GEOSPATIAL ANALYSIS OF FLOOD HAZARD IN MUARA KELINGI DISTRICT

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ABSTRAK

Kecamatan Muara Kelingi, Kabupaten Musi Rawas, merupakan salah satu wilayah yang memiliki riwayat kejadian banjir yang cukup sering terjadi akibat kondisi geografis yang berada di sekitar aliran sungai besar. Penelitian ini bertujuan untuk menganalisis tingkat ancaman banjir di Kecamatan Muara Kelingi berdasarkan karakteristik fisik wilayah. Metode yang digunakan adalah analisis spasial berbasis Sistem Informasi Geografis (SIG) melalui teknik overlay menggunakan perangkat lunak ArcGIS terhadap beberapa parameter, yaitu curah hujan, penggunaan lahan, kemiringan lahan, kerapatan sungai, dan jenis tanah. Data curah hujan dianalisis menggunakan metode Thiessen Polygon, sedangkan data parameter lainnya diperoleh dari DEMNAS, Revisi RTRW Kabupaten Musi Rawas, serta basis data Tanah Air Indonesia. Setiap parameter dianalisis menggunakan pendekatan skoring dan pembobotan untuk menghasilkan indeks ancaman banjir. Hasil penelitian menunjukkan bahwa sebagian besar wilayah Kecamatan Muara Kelingi termasuk dalam kategori ancaman banjir sedang dengan luas 93,89%, sedangkan kategori ancaman tinggi mencakup 2,94% wilayah dan kategori ancaman rendah sebesar 3,16%. Wilayah dengan tingkat ancaman tinggi umumnya berada pada dataran rendah yang berdekatan dengan aliran sungai, memiliki kemiringan lahan yang relatif datar, serta didominasi oleh penggunaan lahan terbangun yang mengurangi kemampuan infiltrasi tanah. Selain itu, dominasi tanah Podsolik Haplik dengan kemampuan infiltrasi sedang hingga rendah turut berkontribusi terhadap potensi genangan. Hasil penelitian ini diharapkan dapat menjadi dasar dalam perencanaan tata ruang berbasis risiko serta upaya mitigasi bencana banjir di Kecamatan Muara Kelingi.

Kata Kunci: *Ancaman banjir; Analisis spasial; Sistem informasi geografis; Penggunaan lahan; Muara Kelingi*

ABSTRACT

Muara Kelingi District, Musi Rawas Regency, is one of the areas that has experienced frequent flood events due to its geographical condition, which is located near major river systems. This study aims to analyze the level of flood hazard in Muara Kelingi District based on the physical characteristics of the area. The method employed is spatial analysis based on a Geographic Information System (GIS) using an overlay technique in ArcGIS software. Several parameters were analyzed, including rainfall, land use, slope, river density, and soil type. Rainfall data were analyzed using the Thiessen Polygon method, while the other parameters were obtained from DEMNAS, the revised Spatial Plan (RTRW) of Musi Rawas Regency, and the Tanah Air Indonesia geodatabase. Each parameter was assessed using a scoring and weighting approach to generate a flood hazard index. The results indicate that the majority of Muara Kelingi District falls into the moderate flood hazard category, covering 93.89% of the area, while the high hazard category accounts for 2.94% and the low hazard category covers 3.16%. Areas with high flood hazard are generally located in lowland areas close to river channels, characterized by relatively flat slopes and dominated by built-up land use that reduces the soil's infiltration capacity. In addition, the dominance of Haplic Podsolic soils with moderate to low infiltration capacity also contributes to the potential for surface water accumulation. The findings of this study are expected to serve as a basis for risk-based spatial planning and flood disaster mitigation efforts in Muara Kelingi District

Keywords: *Flood hazard; Spatial analysis; Geographic information system; Land use, Muara Kelingi*

INTRODUCTION

Muara Kelingi District is one of the areas in Musi Rawas Regency that has repeatedly experienced flooding, primarily due to high rainfall and river overflow. Based on disaster event records over the past five years, flood occurrences documented from 2020 to 2025 indicate a persistent pattern of inundation. This condition is influenced by the characteristics of lowland topography, the distribution pattern of settlements along riverbanks, and changes in land use, which collectively highlight the high level of flood vulnerability and the need for spatial analysis of flood hazards based on local physical conditions. The conversion of water catchment areas into residential settlements along riverbanks has further increased the level of flood vulnerability in the region.

Various previous studies have applied spatial approaches based on Geographic Information Systems (GIS) for flood hazard analysis. However, most studies have been conducted at a regional scale and have utilized limited parameters, thereby not fully representing local physical conditions. In addition, specific studies on flood hazard levels in Muara Kelingi District that integrate physical parameters comprehensively remain relatively limited, despite the rapid land-use development that has occurred in this area in recent years.

The novelty of this research lies in the application of GIS-based spatial analysis using the overlay method by integrating five main physical parameters, namely rainfall, slope gradient, soil type, river density, and land use, at the district scale. This study aims to analyze the level of flood hazard in Muara Kelingi District and to produce more detailed and contextual spatial information as a basis for spatial planning and the formulation of risk-based disaster mitigation strategies in order to minimize potential social, economic, and environmental losses.

LITERATURE REVIEW

Spatial data play a crucial role in analyzing the potential for flood disasters because they provide accurate and relevant information regarding the location and level of flood susceptibility in a particular area, including Muara Kelingi District. This study utilizes various physical factors that significantly influence the level of flood hazard. The analysis was conducted comprehensively and systematically using several key parameters, namely rainfall, land use, slope gradient, River Density, and soil type. The classification and weighting of each of these parameters are presented in detail in the flood hazard parameter table (Table 1).

