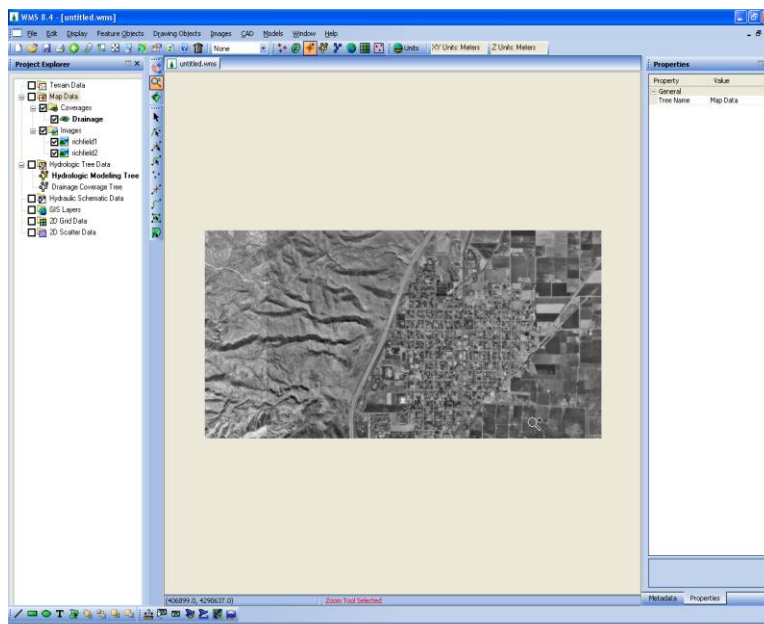


WMS 9.1 Tutorial

GSSHA – WMS Basics – Loading DEMs, Contour Options, Images, and Projection Systems

Learn how to work with DEMs and images and to convert between projection systems in the WMS interface



Objectives

Read digital elevation, image, and GIS shape files into WMS, manipulate the files, and download digital data from the internet. Learn how to get background images , convert coordinate projections, and convert data from shapefile to map feature data that can be used for watershed modeling in the WMS GSSHA interface.

Prerequisite Tutorials

- None

Required Components

- Data
- Map

Time

- 45-60 minutes

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1 Contents

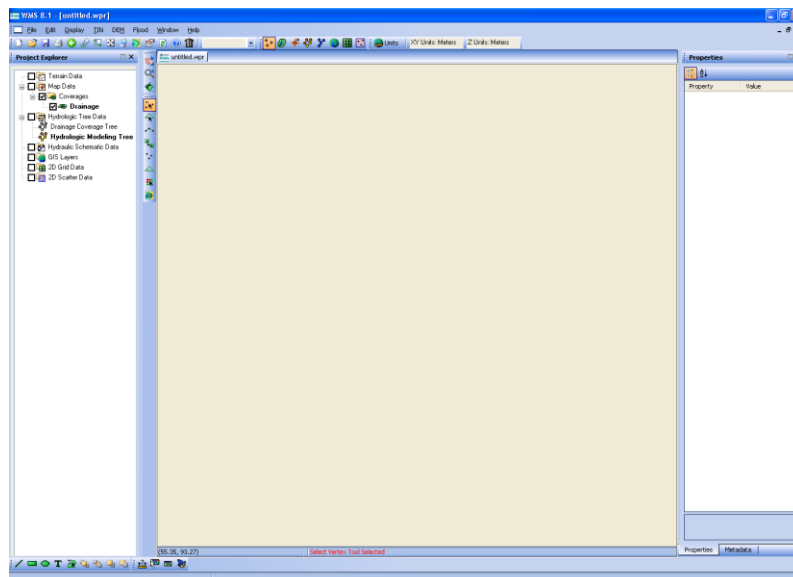
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2 Introduction

In this first exercise you will get familiar with the WMS interface and the help system using data from the Park City, Utah area.

3 Objectives

We will learn the basic layout of WMS and get acquainted with the interface.



The left most portion of the WMS window is called Project Explorer, the central part is the display window, and the right part is the Properties window. The properties window changes based on the selected item.

