



FLOOD INUNDATION MAPPING FOR SATHANUR DAM

V. Aishwaryalakshmi

Assistant Professor, Department of Civil Engineering,
Saveetha Engineering College, Chennai, Tamilandu, India

Nilesh Kumar

Assistant Professor, Department of Civil Engineering,
Saveetha Engineering College, Chennai, Tamilandu, India

M.G. Prathap

Assistant Professor, Department of Civil Engineering,
Saveetha Engineering College, Chennai, Tamilandu, India

B. Abinaya

Assistant Professor, Department of Civil Engineering,
Saveetha Engineering College, Chennai, Tamilandu, India

ABSTRACT

India has totally 4050 large dams and 475 are under construction as per the National Register of Large dams 2002. Some of these dams were built in the early 19th century and many during 20th century. Every dam need a flood inundation map during the heavy rainfall or dam break for dam operation so the main objective of this paper the flood inundation map was prepared for Sathanur Dam for the maximum discharge of 8000 cumces which was occurred in the year 1973 using HEC-RAS software. The totally capacity of the reservoir is 300.601Mm³.

Key words: Sathanur dam, HEC-RAS, flood inundation map.

Cite this Article: V. Aishwaryalakshmi, Nilesh Kumar, M.G. Prathap, B. Abinaya, Flood Inundation Mapping for Sathanur Dam. *International Journal of Civil Engineering and Technology*, 8(8), 2017, pp. 1306–1311.

<http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=8>

1. INTRODUCTION

Dams store large amount of water uncontrolled release of heavy water has great potential for loss of life and damage to properties. Therefore it is important to save the people and properties in the downstream. It was observed that the major floods occurred in year 1942,1964,1966,1972,1992. Out of this 1972 has the maximum discharge of 8000 cumces for this maximum discharge condition flood inundation map was prepared. This studies includes

identification of flood zone of peak discharge for 8000 cumces for Sathanur dam downstream. From the flood zone identification the hydraulic model was carried out by HEC-GeoRAS pre and post processing. The final result will show the flood depth, inundation map. An overlay of the flood extent map with land use map clearly show the inundated villages in downstream.

1.1. Objective

To prepare the flood inundation map for Sathanur Dam downstream for the probable maximum flood condition.

1.2. Study Site

The Sathanur Reservoir is constructed across Ponnir river near sathanur village in Chengam Taluk, Tiruvannamalai District. The location is approachable through barrackpore trunk road and is about 32 km from Tiruvannamalai Town. Detailed investigation of the reservoir was taken up during 1954. The first stage was immediately sanctioned for execution at an estimated cost of Rs. 289 lakhs. Water from the reservoir is let down in the river itself and picked up at about 7Km lower down by an anicut. The Project comprises a reservoir, Pickup anicut and two canal systems.

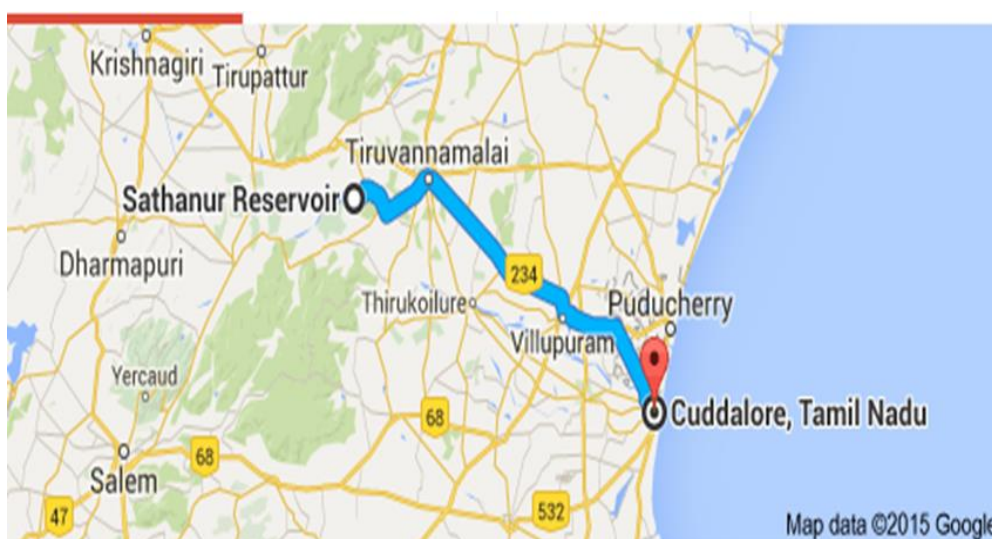


Figure 1

2. DATA REQUIRED IN HEC-RAS

The basic data required to run the HEC-RAS model are digital elevation model (DEM), peak discharge data, land use map for the study area for setting up of HEC-RAS model, the primary data required are triangulation irregular network. These data sets were collected and procured from different sources in Table 1.

