

Australian Hydrological Geospatial Fabric (Geofabric) Tutorial

Visualise aquifer surfaces

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Australian Government
Bureau of Meteorology



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1 Introduction

This tutorial explains how to visualise aquifer surfaces using ESRI ArcScene, which is part of the ESRI ArcGIS software.

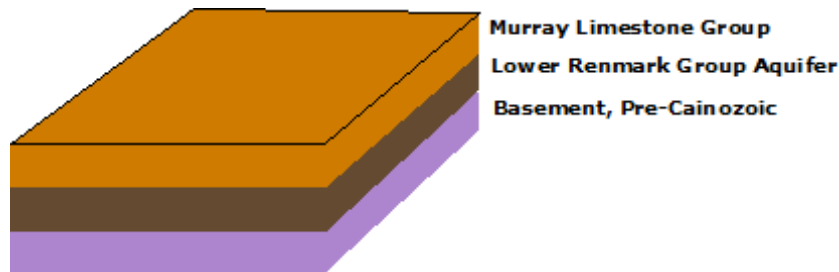
1.1 Prerequisite – top of aquifer elevation surfaces

This tutorial requires top of aquifer elevation surfaces which have elevation values. The aquifer surfaces used in this tutorial were created in the Geofabric tutorial *Calculate aquifer thickness*, which is available from:

<http://www.bom.gov.au/water/geofabric/documentation.shtml>

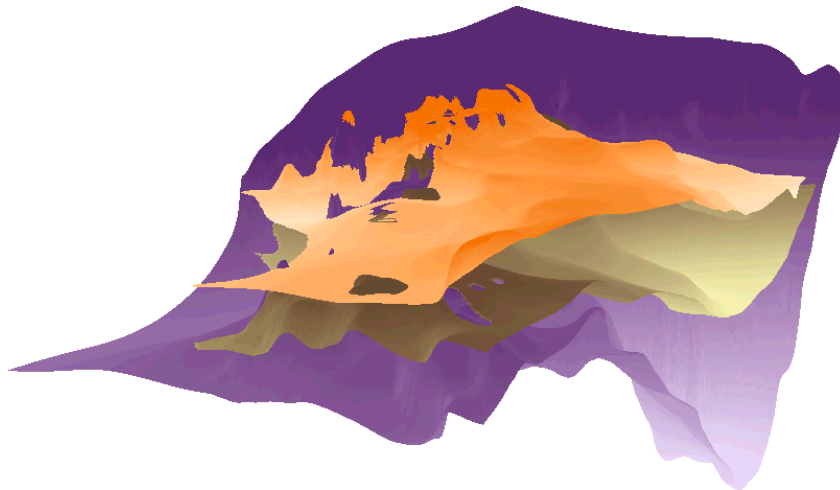
Three aquifers in South Australia are used in this tutorial:

- Murray Limestone Group (Tml)
- Lower Renmark Group Aquifer, Tertiary Eocene Renmark (Ter1)
- Basement, Pre-Cainozoic (pcz).



1.2 Visualise aquifer surfaces

This tutorial will explain how to visualise the top of aquifer elevation surfaces in relation to each other using stretched surface elevation values.



1.3 ArcGIS version

The steps outlined in this tutorial use ArcScene 10.1 (ArcGIS SP 1).

1.4 Symbolology

The symbology used in this tutorial is based on that used in the Geofabric tutorial
Calculate aquifer thickness.

1.5 Disclaimer

This document is a guide only and is not to be used as a substitute for expert knowledge.

2 Tutorial

2.1 Summary of steps

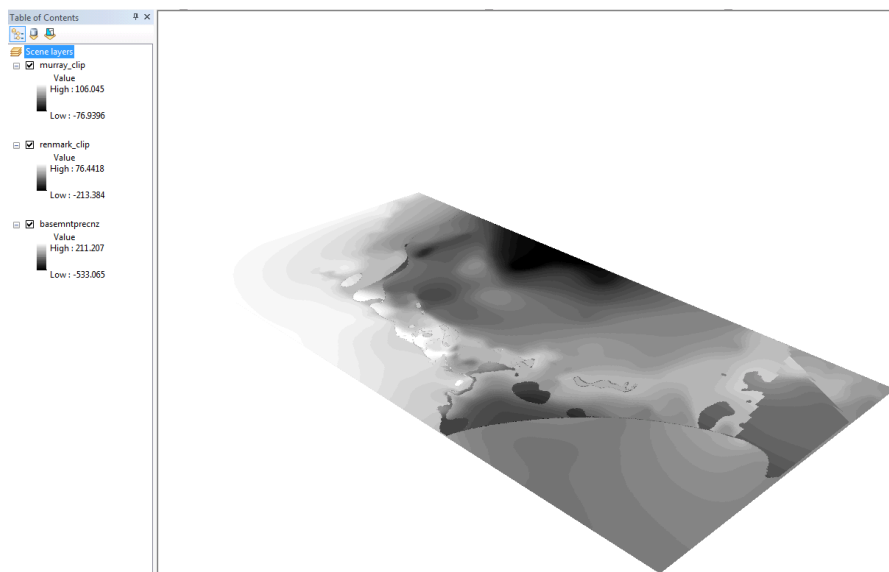
These are the steps involved in visualising aquifer surfaces.

