SUPPLY OF GIS SYSTEM AND CONSULTING SERVICES

PROJECT NAME: BUILDING THE RESILIENCE OF AS AS SAMOU' COMMUNITIES THROUGH TERRITORIAL INTEGRATION OF AS SAMOU' AREA INCLUDING AREA C

FUNDED BY: EUROPEAN UNION
BENEFICIARY: AS SAMOU' MUNICIPALITY

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FINAL REPORT

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Contents

1. Overview 3
2. About the Consultant 4
2.1. Firm Information 4
3. Technical Approach & Methodology 6
3.1. Analysis of As Samou' Municipality Environment 6
3.2. Deployment of the required GIS Software 7
3.3. Designing the Database and building it 8
3.4. Importing the data into the database 19
3.5. Deployment and Customization of Web GIS Application 19
3.6. Training & Capacity Building 21
3.7. Launching the System to the public 21
4. Technical Issues and Obstacles 22
5. Results and Recommendations 22
6. Annexes 23
6.1. Annex-1 System User Manual 23

1. Overview

As Samou' Municipality is implementing a project funded by The European Union represented by the European Commission and implemented jointly with AlQuds Open University for Strengthening the resilience of As Samou' and its surrounding communities, namely "Building the Resilience of As Samou' Communities Through Territorial Integration of As Samou' Area Including Area C".

As Samou' Municipality allocated part of the grant it received from EU to build an integrated Geographic Information System (GIS) Application. In May 30th 2020, As Samou' Municipality signed a contract with external consultant: GIS Plus for Spatial Information Systems & Consultancies (GIS+) in order to design and develop the GIS application.

This report is prepared by GIS+, and aims to illustrate the system's components and the work methodology that was implemented during the project.

2. About the Consultant

2.1. Firm Information

GIS Plus for Spatial Information Systems & Consultancies (GIS Plus) is a Palestinian company specialized in providing professional consulting services in the field of Information Systems & Geographic Information Systems (GIS) and its related technologies.

GIS Plus was established in 2014, and based in Ramallah city (14 Emil Tuma Street, AlMasayef, Ramallah, Palestine), and registered in the Palestinian Ministry of National Economy (ID: 562533521/ registration certificate is attached in Appendix1).

Since its establishment, **GIS Plus was dedicated to afford advanced technical solutions in the field of Information Systems** for multiple institutions in the Palestinian public and private sectors, including building enterprise web, mobile, and desktop applications.

GIS Plus has proven its proficiency in implementing projects due to its multi-disciplinary professional staff has the capacity to accomplish tasks and duties within the strict and tight time frame.

GIS Plus has extensive experience in GIS field and has successfully implemented a number of GIS projects with a distinct staff having massive experience in geospatial industry, planning, surveying and spatial data design and analysis to ensure implementing projects on time and in accordance to specifications. GIS Plus is committed to meet client's needs and considers the end-user satisfaction to be one main pile of our missions.

Through its multi-disciplinary and innovative team, **GIS Plus was able to implement many projects in multiple fields** including but not limited to:

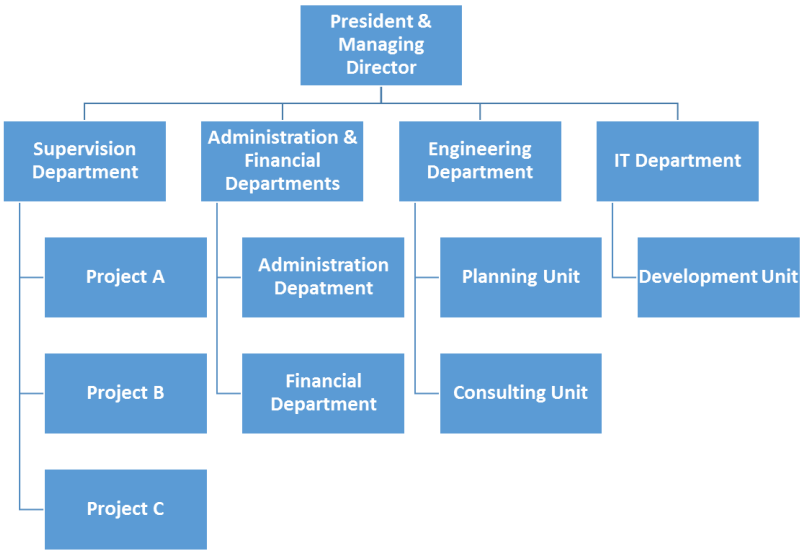
- Building Integrated Web GIS Portals aimed at providing extraordinary visual experience for end-users to view, edit, and analyze spatial data using cutting-edge-technologies.
- Developing Spatial databases specialized in storing and administering spatial and non-spatial data
- Publishing spatial data over web using special publishing engines in form of RESTful web services architecture.
- Integrating enterprise systems with GIS applications
- Building mobile GIS applications for field works with ability to work in online/offline modes
- Field data collection
- Spatial data digitization
- Aerial Photogrammetry
- GIS training services
- Suitability analysis studies by spatial data modelling
- Spatial Analysis studies
- Transforming data to spatial data formats using advanced conversion engines
- Developing custom workflow tools on top of GIS infrastructure

GIS Plus is an entity with consolidated expertise in the GIS sector, with a team of experts, including professionals with over 20 years of development of several projects with focus in implementing GIS solutions in several sectors including but not limited to: IT, municipal, water, valuation, financial, utility management, and health sectors.

GIS Plus has a strong local presence in Palestine and has worked with numerous Palestinian organizations and institutions, this experience played a main role in building a better understanding for the Palestinian IT sector in general and the GIS domain in particular.

GIS Plus understand that it could provide technical, administrative and logistics capacity, being able to support all the needs identified on the services, included under this assignment, the following points better elaborate GIS-Plus capacity to undertake the tasks and duties in this project:

The following diagram shows GIS Plus Organization chart.


President & Managing Director
Supervision Department
Administration & Financial Departments
Engineering Department
IT Department
Project A
Project B
Project C
Administration Depatment
Financial Department
Planning Unit
Consulting Unit
Development Unit

3. Technical Approach & Methodology

The consultant approach was composed of seven main phases that were:

- Analysis of As Samou' Municipality current environment
- Deployment of the required GIS Software
- Designing the Database and building it
- Importing data into database
- Deployment and Customization of Web GIS Application
- Training and Capacity Building
- Launching the system to the public

3.1. Analysis of As Samou' Municipality Environment

After signing the contract, the consultant started implementing the analysis phase based on the action plan that was approved by municipality (The plan is shown in a later section). So, the consultant sorted out many meetings in the period between 30-05-2020 and 13-06-2020 to study the current environment at the municipality, these meetings were with both Engineering department and IT department, and the consultant has collected information about the municipality needs, requirement, available data, software, and hardware; the following points outlines the characteristics of the environment at the municipality:

- **Available Data**
  - **Spatial Data**
    - Valuation and Registered Parcels layer
    - Valuation and Registered Blocks layer
    - Roads centerlines layer
    - Buildings layer
    - Water Distribution Network Layer
    - Electricity Distribution Network layer
    - Urban master plan layer (Land Use Classification)
    - Orthophoto layer
  - **Tabular Data**
    - Citizens Details (Hosted in another separate system)
    - Parcels Owners
    - Buildings Owners
    - Buildings' Tenants
    - Buildings' Licensing Details
    - Attachments related to municipality's buildings