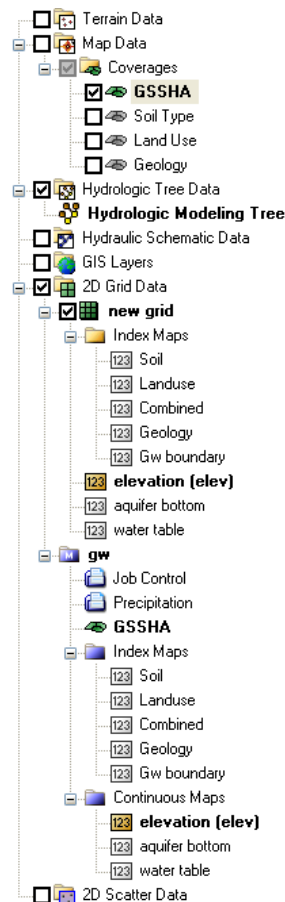
4 Getting Around the WMS Interface

The WMS Help file has a section on some of the basic elements of the WMS graphical user interface (GUI).

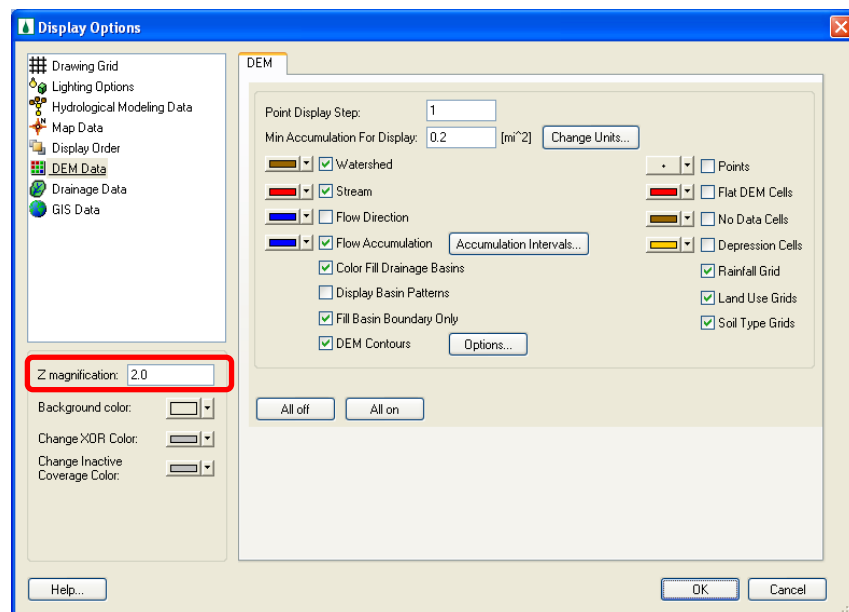
4.1 Self-Guided Tour

The WMS Help file is located on a “wiki” site at <http://www.xmswiki.com> and documents the important elements of the GUI. In this section you will practice on your own to become familiar with the interface, but you can always refer back to the help file on xmswiki.com as needed.

1. Start WMS
2. Select **Help | WMS Help**
3. Take a couple of minutes to review the WMS Help wiki and then close the help page
4. Different operations like spatial data reading/editing, hydrologic modeling or grid generation etc. are done using different modules. Switching from one module to the other can be done by clicking the corresponding module icons  in the menu bar. As you do, you will notice menus and tools change according to the available options. Change the module several times and note how the menus and tools change according to the active module. When you are done, be sure the Terrain Data module is active (the first one from the left).
5. If you look at the WMS project explorer, you can see that there is a folder in the project explorer to contain the data associated with each module (the drainage module shares data from the terrain and map modules).
6. The default behavior of the project explorer window is to switch modules as these folders or data contained in them are selected. For example, if you click on the *GIS Layers* folder, the *GIS Module* will be selected and if you click on the *Coverages* folder, the map module will be selected.
7. WMS 9.1 projects are saved as *.wms files. When you save the project, all necessary files are saved and the saved project can be reopened. You should always save your model as a **.wms** file before creating a 2D grid for a GSSHA model so you have a base project to work with. After building a 2D grid and initializing your GSSHA model, you should save your project as a GSSHA project file (with a .prj extension).
8. You can control which objects are displayed by checking and un-checking the data elements in the Project Explorer window. Set the style, color, and size of elements drawn using the **Display Options** , **Contour Options** , and other macros.



