Arc Hydro Groundwater (AHGW) is a geodatabase design for representing groundwater datasets within ArcGIS. The data model helps to archive, display, and analyze multidimensional groundwater data, and includes several components to represent different types of datasets, including representations of aquifers and wells/boreholes, 3D hydrogeologic models, temporal information, and data from simulation models. The *Arc Hydro Groundwater Tools* help to import, edit, and manage groundwater data stored in an AHGW geodatabase. *Subsurface Analyst* is a subset of the AHGW Tools that is used to manage 2D and 3D hydrogeologic data, and create subsurface models including generation of borehole representations, cross sections, surfaces, and volumes.

In this tutorial we will learn how to add borehole images to an existing cross section.

1.1 Background

Data used in this tutorial are from a study in the city of Woburn conducted by the USGS. The data were modified for the purposes of the tutorial. A separate tutorial (Creating 2D Cross Sections) shows how to create cross section in ArcMap, and its results are a map with cross sections describing hydrogeologic units in the Woburn area (Figure 1).
1.2 Outline

The objective of this tutorial is to introduce the wizard for adding borehole images to cross sections. We will complete the following tasks:

1. Select the well related to a borehole image.

2. Run the wizard that registers the borehole image.

3. View the registered image in the cross section data frame.

1.3 Required Modules/Interfaces

You will need the following components enabled in order to complete this tutorial:

- Arc View license (or ArcEditor\ArcInfo).
- Arc Hydro Groundwater Tools.
- Arc Hydro Groundwater Tutorial Files.

The AHGW Tools require that you have a compatible ArcGIS service pack installed. You may wish to check the AHGW Tools documentation to find the appropriate service pack for your version of the tools. The tutorial files should be downloaded to your computer and saved on a local drive.
2 Getting Started

Before opening our map, let’s ensure that the AHGW Tools are correctly configured.

1. If necessary, launch *ArcMap*.

2. If necessary, open the *ArcToolbox* window by clicking on the *ArcToolbox* icon.

3. Make sure the Arc Hydro Groundwater Toolbox is loaded. If they are not, add the toolboxes by right-clicking anywhere in the *ArcToolbox* window and selecting the *Add Toolbox*… command. Browse to the top level of the *Catalog* and then browse down to the *Toolboxes|System Toolboxes* directory. Select the Arc Hydro Groundwater toolbox and select the *Open* button.

4. Expand the *Arc Hydro Groundwater Tools* item and then expand the *Subsurface Analyst* toolset to expose the tools we will be using in this tutorial.

We will also be using the *Arc Hydro Groundwater Toolbar*. The toolbar contains additional user interface components not available in the toolbox. If the toolbar is not visible, do the following:

5. Right-click on any visible toolbar and select the *Arc Hydro Groundwater Toolbar* item.

When using geoprocessing tools you can set the tools to overwrite outputs by default, and automatically add results to the map/scene. To set these options:

6. Select the *Geoprocessing | Geoprocessing Options*… command.

7. Activate the option: “Overwrite the outputs of geoprocessing operations” as shown in Figure 2.

8. Enable the option to “Add results of geoprocessing operations to the display” as shown in Figure 2.

9. Select *OK* to exit the setup.
Figure 2  Setting Geoprocessing tools to overwrite outputs by default, and to add results of geoprocessing tools to the display.
3 Opening the Map

We will begin by opening a map containing the cross section of the Woburn area.

1. Select the File| Open command and browse to the location on your local drive where you have saved the AHGW tutorials. Browse to the subsurface analyst/XS2D_Borehole_Image folder and open the file entitled woburn_borehole_image.mxd.

Once the file has loaded you will see a map of the model area. The map includes an overview data frame showing the borehole locations and cross section lines, and a cross section (A-A’) data frame showing the cross section for section line A-A’.

4 Adding borehole images to cross sections

The first step will be to select the appropriate Well (borehole) feature.

1. Use the Select tool to select Well 1048 as shown in Figure 3.

![Figure 3](image.png)

**Figure 3** Selected well in the overview map. The borehole image added to the cross section will be related to the selected well.

To add a borehole image to the cross section we will use the Add Borehole Image tool available in the AHGW toolbar.

2. Make sure the Layers data frame is activated. You can activate the data frame by selecting it, right clicking, and selecting the Activate option.

3. Make sure you are in Data View. You can change between Layout View and Data View by going to the View menu.
4. Select the Add Borehole Image tool located in the AHGW toolbar.

5. With the tool activated, select the A-A’ section line.

   Make sure that the A-A’ section line was selected by looking at the Section Line Properties section at the top of the wizard.

6. Specify Well for the Well layer.

7. Select the HydroID field for the Unique ID field.

8. In the Cross Section Setup section make sure that the XS2D_Catalog and Section A-A’ are specified as the inputs.

9. For the Image File, browse to the tutorial folder and select the Log.jpg file.

   At this point the wizard should be filled as shown in Figure 4.

![Add Borehole Image Wizard](image)

**Figure 4** Step 1 of the Add Borehole Image Wizard.

10. Select Next to continue to Step 2 of the wizard.
In Step 2 of the wizard we vertically register the image.

11. Use the sliding bars on the left and right to define top and bottom elevations on the image. Locate the ZTop sliding bar on the 0 tick mark and the ZBottom sliding bar on the 100 tick mark.

The land elevation at the location of the selected well is 45.7 ft. (you can see this by looking at the LandElev attribute of the selected Well feature). Thus, the 0 tick mark is actually at an elevation of 45.7 and the 100 tick mark represents an elevation of -54.3 ft.

12. Specify a value of 45.7 in the Z Top box, and a value of -54.3 in the Z Bottom box.

At this point the wizard should be similar to the one shown in Figure 5.

![Figure 5](image_url)

**Figure 5** Step 2 of the Add Borehole Image Wizard - image registration.

13. Select Next to move to Step 3 of the wizard.

In Step 3 of the wizard we control the positioning and width of the image when it is added to the cross section.
14. Specify 100 as the Offset value.

15. Specify 500 as the Plot Width.

At this point the wizard should be similar to the one shown in Figure 6.

16. Select Finish to complete the wizard registration process.

![Step 3 of the Add Borehole Image Wizard - image positioning.](image.png)

Figure 6  Step 3 of the Add Borehole Image Wizard - image positioning.

Once the wizard has completed you can view the registered image in the A-A' cross section.

17. To view the registered image activate the A-A' Data Frame. You can activate the data frame by selecting it, right clicking, and selecting the Activate option.

You should see the registered image in the A-A' data frame as shown in Figure 7.
5 Conclusion

This concludes the tutorial. The key concept demonstrated in this tutorial is the ability to add borehole images to existing cross sections using the Add Borehole Image wizard.