InfoAssist Lightweight Mapping

IBM DB2 Web Query for i

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Introduction

The Lightweight Mapping functionality in DB2 Web Query allows you to display your data regionally in map charts. Using the Geographic Information System (GIS) capabilities that are built into Web Query, the mapping functionality converts values from underlying data and displays them geographically. You can then easily visualize patterns or trends in the data, as it relates to the location information in the data.

The mapping functionality supports two popular formats, bubble markers and heat-filled polygons, also known as Choropleths. These map formats are described as follows.

- **Proportional Symbol (Bubble).** A technique that uses symbols of different sizes to represent data associated with different areas or locations within the map. Circular bubbles are drawn on top of the map.

- **Choropleth**. A geographically-based heat map. It is useful for visualizing location-based data, trends, and distributions across a geographic area. Specified regions of a map are filled with heat-coded color values. The colors are shaded in proportion to the measurement being displayed on the map, such as revenue.
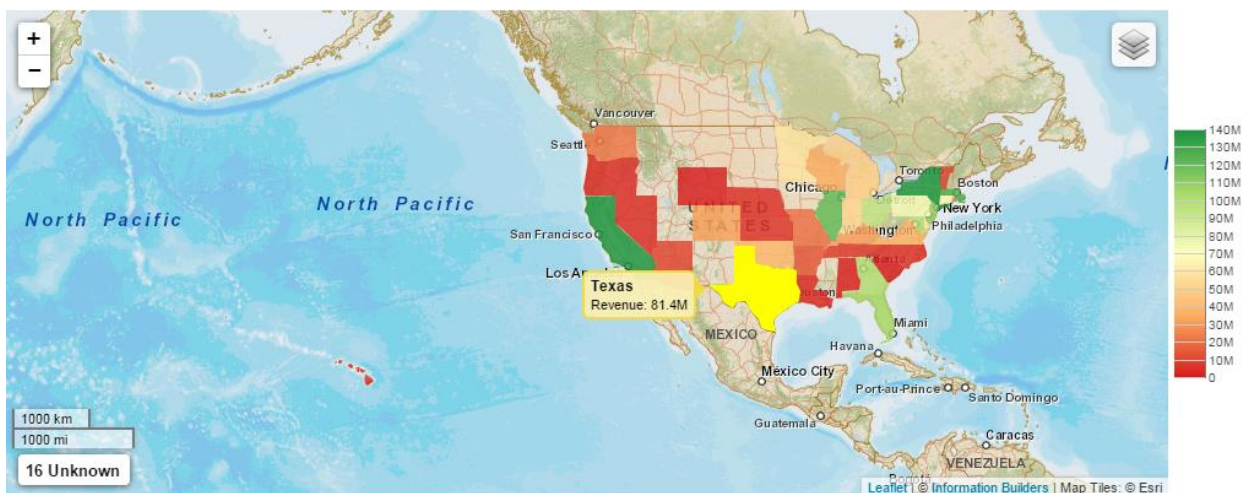
Data that is bound to a geo-location, such as State, Country, and ZIP Code, can be viewed as symbol layers placed over a base map.   The layers are integrated with a powerful map viewer that supports zoom, pan, and scale. The mapping architecture for Web Query features an HTML5 map viewer from Leaflet.

Environmental Systems Research Institute, Inc. (Esri®) provides the base maps used in InfoAssist Lightweight Mapping. The Esri maps were introduced in Web Query 2.1.0 group PTF level 8. Be sure your system is at this level or at a higher release or group PTF level. For latest Web Query levels, refer to the Installation page of the product wiki at http://ibm.co/db2wqwiki.

To further explain the mapping layers on a map chart, there is one static base layer that displays the map tiles. Web maps are made up of many small, square images called tiles that are placed side-by-side to create the illusion of a very large seamless image. On top of the base layer, an overlay layer displays the Web Query request output that either colors specified areas on the map or draws bubble markers on top of them. Web Query supports one base layer and one overlay layer.

The connection between the map positions and the fields in your data are implemented using a location file. Location files contain lists of political or regional subdivisions, such as country, state and city, along with latitudes and longitudes that define borders and other properties, such as the name of a city. Web Query pre-packages a number of location files. You can modify the supplied files if you want to add, remove, or adjust map positions. You can also download or create new maps with your own locations and definitions by configuring the map server to point to the files you want. There are important match-ups that must exist between the contents of a location file and your data.

Location files that are shipped with Web Query are created in JavaScript Object Notation (JSON) format and have a .json extension.   Any location files that you provide yourself must have GeoJSON format and a .geojson extension.

It is easy to add a map to your application. In InfoAssist, you simply create a chart with Map type and HTML5 output format. Like all HTML5 visualizations, the highlighted markers and regions on the maps support chart properties and request features such as drill and informational tooltips. Additional mapping capabilities and interfaces will continue to evolve.
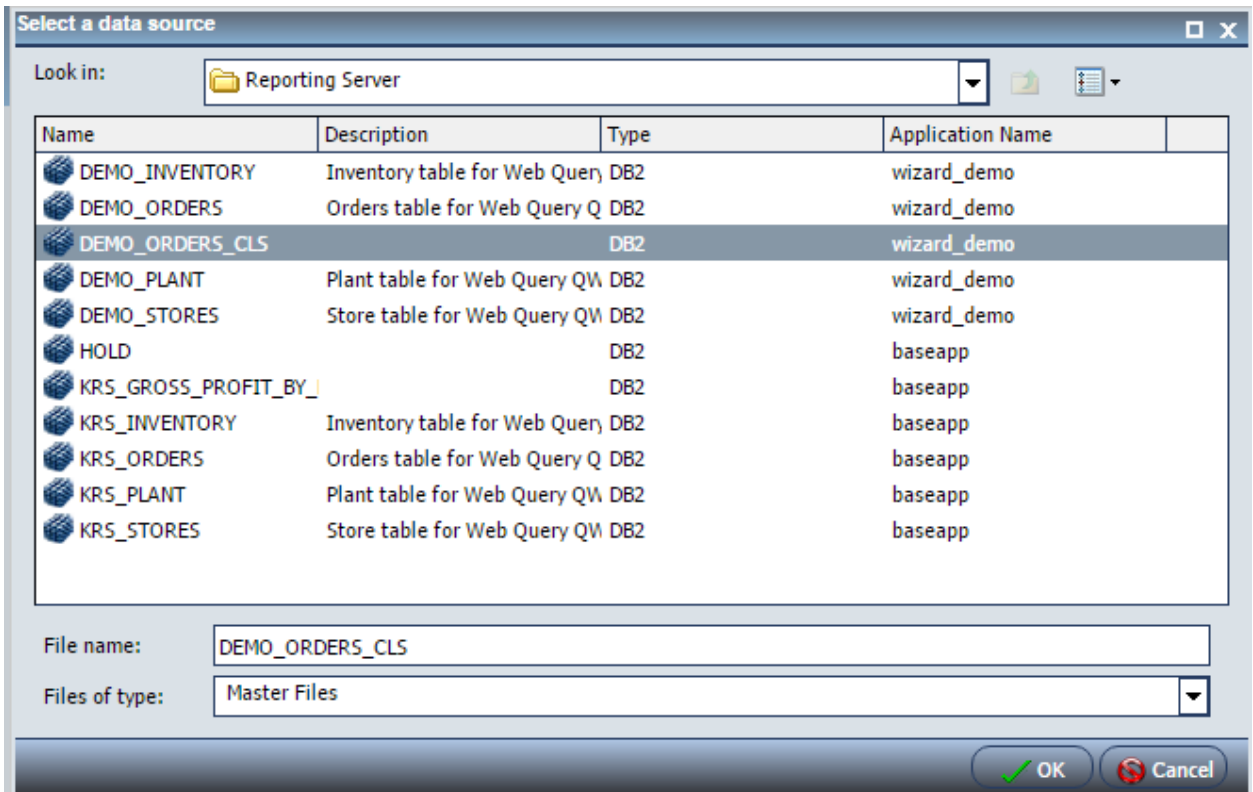

