

#4 – Buffer / Select by Location

Description: You can use the **Buffer** tool to identify or define an area within a specified distance around a feature. For example, you may create a **buffer** to define an area around a river to identify land that can't be developed, or you may want to create a **buffer** to select features within a specified distance of another feature. Sometimes there is a need to know how far an object is from another object (like hospitals from transportation). Buffers are used for proximity analysis; e.g., find all streams within 300 ft of a feedlot; find all crimes occurring within 1 mile of elementary schools, etc.

The end result of using the **Buffer** tool is a new dataset containing the **buffer** polygon(s) around the input features. Input features can be polygons, lines, points, or nodes. The width of the **buffer** can be specified as a fixed distance from an attribute table field (item) or from a distance table.

GOAL: The goal of this lab is buffer the Hennepin County hospitals (created in the previous exercise) to find which hospitals are within close proximity to major transportation routes (highways). As part of this exercise, you will also need to select out some roads using what you learned in the previous “Select by Attribute” exercise.

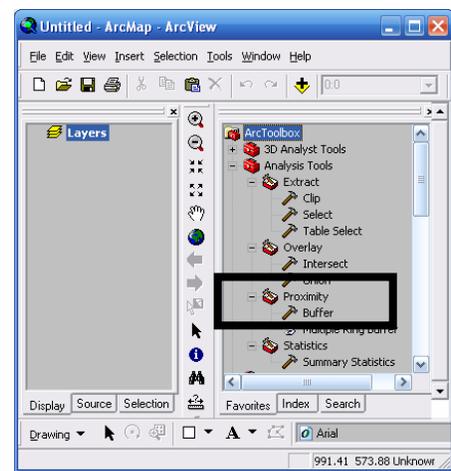
Data Sources:

C:/projects/Select/shapes/henn_hosp_p_mn.shp

C:/geodata/transportation/dot_highways_1_mn.shp

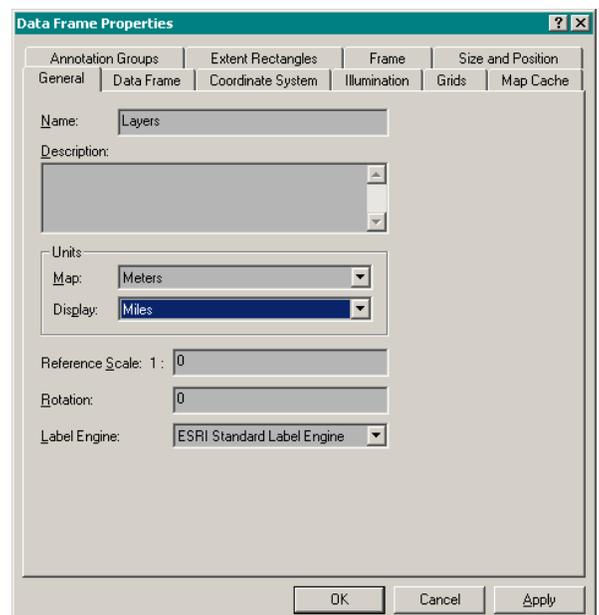
Tools:

Buffer from ArcToolbox (see diagram at right)



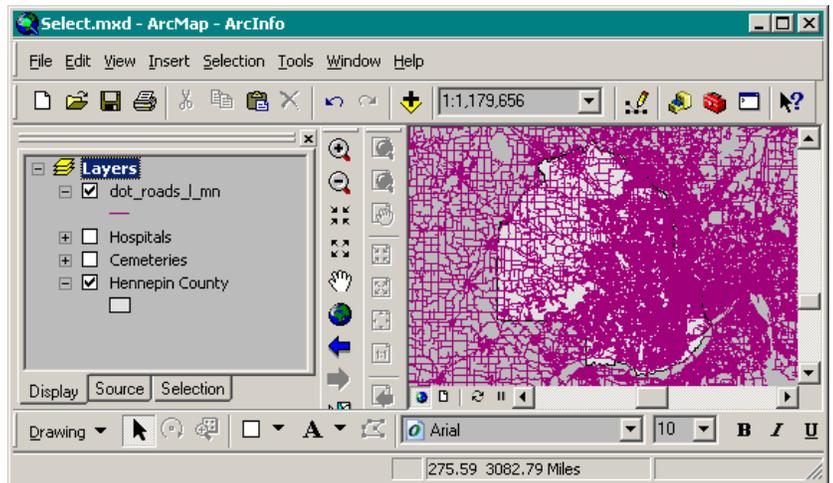
Initial Project Setup:

