Overlay Real-time Operations Data onto Esri ArcGIS Platform for live Situational Awareness and Perform Analysis with Historical Playback

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Introduction

PI Integrator for Esri ArcGIS is a versatile platform that enables real-time geographic data visualization by connecting the PI System with the Esri ArcGIS platform, where you can add dynamic features to functional and geographic maps and continuously update these features as states, values, and location change. In short, PI Integrator for Esri ArcGIS combines the "time" aspect of the PI System with the "space" aspect of the Esri ArcGIS platform to enhance insight over infrastructure processes and increase operational awareness.

This integration has successfully been implemented in many different industry verticals. For example:

- Utilities: For utility companies, keeping customers happy means keeping the power on. That's a delicate balance between a host of interwoven factors such as safety, compliance, coordination of mobile assets, and preventive maintenance. Having insight into asset history and performance, environmental and proximity effects, and analytic tools, will enable your organization to meet these demands.
- Facilities: Initial efforts to develop “smarter” cities may have consisted of a collection of uncoordinated projects. By combining data from buildings, transportation and environment with a single view through digital maps, city leaders, government authorities, business owners and tenants have an instant grasp of information they need to navigate a complex urban environment.
- Oil and Gas: In the Oil and Gas industry, both location of assets and their performance status are critical for operations. Layering a map of assets with real-time and historical data enables an evolution toward reliability-centered operations.

This session explores the partnership between Esri’s ArcGIS powerful mapping platform and the real-time PI System infrastructure. In this session, you will discover how easy it is to connect your PI System to your Esri ArcGIS platform to create an operational view of critical metrics on your enterprise in a geospatial way. To this end, you will be guided through a few different scenarios to discover the power of real-time data in a mapped world. Together, we will explore how to create insightful WebMap with live PI System data, create the time-enabled feature layer, and create the Augmented time-enabled feature layer that contains data from both the PI System and the existing feature layer that contains geometry, without modifying the existing feature layer. Furthermore, you will learn how you can leverage custom OSIsoft Visualization displays from Esri Webmaps to drill-down into your data.

We have prepared an environment for you that contains both a PI System and the Esri ArcGIS platform installed. Specifically, you will each have access to a virtual machine that consists of a self-contained PI System, PI Integrator for Esri ArcGIS 2017 SP1, ArcGIS Server, Portal for ArcGIS, and ArcGIS GeoEvent Server. You will use this machine to walk through the workflow of creating a dashboard with a live map, populated with live data from the PI System.

Regarding the virtual machine that you will be using: on the OSIsoft side, we’ve installed the PI System 2018, which includes both the PI Data Archive and the PI Asset Framework. Additionally, that machine is running OSIsoft Visualization, for visualizing data. We have preinstalled and configured the PI Integrator for Esri ArcGIS 2017 SP1 for you, as well, and finally in order to make using the Integrator easier, we have preloaded a PI AF Database for you that already contains PI AF Templates, in addition to preloading all of the required PI points as well, and the requisite simulated data for the scenario. Of course, we will

also learn how to create an asset structure from-scratch in PI AF using an already existing layers in Esri's GIS platform and updating the AF template to bring-in live PI System data to Esri. Lastly, we will also see how to create an augmented time-enabled feature layer that contains data from both the PI System and the existing feature layer that contains geometry, without modifying the existing feature layer.

On the Esri side, on that VM we have installed ArcGIS Server 10.7.1, along with Portal for ArcGIS, and GeoEvent Server 10.7.1.

Your instructors will inform you how to access these machines; after you have access to them, as a class you'll be guided through the following steps:

1. Verify that the requisite configuration steps have been performed on the GeoEvent Server and on the PI Integrator for Esri ArcGIS 2017 SP1
2. Verify that the PI AF Database is ready
3. Create a Layer based-on the Wells PI AF template on Esri ArcGIS via the PI Integrator for Esri ArcGIS
    - Create the feature service in Portal for ArcGIS for the oil wells and connect through the GeoEvent Server
4. Create a WebMap with both the above feature layers and show how to change symbologies
    - Create the feature service in Portal for ArcGIS for the Maintenance vehicles and connect through the GeoEvent Server
5. Add PI Vision display for a Well and show its integration with WebMap
6. Create an Operations Dashboard view with the above WebMap and integrate it with PI Vision custom dashboard
7. Demonstrate the feature in the PI Integrator that would clean-up the GeoEvent connectors and hosted feature layer when the layer is deleted in the integrator
8. Create a time-enabled feature layer using the Oil Wells & Maintenance vehicles
9. Create an augmented time-enabled feature layer for the coal plants

If you ever have any questions, feel free to ask an instructor.

Below are the names of the machines that you can use for this class, along with the credentials that you'll use for signing into them and ArcGIS Online. We've included the names and credentials twice, and we recommend tearing out one of the below sections from the book and keeping it close so you can be quickly reminded of what credentials and machine names to use.

Windows Credentials (Useful for accessing PI Vision and the PI Integrator)	
Username	pischool\student01
Password	<*password would be provided by your instructor*>

ArcGIS GeoEvent Server Credentials	
Username	siteadmin
Password	vlesiteadmin

Portal for ArcGIS Credentials	
Username	siteadmin
Password	vlesiteadmin

Servers	
PI/AF Server Name	PISRV01
OSIsoft Visualization Server	https://pisrv01.pischool.int:446/pivision/#/
PI Integrator for Esri ArcGIS Server	https://pisrv01.pischool.int:448/configuration/#/services
GeoEvent Server Manager	https://pisrv01.pischool.int:6143/geoevent/manager

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Tear out this page and keep it nearby as a handy reference.

Windows Credentials (Useful for accessing PI Vision and the PI Integrator)	
Username	pischool\student01
Password	

ArcGIS GeoEvent Server Credentials	
Username	siteadmin
Password	vlesiteadmin

Portal for ArcGIS Credentials	
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Password	vlesiteadmin

Servers	
PI/AF Server Name	PISRV01
OSIsoft Visualization Server	https://pisrv01.pischool.int:446/pivision/#/
PI Integrator for Esri ArcGIS Server	https://pisrv01.pischool.int:448/configuration/#/services
GeoEvent Server Manager	https://pisrv01.pischool.int:6143/geoevent/manager

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1. Verify that Prerequisites and Configuration Steps are Complete

We have already installed all the required software components for you, and after doing that, we have completed the prerequisite configuration steps on both the ArcGIS GeoEvent Server and the PI Integrator for Esri ArcGIS.

The steps that we have already completed for you are:

1. Register at least one OSIsoft Visualization Server, Portal for ArcGIS if you are publishing the feature layer to the same, and ArcGIS GeoEvent Server endpoint in the PI Integrator for Esri ArcGIS.
2. Register at least one valid data store on the GeoEvent Server .

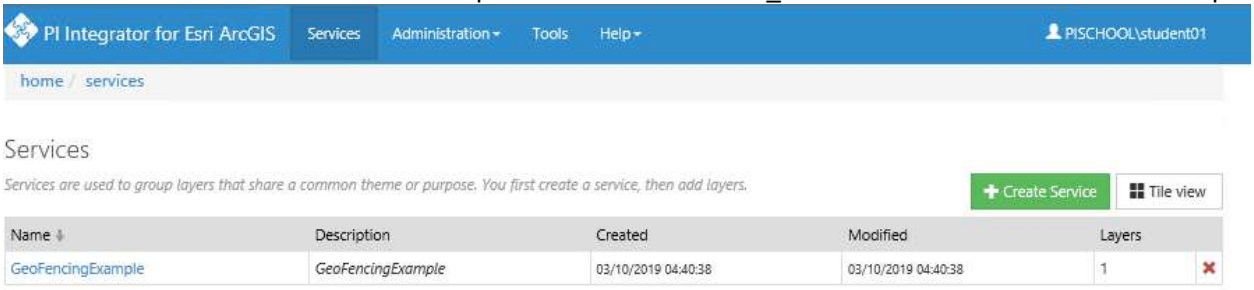
We'll together walk through those configuration steps, even though they are already finished, so that you'll be familiar with what will need to be done on a completely new installation.

a) Confirm at least one OSIsoft Visualization Server & ArcGIS GeoEvent Server endpoints in the PI Integrator for Esri ArcGIS

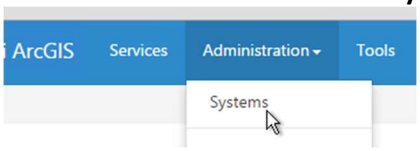
The PI Integrator for Esri ArcGIS allows an OSIsoft Visualization link to be generated for each Layer that is created in the PI Integrator for Esri ArcGIS. That link allows an ad hoc and custom OSIsoft Visualization display to be automatically generated for a specific Esri map Feature. For example, if this link is used in a Feature pop-up, when a user clicks on a particular Feature, then clicks on the Visualization link, the identifying information for that particular clicked Feature will be passed to the PI Integrator for Esri ArcGIS, and the user will be redirected to an automatically generated ad hoc or custom OSIsoft Visualization display for that specific map Feature.

In order for this functionality to work, an OSIsoft Visualization server must be registered in the Integrator PI Integrator for Esri ArcGIS; moreover, that OSIsoft Visualization server must have access to the PI AF Element data that corresponds to the Esri Features in question. For example, if a Layer was created from a PI AF Element Template for oil wells, then the OSIsoft Visualization server should allow access to the PI AF Element database that contains those oil well elements. In our case, we have already registered an OSIsoft Visualization server for you, so we'll check now to show you what that should look like.

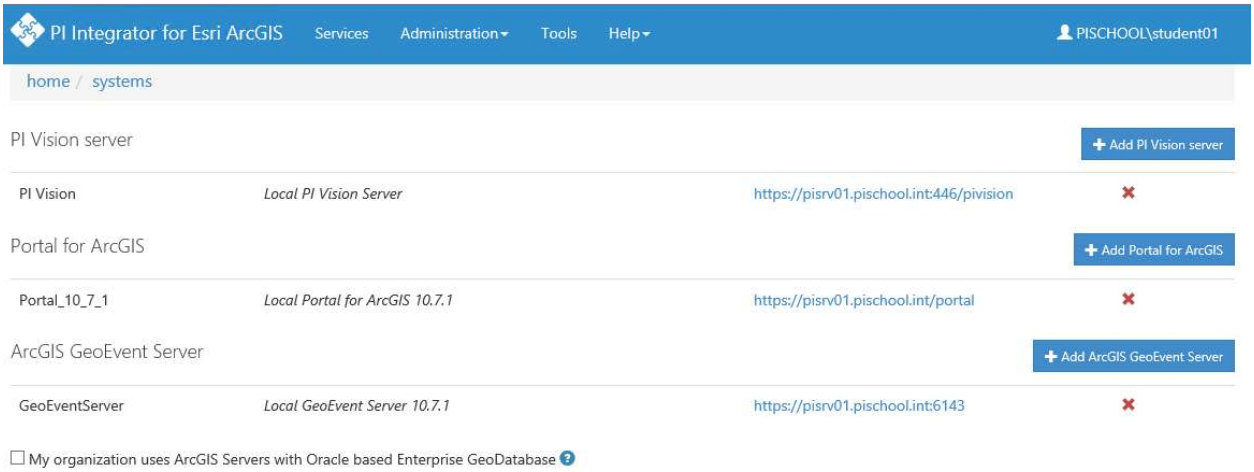
1. Open Internet Explorer web browser and log in to PI Integrator for Esri ArcGIS 2017 SP1 by navigating to, for example, https://pisrv01.pischool.int:448/configuration/#/services or by clicking on the bookmark. It should be a bookmark for you in your Internet Explorer web browser using the username and password as pischool\student01 & ***<password>***, respectively. Note that this credential is also provided in the file URLs_Credentials.txt located in the desktops.



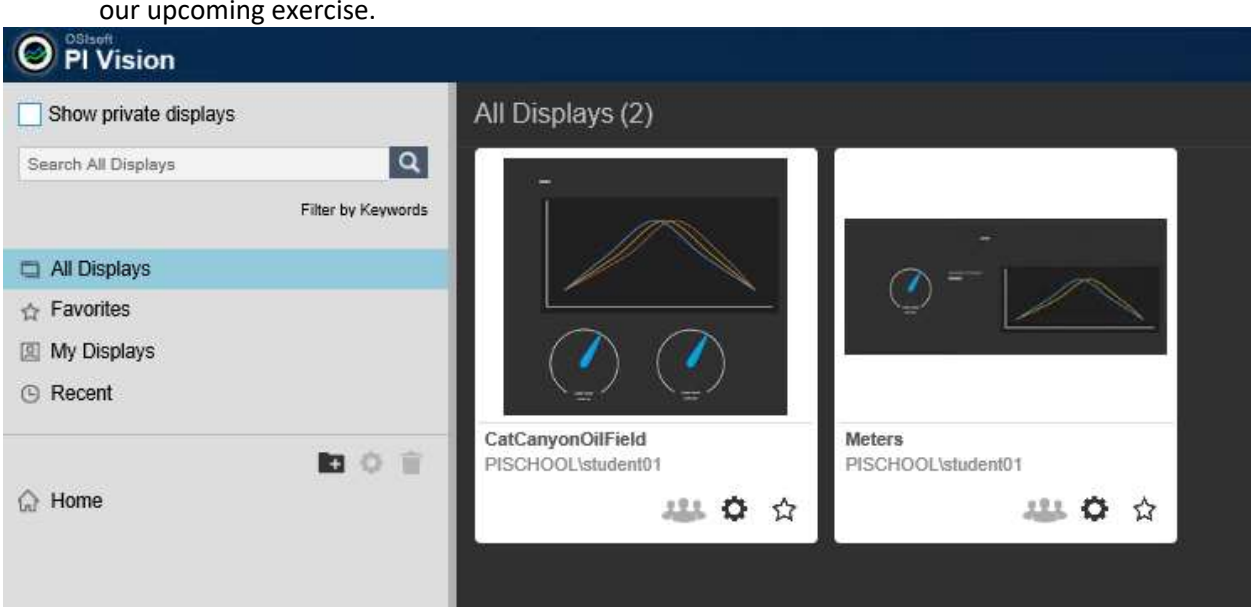
2. Select **Administration** > **Systems**.

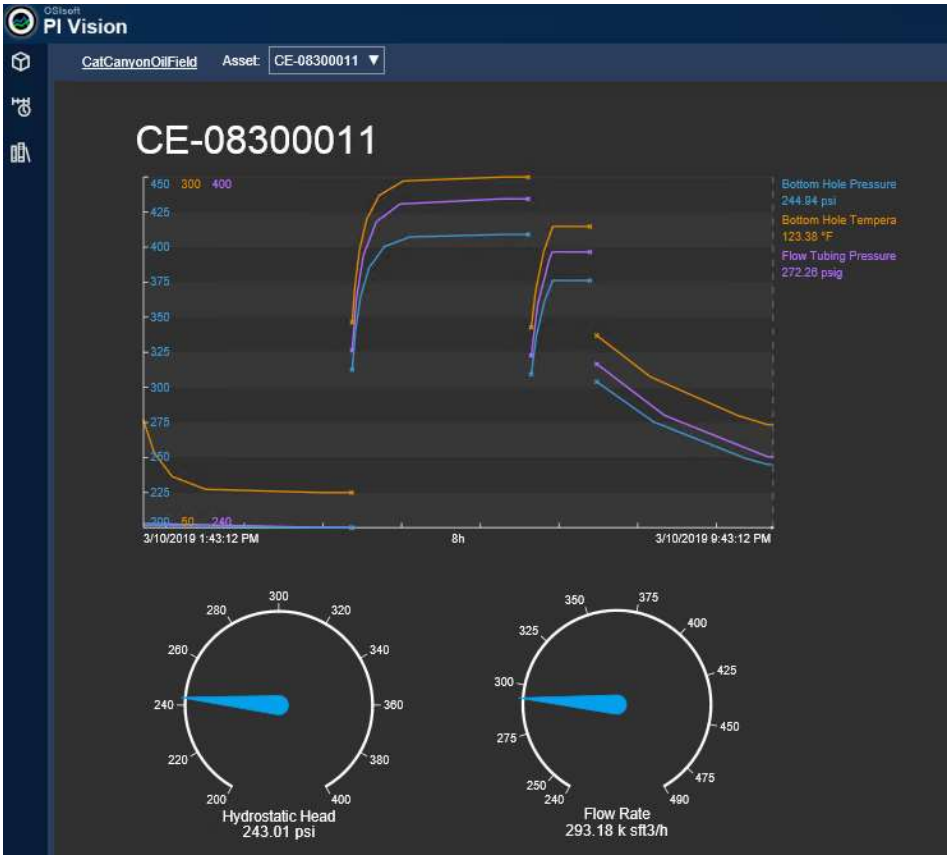


3. Confirm a https based OSIsoft Visualization endpoint, Portal for ArcGIS, and ArcGIS GeoEvent Server are registered in the PI Integrator for Esri ArcGIS.

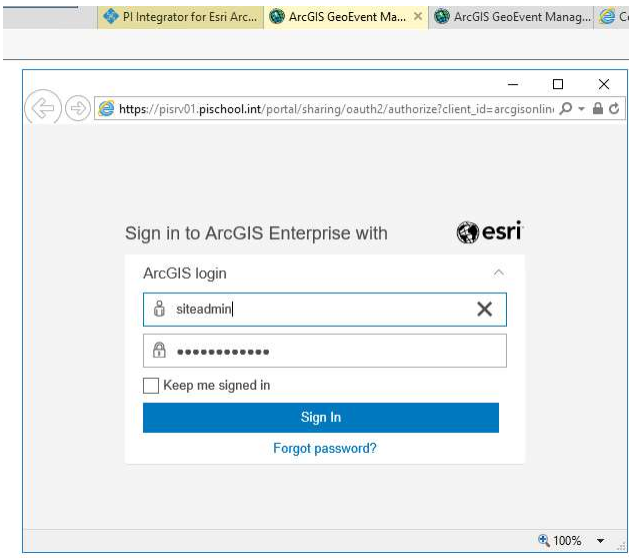


4. Click on the URL for your registered OSIsoft Visualization server in order to launch OSIsoft Visualization. If you are prompted you can enter the same active directory credentials, namely, pischool\student01 & ***<password>*** for the username and password, respectively. As shown below, you would note two custom OSIsoft Visualization displays that we would be leveraging in our upcoming exercise.





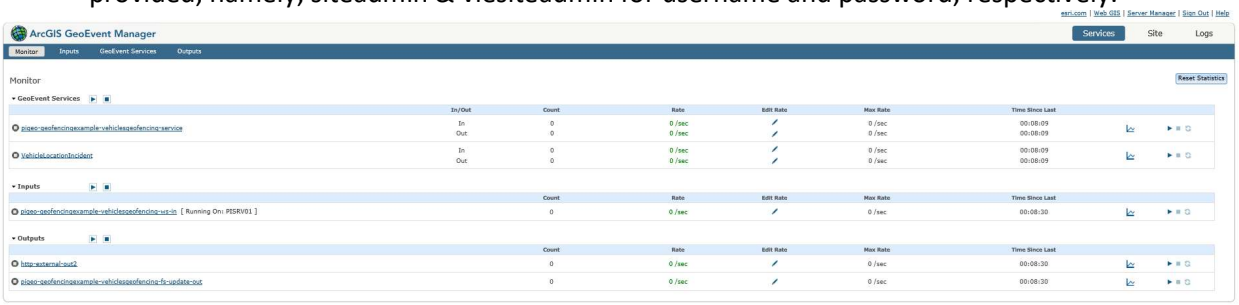
5. Now click the url for the GeoEvent Server that was registered in the PI Integrator for Esri ArcGIS, namely, https://pisrv01.pischool.int:6143 or click the bookmark in the IE browser. If the URL resolves to the GeoEvent Server login screen, then you've indeed successfully registered your GeoEvent Server endpoint.



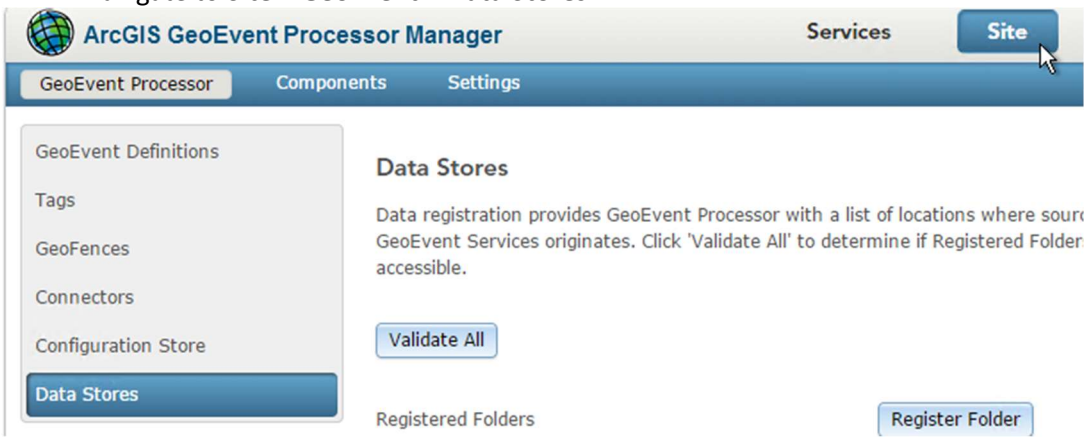
b) Register at least one valid data store on the GeoEvent Server

GeoEvent Server data stores are pointers to ArcGIS servers and ArcGIS online accounts and allow the GeoEvent Server to connect to ArcGIS and read contents such as feature services. The location (ArcGIS server or ArcGIS online account) where the new feature service will be created must be registered as a data store in GeoEvent Server.

1. Sign into your GeoEvent Server manager (https://pisrv01.pischool.int:6143/geoevent/manager); a link should already be in the bookmarks bar of your web browser or you can click the URL for the GeoEvent Server from the PI Integrator for Esri ArcGIS 2017 SP1. Use the credentials provided, namely, siteadmin & vlesiteadmin for username and password, respectively.



2. Navigate to **Site** > **GeoEvent** > **Data Stores**



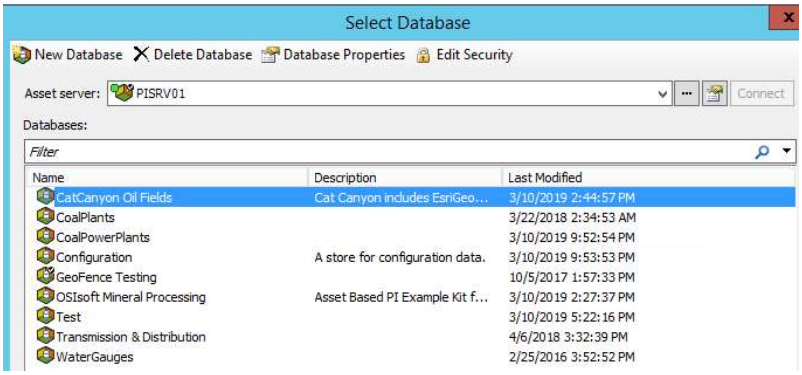
3. You should see, under **Registered server connections**, the button **Register server connection**; go ahead and click it, which will allow us to begin adding a data store. Note that in this case, the data store for the Portal for ArcGIS has already been created successfully.

If a green checkmark appears next to your data store, then you're all ready to proceed to the next section. In this case a green checkmark should appear next to PORTAL as in the screenshot above.

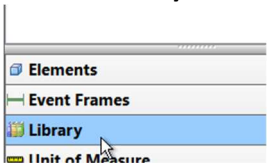
2. Verify that the PI AF Database is ready

We have loaded a PI AF Database for you that already contains Elements, based on PI AF Element Templates (which are required by the PI Integrator for Esri ArcGIS) for both wells and maintenance vehicles. We are going to examine what we have created for you.

1. Open PI System Explorer and connect to the AF Database called **Cat Canyon Oil Fields**.



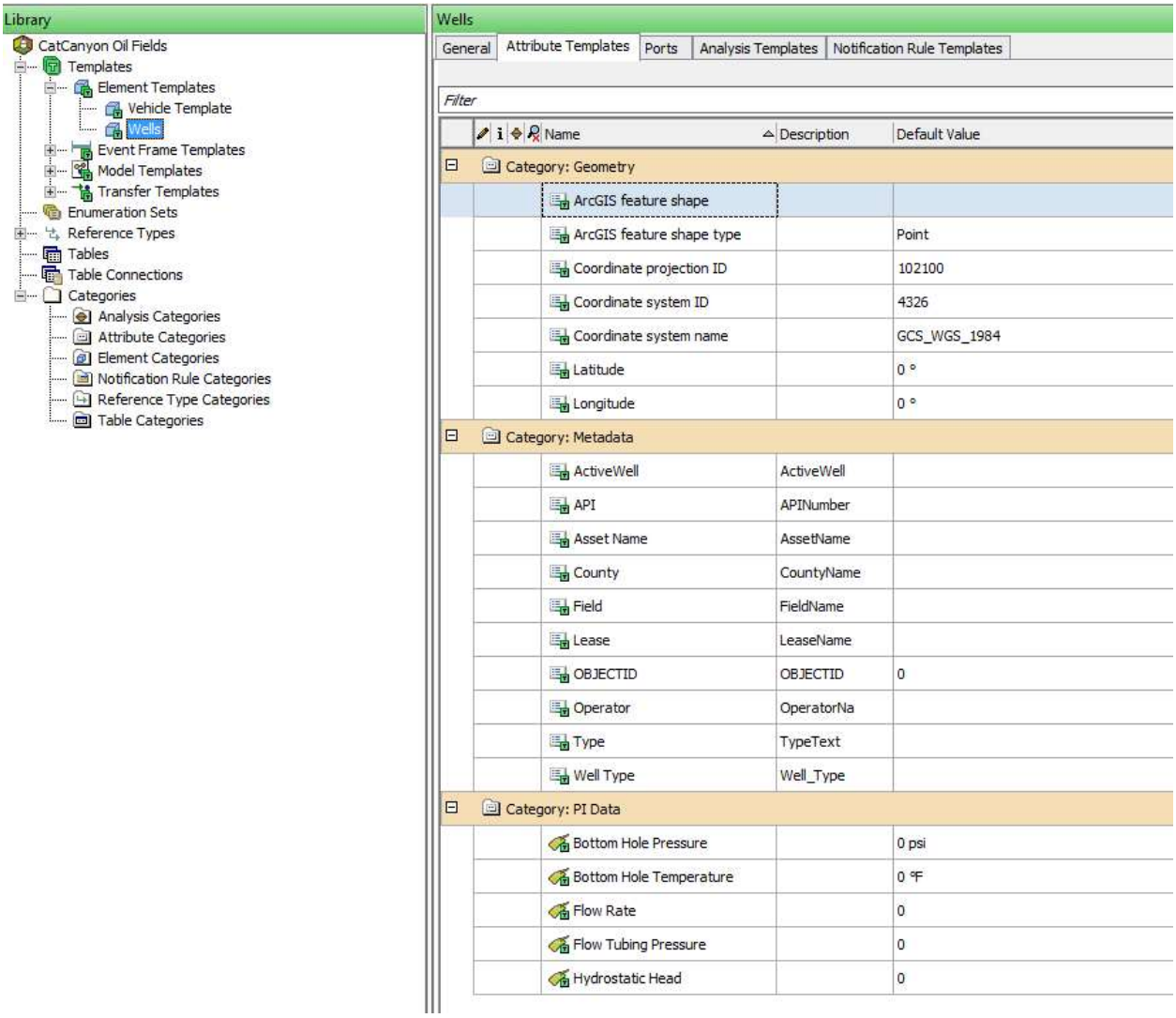
2. We'll start by looking at our Element Templates. Via the navigator pane in the lower left, select **Library**.



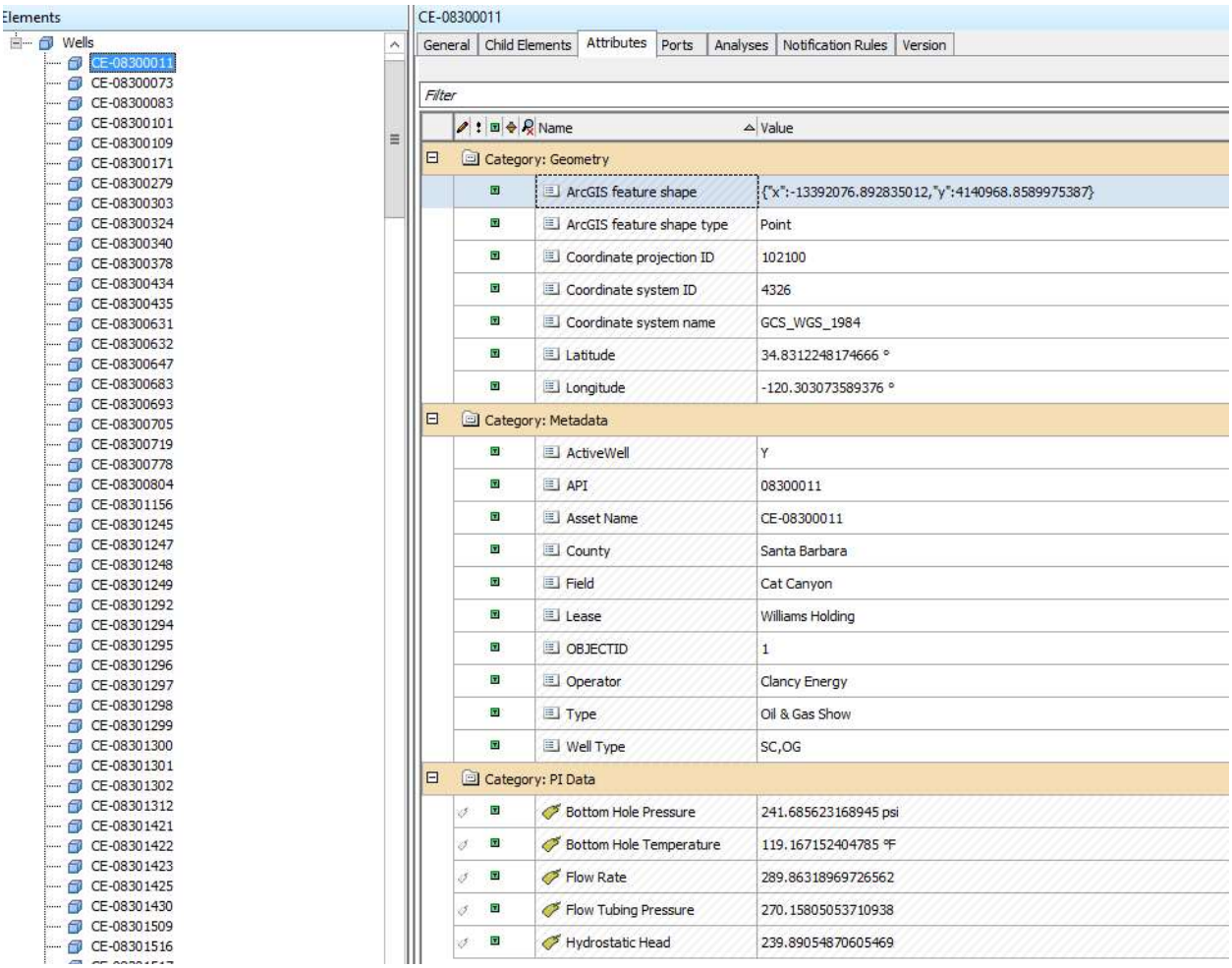
3. Examine one of the two Templates that we'll use to create a live-updating Esri Feature Service; click on it, and then on the right, click the **Attribute Templates** tab.

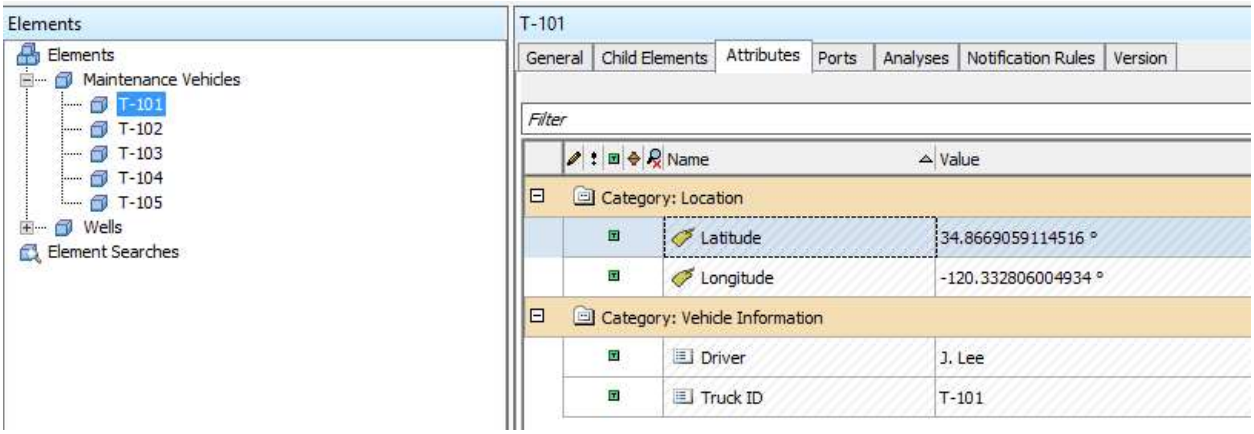
Notice (spoiler alert) that the Wells Element Template contain Attributes that are of type "Double", for **Longitude** and **Latitude**. These will allow instances of this Template to be positioned correctly on a map. Notice that besides that, there is nothing at all special about these Elements—that's right; any PI AF Element Template can be used, so long as it supplies location information[1].

[1] And technically, the PI AF Element template doesn't need to provide location information at all. Using the Augmented feature layer functionality in the PI Integrator for Esri ArcGIS, we can create the time-enabled augmented feature layer that contains data from both PI System and the existing feature layer that contains geometry, without modifying the existing feature layer.



4. Now use the navigator pane to click **Elements** and browse down to the Wells -> CE-08300011 Element. Examine its Attributes under the **Attributes** tab and verify the values of the **Latitude**, **Longitude** and the **PI Data** attributes. The **PI Data** attributes should be updating every few minutes while the location attributes should be static (you can click the **Refresh** button on the top toolbar;).





It's worth noting again that you don't have to use just latitude and longitude as geometry; you can instead, for example, create a brand new Feature Service that has complex geometry, such as for a meandering pipeline, by specifying that geometry in an AF attribute. In short, in this scenario, we are using latitudes and longitudes, but complex geometries like polylines and polygons are supported too.

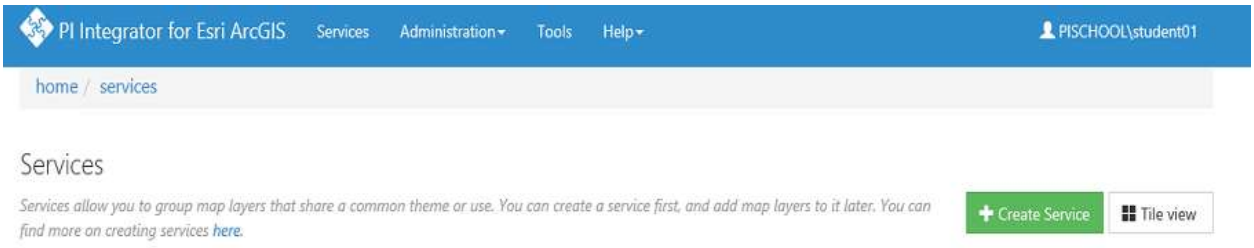
3. Create a Service and Layers via the PI Integrator for Esri ArcGIS

The software has been installed, the configuration steps are done, and our PI AF Database (**Cat Canyon Oil Fields**) is ready for us to use as a data source to create live Esri Feature Services. Next, we'll proceed through the steps to use all that we have created and prepared: actually using the PI Integrator for Esri ArcGIS to create Esri Feature Services that update in real-time with PI System data. Later on, we'll create a map-based dashboard using those Feature Services. For now, let's get started in the PI Integrator for Esri ArcGIS—that's where all this work is done.

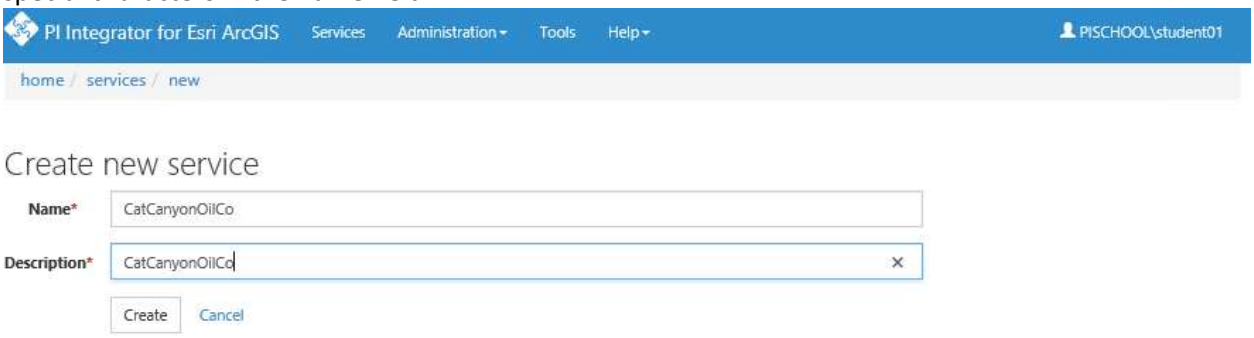
First, let's create a Service to hold both of the Layers that we will create (note: this "Service", which we will create in the PI Integrator for Esri ArcGIS, is different from an ArcGIS "Feature Service", which is what we'll later add to a map).

