducted conventional return period study of flood using log-normal, Log-Pearson type-III and Gumbel's methods to calculate the extreme flows in river for different return periods. By conducting Kolomogorov-Smornov test, they observed that Log-Pearson type-III was found suitable for their study area and the results obtained from this study are provided as input in HEC-RAS model to find out the corresponding flood level expected in river reach from Warsak dam to Attock. The result obtained were exported to ArcGIS software and floodplain maps were prepared for different return period and from the floodplain maps areas vulnerable for flood hazard are identified and they also identified that 400% of the area is likely to inundate in comparison with normal flow of river. They concluded that HEC-RAS in combination with ArcGIS can be used for floodplain mapping and provides more realistic results and same can be used in preparing decision support systems.

Moya Quiroga et al (2016) conducted a 2D simulation on the vast plains of Llanos de Moxos in Bolivian Amazonia which was continuously being flooded by Mamore river. They used new version of HEC-RAS version 5 developed with Two dimensional (2D) capabilities which solves either full 2D Saint Venant equation or 2D diffusive wave equations for simulating February 2014 flood in Bolivian Amazonia. They compared the results obtained from numerical model with satellite images of the flood event and observed that HEC-RAS 2D hydraulic model simulation shows good performance comparing it with observed flood inundation from satellite images and also simulation provides additional information such as flood depth, flow velocity and flood duration. It is identified that river Mamore is most hazardous with bigger flood extent, deeper flood depth and longer flood duration and based on the study, it is concluded that, the new HEC-RAS ver. 5 is an important tool for studying and understanding the flood event and application may help to analyze the possible flood management strategies. From the study carried out, it was also observed that both 2D Saint venant equation and 2D diffusive wave equation provides same results but solving 2D diffusive wave equation simulation is faster than solving 2D Saint Venant equation simulation. HEC-RAS Ver 5 can be used as fully 2D model or as 1D-2D hybrid model. Main river reach can be modeled as 1D model and flood plain can be modeled as 2D model. They also suggested that hybrid 1D2D model is faster than the 2D model.

3. HYDRODYNAMIC MODELS

Numerical models used to carry out the dam break study and flood routing which may be one-dimensional, two-dimensional or combination of both. When the channel width increases or the flow becomes non-channelized, accuracy of one-dimensional models decreases hence two-dimensional models are more reliable while carrying out floodplain study. Most widely used hydrodynamic models used to determine dam breach hydrograph and flood routing are parametric models. Parametric models can either be hydrologic or hydraulic models. Hydrologic models like HEC-HMS solve equation of continuity and these models have the advantage of simplicity, easy to use and efficiency of computation. These models provide attenuated flood hydrograph at required location but they do not provide accurate result over water surface elevation and flow velocity. Because of the constraints of the hydrologic models, for most dam break and flood mapping study, unsteady flow and dynamic routing method is adopted. This method is called as transient flow or hydraulic routing and these models solve equation of continuity and equation of momentum and hence they are adopted to predict the dam breach flood formation and its progression in downstream reaches. The hydrodynamic modelling involves solution of two partial differential equations derived by Barre De Saint Venant in 1871. The equations are a) Conservation of mass equation or Continuity equation and b) Conservation of momentum equation.

$$(\partial Q/\partial X) + \partial(A + A_{0)})/\partial T - q = 0 \qquad \text{............ (1)}$$

$$(\partial Q/\partial T) + \{\partial(Q^2/A)/\partial X\} + gA((\partial h/\partial X) + S_f + S_c) = 0 \qquad \text{............ (2)}$$

Where; Q=discharge, A=active flow area, A0= inactive storage area, h=water surface elevation, q=lateral outflow, x=distance along waterway, t=time, Sf=friction slope, Sc=expansion contraction slope and g=gravitational acceleration. Some of the models used for dam break study and flood inundation mapping are described below:

DAMBRK MODEL was developed by NWS, USA in 1984 and it was updated by BOSS International. This model predicts dam breach wave formation and its progression in downstream. The important three features of DAMBRK are ability to describe dam failure mode temporarily and geometrically, computation of the outflow hydrograph through the breach section and its ability to route the outflow through a downstream channel. This model is good in determining potential influenced area allowing users to input geometric and temporal data to accurately predict the initial breach wave. This includes both piping and overtopping failures. The updated BOSS DAMBRK has many improvements including faster calculations and it has graphic interface.

