-of-babon-river-kang-roto-banjardowo-semarang-city-indonesia.pdf

by

Submission date: 04-Apr-2023 01:51PM (UTC+0700)
Submission ID: 2055435988
File name: -of-babon-river-kang-roto-banjardowo-semarang-city-indonesia.pdf (409.53K)
Word count: 3165
Character count: 14859

TRKU ISSN: 04532198
ISSN: 04532198
Volume 65, Issue 01, January, 2023

Flood Analysis of Babon River (Kang Roto – Banjardowo) Semarang City Indonesia

Ikhwanudin[1], I Harjanto[2], F Yudaningrum[3], Agus Kris Budiman[4]

Department of Civil Engineering, Faculty Engineering, Universitas PGRI Semarang, Central Java, Indonesia[1,2,3]

ABSTRACT— Along with the rapid development of the city of Semarang, numerous problems have emerged, including the occurrence of flood-related natural disasters in several areas along the city's north coast, one of which is the flood. The flow of the Babon River, a component of the East Semarang drainage system, stretches from the Penggaron region in the upstream to the Genuk region in the downstream..Numerous factors affect the Babon Semarang River, including its restricted capacity due to sedimentation, the pace of land subsidence, high tides, and overflows from nearby rivers. This regulation is for figuring out how high the water will get during the rainy season, how much water the river can hold using Hec-ras, and how to handle the Babon river flood. Research Techniques for the Analysis of the Babon River Flood Control in the Karangroto-Banjardowo Area, Semarang City, starts with the gathering of secondary data, such as data on rainfall, data from rain stations, and data on the characteristics of watersheds.Using information on rainfall, channel measurement data, and the state of the channel, the planned flood discharge (R24) is calculated.The researcher will use this information to determine the anticipated rainfall for the return periods of Q 2, 5, 10, 25, 50, and 100 years.We employ the Normal Distribution, Log Normal Distribution, Pearson III Log Distribution, and Gumbel Distribution to calculate the data. Afterward, Log III distribution analysis was used since it was closer based on these calculations. he peak flood discharge (QP) value is 2.07 km³, the Q2 year is 21.82 m/sec, the Q5 year is 25.17 m/sec, the Q10 year is 27.41 m/sec, the Q25 year is 30.25 m/s, the Q50 year is 32.40 m3/s, and the Q100 year is 34.55 km³/s according to data analysis using the Nakayashu method.Following that, it is simulated in the Hydrology Engineering Center River Analysis System (Hec-Ras) application program using the flood discharge data for the Q50 year return period.

KEYWORDS: River, Intensity, Flood, HEC-RAS

1. INTRODUCTION

Many issues have emerged as a result of the passage of time and the city's developments, including the frequent occurrence of natural disasters like floods along Central Java's north coast, particularly along Semarang's northern coast. With regard to the draft regional regulation on spatial planning for the city of Semarang and the occurrence of flood natural disasters in several areas along the Baboon River, it is necessary to consider resolving the issue of natural flooding by looking at the drainage system in its entirety, not just a portion of it. Given this context, it is necessary to examine the issue of flood natural disasters that affected Semarang, to determine how much the flood water level rises in the Baboon River, and to determine what steps will be taken in an effort to address the flood problem [1], [2]. According to the data in the lattice, an analysis of the bencana alam banjir crisis occurring in Kota Semarang is required to determine how large the kenaikan muka air banjir in the relevant sungai babon is and what steps will be taken to resolve the crisis. The study was then conducted using the HEC-RAS tool for a number of reasons [3], [4]. Using the application of what actually occurred in the field, the analysis with HEC-RAS is a type of imitation or simulation, as previously mentioned.5.0.1 of Analysis System). Given this context, it is essential to examine the flood issue that affected Semarang in order to determine how much the river's floodwater level rises and what actions will

be made to address the issue. The HEC-RAS (Hydrologic Engineering Center's - River Analysis System) version 5.0.1 application will be used in this example to analyze the rise in flood water levels and the current condition of the river [5]. The goal of the study was to ascertain the height of the water during the rainy season, compute the river's capacity using Hec-ras, and establish how to manage a flood on the Babon River. In order to prevent flooding for the next five years, Semarang City's Analysis of Flood Management in the Babon River aims to improve the flow of water discharge. As a result, the drainage system has been restructured and the population is protected from flooding caused by rain [6], [7].

