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# ANALYSIS OF RESIDENTIAL AREA DEVELOPMENT IN KARO DISTRICT

**Hendra Gunawan Halawa[1], Wahyu Hidayat[2], Feby Milanie**
[1]Mahasiswa Program Magister Perencanaan Wilayah dan Kota, Universitas Pembangunan Panca Budi
[2,3] Staf Pengajar di Program Magister Perencanaan Wilayah dan Kota, Universitas Pembangunan Panca Budi
Email: hgunawanhalawa@gmail.com

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**Abstract**

The development of a region is greatly influenced by the development of settlements to accommodate the population in the region. Settlement problems often occur due to lack of settlement development planning, resulting in a decline in the quality of settlements. Therefore, it is necessary to conduct an analysis of settlement development. This study was conducted in the scope of Karo Regency which aims to analyze potential land to be used as a settlement area in Karo Regency. The approach used in this study is descriptive qualitative using the superimpose analysis method (overlay) and SWOT analysis. The superimpose method is carried out by overlaying a physical map of the region, and areas that have the potential to be protected. So that it produces a direction for the potential development of the settlement area. The research results show that the limited area of 128,127.81 hectares can be pushed into protected areas and agricultural areas,The constraint area of 44,812.12 Ha is a constraint area that can be developed in a limited way as residential development, and the potential area of 45,791.61 Ha is a potential area that is highly recommended as land for built-up or residential development.

**Keywords**: ***Settlement Development, Development Capacity, Karo Regency***

## I. INTRODUCTION

### A. Background

Settlement is a basic human need that must be met and along with population growth that greatly impacts the need for settlements, this results in an increasing area of land used as settlements by the community in an area. According to Muta'ali and Arif (2016) settlements are all forms, both artificial and natural, with all the equipment used by humans, both individually and permanently, in which there are facilities and infrastructure that complement them. The development of settlements is seen in terms of quality and quantity, in terms of quality it can be seen through the physical quality of the house or the physical quality of the building that meets the standards of decent housing. While in terms of quantity, its development is indicated by changes in land use from unbuilt to built-up areas within a certain period of time, the number will increase according to population growth, social and economic growth, and the culture of the local community.

The development of an area is usually seen from the development of settlements, this means that the more residential areas there are, the more social and economic development in an area increases. On the other hand, population growth results in an increase in the need for residential land that must be met, so special attention is needed in land management so that land use is maintained from an environmental perspective. According to Bintarto (1976:10) said that in a narrow sense, settlements are not only houses where humans live but more about paying attention to the arrangement and distribution of buildings including: houses, buildings, schools, offices, markets, and so on. This opinion shows that in every development of a residential area, it will be followed by the development of facilities and infrastructure that support the lives and activities of the community itself.

Physical characteristics of land are one of the parameters in the development of residential areas that can be seen from the side of land capability and suitability which aims to reduce the negative impact on residential development in an area, for example the level of disaster proneness such as landslides, earthquakes, floods, flash floods, volcanic eruptions and other natural disasters that can have a negative impact on residential development. In addition, protected areas such as forest areas, border areas are also areas that need to be considered in residential development. This is done to maintain the quality of the environment in an area. Karo

Regency is one of the regencies in the North Sumatra Province with an area of 218,732 hectares consisting of 17 sub-districts and 10 urban villages and 259 villages. Karo Regency has a strategic area value because of the availability of tourism areas spread across several sub-districts, so that regional development in terms of housing, trade and services and public facilities is very possible. Based on the Karo Regency Spatial Plan (RTRW) (Karo Regency Regulation Number 4 of 2022), the direction of settlement development is directed at each service center. This is supported by the provision of basic infrastructure in supporting areas for settlement areas.

Significant changes in settlements occurred in Karo Regency in 2013, this was due to the natural disaster of Mount Sinabung which caused the relocation of new settlement areas in Sioar, Merek District. In addition, economic development in terms of trade, services and tourism also had an impact on settlement development in Karo Regency. The problem of increasing population growth has an impact on the need for land for settlement areas, in addition, the settlement areas currently developing in Karo Regency are partly in areas that are not in accordance with existing designations, such as forest areas, border areas and settlements in disaster-prone areas that do not pay attention to disaster mitigation. Good residential development should be carried out on land that is in accordance with environmental carrying capacity, existing uses and meets the requirements for suitability for housing, such as the physical suitability of the area. Based on these conditions, it is necessary to conduct an analysis of the development of residential areas so that residential land is sufficient based on the population growth rate and by paying attention to the physical condition of the land to reduce the impact of the decline in the quality of residential land.

## B. Purpose and objectives

1. Meaning

The purpose of this study is to identify the direction of settlement development in Karo Regency.

2. Objective

The objectives of this study are:

a. Conducting a physical analysis of the area that describes the development capabilities of the area in Karo Regency.
b. Describes potential areas that can be developed as residential areas in Karo Regency.

## II. LITERATURE REVIEW

1. Residential Area

Residential areas are defined based on Law No. 1 of 2011 concerning housing and residential areas as part of the living environment outside protected areas, whether in the form of urban or rural areas, which function as residential environments or residential environments and places for activities that support life and livelihood.

2. Land Use

Land use is an important aspect in regional development because it reflects the level of human growth inhabiting an area. According to Arsyad (1989) land use is defined as a form of human intervention (interference) on land in order to fulfill their life needs, both material and spiritual.

3. Land Capability Unit

According to Arsyad (1989) Land capability is a physical environment that includes climate, relief, soil, hydrology, and vegetation. These factors to some extent affect the potential and capability of the land to support a certain type of use. Land capability units are one aspect in assessing settlement development criteria, land capability aims to group land according to its criteria and can be used for land management based on existing potential. According to Khadiyanto (2005) in hartadi land capability and land suitability determine the feasibility of land use which is the rank of consideration in land use. Thus, land use and utilization are carried out by considering the suitability of land carrying capacity so that more effective land use can be achieved. Land capability needs to be classified according to the physical conditions of the area, in order to determine the potential and problems in the area. According to Arsyad (2010) land capability classification is a systematic assessment of land (land components) and its grouping into several categories based on the characteristics that are potential and obstacles to its sustainable use. Land capability classification is the grouping of land into specific units according to its ability to use incentives and treatments needed to be used continuously (Soil Society of Amenca, 1982 in Sitorus, (1985).

4. Residential area criteria

Based on the Regulation of the Minister of Public Works No. 41/PRT/M/2007 concerning Technical Guidelines for Cultivation Areas, there are several criteria related to settlements as follows:

a. The use of space for residential areas must be in accordance with the local land carrying capacity and must provide a healthy and safe environment from natural disasters and can provide a living environment that is suitable for community development, while still paying attention to the preservation of environmental functions.
b. Residential areas must have road infrastructure and be accessible by public transportation.
c. The utilization and management of residential areas must be supported by the availability of physical facilities or public utilities.
d. Does not interfere with existing protective functions.

