EEET ECOLOGICAL ENGINEERING & ENVIRONMENTAL TECHNOLOGY

Ecological Engineering & Environmental Technology, 25(12), 85–94
https://doi.org/10.12912/27197050/193618
ISSN 2299–8993, License CC-BY 4.0

Received: 2024.09.17
Accepted: 2024.10.15
Published: 2024.11.01

Flood Vulnerability of Masamba Urban Area, North Luwu Regency

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ABSTRACT

This research aimed to analyze the level of flood vulnerability in Masamba urban area, using quantitative and qualitative descriptive approaches. Data analysis techniques were carried out by weighting, scoring, and overlaying for each flood-causing parameter map, including; slope map, rainfall, land elevation, soil type, and land use. Delineation of flood-prone areas is determined based on spatial analysis between the detailed spatial plan map of Masamba urban area and the maps of these parameters, obtaining the area and classification of the level of vulnerability to flood disasters in the Masamba urban area. The results of the analysis show that the low flood vulnerability level is located in the Kamiri village, Masamba village and part of the Kappuna village with an area of 83.39 Ha or 7.22%, the medium flood vulnerability level covers the Radda and Baliase villages with an area of 824.75 Ha or 71.58%, while the Bone and Bone Tua Villages are included in the high vulnerability classification category with an area of 244.07 Ha or 21.18% of the Masamba urban detailed spatial plan (RDTR) area. On the basis of the research findings, mitigation efforts are needed in spatial planning in North Luwu Regency. Directions for spatial utilization in the flood-prone Masamba urban area, including; development of a flood disaster mitigation system with structural and non-structural methods. Recommendations for spatial utilization in Masamba urban area to minimize similar flash flood events in the future are reviewing the RDTR of Masamba urban area, revising the urban drainage system master plan, and modeling the classification of flood-prone areas. With the availability of flood vulnerability data in North Luwu Regency, it can be an input for the government and the community as a basis for decision making in spatial planning, spatial utilization and spatial control to create a resilient and sustainable Masamba City.

Keywords: flash flood, flood vulnerability, Masamba City, detailed spatial plan.

INTRODUCTION

Recent global climate change has resulted in the accumulation of high rainfall in a short period of time. Climate change has also increased the frequency of hydrometeorological disasters in Indonesia, one of which is flooding (Klipper et al., 2021). Flooding is the runoff of water that exceeds the normal water level, so that it overflows from the riverbed causing inundation of low-lying land on the side of the river (Cabrera and Lee, 2020). The same amount of annual rainfall, but with a short duration will have an impact on increasing the intensity of flooding that occurs (Ainurrohmah and Sudarti, 2022). Climate change impacts are considered to be the main driving factor influencing water dynamics (Muto et al., 2022). Natural disasters in Indonesia, such as tornadoes, floods, extreme rainfall or high-intensity rain, are becoming more frequent (BNPB, n.d.). Abnormal rainfall triggers flooding and is exacerbated by disorganized urban planning, illegal construction, and improper design (Gopal et al., 2017). Increased flood risk in some urban areas reflects a combination of physical vulnerability and a legacy of unsustainable land use and development (Bukvic et al., 2023).

Natural flooding will occur in the floodplain (lowland) and generally occurs downstream. However, the current flood problem has changed not only in the plains and downstream areas, but also occurs in the upstream areas. Generally, flooding in upstream areas is caused by changes in land use, such as the increase in settlements on the riverbanks, and the implication is that it causes obstruction to the flow of the river (Ginting, 2021). Uncontrolled land use also greatly influences flooding (Zhou et al., 2019). Densely populated areas are more likely to experience flooding, and the impact will be greater than other areas (Bajracharya et al., 2021). Flood damage and its impacts are very detrimental to the community, thus disaster mitigation efforts are needed to minimize the impact caused (Monger et al., 2022). There are two meteorological factors that cause flooding in Masamba Urban Area; the first is atmospheric factors. This case includes weather factors (rainfall, rainfall intensity, and rainfall duration). The second corresponds to land surface factors (including geological conditions, morphological conditions, soil structure, land cover, as well as drainage and others) (Pranita, 2020).