2. Method

The research method is to analyze the occurrence of flood natural disasters and efforts to mitigate them; the data used is a combination of primary and secondary data. Data processing activities are carried out by optimally accumulating all data, grouping it based on the type of data, and then analyzing it [7]. The following are the results of the data analysis: a. Hydrological analysis to determine the planned discharge due to heavy rainfall in the Jl. Brigadier General S. Sudiarto area The importance of hydrological analysis in prevention cannot be overstated, b.Hydraulic analysis is used to determine the capacity of a channel. Furthermore, to determine the tides, a comparison of Q Full Bank Capacity and Q Plans is required. When a flood occurs, an application program called HEC-RAS can be used to determine the water level profile [8- 10]. Using hydrology and hydraulics methods to analyze data obtained from primary and secondary sources; Hydrological analysis and hydrological studies include the following: a. Average Rainfall Calculation, b. Calculating the Maximum Daily Rainfall, c. Program for simulating hec races, d. Alternative Flood Control is carried out as follows: Data from the Baboon River, Watershed Area 19,3 km2, Channel length 17 km and Coefficient of Watershed Characteristic α 1.445 [11], [12].

3. Research Location

The research site lies on Jl. Brigadier General S. Sudiarto, which is in the centre of the city and connects East Semarang with the suburbs. As a result, the road access serves as the primary route to the city center and other parts of the city, particularly the Demak and Grobogan regions [13].

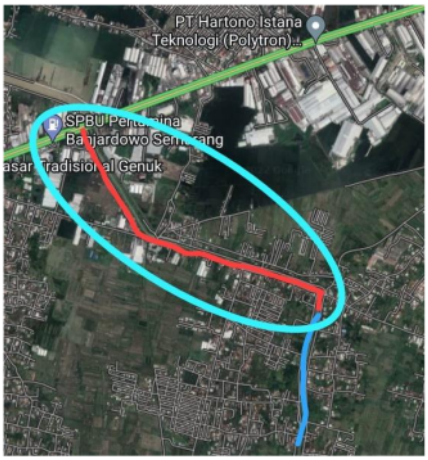

Figure 1. Location of Karangroto-Banjardowo

4. Result

The Theissen method can be used to calculate the amount of annual rainfall that can be expected. The area of the station in question is calculated using this method. A rain station from Pucanggading, Semarang City, which is situated at the following coordinates: 110 29 2,456 E 7 2 39 905 S, is shown below. The maximum

ISSN: 04532198
Volume 65, Issue 01, January, 2023

daily rainfall was used; the following table shows the maximum rainfall.

Table 1. K distribution log characteristic value Thompson III

Koefisien	Kala Ulang					
Skewness	2	5	10	25	50	100
CS	50	20	10	4	2	1
0.8	-0.132	0.780	1.336	1.998	2.453	2.891
0.74	-0.123	0.786	1.334	1.981	2.427	2.853
0.7	-0.116	0.790	1.333	1.967	2.407	2.824

Source: Results of the calculations, 2022

The highest maximum rainfall at Pucanggading Station was 150 mm in 2011, and the lowest was 72 mm in 2019, according to the aforementioned results. The rainfall was calculated using the Thiessen Polygon Method. using data from the rain station, calculate the anticipated rainfall [2]. As shown in the table below, the following information was used to determine the maximum daily rainfall (R24 Maximum) from 2011 to 2020: Analysis of frequency. The amount of a planned rainfall will later be determined using a variety of statistical distributions, including the following types, which are used in frequency analysis: is the frequency distribution's type: a. Pearson Type III Log Distribution, b. Log Normal Distribution, c. Gumbel distribution, The aforementioned method needs to be tested to determine its viability before being used in a flood control calculation. Measurements of dispersion are used in the test (Statistical Parameters) Here's how to calculate rain plans using the distribution of the log Pearson III: Calculation of Re-Planned Rain (Method of Log Pearson III). III [8], [14]. The following table shows the outcomes of the Pearson III log method's calculation of rainfall plans for the return period:

