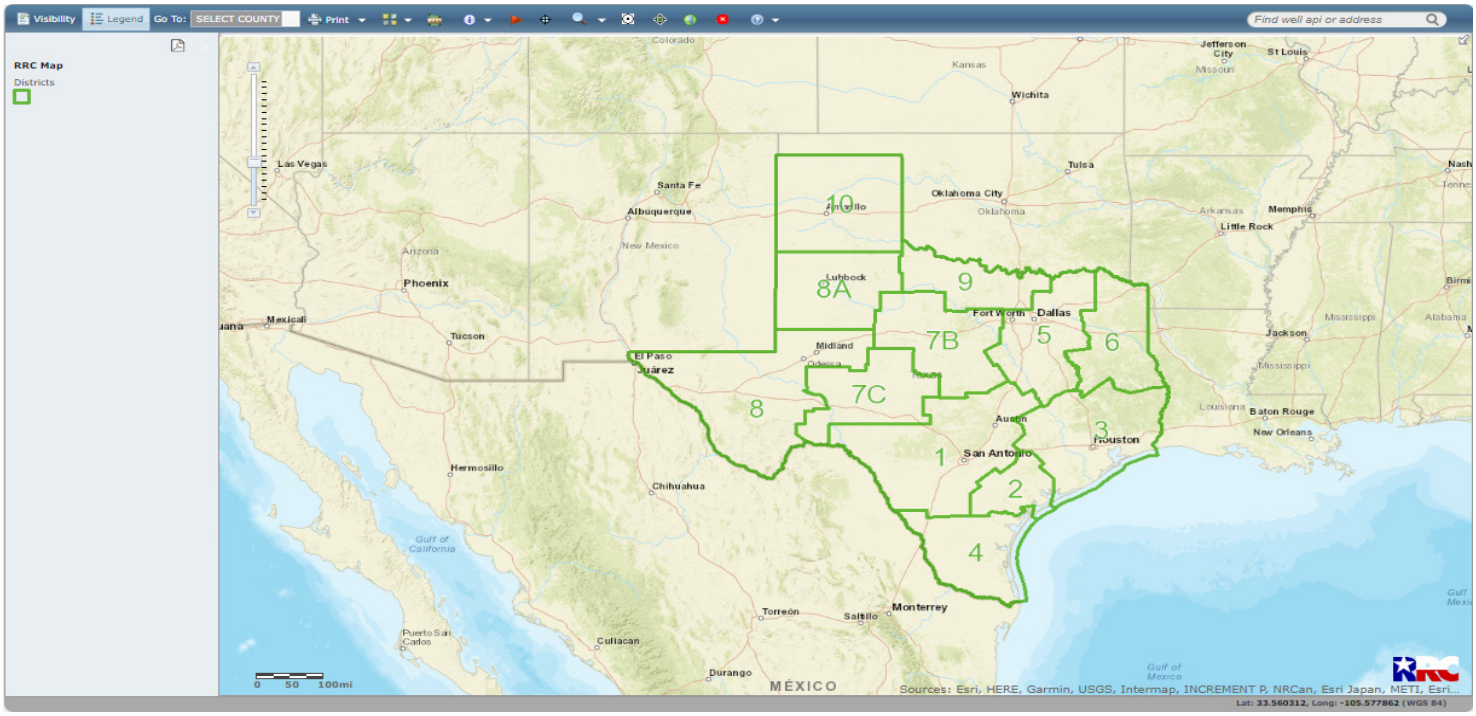
Energy Production Scavenger Hunt Using GIS
Public GIS Viewer, Railroad Commission of Texas

Welcome to the Energy Production Scavenger Hunt using GIS! You will use the Public GIS Viewer hosted by the Railroad Commission of Texas to navigate your way through the Lonestar State!

The goal is to learn about different areas of Texas and its energy resources along with an introduction to using a geographic information system.

Let's begin. First, connect to the Public GIS Viewer at https://gis.rrc.texas.gov/GISViewer/
You will see a screen that looks like the graphic below:

