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DESIGN OF MAKING LAND USE AREA MAPS IN SEMATANGBORANG DISTRICT USING QGIS

Sadam Putra Pratama[1], Anggi Purnama Sari Dewi[2]

Civil Engineering Study Program, Bina Darma University, Palembang, Indonesia
Email: sadamp02@gmail.com[1], anggi.purnama.sari.dewi@binadarma.ac.id[2]

Abstract

The development of urban areas often results in changes in land use to meet infrastructure needs. In Sematangborang District, Palembang, the challenge of efficient land use requires accurate mapping. Quantum GIS (QGIS) is an effective solution in land use mapping because of its open source nature and spatial analysis capabilities. This research aims to improve the accuracy of land use mapping in the region. This research uses the Geographic Information System (GIS) using QGIS Software for Regional Mapping. Data was obtained through interviews with related agencies and secondary data in the form of Shapefile regional maps from Bappeda and RBI from the Indonesia Geospatial Site. Sematangborang District, which is located 11 km from the center of Palembang City, has an area of 36.97 km2 with four villages. The largest regional distribution is Sukamulya Village (46.70%), followed by Karyamulya (26.69%), Srimulya (18.84%), and Lebong Gajah (7.77%). Mapping using QGIS successfully identified a variety of land uses, including public facilities, settlements, agriculture, and green open spaces. The research succeeded in producing land use maps of various data sources, comprehensive maps succeeded in identifying public facilities, settlements, agriculture, and green open spaces. The results of this mapping can support more effective spatial planning and regional development.

Keywords: Land Use, Geographic Information System, Regional Mapping, Sematangborang District

1. INTRODUCTION

The development of a region often occurs along with the development process of the region. In the development of urban areas, there is a change in land function to meet the needs of infrastructure and community facilities. [1]. The process of urban development and development usually tends to marginalize the ecological value of a piece of land in exchange for a more economical function. As one area in the developing city of Palembang, Sematangborang District is facing challenges in using land efficiently and sustainably. To support the maintenance of proper spatial planning and reduce the likelihood of land-use conflicts in these regions, accurate maps are essential. Mapping technology based on geographic information systems (GIS) such as *Quantum Geographic Information System* (QGIS) has been recognized as an effective tool in improving mapping

and land use processes. Its advantage lies in its *open source* and extensive spatial analysis capabilities. (Prigi Coastal Area Using Remote Sensing et al., 2020).

A number of studies have explored the effectiveness of QGIS in making land use maps. Example [3] tested the application of QGIS in land use mapping in urban areas and found that the use of QGIS allows cost-efficient spatial analysis, with map results that have a high level of accuracy. Similarly, research (Andriani Stake, 2024) shows that QGIS can not only produce baseline maps but can also be used to analyze land use changes periodically. This study shows the potential of QGIS in presenting spatial data that is useful for regional management and supports more adaptive spatial policies.

However, these previous studies still face a number of limitations, especially related to the quality of the data used. Research by [5] shows that the accuracy of the maps produced is greatly influenced by the completeness and accuracy of the field data processed in QGIS. Meanwhile, [6] highlighting that in practice, the main challenge still lies in the integration of spatial data and non-spatial data, which often experience gaps in data collection. These limitations show the need to improve data collection and processing methods so that land use mapping can be more representative and in accordance with real conditions in the field.

The purpose of this study is to improve the accuracy of land use mapping in Sematang Borang District, Palembang. It is hoped that more accurate land use maps can be created by combining spatial data from various sources, such as satellite imagery and secondary data from related agencies, as well as by using Geographic Information System (GIS) software such as QGIS. This method is in line with the latest research trend that emphasizes the importance of integrating data from various sources to help the spatial planning process.

The main research question asked is: How can the use of *Quantum* GIS help land use analysis in Sematang Borang sub-district? The purpose of this article is to offer creative solutions through suggestions for the integration of data from various sources to improve the quality of land use mapping in the Sematangborang sub-district area.

2. METHOD

2.1 Geographic Information System

Geographic Information System is a computer system used. Edit geographic data. This system plays a role in collecting and verifying data. Data collection, data storage, data editing and updating, and data management and structuring. Exchange data, manipulate data, call and display data, and analyze data [7]. GIS is a computer-based system used to store, manipulate, and study geographic information [8].

According to Eddy Prahasta (2009), GIS can be broken down into several things such as:

a. Input data.
   Plays a role in collecting, preparing, and storing spatial data Characteristics derived from various sources of *Information produced.*
b. Plays a role in displaying or creating the output of all or part of the Data in digital or physical formats such as tables, graphs, and maps Please explain its different uses.
c. Data *management*
   It functions to organize spatial data and related attribute tables into it. The database has been designed in such a way that it allows for easy retrieval, updating, and editing.
d. Data *manipulation and analysis are imperative.*
   Playing a role in determining the data that can be generated by the Geographic Information System and manipulating and modeling data to produce useful information.

Eddy Prahasta also highlighted that GIS has several interrelated components, including Hardware, Software, Management, Data, and Geographic Information. The Geographic Information System consists of two types of data models, namely:

a. Data Raster
   This model data displays and stores spatial data by utilizing the matrix or pixel structure that forms the grid. The data contained in one pixel is divided into two parts, namely attribute data that includes objects such as housing or rice fields. Coordinate data also includes the geometric position of the data.
b. Data vector
   This model data displays and stores spatial data such as lines, curves, points, or polygons and their attributes. In the vector system model, spatial data is described using the basic shapes depicted in the two-dimensional Cartesian coordinate system, namely (x, y) [9].