- Add aquifer surface layers to ArcScene.
- Edit symbology and Base Height parameters.
- Add a Digital Elevation Model (DEM).
- Add surface hydrology data.

2.2 Add aquifer surface layers to ArcScene

Use the aquifer surfaces referred to in section 1.1.

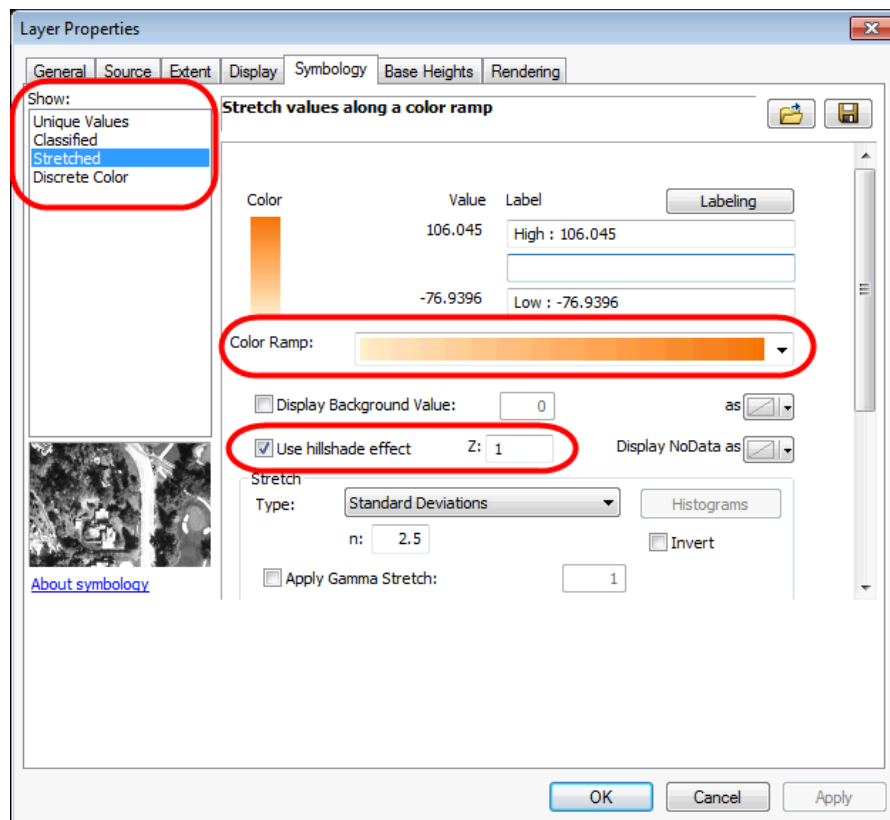
1. In ArcScene, select the Add Data button on the Standard toolbar to add the three aquifer surfaces:
 - Murray Limestone Group (Tml);
 - Lower Renmark Group Aquifer, Tertiary Eocene Renmark (Ter1); and
 - Basement, Pre-Cainozoic (pcz).
2. The surfaces are added as flat surfaces with ArcScene's default Stretched surface elevation values and symbology.



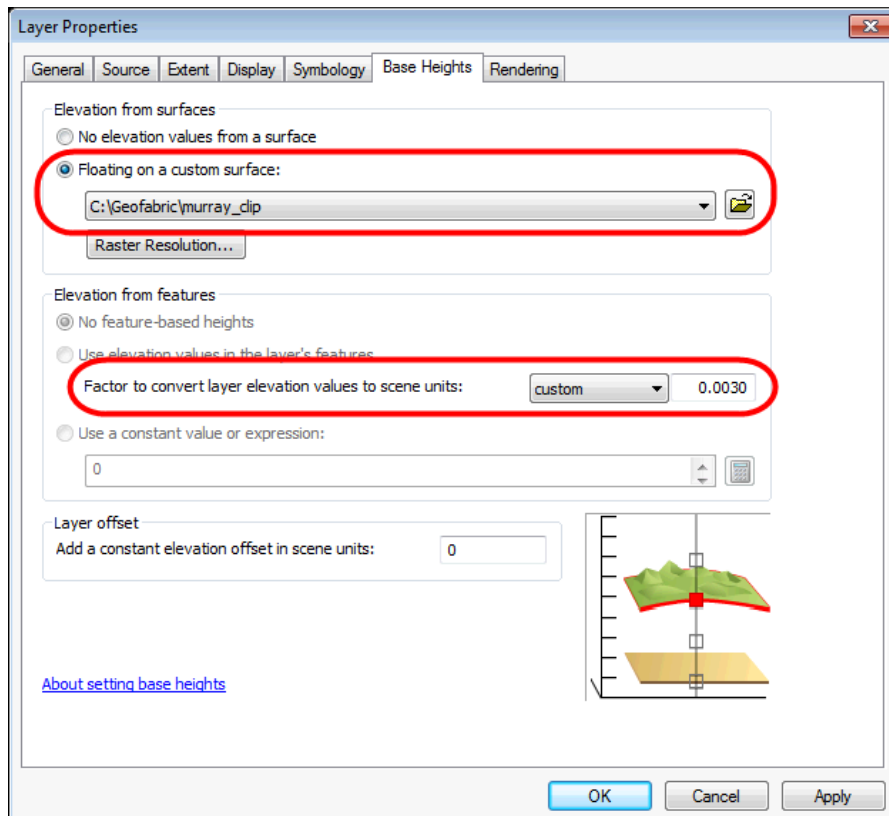
2.3 Visualise stretched surface elevation values

The elevations and colours will be edited to display the surface elevations and to distinguish the surfaces from each other. These steps need to be followed for each aquifer surface layer.