The flash floods that occurred in North Luwu Regency on July 13, 2020 were caused by high intensity rainfall that lasted for approximately 3 days. The impact caused by flash floods in the Masamba Urban area which is traversed by the Masamba River is in the form of damage to residential facilities and infrastructure and agricultural land. The flash flood disaster resulted in the death of around 39 people, 9 missing people, 106 injured people, 1.545 washed away houses and 20.447 displaced people (Adi et al., 2022). The economic impact of flash floods is that they cause massive and rapid property damage and loss, especially to residential buildings (lost due to drifting and damage), public facilities and infrastructure. The lack of community knowledge and information about the characteristics of the area, which is influenced by land elevation, rainfall intensity, and land surface shape, makes the community vulnerable to the impact of flood disasters.

The morphology of North Luwu Regency is highland in the north, west and east with steep slopes, while the southern part is lowland. The city of Masamba is located in a lowland area which is an alluvial plain directly adjacent to Bone Bay "Pusat Studi Kebencanaan UNHAS, 2020". The morphology resembles a depression and the horizontal distance between the headwaters of the rivers in the northern, eastern and western mountains as well as the plains and bays is not too far (Ramadana, 2023). This makes the Masamba Urban Area very vulnerable to flood disasters and is the basis for conducting a study on flood vulnerability in the area. Efforts that have been made by the Government after flash floods in collaboration with the Public Works and Housing (PUPR) ministry are river normalization and the construction of semi-permanent embankments in the form of geotextile embankments along the Masamba riverbanks that cross the city and improvement of urban infrastructure. In addition, the people who live in the affected areas have been partially relocated to safer areas.

Changes in spatial patterns and land functions due to the impact of flash floods must be accommodated in the concept of spatial planning implementation. Therefore, it is necessary to determine how important are the efforts to control space utilization in spatial planning activities in the Masamba urban area and also its condition which is vulnerable to flood disasters. Vulnerability itself is the level of ease of being exposed to a threatening event from a potential phenomenon in an area within a certain period of time (Arif et al., 2017), Vulnerability is a condition determined by physical, socioeconomic and environmental factors or processes. Assessing urban flood vulnerability and disseminating information to stakeholders in urban flood management is critical (Afsari et al., 2022). For this reason, based on the Law of the Republic of Indonesia. No. 24 of 2007 concerning Disaster Management, it is necessary to map the areas that have a level of flood vulnerability so that the government can take the right policy to overcome it, present spatial information especially related to determining the level of flood vulnerability and can analyze and obtain new information in identifying the areas that are often targeted by floods in the Masamba urban area, so that this research is a consideration for the local government regarding the importance of information on river basin flood disaster hazards (UU RI No. 24, 2007).

The purpose of this study was to analyze the level of flood disaster vulnerability in Masamba urban area. In general, the results of this study are also used as input to the Government of North Luwu Regency regarding the direction of space utilization and safe infrastructure to minimize and mitigate negative impacts in the event of a similar flash flood in the future.

RESEARCH METHODS

Research location

The research was conducted in Masamba District, North Luwu Regency, South Sulawesi Province. The research object limitation is the Masamba urban area which is the RDTR area affected by the severe flash floods in 2020, namely the Bone, Kappuna, and Bone Tua villages.

Data type and source

The types of data used in this research are primary data and secondary data. Primary data in the form of tofographic maps of research objects sourced from field measurement results and field documentation. Secondary data include existing maps of RDTR of Masamba urban, Masamba urban land use map, slope map, land elevation map, soil type map sourced from the Public Works Spatial Planning Housing Settlement Areas and Lands (PUTRPKP2) office of North Luwu Regency, and rainfall sourced from Andi Djemma Masamba Airport climatology station.