Table 2: Results of the forecasted precipitation calculation

Period of birthdays (years)	Also, probability	Plan rain (mm)
	A = 19.3	
2	0.5	123.686
5	0.2	142.834
10	0.1	155.805
25	0.04	172.602
50	0.02	185.256
100	0.01	198.196

Source: Results of the calculations, 2023

After obtaining the information necessary to calculate the maximum daily rainfall data (R24), the graph shown above will be created using the design rainfall data.

Table 3 shows how to calculate a flood hydrograph with a return period (t) of one year in Nakayatsu.

Period of birthdays (years)	max value	Plan rain
	A = 25.37	
2	1,84	
5	3,01	

10	9,79
25	11,05
50	19,69
100	20,35

Source: Results of the calculations, 2023

After calculating the Flood Hydrograph using the Nakayashu Method for Return Periods of 2, 5, 10, 25, 50, and 100 years, it shows the results of the recapitulation of the Nakayashu Method Flood Hydrograph calculation with a 2-year Q of 1.82 m3/s, a 5-year Q of 3.01 m3/s, a 10-year Q of 9.79 m3/s, a 25-year Q of 11.05 m/s, a 50-year Q of 19.69. Application of the HEC-RAS Program: The hydraulic analysis is computed using the HEC-RAS application program in order to determine the elevation of the water level on the channel cross section when water flows through the channel. The condition of the channel is not flooded at sta 0.00 according to calculations performed using the HEC-RAS program, which is demonstrated by the following:

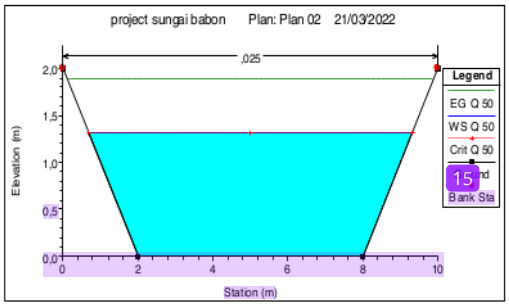

Figure 2 shows the STA 0.00 River in cross-section.

The flood overflowed at sta 5.00 according to calculations made with the HEC-RAS program, as shown in Figure 3:

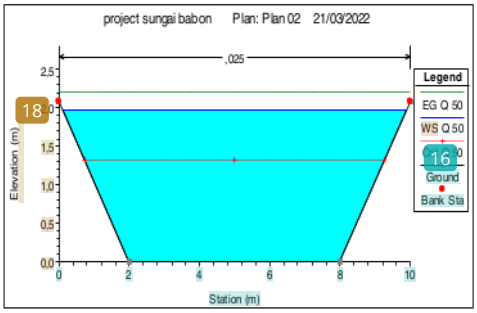

Figure 3 shows the STA 22 in cross-section.

According to calculations made with the help of the HEC-RAS program, the flood overflows at sta. 8.00, as shown by the following:

ISSN: 04532198
Volume 65, Issue 01, January, 2023

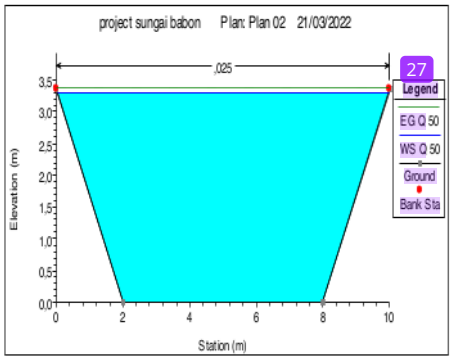

Figure 4 shows the river STA in cross-section.42

The Babon-Banjardowo river is depicted in the side view below based on the findings of the calculation analysis performed using the HEC-RAS as shown below:

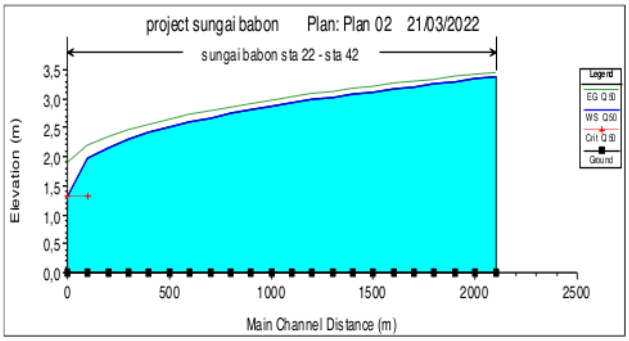

Figure 5 shows the longitudinal cross section of the STA 22-42.

Evaluation of the capacity of both the currently used channel and the one that will be used for the planned discharge. A comparison between the capacity of the existing river and the capacity of the planned discharge can be made by first calculating the capacity of the existing river and then calculating the capacity of the planned discharge. If the capacity of a river is greater than the discharge that was designed for it, then the river is safe to use. On the other hand, if the capacity of a river is lower than its planned discharge, then the river is considered unsafe because it floods more frequently. The findings of the study, which was carried out by employing the HEC-RAS method with a return period (t) of fifty years, are presented in Table 5.

Table 4. Hasil perhitungan debit banjir dengan periode ulang (t) 50 tahun metode Nakayatsu

No	STA	Debit (Q) Qp (m^3/dt)	Penampang Penuh m^3/s	Selisih	Keterangan
1	0	32	33,6	1,6	Tidak Banjir
2	22	32	33,3	1,3	Tidak Banjir
3	23	32	32.9	0,9	Tidak Banjir
4	24	32	31,1	-0,9	Banjir
5	25	32	30,6	-1,4	Banjir
6	26	32	30,2	-1,8	Banjir
7	27	32	29,8	-2,2	Banjir
8	28	32	29,3	-2,7	Banjir

9	29	32	30,9	-1,1	Banjir
10	30	32	30,2	-1,8	Banjir
11	31	32	30,4	-1,6	Banjir
12	32	32	30,7	-1,3	Banjir
13	33	32	29,9	-2,1	Banjir
14	34	32	30,0	-2	Banjir
15	35	32	31,2	-0,8	Banjir
16	36	32	33,1	1,1	Tidak Banjir
17	37	32	34,0	2	Tidak Banjir
18	38	32	35,0	3	Tidak Banjir
19	39	32	35,6	3,6	Tidak Banjir
20	40	32	33,4	2,4	Tidak Banjir
21	41	32	34,0	2	Tidak Banjir
22	42	32	34,7	2,7	Tidak Banjir

The river in Karangroto-Banjardowo Semarang still partially accommodates the planned flood discharge, while the river is still unable to do so in STA 24-35, according to the results of the calculation of flood discharge with a return period (t) of 50 years using the Nakayatsu method. When calculating the capacity of the planned discharge capacity and the capacity of the existing channel, it is possible to compare the two by comparing the capacity of the channel with the capacity of the planned discharge. It is possible to determine whether or not a channel is safe to use by determining whether or not its capacity is greater than the discharge that is planned for the channel. On the other hand, if a channel's capacity is less than the design discharge, then the channel is considered unsafe, and this can lead to flooding.