1. Right-click on the layer in the Table of Contents and select Properties.
2. In the Layer Properties window carry out the following steps.
 - Select the Symbology tab.
 - Show is set to Stretched.
 - Go to the Color Ramp and select a different colour ramp. In this tutorial the colours used are:
 - Murray Limestone—orange;
 - Lower Renmark—dark brown; and
 - Basement—purple.
 - Select Use hillshade effect and accept the default Z value of 1.

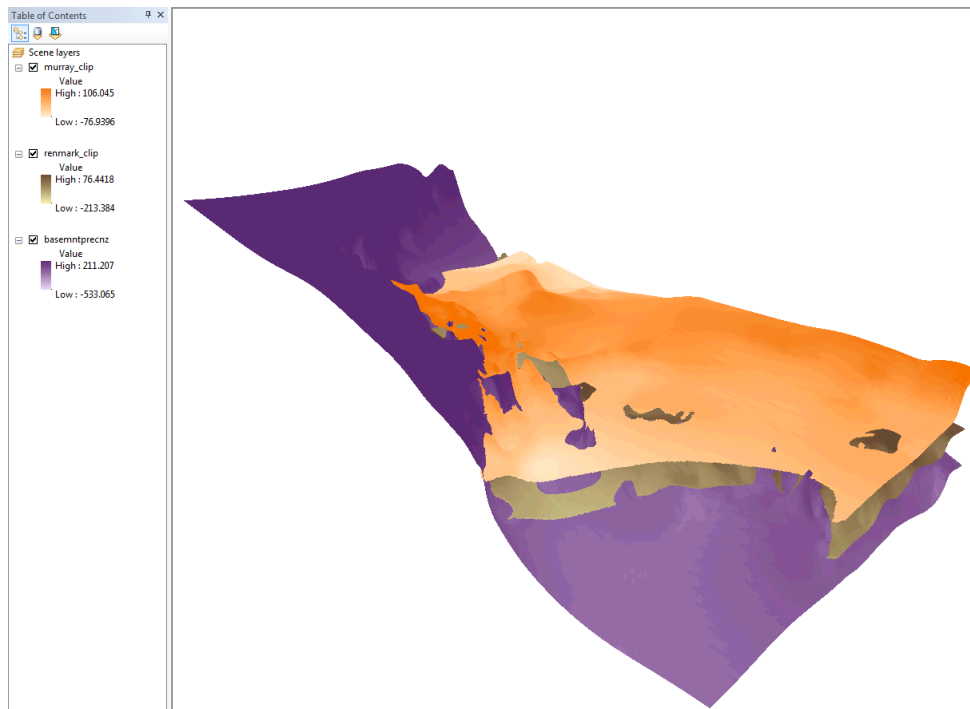


- Select the Base Heights tab to change the default flat surface so that it shows the surface elevation values.
 - In Elevation from surfaces, select Floating on a custom surface, and ensure that the relevant aquifer surface (murray_clip in this example) is selected.
 - In Elevation from features:
 - ensure custom is selected; and
 - edit the custom value to 0.003.



- Select OK to close the Layer Properties window.