Create a feature service to bring-in all the Oil Wells based-on AF element template

1. Access the link to the PI Integrator for Esri ArcGIS home screen using the bookmark link to https://pisrv01.pischool.int:448/configuration/#/services.
2. Click the **Create Service** button to add a new Service.



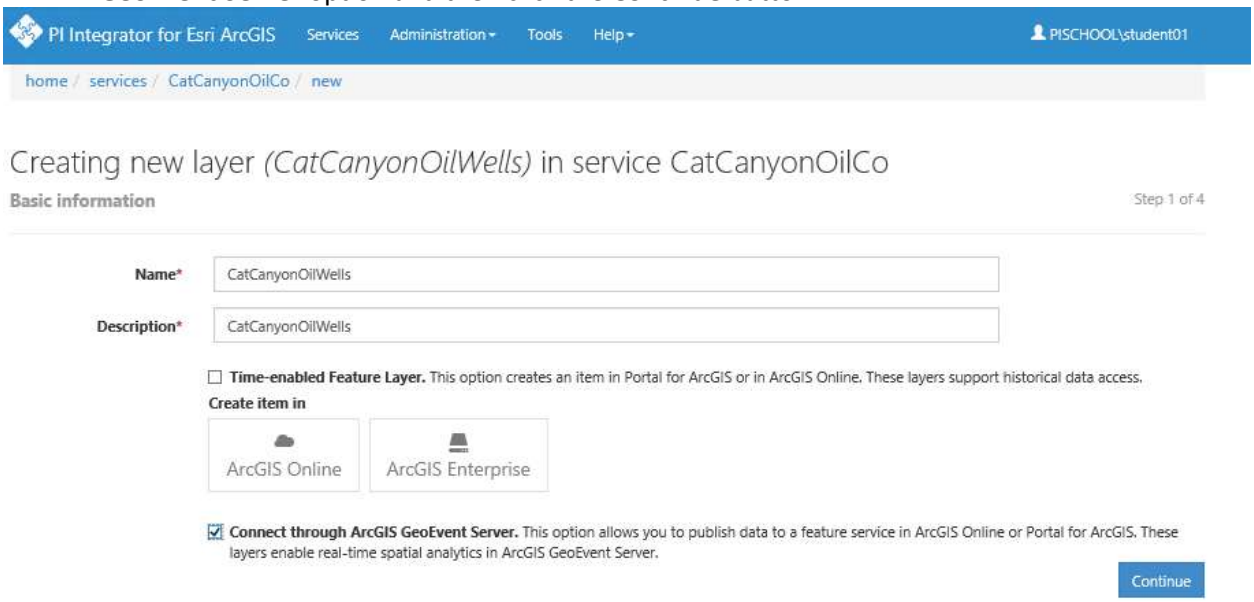
The **Create new service** page opens. Fill in the fields as shown below. Please note that you cannot use special characters in the name field.



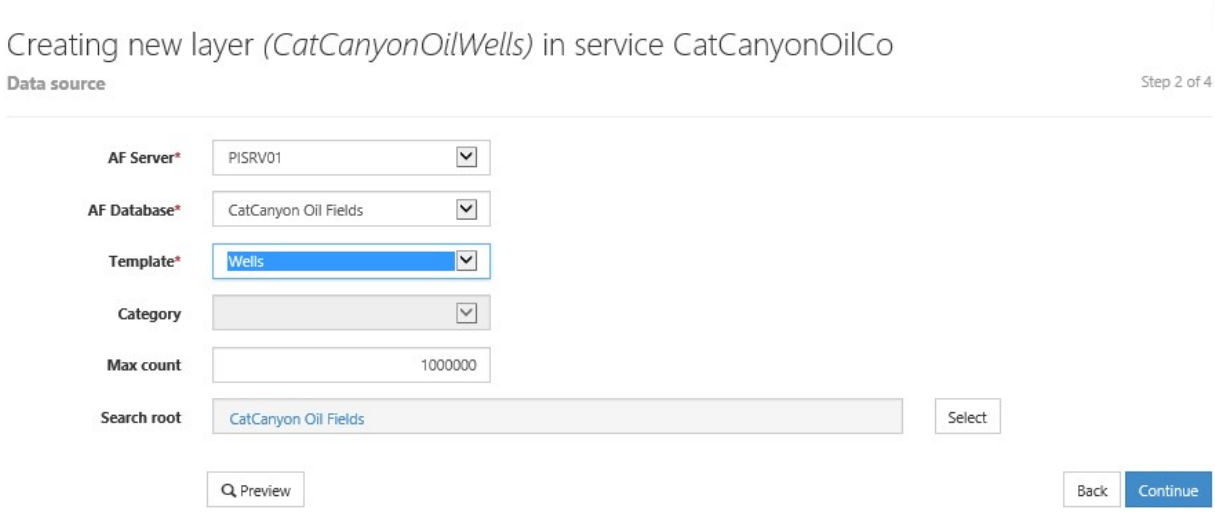
Having finished this step, we will a create layer within this Service based-on a PI AF Element Template, namely, **Wells**. We will first begin with the *creation of the layer for the wells by connecting through the GeoEvent Server*.

3. Examine the Service details page. Click the **Create Layer** button.

4. In the **Name** Field, enter a name for the new Layer. The name is required and must be unique. In addition, the name must contain a minimum of five characters, may contain only lowercase and uppercase alphanumeric characters, hyphens, and underscores, and cannot include spaces or special characters. Uncheck **Time-enabled feature layer** and check **Connect through ArcGIS GeoEvent Server** option and then click the **Continue** button.

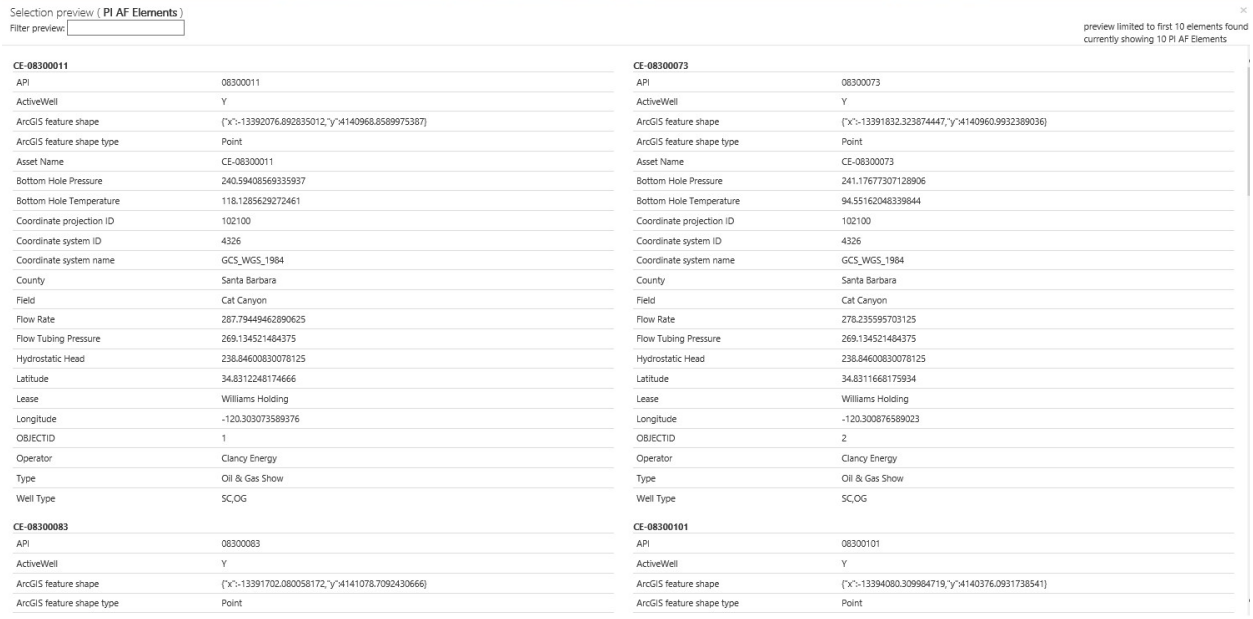


5. For the Data Source, kindly choose **PISRV01**, **CatCanyon Oil Fields**, and **Wells Template** as the AF Server, AF Database, and Template, respectively.



6. There is also a **Preview** button that you can click to see the results of your Layer search.

Using the Preview is an important step that you should always do, as it helps you verify that your layer is indeed referencing data from the intended PI AF Elements. Click **Preview** and make sure that the PI AF data that you expect is returned by your Layer.



Selection preview (**PI AF Elements**)
Filter preview:

preview limited to first 10 elements found
currently showing 10 PI AF Elements

CE-08300011

API	08300011
ActiveWell	Y
ArcGIS feature shape	{"x":-13392076.892835012,"y":4140968.8589975387}
ArcGIS feature shape type	Point
Asset Name	CE-08300011
Bottom Hole Pressure	240.59408569335937
Bottom Hole Temperature	118.1285629272461
Coordinate projection ID	102100
Coordinate system ID	4326
Coordinate system name	GCS_WGS_1984
County	Santa Barbara
Field	Cat Canyon
Flow Rate	287.79449462890625
Flow Tubing Pressure	269.13452148437500
Hydrostatic Head	238.84600830078125
Latitude	34.8312248174666
Lease	Williams Holding
Longitude	-120.303073589376
OBJECTID	1
Operator	Clancy Energy
Type	Oil & Gas Show
Well Type	SC,OG

CE-08300073

API	08300073
ActiveWell	Y
ArcGIS feature shape	{"x":-13391832.323874447,"y":4140960.9932389036}
ArcGIS feature shape type	Point
Asset Name	CE-08300073
Bottom Hole Pressure	241.17677307128906
Bottom Hole Temperature	94.55162048339844
Coordinate projection ID	102100
Coordinate system ID	4326
Coordinate system name	GCS_WGS_1984
County	Santa Barbara
Field	Cat Canyon
Flow Rate	278.23559570312500
Flow Tubing Pressure	269.13452148437500
Hydrostatic Head	238.84600830078125
Latitude	34.8311668175934
Lease	Williams Holding
Longitude	-120.300876589023
OBJECTID	2
Operator	Clancy Energy
Type	Oil & Gas Show
Well Type	SC,OG

CE-08300083

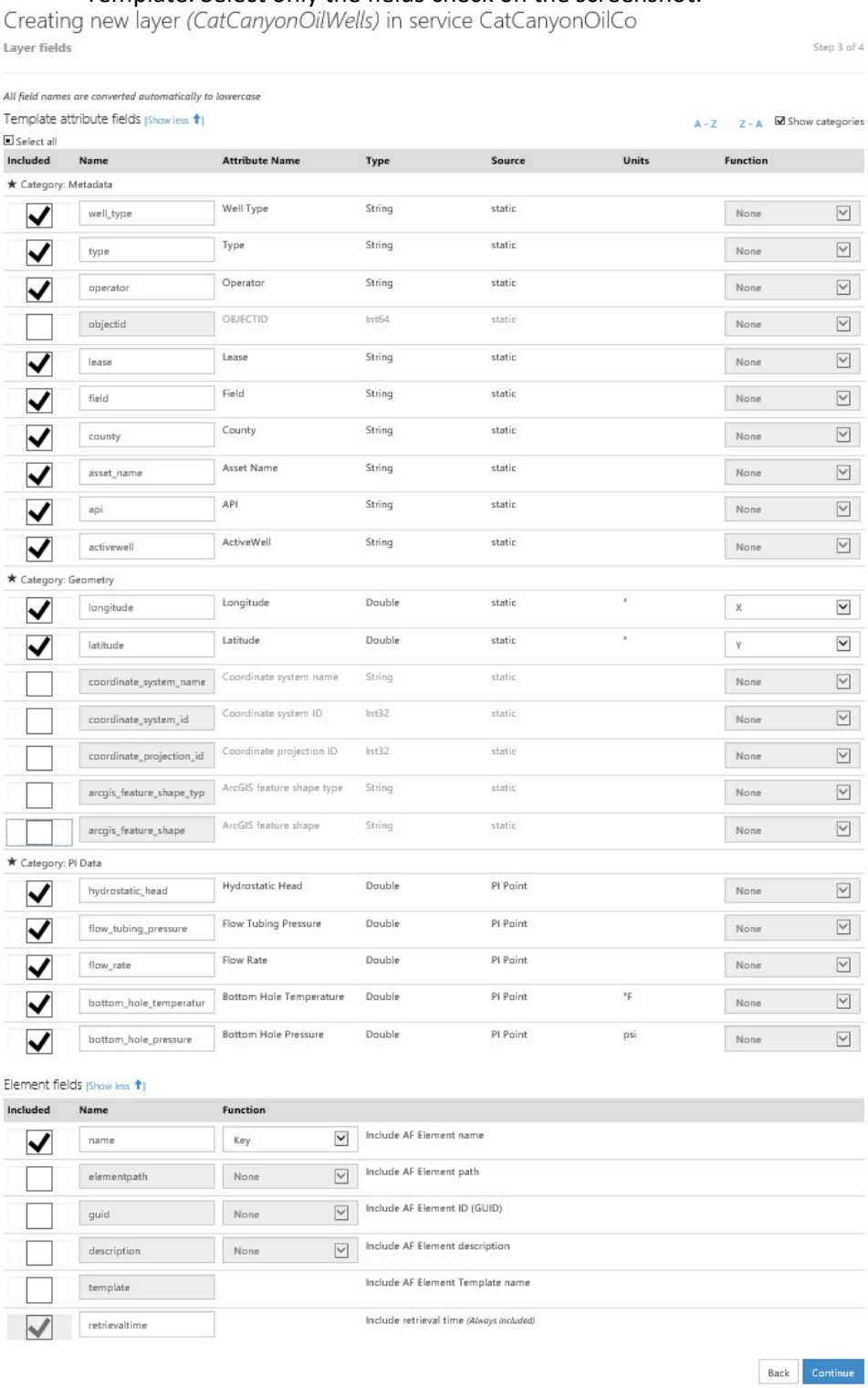
API	08300083
ActiveWell	Y
ArcGIS feature shape	{"x":-13391702.080058172,"y":4141078.7092430666}
ArcGIS feature shape type	Point

CE-08300101

API	08300101
ActiveWell	Y
ArcGIS feature shape	{"x":-13394080.309984719,"y":4140376.0931738541}
ArcGIS feature shape type	Point

7. Click the **Continue** button.

8. Next, we will configure all the Fields for this Layer. You configure Fields for a Layer to determine which AF Attributes will be published as Fields in your Layer. To begin, the **Template Attribute Fields** section of the Layer definition screen shows all the attributes found using the AF Template. Select only the fields check on the screenshot.



Specifying the coordinates
The **X** and **Y** functions are pre-selected if the application finds any Attribute name that contains the words **longitude** or **latitude**, or **X** or **Y**; if so, the application assigns them to the **X** and **Y** function (if desired, you can select a different function: **None**, **X**, **Y**, **Key** or **Geometry**). Generally, you specify **X** and **Y** functions for Attributes that indicate geographic positions, including positions that move over time. Only one **X** and **Y** pair can be specified. In our case, we will accept the default **X** and **Y assignments**.

Specifying a geometry
Another option (which we won't use here), rather than specifying **X** and **Y**, is to specify the geometry for a map Feature by defining it in Esri Feature Geometry Json. Specifying a geometry allows for much more complex areas to be defined, such as polylines or polygons. Geometry function Fields must be of type string.

objectid
The objectid field needs to be unselected because it is used internally in Esri and it will create a conflict.

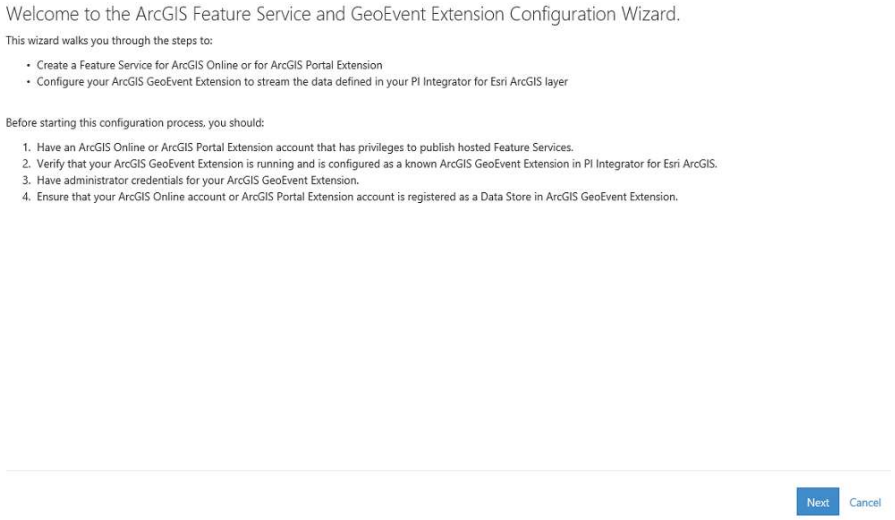
Specifying a key function

In our case, under **Element fields**, set the element **name** Field to have the **key** function. The **key** function specifies a unique identifier for a particular map Feature; the **key** function is used when updating specific map Features in a Feature Service with the right data from the corresponding AF Elements, and also when generating OSIsoft Visualization displays.

9. Press **Continue** when finished configuring Fields.
10. Set **Geometry Type to Point**.

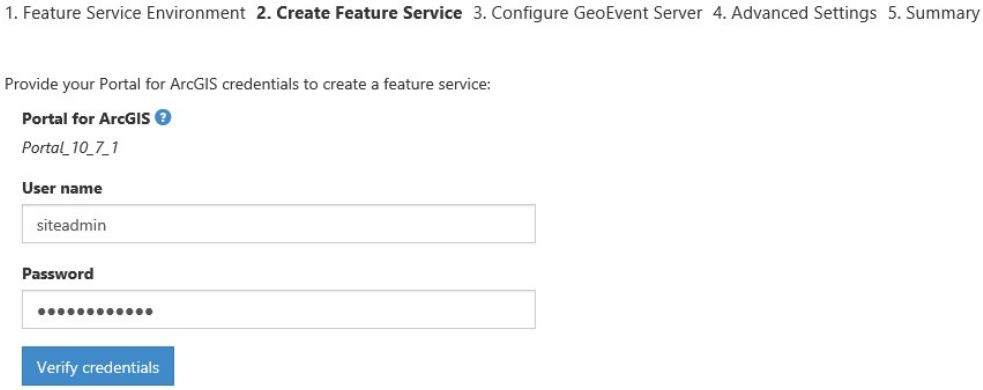
This allows you to specify a different **Geometry Type**, if you're using Features that aren't points, such as polylines; we are only using points in our case, so we'll use the defaults that appear. You can also specify the **Spatial reference**, if you know that your latitude and longitude values were obtained using a particular spatial reference model for the world. In most cases, though, the default reference, **GCS_WGS_1984 (4326)** should suffice, so in summary, leave all these settings as is.
Go ahead and click **Create Layer**.

11. Click Next.

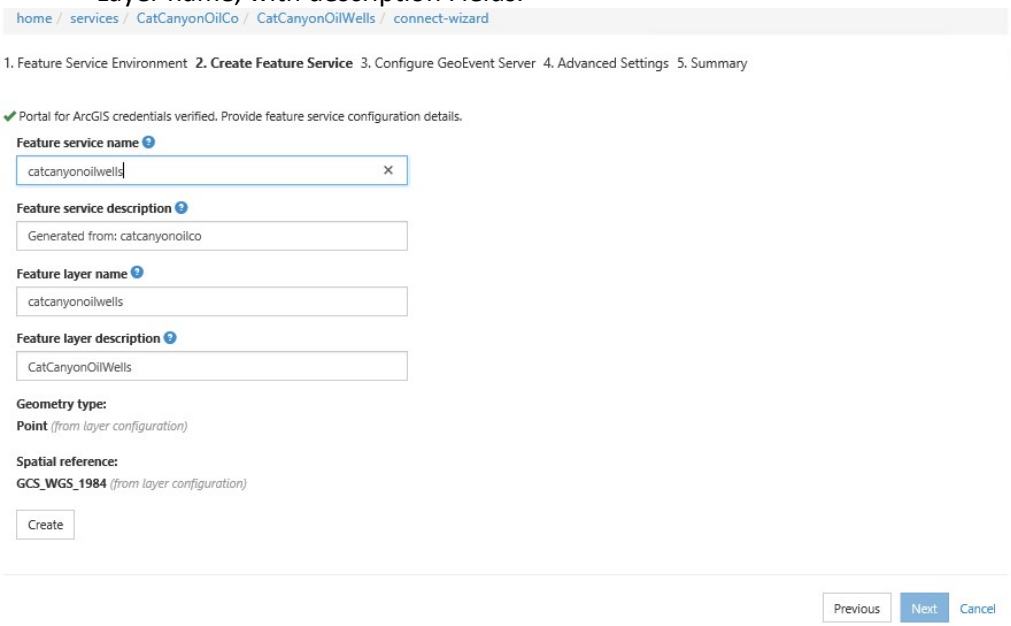


12. Since we are going to the publishing this as a feature layer to Portal for ArcGIS, select the **ArcGIS Enterprise** button.

13. When prompted for the credentials, enter the username and password *siteadmin* & *vlesiteadmin*, respectively and click **Verify Credentials**.



14. Once your Portal for ArcGIS credentials are validated, the wizard shows a suggested Service and Layer name, with description Fields.



1. Leave the default Service description (you could, if you want, enter a new description).
2. Leave the default Layer name and description (you could, if you want, enter a new name and description).
3. Make sure that the Feature service name is the same as Feature layer name.
4. Click **Create**. When you select **Create**, the Service and Layer are created in Portal for ArcGIS.

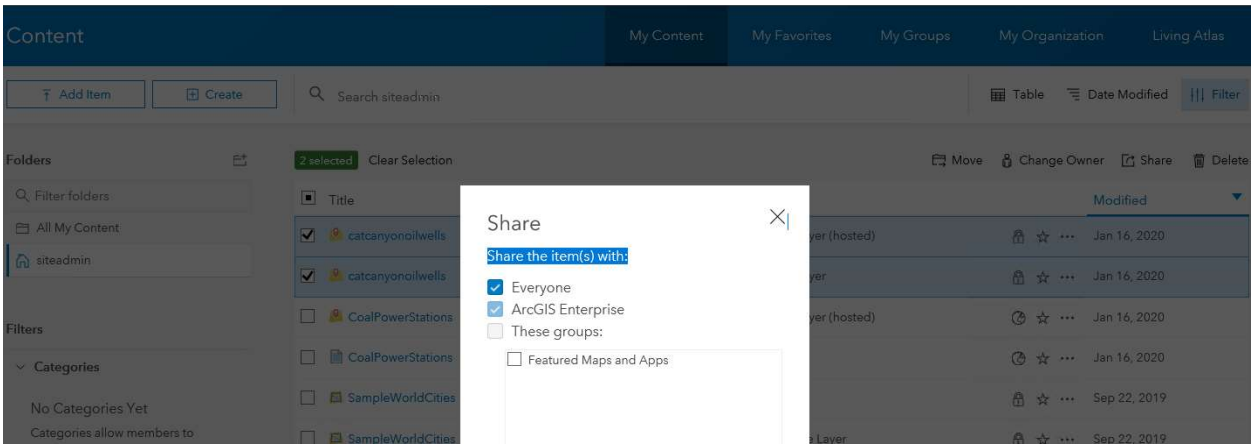
If successful, the "Feature Service Created" message is displayed.

15. **Note:** you could then, in a separate browser window tab, log in to Portal for ArcGIS to view and verify the creation of the feature service. To do this, you can click on the Portal for ArcGIS bookmark, as shown below.

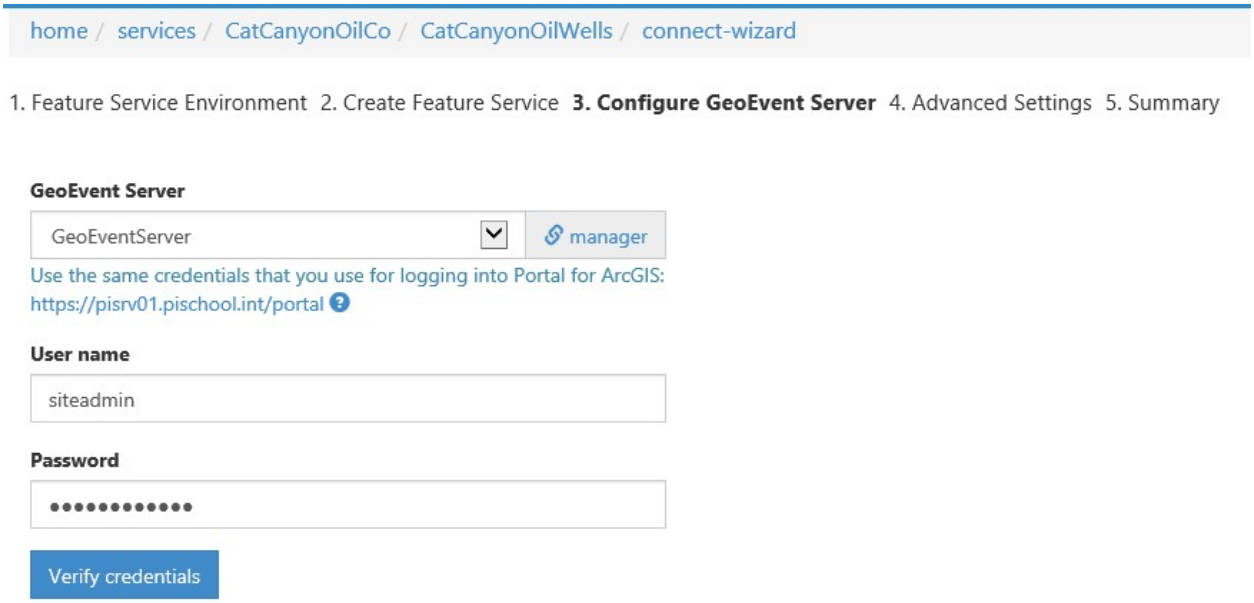
16. Enter the Portal for ArcGIS user credentials, namely, enter the username and password *siteadmin* & *vlesiteadmin*, respectively. Note that if you had already logged-on to GeoEvent Server in another tab, you would be auto logged-in using the above-mentioned credential.

17. Clicking on **My Content** would show you the feature layer that was created. You would note there are 2 with the same name. One is a feature service and the other is a feature collection.

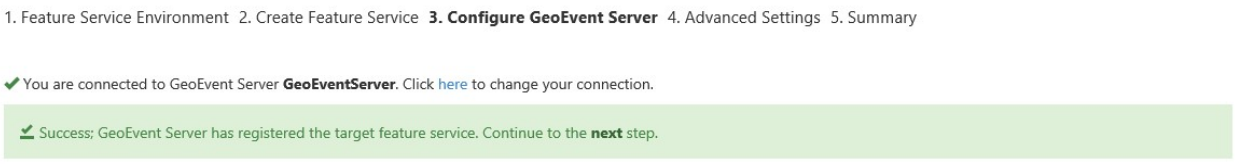
Check both the layers, click Share and share it with Everyone.



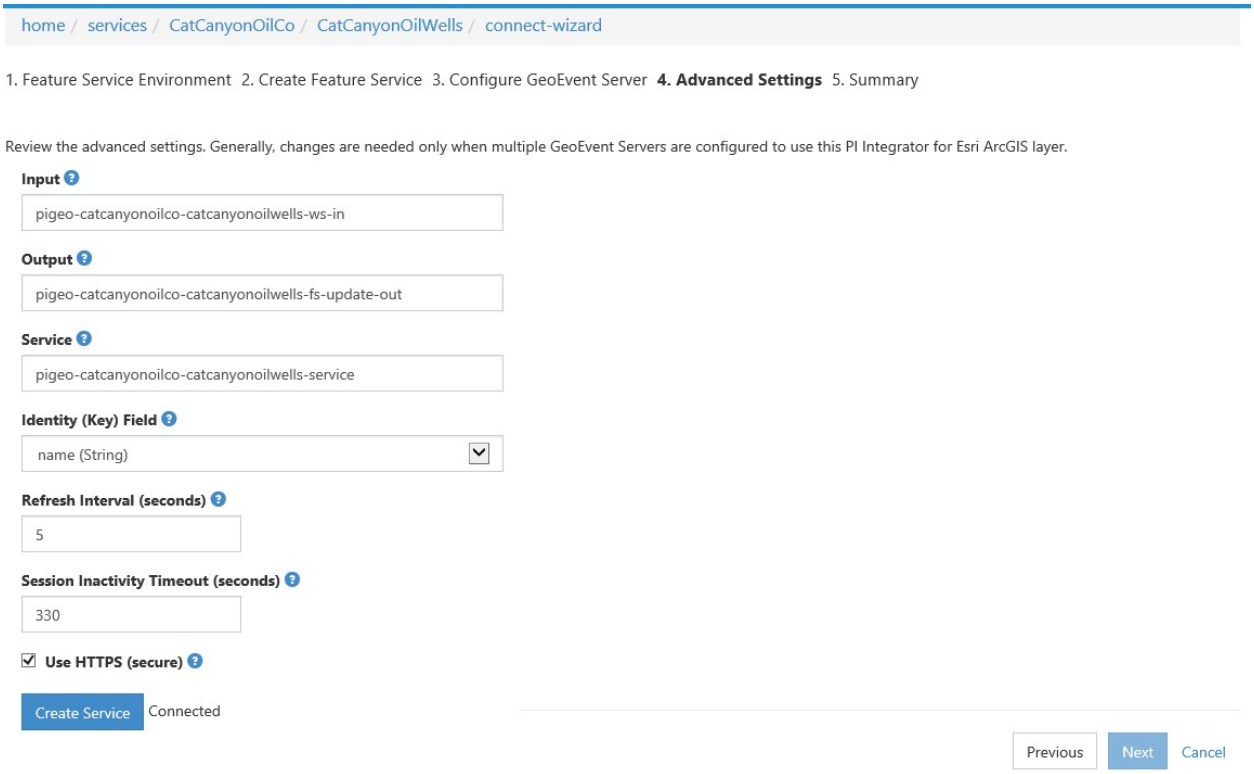
18. Now go back to your PI Integrator for Esri ArcGIS 2017 SP1, which you would have on another tab. Having created your Feature Service, click **Next** to display the Configure GeoEvent Server screen; that will allow you to configure the GeoEvent Server to accept the streamed data from the PI Integrator for Esri ArcGIS 2017 SP1 and output it to the Feature Service that you just created. Enter the User ID and password for the GeoEvent Server (username and password *siteadmin* & *vlesiteadmin*, respectively) and click **Verify credentials**.



19. Since you used the Wizard to create your Feature Service, then after clicking **Verify credentials**, the Wizard begins polling the GeoEvent Server to detect the newly created Feature Service in one of the GeoEvent Server's data stores (which you verified earlier), which can take a few minutes. You will be notified when the process is complete, after which you may proceed to the next step. Click **Next**.

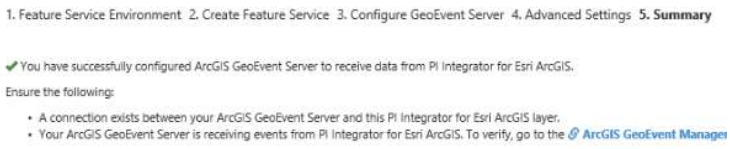


20. In the **Input**, **Output**, and **Service** Fields, verify that the appropriate input, output, and Service values are displayed.



21. **Click Create Service.** If the Service was created without errors, the following message is displayed: **Service Created – Done!**

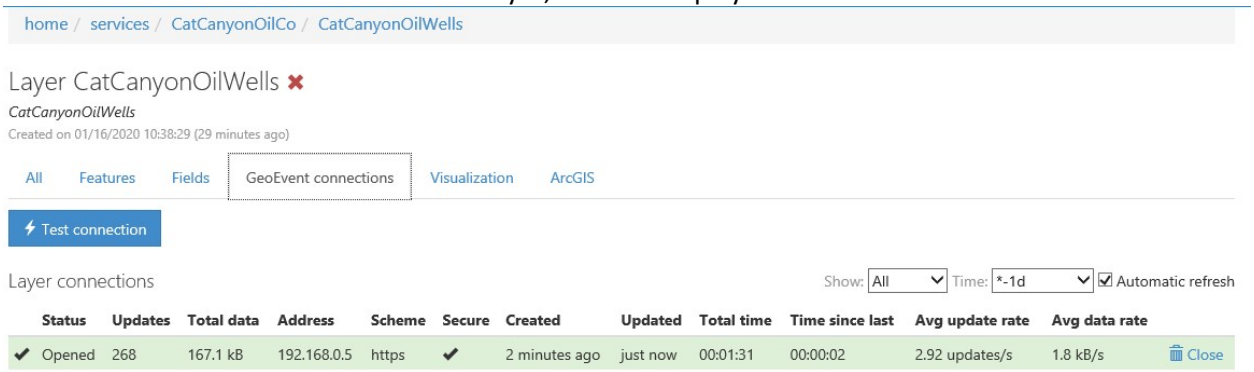
22. Click **Next**. The following message is displayed: **You have successfully configured GeoEvent Server to receive data from PI Integrator for Esri ArcGIS.**



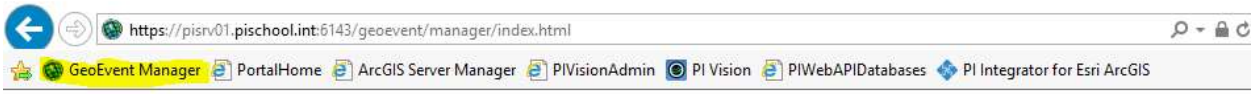
23. Click **Finish**. You will return to the Layer details page.

24. You should next ensure the following:

a. Click on the **GeoEvent Connections** tab and verify that an opened connection from your ArcGIS GeoEvent Server is made to this layer, which is displayed when the wizard is closed.



b. Your ArcGIS GeoEvent Server is receiving events from PI Integrator for Esri ArcGIS. If you have closed the GeoEvent Manager tab on your browser, use the ArcGIS GeoEvent Manager to check whether events are received by clicking the bookmark in IE for the same.



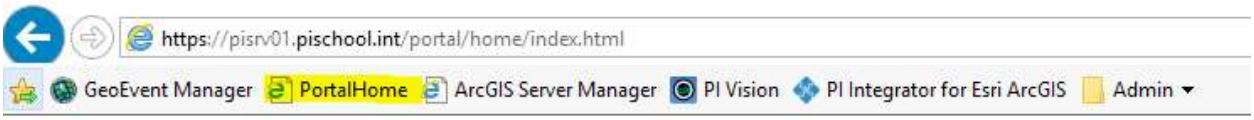
After signing in, click on **Services** at the top then you can scroll down to find the Input, GeoEvent Service, and Output; their names are the values you saw in step 1. You should verify that the **Count** of updates for those objects is indeed increasing. If they are, then you can proceed further.

Congratulations! It's worth mentioning that what we have done is an incredibly powerful ability of the Integrator. You can actually click on each of these objects that was created, and you can see that a lot of configuration values have been automatically entered in for you by the Integrator.

4. Create a WebMap and add OSIsoft Visualization integration to the Portal for ArcGIS Web Map

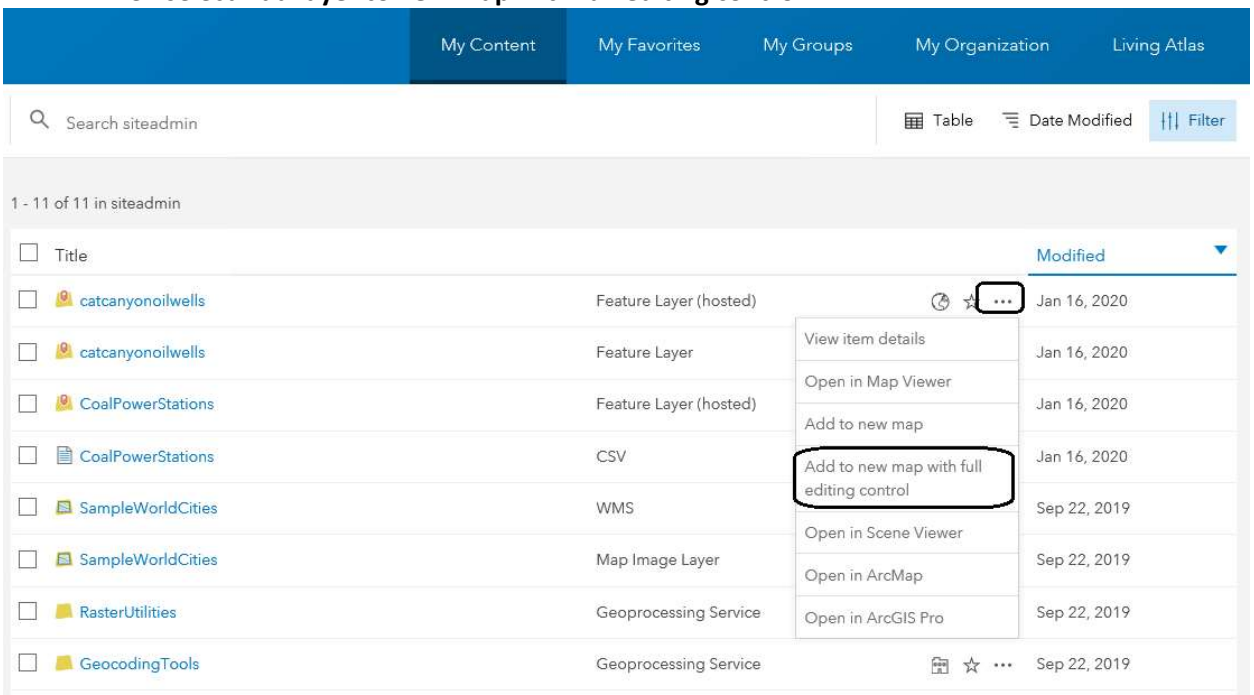
Next, we'll add OSIsoft Visualization integration, so that in addition to seeing a map with live locations, and with pop-ups that feature live values from the PI System, you can also click a pop-up image to automatically open an ad hoc OSIsoft Visualization display.