2.2 Quantum GIS

Quantum GIS, short for QGIS, is a free software used for geographic information systems [10]. This application is here to make it easier for writers to provide, view, and edit data with advanced spatial analysis capabilities. The data treated in QGIS may be in the form of raster data or vector data [11]. QGIS can process almost all spatial data formats such as shapefiles, coverage data, and more. QGIS has the following advantages: [12] :

1. Can open spatial data types.
2. Simple and user-friendly display.
3. It is open source (free).
4. Improved remote sesnsoing processing tool.
5. Geocoding and conversion data tools that are free.

2.3 Research Stages

This research is carried out by following a series of systematic stages to achieve optimal results. These stages are carried out sequentially to ensure that each process can be carried out properly and produce accurate data. The following is a detailed explanation of each stage carried out in this study: The initial stage begins with a literature study, where researchers collect and study various reading sources such as books, journals, and previous research related to land use theory, mapping methods using QGIS, and similar previous research.

After conducting a literature review, the research continues to the stage of identifying problems in the research area. At this stage, researchers conduct in-depth observations to understand land use problems and identify the data needed for research. Data collection is carried out through two main approaches. First, through direct interviews with relevant agencies to obtain primary data. Second, through the analysis of secondary data sourced from the Palembang City map Shapefile provided by Bappeda, which contains detailed information about the boundaries of the administrative area of Palembang City. To produce a more accurate land use map, the researcher also utilized the Shapefile RBI Kec. Sematangborang obtained from the Indonesia Geospatial Site.

The analysis stage of making maps is focused on mapping land use in Sematang Borang District. This process includes several main activities, namely calculating the area of the area, making a basic map using QGIS, preparing an informative map layout, digitizing land use, and sending maps to the sub-district office as a regional planning tool. The conclusion of this study shows that the use of QGIS software in land use mapping in Sematang Borang District has succeeded in producing informative and detailed maps. The mapping process, which started from initial data collection through interviews, followed by data processing using QGIS, to the preparation of the map layout, has succeeded in combining all important information regarding the distribution of land use in the area.

3. Results and Discussion

3.1 Regional Administrative Boundaries

Sematangborang is one of the administrative sub-districts in Palembang City. Located just 11.00 km from the city center [13], it is very strategic for the development of urban areas. With a location quite close to the city center, this sub-district has a comparative advantage in terms of accessibility and connectivity with other important areas in the city of Palembang. This location contributes significantly to the overall development dynamics of the region.

Sematangborang District consists of 4 (four) Villages with an area of 36.97 km² [14]. The boundaries of Sematangborang District include:

1. To the north it is bordered by Banyuasin Regency
2. To the east it is bordered by Kalidoni District
3. The south is bordered by Kalidoni sub-district
4. To the west it is bordered by Sako District

5.

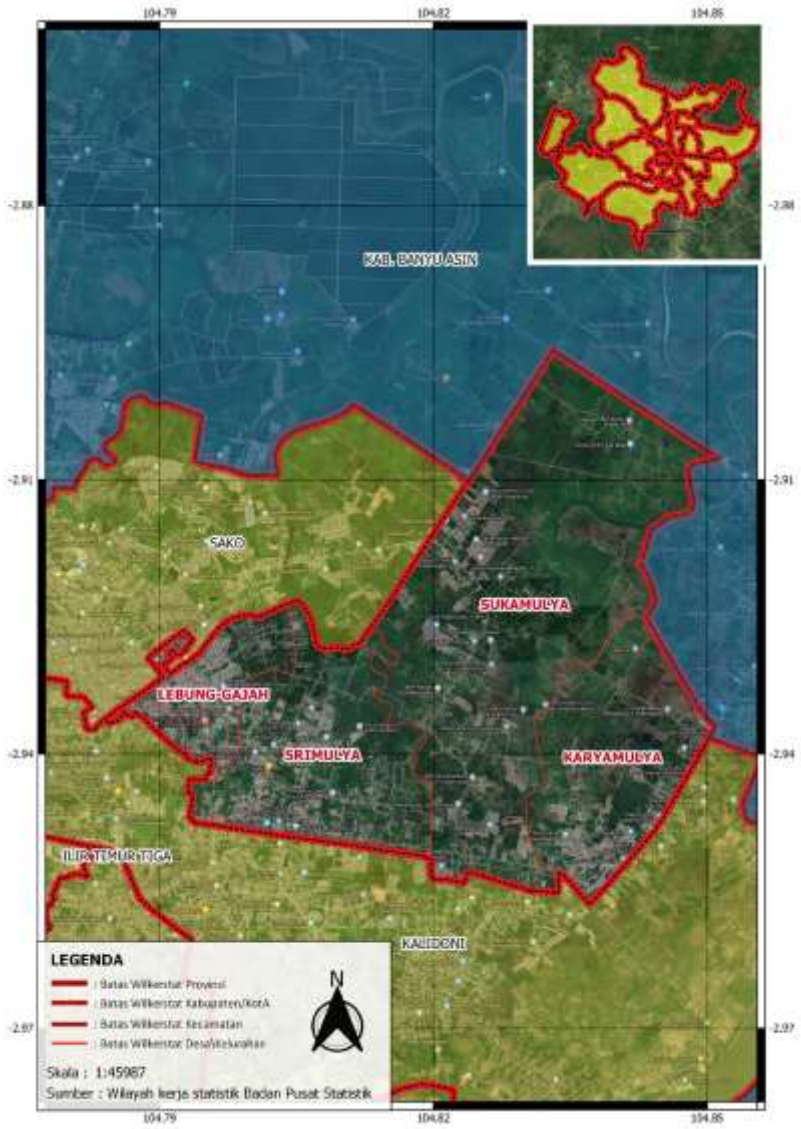
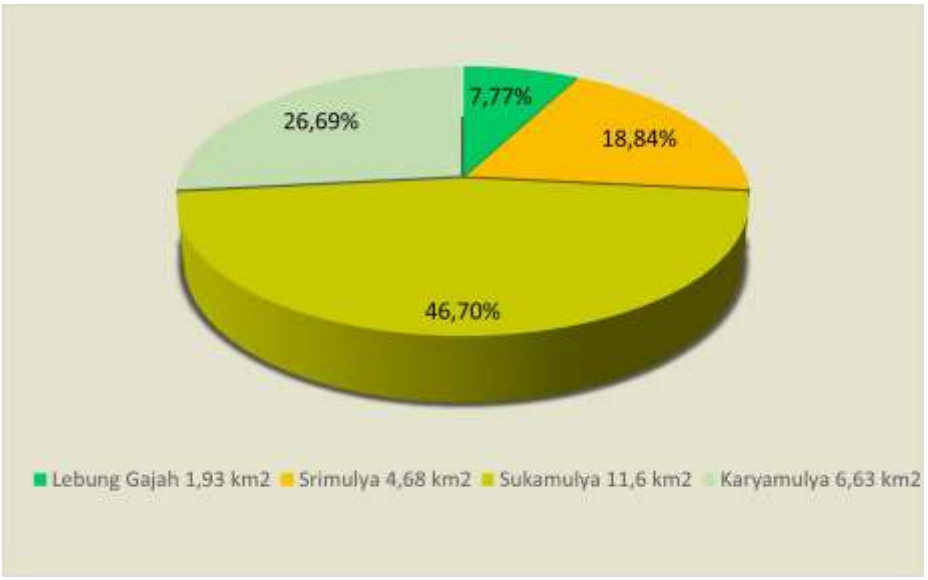