Data collection

The data collection techniques in this study consisted of a combination of observation techniques and literature studies. The observation technique is a process of observing and recording systematically, logically, objectively and rationally about various phenomena, both in actual situations and in artificial situations to achieve certain goals (Arifin, 2011). The literature study is a search for research data or information through reading scientific journals, reference books and publication materials and other sources.

Data analysis

The analysis technique in this research involved collecting data both through primary data and secondary data, first processed and then analyzed. This research used spatial analysis techniques by overlaying as well as weighting and scoring analysis techniques. The data obtained is then processed into variables and subsequently, spatial analysis is carried out between several flood-causing variables to identify the classification of the level of vulnerability of urban flooding in Masamba. Determination of weights and scores in this study refers to the relevant previous research and then modified (Sitorus et al., 2021). The weighting of each parameter or variable is different, namely by considering how much influence the parameter has on the occurrence of flooding, the weight value is large; on the other hand, if the influence is small, the weight value is also small. Scoring analysis is intended as giving a score to each class of each parameter. This scoring is based on the influence of the class on flooding. The higher the influence on flooding, the higher the score given. The results of the summation of scores and weights of all parameters are then divided into three flood-prone classes consisting of low vulnerable class, medium vulnerable class and high vulnerable class. The results of the weighting and scoring of each parameter are then overlaid with RDTR, so that the output of this overlay is a map of the flood-prone class of the Masamba urban RDTR area. Then, the flood-prone class map is analyzed to produce the area and percentage of the area based on the classification of flood vulnerability levels in Masamba urban area. From all the data and analysis results that have been obtained, they are then described in a concept of mitigation-based spatial utilization direction as input to the local government as a policy maker.

RESULTS

Masamba urban flood vulnerability level

On the basis of the results of the scoring analysis between all parameters, namely land use, slope, land elevation, soil type and rainfall, the classification of flood vulnerability intervals and classes in the Masamba urban area involves three classes. The classification of intervals and classes of flood vulnerability in Masamba urban area can be seen in Table 1.

From the results of the analysis and overlay between parameters, the area of the flood vulnerability class level in the Masamba urban area can be seen. Low flood-prone areas are located in

Table 1. Classification of flood vulnerability levels

No	Classification	Vulnerability class
1	130–210	Low flood prone area
2	220–300	Medium flood prone area
3	310–400	High flood prone areas

Source: Analysis results, 2024.

Kamiri Village and Masamba Village and parts of Kappuna Village with an area of 83.39 ha. In this area, based on the results of field observations, there is sloping and hilly land elevation; also, part of the area includes a forest and community plantations, especially the Masamba and Kamiri villages. Moderate flood-prone areas are mostly in the Radda, Kappuna and Baliase villages with an area of 824.75 ha, and high flood prone areas are mostly in the Bone and Bone Tua villages, with an area of 244.07 ha. This area is lowland and is located in the Masamba river border area that crosses Masamba City. Percentage of the area of each flood vulnerability class classification and overlay results are shown in Table 2.

The flood disaster vulnerability area in the RDTR of Masamba urban area can be used as a basis for monitoring development activities. This activity is important as an effort to control spatial utilization as well as evaluate spatial planning and utilization. The following table shows the Table 3 of flood vulnerability areas against the RDTR of Masamba urban area.

Table 2. Classification of flood vulnerability levels of Masamba urban area

Flood classification	Area (ha)	Percentage (%)
Low flood vulnerability	83.39	7.22
Moderate flood prone	824.75	71.58
High flood prone	244.07	21.18
Total	1152.21	100

Source: Analysis results, 2024.

Impact of flash floods on Masamba urban detailed spatial plan RDTR based on sedimentation

The analysis of flash flood studies based on sedimentation that has been carried out by Institute for Research and Community Service (LPPM) Hasanuddin University in 2020, resulting in a total volume of sedimentation due to flash floods on the Masamba river is outlined in Table 4.

