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Disaster Mitigation Policy in Coastal Areas (Case Study : Managing Tidal Floods in Tanjung Pinang City's Coastal Region)

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Abstract. Indonesia is one of the countries most vulnerable to natural disasters, ranking second globally in the World Risk Report (Ilona & Radtke, 2023). Among these, coastal areas face increasing risks from tidal floods (rob), which regularly affect settlements and economic activities. This study focuses on the mitigation policies for handling tidal floods in Tanjungpinang City, the capital of Riau Islands Province, where nearly all regions are coastal and prone to flooding. Using a qualitative, descriptive–exploratory approach, this research analyzes government planning documents, spatial risk maps, and institutional responses led by the Regional Disaster Management Agency (BPBD). The results show that although tidal floods are not the most frequent disaster between 2014–2023, their recent recurrence in 2024—submerging 16 areas—demands serious mitigation actions. Risk mapping identifies the most vulnerable zones in Bukit Bestari, Dompak, and Tanjung Unggat Villages, characterized by lowland topography. Budget analysis of the 2018–2023 Regional Medium-Term Development Plan (RPJMD) indicates continuous allocations for flood control and disaster preparedness programs. However, BPBD's early warning systems and public awareness initiatives remain limited, relying mainly on information dissemination via BMKG channels. Strengthening community-based preparedness, early warning infrastructure, and education campaigns is crucial to build long-term resilience. Overall, effective mitigation in Tanjungpinang requires an integrated approach involving government, local institutions, and communities to reduce vulnerability and enhance adaptive capacity in facing tidal flood threats.

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1 Introduction

Indonesia is a region that is prone to various types of natural disasters. Based on World Risk Report data (Ilona & Radtke, 2023), Indonesia is ranked 2nd out of 193 countries most prone to natural disasters in the world. Natural disasters are a reality that cannot be avoided by humans. Natural disasters are extraordinary events that are capable of causing losses to those who experience them (Yopita, 2023). Natural disasters occur as a result of events caused by nature, including earthquakes, volcanic eruptions, floods, droughts, hurricanes, and landslides.

Most of Indonesia is in the form of a cluster of islands surrounded by the ocean. According to the Indonesian Ministry of Energy and Mineral Resources (2009), Indonesia occupies the number 2 position with the longest coastline in the world reaching approximately 80,000 km. This condition certainly makes people live on the coast with a large number. The vulnerability of coastal communities to natural disasters caused by marine activities is also becoming higher. One of them is the disaster that will be analyzed in this study, namely the threat faced by coastal communities against the impact of flash floods. Definitively, tidal flooding (Rob - tide) is a tidal flood phenomenon that occurs in coastal areas, especially in cities adjacent to the sea. Rob is another term to refer to tidal flooding, where in the area the ground level is lower than the sea level when there is a high tide (Hakam, 2018). Flash floods themselves are permanent, which means that the floods will routinely occur in the area, so human intervention is needed to deal with them.

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Tanjungpinang City as the Capital of Riau Islands Province also has a problem of tidal floods in its coastal areas, considering that almost part of Tanjungpinang is on the coast, so that Tanjungpinang City is routinely faced with the threat of tidal floods that affect people's daily lives and unfortunately will cause significant economic losses. Flash floods caused by overflowing tides are a serious challenge that requires special attention in disaster management and mitigation efforts. The main factor in the occurrence of flash floods is caused by climate change and the increasing population growth and the vulnerability of coastal populations to significant changes (Nabella, Syamsunnasir, & Widana, 2022). Tanjungpinang local media also provided information that in early 2024, there were 16 areas submerged due to flash floods until February 2024 (Riau Islands Daily, 2024). Sadly, not only soaking the settlements, but the flash floods also submerged the State Elementary School (SDN) 009 Tanjungpinang City (Antaranews, 2024).

This study aims to explore mitigation policies in handling flash floods in the Tanjungpinang City area, with the main locus being in coastal areas that are considered vulnerable through risk mapping. Risk mapping is the main foundation in detailing the level of vulnerability and impact that may arise due to flash floods. The risk of flash flood disasters can be reduced by making various mitigation efforts, according to Bakornas (Muhammad, Fatimah, & Taki, 2021), in reducing disaster risk, emphasis should be placed on the vulnerability aspect, not the danger aspect. Mitigation is a series of efforts to reduce disaster risk, both through physical development and awareness and improvement of the ability to deal with disaster threats (Tanjungpinang City Regional Regulation Number 3 of 2016 concerning the Implementation of Disaster Management, n.d.).