9. Select **File | Open** 
10. Locate the **\GSSHA Distributed Hydrologic modeling** folder in your tutorial files. If you have used default installation settings in WMS, the tutorial files will be located in **\My documents\WMS 9.1\Tutorials**.
11. Browse and open file **\GSSHAImages\BaseProj.wms**
12. Select the **Contour Options**  macro and experiment with changing some of the contouring options such as the **Contour Methods**, **Contour Interval** and **Color Ramp**.
13. Controlling what and how objects are visually displayed can be set through the display options. To set the display options, select **Display | Display options** or simply click the display options button  on the menu bar.
14. In the **Display Options** dialog box, uncheck the **Auto z-mag** box and enter 2.0 for **Z magnification**. You can also access the DEM contour options from the display options by selecting the DEM Data object in the upper left corner of the Display Options window. Click the options button next to DEM Contours. Make sure the DEM Contour Method is set to **Color Fill** and click OK twice.



15. Select the **Rotate Tool**  and drag your watershed so you can visualize the watershed relief.
16. Select the **Contour Options**  macro and set the **Contour Method** to **Normal Linear**. Select OK and then select **Plan View**  to reset the drawing of the DEM from the changes you made with the rotate tool.

5 Images

Images are an important part of projects developed using WMS. An image is comprised of a number of pixels (picture elements), each with its own color. The resolution, or size, of the pixels determines the area and detail represented in the image. Images may be used in WMS to derive locations for features such as roads, streams, confluences, land use, soils and so forth. Images also provide a base map for your project.

In order to make use of images they must be georeferenced. Georeferencing an image defines appropriate x and y coordinates so that it can be spatially overlaid with other data. Because images are commonly used in Geographic Information System (GIS) programs like WMS, data developers often store the georeferencing information as either part of the image file (a geotiff file for example), or in a separate file commonly referred to as a “world” file.

In this section we will experiment with JPG and TIFF image files. We will also see how an image without spatial information can be georeferenced.

6 Geotiff Files

Geotiff images are files that embed the georeferencing information. This means that you do not have to specify coordinates when you read in the image.

6.1 Scales

In this section we will see how the scale of an image affects the display. We will use some of the images for Provo, Utah.

1. Select **File|New** or click on macro icon  to open a new instance of WMS.
2. Select **File | Open** 
3. Browse the folder `\GSSHA Distributed Hydrologic modeling\GSSHAImages\` and open the following images:

a) *provo24K.tif*

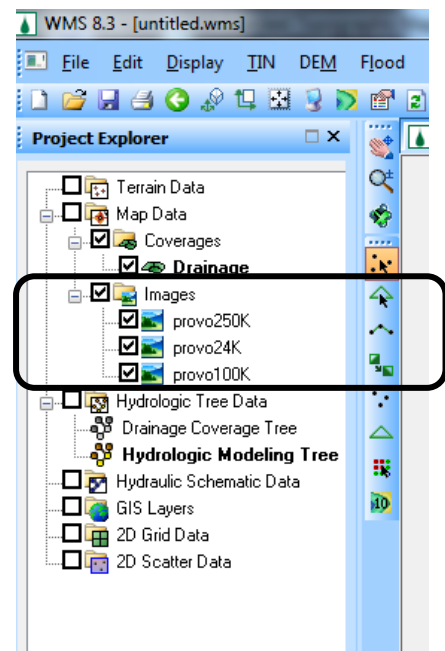
b) *provo100K.tif and*

c) *provo250K.tif*

Click No if prompted to convert to jpg

Note: These are the topographic maps of the Provo, UT area. The three images are of different scales (1:24000, 1:100000 and 1:250000 respectively).

4. Once these files are open, you can see them listed in the project explorer (see the following figure).
5. Turn the display of the images on and off by checking them on and off in the project explorer. Leave them all on when



you are done experimenting.

