SEA for Petroleum Activities

In Lebanese Waters

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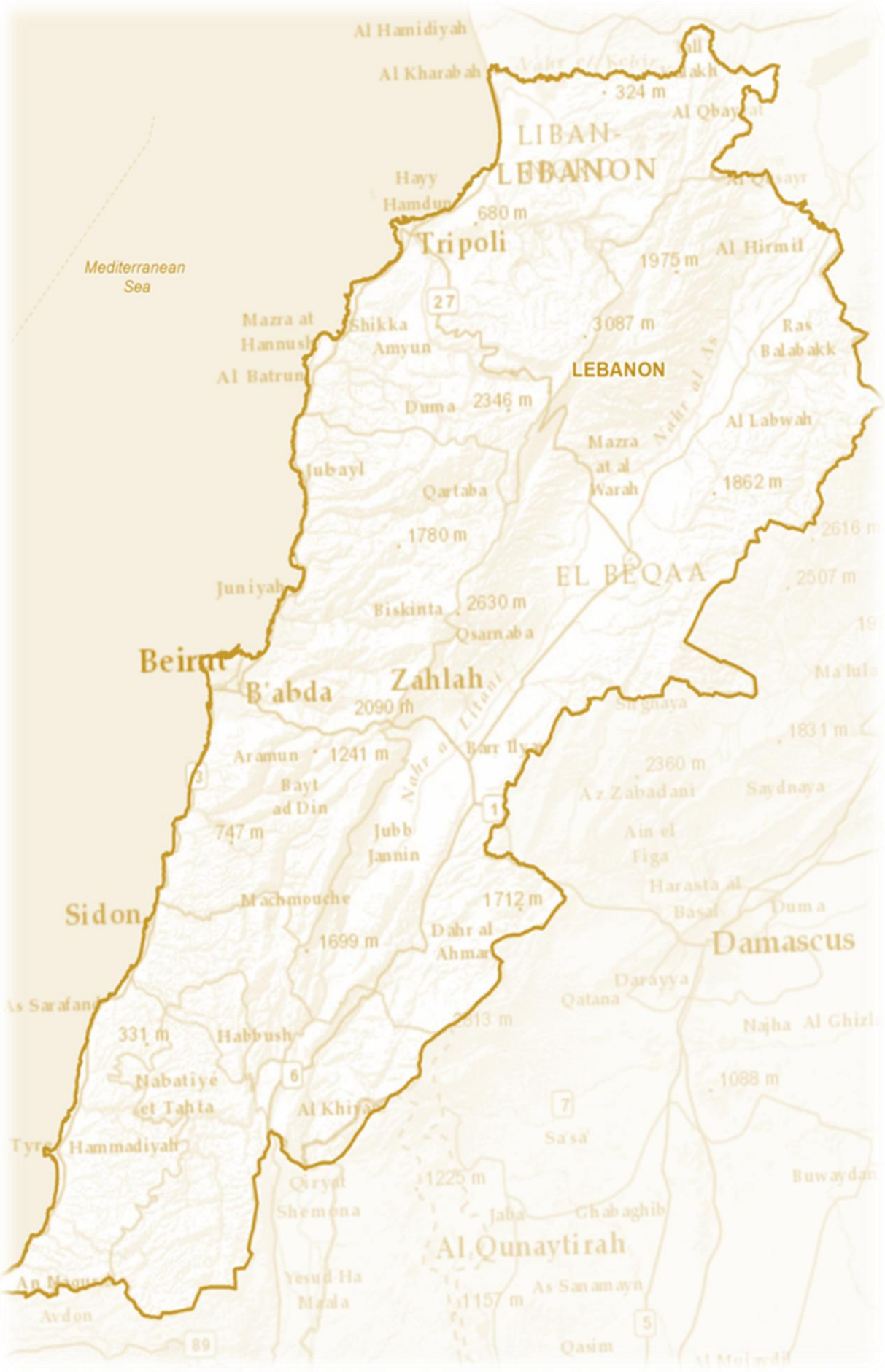
REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER

