



Symbology in ArcMap

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Introduction

This document is one in a series of GIS reference documents compiled by the Connecticut Department of Environmental Protection to help users better understand the ArcGIS line of GIS software products available from the Environmental Systems Research Institute (ESRI), Inc.

This document describes how to apply symbology in ArcMap 9.2. There are many ways to symbolize your spatial data: from a simple line for all features to symbols for multiple attributes. In this workshop, the following types of symbology will be covered:

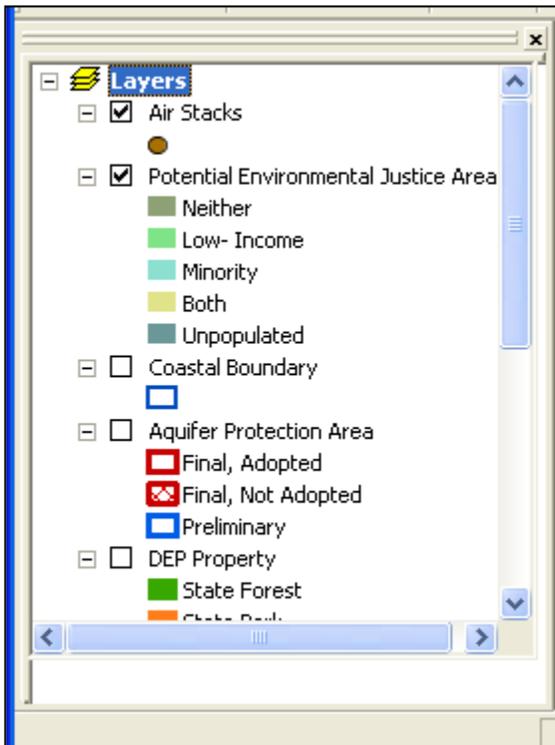
Features (single symbol); Categories (unique values and unique values with many fields); Quantities (graduated colors and symbols; and Multiple Attributes (quantity by category).

Visit the [Course Listing](#) on InSite to view other GIS reference documents.



Displaying Symbols in the Table of Contents

When you add a feature class or shapefile to your project, it will generally appear with its legend displayed.



You can view the legend or hide the legend by expanding or collapsing the layer. The example to the left has legend symbols displayed.

By clicking on the minus sign, you can collapse a legend so that it does not show in your Table of Contents. This might be preferable in order to view more of your layers at one time. See the illustration below.



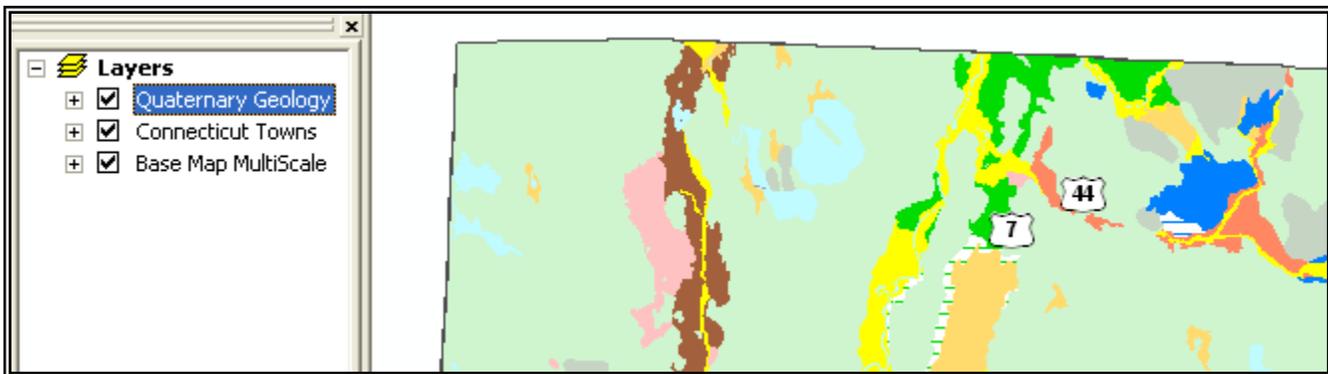
Tip: To collapse or expand all of the layers at once, hold down the Ctrl key while clicking on any layer's plus or minus sign.



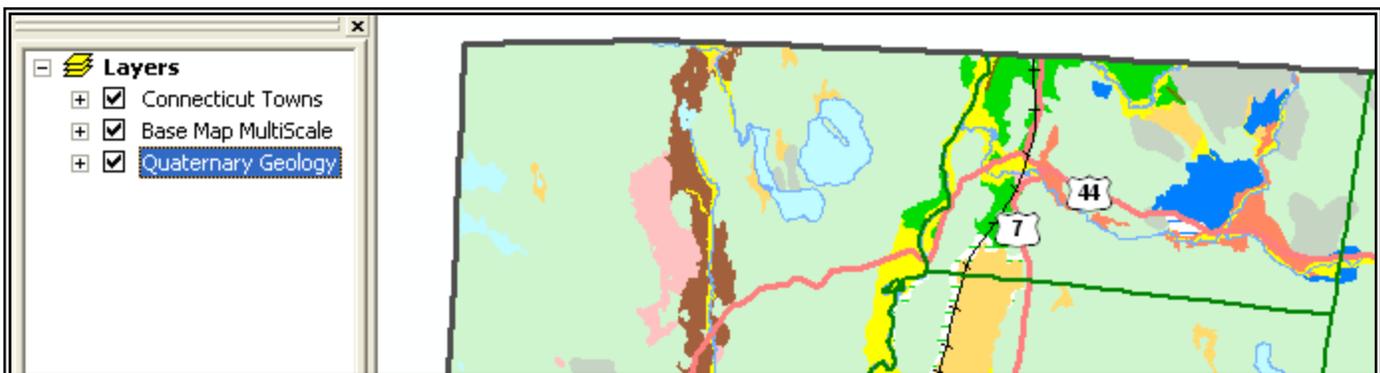
Layer Drawing Order and Symbology

If you click on the Display tab beneath your Table of Contents, you will see the order of your layers. Ordering your layers is important because the bottom layer draws first, the next layer draws on top of that, and the next layer on top of the previous one. This means that, if you have three polygon feature classes at the bottom of your Table of Contents, they all cover the same area, and they are all set to solid fill types, you will be able to view only the layer that is third from the bottom (or above the other two layers).

This example shows Quaternary Geology situated on top of Connecticut Towns and other base map data. Therefore, these two layers cannot be seen since Quaternary Geology is a solid fill polygon.



If you reverse the order, town lines and other base map data will now be visible since they are drawn on top of Quaternary Geology.

