



دولة فلسطين
وزارة الحكم المحلي
State of Palestine
Ministry of Local Government

Integrated Cities and Urban Development Project (ICUD)

Design and Development of Shared Urban Geo-Database for the Targeted Four Urban Areas (Nablus, Ramallah-Al Bireh, Bethlehem and Hebron)

Reference Number: GZ-MDLF-246050-CS-CQS

SUGDB GIS Web Application Technical Users' Manual

Submitted to: **MoLG**

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Prepared by

Al-Ameen Technologies



صندوق تطوير وإقراض الهيئات المحلية
Municipal Development & Lending Fund

Name of Project: Integrated Cities and Urban Development Project (ICUD)

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This document is the users' manual to use SUGDB GIS web application, this document contains the full detailed manual for the Technical and IT users help them using the SUGDB web application and for general users as well.

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1 LIST OF ABBREVIATIONS

API	Application Programming Interface
SUGDB	Shared Urban Geo-Database
BI	Business Intelligence
CAD	Computer-Aided Drafting
CI/CD	Continuous Integration/ Continuous Deployment
COTS	Commercial Of the Shelf
DBMS	Database Management System
GIS	Geographic Information System
GML	Geography Markup Language
GUI	Graphical User Interface
ICT	Information and Communication Technology
ICUD	Integrated Cities and Urban Development
JSC	Joint Service Council
LC's	Local Coordinators
LGU	Local Government Unit
MDLF	Municipal Development and Lending Fund
MOLG	Ministry of Local Government
MOU	Memorandums of Understanding
OSS	Open-Source Software
PLA	Palestine Land Authority
RFP	Request for Proposals
SQL	Structured Query Language
SRS	Software Requirements Specification
SUGDB	Shared Urban Geo Database
TIN	Triangulated Irregular Networks
ToR	Terms of Reference
UAT	User Acceptance Test
WFS	Web Features Service
WMS	Web Map Service

2 INTRODUCTION

Welcome to SUGDB GIS web application. This is the user guide for the web application of the geographical information system (GIS) software (Madenati Plus), The contents of this document have been written and verified to the best of the knowledge of the authors, software developer and the editors, and is subjected to change specially in the software panels. Nevertheless, mistakes are possible.

Therefore, the authors, developer, editors and publishers do not take any responsibility or liability for errors in this document and their possible consequences. We encourage you to report possible mistakes to the software developer by any proper way of communications.

This document contains internal and external links. Clicking on an internal link moves within the document, while clicking on an external link opens an internet address.

Permission is granted to copy and distribute this document with any future users.

SUGDB Team

3 SYSTEM USED TECHNOLOGIES

The SUGDB is developed by an open-source technologies including the following software's:

Postgres SQL database v14.1: open-source object-relational database that uses and extends the SQL language combined with many features that safety store and scale the most complicated data workloads and support geospatial data. Postgres has more than 30 years of active development on the core platform. Postgres comes with many features such as free and open source, high extensible and it help to manage data no matter how big or small the dataset. Will use pgAdmin4 as tool for PostgreSQL database.



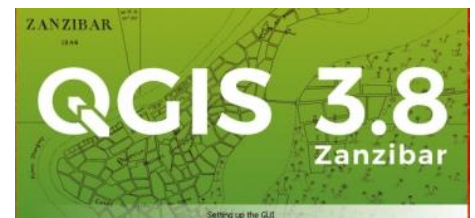
Programming language (Backend) **V.Net 6:** is an open source and cross-platform version of .NET That is maintained by Microsoft and the .NET community on GitHub. And all aspects of .NET core are open source including class libraries, runtime, compilers, languages, ASP.NET core web framework, and Entity Framework Core data access library. Will use visual studio 2022 as tool for asp.net core.



Programming language (Frontend): **Angular v12:** is open-source framework for building single page client application by using HTML and Typescript, and it implements a set of Typescript libraries that import into application. Angular built by team of engineers at google and by a community of individuals and corporations.



(Quantum GIS / **QGIS**): is an open-source framework enabling use to visualize, manage, edit, analyses data and compose printable maps and it run in different environment such as Linux, windows and android.

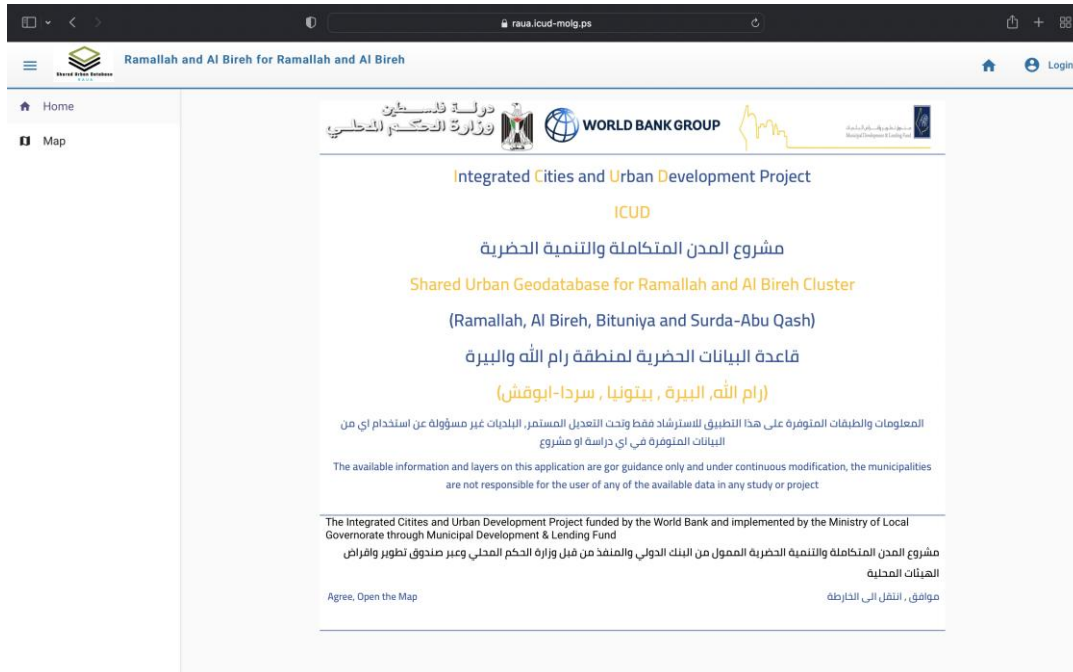


GeoServer: is an open-Source application distributed under GPL license for the handling and dissemination of geospatial data. It provides the functionalities to create spatial data infrastructures according to standards edited by Open Geospatial Consortium and ISO Technical Committee. Geo Sever created to manage and serve geospatial data both vector and raster as well as to create and extend georeferenced maps.



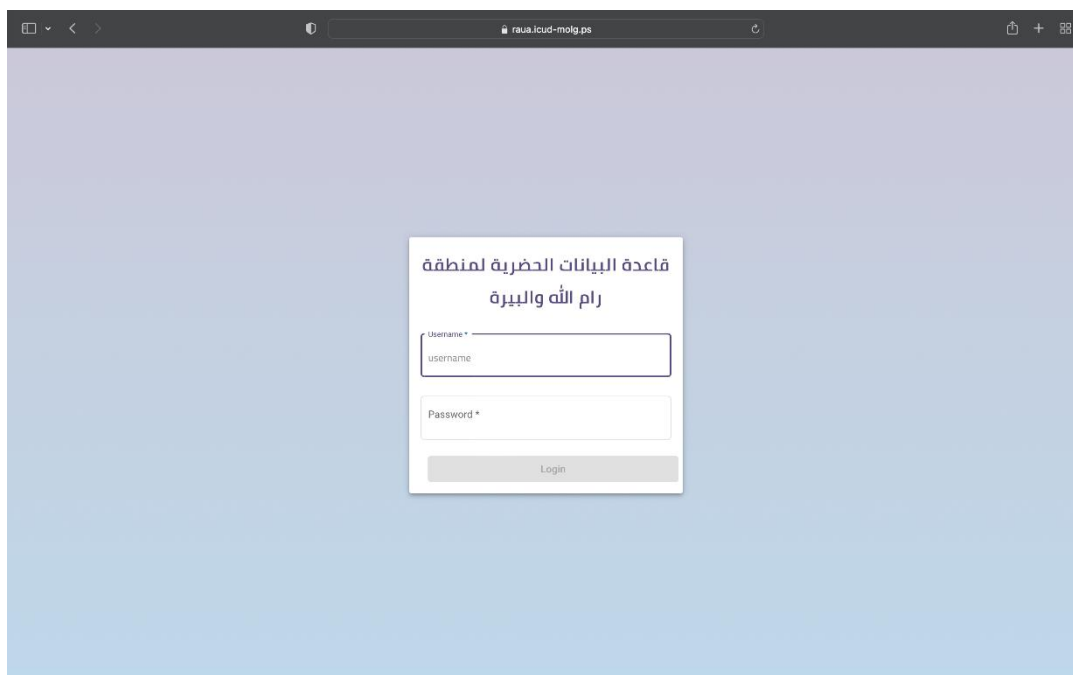
4 MAIN PAGE (HOME PAGE)

The welcoming home page, shows the project name (Integrated Cities and Urban Development Project – ICUD) and the main role of this application about a shared urban geodatabase for a specific urban area (Nablus, Ramallah, Bethlehem and Hebron). To login you need a pre-set user-name and password. To login to the system, in your internet browser type the system domain name then click enter, a welcoming page will started (see below).



Then click login in the top-right corner. Or select (Agree, Open the map) to see the public general map.

When you click (Login), login-page will started as below:



Type the user name and password and click Login

Main page will started as below, a side panel will appear contains the application main section, also a top bar contains some icon will appear as well, at the top right corner the user name will appear as below picture.

raua.icud-molg.ps

Ramallah and Al Bireh for Ramallah and Al Bireh

Home

Map

Reports

Settings

Lookups

Sections

دولة فلسطين
وزارة التخطيط الوطني

WORLD BANK GROUP

المجلس الحكومي للتخطيط
Municipal Development & Lending Fund

Integrated Cities and Urban Development Project

ICUD

مشروع المدن المتكاملة والتنمية الحضرية

Shared Urban Geodatabase for Ramallah and Al Bireh Cluster

(Ramallah, Al Bireh, Bituniya and Surda-Abu Qash)

قاعدة البيانات الحضرية لمنطقة رام الله والبيرة

(رام الله، البيرة، بيتونيا، سردا-ابوقش)

المعلومات والطبقات المتوفرة على هذا التطبيق للاسترشاد فقط وتحت التعديل المستمر، البلديات غير مسؤولة عن استخدام اي من البيانات المتوفرة في اي دراسة او مشروع

The available information and layers on this application are for guidance only and under continuous modification, the municipalities are not responsible for the user of any of the available data in any study or project

The Integrated Cities and Urban Development Project funded by the World Bank and implemented by the Ministry of Local Governorate through Municipal Development & Lending Fund

مشروع المدن المتكاملة والتنمية الحضرية الممول من البنك الدولي والمنفذ من قبل وزارة الحكم المحلي وعبر صندوق تطوير واقرض الهيئات المحلية









موافق , انتقل الى الخارطة

Agree, Open the Map

User Name

5 SYSTEM MAIN PAGE ICON

By default, SUGDB provides many panels to work with. Some of these panels are described below while others may be found in different parts of this document. The following icons will be used in many panels/pages which mean the following:

No	Tool	Meaning
1		Show / Hide sections (Side Panel)
2		Back to home page
3	 عربي	Change system language (English / Arabic)
4	 Logout	Logout
5		Edit filed, open field configurations
6		Edit layer identify settings
7		Edit layer search settings
8		Delete Item




6 MAP PAGE

The main role of this application is to show an interactive map that can show and preview GIS data with its metadata, this interactive map is to allow zooming in and out, panning around, identifying specific features, searching underlying data such as by topic or a specific indicator or information, also searching data using pre-set searching configurations and filters.



7 MAP TOOLS

Madeenti Plus web application contains several tools to help users to navigate and explore the interactive web map simultaneously. The map contains deferent layers, so user could then turn on or off any layer as needed to find the desired data very easy and in simple manner. SUGDB application contains the following map tools:

No	Tool	Meaning
1		Full screen
2		Zoom In
3		Zoom Out

No	Tool	Meaning
4		Print Print report including a snap shot of the zoomed area
5		Extend map (Show all map content)
6		Back to home location in the map (pre-set default location)
7		Identify Identify Tool: display the related information of specific item in the Governorate, Community and Implemented Activities features or any features visible on the map view
8		Pan move the view from an area to another one
9		Get X , Y Coordinates for a point
10		Zoom Window zoom to an area by drawing a box
11		Measure Area
12		Measure Distance (Line or Polyline)
13		Clear Map remove measurements from the view

Search tool: the map is supported by a search tool on the left side of the map page, allow the user to a deep look in the map metadata for specific feature asked by the user. As a result, a list of all features that met the selected search criteria will be presented in the search page, then user can zoom to the selected feature by clicking on one of the selected features.