5. Geographic Information System

In this study, geographic information systems are used as a tool to analyze land that is suitable for use as a built-up area or residential area spatially or coordinated according to the location of a region. The analysis technique used is the superimpose method (overlay). According to Prahasta (2006), map overlay can be done with a minimum of 2 different maps, technically it is said that there must be a polygon formed from 2 types of maps that are overlayed. If you look at the attribute data, it will consist of information on the maps that form it.

## III. METHOD

### A. Research Location

The research location is Karo Regency.

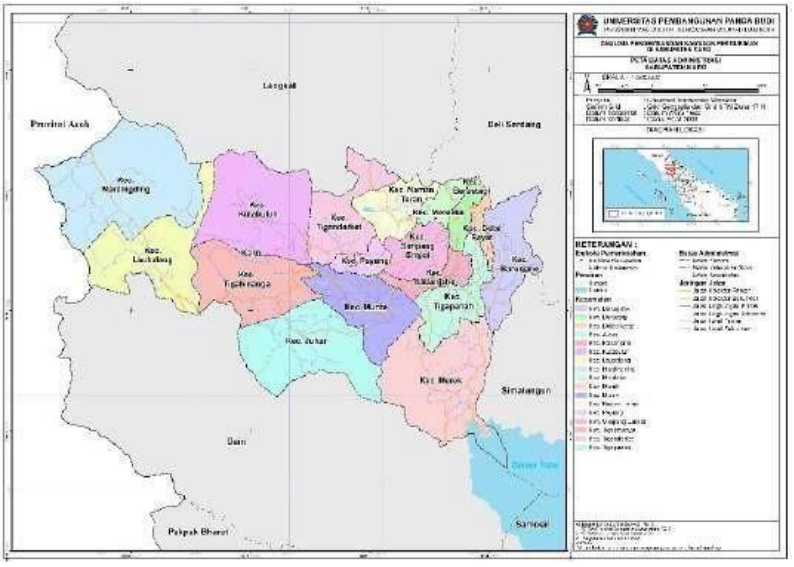


**Figure 1 Administrative Boundary Map of Karo Regency**
*Source: Karo Regency Spatial Planning Plan 2022*

### B. Research Approach

The approach method used in this study is a qualitative descriptive approach. According to Sugiyono (2019), the qualitative descriptive method is a research method based on the philosophy of postpositivism, used to examine the condition of natural objects where the researcher is a key instrument. Based on the understanding of the descriptive research method, this study aims to describe the development of settlements and the direction of settlement development in Karo Regency.

### C. Research Variables

The variables used in this study are:

1. Physical variables, which consist of:
   a) Land Cover
   b) Land Capability Unit

c) Protected Area

2. Non-physical variables are in the form of government policies

**D. Analysis Method**

The analysis method used in this research is to use analysis:

1. Superimpose (overlay)

Superimpose (Overlay) is done by using physical data of the area related to the suitability and development of residential areas. The data includes land cover, protected areas, land capability units, disaster-prone areas, slope gradient, morphology, topography, soil type, rainfall, and geology. The steps taken are to superimpose (overlay) using Argis 10.8 software, thus producing a compilation of physical data on the region and the direction of residential area development in Karo Regency. According to Prahasta (2009), a geographic information system according to one of the library definitions is an information system designed to work with spatially referenced data or geographic coordinates.

2. SWOT Analysis

SWOT analysis is an analysis tool to understand the strengths, weaknesses, opportunities and threats in an activity. SWOT analysis is carried out by identifying various factors, internal factors in the form of strengths and weaknesses and external factors in the form of opportunities and threats related to the development of settlements in Karo Regency.

## IV. RESULTS AND DISCUSSION

**A. Spatial Planning Policy Directions for Residential Areas in Karo Regency**

Based on Karo Regency Regional Regulation number 4 of 2022 concerning Regional Spatial Planning, Karo Regency spatial planning policies and strategies related to cultivation development which includes residential areas. In article 5 letters a and h related to spatial planning policies and article 6 paragraphs 1 and 8 related to spatial planning strategies, it is stated that:

1. Development of a settlement center system in accordance with the hierarchy and scope of services.
2. Integrated cultivation development is synergistic with environmental carrying capacity and capacity.
3. The spatial planning strategy to implement this policy is:
    a. Improving connectivity between urban areas and rural areas and between urban areas and their surrounding areas;
    b. Encourage urban areas and growth centers to be more competitive and effective in developing their surrounding areas;
    c. Controlling settlement growth in protected areas;
    d. Providing infrastructure and facilities to support activities at each activity center;
    e. Facilitating the growth and development of small and medium enterprises for agricultural product management;
    f. Limiting the development of built-up cultivation in protected areas and in disaster-prone areas to minimize the potential for disasters and potential losses due to disasters;
    g. Drafting regulations regarding zoning regulations for each cultivation area with its characteristics; and
    h. Directing the development and expansion of built-up areas on land that is not a sustainable agricultural area.

The residential area development plan according to the Karo Regency RTRW Regional Regulation consists of:

1. Urban residential area with an area of approximately 2,809 Ha in the sub-district:
    a. Berastagi District;
    b. Kabanjahe District;
    c. Merdeka District;
    d. Merek District;
    e. Tigabinanga District; and
    f. Tigapanah District.

2. Rural residential area with an area of approximately 4,922 Ha spread across all sub-districts.

**B. Spatial Planning Policy Directions for Protected Areas in Karo Regency**

Based on Karo Regency Regional Regulation Number 4 of 2022 concerning Regional Spatial Planning, protected areas in Karo Regency include:

4. Water body area with an area of approximately 355 Ha;
5. The area that provides protection for subordinate areas is in the form of a protected forest area with an area of approximately 63,291 Ha;
6. The conservation area is a national park with an area of approximately 23,525 Ha;

**B. Housing Conditions in Karo Regency**

The development of residential areas in Karo Regency shows that Kabanjahe District has the highest total area of 630.51 Ha, followed by Berastagi District with an area of 374.09 Ha, Tigapanah District with an area of 255.82 Ha, Merek District with an area of 227.22 Ha. The four districts have the highest total area of settlements, this is due to economic development and increasing population, in addition, the development of tourism in Beratagi District and Merek District is also a factor in the development of settlements in the district. While the total area of low-lying settlements is in Naman Teran District with an area of 49.13 Ha and Kutabuluh District with an area of 53.53 Ha.