Creating a Map Chart

The Lightweight Mapping functionality is a feature of InfoAssist. To create a map chart, follow these steps.

1. Log into the Web Query portal. Right click on the folder where you want to place the chart. Click New, and then click Chart.
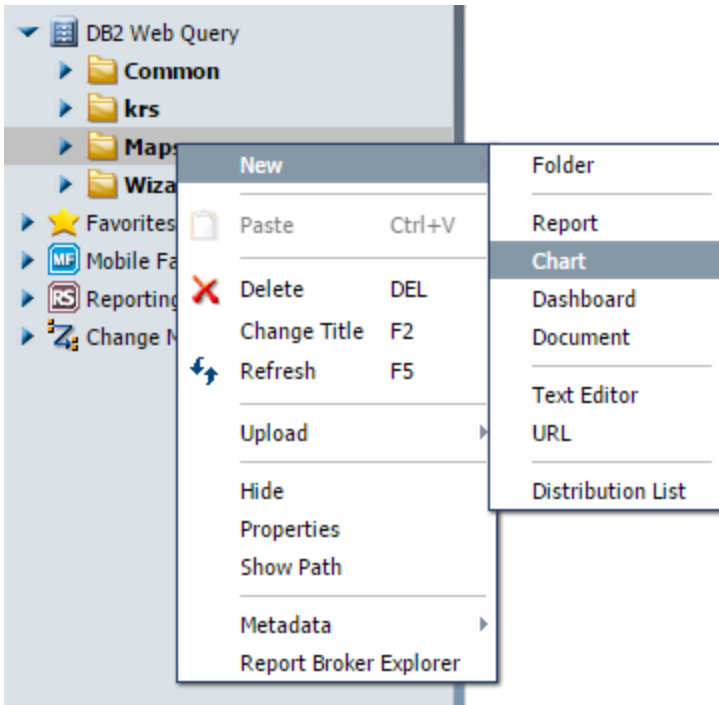
2. InfoAssist will launch. Select the data source that has the measures and locations you want to display in your chart, and click OK. In the example screen shot, a cluster synonym is chosen that was created over the Orders, Plants, Inventory, and Stores tables in the Web Query sample database, QWQCENT.

Select a data source

Look in: Reporting Server

Name	Description	Type	Application Name	
DEMO_INVENTORY	Inventory table for Web Query	DB2	wizard_demo	
DEMO_ORDERS	Orders table for Web Query Q	DB2	wizard_demo	
DEMO_ORDERS_CLS		DB2	wizard_demo	
DEMO_PLANT	Plant table for Web Query QW	DB2	wizard_demo	
DEMO_STORES	Store table for Web Query QW	DB2	wizard_demo	
HOLD		DB2	baseapp	
KRS_GROSS_PROFIT_BY_		DB2	baseapp	
KRS_INVENTORY	Inventory table for Web Query	DB2	baseapp	
KRS_ORDERS	Orders table for Web Query Q	DB2	baseapp	
KRS_PLANT	Plant table for Web Query QW	DB2	baseapp	
KRS_STORES	Store table for Web Query QW	DB2	baseapp	

File name: DEMO_ORDERS_CLS

Files of type: Master Files

OK   Cancel

Note: This step requires that you already created metadata over the underlying DB2 objects that contain your data.   If you do not see your application's master files listed on the data source panel, click Cancel, create the metadata, and then restart your chart. If you need help creating the metadata, refer to the Getting Started videos on the Web Query wiki at http://ibm.co/db2wqwiki.

3. Click the Format tab on the IA ribbon. In the Output Types group, click HTML5 to highlight it, as shown.
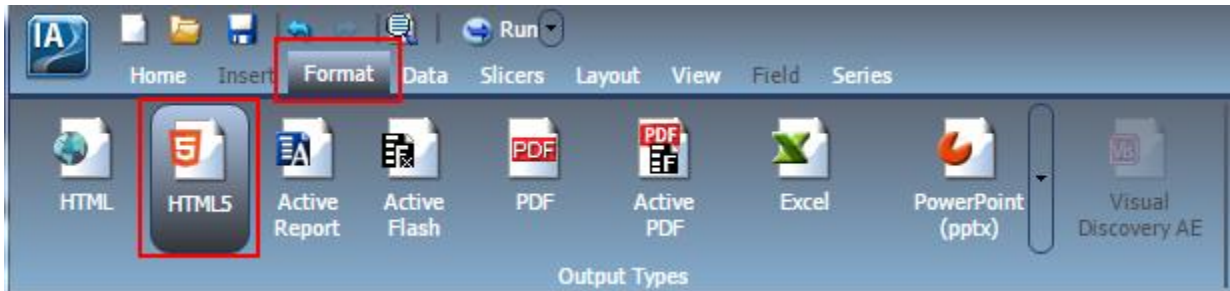