The term "mitigation program" refers to two stages of planning: i) pre-event planning for disaster management, including mitigation activities and disaster planning; and ii) post-incident planning and action, improvement of technical standards, and medical and

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financial assistance for victims (Velasquez, Ditto, Wisner, & Takahashi, 1994). Meanwhile, in line with the arguments presented by disaster management theory, basically disaster management aims to protect people from disasters by reducing the likelihood of abnormal events occurring or by addressing vulnerabilities. Disaster management is a planned process that is carried out to manage disasters properly and safely through three stages: 1. Prevention, 2. Preparedness, 3. Post-disaster stage.

Figure 1. Disaster Management Diagram

Described comprehensively in the diagram above, "Disaster" or a disaster surrounded by various arrows. These arrows show that the disaster cycle is a continuous process and that each stage is interconnected, ideally all stages must be fulfilled for the sake of good disaster management. The foundations of disaster management theory not only involve an understanding of the causes and impacts of disasters, but also include effective management principles in managing risk and protecting communities. The main concept

involves a disaster management cycle consisting of four stages: mitigation, preparedness, response, and recovery.

1. Mitigation: Focus on preventive measures and remedial actions to reduce or prevent the impact of disasters. It involves identifying risks, mapping risks, and implementing policies or infrastructure that can mitigate vulnerabilities.
2. Preparedness: Develop an emergency response plan, involve community training, and ensure the availability of the necessary resources to deal with emergency situations. Preparation creates the basis for a rapid and coordinated response.
3. Response: Measures taken during or after a disaster to save lives, protect property, and provide emergency relief. Inter-agency coordination and effective communication are key at this stage.
4. Recovery: The long-term recovery process after a disaster. Focus on rebuilding infrastructure, supporting the psychosocial recovery of the community, and ensuring the sustainability of development.

To carry out the task of natural disaster management, the Government of Indonesia has had its own institution since 2001 as stated in Presidential Decree No. 3 of 2001 concerning the National Coordinating Board for Disaster Management and Refugee Handling as amended in Presidential Decree No. 111 of 2001. Furthermore, the institution changed its name to BNPB in accordance with Law Number 24 of 2007. In Tanjungpinang City, the main actors who carry out natural disaster management tasks are commanded by the Regional Disaster Management Agency (BPBD) located on Jalan Ahmad Yani, Tanjungpinang City. This research also aims to find out how disaster management has been carried out by the Tanjungpinang City Government under BPBD, especially in the flash flood disaster.

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2 Research Methods

Natural disasters and anthropogenic threats increasingly demand in-depth understanding and appropriate solutions to engage communities more effectively. In this context, qualitative research methods play a central role in exploring the complex and contextual dynamics of disaster mitigation efforts. This journal article aims to detail the problem using a qualitative approach applied in investigating disaster mitigation, understanding challenges, and providing contextual solutions. This study adopts a qualitative approach to gain an in-depth understanding of Mitigation Policies in Handling Flash Floods in the Coastal Area of Tanjungpinang City. Qualitative research is a phenomenon-oriented research approach (Abdussamad, 2021).

Qualitative research uses scientific logic, focusing on the analysis of deductive and inductive thinking processes related to the dynamics of relationships between observed phenomena (Priadana, Sunarsi, 2021). The research design uses an exploratory descriptive approach. This approach provides space for researchers to detail, explain, and deeply understand the phenomenon of flash flood mitigation policies, while facilitating the exploration of complex and multifaceted aspects.

The data collection method is carried out through several steps. First, collect data. The next step is to analyze and collect documents related to governance and disaster risk reduction guidelines. The last step is to draw conclusions from the results of the analysis.

3 Result and Discussion

Risk Mapping of Vulnerable Areas

Risk mapping is the first step in identifying areas that are vulnerable to flash flooding. This analysis involves a combination of geographical, environmental, and social data to provide a comprehensive picture of the conditions and vulnerabilities of an area. Through risk

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mapping, we can highlight areas that have a high potential to be affected by flash flooding. Tide-prone areas are found in sloping coastal areas facing the South China Sea, along the north coast of Tanjungpinang, along the west coast of Tanjungpinang, and along the southern coast of Tanjungpinang

According to data from Tanjungpinang geospatial, some of the areas that are predicted to be prone to flash floods are the Bukit Bestari sub-district area which includes the area of Jalan Aisyah Sulaiman and Kampung Nusantara, Sei Jang Village, Tanjung Unggat Village. The Tanjung Unggat Village area is a coastal area with 83% of the area being lowland, which makes this area vulnerable to flooding. The other area is Bukit Bestari Village, Dompak Village.

