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Digitalization of Marine Space Utilization Guidance Based on Web-gis in the Work area of BPSPL Makassar

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Abstract

The enactment of Law Number 6 of 2023 concerning the Ratification of Government Regulation in Lieu of Law Number 2 of 2022 on Job Creation into Law requires that any permanent utilization of marine space must have basic permit for marine spatial utilization activities (KKPRL). The process of granting KKPRL permit is carried out by assessing the conformity of activities with the guidelines for zoning water space utilization based on the Regional Spatial Plan issued by the Provincial Government. The lack of information regarding the guidelines for marine space utilization causes applicants for marine space utilization activities to be unaware of the guidelines that can be applied to the location, thus hindering the process of issuing the KKPRL permit. The research aims to design a digitalization system for providing spatial utilization guidelines documents in the work area of BPSPL Makassar, which can be accessed online by marine space utilization stakeholders. This will facilitate checking the conformity of marine space utilization activities and accelerate the process of issuing the KKPRL permit. As an initial step, a digitalization system for marine spatial utilization guidelines was designed for two provinces in the work area of BPSPL Makassar, which have integrated the marine spatial planning and land spatial planning into Regional Spatial Plan (RTRWP), namely South Sulawesi Province and Central Sulawesi Province. This initial design will continue to be developed in line with the availability of RTRWP integration documents in four other provinces within the work area of BPSPL Makassar.

Keywords: digitalized, guidelines, spatial, web-gis

1. INTRODUCTION

Utilization of marine space is a crucial aspect in the management of natural resources and the maritime environment. Oceans, which cover more than 70% of the Earth's surface, provide various ecosystem benefits, including food resources, transportation routes, tourism opportunities, and mineral resources. Oceans play a strategic role both economically and ecologically. The Indonesian government has established various policies and regulations to manage marine space, including Marine Spatial Planning and conservation policies. However, the implementation of these policies often faces challenges, such as insufficient information provision and limited availability of marine spatial zoning data.

Marine spatial management is essential for maintaining the sustainability of marine resources and coastal environments. The suitability of marine spatial utilization activities is key to achieving this goal by integrating various interests and needs into a harmonious plan. The suitability of marine spatial utilization activities is a process of assessment and regulation to ensure that various human activities in the ocean do not conflict with each other and are carried out efficiently and sustainably.

To ensure optimal, orderly, and appropriate marine spatial utilization, comprehensive and integrated policies, strategies, and programs are needed, along with coordinated implementation that refers to the established suitability of marine spatial utilization activities. To develop sound policies and strategies, support from accurate and accountable data and databases is needed. Therefore, the “One Data Indonesia” policy was

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initiated by the Government, as outlined in the Circular of the Minister of Administrative and Bureaucratic Reform No. 5/2014 concerning the Revitalization of Data and Information Units of Ministries and Agencies. The policy aims to realize accurate, up-to-date, integrated, and accessible data as a basis for planning, implementation, evaluation, and development control through improved data governance.

More specifically, the Decree of the Minister of Marine Affairs and Fisheries Number 10 of 2023 regarding the Guidelines for Managing Data on Location Suitability for Marine Spatial Utilization Activities in the first dictum states that the Management of Data on Location Suitability for Marine Spatial Utilization Activities is conducted through recording and administration; mapping; and updating. The fourth dictum further states that the Management of Data on Location Suitability for Marine Spatial Utilization Activities, as referred to in the second dictum, is subsequently presented in the form of geospatial information.

Given the importance of achieving integrated planning and implementation of Marine Spatial Utilization Guidance Services and the provision of spatial-based suitability information, and accommodating and harmonizing the mandates of laws and regulations, support is needed for a well-managed and sustainable database that can address the needs in the field of marine spatial utilization. This is to formulate development policies and achieve good governance, which requires the establishment of accountability, transparency, and public participation principles in every public policy process.