4. Click the Chart Types group on the ribbon, and then click Map.
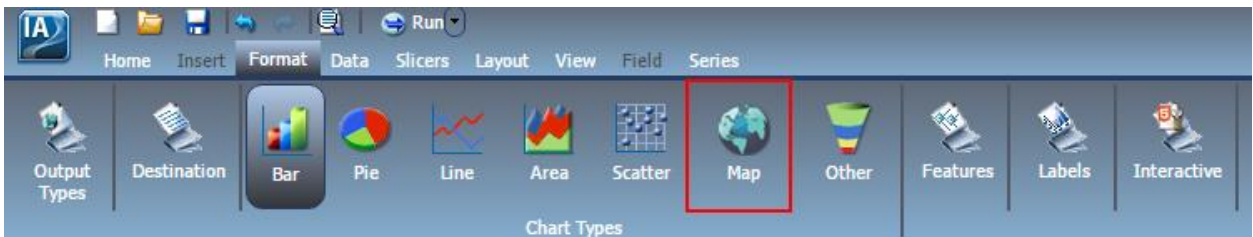
5. The map selection dialog appears. Choose the Type of map you want by clicking one of the images. The default is a Choropleth map which colors in outlines of areas, such as countries or states, based on a measure. The other is a Bubble map which creates bubbles of various sizes on top of a geographic location.

    From the Type group, select **Proportional Symbol (Bubble)** or accept the default, **Choropleth**.
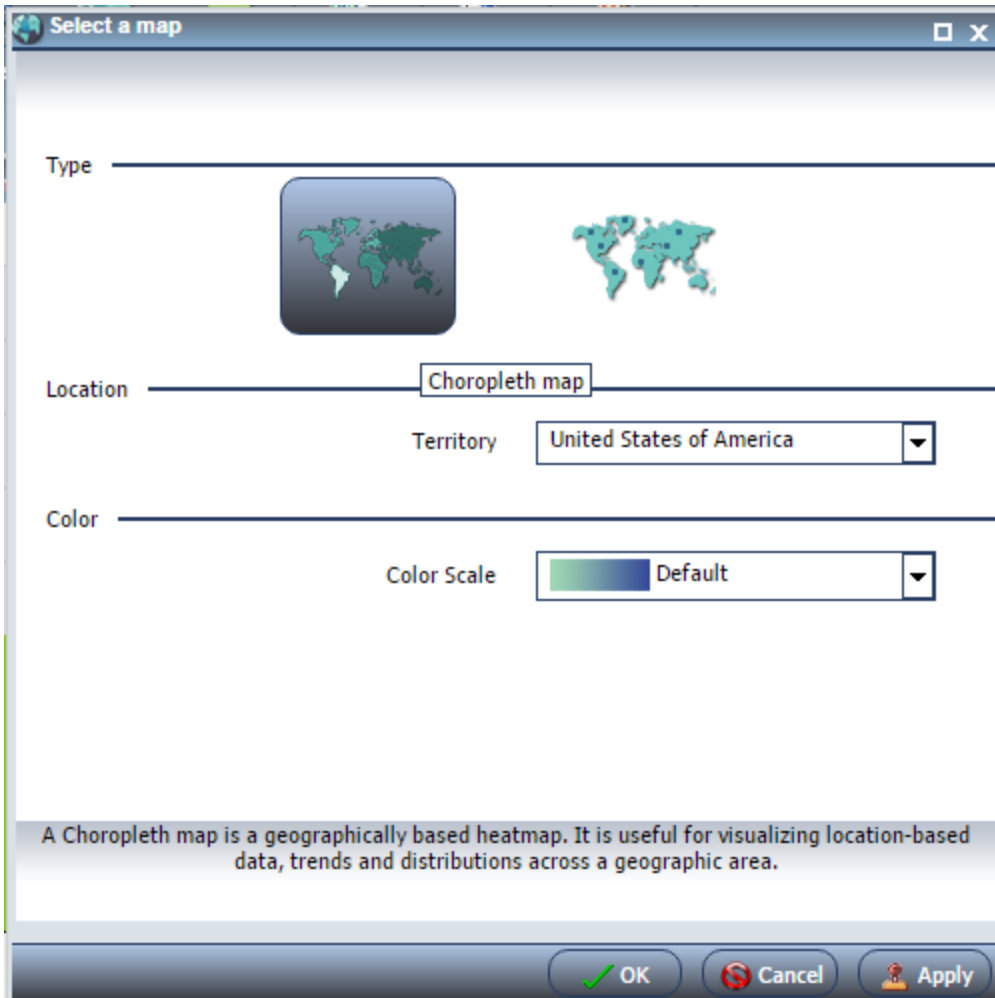
6. From the Location group, select a Territory from the drop-down list. In the example below, the United States of America is chosen.

The drop-down shown above displays the default list of territories available for selection out-of-box with the Web Query product. It's a partial list of the territories that are supplied with the Web Query

product. You can customize the list, but more detail will be provided in a later section.

7. For choropleth maps, from the Color group, select a Color Scale from the drop-down list. There are seven color scale options, as shown below.
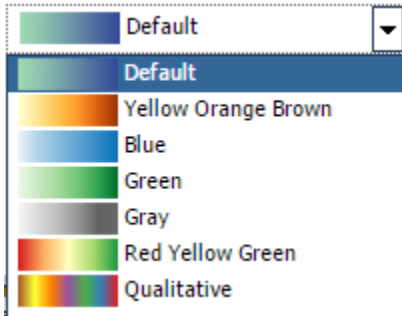

Tip: For bubble maps, you cannot change the color of the bubbles using the color scale.   The color scale is not applicable and is therefore disabled. If you want to change the color of the bubbles you can do so from the Live Preview panel of the bubble chart. Right click the measure in the right-side legend and select 'More Style Options…' in the drop-down.