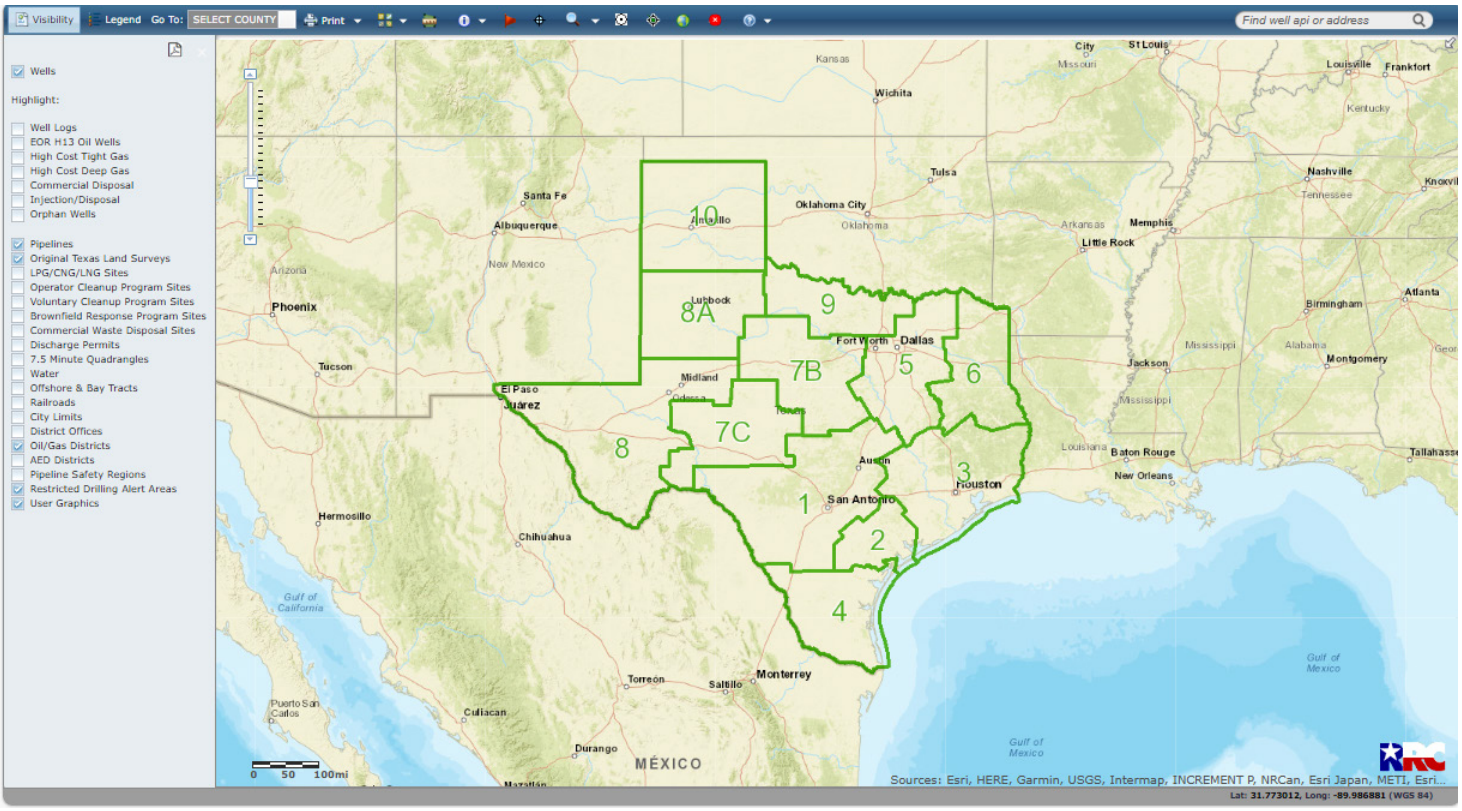


The green outline shows the various Oil and Gas Districts at the Railroad Commission of Texas.

Question: How many districts do you see in the viewer?

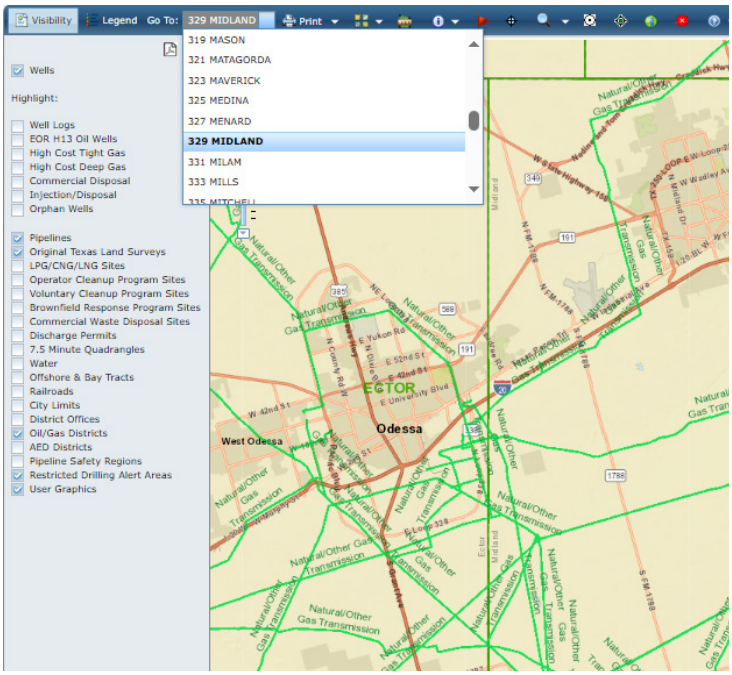
Answer: 12. Although the highest number you see is 10, there is a District 8 and District 8A, and a District 7B and District 7C, but no District 7A. The important thing is each district boundary is represented as a polygon. Later we'll learn more about how GIS uses polygons, lines and points.