Table 1 data collection and sources

DATA REQUIRED	SOURCE
Discharge data from 1958 to 2015	Public works department
Land use map	Institute for water studies
Hydraulic particulars of main spillway, saddle spillway, additional spillways	Public works department

Table 2 Flood history of Sathanur Dam

DATE	INFLOW IN CUSEC (DISCHARGE)	INFLOW IN M ³ /S (DISCHARGE)	RANK
12.11.1991	8000	2131.66	1
25.10.2005	47260	1338.25	2
18.12.1996	41819	1184.18	3
5.12.1993	28680	812.13	4
20.12.2007	15498	438.85	5
9.10.1986	15283	432.77	6
16.11.1994	13300	376.61	7
17.11.1992	11236	318.17	8
28.11.1997	10067	285.07	9
11.12.1998	9424	266.86	10
13.9.1988	9154	259.21	11
7.10.2001	8877	251.37	12
24.12.1983	8807	249.39	13
25.10.2000	8500	240.69	14
4.10.2011	7905.093	223.85	15
20.11.2008	7581	214.67	16
18.10.2004	7338	207.79	17
28.10.1999	6449	182.62	18
2.12.2010	5035	142.58	19
8.12.1987	4651	131.70	20
3.11.1995	4433	125.53	21
4.10.1984	4236	119.95	22
1.1.2012	3472	98.32	23
17.9.2013	2789	78.98	24
5.11.2009	2465	69.80	25
30.10.2014	2418.981	68.50	26
29.9.1985	1945	55.08	27
14.11.1989	1703	48.22	28
19.10.2006	1678	47.52	29
19.9.1982	1483	41.99	30
12.10.2003	1238	35.06	31
30.10.2002	1204	34.09	32

3. METHODOLOGY

The following methodology was adopted for the preparation of flood inundation map

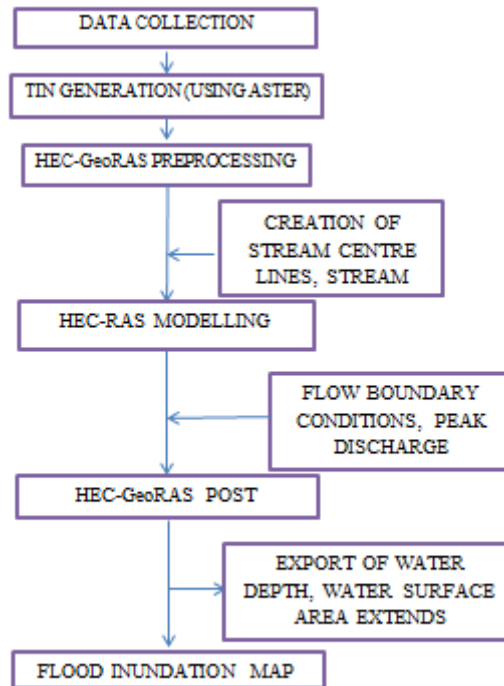


Figure 2 Methodology Flow Chart

4. RESULT

The HEC-RAS model output was in form of water surface profile, cross sectional plots, cross sectional profile Table and X-Y-Z perspective plots for the river. It also gives information about flow velocity, water surface elevation and discharge along the channel. Figure 3 shows the cross section data of the river station of 127341.6 of peak discharge 1972 year(8000m³/s).