Figure 1. Administrative Boundaries of Sematang Borang District.
Source : Sematangborang in figures 2024.

The division of the administrative area of the Sematangborang District government consists of 4 villages, for more details can be seen in pie chart 1.



Pie Chart 1. Distribution of Sematangborang District Village in 2023.
Source : Sematangborang Sub-district Office.

The data shows the distribution of regions based on area, as shown by the pie chart in the image above. The Sukamulya Village area has the largest proportion with 46.70%, followed by Karyamulya Village with 26.69%, Srimulya Village with 18.84%, and Lebung Gajah Village with 7.77%. This data shows a comparison of the area in each region.

3.2 Mapping Process on QGIS

Figure 2. Data Input in Qgis.

The first step after installing QGIS on a laptop and creating a new project, On QGIS, open the Palembang city map layer by clicking the Add Vector Layer tool and looking for the Kota_Palembang.shp file. Then click Open

in the Add vector layer dialog, then the layer will appear in the list of layers in QGIS as seen in figure 3.

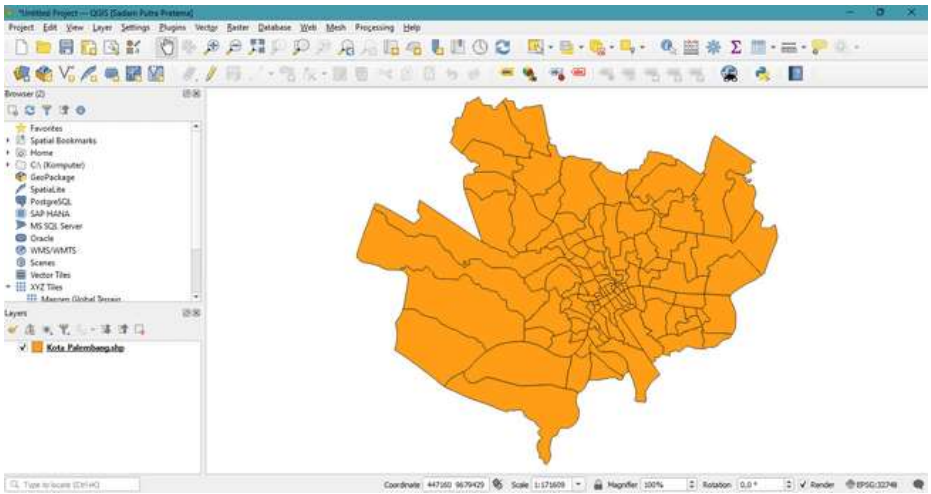


Figure 3. Shp Palembang City

Next, right-click the layer and select Open Attribute Table, click select features. Then a table of the selected map layer attributes will appear. can be seen in figure 4.

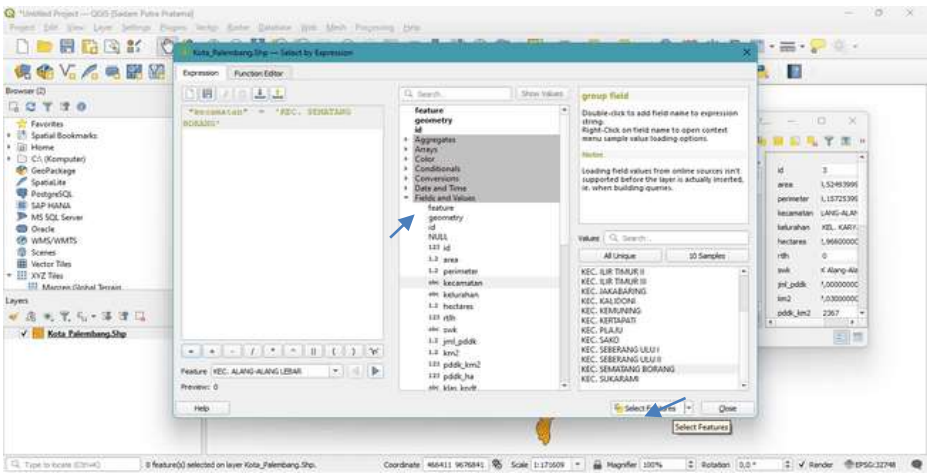


Figure 4. Select By Expression.