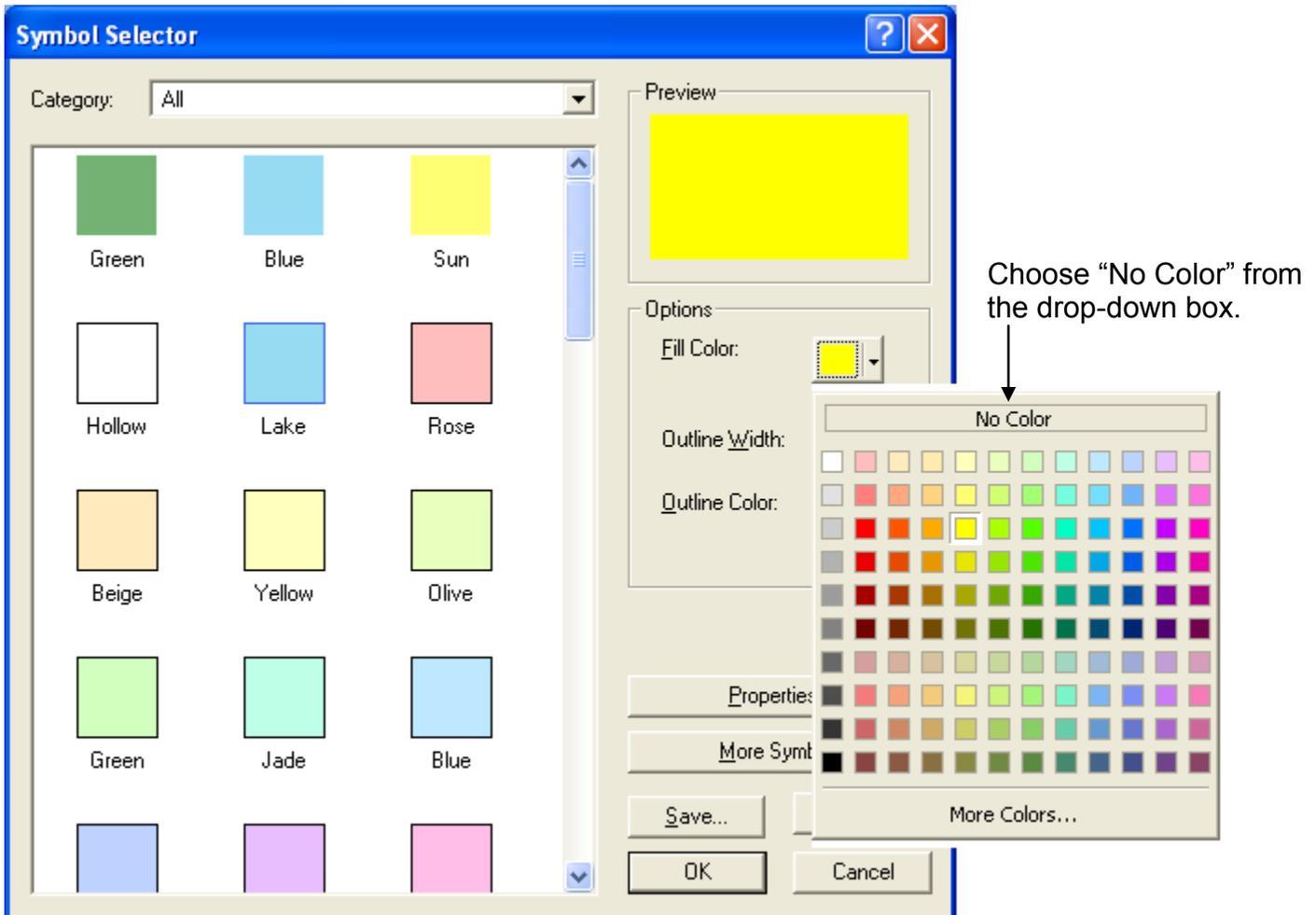


Tip: If one of your layers fails to display, check that it is not beneath another solid filled polygon layer.



Fill Color vs. Transparency

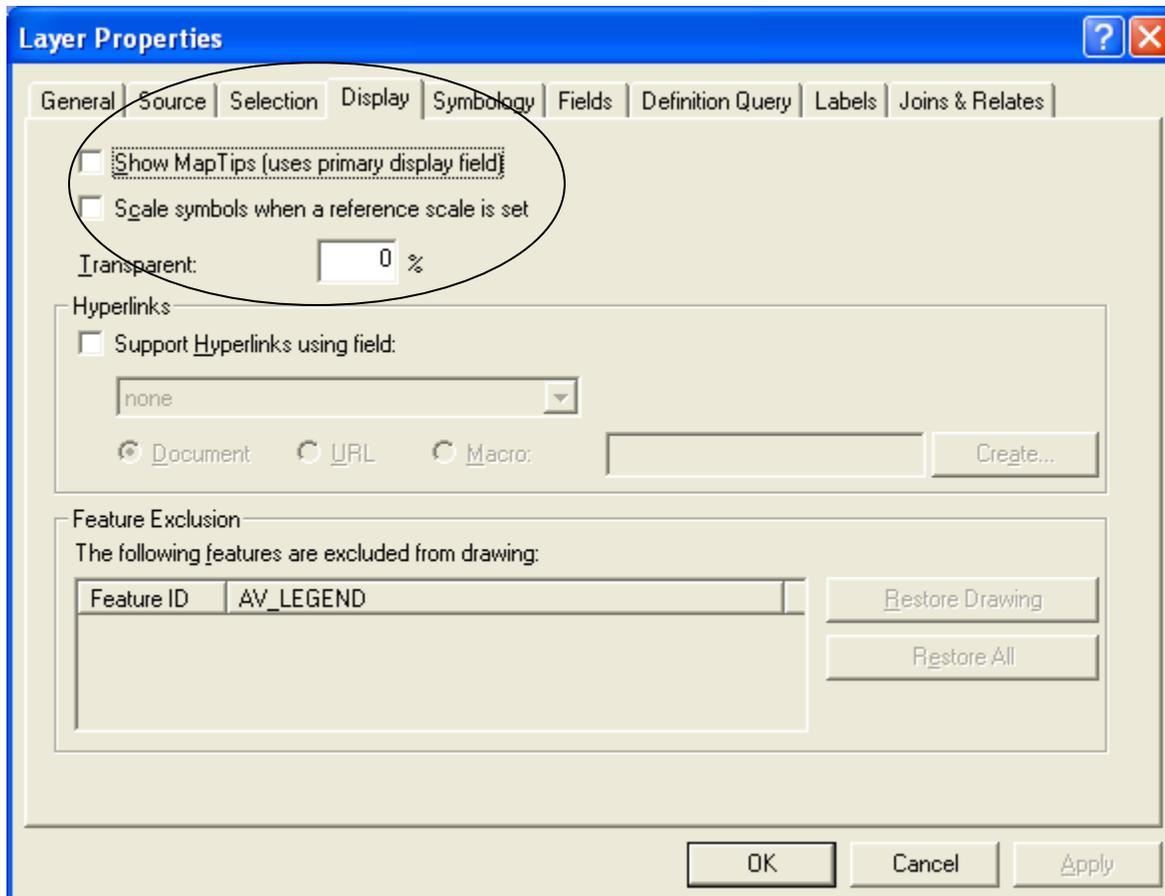
If you have a polygon layer that has solid fill and you need to be able to see “through” it, you have two options. The first is to symbolize it so that there is **no fill color** in the symbol properties dialog box.



This option will remove any fill and display your polygon feature class with only an outline.



The second option you have for “seeing through” your feature class is to make your layer all or partly transparent. Right click on the layer and choose Properties. Then choose Display. Type in a percentage of how much transparency you would like. You may have to experiment with different percentages to arrive at the one you need.



Quaternary Geology set at 80% transparency over the 2004 Orthophotography.

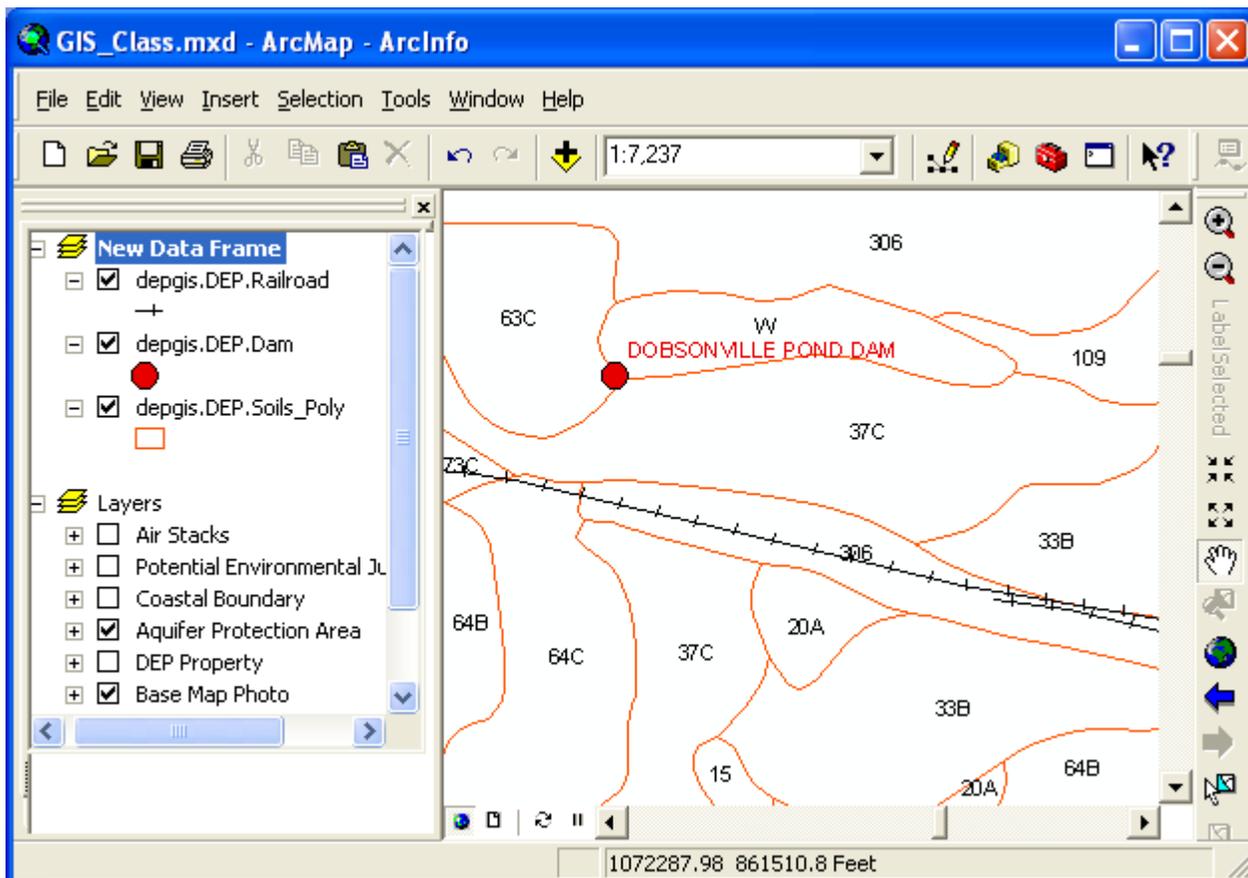




Types of Symbology

Features (Single Symbol)