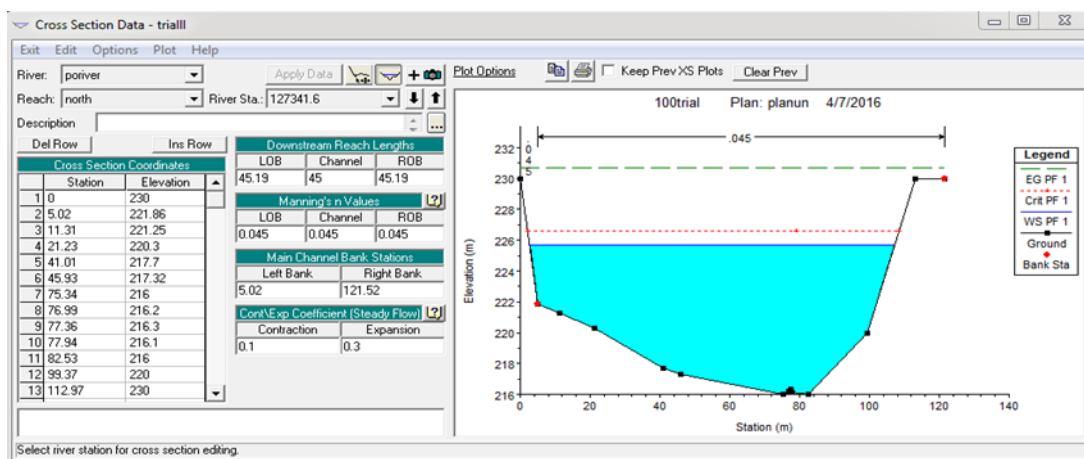


Figure 3 Cross section Data of River Station of 127341.6

The flood Inundation map are final out obtained after the pre and post processing in HEC-RAS which shows the extent and depth of flood for different scenarios. There was a changes in depth of flood for different conditions. Figure 4 shows the inundation map for 1972 peak discharge, This map are imposed on the Google earth map to find out the inundated villages.

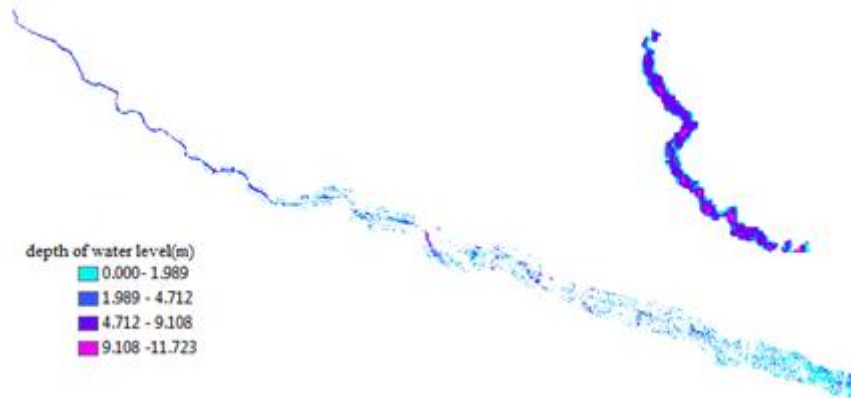


Figure 4 The flood inundation map for 1972 peak discharge

The inundation map was overlaid on the Google earth map to find out the inundated villages for the different scenarios and the detailed inundated. Figure 5 shows the overall view of flood inundation map for the 1972 year peak discharge.



Figure 5 Flood Inundation Map Overlaid for 1972 Years

5. CONCLUSIONS

This study focuses on the preparation on flood inundation map and identifying the vulnerable areas of the Sathanur dam downstream. The model was run to find the peak discharge to find the depth. In the flood prone areas estimation of the depth of water was done and it is done for the 1972 event the depth of inundation found to be 11.8m. The output was overlaid on Google earth map to find out the inundated villages.

REFERENCES

- [1] Abdelkader T. Ahmed (2015) 'Hydrological And Environmental Impacts of Grand Ethiopian Renaissance Dam on the Nile River' Eighteenth International Water Technology Conference, IWTC18
- [2] Aidin Rahmani (2001) 'A Survey of Flood Risk and Statistical Analysis of Floods in a Stretch of TALEGAN River in KAMAKAN Station' world of science journal volume:1,issue:6,page:93-100