8 ADDING LAYER IN SUGDB WEB APPLICATION

User should have administrator role to add new layer/s

After finishing all the “Adding layer technical part”, user can complete the work in SUGDB web application, the user should complete all prerequisites of the technical part of adding layer in PostgreSQL, QGIS and GeoServer software’s, then user can complete the work in the SUGDB as the following:

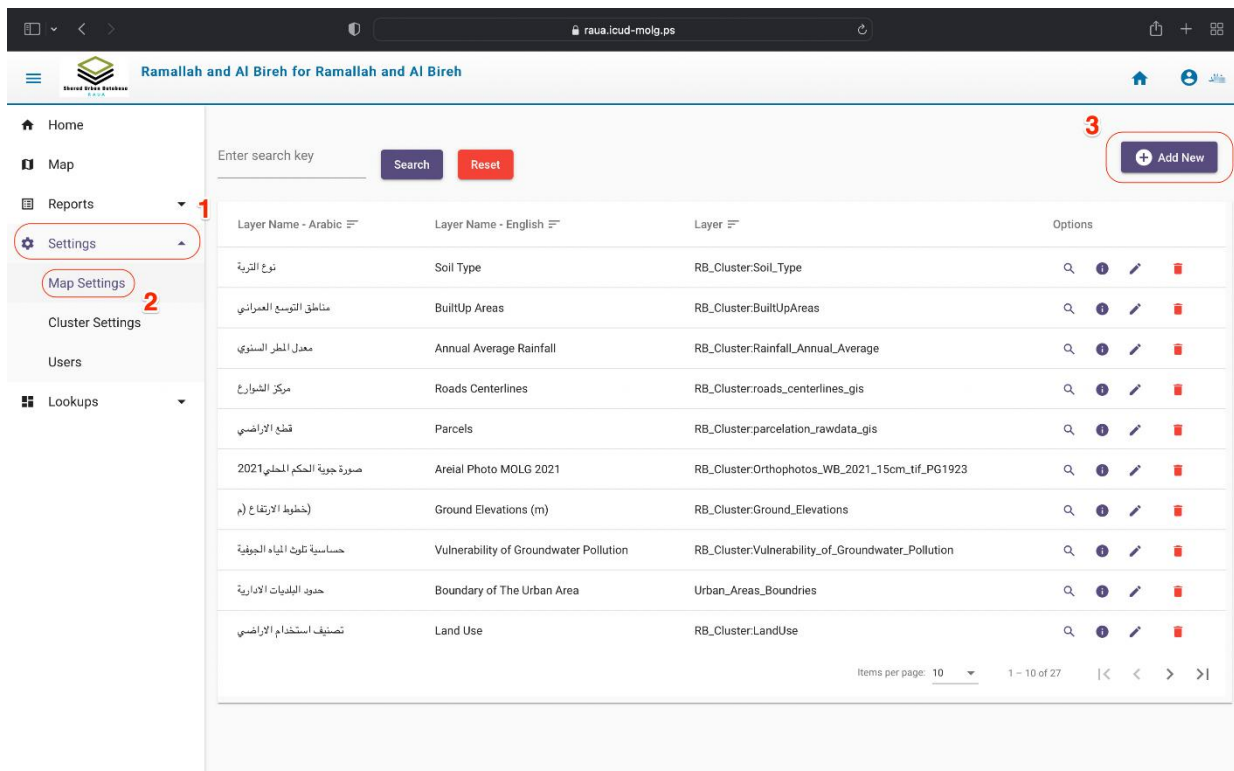
1. Click  Icon

2. Click Setting Section  Settings

3. Select (Map Settings)

4. Select (+Add New) Button





The screenshot shows the SUGDB web application interface. The left sidebar contains a menu with the following items: Home, Map, Reports, Settings (highlighted with a red circle and a red '1'), Map Settings (highlighted with a red circle and a red '2'), Cluster Settings, Users, and Lookups. The main content area displays a table of layers with columns for Layer Name - Arabic, Layer Name - English, Layer, and Options. The table contains 10 rows of data. A red '3' is placed above the '+ Add New' button in the top right corner of the main content area.

Layer Name - Arabic	Layer Name - English	Layer	Options
نوع التربة	Soil Type	RB_Cluster:Soil_Type	🔍 📄 ✎ 🗑
مناطق التوسع العمراني	BuiltUp Areas	RB_Cluster:BuiltUpAreas	🔍 📄 ✎ 🗑
معدل المطر السنوي	Annual Average Rainfall	RB_Cluster:Rainfall_Annual_Average	🔍 📄 ✎ 🗑
مركز الشوارع	Roads Centerlines	RB_Cluster:roads_centerlines_gis	🔍 📄 ✎ 🗑
قطع الأراضي	Parcels	RB_Cluster:parcelation_rawdata_gis	🔍 📄 ✎ 🗑
صورة جوية الحكم المحلي 2021	Aerial Photo MOLG 2021	RB_Cluster:Orthophotos_WB_2021_15cm_tif_PG1923	🔍 📄 ✎ 🗑
(خطوط الارتفاع م)	Ground Elevations (m)	RB_Cluster:Ground_Elevations	🔍 📄 ✎ 🗑
حساسية تلوث المياه الجوفية	Vulnerability of Groundwater Pollution	RB_Cluster:Vulnerability_of_Groundwater_Pollution	🔍 📄 ✎ 🗑
حدود البلديات الادارية	Boundary of The Urban Area	Urban_Areas_Boundries	🔍 📄 ✎ 🗑
تصنيف استخدام الاراضي	Land Use	RB_Cluster:LandUse	🔍 📄 ✎ 🗑

5. When click (+Add New) button, a new page name (Add Layer) will appear as in below picture.

Add Layer

Layer Name - Arabic * Layer Name - English *

Layer URL * Layer Name *

Arabic Style * English Style *

Layer Order in List * Display Order *

Is Published Show on Startup
 Is Basemap Show Legend in List
 Show Legend in Panel

Submit and New Submit Cancel

8.1 Setting Layer Information

To add layer information in (Add layer) page user should be in Administrator rol, each field with (* simbole) is a mandatory field.

Add Layer **How layer will be displayed in the Map**

Layer Name - Arabic * Layer Name - English *

Should be mach with GeoServer URL

Layer URL * Layer Name *

As it designed in QGIS (.sld file) **As it designed in QGIS (.sld file)**

Arabic Style * English Style *




Layer order when use Identify tool **Layer order on the map**

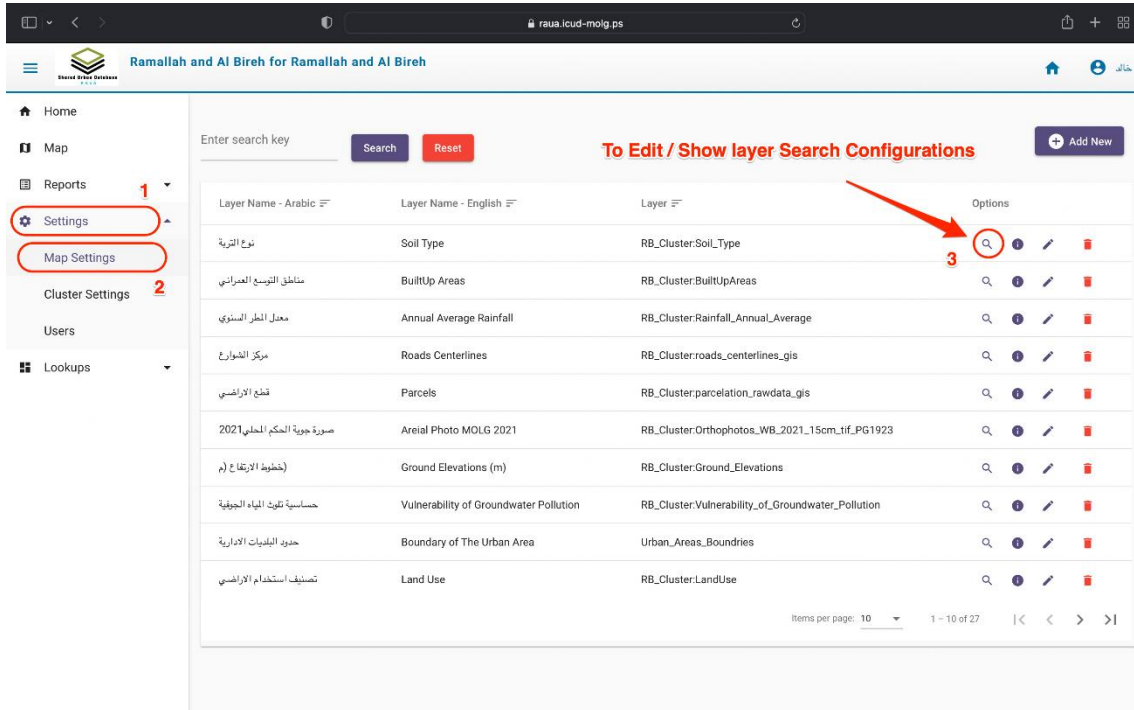
Layer Order in List * Display Order *

Is Published Show on Startup
 Is Basemap Show Legend in List
 Show Legend in Panel









































Submit and New Submit Cancel

8.2 Setting Layer Searchability (Search Settings)

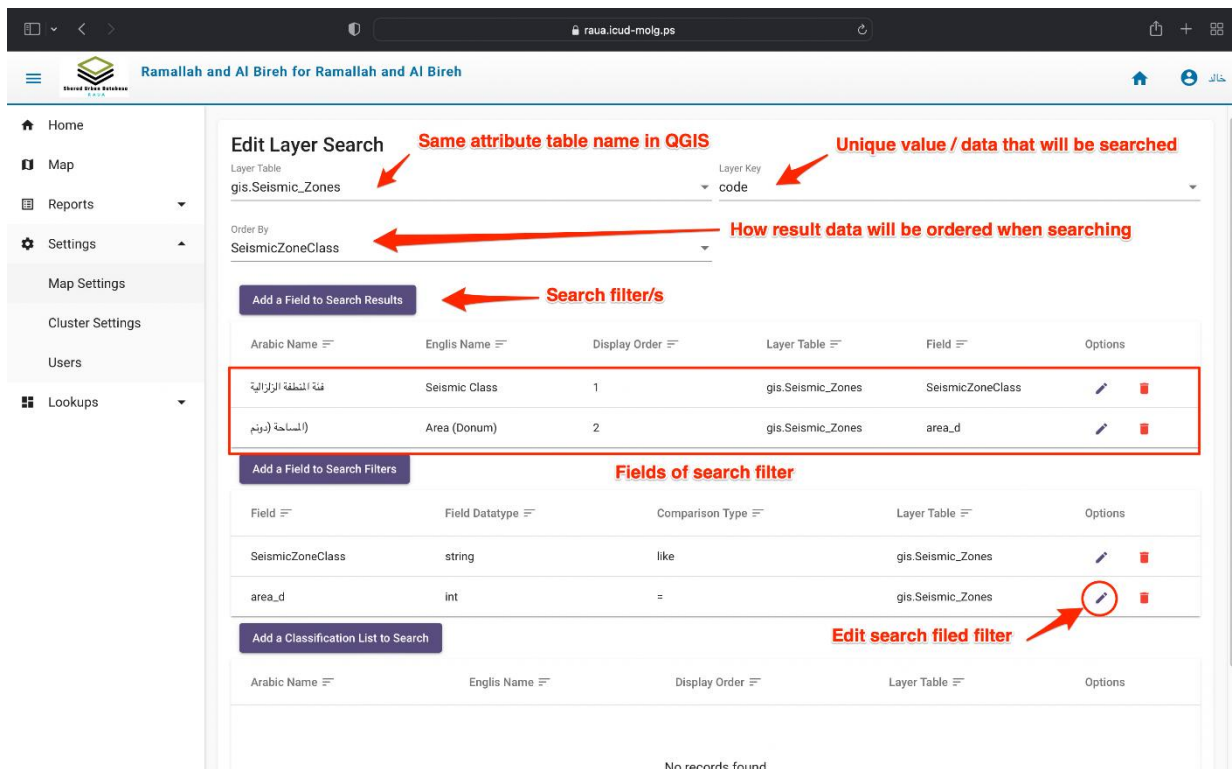
1. Click  Icon
2. Click Setting Section  Settings
3. Select (Map Settings), then click on the Search icon  to show or edit layer search configurations.



The screenshot shows the 'To Edit / Show layer Search Configurations' page. The table lists various layers with their search configurations. A red arrow points to the search icon in the 'Options' column for the 'Soil Type' layer.

Layer Name - Arabic	Layer Name - English	Layer	Options
نوع التربة	Soil Type	RB_Cluster:Soil_Type	   
مناطق التوسع العمراني	BuiltUp Areas	RB_Cluster:BuiltUpAreas	   
معدل المطر السنوي	Annual Average Rainfall	RB_Cluster:Rainfall_Annual_Average	   
مركز الشوارع	Roads Centerlines	RB_Cluster:roads_centerlines_gis	   
قطع الأراضي	Parcels	RB_Cluster:parcelation_rawdata_gis	   
صورة جوية المحكم المظهر 2021	Aerial Photo MOLG 2021	RB_Cluster:Orthophotos_WB_2021_15cm.tif_PG1923	   
(خطوط الارتفاع م)	Ground Elevations (m)	RB_Cluster:Ground_Elevations	   
حساسية تلوث المياه الجوفية	Vulnerability of Groundwater Pollution	RB_Cluster:Vulnerability_of_Groundwater_Pollution	   
حدود البلديات الادارية	Boundary of The Urban Area	Urban_Areas_Boundries	   
تصنيف استخدام الأراضي	Land Use	RB_Cluster:LandUse	   

4. On layer search configuration page (Edit Layer Search), user can edit modify or remove any search configuration for this specific layer.







The screenshot shows the 'Edit Layer Search' page. It includes configuration options for a layer search, such as Layer Table, Layer Key, Order By, and Search filters. Red arrows point to specific fields and icons.

Same attribute table name in QGIS (points to Layer Table: gis.Seismic_Zones)





Unique value / data that will be searched (points to Layer Key: code)

How result data will be ordered when searching (points to Order By: SeismicZoneClass)


Search filter/s (points to Add a Field to Search Results button)

Arabic Name	Englis Name	Display Order	Layer Table	Field	Options
فئة المنطقة الزلزالية	Seismic Class	1	gis.Seismic_Zones	SeismicZoneClass	 
(المساحة دونم)	Area (Donum)	2	gis.Seismic_Zones	area_d	 

Fields of search filter

Field	Field Datatype	Comparison Type	Layer Table	Options
SeismicZoneClass	string	like	gis.Seismic_Zones	 
area_d	int	=	gis.Seismic_Zones	 

Edit search filed filter (points to Edit icon in the second filter row)

5. Click in the pencil icon  to edit the field for any used filter for this specific layer future searching.

ramallah-and-ai-bireh-for-ramallah-and-ai-bireh

Home Map Reports Settings Map Settings Cluster Settings Users Lookups

Edit Layer Search

Layer Table: gis.Seismic_Zones Layer Key: code

Order By: SeismicZoneClass

Filed display order in search results

Pop-up screen will appear

Search result

Click on the Pencil icon to edit filed

Field	Options
Arabic Name	Seismic Class
Display Order	SeismicZoneClass
SeismicZoneClass	
area_d	
Layer Table	Options
gis.Seismic_Zones	
gis.Seismic_Zones	




Arabic Name * قِطْعَةُ الْمَنْطِقَةِ الزَّلزَلِيَّةِ
Englis Name * Seismic Class
Display Order * 1
Field SeismicZoneClass
Enabled

