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# Strategy for Handling Pre-Disaster Floods Lere Sub-District Case Study

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**Abstract:** Lere Village is an area affected by flooding problems. The threat of disasters that routinely occur in Lere Village has harmed residential areas. Therefore, it is necessary to research pre-flood disaster management strategies. The research employed a qualitative approach with data collection methods based on primary and secondary data sources. Primary data was collected through field observations, documentation, and interviews with the community related to the management strategy before the flood. In contrast, secondary data is collected from the agency BPBD (Regional Disaster Management Agency), which is then processed to achieve research objectives. This study used a qualitative method, which was analyzed using a SWOT analysis. The results of this study indicate that eight alternative flood pre-disaster management strategies can be carried out: 1) Can build embankments along the Palu River. 2) Improving the flood control system in Palu Bay and Palu River. 3) It is hoped that the government will build floodgates to handle floods. 4) Optimization of the drainage system. 5) It is hoped that it can facilitate early warning tools at the point of flooding. 6) Directions for handling coastal border areas. 7). Directions for making houses on stilts for vulnerable areas, 8) Increased cooperation with various parties in handling Land subsidence for vulnerable areas, and Increasing cooperation parties in handling land subsidence.

**Keywords**: Flood, Pre Disaster, Management Strategy, SWOT.

## INTRODUCTION

Disaster is defined as an event that threatens and disrupts the lives and livelihoods of communities. Floods rank third in causing economic losses among all natural disasters worldwide (Findayani, 2015). Floods are a mass of water produced from surface runoff on relatively high ground that cannot be contained, naturally overflowing and causing inundation or large-scale flow (Anggrayni et al., 2021). Throughout Indonesia, there are 5,590 main rivers and 600 of them have the potential to cause floods (Aditianata, 2017). The flood-prone areas covered by these main rivers amount to 1.4 million hectares. According to Idati et al. (2020), floods that occur in these vulnerable areas are primarily caused by three factors. First, human activities that result in changes in spatial structure and impact natural changes. Second, natural events include very high rainfall, sea level rise, storms, etc. Third, environmental degradation consists of the loss of ground cover vegetation in the catchment area, river siltation leading to riverbed shallowing, river channel narrowing, and so on.

Palu is located in the Palu Valley and Palu Bay area, with an average elevation of 0 - 700 meters above sea level, at 0º 36" - 0º 56" South Latitude and 119º 45" - 121º 1" East Longitude. The area of Palu City is 395.06 square kilometers, situated in the Palu Valley and Palu Bay area. The government has the authority to control the situation in flood-prone areas. This capability includes planning and preparation, disaster response, coordination assistance, reconstruction policies, and addressing population issues. Efforts to handle floods in local areas are focused on local governments (regencies/cities) as the first level of flood disaster management (Awaliyah & Ghozali, 2020).

In management directives, there are several approaches to mitigate floods, namely technological approaches, social approaches, and governance approaches, which must be in line with the conditions in the respective areas (Santoso, 2019).

The Palu City government must take a proactive stance as a mitigation effort. To achieve sustainable development and avoid broader disaster impacts, mitigation efforts must be conducted comprehensively across industries and regions, considering the area's environmental carrying capacity. Thus, losses and damages due to flood disasters can be reduced (Ningrum & Ginting, 2019).

Almost every year, Palu City experiences floods due to the overflowing of the Palu River. This river runs through the middle of Palu City, dividing it into two parts and flowing directly into the waters of Talise Beach in Palu Bay. As the mouth of the river, this beach should be free from anything that might impede the flow of the Palu River. If there are obstacles, the flow of the Palu River can be hindered, and overflow into Palu Bay can cause a blockage of waterways. One of the causes of flash floods is seawater entering through floodgates. When the rainy season arrives, the river water will overflow, causing flooding in the surrounding areas. This occurred in the Lere Subdistrict on April 29, 2019, when the Palu River overflowed, inundating houses near the Palu River, and on April 1, 2021, flash floods also occurred, flooding roads. The rivers originating from the west, east, and south converge into the Palu River. Towards the city center, this river has a high potential for causing flood inundation due to its low gradient slope and residential areas located at elevations close to the riverbanks.