To achieve the optimal, orderly, and organized development of a webGIS-based application, efforts are needed to accommodate and harmonize the mandates of laws and regulations through the development of databases, information systems, and supporting applications that are expected to meet development needs in the field of marine spatial utilization. This will help formulate development policies and achieve good governance.

2. METHODS

The implementation of developing a geospatial information system database in the form of WebGIS, an Information System design is carried out, consisting of several stages: System Initiation, System Requirement Analysis, System Design, System Construction, System Acceptance, and System Implementation and System Maintenance. The following diagram illustrates the stages of software design and development and the relationships between each stage.

1. System Initiation

The System Initiation stage aims to validate the development goals and estimate the benefits of system development in detail. This stage also defines clear (general) parameters that will serve as references for the new system. The System Initiation stage consists of several processes:

1. System Initiation Preparation, where the project is defined in the form of documents and a work plan for the implementation of software development.
2. Validation of the development goals, to ensure that the technological approach to be used and the development system is relevant for producing an optimal solution.
3. Developing a work schedule, where the detailed schedule for the overall implementation of the system development stages is defined.

2. System Requirement Analysis

The System Requirement Analysis stage is a crucial phase for the continuation of subsequent stages, as it determines the system requirements specifications and objectives to be achieved. The quality of the product that will be produced greatly depends on the identification process in this stage. The System Requirement Analysis stage consists of several processes:

1. Preparation for System Requirement Analysis, to ensure that the development team is ready to analyze the information system requirements.
2. Defining system requirements, where system requirements and rules are defined, identified, and documented.
3. Defining the process model, where a top-down illustration is conducted to represent the processes within the system in general.
4. Defining the logical data model, where the representation of logical data supporting the processes and rules of the new system is described.
5. Integrating requirements with the model used, where the development team ensures that the processes and logical data model accommodate all the required needs and rules.

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6. Producing specific functions, where interfaces, processes, and data are combined to systematically describe how users interact with the information system and how data is displayed, processed, and stored.

3. System Design

The purpose of System Design is to create a technical solution that meets the functional requirements of the system to be developed. Functional requirements include a complete description of the operational needs of the various organizational units that will use the system. The challenge lies in translating all existing information into accurate technical specifications that describe the design and will serve as input for System Construction. The System Design stage consists of several processes:

1. System Design Preparation, where the storage media of the existing project is expanded to accommodate design work products, development tools, and technical environments to support the system design, as well as training provided to team members involved in the design stage.
2. Defining system architecture, where the foundation and structure of the system are identified in relation to hardware systems, software systems, supporting tools, and development strategies for distributing various system components into a complete architecture.
3. Defining system standards, where general processes, techniques, development tools, and conventions to be used throughout the project are identified in an effort to maximize efficiency and introduce uniformity across the entire system.
4. Creating a database, where the database used by the system is defined, validated, and optimized to ensure the completeness, accuracy, and reliability of the data.
5. Prototyping system components, where various solution components are developed in the form of prototypes that provide initial functions for validation purposes.
6. Producing technical specifications, where all operational requirements are translated into technical design specifications for the entire system components, as well as determining the steps for the system construction phase.

4. System Construction

The System Construction stage includes all activities required to build and validate the new system, which will serve as a reference in the System Acceptance phase.

The System Construction stage consists of several processes:

1. System Construction Preparation, where system development and testing are prepared, and the development team is informed about the processes and development tools to be used.
2. Redefining system standards, where the standards created in the System Design are enhanced and adjusted so that the development team becomes more familiar with the project environment. The development team is expected to respond to any technical or strategic changes in the project.
3. Building, testing, and validating, where each component is built, then tested to ensure that they function according to technical and functional specifications.
4. System integration and testing, where logically related components are combined and tested as a cohesive system unit.
5. Preparing training materials, where all user-related training materials are prepared.
6. Preparing technical documentation, where all materials required by the system maintenance team are generated.

5. System Acceptance

The System Acceptance stage is the point in the development process where every aspect of the developed application, including data conversion and system utilities, is thoroughly validated by user representatives before proceeding to the System Implementation phase.