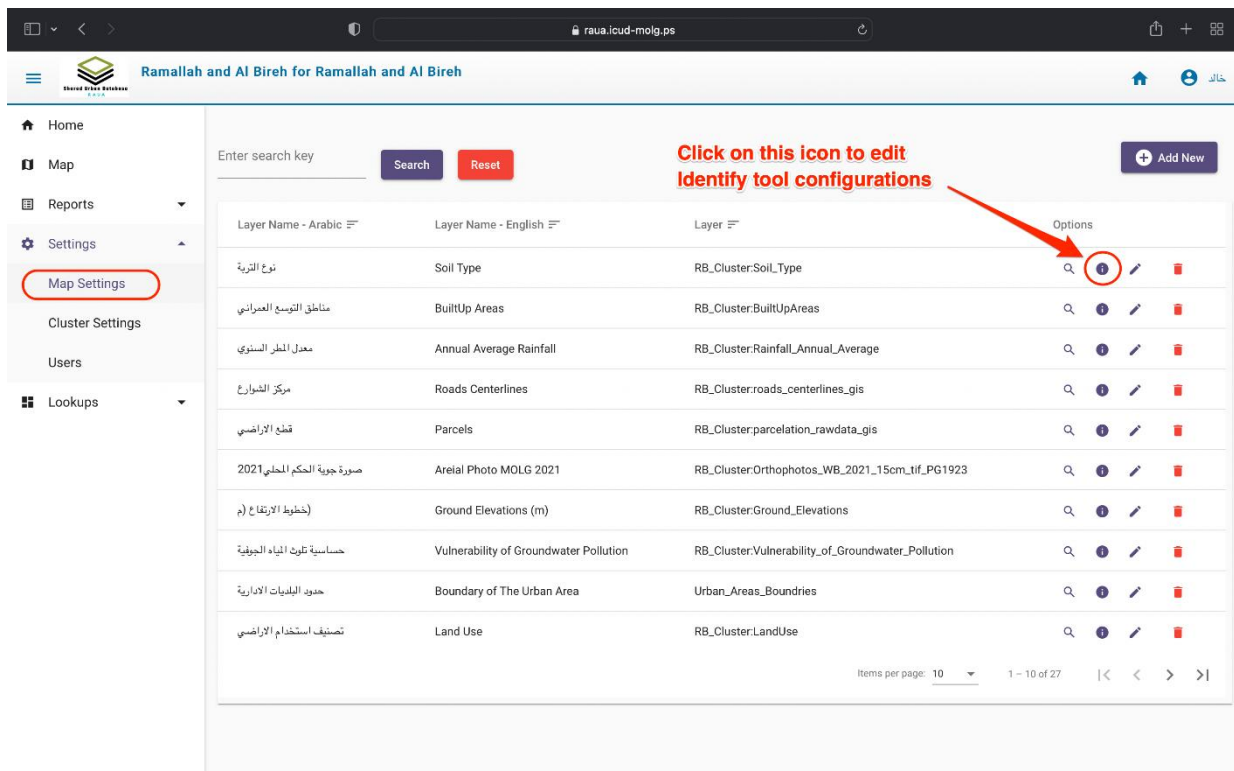
Submit Cancel

Arabic Name * Englis Name *
Display Order * Field
SeismicZoneClass
area_d
Layer Table * Options
gis.Seismic_Zones
gis.Seismic_Zones
Arabic Name * Englis Name * Display Order * Layer Table * Options









































8.3 Setting Layer Identificationability (Identify Settings)


To edit Identify tool results, user can edit or modify this result as the following:

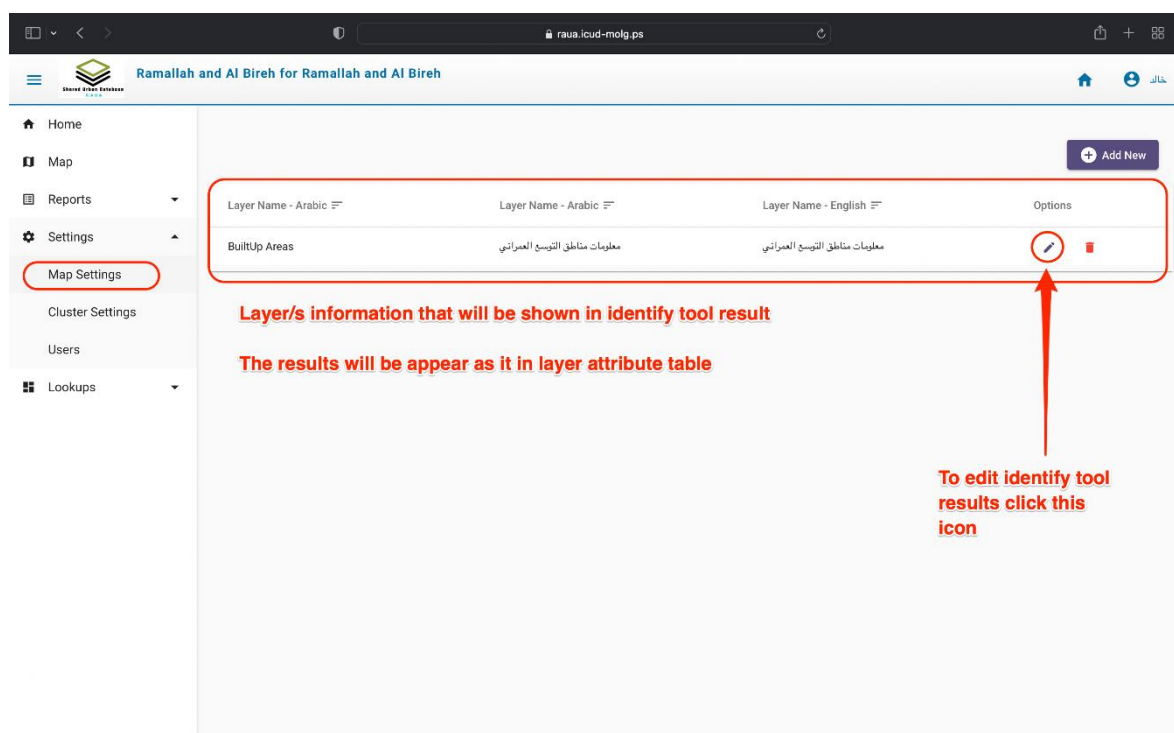
1. Click  Icon
2. Click Setting Section  Settings
3. Select (Map Settings), then click on this icon  to show or edit layer identify tool configurations.



Click on this icon to edit Identify tool configurations

Layer Name - Arabic	Layer Name - English	Layer	Options
نوع التربة	Soil Type	RB_Cluster:Soil_Type	   
مناطق التوسع العمراني	BuiltUp Areas	RB_Cluster:BuiltUpAreas	   
معدل المطر السنوي	Annual Average Rainfall	RB_Cluster:Rainfall_Annual_Average	   
مركز الشوارع	Roads Centerlines	RB_Cluster:roads_centerlines_gis	   
قطع الأراضي	Parcels	RB_Cluster:parcelation_rawdata_gis	   
صورة جوية الحكم المحلي 2021	Aerial Photo MOLG 2021	RB_Cluster:Orthophotos_WB_2021_15cm.tif_PG1923	   
(خطوط الارتفاع م)	Ground Elevations (m)	RB_Cluster:Ground_Elevations	   
حساسية تلوث المياه الجوفية	Vulnerability of Groundwater Pollution	RB_Cluster:Vulnerability_of_Groundwater_Pollution	   
حدود البلديات الادارية	Boundary of The Urban Area	Urban_Areas_Boundries	   
تصنيف استخدام الاراضي	Land Use	RB_Cluster:LandUse	   





4. To edit Identify tool results for this specify layer, click on the  icon, a new page will appear as below.





Layer/s information that will be shown in identify tool result

The results will be appear as it in layer attribute table

To edit identify tool results click this icon

Layer Name - Arabic	Layer Name - Arabic	Layer Name - English	Options
BuiltUp Areas	معلومات مناطق التوسع العمراني	معلومات مناطق التوسع العمراني	   

5. To edit identify tool results, click on the pencil  icon, a new page will appear as below.



Edit Layer Identify

Group Name - Arabic * معلومات مناطق التوسع العمراني

Group Name - English * معلومات مناطق التوسع العمراني

Group Order * 1

Show Style List

Layer Table gis.BuiltUpAreas

Layer Key code





Data Table gis.BuiltUpAreas

Data Key code

Order By By_Year_Arb

Data order when Identify several layers

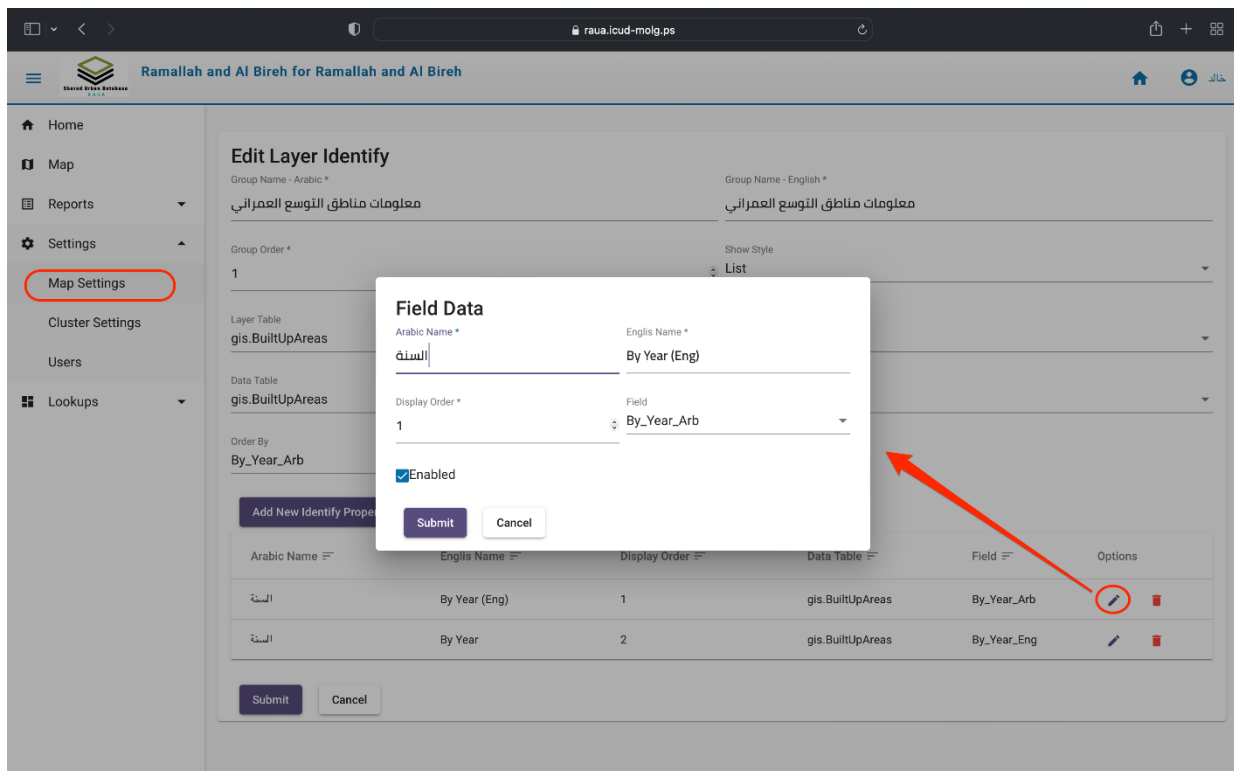
Identify tool filter

Arabic Name	Englis Name	Display Order	Data Table	Field	Options
السنة	By Year (Eng)	1	gis.BuiltUpAreas	By_Year_Arb	 
السنة	By Year	2	gis.BuiltUpAreas	By_Year_Eng	 

Identify tool result for this layer

Submit Cancel

6. Click on the pencil icon  to edit field for this filter.



Edit Layer Identify

Group Name - Arabic * معلومات مناطق التوسع العمراني

Group Name - English * معلومات مناطق التوسع العمراني

Group Order * 1

Show Style List

Layer Table gis.BuiltUpAreas

Layer Key code

Data Table gis.BuiltUpAreas

Data Key code

Order By By_Year_Arb

Field Data

Arabic Name * السنة

Englis Name * By Year (Eng)