1. Open ArcCatalog.
2. Create a new folder called **Buffer** under your **Projects** folder on your C drive. Inside this folder, create a new folder called **shapes**,
3. To Begin and Save your Project:
 - Open your previously created Select.mxd. Click on **File - Save As – Buffer.mxd**.
 - Make sure you navigate and save this project to your C:/Projects/Buffer folder.
4. Click on the **Data Frame – Properties – General** and set your **Units** to **Meters** and **Miles** (see diagram at right). Click OK and close.



Begin The Project:

5. First, click **View – Data View** to get back to the normal working space.
 - Click off the Hospitals and Cemeteries
6. Next, **Add** the following dataset using the tool shown at right (yellow diamond with “+” sign):

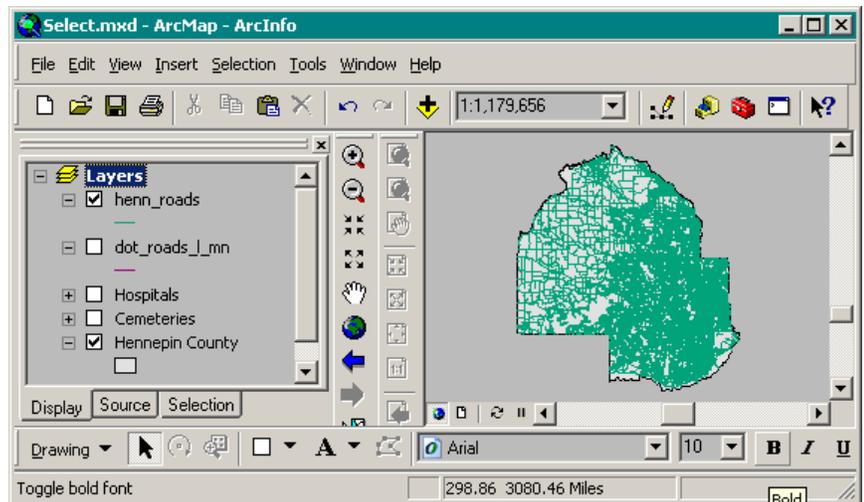


C:/geodata/transportation/dot_roads_l_mn.shp

Your colors may vary from what’s shown at right.

We are only concerned with those roads that are inside Hennepin county, so we need to extract those shapes out of the current shapefile. To do this, we’ll need to clip to the boundary.

7. CLIP these roads to Hennepin County following guidelines provided in the previous **Clip Exercise**.
 - a. Name the new dataset: **“henn_roads.shp”** and save to your project’s shape folder.
 - Click “Yes” when asked if you want to add the new data to your project.



Turn off the “dot_roads_l_mn” shapefile
SAVE

6. Next, open the roads Attribute Table and look at the contents:
 - **Right –click** on the shapefile name
 - Click on **Open Attribute Table**

FID	Shape	CODE	IUNI_MCD	TIS_CODE	STREET_NAM	COUNTYNAME	ROAD_NUM	STREETHAM2	FNAME
0	Polyline M	03		0300000065	Central Ave NE	ANOKA	65	State Hwy 65	Central
1	Polyline M	03		0300000065	Central Ave NE	ANOKA	65	State Hwy 65	Central
2	Polyline M	03		0300000007	State Hwy 7	CARVER	7		State Hwy 7
3	Polyline M	03		0300000007	Bayview Rd	CARVER	7	State Hwy 7	Bayview
4	Polyline M	01		0100000035W	I-35W	DAKOTA	35W		I-35W
5	Polyline M	01		0100000035W	I-35W	DAKOTA	35W		I-35W

7. There are some specialized codes that tell us what type of roads are included in this dataset. If you look at the field called “CODE” you will see 2 digit numbers. Of major interest to us are the following codes and what they mean:

01 = Interstates

02 = US Highways

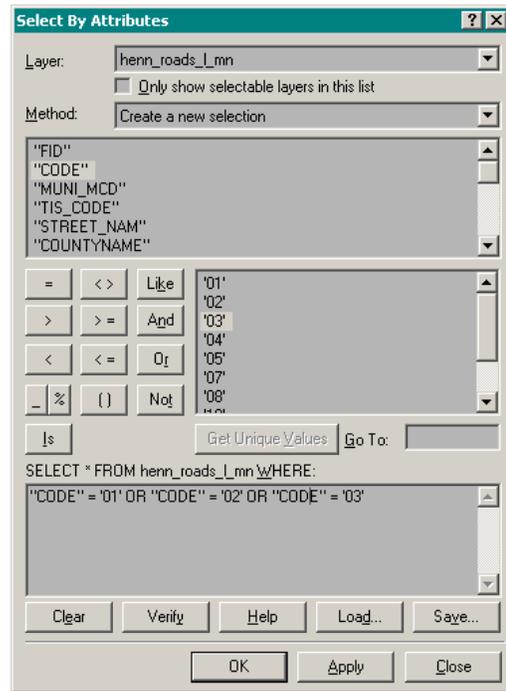
03 = MN State Highways

8. As you recall, the goal of this exercise is to determine proximity of the hospitals to major transportation routes.

So, to do this, we need to pull out all highways with the Codes 01, 02 and 03 from the roads shapefile. Recall that we have done this previously in the “**Select by Attribute**” Exercise.

I will not provide step-by-step instructions on how to do this, but will provide a snapshot of the query you need to build (at right), which is a little more complicated than the one you previously created.

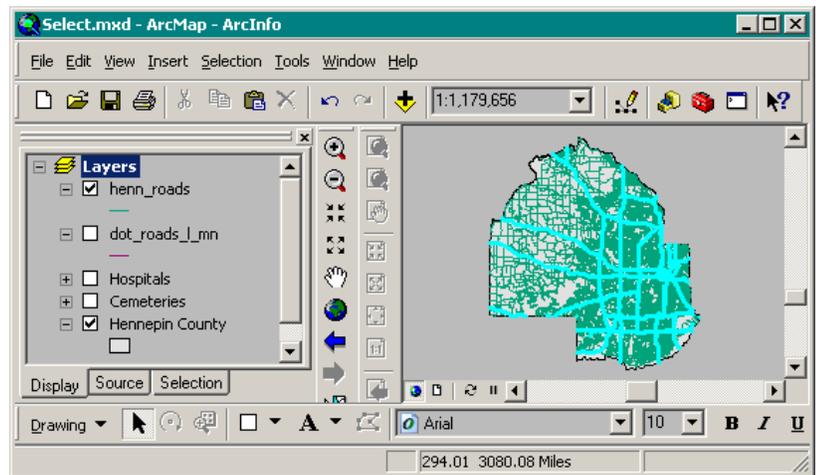
Notice that instead of a single query, we are actually querying for all 3 attributes.



When you run your Query, the following roads will be highlighted.

Recall that to create a new dataset from the current shapefile, you need to export it to a new shapefile. Refer to the previous lab if you do not remember how to do this.

The name of your new shapefile should be “**henn_major_roads.shp**”



9. In the TOC, rename to “**Major Roads.**”

End result should resemble that at right.