Table 1. Parameters for Flood Hazard Analysis in Muara Kelingi District (Syawal et al., 2025)

Land Use Criteria and Scoring				
No	Land Use Type	Score		Weight
1	Forest	1		2.5
2	Shrubland	2		2.5
3	Dryland Farming / Fields / Plantations	3		2.5
4	Rice Fields / Fish Ponds	4		2.5
5	Settlements, Built-up Areas, Industrial Areas	5		2.5
Slope Criteria				
No	**Slope (%)**	**Description**	**Score**	**Weight**
1	0-8	Flat	5	2
2	>8-15	Gentle	4	2
3	>15-25	Moderately Steep	3	2
4	>25-45	Steep	2	2
5	>45	Very Steep	1	2
Soil Type Classification				
No.	**Soil Type**	**Infiltration**	**Score**	**Weight**
1	Alluvial, Planosol, Grey Hydromorphic, Laterite, Groundwater Soil	Very Slow	5	1
2	Latosol	Moderately Slow	4	1
3	Brown Forest Soil, Mediterranean Soil	Moderate Infiltration	3	1

4	Andosol, Laterite, Grumosol, Podsol, Podzolic	Sensitive	2	1
5	Regosol, Lithosol, Organosol, Renzina	Very Sensitive	1	1
Rainfall Criteria				
No.	**Description**	**Rainfall (mm/month)**	**Score**	**Weight**
1	Light Rain	0-100	1	1.5
2	Moderate Rain	101-300	2	1.5
3	Heavy Rain	301-500	3	1.5
4	Very Heavy Rain	>500	4	1.5
River Density Criteria				
No.	**River Density (km/km²)**	**Score**	**Weight**	
1	<0.62	5	1	
2	0.62-1.44	4	1	
3	1.45-2.7	3	1	
4	2.28-3.10	2	1	
5	>3.10	1	1	

Land use change has been demonstrated to exert a significant influence on the increase in surface runoff and peak discharge, thereby directly contributing to a heightened risk of flooding. A study by Dirk Niehoff, Uwe Fritsch, and Axel Bronstert indicates that alterations in land use substantially affect storm-runoff generation processes and can lead to increased peak discharge within a catchment area (Niehoff et al., 2002). Furthermore, research published in Hydrological Processes confirms that land use constitutes a dominant factor controlling flood events in river basins, even surpassing the influence of other physical parameters such as soil characteristics and topography (Ott et al., 2001). Therefore, land use can be regarded as a key parameter in hydrological analysis, as it directly governs runoff dynamics and flood potential.

RESEARCH METHODS

The research method represents a comprehensive framework that includes the determination of the study approach, research type, location and duration of the study, identification of data sources, data collection techniques, and the analytical methods employed. The selection of each methodological component is adjusted to the characteristics of the issue being examined and the objectives of the study, thereby ensuring that the results obtained possess high validity and can be scientifically justified.

Research Type

This study is categorized as spatial descriptive research. This type of research aims to identify and describe in detail the distribution patterns, trends, and interrelationships among geological or spatial phenomena within the boundaries of the study area. Therefore, the focus of the study is directed toward the analysis of locations, spatial aspects, and interactions among elements within the geological context of the research area.

Location and Time of the Study

The research was conducted in Muara Kelingi District, which has a study area of 67,505 hectares and encompasses 21 villages. Geographically, Muara Kelingi District is located in Musi Rawas Regency, South Sumatra Province, at approximately 3°04′37″ South Latitude and 103°13′43″ East Longitude. Administratively, the district is bordered to the north by Tuah Negeri District and part of Musi Rawas Regency, to the east by Tuah Negeri District and other administrative areas within Musi Rawas, to the south by Suka Karya District and Muara Lakitan District, and to the west by Muara Lakitan District and other parts of Musi Rawas Regency (Figure 1).

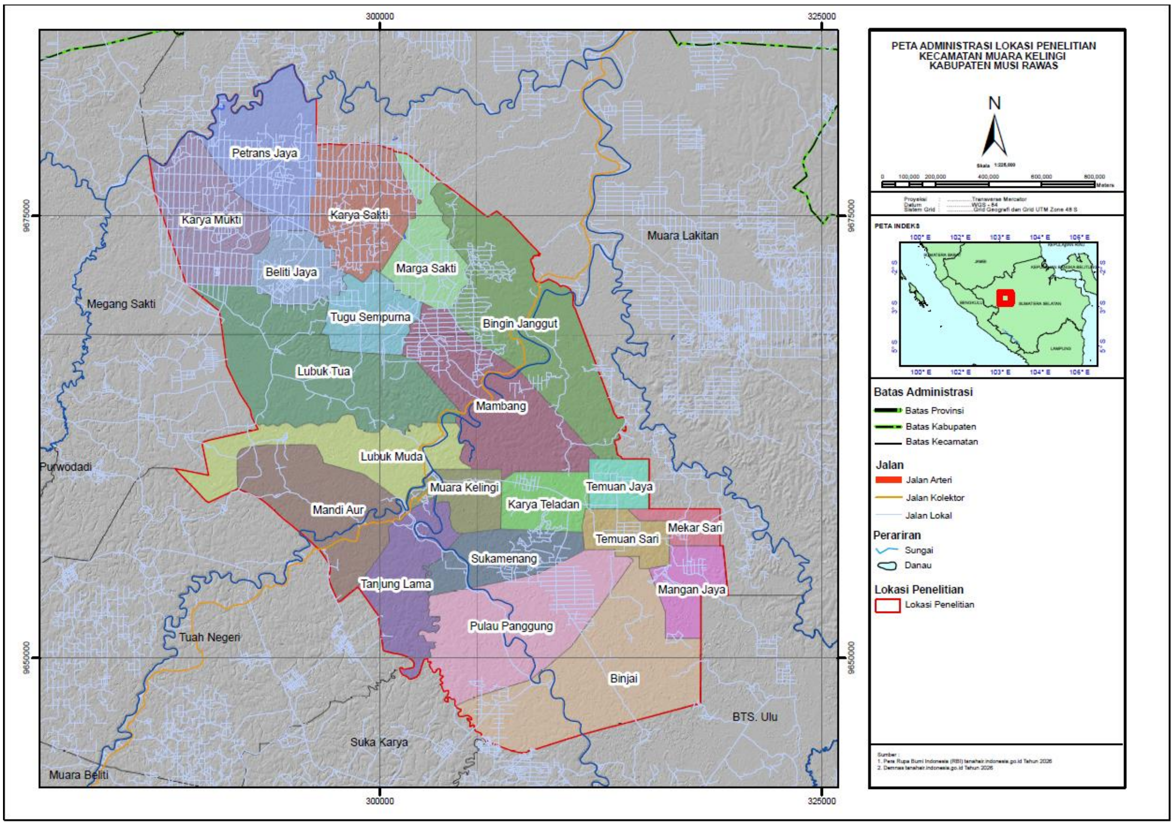

Figure 1. Administrative Map of Muara Kelingi District, consisting of 21 villages, with the largest village being Lubuk Tua Village and the smallest village being Mekarsari Village

