# WMS

**v. 9.0**

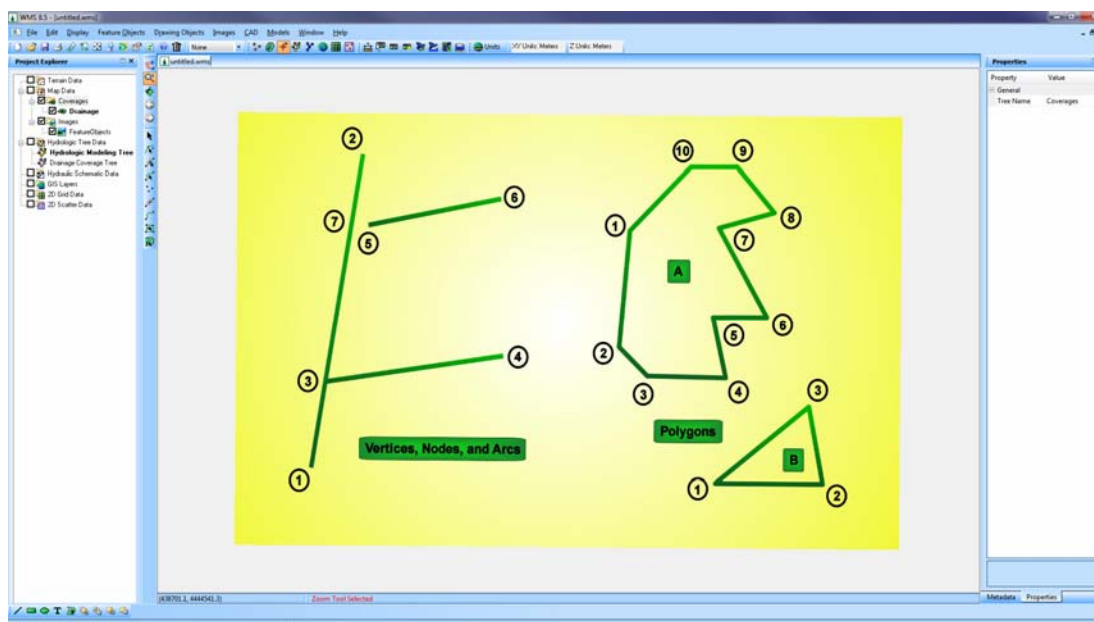*WMS 9.0 Tutorial*

# Introduction – Basic Feature Objects

Learn about feature objects, create, edit, and manage them in WMS, and import and use GIS data



## Objectives

Define the term "Feature Objects". Create, edit, and manage feature objects and coverages in WMS. Import GIS data and convert the data to feature objects in the map module. Use images to create feature objects from scratch.

## Prerequisite Tutorials
- None

## Required Components
- Data
- Map

## Time
- 30-60 minutes

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# 1    Contents

# 2    Introduction

Feature objects are points, lines, and polygons organized in coverages by different attribute sets such as drainage features, land use, soils, time travel paths, cross sections, etc. The primary coverage in WMS is the drainage coverage, which holds drainage boundary polygons, stream lines, and outlet nodes. Most of the other coverages are secondary to the drainage coverage and are used to "map" other hydrologic parameters such as travel time or curve numbers. Feature objects are equivalent to GIS vector data, therefore, importing from GIS databases is one important way to create coverages in WMS. Another important method for creating feature object coverages is to digitize directly from the screen, using a georeferenced image in the background as a guide. In this exercise you will experiment with both methods, with the main focus being the use of the various tools and assigning attributes.

# 3    Objectives

In this exercise you will learn the basics for creating and importing feature objects and managing different coverages. This includes the following:

1. Creating and editing feature objects

2. Defining feature object attributes

3. Creating coverages and specifying attribute sets

4. Using shapefiles

5. Using images to create feature objects

6. Managing multiple coverages

# 4    Creating and Editing Feature Objects

The Terrain Data, Drainage, and Map modules are where the feature objects are created and manipulated. All feature objects are made from a set of points and the lines connecting the points. There are three main types of feature objects: points, arcs, and polygons. The following steps will teach you how to create and edit the different types of feature objects.