3. The three aquifer surfaces will display as per the screen grab below.



4. On the Tools toolbar, select the Navigate button to examine the layers from different angles.



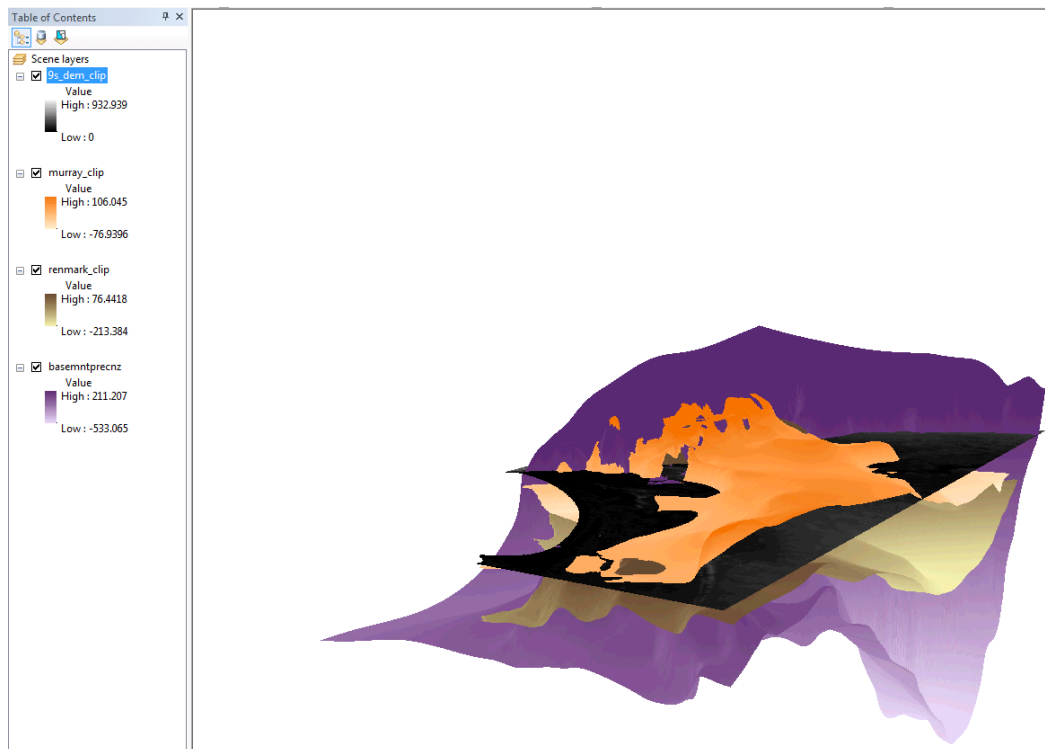
2.4 Add a Digital Elevation Model (DEM)

A DEM can be added to the three aquifer surfaces to assist in the interpretation of the aquifers in relation to the surface topography.

A 9-second DEM has been used in the following step. This is available to download from Geoscience Australia's website:

<http://www.ga.gov.au/topographic-mapping/digital-elevation-data.html>

1. To limit the DEM's file size, clip it to the area of interest, as has been done for this tutorial.
 - Go to ArcToolbox > Data Management Tools > Raster > Raster Processing > Clip.
 - For Input Raster choose the DEM.
 - For Output Extent choose the file which defines the area of interest, in this tutorial it is the clip mask created in the tutorial *Calculate aquifer thickness*.
 - For Output Raster Dataset navigate to a folder and name the output.
2. In ArcScene, go to the Standard toolbar and select the Add Data button to add the (clipped) DEM. The DEM is added as a flat surface, using ArcScene's default Stretched Values and symbology.

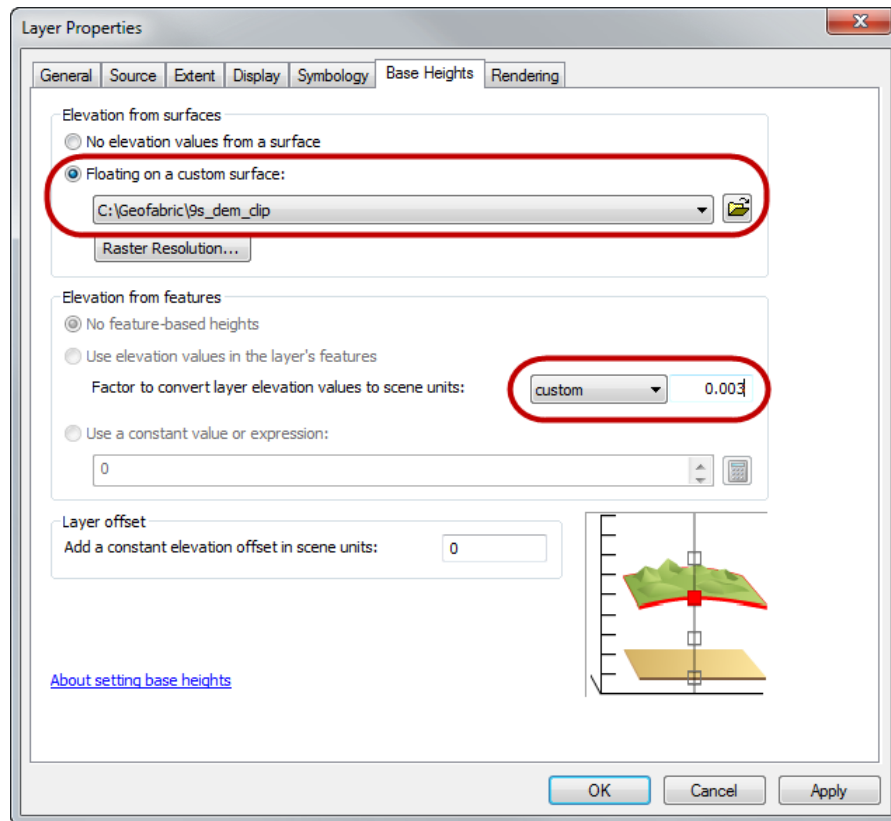


3. Invert the colour ramp so that the highest elevations will be visible.
 - Click on the colour ramp in the Table Of Contents.
 - In the Select Color Ramp window choose Invert.
 - Select OK.