**Table 1 Distribution of Existing Residential Areas**

| No | Subdistrict | Area (Ha) |
|---|---|---|
| 1 | Barusjahe District | 153.54 |
| 2 | Berastagi District | 374.09 |
| 3 | Dolat Rayat District | 106.14 |
| 4 | Juhar District | 77.55 |
| 5 | Kabanjahe District | 630.51 |
| 6 | Kutabuluh District | 53.53 |
| 7 | Laubaleng District | 173.59 |
| 8 | Mardingding District | 167.30 |
| 9 | Merdeka District | 61.30 |
| 10 | Merek District | 227.22 |
| 11 | Munte District | 141.04 |
| 12 | Naman Teran District | 49.13 |
| 13 | Payung District | 72.63 |
| 14 | Simpang Empat District | 137.49 |
| 15 | Tigabinanga District | 195.92 |
| 16 | Tiganderket District | 64.43 |
| 17 | Tigapanah District | 255.82 |
| **Total Area (Ha)** | | **2941.24** |

*Source: Satellite Imagery Digitization, 2024*

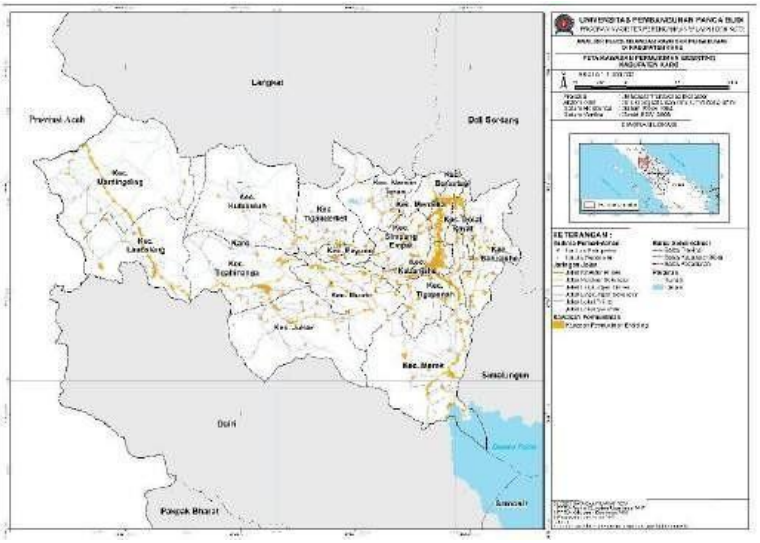

**Figure 2 Map of Existing Settlement in Karo Regency**
*Source: Satellite Imagery Digitization, 2024*

## C. Physical Condition of the Area

1. Morphological Condition

Morphological conditions in Karo Regency tend to be in the morphological class of medium hills and steep hills, while the plains area is only around 34.24 Ha. Geographically, Karo Regency is a plateau and undulating land area, so Karo Regency tends to be in steep hills which reach an area of 79,909.33 Ha of the total area of Karo Regency.

**Table 2 Morphological Conditions in Karo Regency**

| Morphology Class | Area (Ha) |
|---|---|
| Plains | 34.24 |
| Sloping | 48142.23 |
| Medium Hills | 63331.83 |
| Steep Mountains/Hills | 79909.33 |
| Very Steep Mountains/Hills | 27313.91 |
| **Total (Ha)** | **218731.53** |

*Source: Results of DEM Data Processing and Analysis, 2024*

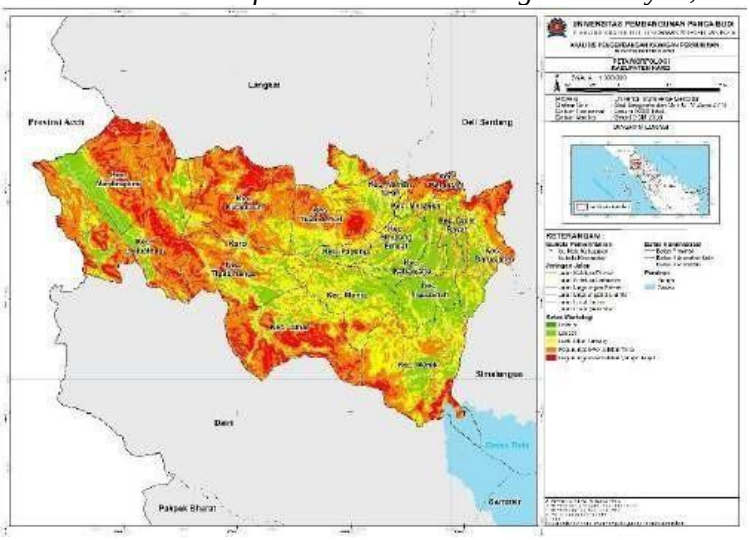

**Figure 3 Morphological Map of Karo Regency**
*Source: Results of DEM Data Processing and Analysis, 2024*

2. Slope Gradient Conditions

Slope gradient is one of the important factors in determining settlement development. When viewed in terms of slope gradient, Karo Regency is wider at a slope gradient of 15-40% with an area of 79,909.33 Ha. While the slope gradient of 0-2% is 34.24 Ha, 2-5% is 48,142.23 Ha, and 5-15% is 63,331.83 Ha.

**Table 3 Slope Gradient Conditions in Karo Regency**

| Slope Gradient Class | Area (Ha) |
|---|---|
| 0-2 % | 34.24 |
| 2-5 % | 48142.23 |
| 5-15% | 63331.83 |
| 15-40% | 79909.33 |
| >40% | 27313.91 |
| **Total (Ha)** | **218731.53** |

*Source: Results of DEM Data Processing and Analysis, 2024*

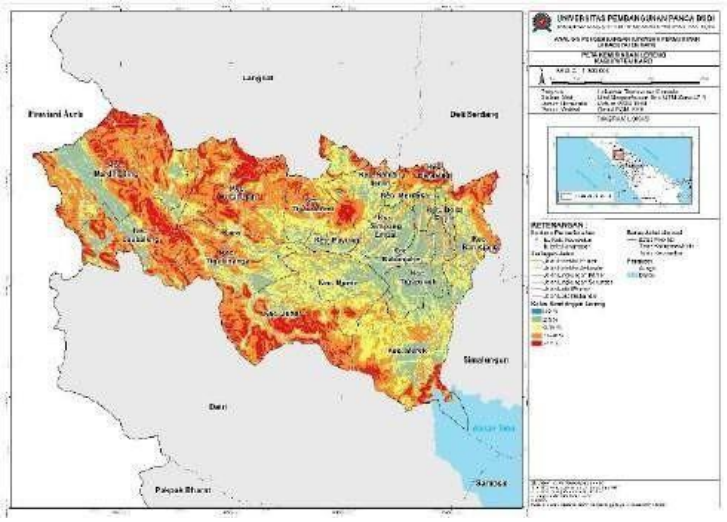

**Figure 4 Karo Regency Slope Map**

*Source: Results of DEM Data Processing and Analysis, 2024*

3. Disaster Prone Conditions

Disaster-prone conditions in Karo Regency include disaster-prone areas such as floods, flash floods, earthquakes, volcanic eruptions and landslides. In determining the development of residential areas, it is very important to pay attention to disaster-prone areas. Flood-prone areas in Karo Regency are in Mardingding District and Lau Baleng District with a high level of flood disaster prone area of 4,515.04 Ha, flash flood disaster prone areas are in 10 districts with a high level of flood disaster prone area of 1,639.10 Ha, earthquake disaster prone areas are in all districts with a high level of earthquake disaster prone area of 40,414.19 Ha, volcanic eruption disaster prone areas are in 11 districts with a high level of volcanic eruption area of 7,392.91 Ha which are located in 5 districts, and landslide disaster prone areas are in all districts which have a high level of landslide disaster prone area of 567.59 Ha. For more details, please see table 4 to table 8.