The west, east, and south rivers converge into the Palu River. As the river flows towards the city center, there is a high potential for flooding due to the low slope gradient and residential areas at elevations close to the riverbanks. These areas include the Palu Barat District (Nunu, Ujuna, Baru, and Lere neighborhoods).

Flooding occurred in the Lere neighborhood, caused by the overflow of the Palu River and tidal floods. One contributing factor was temporary flood barriers, like metal plates, which failed to contain the water, leading to flooding in the area. Lere is bordered by the Palu River and Palu Bay.

Given the negative impacts of flooding in Lere and considering various factors, the researcher feels it is crucial to study the area, assess the flood hazard level, and develop strategies for flood prevention. The research is titled "Flood Pre-Disaster Management Strategy: A Case Study of Lere Neighborhood." The goal is to identify the types of floods in Lere Village. And To identify strategies for flood prevention in Lere Village.

## METHODOLOGY

Researchers used qualitative descriptive research. This research was conducted in the Lere Subdistrict, West Palu District, Palu City. This study's data type is qualitative data obtained through primary and secondary data sources. According to Sugiyono (2017), primary data is data obtained directly, while secondary data is data sources not directly provided to the data collector. Primary data in this study were obtained through field observations and interviews, while secondary data were obtained through a historical flood event document study.

The data analysis method used in this research is SWOT analysis.

**TABLE 1**. SWOT Analysis Matrix

| IFAS EFAS | Strength | Weakness |
|---|---|---|
| Opportunity | SO Strategy | WO Strategy |
| | Create a strategy that utilizes strengths to seize opportunities. | Create a strategy that minimizes weaknesses to capitalize on opportunities. |
| Threats | ST Strategy | WT Strategy |
| | Create a strategy that utilizes strengths to overcome threats. | Create strategies that minimize weaknesses and avoid threats. |

Source: Rangkuti, 2015.

Here is the explanation of the above SWOT matrix:

1. SO Strategy (Strength and Opportunity). This strategy is based on policies, namely utilizing all strengths to seize and maximize opportunities as much as possible.
2. ST Strategy (Strength and Threats). The strategy involves using the strengths possessed by policies to overcome threats.
3. WO Strategy (Weakness and Opportunity). This strategy is implemented based on utilizing existing opportunities by minimizing existing weaknesses.
4. WT Strategy (Weakness and Threats). This strategy is based on defensive activities to minimize existing weaknesses and avoid threats.

The flooding that occurs in the Lere Subdistrict is a frequent phenomenon caused by the overflow of the Palu River and tidal flooding due to rising sea levels. Lere, which directly borders the Palu River and Palu Bay, is a flood-prone area with significant adverse effects on residential areas. Based on the literature review, flooding can be defined as water inundation in an area, usually triggered by factors such as heavy rainfall, river overflow, or rising sea levels. The impacts of flooding can be economically, socially, and environmentally destructive. There are various types of floods, including tidal and river overflow floods, such as those experienced in Lere. Therefore, appropriate management strategies are required to minimize these negative impacts, particularly during the pre-disaster stage.

An analysis was conducted using the Overlay approach to determine the level of flood hazard in the Lere Subdistrict, combined with a SWOT analysis to devise a management strategy in line with existing policies and conditions. This study aims to identify the flood hazard level in Lere and formulate an effective pre-disaster management strategy. The results of this analysis are expected to produce a more robust and targeted pre-disaster flood management strategy for the Lere Subdistrict, aimed at minimizing the risks and impacts of flood disasters.