To display the area of Sematangborang District, follow these actions:

1. Click on the "*Field and Value*" column and find the row "sub-district" double-click. This will open a menu to select the value you want to display. Next

2. Click the "=" sign, which will open a dialog box to search for a custom value.
3. Click "*all unique*", which will display all the unique values in the "district" column.
4. Search for and click "Menu", which will be the selected value. Then
5. Click "*Select Features*", which will select and display all regional features that have the value "Menungborang" in the "District" column on the map.

Sematangborang District will be displayed in different colors (see Figure 5). This allows the authors to analyze these regions separately and compare them with other regions."

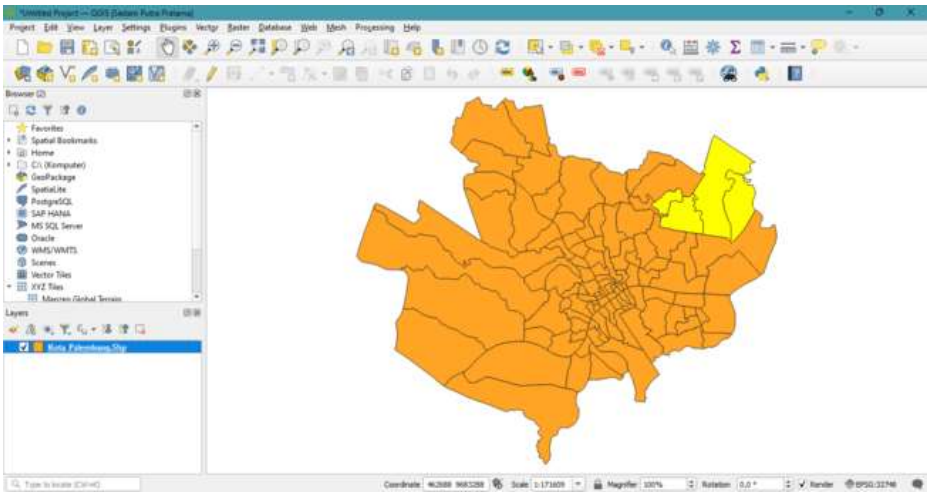


Figure 5. Map Display of Sematangborang District Map on Qgis

The next step is to eliminate all sub-districts, with the exception of Sematang Borang District which will be maintained. Click the *Toggle Editing* tool. To select areas that are not needed, use the *Select Features by Area tool*. Figure 6 shows the results of clicking on the area you want to delete.

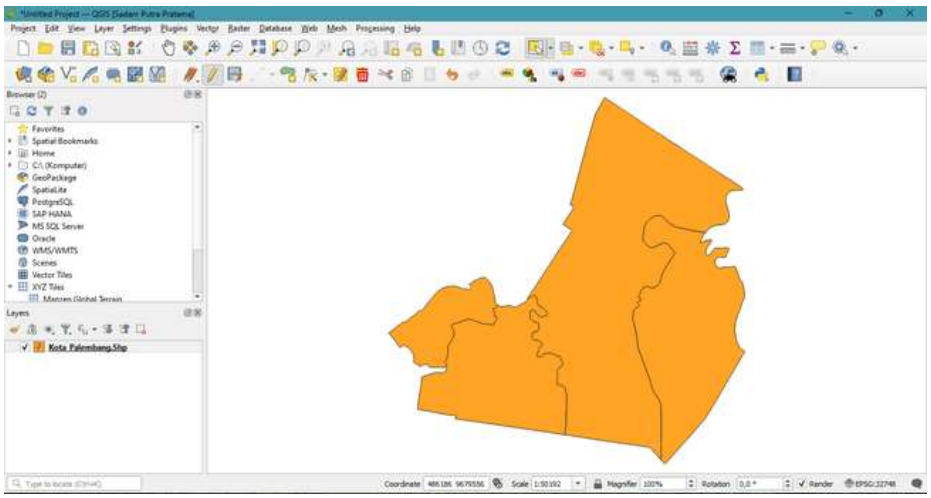


Figure 6. Results of the Select Region of Sematangborang District.

Like the previous step, the next step is to enter the Sematangborang District RBI file in the form of SHP. This is done by clicking on Open *Data Source Manager* on the right-hand toolbar. To search for SHP files such as education data, health centers, roads, settlements, agrisawah, etc. select the Vector menu and click the three-dot icon in *the Base Vector*. The results will be tamed; ilkan is seen in figure 7.