RPS Energy


Al Hamidiyah
Al Kharabah
324 m
Al Qbayat
LIBAN-
LEBANON
Hayy
Hamdun
680 m
Tripoli
Al Hirmil
1975 m
Mediterranean
Sea
27
Mazra at
Hannush
Shikka
Amyun
3087 m
Ras
Balabakk
Al Batrun
LEBANON
Duma
2346 m
Al Labwah
Mazra
at al
Warah
Nahr al As
Jubayl
Qartaba
1862 m
1780 m
2616 m
EL BEQAA
2507 m
Juniyah
Biskinta
2630 m
Qsarnaba
Beirut
B'abda
Zahlah
2090 m
Sighaya
1831 m
Aramun
1241 m
Barr Ilyas
2360 m
Bayt
ad Din
Az Zabadani
Saydnaya
747 m
Jubb
Jannin
Ain el
Figa
Harasta al
Basal
Duma
Sidon
Machmouche
1712 m
Damascus
1699 m
Dahr al
Ahmar
Darayya
Qatana
331 m
Habbush
Najha
Al Ghizl
Nabatiye
et Tahta
1088 m
Al Khiyam
Tyre
Hammadiyah
Sa'sa'
Qiryat
Shemona
1225 m
Buwaydan
Jaba
Ghabaghib
Al Qunaytirah
Yesud Ha
Mazala
As Samamayn
1157 m
Avdon
Qasim
89
5

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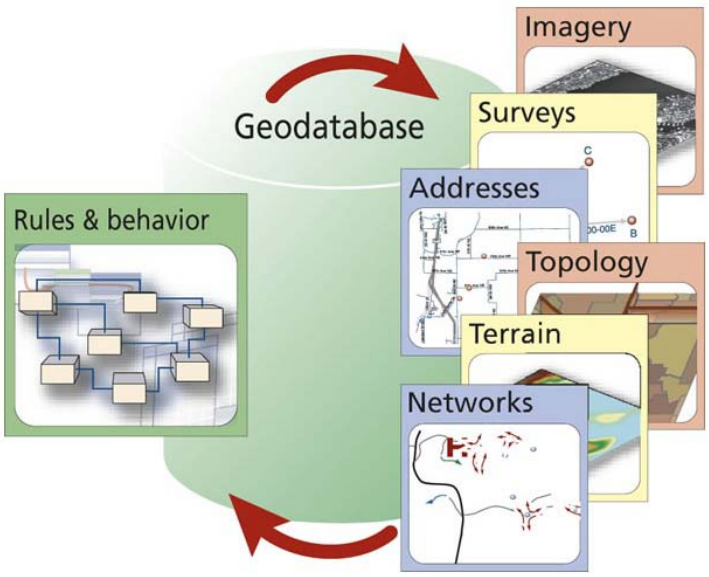
1. INTRODUCTION

During the SEA GIS has played an integral role and has been used at every stage of the project as a way of storing data but also as a powerful analytical and cartographic tool. GIS provides the ability to store and retrieve spatial data and allows for the creation of models that help learn more about the possible outcomes of natural trends, planning decisions or disasters.

GIS has aided this project in the following ways:

- Data acquisition of vector and raster data
- Data capture and digitizing
- Two-dimensional cartography
- Scanning, geo-referencing and re-projecting data
- Spatial Analysis
- Design and creation of vector and raster geodatabases

Data acquisition has been a major part of this project but without the use of GIS and its ability to successfully capture, store and display spatial data then the data collected could not be viewed and analysed to get the most out of it. Because data collection has been an ongoing process throughout the lifecycle of this project it was essential to organise the data in a way that was structured and easy to locate and understand, this was done through the creation of file geodatabases. A file geodatabase is a collection of geographic datasets of various types held in a common file system folder. File geodatabases are ideal for storing, editing and managing geospatial data as they have no size limit so they can be scalable and can also hold a variety of different datasets including feature classes, topologies, raster catalogs, network datasets, terrain datasets, tables etc.



2. METHODOLOGY

Two geodatabases have been created for the purpose of the SEA which contain all the spatial data that has been acquired throughout this project. One geodatabase holds all the vector data (points, lines and polygons) collected and one geodatabase contains all the raster data (Image data) collected. This is data that is not only relevant to the SEA phase but will also be very useful going forward to the first round of licensing because they also contain the 2D and 3D seismic survey data collected by PGS.

An important aspect of geodatabase creation is in the design process so time was spent designing a geodatabase that would have a strong base and that could be continually added to throughout all phases of petroleum activity in Lebanon.

The first aspect that was looked at was how the data would be structured within the file geodatabase as it is important to design a manageable and organized structure. The data was therefore organised into different data themes (thematic layers) i.e. GEOGRAPHICAL, ENVIRONMENTAL etc. Each data theme was also organised by the different co-ordinate reference systems and made into a feature dataset. Finally the contents of each theme were specified and organised into feature classes. Organising data in this way means that it can quickly be located to view and analyse.