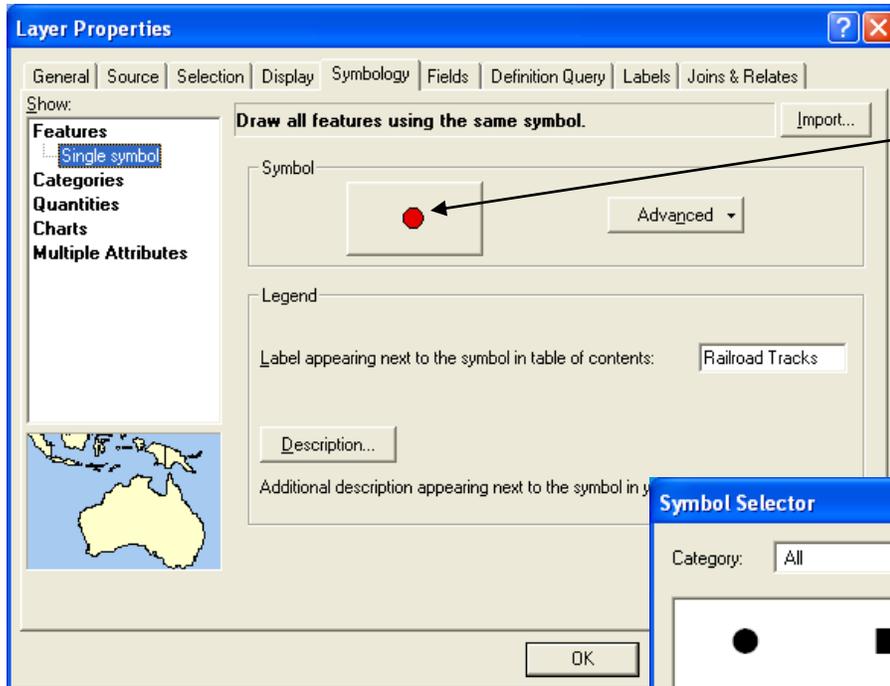
This is the simplest method of symbolizing your data. It is used when there is no need to distinguish between categories within an attribute field. For example, soils (polygons), railroads (lines), and dam locations (points) are typically displayed using a single symbol. This means that every feature in that dataset uses the same symbol.



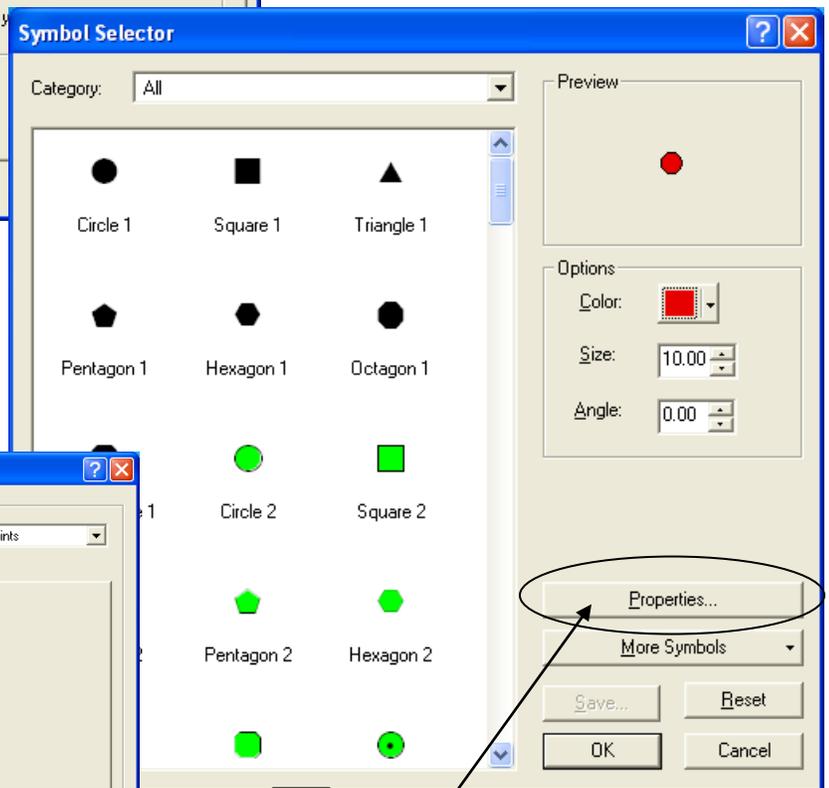
To create or modify your symbol for a feature class when only one symbol is used, go to the feature class's Properties (right click on the data layer and choose "Properties").



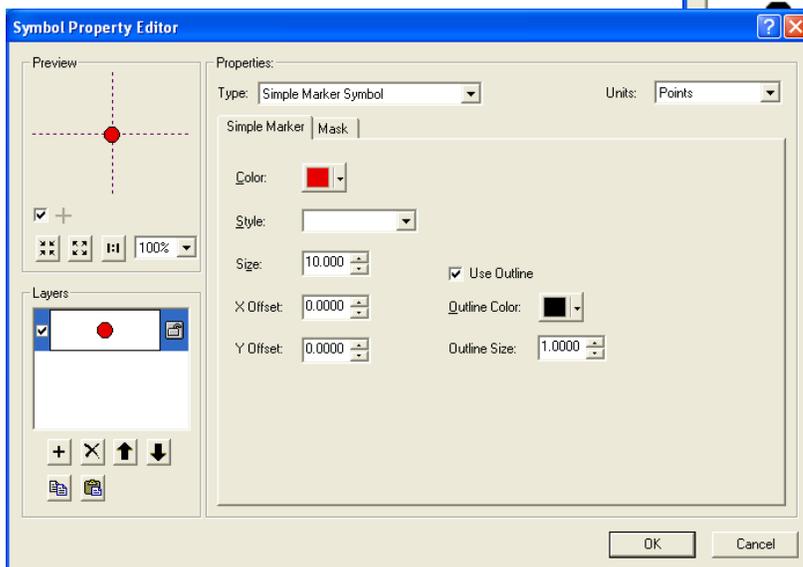
The following dialog box is displayed:



Now click directly on the symbol to customize its properties.



Clicking on the Properties button will give you more options for customizing your symbol.