- **IT Environment**
  - **Machines**
    - One Server for Hosting central GIS system (8 Cores, 64 GB RAM, 3 TB)
    - Three Desktop Machines for GIS officers at municipality
  - **Virtual Environment**
    - One Hyper-V Virtual Machine has been created on GIS server to host the GIS system with the following specs:
      - 8 Logical Processors
      - 32 GB RAM
      - 500 GB HDD
      - IP: 192.168.0.154
  - **Firewall**
    - A Firewall has been recently deployed at the municipality (at the end of the project), and the following should be opened and redirected to GIS virtual machine:
      - Port: 443

    - Port: 8888
  - **Backup Solution**
    - No backup solution available at the municipality, and the system's components are backed up frequently in a manual way until a backup solution is available that should backup the whole GIS virtual machine
  - **External Storage**
    - No external storage available at the municipality

- **Software on GIS Virtual Machine**
  - **Non-GIS Software**
    - Licensed Windows Server 2016
    - Antivirus: Not available
  - **GIS Software**
    - QGIS Desktop (Deployed by Consultant)
    - PostgreSQL Enterprise Database (Deployed by Consultant)
    - PostGIS extension for PostgreSQL (Deployed by Consultant)
    - Geoserver (Deployed by Consultant)
    - Geogate (Deployed by Consultant)
- **Municipality Systems**
  - Financial System (IFMIS): Available and running
  - Customer Care system: Old version is retired, and new system is under development

3.2. Deployment of the required GIS Software

3.2.1. Desktop Mapping Application

QGIS Desktop software has been selected as fundamental desktop mapping application to handle, edit, visualize and administrate the entire GIS system. This software application has massive capabilities in handling spatial data in all its format (vector and raster) as well as in demonstrating data in form of maps.

3.2.2. Spatial Database

PostgreSQL / PostGIS database engine is specialized in dealing with spatial data and is one of the most robust databases particularly when it comes to heavy data and processes. Fortunately, this database is fully compatible with other databases like SQL Server, Oracle, and MySQL databases, so it can read/write data from any other database that may be available at SQL Server. In this regard, **PostgreSQL / PostGIS** has been selected as a core database engine for spatial data. Having the data hosted in PostgreSQL / PostGIS, this will provide the system with:

1. Multiple and concurrent data editing;

2. Data archiving where data can be viewed\restored at particular date;

3. Data tracking where data can be accompanied with information about editors and the time the editing took place.

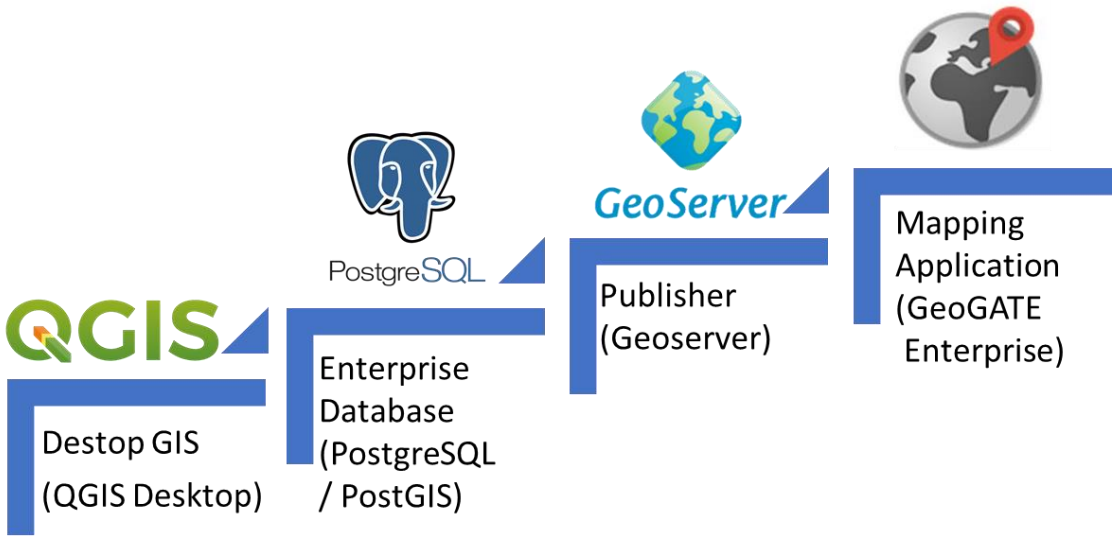
3.2.3. Server Mapping Application (Publishing Engine)

Geoserver has been deployer as publishing engine for As Samou' municipality. Geoserver is a powerful software that can publish multiple data formats such as vectors and rasters and all kinds of GIS data formats available at As Samou' Municipality, and can be tuned to achieve optimal performance over intranet/internet.

3.2.4. Web Mapping Application

As the main goal of the project is to serve municipality's spatial data by web mapping application. The selection of web mapping application must consider least efforts on development but rather configuration. Accordingly **GeoGATE Enterprise** has been used as web mapping application and has been customized to meet the municipalities functional requirements.

The figure below illustrates the proposed software components.



3.3. Designing the Database and building it

Following to the analysis and deployment phases, the consultant designed the database structure and tables/datasets schema in harmony with the data available at the municipality, the following tables summarize the schema of the tables in the database:

Table Name: Blocks

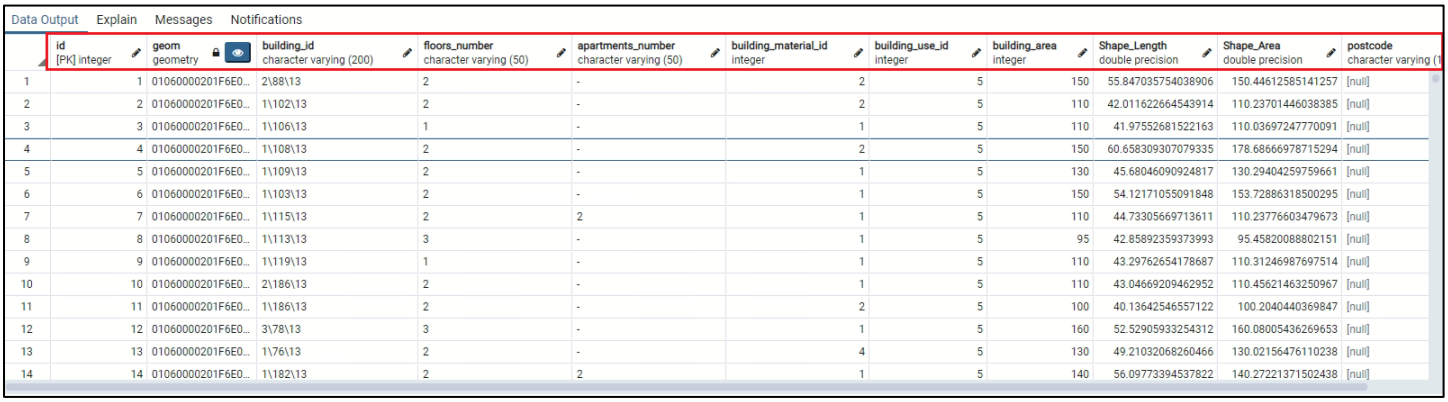
Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	block_number character varying (50)	block_name character varying (50)	Shape_Length double precision	Shape_Area double precision	Quarter_Number double precision	Quarter_Name text	registration text	active boolean
1	60	01060000201F6E0...	13	قطعات اسعيد الشمالية	2273.810585	268483.462257	0	-	تسوية	true
2	61	01060000201F6E0...	3	غوين الفوقا	2969.232906	382715.599576	1	البقارية الشمالية	تسوية	true
3	62	01060000201F6E0...	32	خلة انياص	4178.719509132063	773904.2315430143	0	-	تخمين	true
4	63	01060000201F6E0...	30	طوال امحمد	3853.377188747925	477605.7786116696	0	-	تخمين	true
5	64	01060000201F6E0...	31	رافات الدير	2923.573213267792	205466.97840897847	0	-	تخمين	true
6	65	01060000201F6E0...	37	واد شمعون السيميا	4706.458066548693	951468.7173933575	0	-	تخمين	true
7	66	01060000201F6E0...	36	خلة الكرسنة	5554.276547859776	1289396.9651104638	0	-	تخمين	true
8	67	01060000201F6E0...	24	واد جحيش	2962.8458785553744	418216.26302136347	0	-	تخمين	true
9	68	01060000201F6E0...	33	خادور	3829.315100615357	617543.25724621	0	-	تخمين	true
10	69	01060000201F6E0...	26	واد العمايز	4593.725404121079	1098456.361675745	0	-	تخمين	true
11	70	01060000201F6E0...	27	خلة رافات الشمالية	3768.361067346344	656324.8103463348	0	-	تخمين	true
12	71	01060000201F6E0...	34	خلة رافات	4425.9955767696865	837107.1892418194	0	-	تخمين	true
13	72	01060000201F6E0...	25	خلة الكروم	2318.973830248882	243050.2440572069	0	-	تخمين	true
14	74	01060000201F6E0...	13	الزقراق	2355.9792666483645	250014.6859382666	0	-	تخمين	true
15	75	01060000201F6E0...	39	ام غانم	3412.073282694368	643894.3165466276	0	-	تخمين	true
16	76	01060000201F6E0...	14	الحارة الشرقية	2281.607434153302	204678.77681096448	0	-	تخمين	true
17	77	01060000201F6E0...	21	المدارس	2970.5045145005233	513406.5492714505	0	-	تخمين	true
18	78	01060000201F6E0	16	الحارة الغربية	1601.9186056798376	116687.70277609705	0	-	تخمين	true

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
block_number	The number of the block
block_name	The name of the block
Shape_Length	The perimeter of the block in meter
Shape_Area	The area of the block in meter square

Quarter_Number	The number of the quarter
Quarter_Name	The name of the quarter
registration	The registration type of the block (two values: تسوية/ تخمين)
active	The activity status of the block (true: active/ false: inactive)

Table Name: Buildings

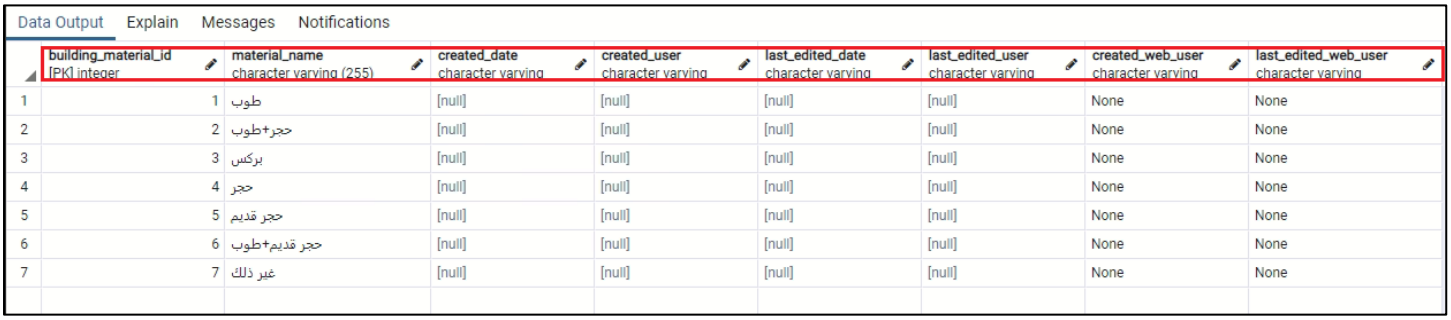


Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	building_id character varying (200)	floors_number character varying (50)	apartments_number character varying (50)	building_material_id integer	building_use_id integer	building_area integer	Shape_Length double precision	Shape_Area double precision	postcode character varying
1	1	01060000201F6E0...	2\88\13	2	-	2	5	150	55.847035754038906	150.44612585141257	[null]
2	2	01060000201F6E0...	1\102\13	2	-	2	5	110	42.011622664543914	110.23701446038385	[null]
3	3	01060000201F6E0...	1\106\13	1	-	1	5	110	41.97552681522163	110.03697247770091	[null]
4	4	01060000201F6E0...	1\108\13	2	-	2	5	150	60.658309307079335	178.68666978715294	[null]
5	5	01060000201F6E0...	1\109\13	2	-	1	5	130	45.68046090924817	130.29404259759661	[null]
6	6	01060000201F6E0...	1\103\13	2	-	1	5	150	54.12171055091848	153.72886318500295	[null]
7	7	01060000201F6E0...	1\115\13	2	2	1	5	110	44.73305669713611	110.23776603479673	[null]
8	8	01060000201F6E0...	1\113\13	3	-	1	5	95	42.85892359373993	95.45820088802151	[null]
9	9	01060000201F6E0...	1\119\13	1	-	1	5	110	43.29762654178687	110.31246987697514	[null]
10	10	01060000201F6E0...	2\186\13	2	-	1	5	110	43.04669209462952	110.45621463250967	[null]
11	11	01060000201F6E0...	1\186\13	2	-	2	5	100	40.13642546557122	100.2040440369847	[null]
12	12	01060000201F6E0...	3\78\13	3	-	1	5	160	52.52905933254312	160.08005436269653	[null]
13	13	01060000201F6E0...	1\76\13	2	-	4	5	130	49.21032068260466	130.02156476110238	[null]
14	14	01060000201F6E0...	1\182\13	2	2	1	5	140	56.09773394537822	140.27221371502438	[null]

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
building_id	The id of the building
floors_number	The number of the floors in the building
apartments_number	The number of the apartments in the building
building_material_id	The id of the material used in the building (this id is linked with the building_material table)
Building_use_id	The id of the building use (this id is linked with the building_use table)
Building_area	The area of the building in meter square
Shape_Area	The area of the building in meter square (from drawing)
Shape_Length	The perimeter of the building in meter
postcode	The postcode of the building

Table Name: Buildings_material



Data Output | Explain | Messages | Notifications

	building_material_id [PK] integer	material_name character varying (255)	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	طوب	[null]	[null]	[null]	[null]	None	None
2	2	حجر+طوب	[null]	[null]	[null]	[null]	None	None
3	3	برکس	[null]	[null]	[null]	[null]	None	None
4	4	حجر	[null]	[null]	[null]	[null]	None	None
5	5	حجر قديم	[null]	[null]	[null]	[null]	None	None
6	6	حجر قديم+طوب	[null]	[null]	[null]	[null]	None	None
7	7	غير ذلك	[null]	[null]	[null]	[null]	None	None

Field	Description
building_material_id	Unique id, its value is generated by database in an auto-increment way.
material_name	The name of the material used in a building
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: Buildings_use

