

# Evaluating Environment, Erosion and Sedimentation Aspects in Coastal Area to Determine Priority Handling (A Case Study in Jepara Regency, northern Central Java, Indonesia)

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**Abstract.** Many areas of the northern coastal in Central Java, Indonesia, have been suffering from damage. One of the areas is Jepara, which has been experiencing this kind of damage for 7.6 kilometres from total 72 kilometres long beach. All damages are mostly caused by coastal erosion, sedimentation, environment and tidal flooding. Several efforts have been done, such as replanting mangroves, building revetment and groins, but it still could not mitigated the coastal damage. The purposes of this study are to map the coastal damages, to analyze handling priority and to determine coastal protection model. The method used are by identifying and plotting the coastal damage on the map, assessing score of each variable, and determining the handling priority and suitable coastal protection model. There are five levels of coastal damage used in this study, namely as light damage, medium, heavy, very heavy, and extremely heavy. Based on the priority assessment of coastal damage, it needs to be followed up by designing in detail and implementing through soft structure for example mangrove, sand nourishes and hard structure, such as breakwater, groins and revetment.

## 1. Introduction

Some coastal areas in the Northern Coast of Java Island have been damaged. The damage area is about 7.6 km of the 72 km long of coastal line in Jepara, Central Java. The damage was mainly caused by coastal erosion. This coastal erosion brings some effects to the settlement nearby, fish ponds, agricultural and tourist area which has high economic value [1]. The problem in the coastal area is not only erosion, but also sedimentation. Both of the parameters involve environment problem, although some areas give benefit of sedimentation process.

Some efforts have been done, such as, planting mangrove, revetment, and groins. However, the problem of erosion has not resolved yet. The method to solve the coastal damages is by assessing and determining the handling priority. In one side, the area requires to develop infrastructure. In the other side, the area needs a better maintenance[2]. Therefore, it is required to have priority orders and handling stages. The purpose of this study is to map the coastal damage, to analyze the priority handling model and to determine the coastal protection model which is observed by environment, erosion and sedimentation aspects.

## 2. Literature Review

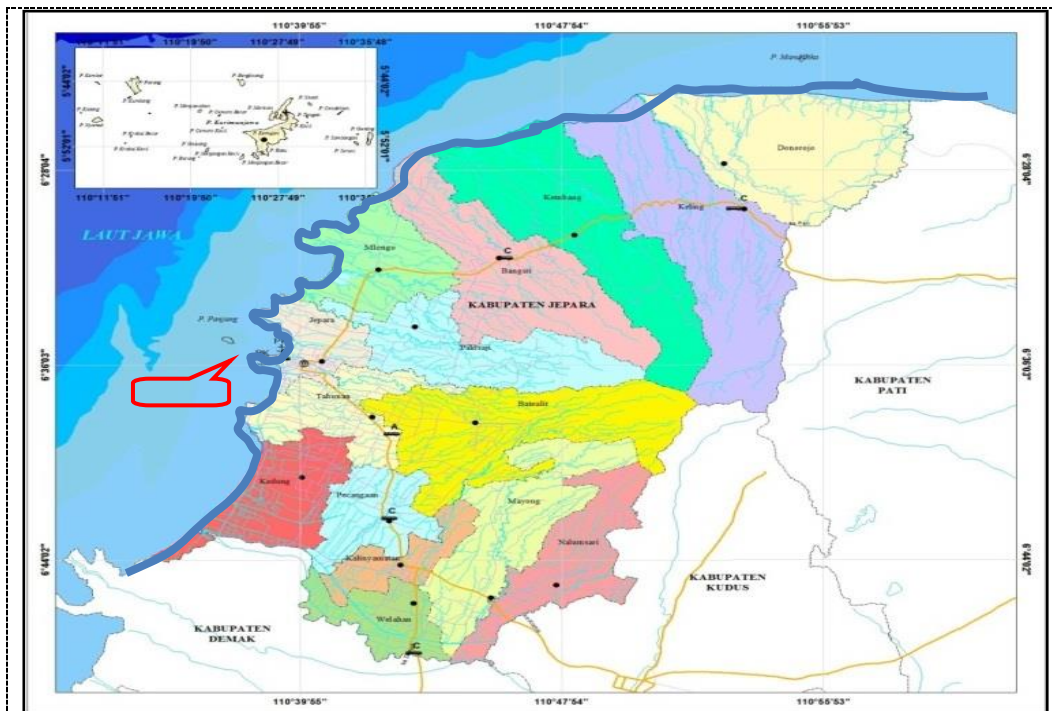
Jepara regency is one of the regencies in Central Java. This regency is selected because its beach has various models and the tourism areas. Jepara regency is about 100,413 hectares or 1004 km<sup>2</sup> wide.