2.4.1 Change Base Height elevation factor to 0.003

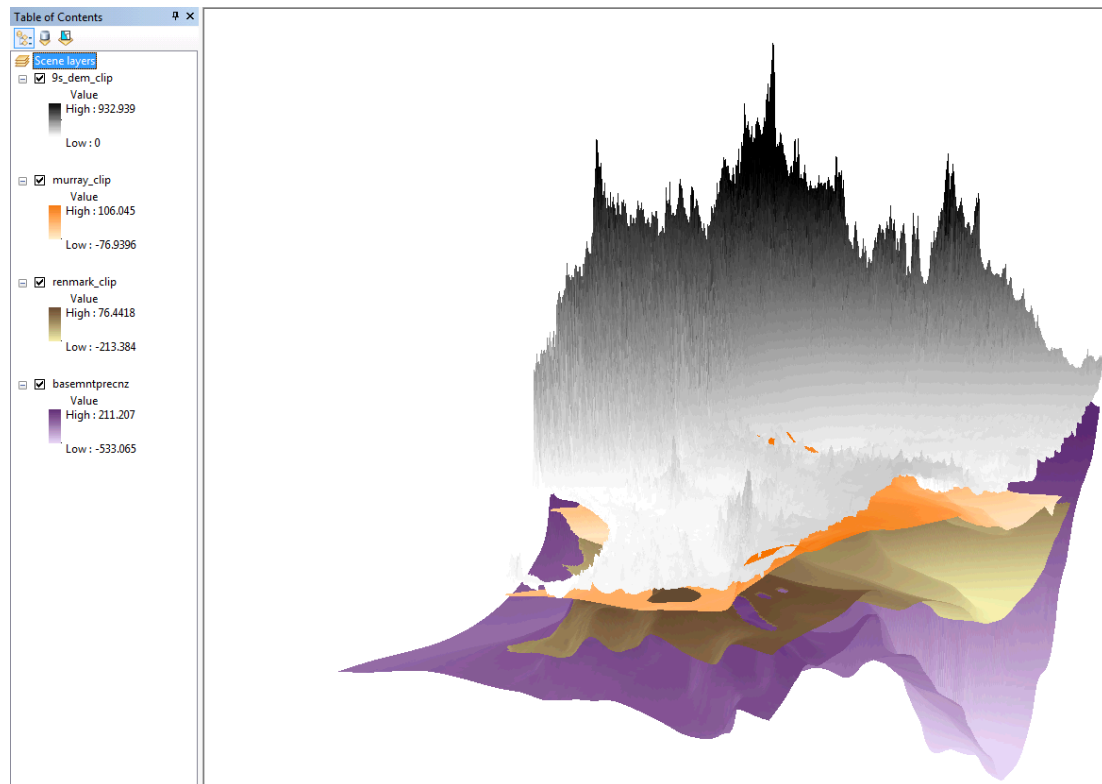
Edit the DEM elevation surface to be consistent with the aquifer surfaces, and modify the DEM symbology.

1. Right-click on the DEM layer and select Properties.
2. In the Layer Properties window carry out the following steps.
 - Select the Symbology tab and select a Color Ramp which reflects surface elevation.
 - Select the Base Heights tab.
 - In Elevation from surfaces, select Floating on a custom surface: and ensure that the (clipped) 9-second DEM is selected.
 - In Elevation from features, ensure custom is selected and enter 0.003. This is the same factor used for the three aquifer surfaces.



- Select OK to close the Layer Properties window.

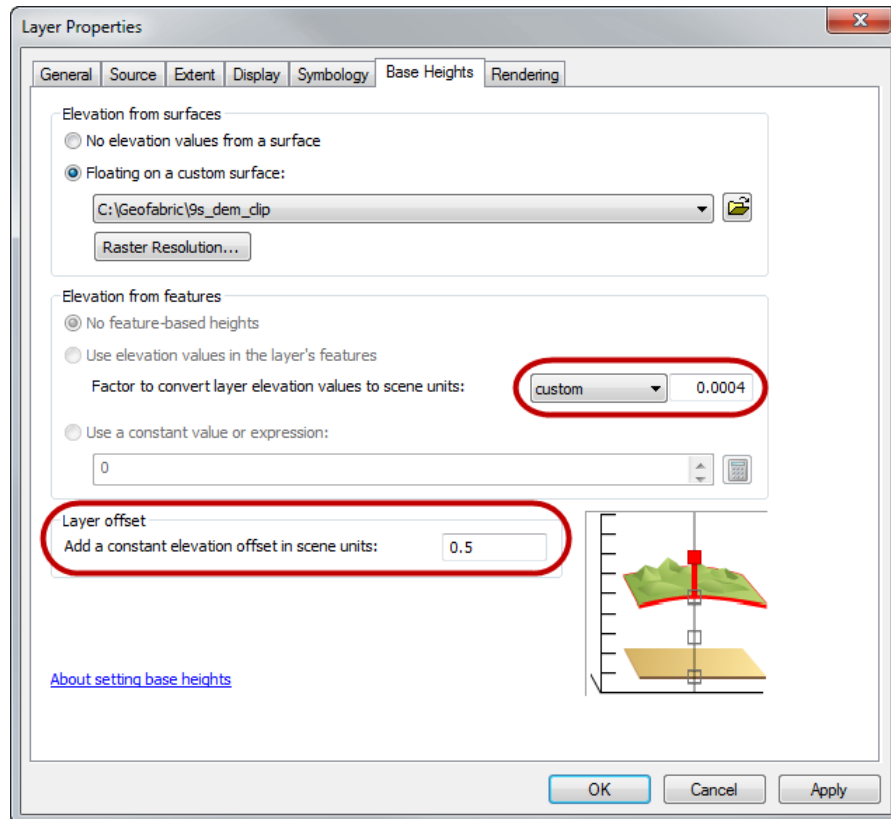
The DEM that displays is distorted, due to the factor used to convert the elevation values to scene units.