1. Close all instances of WMS

2. Open WMS

3. Switch to the *Map* module

4. Select *File | Open*

5. Locate the *feature* folder in your tutorial files. If you have used default installation settings in WMS, the tutorial files will be located in *\My documents\WMS 9.0\Tutorials\.*

6. Open *"FeatureObjects.jpg"*

This is just a picture of feature objects that you will use to trace and create feature objects. Do not be confused that it already "looks" like the feature objects are created.

## 4.1    Creating Feature Arcs

1. Find the portion of the image labeled Vertices, Nodes, and Arcs

2. Choose the *Create Feature Arc* tool

3. Single-click on the image near the point labeled 1

4. Double-click on the image near point 2 to end the arc

While you are creating a feature arc, you can press Esc to cancel, Backspace to back up one vertex, Enter or single-click to make a vertex, and double-click to end the arc. When WMS creates an arc, each end is a node and all points in the middle are vertices.

5. Single-click at point 3, directly on top of the arc you just made

6. Double-click at point 4 to end the arc

Notice how WMS automatically links the new arc to the existing arc and creates a node at the point of intersection.

7. Single-click at point 5

8. Double-click at point 6

## 4.2    Inserting Vertices and Snapping Arcs

Oftentimes you will have two arcs very close to each other that should share a common node, but do not. WMS has an option to snap these nodes together.

1. Choose the *Create Feature Vertex* tool

2. Single-click on the arc where it is labeled 7

A vertex is inserted here just as if you had clicked here when creating the arc originally. You must create a vertex at this location so that the arc can be "snapped" to this location.

3. Choose the *Select Feature Point/Node* tool

4. Right-click on the node labeled 5 and select ***Clean*** on the pop-up menu.

5. Make sure the *Snap selected nodes* option is checked

6. Select *OK*

At the bottom of the WMS screen, you will notice the help script is prompting you to select a snapping point.

7. Select the vertex you just created (labeled 7).

WMS snaps the two arcs together and changes the vertex at point 7 to a node.

## 4.3    Deleting a Portion of an Arc

Now that the main arc you created has two nodes along its length, you can delete the center portion only.

1. Choose the *Select Feature Arc* tool

2. Select the portion of the arc between nodes 3 and 7

3. Press the DELETE key, or right click and select 'Delete', to delete the arc

4. Select *OK*

You can also create arcs between two existing nodes. Practice this by reforming the arc that you just deleted.

5. Choose the *Create Feature Arc* tool

6. Click on the node labeled 3

7. Click on the node labeled 7 to re-form the arc

## 4.4    Converting Vertices to Nodes

WMS uses vertices and nodes for different purposes. For example nodes can have attributes while vertices simply define the shape or position of the arc. Sometimes you will need to change a vertex to a node or a node to a vertex.

1. Choose the *Create Feature Vertex* tool

2. Click on the arc somewhere between nodes 3 and 7

3. Choose the *Select Feature Vertex* tool

4. Right-click on the vertex you just made and select *Vertex <-> Node* on the pop-up menu.

You should now see a red node at this location. You have effectively broken the arc in half. You have also made it possible to define attributes (e.g. a drainage outlet) at this location.

## 4.5    Converting Nodes to Vertices

Just as you can change vertices to nodes, you can change nodes to vertices. It is not necessary in most cases to do this, but can leave you with a "cleaner" representation of your feature arcs. For example you now have to manage and assign attributes to one arc instead of two because converting a vertex to a node merges two arcs together.

1. Choose the *Select Feature Point/Node* tool

2. Right-click on the node you just converted and select *Node <-> Vertex* on the pop-up menu.

You can see that the node has been changed back to a vertex.