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This area is located at 1100 36 '20 " to 1100 58' 15" East Longitude and 050 43 '30 " to 060 47 '44" South Latitude.

According to the geographical location, Jepara Regency has a coastline which stretches from the border Demak Regency in the south to the border Pati Regency in the north. Its total area is around 72 km<sup>2</sup> [3]. As shown in Figure 1, the coastal area in Jepara Regency includes District of Kedung, Tahunan, Jepara, Mlonggo, Bangsri, Kembang and Donorojo.



**Figure 1.** Study Location of 72 km coastal line in Jepara Regency, Northern Central Java

According to the guidelines used in the Damage Assessment and the Priority Handling contained in the manual of the Minister of Public Works of the Republic of Indonesia, No. 08/ SE/M /2010. [4], there are five levels of damage in coastal damage assessment; namely as light damage (LD), medium (M), heavy (H), very heavy (VH), and extremely heavy (EH). In assessing the beach damage, it is used an approach to the coastal environment, erosion or abrasion and damage of buildings, as well as the problems because of sedimentation.

The environmental damage can be shown in the residential areas and public facilities, agricultural areas (fields, gardens, and ponds) near coastline. Several impacts occurred from the damage, such as sea water pollution, intrusion of sea water into groundwater or rivers, mangrove logging in the coastal area, mining/destruction of coral reefs in coastal areas, tidal flood caused by sea level rise and land subsidence [5].

There are two parameters to assess the damage. The first one is erosion/ abrasion which can change shoreline position. The second parameter is erosion/ abrasion which caused damage to the building foundation and the building itself. Some areas must be moved to the upstream land of coastal area[6].

Meanwhile, there are two issues for analyzing the problems of sedimentation; the sedimentation of non-shipping river estuary and the river estuary that serves as shipping lanes [7].

### 3. Research Methodology

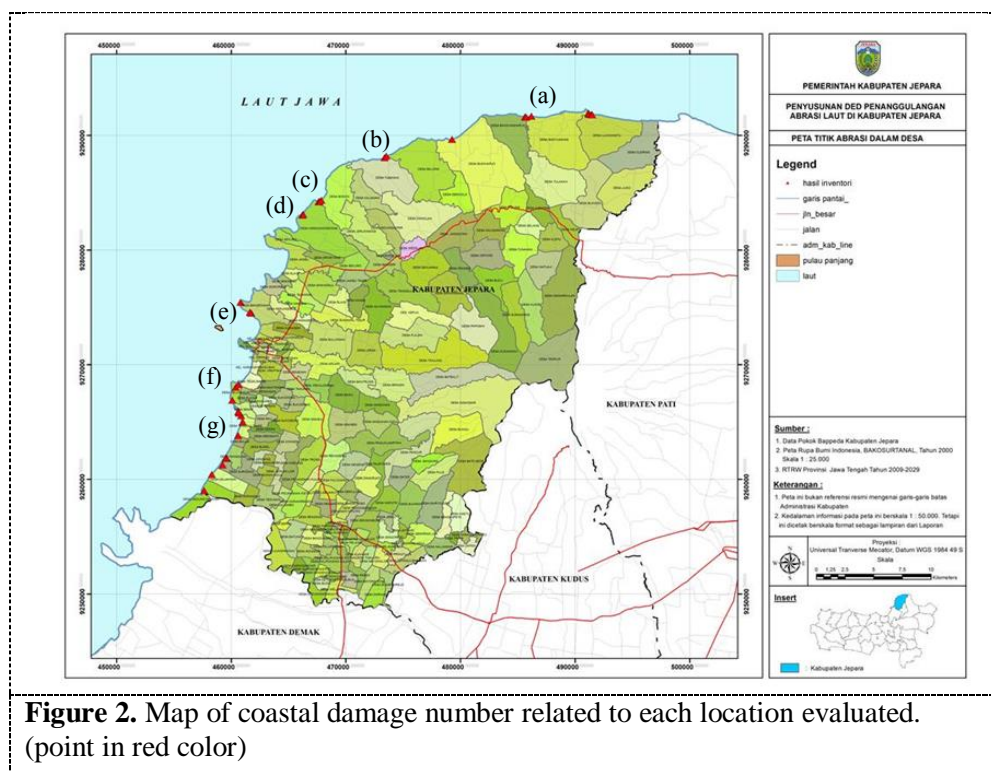
The method of the study is to identifying and mapping coastal damage, determining the variables scoring, and determining the priority scales in one program [8]. The assessment was done to the

coastal location damage. Ratings on the site were done separately from other locations. Supposedly by varieties of damages, the assessment should be conducted to the worst damaged location. Based on the determination criteria, surveys, questionnaires and interviews, the following prioritized areas were obtained: Ujungwatu Beach in the district of Donorejo, Mulyorejo Beach in the district of Donorejo, Bandengan Beach in the district of Jepara, Tanggul Tlare Beach in the district of Kedung, Bulakbaru Beach in the district of Kedung, Semat Beach in the district of Tahunan, Bondo Beach in the district of Bangsri, Kedungmalang Beach in the district of Kedung, Kalianyar Beach in the district of Kedung, Surodadi Beach in the district of Kedung [9].