Next, select the Visibility box at the top left of the screen. You will see a list of layers beginning with Wells at the top of the list. You can select the checkbox next to any layer to make it visible. These layers represent real-world features at their mapped locations. This allows you to find a feature and see all of the information that is available for regulatory purposes. For now, make sure that **Wells, Original Texas Land Surveys, Oil/Gas Districts, Restricted Drilling Alert Areas,** and **User Graphics** are checked. It will look like the graphic on the next page:

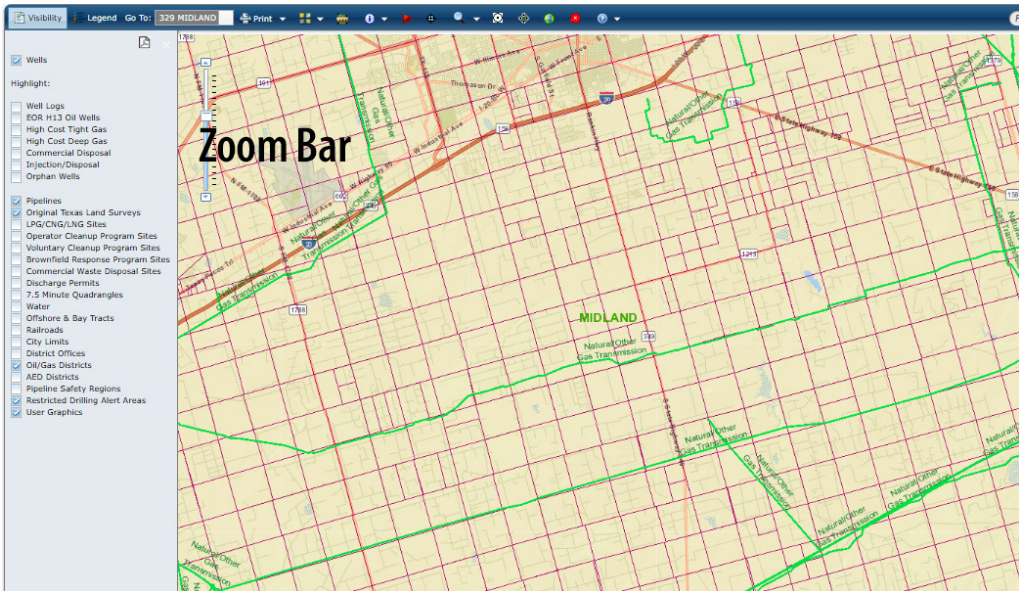


GIS uses polygons, lines and points to depict features. These are graphical representations of real-world items like oil wells, gas pipelines, and alert areas. In the RRC Public GIS Viewer, oil and gas wells are represented as points, pipelines are represented as lines, while district boundaries and alert areas are represented as polygons.

Select the checkbox next to Pipelines. At the top of the screen in the blue tool ribbon you will see Go To: **SELECT COUNTY**. This allows you to quickly move in the GIS viewer to a specific county. Click the drop-down area next to SELECT COUNTY. You will see a scroll down menu that lists every county in Texas. Scroll down the list of counties until you find 329 Midland. Click Midland. This will zoom in and center Midland County on your screen.