**Table 4 Flood-Prone Areas in Karo Regency**

| Subdistrict | Flood Disaster Prone | | | Total (Ha) |
|---|---|---|---|---|
| | Low | Currently | Tall | |
| Laubaleng District | 276.25 | 509.69 | 1384.98 | 2170.92 |
| Mardingding District | 599.43 | 1799.68 | 3130.06 | 5529.17 |
| **Total (Ha)** | **875.68** | **2309.37** | **4515.04** | **7700.09** |

*Source: KRB Document, Karo Regency, 2020*

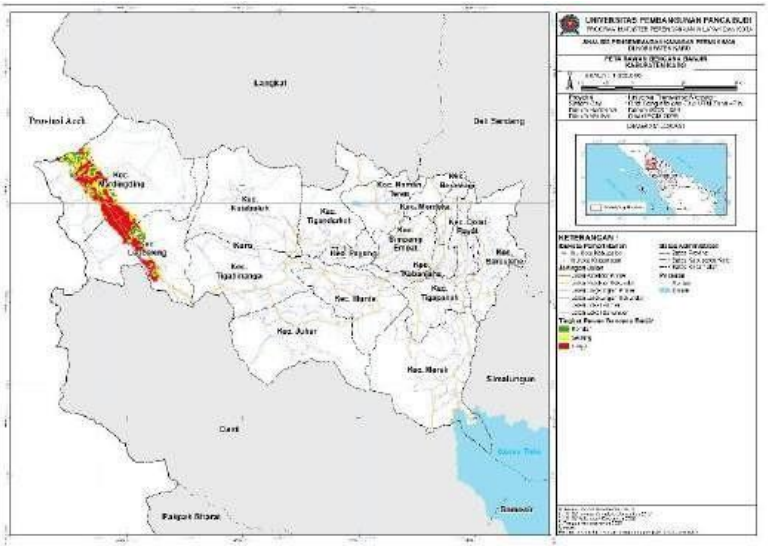

**Figure 5 Flood Disaster Prone Map in Karo Regency**

*Source: KRB Document, Karo Regency, 2020*

**Table 5 Areas Prone to Flash Flood Disaster in Karo Regency**

| Subdistrict | Prone to Flash Flood Disaster | | | Total (Ha) |
|---|---|---|---|---|
| | Low | Currently | Tall | |
| Juhar District | 60.90 | 201.59 | 249.88 | 512.37 |
| Kabanjahe District | 6.16 | 19.80 | 15.80 | 41.76 |
| Kutabuluh District | 71.67 | 230.18 | 450.98 | 752.83 |
| Laubaleng District | | 1.21 | 1.77 | 2.99 |
| Mardingding District | 64.98 | 130.25 | 147.86 | 343.09 |
| Munte District | 75.58 | 172.66 | 272.95 | 521.20 |
| Payung District | 7.46 | 29.42 | 56.80 | 93.68 |
| Simpang Empat District | 9.29 | 20.83 | 11.86 | 41.98 |
| Tigabinanga District | 73.35 | 220.94 | 262.72 | 557.01 |
| Tiganderket District | 158.57 | 218.38 | 168.48 | 545.42 |
| **Total (Ha)** | **527.98** | **1245.25** | **1639.10** | **3412.32** |

*Source: KRB Document, Karo Regency, 2020*

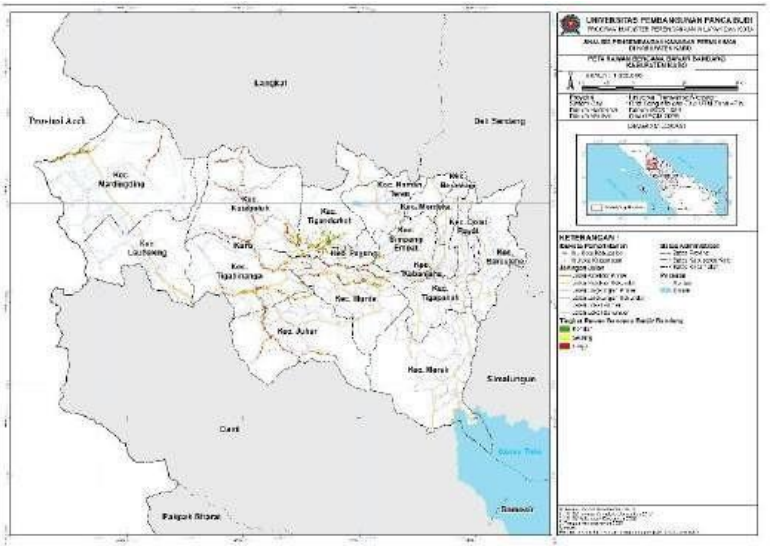

**Figure 6 Map of Flash Flood Disaster Hazards in Karo Regency**

*Source: KRB Document, Karo Regency, 2020*

**Table 6 Earthquake-Prone Areas in Karo Regency**

| Subdistrict | Earthquake Prone | | | Total (Ha) |
|---|---|---|---|---|
| | Low | Currently | Tall | |
| Barusjahe District | 8249.86 | 3795.59 | | 12045.45 |
| Berastagi District | 1691.48 | 1550.98 | | 3242.46 |
| Dolat Rayat District | 1418.84 | 889.85 | | 2308.69 |
| Juhar District | 1911.81 | 12704.20 | 7202.83 | 21818.83 |
| Kabanjahe District | 603.74 | 3720.07 | | 4323.81 |
| Kutabuluh District | 11165.02 | 11727.50 | 689.55 | 23582.06 |
| Laubaleng District | 543.93 | 6482.58 | 11853.88 | 18880.39 |
| Mardingding District | 2388.54 | 14964.98 | 15849.74 | 33203.26 |
| Merdeka District | 2277.98 | 1072.26 | | 3350.24 |
| Merek District | 2993.67 | 23230.82 | 133.13 | 26357.63 |
| Munte District | 4124.37 | 9624.36 | 3.86 | 13752.58 |
| Naman Teran District | 2314.65 | 5640.48 | | 7955.13 |
| Payung District | 1112.02 | 1975.01 | | 3087.03 |
| Simpang Empat District | 567.84 | 6740.59 | | 7308.43 |
| Tigabinanga District | 1225.32 | 9493.02 | 4681.21 | 15399.55 |
| Tiganderket District | 4162.41 | 8445.93 | | 12608.34 |
| Tigapanah District | 734.92 | 8831.73 | | 9566.64 |
| **Total (Ha)** | **47486.40** | **130889.94** | **40414.19** | **218731.53** |