From the surveys, questionnaires and interviews, an assessment of damage level and the priority scales were conducted [10]. The questioners have been distributed to 5 (five) inhabitants for each area of observation. The surveyors interviewed the village chief of each location. The weight values the level of damage according to the guidelines: light damage (LD) = 50, medium (M) = 100, weight (W) = 150, very weight (VW) = 200, extremely heavy (EH) = 250. In determining the order of handling priority, this issue was based on the cumulative weight values: Priority A (highly preferred / emergency) > 300, Priority B (highly preferred) = 226-300, Priority C (preferred) = 151-225, Priority D (less preferred) = 76-150, Priority E (not preferred) < 75.

#### 4. Result and Discussion

The mapping of coastal damage was conducted along the coast from Donorojo district (east area) to Kedung district (west area). The results of mapping data are the damages which were caused by the changes of environment, sedimentation and coastal erosion [11]. It can be seen on Figure 2. The figure shows the number of each location area evaluated in the three principal aspects of environment, sedimentation and erosion.



**Figure 2.** Map of coastal damage number related to each location evaluated. (point in red color)

Based on the evaluation of environment, erosion and sedimentation, the detailed coastal damage of Jepara Regency can be divided as follows: The District of Donorejo (a) consists of Ujungwatu Beach, Mulyorejo Beach, and Jeruk Beach. The District of Kembang (b) consists of Balong Beach and



Bayuran Beach. The District of Bangsri (c) consists of Bondo Beach. The District of Mlonggo (d) consists of Kepoh Beach. The District of Jepara (e) consists of Bandengan Beach. The District of Tahunan (f) consists of Telukawur Beach, Semat Beach. The District of Kedung (g) consists of Tanggul Beach, Bulakbaru Beach, Panggung Beach, Surodadi Beach.

The following figures show some examples of beach area evaluation. The figures describe the position and one of condition.



**Figure 3.** Sedimentation in Ujungwatu Beach of Donorojo District (in a location)



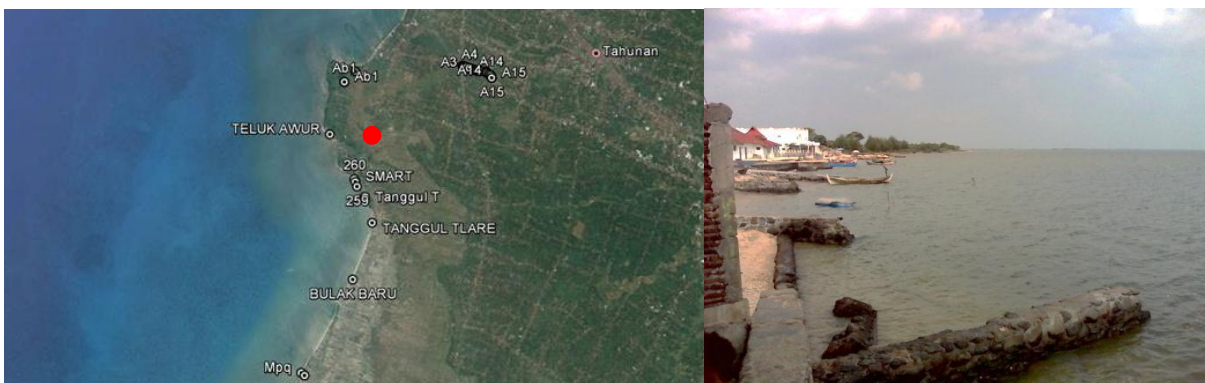
**Figure 4.** Erosion in Mulyorejo Beach of Donorojo District (in a location)



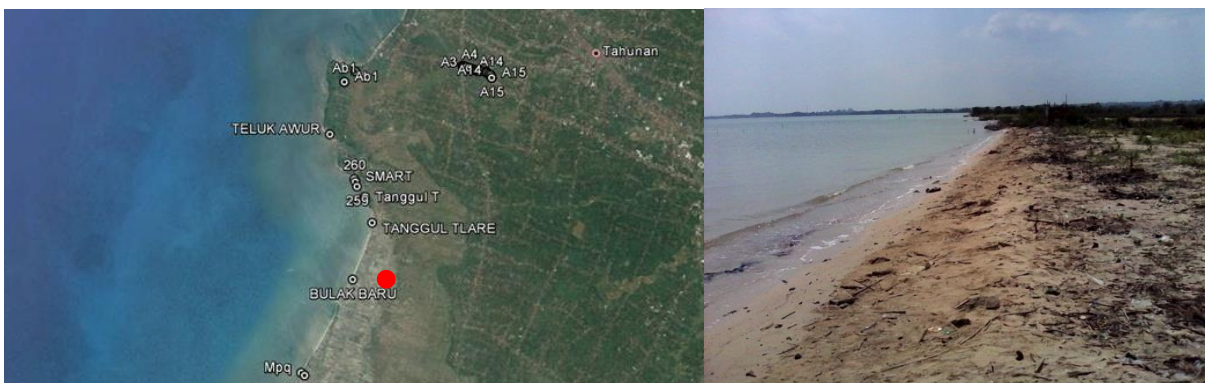
**Figure 5.** Erosion in Bayuran Beach of Kembang District (in b location)