8. It's time to build your chart! Drag the Measures and Location fields from the Data panel to the Query. The example below will plot revenue by state.
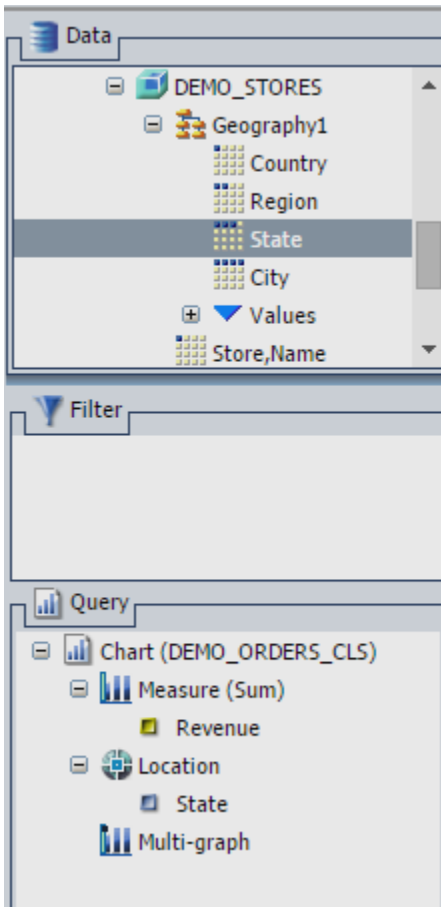
When you drag a field to Location, Web Query will prompt you for the location type, also known as the geographic role.   This is where you will make the connection between your data and the location file mentioned earlier.
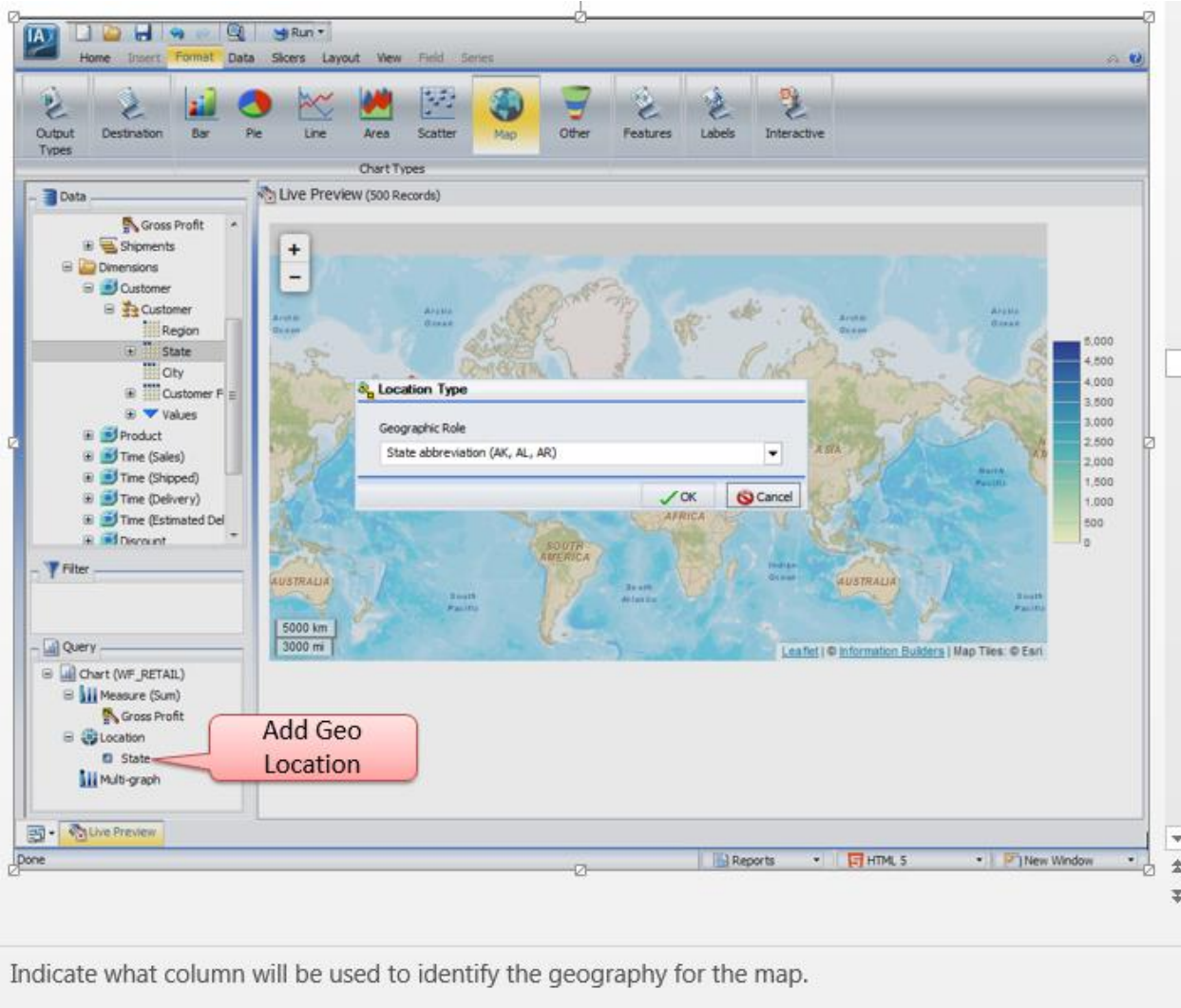
Indicate what column will be used to identify the geography for the map.

Each Territory has a corresponding map file that provides properties and coordinates for the region it represents.   If the file for the Territory you selected has more than one property that describes a given set of coordinates, then InfoAssist will prompt you to select the geographic role (i.e. the property) that exists in your data.   In other words, InfoAssist will prompt you to specify which of several possible formats your data is using. In the below example, the territory map – that is, the location file – allows the U.S. state to be represented in the data in any of these possible ways: FIPS code, the full state name, an ISO code, or the 2-character state abbreviation.   The prompt is asking you to specify which one of those formats you are using for your data. The prompt is automatic; Web Query uses its underlying mapping architecture and the location file to determine the drop-down selection.
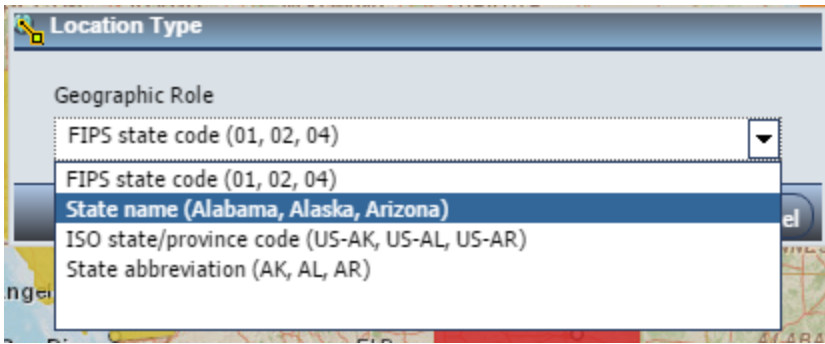
Select the geographic role that applies to your data and click OK.

9. You can now review a Live Preview display of your map, based on your data and selections for Type, Location, and Color. The below example shows a United States overlay on top of a world base layer, in which population ranges are represented by the color of the polygons representing the different states. The output has a legend that defines the color for each measure range.

