Makassar City WEBGIS Development

Output 2 Report

"Improving the use and sharing of geospatial information for resilient and sustainable development in Makassar City, Indonesia"

ESCAP (Economic Social Council for Asia Pacific) UN LAPAN (Lembaga Penerbangan dan Antariksa)
Bappeda Kota Makassar
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Report on Output

Report on the architecture and operation procedure on Smart City Command Center in MakassarCity, South Sulawesi.

There are targets needed to beacheived in this outpout 2 of the project:

1. Designing the integration architecture between platform in The National Aeronautics and Space Agency (LAPAN) and Smart City Command Center of Makassar City.
2. Developing the manual and operation procedure and guideline on common data formats in pilot city for integrating geospatial information for urban development, waste management, air/water pollution, as well as land use management.

Designing the suitable Web GIS Platform to be used needs some considerations on the efficiency and amount of budget to build it up. WebGIS is an advanced form of Geographic Information Systems available on web platforms. It is like a GIS running in web browsers and hasevolved into Web GIS serving desktop and mobile clients. This web needs at least client and a server to be put in as simple components. Implementing a WebGIS relies on the client/server model. The whole operation is broken down into client facing side and the server-side. The clientcan be a web browser or a desktop GIS software and the server-side consists of a Web Server (e.gApache Tomcat), Web GIS server (e.g GeoServer or MapServer), and a Database. Below is a graphic that illustrates the whole process (www.gislounge.com).

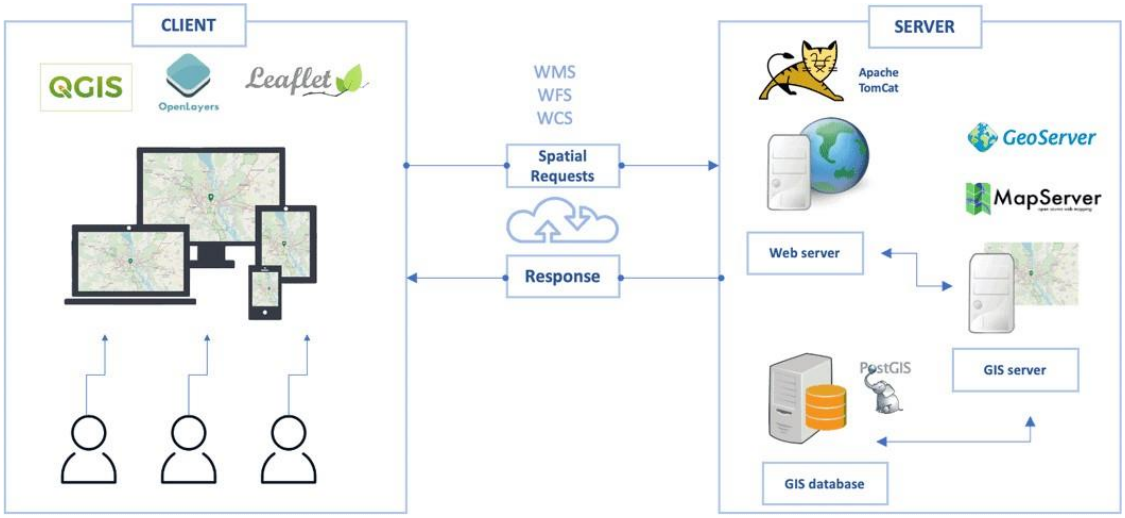

Figure 2.1. General illustration of a Web GIS components

It is any GIS that uses Web technology to communicate between some components: a GIS server (identified by a URL) and a client (a web browser, a desktop application, or a mobile application). The communication is via Hypertext Transfer Protocol (HTTP/HTTPS) and the format of the response can be an HTML, binary image, XML (Extensible Markup Language), GML (Geography Markup Language), or JSON (JavaScript Object Notation).

The overall goal of this technology is to allow users to dynamically access, share, and manipulate geospatial data on the web no matter the platform or protocol.

Characteristics And Key Elements Of A Web GIS

A WebGIS must satisfy the following;

1. Global reach by HTTP/HTTPS i.e the server must have a specific Uniform resource locator(URL) on the web so that client can access it easily.

2. Support a large number of users simultaneously: requires high performance and scalability.

3. Better cross-platform capability: – Different Web browsers: IE, Firefox, G. Chrome for diverse OSs (Win, Linux, Mac OS, iOS). etc.

The Applications of WebGIS can be in various form of applications such as Collaborativecollection of Geospatial Data. Most important is Wb GIS can be used to design and plan government projects like urban flood management, natural disasters, etc.

Challenges of WebGIS

Developing WebGIS must address certain issues as challenges among them are security, dataquality, system performance, accessibility in poorly connected areas and the costs for maintenance and so on. Security implies to the condition that not all data can be distributed tothe public as well as the security of the system itself.

The popularity of ARCGIS Online designed by ESRI as WebGIS has been one consideration why this smart city of Makassar WEbGIS Platform uses the product. The integration of geospatial data from various important agencies in Indonesia such as The Land Information and Cadastre Ministry, Public Works Ministry, The National Disaster Mitigation Agency as well the National Agency of Aeronautics and Space. Geospatual Information Agency (BIG) has been campaigning the one-map policy for the common use of data format and platform.

Below are descriptions of the advantagoues of this product from ESRI quoted from ESRI website.