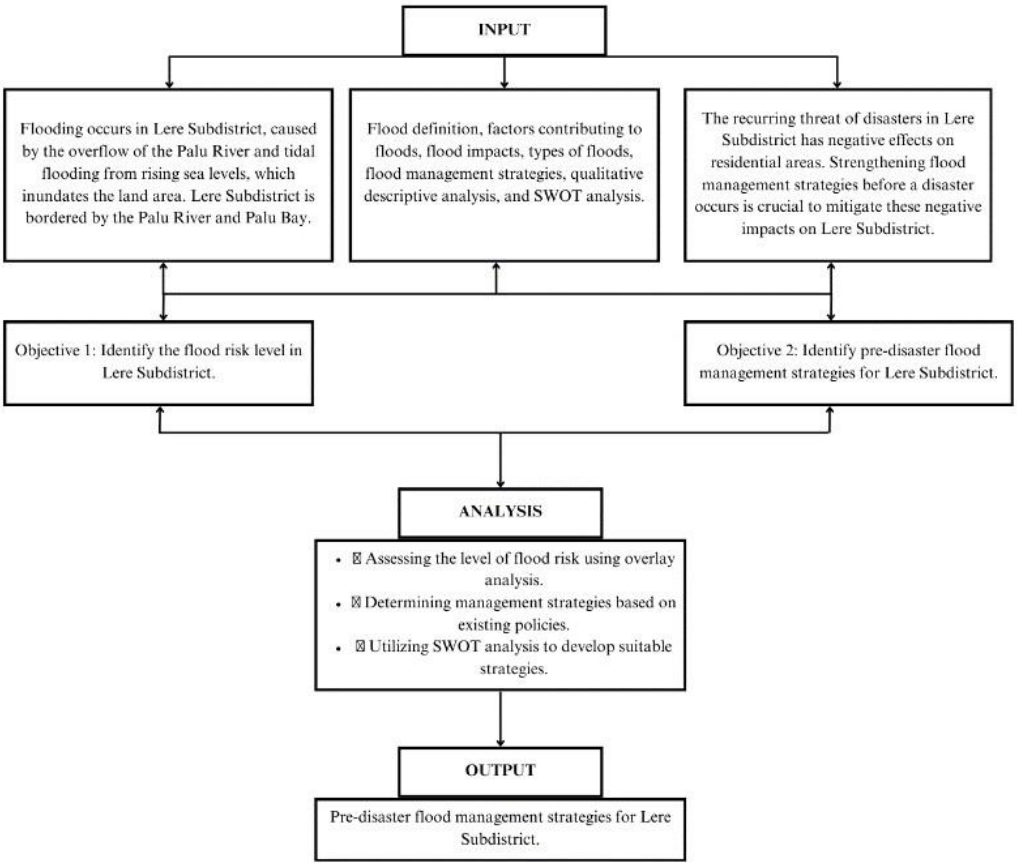


**FIGURE 1.** Flowchart and the stages of the research
*Source : Fira Anisya Pettalolo, Ahmad Haqiq Mukafih, 2024*

# RESULT AND DISCUSSION

## Descriptive Analysis Of Flood Type

The floods in Lere Village can be categorized into two types: river overflow floods and tidal floods (rob). First, river overflow floods occur when the river's capacity cannot hold the excess water, causing it to spill over the riverbanks. This reduction in river capacity is often due to sediment buildup and garbage accumulation at the bottom of the river. Drainage systems also fail to handle heavy rain, and blocked drains caused by trash worsen the situation. River overflow floods commonly affect RW 001, RW 002, and RW 003 areas.

Second, tidal floods (rob) happen due to rising sea levels, particularly in low-lying coastal areas with river mouths and tributaries. Seawater or river water can flood these areas when the sea level increases, especially during high tides. Tidal floods in Lere Village occur in RW 001 and RW 005.

Based on the results of the SWOT analysis, strengths, weaknesses, opportunities, and threats can be identified in efforts to handle flood disasters in Lere Village, namely:

Strengths:

Strengths identified based on the SWOT analysis include the availability of flood control infrastructure, such as embankments along Palu Bay, the construction of surface flow control infrastructure (water infiltration and flood storage), and the existence of disaster evacuation route guidance.

## Flood Pre-Disaster Management Strategy

In the strategy phase for flood disaster management in the Lere Subdistrict, a SWOT analysis explains the strengths, weaknesses, opportunities, and threats encountered in preparing the strategy. The internal and external factors identified in the research are:

1) Internal Factors

Strengths:

- Availability of flood control infrastructure, such as a levee along Palu Bay.
- Construction of surface runoff control infrastructure (water absorption and flood storage).
- Availability of disaster evacuation routes.

Weaknesses:

- Inadequate flood infrastructure, as watergate covers are made from non-permanent materials.
- The ground level is lower than the water level of the downstream Palu River and the sea, causing flooding in residential areas.
- Poorly maintained drainage in some locations, leading to blockages.