6. Select the Zoom Tool  and draw a rectangle over the image to zoom into the area of your preference.

Zooming Tips: With the zoom in tool  selected, if you press and hold the Shift key in the keyboard, the zoom in tool changes to zoom out tool. The zoom in tool performs as zoom out tool if operated with Right mouse button.

You can also use the scroll wheel of your mouse to zoom in and out with any tool or module selected. The direction of scroll to zoom in/out can be set in **Edit\Preferences** in *General* tab.

If you click the scroll wheel of the mouse, it performs as a pan tool without having to select pan tool . This is especially useful when you are tracing an arc.

7. Zoom into the same location in the three different images and see the difference in resolution, area covered by the images, details captured etc.

7 Overlaying Images

WMS allows you to overlay different types of images, provided that the images are in the same projection system.

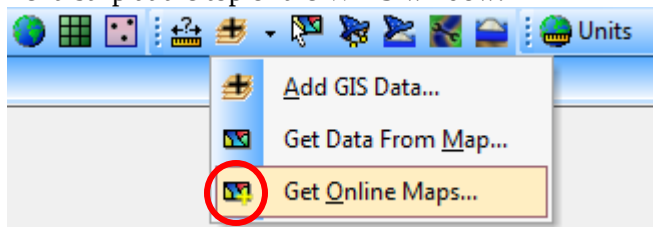
1. Close WMS and open a new instance of WMS. Browse and open image **\GSSHA Distributed Hydrologic modeling\GSSHAImages\provoTStopo.jpg**. This is a topographical map of the Provo area. This image is already georeferenced.

Many of the tools in WMS depend on your currently defined projection system. Some of such features that use your current projection system are the *get data* tool  and the *Get Online Maps* tool . Before using these tools, you must have your current projection defined so that WMS can determine the latitude/longitude coordinates of your required data.

2. Select **Edit | Current projection...** to set your the projections
3. Select the *Global Projection* option
4. Select *Set Projection*
5. Set *Projection* to *UTM*, *Datum* to *NAD 83*, *Planar Units* to *Meters*, and *Zone* to *12 (114°W - 108°W – Northern Hemisphere)*
6. Select *OK*
7. Set the vertical projection to *Local* and the vertical units to *Meters*
8. Select *OK*

WMS 9.1 uses an Internet connection to load a background image (Aerial photo or a topo map) for the project site. WMS uses built in web services tool to load such images.

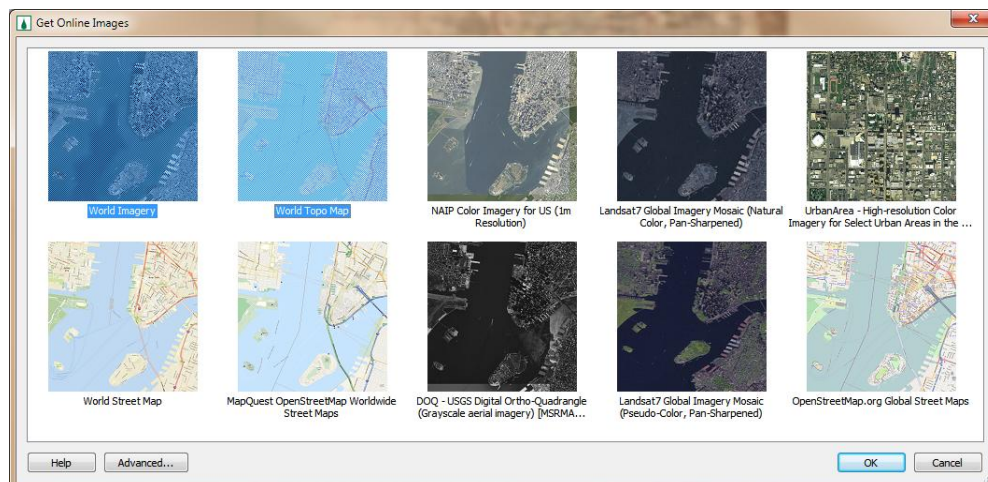
Get Online Maps button , located in the Add GIS Data dropdown which is normally located near the menu strip at the top of the WMS window.