Data Output | Explain | Messages | Notifications

	building_use_id [PK] integer	building_use character varying (255)	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	مبنى فارغ	[null]	[null]	[null]	[null]	None	None
2	2	تجاري	[null]	[null]	[null]	[null]	None	None
3	3	تجاري_سكني	[null]	[null]	[null]	[null]	None	None
4	4	ديوان	[null]	[null]	[null]	[null]	None	None
5	5	سكني	[null]	[null]	[null]	[null]	None	None
6	6	صناعي	[null]	[null]	[null]	[null]	None	None
7	7	صناعي_سكني	[null]	[null]	[null]	[null]	None	None
8	8	صحي	[null]	[null]	[null]	[null]	None	None
9	9	قيد الانشاء	[null]	[null]	[null]	[null]	None	None

Field	Description
building_use_id	Unique id, its value is generated by database in an auto-increment way.
building_use	The building use
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

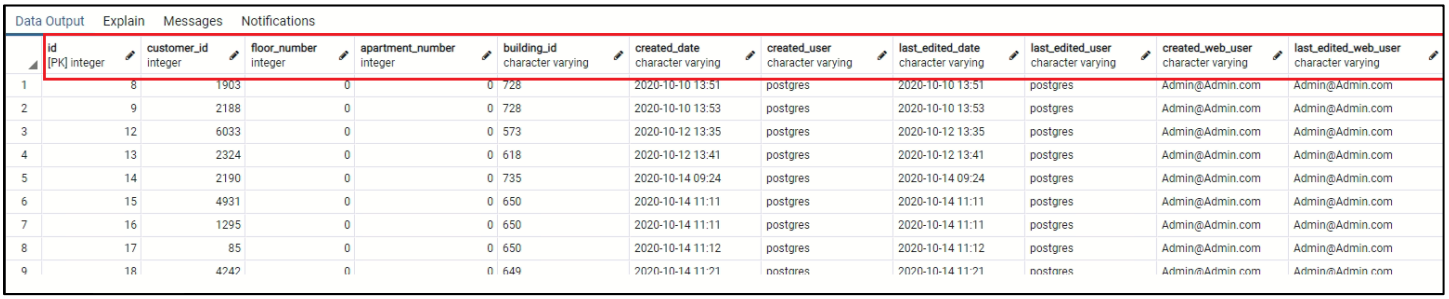
Table Name: Buildings_owners

Data Output | Explain | Messages | Notifications

	id [PK] integer	customer_id integer	floor_number integer	apartment_number integer	building_id character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying	notes text
	2	24	0	0	4905	2020-10-10 11:44	postgres	2020-10-10 11:44	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	5	829	0	0	680	2020-10-10 13:19	postgres	2020-10-10 13:19	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	6	1830	0	0	681	2020-10-10 13:20	postgres	2020-10-10 13:20	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	7	1052	0	0	728	2020-10-10 13:23	postgres	2020-10-10 13:23	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	8	321	0	0	729	2020-10-10 13:54	postgres	2020-10-10 13:54	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	9	321	0	0	730	2020-10-10 13:56	postgres	2020-10-10 13:56	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	10	7198	0	0	731	2020-10-11 10:22	postgres	2020-10-11 10:22	postgres	Admin@Admin.com	Admin@Admin.com	[null]
	11	514	0	0	726	2020-10-11 10:31	postgres	2020-10-11 10:31	postgres	Admin@Admin.com	Admin@Admin.com	[null]

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
Customer_id	The id of the citizen who owns the building in the IFMIS system
floor_number	The floor number in the building
apartment_number	The apartment number in the building
building_id	The id of the building
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record
note	General notes for a building

Table Name: Buildings_renters

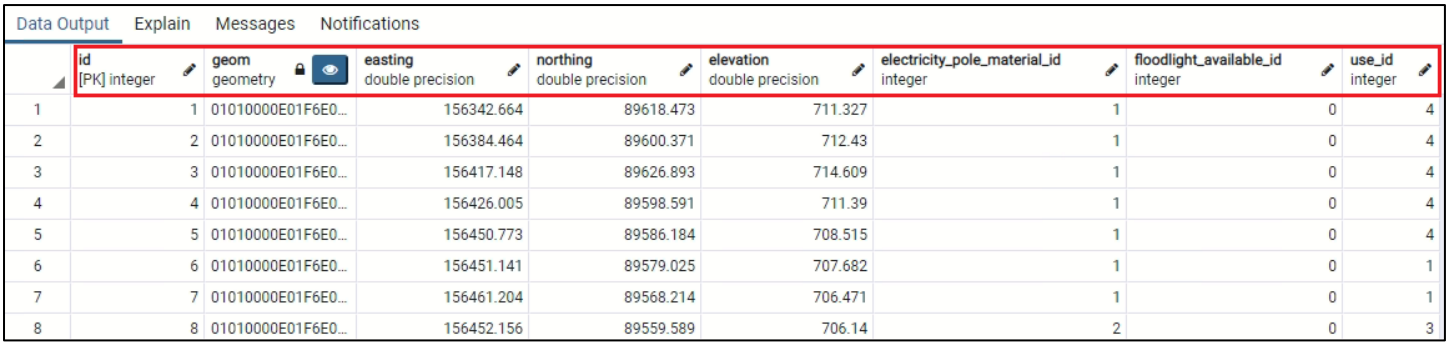


Data Output | Explain | Messages | Notifications

	id [PK] integer	customer_id integer	floor_number integer	apartment_number integer	building_id character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	8	1903	0	0	728	2020-10-10 13:51	postgres	2020-10-10 13:51	postgres	Admin@Admin.com	Admin@Admin.com
2	9	2188	0	0	728	2020-10-10 13:53	postgres	2020-10-10 13:53	postgres	Admin@Admin.com	Admin@Admin.com
3	12	6033	0	0	573	2020-10-12 13:35	postgres	2020-10-12 13:35	postgres	Admin@Admin.com	Admin@Admin.com
4	13	2324	0	0	618	2020-10-12 13:41	postgres	2020-10-12 13:41	postgres	Admin@Admin.com	Admin@Admin.com
5	14	2190	0	0	735	2020-10-14 09:24	postgres	2020-10-14 09:24	postgres	Admin@Admin.com	Admin@Admin.com
6	15	4931	0	0	650	2020-10-14 11:11	postgres	2020-10-14 11:11	postgres	Admin@Admin.com	Admin@Admin.com
7	16	1295	0	0	650	2020-10-14 11:11	postgres	2020-10-14 11:11	postgres	Admin@Admin.com	Admin@Admin.com
8	17	85	0	0	650	2020-10-14 11:12	postgres	2020-10-14 11:12	postgres	Admin@Admin.com	Admin@Admin.com
9	18	4242	0	0	649	2020-10-14 11:21	postgres	2020-10-14 11:21	postgres	Admin@Admin.com	Admin@Admin.com

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
Customer_id	The id of the citizen who rents the building in the IFMIS system
floor_number	The floor number in the building
apartment_number	The apartment number in the building
building_id	The id of the building
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: electricity_network