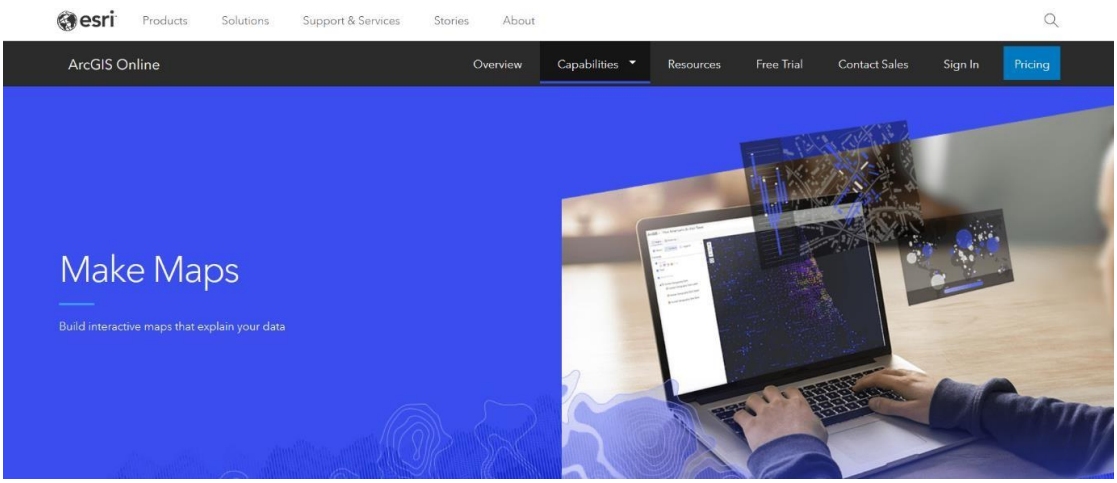

Figure 2.2. ESRI Website featuring ArcGIS Online

Interactive maps create immersive experiences that take maps from a static view to an opportunityfor users to explore. Enhanced details and new perspectives spring from the map as you zoom in,search, and interact with the data.

There are many ways to explore interactive maps. Here are several options:

- Gain additional details as you zoom in
- Click on the map to see region-specific information in text, tables, and images
- Search the world's locations and your custom locations
- Get additional perspectives by filtering data and changing colors

Map data from various sources

Bring a variety of data, including spreadsheets, geospatial files, and imagery, into ArcGIS Online. Connect to external sources of observational data such as IoT (Internet of Things) platforms.

Data exists in a variety of formats. ArcGIS Online makes it simple to bring in content

from the cloud and upload files including spreadsheets, KML, GeoJSON, and common geospatial files. Usethe included tools to refine your data and prepare it for visualization and analysis.

Connect to IoT and sensor data

Leverage real-time spatial data for essential operational decisions. With ArcGIS Velocity, an add-on capability, ingest data from IoT platforms, message brokers, or sensor APIs and apply real-time analytics to perform actions such as geofencing and incident detection.

Designing Geoportal Web GIS using ESRI's ArcGIS hub platform

After most geospatial data collected and websites portal searched and considering the building of the portal, The Smart City of Makassar WebGIS team decided to use the geoportal WebGIS developed ESRI, ArcGIS online that can also be used for information distribution in the web as hub platform as well as for geospatial publication and data sharing. Below is the illustrationof how ESRI develop ArcGIS Platform and transform it to become a WebGIS. Geospatial data is

being prepared with Desktop integrate with GIS Server to create applications that

include Web Maps, layers, scenes, news, etc.

Figure 2.3 Transformation of ARCGIS Platform (ESRI, 2021)

This WebGIS portal connects the interface of any desktops, webs, devices with the serverad online content services. The portal is hosted by ESRI and we do not need to install or perform maintenance. For a deployment using portal for ArcGIS there are three main components that make up a WebGIS; the portal itself, the hosting server and the database (data store).

Having the GIS server connected with the enterprise geodatabase, the infrastructure can support the publishing of authoritative data from the enterprise geodatabase in conjunction with aWebGIS. ArcGIS online enable the users to share maps and applications, collaborate with variousinstitutions in analyzing geospatial along with its attribute data and share the data among the related parties and to public. Analyzed data can be shared to any relevant users.