This tool uses a web map service to download and view various types of images in the WMS graphics window. These images are pre-registered to your current projection (or if no data exists, your projection is set to the image's native projection) and more than one online image can be read at a time.

The advantages of online images are that they are seamless, data is available throughout the world, and that they can be reprojected to your current projection without needing to georeference the image. The disadvantage of online images is that the image can take a long time to refresh when zooming or panning your display in the graphics window.

9. Locate and select the *Get Online Maps* button  in the *Add GIS Data* drop down at the top of the WMS window near the menu.
10. Drag a box or select the *Ctrl* button and click to select both the *World Imagery* and the *World Topo Map* options and select *OK*.



11. Notice that the online images are read and displayed based on your current screen coordinates. Notice that two new layers symbolizing online images are created for the *World Imagery* and the *World Topo Map* in the *Project Explorer*. In the *Project Explorer*, turn off the *World Imagery* online image. Zoom into various areas of the online image and compare the online image with the topographic maps read earlier in this tutorial by turning the online image off and on after zooming or panning. Notice that the display takes some time to update when moving the display. This display slow-down can be fixed by converting the online image to a static image.
12. Select the *Frame* macro .

13. Online images can be exported and added back to your project immediately or used in another project. To export an image, right-click on the *World Imagery* online image and select the **Export** menu option. Enter a **resampling ratio** of 4.0, select the option to *add the image to the project after saving*, and select **OK**. It will take some time for WMS to download the higher-resolution image. After the image is downloaded and loaded into WMS, you can turn the image off or use it in place of an online image.
14. Zoom into various areas and compare the online images with the topographic maps read earlier in this tutorial.
15. Right click on the **World Imagery** item in the project explorer and select *Set Transparency*.
16. Move the slider to 50% and click **OK**. You should be able to see the aerial photo on top of the topo map.

8 GIS Shapefiles

GIS shapefiles are another data source frequently used in developing models with WMS. In this section you will see how commonly used shape files for land use and soil data can be obtained and used in WMS.

8.1 Geospatial data acquisition

There are several locations where you can obtain various types of geospatial data. The XMS wiki at <http://www.xmswiki.com> has a special geospatial data acquisition page which has tutorials and tips on downloading these data from the most convenient sources for use in WMS, SMS or GMS. In this section, you will download a shapefile with land use data and open it in WMS.

1. Start a web browser and type the following link into the address bar: <http://www.xmswiki.com/xms/GSDA:GSDA>. This will take you to the Geo-Spatial Data Acquisition Home page.
2. Under *Surface Characteristics*, select *Land Use*.
3. Select the *WebGIS* link.

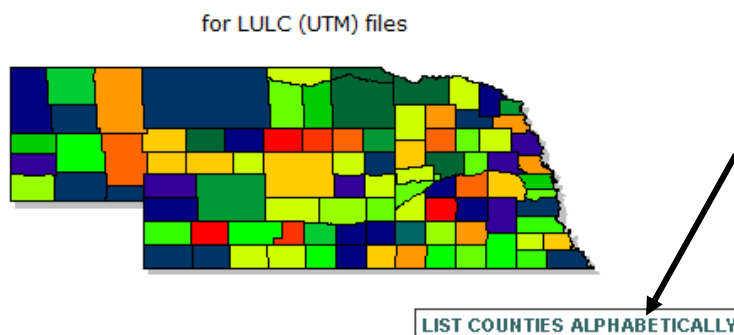
Web GIS



4. Under *Land Use* select *Shapefile (UTM)*



5. For this exercise, you will get the land use data for Omaha. In the US map, select Nebraska.
6. Click on *List Counties Alphabetically*