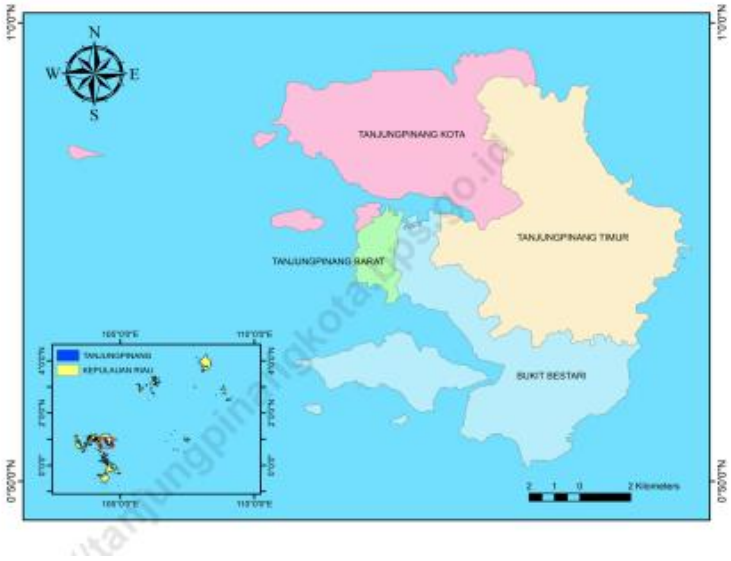

Figure 2. Map of Tanjungpinang City Area

The astronomical position of Tanjungpinang City is between 00 50' 25.93" LU00 58' 54.62" N and 1040 23' 23.40" E - 1040 34' 49.9" E . The land area of Tanjungpinang City is based

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on the Minister of Home Affairs Regulation Number 56 of 2015 concerning the Code and Data of the Government Administrative Area The land area is 144.56 km2. For the Tanjungpinang City area, risk mapping will pay attention to geographical characteristics such as topography and elevation. Low or flat areas tend to be more susceptible to high sea tides. This analysis also includes the morphology of the area, including the presence of rivers, waterways, and drainage systems that can affect the movement of tides.

Planning

After the risk mapping of natural disaster-prone areas in Tanjungpinang City, the next stage is the analysis of city government strategic documents related to natural disaster management or mitigation. This planning is contained in the Regional Medium-Term Development Plan (RPJMD) of Tanjungpinang City for 2018-2023, but after reviewing the documents, no specific threat of flash floods was found, but only the threat of disasters that occurred in Tanjungpinang City which included floods, tides, tornadoes, and landslides. In line with the details of the strategic issues of the 2018-2023 Tanjungpinang City RPJMD which intersect with the Environmental Quality Improvement Program, Natural Disaster Mitigation and Climate Change Management, the two main points of the strategic issue are: suboptimal environmental management, including in the management of the Ganet 8 Landfill, and the lack of quantity and quality of Green Open Space (RTH) that is child- and female-friendly, elderly and people with disabilities.

Furthermore, the Tanjungpinang City BPBD planning document contains community empowerment programs in disaster preparedness mitigation, early prevention and natural disaster management programs, environmental safety and comfort improvement programs, disaster rehabilitation and reconstruction programs, and disaster emergency handling programs.

