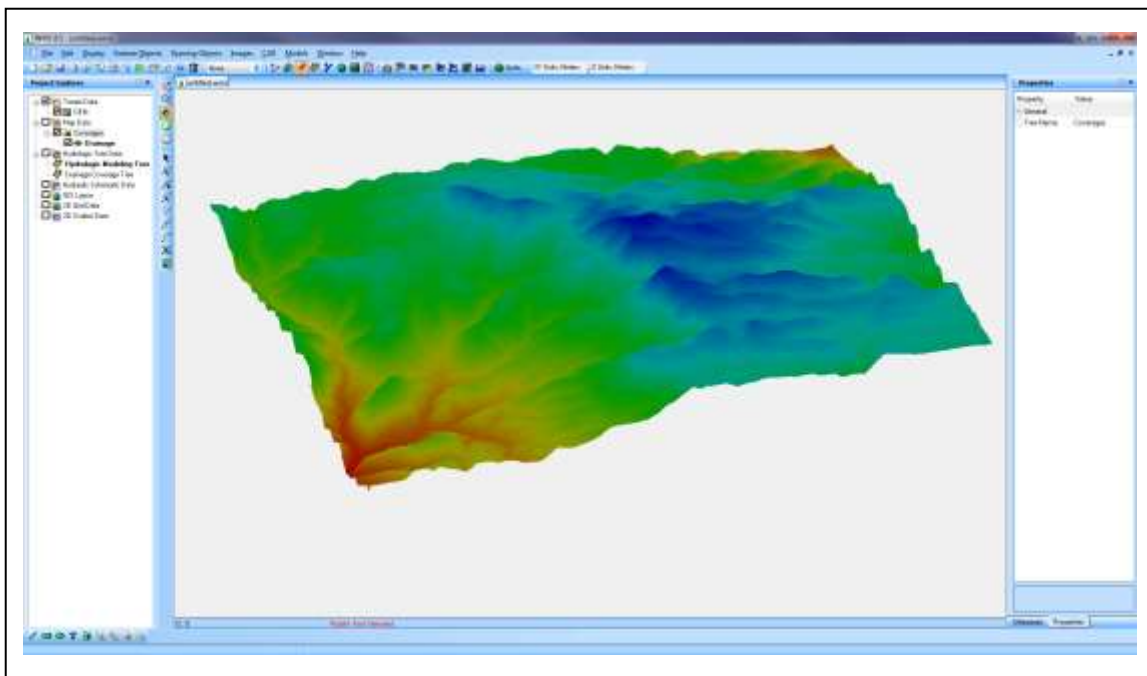


## WMS 10.0 Tutorial

### ***Editing Elevations – DEM Basics***

Import, view, and edit digital elevation models



### Objectives

Import DEMs from an online database. Set the display options of an imported DEM and view and edit the DEM attributes.

### Prerequisite Tutorials

- None

### Required Components

- Data
- Map

### Time

- 20-30 minutes

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## 1 Introduction

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Digital Elevation Models (DEMs) are the most commonly available digital elevation source and therefore an important part of using WMS for watershed characterization. A DEM is a rigid data structure that contains a two-dimensional array of elevations where the spacing between elevations is constant in the x and y directions. In the US, DEMs are downloadable from the Internet at 10m, 30-meter (1:24,000 map series) and 90-meter (1:250000 map series) resolutions. There are several free online data sources where such DEMs can be downloaded.

The Arc/Info ASCII grid format is common throughout the GIS world and is common outside the US. WMS has an automated tool to download the DEM at different resolutions and different projection systems. The basics of downloading, importing, editing, and displaying DEMs will be demonstrated in this exercise. Actually using the DEM for watershed delineation is the subject of the next chapter.

## 2 Objectives

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In this exercise users will learn the basics of importing, viewing and preparing DEMs for automated watershed delineation. This includes the following:

1. Importing DEMs using **Get Data** tool in WMS
2. Tiling multiple DEMs together
3. Editing DEM elevations
4. Setting DEM display options

## 3 Getting DEMs from the Internet

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In this part of the exercise, users will learn how to download DEM data using **Get Data** tool in WMS.

Even without an Internet connection, users can still work through this exercise using the files which have been downloaded already and placed in the tutorial directories by skipping ahead to section 4 now.

### 3.1 Using Virtual Earth Map Locator

In order to locate the site, WMS uses *Virtual Earth map Locator*.


1. Open WMS.
2. Click on the drop-down arrow next to the *Add GIS Data*  located in the tool bar and select **Get Data from Map...**



Figure 1 Add GIS Data Menu

This will open *Virtual Earth map Locator* Window.