1. On a separate browser tab, connect to the Portal for ArcGIS by clicking on the bookmark.

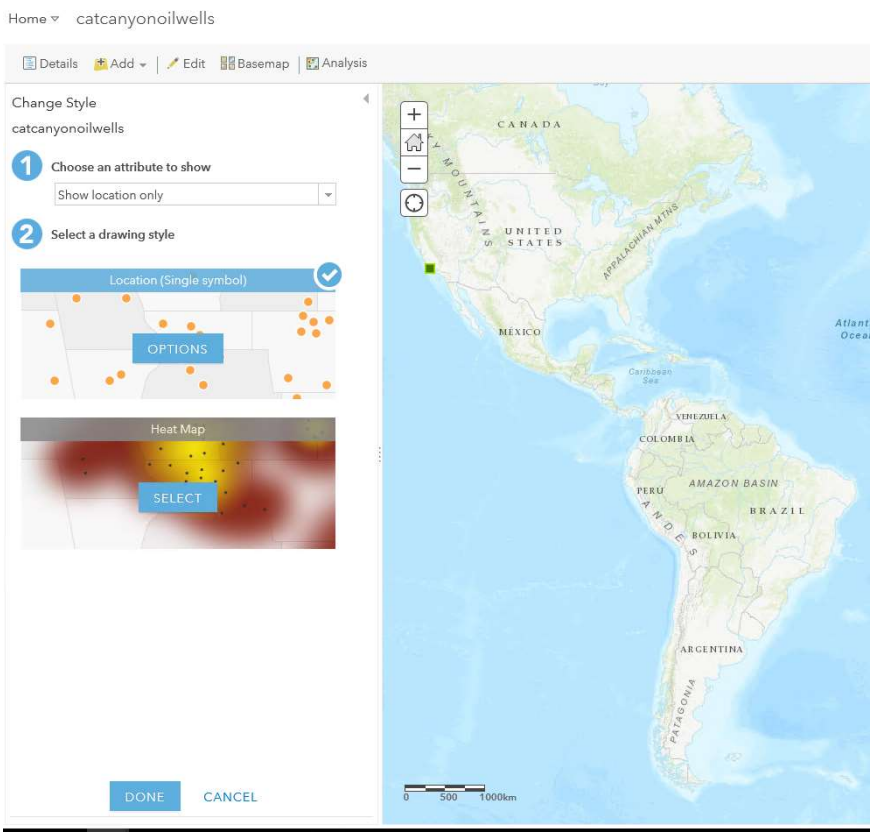


2. Then click **Content**

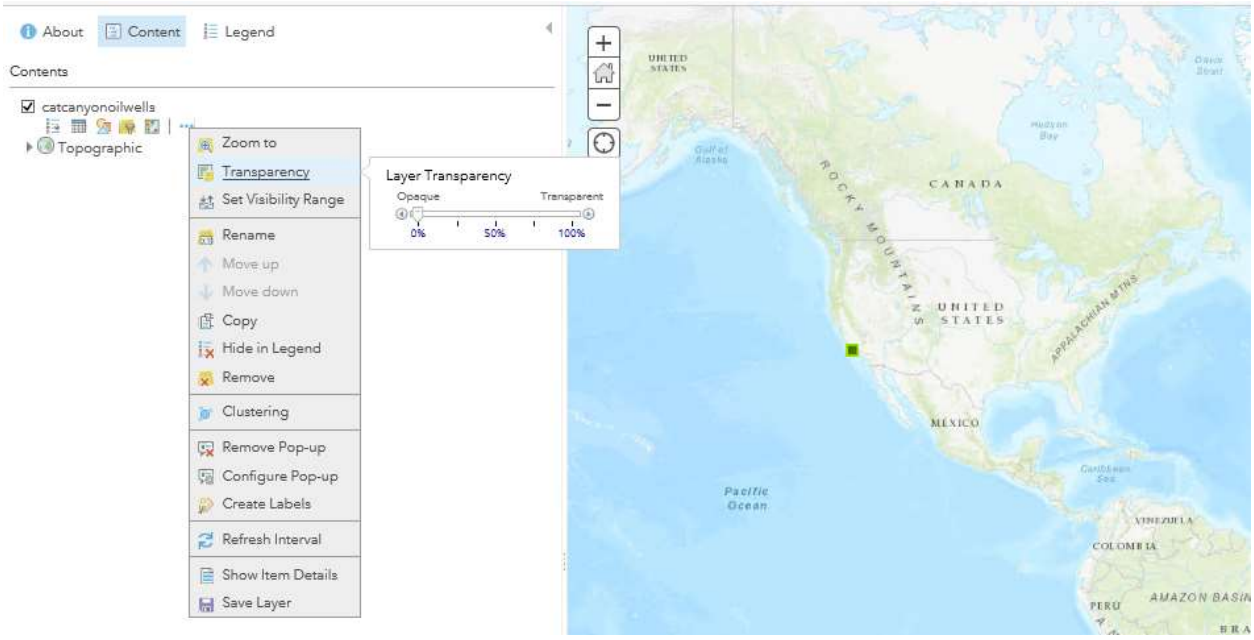
3. You would note two items called **Catcanyonoilwells**. Click on the dropdown arrow next to one of them. The feature layer that shows 7 options is the feature service that we are interested in. Then select **Add layer to new map with full editing control**.



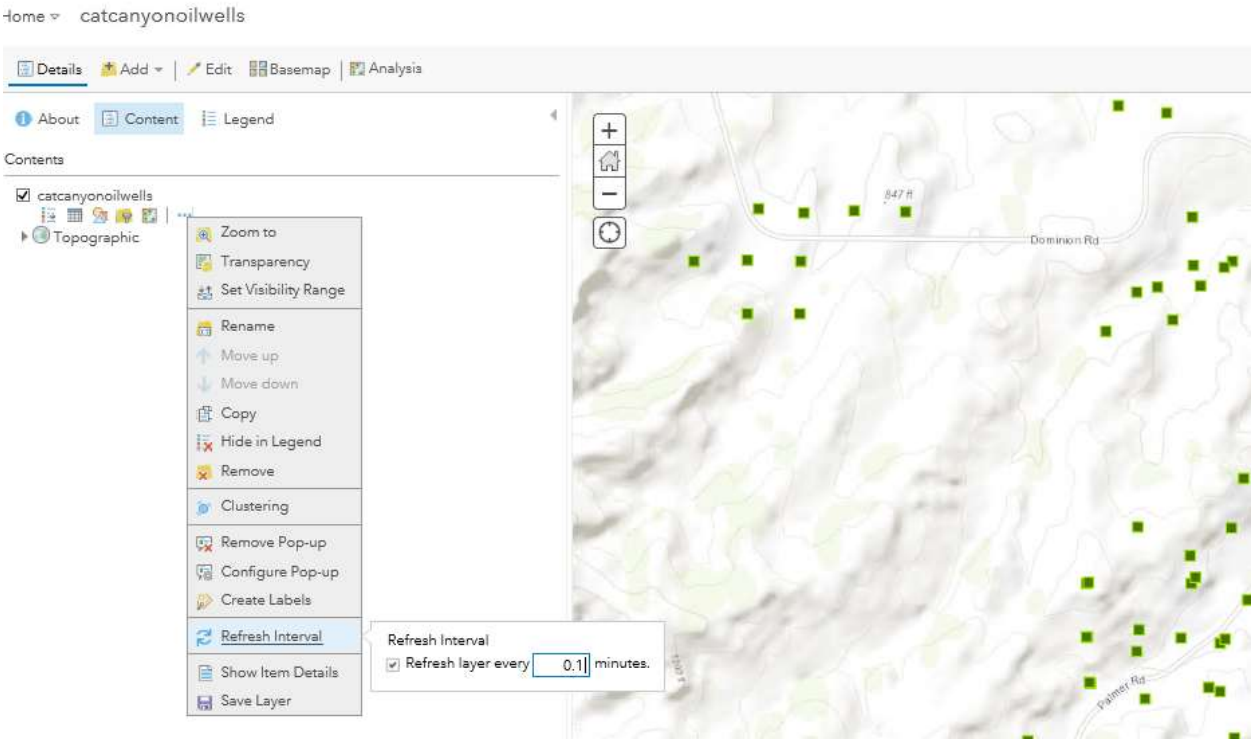
4. Click No if you see a warning and then click DONE in the lower left.



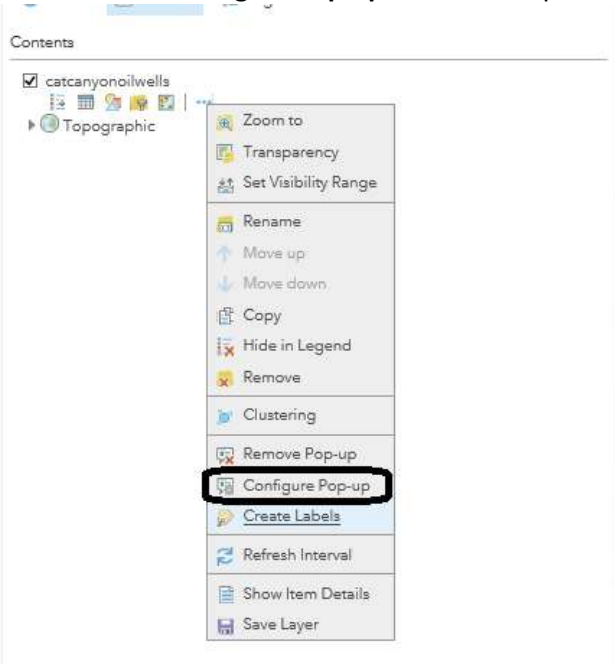
5. Now click on the … next to the layer on the map and select **Zoom to**.



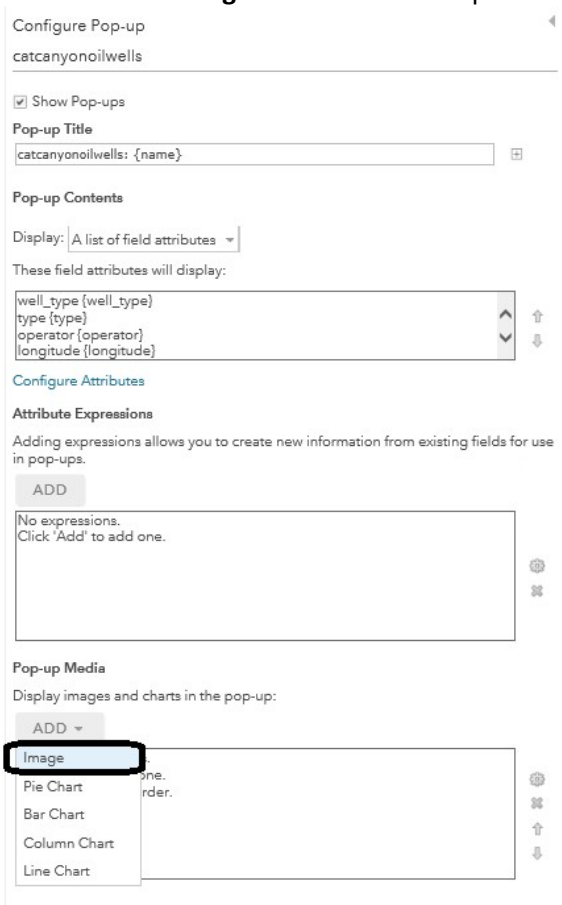
6. Similarly, select the Refresh Interval and specify 0.1 minutes.



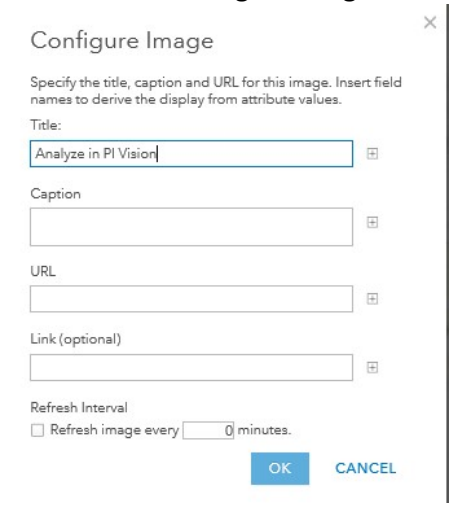
7. Select **Configure Pop-up** from the drop-down list.



8. Select **Image** from the **ADD** drop-down list in the **Pop-up Media** section.

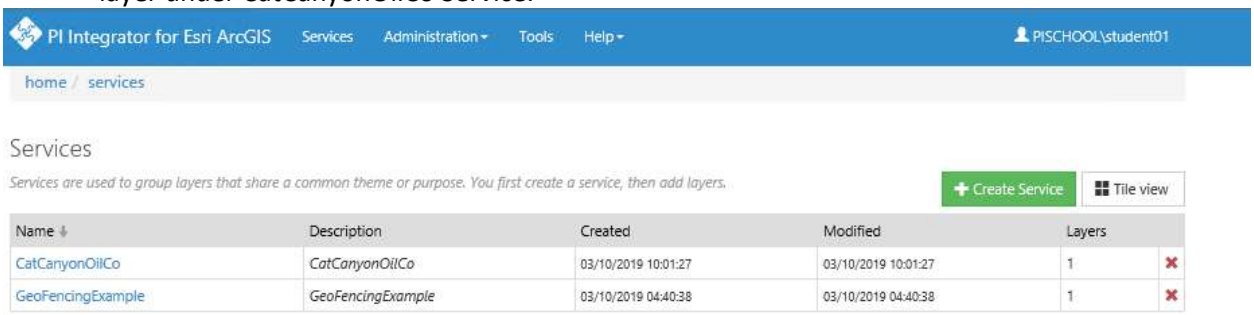


9. In the **Configure Image** window, as a title, you can enter "Analyze!"

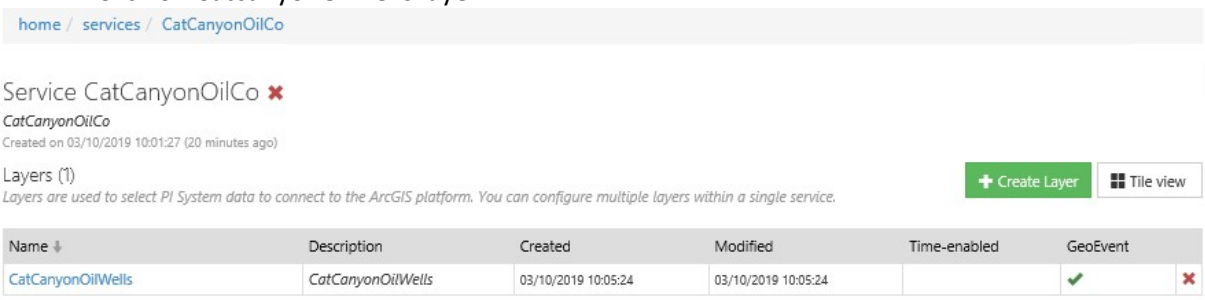


10. For the URL, we'll need to go back to the PI Integrator for Esri ArcGIS. Either go back to the PI Integrator tab or if you had closed that browser tab, in a separate browser tab, open the PI Integrator for Esri ArcGIS.

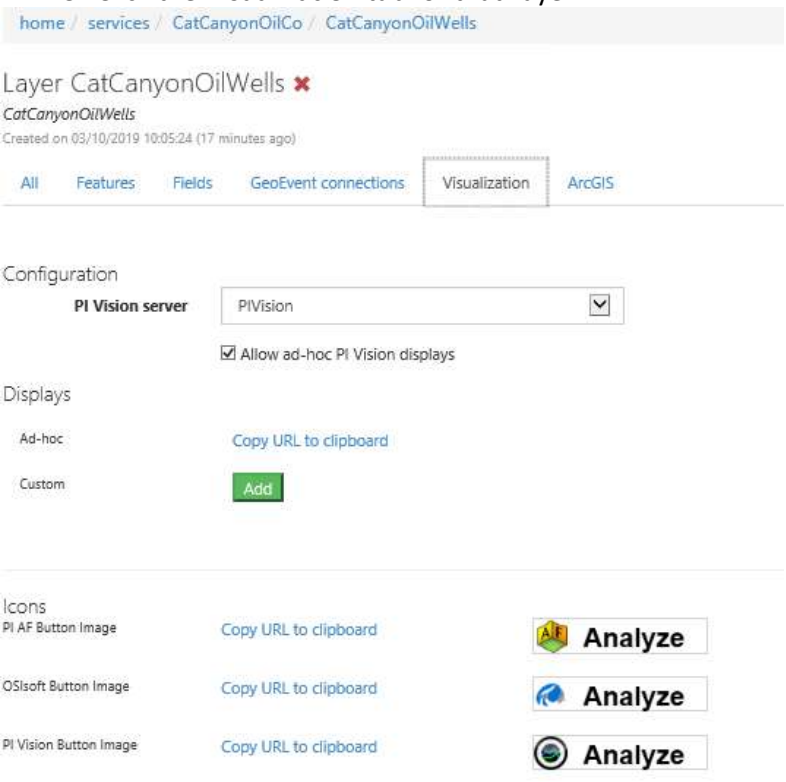
11. Click on Services from the PI Integrator for Esri ArcGIS 2017 SP1. Then select CatcanyonOilwells layer under CatCanyonOilCo Service.



12. Click on CatcanyonOilwells layer

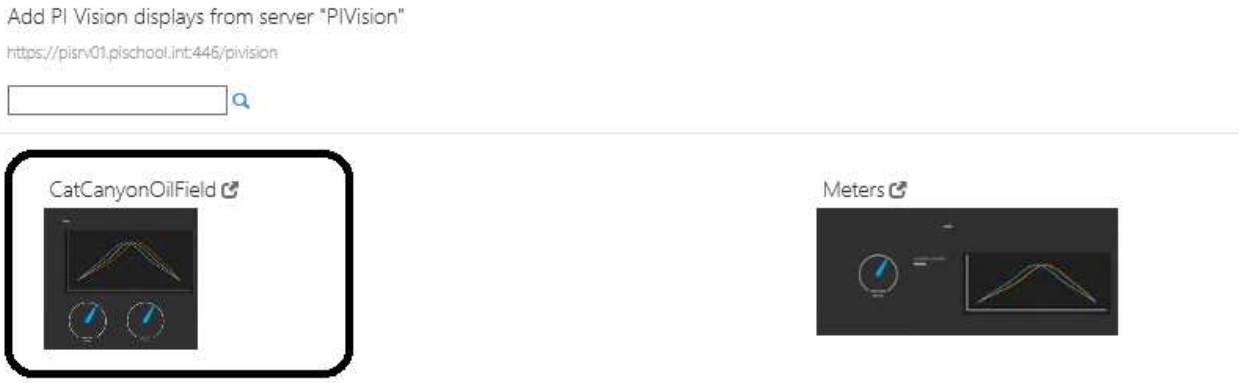


13. Click the **Visualization** tab for that Layer.

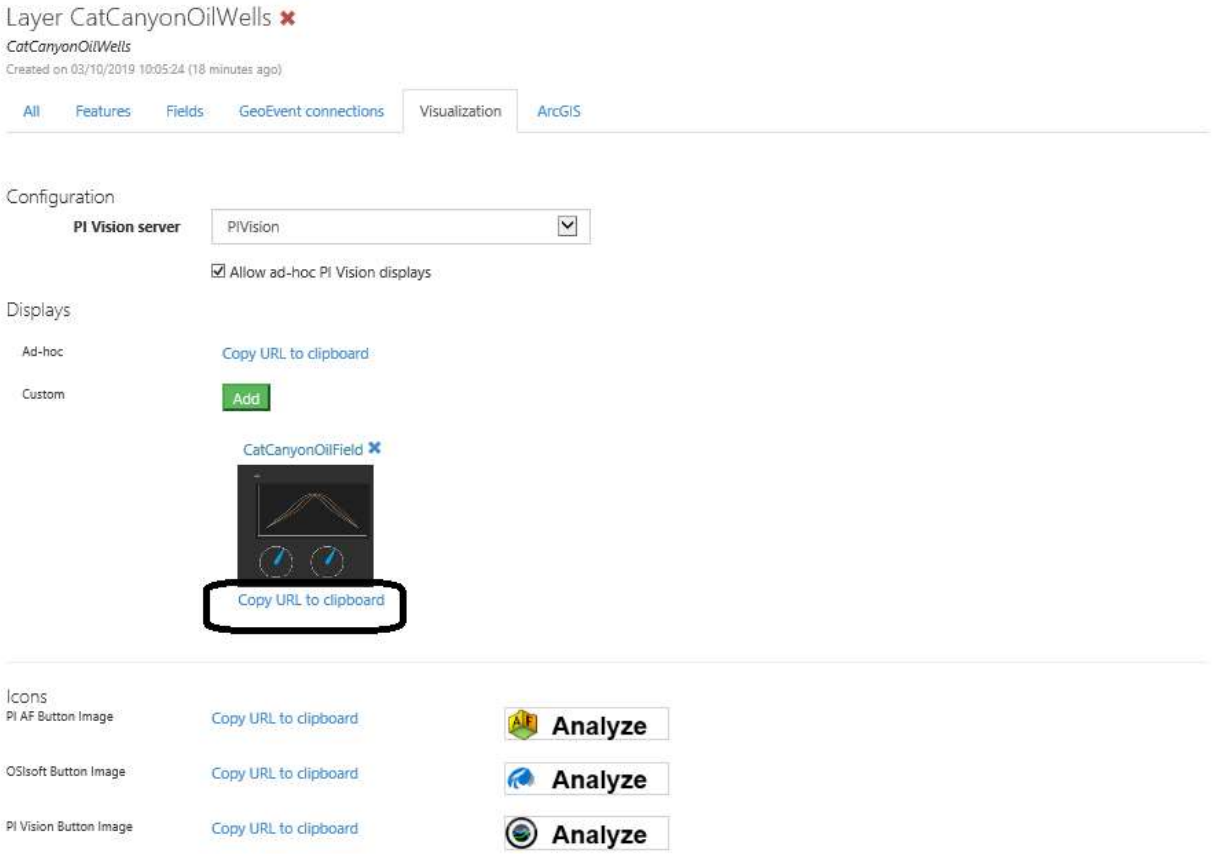


14. Now we will use the custom OSIsoft Visualization displays as shown on page 12. Click on **Add** next to Custom.

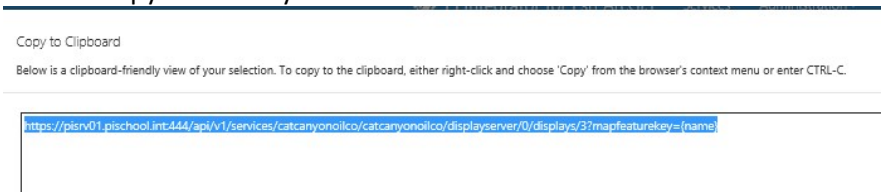
15. Select the Custom CatCanyonOilField display and click Close.



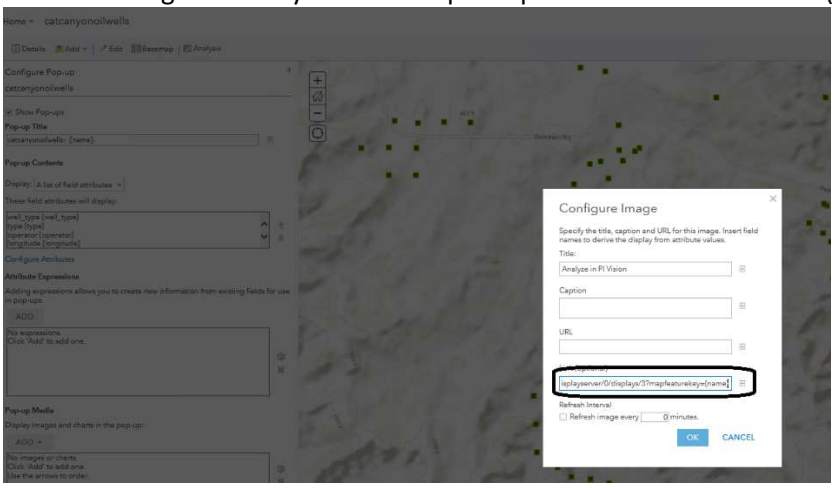
16. Click on Copy URL to clipboard.



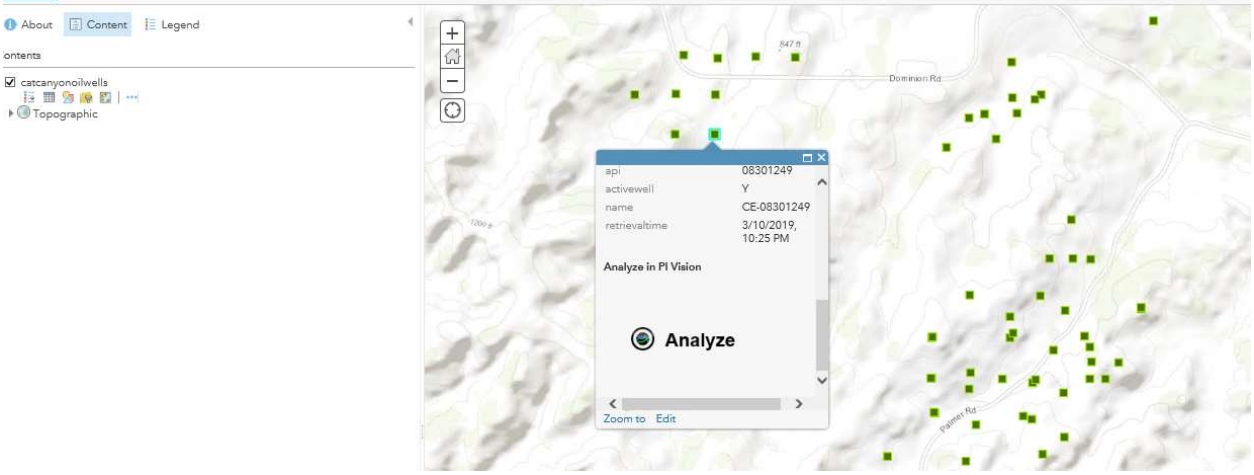
17. Copy the URL by CTRL+C.



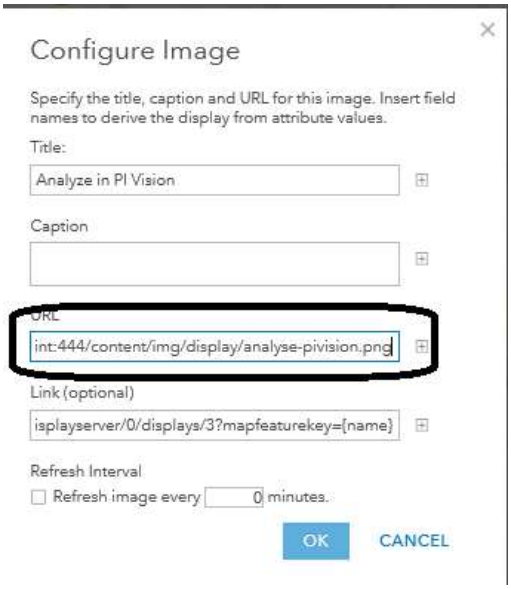
18. Now go back to your WebMap and paste the URL to the Link (Optional) field.



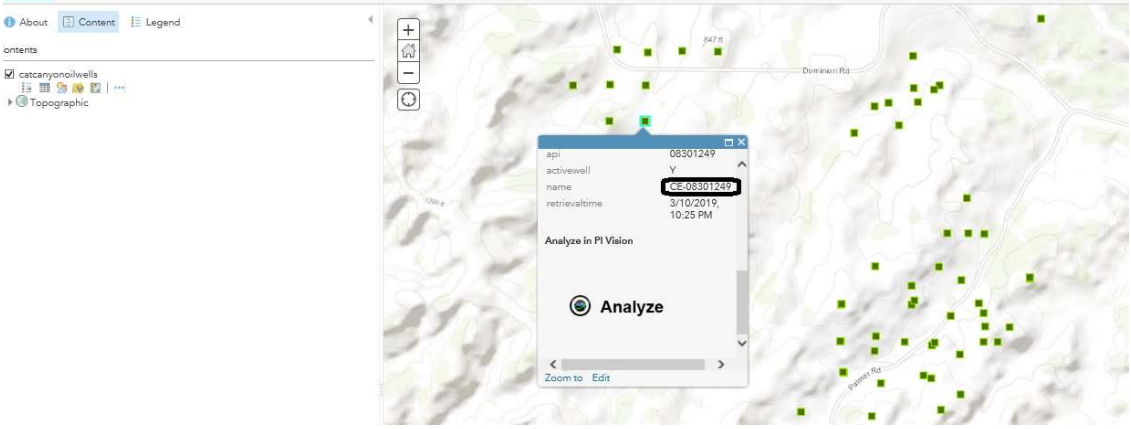
19. Now go back to your PI Integrator for Esri ArcGIS and copy the URL for the OSIsoft Visualization Button Image.



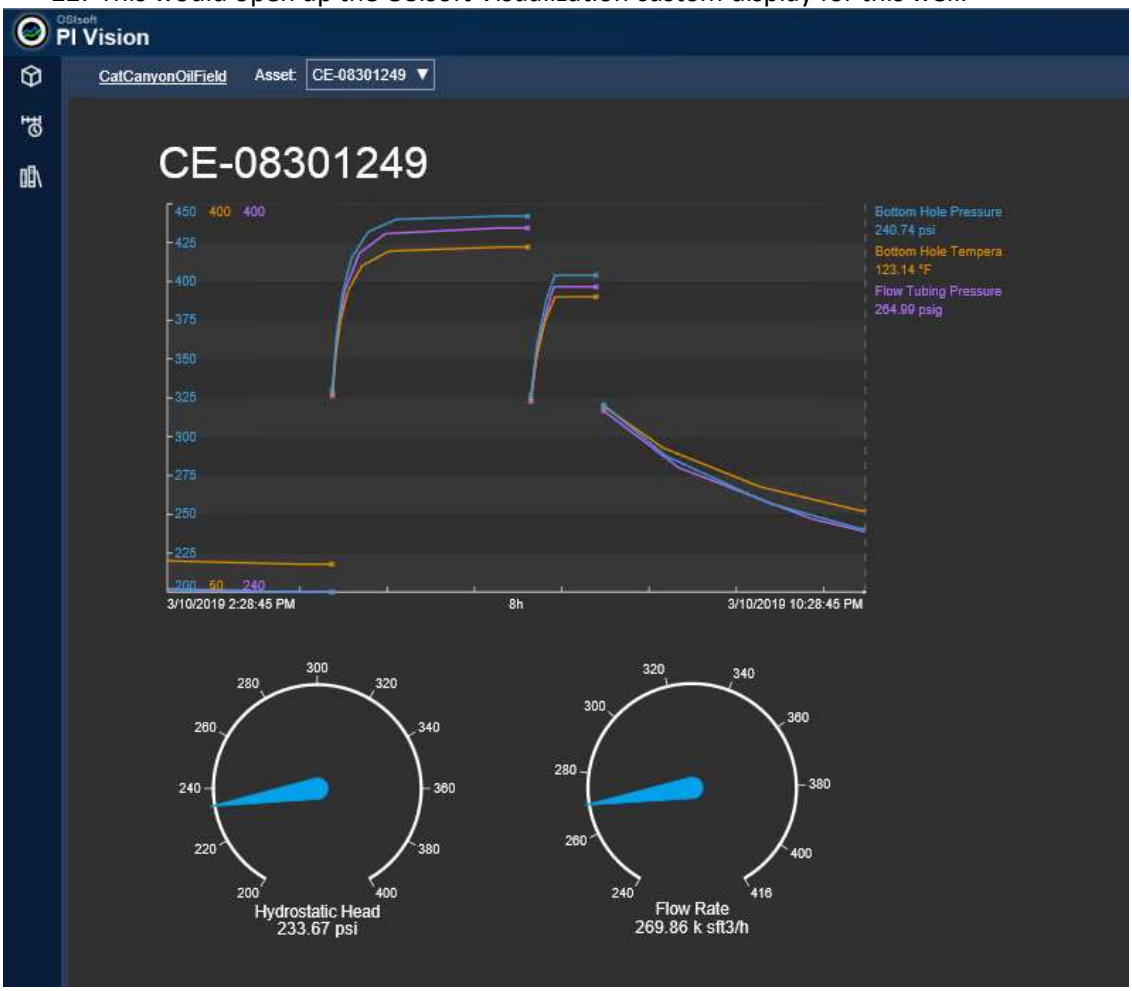
20. **Paste it in the URL field** and click **OK**. The click **OK** again.