The second aspect that was looked at was file naming i.e. to design a standard so that all datasets are named in the same way. This helps to keep the files in a consistent format that is easy to understand. This is especially important when there are large volumes of data from different data sources. The naming structure that was used in the SEA Vector and Raster Geodatabase's is detailed below:

<THEME>, <FEATURE TYPE>, <FEATURE SUBTYPE>, <SOURCE>, <DATE>, <DATA TYPE>

<THEME> e.g. GEOGRAPHICAL – Feature Dataset

<FEATURE TYPE> e.g. TOPOGRAPY – Name of sub theme

<FEATURE SUBTYPE> e.g. CONTOURS – Feature Class

<SOURCE> e.g. Company name

<DATE> e.g. 111101 - wherever possible YYMMDD otherwise YYYY OR Unknown

<DATA TYPE> e.g. Point, Line, Area

The third aspect that was looked at was metadata. Information that describes the items stored in the geodatabase is called metadata. Metadata is key in good data management because information can be stored that will be useful to the user. Metadata formats help enhance the

use of GIS ensuring the data is understood and used in the most efficient way because with good metadata items can be found through search options. The metadata style that was chosen for the SEA geodatabases was 'Item description' as it is straight forward and provides a summary and description of the data, details about the credits of the data and also information regarding the access and use limitations.

The two geodatabase created currently contain a majority of data that was from free sources or created by RPS Energy, however there is a lot more data out there that is available to purchase and would add considerable value to the project. This includes the following:

- Offshore Pipelines and Cables
- Shipping Routes
- Remote Sensing data
- Current Landuse data
- Current Population data

The Lebanese Army have extensive GIS datasets available to purchase, some of which are detailed in the table below. The more data that is added to these geodatabases the better the system will be and the more it will become a fundamental tool in decision making processes.

A list of all the current data that has been collected and is stored in the geodatabases can be found in the table below . The second table details data that can be purchased.

Source	Data Description	Format	Spatial Extent	Date	Contact Person
Ministry of Energy and Water/PGS	Regional International Boundaries	Vector	Onshore	Unknown	Fadi Nader
	Cities	Vector	Onshore		
	Coastline	Vector	Onshore		
	Official international border	Vector	Onshore		
	Lebanon Sea	Vector	Offshore		
	Offshore Boundaries	Vector	Offshore		
	Onshore Boundaries	Vector	Onshore		
	Rivers	Vector	Onshore		
	Urban areas	Vector	Onshore		
	2D Seismic Surveys	Vector	Offshore	Various	
	3D Seismic Surveys	Vector	Offshore	2006-2012	
	Geology_200k	Vector	Onshore	Unknown	

	Seabed depth contours 100m	Vector	Offshore		
	Hillshade_50m	Raster	Onshore		
	Seabed depth_100m	Raster	Offshore		
	Seabed depth_100m Hillshade	Raster	Offshore		
	GEBCO2008 Bathy	Raster	Offshore		
	GEBCO_LAND	Raster	Onshore		
	GEBCO_OCEAN	Raster	Offshore		
	GEBCO2008_Hill	Raster	Onshore		
	Lebanon_50m	Raster	Onshore		
	Offshore Contours_250m	Vector	Offshore		
Protected Planet	Current Protected Areas	Vector	Onshore	2012	
Greenpeace	Proposed Marine Protected Areas Network	Co-ordinates	Offshore	2010	Greenpeace
Seazone Hydrospatial	Admiralty Chart - 2633	Raster	Offshore	2012	Zack Abraham
RPS Energy	Stochastic and Trajectory Oil Spill Models	Vector	Offshore	2012	Tim Endean
	Proposed Gas Pipeline (MOEW)	Vector	Onshore and Offshore	2011	Fiona Buckingham
Council for Development	**Topography** Contours_50m	Vector	Onshore	Unknown	Sami Feghali

and Reconstruction	**Natural Resources** Biocorridors Botanical Features Caves Drain Density Fertility Geology_200k Hydrogeology Karst Natural Zones Protected Valleys Natural Reserves Protected Areas Rainfall Rivers Pedology_200k Springs Vegetation Levels Watershed Water Table Vulnerability	Vector	Onshore		
	Natural Risks Coastal Flood Desertification Earthquake Erosion Flood Mass Movement	Vector	Onshore		
	Landcover Landuse 1998 Forest 1967 Landuse Greater Beirut 1998	Vector	Onshore		