## 4.6    Building Polygons

Find the portion of the image labeled Polygons.

1. Choose the *Create Feature Arc* tool

2. Single-click at the point labeled 1 on polygon A

3. Single-click on points 2 through 10

4. Single-click on point 1 again to end

5. Trace polygon B in the same manner

You should now have two closed loops made out of the arcs just created. They are not polygons at this time – they are still just arcs.

6. Right-click on the *Drainage* coverage and select ***Build Polygon*** on the pop-up menu.

7. Select *OK* to use all the arcs

The two polygons should now be drawn with a thick line instead of the thinner arc lines. Polygons are built from their constituent arcs and it is during the build polygon function that the appropriate topology is established.

## 4.7    Assigning Attributes

Each of the nodes, arcs, and polygons you created were created with default properties or attributes. WMS allows you to change the attributes of feature objects.

1. Choose the *Select Feature Arc Tool*

2. While holding the SHIFT key down, select (multi-select) all 5 arc sections in the Vertices, Nodes, and Arcs portion of the image

3. Select ***Feature Objects | Attributes***

A dialog will come up allowing you to choose whether you want the arcs to have the Generic, Stream, Pipe, Lake, or Ridge attribute.

4.  Select the *Stream* option

5.  Select *OK*

The arcs should now be colored blue. Each arc portion should have a small blue arrow on it. These arrows show the way the stream you have created flows. The original direction you created the arc determines the way the stream flows now. Stream arcs should always be created from downstream to upstream. You should also be able to see that the lower node on the arc looks different now. WMS has automatically changed it to a drainage outlet instead of a generic node.

6.  Choose the *Select Feature Point/Node* tool

7.  Double-click on the lower node (now an outlet)

A dialog comes up showing that the node now has the Drainage outlet attribute. For any feature object (point, line, arc) you can select and then choose the Attributes command from the Feature Objects menu, or double-click to bring up the attributes dialog.

8.  Select *OK*

Just as you can change the attributes of arcs and nodes, you can change the attributes of polygons.

9.  Choose the *Select Feature Polygon* tool

10. Double-click anywhere inside Polygon A in the polygons portion of the image

11. Select the *Drainage boundary* type

12. Select *OK*

Polygon A should now be drawn in a thick colored line.

13. Double-click anywhere inside Polygon B

14. Select the *Lake/Reservoir* type

15. Select *OK*

Polygon B should now be drawn in light blue.

# 5    Using Shapefiles to Create Feature Objects

One of the most important features of WMS is the ability to automatically create feature objects using shapefiles.

1.  Select *File | New*

2.  Select *No* when asked if you want to save your changes

You will import shapefile data differently depending on whether the computer you are working on has ArcView installed on it or not. For this exercise, the two ways are basically equivalent. However, if you have ArcView installed, you have access to more data types and display options.

### 5.1    Importing a Shapefile and Mapping to Feature Objects

1.  Right-click on "GIS Layers" in the Project Explorer and select ***Add Shapefile data.***

2.  Open *"streams.shp"*

In order for the shapefile to work correctly, *streams.dbf* and *streams.shx* must be located in the same directory as *streams.shp*. This is true for all shapefiles.

3.  Choose the *Select Shapes* tool

4.  Draw a box around all the shapes to select them all

5.  Select ***Mapping | Shapes -> Feature Objects***

This is the GIS to Feature Objects Wizard. It is used to map shapefile data to feature objects in WMS.

6.  Choose *Next*

The spreadsheet that is presented shows each shapefile attribute in capitalized letters. In this file, you should see DRAINTYPE, LENGTH, SLOPE, etc. Underneath each attribute is a dropdown box containing the WMS attributes you can choose to map the shapefile attributes to.

7.  The DRAINTYPE attribute should be mapped to *Drainage Arc type*

8.  The LENGTH attribute should be mapped to *Stream length*

9.  The SLOPE attribute should be mapped to *Stream slope*

10. The DMANNINGS attribute should not be mapped (*Not mapped*)

This attribute cannot be mapped because there is not a corresponding WMS attribute available to map it to.