The System Acceptance stage consists of several processes:

1. System Acceptance Preparation, where the System Acceptance environment is established, and the testing team is instructed on the use of system development tools and the required processes.
2. Validation, initialization, and data conversion, where processes are used to test the database system and ensure that the new system can perform its processes.
3. Test, Identify, Evaluate, React (TIER), where functions and processes in a system sequence are tested to validate capabilities, and the test results determine whether the system is ready for deployment.
4. Determining support materials, where various support materials for system usage, operation, and maintenance are updated to determine whether adjustments are needed based on the test results.
5. The outcome of this phase is a system that meets user requirements and is free of bugs.

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6. System Implementation

The System Implementation stage aims to:

1. Prepare the new system for user availability
2. Position the system for ongoing maintenance
3. Install the new system and conduct training for information system users
4. Ensure that the initial data used for operating the new system is available and accurate.
5. The System Implementation stage consists of several processes:
6. System Implementation Preparation, where all steps needed to install the application, including technical and user environments, are conducted.
7. System installation, where all installation steps developed during the system design phase are implemented and validated.
8. Transition, where responsibility and ownership of the application are transferred from the development team to the user unit, along with the provision of support and maintenance systems for the application.

7. System Maintenance

System maintenance begins as soon as the new system becomes operational and ends when the system reaches the end of its lifecycle. The System Maintenance phase consists of several processes:

1. Understanding maintenance requests
2. Transforming maintenance requests into changes
3. Specifying the changes
4. Developing the changes
5. Testing the changes
6. Training users and conducting acceptance testing
7. Converting and launching operations
8. Updating documentation
9. Conducting post-implementation review

3. RESULTS AND DISCUSSION

The database and application system were implemented using HTML, PHP, JavaScript, and MySQL. The implementation of the WebGIS LAYAR PINISI system has a responsive interface across various devices, including both desktop and mobile. The display of the WebGIS LAYAR PINISI can be seen in the following image:

Figure 1. Main Page Display of WebGIS LAYAR PINISI on the Browser

The features available in WebGIS LAYAR PINISI include:

1. Basemap Gallery

By default, the basemap used in WebGIS is 'Satellite Imagery (ESRI)'. This feature contains reference options that can be selected to change the WebGIS basemap. There are 7 references available, including Open Street Map (OSM), Rupabumi Indonesia, Roadmap, Terrain, Traffic, Aerial, and Hybrid. The following image shows the basemap gallery display.

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Figure 2: Basemap Gallery Feature Display

2. Layer List

This menu is used to display the list of layers and operational options for the data layers shown on the map. The layers are divided into four (4) groups based on their data categories: Activity Suitability, Conservation Area, General Utilization Area, and Other Thematic Layers. The operational options for each layer can be accessed by clicking the layer icon, which will display layer categories containing sub-layers. To the right of each sub-layer, there is a checkbox that allows you to display the selected layer on the map. Below is the appearance of the layer list.