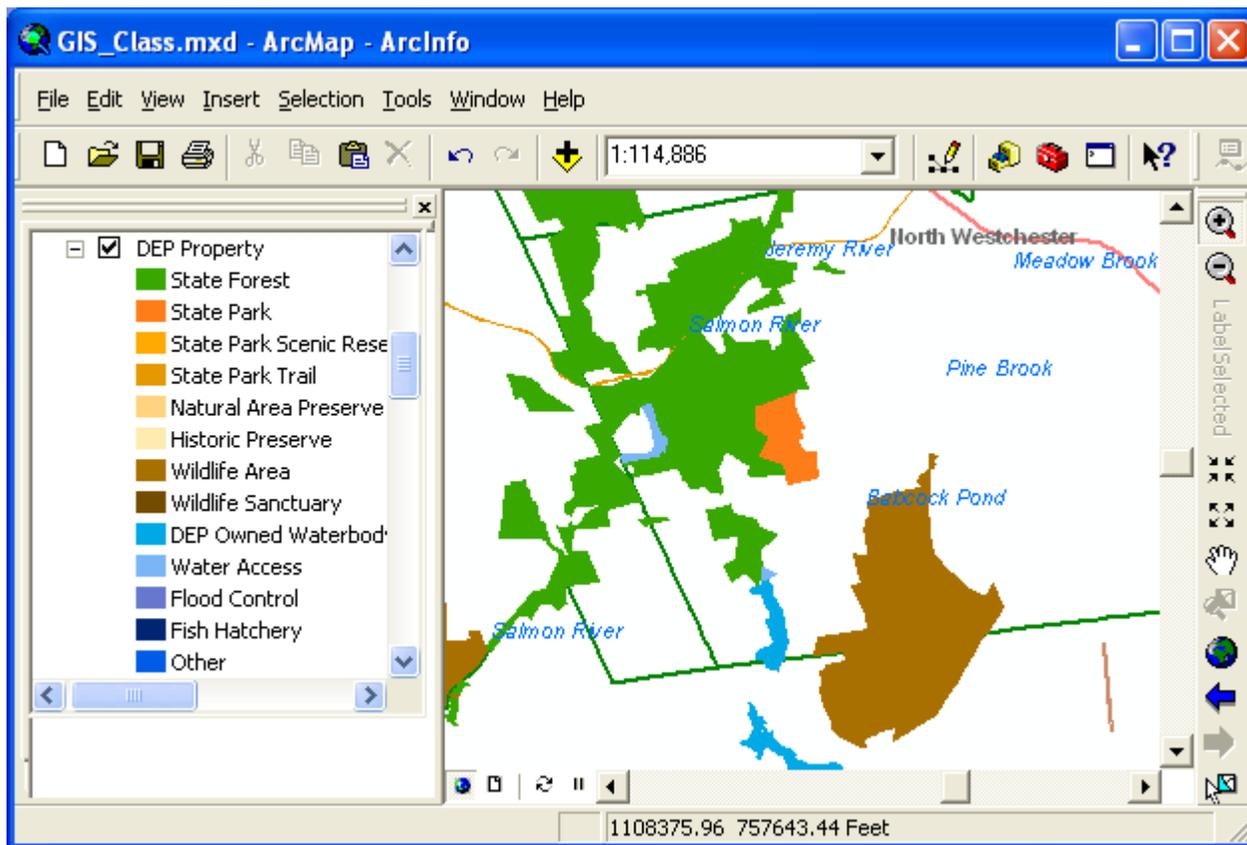




Categories

Unique Values

This method of symbolizing is appropriate when you would like to group features based on an attribute in your table. For example, the DEP Property feature class contains a field called AV_LEGEND. This is a user defined field in which DEP Property types are identified. If we symbolize based on this field in the DEP Property feature class, the result might look like this:



Each DEP Facility is now individually identified based on its type in the AV_LEGEND field.

Tip: You can also combine categories so that you have less symbols in your display. In the symbology dialog box, highlight the categories you would like to combine, right click on one of them, and choose “Group Values”. Using the above DEP Property example, you might want to combine State Park, State Park Scenic Reserve, and State Park Trail into one category. Your resulting symbology might look like the illustration on the right.





Unique Values, Many Fields

You may have a need to combine symbols to display more than one field. In the example below, Aquifer Protection areas are symbolized on the AV_Legend field which classifies the area as “final” or “preliminary”. It is also symbolized on the ADOPTED field which classifies the area’s classification as “adopted” or “not adopted”. The resulting symbology is easy to read and displays more information.

The screenshot shows the ArcMap interface with a map of Aquifer Protection Areas. The Layer Properties dialog box is open, showing the Symbology tab. The 'Draw categories using unique values combining up to 3 fields' option is selected. The 'Value Fields' are set to AV_LEGEND and ADOPTED. The 'Multiple Attributes' table shows the resulting symbology for combinations of values.

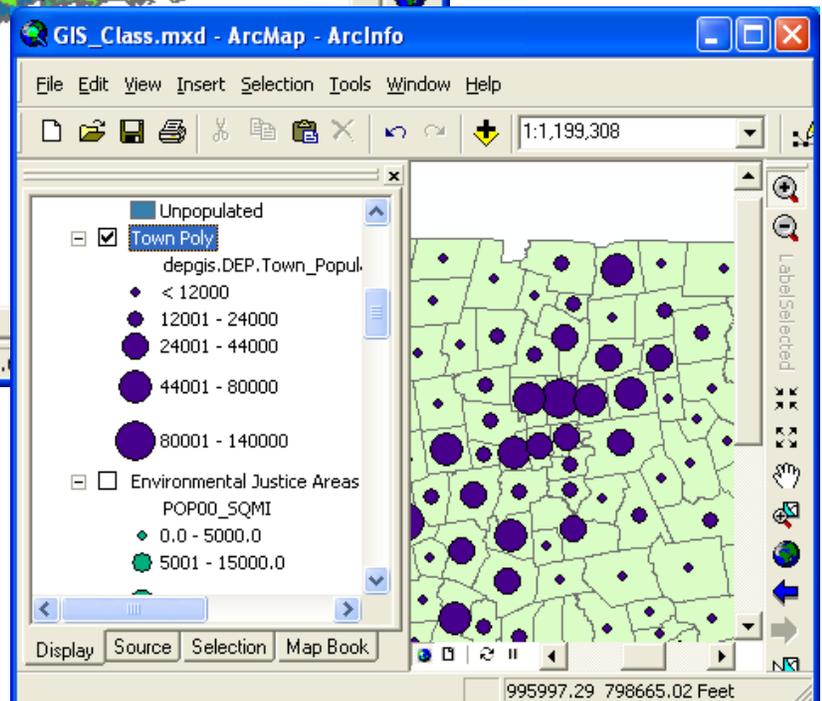
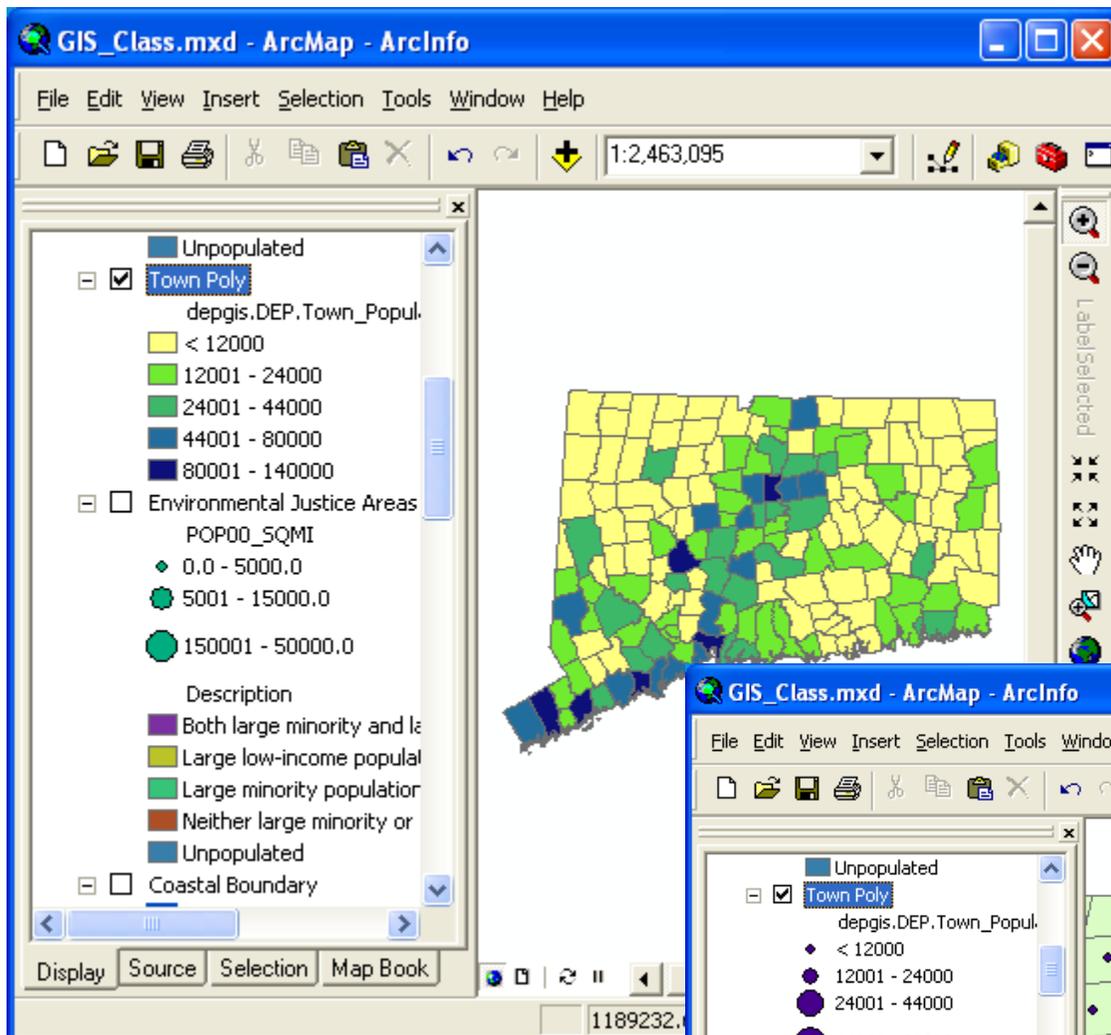
Symbol	Value	Label	Count
[White box]	<all other values>	<all other values>	
[Red box]	Final, Yes	Final, Adopted	?
[Red box with cross-hatch]	Final, No	Final, Not Adopted	?
[Orange box]	Preliminary, NA	Preliminary	?