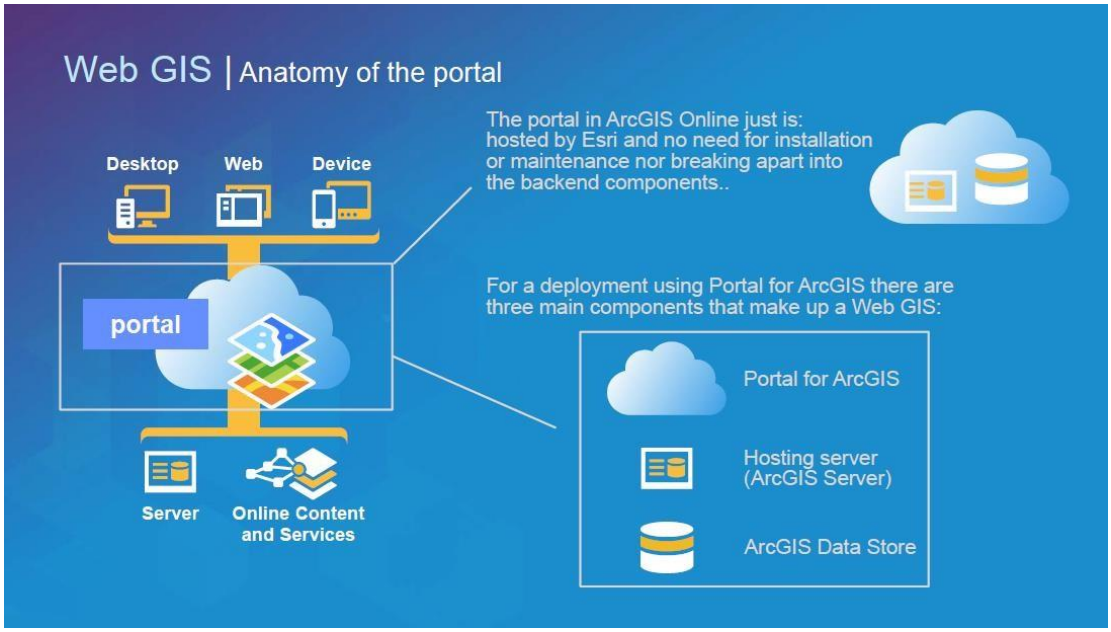

Figure 2.4. The Anatomy of the portal

Geospatial data was prepared from a GIS software called ArcGIS for input into the system.

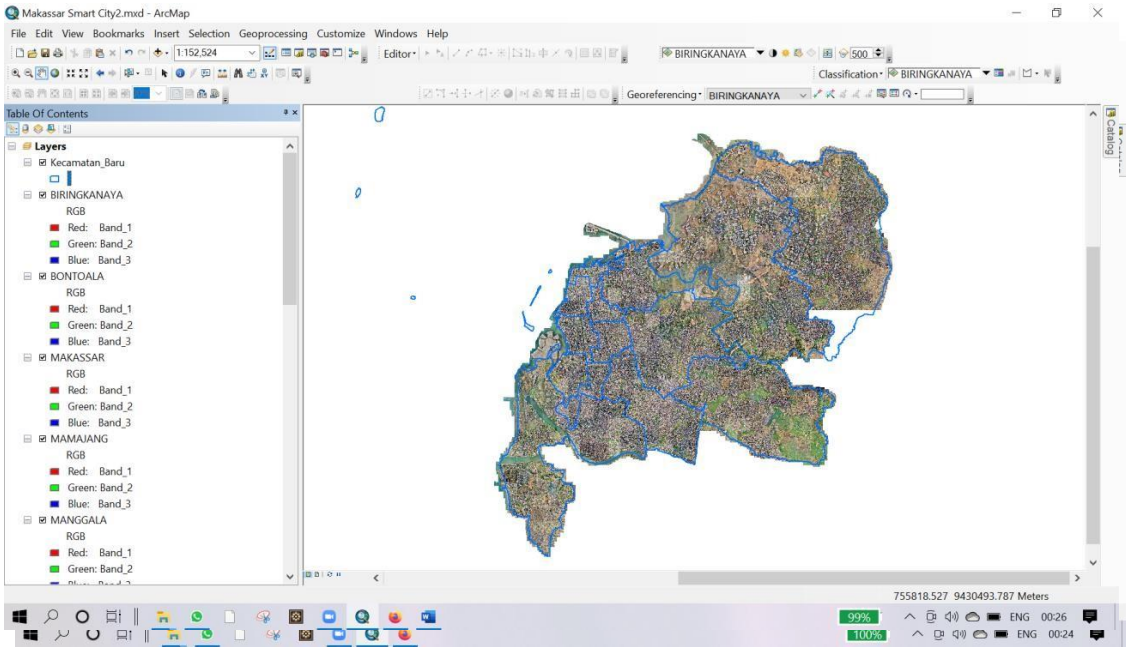

Figure 2.5. Drone picture covering the whole city with very high-resolution image.

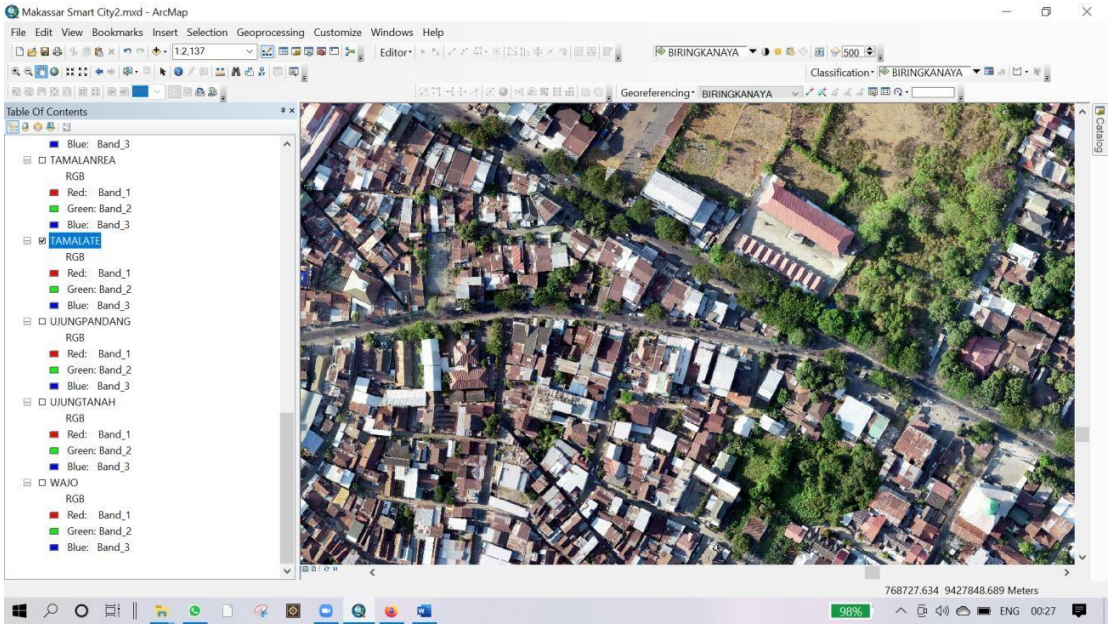

Figure 2.6. Drone picture covering the whole city with very high-resolution image overlaid withadministrative boundary layer.

