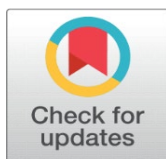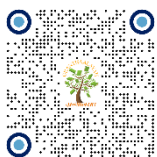# ANALYZING THE CAUSE OF TIDAL FLOODING IN RANDUSANGA KULON VILLAGE, BREBES DISTRICT, BREBES REGENCY

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ABSTRACT

In Indonesia, many regions experienced inundation as a result of the rise of seawater. One of them is the coast of Randusanga Kulon village. The coastal area of Randusanga Kulon village has recreation spots and ponds. These areas are located at the edge of a river estuary which is directly adjacent to the sea. On the other hand, the settlement area is located just 3 km from the seaside. Therefore, when a high tide occurs, the recreation, pond, and settlement areas will be hit by tidal floods. This study aimed to analyze the causes and impacts of tidal floods that hit Randusanga Kulon Village of Brebes District of Brebes Regency.

The methods used to process the data are the Formzahl and Admiralty methods. The result of calculating using the admiralty method is that Brebes Sea has Mixed Semi-Diurnal type of daily tides with a Formzahl value of 0,9948. The value of HHWL was calculated to determine the prediction of seawater rise. By using the Admiralty Method the result is 47 cm, and by using SLR data due to global warming, it is 30 cm.

Keywords: Flood, Sea Wave, Tide, Tidal Flood

1. INTRODUCTION

Nowadays, some regions in Indonesian waters are often hit by tidal floods. One of them is Randusanga Kulon Village of Brebes District of Brebes Regency. In Randusanga Kulon Village of Brebes District of Brebes Regency, there is a recreation area with the name of Randusanga Indah Beach located at the edge of the river estuary that is directly adjacent to the sea, so that when high tide occurs, the recreation area has the potency to be hit by a tidal flood. Anggrain et al. (2012)

For example, in 2022, the coastal tourism area of Randusanga Kulon Village experiencing a tidal flood.

Figure 1

Figure 1 Inundation in Randusanga Kulon Village that Hit by Tidal Flood.
Source detik.com, 2022

Aside from sea tides, tidal flood is caused by several factors. Therefore, this study analyzed the factors that cause tidal floods in Randusanga Kulon village of Brebes District of Brebes Regency. Based on the background, researchers analyzed tidal floods in Randusanga Kulon Village of Brebes District of Brebes Regency to determine a good concept of disaster countermeasure for that location. Anonymous (2020)

A tidal flood is a phenomenon in which land overflows by seawater caused by sea tides that inundate coastal areas lower than the mean sea level. Tidal floods occur because of land use changes in coastal areas, land subsidence in coastal areas, the lowering of the groundwater level caused by groundwater overuse, bad groundwater recharge in conservation areas, and the rise of sea level because of global warming Cahyaningtias (2018).

1.1. PROBLEM FORMULATION

Based on above background, the formulated problems are :
1) What factors caused tidal floods in Randusanga Kulon Village of Brebes District of Brebes Regency?
2) What are the impacts of tidal floods in Randusanga Kulon Village of Brebes District of Brebes Regency?

1.2. STUDY OBJECTIVES

This study aimed to :
1) To find out the cause of tidal flood in Randusanga Kulon Village of Brebes District of Brebes Regency
2) To analyze the impact of tidal flood in Randusanga Kulon Village of Brebes District of Brebes Regency

1.3. STUDY BOUNDARIES

Considering the limited study time, the study set up boundaries as follows :
1) Determine the wave height and period using the hindcasting method acquired from wind data processing.
2) This study focused only on tidal floods that had occurred.

3) Study location visits were carried out only in the coastal area of Randusanga Kulon Village.