5. Conclusion

According to the findings of this research, one can draw the following conclusions regarding the calculation of the planned discharge using the Nakayashu method: QP has a value of 2.07 m3/sec; Q 2 years has a value of 21.82 m/sec; Q 5 years has a value of 25.17 m3/sec; Q 10 years has a value of 27.41 m3/sec; Q 25 years has a value of 30.25 m3/s; Q 50 years has a. According to the findings of a simulation run with the HAC-RES program, the baboon river in the Karangroto - Banjardowo area of Semarang City in Q 50 years will not be able to handle a flood with a flow rate of 32.40 m3/sec at sta 22-sta42. These findings are based on the results of the simulation. Therefore, in order to prevent flooding on the Babon River in the Karangroto - Banjardowo area of Semarang City, channel normalization and increasing the channel discharge capacity using the Hec-Ras application program by either elevating or constructing embankments have been implemented as preventative measures.

6. References

[1] S. I. Wahyudi, "Perbandingan Penanganan Banjir Rob Di La Briere (Prancis), Rotterdam (Belanda) Dan Perspektif Di Semarang (Indonesia)," J. Riptek, vol. 4, no. 2, pp. 29–35, 2010.

[2] Ikhwanudin, S. I. Wahyudi, and Soedarsono, "Methods for Handling Rob Floods in the Banger River Basin in Semarang City," J. Phys. Conf. Ser., vol. 1625, no. 1, 2020, doi: 10.1088/1742-6596/1625/1/012041.

[3] R. Wigati and S. Soedarsono, "ANALISIS BANJIR MENGGUNAKAN SOFTWARE HEC-RAS 4.1 (Studi kasus sub DAS Cisimeut hilir HM 0+00 Sampai dengan HM 69+00)," Fondasi J. Tek. Sipil, vol. 5, no. 1, 2016, doi: 10.36055/jft.v5i1.1243.

[4] L. T. Sihotang, Syahrizal, and I. Indrawan, "Analisa Kapasitas Pengendalian Banjir Dengan Perbandingan Metode Hss, Hec- Hms Dan Hec-Ras Di Daerah Aliran Sungai Sei Sikambing, Kabupaten Deli Serdang," 2015.

[5] M. Perkiraan Laju Aliran Puncak Sebagai Dasar Analisis Sistem Drainase di Daerah Aliran Sungai Wilayah Semarang Berbantuan SIG, T. Wismarini, and D. Handayani Untari Ningsih dan Fatkhul Amin, "Metode Perkiraan Laju Aliran Puncak (Debit ir) sebagai Dasar Analisis Sistem Drainase di Daerah Aliran Sungai Wilayah Semarang Berbantuan SIG," J. Teknol. Inf. Din., vol. 16, no. 2, pp. 124–132, 2011.

[6] I. Suprayogi, B. Sujatmoko, Y. Morena, and K. Ghofirin, "Analisis Pengaruh Perubahan Tata Guna Lahan terhadap Saluran Drainase Jalan Dorak (berdasarkan Pola Rencana Tata Ruang Tata Wilayah Kabupaten Meranti Tahun 2013-2032) menggunakan Model Epa Swmm 5.0," J. Saintis, vol. 17, no. 1, pp. 1–14, 2017.

[7] A. R. Ikhwanudin, F Yudnangrum, N Hidayah, "Penanggulangan banjir di jalan brigjen s. sudiarto kota semarang sta. 0.00 – 8.00," vol. 10, no. 2, pp. 168–174, 2022.

[8] R. A. Syuhada, Y. L. Handayani, and B. Sujatmoko, "Analisa Debit Banjir Menggunakan Epa Storm Water Management Model (SWMM) di Sub DAS Kampar Kiri," Jom FTEKNIK, vol. 3, no. 2, pp. 1–8, 2016.

[9] S. Suripin and D. Kurniani, "Pengaruh Perubahan Iklim terhadap Hidrograf Banjir di Kanal Banjir Timur Kota Semarang," Media Komun. Tek. Sipil, vol. 22, no. 2, p. 119, 2016, doi: 10.14710/mkts.v22i2.12881.

[10] Ikhwanudin, S. I. Wahyudi, and Soedarsono, "Simulation of Catchment Area, Water Storage and Pump Capacity in Polder Drainage System," in IOP Conference Series: Earth and Environmental Science, Jun. 2020, vol. 498, no. 1. doi: 10.1088/1755-1315/498/1/012073.