Quantities

Graduated Colors and Symbols

If you have quantities in your attribute table and would like to display these quantities in relationship to specific features, you can use graduated colors, graduated symbols, proportional symbols, or dot density. In the example below, the colors of each of the towns in Connecticut depends upon their population. Therefore, this symbology style is “graduated color”. There are five categories, depicting ranges of population. The designated ranges can be automatically determined by ArcMap or can be determined manually by the user.

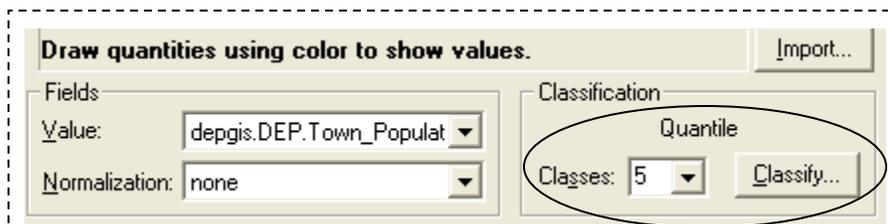


The example to the right uses graduated symbols (points) rather than colors.

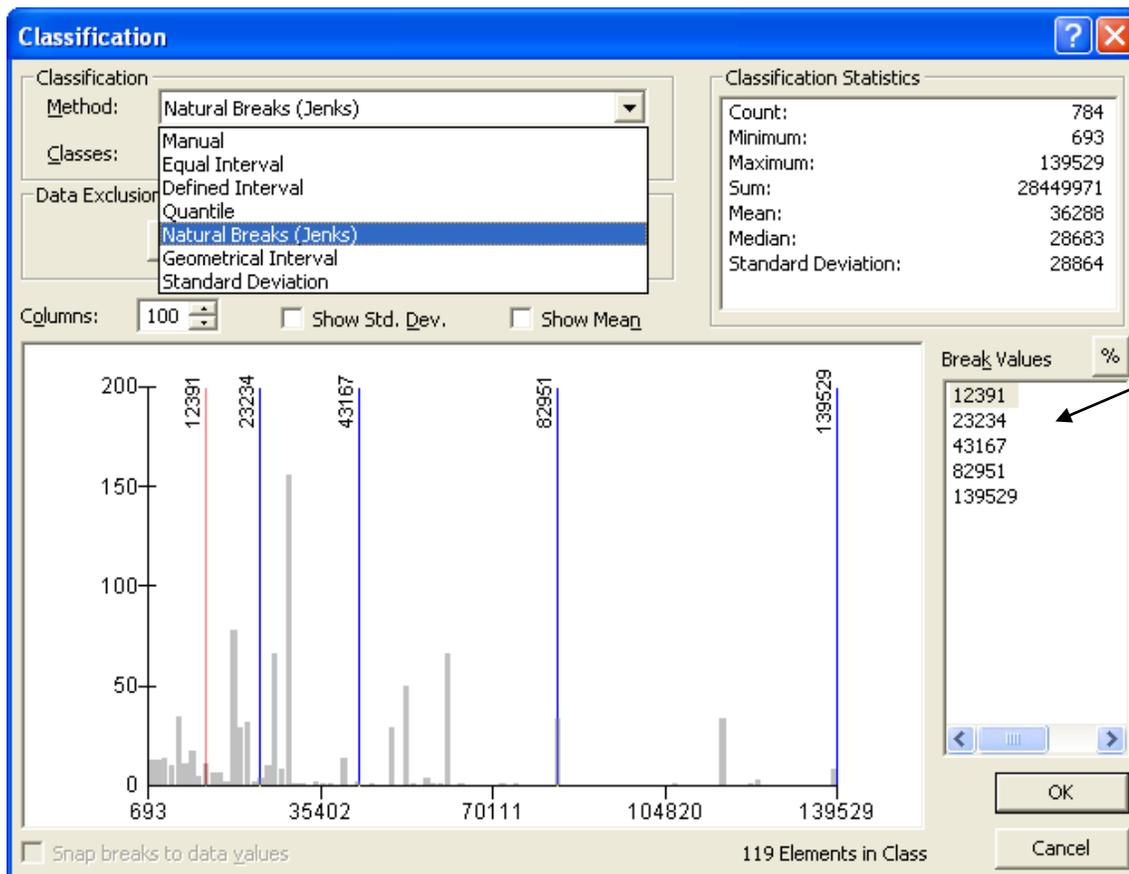


To symbolize with graduated colors or symbols, open the Symbology dialog box, choose the field value that you would like to symbolize on, and then choose the normalization method and the classification method. The normalization method would generally be set at “none” unless you need “percent of total” values for each classification.

Once you have chosen your normalization method, choose the number of breaks you would like in your legend, and then click on “Classify”.



In this dialog box, you choose the method or classifying your data. The default is “natural breaks”. You have a choice of other methods, but the only other one you might use most often is the “manual method”. Here you can manually set your breaks to further customize your symbology.



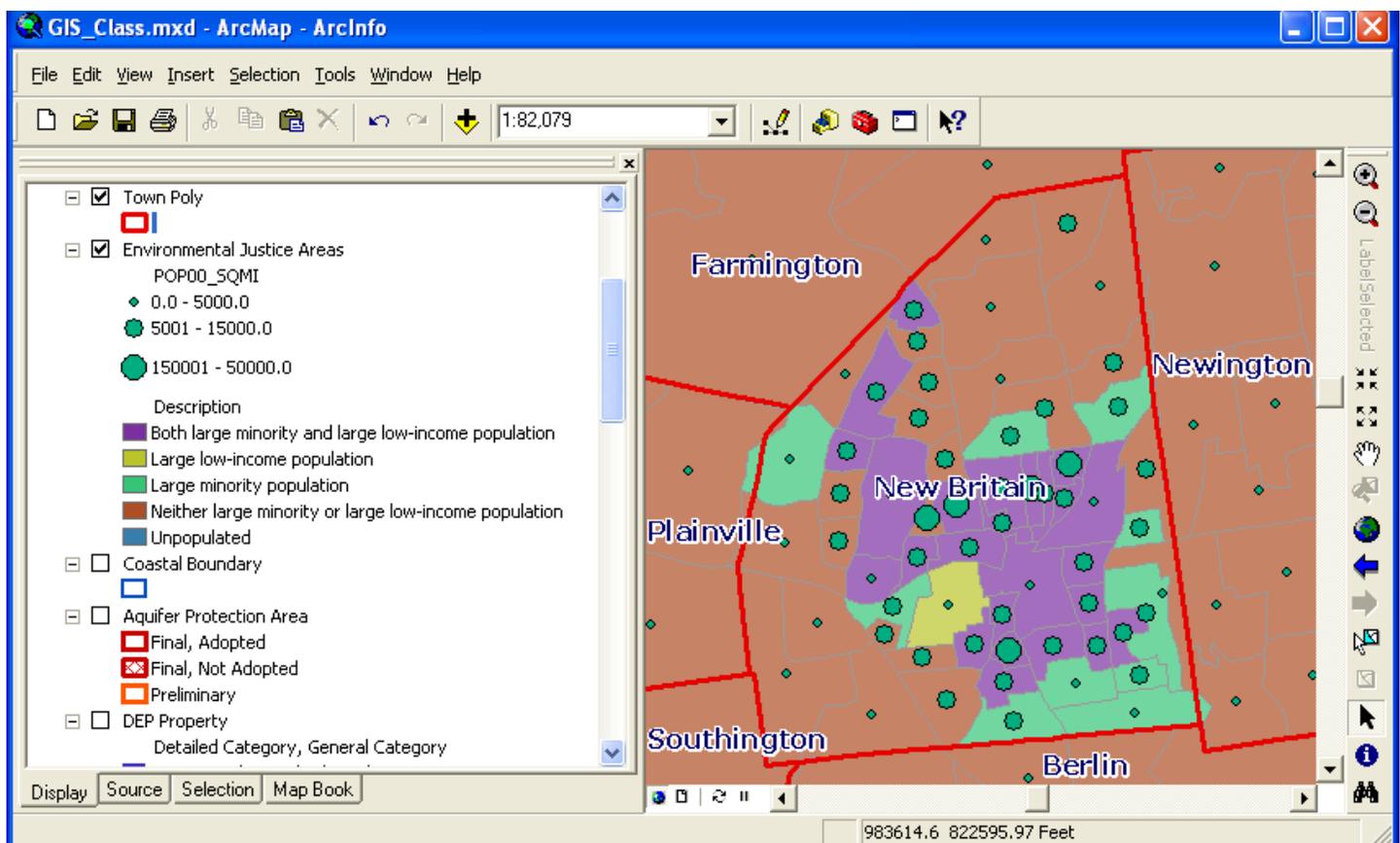
Tip: To edit your labels so that the numbers are displayed as rounded to the nearest thousand, click on each Break Value and revise it.