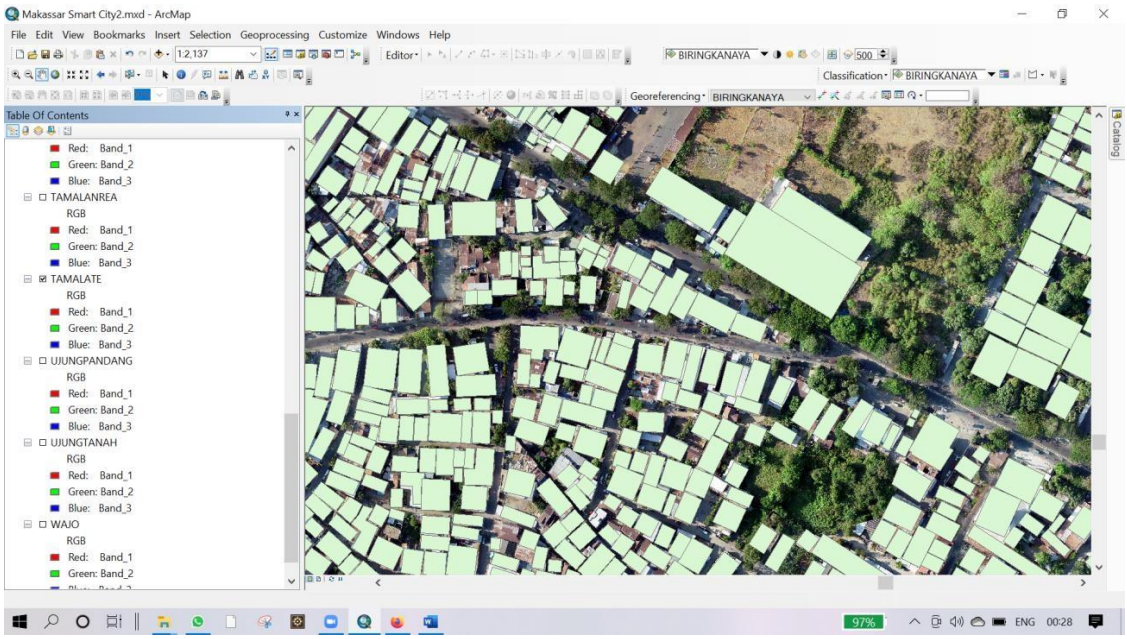

Figure 2.7. Drone picture covering the whole city with very high resolution image. Figure 2.7. Drone picture covering the whole city Green polygons indicated digitized buildingAbove figures are images prepared in ArcGIS before the geospatial posted in the Geoportal

WebGIS prepared for the Makassar city..\

1. The Geoportal Platform. WebGIS Smart City of Makassar.

The website address: https://smart-city-of-makassar-unhas.hub.arcgis.com/

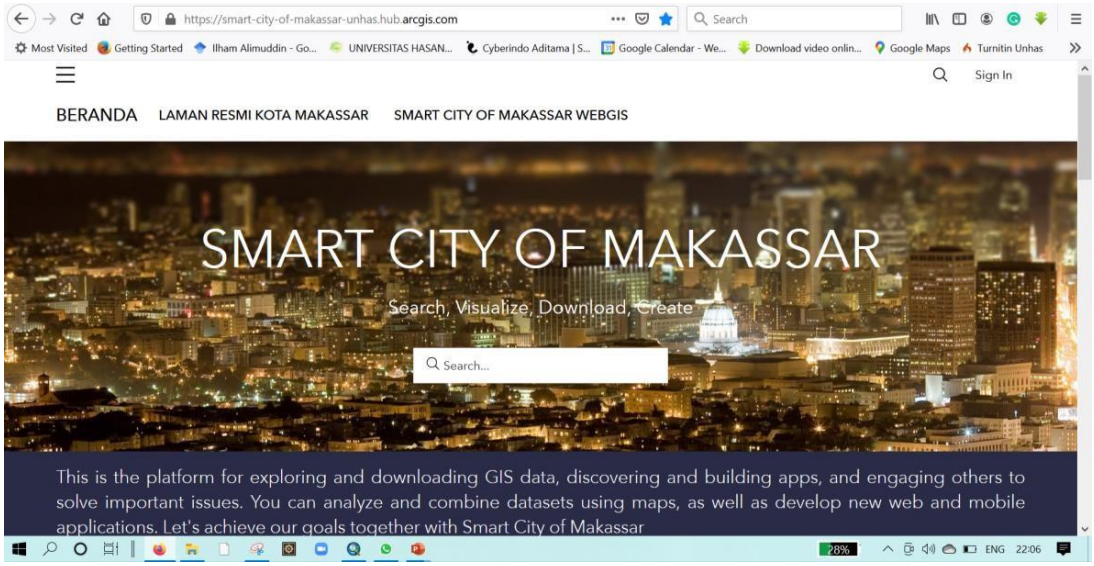

Figure 2.8 Home of the WebGIS Platform with the administrive boundary

The platform uses the ESRI ArcGIS Online. The use is easier and faster access to maps comparedto existing geoportal. Geodatabase can be shared among government institutions as it is able to share and updated the geospatial data. Shapefile format data can be downloaded by users freely. LAPAN's provision of updated satellite data is also possible to be directly shared on the platform.