Display Order * 1




Field By_Year_Arb

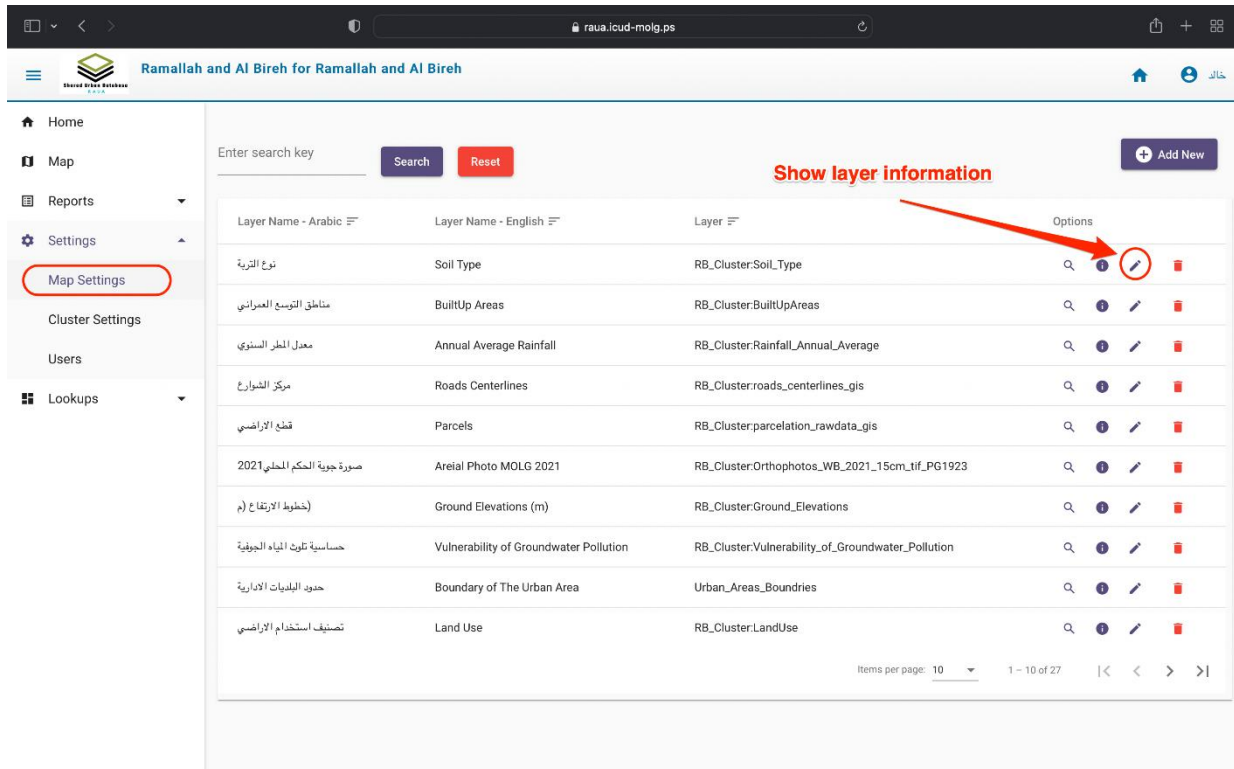
Enabled





















Submit Cancel

8.4 Save and Publish Layer

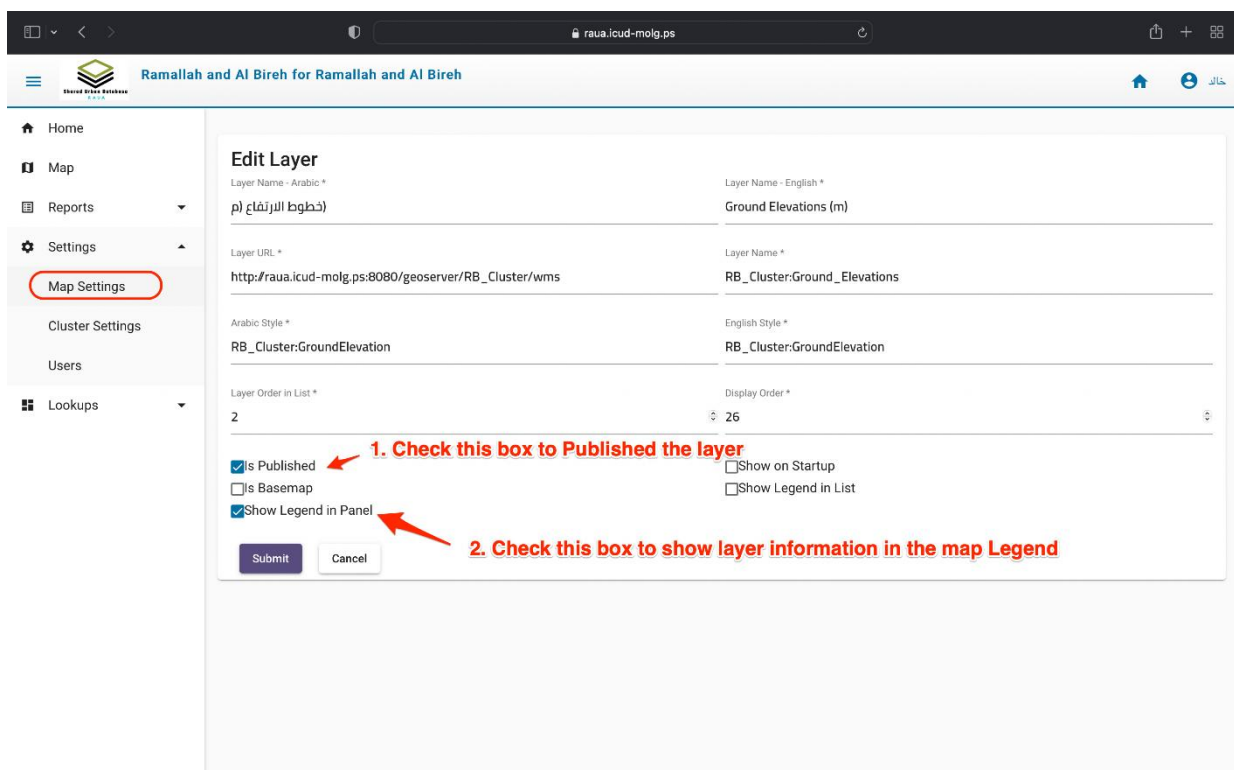
When user setup the (Search and Identify tools) results and setup its configurations, and after setting all layer needed information, user can publish this layer as the following:

1. Click  Icon
2. Click Setting Section  Settings
3. Select (Map Settings), then click on the pencil  icon, as below.



Layer Name - Arabic	Layer Name - English	Layer	Options
نوع التربة	Soil Type	RB_Cluster:Soil_Type	<input type="checkbox"/>  
مناطق التوسع العمراني	BuiltUp Areas	RB_Cluster:BuiltUpAreas	<input type="checkbox"/>  
معدل المطر السنوي	Annual Average Rainfall	RB_Cluster:Rainfall_Annual_Average	<input type="checkbox"/>  
مركز الشوارع	Roads Centerlines	RB_Cluster:roads_centerlines_gis	<input type="checkbox"/>  
قطعة الأراضي	Parcels	RB_Cluster:parcelation_rawdata_gis	<input type="checkbox"/>  
صورة جوية الحكم المحلي 2021	Aerial Photo MOLG 2021	RB_Cluster:Orthophotos_WB_2021_15cm_tif_PG1923	<input type="checkbox"/>  
(خطوط الارتفاع م)	Ground Elevations (m)	RB_Cluster:Ground_Elevations	<input type="checkbox"/>  
حساسية تلوث المياه الجوفية	Vulnerability of Groundwater Pollution	RB_Cluster:Vulnerability_of_Groundwater_Pollution	<input type="checkbox"/>  
حدود البلديات الادارية	Boundary of The Urban Area	Urban_Areas_Boundries	<input type="checkbox"/>  
تصنيف استخدام الأراضي	Land Use	RB_Cluster:LandUse	<input type="checkbox"/>  

4. On layer information page (Edit Layer Page) check the box Is Published box, to publish the layer on the map.



Edit Layer

Layer Name - Arabic * (خطوط الارتفاع م)

Layer Name - English * Ground Elevations (m)

Layer URL * http://raua.icud-molg.ps:8080/geoserver/RB_Cluster/wms

Layer Name * RB_Cluster:Ground_Elevations

Arabic Style * RB_Cluster:GroundElevation

English Style * RB_Cluster:GroundElevation

Layer Order in List * 2

Display Order * 26

Is Published **1. Check this box to Published the layer**

Is Basemap

Show on Startup

Show Legend in Panel **2. Check this box to show layer information in the map Legend**

Show Legend in List

9 SYSTEM USERS

General Note: User should be an administrator to access this page

1. You can add new users and its rule in the application from (Add new button)
2. To edit user information, click on the (Pencil Icon) beside the users name as in the below picture.

Search User

Enter search key

Add new User

Edit user configuration

UserName	Full Name - Arabic	Full Name - English	Role	Options
admin	admin	admin	Cluster Admin	
Ramadmin	باندية رام الله	Ramallah Municipality	Community Admin	

Items per page: 10 1 - 7 of 7

Delete User

3. In users information page (see below) administrator can change any information or configurations related/for any user.

Edit User

Full Name - Arabic * admin Full Name - English * admin UserName * admin

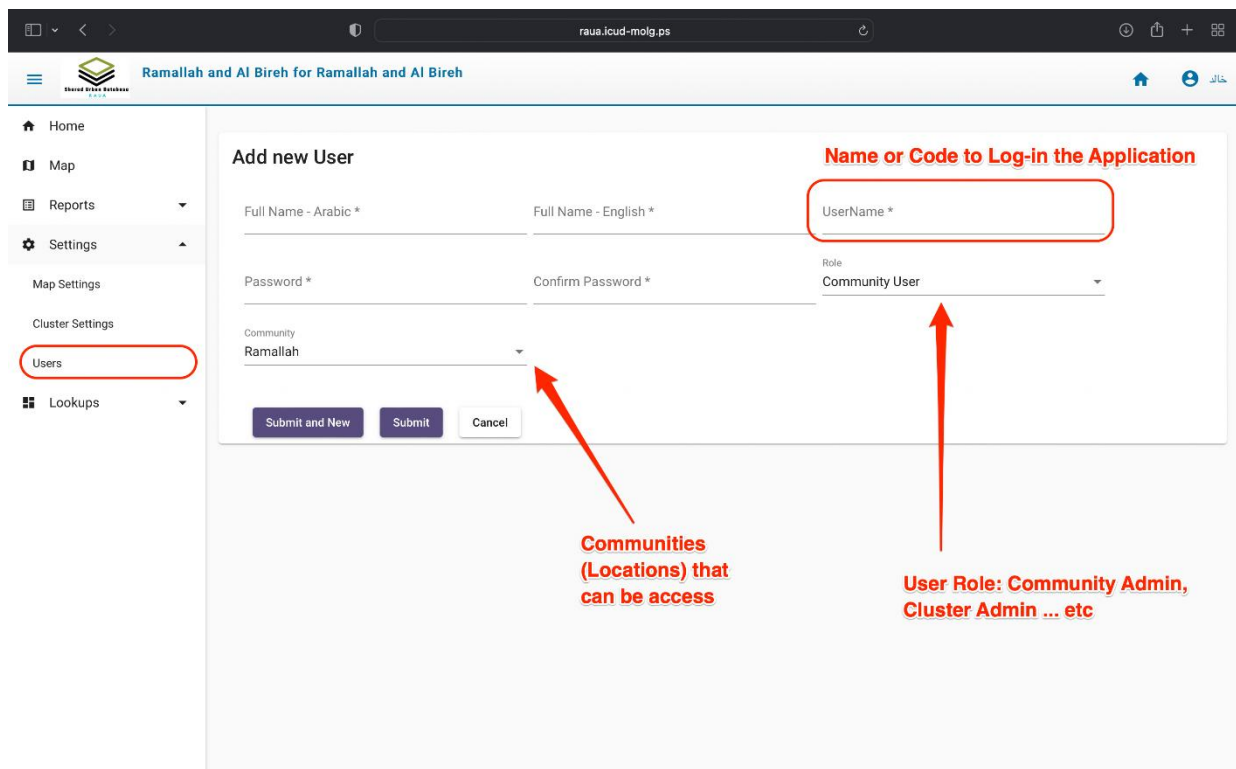
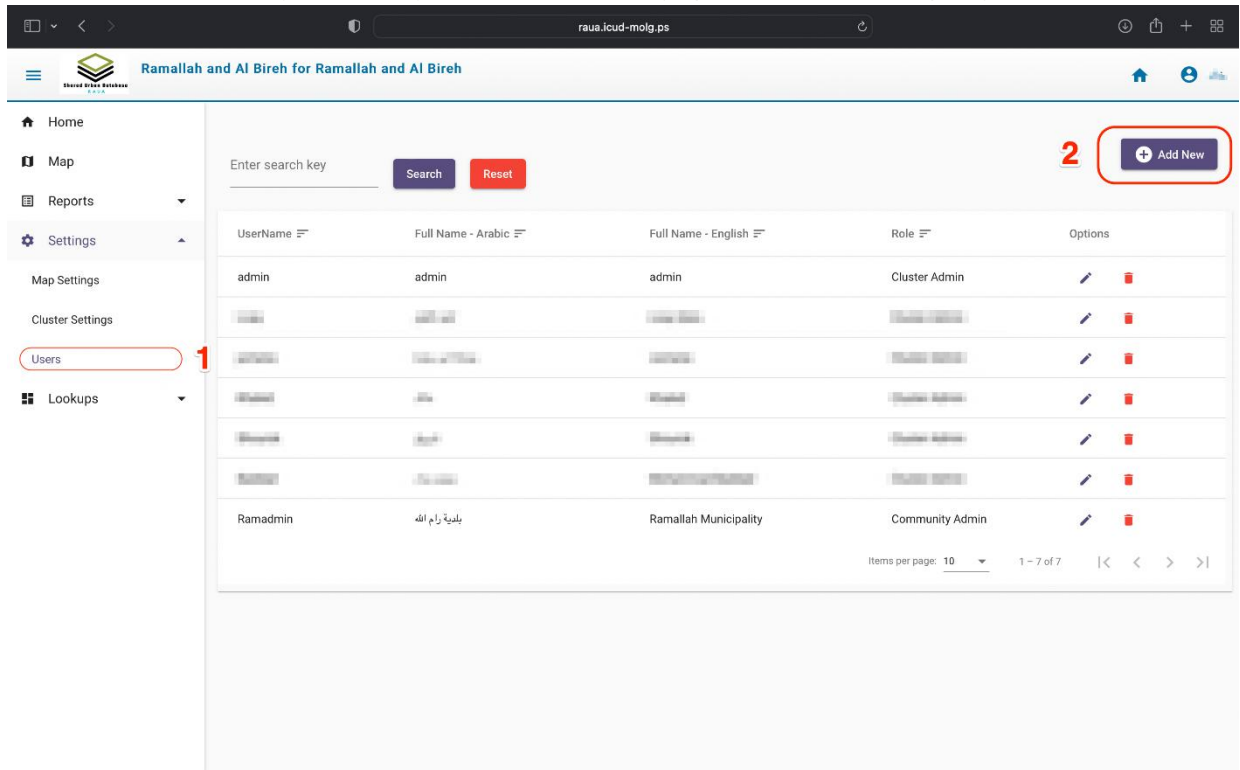
Role Cluster Admin Community Ramallah

Change User role : Community Admin, Cluster Admin ... etc.

The community that user can access

The user-name to log-in the application

4. To add new user, click on (+ Add New) button in the users page as in the following steps.




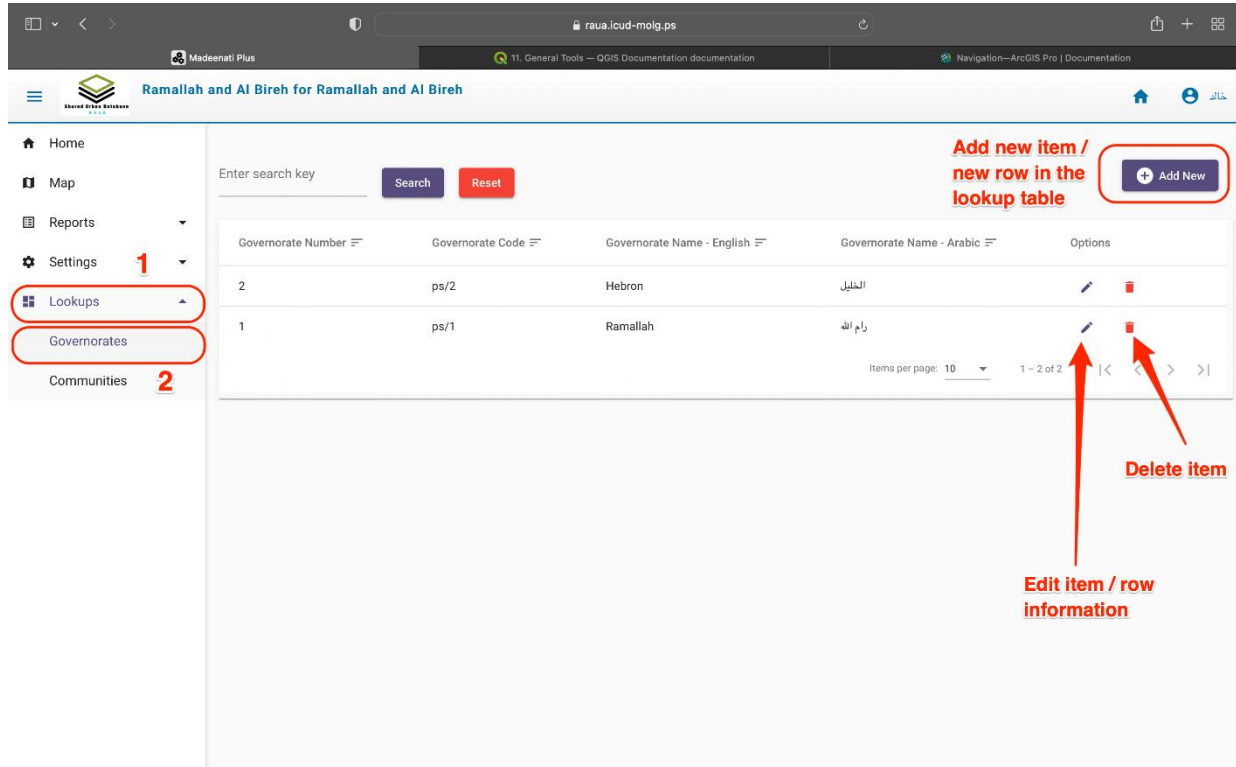
SUGDB System users is the following





1. **Cluster Admin:** Administration user can access and edit all information in all the urban area (Cluster) such as Ramallah-Cluster that contains: Ramallah, Al-Bireh, Betunia, Surda-Abu-Qash.
2. **Community Admin:** Administration user can access and edit all information in a specific community like (Ramallah city, or Al-Bireh ... ect.)
3. **Community User:** user can view data and fill some filed in a specific community.