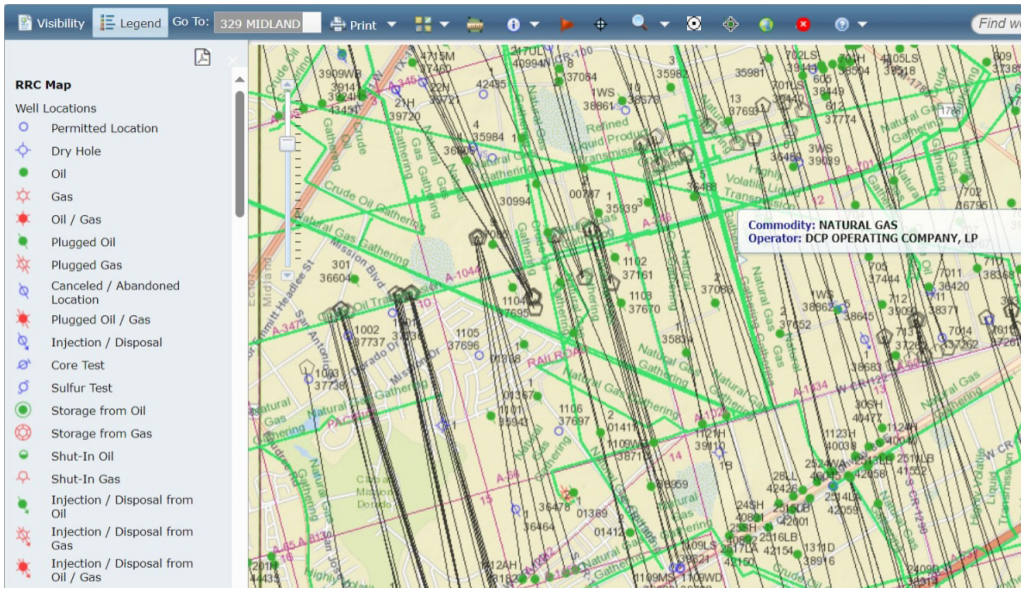


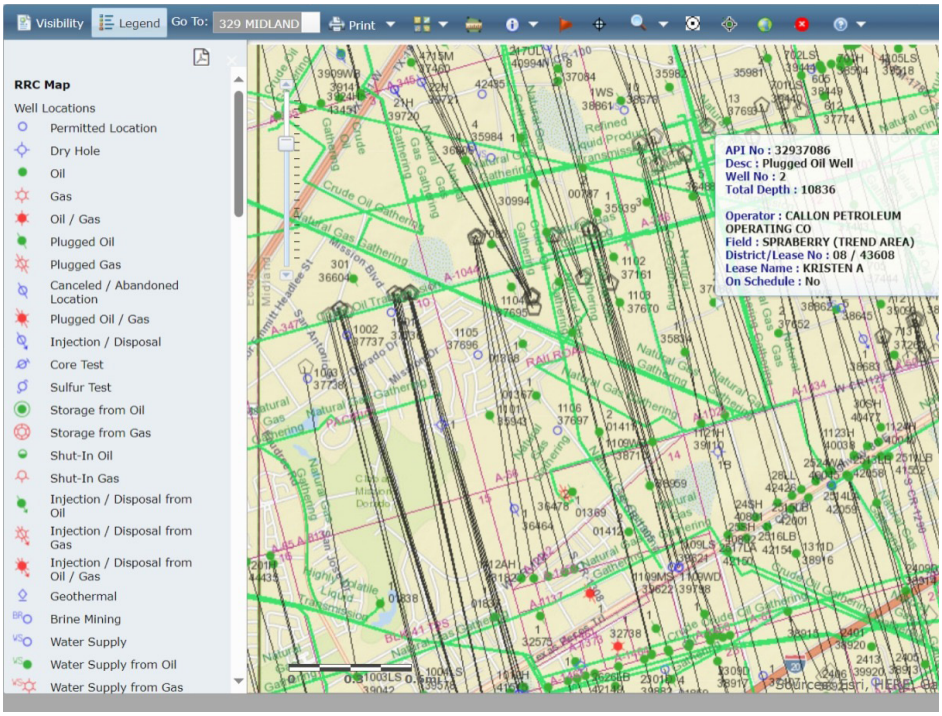
You will now see some of the features in Midland County. This includes the county boundary, pipelines in the area, along with cities and roads. To view additional features you can zoom in using the zoom bar at the top left of the map screen. You can use the scroll slide selector to zoom in and out, or you can use the top and bottom scroll arrows to scroll in and out. Fow now, click the top arrow of the zoom bar. The screen will change as you zoom in. You will see the Original Texas Land Survey boundaries (looks like purple grid squares) on the screen. Let's do a quick knowledge check. How is the Original Texas Land Survey depicted, as points, lines, or polygons? **Answer:** Polygons. Each box in the land survey is a specific land survey boundary located in Midland County. How are the pipelines depicted, as points, lines or polygons? **Answer:** Lines. Each pipeline is a specific line feature that represents the type of pipeline and its location in Midland County. Next, we'll zoom in and see what other features are in the county.



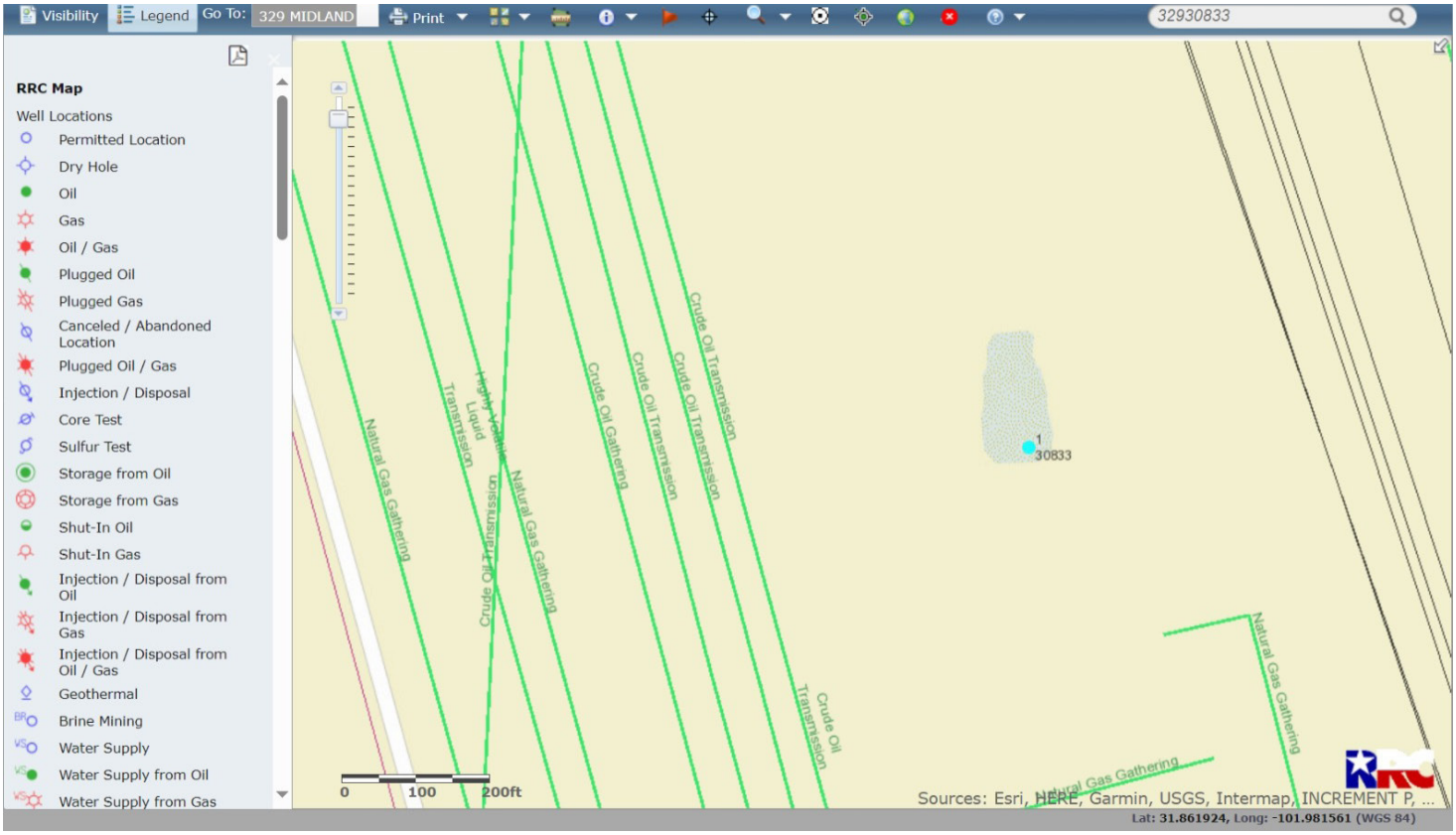
Use the scroll slide selector to zoom in by sliding the selector up one position. Or you can click the top arrow on the zoom bar one time. You will see several oil and gas wells appear on the screen. Next, select the **Legend** tab in the blue tool bar at the top left of the screen (the Legend tab is next to the Visibility tab). You will see a list of well types in the legend area of the screen.