Data Analysis Technique

This study applies the overlay method as the primary analytical technique for producing the flood hazard map. The overlay method is a spatial data analysis procedure conducted by combining or superimposing several thematic map layers relevant to the research objectives (Darmawan et al., 2017). Conceptually, this method is based on the application of an evaluation system involving scoring and weighting to determine the level of vulnerability within each spatial unit (Fauzi & Septian, 2020). Through the integration of various data layers, such as rainfall maps, slope gradient, soil types, and river density, the level of flood hazard can be spatially identified based on the accumulation and combination of values from each analyzed parame

Table 2. Types of Data, Data Sources, and Data Period Used in the Study

Data Type	Data Source	Period	Data Utilization
Land Use	1. Administrative Map of Musi Rawas Regency 2. RBI Map – Ina Geoportal 2026 3. Revision of the Musi Rawas Regional Spatial Plan (RTRW) 2026	2026	To identify land use patterns and analyze land-use changes.
Rainfall	1. Administrative Map of Musi Rawas Regency 2. RBI Map – Ina Geoportal 2026 3. Revision of the Musi Rawas Regional Spatial Plan (RTRW) 2026	2026	To provide rainfall data for the preparation of a Thiessen rainfall map and analyze potential water inundation during high rainfall intensity.
Slope	1. Administrative Map of Musi Rawas Regency 2. RBI Map – Ina Geoportal 2026 3. DEMNAS – Ina Geoportal 2026	2026	To analyze slope gradients within the Kelingi District area.
Elevation	1. Administrative Map of Musi Rawas Regency 2. RBI Map – Ina Geoportal 2026 3. DEMNAS – Ina Geoportal 2026	2026	To evaluate variations in topographic elevation in Muara Kelingi District.

Soil Type	1. Administrative Map of Musi Rawas Regency 2. RBI Map – Ina Geoportal 2026 3. Revision of the Musi Rawas Regional Spatial Plan (RTRW) 2026	2026	To identify soil type characteristics in Muara Kelingi District as the basis for overlay analysis in flood hazard mapping.
River Density	1. Administrative Map of Muara Kelingi District 2. RBI Map – Ina Geoportal Indonesia 2026 3. GIS Analysis Results 2026	2026	To analyze the density of the river network in Muara Kelingi District.

Flood hazard analysis in this study was conducted by considering several major physical factors, namely land use, slope gradient, elevation, and soil type. Land use dominated by vegetation cover tends to reduce flood potential by increasing rainfall infiltration capacity and decreasing surface runoff (Salsabila et al., 2024). Slope and elevation data were obtained through the extraction of the Digital Elevation Model (DEM) using ArcGIS software. Meanwhile, soil type data were obtained from the Ministry of Agriculture and adjusted to the administrative boundaries of the study area. Each of these physical variables was assigned specific scores and weights representing their contribution to the area's flood vulnerability.

In addition to these factors, the analysis also included rainfall and river density variables. Average rainfall was calculated based on 2024 data obtained from the Meteorology, Climatology, and Geophysics Agency (BMKG) of Musi Rawas Regency through several observation stations to produce the spatial distribution of rainfall intensity. River density was determined through spatial analysis using ArcGIS software, utilizing geodatabase data of rivers, canals, and drainage systems obtained from the Tanah Air Indonesia portal. All data used in this study were first integrated and adjusted to the administrative boundaries of the study area before being used in the analytical process.

The final stage of the research involved the weighting process and the determination of total scores to produce the flood hazard level map. Each physical parameter was assigned a score ranging from 1 to 5, which was then multiplied by a predetermined weight. These weights represent the relative importance or influence of each parameter on flood vulnerability (Darmawan et al., 2017). Referring to the approach proposed by Alyudin (2024), the flood hazard level was obtained through the multiplication operation between the score and weight of each physical parameter. The final results were then used to classify and map the flood hazard levels in the study area. The weight values for each parameter are presented in the relevant table (Table 2).

Formula for Total Flood Hazard Score

$$S_{\text{total}} = \sum_{i=1}^{n} w_i \cdot s_i$$

Where:

S_{total} : total flood hazard score

w_i: weight of the i-th parameter

s_i: score of the i-th parameter

n: number of parameters

Based on the total score, the vulnerability category for each polygon or spatial unit can be determined using the following formula. The classification used in this study consists of four categories, namely very high, high, moderate, and low vulnerability.

$$KB = \frac{ST - SR}{n}$$

Where:

$\boldsymbol{KB}$: class interval

$\boldsymbol{ST}$: highest score

$\boldsymbol{SR}$: lowest score

$\boldsymbol{n}$: number of classes

RESULTS AND DISCUSSION

The results of the spatial analysis for each indicator were subsequently assigned weights in order to determine the relative contribution of each variable to the level of flood hazard. The weighting process was carried out by considering the physical characteristics of the region and the magnitude of influence of each indicator on the potential occurrence of flooding. The predetermined weights were then used to develop hazard index maps for each parameter, such as land use, elevation, and slope gradient.

These index maps were subsequently integrated through a systematic overlay process, resulting in a more comprehensive flood hazard level map. Through this stage, the spatial distribution pattern of flood hazards can be identified in greater detail, thereby providing a clear representation of areas with low, moderate, and high hazard levels.

Rainfall

Rainfall data for Muara Kelingi District in 2026 were analyzed using the Thiessen Polygon method with the assistance of ArcGIS software, and subsequently overlaid with other physical indices to evaluate its contribution to the level of flood hazard. Based on data from the Revised Regional Spatial Plan (RTRW) of Musi Rawas Regency, the average annual rainfall ranges between 2000–3000 mm per year, which falls into the moderate rainfall category. This category was assigned a score of 2, a weight of 1.5, and a total value of 3 in determining the rainfall index. The rainfall distribution is presented in Table 3, while its spatial distribution is illustrated in Figure 2. The rainfall parameter shows no spatial variation across the study area, as all regions fall within the same classification score. This indicates that rainfall is relatively homogeneous in the Muara Kelingi District. Although it does not contribute to spatial differentiation in the model, rainfall remains an essential triggering factor in flood occurrence and is therefore retained in the analysis and than rainfall acts as a triggering factor rather than a spatial differentiating factor in this study.

