

# ***How to use ArcGIS to produce the Web Services and XML's to add wells, lithology, well summary and water quality data to the National Groundwater Monitoring Network (NGWMN)***

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We chose to use ArcGIS to process our well data for the NGWMN. When creating the Web Map Services (WMS) and the Web Feature Services (WFS) in ArcMap, the software creates the web service and the XML's for loading into NGWMN automatically. With this the GIS users are able to create the web services used by the United States Geological Survey (USGS) without spending money to hire consultants to produce the services; therefore, saving money to add the wells to the network. This procedure gives the step-by-step process that we followed for adding of the wells to the network as seamlessly as possible.

The first step that is not included in this process is to have your data person add the wells and their corresponding data into an Excel spreadsheet or into a database (ArcMap recognizes both types of data out of the box). We also made sure to cross walk our data with the attribute field list provided by the USGS in order to perform a seamless upload.

Next, in order to serve out non-spatial data, map services will need to be created that have the WMS and WFS functions turned on.

The first step is to create a NGWMN feature dataset in you SDE database.

1. In ArcCatalog, double click your SDE connection to connect to your SDE DB.
2. Right Click in the Geodatabase and choose *New>Feature Dataset*
3. IN the dialogue box for Name: type <NGWMN> and click Next
4. Next set the Feature Datasets Coordinate System, for Wyoming we used *Geographic Coordinate Systems>North America>USA and Territories>NAD 1983* and click Next
5. For a Vertical Coordinate System do not set a system just click Next
6. Just use the defaults on the Tolerance page and click *Finish*

The next section will be adding the tables into the SDE DB and getting them imported into the feature dataset. We will first add the tables to SDE, then load into ArcMap, and then we will save them into the feature dataset as a feature class. This process is a work around from not registering the table with the server, because these tables are in an Excel workbook.

7. Open ArcCatalog and connect to your SDE DB.
8. Right click in the geodatabase and choose *Import>Table (multiple)*
9. Browse into the Excel Workbook that houses your three tables
10. Click on the first table, then click/hold the shift key and click on the third layer, and click the Add button (the 3 tables will load into your SDE DB).

Next, we are going to add the three tables to the ArcMap document as XY data. This allows us to add the data in a spatial context as a graphic; by doing this the last thing, which we need to do is to export the tables as feature classes in the feature dataset. Here is the procedure to save the loaded tables back as feature classes.

11. Open a blank ArcMap session
12. In the ArcMap document click *File>Add data>Add XY data*

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13. Browse to your Lithology table that you loaded into your SDE connection select the table from the list choose Add
14. Next set the X Field parameter = to DecLongVa
15. Set the Y Field parameter = to DecLatVa
16. Click the Edit... button to set the input coordinate system
17. Browse to *Geographic Coordinate System>North America>USA and Territories>NAD 1983*
18. Click OK
19. Click OK to apply the Add XY Data dialogue
20. Repeat steps 12 – 19 for both the Summary and Well\_Log tables

Once the event themes are loaded into the map document, we will save them out as feature classes in our NGWMN feature dataset.

21. Right click on the Lithology event theme and *choose Data>Export Data*
22. Browse to your *SDE DB connection>NGWMN*
23. Save as Type: **LITHOLOGY**, click *Save*
24. Click OK to create the Feature Class in the NGWMN Feature Dataset
25. Repeat steps 21 – 24 to save the SUMMARY and WELL\_LOG feature classes

With the Lithology, Summary, and Well\_Log feature classes created we will now add the layers to ArcMap, save the map document as named NGWMN, and publish the map as a map service with WMS/WFS capabilities. These capabilities are open geospatial consortium capabilities that will allow us to share these layers tabular data as web services that will be consumed by the USGS National Groundwater Monitoring Network.