10. The last step is to save your report. Enter a title and click Save.
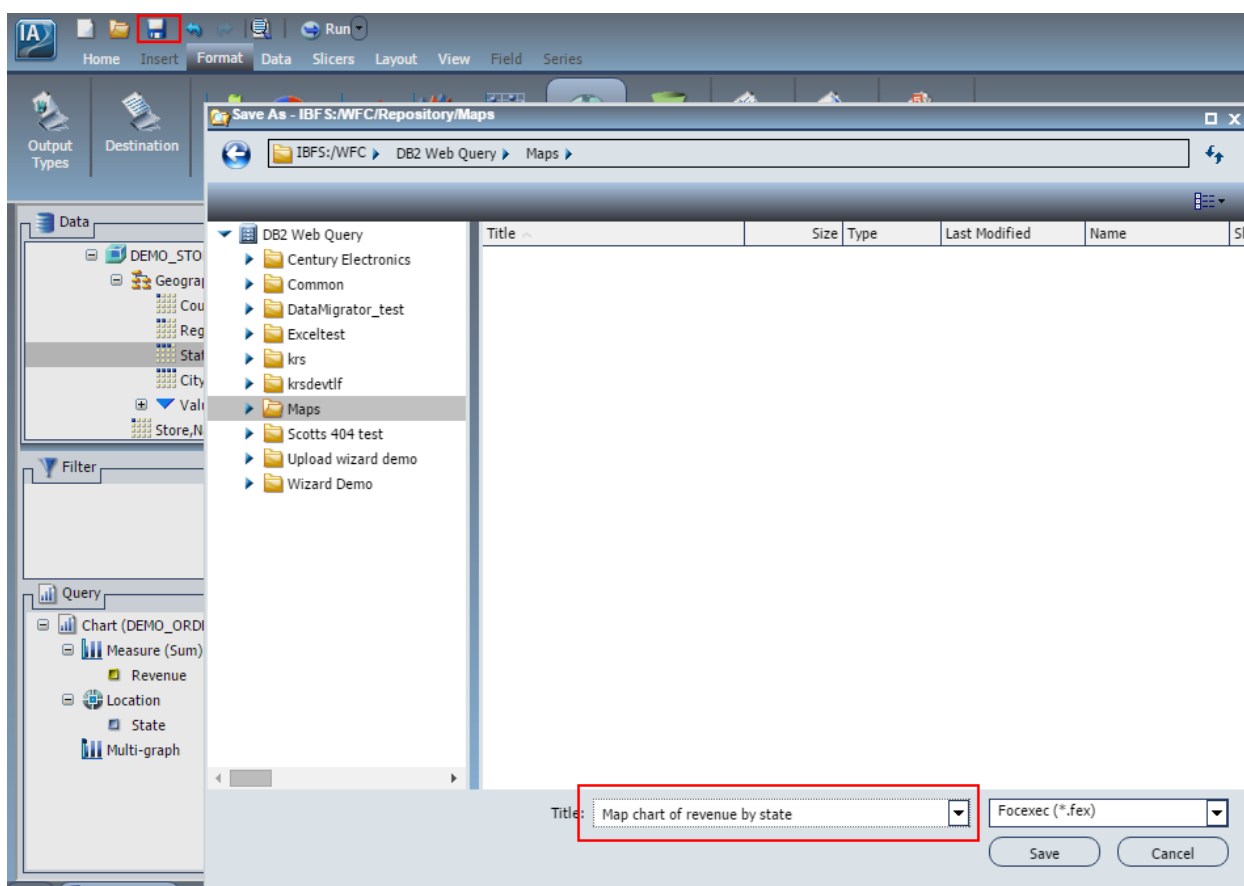
Your map chart will now be visible in the portal tree under the folder where you created it. You can run it or schedule it for distribution as you would any other report.

Navigating the Map Viewer

When you run the report, you or your end user can look at it using the map viewer.   The Web Query mapping architecture features an HTML5 map viewer with zoom, pan, and scale controls. It also includes a mapping server with additional levels of zoom.

You can use the plus (+) and minus (-) symbols on the upper left of the map to zoom in and out of different areas of the map. They are shown below. Use + to zoom in a level and use – to zoom out a level. You can also mouse scroll forward to zoom in, or mouse scroll backward to zoom out.

The automatic positioning in map charts is described as follows:

- By default, the map viewer determines a bounding box that completely encapsulates all of the markers in your data source and chooses a zoom level that nicely bounds your data. For example, if your data is 48 continental US states, the zoom level will be set so that you see only the continental US, with perhaps a bit of Mexico and Canada also visible.
- Also by default, the map viewer sets a center point that is the exact middle of the automatic bounding box. In the continental USA, this puts the mid-West states in the middle of the screen.

To pan the map you can drag the mouse or you can use the arrow keys on your keyboard.

In the upper right of the map is a layer control symbol . Hovering the mouse over the layer symbol you will see the title names of the base layer map and the overlay map that are used by the report.

In the lower left corner of the map you will find the scale. As you zoom in and out, the scale is adjusted automatically.
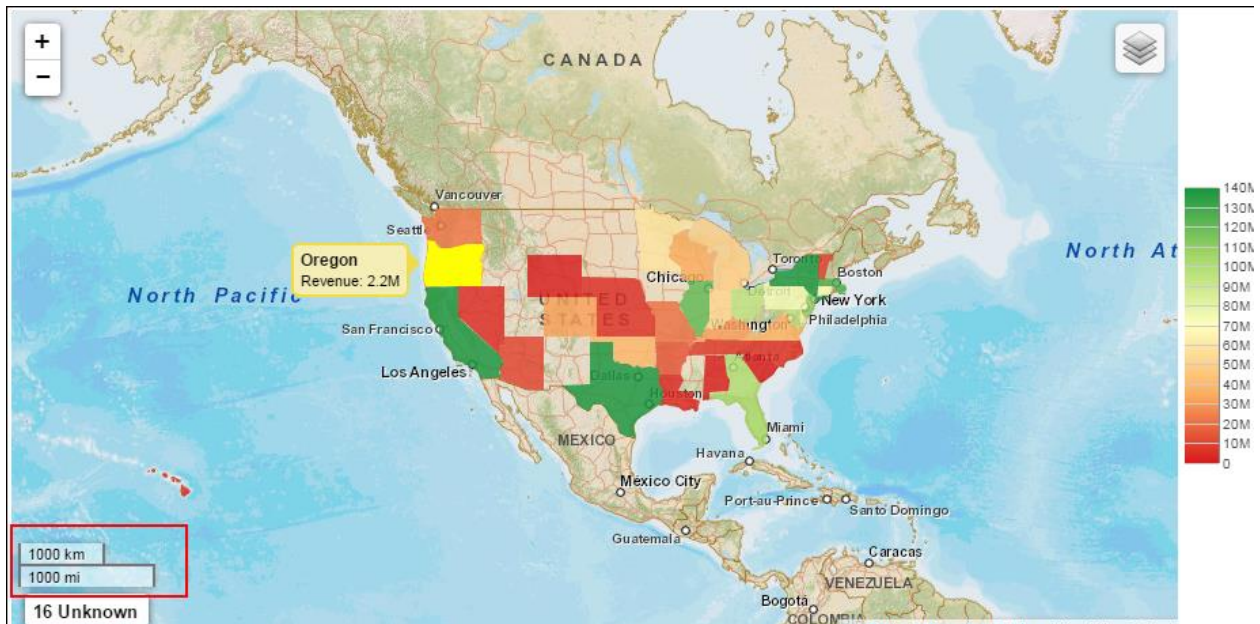
Also in the lower right, you may notice a white box with a count of Unknowns. This will occur if there are values in the location field of your data that do not match to positions in the location file for your territory.