Table 3. Rainfall in Kelingi District, 2026

Average Rainfall (mm/year)	Rainfall Type	Area (ha)	Percentage (%)	Score	Weight	Total
2000–2500	Moderate Rainfall	17,415	26	2	1.5	3
2500–3000	Moderate Rainfall	50,091	74	2	1.5	3

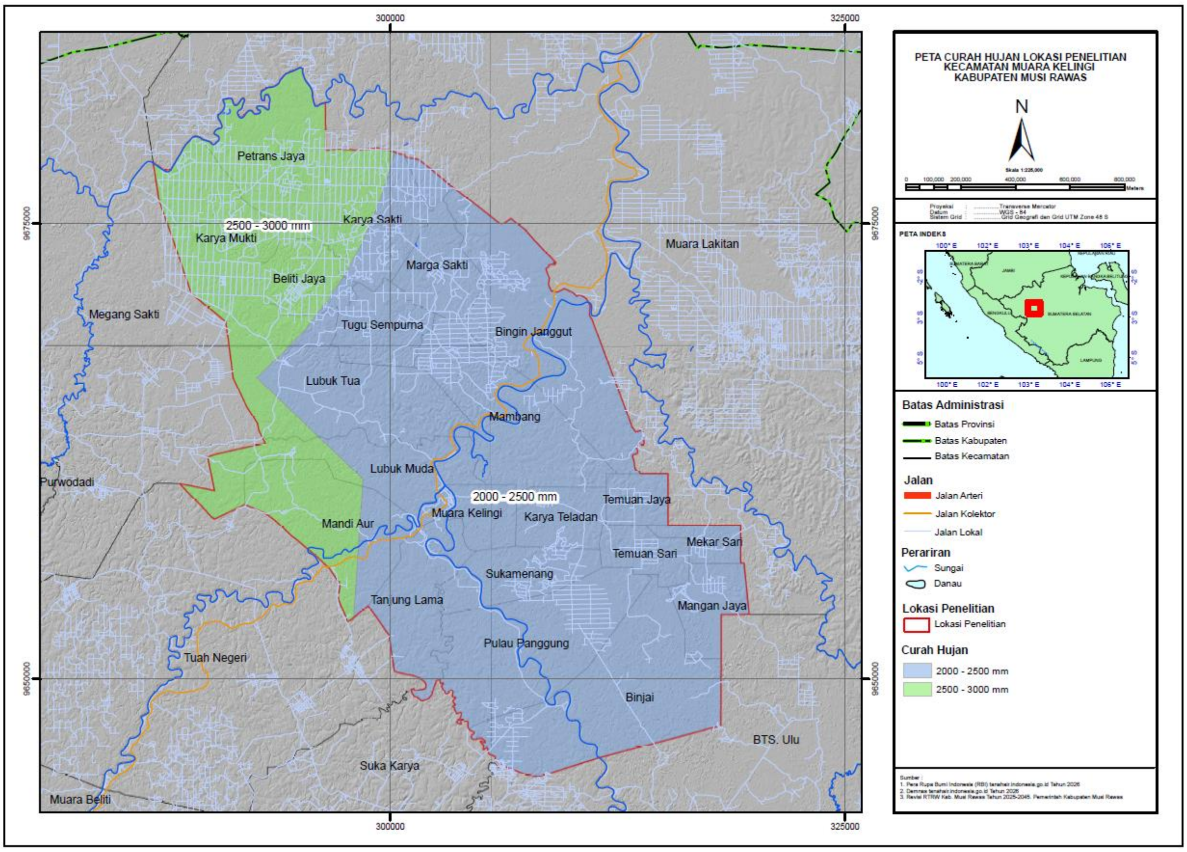

Figure 2. Map of Rainfall Distribution in Kelingi District, 2026.

Land Use

The land use data used in this study were obtained from the Revised Regional Spatial Plan (RTRW) of Musi Rawas Regency, 2026. The land use areas are presented in Table 4 and illustrated in map form in Figure 3 below.

Table 4. Scores, Weights, Area, and Total Values of Land Use in Muara Kelingi District

Land Use	Score	Weight	Total	Area (ha)	Percentage (%)
Dryland Farming / Fields	3	2.5	7.5	1,603	2.4
Plantation	3	2.5	7.5	46,547	69
Settlement	5	2.5	12.5	1,250	1.85
Shrubland	2	2.5	5	17,451	26

Based on Table 4 and Figure 3, the dominant land use in Muara Kelingi District is plantation areas, covering approximately 46,547 hectares. The next largest land use type is shrubland, covering 17,451 hectares, followed by dryland farming/fields, which occupy approximately 1,603 hectares. Meanwhile, settlements represent the smallest land use category, covering only about 1,250 hectares.

This distribution pattern of land use indicates variations in regional characteristics that influence the level of flood disaster vulnerability, particularly in areas dominated by built-up land and reduced water infiltration zones (Fajri & Widayanti, 2018).