[11] H. S. Budinetro, S. Rahayu, T. A. Praja, A. Taufiq, and D. Junarsa, "Semarang City Flood Control Strategy," J. Sumber Daya Air , vol. 8, no. 2, pp. 141–156, 2012.

[12] A. M. Marfai, A. Cahyadi, and F. D. Anggraini, "TIPOLOGI, DINAMIKA, DAN POTENSI BENCANA DI PESISIR KAWASAN KARST KABUPATEN GUNUNGKIDUL Typology, Dynamics, and Potential Disaster in The Coastal Area District Karst Gunungkidul," Forum Geogr., vol. 27, no. 2, pp. 147–158, 2013.

[13] R. K. Yudi, A. M. Nugroho, S. Darsono, and D. A. Wulandri, "Perencanaan Sistem Polder Wilayah Semarang Timur," J. Karya Tek. Sipil, vol. 6, no. 2, pp. 265–275, 2017.

[14] J. Karya, T. Sipil, J. Karya, and T. Sipil, "No Title," vol. 3, pp. 87–92, 2014.

-of-babon-river-kang-roto-banjardowo-semarang-city-indonesia.pdf

ORIGINALITY REPORT

19%	16%	10%	11%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	jurnal.uns.ac.id Internet Source	2%
2	jurnal.narotama.ac.id Internet Source	2%
3	Submitted to Academic Library Consortium Student Paper	2%
4	eprints.unisbank.ac.id Internet Source	1%
5	repository.president.ac.id Internet Source	1%
6	Mariana Marselina, Siti Ai Nurhayati, Stenfri Loy Pandia. "Flood Analysis and Estimating Economic Losses in an Affected Area (Case Study: Cikapundung Watershed)", Air, Soil and Water Research, 2022 Publication	1%
7	teslink.nusaputra.ac.id Internet Source	1%

8	tekniksipil.untirta.ac.id Internet Source	1 %
9	journals.ums.ac.id Internet Source	1 %
10	scitepress.org Internet Source	1 %
11	www.hrpub.org Internet Source	1 %
12	www.sciencepublishinggroup.com Internet Source	<1 %
13	Ikhwanudin, S I Wahyudi, Soedarsono. "Methods for Handling Rob Floods in the Banger River Basin in Semarang City", Journal of Physics: Conference Series, 2020 Publication	<1 %
14	A Huddiankuwera, R Rochmawati, Iriaanto. "Makanuai river flood control study at Jayapura district", IOP Conference Series: Earth and Environmental Science, 2021 Publication	<1 %
15	www.comune.pisa.it Internet Source	<1 %
16	Submitted to Kuala Lumpur Infrastructure University College Student Paper	<1 %

17	Yunita Ismail, Dyah Ayu Lestari. "Analysis of drainage system using EPA SWMM 5.1 (Case study: Setia Asih Village, Bekasi District)", AIP Publishing, 2022 Publication	<1 %
18	www.comune.pietrasanta.lu.it Internet Source	<1 %
19	www.vulhm.cz Internet Source	<1 %
20	Submitted to Sultan Agung Islamic University Student Paper	<1 %
21	ejournal.pelitaindonesia.ac.id Internet Source	<1 %
22	ph01.tci-thaijo.org Internet Source	<1 %
23	unisbank.ac.id Internet Source	<1 %
24	ceias.nau.edu Internet Source	<1 %
25	idoc.pub Internet Source	<1 %
26	scholarworks.uno.edu Internet Source	<1 %
27	core.ac.uk Internet Source	<1 %

28	repository.unikama.ac.id Internet Source	<1 %
29	repository.unmuhjember.ac.id Internet Source	<1 %
30	www.sciencegate.app Internet Source	<1 %
31	Achmad Syarifudin, Alfrendo Satyanaga, Henggar Risa Destania. "Application of the HEC-RAS Program in the Simulation of the Streamflow Hydrograph for Air Lakitan Watershed", Water, 2022 Publication	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		