2.4.2 Change Base Height elevation factor to 0.0004

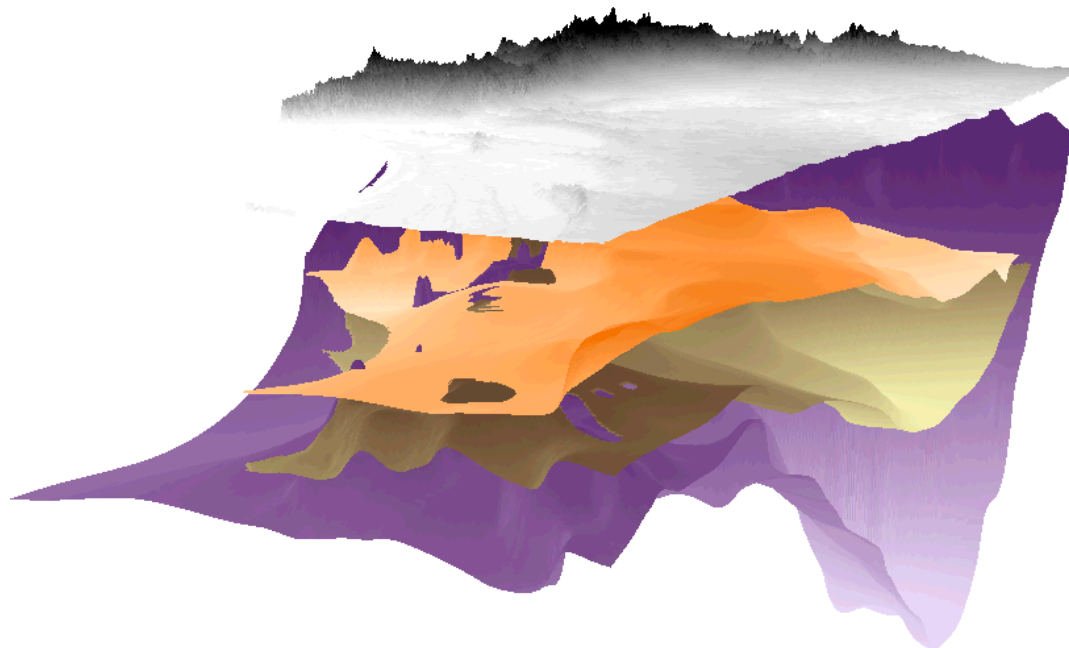
This step will modify the Base Height elevation factor so that the DEM looks less distorted. It will also be given an elevation offset to float above the aquifer surfaces.

1. Right-click on the DEM layer and select Properties.
2. In the Layer Properties window, select the Base Heights tab.
 - In Elevation from features, ensure custom is selected and enter 0.0004.
 - In Layer offset, edit Add a constant elevation offset in scene units to 0.5.



3. Select OK to close the Layer Properties window.

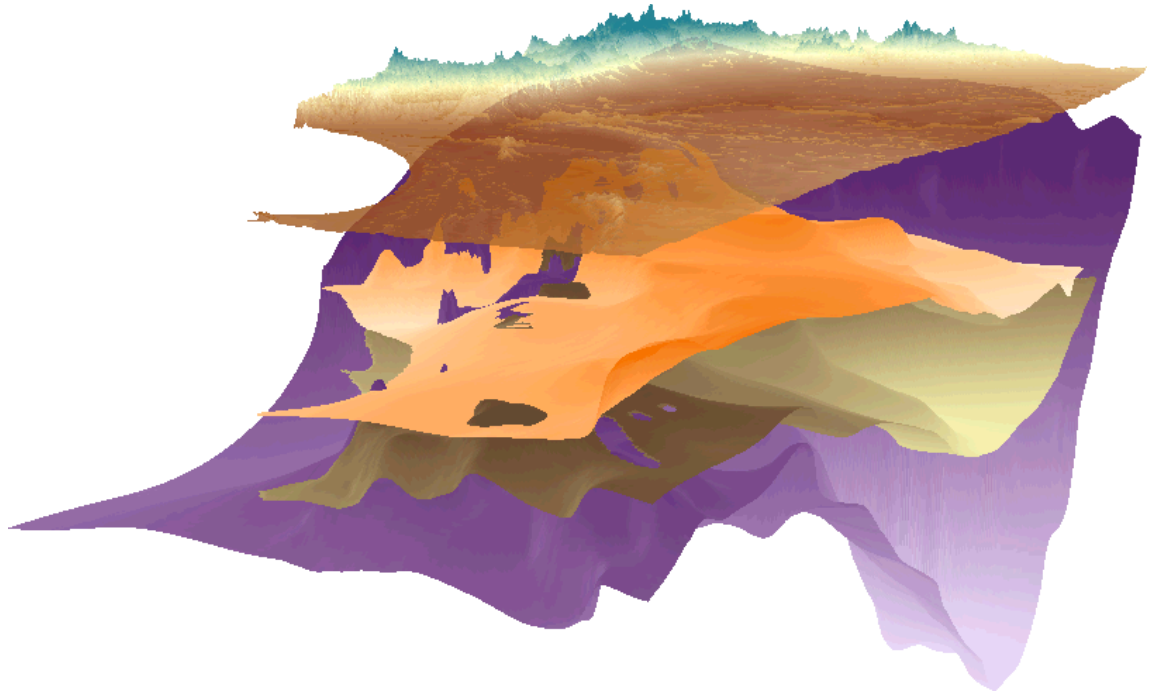
4. The DEM will display as per this screen grab.



