Lab III   ENVR 4305 Fall 2019 (18 pts)   Name _____

Managing Map Layers

Part I: From the "Getting to Know ArcGIS" book provided in lab, work through the Chapter 4 **Exercise 4c**.

Part II: Go through the attached exercise "**Use layers to create optimal map displays**."

The data files for part I should be in the C drive under folder EsriPress/GTKarcGIS/

The data files for part II should be in the C drive under folder EsriTraining/ARC2/

Ask the TA or Instructor for help if you are confused at any time.

Each student should sign their own lab and turn it in at the end of lab.

# Exercise .1 Use layers to create optimal map displays

In this exercise, you will create a dynamic map of the state of Florida that supports display at multiple map scales. The visibility of layers and features in your map will be controlled using attribute queries and map scales. You will also organize layers into groups.

In this exercise, you will:

- Control layer and feature visibility.
- Organize layers into groups.

Figure

A dynamic map supports display at multiple map scales with increasing detail as you zoom in and decreasing detail as you zoom out.
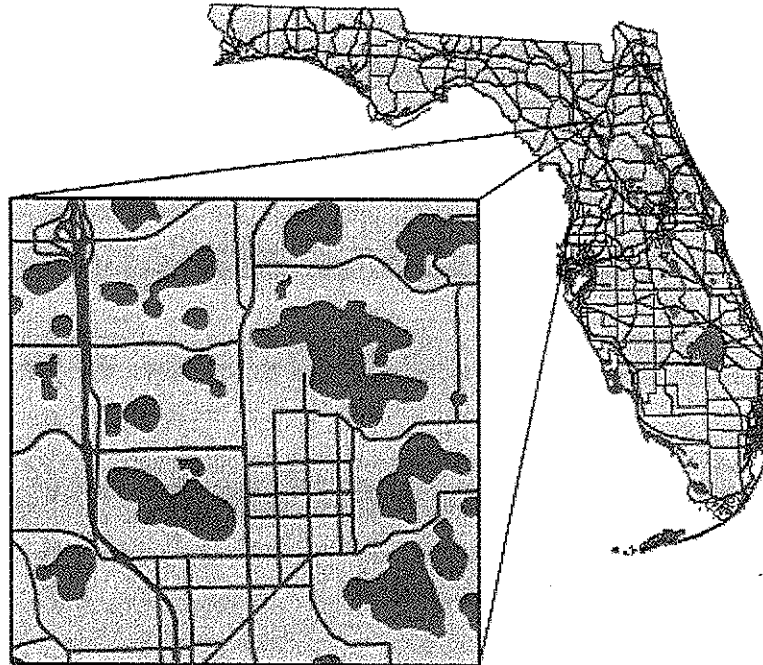
Step 1: Use map scales to explore level of detail

ArcGIS allows you to control the display of your map layers based on map scale. This capability allows you to create dynamic map displays that change the level of detail as you change your map scale. Determining the appropriate scale at which to display your data is based on the scale in which the data was created and also the symbology you choose to display your map.

In this step, you will open and explore a map of Florida.

a Start ArcMap.

b From the File menu, click Open.

c Browse to your ..\EsriTraining\ARC2\Managing_map_layers folder and open Florida.mxd.

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The map includes layers for counties, roads, and lakes. The Major Roads and Counties layers are turned on in the map. You will work with the roads first.

d On the Standard toolbar, from the Map Scale drop-down list choose 1:5,000,000.

e At this scale, examine the Major Roads layer and consider the following questions.

1. How could you find out the scale at which this data was meant to be used?

_____

f Right-click the Major Roads layer, point to Data, and then choose View Item Description.

2. According to the item description, what is the appropriate map scale for using this data?

_____

Most data will be useful within a range of scales. However, the scale at which the data was created is important because it often indicates the largest scale at which the data should be used. This is especially important when using your data for analysis.

(g) Close the item description.

(h) From the Bookmarks menu, choose Miami.

(i) If necessary, change the map scale to 1:24,000.

(j) On the Tools toolbar, click the Full Extent button ⊙ to zoom to the extent of all layers in your map.

(k) Select the check box next to the Major Roads layer to turn off the layer.

(l) Turn on the Lakes layer.

(m) From the Bookmarks menu, choose Central Florida.

(n) Use the list of map scales to zoom to the following scales, and use the Pan tool 🖐 to explore the Lakes layer.