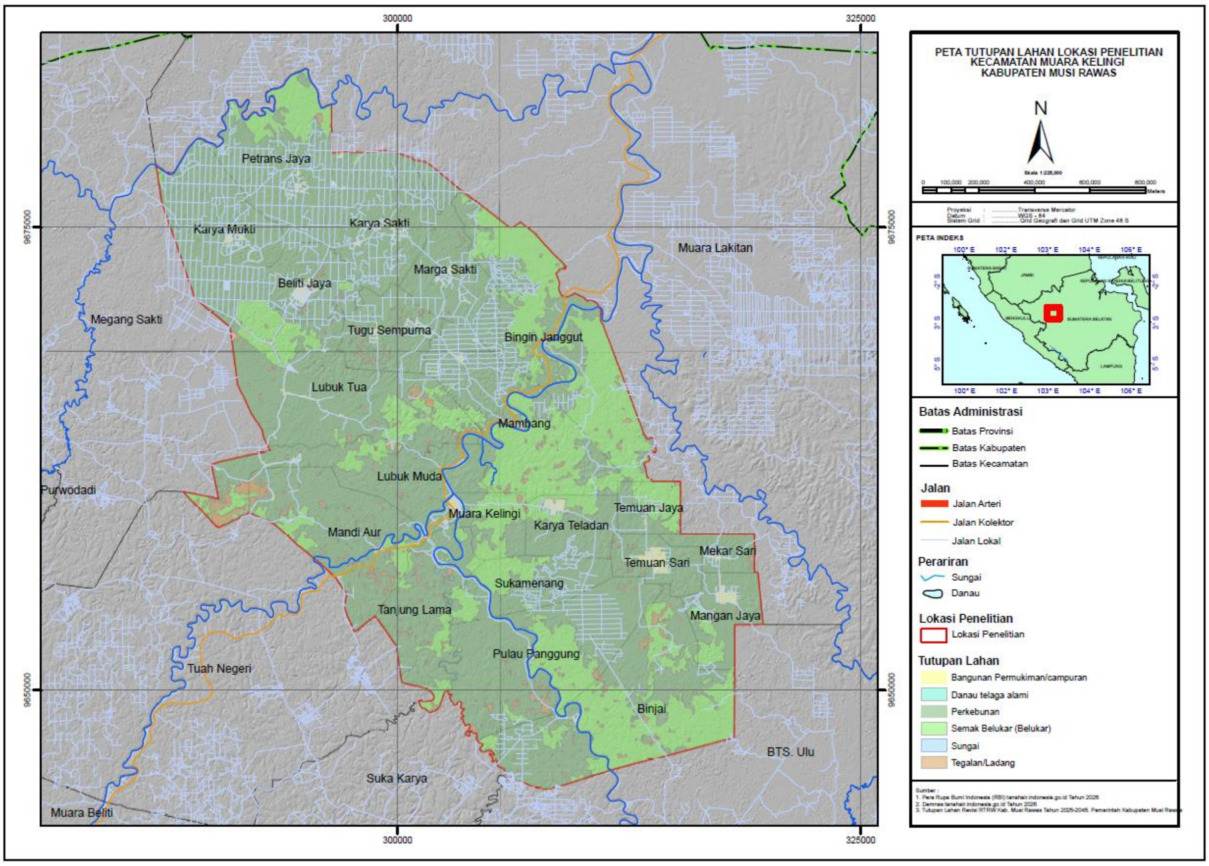

Figure 3. Land Use Map of Muara Kelingi District

Slope

In this study, DEMNAS raster data (2026) were used to obtain slope information by utilizing the slope tool in the GIS analysis process. The slope area distribution is presented in Table 5 and visualized in Figure 4 below.

Table 5. Scores, Weights, Total Values, and Area of Slope Classes in Muara Kelingi District

Slope Class	Score	Weight	Total	Area (ha)	Percentage (%)
Flat (0–8)	5	2	10	46,036	68
Gentle (>8–15)	4	2	8	16,057	24

Moderately Steep (>15–25)	3	2	6	4,445	7
Steep (>25–45)	2	2	4	890	1
Very Steep (>45)	1	2	2	77	0

Based on Table 5 and Figure 4, the topography of Muara Kelingi District consists of five slope categories. Approximately 68% of the area falls within the flat category, 24% within the gentle slope category, 7% within the moderately steep category, 1% within the steep category, and less than 1% within the very steep category. These variations in slope gradient constitute one of the physical parameters analyzed in determining the flood hazard level in Muara Kelingi District, with a weight value of 2 assigned to represent the contribution of slope gradient to the potential occurrence of flooding.