*Source: KRB Document, Karo Regency, 2020*

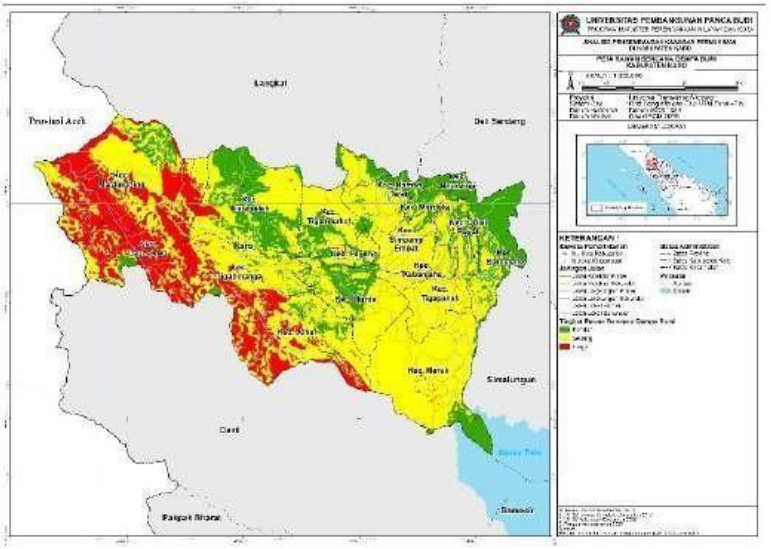

**Figure 7 Earthquake Disaster Hazard Map in Karo Regency**
*Source: KRB Document, Karo Regency, 2020*

**Table 7 Areas Prone to Volcanic Eruption Disasters in Karo Regency**

| Subdistrict | Disaster Prone LGA | | | Total (Ha) |
|---|---|---|---|---|
| | Low | Currently | Tall | |
| Berastagi District | 1163.37 | 22.76 | | 1186.13 |
| Dolat Rayat District | 6.35 | | | 6.35 |
| Kabanjahe District | 18.10 | 12.63 | | 30.73 |
| Kutabuluh District | 21.42 | | | 21.42 |
| Merdeka District | 1422.35 | 542.60 | 129.47 | 2094.42 |

| Subdistrict | Disaster Prone LGA | | | Total (Ha) |
|---|---|---|---|---|
| | Low | Currently | Tall | |
| Munte District | 219.63 | | | 219.63 |
| Naman Teran District | 2957.64 | 237.54 | 3352.57 | 6547.76 |
| Payung District | 432.66 | 891.05 | 1227.11 | 2550.82 |
| Simpang Empat District | 261.23 | 1258.75 | 698.47 | 2218.45 |
| Tigabinanga District | 101.28 | | | 101.28 |
| Tiganderket District | 3083.73 | 508.37 | 1985.30 | 5577.39 |
| **Total (Ha)** | **9687.76** | **3473.70** | **7392.91** | **20554.37** |

*Source: KRB Document, Karo Regency, 2020*

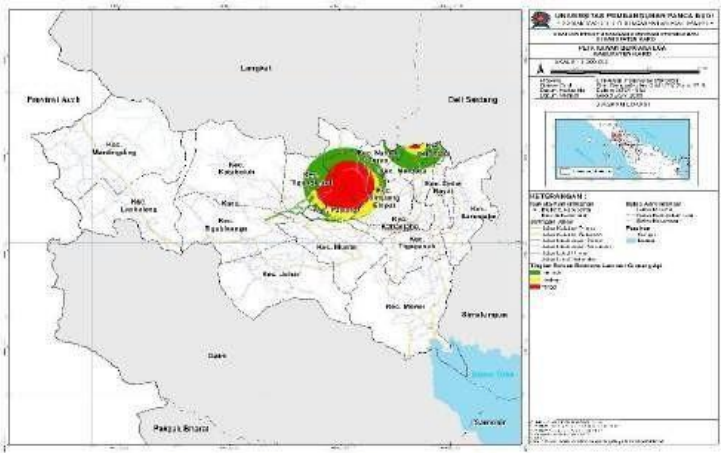

**Figure 8 Map of Volcanic Eruption Disaster Risk Areas in Karo Regency**
*Source: KRB Document, Karo Regency, 2020*

**Table 8 Landslide Prone Areas in Karo Regency**

| Subdistrict | Landslide Disaster Prone | | | Total (Ha) |
|---|---|---|---|---|
| | Low | Currently | Tall | |
| Barusjahe District | 1537.90 | 4310.31 | 14.22 | 5862.43 |
| Berastagi District | 566.91 | 541.91 | 10.36 | 1119.17 |
| Dolat Rayat District | 608.53 | 240.02 | 0.48 | 849.04 |
| Juhar District | 7205.73 | 7719.93 | 56.43 | 14982.09 |
| Kabanjahe District | 330.09 | 19.20 | | 349.29 |
| Kutabuluh District | 7490.60 | 10226.80 | 185.82 | 17903.22 |
| Laubaleng District | 9220.21 | 2534.14 | 77.90 | 11832.25 |
| Mardingding District | 12439.99 | 7647.46 | 98.77 | 20186.22 |
| Merdeka District | 564.23 | 1207.32 | 8.36 | 1779.91 |
| Merek District | 5243.33 | 3566.27 | 61.96 | 8871.56 |
| Munte District | 2392.48 | 895.61 | 1.74 | 3289.83 |
| Naman Teran District | 862.45 | 2402.24 | 5.59 | 3270.28 |
| Payung District | 319.99 | 558.98 | 3.76 | 882.73 |
| Simpang Empat District | 941.90 | 456.58 | | 1398.48 |
| Tigabinanga District | 6444.91 | 2847.52 | 23.38 | 9315.81 |
| Tiganderket District | 2826.02 | 3369.49 | 18.84 | 6214.34 |
| Tigapanah District | 659.66 | 214.53 | | 874.19 |
| **Total (Ha)** | **59654.93** | **48758.31** | **567.59** | **108980.83** |