- 1:1,000,000
- 1:250,000
- 1:24,000

3. Which scale appears best-suited for displaying the lakes?

_____

(o) Open the item description for the Lakes layer.   Data → View Item Description

4. Which scale is appropriate for displaying the Lakes layer?

_____

(p) Close the item description.

Step 2: Build an attribute query

Now that you have explored the layers in your map, you will begin to create layers appropriate for display at different map scales.

(a) Zoom to the full extent of your map.

b Turn off the Lakes layer and turn on the Major Roads layer.

You will begin by creating a separate layer that contains only the highways. You will use this layer when zoomed to smaller map scales, such as the statewide view.

c Right-click the Major Roads layer and choose Open Attribute Table.

Several attributes that describe each road segment are shown.

d Resize the Table window so you can see all the attribute fields.

> *Hint:* Pause your pointer over one of the corners of the window until it appears as a two-sided arrow, and then click and drag to make the window larger.

	NAME	US_ROUTE	ST_ROUTE	CLASS	DESCRIPTION
▶	VETERANS BLVD			Major_Road	URBAN: Minor Arterial
	OIL WELL ROAD			Major_Road	RURAL: Local
	WOOD STREET			Major_Road	URBAN: Local
	EDGEWATER DRIVE			Major_Road	URBAN: Collector
	SULLIVAN ST			Major_Road	URBAN: Local
	CORONADA DR.			Major_Road	URBAN: Collector

e Examine the attribute values.

5. Is there an attribute that could be used to separate the highways from the rest of the major roads?

_____

_____

Now you will select only the roads that are highways.

f In the Table window, click the Table Options button 📃 and choose Select By Attributes.

g In the Select By Attributes dialog box, confirm that Method is set to Create A New Selection.

Next, you see a list of the attributes from which you can build a selection statement.

h Double-click the CLASS attribute in the list.

Enter a WHERE clause to select records in the table window.

Method: Create a new selection

NAME
USROUTE
STROUTE
CLASS
DESCRIPTION

=	< >	Like
>	> =	And
<	< =	Or
_ %	( )	Not

| Is | | Get Unique Values | Go To: |

SELECT * FROM Major_Roads WHERE:

CLASS

The attribute is added to the expression at the bottom of the dialog box.

i Click the equal (=) operator to add it to your expression.

The last part of your expression is to select the highway value.

j Click Get Unique Values.

This displays a list of all unique values that occur for this attribute. In this case, there are only two values: a road is either a Highway or a Major_Road.

k Double-click 'Highway' to finish your expression.

=	< >	Like	'Highway'
>	> =	And	'Major_Road'
<	< =	Or	
_ %	( )	Not	

| Is | | Get Unique Values |

SELECT * FROM Major_Roads WHERE:

CLASS = 'Highway'

l Click Verify to confirm that your expression is entered correctly.

m On the Verifying Expression message, click OK.

n Click Apply to execute your query.

o Scroll through the attribute table to view the various fields.

NAME	US_ROUTE	ST_ROUTE	CLASS	DESCRIPTION
QUESADA AVE.			Major_Road	URBAN: Collector
MAIN ST	US 41	SR 44	Major_Road	URBAN: Minor Arterial
S SUNCOAST BLVD	US 19	SR 55	Highway	RURAL: Principal Arterial--Other
N SUNCOAST BLVD	US 19	SR 55	Highway	RURAL: Principal Arterial--Other
N LECANTO HWY		CR 491	Major_Road	RURAL: Minor Arterial
N LECANTO HWY		CR 491	Major_Road	RURAL: Minor Arterial

All rows with a CLASS value of Highway are selected and highlighted in blue.

p Close the Select By Attributes dialog box.

q Close the Table window.

Notice that the highways that you selected in the table are also selected in the map.

6. Using the table of contents, how can you determine the number of selected features?

_____

7. How many features are selected?

_____

Step 3: Create a layer from selected features

In this step, you will create a layer from the selected features.

a If necessary, click the List By Drawing Order button at the top of the table of contents.

b Right-click the Major Roads layer, point to Selection, and then choose Create Layer From Selected Features.

A new layer named Major Roads Selection is added to your table of contents.

The query that creates this layer is held internally by the map document. If you examine the layer, it is not obvious that it was created from a selected set of features.

> Selection layers are a powerful way to isolate features by displaying them within a separate layer. However, if you share a map document with others, consider exporting the data that is represented by a selection layer.

c On the Tools toolbar, click the Clear Selected Features button.

d Turn off the Major Roads layer.

e Rename your new layer **Highways**.