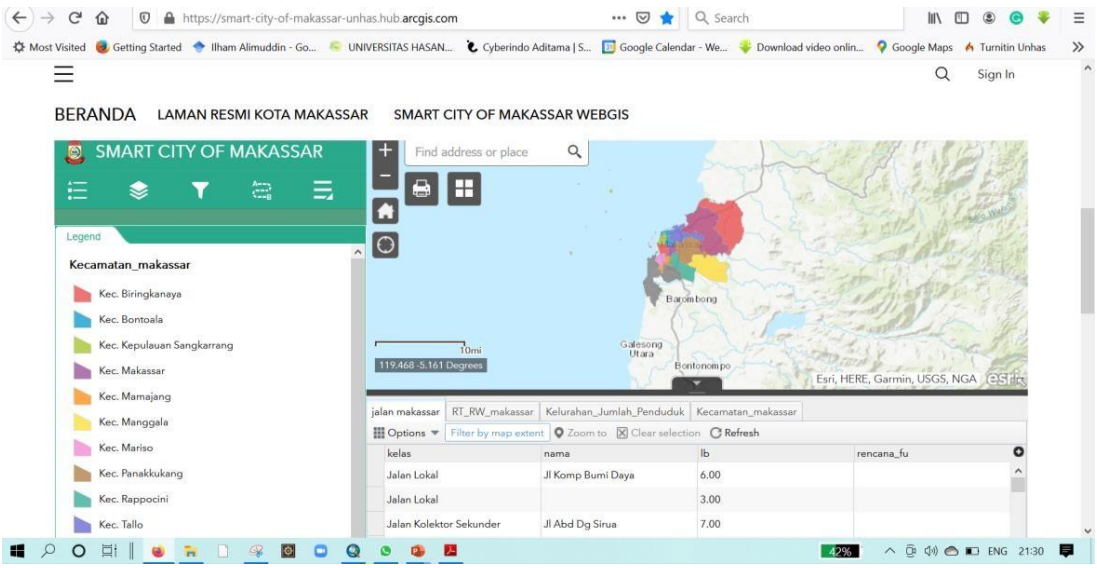

Figure 2.9. Shapefile processed image of vegetation cover from time to time, 2015

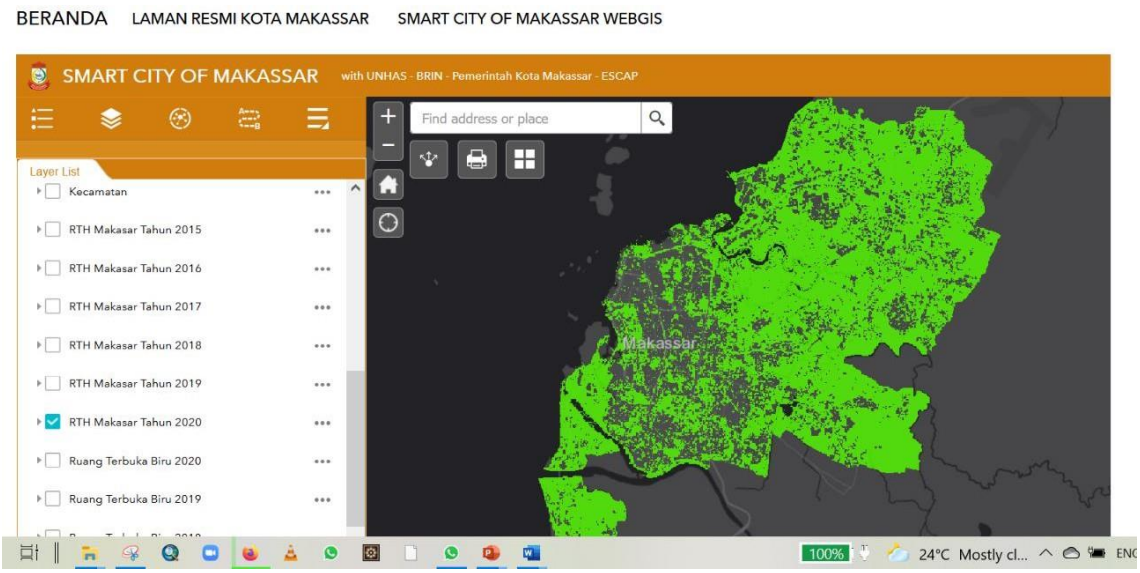

Figure 2.10 Shapefile processed image of vegetation cover from time to time, 2020

LAPAN BRIN support on the provision of geospatial data

The advantageous of the WebGIS platform designed by our team is supported by LAPAN's provision of geospatial data both vector model data and raster satellite and

processed ready to usedata. All these data can be downloaded from Lapan's website Space Map. https://spacemap.lapan.go.id/