21. Now clicking on any one of the wells would open the popup window. Then click on the Analyze.

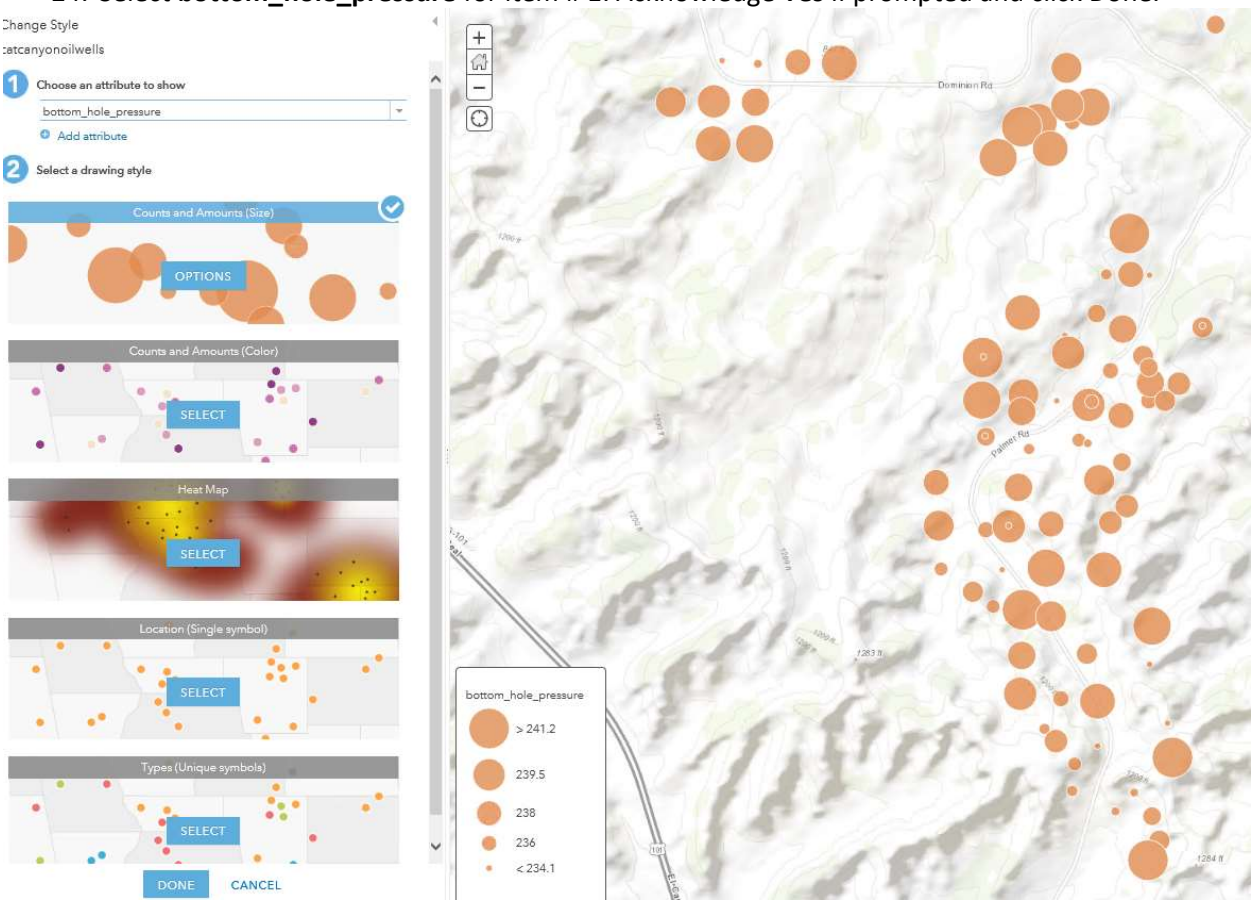


22. This would open up the OSIsoft Visualization custom display for this well.

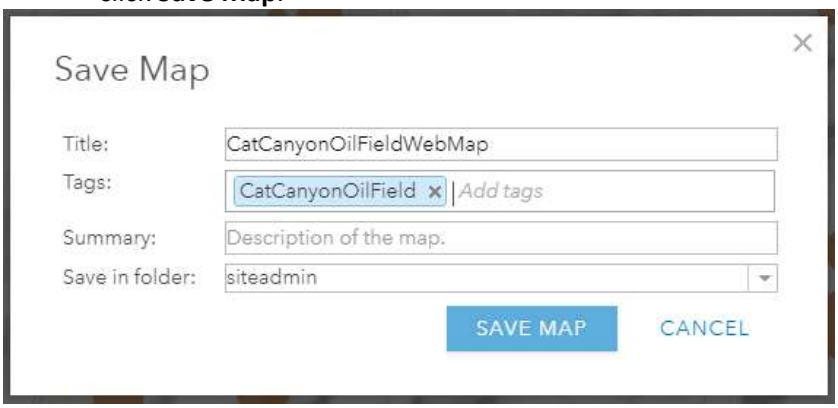


23. Now let's add the symbology to indicate the status of the Wells.

24. Select **bottom_hole_pressure** for item # 1. Acknowledge **Yes** if prompted and click Done.

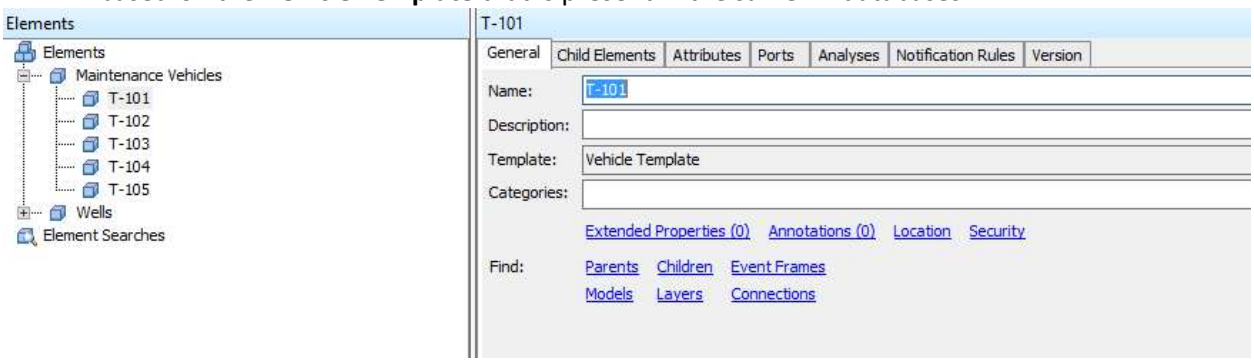


25. Select the **Save As** from Save dropdown menu. Specify the Title and Tags mentioned below and click **Save Map**.

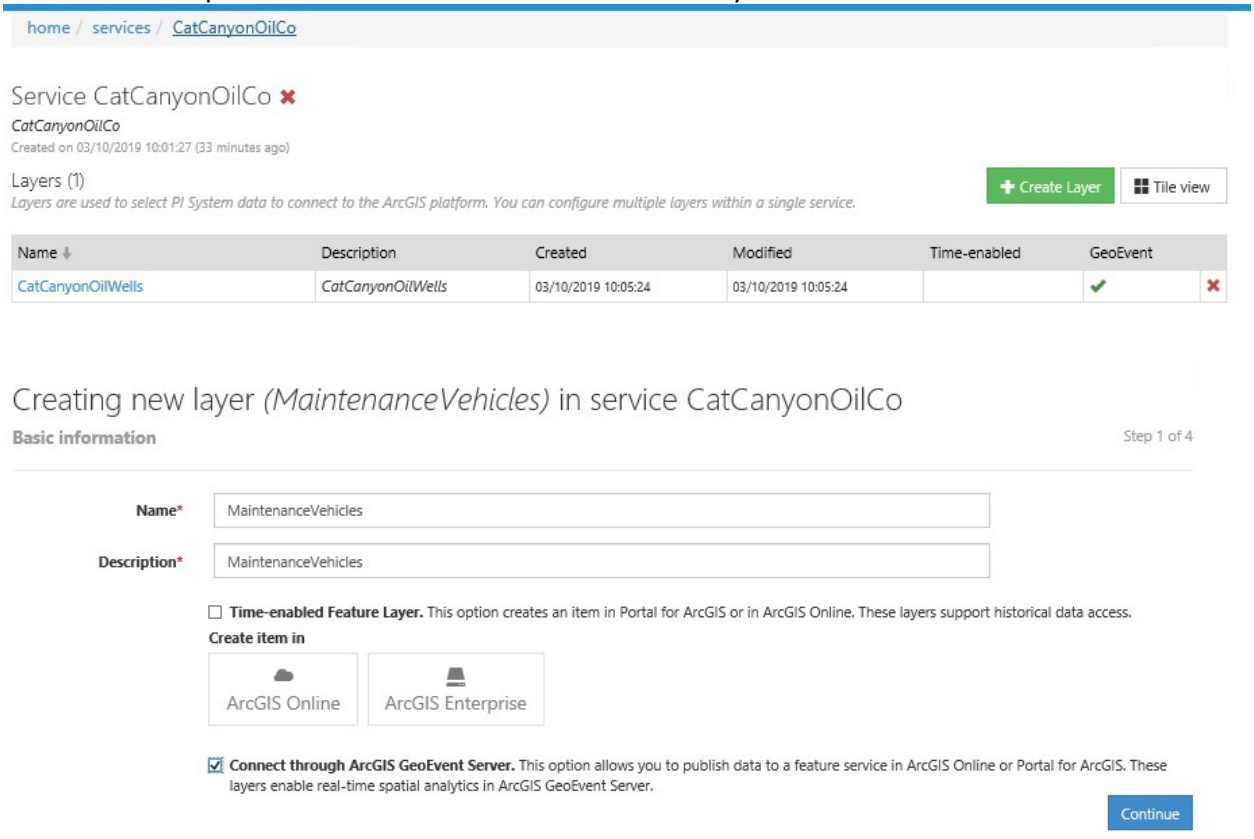


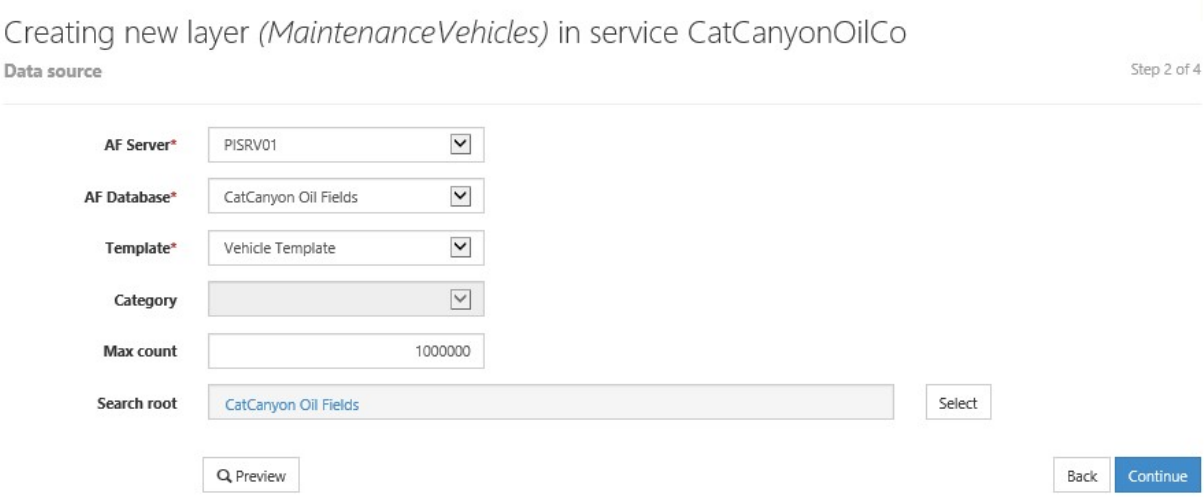
Create a feature service to bring-in all the Maintenance Vehicles based on AF element template

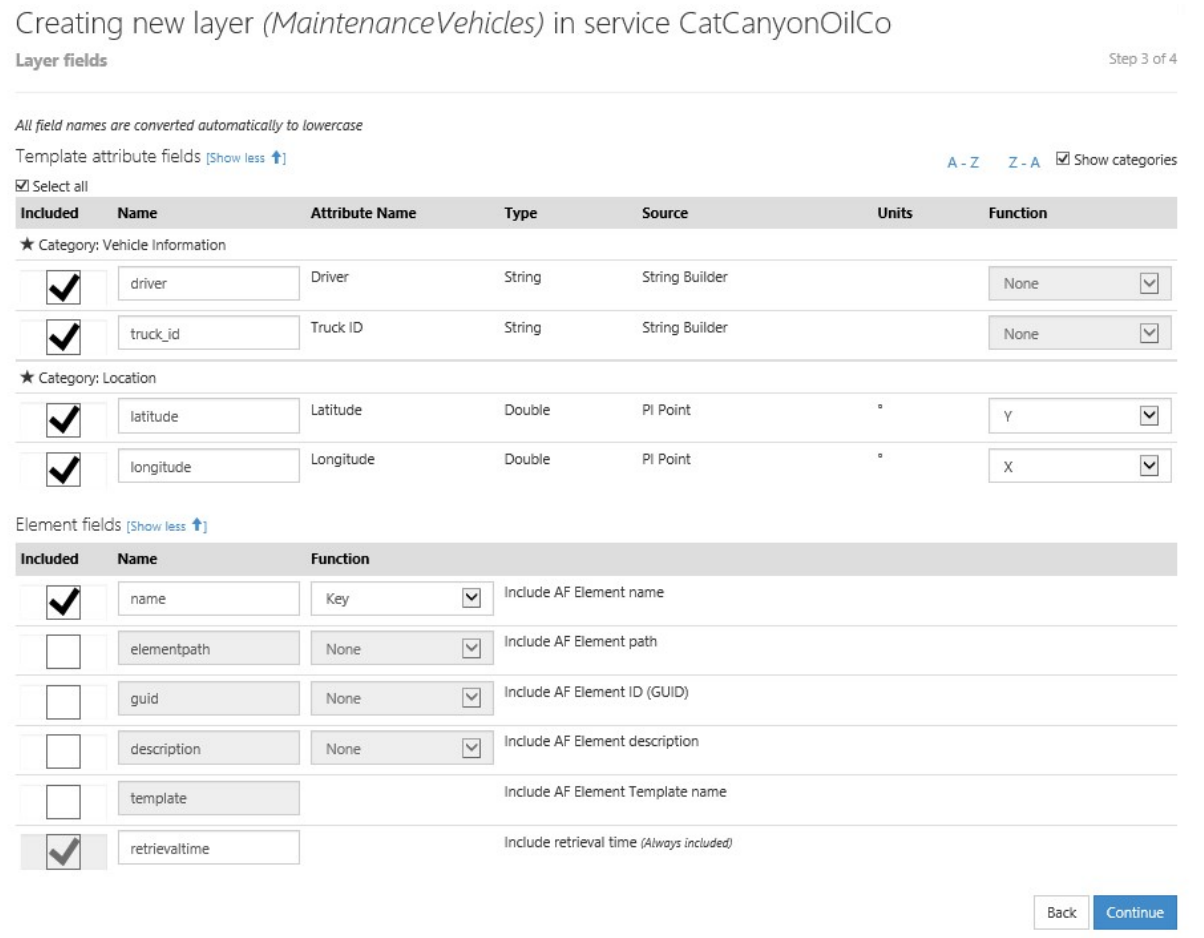
1. Now kindly try to create the layer using the PI Integrator for Esri ArcGIS 2017 SP1 for vehicles based-on the **Vehicle Template** that is present in the same AF databases.



2. Click Create Layer button to commence creating the feature layer for the vehicles. Follow the same steps described in exercise 3 where the wells layer was created.



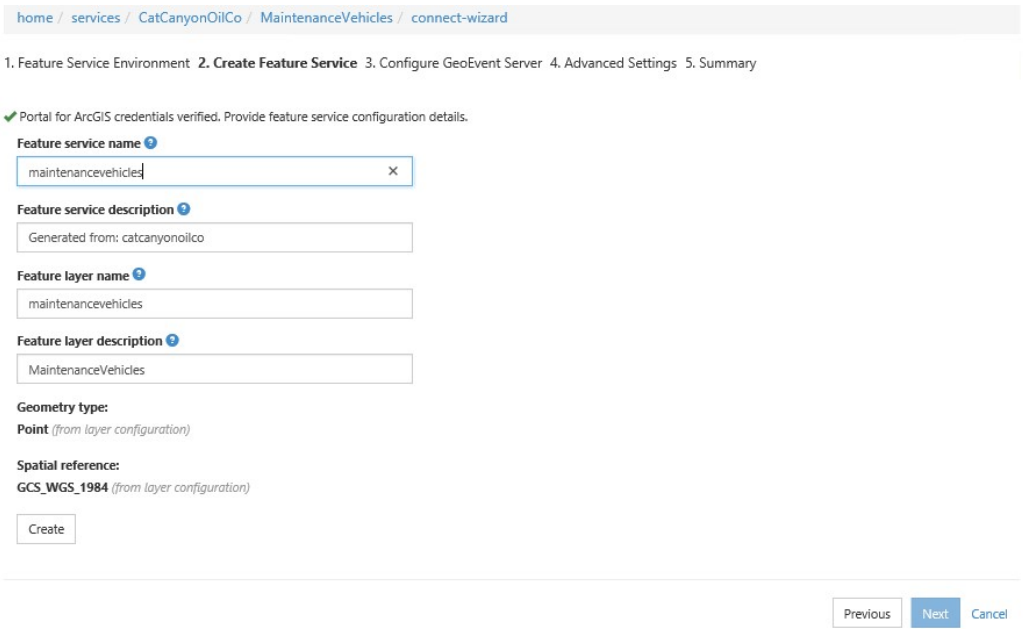

Creating new layer (MaintenanceVehicles) in service CatCanyonOilCo
Data source
Step 2 of 4
AF Server*
PISRV01
AF Database*
CatCanyon Oil Fields
Template*
Vehicle Template
Category
Max count
1000000
Search root
CatCanyon Oil Fields
Select
Preview
Back
Continue

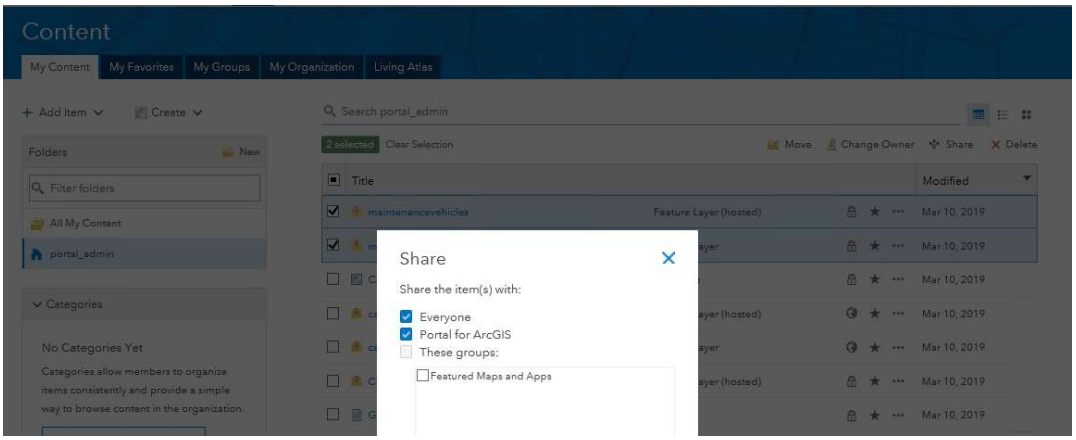

Creating new layer (MaintenanceVehicles) in service CatCanyonOilCo
Layer fields
Step 3 of 4
All field names are converted automatically to lowercase
Template attribute fields [Show less]
A - Z
Z - A
Show categories
Select all
Included
Name
Attribute Name
Type
Source
Units
Function
Category: Vehicle Information
driver
Driver
String
String Builder
None
truck_id
Truck ID
String
String Builder
None
Category: Location
latitude
Latitude
Double
PI Point
°
Y
longitude
Longitude
Double
PI Point
°
X
Element fields [Show less]
Included
Name
Function
name
Key
Include AF Element name
elementpath
None
Include AF Element path
guid
None
Include AF Element ID (GUID)
description
None
Include AF Element description
template
Include AF Element Template name
retrievaltime
Include retrieval time (Always included)
Back
Continue

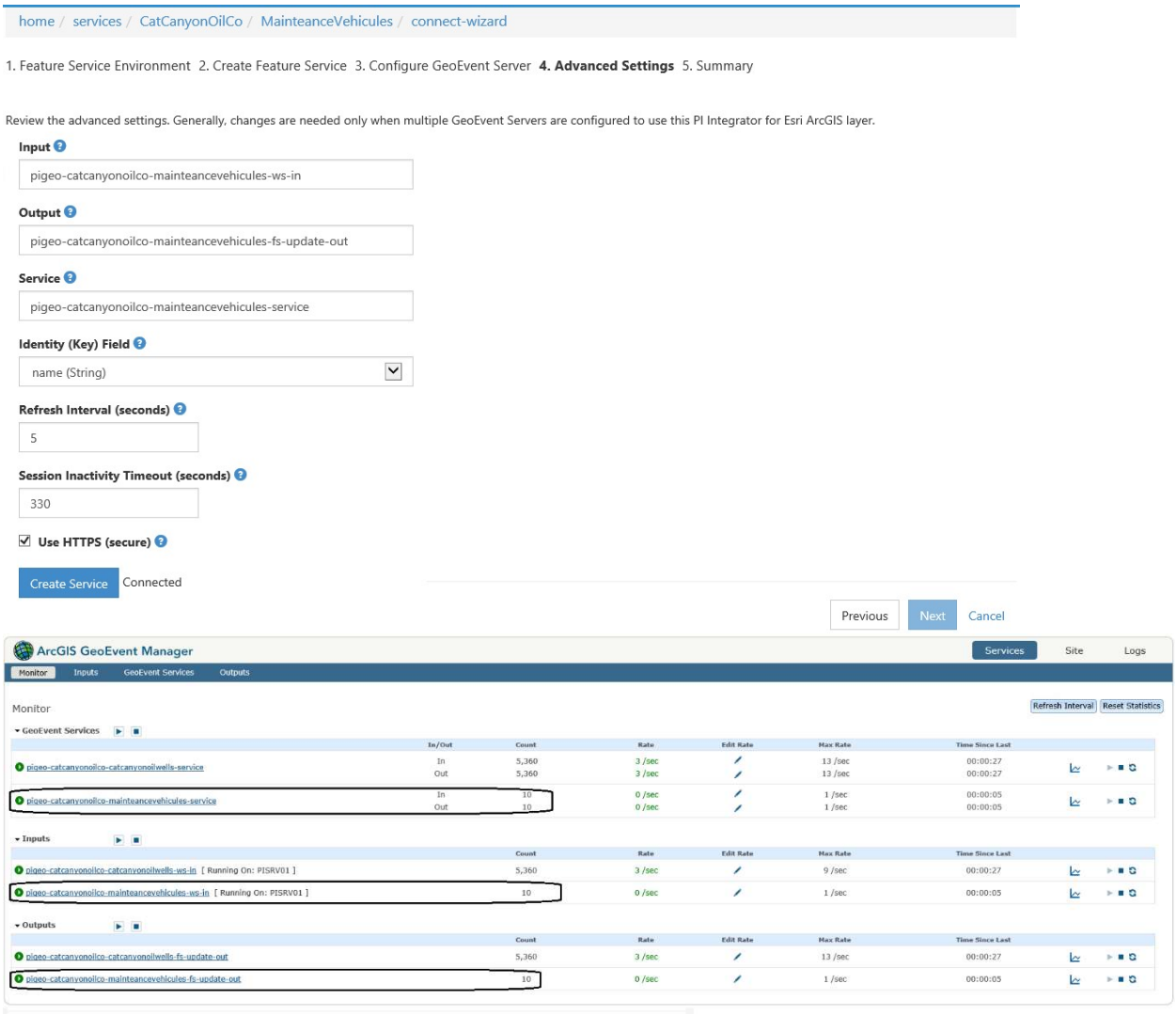
.....

.....

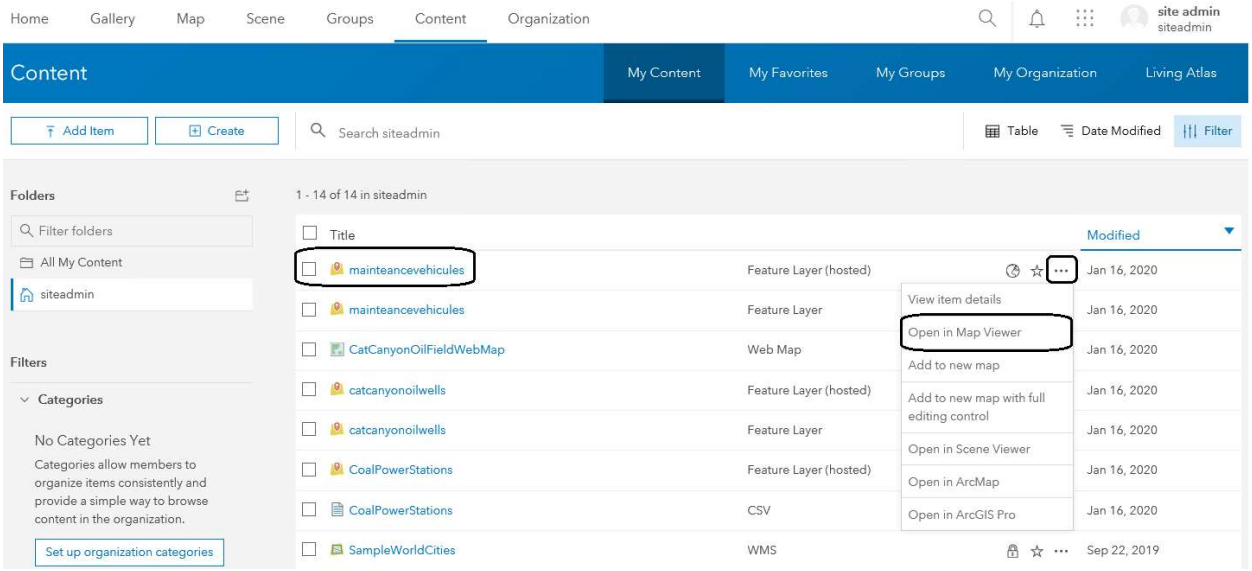
.....


home / services / CatCanyonOilCo / MaintenanceVehicles / connect-wizard
1. Feature Service Environment 2. Create Feature Service 3. Configure GeoEvent Server 4. Advanced Settings 5. Summary
Portal for ArcGIS credentials verified. Provide feature service configuration details.
Feature service name
maintenancevehicles
Feature service description
Generated from: catcanyonoilco
Feature layer name
maintenancevehicles
Feature layer description
MaintenanceVehicles
Geometry type:
Point (from layer configuration)
Spatial reference:
GCS_WGS_1984 (from layer configuration)
Create
Previous
Next
Cancel

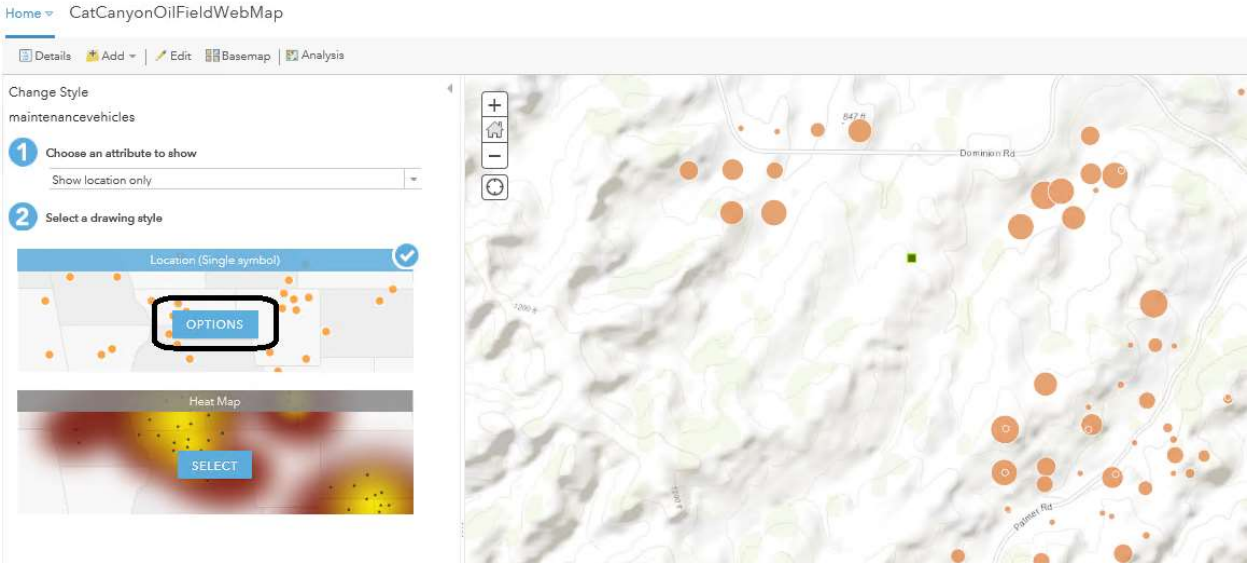

Content
My Content
My Favorites
My Groups
My Organization
Living Atlas
Add Item
Create
Search portal_admin
Folders
New
Filter folders
All My Content
portal_admin
Categories
No Categories Yet
Categories allow members to organize items consistently and provide a simple way to browse content in the organization.
2 selected
Clear Selection
Move
Change Owner
Share
Delete
Title
Modified
maintenancevehicles
Feature Layer (hosted)
Mar 10, 2019
Share
Share the item(s) with:
Everyone
Portal for ArcGIS
These groups:
Featured Maps and Apps



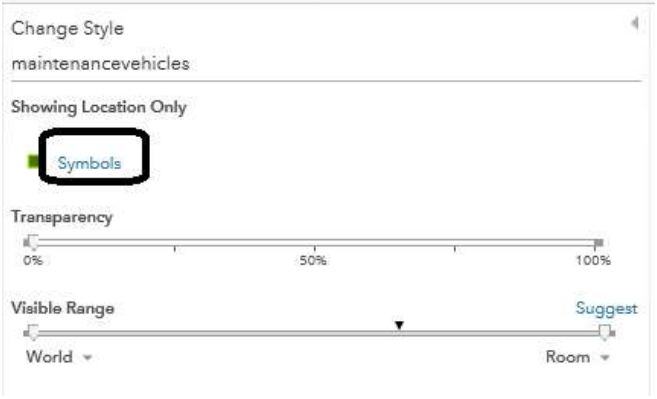
3. Now add the maintenancevehicles to the map by selecting **Open in Map Viewer**.



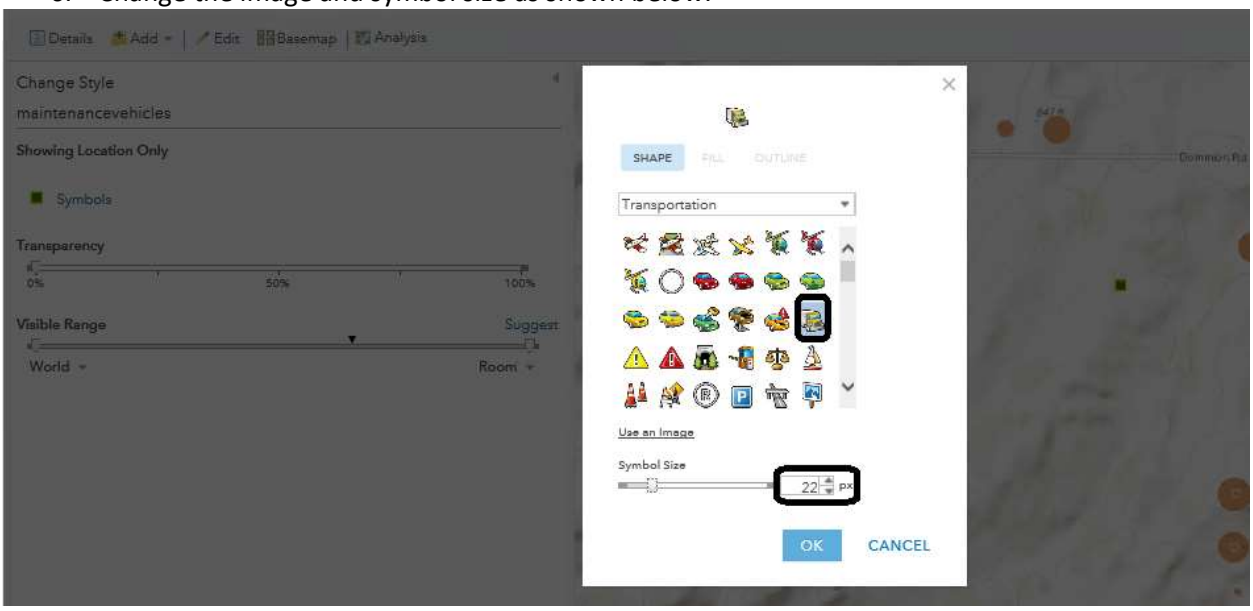
4. Click **Options**.



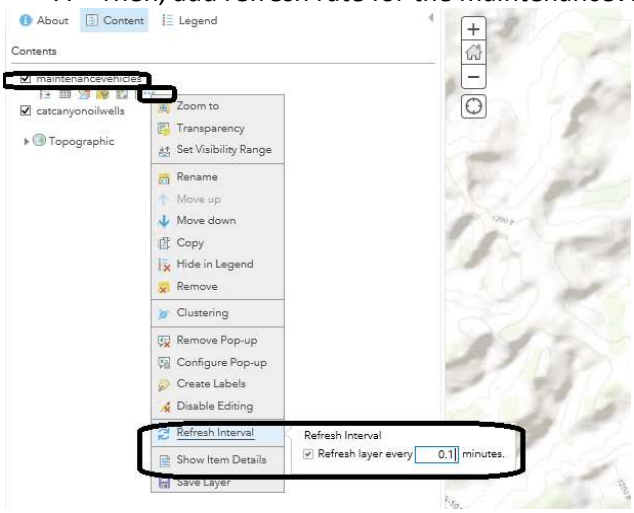
5. Click **Symbol**.



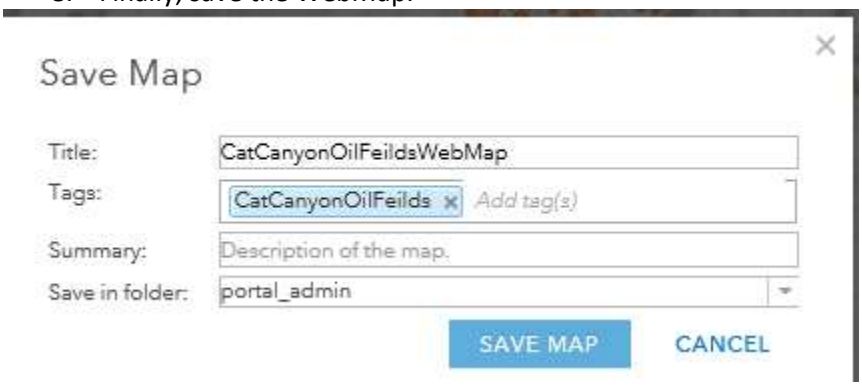
6. Change the image and symbol size as shown below.



7. Then, add refresh rate for the maintenancevehicles layer to see the trucks moving in real-time.

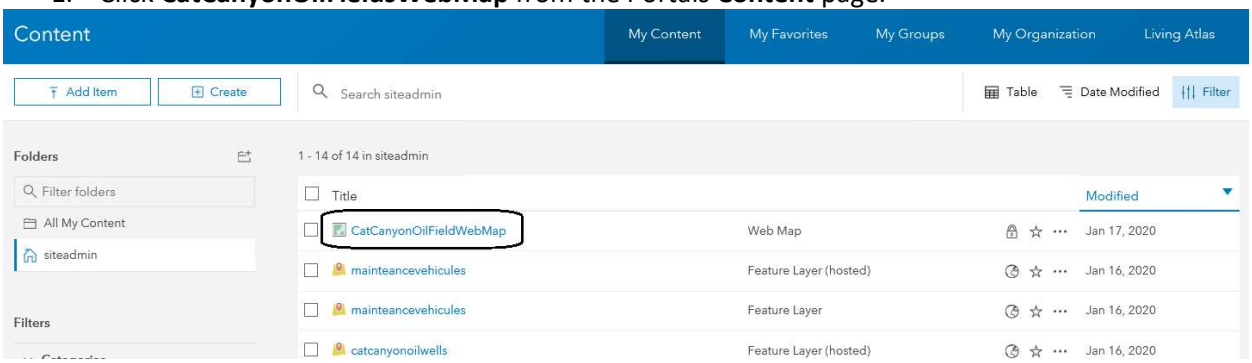


8. Finally, save the WebMap.

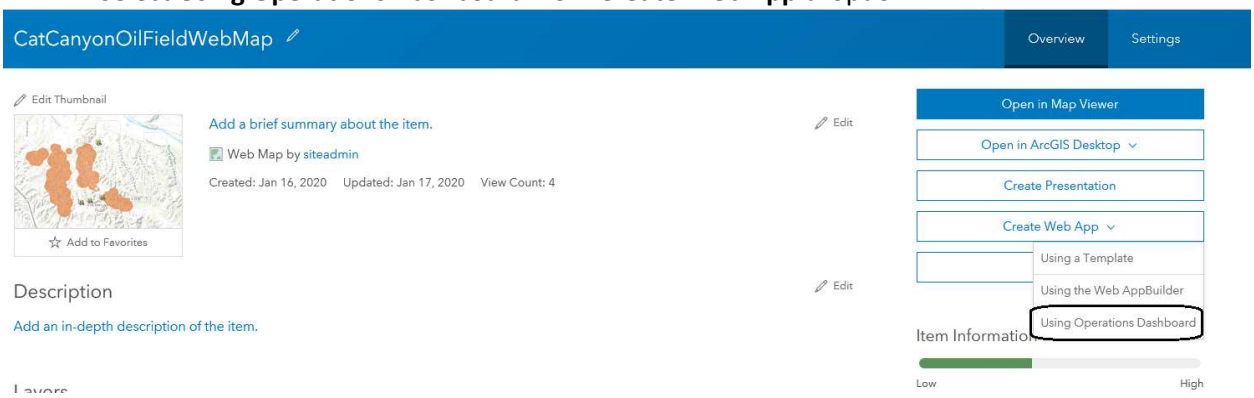


5. Create an Operations View with PI Vision Integration

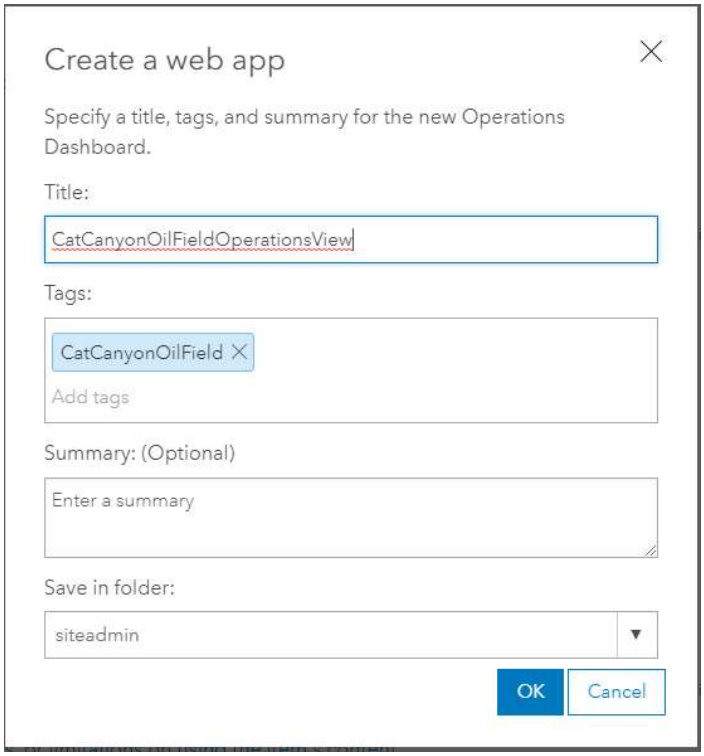
1. Click **CatCanyonOilFieldsWebMap** from the Portals **Content** page.



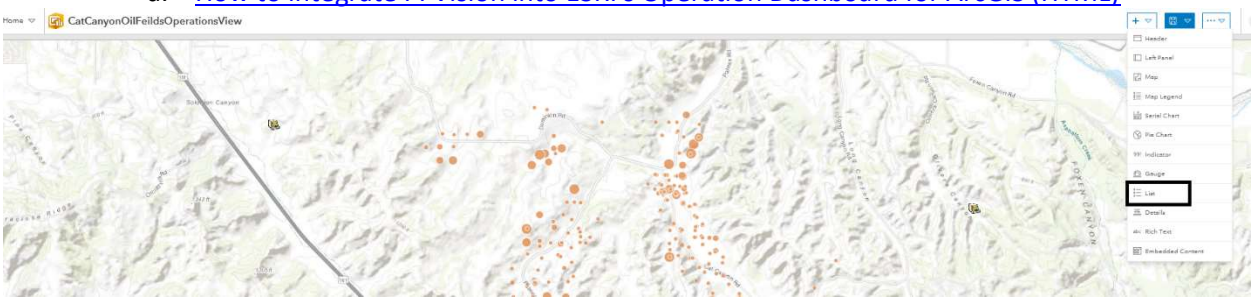
2. Select **Using Operations Dashboard** from **Create Web App** dropdown.