*Source: KRB Document, Karo Regency, 2020*

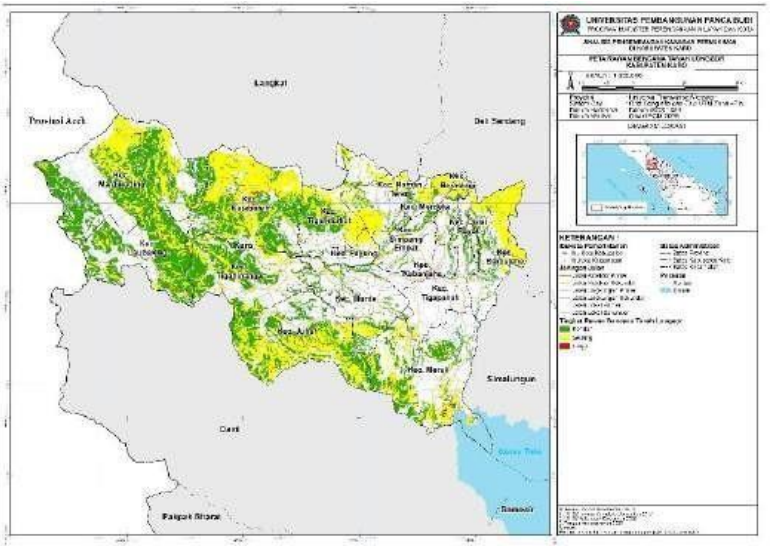

**Figure 9 Landslide Disaster Prone Map in Karo Regency**
*Source: KRB Document, Karo Regency, 2020*

4. Land Use

Most of the land use in Karo Regency is forest vegetation with an area of 78,737.61 Ha, then fields/dry fields with an area of 62,847.66 Ha. While the built-up area in this case is grouped into residential land use with an area of 2,941.24 Ha. With the use of unbuilt land, the development of residential areas in Karo Regency will be very easy to realize while still paying attention to the physical conditions of the area to reduce the impact of declining quality of settlements in Karo Regency.

**Table 9 Land Use in Karo Regency**

| Land Use | Area (Ha) |
|---|---|
| Lake/Reservoir | 113.98 |
| Lava expanse | 1529.79 |
| Forest | 78737.61 |
| Garden/Plantation | 40452.39 |
| Pool | 12.71 |
| Fields/Fields | 62847.66 |
| Open Land | 48.05 |
| Settlement | 2941.24 |
| Swamp | 2.66 |
| Ricefield | 10286.77 |
| Shrubs | 21612.89 |
| River | 145.78 |
| **Total (Ha)** | **218731.53** |

*Source: Satellite Imagery Digitization, 2024*

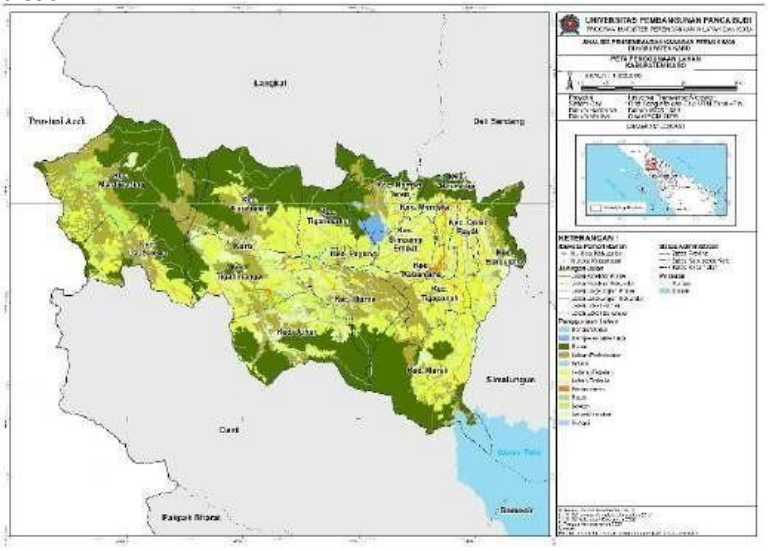

**Figure 10 Land Use Map in Karo Regency**
*Source: Satellite Imagery Digitization, 2024*

5. Land Capability Unit

Land capability units are land analysis conducted to determine land conditions and land capability for land use development on it. Land capability units are conducted by overlaying physical maps of the area which produce nine land capability units consisting of morphological land capability units, natural disasters, drainage, ease of work, slope stability, foundation stability, water availability, waste disposal, and land capability units against erosion. The nine land capability units produce land development capability units.

**Table 10 Land Capability Units in Karo Regency**

| Subdistrict | Land Capability Unit | | | Total (Ha) |
|---|---|---|---|---|
| | Low Development Ability | Medium Development Ability | High Development Ability | |
| Barusjahe District | 2359.33 | 4192.21 | 5493.90 | 12045.45 |
| Berastagi District | 533.70 | 1253.25 | 1455.50 | 3242.46 |
| Dolat Rayat District | 197.37 | 868.45 | 1242.86 | 2308.69 |
| Juhar District | 10999.58 | 6558.09 | 2305.09 | 19862.77 |
| Kabanjahe District | | 849.83 | 3473.97 | 4323.81 |
| Kutabuluh District | 14054.35 | 9232.48 | 295.23 | 23582.06 |
| Laubaleng District | 7719.19 | 8050.69 | 3110.51 | 18880.39 |
| Mardingding District | 16768.15 | 9902.63 | 6532.47 | 33203.25 |
| Merdeka District | 863.13 | 1870.59 | 616.52 | 3350.24 |
| Merek District | 3799.70 | 9914.30 | 12643.63 | 26357.63 |
| Munte District | 311.97 | 3274.42 | 10166.19 | 13752.58 |
| Naman Teran District | 2227.18 | 3977.31 | 1750.64 | 7955.13 |
| Payung District | 571.28 | 1009.02 | 1506.73 | 3087.03 |
| Simpang Empat District | 135.10 | 2805.93 | 4367.41 | 7308.43 |
| Tigabinanga District | 4874.28 | 8832.46 | 3589.87 | 17296.61 |
| Tiganderket District | 5856.88 | 5425.52 | 1325.94 | 12608.34 |
| Tigapanah District | | 1284.35 | 8282.29 | 9566.64 |
| **Total (Ha)** | **71271.21** | **79301.55** | **68158.77** | **218731.53** |