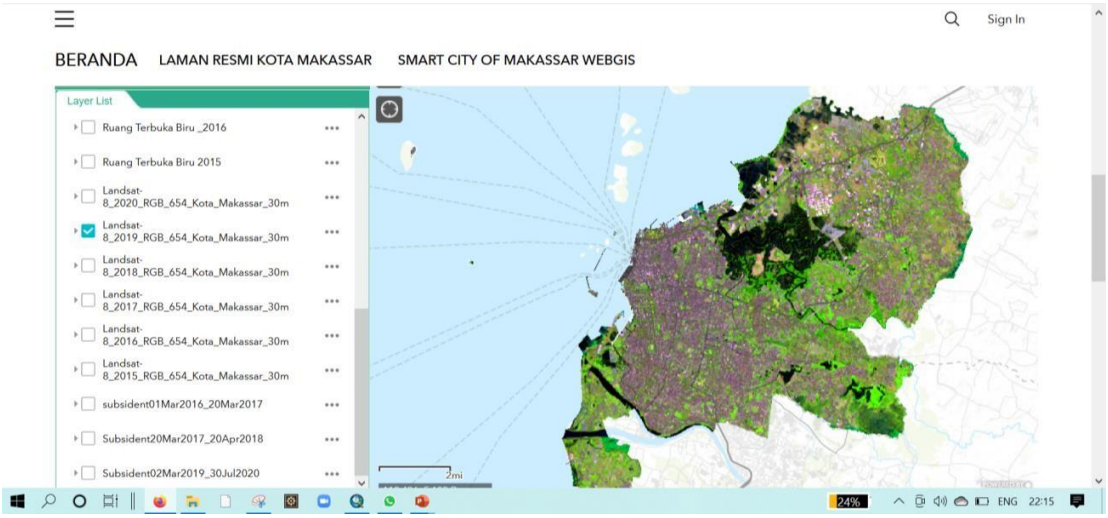

Figure 2.11 Landcover image can be shared on the geoportal with different acquisition year.

Land Subsidence in 2019

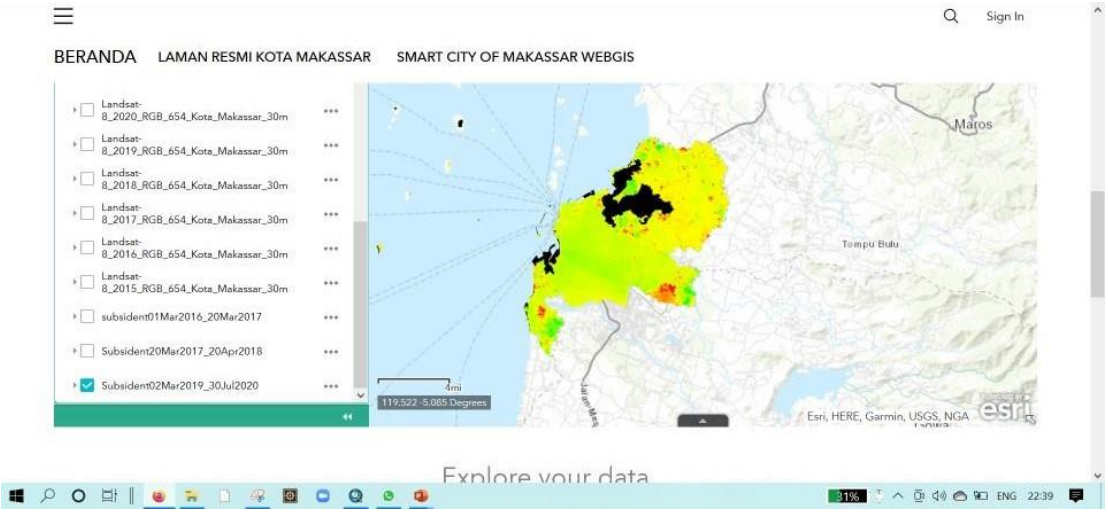

Figure 2.12. Land subsidence image can be shared on the geoportal with different acquisition year.

Waterbodies in 2019

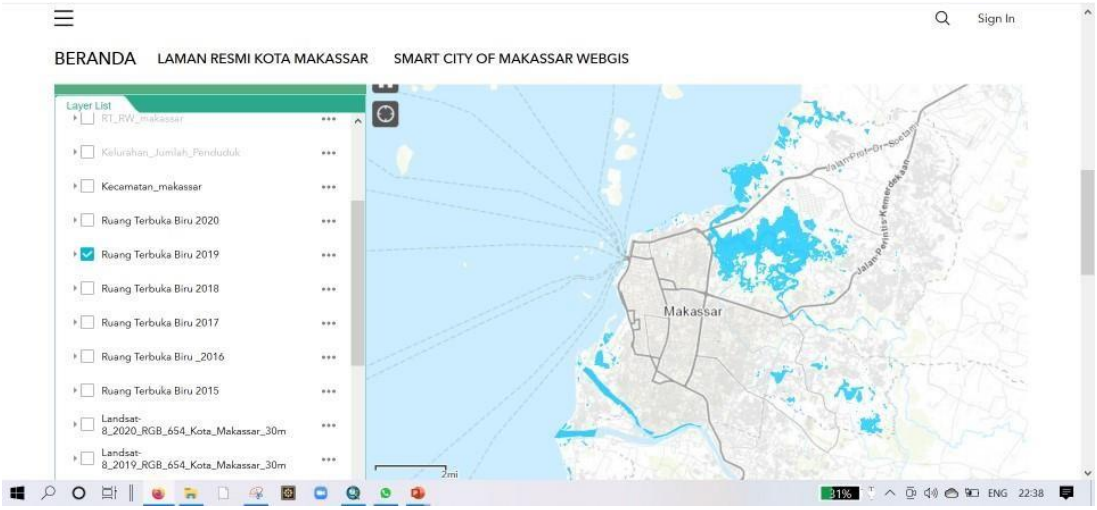

Figure 2.13. Waterbodies image can be shared on the geoportal with different acquisition year.