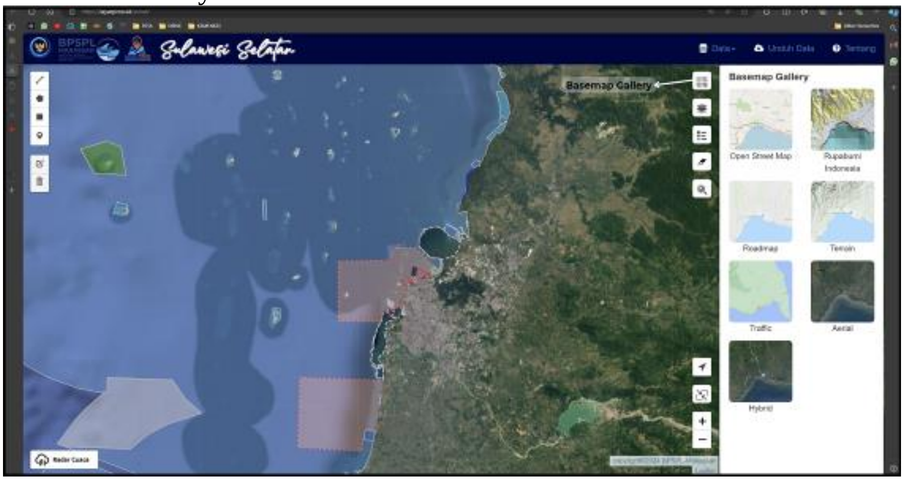

Figure 3: Layer List Feature Display

3. Download the Data

This menu is used to download the data available in WebGIS. To download data, click the "Download Data" button on the Menu Bar, and a Download Data dialog box will appear as shown in Figure 3.4. Users can then select the data they wish to download.

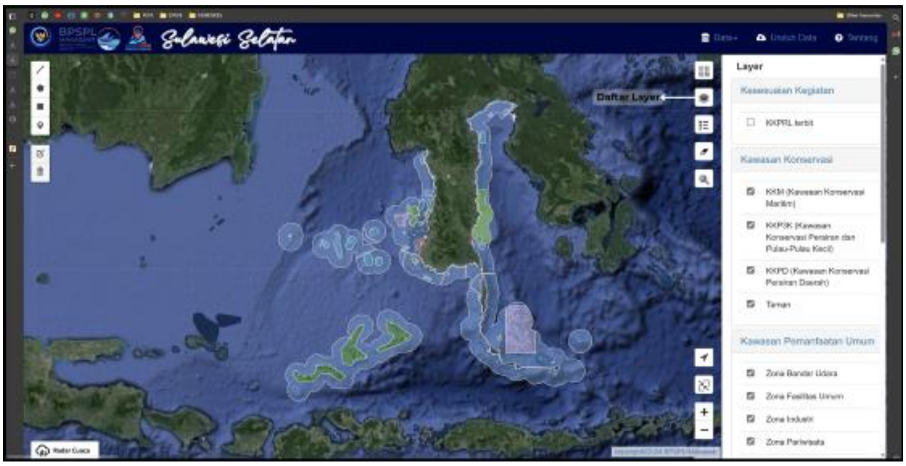

Figure 4: Download Data Page Display

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4.Layer Legends

This menu contains a list of active layer legends on the map. Below is the display of the legend feature.

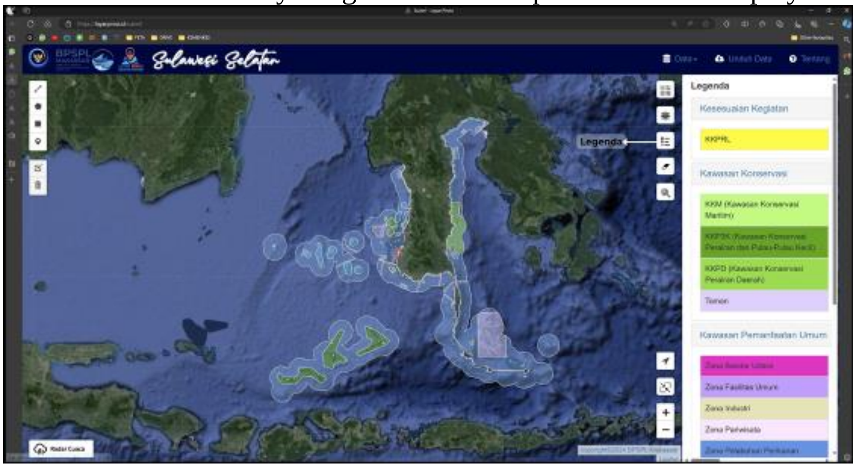

Figure 5: Legend Feature Display

5.Determine Activity Plan Location

This menu is used to input specific coordinates that users want to mark on the map. There are two (2) types of coordinates that can be entered: Decimal Degrees (DD) and Degrees Minutes Seconds (DMS). Users can add a marker by inputting the Longitude and Latitude coordinates, then clicking the "Go to Location" button, which will automatically display the marker on the map. The feature display can be seen in the following figure.