3. At the top of the map locator window, turn on the **Locator Tool**.
4. In the search box enter “Provo” and click **Find**.

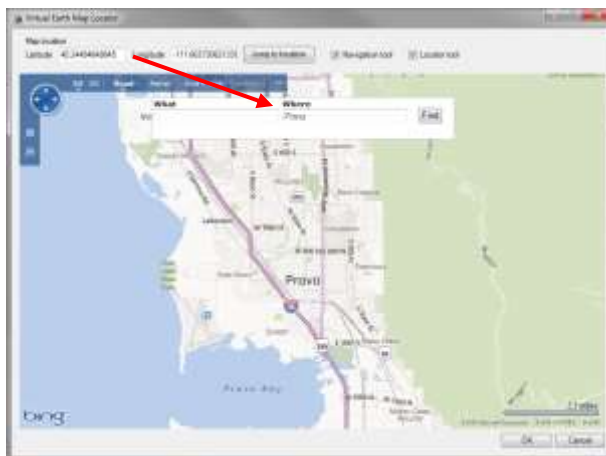


Figure 2 WMS Virtual Earth Map Locator

5. Zoom in using mouse scroll wheel near Utah Lake State Park, see following image:

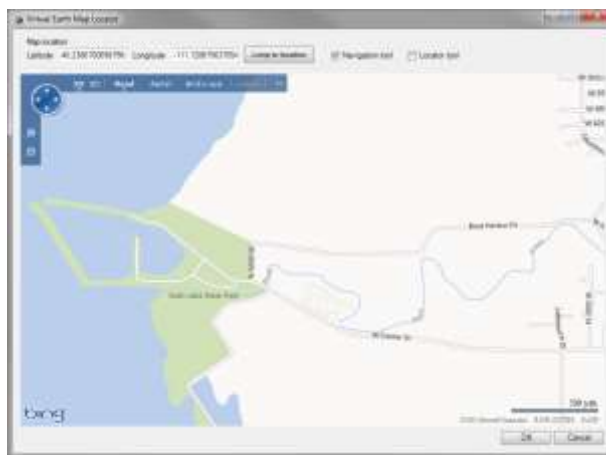


Figure 3 Zoomed Image on Virtual Earth Map Locator

6. WMS will use the extents of this window to download the DEM data. Resize the window or zoom in/out to get the proper extent of the data.
7. Click **OK**. This will bring up the *Data Service Options* dialog.
8. Select *United States Elevation Data (NED) (10m Resolution)* and click **OK**.

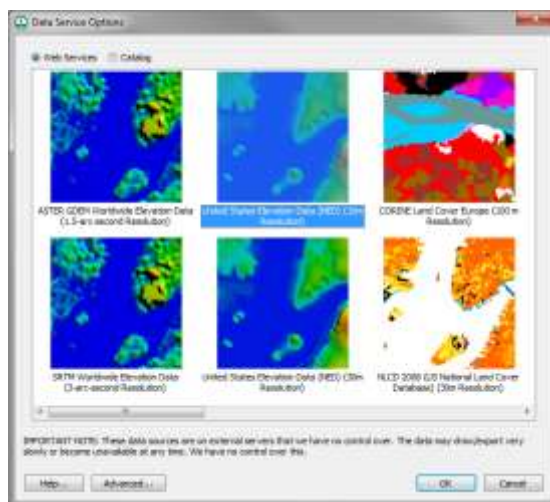


Figure 4 Data Service Options Dialog

9. A *Save Web Services Data File(s)* dialog will appear. Define a filename and location where DEM data should be saved and click **Save**.
10. A dialog will appear asking for confirmation to create the file. Click **Yes** to confirm creating the file in the location specified.
11. *Elevation Cell Size* dialog will appear. Click **OK** to accept suggested *DEM cell Size*.
12. WMS will now download the DEM data for the selected area. Notice the progress bar.
13. As soon as the data download is complete, all the dialogs will close and WMS will plot the elevation contours for the DEM.

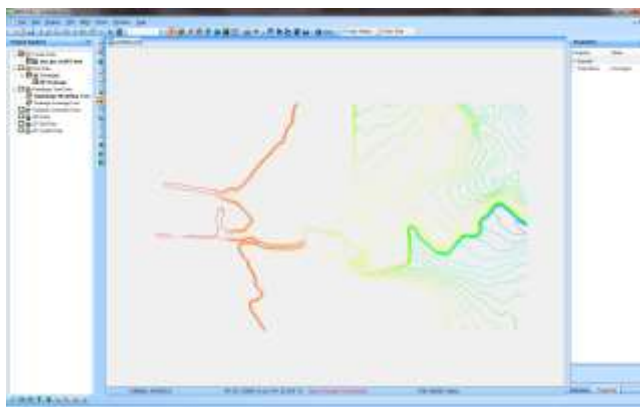




Figure 5 WMS DEM Contours

During this download process, the data has been projected into the projection system users specified earlier in this workshop. Users will see in further sections how such DEMs can be used.