This WebGIS platform enables the data sharing in the raw data format which can be used forfurther analysis and overlay with other geospatial data.

Downloadable datasharing

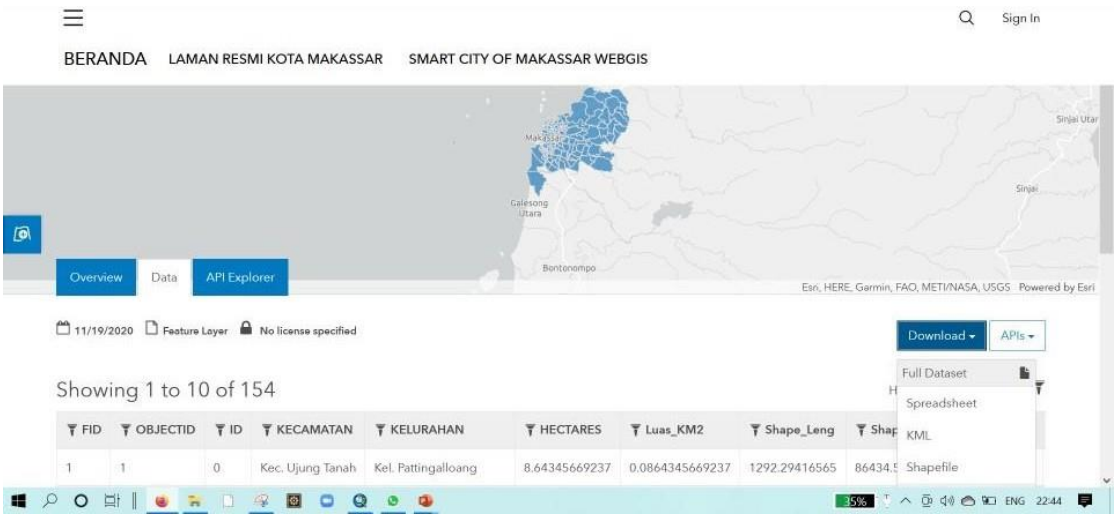

Figure 2.14. A caption showing that the shapefile data can be directly downloaded for data sharing.

In tackling the issue of SDG No. 3 of the provision of health facilities to public, our team has collaborated with Indonesian Dentist Association South Sulawesi Chapter (PDGI) to map theprovision of Dental Services at the Community Health Centers, hospitals run by the localgovernment as well the private clinics run by private dentist practices. The committee provided tables of the addresses as well as name of the dentist and their place of practices. Before putting the data into the maps, we need to validate the address name correctly otherwise there are some addresses mentioned twice or three times. Validating the tabular data needs some extra checking before we the location finally can be plotted. This map then shared in the geoportal based on the location and the name of the dentist. That can be seen from the pictures. With this information thepublic can run a search of proximity on the dental services available close to their houses and we also can analyze the distribution of health services based on each administrative boundaries like subdistricts. The distribution pattern can give information which area has been crowded for services while other areas are still lacking of the dental health services.

Another goal that is specially mapped in this geoportal is SDG no 11 as mentioned in the report 1 of this project mapping the slum areas and updated the map based on the city programs. The map must be updated and the updating process is handled by the operational staffs at assignedoffices.