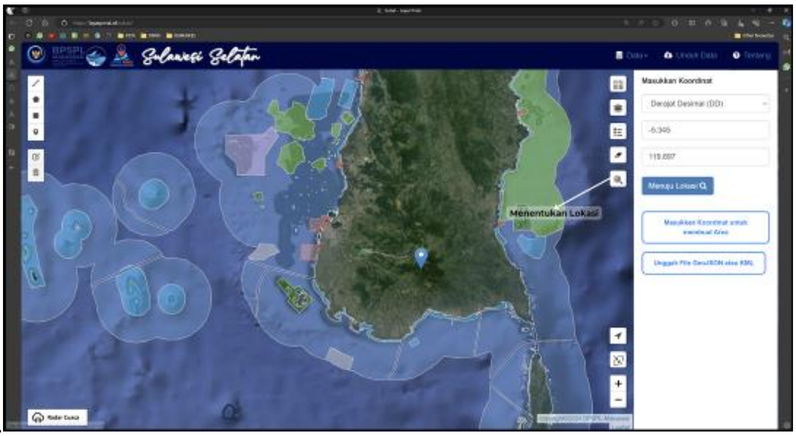

Figure 6 Display of the Location Search Feature with Coordinate Input

In the Determine Location menu, users can also create coordinate areas by clicking the 'Enter Coordinates to Create Area' button, which will display a coordinate input dialog box as shown in the image below.

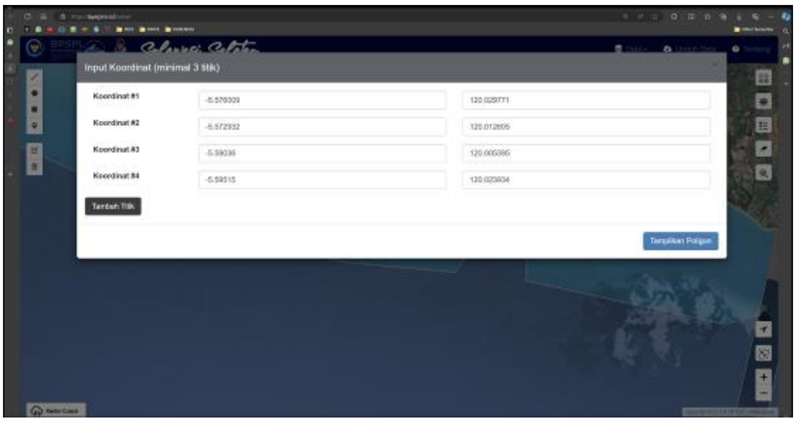

Figure 7 Display of the Feature for Creating a Study Area Polygon

To navigate to the user-specified location, enter the desired location coordinates and then press the 'Display Polygon' button in the Coordinate Input dialog box. The polygon corresponding to the entered coordinates

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will then appear on the map. Additionally, users can upload their own GeoJSON or KML files to be displayed on the map by clicking the 'Upload GeoJSON or KML File' button. After clicking the 'Upload GeoJSON or KML File' button, an Open File dialog box will appear, allowing users to select the GeoJSON or KML file they wish to display on the map, as shown in the following image.