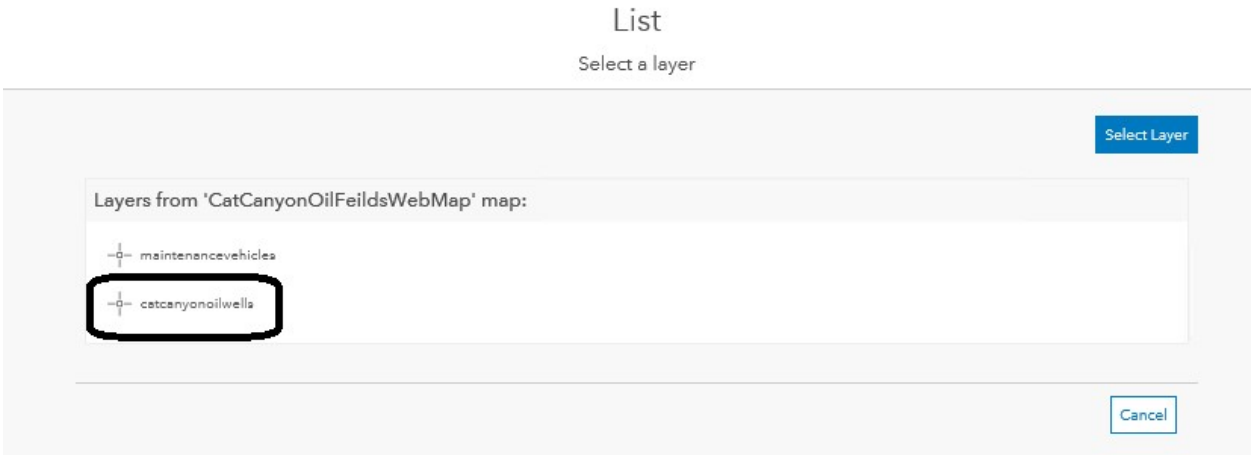
3. Provide a suitable name and click **OK**.



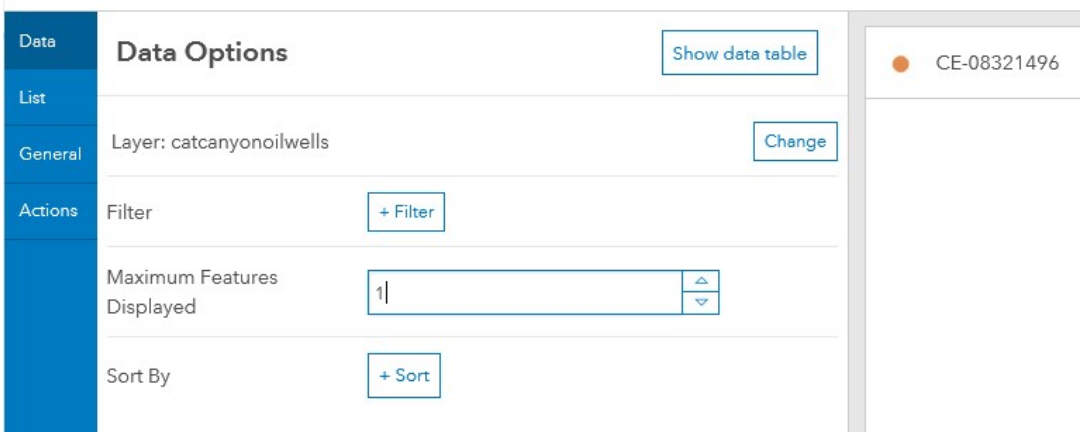
4. Select List from as shown below, more details are given in the article below.
    a. [How to integrate PI Vision into ESRI's Operation Dashboard for ArcGIS (HTML)]



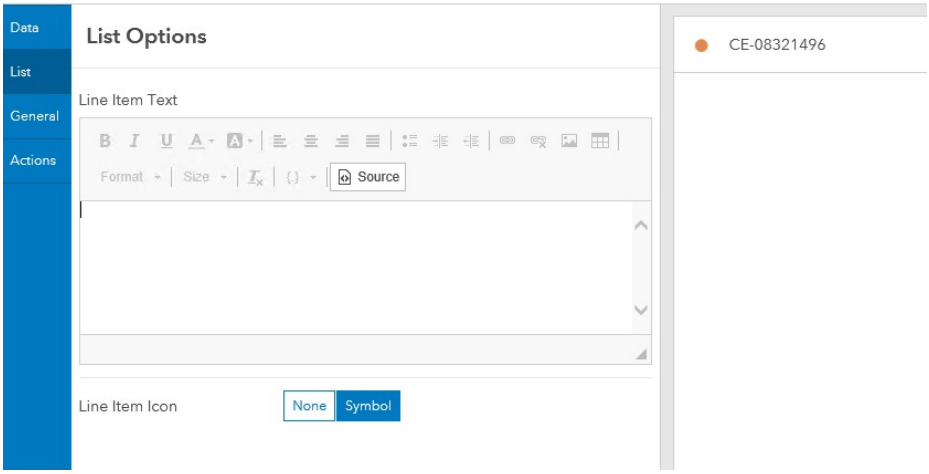
5. Select **CatCanyonOilWells** Layer.



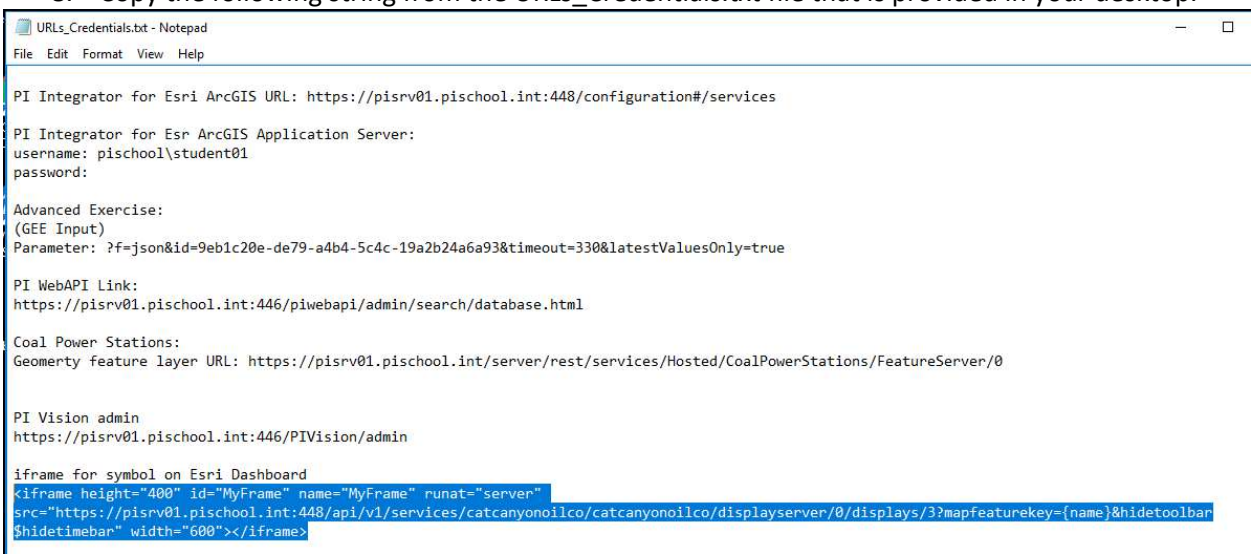
6. Under the Data tab, select a value of 1 for **Maximum Features Displayed**.



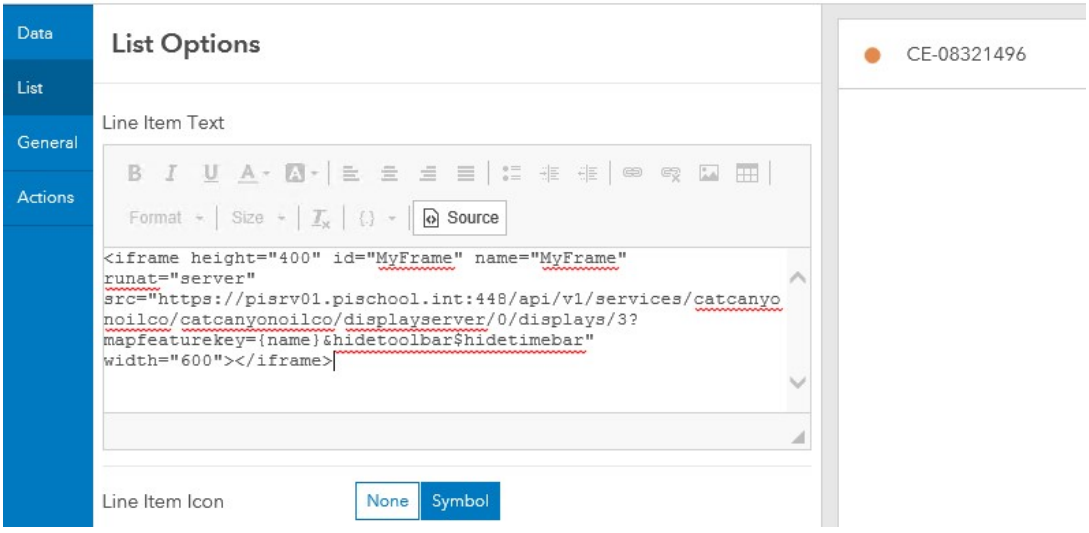
7. Then click on the list tab and then Source.



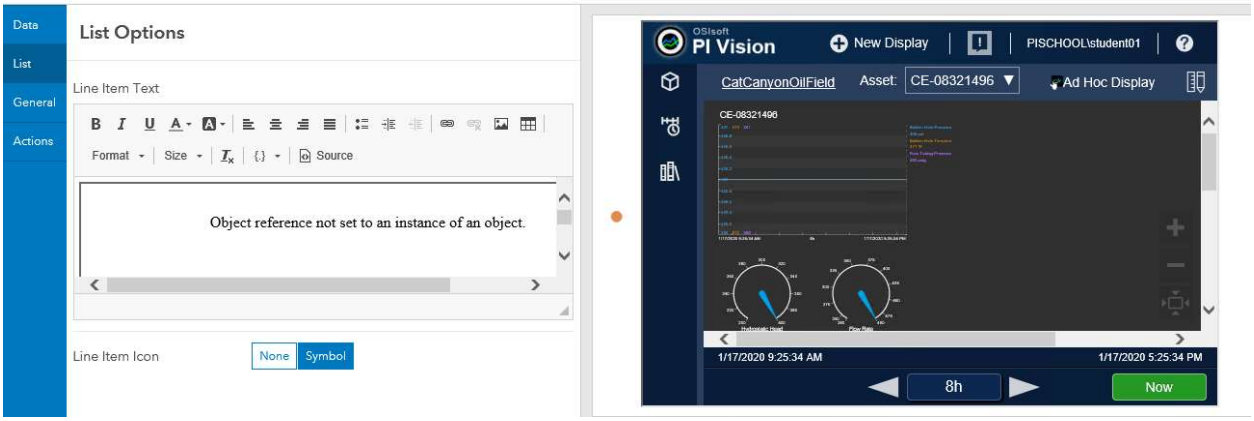
8. Copy the following string from the URLs_Credentials.txt file that is provided in your desktop.



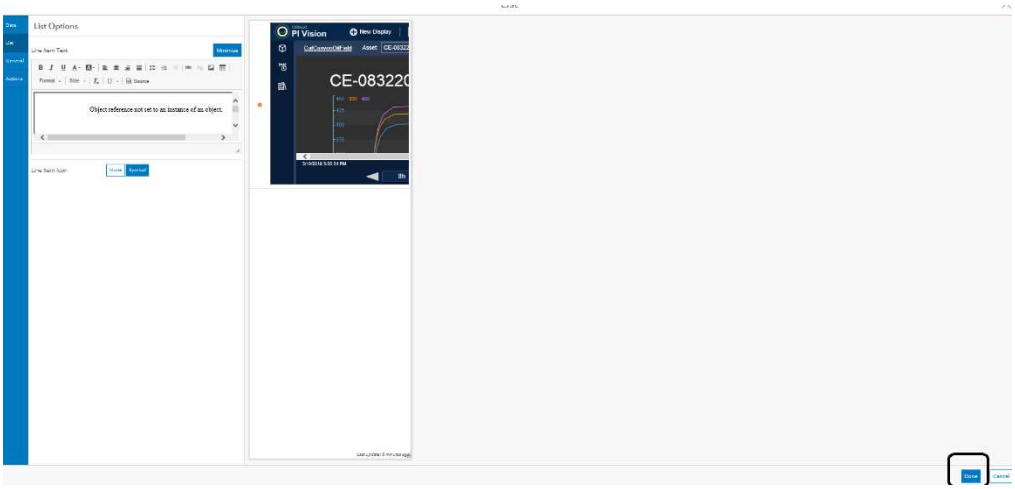
9. Paste it in the edit box as show below.



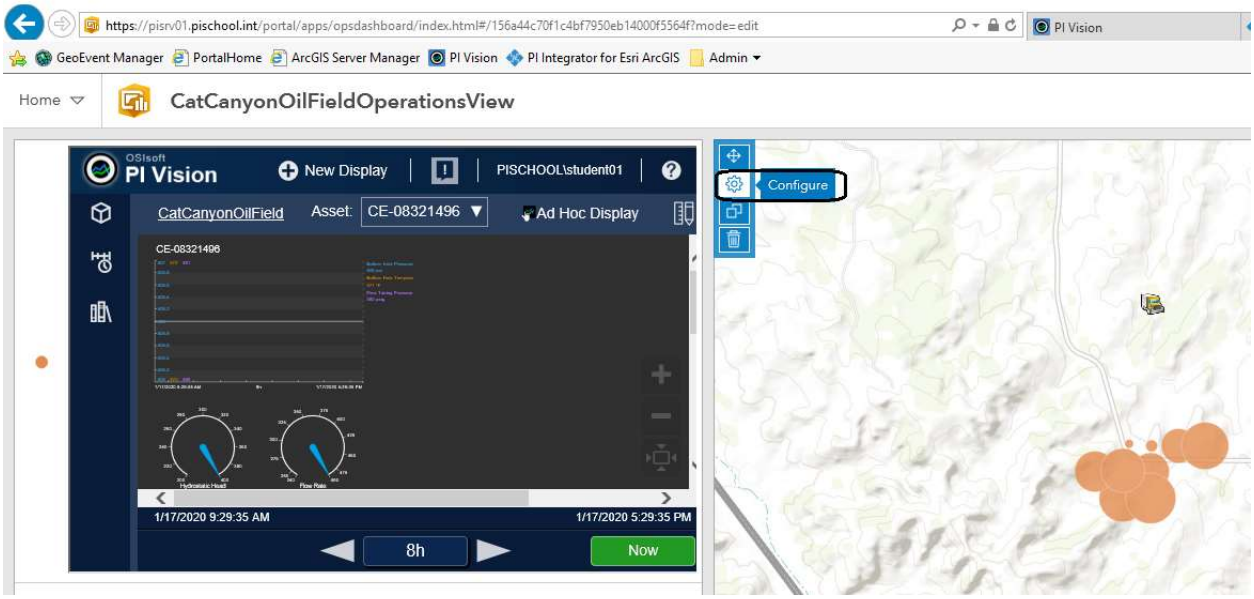
10. Click **Source** again.



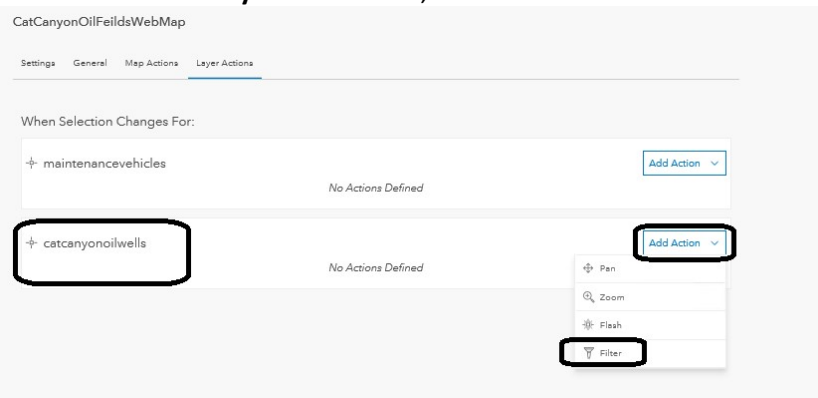
11. Click **Done** from bottom RHS.



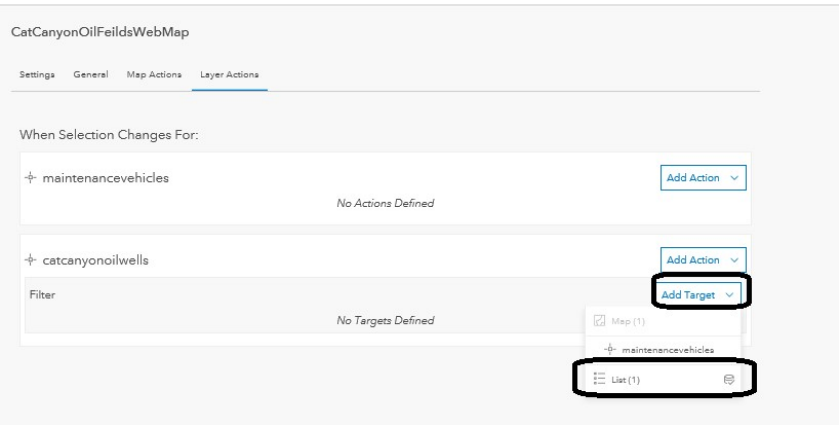
12. Now to create a layer action, select the **Configure** button as shown below.

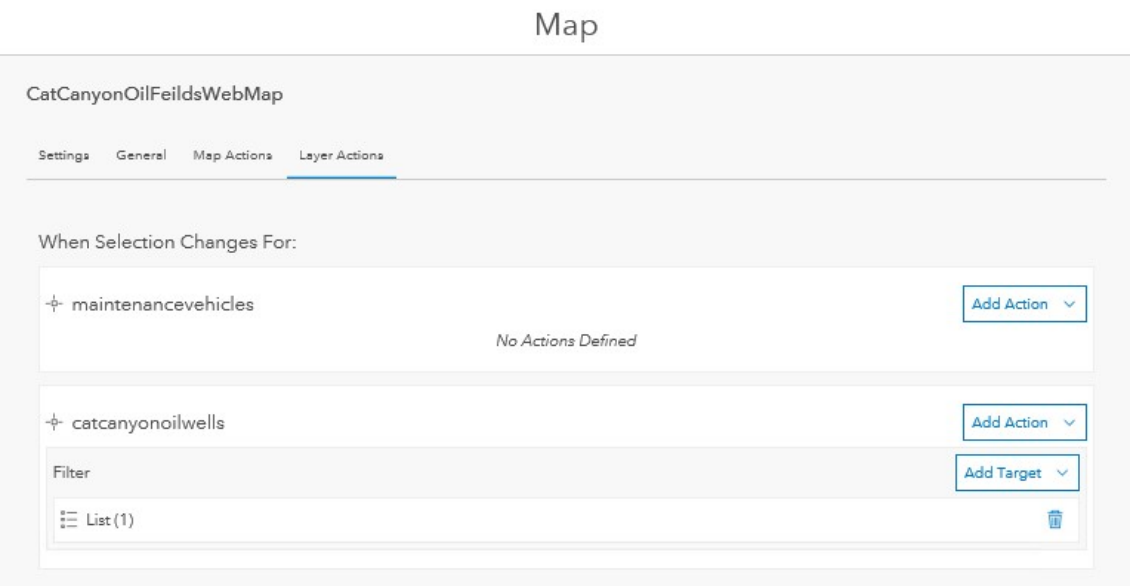


13. From the **Layer Actions** tab, select **Filter** from **Add Action** dropdown menu.

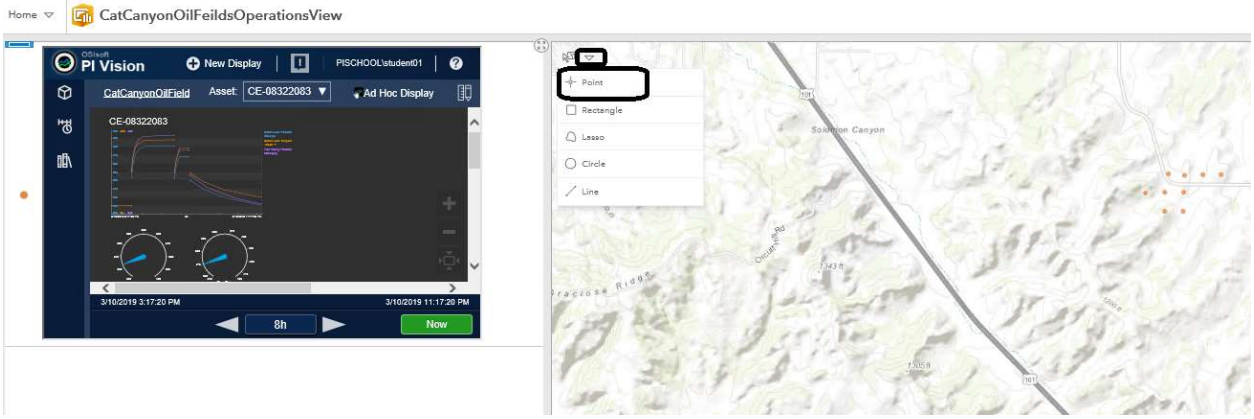


14. Now select List from the **Add Target** dropdown menu. Then click **Done**.

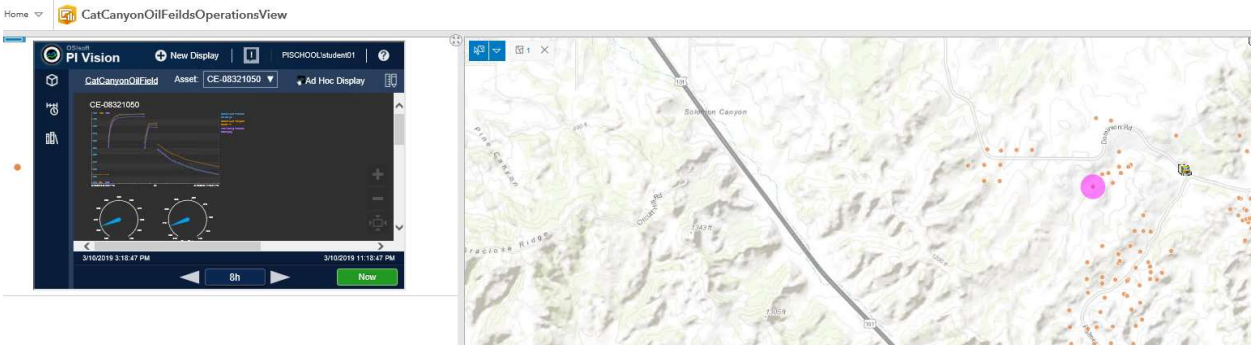




15. Select **Point** from the menu shown below.

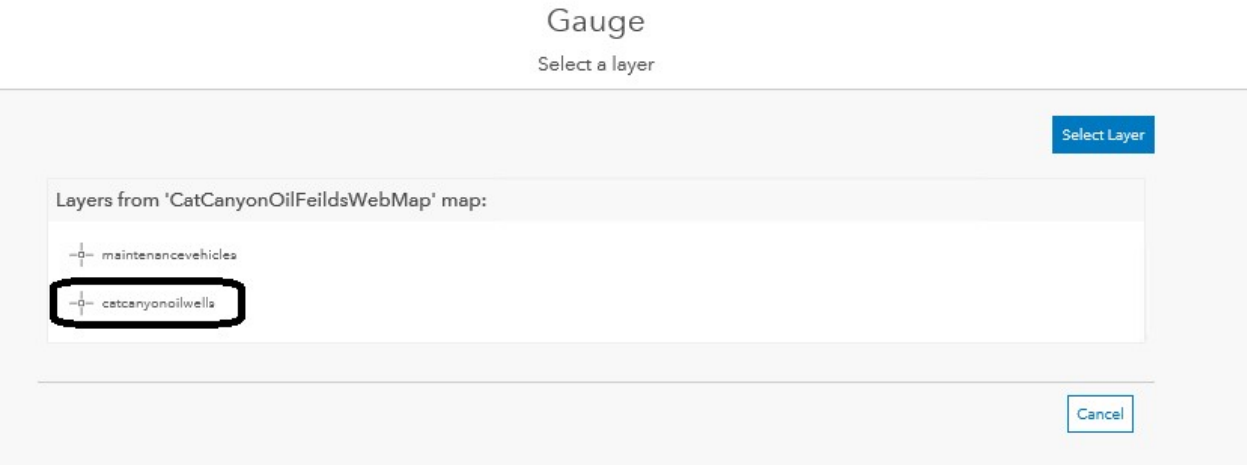


16. Then click on any one of the oil wells and notice that the PI Vision display changes.

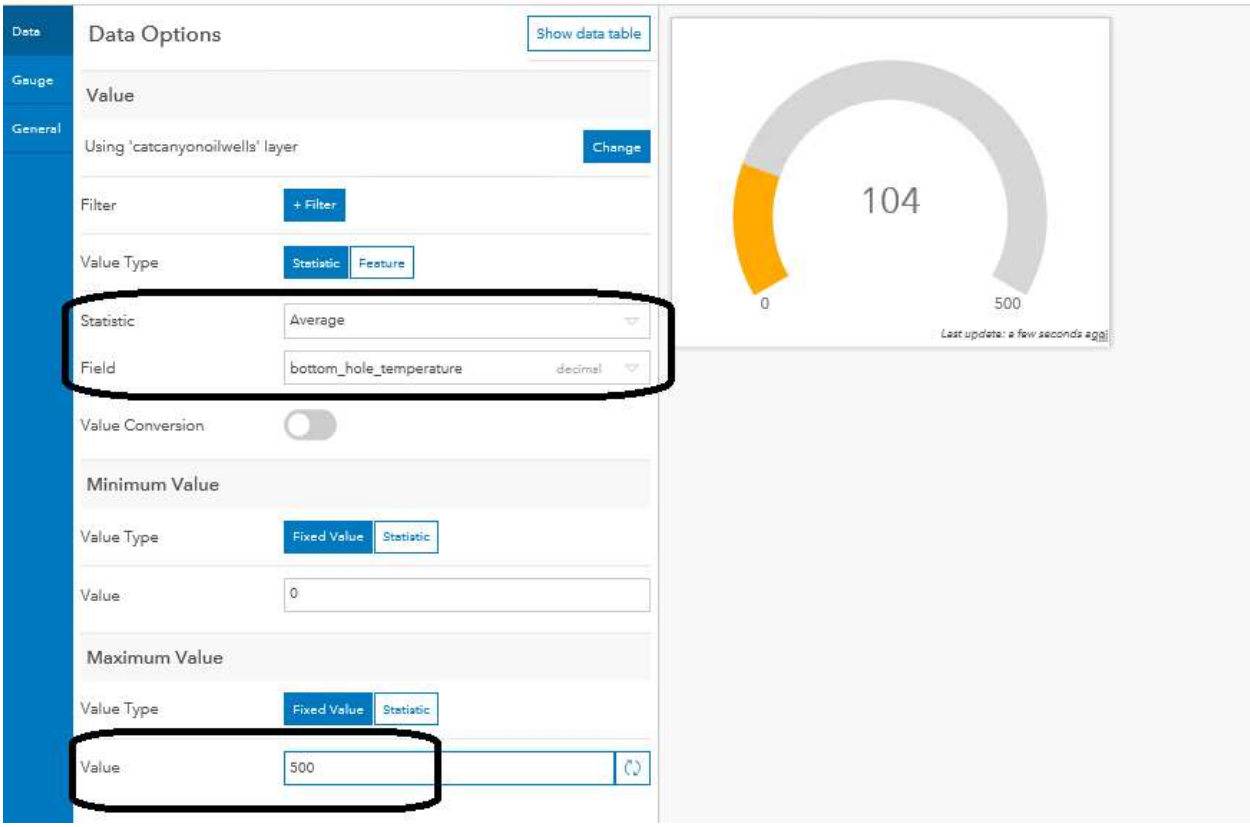


17. Again, select **Gauge** as another widget to add to the dashboard.

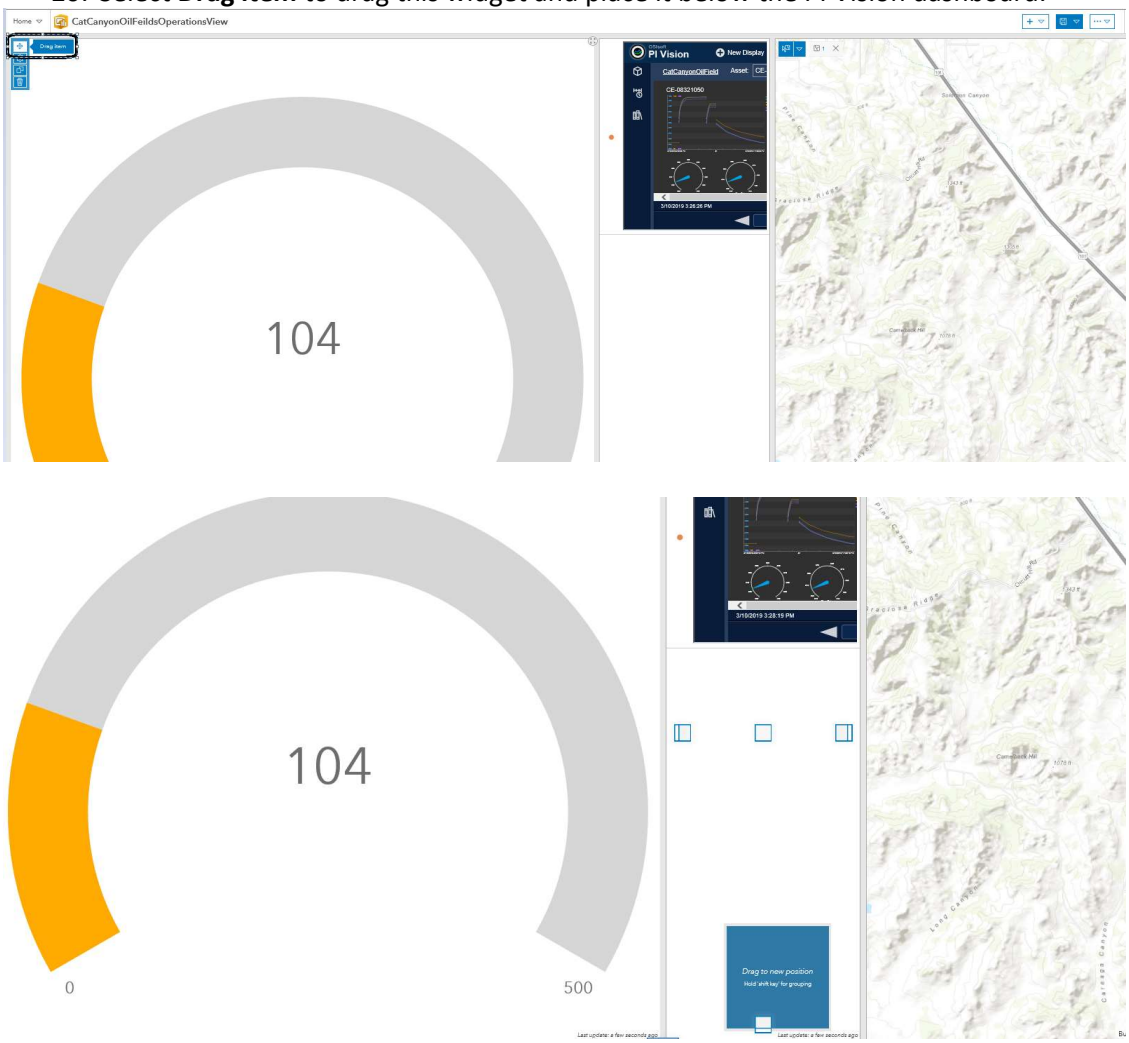
18. Select **catcanyonoilwells** as the layer.

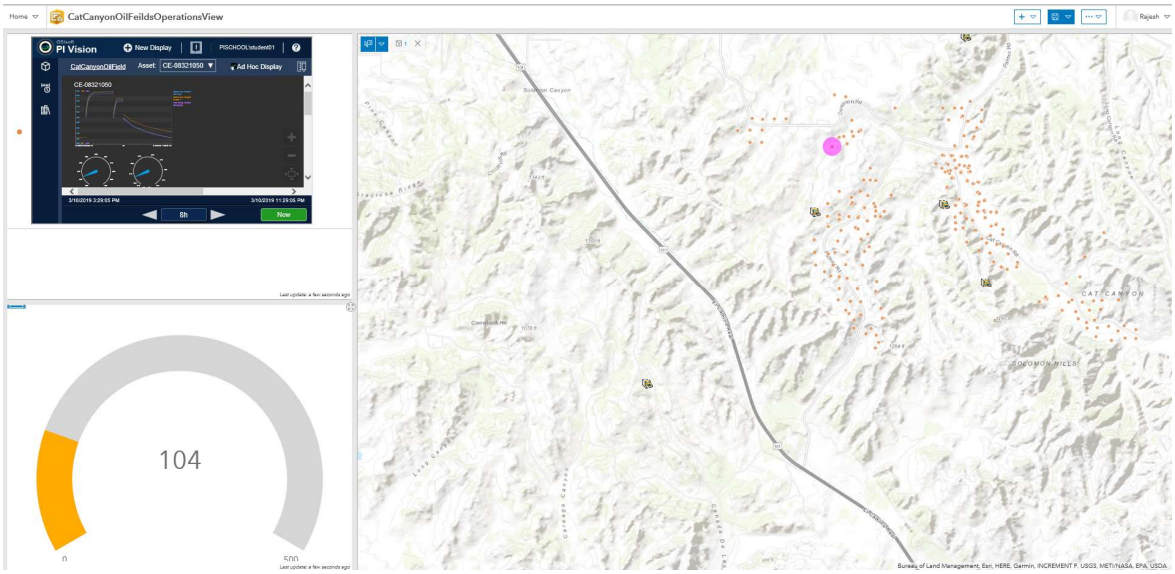


19. Select Average, **bottom_hole_temperature**, and 500 as values for Statistics, Field, and Maximum Value fields, respectively. Then click **Done**.