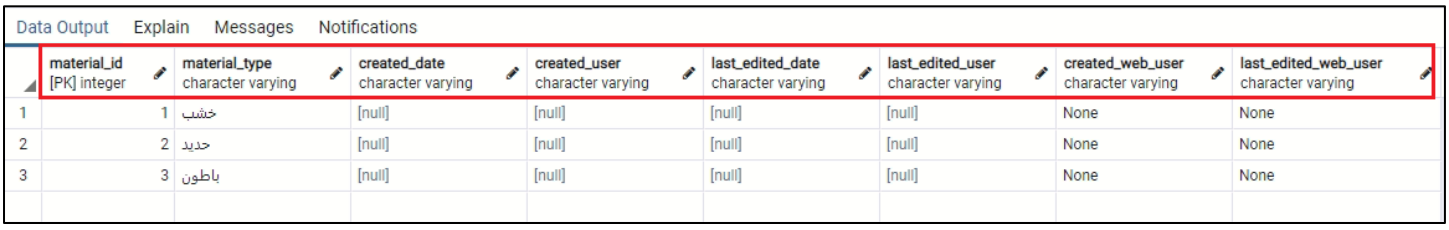


Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	easting double precision	northing double precision	elevation double precision	electricity_pole_material_id integer	floodlight_available_id integer	use_id integer
1	1	01010000E01F6E0...	156342.664	89618.473	711.327	1	0	4
2	2	01010000E01F6E0...	156384.464	89600.371	712.43	1	0	4
3	3	01010000E01F6E0...	156417.148	89626.893	714.609	1	0	4
4	4	01010000E01F6E0...	156426.005	89598.591	711.39	1	0	4
5	5	01010000E01F6E0...	156450.773	89586.184	708.515	1	0	4
6	6	01010000E01F6E0...	156451.141	89579.025	707.682	1	0	1
7	7	01010000E01F6E0...	156461.204	89568.214	706.471	1	0	1
8	8	01010000E01F6E0...	156452.156	89559.589	706.14	2	0	3

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
easting	The eastward-measured distance (or the x-coordinate)
northing	The northward-measured distance (or the y-coordinate).
elevation	The hight above or below a fixed reference *point (or the z-coordinate)*
electricity_pole_material_id	The id of the material used for a pole (this id is linked with the Electricity_pole_material table)
use_id	The id of the pole use (this id is linked with the Electricity_pole_use table)

Table Name: electricity_pole_material



Data Output | Explain | Messages | Notifications

	material_id [PK] integer	material_type character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	خشب	[null]	[null]	[null]	[null]	None	None
2	2	حديد	[null]	[null]	[null]	[null]	None	None
3	3	باطون	[null]	[null]	[null]	[null]	None	None

Field	Description
material_id	Unique id, its value is generated by database in an auto-increment way.
material_type	The type of the material used for a pole
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: electricity_pole_use

Data Output | Explain | Messages | Notifications

	use_id [PK] integer	use_type character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	اتصالات	[null]	[null]	[null]	[null]	None	None
2	2	اضاءة	[null]	[null]	[null]	[null]	None	None
3	3	ضغط عالي	[null]	[null]	[null]	[null]	None	None
4	4	كهرباء	[null]	[null]	[null]	[null]	None	None
5	5	متعدد الاستخدام	[null]	[null]	[null]	[null]	None	None
6	6	خاص بالشبكة القطرية ...	[null]	[null]	[null]	[null]	None	None
7	7	ضغط عالي+محول	[null]	[null]	[null]	[null]	None	None

Field	Description
use_id	Unique id, its value is generated by database in an auto-increment way.
use_type	The pole use
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: electricity_room

Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	room_id integer	Shape_Length double precision	Shape_Area double precision
1	1	01060000201F6E0...	100	11.777656250371223	8.238969049692576
2	2	01060000201F6E0...	101	14.222964303887787	12.59981849924806
3	3	01060000201F6E0...	102	5.660891099039517	1.6805950001987815
4	4	01060000201F6E0...	103	12.365658803307646	9.539613499264675

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
room_id	The id of the electricity room
Shape_Area	The area of the electricity room in meter square
Shape_Length	The perimeter of the electricity room in meter

Table Name: electricity_subscription

Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	subscription_number character varying (50)	ownership_type_id integer	customer_id integer	customer_name character varying (50)	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying
1	1	01010000201F6E0...	1901	2	1903	ياسر سليمان محمد الزعارير	[null]	[null]	2020-10-13 13:39	postgres	None
2	2	01010000201F6E0...	2188	2	2188	...ى عبدالكريم عبدالغني ابوعواد	[null]	[null]	2020-10-13 13:39	postgres	None
3	3	01010000201F6E0...	2630	1	5770	جواد حميدان محمود الزعارير	[null]	[null]	2020-10-13 13:41	postgres	None
4	4	01010000201F6E0...	2430	1	2430	ايمن حميدان محمود الزعارير	[null]	[null]	2020-10-13 13:41	postgres	None
5	5	01010000201F6E0...	321	1	321	عيسى علي جابر الزعارير	[null]	[null]	2020-10-13 13:42	postgres	None
6	6	01010000201F6E0...	3036	1	3036	زينب محمد علي الزعارير	[null]	[null]	2020-10-13 13:43	postgres	None
7	7	01010000201F6E0...	572	1	2427	احمد سليمان احمد الزعارير	[null]	[null]	2020-10-13 13:37	postgres	None

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
subscription_number	The electricity subscription number
ownership_type_id	The id of the ownership type (this id is linked with the electricity_subscription_ownership_type table)
customer_id	The id of the citizen who owns the electricity subscription in the IFMIS system
customer_name	Temporary, will be replaced by the customer name from the IFMIS system
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: electricity_subscription_ownership_type

Data Output | Explain | Messages | Notifications

	type_id [PK] integer	ownership_type character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	ملك	[null]	[null]	[null]	[null]	None	None
2	2	مستأجر	[null]	[null]	[null]	[null]	None	None
3	3	ملك عام	[null]	[null]	[null]	[null]	None	None
4	4	غير ذلك	[null]	[null]	[null]	[null]	None	None

Field	Description
type_id	Unique id, its value is generated by database in an auto-increment way.
ownership_type	The ownership type
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

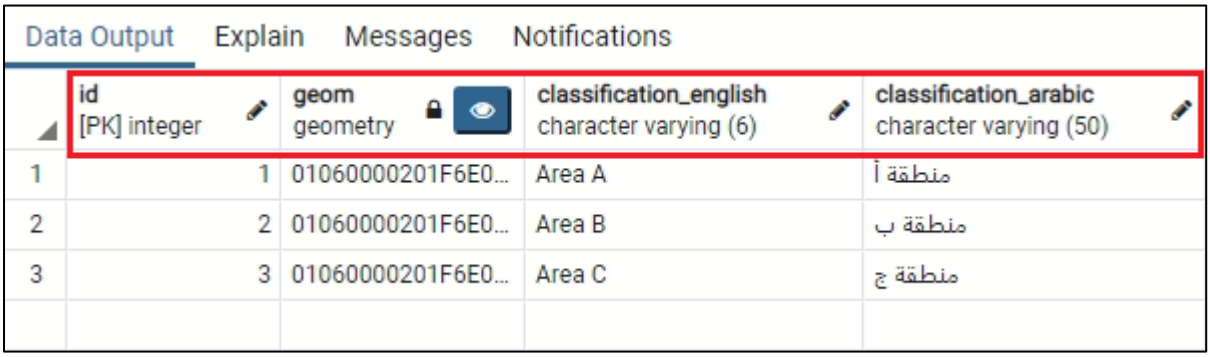
Table Name: is_available

Data Output | Explain | Messages | Notifications

	available_id [PK] integer	available_type character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	0	لا يوجد	[null]	[null]	[null]	[null]	None	None
2	1	يوجد	[null]	[null]	[null]	[null]	None	None