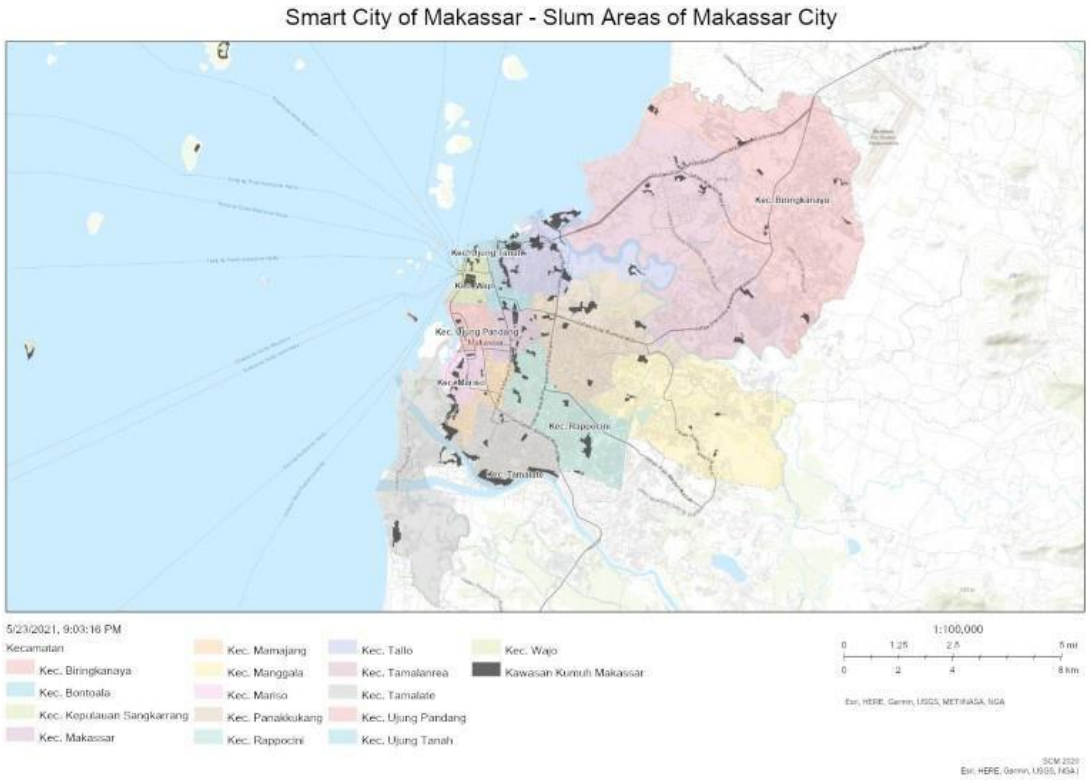

Figure 2.15. Slum areas of Makassar City

DISTRIBUTION MAP OF DENTAL PRACTICES IN MAKASSAR CITY

Figure 2.16. Map created by ArcGIS showing the distribution of dental services

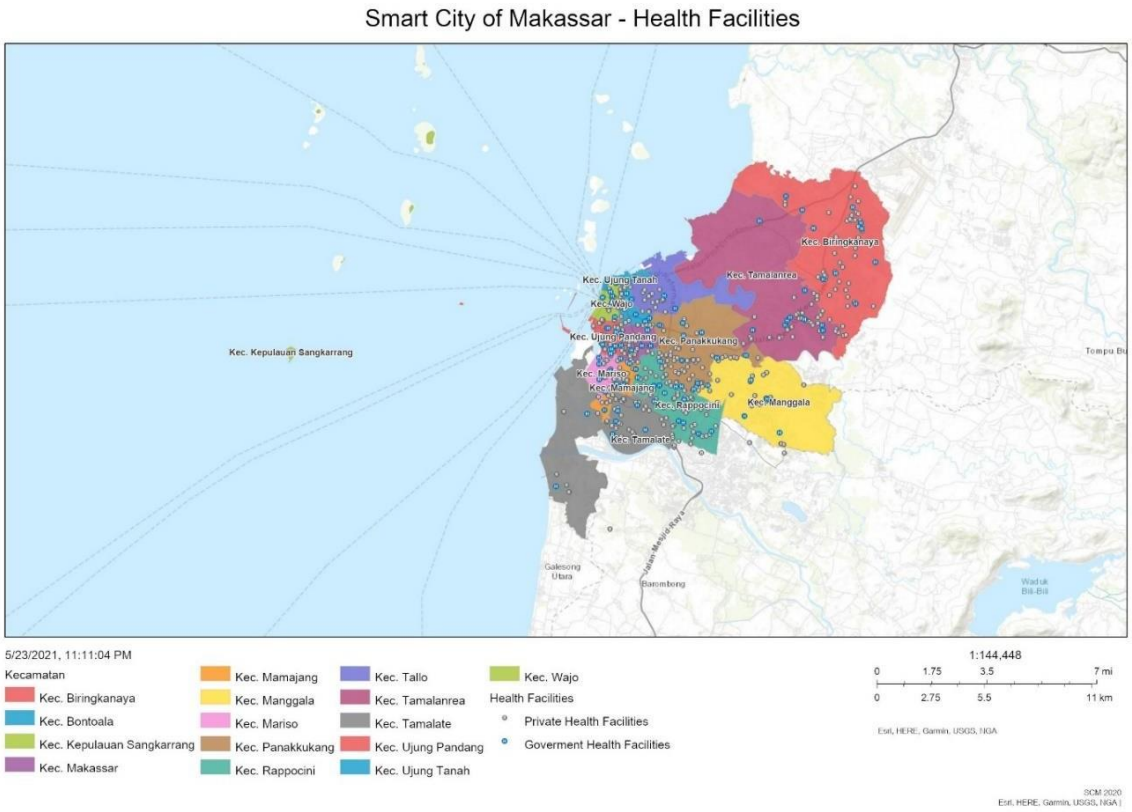

Figure 2.17 The tabular data has been mapped into shapefile and plotted in the WebGIS portal

Connecting The Command Center of Makassar City (War Room) which situated inMayor's office top floor will take some time later but the possibility is there to connect once the Office of Information and Communication has one workstation in this center and can be shown inthe command Center. In the future we hope to integrate the CCTV installed by the office in to theportal.

Figure 2.18. Team visit to the command center in Mayor's Office 9a) and CCTV live thatconnected to the center (b)

Finally, this WebGIS portal is expected to have Makassar City stakeholders can be included using this facility especially functional office of Makassar city that implement the geospatial data as major data for the operational.

Figure 2.19. All stakeholders can be included using the geoportal.

1. Developing the manual and operation procedure and guideline on common data formats in pilot city for integrating geospatial information for urban development, waste management,air/water pollution, as well as land use management.

Attached is the procedure and guideline or tutorial on how the users can use the WebGIS platformand where users can integrate the geospatial information for use of other SDGs indicators in urbandevelopment, waste management, air and water pollution as well as land management.Thepresentation material for the training which conducted in hybrid mode with some participants joining offline at the Spatial Planning Office in Makassar and most participants joining online through Zoom meeting application provided by the committee.