- [3] Aliakbar Matkan et.al (2009)' Flood Early Warning with Integration of Hydrologic and Hydraulic Models, RS and GIS (Case Study: Madarsoo basin, Iran)', World Applied Sciences Journal 6 (12): 1698-1704, ISSN 1818-4952.
- [4] Amir abbas (2014)' Effects of Dam Break on Downstream Lands Using Gis and Hec-Ras (Case Study: Eyvashan in Lorestan-Iran)', Advances in Environmental Biology, 8(7) May 2014, Pages: 2314-2321.
- [5] Claudia Kuenze (2010)' sar time series for the analysis of inundation pattern in the yellow river delta, china' volume 22 of the series remote sensing and digital image processing pp427-441.
- [6] Collins fosu et.al (2011)' River Inundation and Hazard Mapping – a Case Study of Susan River – Kumasi', international journal of social science and interdisciplinary reseArch,vol.2.
- [7] Darshan Mehta et.al(2014)' Geomorphic effectiveness of flood on lower Tapi river basin using 1-D hydrodynamic model, HEC-RAS', international journal of advanced research in engineering, science and management.
- [8] Dhruv Sen Singh (2015)' Climatically induced levee break and flood risk management of the Gorakhpur region, Rapti River basin, Ganga Plain, India' journal of the geological society of India volume 85,issue 1,pp 79-86
- [9] Hamed Hasani (2013)' Determination of Flood Plain Zoning in Zarigol River Using the Hydraulic Model of HEC-RAS', International Research Journal of Applied and Basic Sciences ISSN 2251-838X / Vol, 5 (3): 399-403
- [10] Jie yin (2012)'multiple scenario analyses of Huangpu river flooding using a 1D/2D coupled flood inundation model' springer science and business media Dordrecht.
- [11] Jin Woo Lee (2012)'numerical simulation of flood estimation for Gis based local inundation map' advances in water resources and hydraulic engineering pp98-101
- [12] Johnson, GD Strickland, MD and Byyok, L. 2001. Quantifying impacts to riparian wetlands associated with reduced flow along the Greybull River Wyoming, 19 (1): 71-77.
- [13] Josh G.I and Shah S.D.(2014) 'Tapi River Flood Risk Map For Surat By Using Gis', Indian Journal Of Applies Research, Vol.4,Issue 8, ISSN 2249-555.
- [14] Kelvin mabao et.al (2014)' Assessment and Analysis of the Floodplain of Cagayan De Oro River Basin', Mindanao Journal of Science and Technology Vol.12.
- [15] Kourgialas (2012) 'estimating flood inundation and the consequent economic lossesin the koiliaris river basin in crete, greece' Department of Environmental Engineering N.N. kourgialas Technical University of Creteg.p. karatzas Polytechnioupolis, 73100 Chania
- [16] M.S.Altinakar (2010) '2D Modeling of Big Bay Dam Failure in Mississippi: Comparisonwith Field Data and 1D Model Results' River Flow 2010 - Dittrich, Koll, Aberle & Geisenhainer (eds) - © 2010 Bundesanstalt für Wasserbau ISBN 978-3-939230-00-7
- [17] Minyan duan (2003)' Use of remote sensing and GIS for flood hazard mapping in Chiang mai Province ,northern Thailand', Bureau of Research Development and Hydrology, Department of Water Resources.
- [18] Mohamad Reza Madadi (2015) 'Application of Google earth to investigate the change of flood inundation area due to flood detention dam'eartg science informatics volume 8, issue 3, pp 627-638.
- [19] Mohamed Djebbi (2012) 'Delineation of the Flood Prone Zones Along the Medjerda River Downstream of Sidi Salem Dam in Tunisia', Journal of Sustainable Watershed Science & Management.
- [20] Muhammad Irfan Malik (2014) 'Flood Inundation Mapping and Risk Zoning of the Swat River Pakistan using HEC-RAS Model', Lasbela. Uni. J. Sci., Tech., vol.3, pp. 45-52, 2014 Parviz Kardavani et.al (2013) 'Effi.
- [21] Kalpalatha.Ganamala and P. Sundar Kumar , A Case Study on Flood Frequency Analysis , International Journal of Civil Engineering and Technology , 8(4), 2017, pp. 1762 -1767.
- [22] R. S. Meena and R. Jha. Approximating Soil Physical Properties Using Geo -Statistical Models in Lower Kosi Basin, of Ganga River System, India Prone to Flood Inundation. International Journal of Civil Engineering and Technology , 8(5), 2017, pp. 1445 –1459