2) External Factors

Opportunities:

- Development of urban infrastructure systems, such as waste management.
- Wastewater management to prevent pollution in Palu Bay.
- A flood control system in Palu City, including a levee along the Palu River.

Threats:

- Lack of flood warning equipment (Early Warning System).
- The research location is within the river and coastal buffer zone.
- The area is located between Palu Bay and the Palu River.

The analysis was based on direct observation and interviews. This can serve as a basis for future flood disaster management strategies in the Lere Subdistrict. The calculations use weights and scales obtained from data collection. The total weight must add up to 1, and the scale follows the importance level based on the sources used. Besides internal factors, external factors are also considered, focusing on outside influences.

**TABLE 2**. Internal factor analysis (IFAS)

| IFAS | NO | INDICATOR | WEIGHT | RATINGS | SCORE |
|---|---|---|---|---|---|
| STENGTH | 1 | Available flood control infrastructure (dykes) | 0.20 | 4 | 0.08 |
| | 2 | Construction of surface flour control infrastructure (water catchment and flood storage) | 0.20 | 4 | 0.08 |
| | 3 | There are directions for disaster | | | |
| WEAKNESS | 1 | The provision of flood infrastructure is inadequate because it only uses a sluice get covers made from non-permanent materials | 0.15 | 3 | 0.45 |
| | 2 | Land subsidence causes flooding to hit settlements | 0.20 | 4 | 0.08 |
| | 3 | Damage is not maintained in several locations causing blockage of drainage | 0.10 | 2 | 0.02 |
| Total number (Strength + Weakness) | | | 1 | | 3.05 |

Source: Fira Anisya Pettalolo, Ahmad Haqiq Mukafih, 2021

Based on the results of weighting internal factors related to pre-disaster flood management strategies in Lere Village in the table above, it is known that the total Strengths and Weaknesses score is 3.5. The total Strengths (S) score is 2.05, while the Weaknesses (W) factor is 1.45. This can prove that Lere Village's weaknesses are more significant than its strengths.

**TABLE 3**. External factor analysis (EFAS)

| IFAS | NO | INDICATOR | WEIGHT | RATINGS | SCORE |
|---|---|---|---|---|---|
| OPPORTUNITIES | 1 | There is the development of urban infrastructure systems such as waste system | 0.15 | 3 | 0.45 |
| | 2 | wastewater management to avoid pollution in the waters of Palu Bay | 0.20 | 4 | 0.08 |
| | 3 | There is a flood control system in Palu. City, namely embankments along the banks of the Palu River | 0.20 | 4 | 0.08 |
| THREATS | 1 | There is no flood protection device (EWS) | 0.15 | 3 | 0.45 |
| | 2 | The research location is in the coastal and river border area | 0.15 | 3 | 0.45 |
| | 3 | The research location is between Palu Bay and the Palu River | 0.15 | 3 | 0.45 |
| Total amount (Opportunities+Threats) | | | 1 | | 3.04 |

Source : Fira Anisya Pettalolo, Ahmad Haqiq Mukafih, 2021

Based on the results of weighting external factors in the table above, it is known that the total Opportunity and Threat score is 3.4. The total Opportunity (O) score is 2.05, while the total Threat (T) score is 1.35. This can be seen from the fact that the total opportunities in Lere Village are more significant than the threats. To find out the location of the strategy quadrant that is considered to have high priority, the X and Y axis formulation is used, where the X axis is IFAS (Strengths and Weaknesses) and the Y axis is EFAS (Opportunities and Threats), which are expressed in scoring results.