2. MATERIALS AND METHODS
2.1. LOCATION

This study was carried out in Randusanga Kulon Village of Brebes District of Brebes Regency located approximately 3 km from the seashore. Brebes Regency has a total area of 1.769,62 km2 with a 60,74 km coastline that extends from the Brebes District in the East End to the Losari District in the West End. Geographically, Brebes Regency is located at 6 44'56'5'' - 7 20'51,48 South latitude and 108 41'37,7'' - 109 11'28,92'' East longitude coordinates and directly borders with West Java Province.
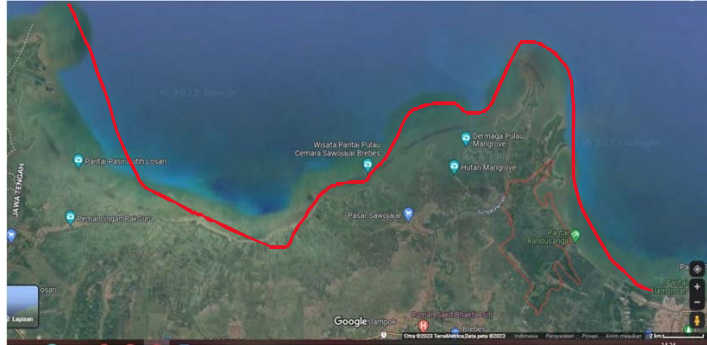
Figure 2

Figure 2 Study Location
Source Google Earth 2022
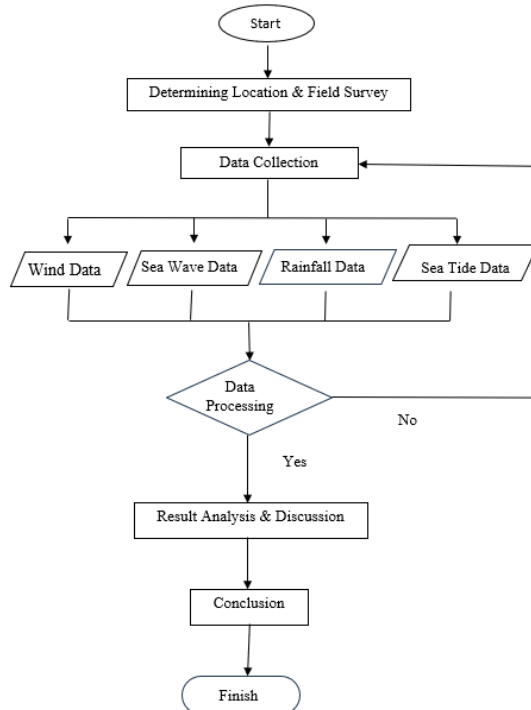
2.2. METHOD
Figure 3

Figure 3 Study Flowchart

This study uses a quantitative method. The quantitative method consists of numbers, statistics, and tables. Quantitative study is a process of gaining knowledge by using data in the form of numbers as a tool to analyze information about something that needs to be found Kasiram (2008)

3. RESULTS AND DISCUSSIONS

Below is an analysis of Sea Tide classification that counted with the Formzahl formula :

$$F = \frac{AK_1 + AO_1}{AM_2 + AS_2} \rightarrow F = \frac{20{,}73 + 6{,}63}{20{,}56 + 6{,}94} = 0{,}9948$$

Classification of Sea Tide Types according to Ongkosongo & Suyarso (1989) with the above Formzahl value can be seen in Table 1.

Table 1

Table 1 Analysis of Sea Tide Classification		
0 < 0,25	=	*Semi Diurnal*
0,25 < 1,50	=	*Mixed Semi – Diurnal*
1,50 < 3,00	=	*Mixed – Diurnal*
3,00 < ~	=	*Diurnal*

Source Jeri Kurniawan, 2014

Based on the above Sea Tide classification, Brebes Sea has a Mixed Semi-Diurnal type of tide. It means that in the Brebes Sea, within one day there are two high tides and two low tides with different heights. Nichollas (2002)

Table 2

Table 2 Formzahl Value of the Brebes Sea in 2022	
Time	**Formzahl Value**
January	0,6717
February	0,5436
March	0,4049
April	0,4136
May	0,5618
June	0,6749
July	0,6680
August	0,5476
September	0,4409
October	0,4509
November	0,9948
December	0,6058