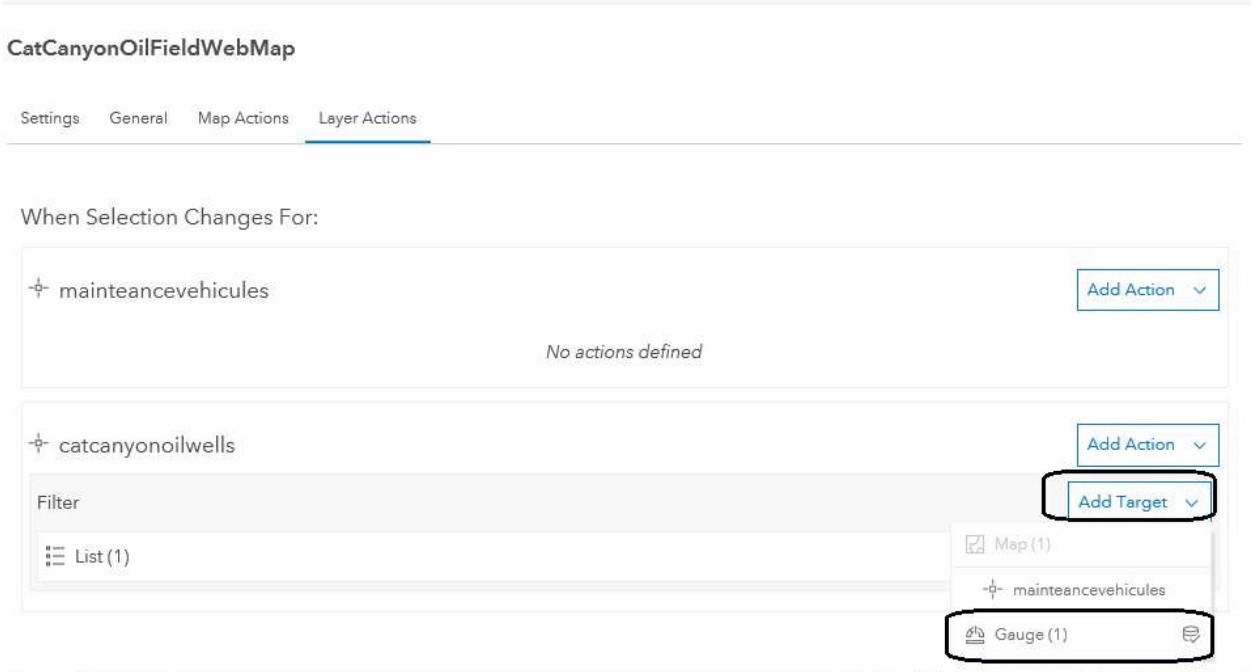


20. Select **Drag item** to drag this widget and place it below the PI Vision dashboard.

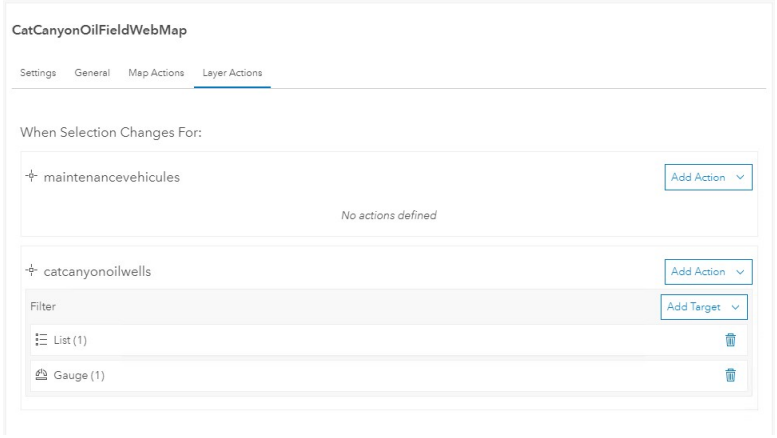




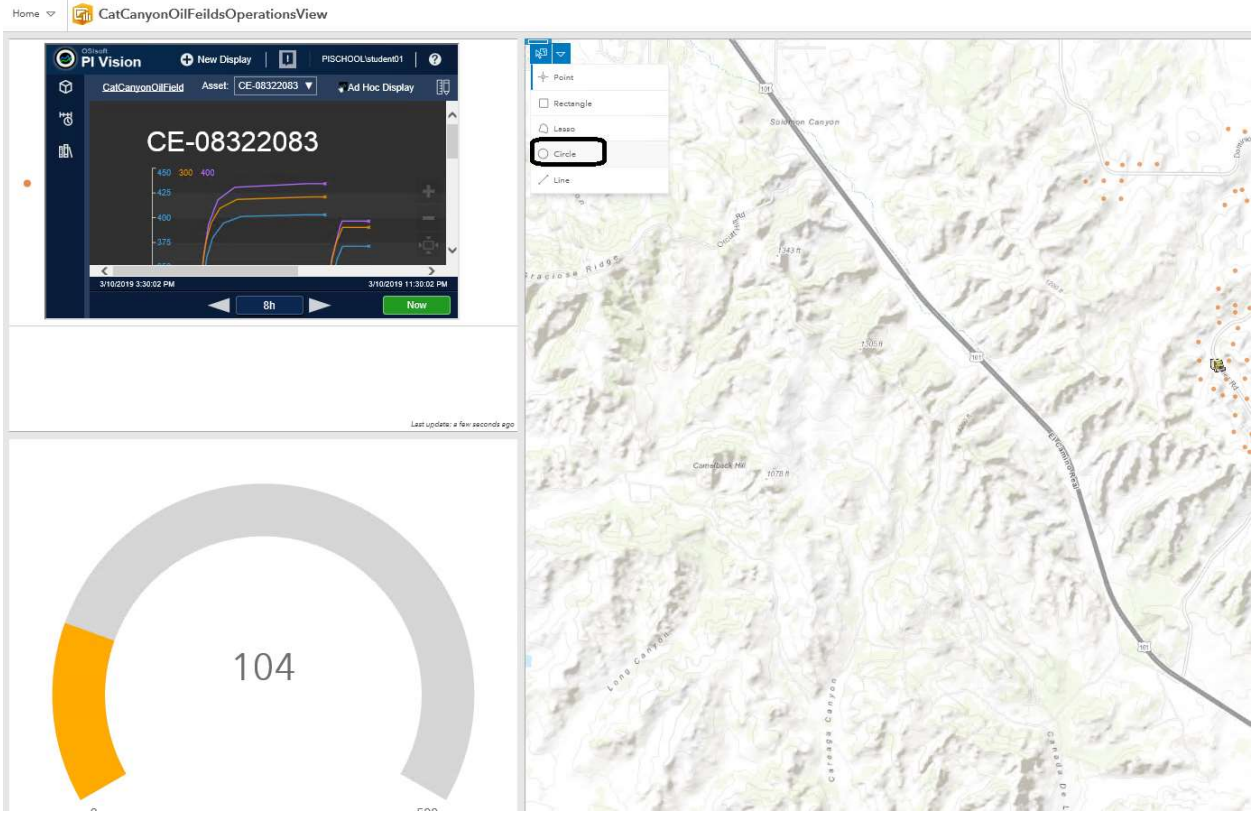
21. Add another target for Gauge (1) to the layer action previously added to the map with the gauge as target then click **Done**.

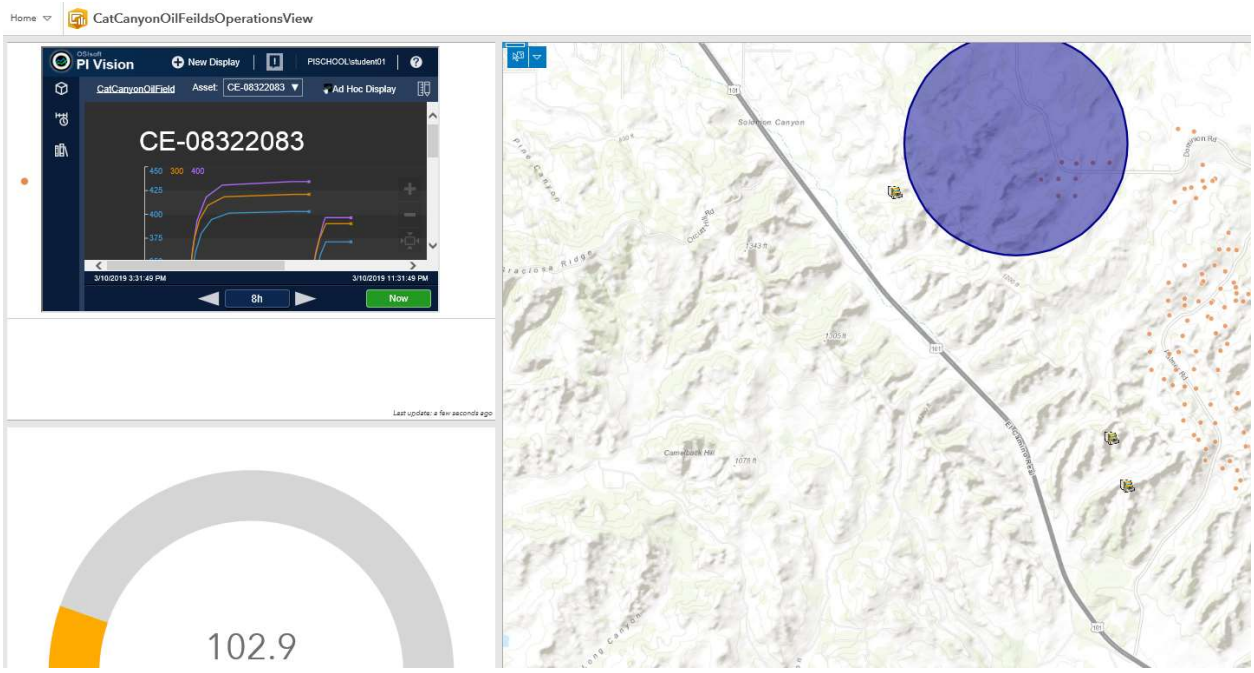


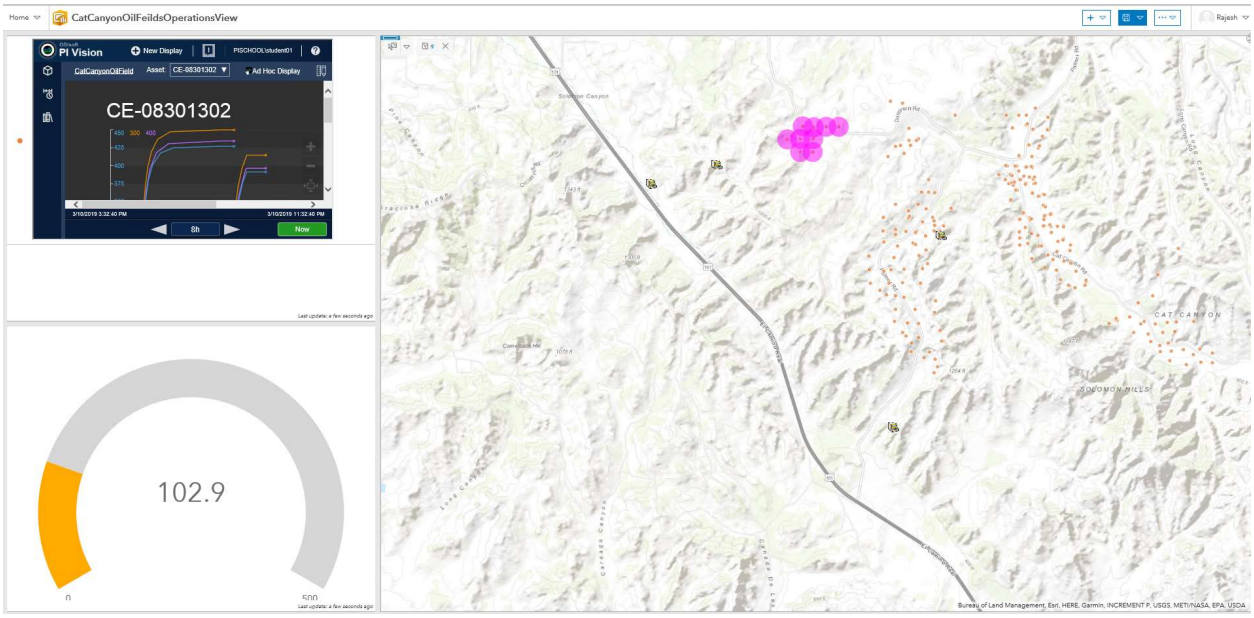
Map



22. Select Draw a circle option as shown below and draw a circle for a group of oil well to render the calculated averages shown using the gauge.



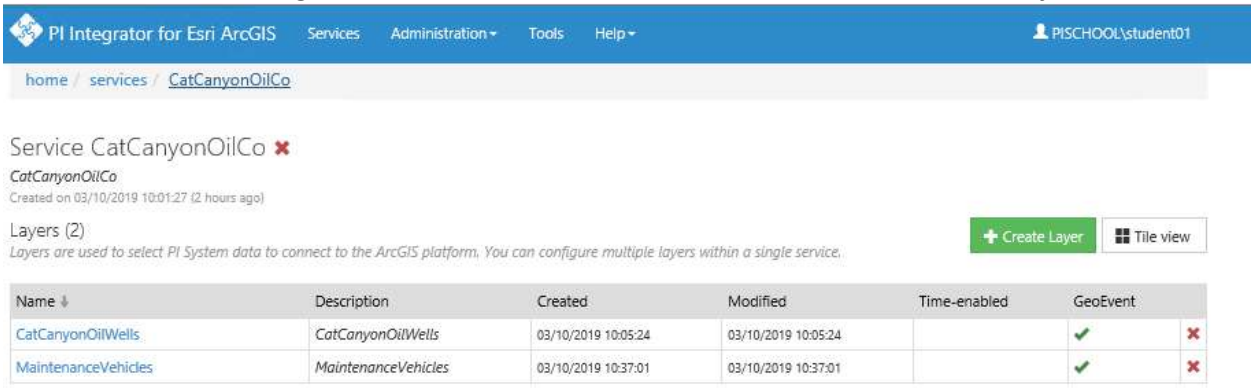



Home
CatCanyonOilFeildsOperationsView
Rajesh
PI Vision
New Display
PISCHOOL\student01
CatCanyonOilField
Asset: CE-08301302
Ad Hoc Display
CE-08301302
8h
Now
102.9
CAT CANYON
SOLOMON HILLS
Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA

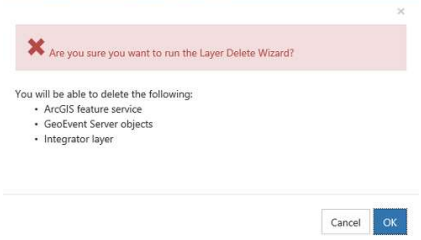
6. Demonstration of the feature in the PI Integrator for Esri ArcGIS 2017 SP1 that would delete the associated GeoEvent Server connectors

Now we would like to demonstrate a feature in the Esri Integrator 2017 that will delete the associated GeoEvent objects, when deleting the layer from the PI Integrator for Esri ArcGIS 2017 SP1.

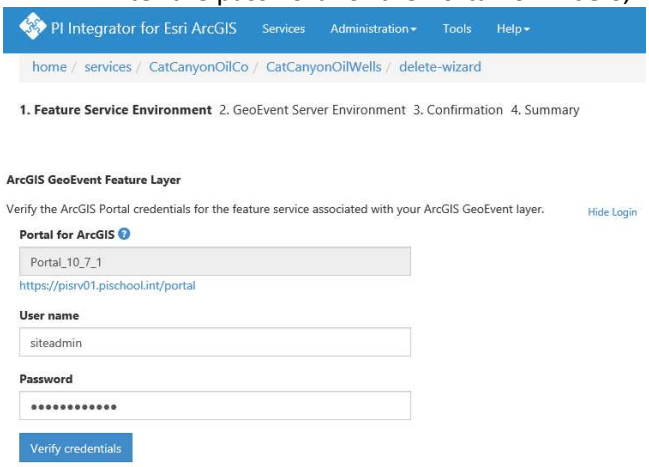
1. Go to the PI Integrator for Esri ArcGIS 2017 SP1 and click on the service **CatCanyonOilCo**.



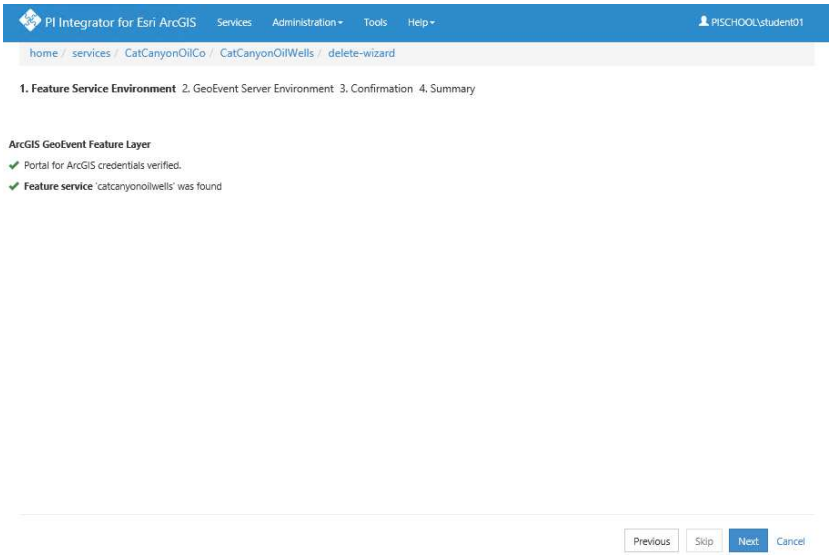
2. Now we will delete the CatCanyonOilWells layer. Click on the X icon in the last column next to Well layer. This will open up another dialog box and click OK to acknowledge that you wish to delete this layer, which would delete the associated ArcGIS feature service, GeoEvent Server Objects, and this Integrator layer.



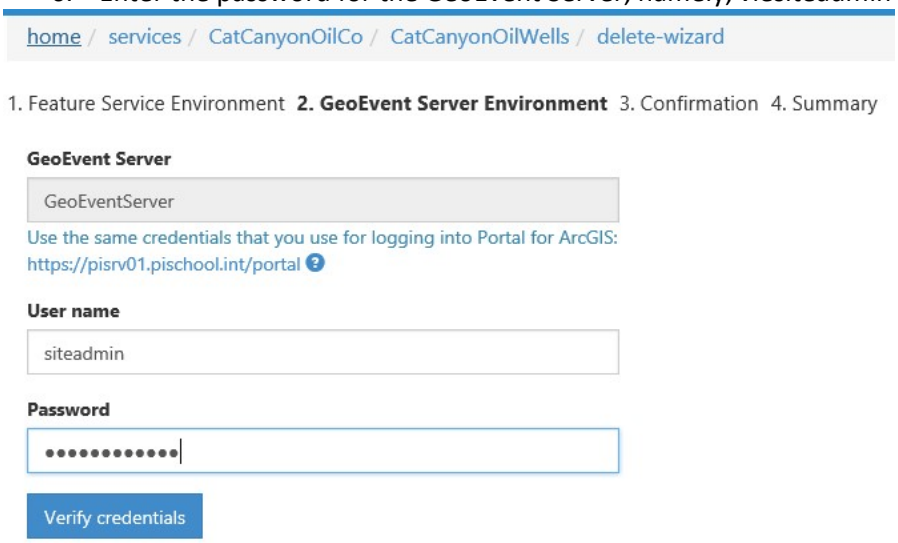
3. Click **Next**.
4. Enter the password for the Portal for ArcGIS, namely, vlesiteadmin and click **Verify Credentials**.



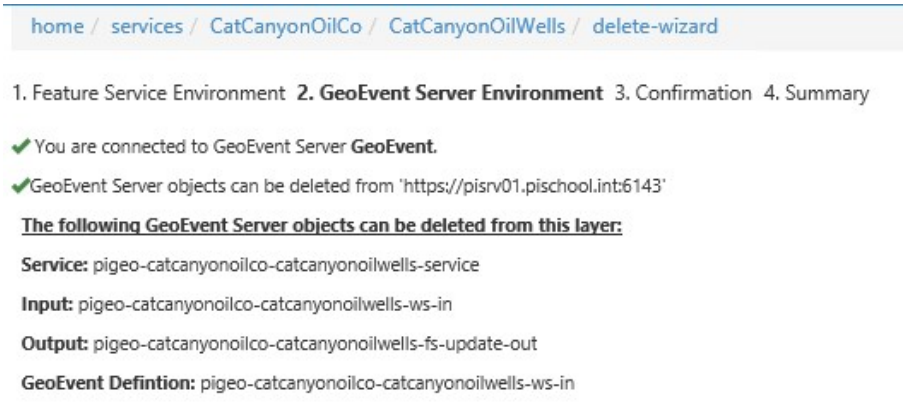
5. Click **Next**.



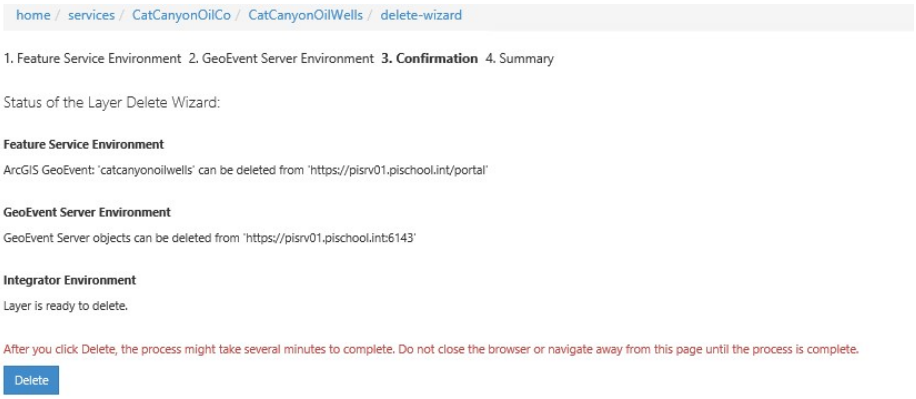
6. Enter the password for the GeoEvent Server, namely, vlesiteadmin and click **Verify Credentials**.



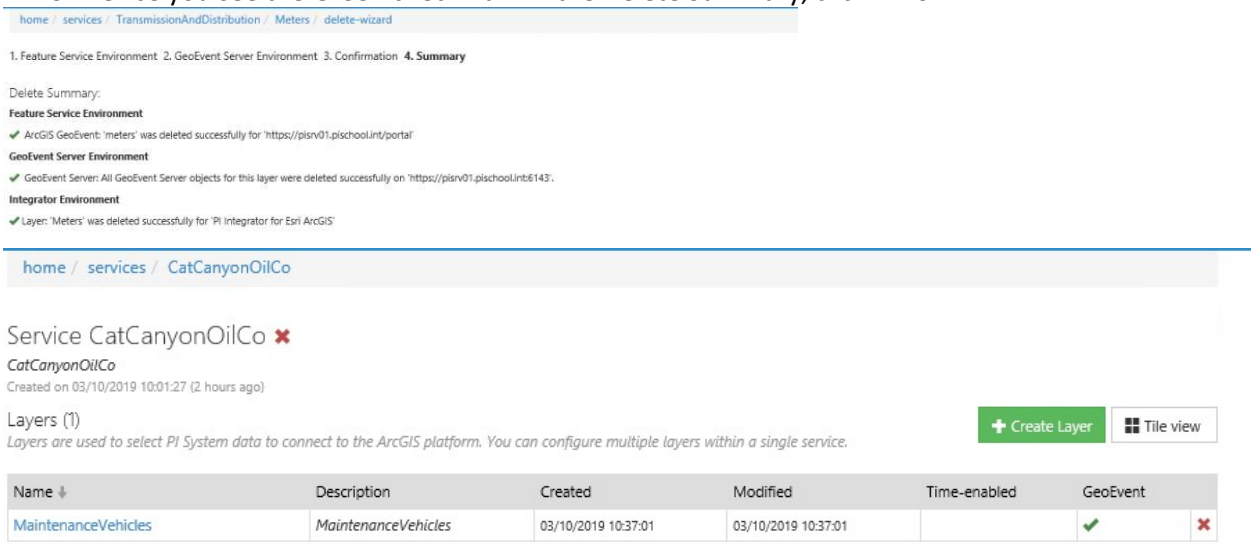
7. Click **Next**.



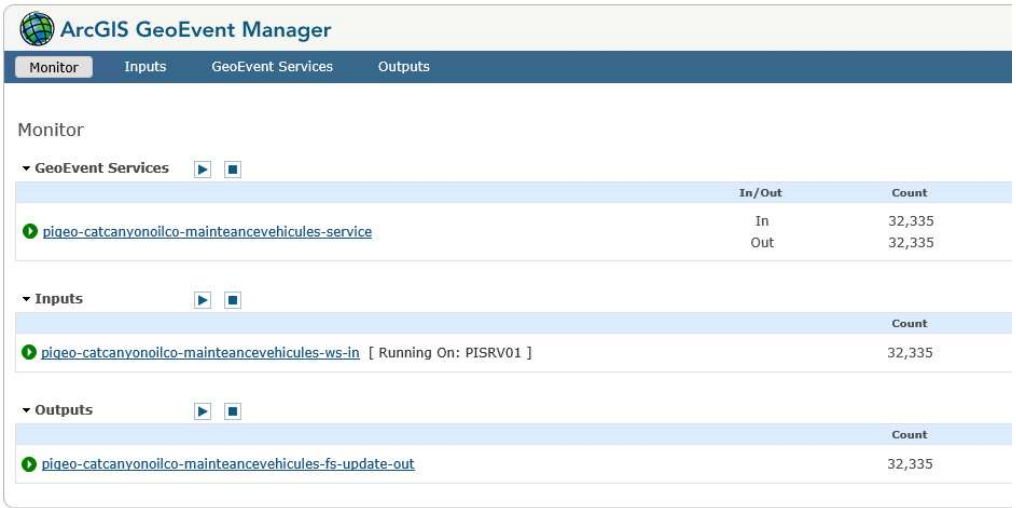
8. Click **Delete**.



9. Once you see the Green checkmark in the Delete Summary, click **Finish**.



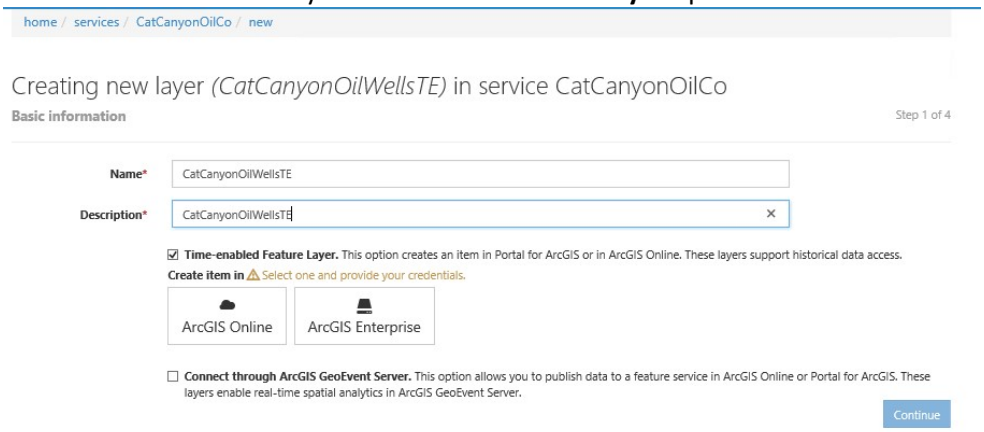
10. Confirm that the GeoEvent Server components are deleted.



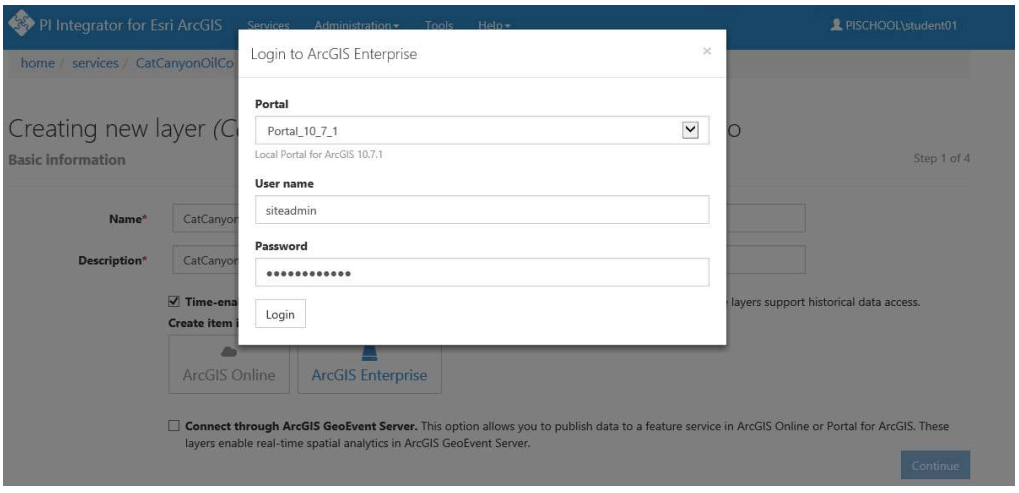
7. Create Time-enabled Feature Layer for the Oil Wells & Maintenance Vehicles

1. Click on Services and then click on **CatCanyonOilCo** service on the PI Integrator for Esri ArcGIS 2017 SP1.

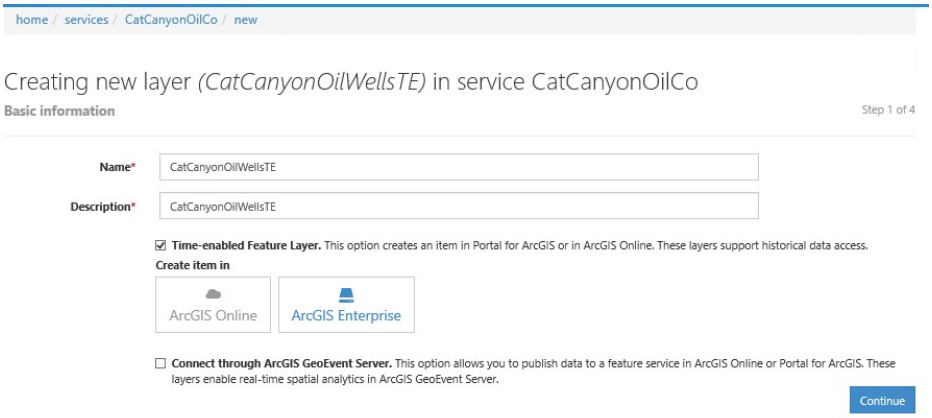
2. Now to create a new layer for the Oil Wells and click **Create Layer** button.
3. Enter **CatCanyonOilWellsTE** for both Name and descriptions fields. Kindly make sure that you have checked only **Time-enabled Feature Layer** option.



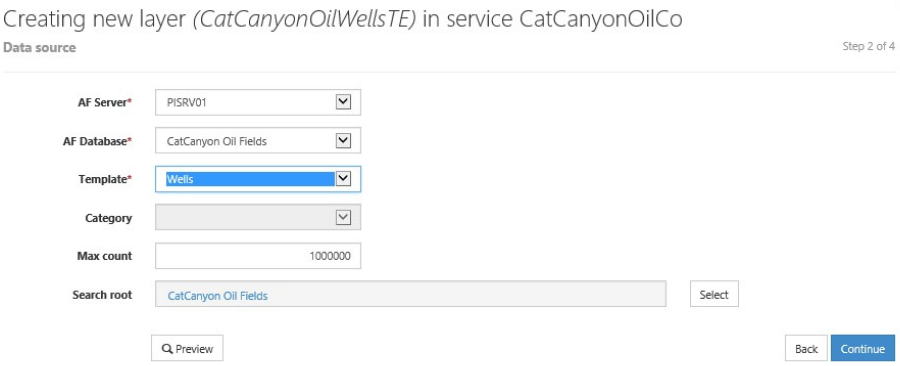
4. Click on **ArcGIS Enterprise** button
5. Enter the username and password as siteadmin and vlesiteadmin, respectively, and click **Login**.



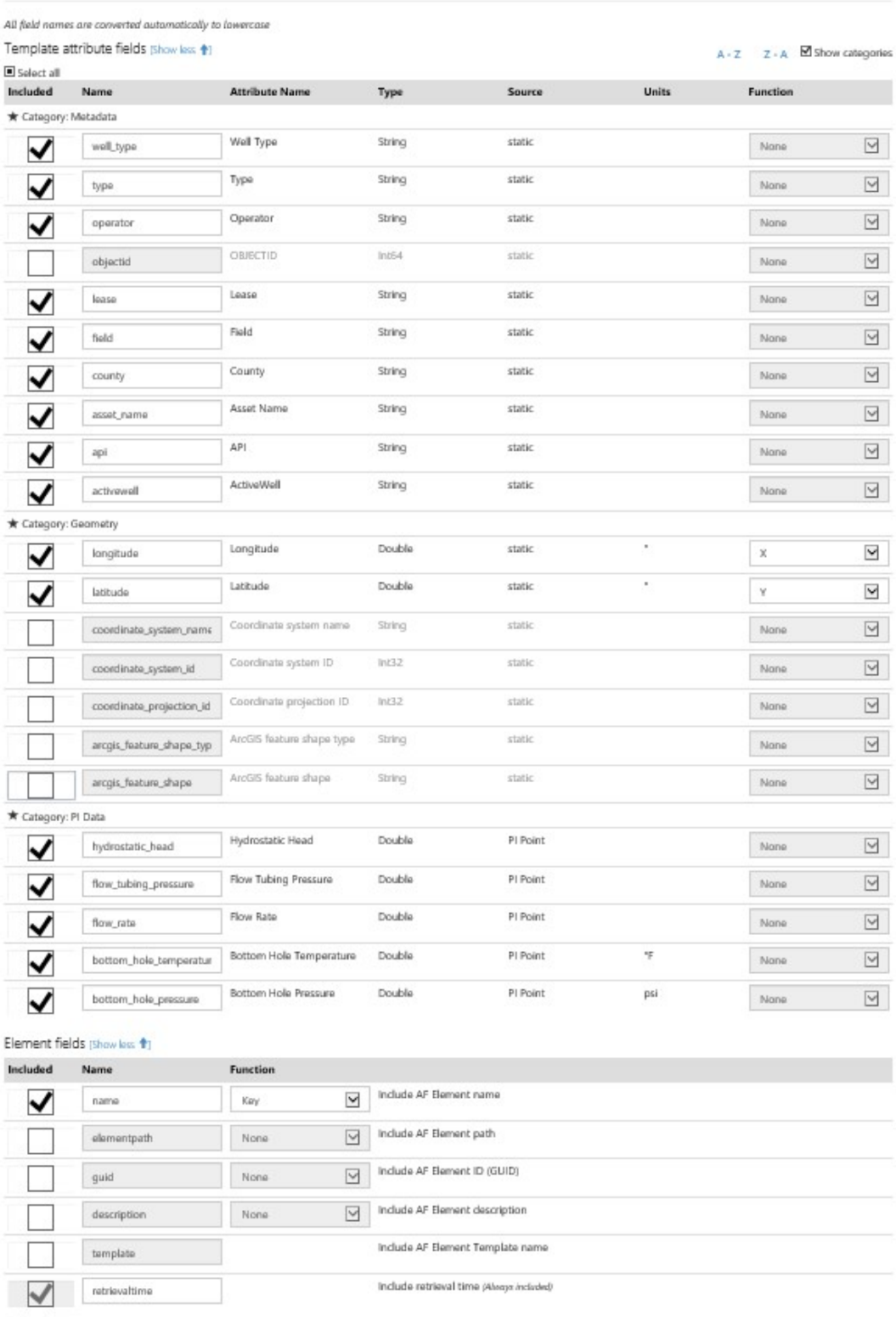
6. Click **Continue**.



7. Select now **Wells** for the Template field. Make sure to select **CatCanyon Oil Fields** as the AF database and click **Continue**.