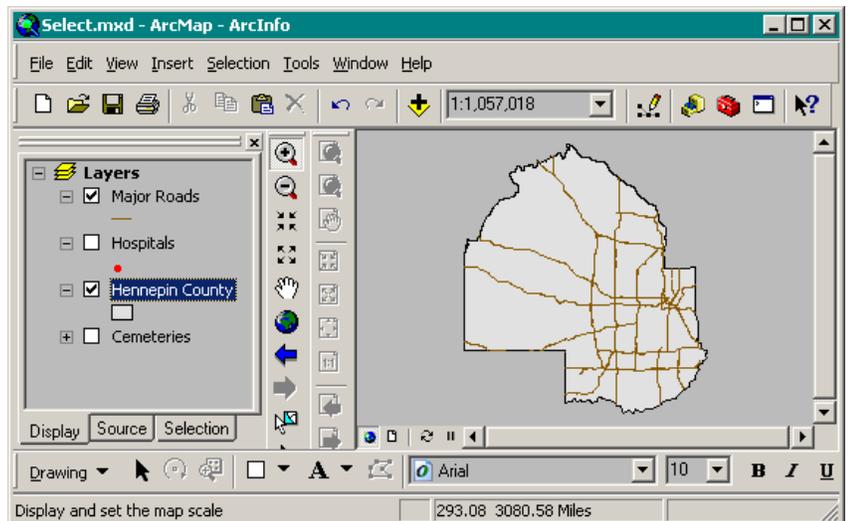
You can now remove

- henn_roads
- dot_roads_l_mn

from your project.

Move Cemeteries to the bottom of the TOC.

SAVE

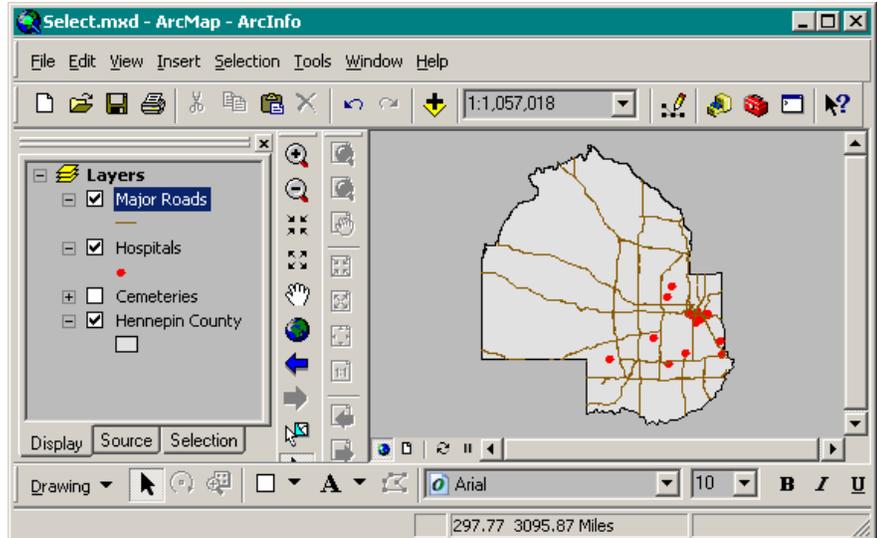


BUFFER the Hennepin County Hospitals

So now we are ready to begin using the Buffer tool to show the proximity of hospitals to these major roads. Recall, that buffering is a proximity type analysis. Consequently, when you open ArcToolbox, you will see that the Proximity Toolset is included inside the Analysis Toolbox, which resides inside ArcToolbox. The directions below will provide the step-by-step process. (Again, use the Help to learn more information on this tool.)

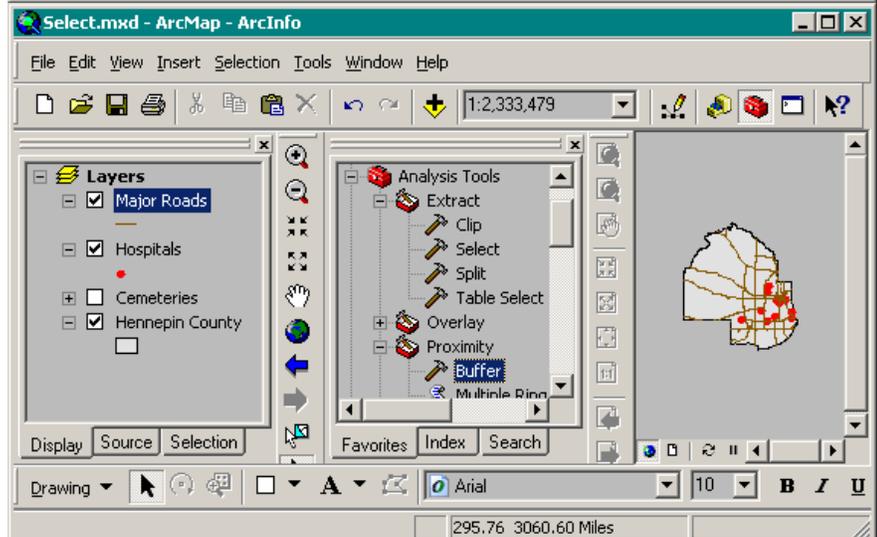
1. Turn on your **Hospital** dataset to make it visible.