Field	Description
available_id	Unique id, its value is generated by database in an auto-increment way.
available_type	The available type (two values: available/ not available)
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: jurisdiction_borders

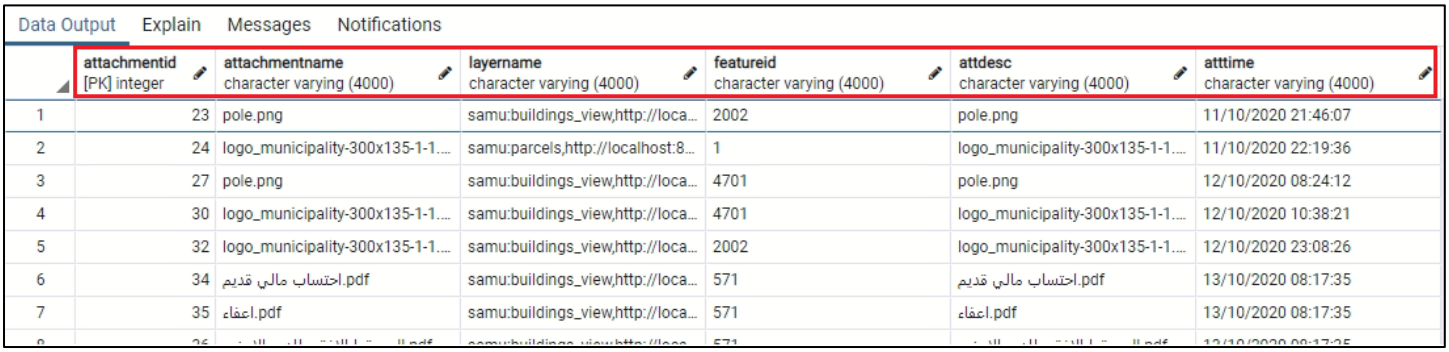


Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	classification_english character varying (6)	classification_arabic character varying (50)
1	1	01060000201F6E0...	Area A	منطقة أ
2	2	01060000201F6E0...	Area B	منطقة ب
3	3	01060000201F6E0...	Area C	منطقة ج

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
classification_english	The jurisdiction border classification in English.
classification_arabic	The jurisdiction border classification in Arabic

Table Name: layersattachments



Data Output | Explain | Messages | Notifications

	attachmentid [PK] integer	attachmentname character varying (4000)	layername character varying (4000)	featureid character varying (4000)	attdesc character varying (4000)	atttime character varying (4000)
1	23	pole.png	samu:buildings_view,http://loca...	2002	pole.png	11/10/2020 21:46:07
2	24	logo_municipality-300x135-1-1....	samu:parcels,http://localhost:8...	1	logo_municipality-300x135-1-1....	11/10/2020 22:19:36
3	27	pole.png	samu:buildings_view,http://loca...	4701	pole.png	12/10/2020 08:24:12
4	30	logo_municipality-300x135-1-1....	samu:buildings_view,http://loca...	4701	logo_municipality-300x135-1-1....	12/10/2020 10:38:21
5	32	logo_municipality-300x135-1-1....	samu:buildings_view,http://loca...	2002	logo_municipality-300x135-1-1....	12/10/2020 23:08:26
6	34	احتساب مالي قديم.pdf	samu:buildings_view,http://loca...	571	احتساب مالي قديم.pdf	13/10/2020 08:17:35
7	35	اعفاء.pdf	samu:buildings_view,http://loca...	571	اعفاء.pdf	13/10/2020 08:17:35

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
attachmentname	The name of the attachment
layername	The name of the layer to which the attachment is linked
featureid	The id of the feature to which the attachment is linked
attdesc	The description of the attachment
atttime	Time when the attachment was added

Table Name: parcels

Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	parcel_number character varying (50)	block_number character varying (50)	parcel_area double precision	notes character varying (50)	Shape_Length double precision	Shape_Area double precision	registration character varying (25)	active boolean	quarter_number character varying (5)
1	1	01060000201F6E0...	257	11	2298	[null]	201.42396468777116	2298.106077889963	تخمين	true	0
2	2	01060000201F6E0...	270	11	1989	-	202.32770564211177	1989.1197551805508	تخمين	true	0
3	3	01060000201F6E0...	272	11	2024	[null]	202.54891023066702	2024.2784782449176	تخمين	true	0
4	4	01060000201F6E0...	229	11	500	[null]	96.43123885966403	500.0451673065036	تخمين	true	0
5	5	01060000201F6E0...	235	11	519	[null]	91.95897637419122	519.0395978838584	تخمين	true	0
6	6	01060000201F6E0...	311	11	66	[null]	38.95359253734668	66.24123979727011	تخمين	true	0
7	7	01060000201F6E0...	250	11	542	[null]	93.91288869458253	542.0061396378366	تخمين	true	0

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
parcel_number	The number of the parcel
block_number	The number of the parcel
parcel_area	The area of the parcel in meter square
notes	General notes
Shape_Length	The perimeter of the parcel in meter
Shape_Area	The area of the parcel in meter square (from drawing)
registration	The registration type of the parcel (two values: تخمين/ تسوية)
active	The activity status of the parcel (true: active/ false: inactive)
quarter_number	The number of the quarter

Table Name: parcels_owner

Data Output | Explain | Messages | Notifications

	id [PK] integer	parcel_id integer	customer_id integer	owner_share text	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	3	265	5142	[null]	[null]	[null]	[null]	[null]	None	None
2	4	313	5042	[null]	[null]	[null]	[null]	[null]	None	None
3	5	304	5142	[null]	[null]	[null]	[null]	[null]	None	None
4	7	90	5175	[null]	[null]	[null]	[null]	[null]	None	None
5	8	262	5175	[null]	[null]	[null]	[null]	[null]	None	None
6	10	78	5183	[null]	[null]	[null]	[null]	[null]	None	None
7	12	212	5836	[null]	[null]	[null]	[null]	[null]	None	None

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
parcel_id	The parcel unique id
customer_id	The id of the citizen who owns the parcel in the IFMIS system
owner_share	The share of the owner from the parcel
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: permits

Data Output | Explain | Messages | Notifications

	id [PK] integer	file_number character varying (255)	building_id character varying (255)	status_id integer	permit_number character varying (255)	applicant_name character varying (255)	customer_id integer	date_of_application timestamp without time zone	personal_id character varying (255)	notes character varying
1	1	96/7172/غ		3	71	بدر موسى بدر الحوامدة	[null]	1996-11-24 00:00:00	986826337	[null]
2	2	96/7178/غ	1\153\18	3		نعيم عمر اقطيفان الحوامدة	[null]	1999-11-27 00:00:00	930581533	[null]
3	3	97//7015	1\39\13	3	10	احمد محمد احمد ابوسيف	1759	1997-12-02 00:00:00	993080365	[null]
4	4	96/7142/غ		3	8	صالح خليل حمدان الزعارير	[null]	1996-09-24 00:00:00	985580224	[null]
5	5	96/7207/غ		3	62	حسن اسماعيل موسى ابوسيف	[null]	1996-12-22 00:00:00	983051137	[null]
6	6	97/7200/س	1\77\20	1		عيسى موسى سلامة الحوامدة	[null]	1997-07-23 00:00:00	986815645	الملف في القسم
7	7	7/977201/س	1\92\27	3	7	موسى سلامة أحمد الحوامدة	[null]	1997-07-23 00:00:00	986815611	[null]

created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
[null]	[null]	[null]	[null]	None	None
[null]	[null]	[null]	[null]	None	None
[null]	[null]	2020-10-26 08:26	postgres	None	Admin@Admin.com
[null]	[null]	[null]	[null]	None	None
[null]	[null]	[null]	[null]	None	None
[null]	[null]	[null]	[null]	None	None
[null]	[null]	[null]	[null]	None	None