Hint: Click twice on the layer name to edit the text.

> If you have several layers of similar data, such as roads and highways, you may want to name each layer according to the scale at which it should be displayed; for example, use Highways100K for a Highways layer that is meant to be displayed at 1:100,000 scale.

f Right-click the line symbol below the Highways layer name and choose a dark red color from the color palette.

By creating a separate selection layer of highways and turning off the Major Roads, you have simplified the appearance of your map and created a more meaningful map display. You now have two layers, symbolized differently, that point to the same source data. Selection layers are useful for isolating a set of features and displaying them as their own layer.

Step 4: Set layer scale ranges

Now that you have your two roads layers, you will set the display scale for each layer.

Most GIS data has a range of map scales at which the data is meaningfully displayed. Each layer is different depending on the data and how it is symbolized. You can determine these scale ranges

by zooming into the data and finding the smallest and largest scales at which the data is visually meaningful. Refer to the Item Description to determine the appropriate scale for the data.

Earlier, you determined that 1:24,000 was an appropriate map scale for the Major Roads layer. However, the roads may be displayed at smaller scales and still provide a meaningful map.

a Turn off the Highways layer and turn on the Major Roads layer.

b Zoom to the Central Florida bookmark.

> A useful technique for determining a meaningful map scale is to zoom to an area with a high density of features, such as an urban area, and then zoom out until the features start to draw too close together to be seen individually.

To see your current display scale, refer to the map scale on the Standard toolbar. You should have determined that most roads are still individually recognized at a map scale close to 1:100,000.

c Set your map scale to 1:100,000.

d Right-click the Major Roads layer and choose Properties.

e In the Layer Properties dialog box, click the General tab.

Under Scale Range, notice that you can specify a range of scales at which the layer appears in the map. The default setting is to show the layer at all scales.

f Select the Don't Show Layer When Zoomed option.

g Set the Out Beyond value to 1:100,000 for the minimum scale.

1:100,000 is the smallest scale at which your map will display the Major Roads layer. When zooming in, this is the map scale at which the Major Roads will turn on.

h Click OK to close the Layer Properties dialog box.

i On the Tools toolbar, click the Fixed Zoom Out button.

Notice that the Major Roads layer no longer appears in the map.

j Click the Fixed Zoom In button ⁙ to display the layer again.

Now that you know the scale at which your Major Roads layer will turn on, you will use this same scale to turn off your Highways layer.

You can also set a minimum and maximum scale for a layer based on the current map scale.

k Right-click the Highways layer, point to Visible Scale Range, and choose Set Maximum Scale.

1:100,000 is now the largest scale at which your map will display the Highways layer.

Step 5: Use your map scale ranges

In this step, you will see the effect of applying map scales to your layers.

a Zoom to the full extent of your map.

Notice that the check box next to the Major Roads layer is gray. The gray indicates that the layer is enabled for display, but a map scale range is preventing the layer from drawing.

b Turn on the Highways layer.

8. Does the Highways layer appear in the map?

_____

The map displays the Highways layer because you are zoomed out to a scale smaller than the layer's maximum scale, which is 1:100,000. Notice that the Major Roads layer also has a grayed-out scale box under it, indicating it has a display scale range set on it.

c Use the Zoom In tool ⊕ or Map Scale list to experiment with different map displays.

You should see the Major Roads turn on when you zoom to a scale of 1:100,000. You should see the Highways turn off once you zoom in beyond this scale.

If you had other roads layers, you could set them to draw at different scales, creating a map that shows continuously more detail as you zoom in and less detail as you zoom out.

d Turn off the Major Roads and Highways layers.

(e) Zoom to the full extent of your map.

Step 6: Display data using a definition query

In this step, you will create two layers to represent your lakes at different map scales. This will be similar to what you just did with your roads, but you will use another technique to show just the features you want at each scale.

(a) Right-click the Lakes layer and choose Copy.

(b) Right-click the Florida data frame at the top of your table of contents, and choose Paste Layer(s).

> **Florida**
> ☐ Highways
> —
> ☐ Major Roads
> —
> ☐ Lakes
> ☐ Lakes
> ☑ Counties
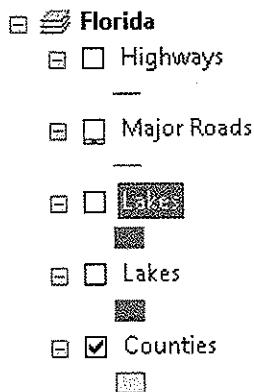
You have duplicated the Lakes layer. Now you will change the layer properties so the map displays only the lakes that are visually meaningful based on your map scale.