- Notice that the symbology worked great for the previous layout, but is rather confusing for this analysis.
- Change the hospital symbol to just a small point as shown at right.



2. Next, open ArcToolbox.

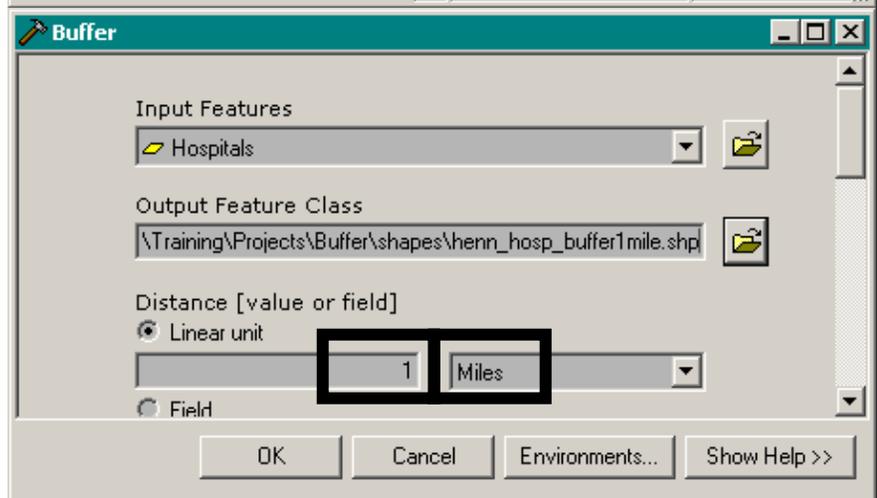
- Scroll down/up until you see the “Analysis Tools” toolbox.
- Open it and click on the Proximity toolset.
- Finally, Double-click the **Buffer** tool to open its dialog box.



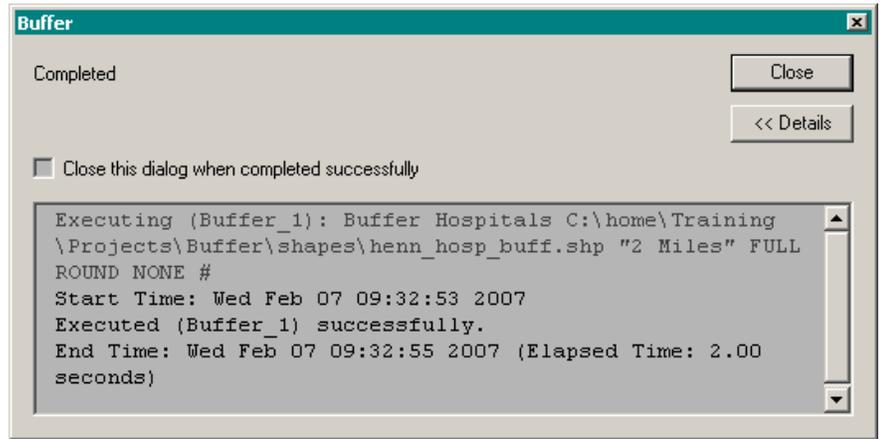
3. Now let's create some buffers. Double-click on the **Buffer** tool in the Proximity toolset.

4. Click and drag....or click down arrow....to select your hospitals dataset. Fill in the rest as shown at right. You will create a set of buffers at a 1 mile distance.