**Figure 6.** Erosion in Kepoh Beach of Mlonggo District (in d location)



**Figure 7.** Erosion on Teluk Awur Beach of Tahunan District (in f location)



**Figure 8.** Erosion on Bulak Baru Beach of Kedung District (in g location)

Besides evaluation of environment, erosion and sedimentation, this level of beach interest also evaluates the type of space utilization including area of the protected beach / world heritage conservation, international scale; tourist beaches in national scale, places of worship, places of business, industry, security facilities, urban, state roads, airports, harbors & outer islands; tourist beaches in provincial scale, places of worship, places of business, industry, defense, airport, provincial roads; tourist beaches in city scale, settlements in local scale, village markets, village roads, places of worship, and local economic interests; agricultural land (rice fields, farms, ponds) of the people and agricultural activities, unused land which does not have economic and environmental impact.

Based on an assessment of the level of damage, it can be determined scale priority handling as listed in Table 1.



**Table 1.** Assessment Analysis of the coastal damage and priority scale determination.

No	Survey Location	Coastal damage level						Coefficient of using level	Base on environment and using level		Base on erosion and using level		Base on sedimentation and using level		Score & Priority
		Environment		Erosion		Sedimentation			Amount level= (3) x (9)	Priority	Amount level= (5) x (9)	Priority	Amount level= (7) x (9)	Priority	
		Level	Code	Level	Code	Level	Code								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	Coast of Ujungwatu, Desa Ujungwatu, Kec.Donororojo.	250	L1	200	EA1	250	SP2	1.00	250	B	200	C	250	B	700 Priority-1
2	Coast of Mulyorejo, Desa Bandungharjo, Kec. Donorojo.	250	L1	200	EA1	100	SP2	1.00	250	B	200	C	100	D	550 Priority-2
3	Coast of Mulyorejo, Desa Bandungharjo, Kec. Donorojo.	150	L2	250	EA1	0	--	1.00	150	C	250	A	0	E	450 Priority-3
4	Coast of Semat, Desa Semat, Kec. Tahunan.	200	L1	250	EA1	0	--	1.00	200	C	250	B	0	E	400 Priority-4
5	Coast of Bondo, Desa Bondo, Kec. Bangsri	200	L1	50	EA1	50	SP2	1.25	250	B	62.5	E	62.5	E	375 Priority-5
6	Coast of Panggung, Desa Panggung, Kec. Kedung.	200	L2	250	EA1	0	--	0.75	150	D	187.5	C	0	E	337.5 Priority-6
7	Coast of Telukawur, Desa Telukawur, Kec. Tahunan.	100	L2	150	EA2	0	--	1.25	125	D	187.5	C	0	E	312.5 Priority-7
8	Coast of Jeruk, Desa Banyumanis, Kec. Donorojo	200	L2	150	EA1	0	--	0.75	150	D	112.5	D	0	E	262.5 Priority-8

Based on the assessment of the level of damage and the scale of priorities, the following points are shown; almost all coastal locations suffer from damage which was caused by natural factors (abrasion/erosion), sedimentation and environment [12]; wind and waves are the factors that contribute a very big impact to coastal damage as happened in Donorojo Beach. Therefore, barrier beach building to break waters or groins is urgently needed; based on the survey results, waves were attacking several area types that determine point of priority scale; the handling priority of this study is addressed to the 1<sup>st</sup> priority to 8<sup>th</sup> priority.

## 5. Conclusion and recommendation

From the discussion, the writers conclude that almost all of coasts in Jepara district are damaged. The coastal areas are: three locations in the District of Donorojo, two locations in the District of Kembang, one location in the District of Bangsri, one location in the District of Mlonggo, one location in the District of Jepara, two locations in the District of Tahunan, and six locations in the District of Kedung. The handling priority in this study was addressed to Ujungwatu Beach, Bandengan Beach, Tanggultlare Beach and Bulakbaru Beach. The priority location needs to be followed up with Detail Engineering Design (DED) and its physical realization.

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