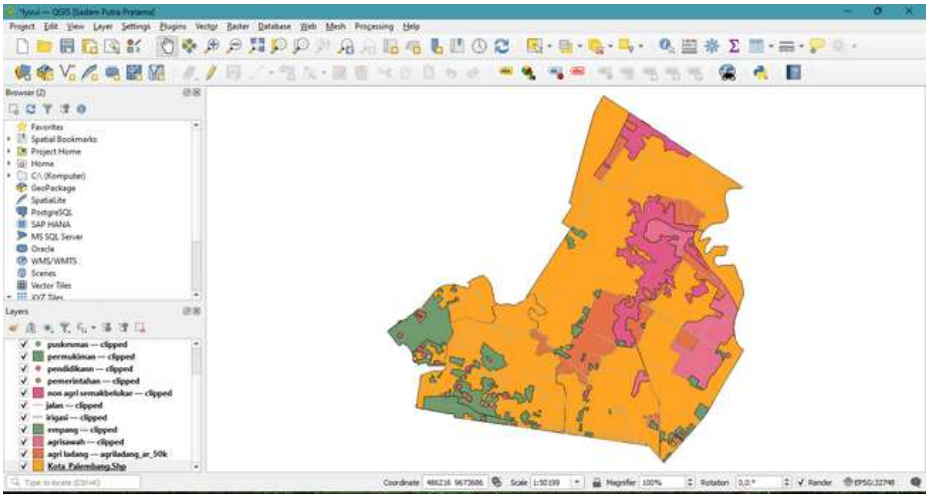


Figure 7. Form of RBI Kec. Sematangborang.

Next, adjust the RBI file to the shape of the symbol that has been set. Place a line-shaped symbol at the bottom of the dot symbol, and place a polygon-shaped

symbol underneath. The purpose of this arrangement is to make the display of data neater and more structured. Figure 8 shows the final result of this setup.

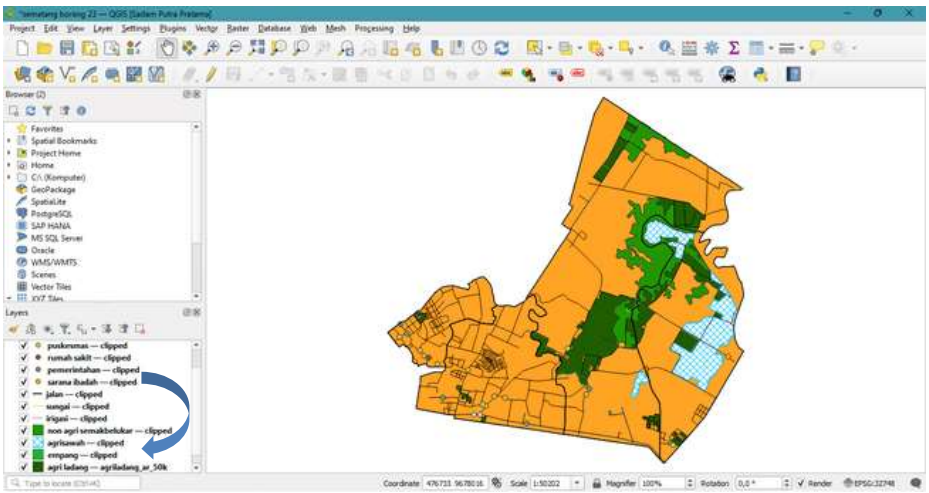


Figure 8. Results of Land Use Maps in Qgis.

3.3 Map Layout

To start creating a map layout, select the Project Menu → New Print Composer (Ctrl+p). A blank composer window will then appear.

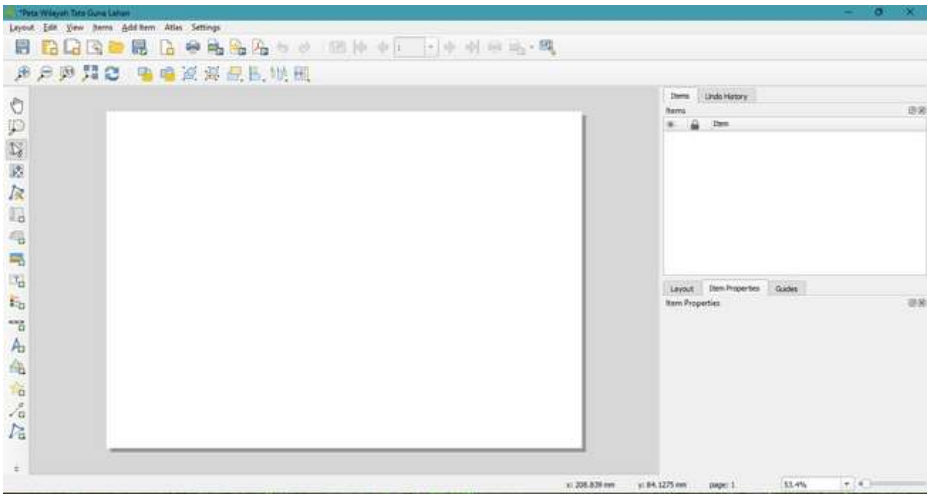


Figure 9. Layout on QGIS.

Using the Add shape tool, add an outline for a square layout. Then click, hold, and slide to create a square shape on the map layout. To change the thickness

and color of the line in Item Properties → Style → Change. You can see it in figure 10.

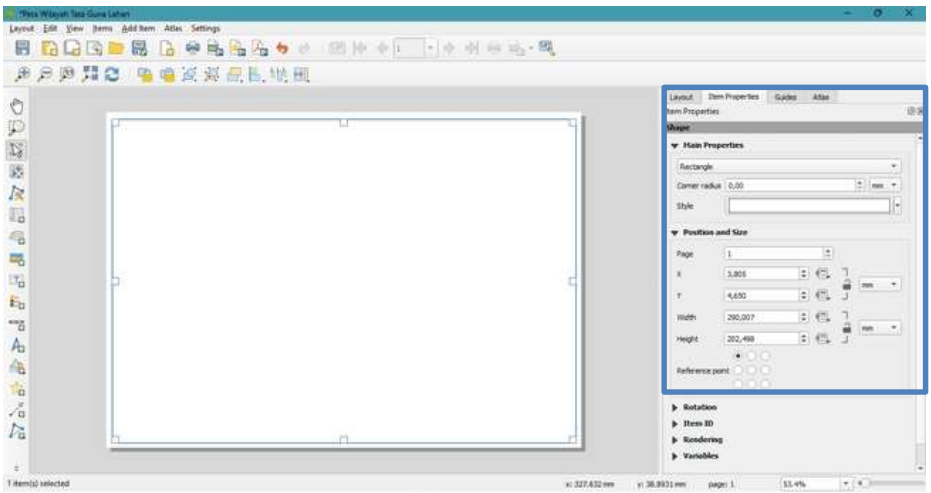


Figure 10. Edit Layout on Qgis.