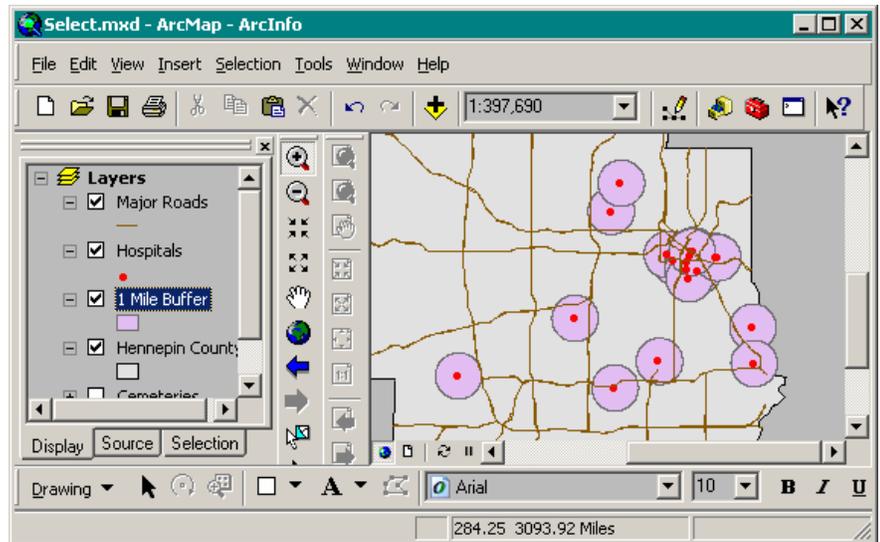
- Just type in “1”
- Click on drop down arrow and select **Miles**.
- Click **OK**



- A new dialog box will open showing the processing. When it is completed (example at right), just click on **Close**.



- Rename the Buffer shapefile “**1 Mile Buffer**”
- Zoom in to the Hospital points.
- Your map should resemble at right (although colors will vary).



SAVE

Visually, you can begin to see that some hospitals are within 1 mile of some major transportation routes.

This is where the Circles intersect the highway segments. But with a huge dataset, this would not necessarily be possible to see.

- Open up the attribute for both the Hospitals and the new buffer layer and notice that the field headings are exactly the same. No changes occurred to any attribute fields when creating this new dataset.

Attributes of Hospitals								
FID	Shape*	AREA	PERIMETER	GNIS_	GNIS_ID	FEAT_NAME	FEAT_TYPE	CNTY_NAME
0	Point	0	0	13	13	Abbott Hospital	hospital	Hennepin
1	Point	0	0	643	643	Asbury Hospital	hospital	Hennepin
2	Point	0	0	6382	6382	Deaconess Hospital	hospital	Hennepin
3	Point	0	0	7516	7516	Eitel Hospital	hospital	Hennepin
4	Point	0	0	8094	8094	Fairview Hospital	hospital	Hennepin
5	Point	0	0	8101	8101	Fairview-Southdale Hospital	hospital	Hennepin

Attributes of 1 Mile Buffer								
FID	Shape*	AREA	PERIMETER	GNIS_	GNIS_ID	FEAT_NAME	FEAT_TYPE	CNTY_NAME
0	Polygon	0	0	13	13	Abbott Hospital	hospital	Hennepin
1	Polygon	0	0	643	643	Asbury Hospital	hospital	Hennepin
2	Polygon	0	0	6382	6382	Deaconess Hospital	hospital	Hennepin
3	Polygon	0	0	7516	7516	Eitel Hospital	hospital	Hennepin
4	Polygon	0	0	8094	8094	Fairview Hospital	hospital	Hennepin
5	Polygon	0	0	8101	8101	Fairview-Southdale Hospital	hospital	Hennepin