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In the example screen below, there are 16 data values that could not be matched to map positions. This was because the U.S. territory was selected for the map, but the data included locations outside of the U.S.
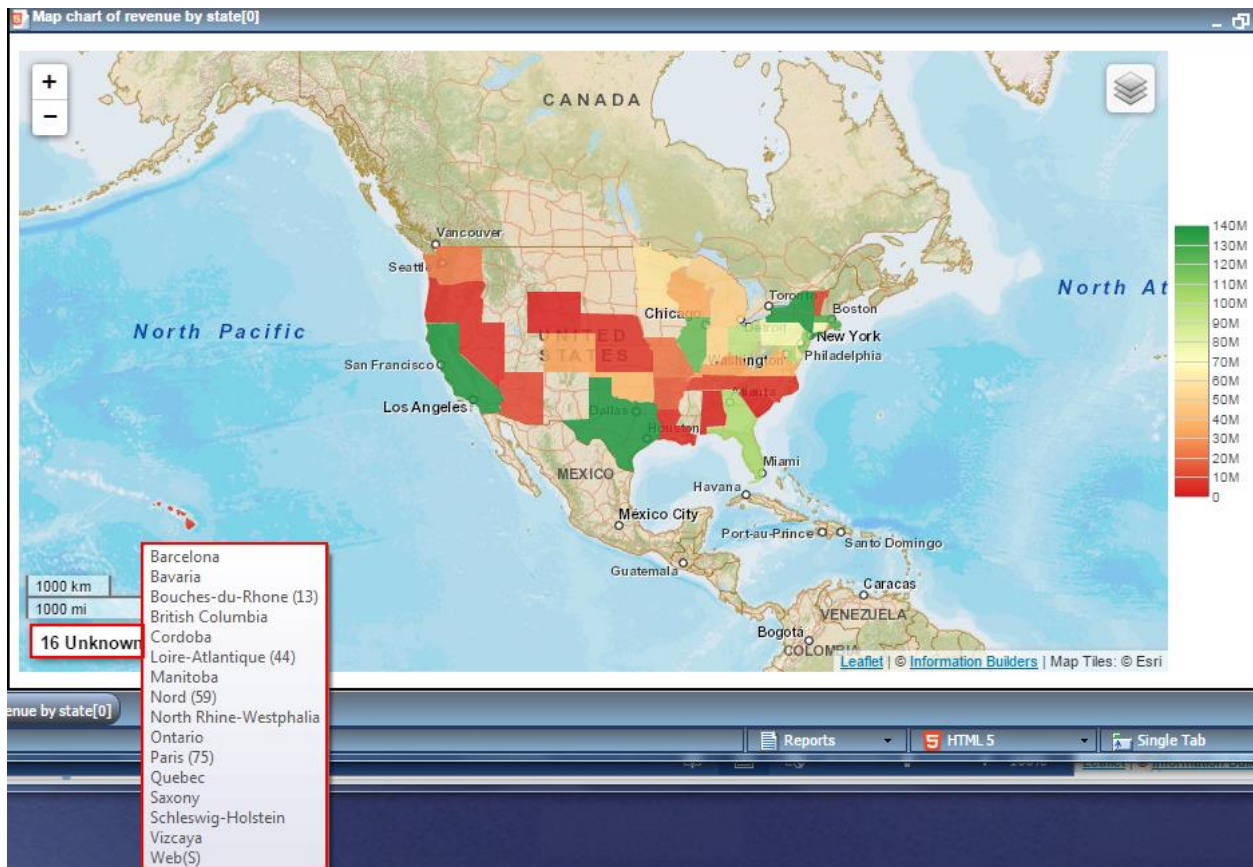
Changing the Map Selections

The Web Query product has a default set of about ten Territory maps that you can select from when creating a map chart. You can customize that list by adding more maps. You can choose to add any of the other maps available in the Web Query product or you can add your own.

The Web Query product also has a default base layer map, which is the OpenStreet world map. You can use the default or you can customize the base layer to be any of the Esri maps available to Web Query.

More details for changing your map selections are provided in the following sections.

Territory Maps

The Web Query product provides pre-packaged overlay maps for the following geographic subdivisions:

- World
- Continents

- Countries
- U.S. state landmarks
- U.S. 3-digit postal zip codes

A territory is defined by its location file. For each territory, there is an underlying location file that contains the properties and geo-spatial information for the map. Recall that location files contain lists of major political subdivisions (such as state and city) along with the latitudes and longitudes that define the borders of the primary subdivision (for example, state).

The pre-packaged territories are contained in .json files in the IFS directory /qibm/proddata/qwebqry/base80/webapps/webfocus/tdg/jschart/distribution/map. Recall that only a partial list of the supplied maps are shown in the default drop down for Territory when creating a map chart. You can look at the IFS directory to see the full list of supplied files.

A zip3 file is provided for each U.S. state as well as the uszip3.json which is a concatenated and simplified version representing the zip codes for all 50 states. The supplied location files are all "Zip3" meaning they only represent the first 3 digits of USA zip codes. For example, Rochester, Minnesota's zip code is 55901, so the 3-digit zip would be 559.