FLO-2D model is developed based on MUDFLOW model in 1989. This predicts the flood hazard, mudflow and debris flow over alluvial river and this uses grid system to determine floodplain based on elevation, roughness coefficient and it is good in predicting flow path and area. In this model, sediment laden and without sediment flow can modelled. In this model, discharge is estimated based on depth of flow over each sector and summing up all sector on all the four sides of grid. Accuracy of the model is dependent on the density of grid system and the data available.

FLDWAV model was developed by the National Weather Services, USA as a replacement to DAMBRK model. This model has wave front tracking for more accuracy and computational time required is less. This allows dam breach prediction and potential concerned area are calculated. This model is designed to model rapid flood events from large precipitation event or dam break occurrences predicting flow through single stream or network of streams using real forecasting technology and considers terrain and properties of material at different time interval and adjust flow pattern. This model also has secondary function to predict flow through hydrological structures and river basins and it performs dam break analysis, flood predictions, pumping stations and other rapid flow scenarios. It allows flow to change from subcritical to supercritical vice versa based on location and time and can model one dimensional unsteady debris flow also.

SMPDBK was model is developed by National Weather Services (NWS), USA as simplified version of DAMBRK. This is good for obtaining dam classification and potential dam break risk. Unlike DAMBRK this model is quick and easy to use and does not require many parameters but provides similar results compared to DAMBRK when performed on simpler cases. The model produces the information needed to find out the downstream inundation areas. The SMPDBK model does not require a computer with high specification to run the model and it is efficient model to simulate the dam break scenario and for preparing emergency action plan.

Danish Hydraulic Institute (DHI) MIKE 11 is a new generation software comprising of fully windows integrated graphical user interface. It is 32 bit and 64-bit application having fast computation speed compared to earlier versions of MIKE and other software. It is fully dynamic, user friendly, one dimensional tool for the break analysis which simulates flood waves, sediment transportation, water quality in channels or water bodies, etc.., The main feature of MIKE 11 is that it is an integrated modular structure with various add on modules like hydrology, advection – dispersion, water quality model, cohesive sediment transport, non-cohesive sediment transport, hydrodynamic model, rainfall – runoff model and flood forecasting model. Hydrodynamic module is one of the core module of MIKE 11 package simulating unsteady flow in open channel. It uses implicit finite difference method for simulation.

Danish Hydraulic Institute (DHI) MIKE 2 is a two-dimensional modeling software developed based on MIKE 11 for 2D free surface flows and the model perform study on Newtonian fluids over initial dry terrain. It is used for the two dimensional simulation of the flow in rivers and estuaries and predict a wide range of floodplain situation in two-dimension. This allows sub-critical, super-critical and mixed flow condition of flow and it is applicable to the designing of the coastal and offshore structure, inland flooding and overland flood modeling. Care should be taken when modelling heavy steeply rising floods and shallow wave fronts. It uses a finite difference method to solve the numerical solution of the two dimensional shallow water equations, the depth integrated incompressible Reynolds averaged Navier Stokes equations subject to Boussinesq assumption and the presence of hydrostatic pressure.

Hydraulic Engineering CENTRE'S River Analysis System (HEC-RAS) is developed by USACE's Hydrologic Engineering Center. In the previous versions of HEC-RAS, it was possible to simulate the flow as one-dimensional flow only using full Saint Venant equation to simulate the flow. In February 2016, RAS model with ability to perform 2D hydrodynamic unsteady flow routing using Saint Venant equation or Diffusion wave equation was introduced. HEC_RAS model simulate the flow in river channels and floodplains and the model was considered as efficient model for predicting downstream flooding effects from an upstream event i.e., by dam break study. HEC-RAS model uses the breach information and breach geometry as input data to simulate the dam break model. The model simulates the resulting flood wave generated based on the consequences of an upstream event and models downstream effects based on the results of dam break studies. It works with both off channel and on channel reservoir storages, dam break modeling and mixed flow analysis.

4. CONCLUSION

Dams are the storage structure constructed across the river to store water in the upstream and release it to downstream as and when the demand arises. Inspite of many advantages of dams and reservoir, the failure of dam creates disaster to human beings in the form of loss of life and properties like roads, railways, bridges and buildings. Hence it is necessary to carry out dam break analysis to study the behavior of the flood wave generated from the dam break and to prepare the inundation maps as a part of emergency action plan to evacuate the population during the flood event. Selection of the appropriate model is very important in dam break study, the model can be selected by analyzing the study area, dam breach parameters available and accuracy of the model. From the literature review carried out it was found that HEC-RAS is efficient tool which provides more reliable results in dam break study and results obtained from the simulation model can be exported to GIS platform through GeoRAS to prepare the inundation mapping.

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