	Transport Roads Airport Airport Runways Railroads Schematic Sea ports Traffic survey points	Vector	Onshore		
	Economic Activities Ceramic Industries Chemical Industries Food Industries Leather Industries Metal Industries Paper Industries	Vector	Onshore		
	Industrial Rock Quarries Sand Quarries	Vector	Onshore		
	Water Management Existing Lakes Irrigation Perimeters Water Authorities Boundaries Water Treatment Plants	Vector	Onshore		
	Sewage/Waste Industrial Sea outfalls Landfill Sewage Treatment Plants Sewer Sea outfalls	Vector	Onshore		

	Services/Facilities Schools Universities Hospitals Red Cross Research Centers	Vector	Onshore		
	Urban Structure Planning Urban Agglomerations Urban Centers Major Towns Urban Areas_1998 Villages	Vector	Onshore		

Source	Data Description	Format	Spatial Extent	Date	Contact Person
CNRS - Remote Sensing Data	Landuse	Paper/Raster/Vector	Onshore	2010	Dr Mohamad Awad and Dr Talal Darwish
	Soil Maps	Paper/Raster/Vector	Onshore	2008	
	Landslide and Mss Movement prone areas	Paper/Raster/Vector	Onshore	2010	
	Geology Map	Paper/Raster/Vector	Onshore	2010	
	DEM - 10M Resolution	Paper/Raster/Vector	Onshore	Annual	
	Average Precipitation	Paper/Raster/Vector	Onshore	Annual	
	Average Temperature	Paper/Raster/Vector	Onshore		
	Natural Hazards	Paper/Raster/Vector	Onshore		
	Freshwater Sources	Paper/Raster/Vector	Onshore		
Geography Affairs - Lebanese Army	Urban Structures - Buildings	Paper/Raster/Vector			Lt.Col.Richard Malek
	Road Network	Paper/Raster/Vector		Annual	
	Fixed Telecom				

	Network				
	Tourist Maps	Paper/Raster/Vector		2010	
	Educational Institutes				
	Biosphere Reserves	Paper/Raster/Vector			
	Topographic Maps	Paper/Raster/Vector		2005	
	DEM - 10m	Raster			
	Contours	Vector		1962	
Seazone Hydrospatial	Seazone Hydrospatial Lite - pipelines, cables, shipping routes etc	Vector	Onshore and Offshore	2012	Zack Abraham

3. ISSUES AND RECOMMENDATIONS

The use of Geographical Information Systems (GIS) facilitates easier, quicker solutions for technically complicated, time-absorbing geographical problems. GIS is a powerful system that can be used for storing, retrieving, transforming and displaying spatial data .

Decision making at the national level in both developing and developed countries requires the integrated use of information from a multitude of sources. Both local and national governments in many developed countries have found GIS to be a critical tool in resource management, regional planning, and economic development. Unfortunately, the practical use of GIS in Lebanon is hampered by the lack of accurate and detailed spatial and demographic data, political considerations, management issues and transparency. This was found during data mining phase of the SEA project, during which RPS interacted with various institutions and government bodies to collect data relevant to the SEA. As explained above the vector geodatabase that was created contains data put together by PGS for the 2D and 3D seisimic database alongwith data obtained by RPS during the SEA from agencies such as the Lebanese Army , Council for Development and Reconstruction etc. This database should provide a strong foundation for the MOEW to build a Geospatial Data Infrastructure that will support the data management and analytical challenges faced during the first round of hydrocarbon exploration within the Lebanese offshore EEZ (Exclusive Economic Zone) as this database can be added to throughout all phases.

RPS recommends that the Ministry sets up a Geoportal –accessible either internally within the Ministry itself or externally via the public internet (with secure resticted access), which will help increase the dialougue between the ministry and its stakeholders by sharing information and data. A Geoportal is essentialy an intranet or internet based site used to find and access spatial information and any associated geographic datasets. This is done by using metadata or

descriptions of the various data that make searching and accessing relevant information easy. The Geoportal will help the Ministry to share its geographic information better, avoid duplicated efforts, inonsistencies, delays, confusions and wasted resources. A good example of the capabilities of such a system is the Abu Dhabi GeoSpatial Portal (http://geoportal.abudhabi.ae/geoportal/) which was designed to provide a single point of access for geospatial information across the whole of Abu Dhabi . The ESRI Geoportal Server, which started out as a paid–for software is now open source and free and we would recommend that the Ministry implement this sytem to integrate the exisiting spatial data that is already acquired thus far and provide a mechanism for loading of new data that will be available as the first round of exploration progresses.