Each location file consists of:

1) Name of the map

2) Landmarks: Primarily a list of city names with their <lat,long>, and a size suggestion for a marker (I.e. the marker for New York City should be a bigger marker than the marker for Albany).

3) Regions: The "Z3" polygons. Each polygon is given a zip3 identifier (for example, "559") followed by a set of <lat, long> points representing the boundary points of that zip code.

When creating a map chart, the territory is selected from the following dialog.
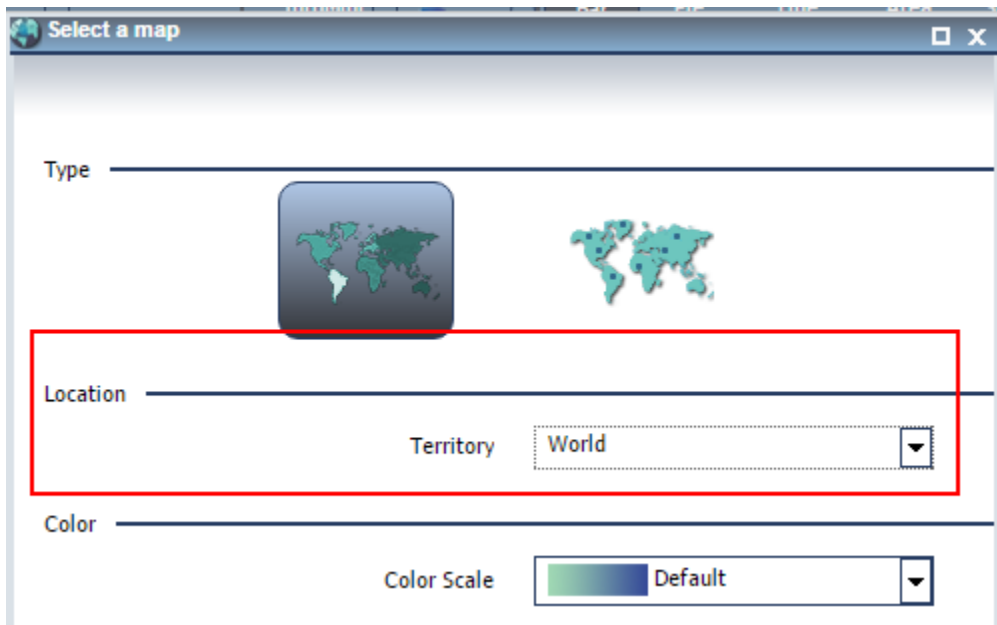
The drop-down has a default selection list, shown below, that is a sampler of available maps.

You can customize the pull down list to add in any of the other supplied maps or add in your own maps. It is not possible, at this time, to remove any of the default maps from the list.

To add any of the other pre-packaged maps available with Web Query into the drop-down list follow these steps:

1. Copy the location file for the map from /qibm/**proddata**/qwebqry/base80/webapps/webfocus/tdg/jschart/distribution/map to /qibm/**userdata**/qwebqry/base80/config/web_resource/map. Here is an example command that copies the Antarctica map:

```
CPY
OBJ('/qibm/proddata/qwebqry/base80/webapps/webfocus/tdg/jschart/distribution/map/an
tarctica.json') TODIR('/qibm/userdata/qwebqry/base80/config/web_resource/map')
OWNER(*KEEP)
```

Note: If you use another command or tool to copy the file, be sure to retain the same ownership and authorities on the new file as the old file.

2. Edit the CustomUIMaps.xml file in /qibm/userdata/qwebqry/base80/config/web_resource/map to add in the new location file. Specify the following within the <json> tag for each territory that you want to enable.

   Map file: This is the .json file name.

   Name: The label, or identifying name, that displays in the Territory drop-down list.

   Layer: Files may have multiple layers in them. If they do, and if you want to use a non-default layer, then you must specify the layer.

   The CustomUIMaps file has examples that are commented-out. If you use these examples, be sure to remove the commenting characters. That is, remove the <!- from the beginning of the line and the --> from the end.

   Following is a snippet of the CustomUIMaps.file that shows an example of adding the Antarctica map.

```
  <Json>
   <!-- <Map file="zip-Wyoming.json" name="zip-Wyoming" layer='regions'> </Map>-->
```

```
     <!-- <Map file="us-state-centroids.csv" name="us-state-centroids"
   csvfields='fred,lat,lng'></Map>-->
     <!-- <Map file="sample_ggsales_regions.geojson"  name="GGSales Sample Regions">
   </Map> -->
     <!-- <Map file="sample_wfretail_regions.geojson" name="WFRetail Sample Regions">
   </Map> -->
     <Map file="antarctica.json" name="Antarctica"> </Map>
     </Json>
```

3. Save the CustomUIMaps.xml file.

4. End Web Query and restart it using the Work Web Query (WRKWEBQRY) command.

The name of the territory you enabled will now show in the territory drop-down list when you create a map chart. For our example, Antarctica appears at the top of the list as shown.

Base Layer Map

The base layer maps for the current version of InfoAssist Lightweight Mapping are provided by Esri. Several Esri base layer maps are available to Web Query.

Following is the list of URL references needed to access the different types of maps provided by Esri that are available to Web Query:

http://services.arcgisonline.com/ArcGIS/rest/services/World_Street_Map/MapServer/tile/{z}/{y}/{x};

http://services.arcgisonline.com/ArcGIS/rest/services/World_Topo_Map/MapServer/tile/{z}/{y}/{x};

http://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer/tile/{z}/{y}/{x};

http://services.arcgisonline.com/ArcGIS/rest/services/World_Terrain_Base/MapServer/tile/{z}/{y}/{x};

http://services.arcgisonline.com/ArcGIS/rest/services/Canvas/World_Light_Gray_Base/MapServer/tile/{z}/{y}/{x};

http://services.arcgisonline.com/ArcGIS/rest/services/NatGeo_World_Map/MapServer/tile/{z}/{y}/{x};

http://services.arcgisonline.com/ArcGIS/rest/services/Ocean_Basemap/MapServer/tile/{z}/{y}/{x};

The default base layer map for Web Query is the World_Street_Map.   To configure Web Query to use one of the other Esri base layer maps, follow these steps:

1. Edit the CustomerUIMaps.xml file located in /qibm/userdata/qwebqry/base80/config/web_resource/map. Modify the <BaseMap> object to specify a descriptive name and title for the map, and specify the Esri URL for the map.

   There exists an example <BaseMap> object in the file that you can edit.   If you use it, be sure to uncomment the section of code by removing the commenting characters <!—and --> or your changes will not take effect.