Using the *Add new map* tool, insert the map content into the composer. Then, click, hold, and swipe to add a new map. Settings related to the newly added map can be found in the *Item Properties* section on the right. *Move Item Content* allows to change the position and scale of the map content. Move the contents of the map to adjust the position and use the scroll to set the scale. The scale can also be changed by using Item Properties. It can be seen in figure 11.

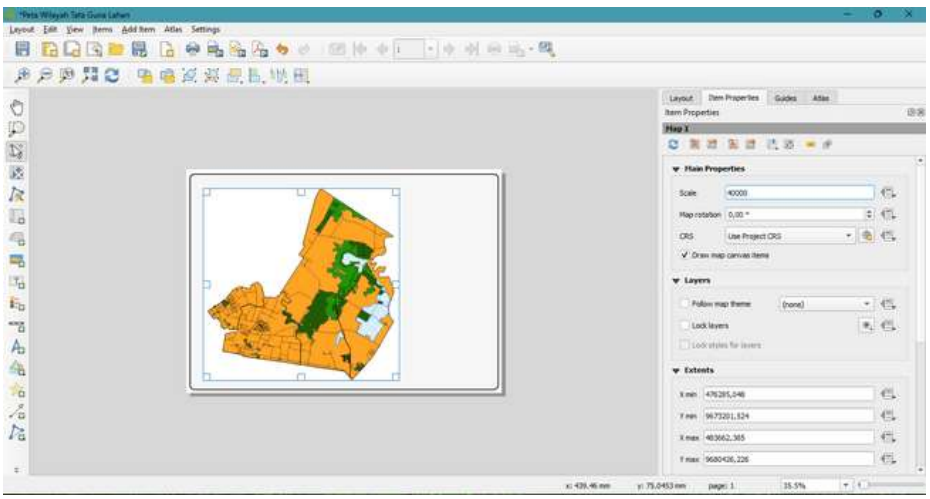


Figure 11. Add Map to Qgis.

The next step is to add a rectangle to the right of the map. Click add item select this rectangle will be used to store important information such as title, wind direction, scale, legend, and other elements. The purpose of this addition is to make the information displayed on the map clearer. It can be seen in figure 12.

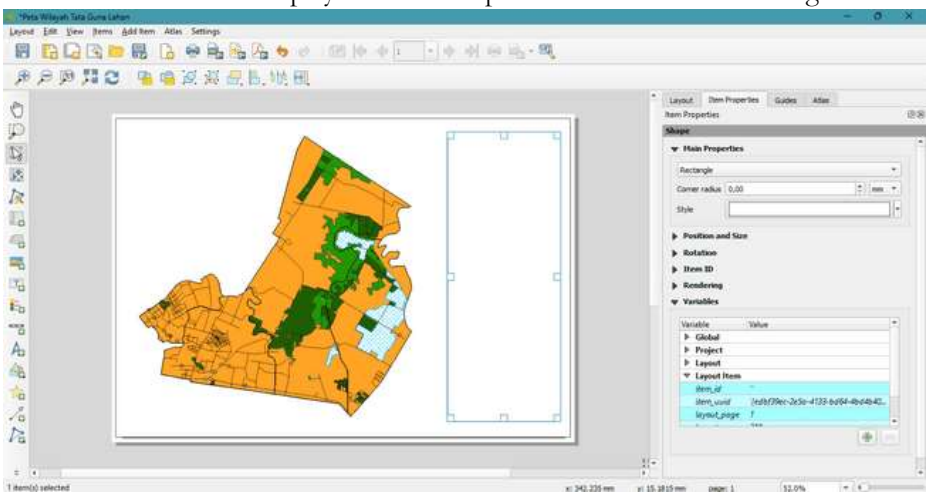


Figure 12. Adding Captions to Qgis

The next step is to add an image of the campus logo and MBKM. To do this, click *Add Item* then select *Add Picture select area* click *item properties* select the *Raster Image column* click the three dots select the image on the laptop file. After that, select the appropriate image file to add to the map. It can be seen in figure 13.