Multiple Attributes

Quantity By Category

Sometimes it may be necessary to symbolize on two or more fields, *with each field symbolized differently*. For example, you might want to see if there is a correlation between environmental justice designations and population. You would symbolize the Description field in differing colors, and the Population per Square Mile field in graduated symbols, in this case, points. Your map may look like the following:



By comparing the point sizes to the colors, you can more easily visualize a possible relationship between these two attributes.

To use this method of symbolizing, choose “Multiple Attributes – Quantity by category” from the Symbology menu. Choose your two or three fields and then symbolize each one by your preferred method.



Layer Properties [?] [X]

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates

Show: Features, Categories, Quantities, Charts, Multiple Attributes

Draw quantities for each category. [Import...]

Value Fields: EJDESC, none, none

Color Scheme: [Color Ramp]

Variation by: Color Ramp..., **Symbol Size...**

Symbol	Value	Label	Count
[White]	< all other values >	< all other values >	
<Heading> Description			
[Purple]	Both large minority and large	Both large minority and large ?	
[Yellow]	Large low-income populatio	Large low-income populatio ?	
[Green]	Large minority population	Large minority population ?	
[Orange]	Neither large minority or larg	Neither large minority or larg ?	
[Blue]	Unpopulated	Unpopulated	

Add All Values | Add Values... | Remove | Remove All | Advanced ▾

Draw quantities using symbol size to show relative values. [?] [X]

Fields: Value: POP00_SQMI, Normalization: none

Classification: Manual, Classes: 3, [Classify...]

Symbol Size from: 4 to: 12

Symbol	Range	Label
[Small Green Circle]	0.0 - 5000.0	0.0 - 5000.0
[Medium Green Circle]	5000.1 - 15000.0	5001 - 15000.0
[Large Green Circle]	15000.1 - 50000.0	150001 - 50000.0

Show class ranges using feature values

Template: [Green Circle], Background: [Purple]

[OK] [Cancel]

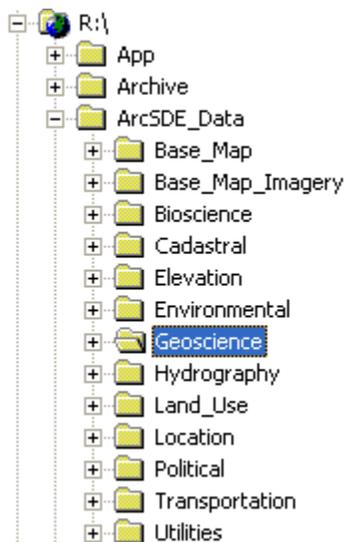


Examples of DEP Layer Symbology

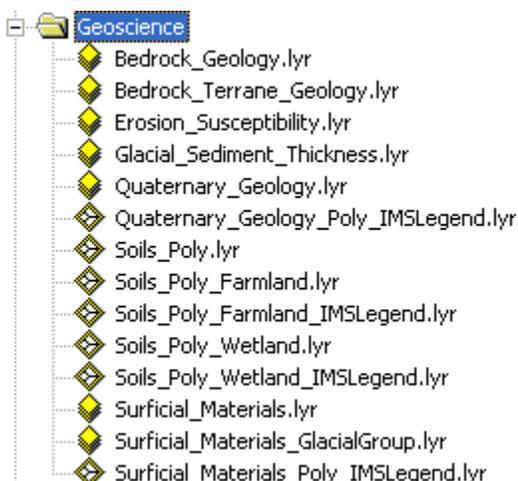
Location of DEP's Layer Files

DEP has a wealth of GIS data available to staff. To make it as easy as possible to view data in a logical and organized format, Layer files were created. Layer files have a .lyr file extension and are merely a set of instructions to ArcMap for symbolizing data, setting scale levels, and designating other attributes of feature classes and shapefiles.

If you navigate to the R:\ drive in ArcCatalog, you will see a folder entitled "ArcSDE_Data". In this folder are subfolders that represent categories of GIS data.



Within these subfolders are layer files.



In this example, the Geoscience subfolder contains layers related to geology, soils, and surficial materials.

Some of the layer files are group layers, depicted by this symbol:

Other layer files are single feature classes, depicted by either a point , line , or polygon symbol.

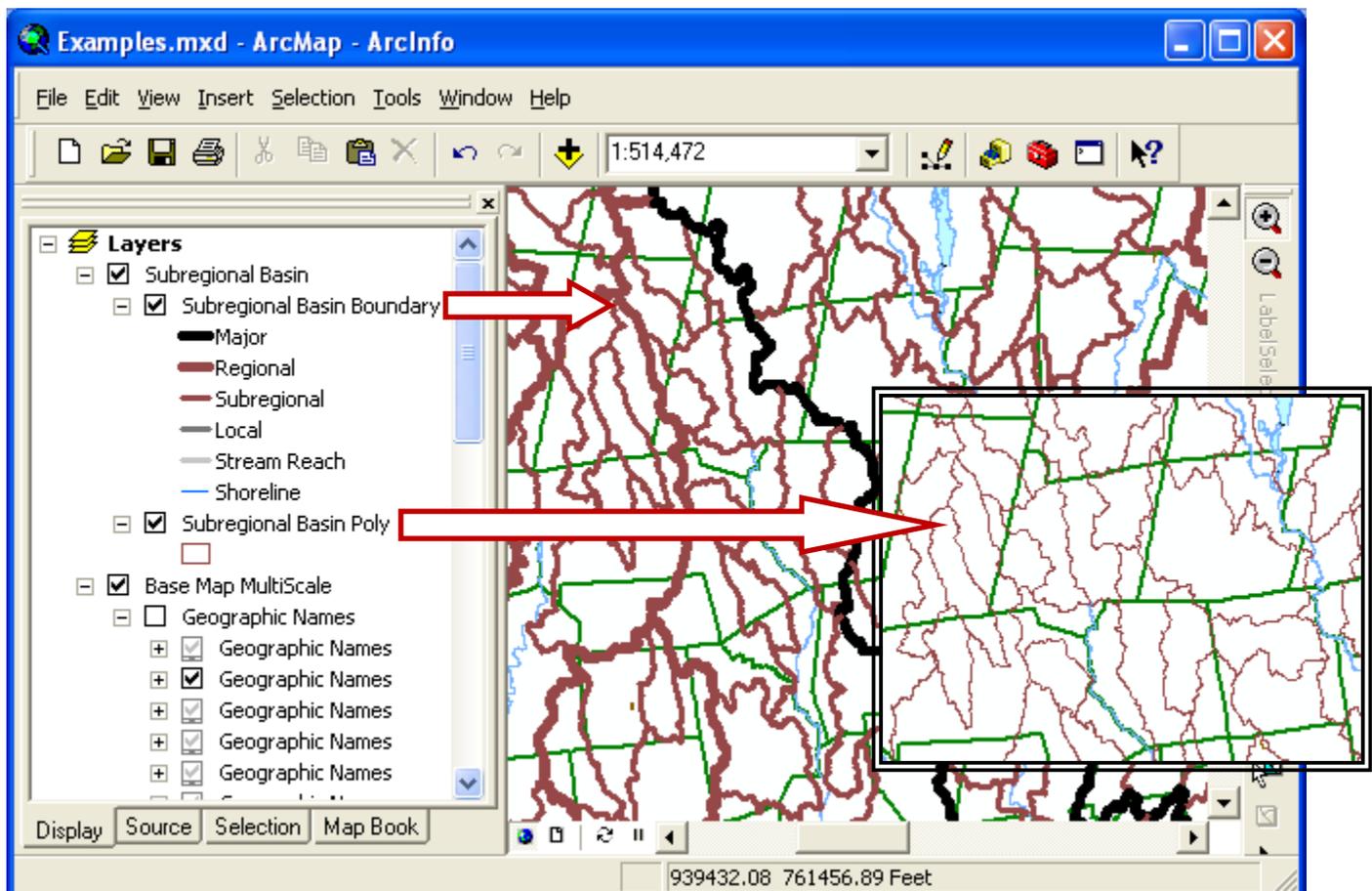
Raster data, such as the 2004 orthophotos, are shown with this symbol:



Example – Subregional Basins Basin_Subregional.lyr

The subregional basin layer is located within the Hydrography subfolder in the R:\ArcSDE_Data\ folder. If you add it to ArcMap and expand it, you will see that it contains two feature classes: the subregional basin boundary **line** feature class and the subregional basin **polygon** feature class. Each of these feature classes contains specific characteristics that were created at the time of creation of the layer file.