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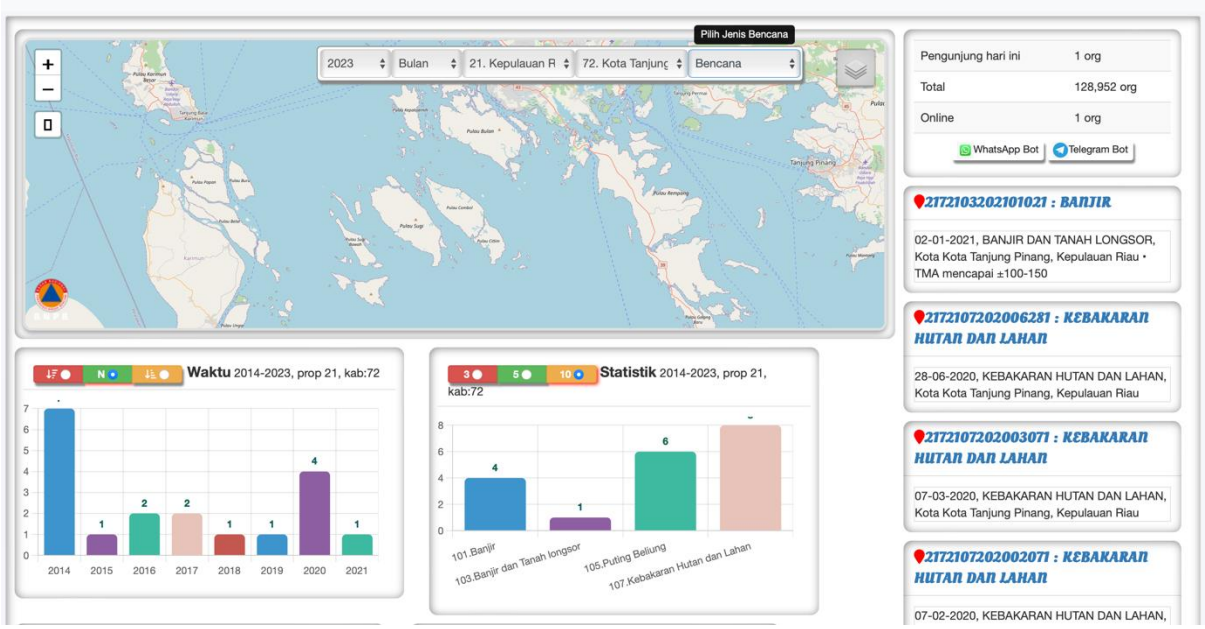

Figure 3. Indonesian Disaster Information Data for Tanjungpinang City in 2014-2023

In the image above, statistical data is shown for the category of natural disasters that occurred in Tanjungpinang City from 2014 to 2023, the most natural disasters that occurred during that period were forest and land fires, which were 8 times, followed by tornadoes 6 times, floods 4 times, and floods and landslides 1 time. This means that flood disasters are not natural disasters that occur most often throughout 2014 to 2023, nor is it mentioned whether the flood is included in the category of flash floods or not. The data in the image above concludes that flash floods are not included in the category of natural disasters with a significant level of risk in Tanjungpinang City during that period. Although flooding occurs,

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the data does not specify whether it falls into the category of tidal floods or not, and is not considered the dominant natural disaster in the region.

Although Tanjungpinang City is located in a coastal area, tidal floods did not become the dominant natural disaster during the period 2014 to 2023. Statistical data shows that the most frequent natural disasters are forest and land fires, followed by tornadoes, floods, and floods and landslides. This indicates that, although the potential for flooding in coastal areas can be a concern, it does not significantly characterize the severity of the natural disaster experienced by the City of Tanjungpinang.

Meanwhile, in terms of budget planning, especially for programs related to natural disaster management, it has been stated in the 2018-2023 Tanjungpinang City RPJMD below:

Table 1. Natural Disaster Management Program Budget Planning

Program	Regional Apparatus in Charge of the Program	Year 2019	Year 2020	Year 2021	Year 2022	Year 2023	Total Budget
Program Control Flood	Public Works and Spatial Planning Office	3,631,800,000	3,994,980,000	4,394,478,000	6,833,925,800	6,317,318,380	25,172,502,180
Program Empowerment Community In Readiness Facing Disasters	BPBD	-	335,000,000	427,253,612	640,706,802	710,036,090	2,112,996,504

Program Prevention Early and Natural Disaster Management	BPBD	285,657,250	360,580,248	585,000,000	455,000,000	555,000,000	2,241,237,498
Program Rehabilitation and Reconstruction on Disaster	BPBD	-	1,957,464,752	1,957,464,752	1,957,464,752	1,957,464,752	7,829,859,008
Program Handling Disaster Emergency	BPBD	172,520,000	100,000,000	150,000,000	150,000,000	150,000,000	722,520,000

Source: Tanjungpinang City RPJMD in 2018-2023

The table above shows that from 2018 to 2023, budget planning has been carried out for disaster control programs managed by the PUPR Office and BPBD, the involvement of these two agencies illustrates a joint commitment to managing disaster risk with a comprehensive approach. This budget planning covers various aspects of disaster management, from community empowerment in disaster preparedness to rehabilitation and reconstruction programs, by strategically allocating financial resources, the Tanjungpinang City government shows that they not only have an acute response to disasters, but are also committed to reducing long-term impacts and strengthening community resilience.