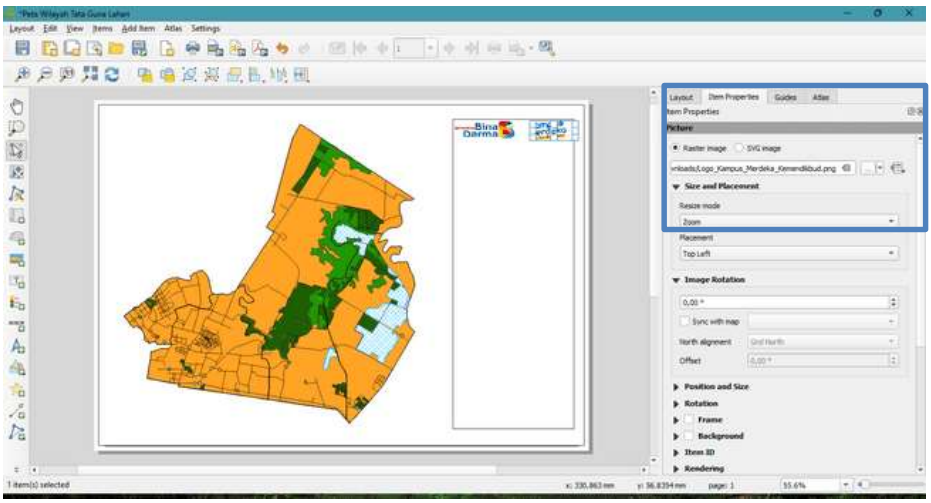


Figure 13. Add Logo to Qgis

The next step is to add a map title. To do this, click *Add Item* and then select *Add Label*. Then, select the area you want to title and edit the text on the *Item Properties* menu. The results can be seen in Figure 14.

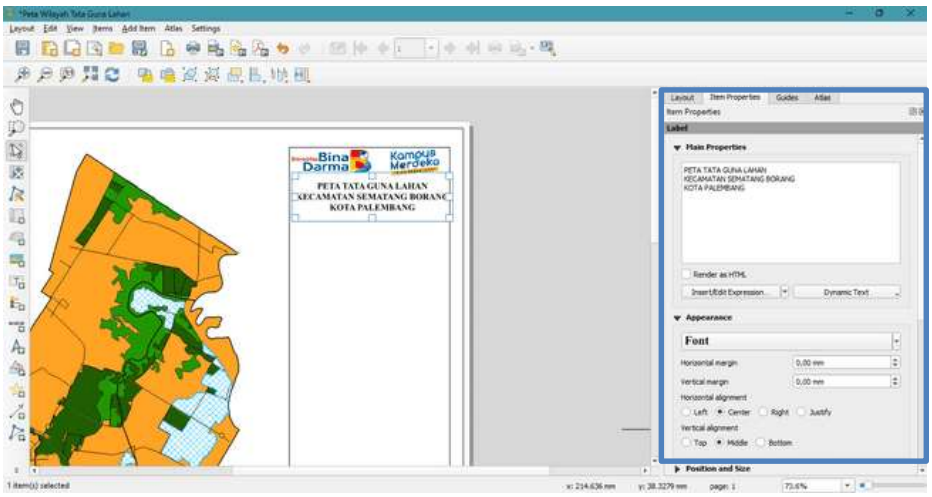


Figure 14. Adding Map Titles to QGIS.

Next, add the cardinal direction by clicking *Add Item*, then selecting *Add North Arrow*. After that, select the desired area to place the cardinal direction symbol.

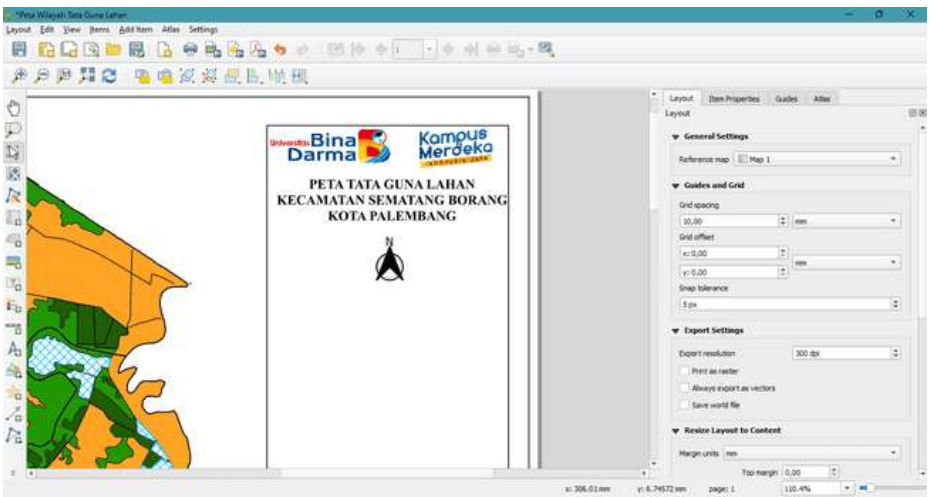


Figure 15. Adding the Cardinal Direction to the Qgis

The next step is to add a map scale. Click *Add Item*, then select *Add Scale Bar*. After that, edit the scale in the *Item Properties* menu by selecting the *Double Box* style. The results can be seen in figure 16.

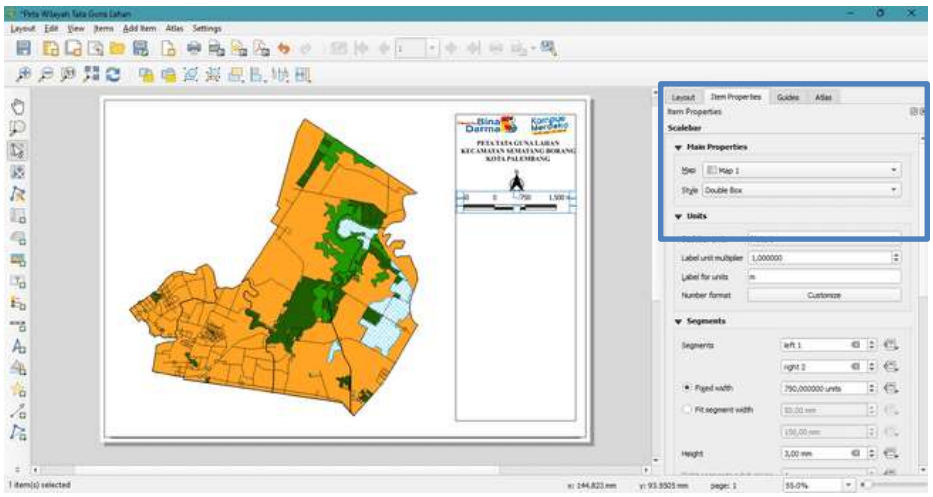


Figure 16. Adding a Scale Bar to Qgis.