Move your cursor across the screen and position it over any well. A small dialogue window will appear that shows information about the well. The well feature is depicted as a point. Any information about the well is called an attribute. In GIS, features are depicted as points, lines and polygons (oil and gas wells are depicted in the viewer as points) and the attributes are text and numbers that describe important information about the well.



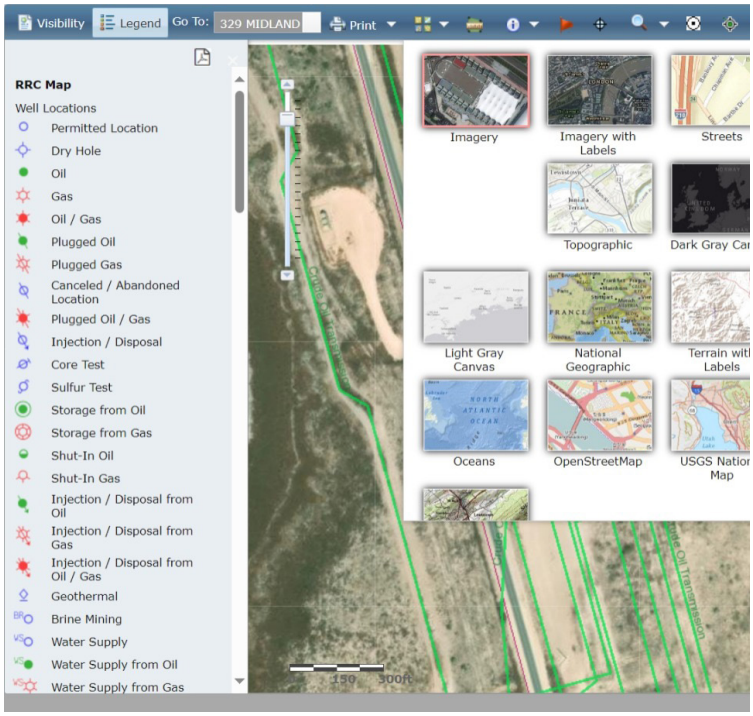


Attribute information includes the American Petroleum Institute (API) number, which is a distinct number assigned to each well. It also includes the well description (type of well it is), the well depth, the operator, and the field location of the well. To the left is an example of what you will see when you scroll over a well site. Let's explore the wells in this area using more tools in the Public GIS Viewer. The API number is assigned to a well, so it is easy to catalog and track. Most API numbers will begin with a county designator and then have a unique set of numbers for the well.