- The **symbology** in the line (boundary) feature class contains six types of lines, depending on their designation: major, regional, subregional, local, stream reach and shoreline. The polygon feature class contains a single symbol designated as a reddish brown thin line. If you turn off the boundary feature class, you would see only the polygon feature class, since the order of the two layers is also designated within the layer file.

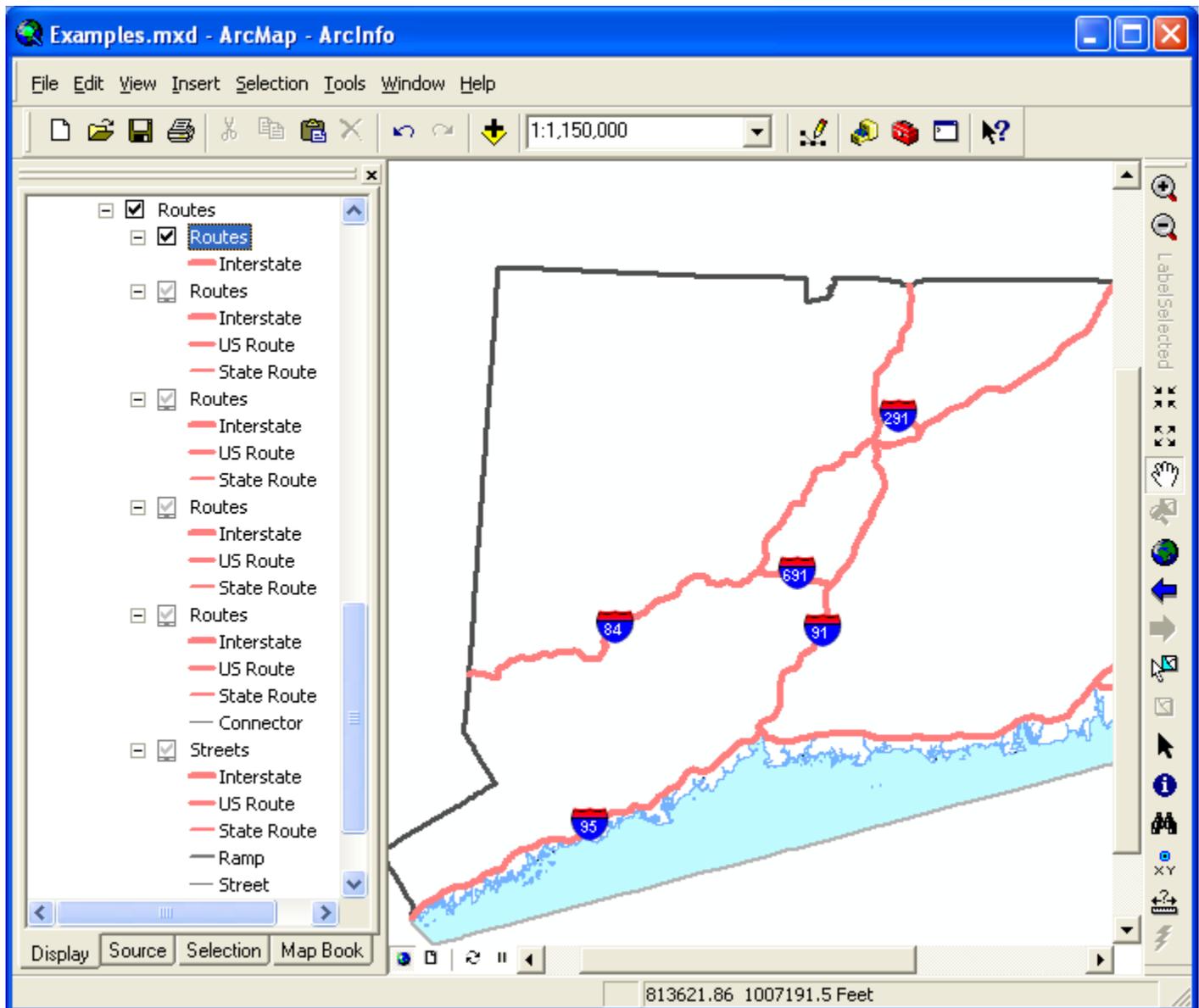


- Other characteristics of this layer file include the **scale threshold**. This layer is set to display at all scales. This means that whether you are viewing the extent of the entire state, or just a small corner of the town of Windsor, you will be able to view the subregional basin lines and polygons.



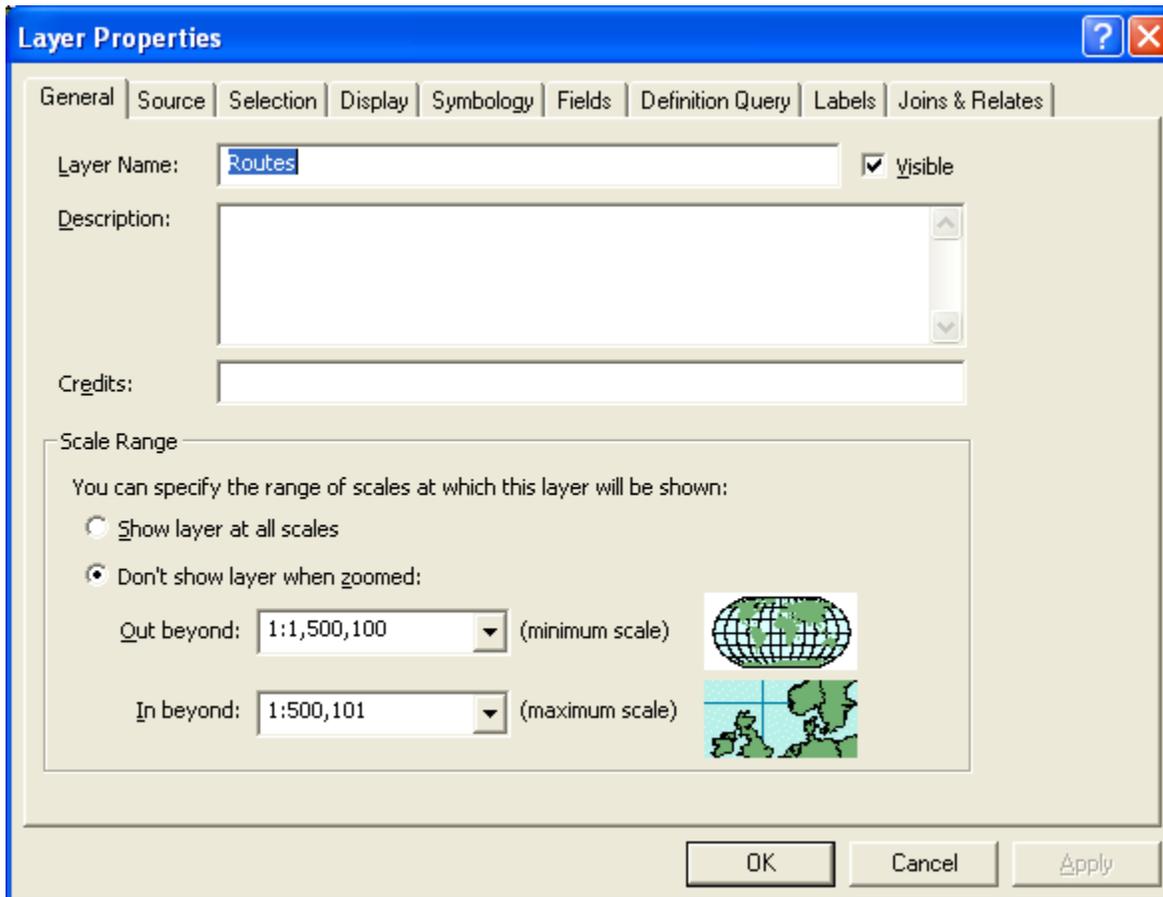
Example – Routes Routes.lyr

The Routes layer contains Interstates, State and US routes, highway connectors, highway ramps, and local streets. There are a total of five instances of the “routes” feature class, and one instance of the “streets” feature class. In this way, scale thresholds can be set for viewing differing levels of detail for routes and streets.