11. The BASINID attribute should be mapped to *Stream basin id*

You can scroll through the mapping spreadsheet to see the value that is assigned to each attribute for each shape.

12. Click *Next*

13. Click *Finish*

14. Toggle off the *streams.shp* shapefile in the Project Explorer to see result of mapping the shapefile to WMS feature objects.

You have now imported a shapefile containing streams and basins, converted all the shapes to WMS feature objects, and mapped data from the original shapefile to WMS attributes.

# 6    Creating Feature Objects Using Background Images

Another important feature of WMS is the ability to create feature objects using background images as guides. For instance, you may have a soil use map you want to read into WMS. The following procedure explains how this is done.
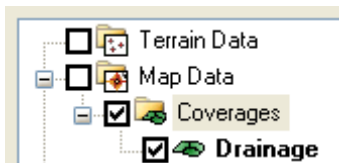
### 6.1    The Project Explorer

First, you will need to create a new coverage by utilizing the Project Explorer on the left hand side of the WMS main window.

The Project Explorer displays and allows users to manage the current coverages and data in WMS.

1.  Select *File | New* 🗋

2.  Select *No* if asked if you want to save your changes

In the Project Explorer, you should see a folder entitled Map Data. You should also see the default coverage listed (always a Drainage coverage when beginning a new project) in the Coverages folder. From the Project Explorer, you can manage the default coverage, make new coverages, delete coverages, edit coverage properties, and change the active coverage.



3.  Right-click on the existing coverage in the Project Explorer, named *Drainage*

4.  Select *Rename*

5.  Enter *PracticeDrainage* for the new coverage name

6.  Right-click on the Coverages folder

7.  Select *New Coverage*

8.  From the Coverage type dropdown box, select *Soil Type*

9.  Notice that the coverage name is automatically changed to *Soil Type*

10. Select *OK*

11. Click on the *PracticeDrainage* coverage

You can see that this coverage shows up in color and bold, while the Soil Type drainage is in gray and regular font. This means that the *PracticeDrainage* coverage is the active coverage.

12. Select the *Soil Type* coverage to make it active

13. Uncheck the box next to the *PracticeDrainage* coverage

14. Now the *PracticeDrainage* coverage is not visible. Turn this coverage back on to make it visible again.

### 6.2    Reading in Images

Now that you have added a soil type coverage, you can read in the soils image.

Select *File | Open* 📂

Open *"soils.img"*

### 6.3    Manually Digitizing Feature Objects

1.  Choose the *Create Feature Arc tool* 🖊

2.  Make sure that the *Soil Type* coverage is selected

3.  Starting anywhere on the border of the large orange area, outline the entire region, labeled D, with an arc

You can be as accurate as you like. If you wish, you can even zoom in to get a closer view of the image. You will have to end the arc by double-clicking in order to be able to select any other tools, such as zoom, pan, or show all. Once you have zoomed to the location you want, you can just pick up where you left off. Remember that when you click near an existing vertex or arc, WMS will automatically snap the new arc to the existing one.

4.  Outline all the other soil type polygons similarly, without creating arcs on top of previously defined borders

NOTE: When outlining the other regions, simply start somewhere on the previously created arc and proceed around a border without re-drawing where another border has already been defined by arcs.

5.  Right-click on the *Soil Type* coverage and select **Build Polygon**

6.  Select *OK* to use all the arcs

Check to make sure that each soil use polygon is completely outlined. If one or more polygons do not build correctly, check to be sure that the arcs surrounding the polygons are completely closed.

## 6.4    Assigning Feature Polygon Attributes

Now that you have created the soil use polygons, you will need to assign the soil use attributes to the correct polygons.