Table 5 shows the results of overlaying flash flood hazards based on Masamba urban sediments with the existing spatial pattern map of the Masamba urban spatial plan, which resulted in a percentage of suitability and unsuitability of the Masamba urban spatial plan space for flash flood risk. Where the spatial pattern of the Masamba urban spatial detail plan which is suitable is 67% or an area of 771.95 ha and which is not suitable is 33% or an area of 380.26 ha.

The absence of flood vulnerability mapping and inconsistent urban space utilization directions from the local government after the 2020 flash flood related to the flood-prone areas in Masamba urban area, as well as the lack of information to the public about flood-prone areas in the

Table 3. Flood prone areas against the Masamba urban spatial detail plan (RDTR)

Land cover	Area (ha)	Flood vulnerable area (ha)		
		Vulnerable low	Medium vulnerable	High vulnerable
Open area	213.57	9.12	92.67	111.78
Fasum building	71.99	0.05	24.78	47.16
Forest	62.24	47.42	1.57	13.25
Parairan	22.63	0.00	9.18	13.45
Agriculture and animal husbandry	718. 20	5.06	660.02	53.12
Transportation	63.58	21.74	36.53	5.31
Total	1,152.21	83.39	824.75	244.07

Source: Analysis results, 2024.

Table 4. Total sediment volume of Masamba River after flash flood in 2020

Zone	Delineation area (m²)	Sediment thickness (m)	Vol. sediment (m³)
Green	3.511.105,03	1.00	3.511.105,03
Yellow	6.236.683,40	3.00	18.710.050,21
Red	6.582.121,21	5.00	32.910.606,04
Total		55.131.761,28	

Source: Sedimentation study results after flash flood 2020 LPPM UNHAS, 2020.

Table 5. Comparison of percentage of conformity and non-conformity of spatial plan (RDTR) of Masamba urban area

Type of space pattern	Area (ha)	Land area non-conformity of RDTR (ha)	Ercentage of non-conformity per spatial pattern	Percentage of RDTR non-conformity
Deret	17.18	4.54	26.42%	0.39%
IPAL	7.26	0.00	0.00%	0.00%
Road	88.95	18.01	20.25%	1.56%
Health	7.64	5.62	73.61%	0.49%
Kopel	13.40	0.00	0.00%	0.00%
Tourism	23.69	1.03	4.35%	0.09%
Government	16.29	0.00	0.00%	0.00%
Education	7.76	3.78	48.72%	0.33%
Worship	1.82	1.27	69.86%	0.11%
Urban and trade services	4.67	4.44	95.18%	0.39%
Agriculture	557.96	158.24	28.36%	13.73%
Rth	33.87	11.19	33.04%	0.97%
Low density house	74.29	10.87	14.63%	0.94%
Medium density house	138.10	80.58	58.35%	6.99%
High density house	78.65	55.70	70.82%	4.83%
Riverbanks	26.41	0.00	0.00%	0.00%
River	18.95	0.00	0.00%	0.00%
Transportation	27.37	24.99	91.30%	2.17%
Single	7.98	0.00	0.00%	0.00%
Total	1.152.21	380.26		33.00%

Masamba urban area, so from the results of the analysis obtained, a handling direction based on the level of flood vulnerability and affected zoning based on mitigation-based sedimentation can be made as input to the local government. The physical condition of the areas vulnerable to flood disasters can be prevented and handled through spatial planning that is carried out effectively. Prevention and handling are carried out to provide development direction as flood risk control. On the basis on this, a spatial planning system is needed by considering the direction of space utilization to mitigate flood hazards both structurally and non-structurally. The mitigation directions that are in accordance with the characteristics of the research area are shown in Tables 6 and 7.