(c) Rename the bottom Lakes layer **Large Lakes**.

You will write a query to select only a certain category of features. These lakes will be shown at a smaller map scale.

(d) Turn on the Large Lakes layer.

All the lakes and other water bodies, such as swamp and marsh areas, are displayed. There are also many small lakes that are not visible at this map scale.

(e) Open the layer properties for the Large Lakes layer.

💡 You can double-click the layer name to open the Layer Properties.

f Click the Definition Query tab.

A definition query is much like the Select By Attributes query you created earlier. However, with a definition query, you are not selecting features but creating a condition that features have to meet to be displayed. Features that do not meet the query condition will not be displayed on your map.

> Use a definition query when you want to control the *display* of features based on an attribute. If you want to *select* features based on an attribute, use Select By Attributes.

g Click Query Builder.

The Query Builder dialog box opens. Notice that this dialog box looks similar to the Select By Attributes dialog box you used earlier. In fact, you will build your query the same way.

Only three attributes are shown for the Large Lakes layer. You will first write a query to select only values from the TYPE field, which specifies the type of water body. Then you will see the effect of the definition query on your map.

h At the top of the Query Builder, double-click TYPE.

i Click the equal (=) operator, and then click Get Unique Values.

Notice the different types of water bodies present in the Large Lakes layer.

j Double-click 'LAKE/POND' to add this value to your expression.

```
TYPE = 'LAKE/POND'
```

k Click Verify to confirm that your expression is entered correctly.

You are going to display lakes only if they are classified as either a lake or a pond.

l On the Verifying Expression message, click OK.

m Click OK to close the Query Builder.

n In the Layer Properties dialog box, click OK to apply your changes.
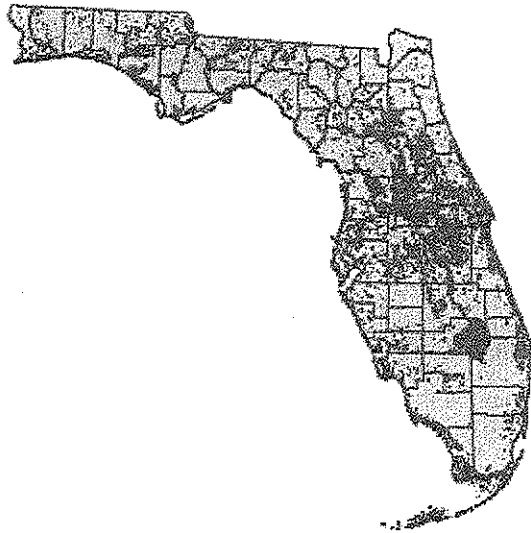
Your map looks much better. You have reduced the number of features shown on your map by using a definition query. However, many small lakes that should not appear at this map scale are visible.

o Zoom to the Blue Cypress Lake bookmark.

Blue Cypress Lake is the large lake near the center of your map.

p On the Tools toolbar, click the Identify tool.

q Click Blue Cypress Lake on your map.

r Look at the attribute values in the bottom section of the Identify window.

Field	Value
SQ_KM	26.385
NAME	BLUE CYPRESS LAKE
TYPE	LAKE/POND

The SQ_KM field lists the area of each lake in square kilometers.

9. What is the area of Blue Cypress Lake?

_____

You will use the SQ_KM attribute to further enhance your definition query by showing only the larger lakes and ponds greater than 25 square kilometers.

(s) Close the Identify window.

(t) Open the layer properties for the Large Lakes layer and confirm that the Definition Query tab is active.

Your previous query is displayed. Now you will add another query based on the area of each lake.

(u) Click Query Builder.

(v) Place your cursor at the end of the existing query (as shown by the arrow).

TYPE = 'LAKE/POND| ◄———

(w) Update the query condition to match the following:
TYPE = 'LAKE/POND' AND SQ_KM > 25

Hint: To create your query, complete the following steps:

- Click the AND operator.
- Double-click SQ_KM.
- Click the greater-than (>) operator.
- Type **25**.
- Click Verify to confirm that your expression is entered correctly.

(x) On the Verifying Expression message, click OK.