10 SYSTEM LOOKUP

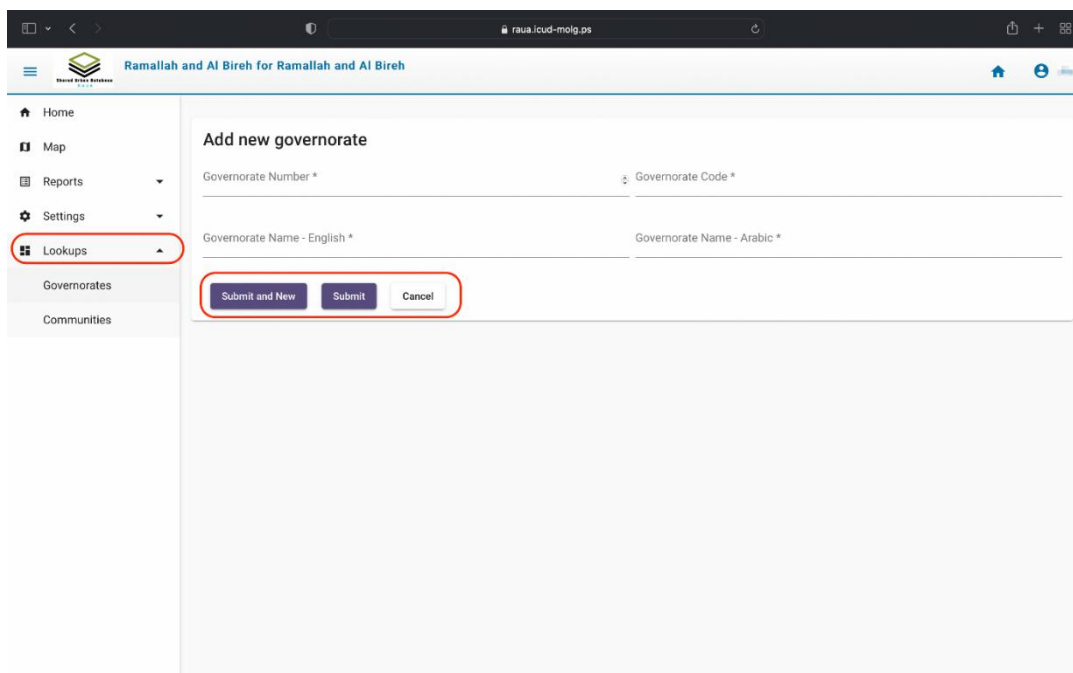
In order to ease the users works, especially when it comes filling the names of communities or governorate, the user

can chose from a drop-down lists  rather than fill the full name of the community or governorate, this information can be prepared in “Lookup tables” under the Lookups section, the application user can add, edit, create new items in the lookup as in the following steps:



Governorate Number	Governorate Code	Governorate Name - English	Governorate Name - Arabic	Options
2	ps/2	Hebron	الخليل	 
1	ps/1	Ramallah	رام الله	 

1. Click on (+ Add New) button.
2. Fill the lookup row data as in below picture
3. Click submit to save and close, or Submit and New to save the data and clear the content of all fields to fill new data, or click Cancel to cancel the data filling and return to lookup section.



Add new governorate

Governorate Number * Governorate Code *

Governorate Name - English * Governorate Name - Arabic *

11 ADDING NEW LAYER (TECHNICAL)

To add a new layer, user should following the following steps from 9.1 to 9.8 subsection on this manual, moving from QGIS, PostgreSQL, GeoServer and SUGDB web application as in the following:

11.1 In PostgreSQL and QGIS:

Generally, the Geodatabase is required to store all data and features in a structural way as well as to establish the necessary views, relations, triggers, connections, and others. The PostgreSQL is used to develop the geodatabase for the USGDB which consider all the administrative requirements of the intended application. Mainly, each community will have access to its features only at database scale while all of municipalities with each cluster can view the feature at cluster scale using the GIS-Web-Based application.

For the SUGDB, four main schemas (Geodatabases) were developed to store the collected features, each schema represents one cluster, in addition to one more schema used for the purpose of the GIS-Web-Based application (discussed in later sections), Figure 2. The list below shows the developed schemas for each targeted community, Appendix 1.

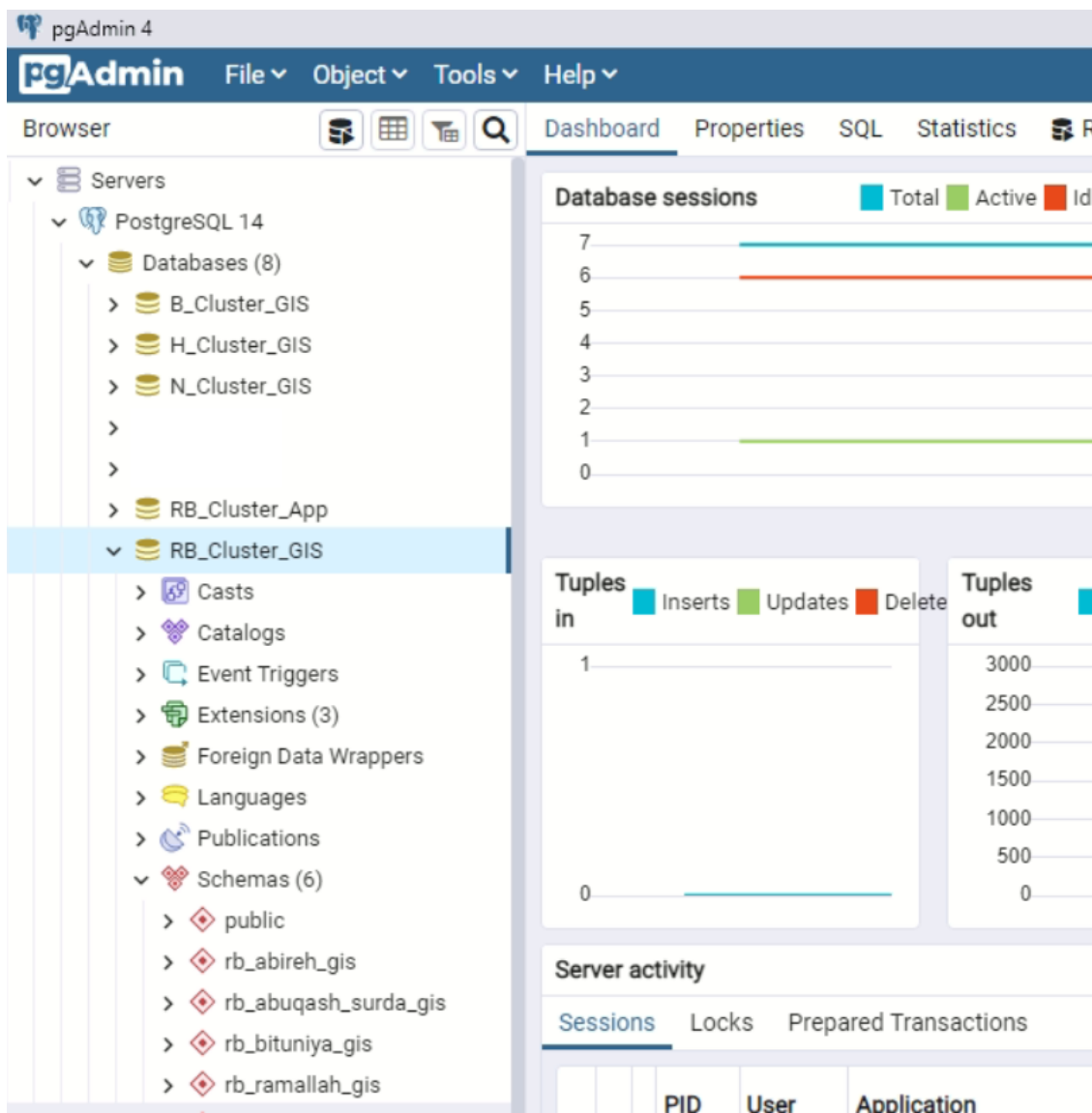


Figure 2: Developed USGDB schemas for the four target clusters on PostgreSQL

The features of each community were stored in their geodatabase within their cluster. For example, the features of Al Bireh were stored in “rb_ramallah_gis” sub-schema under the RB_Cluster_GIS main schema. Figure 3 shows the list of all features for Ramallah as developed in the PostgreSQL.

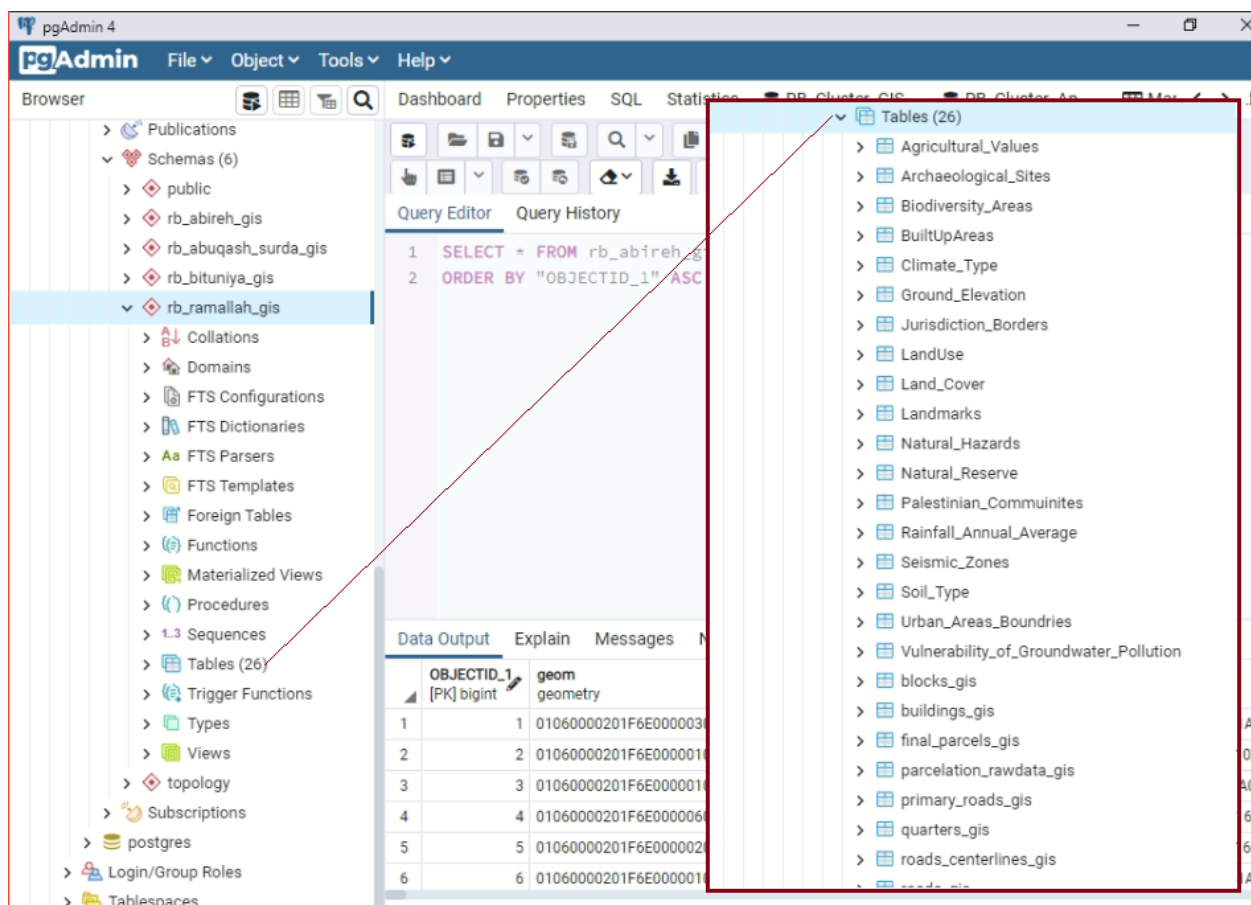


Figure 3: List of Ramallah features stored in its sub-schema

In addition to community sub-schemas within each cluster, a public schema was created. The main aim of this sub-schema is to merge all the relevant features in all sub-schemas into one feature covering the boundary of each cluster. Consequently, a special “View” was created for each feature within each cluster. To clarify the concept of views, the blocks features in four communities within Ramallah cluster is shown in Figure 4.a, the feature was obtained from the sub-schemas of each community (e.g., Ramallah and Al Bireh Cluster) as a separate feature. However, Figure 4.b shows the merged blocks in one feature on public sub-schema.