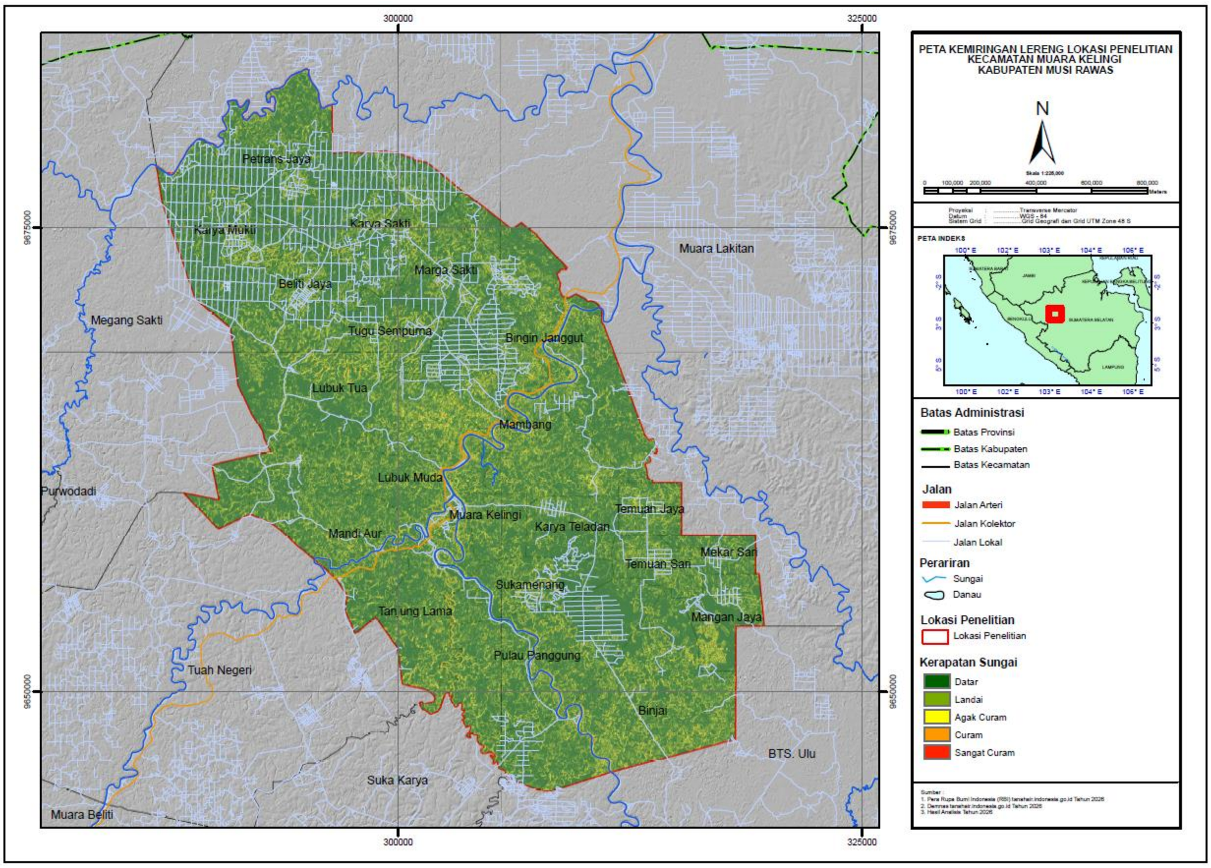

Figure 4. Slope Map of Muara Kelingi District

River Density

The river network data used in this study were obtained from the Tanah Air Indonesia portal in geodatabase format (2026). The distribution of river density areas is presented in Table 6 and visualized in Figure 5 below.

Table 6. River Density in Muara Kelingi District

River Density	Score	Area (ha)	Percentage (%)
Sparse	1	54,439	81
Slightly Sparse	2	3,274	5
Moderate	3	3,237	5
Dense	4	3,335	5
Very Dense	5	3,228	5

Based on Table 6 and Figure 5, the sparse river density class covers the largest area in Muara Kelingi District, reaching 54,439 hectares. This is followed by the dense river density class, with an area of 3,335 hectares. Meanwhile, the smallest coverage area belongs to the very dense river density class, which occupies approximately 3,228 hectares.

Nevertheless, areas classified as having very dense river networks are generally located in densely populated settlement areas, which tend to have a higher level of vulnerability to surface runoff and potential water inundation.

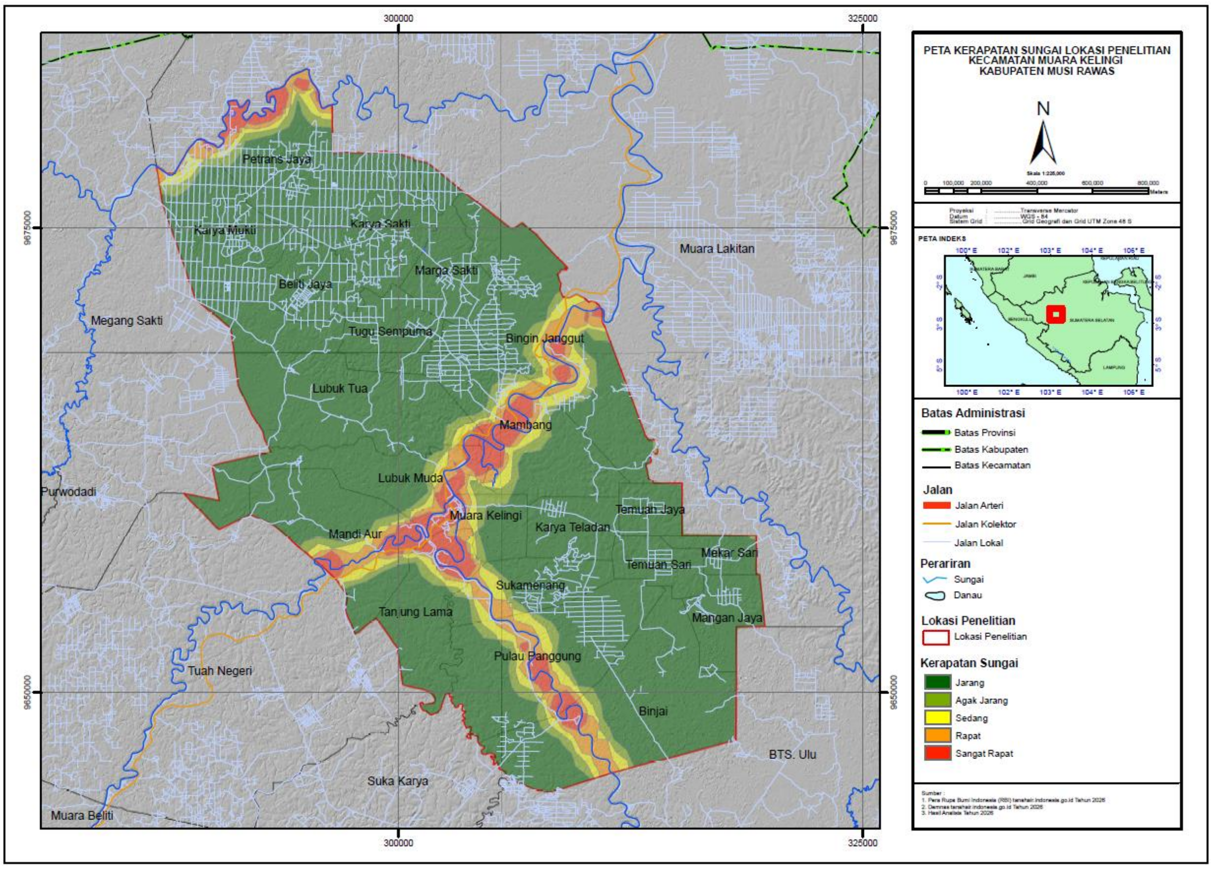

Figure 5. River Density Map of Muara Kelingi District

Soil Type

The soil type data used in this study were obtained from the Revised Regional Spatial Plan (RTRW) of Musi Rawas Regency. These data indicate that several soil types are present within the soil classification of Muara Kelingi District. The distribution of soil types is presented in Table 7 and visualized in Figure 6 below

Table 7. Soil Types in Muara Kelingi District

Soil Type	Area (ha)	Percentage (%)	Infiltration Level	Score
Gleyic Alluvial	12,280	18	Very Slow	5
Haplic Podsolic	55,226	82	Sensitive	2

Based on Table 7 and Figure 6, the dominant soil type in Muara Kelingi District is Haplic Podsolic, covering approximately 55,226 hectares. This soil type is generally characterized by red-yellow coloration, acidic properties, low fertility, and the presence of a clay accumulation horizon (Bt), which commonly forms in humid tropical climates with high rainfall.