Next, add a legend by clicking *Add Item* and then selecting *Add Legend*. Select the desired area to place the legend, then set its appearance through the *Item Properties* menu. Make edits to make the legend look neat. The results can be seen in Figure 17.

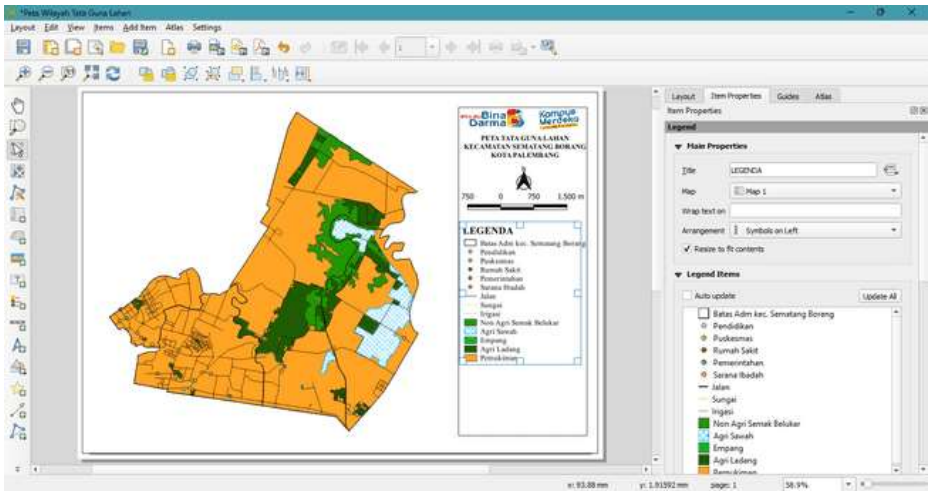


Figure 17. Adding Legends to Qgis.

Finally, add a grid to the map with the following steps:

1. first, click on the map you want to add the grid to, then go to *the Item Properties* menu.
2. Second, select the *Grid column* on the *Item Properties*.
3. Third, click the + sign to add a grid, then click *Modify Grid*.
4. Fourth, set the grid interval with the values X: 3000.0000000000000 and Y: 3000.00000000000000.
5. Fifth, check the *Draw Coordinates column* and adjust the appearance to be neat according to the map paper.

The final result can be seen in Figure 18.

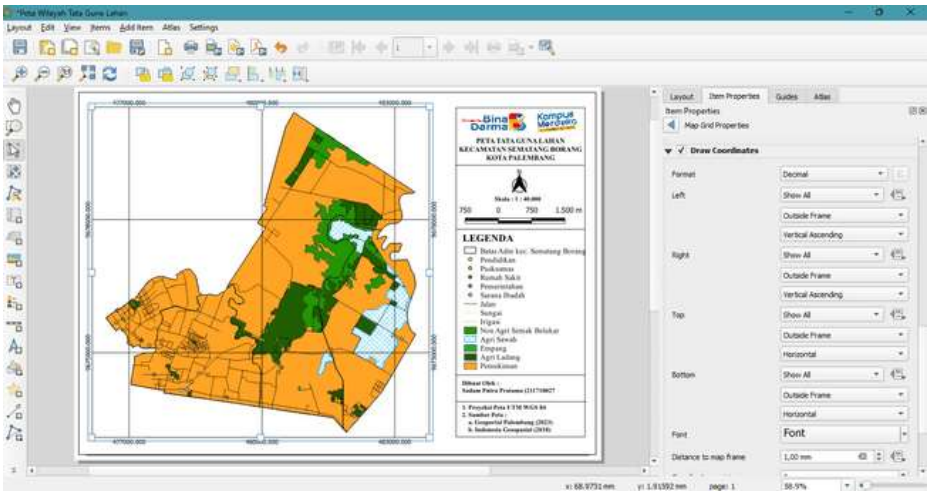


Figure 18. Adding a Map Grid to QGIS.

3.3 Digitization of Land Use Area Maps

Figure 19. Submission of Land Use Area Map of Sematangborang District.

The mapping process involves digitizing spatial data with GIS software to identify and group land use in the area. This map includes various information, such as the location of public facilities (education, health), residential areas, agricultural areas, and green open spaces that are arranged in a structured manner. This work was produced as part of an independent study that aims to support more effective and efficient spatial planning in the Sematang Borang area.

4. CONCLUSION

This research produces a comprehensive land use map using QGIS technology. The administrative distribution of Sematang Borang District is very different. Sukamulya Village accounted for 46.70% of the total area, followed by Karyamulya Village (26.69%), Srimulya Village (18.84%), and Lebung Gajah Village (7.77%). This research has succeeded in identifying and mapping various land uses, such as public facilities (education and health), residential areas, agricultural areas, and green open spaces. This is done through the process of digitizing spatial data using QGIS. A comprehensive and accurate map to support spatial planning is made by combining data from various sources, such as interviews with related agencies, shapefiles from Bappeda, and RBI data from the Indonesia Geospatial Site. With its strategic location, Sematang Borang District is only 11 km from the center of Palembang City, has significant potential for regional development, especially in the context of urban development. These mapping findings can be used as a tool to help better spatial planning and assist in decision-making related to the development of the area.

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