2.4.3 Enhance symbology

The DEM's symbology can be enhanced by changing its colour and transparency.

1. Right-click on the DEM layer in the Table Of Contents and select Properties.
2. To alter the Color Ramp, select the Symbology tab and select another Color Ramp.
3. To alter the transparency of the DEM so that the aquifer surfaces are visible, select the Display tab and set Transparency to 20%.



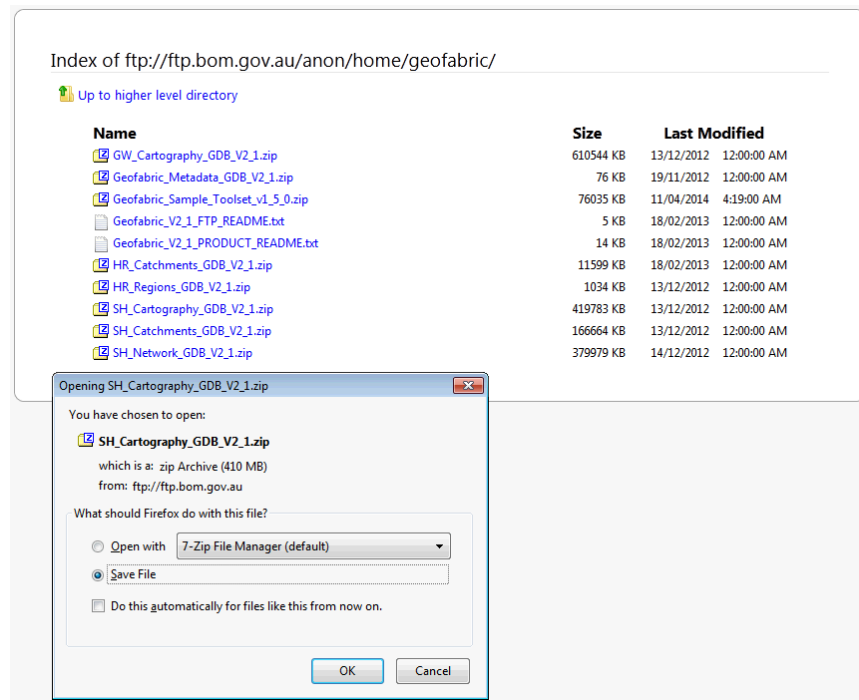
2.5 Add surface hydrology data

The DEM shows that a stream passes through this area of interest. Surface hydrological features can be added from the Geofabric Surface Cartography product available from the Geofabric FTP site:

<ftp://ftp.bom.gov.au/anon/home/geofabric/>

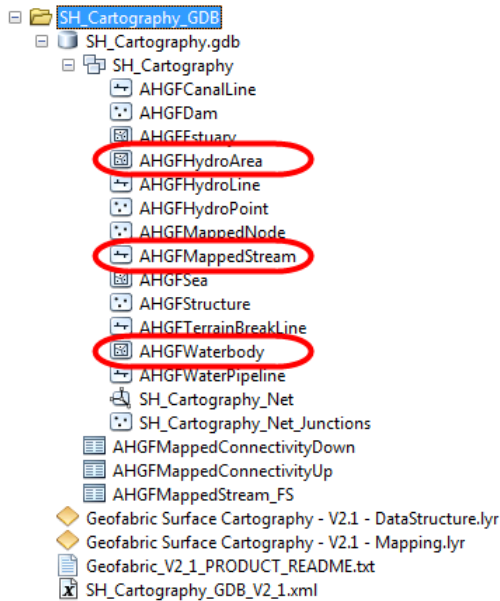
2.5.1 Download Geofabric Surface Cartography

1. Select the SH_Cartography_GDB zip file and save it to disk.



2. Unzip the downloaded file, which will contain a folder ending in GDB.

3. In ArcCatalog, the SH_Cartography_GDB folder contains feature classes.
AHGFHydroArea, AHGFMappedStream and AHGFWaterbody will be added to ArcScene.
 - AHGFHydroArea contains hydrological areas (pondage areas, foreshore flats, flats, canal areas and rapid areas).
 - AHGFMappedStream contains a cartographic stream network.
 - AHGFWaterbody contains water bodies (lakes, reservoirs and swamps).