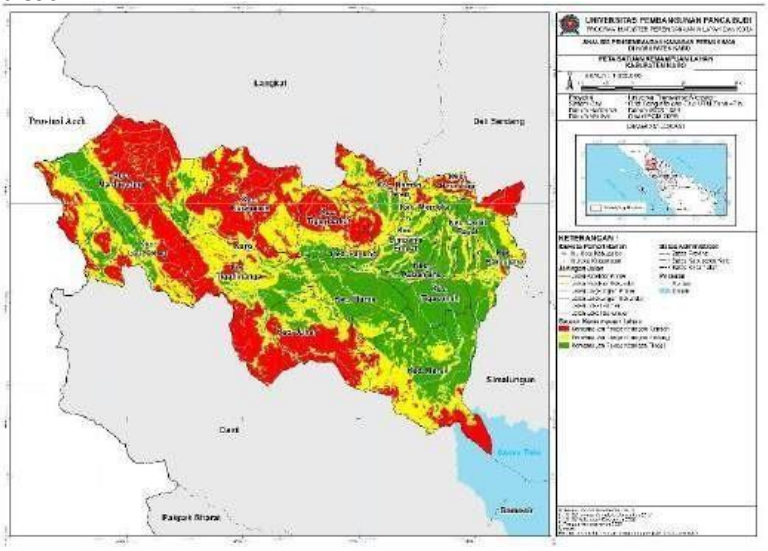

**Figure 11 Map of Karo Regency Land Capability Units**
*Source: Analysis Results, 2025*

Based on the results of the analysis of land capability units in Karo Regency, low development capability covers an area of 71,271.21 Ha, medium development capability covers an area of 79,301.55 Ha, and high development capability covers an area of 68,158.77 Ha. Low development capacity can be encouraged for protected areas as buffer zones for cultivated areas and agricultural areas, moderate development capacity can be encouraged for agricultural areas and limited built-up areas, while high development capacity can be encouraged to become built-up areas.

## D. SWOT Analysis

SWOT analysis was conducted to identify various factors so that strategies can be formulated in developing settlements in Karo Regency based on the strengths, weaknesses, opportunities and threats in Karo Regency.

1. Internal Factors
   a. Strengths
   - Natural resource potential
     Karo Regency has natural resources that can support residential development, such as fertile land and natural beauty.
   - Infrastructure availability
     Availability of basic infrastructure that supports settlement development, such as roads, clean water and electricity
   - Community involvement
     Communities that are active in regional development can assist in the implementation of settlement policies.

   b. Weaknesses
   - Settlements that do not comply with the spatial designation
     The existence of settlements that are built without considering land use, results in land use conflicts.
   - Disaster prone areas
     Some settlements are built in disaster-prone areas and do not pay attention to disaster mitigation, thereby increasing the risk to residents' safety.
   - Built-up area in forest area
     Settlements in forest areas result in ecosystem damage and conflict with existing laws and regulations.
   - Conversion of agricultural land
     Settlements growing in sustainable food agriculture areas can threaten food security.

2. External Factors
   a. Opportunities
   - Spatial Planning
     The existence of a spatial plan that can be optimized to regulate settlement development

- Technology Innovation
  Leveraging technology for more efficient planning and development
- Funding for development
  Availability of various sources from governments and international institutions for sustainable development projects

b. Threats (Thretas)
- Climate change
  The threat of natural disasters due to climate change can worsen residential conditions in disaster-prone areas.
- Social conflict
  Unplanned settlement development can trigger conflict between communities and the government.
- Deforestation
  Conversion of forest areas can worsen environmental quality

3. Strategy for internal and external factors

a. SO Strategy (Strengths - Opportunitie)
- Utilizing existing infrastructure to encourage spatial planning programs in the development of environmentally friendly settlements.
- Increasing community involvement in sustainable development programs by providing training and education related to environmental issues.

b. ST (Strengths - Threats) Strategy
- Using the potential of natural resources and infrastructure to build an early warning system for disasters, in order to protect settlements in disaster-prone areas.
- Integrating natural disaster risk analysis with spatial planning to ensure that existing settlements in disaster-prone areas have disaster mitigation measures such as evacuation routes, evacuation sites and natural disaster signs.
- Conducting outreach to the community regarding land use as stipulated in the spatial planning.

c. WO Strategy (Weaknesses - Opportunitie)
- Implement strict regulations regarding land use to prevent the development of settlements that are not in accordance with their intended use.
- Conducting educational programs for the community on laws and regulations related to land use to reduce land use conflicts and environmental damage.
- Utilization of GIS technology for better planning and analysis of potential natural disasters

d. WT (Weaknesses - Threats) Strategy
- Strengthening disaster management teams or institutions related to settlements in disaster-prone areas to respond quickly and minimize the impact of climate change.
- Conduct strict supervision of the conversion of agricultural land into settlements, to maintain food security.

**Table 11 SWOT Analysis**

| Internal Factors / External Factors | **Strength(Strengths)** | **Weakness(Weaknesses)** |
|---|---|---|
| | 1. Natural resource potential<br>2. Infrastructure availability<br>3. Community involvement | 1. Settlements that do not comply with the spatial designation<br>2. Disaster prone areas<br>3. Built-up area in forest area<br>4. Conversion of agricultural land |
| **Opportunity(Opportunities)**<br>1. Spatial planning<br>2. Technological innovation<br>3. Funding for development | **SO Strategy :**<br>• Utilizing existing infrastructure to encourage spatial planning programs in the development of environmentally friendly settlements.<br>• Increasing community involvement in sustainable development programs by providing training and education related to environmental issues. | **WO Strategy:**<br>• Implement strict regulations regarding land use to prevent the development of settlements that are not in accordance with their intended use.<br>• Conducting educational programs for the community on laws and regulations related to land use to reduce land use conflicts and environmental damage.<br>• Utilization of GIS technology for better planning and analysis of potential natural disasters |
| **Threat(Thretas)**<br>1. Climate Change<br>2. Social conflict<br>3. Deforestation | **ST Strategy :**<br>1. Using the potential of natural resources and infrastructure to build an early warning system for disasters, in order to protect settlements in disaster-prone areas.<br>2. Integrating natural disaster risk analysis with spatial planning to ensure that existing settlements in disaster-prone areas have disaster mitigation measures such as evacuation routes, evacuation sites and natural disaster signs.<br>3. Conducting outreach to the community regarding land use as stipulated in the spatial planning. | **WT Strategy :**<br>1. Strengthening disaster management teams or institutions related to settlements in disaster-prone areas to respond quickly and minimize the impact of climate change.<br>2. Conduct strict supervision of the conversion of agricultural land into residential areas, to maintain food security. |

*Source: Analysis Results, 2025*

## E. Settlement Development in Karo Regency

In determining the development of residential areas, an overlay map analysis is carried out. The maps used in determining residential development are maps of disaster-prone areas, land capability units, sustainable food agriculture areas and forest areas. Areas that need to be avoided from residential development are protected areas and sustainable food agriculture areas, this is done to maintain environmental sustainability in the Karo Regency area, while in disaster-prone areas it is very necessary to pay attention to the type of disaster and pay attention to disaster mitigation if there are residential areas in disaster-prone areas. Meanwhile, areas that have great potential for development are land capability units with high development capabilities that are not included in protected areas, sustainable food agriculture areas, and disaster-prone areas.