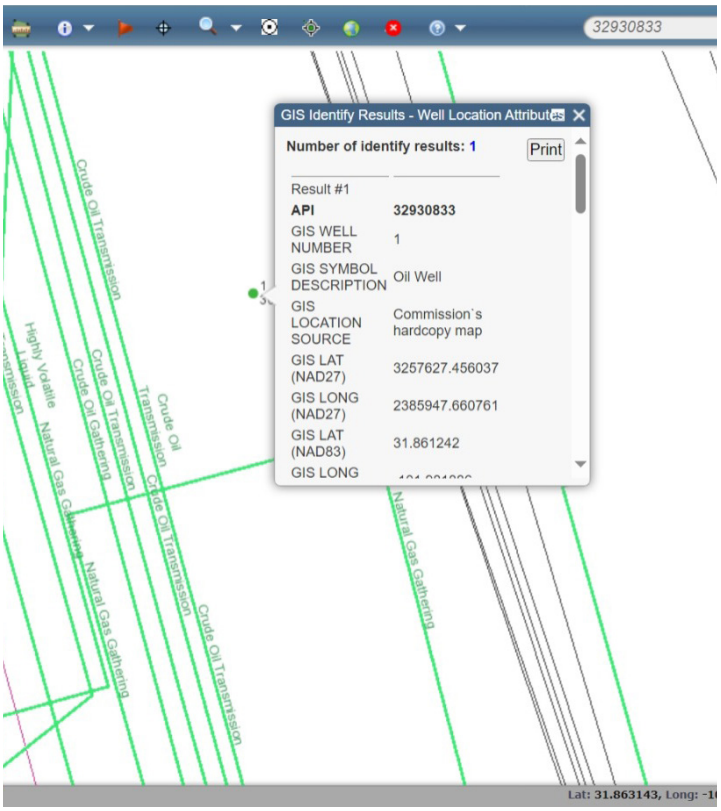


An example is API 32930833. The first three numbers are the county code. Does that number look familiar? 329 is the county code for Midland County (If you look at the Go To area of the blue tool ribbon, you will see 329 Midland in the pull down). We can navigate to a county and then find wells in that county. Another way is to use the Find Well API or address search function in the blue tool ribbon at the top right of the screen. In the Find Well API or address search function type in 32930833 and click the gray magnifying glass icon. The screen will zoom into the well location of API 32930833, and you will see it highlighted as a cyan circle in the middle of the screen.

Let's gain some context of the area by changing the map background. In the blue tool ribbon, you will see four small squares next to a pulldown arrow. This is the **Switch Basemap** function. Click the down arrow and you will see several basemaps. The default basemap that you see in the viewer is the topographic background. To see how the area would appear if you were to fly over it in an aircraft, change the background by selecting Imagery with Labels. You will see the basemap change to an imagery background. Feel free to change to different basemaps and learn about the different ways to depict the ground surface. If you were not familiar with the area and were driving out to the well site, then you might want to use the Streets basemap or the OpenStreetMap as a background. If you want to see how the terrain is defined in the area, then you could use the Topographic basemap or the USA Topo Maps background. If you wanted a "real world" look at the area, then you could use the **Imagery** basemap or the **Imagery with Labels** basemap.



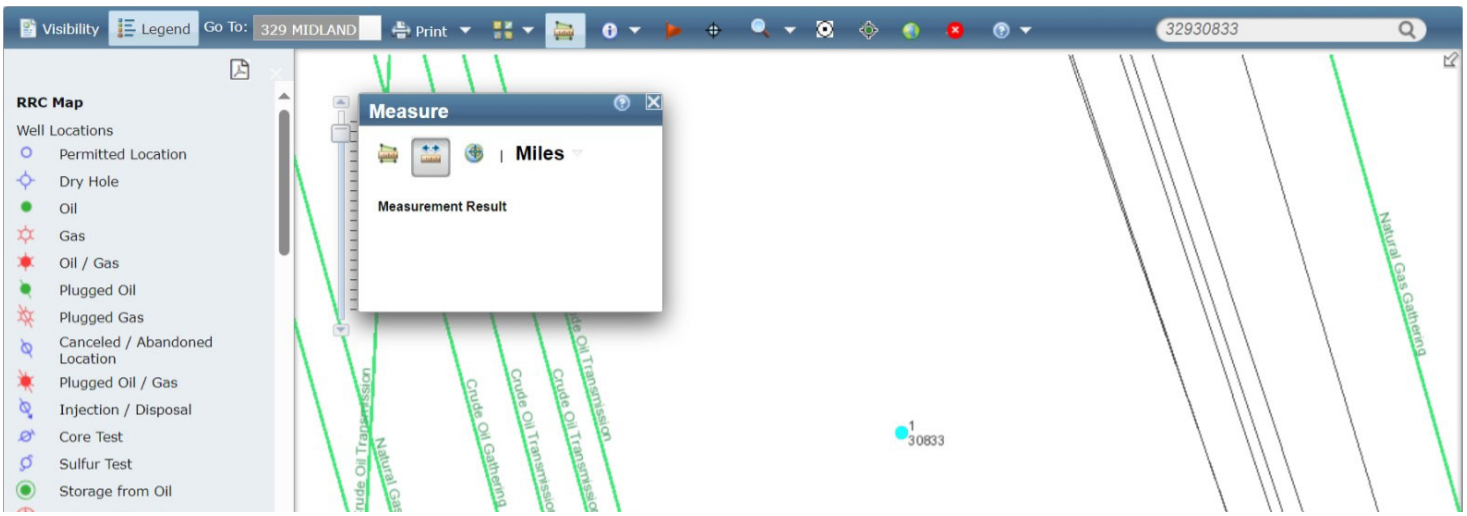
As for the GIS, the features are represented as points, lines or polygons in a vector format. Vector data provides a numerical representation of data objects and is useful because it graphically depicts a feature and stores the attributes associated with the object in a database. The GIS viewer uses vector data for oil wells, gas pipelines, and survey boundaries. The GIS viewer uses another type of data called Raster data. The basemaps are raster data. Raster data stores a single value in a pixel, such as a color code, and is useful for basemaps and imagery.