Based on the calculation results, the IFAS (Strengths and Weaknesses) score is 2.05 – 1.45 = (+) 0.6, while the EFAS. (Opportunities and Threats) score is 2.05 - 1.35 = (+) 0.7. So, the IFAS value shows a (+) value, while the EFAS also shows a (+) value.
IFAS Strengths – Weaknesses is 2.05 – 1.45 = (+) 0.6 (X)
EFAS Opportunities – Threats is 2.05 - 1.35 = (+) 0.7 (Y)

The results can be seen in the SWOT analysis graph as follows:

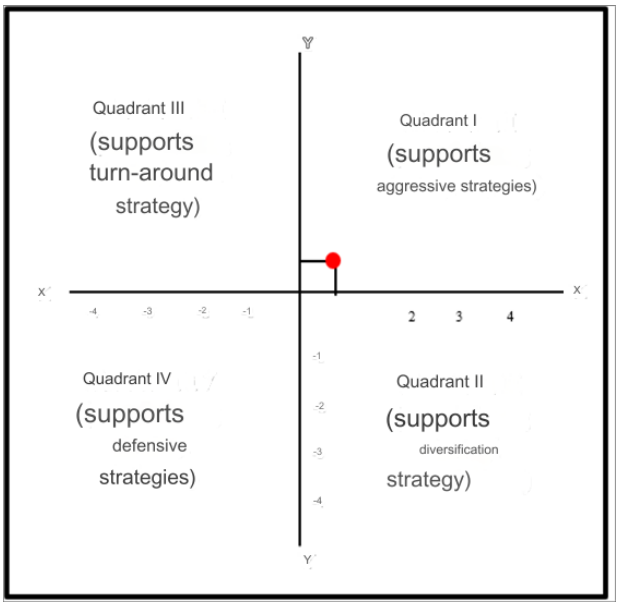


**FIGURE 2.** SWOT Analysis Graph
*Source : Fira Anisya Pettalolo, Ahmad Haqiq Mukafih, 2024*

Based on the SWOT analysis graph above, it can be seen that the flood pre-disaster strategy that can be implemented in the Lere Village area is in quadrant I (Positive, Positive), which is a very profitable situation. Quadrant I illustrates the perfect situation because strengths are utilized to achieve profitable opportunities. The strategy that must be implemented in this condition is developing an aggressive approach. Based on the results of this analysis, a SWOT matrix can be created in the following table:

**TABLE 4**. SWOT Matrix

| IFAS / EFAS | Strength (S) | Weakness (W) |
|---|---|---|
| | 1. Available of flood control infrastructure (dykes) | 1. The provision of flood infrastructure is inadequate because it only uses a sluice gate covers made from non-permanent materials |
| | 2. Construction of surface flow control infrastructure (water catchment and flood storage) | 2. Land subsidence causes flooding to hit settlements |
| | 3. There are directions for disaster evacuation routes | 3. Drainage is not maintained in several locations, causing blockage of drainage |
| Chance (O) | SO Strategy | WO Strategy |
| 1. There is development of urban infrastructure systems, namely waste | 1. Can build embankments along the Palu river | 1. It is hoped that the the Government will build a flood gates to handle floods |
| 2. Wastewater management to avoid pollution in the waters of Palu Bay | 2. Improving the flood control system in Palu Bay and Palu River | 2. Drainage system optimization |
| 3. There is a flood control system in Palu City, namely embankments along the banks of the Palu river | | |
| Threat (T) | ST Strategy | WT Strategy |
| 1. No early warning system (EWS) | 1. It is hoped that it can Facilitate early warning tools at the point where flooding | 1. Directions for handling coastal and river border areas |
| 2. The research location is in the coastal and river border area | 2. Directions for building houses on stilts for Vulnerable areas. | 2. Increased cooperation with various parties in the context, I will schedule some time for us to connect. of handling Land Subsidence |
| 3. The research location is between Palu Bay and the Palu River | | |

Source : Fira Anisya Pettalolo, Ahmad Haqiq Mukafih, 2021

## Swot Analysis Results

Based on the results of the SWOT analysis that has been carried out, various alternative strategies were found, namely:

1. SO Strategy

The SO strategy can be implemented by building embankments along the Palu River. It is hoped that the government will pay more attention to areas around rivers; for example, the river embankment around Lere Village is not functioning correctly; a strategy is needed to build embankments in areas along the Palu River to minimize tidal floods and river overflow floods in Lere Village. Apart from that, improving the flood control system in Palu Bay and Palu River is necessary. Carrying out flood control to reduce or prevent the detrimental effects of flooding. Flood control among them, namely increasing river capacity (normalization), embankments, pumps/flood spillways, and improved drainage.