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Analysis of Mitigation Efforts

Flash flooding, a tidal phenomenon of seawater that affects coastal areas, has become a serious threat to coastal settlements. To detail the level of vulnerability of the area to tidal floods, risk mapping is a critical instrument in the framework of mitigation policies in handling tidal floods in the coastal area of Tanjungpinang City.

Flash flooding, caused by extreme seawater tides, requires a holistic and effective approach in its mitigation and handling. Mitigation policies play an important role in formulating preventive and adaptive measures, with a particular focus on developing reliable early warning systems. Early warning systems are the most important thing in a quick response to the threat of flash flooding. The success of an early warning system lies not only in the technology used, but also in the effectiveness of communication, community participation, and alignment with existing mitigation policies.

After carrying out further document analysis, it was revealed that the role of the Regional Disaster Management Agency (BPBD) in Tanjungpinang City, especially in providing early warning of the potential for flash flooding, is still limited. Currently, BPBD only relies on the delivery of information through press releases published on the BMKG website of the RHF Tanjungpinang Meteorological Station and several other social media platforms (BPBD Tanjungpinang City, 2024). Although this step was carried out for preventive purposes, its effectiveness is doubtful. This approach is not optimal in dealing with the complexity and dynamics of flash floods in coastal areas. The vulnerability of coastal areas to natural disasters further underscores the urgency of increasing the effectiveness of early warning systems. Given the limited access and limited coverage of information, communities around risk zones can find it difficult to receive alerts quickly and responsively. There is an urgent need to update and expand the early warning infrastructure, as well as integrate it with advanced technology that can provide information more timely and accurately.

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It is also not found how BPBD's efforts to increase public awareness in dealing with the flash flood disaster. This activity is considered crucial, considering that community awareness campaigns can aim to provide the public with an in-depth understanding of the risks and consequences of flash floods. Efforts to actively involve the community are expected so that they can be more aware of behaviors that can minimize risks and respond more quickly in emergency situations. Activities related to the campaign to increase public awareness should be increased in frequency with various forms of educational programs, such as initiatives to organize emergency response training, evacuation simulations, and community education campaigns, which need to be improved so that their effectiveness can be felt more by all levels of society, especially in areas vulnerable to flash floods.

This condition is actually understandable because in the period 2014 to 2023 according to Indonesian Disaster Information Data, the tidal flood disaster is actually not included in the category of natural disasters with a significant level of risk in Tanjungpinang City, even though there are coastal areas in Tanjungpinang City. However, national media reported that by 2024, there will be 80% of urban villages in Tanjungpinang City affected by flash floods (Antaranews, 2024). The efforts of the city government in terms of budget planning (especially in 2018 to 2023) are positive steps that should be appreciated. Although flash floods do not occur regularly, the government's sustainability and readiness in allocating resources for disaster control shows their seriousness in ensuring the safety and welfare of the community. The preventive and adaptive measures implemented through this budget allocation include not only the handling of flash floods, but also other efforts in the management of other natural disasters as a whole. Although the risk level of flash flooding is not comparable to other disasters, the role of BPBD and public awareness is still crucial in mitigating and overcoming the impact of disasters. In the context of natural disaster mitigation, strategic measures that include emergency response training, education

campaigns, and evacuation simulations can be a valuable addition to improving community preparedness for potential disasters, even those considered to be low-risk, thus providing a foothold to increase public awareness and engagement in dealing with various potential disasters.

4. Conclusion

Flash floods, which occur as a result of extreme tides, demand a holistic and effective approach in its mitigation and handling. Mitigation policies have a central role in designing preventive and adaptive measures, especially in the development of reliable early warning systems. This conclusion emphasizes the importance of joint efforts from the government, the community, and various related sectors in creating a resilient and empowered environment, able to reduce the risk and impact of flash floods in Tanjungpinang City. These measures are not only relevant for acute responses, but also for building long-term resilience that ensures the safety and well-being of communities in coastal areas. Although flash floods are not a natural disaster with the frequency that often occurs in the coastal areas of Tanjungpinang City, in particular the Tanjungpinang City government has shown that they not only have an attention to acute response to disasters, but are also committed to reducing long-term impacts and strengthening community resilience.

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