8. Select the attributes as in the screenshot below and click **Continue**.



All field names are converted automatically to lowercase

Template attribute fields [Show less]

A - Z Z - A Show categories

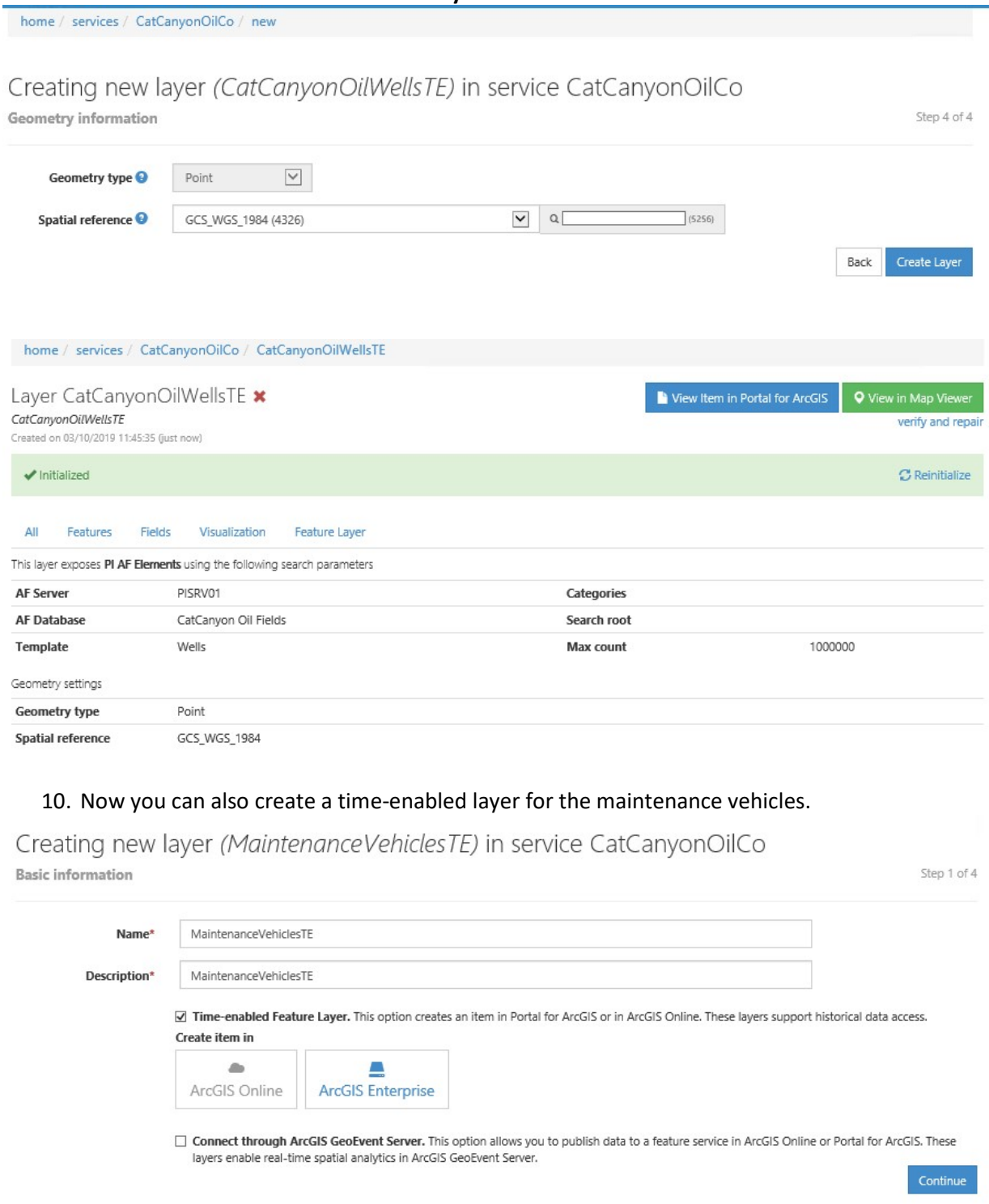
Select all

Included	Name	Attribute Name	Type	Source	Units	Function
★ Category: Metadata						
☑	well_type	Well Type	String	static		None
☑	type	Type	String	static		None
☑	operator	Operator	String	static		None
☐	objectid	OBJECTID	Int64	static		None
☑	lease	Lease	String	static		None
☑	field	Field	String	static		None
☑	county	County	String	static		None
☑	asset_name	Asset Name	String	static		None
☑	api	API	String	static		None
☑	activewell	ActiveWell	String	static		None
★ Category: Geometry						
☑	longitude	Longitude	Double	static	°	X
☑	latitude	Latitude	Double	static	°	Y
☐	coordinate_system_name	Coordinate system name	String	static		None
☐	coordinate_system_id	Coordinate system ID	Int32	static		None
☐	coordinate_projection_id	Coordinate projection ID	Int32	static		None
☐	arcgis_feature_shape_typ	ArcGIS feature shape type	String	static		None
☐	arcgis_feature_shape	ArcGIS feature shape	String	static		None
★ Category: PI Data						
☑	hydrostatic_head	Hydrostatic Head	Double	PI Point		None
☑	flow_tubing_pressure	Flow Tubing Pressure	Double	PI Point		None
☑	flow_rate	Flow Rate	Double	PI Point		None
☑	bottom_hole_temperatur	Bottom Hole Temperature	Double	PI Point	°F	None
☑	bottom_hole_pressure	Bottom Hole Pressure	Double	PI Point	psi	None

Element fields [Show less]

Included	Name	Function	
☑	name	Key	Include AF Element name
☐	elementpath	None	Include AF Element path
☐	guid	None	Include AF Element ID (GUID)
☐	description	None	Include AF Element description
☐	template		Include AF Element Template name
☑	retrievaltime		Include retrieval time *(Always included)*

9. Then in the next screen click **Create Layer**.



10. Now you can also create a time-enabled layer for the maintenance vehicles.

Creating new layer *(MaintenanceVehiclesTE)* in service CatCanyonOilCo

Data source Step 2 of 4

AF Server*	PISRV01
AF Database*	CatCanyon Oil Fields
Template*	Vehicle Template
Category	
Max count	1000000
Search root	CatCanyon Oil Fields [Select]

[Preview] [Back] [Continue]

Creating new layer *(MaintenanceVehiclesTE)* in service CatCanyonOilCo

Layer fields Step 3 of 4

All field names are converted automatically to lowercase

Template attribute fields [Show less] A - Z Z - A ☑ Show categories

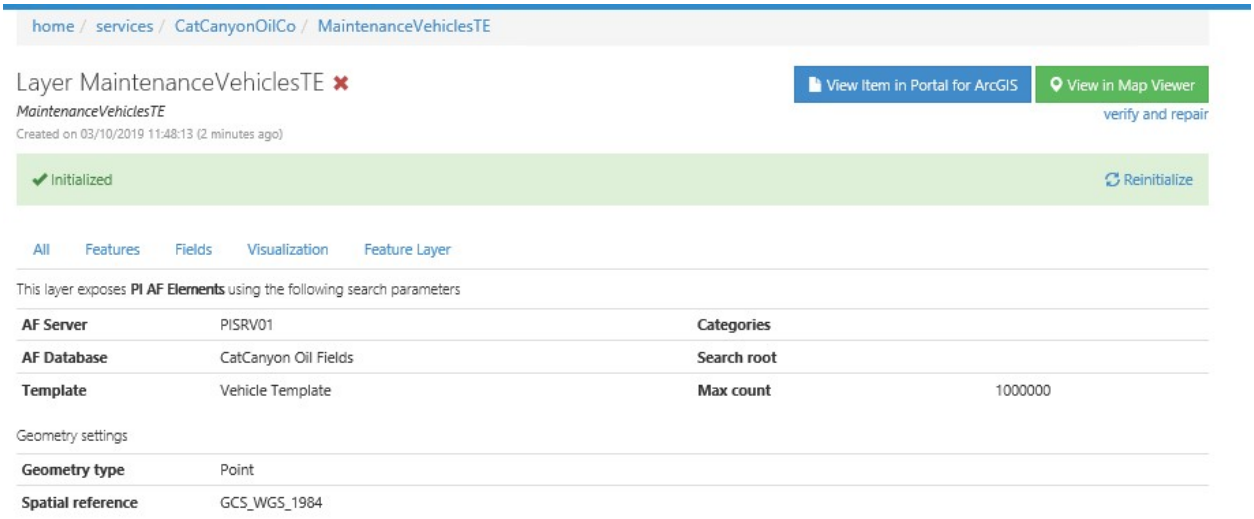
☑ Select all

Included	Name	Attribute Name	Type	Source	Units	Function
★ Category: Vehicle Information						
☑	driver	Driver	String	String Builder		None
☑	truck_id	Truck ID	String	String Builder		None
★ Category: Location						
☑	latitude	Latitude	Double	PI Point	°	Y
☑	longitude	Longitude	Double	PI Point	°	X

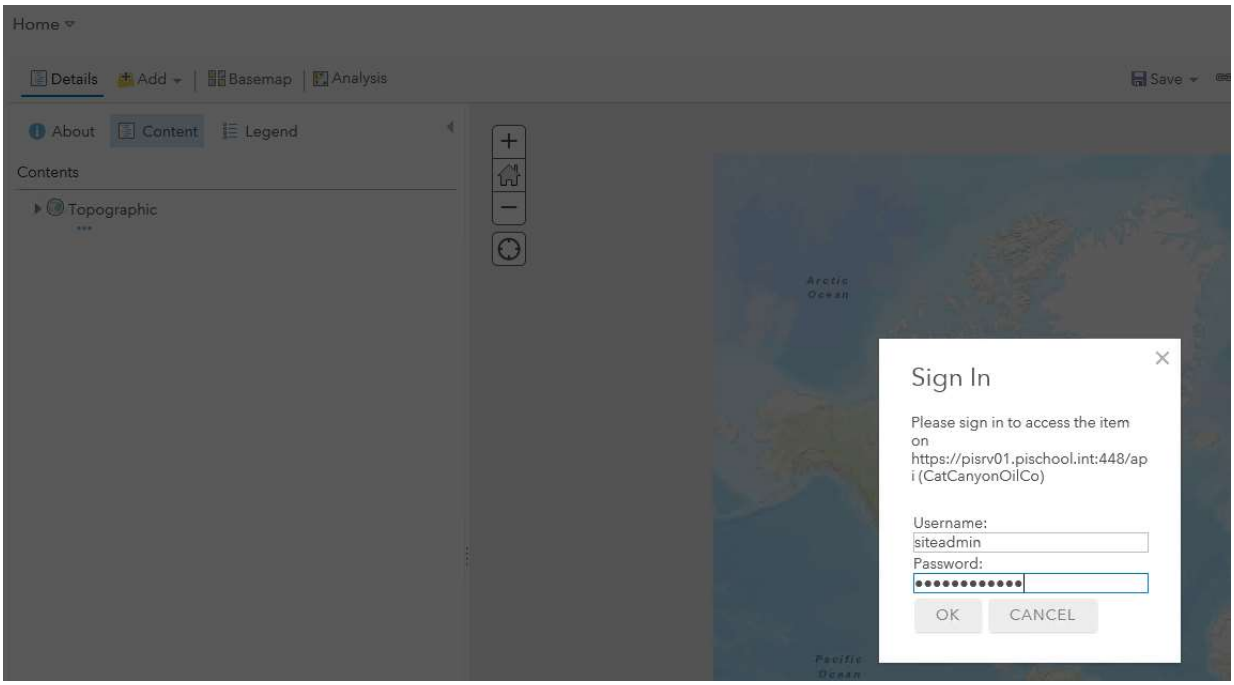
Element fields [Show less]

Included	Name	Function	
☑	name	Key	Include AF Element name
☐	elementpath	None	Include AF Element path
☐	guid	None	Include AF Element ID (GUID)
☐	description	None	Include AF Element description
☐	template		Include AF Element Template name
☑	retrievaltime		Include retrieval time *(Always included)*

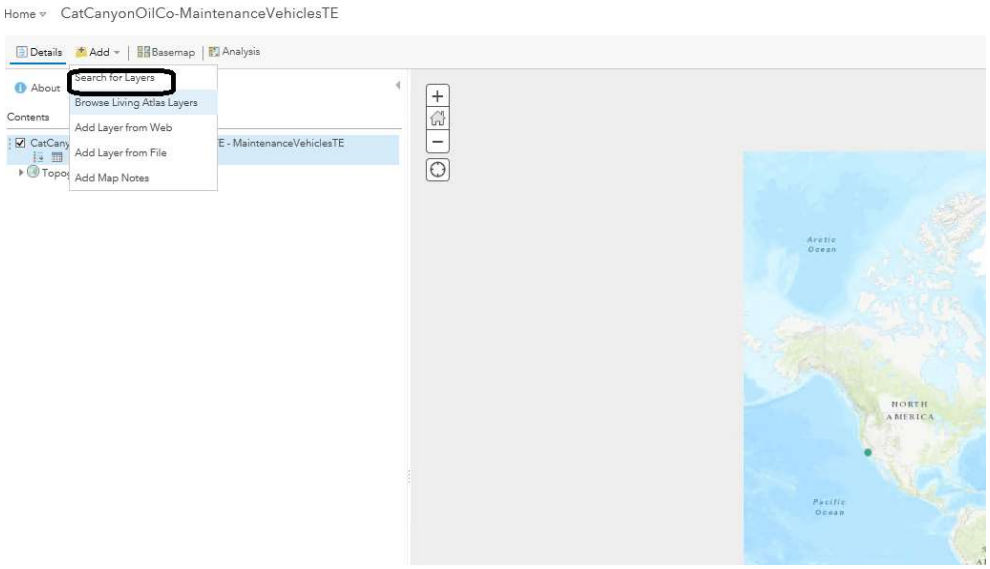
[Back] [Continue]

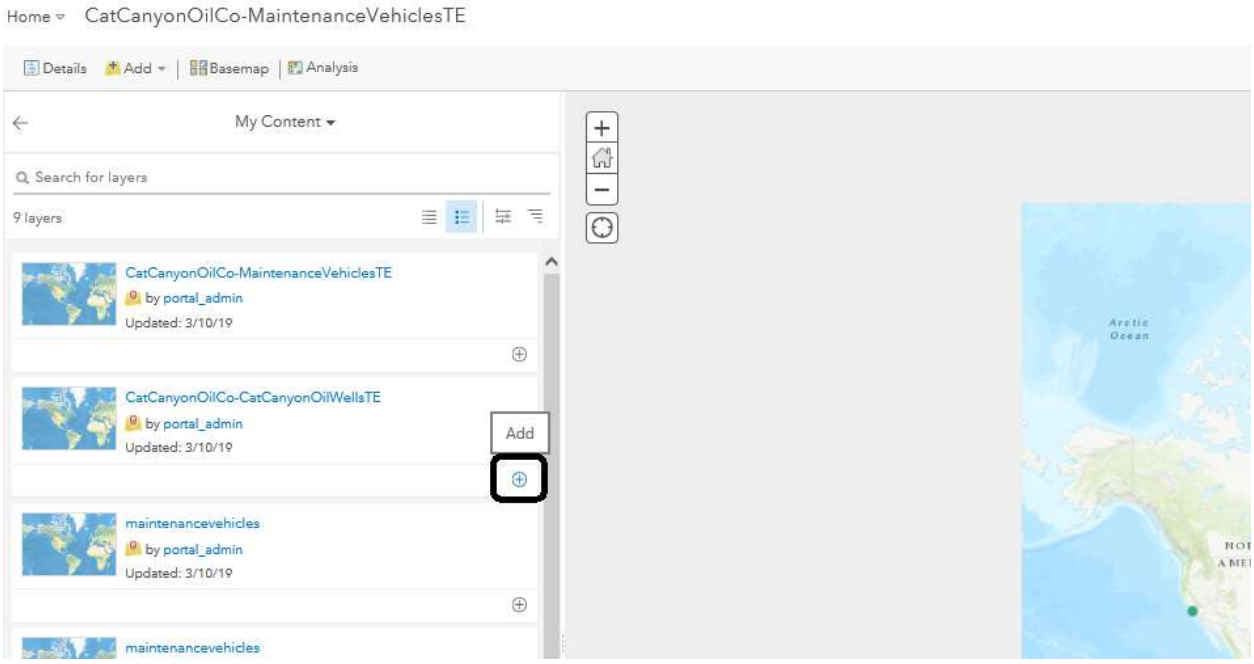


11. You would note 2 buttons at the top, namely, **View Item in Portal for ArcGIS** and another one **View in Map Viewer**. If you click the **View in Map Viewer** button, it will open another tab on the browser, where you can see the layer in the Portal for ArcGIS. Enter the ArcGIS credentials and click **OK**.

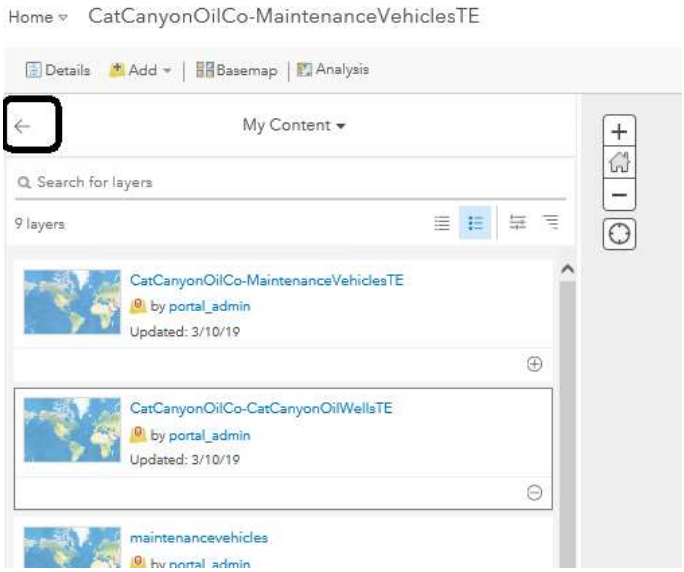


12. Now search for the **CatCanyonOilWellsTE** layer by selecting **Search for Layers** and selecting the relevant layer.

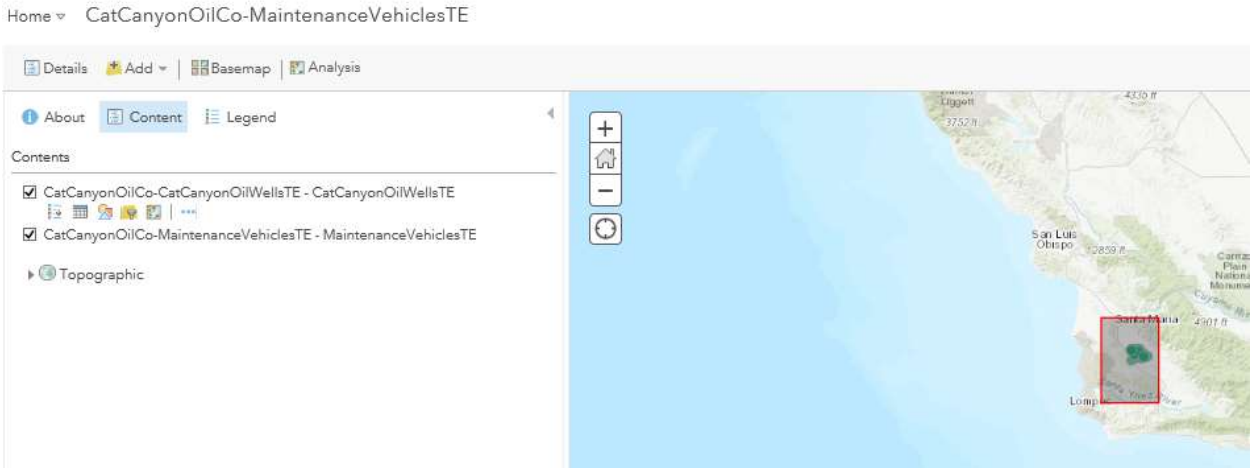




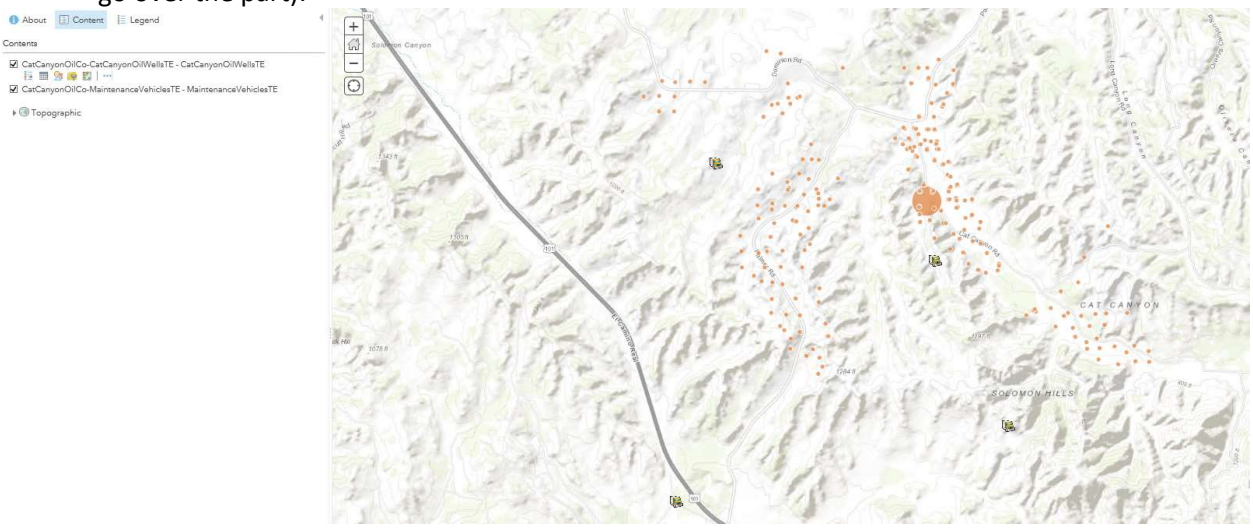
13. Click **<-** from the top as shown below.



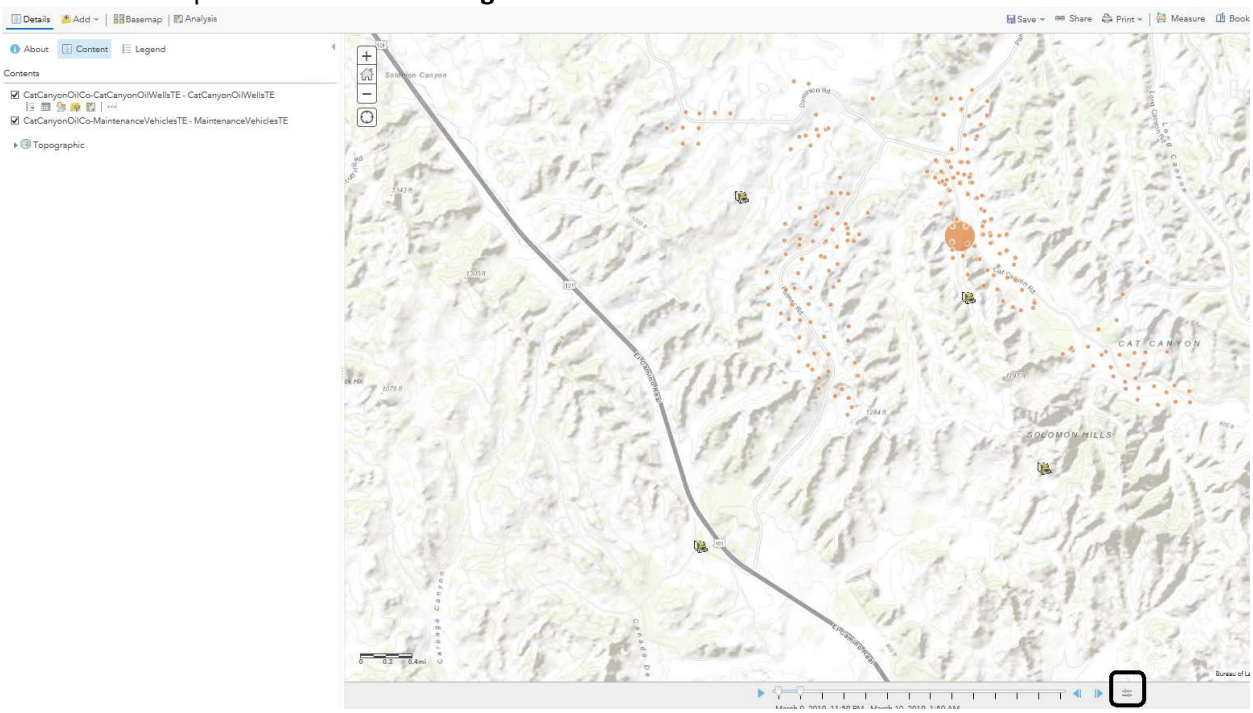
14. Click **SHIFT** on your keyboard and draw a rectangle around the area where you see the assets.



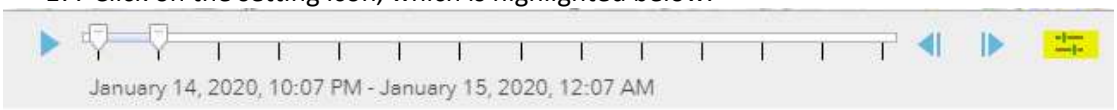
15. Add the symbology and refresh rates for both the layers as show earlier (instructor would also go over the part).



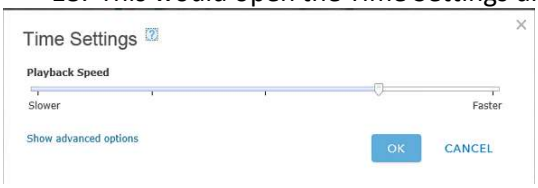
16. Now we would see the ability of the time-slider, which you can see at the bottom of the WebMap and click on the **Setting** button as shown below.



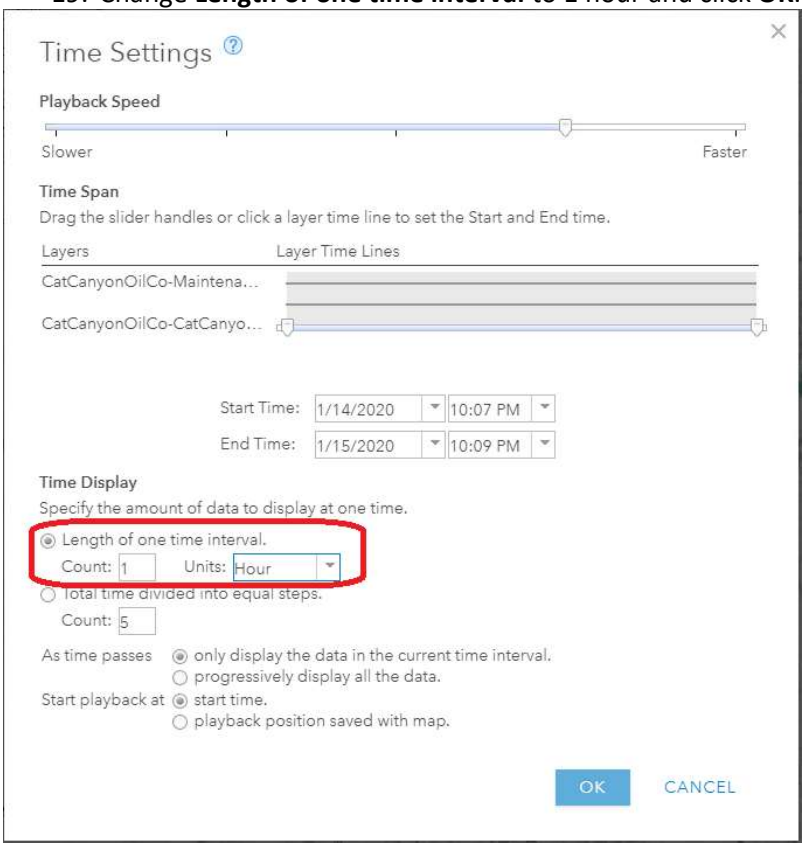
17. Click on the setting icon, which is highlighted below.



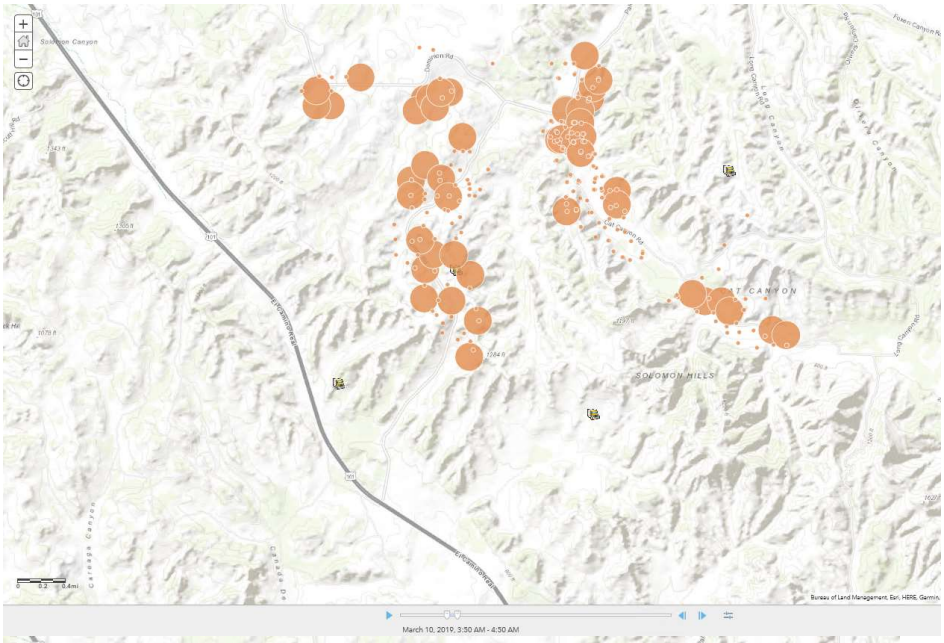
18. This would open the Time Settings dialog box. Click on **Show advanced options**.

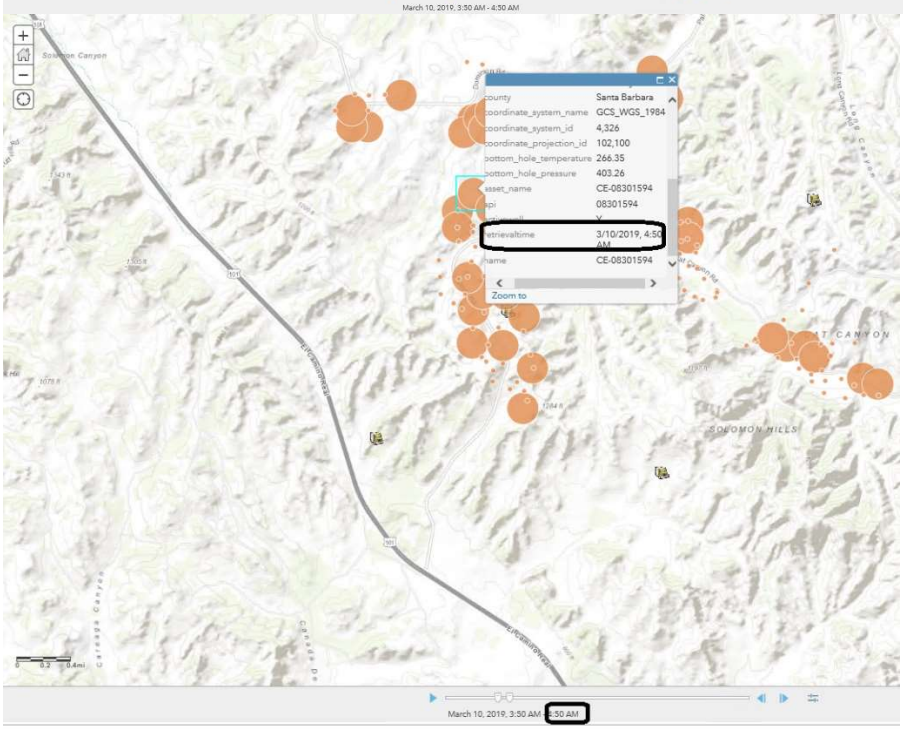


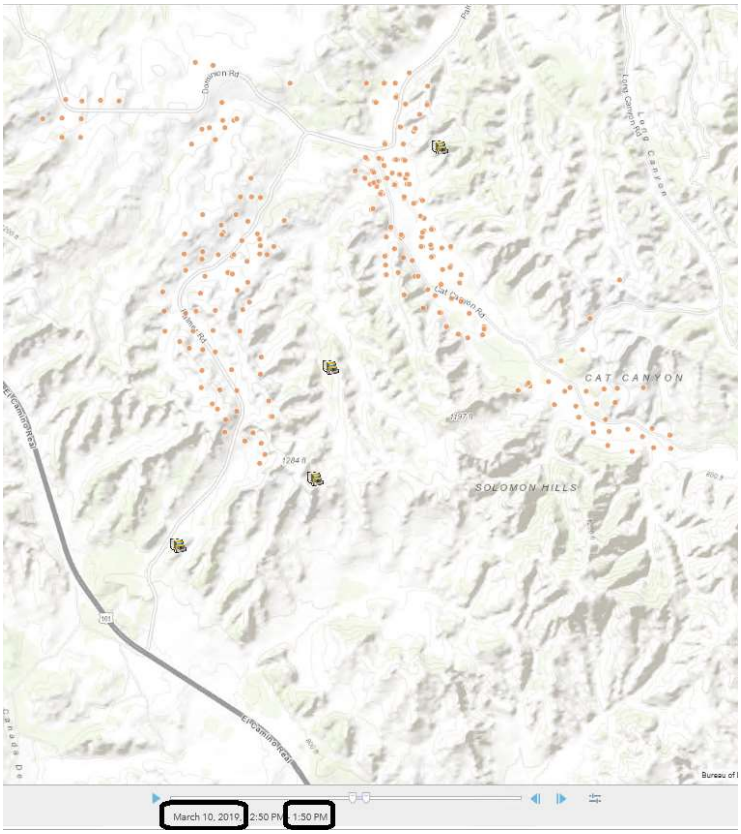
19. Change **Length of one time interval** to 1 hour and click **OK**.



20. Now click the play bottom to render the historical playback of the events for the past 1 day in 1 hour increment.



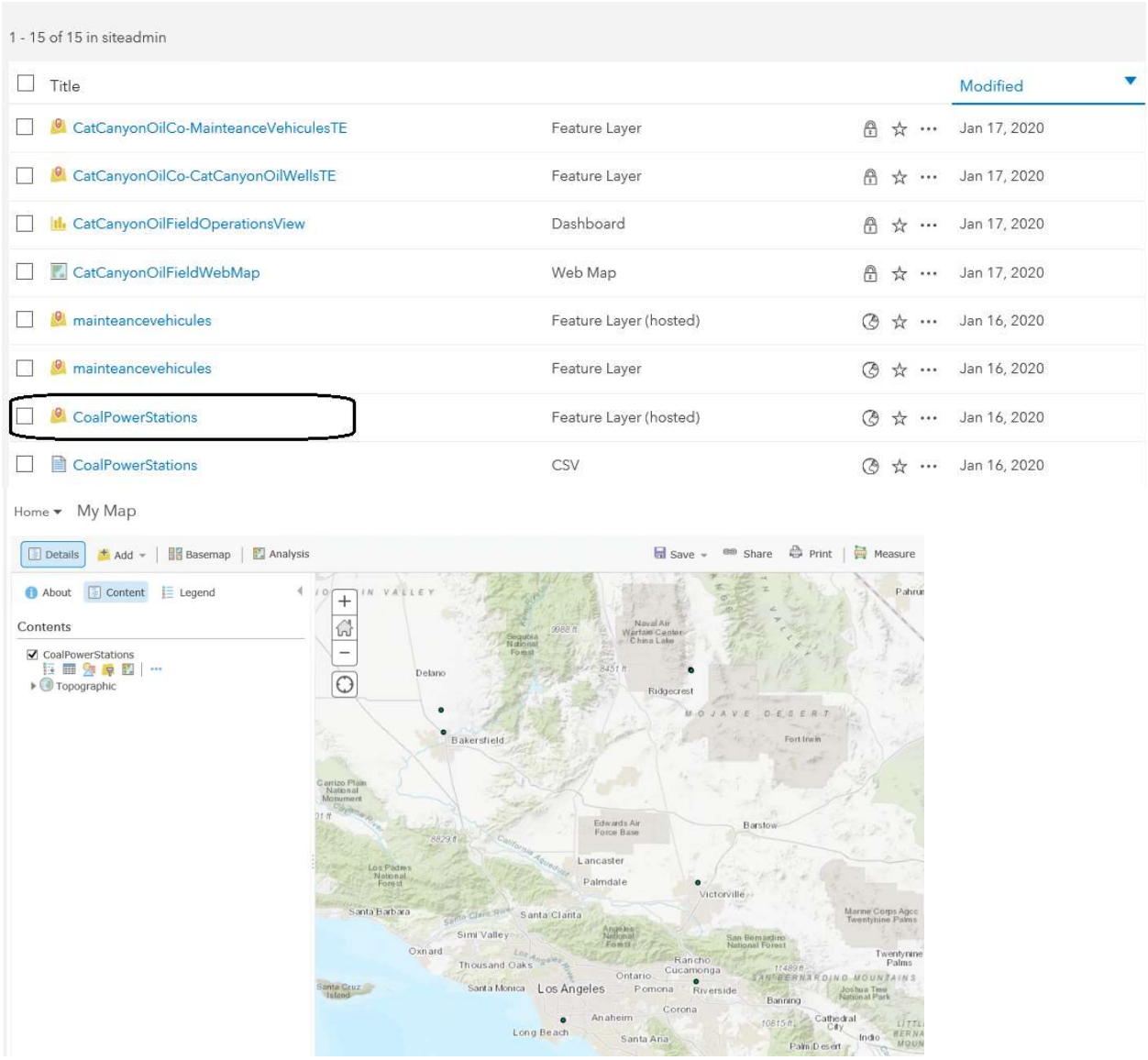



CAT CANYON
SOLOMON HILLS
March 10, 2019
2:50 PM
1:50 PM

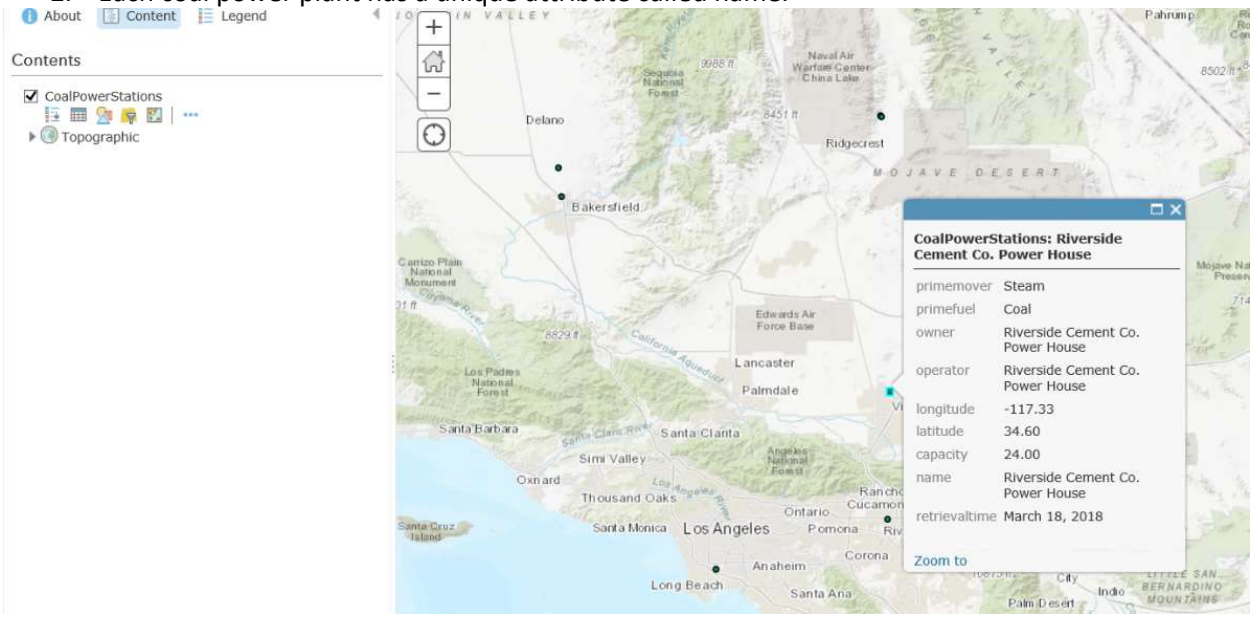
8. Create an Augmented Time-enabled Feature Layer that contains data from both the PI System and the existing feature layer that contains geometry, without modifying the existing feature layer

In this exercise, we would like to also highlight the point that it's easy to join real-time data from PI System with data from an existing ArcGIS feature layer in a new time-enabled feature layer.

1. For this example, we have a feature layer present in Portal for ArcGIS called CoalPowerStations. Currently, it does not have any live PI data.