Before these nationwide feature classes can be added to ArcScene they need to be clipped to the area of interest.

1. In ArcToolbox go to Analysis > Extract > Clip and complete the Clip window.
 - For Input Features, select AHGFHydroArea, AHGFMappedStream or AHGFWaterbody.
 - For Clip Features, select the polygon defining the extent of the area of interest.
 - For Output feature, class name and save the output. In this tutorial the outputs are saved as AHGFHydroArea_clip, AHGFMappedStream_clip and AHGFWaterbody_clip.
 - Select OK.
2. The output will be automatically added to ArcScene's Table Of Contents.

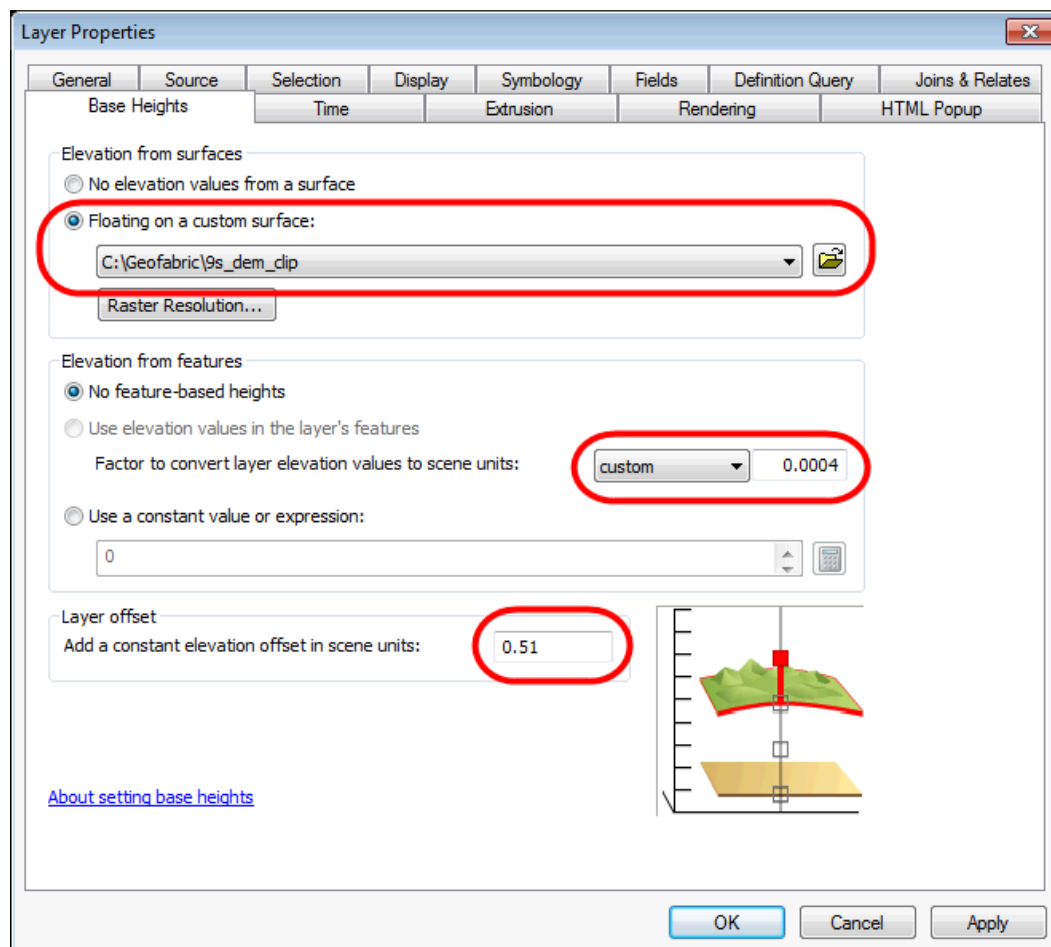
2.5.2 Edit properties

The surface hydrology features will display below the DEM. Their properties need to be edited to place them on top of the DEM.

These steps apply to all three surface hydrology ArcScene layers.

1. Right-click on the layer and select Properties.
2. Select the Symbology tab and choose an appropriate colour and line weight.
For the purposes of this tutorial, a single colour will be selected to represent all the different types of AHGFHydroArea features. (These features are symbolised individually in the Geofabric Surface Cartography – V2.1 – DataStructure.lyr file, which can be viewed in ArcMap.)
3. Select the Base Heights tab and populate it with these options.
 - For Floating on a custom surface, choose the clipped DEM.
 - For Elevation from features choose No feature-based heights, choose custom and set the elevation factor to 0.0004.
 - For Layer offset choose Add a constant elevation offset in scene units and enter a value of 0.51.

Note this value needs to be greater than the value used for the DEM so that it is displayed above it.



4. Select OK.

5. The output will display as follows, with all three surface hydrology layers.