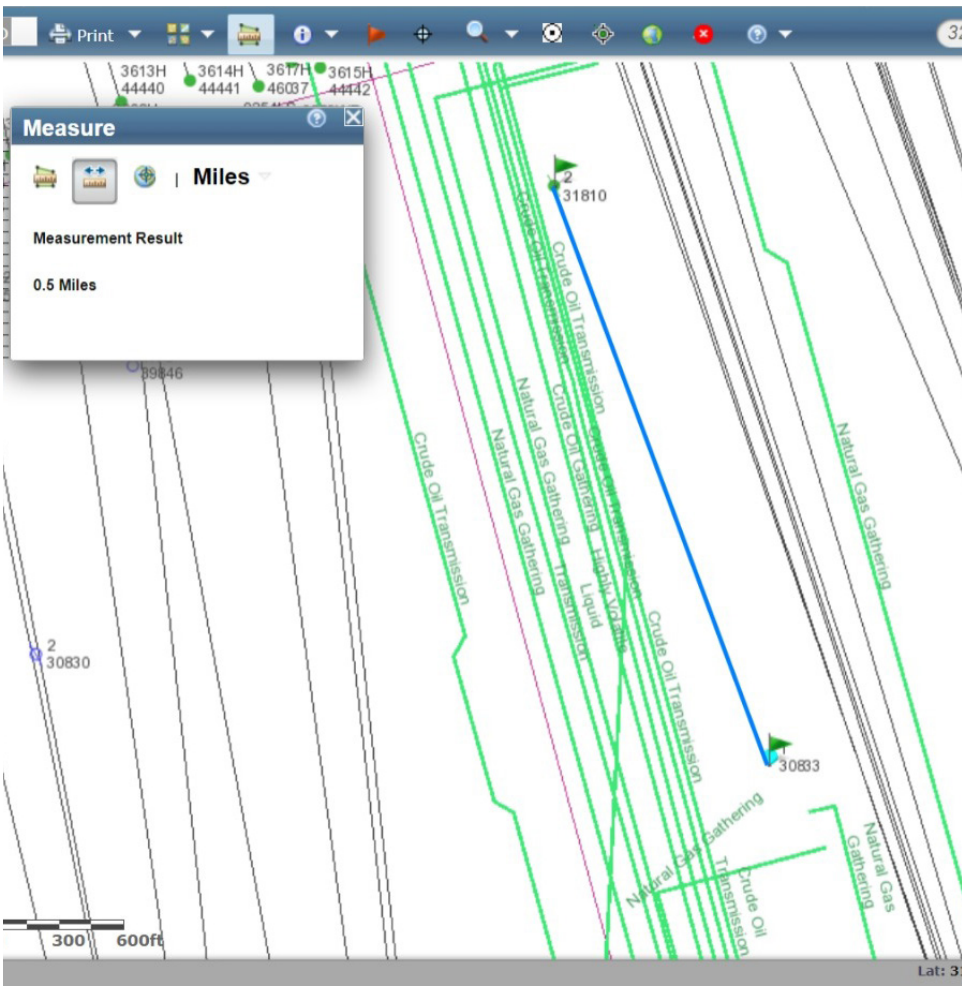
Now that you have an understanding of data types and data structures, let's learn more about the features and functions in the GIS Viewer. Make sure your basemap is set to **Imagery with Labels**. Next, select the Identify icon (looks like a circle with i in the center) in the blue tool ribbon. In the drop-down menu select **Wells**. Move your cursor to the highlighted well and click on the well (API 32930833). You will see the **GIS Identify Results – Well Location Attributes** dialogue box appear. Your screen will appear similar to the screen capture to the right:

Scroll down in the dialogue box and view the well's attribute information. All the attribute information is stored in a database and associated with the well. The feature you see on the screen is the well (a point) and the attributes you see in the dialogue box are text and numbers that describe various aspects of the well. This is much like the "birth certificate" and the "medical records" or the "academic transcript" of a well. The ability to track and store this amount of information is possible using GIS and a viewer like the RRC Public GIS Viewer. Close the dialogue box by clicking the X at the top right of the dialogue box.

You can also measure distances between features using the Measure tool in the blue tool ribbon. This tool has an icon that looks like a ruler (it is located between the Switch Basemap tool and the Identify tool) superimposed over a green polygon. Click the **Measure** tool and it will open a dialogue box. The Measure dialogue box shows three icons which are different ways to measure items in the viewer. You can measure by Area, Distance, or Location. Select the Distance icon (the middle icon) and you will see the dialogue box show Miles and a drop-down arrow. Select the dropdown arrow and it will show the available units of measure that you can use. Click Miles and then use your cursor to navigate to the API 32930833 well.



Click on the well to open activate the Measure tool. Move your cursor to the well labeled 31810 directly north. Double-click on the well labeled 31810. This closes the measuring between the points and will show a small green flag at the starting point and the ending point.



Question: What is the measured distance between the two wells?
Answer: 0.5 miles.

If you measured the distance as 0.5 miles, then congratulations, you have mastered the **Measure** tool. If not, repeat the instruction and re-measure the distance between the two wells. If you want to know the distance in kilometers, then select the drop-down arrow next to **Miles** in the Measure dialogue box, select **Kilometers** from the drop-down list, and it will show the measurement result.

Question: What is the distance in kilometers?
Answer: 0.9 kilometers.

You can also clear any graphics from the **Measure** tool from the screen using the **Clear Graphic** function in the blue tool ribbon. The **Clear Graphic** icon looks like a red circle with a small X in the middle of it. Click the **Clear Graphic** icon and it will remove the measured line and the small green flags. It will also remove any other graphics you created or any highlighted items.