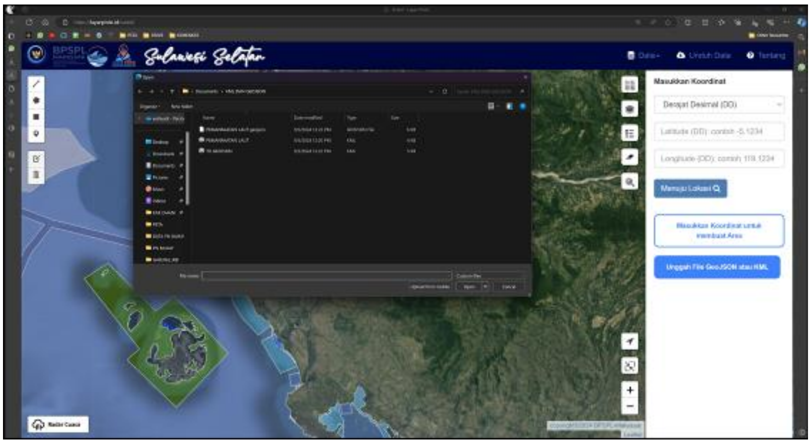

Figure 8 Display of the Open File Dialog

After the user selects the GeoJSON or KML file they wish to display, click 'Open', and the GeoJSON or KML layer will automatically appear on the map as shown in Figure 3.9. To remove a point or area location that the user has input into the map layer, the 'Delete Selection' button can be used

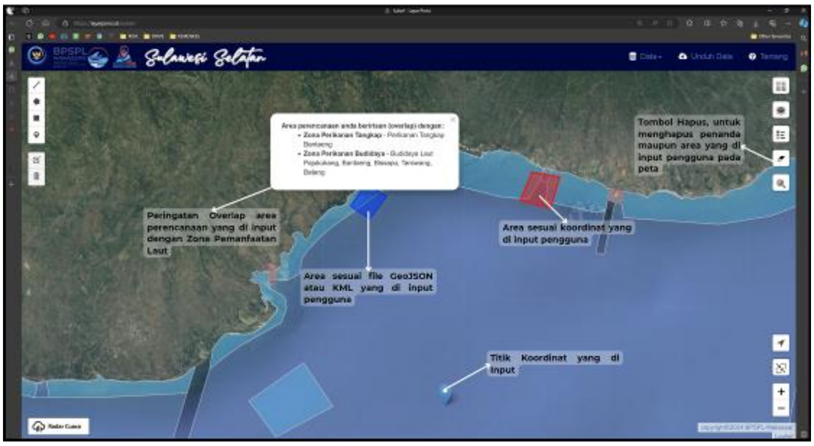

Figure 9 Display of the Uploaded GeoJSON or KML File Layer

6. Navigation

Contains simple WebGIS navigation features, such as the current location feature, which functions to display the real-time current location on the map, the home view to return to the default zoom level and coverage area of the WebGIS, as well as zoom in and zoom out. The navigation feature display is as follows.

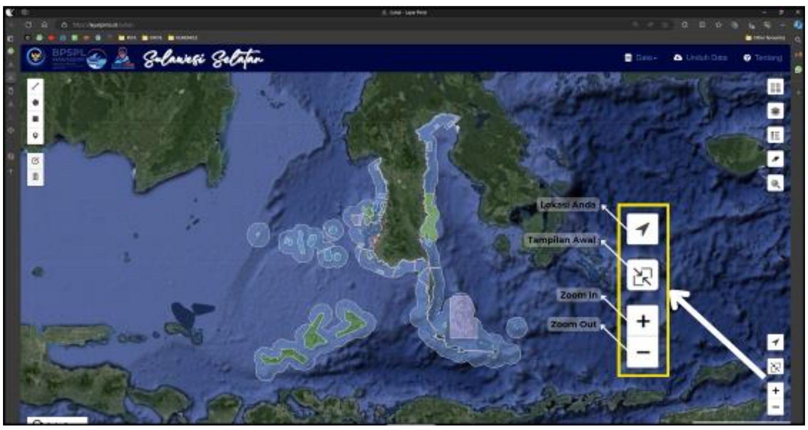

Figure 10 Navigation Feature Display

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7. Drawing Sketch

This feature is useful for adding sketch drawings to the map, but the data will not be saved in the database. Sketch drawings consist of several menus, including draw a polyline, draw a polygon, draw a rectangle, draw a marker, edit layers, and delete. The drawing menu can be used to create “scribbles” on the map to aid in analysis or to indicate specific locations during presentations or when printing maps.