## 4 Merging DEMs

This section of the workshop will be useful if users already have a DEM and the area they are studying lies across two or more DEM quads. WMS is able to merge multiple DEM files that span quad sheets.

To see how this works, complete the following steps:

1. Select *File / New* .
2. Select **No** if asked to save changes.
3. Select *File / Open* .
4. In the *Open* dialog, locate the *dembasics* folder in the files for this tutorial. If needed, download the tutorial files from [www.aquaveo.com](http://www.aquaveo.com).
5. Find and multi-select “josephpeak.dem”, “redridge.dem”, “marysvalecanyon.dem”, and “trailmountain.dem”.
6. Choose **Open**.

Users will be taken to the *Importing USGS DEMs* manager, which will pop up as a dialog box. The area covered by the DEM selected will be colored in a box near the center of the dialog. The boundaries of the DEM area will show up in the four edit boxes around the center box.

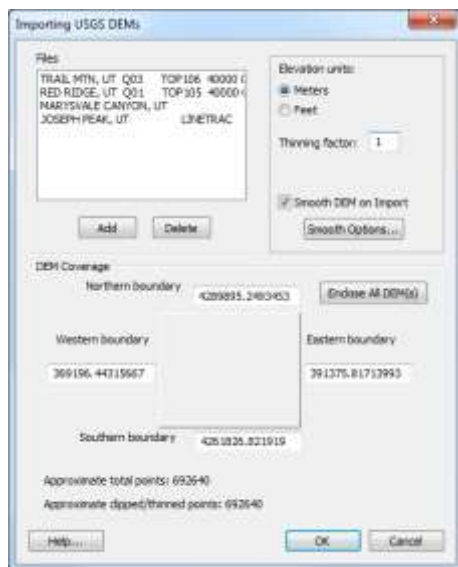


Figure 6 Importing USGS DEMs dialog

7. Select **OK**.



By multi-selecting the DEMs users want, they can read in all the quads they need at the same time. WMS is able to read in an unlimited number of DEMs at a time (unless the computer runs out of memory). Users can read in multiple DEMs in the standard USGS

format (from the WebGIS site), the SDTS format, or Arc/Info ASCII grid format, but they cannot mix and match formats in WMS (you could export any DEM in the Arc/Info ASCII grid format in order to get them all to a common format, though). Users cannot tile multiple DEMs from the NED site (this should not be a problem though since the data from this site is “seamless” in the first place).

## 5 Trimming DEMs

WMS allows users to select the portion of the DEM they need and eliminate all of the surrounding elevation points. This can be done either with an existing polygon or with a polygon entered interactively.

### 5.1 Trimming DEMs

1. Right-click on “trailmountain, redridge, marysvalecanyon, josephpeak” in the Project Explorer and select *Trim / Polygon*.
2. In the *Polygon Selection Options* dialog, choose the *Enter a polygon interactively* option.
3. Select **OK**.
4. Users can now trim the polygon. Make sure the **Terrain Data**  module is selected.
5. Using the **Select Vertices**  tool, make a box as seen in Figure 7, clicking to create each corner. Double-click when creating the last corner, to close the polygon.

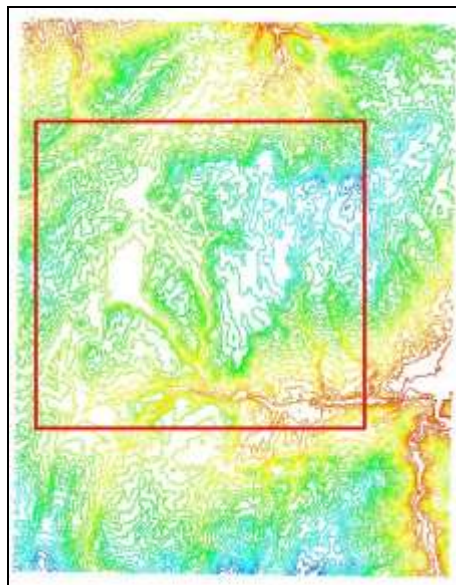


Figure 7: DEM Trim Area

## 6 Displaying DEMs

### 6.1 Contour Options

WMS has several options for displaying DEMs. Users can change the contour display options by following these steps:

1. Right-click on “trailmountain, redridge, marysvalecanyon, josephpeak” in the Project Explorer and select **Contour Options...** in the pop-up menu.
2. In the *Contour Options* dialog box, find the heading *Contour Interval*.
3. Under *Contour Interval* select “Number of Contours” on the dropdown menu and set the edit box value next to it to “10”.
4. Select **OK**.