   Below is an example snippet that shows the proper syntax to set the base layer map to World_Imagery.

```
</Json>
<BaseMap>
 <Map name="ESRI World Imagery">
  <![CDATA[
  {
   title: "ESRI World Imagery",
   url : function() { return
'http://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer/tile
/{z}/{y}/{x}'},
  layerInfo: {

    attribution: function() { return "&copy; <a target='_blank'
href='http://www.InformationBuilders.com'>Information Builders</a>
    "&copy; <a target='_blank'
href='http://www.openstreetmap.org/copyright'>OpenStreetMap</a> contributors";},
    minZoom: 0,
    maxZoom: 8
     }
  }
  ]]>
  </Map>
</BaseMap>
```

2. Restart Web Query.   Anytime you make a change to the CustomUIMaps.xml file, it is necessary to restart Web Query to activate the change.

For the above example where Web Query is configured to use the Esri World Imagery URL, the base layer map will appear like the following.
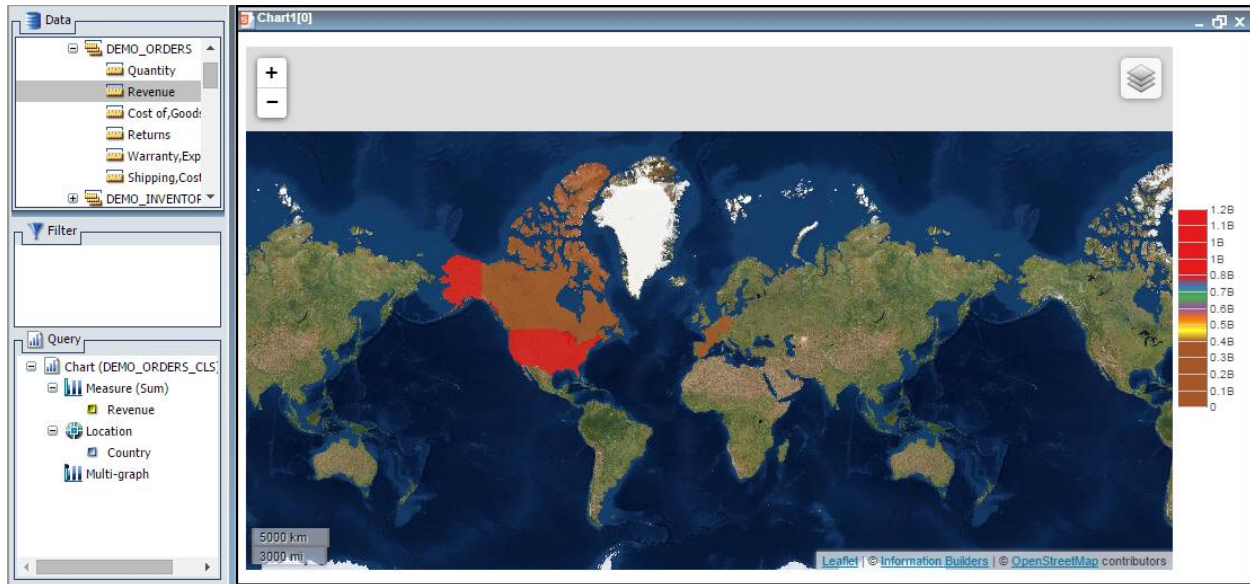
Since the maps displayed on any map chart are owned by the services that supply them, they require that a copyright attribution be displayed on the chart, which is one of the properties you'll see on the base layer. The bottom right of the map displays the copyrights for the providers whose maps are included with Web Query.

It is not possible at this time to customize your map charts with a base layer map that is not provided by Web Query and listed above.

Customizing Territory Maps

There are many reasons why you might want to modify the overlay maps available with Web Query or create new maps entirely. This section describes how to do that.

One reason you may want to edit an existing map is to add in more locations, or to adjust a map property to match your data. For example, the World map (in the territory drop-down) has a list of countries, including Dem. Rep. Korea and Republic of Korea. If you are using the country name as the geographic role, and if your data instead uses the names North Korea and South Korea, then you have a problem! To resolve it, you can create a mapping in your synonym from one name to the other, or you can simply edit the location file and change the names.

Before making customizations to a Web Query supplied location file, always copy it from the IFS proddata directory to the userdata directory, as described previously, and only make changes on the userdata side. The Web Query product directory is overwritten each time group PTFs are applied so any changes to proddata will be lost!

You are not restricted to use only territories that IBM provides. However, to use custom maps, the following Web Query individual PTFs are required:

   2.1.0 - SI59139
   2.1.1 - SI59154
   2.2.0 - None

Maps are available on the internet, free or purchased, that can be downloaded and used. Government sites, for example, are a good source for maps in the U.S. Advanced users who are savvy in geospatial technology can add their own locations and map definitions. Custom maps newly added to Web Query should:

- Have GeoJSON format. For information about GeoJSON, go to http://geojson.org/.
- Have a maximum size of 33 megabytes.
- Have QWQADMIN ownership.
- Reside in /qibm/**userdata**/qwebqry/base80/config/web_resource/map.
- Contain simple polygons (areas). No multipart are supported.

Here are high-level steps to download and configure a new map.

1. Download a shapefile for the desired map. A shapefile is an Esri format for storing the location, shape, and attributes of geographic features. A shapefile consists of a set of related files.

2. Convert the shapefile to GeoJSON format and give the resulting file a .geojson extension. There are free converter tools on the internet to do the conversion.

3. Verify that your new file has a valid GeoJSON format. There are also free tools on the internet to do this check. It may seem silly to validate the file after you just converted it, but it is a worthwhile step.

4. Transfer the .geojson file to /qibm/**userdata**/qwebqry/base80/config/web_resource/map. If you use FTP, but sure to transfer the file in binary mode.

5. Change ownership of the file to QWQADMIN and grant authorities. Unless it is a sensitive file, *PUBLIC can be granted *RX authority.

6. Edit the CustomUIMaps.xml file in /qibm/**userdata**/qwebqry/base80/config/web_resource/map to add in a <map> object for your map. Following is example syntax to add in a territory for Minnesota townships. The map file in the IFS is named mn_2015_townships_500k.geojson. The name of the map that will appear in the Territory drop-down list is Minnesota townships.

   ```
   <Map file="mn_2015_townships_500k.geojson" name="Minnesota townships">
   </Map>
   ```

7. End Web Query and restart it using the WRKWEBQRY tool or the STRWEBQRY and ENDWEBQRY commands.

End of document.