a. Draw A Polyline

This menu is used to create lines and measure distances on the map. To create a polyline, click on the 'Draw a Polyline' menu and then draw the line as desired. If there is an error in placing a point while creating the polyline, the user can delete it by clicking 'Delete last point'; the incorrect point will be removed, and the user can continue creating the polyline. Once finished, click the 'Finish' button. The created polyline will appear on the map.

b. Draw A Polygon

This menu is used to create polygons and measure the desired area on the map. To create a polygon, click on the 'Draw a Polygon' menu and then draw the area as desired. If there is an error in placing a point while creating the polygon, the user can delete it by clicking 'Delete last point'; the incorrect point will be removed, and the user can continue creating the polygon. Once finished, click the 'Finish' button. The created polygon will appear on the map.

c. Draw A Rectangle

This menu is used to create a rectangle on the map and provides information about the area covered by the created rectangle. The process of creating a rectangle is similar to creating a polyline or polygon. To create a rectangle, press and hold the right mouse button, then drag it to form the desired rectangle. Once positioned correctly, release the right mouse button, and the created rectangle will appear on the map.

d. Draw A Marker

This menu is used to create points that can display the coordinates of the created location. A marker can be added by clicking the 'Draw a Marker' menu and positioning the mouse on the desired location. The marker will immediately appear on the map. To view the marker's coordinates, hover the mouse over the marker icon on the map.

In addition to the four menus above, there is also an 'Edit Layers' menu for editing polylines, polygons, rectangles, and markers that have been created, as well as a 'Delete' option to remove all previously created objects. The drawing menu can be used to create “scribbles” on the map to aid in analysis or to indicate specific locations during presentations or when printing maps. The following is the display of the sketch creation feature.

Figure 11 Display of the Sketch Drawing Feature

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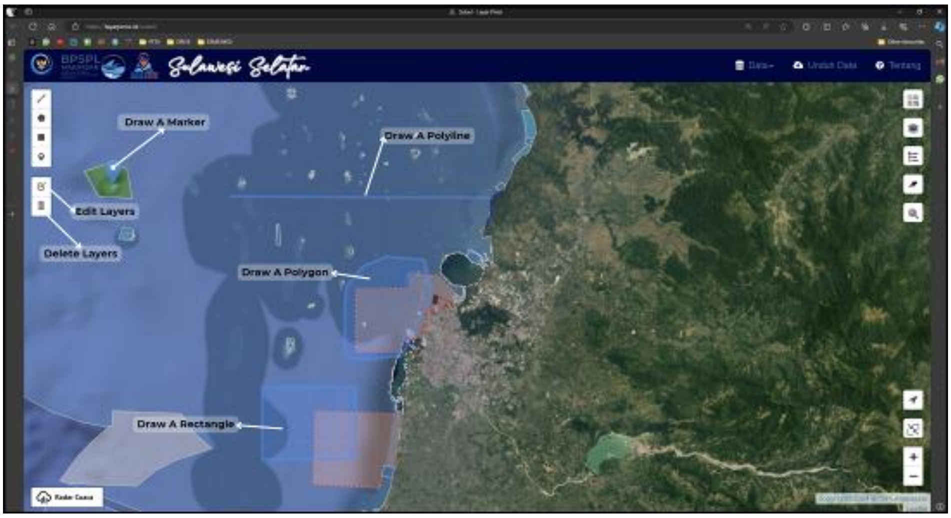

Figure 12. Feature Display and Sketch Examples

8. Identification Mode

This feature is used to identify the layers displayed on the map. By clicking on the layer that you want to identify, a pop-up will appear with information about the layer, along with an infographic containing information about marine space utilization, as shown in the image below. In this feature, users can also perform a direct search according to the keywords they wish to display.