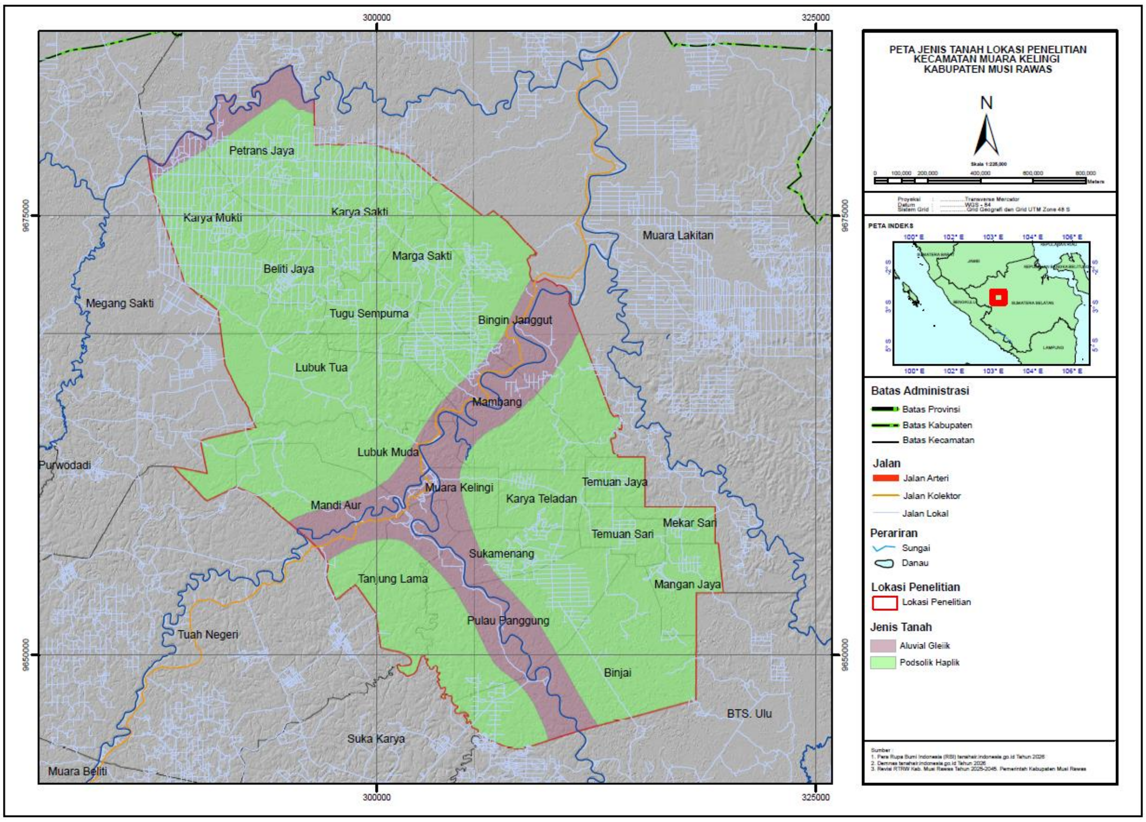

Figure 6. Soil Type Map of Muara Kelingi District

The infiltration capacity of Haplic Podsolic soils is generally moderate to low, because the subsurface layer contains a clay-rich Bt horizon, which slows the movement of water into the soil. As a result, during periods of high rainfall or flooding, water tends to accumulate on the surface before gradually infiltrating into the soil.

Flood Hazard in Muara Kelingi District

The flood hazard in Muara Kelingi District was determined through an overlay process of all physical variables that had been assigned scores and weights, namely rainfall, land use, slope gradient, river density, and soil type. This process produced three flood hazard classes, namely low, moderate, and high hazard categories.

The calculation results indicate that the highest score from the total of all physical characteristics is 36.5, while the lowest score is 16. This range of values was then used in the flood hazard equation to determine the interval for each hazard class, resulting in an interval value of 6.83. The area distribution of each flood hazard class at the district level is presented in Figure . Based on Figure 7, the distribution of flood hazard classes in Muara Kelingi District is divided into three categories: low hazard (3.16%), moderate hazard (93.89%), and high hazard (2.94%). Areas with a high hazard level are distributed across several villages, indicating that these areas are more vulnerable to potential flooding.

Based on the map, the total area categorized as high flood hazard reaches approximately 1,960 hectares, covering Muara Kelingi Village, Lubuk Muda Village, Mandi Aur Village, Bingin Janggut Village, and Pulau Panggung Village. Meanwhile, the moderate hazard class covers approximately 62,537 hectares, predominantly located in Sukamenang Village and Tanjung Lama Village. The low hazard class represents the smallest area, covering approximately 2,107 hectares, most of which are located in Mambang Village and Tugu Sempurna Village.

Compared to other villages classified within the high hazard category, Muara Kelingi Village is considered the most vulnerable area to flooding in Muara Kelingi District. This village has a population density of approximately 62 people per km², where settlements are distributed around the confluence of two major rivers, the Musi River and the Kelingi River. This condition indicates that the potential number of affected residents could be very large if flooding occurs in this area**.**

