

## GIS III: GIS Analysis Toolset Network Analysis Tools Exercise

\*\*\* Files needed for exercise: *NY\_county10\_prj\_carto.shp* ,*BA\_Pharm\_NY.dbf* ,  
*NY\_PWC\_tract\_2010\_prj.shp*, and *streets* (network dataset provided by StreetMap USA)

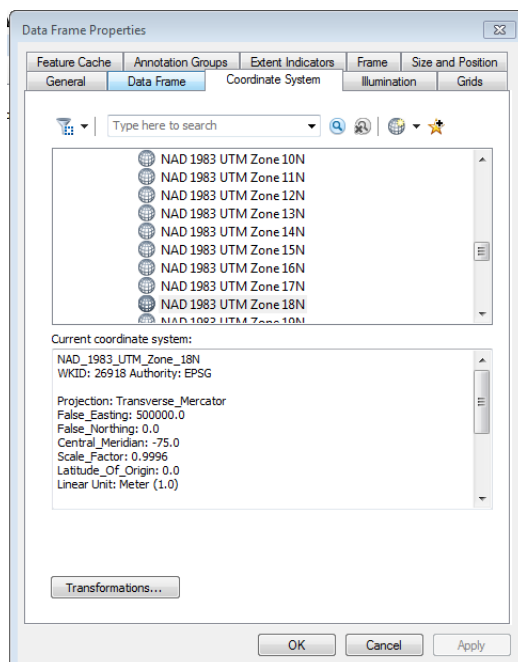
**Goals:** The goal of this exercise is to learn how to use the Network Analyst tools to perform network-based analyses. Specifically, you will learn to use the Network Analyst Extension to add network locations, set your analysis properties, and perform a basic service area analysis.

**Skills:** After completing this exercise, you should have a basic familiarity with Network Analyst Tools and have experience performing a service area analysis.

**Service Area Problem:** You are interested in finding the percentage of New York's population that is within a 15 minute drive time to a RITE AID Pharmacy. To do this, you will create a service area polygon representing a 15 minute drive time through a network dataset (StreetMap USA) to any RITE AID pharmacy. You will select RITE AID locations for your area of interest from a business dataset.

### Preparing your Node Data

1. Open a new blank map in ArcMap.
2. Right click on the data frame and set your coordinate system to New York's standard projected coordinate system: **Projected Coordinate Systems > UTM > NAD 1983>NAD\_1983\_UTM\_Zone\_18N**. Click **OK**.

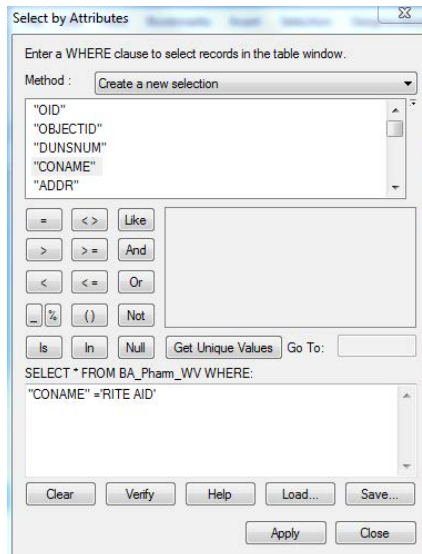


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3. Add the New York shapefile: *NY\_county10\_prj\_carto.shp*. This state shapefile will provide some useful geographical context for your analysis.
4. Add the business data table: *BA\_Pharm\_NY.dbf*. These data represent pharmacies in and around New York from the 2014 Esri Business Analyst dataset.
5. You will make a selection from the *BA\_Pharm\_NY.dbf*, table to select only those records representing RITE AID stores.
  - a. Right click on the table in your table of contents (TOC) and select **Open** to view the table.
  - b. Click on the dropdown arrow on the **Table Options** icon and go to **Select By Attributes**.



- c. **Create a new selection** WHERE: "CONAME" ='RITE AID' and click **Apply**.



Select by Attributes

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

Method: Create a new selection

Attributes: "OID", "OBJECTID", "DUNSNUM", "CONAME", "ADDR"

Buttons: =, <>, Like, >, >=, And, <, <=, Or, %, (), Not, Is, In, Null, Get Unique Values, Go To:

SELECT \* FROM BA\_Pharm\_WV WHERE:  
"CONAME" =\'RITE AID\'

Buttons: Clear, Verify, Help, Load..., Save..., Apply, Close

You should note that 634 out of 5,024 records have been selected in the lower left hand side of your table.