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
file_number	The number of the permit file
building_id	The building unique id
status_id	The id of the permit status (this id is linked with the permits_status table)
permit_number	The number of the permit
applicant_name	Temporary, will be replaced by the customer name from the IFMIS system
customer_id	The id of the citizen who owns the permit in the IFMIS system
date_of_application	The date of permit
personal_id	Temporary, will be replaced by the customer personal id from the IFMIS system
notes	General notes
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: permits_status

Data Output | Explain | Messages | Notifications

	status_id [PK] integer	status character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	مساحة	[null]	[null]	[null]	[null]	None	None
2	2	معماري	[null]	[null]	[null]	[null]	None	None
3	3	مرخص	[null]	[null]	[null]	[null]	None	None

Field	Description
status_id	Unique id, its value is generated by database in an auto-increment way.
status	The status of the permit
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: transformer

Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	Shape_Length double precision	Shape_Area double precision
1	1	01060000201F6E0...	4.097468784096362	1.0406439999894648
2	2	01060000201F6E0...	3.668602629812643	0.8100262506463751
3	3	01060000201F6E0...	3.736041205274314	0.8538620002662874
4	4	01060000201F6E0...	3.912175332868757	0.9351114990600609
5	5	01060000201F6E0...	3.6818481879651106	0.8031654999937192
6	6	01060000201F6E0...	3.8118843221578134	0.9022950005009025
7	7	01060000201F6E0...	3.975941074224221	0.9814275008344463

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
Shape_Length	The perimeter of the transformer in meter
Shape_Area	The area of the transformer in meter square (from drawing)

Table Name: urban_master_plan

Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	landuse_arabic character varying (50)	number_of_floors character varying (150)	surface_area_percentage character varying (200)	accumulative_floor_area_percentage character varying (200)	building_hight character varying (200)	front_setback character varying (150)	side_setback character varying (150)
1	1	01060000201F6E0...	سكن أ	5	36%	180%	18	5	4
2	2	01060000201F6E0...	سكن أ	5	36%	180%	18	5	4
3	3	01060000201F6E0...	سكن زراعي						
4	4	01060000201F6E0...	سكن أ	5	36%	180%	18	5	4
5	5	01060000201F6E0...	سكن أ	5	36%	180%	18	5	4
6	6	01060000201F6E0...	سكن أ	5	36%	180%	18	5	4
7	7	01060000201F6E0...	سكن أ	5	36%	180%	18	5	4

rear_setback character varying (150)	minimum_parcel_area_m2 character varying (150)	frontside_Length_parcel_m character varying (150)	parcel_area character varying (150)	Shape_Length double precision	Shape_Area double precision
5	1,000	25	---	1558.5863971640108	102377.4490636274
5	1,000	25	---	261.49182427337854	3389.29216155445
		25		887.5909078047234	32886.20454416513
5	1,000	25	---	2150.1034243680583	253813.9458855614
5	1,000	25	---	919.9173770463061	55919.47974419724
5	1,000	25	---	582.7612210599943	19460.375382041126
5	1,000	25	---	1157.141515205045	64227.161056548444

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
landuse_arabic	The type of the land use in Arabic
number_of_floors	The allowable number of floors
surface_area_percentage	The allowable percentage of the surface area
accumulative_floor_area_percentage	The allowable percentage of the accumulative floor area
building_hight	The allowable building hight
front_setback	The required front setback in meter
side_setback	The required side setback in meter

rear_setback	The required rear setback in meter
minimum_parcel_area_m2	Minimum area of parcel in square meter for building on it
frontside_length_parcel_m	The length of front side of the parcel
parcel_area	Area of parcel
Shape_Length	The perimeter of the parcel in meter
Shape_Area	The area of the parcel in meter square (from drawing)

Table Name: water_network

Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	diameter_inch integer	type_id integer	Shape_Length double precision
1	1	01050000201F6E0...	8	2	908.3319005110744
2	2	01050000201F6E0...	8	2	5167.284212330304
3	3	01050000201F6E0...	8	2	128.52791400953774
4	4	01050000201F6E0...	4	2	438.7843683880412
5	5	01050000201F6E0...	12	2	405.6420404573906
6	6	01050000201F6E0...	12	2	2696.5723555370514
7	7	01050000201F6E0...	4	1	740.2649559391708

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
diameter_inch	The network diameter in inch
type_id	The type id (this id is linked with the water_network_type table)
Shape_Length	The perimeter of the parcel in meter

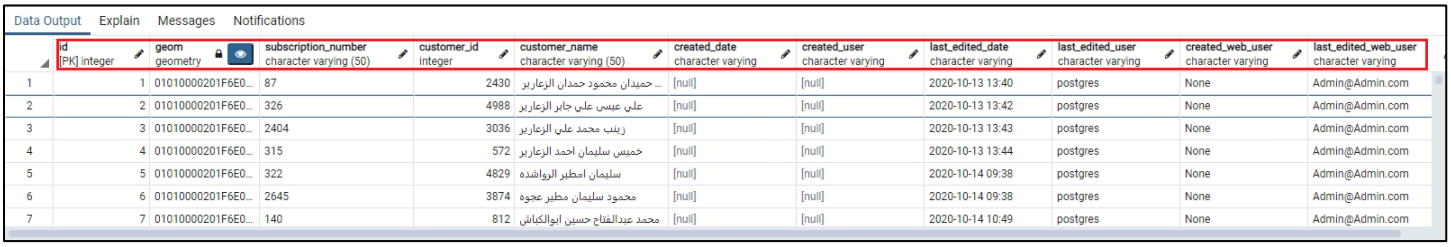
Table Name: water_network_type

Data Output | Explain | Messages | Notifications

	type_id [PK] integer	type character varying	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	شبكة المياه التابعة للبلدية	[null]	[null]	[null]	[null]	None	None
2	2	خطوط تغذية رئيسية	[null]	[null]	[null]	[null]	None	None

Field	Description
type_id	Unique id, its value is generated by database in an auto-increment way.
type	The water network type
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

Table Name: water_subscription



Data Output | Explain | Messages | Notifications

	id [PK] integer	geom geometry	subscription_number character varying (50)	customer_id integer	customer_name character varying (50)	created_date character varying	created_user character varying	last_edited_date character varying	last_edited_user character varying	created_web_user character varying	last_edited_web_user character varying
1	1	01010000201F6E0...	87	2430	حميدان محمود حمدان الزعارير ...	[null]	[null]	2020-10-13 13:40	postgres	None	Admin@Admin.com
2	2	01010000201F6E0...	326	4988	علي عيسى علي جابر الزعارير	[null]	[null]	2020-10-13 13:42	postgres	None	Admin@Admin.com
3	3	01010000201F6E0...	2404	3036	زينب محمد علي الزعارير	[null]	[null]	2020-10-13 13:43	postgres	None	Admin@Admin.com
4	4	01010000201F6E0...	315	572	خميس سليمان احمد الزعارير	[null]	[null]	2020-10-13 13:44	postgres	None	Admin@Admin.com
5	5	01010000201F6E0...	322	4829	سليمان امطير الرواشده	[null]	[null]	2020-10-14 09:38	postgres	None	Admin@Admin.com
6	6	01010000201F6E0...	2645	3874	محمود سليمان مطير عجوه	[null]	[null]	2020-10-14 09:38	postgres	None	Admin@Admin.com
7	7	01010000201F6E0...	140	812	محمد عبدالفتاح حسين ابوالكباش	[null]	[null]	2020-10-14 10:49	postgres	None	Admin@Admin.com