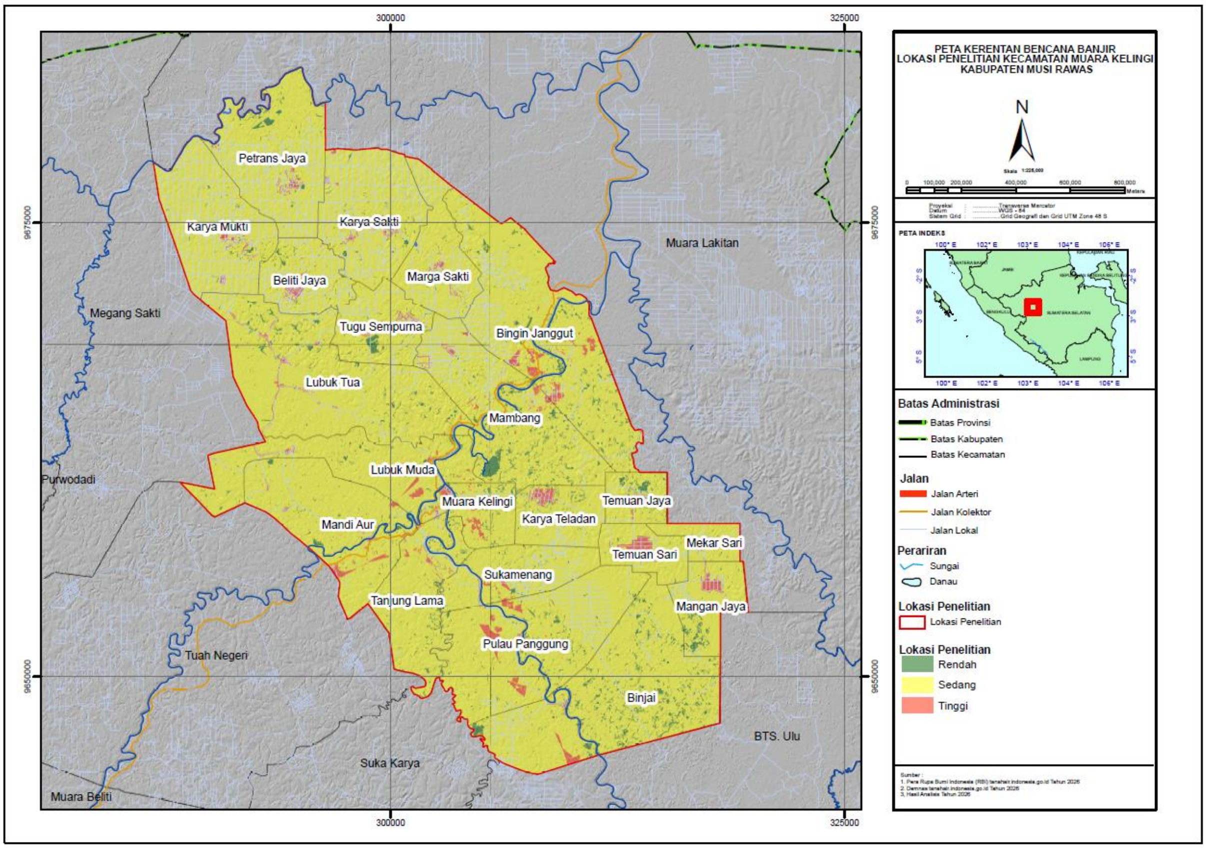

Figure 7. Flood Hazard Map of Muara Kelingi District

Discussion

This study aims to present spatial information on flood hazard levels based on the physical characteristics of the region in Muara Kelingi District. According to Shalih (2023), a disaster hazard refers to the potential occurrence of an event that may cause losses to humans, property, the environment, and social and economic activities, triggered by natural factors, non-natural factors, or human activities.

The results of the analysis indicate that the flood hazard level in Muara Kelingi District is influenced by several factors, including land use, elevation, slope gradient, and river density, with varying risk distributions across the region. Approximately 2.94% of the area falls into the high flood hazard category, which is generally dominated by built-up land, such as densely populated residential areas, commercial zones, and public infrastructure located near rivers with relatively low elevations. Changes in land conditions from their natural state reduce the soil's capacity to absorb water and increase the volume of surface runoff, particularly in areas where spatial planning has not been well managed. The shift in land functions within river buffer zones from agriculture, dryland fields, or forest areas—previously functioning as water catchment zones—into settlements, industrial areas, and other non-agricultural activities has negatively affected the balance of natural ecosystems (Umam, 2023).

In addition, elevation also plays a significant role in determining flood hazard levels. Areas with low elevation, particularly within floodplain zones, are more susceptible to inundation because they become accumulation points for water flow from surrounding areas. This vulnerability is further exacerbated by the relatively flat slope characteristics across most parts of Muara Kelingi District. When the river capacity is no longer able to accommodate the water discharge, overflow spreads into flat areas and triggers inundation, especially during periods of high rainfall intensity. Land use changes from open areas to built-up zones also reduce soil infiltration capacity, increase surface runoff, and expand the extent of inundated areas (Hariyra et al., 2025), thereby contributing to the increased risk of flooding. Land conversion into residential areas ultimately places additional pressure on the environment and increases the likelihood of flood events (Reza, 2025).

Areas classified under the moderate flood hazard category cover approximately 93.89% of the total area of Muara Kelingi District. These areas generally have gentle slopes and relatively higher elevations, such as in Sukamenang Village and Tanjung Lama Village. In these locations, the presence of green spaces and vacant land plays an important role in reducing flood risk. Meanwhile, areas classified as low hazard cover approximately 3.16% of the total area, which generally have gentle slopes and land use that supports water infiltration, such as forested areas and well-vegetated land.

The distribution of these hazard levels indicates that areas characterized by built-up land use, low elevation, gentle slopes, and proximity to river networks require special attention in flood mitigation planning. Therefore, the government of Muara Kelingi District needs to prioritize risk-based spatial planning by considering the physical factors that influence flood potential. Furthermore, infrastructure improvement should become an essential component of mitigation policies to minimize flood impacts in vulnerable areas. In addition, non-physical factors, such as bureaucratic and regulatory frameworks related to ecosystem protection—particularly in upstream areas and river buffer zones—should also be strengthened. These efforts are expected to reduce environmental damage and enhance community resilience to disasters in the future.

CONCLUSION

The results of the spatial analysis through the overlay process of physical hazard data indicate that approximately 2.94% of the area in Muara Kelingi District falls into the high flood hazard category, which is generally located in densely populated residential areas situated near rivers. In addition, about 93.89% of the area is classified under the moderate hazard category, while the remaining 3.16% falls into the low hazard category.

The distribution of these hazard levels indicates that Muara Kelingi District has a significant potential for flood disasters, particularly in areas characterized by high physical vulnerability and extensive built-up land use. These findings provide an important basis for stakeholders, including local governments, in formulating spatial planning policies and environmental reconstruction strategies at the village level.

Furthermore, the results of this study are expected to encourage active community participation in Muara Kelingi District in efforts to reduce the impacts and risks of flooding, while also increasing public awareness of the potential flood hazards in the region.

In particular, Muara Kelingi Village represents one of the most vulnerable areas, with a population density of approximately 62 people per km². Settlements in this village are distributed around the confluence of two major rivers, namely the Musi River and the Kelingi River, which further increases the potential exposure of the population to flood hazard

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