DISCUSSION

The results of the flood vulnerability analysis in this study found that flood vulnerability in the Masamba urban area is dominated by the level of flood vulnerability with the category of moderate flood vulnerability with an area of 824.75 ha, with coverage areas including Baliase, Radda and

Table 6. Mitigation measures for medium flood prone areas

Mitigation direction		Village
Structural	Non-structural	
1. Minimum building height above 2 floors in areas near the river border 2. Construction of new houses of more than 1 floor and directed to make buildings on stilts 3. Construction of Urban master drainage 4. Construction of permanent embankments on the left and right sides of the river 5. Provision of green space 6. River Normalization 7. New development must have an environmental permit (UKL/UPL/Amdal)	1. Cleaning and normalization of urban drainage 2. Water-absorbing tree planting 3. Prohibition and restriction of building in the riparian area 4. Establishing an early warning system at river water level observation points 5. Preventing tree cutting in water catchment areas and plant maintenance 6. Formulation of policies related to buffer zones as water catchment areas 7. Creation of disaster evacuation map	Bone Tua Village, Bone Village, Kappuna Village, Baliase Village, and Radda Village

Table 7. Mitigation measures for high flood prone areas

Mitigation direction		Village
Structural	Non-structural	
1. Sabo and Upstream Development 2. Urban canal construction 3. Integrated urban master drainage development 4. Construction of permanent embankments on the left and right sides of the river 5. Minimum building height above 2 floors 6. Normalization / Dredging of river sediments periodically 7. Resident Relocation	1. Conservation/preservation (reforestation/ reforestation) 2. Disaster mitigation counseling and education 3. Prohibition of building in the river border area 4. Establishment of an early warning system at river level observation points 5. Produce disaster risk maps, early warning (rainfall and high water discharge) 6. Disaster preparedness village evacuation training 7. Public education on forest management techniques and agricultural and plantation processing as water catchment areas	Bone Tua Village, Bone Village

Kappuna villages and the category of high flood vulnerability with coverage areas, namely Bone and Bone Tua villages with an area of 244.07 Ha. This result is directly proportional to the sedimentation study conducted by LPPM Unhas in 2020 after the flash flood. The Masamba urban area, which is in the category of medium flood vulnerability and high flood vulnerability, is the economic center of the community as well as the service center for government activities and the capital of North Luwu Regency. The moderate flood vulnerability level is a flood hazard that has an impact on infrastructure such as roads, bridges, buildings, and drainage. Moderate flood vulnerability inundates several areas of densely populated settlements, rice fields, agricultural land, and service and government trade centers. However, it does not have an impact for a long period of time and only paralyzes community activities for a few hours. In turn, the high flood vulnerability level is a level of flood hazard that provides a very high level of loss to the affected community. The impact caused is physical damage consisting of damage to various types of infrastructure facilities and infrastructure, agricultural land and plantations as well as economic centers and even casualties. High flood vulnerability levels can paralyze activities for several days and even months as happened during the flash flood in Masamba City in 2020.

In the last decade, there have been many studies related to flood vulnerability and flood control, both structural (Alam et al., 2018), and non-structural, not only in Indonesia but also in the world (Prastica et al., 2019). The research related to structural mitigation claims that mitigation in this way is considered more effective in reducing flood volume (Ezzine et al., 2020). On the other hand, non-structural mitigation also needs to be carried out and claimed as an effective way compared to structural mitigation methods (Farooq et al., 2019). The many debates and differences in regional characteristics from one another make flood disaster control management strategies also different. Many developing countries are still pursuing structural mitigation as an effort to control floods that occur every year.

Oluwasegun (2017), conducted research with the aim of identifying the flood-prone areas for disaster mitigation and preparedness planning in the Benin Owena watershed of Nigeria, identifying and detailing the factors relevant to current and future flood risk, assessing the impact and vulnerability of residents to increased flood risk, as well as directions to be applied to the area to minimize and manage flood risk. The study utilized geographic information system (GIS) analysis and used variables of topography map, soil type map, land use map, rainfall, and population data. It resulted in a flood vulnerability classification with three categories: high, medium and low risk. The factors that cause flood disasters in the research area are the topography of the area. The direction proposed based on the results of the study is to formulate disaster geoinformation management into disaster emergency preparedness planning, spatial planning and flood risk mapping, and policy affirmation.