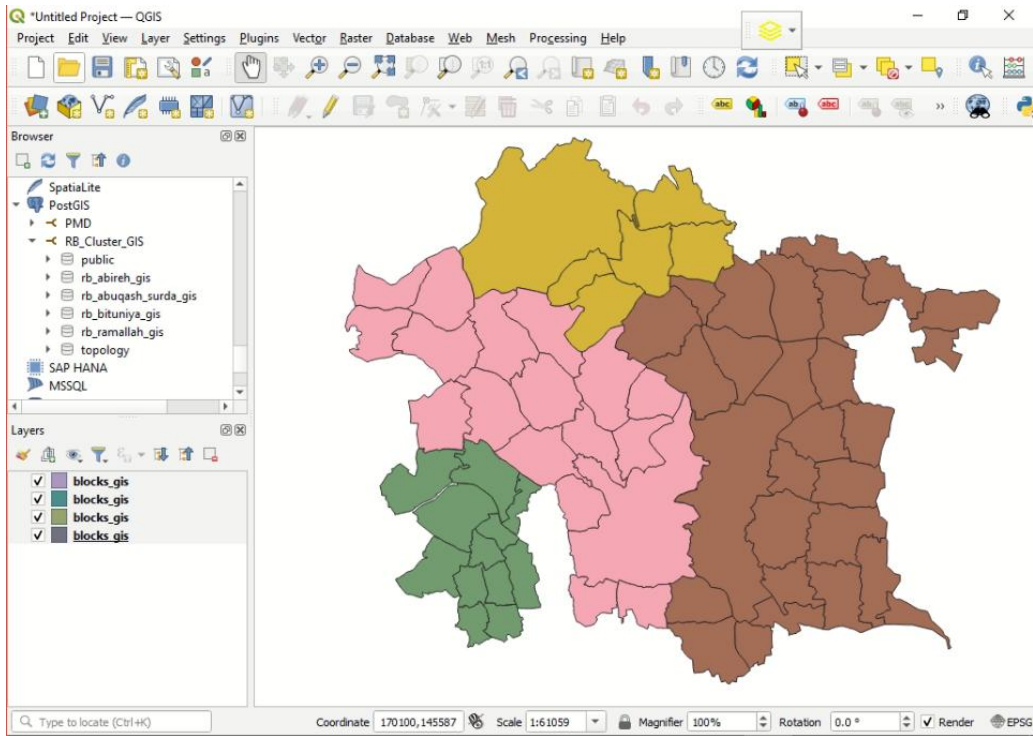


Figure 4.a: Four Blocks features as obtained from the community’s sub-schemas as separate features.

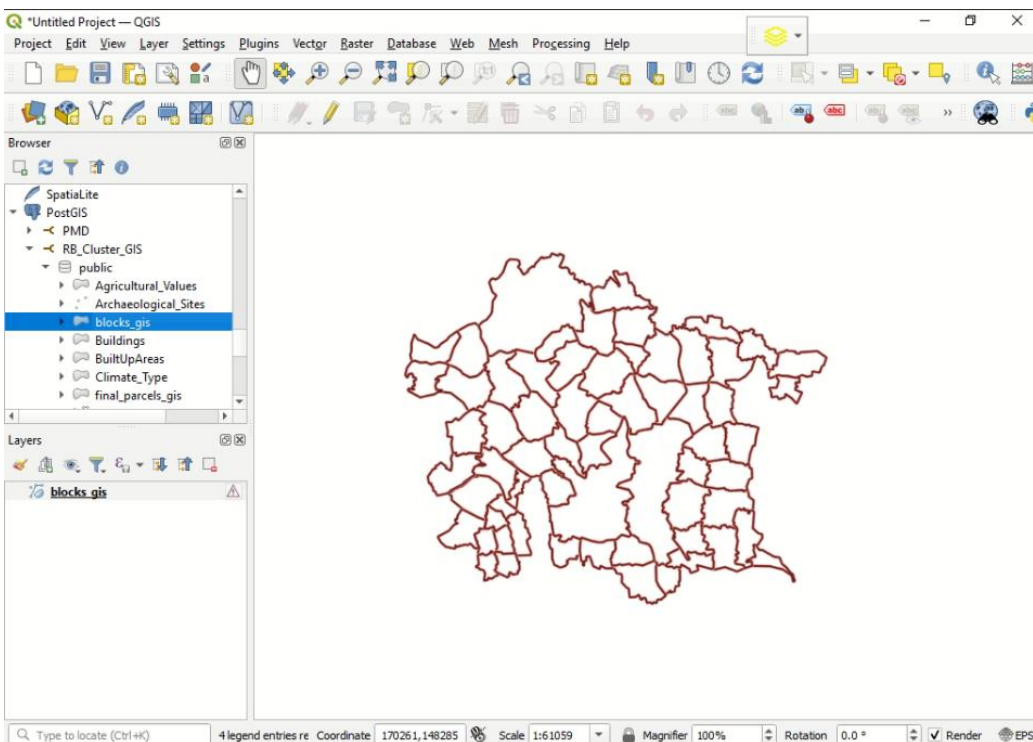


Figure 4.b: Merged Blocks feature representing all blocks within the entire cluster as obtained on Public sub-schema.

Accordingly, a special “**View**” for each feature on Public sub-schema in each cluster should be developed, noting that the features in terms of their structure shall be identical in all communities within each cluster. Figure 5 shows an example of the view of the Block features within Ramallah and Al Bireh cluster, the view shows how the features are merged within each cluster.

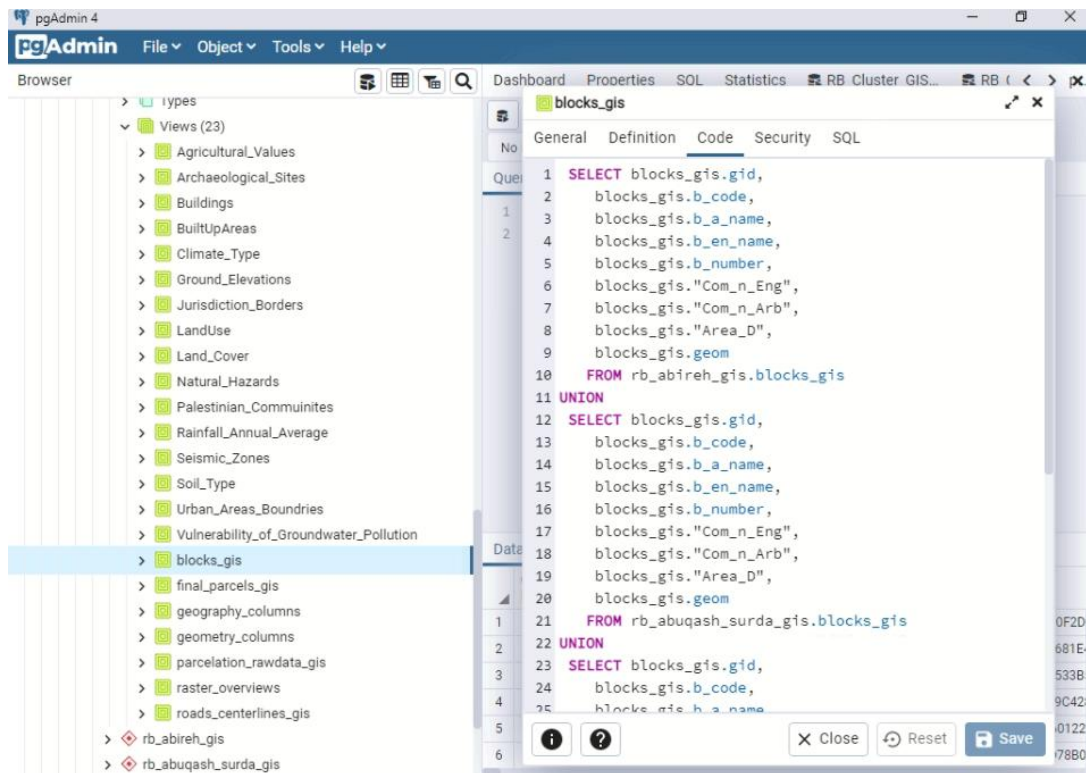


Figure 5: List of views that merge features for Ramallah and Al Bireh Cluster

11.2 GeoServer (Publishing Layer)

As a further next step to view features on a GIS_Web Based-Application, publishing features on the Geoserver (or other similar applications) is needed. To do this development, a number of steps shall be conducted on the Geoserver application starting from connecting the Geoserver with the SUGDB and ending with defining the style of each layer. The following sections present how the features of Ramallah and Al Bireh cluster were published on the Geoserver as an example. Similar steps shall be conducted for the other three clusters.

1. Development of RB_Cluster Workspace: Workspaces are containers to organize data for each cluster, used to group similar layers together. Figure 6 shows the development and parameters of the workspace for Ramallah and Al Bireh Cluster “RB_Cluster”.

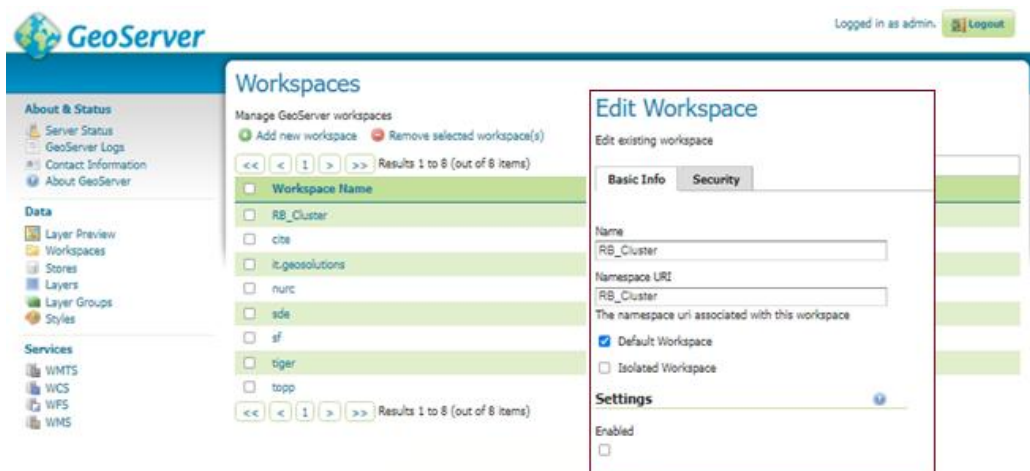


Figure 6: development of Workspace for Ramallah and Al Bireh Cluster

2. Establish Stores for Workspace: for each workspace one or more stores could be created. The store is used to connect the Geoserver with specific geodatabase of folders (as the used case to publish aerial

photos). For Ramallah and Al Bireh Cluster, two stores were created; the first store is used to connect Workspace with the public sub-schema for Ramallah and Al Bireh Cluster, Figure 7. The second store was used to connect the available aerial photos to the workspace, Figure 8.

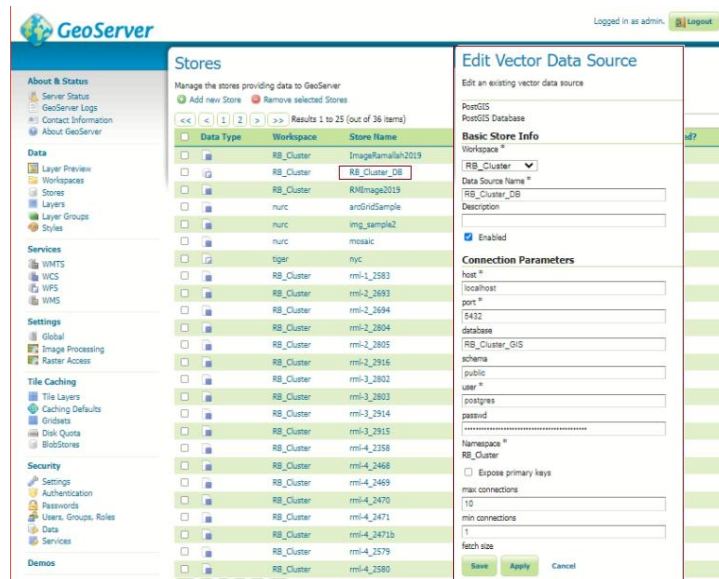


Figure 7: Development of RB_Cluster_DB for Ramallah and Al Bireh Cluster connecting features to the Geoserver.

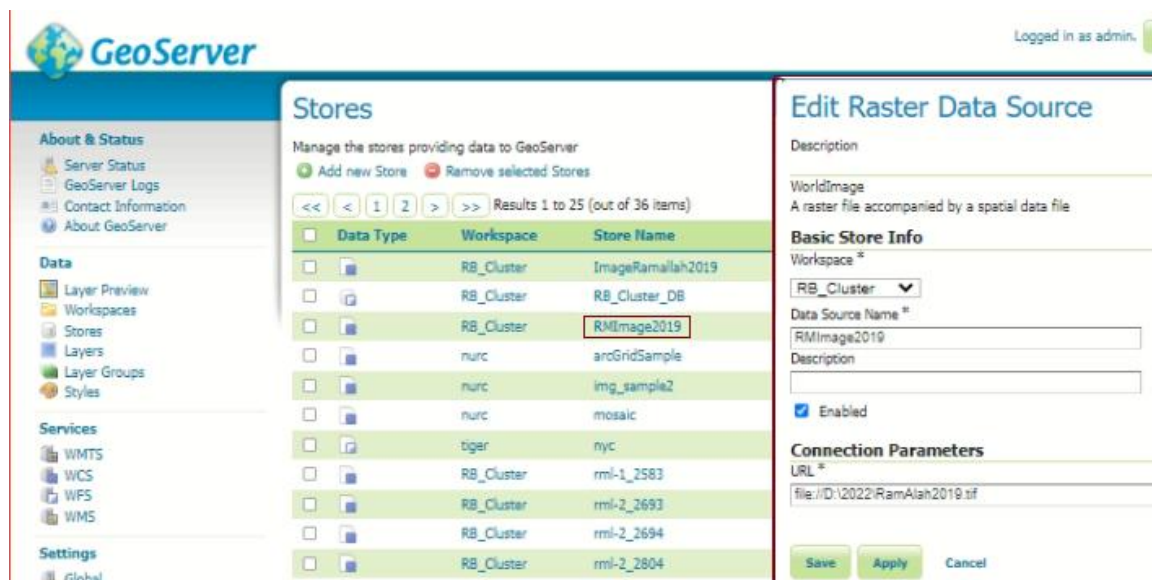


Figure 8: Development of RMImages2019 for Ramallah and Al Bireh Cluster connecting aerial photos from folder to the Geoserver.

3. Publishing layers: in each developed store, by adding a new layer, all available features under the connected geodatabase will be listed and ready for publish, Figure 9. User should publish each feature as service, mainly defining the spatial extend of the feature as well as the suitable style for the published feature. Figure 10.