Notice that there are fewer contours and they are spread farther out now.

5. Right-click on “trailmountain, redridge, marysvalecanyon, josephpeak” in the Project Explorer and select **Contour Options...** in the pop-up menu.
6. In the *Contour Options* dialog which just popped up, find the heading *Contour Method*.
7. Under *Contour Method*, select “Color Fill”.

This option will “color in” the contours.

8. Click the **Legend** button located at the bottom of the dialog box.
9. A new dialog named *Contour Legend Options* will open. Under *Legend Specifications*, check the *Display Legend* check box.
10. Select **OK**. To close the *Contour Legend Options* dialog box.
11. Select **OK** in the *Contour Options* dialog.
12. Users should have a similar image to Figure 8 in their Main Graphics Window.

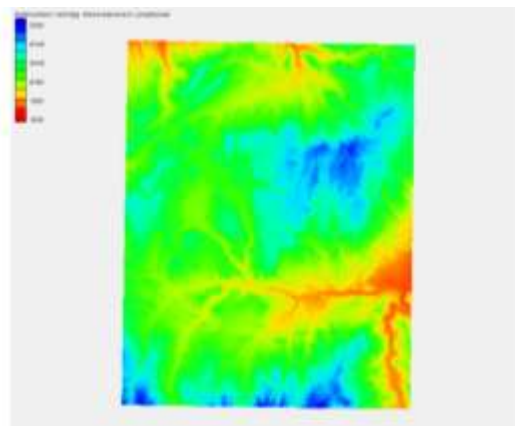


Figure 8 Contour Map and Legend




Users can go back into the Contour options dialog and explore more of the contour display options if they wish.



## 6.2 Point Display Step

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Next users will explore the point display step option:

1. Right-click on “trailmountain, redridge, marysvalecanyon, josephpeak” in the Project Explorer and select **Display Options**  in the pop-up menu.
2. In the *Display Options* dialog, change the number in the *Point Display Step* edit box to “4”.
3. Select **OK**.

Notice that the display is not as smooth now.


4. Right-click on “trailmountain, redridge, marysvalecanyon, josephpeak” in the Project Explorer and select **Display Options**  in the pop-up menu.
5. In the *Display Options* dialog, change the Point Display Step to “12”.
6. Select **OK**.
7. Right-click on “trailmountain, redridge, marysvalecanyon, josephpeak” in the Project Explorer and select **Display Options**  in the pop-up menu.
8. In the *Display Options* dialog, change the Point Display Step back to “2”.
9. Select **OK**.

Raising the point display step will allow the DEM display to refresh noticeably faster, especially if the computer is slow. Although WMS is not drawing every DEM point, each point that was read in is still there, so changing the point display step does not change the accuracy.

## 6.3 Shading Options

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Now users will explore the shading options:

1. Select *Display / Display Options* .
2. In the *Display Options* dialog, select *Lighting Options* from the menu on the left side.
3. Toggle on *Use light source*.
4. Click on the globe to move the light source and adjust the slide bar to change the amount of ambient light.
5. Select **OK**.


Changing the position of the light source and the ambient light alters the display of the DEM. Users can experiment with these options to accentuate the elevations that are most important for them to see.

## 6.4 Views

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Many times it is easier to see the DEM elevations from a view other than the plan view.



1. Select *Display / View / Oblique View*. (Alternatively, users can also select the **Perspective View**  macro.)

It is now much easier to see the changes in elevation on the DEM. If the elevation relief cannot be seen clearly, users can change the Z-magnification to accentuate the elevation relief.

2. Select *Display / View / Z Magnification*.
3. The *Z Magnification* dialog will pop up.
4. Enter “3” in the edit box.
5. Select **OK**.

The image will redraw on its own. Users will see the elevation relief better now.

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## 7 Conclusion

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DEM data for the United States is found in several places on the Internet. Data is available for most areas of the US and some parts of other countries. DEM data is very useful for delineating watersheds in WMS.

In this exercise users should have learned how to do the following:

1. Import USGS DEMs in different formats
2. Tile multiple DEMs together
3. Edit DEM elevations
4. Set DEM display options