Field	Description
id	Unique id, its value is generated by database in an auto-increment way.
geom	Geometry / location information
subscription_number	The water subscription number
Customer_id	The id of the citizen who owns the water subscription in the IFMIS system
created_date	The created date of the record
created_user	The name of the database user who created the record
last_editied_date	The last edited date of the record
last_edited_user	The name of the database user who edited the record
created_web_user	The name of the geogate (web) user who created the record
last_edited_web_user	The name of the geogate (web) user who edited the record

3.4. Importing the data into the database

The consultant has worked in close cooperation with the municipality for importing the data into the new spatial database this included the following:

- Importing the municipality layers, that where stored as feature classes inside a file geodatabase into the PostGIS database
- Creating unique identifiers for all tables in the database
- Building lookup tables for data attributes with pre-defined values
- Normalizing database tables
- Building spatial indexes for GIS layers to improve its performance
- Integrating the citizens data stored at finanacial system (IFMIS) by consuming an API that gets the citizens information in the GIS applications, and appending the API's ids into the database tables
- Developing one-to-many relationships to link spatial data with its related tabular data

3.5. Deployment and Customization of Web GIS Application

After preparing the data and importing it to the database, the fundamental layers where published via Geoserver, and made ready to be consumed be GeoGate web GIS application, accordingly the following layers are available via the web Mapping application:

- Landmarks
- Blocks Registered
- Blocks Non-Registered
- Jurisdiction Borders
- Blocks
- Parcels
- Buildings
- Electricity Network
- Electricity Subscription
- Electricity Room
- Transformers
- Water Network

- Water Subscription
- Urban Master Plan
- Orthophoto

In terms of functions available at the map level, the map is equipped with the following tools:

- Zoom in/out buttons
- Pan/Drag
- Geolocation tool
- Full-screen button
- Next/Previous Extent button
- Home Extent Button
- Geo-bookmark tool
- Interactive coordinates measurement widget (finds the coordinates of cursor on map automatically)
- Interactive Scale widget (measures the current map extent)
- Interactive Scale bar widget
- Layers list tool
- Legend tool
- Searches tools:
    - Parcel Search
    - Building Search
    - Electricity Subscription Search
    - Water Subscription Search
    - Parcel Owner Search
    - Building Owner Search
    - Landmarks Search
- Go to Location by coordinates
- Find Extent tool
- Measurement tools:
    - Measure Area
    - Measure Length
    - Measure Coordinates
- Sketching Tools:
    - Point Sketch
    - Line Sketch
    - Polygon Sketch
    - Circle Sketch
    - Freehand Polygon Sketch
    - Freehand Line Sketch
    - Square Sketch
    - Rectangle Sketch
    - Text Sketch
    - Text in Popup Sketch
- Interactive Editing for all editable layers
- Printing Tool:
    - A4 Landscape
    - A4 Portrait
    - A3 Landscape
    - A3 Portrait
    - A2 Landscape
    - A2 Portrait
    - A1 Landscape
    - A1 Portrait
    - A0 Landscape

  - A0 Portrait
- Layer Swipe tool
- Generic Query tool
- Basemaps selector tool

3.6. Training & Capacity Building

The consultant carried out two technical training courses:

- **Admin Training**: On job training for the system admin
  - **Audience**: Eng. Marwa Iqeili
  - **Duration**: Four working days during September and October 2020.
  - **Trainer**: Eng. Hani Draidi
  - **Topics**:
    - System Administration
    - Municipal Data Maintenance and update
    - QGIS Desktop
    - Database Administration
    - Publishing data via Geoserver
    - Geogate administration tools
- **User Training**: Instructor-led training session for municipality officers
  - **Audience**: Regular end users (municipality officers who need to use the system in their daily workflows)
  - **Duration**: one day on November 8th 2020
  - **Trainer**: Eng. Hani Draidi
  - **Topics**:
    - Data Visualization
    - Mapping Tools
    - Searching municipal data
    - Identifying data from map
    - Exploring municipal tabular data
    - Measuring objects on map
    - Printing Maps

A user manual was prepared and it is shown in annex-1

3.7. Launching the System to the public

As launching the system to the public is a main goal of the project, the municipality needs to afford technical requirements for launching the system over internet which can be summarized in the following:

- Static public IP to be fixed for GIS virtual Machine
- Fully Qualified Domain Name to be pointed to the public IP of the GIS virtual machine
- SSL certificate to be installed on the web server hosting the web GIS application in the virtual machine
- Opening port 443 and port 8888 on the municipality firewall to allow traffic through these ports to the GIS virtual machine

The municipality IT officer (Mr. Ahmad Badran) mentioned that the municipality has started securing the above requirements, and it will be available as soon as possible.

4. Technical Issues and Obstacles

In this section, the main technical obstacles that faced the consultant are outlined in the following points:

- The Covid-19 pandemic caused some delays due to quarantine policies that were applied by the government.
- There was a delay from municipality side in preparing a virtual machine / server dedicated for GIS system that was requested by the consultant.
- The unavailability of a robust backup solution (software/hardware), and the backup is being made manually.
- There were problems in the accuracy of some spatial datasets that caused shifts in locations that resulted from coordinate systems transformation errors while digitizing data, and this problem was resolved.
- There were problems in accessing the GIS virtual machine from the consultant side in the beginning of the project, and the problem was resolved.
- There were some problems in the communication between the consultant and the IT department in the beginning of the project.
- In the first meeting, the consultant requested preparing a server / virtual machine for hosting the GIS system, and the IT department was not able to prepare this item for two weeks, thus the consultant has prepared it in the second meeting.

5. Results and Recommendations

By the end of this project, an integrated GIS application was built and put in operation for As Samou' municipality according to the project's Terms of Reference, and this system is being fed by spatial and non-spatial municipal data.

Like any other enterprise system, the GIS system needs continuous follow up and update in order to respond to the municipality current and future needs, and the consultant raise the following suggestions to improve the efficiency and benefits from the system:

- Allocating more human resources dedicated for inserting and updating data into the system. Currently, only one resource (Eng Marwa Iqeily) is dedicated to manage the system's data, and in order to maintain the whole data, Eng. Marwa needs at least one more resource to help her in managing the data.
- In terms of electricity network data, more data should be collected in terms of poles' attributes, identifiers, and covered units
- In terms of Solid Waste containers, the containers locations should be captured
- Electricity Data should be updated directly from electricity department
- Water Data should be updated directly from water department
- The customer service department's employee should learn how to use and benefit from the system when dealing with citizens.
- The system should be integrated with any new municipal system like the newly developed Customer Care system.

6. Annexes

6.1. Annex-1 System User Manual