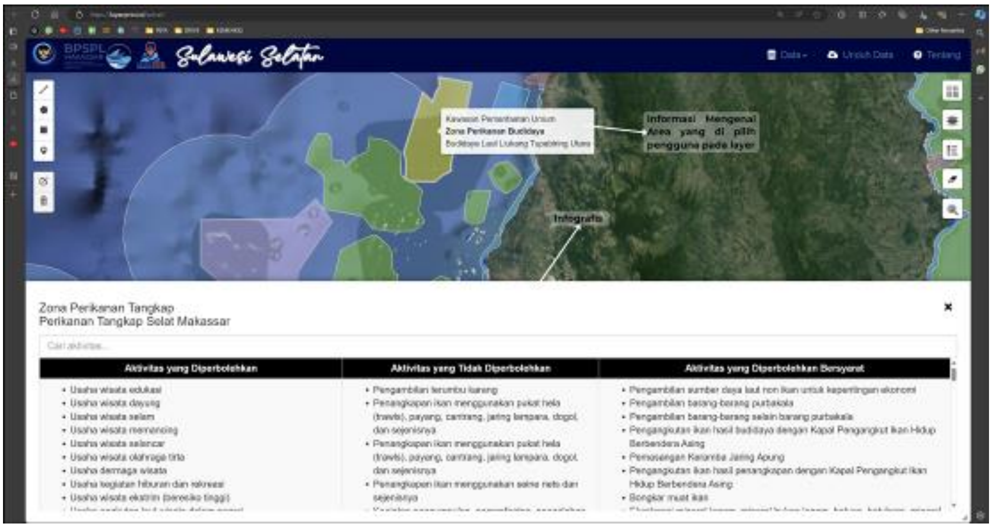

Figure 13 Display of the Layer Information Pop-Up

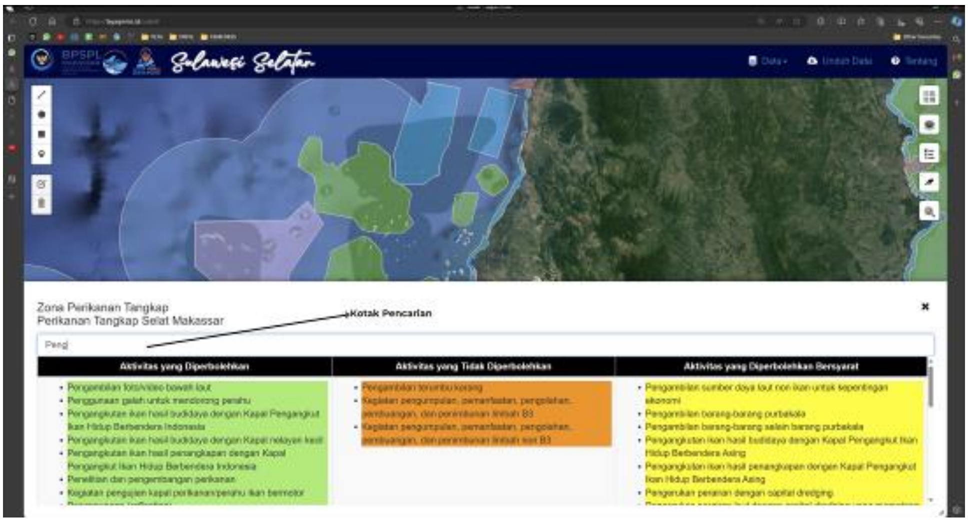

Figure 13 Display of the Layer Information Search Feature

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7. CONCLUSION

The development of the WebGIS-based application 'Guidance Services and Provision of Spatial-Based Marine Space Utilization Activity Suitability Information' in Sulawesi has involved the design and construction of a database for the Makassar Coastal and Marine Resource Management Agency, along with its application system. The design and construction process includes several stages: System Initiation, System Requirement Analysis, System Design, System Construction, System Acceptance, and System Implementation. The WebGIS-based application of the Makassar Coastal and Marine Resource Management Agency can be accessed at www.layarpinisi.id.

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