1.  Choose the *Select Feature Polygon* tool 

2.  Double-click on the yellow polygon labeled B

The Soil type mapping dialog should come up automatically. Just as in the first part of the exercise, double-clicking on a feature object brings up a dialog allowing you to select or edit its attributes. Since you are now using a *Soil Type* coverage, the automatic attribute for a polygon is Soil Type.

3.  Choose the *Add soil ID to list* button

4.  Choose this button three more times, so that there are four soil types in the list box

We will now assign soil types to the WMS Soil IDs.

5.  Under Soil type properties, notice the drop-down buttons used to assign relationships to the Soil IDs

6.  Soil ID 1 should be assigned to Soil *Type A*

7.  Soil ID 2 should be assigned to Soil *Type B*

8.  Soil ID 3 should be assigned to Soil *Type C*

9.  Soil ID 4 should be assigned to Soil *Type D*

10. Since the polygon we clicked on originally is Type B, select *Soil ID 2* from the WMS soil ID list and choose the *Apply* button

11. Double-click on the polygon labeled A

12. Select *Soil ID 1* from the WMS soil ID list and choose *Apply*

13. Similarly, assign Soil ID 3 to all the polygons labeled C and Soil ID 4 to all the polygons labeled D

14. Make sure each polygon has the proper Soil ID assigned by double-clicking on each and checking the soil type in the Selected Soil Properties box

# 7      More Feature Objects from Images

WMS handles land use images the same as it does soil type images. You will now read in a land use image, digitize polygons, and assign land uses. You need the land use image (and the resulting land use polygons) to be on its own coverage, so you will need to create a land use coverage.

1. Right-click on the Coverages folder in the Project Explorer

2. Select *New Coverage*

3. From the Coverage type dropdown box, select *Land Use*

4. Select *OK*

Usually you would open the land use image and digitize the land use polygons yourself. Here, you will open a completed file. To use the completed file, complete the following steps:

5. Select *File | Open*

6. Open *"luse.map"*

If you were digitizing the image yourself, you would complete the following steps:

1. Select *Images | Import*

2. Open *"luse.img"*

As outlined in Parts 6.3 and 6.4, you would trace all the land use polygons with arc segments (while in the Map module), build polygons, and then map the land use IDs to the correct polygons.

# 8      Display Options

WMS has many display options to help you tailor the look of your project to your needs. You can change options such as polygon colors, presence of nodes and vertices, and legends using the *Display Options* command.

1. Right-click on the *Soil Type* coverage and select *Display Options* on the pop-up menu.

2. On the *Map* tab, check the *Color Fill Polygons* box

3. Uncheck the *Points/Nodes* and *Vertices* boxes

4. Choose the *Soil Type Display Options* button at the bottom of the spreadsheet

5. Select the first Soil ID listed in the list box and click on the color square to the right

6. Choose a new color from the color palette

7. Change the colors of the other soil groups uses if you desire

8. Select *OK*

9. Check the *Soil Type Legend* box

10. Select *OK* once again to exit the Display Options dialog

You can continue to explore the display options if you wish. If you wanted to assign new colors to the land uses, you would need to make the land use coverage active before going back into the Display Options dialog or switch to Land Use in the coverage type combobox

## 8.1    Managing Coverages

Using the Project Explorer, you can choose to hide and/or show coverages and designate which coverage is the active coverage

1. From the Project Explorer, toggle off the check boxes for the *PracticeDrainage* and the *Soil Type* coverages

2. Click on the land use coverage so it will be active

Now only the land use coverage will be visible on the screen. The other coverages still exist; they simply will not show on the screen until you turn their visibility back on.


# 9    Conclusion

In this exercise you should have learned the basics for creating and importing feature objects and managing different coverages. Both these concepts are central to your understanding of WMS. You should now be able to:

1. Create and edit feature objects

2. Set feature object attributes

3. Create coverages and specify coverage attribute sets

4. Import shapefiles

5. Use images to create feature objects

6. Manage multiple coverages

7. Import and edit feature objects from DXF data