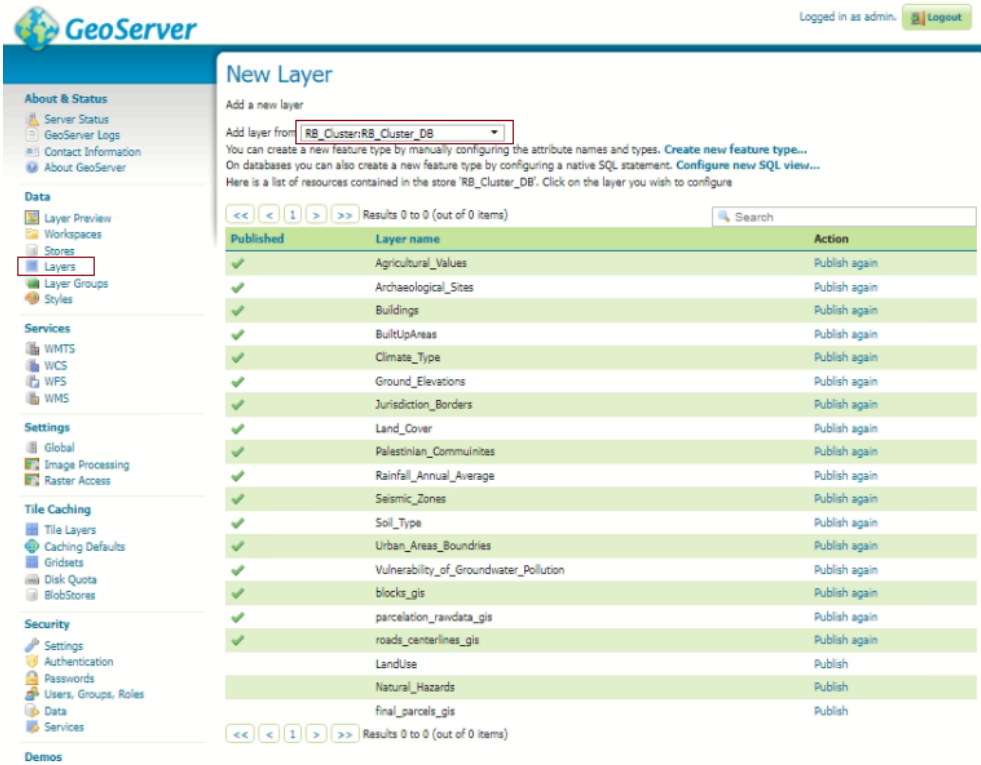


Figure 9: list of available features under RB_Cluster_DB Store

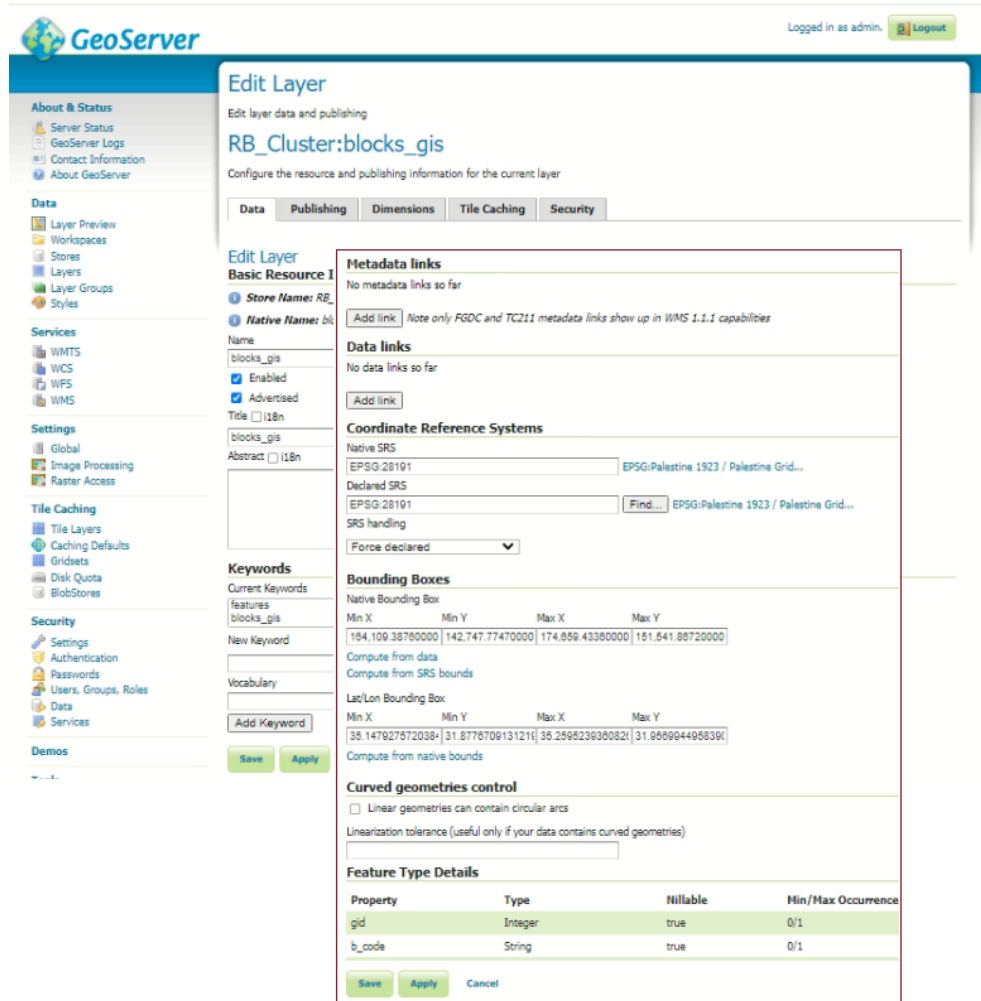


Figure 10.a: Defining the spatial extend of the blocks feature

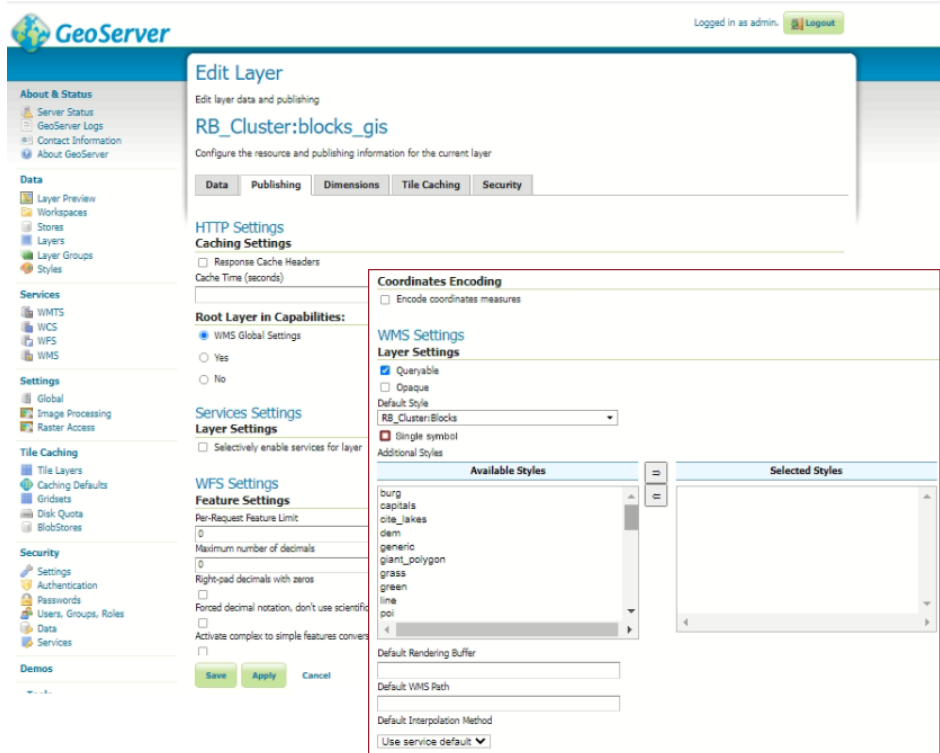


Figure 10.b: Defining the style of the blocks feature

- Preview Published layers: To make sure that the feature is correctly published in terms of spatial extend and the selected style, user can preview the published feature using “Layer Preview” tool using one of the available tools (e.g., OpenLayers), Figure 11

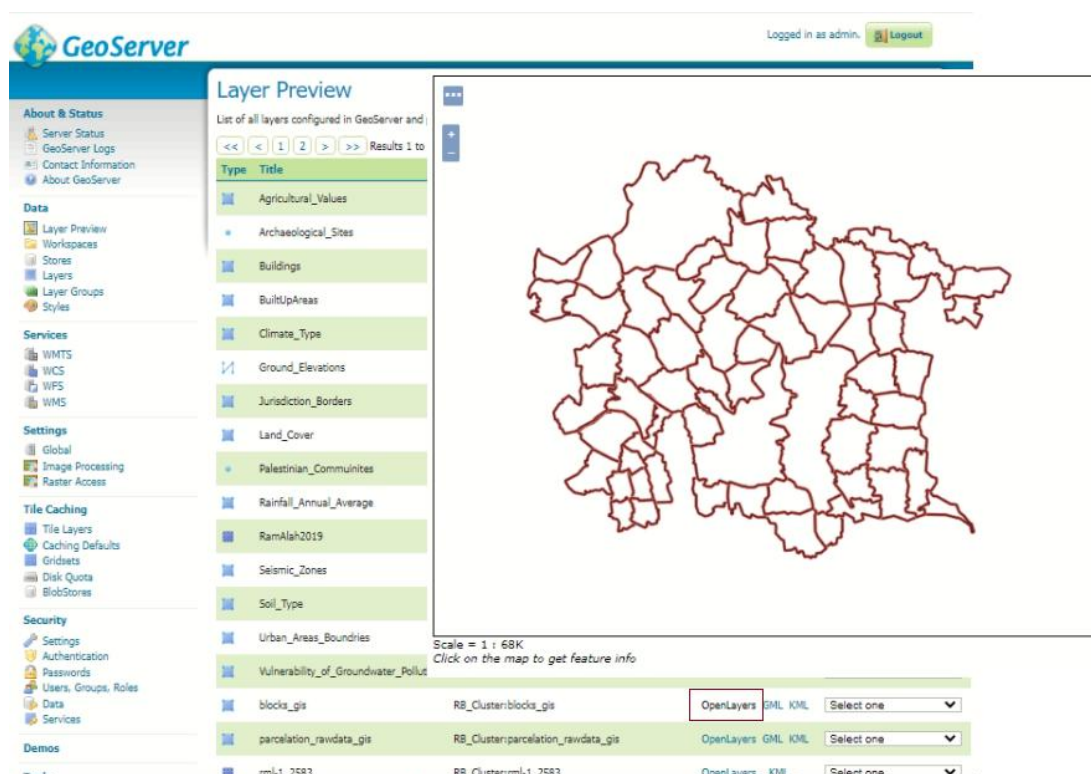
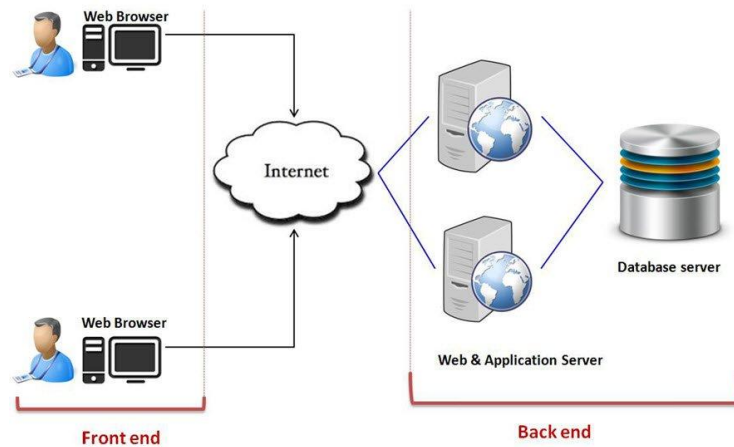


Figure 11: Preview Blocks feature using “OpenLayers” tool

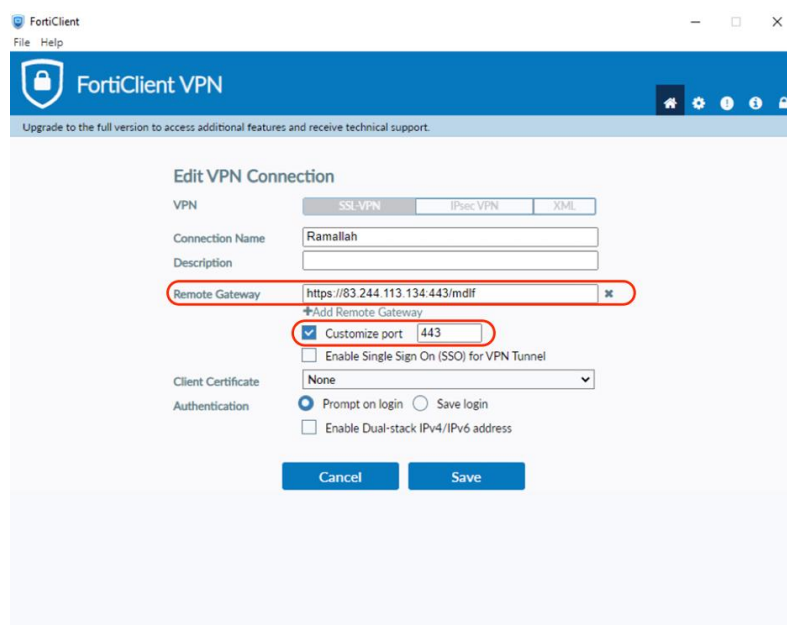
12 VPN CONNECTION TO SYSTEM SERVER:

SUGDB web application is deployed on cloud server been designated for the ICUD project, so Technical users or IT specialist can access the system servers via VPN¹ using the following steps, also see digram below shows the system connection in the cloud servers:



Setting connection remote gateway as the following:

VM Name	Cluster Name	VM Network	VM IP	VM VPN IP	VM VPN port
MDLF-01	Ramallah and Al Bireh Cluster Code	VMXNET3	172.16.210.10	83.244.113.134	443/mdlf
MDLF-02	Hebron Code	VMXNET3	172.16.210.20	83.244.113.134	443/mdlf
MDLF-03	Bethlehem Code	VMXNET3	172.16.210.30	83.244.113.134	443/mdlf
MDLF-04	Nablus Code	VMXNET3	172.16.210.40	83.244.113.134	443/mdlf
MDLF-05	Ramallah and Al Bireh Cluster DB	VMXNET3	172.16.210.50	83.244.113.134	443/mdlf
MDLF-06	Hebron DB	VMXNET3	172.16.210.60	83.244.113.134	443/mdlf
MDLF-07	Bethlehem DB	VMXNET3	172.16.210.70	83.244.113.134	443/mdlf
MDLF-08	Nablu DB	VMXNET3	172.16.210.80	83.244.113.134	443/mdlf



¹ In case user didn't have the VPN program, they can download it from the following link: <https://www.fortinet.com/support/product-downloads#vpn>

13 CONNECTING QGIS TO WEB APPLICATION

Technical users or IT specialist can connect the QGIS² to the system servers using the following steps

1. Setting connection remote gateway as the following:

Location	Name	Host / IP Address	Sub-Domain Name
Ramallah Urban Area	Ramallah-GIS	172.16.210.50	RAUA.icud-molg.ps
Nablus Urban Area	Nablus-GIS	172.16.210.40	NUA.icud-molg.ps
Hebron Urban Area	Hebron-GIS	172.16.210.20	HUA.icud-molg.ps
Bethlehem Urban Area	Bethlehem-GIS	172.16.210.30	BUA.icud-molg.ps

Edit PostGIS Connection

Connection Information

Name: Ramallah-GIS

Service:

Host: 172.16.210.50

Port: 5432

Database: RB_Cluster_GIS

SSL mode: disable

Authentication

Configurations Basic

User name: ramallah_gis Store

Password: Store

Warning: credentials stored as plain text in project file.