7. In the list that displays, select *Douglas County*
8. Select *Omaha* on the top of the list.

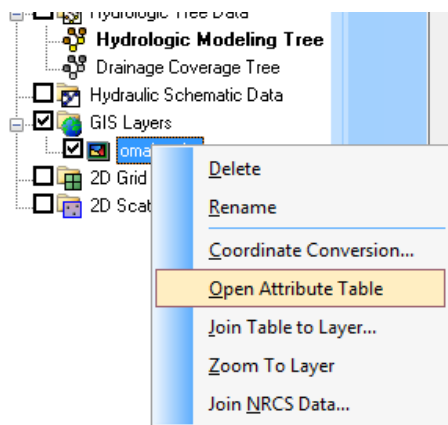
DOUGLAS - Nebraska
 LULC Data (UTM)

NAME	MIN X	MAX X	MIN Y	MAX Y	ZONE
FREMONT	584041	748468	4539198	4654179	14
OMAHA	247597	417187	4543002	4650411	15

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9. Save ZIP file archive on your computer.
10. Outside of WMS, browse to the folder where you saved the Omaha.zip file and extract the files to **\GSSHA Distributed Hydrologic modeling\Personal\Images**.
11. In WMS, delete your data by selecting **File | New**.
12. Before reading any data, you should set your projection system. Select **Edit | Current projection...** to set your current projection.
13. Select the *Global Projection* option.
14. Select *Set Projection*.
15. Set *Projection* to *UTM*, *Datum* to *NAD 83*, *Planar Units* to *Meters*, and *Zone* to *15 (114°W - 108°W – Northern Hemisphere)*.
16. Select **OK**.
17. Set the vertical projection to *NAVD 88(US)* and the vertical units to *Meters*.
18. Select **OK**.
19. Open the aerial photo covering the region surrounding Omaha at the following location: **\GSSHA Distributed Hydrologic modeling\GSSHAImages\Omaha\AerialPhoto.jpg**. Select **Yes** if asked to generate image pyramids.

20. In the project explorer, right click on *GIS Layers* and select *Add Shapefile Data...*
21. Browse and open the land use shapefile that you downloaded (**GSSHA Distributed Hydrologic modeling\Personal\Images\omaha\omaha.shp**)
22. Now you can see the land use shape file overlaying the aerial photo for the city of Omaha.
23. Right click *omaha.shp* on the project explorer and select *Open Attribute Table*. This will open the attribute table for the land use shape file. You should be able to see *LUCODE* as one of the attributes. **LUCODE** is the USGS land use code. You will be using this attribute to define overland flow roughness values and other surface characteristics in later tutorials.



24. This shapefile is in the GIS module of WMS. To use this shapefile for hydrologic and hydraulic calculations, you need to convert it to data in the map module of WMS. You will do this in a later section.
25. Do not close WMS, we will keep working with this data in the following section.

8.2 Geospatial data processing

Some of the GIS data are not 'ready to use' like the land use shapefile we used in the previous section. We need to process these data before they can be used. In this section we will see how some of these tools can be used in WMS with a soils shapefile.

We will open a SSURGO soil shapefile for Omaha and process it so that it can be used for defining infiltration and other soil-derived properties required for GSSHA models.

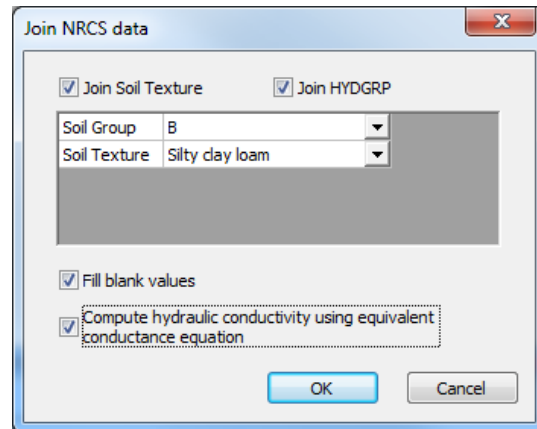
1. Right click *GIS Layers* in the project explorer. Browse to and open the file **GSSHA Distributed Hydrologic modeling \GSSHAImages\Omaha\Soil\Spatial\soilmu_a_ne055.shp**.
2. When the soil shapefile is read into WMS, the projection file associated with the file is read and WMS reprojects the data from Geographic (Lat/Lon) to the current coordinate system (UTM Zone 15).
3. Right click on *soilmu_a_ne055.shp* and open its attribute table. In the attribute table, notice that there are only a few properties associated with each soil polygon, but there are no recognizable soil attributes. To get the

soil properties associated with each soil polygon, you will need to read these properties from tables included with the SSURGO data.