RPS is hugely experienced in managing large volumes of spatial data by combining best industry practices with latest GIS software and would be happy to assist the Ministry with setting up its own Geoportal , migrating all available data to the Geoportal and provide in-house training to Ministry officials to use and spread the application of the Geoportal Server. In order to maintain interoperability of data within the E&P industry, our team of GIS Analysts and Geodesists can advise and implement data model, data exchange, metadata and coordinate reference system standards.

Setting up a geoportal is highly recommended by RPS as this will also boost the profile of the Ministry of Energy and Water as they will be seen to be moving with the times and adopting a high technology solution.

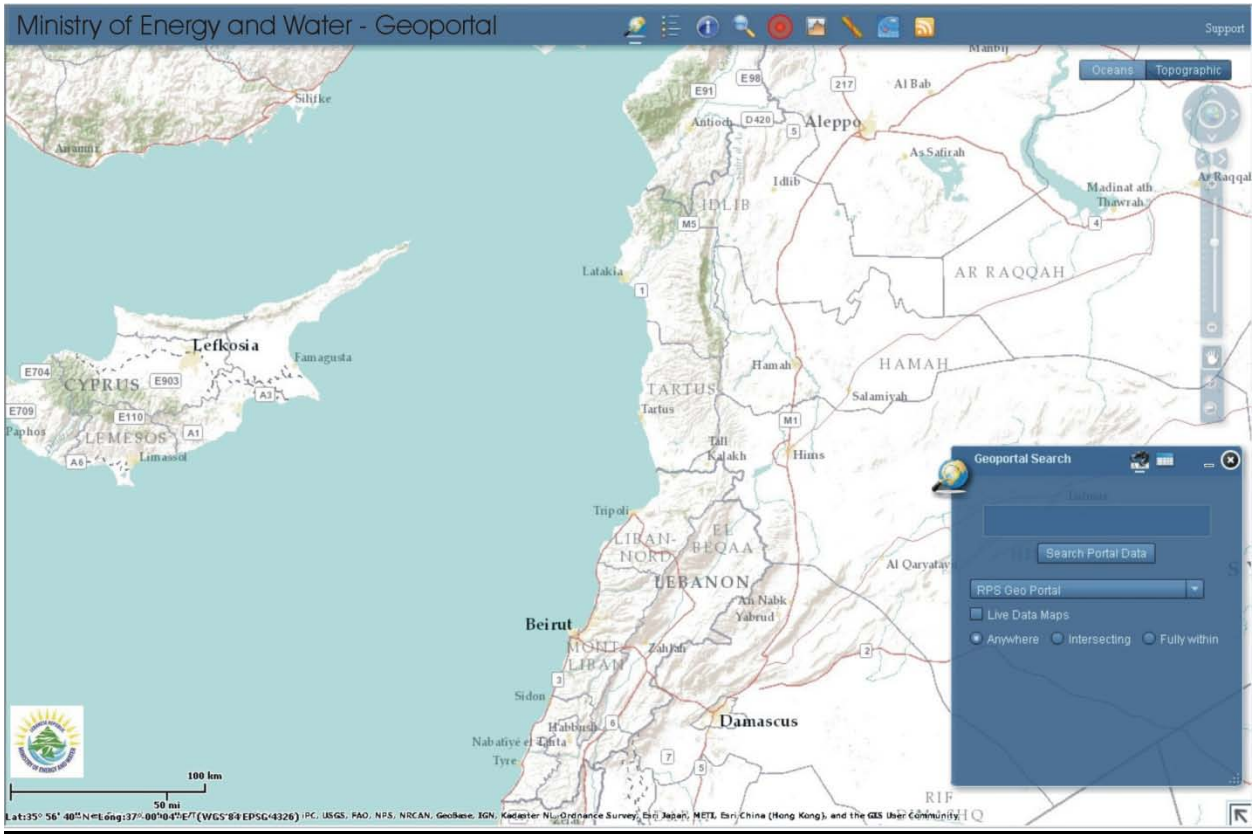


Figure: Mock-up of MoEW Geoportal Site