Source Results of Calculation

1) Brebes Coast Characteristics
Land Use

Table 3

Table 3 Land Use Classification Based on Satellite Imagery					
Number	Types of Land	Symbol	Area		Description
			Ha	%	
1	Coastal area	☐	3039,70	1,72	Waters

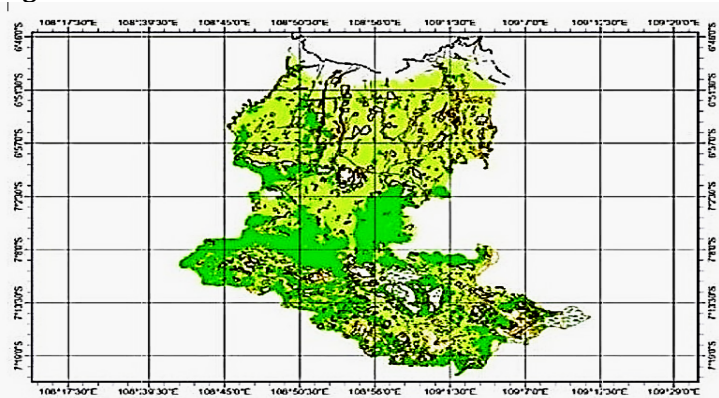|					
2	Bush		4006,00	2,26	Undeveloped land
3	Forest		12032,00	6,79	Tree Vegetation
4	Grassland		107,04	0,61	Plant Vegetation
5	Plantation		66284,70	37,45	Similar Vegetation
6	Farm		11502,30	6,49	Mix Vegetation
7	Ricefields		70605,20	39,89	Wetland Vegetation
8	Settlement		8456,10	4,78	Developed Land
9	Total		177000,00	100,00	

Figure 4

Figure 4 Map of Land Use of Brebes Regency in 2022

2) Tidal Flood Spread

The area of tidal flood spread over almost the entire Brebes coast. The inundation area is 37,87 km² or 3.787 Ha. Villages that were affected by the Tidal Flood are Limbangan, Karangdempel, Prapag Lor, Prapag Kidul, Pangaradan, Griting, Pulogading, and Randusanga Kulon.

Figure 5

Figure 5 Map of Tidal Flood in 2022

4. CONCLUSIONS AND RECOMMENDATIONS
4.1. CONCLUSIONS

Based on the results, the study can be concluded as follows :

1) The result of the calculation using the admiralty method is that Brebes Sea has a Mixed Semi-Diurnal tide type with a Formzhal value of 0,9948. HHWL value is calculated to predict the rise of the sea surface, by using the Admiralty method the result is 47 cm. And by using SLR data on global warming the result is 30 cm.

2) Area characteristics review on the condition of Brebes Regency which is based on land use, the overall study area of 177.000 ha with each class percentage as follows: Coast area 1,72%, Bush 2,26%, Forest 6,79%, Grassland 0,61%, Plantation 37,45%, Farm 6,49%, Ricefield 39,89%, Settlement 4,78%. Based on the height of elevation, the study area has an elevation of 0-200 mdpl of 119.431,67 ha area which is categorized as low. Based on the level of slope Brebes coast has the highest area value of 97.355,14 ha area of 0-8% flat relief.

3) The result of tidal flood inundation modeling in 2022 shows a distribution area of 3.787 ha. The regions that experiencing inundation are 13 villages that are directly adjacent to the sea.

4.2. RECOMMENDATION

Based on the study results, it is recommended to conduct further studies related to other factors that influence the rise of sea surface such as extreme climate, sea waves, wind, and land subsidence in the studied area. On the other hand, for the application of this study, it is expected to become a model of tidal flooding in coastal areas as a warning for the community to be more responsive towards that disaster. Moreover, this model can be used as a guide for the government in tidal flood disaster prevention and control.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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