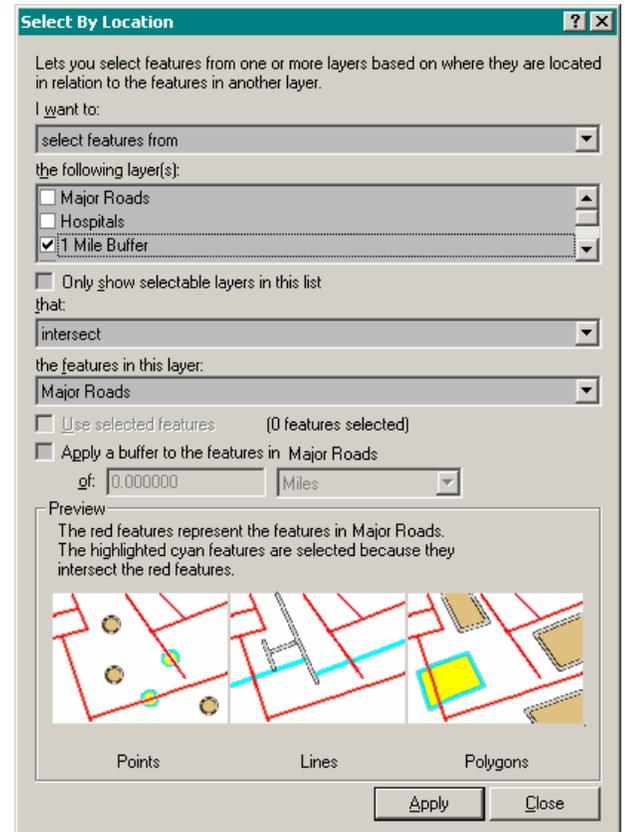
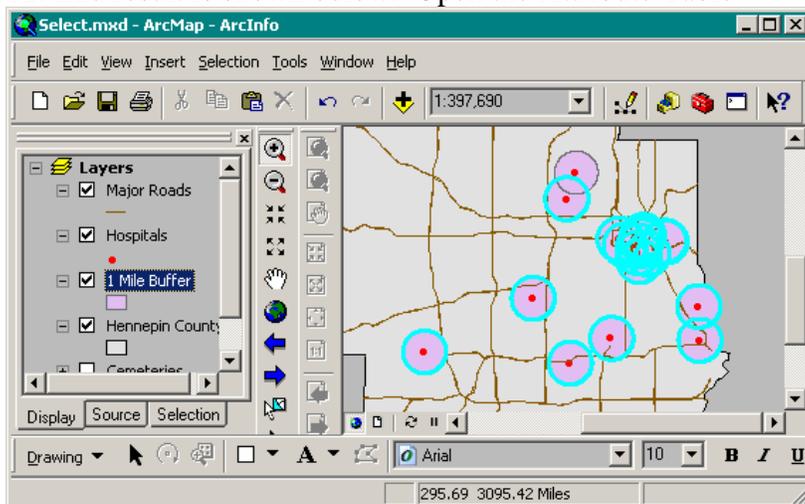
Select by Location

Now, let's say our dataset is too large to visually check. So, now we can use another method called **Select By Location**. This function creates, updates, or removes a selection on the input layer based on spatial relationships to select features.

10. So, back to our map with the 1 mile buffers.

11. To find out which buffers intersect the major roads, we need to click on **Selection – Select by Location**. Follow diagram at right for the parameters and click **Apply**.

12. End result is shown below. Open the Attribute Table



Notice that 18 of the 19 buffers, intersect major roads.

FID	Shape*	AREA	PERIMETER	GNIS_	GNIS_ID	FEAT_NAME	FEAT_TYPE	CNTY_NAME
10	Polygon	0	0	17428	17428	Mount Olivet Home for the Aged	hospital	Hennepin
11	Polygon	0	0	17434	17434	Mount Sinai Hospital	hospital	Hennepin
12	Polygon	0	0	18367	18367	North Memorial Hospital	hospital	Hennepin
13	Polygon	0	0	18504	18504	Northwestern Hospital	hospital	Hennepin
14	Polygon	0	0	21978	21978	Saint Barnabas Hospital	hospital	Hennepin
15	Polygon	0	0	22416	22416	Saint Marys Hospital	hospital	Hennepin

- Notice that only North Memorial Hospital (unselected above) is the ONLY hospital that is NOT within 1 mile of a major transportation route. Curious too is the fact that it is one of the larger, more popular, metropolitan hospitals.
- Close the table.
- Click on **Selection – Clear Selected Features** to unhighlight. **SAVE**

EXPERIMENT AND FIND OUT JUST HOW FAR NORTH MEMORIAL HOSPITAL IS FROM A MAJOR TRANSPORTATION ROUTE....2 MILES, 1.5 MILES, 3 MILES?????

Close all and **Save your Project**

Create a layout showing the features in your map. Symbolize accordingly.