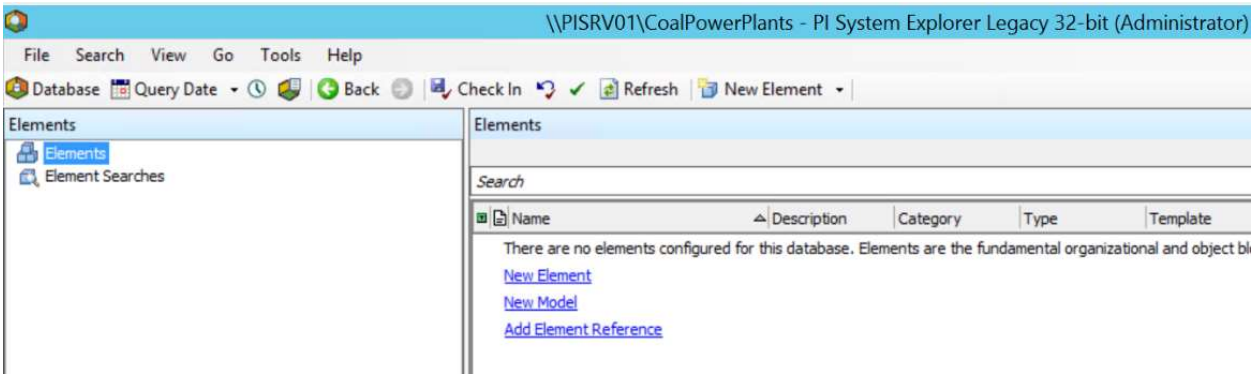


2. Each coal power plant has a unique attribute called name.

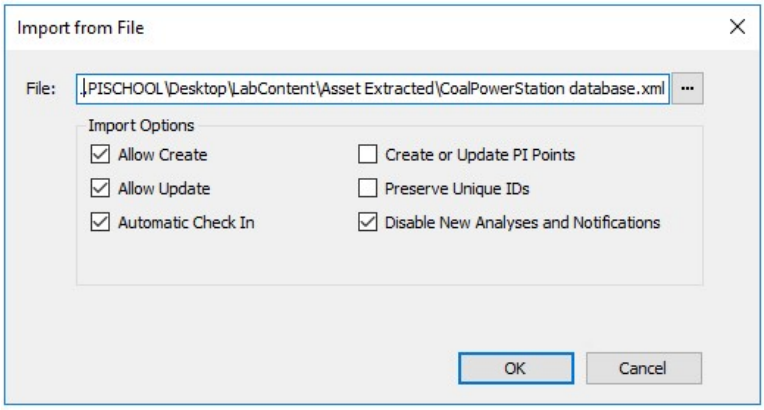


3. Now in order to feed this layer with live PI system values, we will create an AF database that contains all the Coal Power Plants with live PI attributes along with the power plant's unique identifier, namely, PlantID. To accomplish this, the layer information was extracted for you using the Asset extractor (not covered in this training) and an xml file is ready to import into PI AF. The XML file contains the information about the AF template and assets needed.
4. Open PI System Explorer. The shortcut for the same is provided for you in the toolbar.

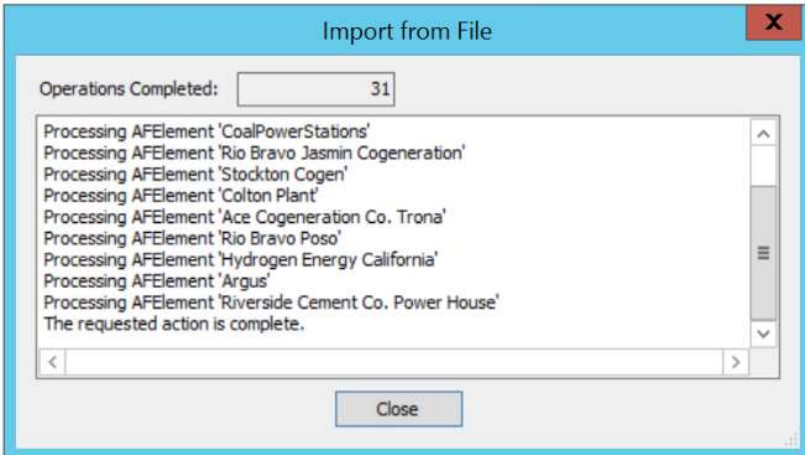
5. Select the empty AF database called **CoalPowerPlants**.



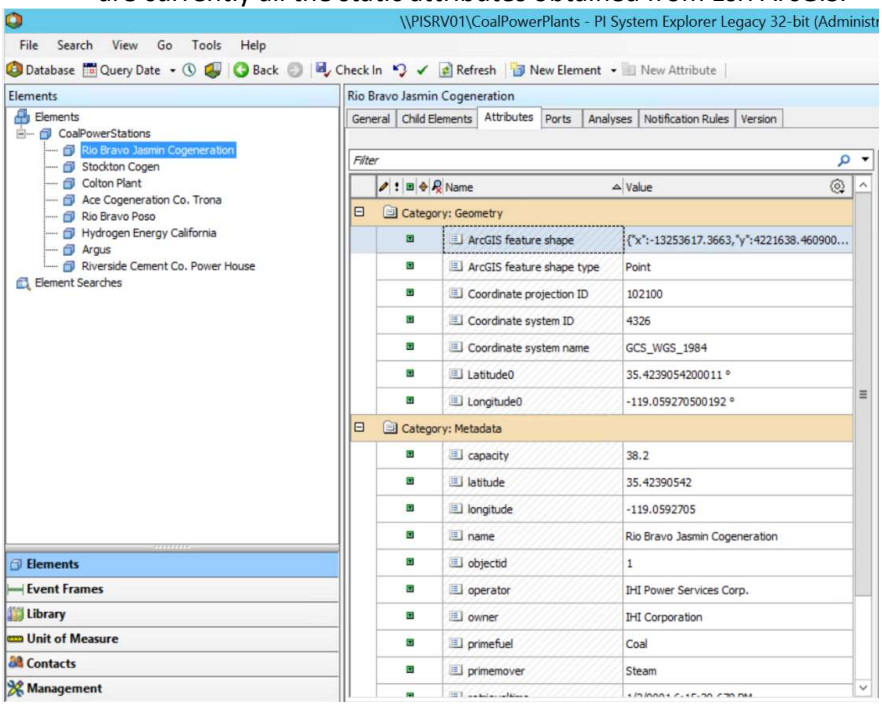
6. Click File -> Import from file and select the xml file that you downloaded to the **LabContent\Asset Extracted** folder on your desktop and click **OK**.



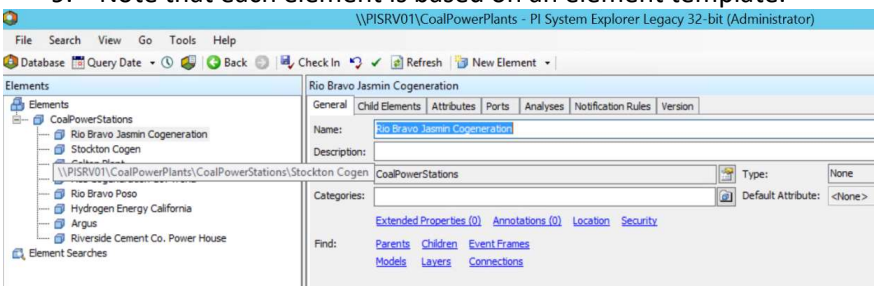
7. Once the import is complete, click **Close**.



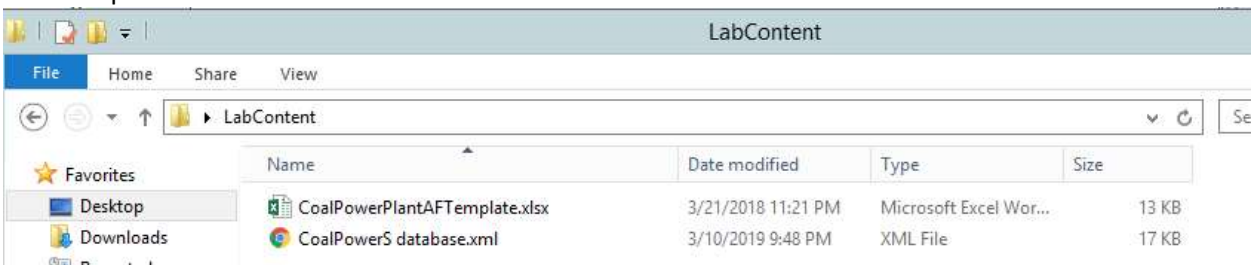
8. Clicking on one the elements and selecting the Attributes tab exposes all the attributes, which are currently all the static attributes obtained from Esri ArcGIS.



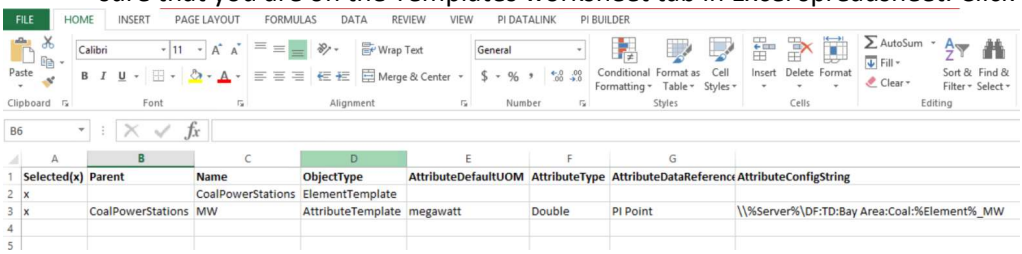
9. Note that each element is based on an element template.



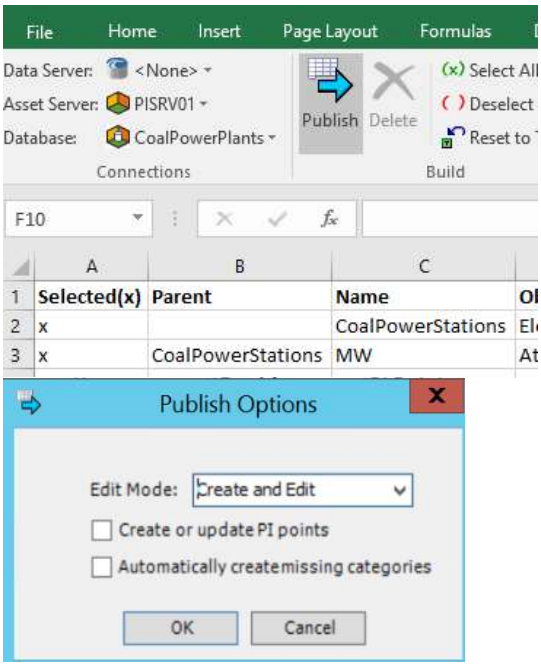
10. Now we will update the Element Template to bring in an additional attribute based on PI System data. To do this, you are already provided with the necessary script. Kindly open the Excel spreadsheet.



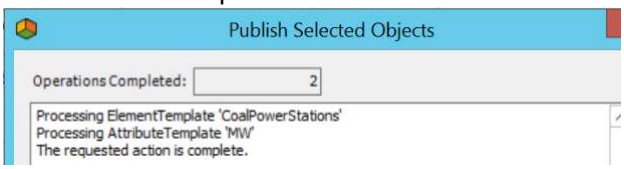
11. We will open the **CoalPowerPlantAFTemplate.xlsx** from the LabContent folder and use PI Builder (Excel plugin to interact with PI System) to update the Element Template. First make sure that you are on the Templates worksheet tab in Excel spreadsheet. Click on **PI Builder**.



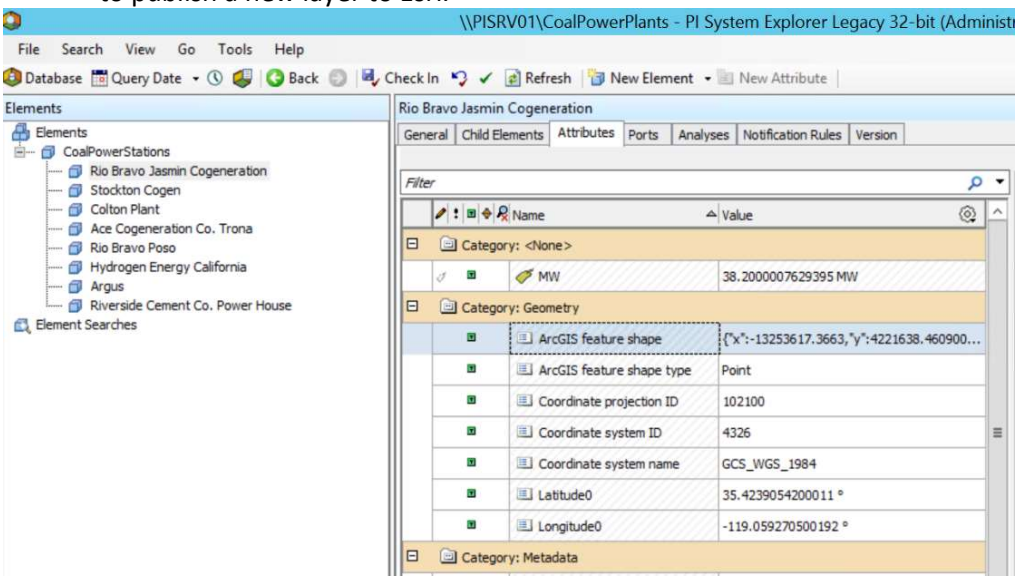
12. Select the PI AF Server and PI AF Database, PISRV01 and CoalPowerPlants Click respectively, then Publish and click **OK**.



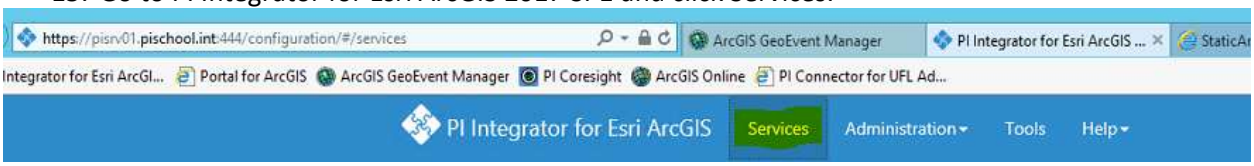
13. Once complete click Close.



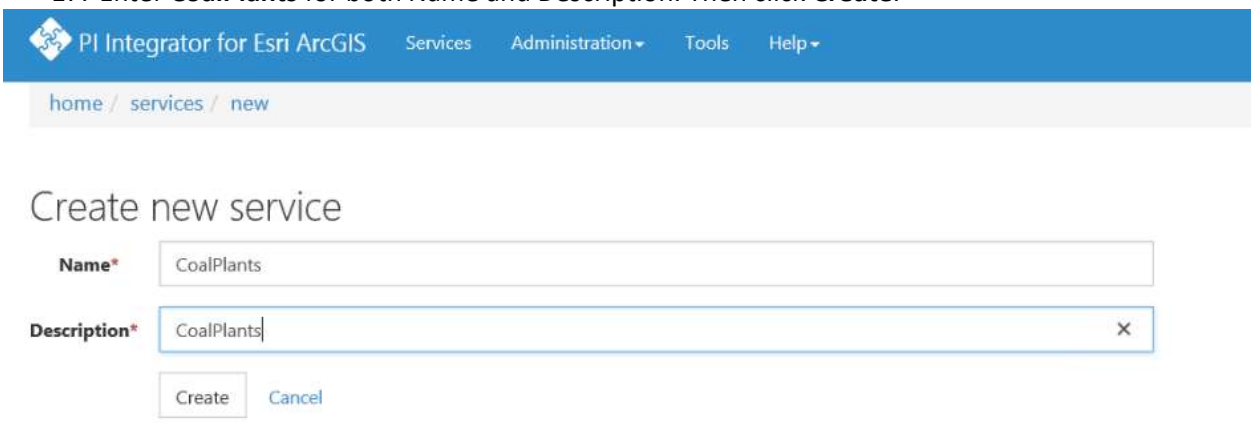
14. Now open the PI System Explorer and click **Refresh**. At this point you have just added a PI point attribute for MW to the database created from the existing Esri layer. The next few steps will be to publish a new layer to Esri.



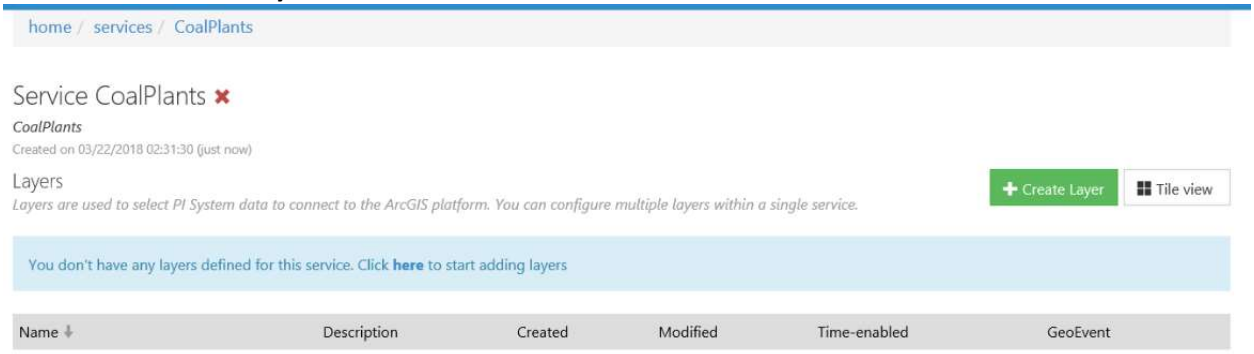
15. Go to PI Integrator for Esri ArcGIS 2017 SP1 and click Services.



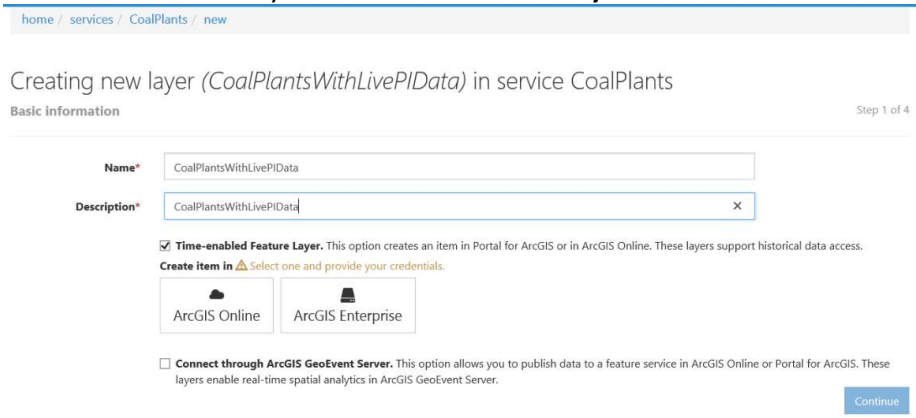
16. Click **Create Service**.
17. Enter **CoalPlants** for both Name and Description. Then click **Create**.



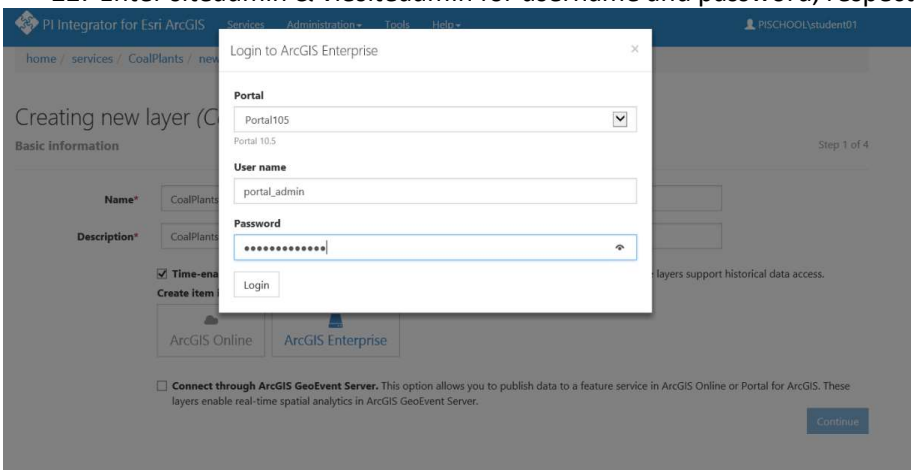
18. Click **Create Layer button**.



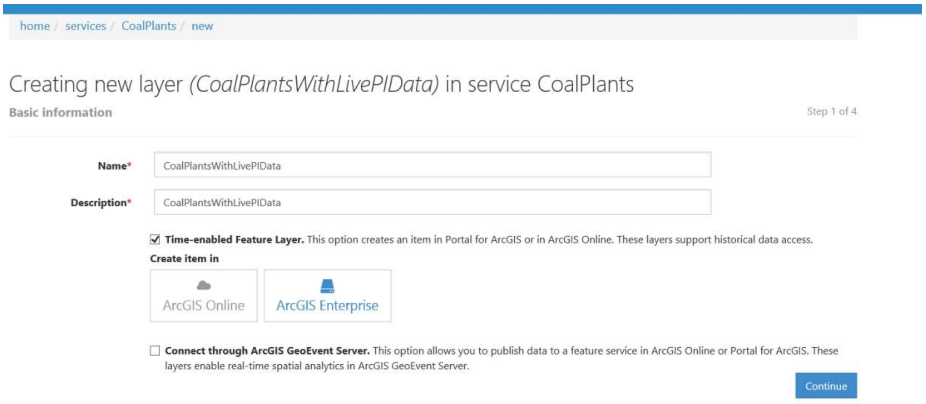
19. Enter **CoalPlantsWithLivePIData** for both Name and Description.
20. Make sure only **Time-enabled Feature Layer** is selected.



21. Click **ArcGIS Enterprise** button.
22. Enter siteadmin & vlesiteadmin for username and password, respectively.

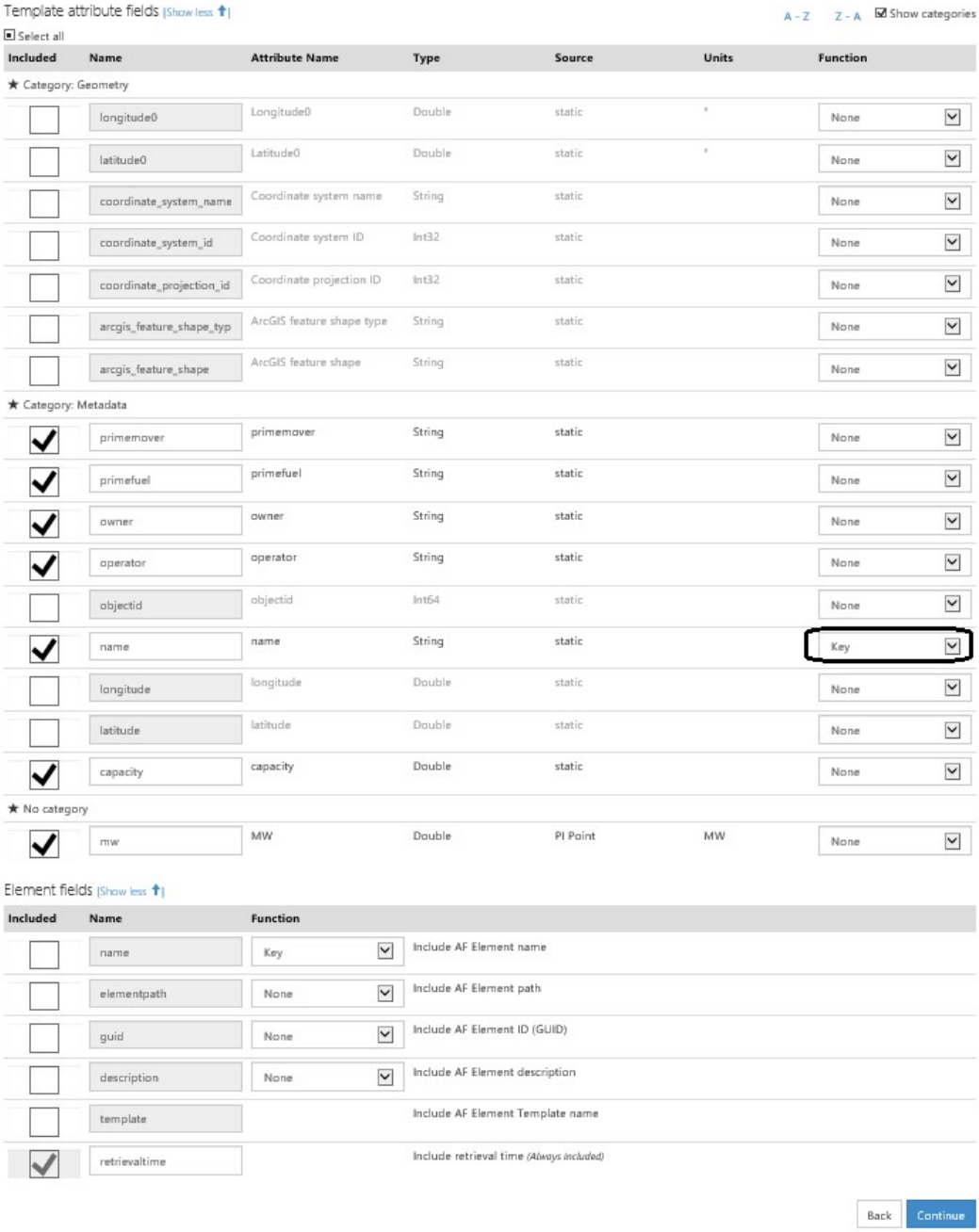


23. Click **Continue**.

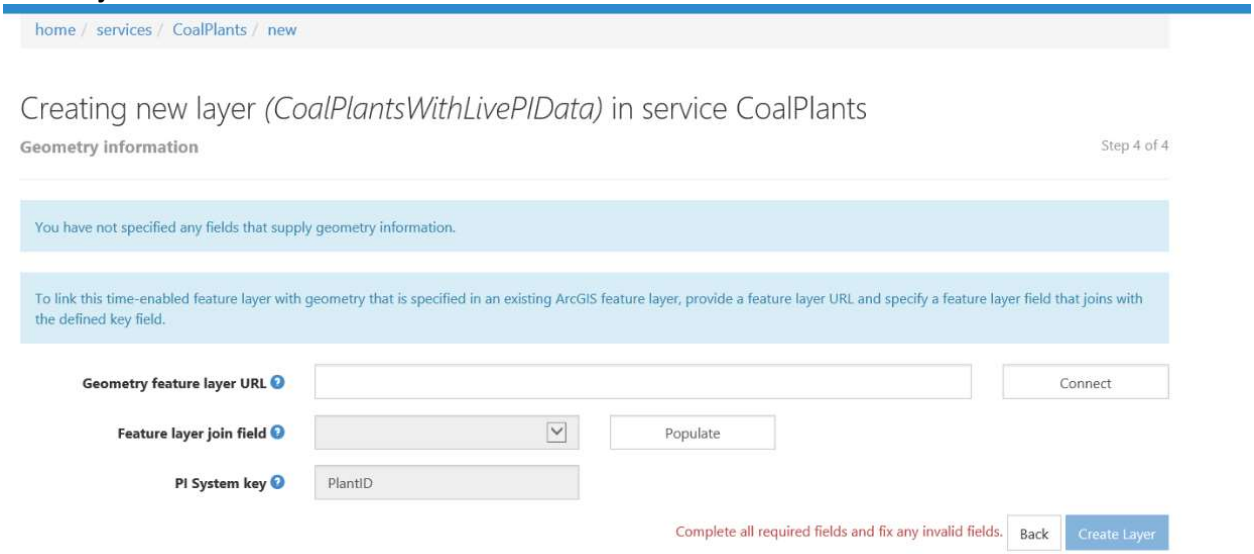


24. Select **CoalPowerPlants** and **CoalPowerStations** for AF Databases and Templates, respectively and then click **Continue**.

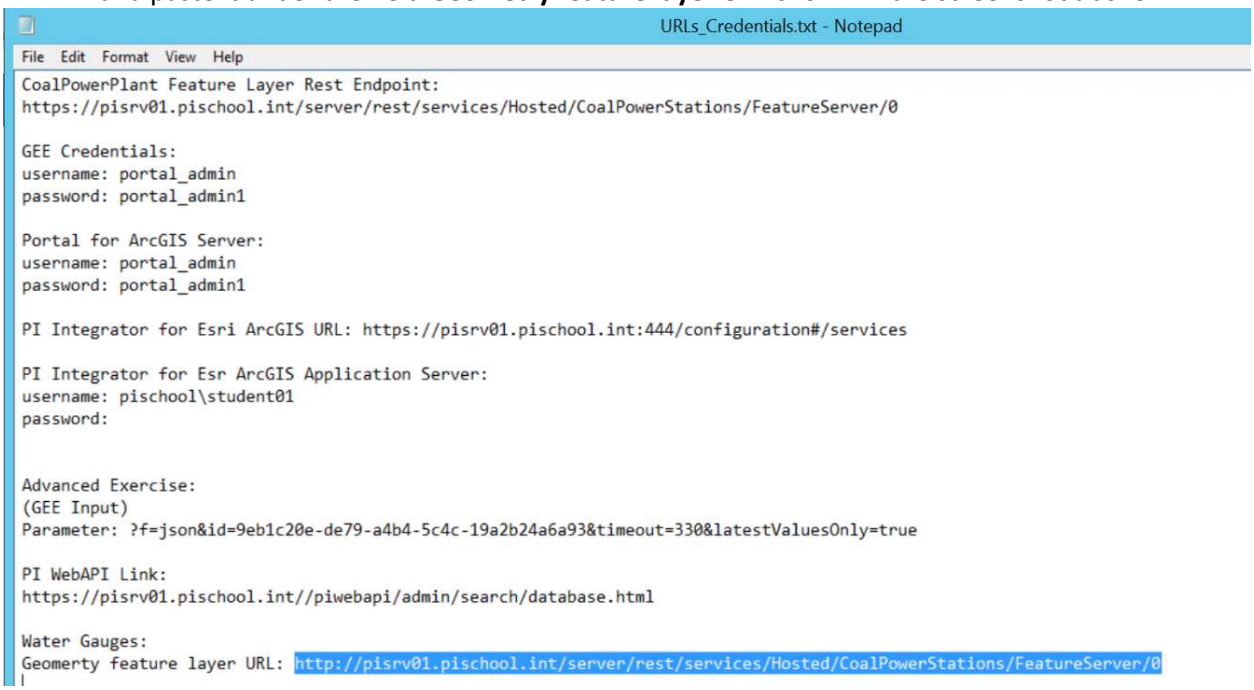
25. Select **name** as the **Key** and all other attributes in the screenshot below. Make sure that the Geometry and Location attributes are not selected, we will be getting the longitude and latitude from the existing Esri layer. Click **Continue**.



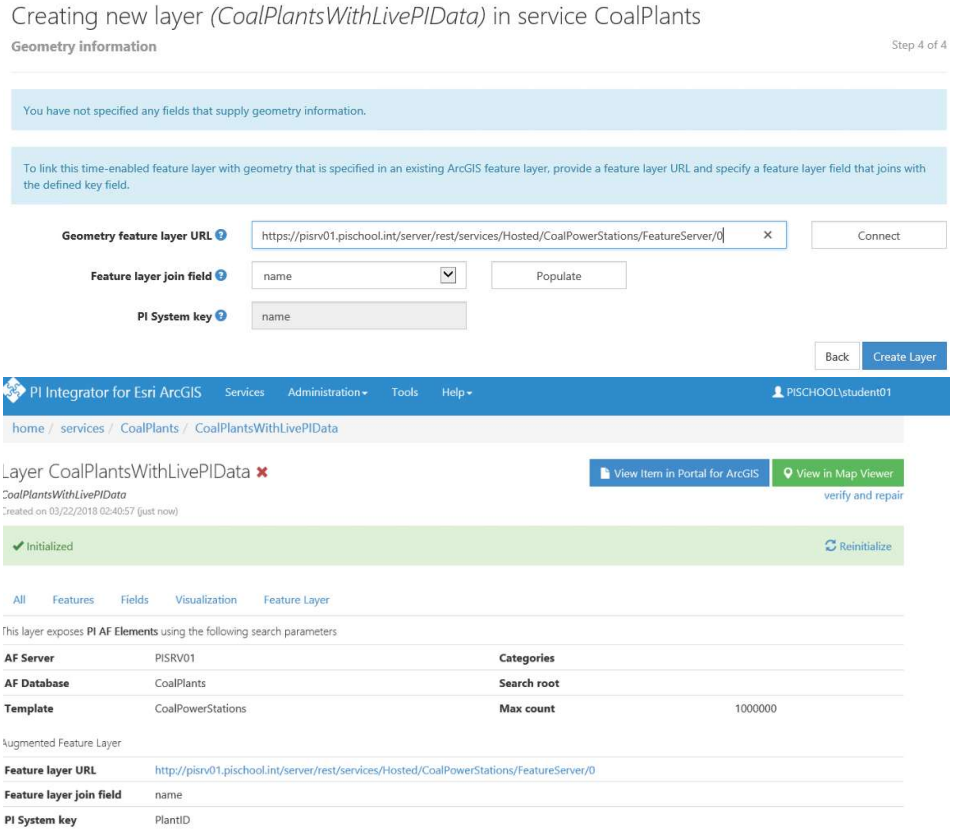
26. Now you need to fill-in 2 parameters, namely, **Geometry feature layer URL**, and **Feature layer join field**.



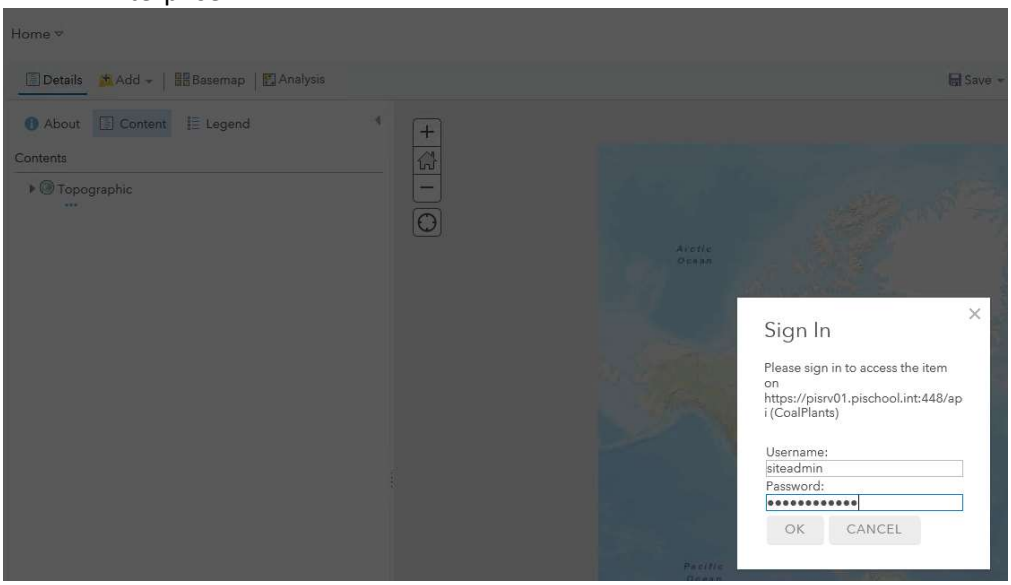
27. Open the file **URLs_Credentials.txt** file in the Desktop and copy first the URL highlighted below and paste it under the field **Geometry feature layer URL** shown in the screenshot above.



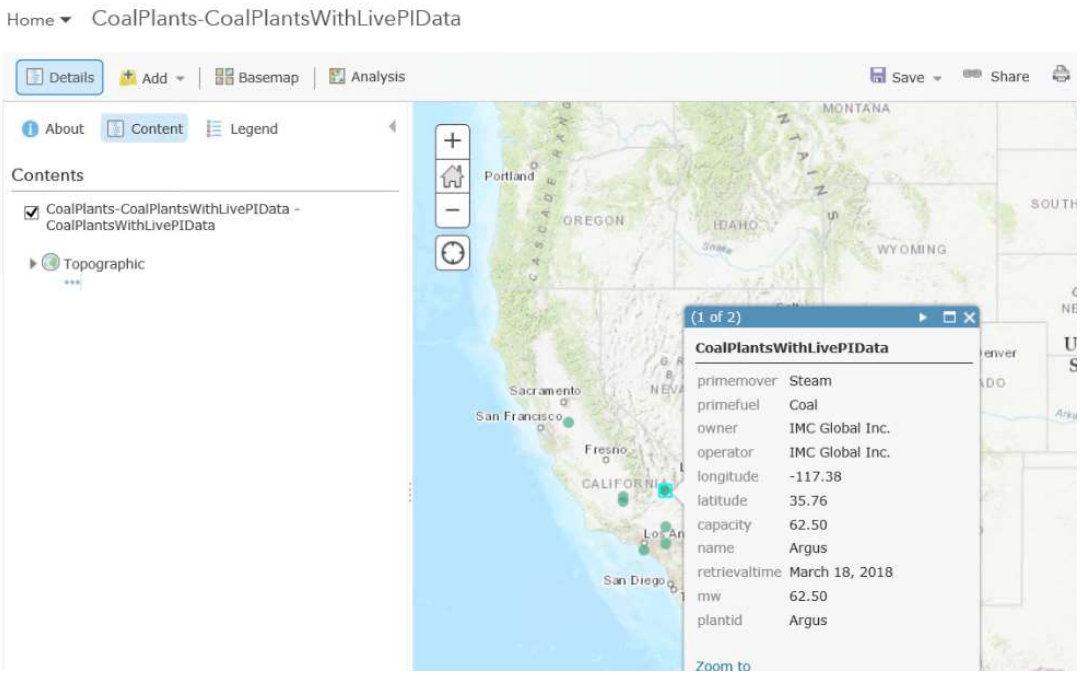
28. Enter the URL into **Geometry feature layer URL** and click **Connect** button and then click **Populate** button. Select **name** as **Feature layer join field**. Then click **Create Layer**.



29. Go to the Portal for ArcGIS and click **View in Map Viewer** and enter the credentials for ArcGIS Enterprise.



30. Zoom-into the location and you would note the Augmented time-enabled feature layer containing **MW** attribute, as well.



Conclusion

Congratulations!

It's been quite a lot--thanks for your attention and participation. If you've any questions, feel free to bring them up with your instructors—we'd be glad to help. And if ever have any future questions, remember to consult the handy OSIsoft Live Library, available for anyone, for free, at anyone at livelibrary.osisoft.com; click the "Integrators" section to see the full user manual for the PI Integrator for Esri ArcGIS 2017 SP1.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