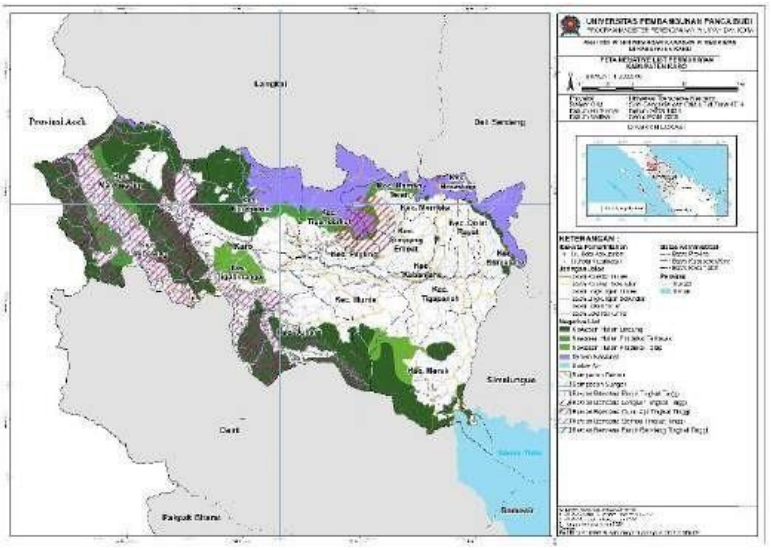

**Figure 12 Negative List Map of Settlement in Karo Regency**
*Source: Data Processing, 2025*

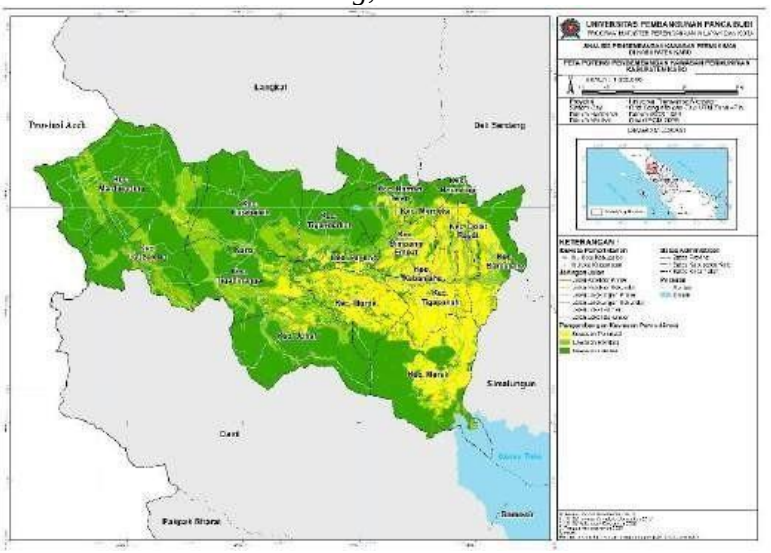

**Figure 13 Map of Potential Development of Residential Areas in Karo Regency**
*Source: Analysis Results, 2025*

**Table 12 Potential for Settlement Development in Karo Regency**

| Subdistrict | Area Status | | | Total (Ha) |
|---|---|---|---|---|
| | Limitation Area | Constraint Area | Potential Area | |
| Barusjahe District | 5,498.37 | 1,893.93 | 4,653.16 | 12,045.45 |
| Berastagi District | 1,010.03 | 865.56 | 1,366.87 | 3,242.46 |
| Dolat Rayat District | 620.82 | 612.58 | 1,075.29 | 2,308.69 |
| Juhar District | 16,263.80 | 4,240.58 | 1,314.46 | 21,818.83 |

| | | | | |
|---|---|---|---|---|
| Kabanjahe District | 406.78 | 784.82 | 3,132.21 | 4,323.81 |
| Kutabuluh District | 18,901.00 | 4,466.12 | 214.94 | 23,582.06 |
| Laubaleng District | 13,478.69 | 5,338.91 | 62.79 | 18,880.39 |
| Mardingding District | 26,319.35 | 6,585.99 | 297.92 | 33,203.25 |
| Merdeka District | 1,785.64 | 1,067.19 | 497.42 | 3,350.24 |
| Merek District | 12,615.54 | 2,380.02 | 9,406.00 | 24,401.56 |
| Munte District | 3,475.12 | 1,980.12 | 8,297.34 | 13,752.58 |
| Naman Teran District | 5,554.47 | 1,658.59 | 742.06 | 7,955.13 |
| Payung District | 1,430.94 | 859.87 | 796.22 | 3,087.03 |
| Simpang Empat District | 760.92 | 2,695.59 | 3,851.93 | 7,308.43 |
| Tigabinanga District | 9,269.25 | 6,311.31 | 1,716.05 | 17,296.61 |
| Tiganderket District | 10,256.56 | 1,843.74 | 508.04 | 12,608.34 |
| Tigapanah District | 480.53 | 1,227.20 | 7,858.91 | 9,566.64 |
| **Total (Ha)** | **128,127.81** | **44,812.12** | **45,791.61** | **218,731.53** |

*Source: Analysis Results, 2025*

Based on the analysis results, there are three development criteria, namely, limitation areas, constraint areas and potential areas. The limitation area of 128,127.81 Ha, the limitation area is a low development area and is a forest area and a sustainable agricultural land area. The limitation area can be categorized as an area that is difficult to develop so that it can be pushed into a protected area and agricultural area, while the constraint area of 44,812.12 Ha includes medium and high development and disaster-prone areas. This area can be developed in a limited and conditional manner and really needs to pay attention to disaster mitigation, while the potential area of 45,791.61 Ha is a high development area and outside the protected area and disaster-prone area so that this area is highly recommended as a built-up or residential development area.

## V. CLOSING

### A. Conclusion

Based on the analysis and discussion in this study, the following conclusions can be drawn:

a. Existing settlements in Karo Regency located in disaster-prone areas and forest areas require special attention and disaster mitigation to maintain the quality of settlements.
b. The development of settlements in constrained areas can be done by paying attention to the physical quality of the environment.
c. Potential areas can be encouraged to become built-up or residential land in Karo Regency.

### B. Suggestion

Based on the conclusions above, several suggestions can be put forward for the development of settlements in Karo Regency. Through the implementation of these suggestions, it is hoped that this research can be a foundation for supporting sustainable development in Karo Regency. Some of these suggestions are:

a. In existing settlements located in forest areas, disaster-prone areas and obstacle areas, studies or assessments can be carried out to determine the direction of policies taken by the local government and to be able to carry out disaster mitigation in these areas.
b. Establishing development mechanisms for settlement development in potential areas so that development can be focused and effective.

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