26. Click on File and choose **Sign In** in order to publish using ArcGIS online in order the share the service with the public.
27. In the ArcGIS Sign In dialogue, sign in using your ArcGIS Online credentials.
28. Next click File and choose Share As>Service.
29. In the Share as Service dialogue, choose Publish a Service, and click **Next**.
30. In the next screen in Choose a Connection choose your GIS Server Admin connection (In order to publish the service).
31. For a Service name use NGWMN (or choose whatever makes sense for your service) and click Next.
32. In this screen Just Use the default settings; Use Existing folder is checked and [root] is the default folder.
33. Click Continue to start publishing.

We are now at the Service Editor Dialogue, this screen allows the user to set the parameters for the service, analyze the service, and then publish the service.

34. On the General Screen, use the defaults.
35. Choose Parameters in the Left Window.
36. Use the defaults in the Parameters Screen, and choose Capabilities on the left.
37. Choose the WFS/WMS options.
38. Click on Pooling in the left window.
39. You can just use the defaults here, but you can work with the Min/Max number of instances per machine if you have problems with the speed of the service.
40. Use the defaults on the Processes, Caching, and Item Description windows.
41. Click on Sharing, and choose Everyone (public).

42. Click the (Green Checkmark) Analyze options in the Upper Right.

As long as there are only Warnings and Messages in the Prepare Dialogue at the bottom of your screen, you can continue with the publishing. However, you may want to check some of the warnings, and change to the specified fix or choose Exception, because this Prepare Dialogue is designed to help you get the best experience with you Map Service after publishing.

43. Next, click the Publish Button to publish the service.

44. If the service was published successfully, click OK on the Service Publishing Results box.

45. Click on the Save button in your Map Document and click the X to close out.

After publishing the service, ArcGIS Server automatically creates the web services for the WFS/WMS options. We will now go into the browser and go into the ArcGIS Online tools to get the Web Services.

46. Open your browser of choice, and added the following URL:

<https://<your.server>/arcgis/admin/login>

47. Add your ArcGIS Server Administrator Account/Password.

48. Click the Services button.

49. Click on NGWMN Service.

50. Show: WMS Services

Here is the WMS service:

<https://<your server>/<your public facing web adaptor>/services/NGWMN/MapServer/WMServer>

51. Show: WFS Service:

Here is the WFS service:

<https://<your server>/<your public facing web adaptor>/services/NGWMN/MapServer/WFSServer>

These services are the start of the web services needed for the publishing of your web services to be accessed by the NGWMN. Here are the Wyoming DEQ public facing web services, items that you will or may need to change in the services to get them to work for you are the server name, the web adaptor name, and possibly the TypeName (depending on what you name your layers).

DEQ GetFeature Lithology:

<https://gis.deq.wyo.gov/arcgis/services/NGWMN/MapServer/WFSServer?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&service=WFS&version=2.0.0&TypeName=Lithology>

DEQ GetFeature Well Summary:

<https://gis.deq.wyo.gov/arcgis/services/NGWMN/MapServer/WFSServer?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&service=WFS&version=2.0.0&TypeName=Summary>

DEQ GetFeature Well\_Log:

[https://gis.deq.wyo.gov/arcgis/services/NGWMN/MapServer/WFSServer?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&service=WFS&version=2.0.0&TypeName=Well\\_Log](https://gis.deq.wyo.gov/arcgis/services/NGWMN/MapServer/WFSServer?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&service=WFS&version=2.0.0&TypeName=Well_Log)

DEQ GetFeature Water Quality:

[https://gis.deq.wyo.gov/arcgis/services/NGWMN/MapServer/WFSServer?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&service=WFS&version=2.0.0&TypeName=NGWMN\\_WQ](https://gis.deq.wyo.gov/arcgis/services/NGWMN/MapServer/WFSServer?SERVICE=WFS&VERSION=2.0.0&REQUEST=GetFeature&service=WFS&version=2.0.0&TypeName=NGWMN_WQ)

## *Conclusion*

Using ArcGIS can be a very affordable and time saving way to create the web services needed to upload your wells to the National web site. For the average GIS user, the process is not bad, once you understand the way the URL's are developed (the pieces required to get the web services to work).