(y) Click OK to close the Query Builder, and then click OK to close the Layer Properties dialog box.

(z) Zoom to the full extent of your map.
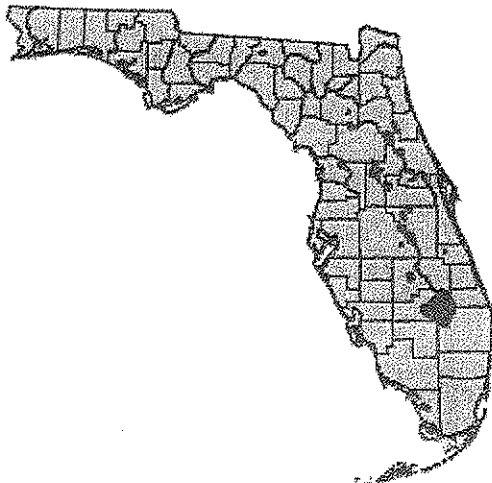
Now the number of lakes has been reduced even further.

(aa) Open the attribute table for the Large Lakes layer.

Hint: Right-click the layer and choose Open Attribute Table.

When you create a definition query, the attribute table is affected by the query just like the features on your map. At the bottom of the attribute table, you can see how many features are being displayed by the definition query.

10. How many lakes are being displayed?

_____   _____

(ab) Close the attribute table.

Step 7: Set layer scale ranges for lakes

In this step, you will display the lakes for use with larger map scales.

(a) Turn on the Lakes layer.

(b) Rename the Lakes layer **Lakes and Ponds.**

(c) Write a definition query for the Lakes And Ponds layer to display only the lakes that are of type lake or pond.

(d) Zoom to the Central Florida bookmark, then zoom to a scale of 1:100,000.

11. What map scale did you determine should be used to turn on the Lakes And Ponds layer?

_____

_____

(e) Using the method of your choice, set the minimum scale at which to display the Lakes And Ponds layer.

Hint: Use the Layer Properties or right-click the layer and choose Visible Scale Range.

(f) Set the maximum scale at which to display the Large Lakes layer.

Now you will explore how your final map will appear using your scale settings for the roads and lakes layers.

(g) Zoom to the full extent of your map.

(h) Turn on all layers in the table of contents.

(i) Zoom in and out while noticing the scales at which your layers turn on and off.

Step 8: Create group layers

In this step, you will organize your layers into groups. Creating group layers allows you to turn all the layers on or off within the group by selecting the check box next to the group layer. Group layers also have properties that allow you to control the display of all layers within the group.

You will use two different techniques for creating your group layers.

(a) In the table of contents, click the Highways layer name to select the layer.

(b) Press Shift on your keyboard and click the Major Roads layer to add it to your selection.

> Use the Shift key when selecting multiple adjacent layers within the table of contents. Use the Ctrl key when selecting multiple layers that are not adjacent in the table of contents. In the previous task, you could have used either the Shift or the Ctrl key.

(c) Right-click one of the selected layers and choose Group.

Your two layers are now sublayers within a new group layer.
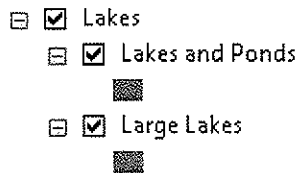
(d) Rename your group layer **Transportation.**

    ☑ Transportation
        ☑ Highways
        —

        ☑ Major Roads
        —

Now you will use a different technique to create a group layer for the lakes layers.

e Right-click the Florida data frame and choose New Group Layer.

f Click the Lakes And Ponds layer name and drag the layer under the New Group Layer.

You will see a black horizontal bar indicating the layer position as you drag the layer.

g Move the Large Lakes layer into the New Group Layer.

h Rename your New Group Layer **Lakes**.

> ☐ ☑ Lakes
>   ☐ ☑ Lakes and Ponds
>   ▨
>   ☐ ☑ Large Lakes
>   ▨

i Zoom to the Miami bookmark, and then set your map scale to 1:100,000.

j Turn the Transportation group layer off and on.

Turning off the visibility of a group layer turns off all its sublayers in the map.

k From the File menu, choose Save As.

l Browse to your ..\ARC2\Managing_map_layers folder and save your map as **MapLayers.mxd**

m Exit ArcMap.

Customizing the level of detail as you zoom in and out can greatly enhance the experience of using dynamic maps. Organizing your layers into groups can simplify the table of contents and allow you to control the display of all layers within the group.