2. WO Strategy

Alternative WO strategies that can minimize weaknesses to open up opportunities; first, It is hoped that the government will build floodgates to handle floods. Flood management sluice gates are beneficial in reducing floods entering residential areas. It is hoped that the government can plan to make automatic composite sluice gates that do not require human assistance to deal with river overflow floods and ROB that occurred in Lere Village. This composite sluice gate works in operation based on the high and low water levels.

Second, optimizing the drainage system. The performance of the existing drainage system must be maintained by

Maintaining facilities and infrastructure while optimizing the drainage system can be used as environmentally friendly drainage, so excess water during the rainy season must be managed so it does not flow quickly into rivers. However, efforts are made to seep into the soil to increase the groundwater content for reserves during the dry season. This concept is absolute in tropical climates with extreme differences in rainy and dry seasons, such as Indonesia. Several environmentally friendly drainage methods can be used in Indonesia, including the conservation pond, infiltration well, riverside polder, and groundwater protection area development methods.

3. ST Strategy

Alternative ST strategies that can utilize strengths to reduce threats, namelyFacilitate early warning tools at the point of flood occurrence. Recommendations for suitable early warning tools in Lere Village are an Automatic Weather Station, a Disaster Warning System, and an Automatic Water Level Recorder. Apart from that, instruction needs to be given on the construction of stilt houses for vulnerable areas. The benefits of houses on stilts so that they are free from flooding, such as those located downstream of rivers and beaches, will be the best option for areas prone to flooding. High support poles will be safer from flooding. A house on stilts would be suitable for those living in coastal areas worried about high tides.

4. WT Strategy

Alternative WT strategies to prevent conditions from moving in a worse direction: Firstly, directions for handling coastal and river border areas were provided. Coastal border protection areas are border areas that still need to be developed along Palu Bay. Coastal border boundaries for disaster-prone areas in coastal areas can be determined at less than the calculated results with the mandatory provisions for implementing disaster-building guidelines. The calculation of coastal boundaries must be adjusted to the coast's topographic, biophysical, and hydro-oceanographic characteristics and economic and cultural needs. The calculation of coastal border boundaries must follow the provisions: Protection against earthquakes and tsunamis, Protection of beaches from erosion or abrasion, Protection of artificial resources on the coast from storms, floods, and other natural disasters, Protection of coastal ecosystems such as wetlands, mangroves, reefs corals, seagrass beds, sandbanks, estuaries, and deltas, public access arrangements and arrangements for water and waste channels.

Second, The arrangement of coastal borders must pay attention to specific areas on the coast which must be used as coastal borders in the form of land along the shore whose width is proportional to the shape and physical condition of the beach at least 100 meters from the highest tide point towards the land. Areas with mangrove vegetation are maintained as conservation areas against the threat of abrasion, and long-established fishing settlements and their economic businesses must be supported through access reform and various other sectoral activities; the use of coastal areas must pay attention to priorities for the interests of Indigenous coastal communities, coastal area

conservation, security defense, integrated economic development and protection of specific areas that have unique ecosystems;

The development of coastal areas for commercial purposes must follow the spatial planning determined by the regional government and other provisions required by the relevant technical agencies. River border u For rivers in residential areas, the minimum width of the border is around 10-15m.

Third, cooperation with various parties in handling land subsidence should be increased. Increased collaboration with multiple parties in the context of handling land subsidence. It is hoped that the Palu City Government can manage the land subsidence in Lere Village after the 28 September tsunami. The Palu City Government should collaborate with these parties so as not to harm Lere Village.

## CONCLUSION

The pre-disaster flood management strategy for Lere Subdistrict, West Palu District, focuses on reducing flood risks through several critical actions based on a SWOT analysis. First, it emphasizes the construction of embankments along the Palu River and improving flood control systems in Palu Bay and the river. The government's role is crucial, especially in building water gates to regulate water flow.

The strategy also includes optimizing drainage systems to handle excess water, installing early warning devices at flood-prone points to alert residents, and providing guidance on managing coastal and river boundaries to prevent the worsening of the flood situation. Additionally, it encourages building raised houses in vulnerable areas and improves cooperation with various stakeholders to manage land subsidence, which can increase flood risks. This approach aims to create a more flood-resilient community in the Lere Subdistrict.

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