The first, or top level of the Routes layer, has a scale threshold set so that the layer will display between 1:500,101 scale and 1:1,500,100 scale. This is set in the Layer Properties dialog box:



At this scale, which includes the entire State of Connecticut, only major interstates are displayed, along with their labels, which are interstate shields.

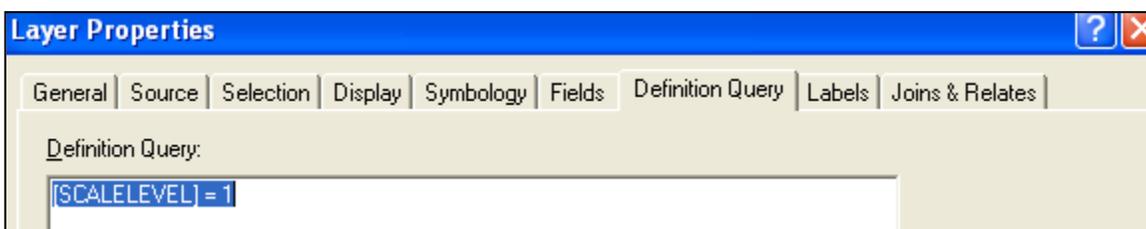


ROUTE	SCALELEVEL	ROUTECLASS
State Route 22	5	State Route
State Route 189	4	State Route
State Route 138	4	State Route
US Route 5	3	US Route
US Route 1A	4	US Route
US Route 202	3	US Route
US Route 1	3	US Route
US Route 7	2	US Route
US Route 6	3	US Route
US Route 44	3	US Route
Interstate 84	1	Interstate
Interstate 91	1	Interstate
Interstate 395	1	Interstate
Interstate 291	1	Interstate
Interstate 384	2	Interstate
Interstate 691	1	Interstate
Interstate 95	1	Interstate
Interstate 684	2	Interstate

To display only certain features at certain scales, there must be a field in the table that specifies the type of each road. In this table, there is a field entitled “ScaleLevel” that codes each type of road. Here, the scale level for State Routes is 5 or 4, depending on its significance, the scale level for US Routes is 4 or 3, depending on its significance, the scale level for interstates is 1 or 2, etc.

To display only certain types of routes, a Definition Query must be created that extracts only those codes for a specified scale level.

Open the Properties dialog box for the top instance of Routes. Click on the Definition Query tab. You will see that the Scale Level is set to a value of “1”. This means that only those roads with a Scale Level of “1” will be extracted from the total number of records and therefore, only those features will be displayed. Since the scale has already been set for this instance of Routes, we know that the features that have a Scale Level of 1 will only be displayed when the scale is between 1:500,101 and 1:1,500,100. In this way, we can restrict the display of certain data to specified scales.



Tip: The reason why “100” or “101” is added to the end of each scale is so that there is no question that the data will be displayed at that specified scale. ArcMap is sometimes not accurate in its display of exact scales.



Resetting Scale Thresholds

There may be a need at times to change the scale threshold within a layer. For example, if you would like to view local streets at a 1:36,000 scale rather than equal to or smaller than a 1:24000 scale, then you would need to revise that scale threshold.

Open the Properties dialog box for Streets. Click on the General tab and type in either a different scale in the “Out beyond” box or just click on “Show layer at all scales”.

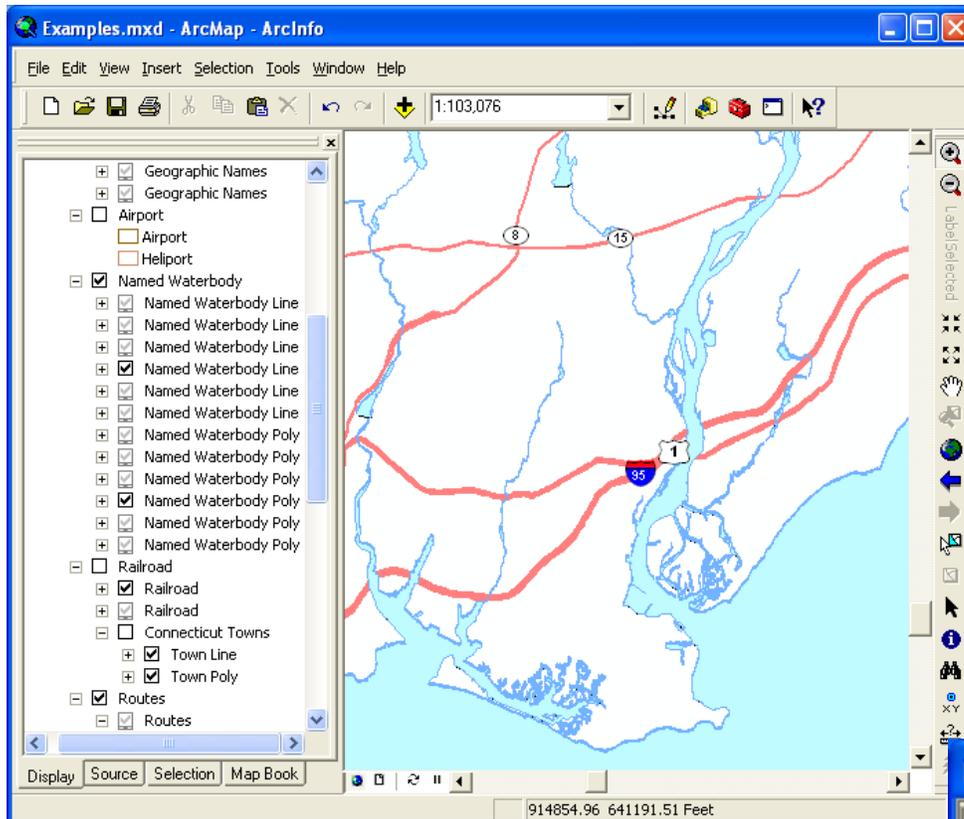
Tip: Be aware that if you set a layer to display at any scale, then it may take extra long to re-draw that layer at the larger extent. For example, setting Streets to draw at any scale and zooming to the full extent of the State will take very long to re-draw.

Turning layers on and off within a group can be done by clicking on the checkbox to the left of each layer. This might be necessary to temporarily suspend drawing of that feature class.



Example – Named Waterbody

Named_Waterbody.lyr



The Named Waterbody layer is similar to the Routes layer in terms of differing scale thresholds and repeating instances of the feature classes. However, where Routes contained only line features, Named Waterbody contains both lines and polygon features. In this respect it is more complex and requires even more repetitions of the Named Waterbody feature classes within the layer.

The tables in both the line and polygon feature classes contain a ScaleLevel field that codes each feature, similar to the Routes layer. A Definition Query was created for each feature class instance to extract out features depending on their scale level code. In this way, more detailed waterbodies and streams can be displayed as the scale becomes smaller.

NAMED_POLY	SCALELEVEL
Named Waterbody	3
Named Waterbody	6
Named Waterbody	4
Named Waterbody	6
Named Waterbody	5
Named Waterbody	3
Named Waterbody	1
Named Waterbody	5
Named Waterbody	6
Named Waterbody	3
Named Waterbody	3
Named Waterbody	3
Named Waterbody	5
Named Waterbody	4
Named Waterbody	2
Named Waterbody	6
Named Waterbody	5
Named Waterbody	2
Named Waterbody	1
Named Waterbody	2
Named Waterbody	3



Exporting a Layer File

If you need to change scale thresholds, symbols, or any other aspect of a layer file that was added to your project from R:\ArcSDE_Data\, you can make your changes and then export (save) a new layer file. Right click on the layer file name, then choose "Save As Layer File". You can then save your custom layer file to any folder for which you have write access. Every time you open your ArcMap project, that layer will display according to your saved layer file.

Summary

Symbology in ArcMap is a powerful tool for displaying your spatial data. It contains many features that allow you to create simple or complex maps that are cartographically pleasing. As you become more familiar with creating symbology, you will learn more about symbol sets and creating custom symbols. The creation of Layer (.lyr) files allows you to create and save logical views of your map data, consistent with the features in your tables.