Only show layers in the layer registries

Don't resolve type of unrestricted columns (GEOMETRY)

Only look in the 'public' schema

Also list tables with no geometry

Use estimated table metadata

Allow saving/loading QGIS projects in the database

² In case user didn't have the QGIS program, they can download it from the following link:
<https://qgis.org/en/site/forusers/download.html>

14 CLOUD SERVE'S TECHNICAL TEAM

The service provider of the cloud service (TELNET Company) assigned the following team member's to follow-up the servers and to provide the needed technical support 24/7, where this team is the following:

Team member	Sohaib Herzallah	Ahmad Swailem	Loay Dmidy
Title	System Engineer	Network Engineer	Network Engineer
Mobile	0598102094	0593288885	0593288883
Email	sohaib@telnet.ps	ahmad@telnet.ps	loay@telnet.ps

15 APPENDIX 1: CLUSTER SCHEMA

List of USGDB schemas for the four target clusters on PostgreSQL

Cluster Schema	Cluster	Sub-Schema (Community DB)	Community
B_Cluster_GIS	Bethlehem	B_AIDoha_GIS	Al Doha
		B_AIKhader_GIS	Al Khader
		B_Artas_GIS	Artas
		B_Beit_Jala_GIS	Beit_Jala
		B_Beit_Sahour_GIS	Beit Sahour
		B_Bethlehem_GIS	Bethlehem
H_Cluster_GIS	Hebron	H_Beit_Kahel_GIS	Beit Kahel
		H_Dura_GIS	Dura
		H_Halhoul_GIS	Halhoul
		H_Hebron_GIS	Hebron
		H_Taffouh_GIS	Taffouh
N_Cluster_GIS	Nablus	N_Azmout_GIS	Azmout
		N_Beit_Iba_GIS	Beit Iba
		N_Beit_Wazan_GIS	Beit Wazan
		N_Dier_AlHatab_GIS	Dier AlHatab
		N_Dier_Sharaf_GIS	Dier Sharaf
		N_Iraq_Bureen_GIS	Iraq Bureen
		N_Kafer_Qalill_GIS	Kafer Qalill
		N_Nablus_GIS	Nablus
		N_Qouseen_GIS	Qouseen
		N_Rujeib_GIS	Rujeib
		N_Salem_GIS	Salem
		N_Surra_GIS	Surra
		N_Tell_GIS	Tell
		N_Zawata_GIS	Zawata
RB_Cluster_GIS	Ramallah and Al Bireh	RB_AlBireh_GIS	Al Bireh
		RB_AbuQash_Surda_GIS	AbuQash_Surda
		RB_Bituniya_GIS	Bituniya
		RB_Ramallah_GIS	Ramallah

16 APPENDIX 2: SAYTEM GIS MAIN LAYERS

Original Layer Name	New Name_Eng	New Name_Arb	Fields	Type	Length	Language
ABCAreas	Political Classifications	حدود الصلاحيات	Class_Eng	Text	100	English
			Class_Arb	Text	100	Arabic
AgriculturalLands_NSP	Lands Classification According to Agricultural Value	تصنيف الاراضي حسب القيمة الزراعية	LandValue_Eng	Text	100	English
			LandValue_Arb	Text	100	Arabic
Amenities	Landmarks	معالم المنطقة	LandmarkName_Eng	Text	100	English
			LandmarkName_Arb	Text	100	Arabic
			LandmarkType_Eng	Text	100	English
			LandmarkType_Arb	Text	100	Arabic
ApprovedMasterPlans	Approver Master Plans	المخطط الهيكلية	LandUse_Eng	Text	100	English
			LandUse_Arb	Text	100	Arabic
UnderObjectionMasterPlans	Under Objection Master Plans	المخطط الهيكلية (مرحلة الاعتراض)	LandUseObj_Eng	Text	100	English
			LandUseObj_Arb	Text	100	Arabic
UnderApprovalMasterPlans	Under Approval Master Plans	المخطط الهيكلية (مرحلة الموافقة)	LandUseApproval_Eng	Text	100	English
			LandUseApproval_Arb	Text	100	Arabic
			LandUseApproval_Date	Date	10	English
			LandUseApproval_Year	Year	4	English
ArchaeologicalSites_NSP	Archaeological Sites	مواقع اثرية	SiteName_Eng	Text	100	English
			SiteName_Arb	Text	100	Arabic
			SiteType_Eng	Text	100	English
			SiteType_Arb	Text	100	Arabic
BUILTUPAREAS1997	Built Up Areas 1997	المناطق المبنية سنة 1997	Governorate_Eng	Text	100	English
			Governorate_Arb	Text	100	Arabic
			Municipality_Eng	Text	100	English
			Municipality_Arb	Text	100	Arabic
BUILTUPAREAS2007	Built Up Areas 2007	المناطق المبنية سنة 2007	Governorate_Eng	Text	100	English
			Governorate_Arb	Text	100	Arabic
			Municipality_Eng	Text	100	English
			Municipality_Arb	Text	100	Arabic
BUILTUPAREAS2016	Built Up Areas 2016	المناطق المبنية سنة 2016	Governorate_Eng	Text	100	English
			Governorate_Arb	Text	100	Arabic
			Municipality_Eng	Text	100	English
			Municipality_Arb	Text	100	Arabic
Climate_Classification	Zones Classification According to Climate	تصنيف المناطق حسب المناخ	ClimateType_Eng	Text	100	English
			ClimateType_Arb	Text	100	Arabic
Communities_Points	Palestinian Communities	المجتمعات الفلسطينية	CommunityName_Eng	Text	100	English
			CommunityName_Arb	Text	100	Arabic
			CommunityType_Eng	Text	100	English
			CommunityType_Arb	Text	100	Arabic
Healthfacilities	Healthcare Centers	مراكز الرعاية الصحية	HealthcareCenterType_Eng	Text	100	English
			HealthcareCenterType_Arb	Text	100	Arabic

Original Layer Name	New Name_Eng	New Name_Arb	Fields	Type	Length	Language
			HealthcareCenterName_Eng	Text	100	English
			HealthcareCenterName_Arb	Text	100	Arabic
IsraeliNatureReserves	Nature Reserves under Israeli control	محميات الطبيعة تحت السيطرة الاسرائيلية	Governorate_Eng	Text	100	English
			Governorate_Arb	Text	100	Arabic
			Municipality_Eng	Text	100	English
			Municipality_Arb	Text	100	Arabic
LandCover_NS P	Land Cover	الغطاء الأرضي	LandCoverType_Eng	Text	100	English
			LandCoverType_Arb	Text	100	Arabic
Palestine_Natural_Hazards_Classification	Natural Hazards	المخاطر الطبيعية	NaturalHazardsType_Eng	Text	100	English
			NaturalHazardsType_Arb	Text	100	Arabic
			NaturalHazardsRate_Eng	Text	100	English
			NaturalHazardsRate_Arb	Text	100	Arabic
Rainfall_Annual Average	Rainfall Annual Average	معدل هطول الأمطار السنوي	RainfallAnnualAverageAmount_MM	String	100	English
Seismic_Zones	Seismic Zones	المناطق الزلزالية	SeismicZoneClass	String	100	English
Temperature_meanAnnual	Annual Temperature Mean	المتوسط السنوي لدرجات الحرارة	AnnualTemperatureMean_C	String	100	English
Soil	Lands Classification According to Soil Type	تصنيف الاراضي حسب نوعية التربة	SoilType_Eng	Text	100	English
			SoilType_Arb	Text	100	Arabic
			SoilTypeClass_Eng	Text	100	English
			SoilTypeClass_Arb	Text	100	Arabic
VulnerableAreas	Areas	تصنيف الأرض حسب مقاومة تلوث المياه الجوفية	VulnerableClass_Eng	Text	100	English
	Classification					
	according to the vulnerability of					
	Groundwater pollution					
VulnerableClass_Arb	Text	100	Arabic			
WBContours5m	5 Meters Contours	خطوط الكنتور كل 5م	Elevation	String	100	English
Landscape_NS P	Lands Classification according to Landscape	تصنيف الاراضي حسب المشهد الطبيعي	Governorate_Eng	Text	100	English
			Governorate_Arb	Text	100	Arabic
			Municipality_Eng	Text	100	English
			Municipality_Arb	Text	100	Arabic
Dumpsites	Dumping Sites	مواقع مكبات النفايات	DumpingSiteType_Eng	Text	100	English
			DumpingSiteType_Arb	Text	100	Arabic
			Governorate_Eng	Text	100	English
			Governorate_Arb	Text	100	Arabic
			Municipality_Eng	Text	100	English
			Municipality_Arb	Text	100	Arabic
IsraeliColoniesBuiltup2020	Israeli Colonies	المستعمرات الاسرائيلية	SettlementName_Eng	Text	100	English
			SettlementName_Arb	Text	100	Arabic

Original Layer Name	New Name_Eng	New Name_Arb	Fields	Type	Length	Language
Israeli_Industrial_Zones	Israeli Industrial Zones	المناطق الصناعية الإسرائيلية	IndustrialZoneName_Eng	Text	100	English
			IndustrialZoneName_Arb	Text	100	Arabic
NaturalReserves_NSP	Lands Classification according to Natural Reserve	تصنيف الاراضي وفق المخطط الوطني المكاني	SiteName_Eng	Text	100	English
			SiteName_Arb	Text	100	Arabic
Quarries	Quarries	المحاجر	QuarriesType_Eng	Text	100	English
			QuarriesType_Arb	Text	100	Arabic
Seperationwall 2018	Seperation and Annexation wall	جدار الضم والتوسع	WallStatus_Eng	Text	100	English
			WallStatus_Arb	Text	100	Arabic
			WallType_Eng	Text	100	English
			WallType_Arb	Text	100	Arabic
Transfer_Stations	Solid Waste Transfer Stations	محطات نقل النفايات الصلبة	StationName_Eng	Text	100	English
			StationName_Arb	Text	100	Arabic
Wastewater_Treatment_Plants	Wastewater Treatment Plants	محطات معالجة المياه العادمة	PlantName_Eng	Text	100	English
			PlantName_Arb	Text	100	Arabic
			PlantType_Eng	Text	100	English
			PlantType_Arb	Text	100	Arabic
Forest_NSP	Forests	غابات				
Ad_Doha_Urban_Area	Ad Doha Urban Area	الدوحة				
Al_Bireh_Urban_Area	Al Bireh Urban Area	البيرة				
Al_Khader_Urban_Area	Al Khader Urban Area	الخضر				
Artas_Urban_Area	Artas Urban Area	أرطاس				
Azmut_Urban_Area	Azmut Urban Area	عزموط				
Beit_Iba_Urban_Area	Beit Iba Urban Area	بيت ايبا				
Beit_Jala_Urban_Area	Beit Jala Urban Area	بيت جالا				
Beit_Kahil_Urban_Area	Beit Kahil Urban Area	بيت كاحل				
Beit_Sahur_Urban_Area	Beit Sahur Urban Area	بيت ساحور				
Beituniya_Urban_Area	Beituniya Urban Area	بيتونيا				
Beit_Wazan_Urban_Area	Beit Wazan Urban Area	بيت وازن				
Bethlehem_Urban_Area	Bethlehem Urban Area	بيت لحم				
Deir_al_Hatab_Urban_Area	Deir al Hatab Urban Area	دير الحطب				
Deir_Sharaf_Urban_Area	Deir Sharaf Urban Area	دير شرف				

Original Layer Name	New Name_Eng	New Name_Arb	Fields	Type	Length	Language
Dura_Urban_Area	Dura Urban Area	دورا				
Halhul_Urban_Area	Halhul Urban Area	حلحول				
Hebron_Urban_Area	Hebron Urban Area	الخليل و حدود اوسلو في الخليل H2 & H1				
Iraq_Burin_Urban_Area	Iraq Burin Urban Area	عراق بورين				
Kafr_Qallil_Urban_Area	Kafr Qallil Urban Area	كفر قليل				
Nablus_Urban_Area	Nablus Urban Area	نابلس				
Qusin_Urban_Area	Qusin Urban Area	قوصين				
Ramallah_Urban_Area	Ramallah Urban Area	رام الله				
Rujeib_Urban_Area	Rujeib Urban Area	روجيب				
Salim_Urban_Area	Salim Urban Area	سالم				
Sarra_Urban_Area	Sarra Urban Area	صرة				
Surda_Abu_Qash_Urban_Area	Surda Abu Qash Urban Area	سردا ابوقش				
Taffuh_Urban_Area	Taffuh Urban Area	تفوح				
Tell_Urban_Area	Tell Urban Area	تل				
Zawata_Urban_Area	Zawata Urban Area	زواتا				
Bethlehem_FutureExpansion	Bethlehem Future Expansion	منطقة توسع مستقبلي لمنطقة بيت لحم الحضرية				
Hebron_FutureExpansion	Hebron Future Expansion	منطقة توسع مستقبلي لمنطقة الخليل الحضرية				
Nablus_FutureExpansion	Nablus Future Expansion	منطقة توسع مستقبلي لمنطقة نابلس الحضرية				
RamallahAlBireh_FutureExpansion	Ramallah AlBireh Future Expansion	منطقة توسع مستقبلي لمنطقة رام الله والبيرة الحضرية				