4. To read the properties, close the attribute table and right click on *soilmu_a_ne055.shp* in the project explorer. Select *Join NRCS Data*.

The soil attributes associated with the soil polygons are stored as separate tables. Selecting the **Join NRCS Data** command allows you to link these tables to your shapefile so you can use them.

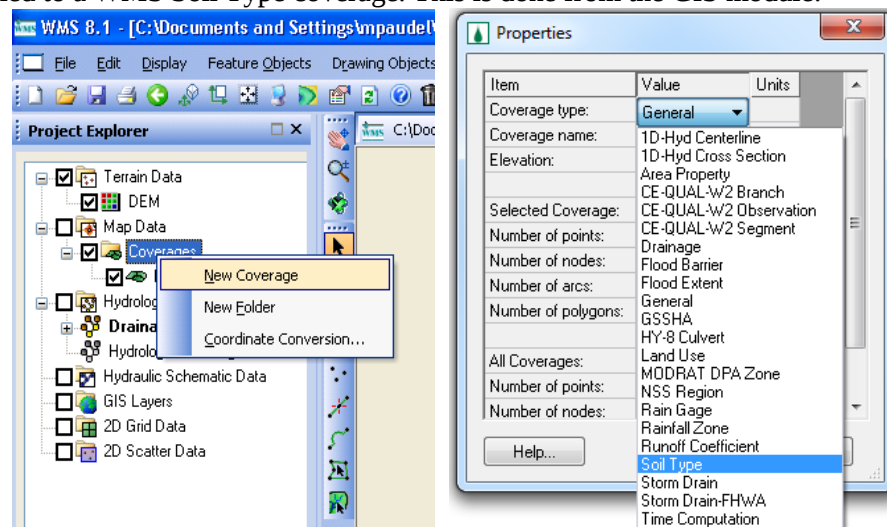
5. In the *Join SSURGO Data* dialog select all the check boxes and leave the Soil Group and Soil Texture fields as they are. See the following figure:



6. Click OK.
7. Right click on the soils shape file under GIS Layers and open the attribute table again. This time you will see that several soils properties have been added as attributes.

9 Mapping Shapefiles to WMS coverages

The SSURGO shapefile that we processed in the previous step is still in a GIS format that WMS cannot use directly. In order to use it the polygons overlapping our watershed need to be copied to a WMS Soil Type coverage. This is done from the GIS module.



1. In the project explorer (left side of WMS main window), right click on “Coverages” and select “New Coverage”
2. Select the coverage type to be *Soil Type* and click OK. This will create a new soil type coverage in the project explorer. Note that WMS creates a Drainage coverage automatically as soon as WMS is opened. When you create a GSSHA grid, the drainage coverage is converted to a GSSHA coverage.
3. Click on the new soil type coverage in the Explorer window to make it active.
4. Click on the *soilmu_a_ne055.shp* (under GIS layers) to make it active and change to the GIS module as we are going to map the data from the soil shapefile to the soil type coverage.
5. Turn off the check box next to the **omaha.shp** shapefile you read in a previous section. This is the land use shapefile and you do not want the data in this shapefile included in your soil type coverage.
6. Click on the “Select shapes tool”  and drag a rectangle around a watershed area you are interested in to select all land use polygons that overlap your watershed. Do not worry if you select polygons that are outside the watershed boundary, WMS will use the watershed boundary to clip the land use polygons.
7. Select **Mapping | Shapes -> Feature objects**, click “Next” and make sure that the fields are mapped properly. For example, the TEXTURE field should be mapped to Texture, HYDGRP should be mapped to SCS soil type, and so on. Click “Next” and click “Finish”.
8. The selected soil polygons are now converted to a coverage in the WMS map module and saved in the WMS map file format. You no longer need the GIS data once it is mapped to a coverage. You may delete the soil shape file under GIS layers (Right click on *soilmu_a_ne055.shp* and select delete).