The difference related to the conducted research is in the research variables, namely using the population. In addition, the characteristics of the area are different. The main factor causing flooding in this study is the topography of the area which is on the coast, while in our research the main factor causing flooding besides topographic conditions is also the dominant high rainfall that occurs almost every year and the Masamba urban area which is flanked by two large rivers, namely the Baliase river and the Radda river and is divided by the Masamba river so that it is very vulnerable to flood disasters. On the basis of the results of observations and identification in the field, the cause of flooding is not only the topography and rainfall factors but also the absence of a sustainable flood control system in the Masamba urban area. In this research, the mitigation direction focuses on non-structural mitigation, in contrast to the presented research, which directs the direction of handling urban spatial planning with a combination of structural and non-structural mitigation.

Afsari et al. (2022), conducted a study with the aim of proposing the design and implementation of a spatial decision support tool to map flood vulnerability in Tehran metropolitan city of Iran in various risk scenarios. The variables used include topography and hydrology, demography, vegetation, rainfall, soil type and land use. The analysis technique used analysis hierarchical process (AHP). The results of flood vulnerability mapping show that the eastern and northern areas of Tehran City are highly vulnerable to flooding due to rainfall in the mountains and runoff entering urban Tehran through rivers and canals. The resulting vulnerability map can serve as an analytical tool to provide solutions to reduce vulnerability through various practices such as infrastructure reallocation, adaptation of nature-based solutions, and landscape engineering to reduce the impact of flooding in Tehran Urban. Flood vulnerability mitigation includes the information on land treatment plans, urban planning, land use allocation, land use change, and urban land use determination. Recommendations and directions model the vulnerability of urban morphology including road networks and facilities, incorporate future urban development plans in the analysis and potential urban and population growth, account for climate change impacts such as future rainfall projections, develop a publicly available flood warning system for real time awareness of flood hazards that can contribute to the safety of urban communities, as well as elaborate on the inclusion of expert knowledge and stakeholder analysis.

The main difference in this study is that the area is located on the slopes of the mountains and is a rapidly developing urban area, and generally rivers and canals lead to the urban area of Tehran. In contrast, the research area considered in the presented study is an undeveloped urban area and the characteristics of the community are still traditional. The research variables used are the same but use different analysis techniques where this research uses AHP while the conducted research uses Scoring Analysis. The results of the analysis only map areas of high vulnerability (very vulnerable), while this research divides three classifications of flood vulnerability levels, namely low, medium and high. The classification of flood vulnerability of an area is needed as a basis for mapping the necessary mitigation adaptation scenarios. The mitigation direction in this research uses modern technological advances, which is different from our research that relies on regional financial capabilities.

Taufik, et al. (2023), conducted research with the aim of identifying the level of flood vulnerability in Pondidaha Subdistrict, Konawe Regency and providing direction for spatial utilization in affected areas. Research variables include rainfall, slope, soil type and land use with spatial analysis techniques (overlay). The results of the study classified the level of flood vulnerability as not prone / safe, prone and very prone, and the Pondodidaha sub-district area is dominated by the level of vulnerability with the prone category. Direction of spatial utilization in the Pondodidaha sub-district needs to be carried out both structurally and non-structurally based on the characteristics of the level of flood vulnerability.

Rakuasa, et al. (2022), conducted research with the aim of spatially analyzing the level of flood vulnerability and affected settlements in Ambon Bay Baguala Sub-district, Ambon City, research variables include slope, land elevation, land use, river buffer, soil type and rainfall with weighting and scoring analysis techniques, resulting in three classes of flood vulnerability, namely high, medium and low vulnerability classes. The classification of flood vulnerability areas in the Teluk Ambon Baguala sub-district is dominated by the low vulnerability class. The results of this research are expected to be used as a basis for future flood disaster mitigation efforts to minimize losses, both casualties and physical damage in the Teluk Ambon Baguala sub-district.