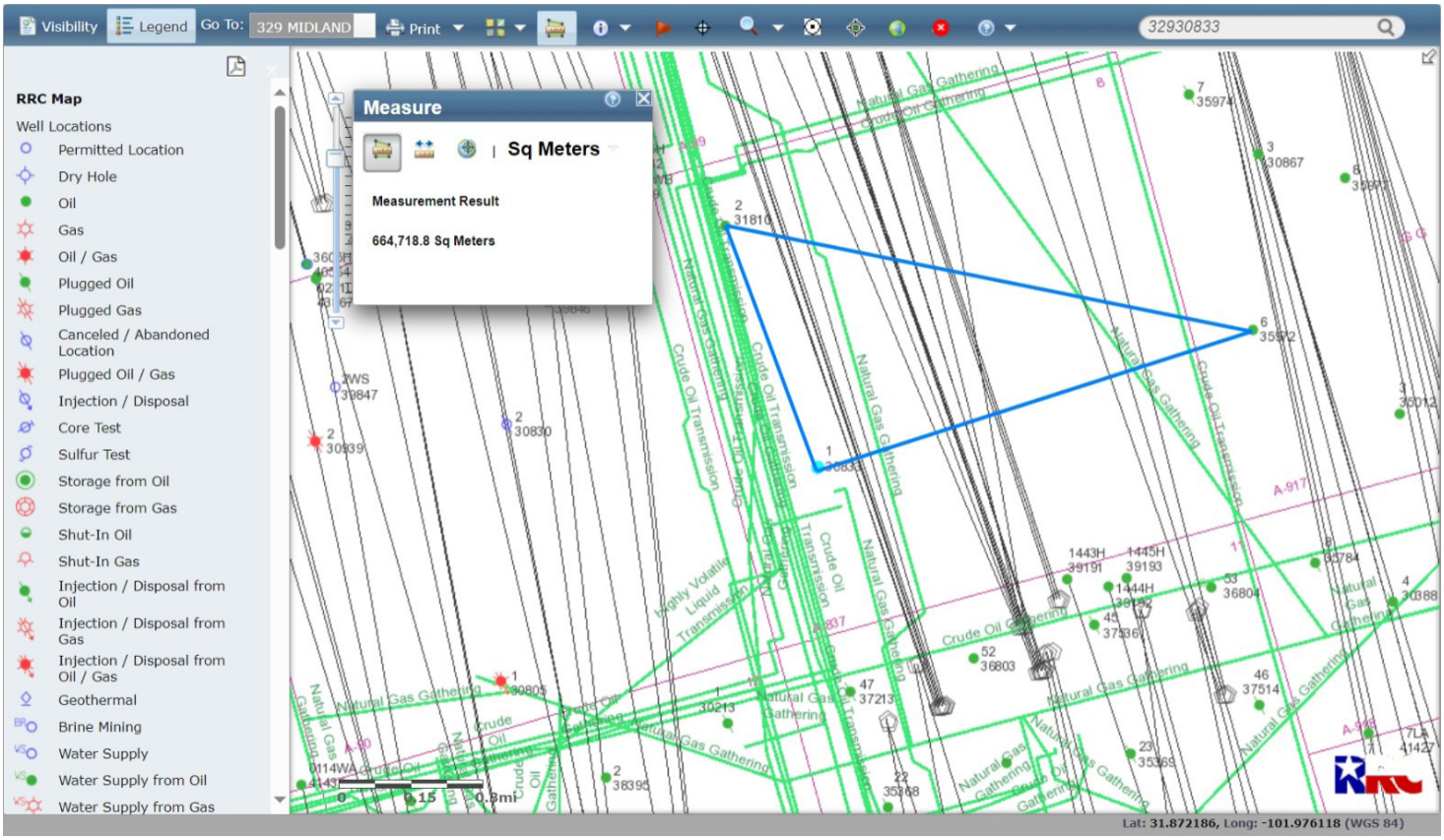
Next, select the **Area** icon (left-most icon in the Measure tool dialogue box). You will see the measurement type change to **Acres**. Select the dropdown arrow next to **Acres** and view the list of available measurement units. Scroll to the bottom of the list and select **Sq Meters** – this will measure area in terms of square meters.

Click the well labeled **30833**, then move the cursor to the well labeled **31810** and click on that well, then move the cursor to the well labeled **35972** and double-click that well. This will close the area and the ability to keep measuring.

Question: What is the area of the triangle between these three wells?
Answer: Approximately 655,000 square meters.

If you are close to the approximate area measurement, then congratulations on measuring the area between three wells locations. If you want to continue trying to get something in the range of 655,000 square meters, then continue to practice your measuring skills.

Close the **Measure** tool by selecting the small white box with an X at the upper right of the dialogue box. To start again, reopen the **Measure** tool, select the Area tool and click between the three wells. If Acres is showing as the measuring unit, then you can change that to **Sq Meters** using the drop-down arrow, select **Sq Meters**, and it will display the measurement result in square meters. Your area measurement will look similar to the screen display below:



When you have completed measuring, close the Measure tool and select the Clear Graphics icon to remove any created graphics from the screen.