The fundamental difference between that research and the presented study is the characteristics of the area. The location of the urban area in this study is on the coast that is affected by the tides when flooding, so disaster mitigation is different from our research. Several previous studies have shown that to determine a disaster mitigation direction for an area, it is necessary to identify and prepare flood vulnerability mapping in an area, and pay attention to local characteristics that can be used as a basis or basis in determining a disaster mitigation model. In addition, technological advances and community participation are needed. Therefore, based on the results of the analysis of this research, a mitigation scenario model is made in accordance with the characteristics of the research area which is different from previous studies. Structural mitigation scenarios include river normalization, construction of permanent embankments left and right of the river, and construction of sabo dams in upstream areas. This can effectively handle the Masamba Urban area from flood disasters considering the characteristics of the city of Masamba which is very vulnerable to flood disasters, because it is located between two large rivers, namely the Baliae River and the Radda River and is divided by the Masamba River.

Although it looks like an easy scenario in carrying out flood control, it has weaknesses that need to be considered by policy makers in determining an effective scenario in handling disasters in the research area. If control only relies on structural mitigation, the government will incur large costs (Prastica et al., 2019), Moreover, if this structural mitigation will be sustainable from time to time without non-structural mitigation. One of the non-structural mitigations in question includes socialization or adding community capacity in handling and preventing flood disasters such as green infrastructure insights, such as making biopores and land conservation (Mohamed and Worku, 2021), and other conservation efforts that can be carried out independently by the community (Abon et al., 2012). This community capacity building can create a sustainable flood disaster control program that can be carried out independently by the community.

Therefore, the direction of spatial utilization in the flood-prone Masamba urban area based on the characteristics of the region includes the development of a flood disaster mitigation system with structural and non-structural methods. Recommendations for spatial utilization in Masamba urban area to minimize the occurrence of similar flash floods in the future are reviewing the RDTR of Masamba urban area, planning the master plan of urban drainage system, and modeling the classification of flood-prone areas.

CONCLUSIONS

On the basis of the results and discussion, it can be concluded that flood vulnerability in the Masamba Urban Area is classified into three levels of flood vulnerability, namely low flood vulnerability, medium flood vulnerability and high flood vulnerability. In general, the level of flood vulnerability in the Masamba Urban area is dominated by moderate flood vulnerability with a percentage of 71.58% of the total area of the RDTR area of Masamba city. With the absence of mapping the classification of flood vulnerability in the Masamba Urban area, this can be an input to the local government for a review of the RDTR of the Masamba urban area based on disaster mitigation by taking into account economic, social and environmental aspects. There are several challenges that need to be overcome to achieve community and related stakeholder satisfaction in terms of handling flood vulnerability in Masamba Urban. These challenges include the government efforts in mapping the potential for disasters that threaten the lives of its citizens at any time, unsatisfactory performance and the management of urban spatial planning that is not yet optimal. There needs to be a joint effort between the government, related agencies and community participation to improve planning, coordination, resource allocation and participation in the arrangement of Masamba Urban Space. In addition, this research plays an important role in the study and analysis of flooding for regional, city and urban scales. With the availability of the flood vulnerability data in North Luwu Regency, especially the Masamba urban area, it can be an input for the government and the community as a basis for decision making in spatial planning, spatial utilization and spatial control to realize a resilient and sustainable Masamba City.

The direction for the spatial utilization of the Masamba Urban area after the 2020 flash flood is to create a model of land use opportunities in flash flood affected areas in the Masamba Urban area in accordance with the level of flood vulnerability, Opportunities for the reutilization of riparian areas, namely with the model and concept of settlement development in riparian areas after flash floods is the reutilization of riparian areas in accordance with the RDTR of the Masamba Urban area by creating a concept or medium and long-term planning for the construction of permanent embankments on the right and left flow of river areas in the Masamba Urban area with architectural concepts in accordance with local wisdom and local area characteristics.

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