ID	OBJECTID	DUNSNUM	CONAME
1	11792081	145132278	LOW CASSARA
2	11792082	037996300	RITE AID
3	11792083	107266816	RITE AID
4	11792084	040914218	BATHS PHARMACY
5	11792085	044208843	GENOVESE DRUG STORES
6	11792086	057145111	THE MEDICINE SHOPPE
7	11792087	02787824	CVS
8	11792088	024230207	PHARMACY
9	11792089	176814477	CVS
10	11792090	198322593	CVS
11	11792091	08137402	CVS
12	11792092	021859140	MEDICINE MAN INC
13	11792093	028395426	SHIRLEY PHARMACY AND SURGICAL
14	11792094	027716883	SHIRLEY DRUG & SURGICAL
15	11792095	027934023	RITE AID
16	11792096	190959889	CVS
17	11792097	194622432	CVS
18	11792098	026912749	RITE AID
19	11792099	062091983	CVS
20	11792100	080119821	RITE AID
21	11792101	028738118	GENOVESE DRUG STORES INC
22	11792102	018120816	SUNSHINE DRUG INC
23	11792103	020656745	WALLSTREET CHEMISTS INC
24	11792104	107032480	PRESCRIPTION CENTRE OF CORAIR INC
25	11792105	062081476	MEDICINE SHOPPE EAST PATENTHOUSE
26	11792106	125811989	RITE AID
27	11792107	022822337	GENOVESE DRUG STORES
28	11792108	021853220	LIFE EXTENSION
29	11792109	196878114	WALGREENS
30	11792110	020268845	PHARMACY 112
31	11792111	082341827	SHIRLEY DRUG & SURGICAL
32	11792112	020998669	MEDICINE SHOPPE INC
33	11792113	081365711	BROOKHAVEN PHARMACY

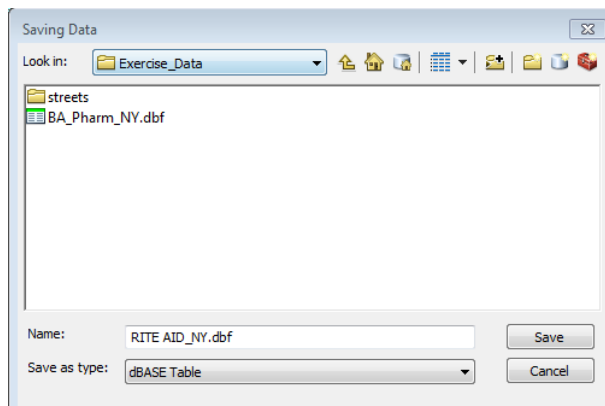
Status: 634 out of 5024 Selected

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These represent the records that meet the requirements of your query: RITE AID stores.

Close the *select by attributes* dialogue.

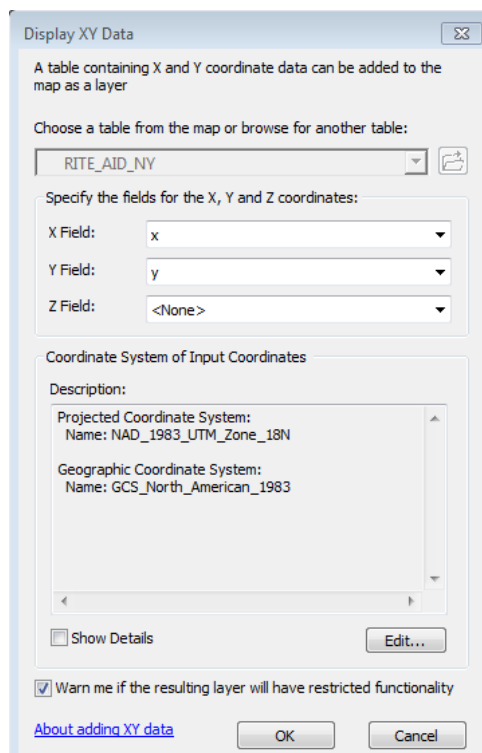
6. **While the table is still open** click on the Table Options icon again and select **Export**; this will export the 634 selected records to create a new table.
7. Save the table as *RITE AID\_NY.dbf* in the Exercise\_Data folder; make sure you select dBASE Table in the **Save as type** dropdown.



When you are asked if you would like to add the new table to the current map, click **Yes**.

You can close the *BA\_Pharm\_NY.dbf*, table and remove it from your TOC.

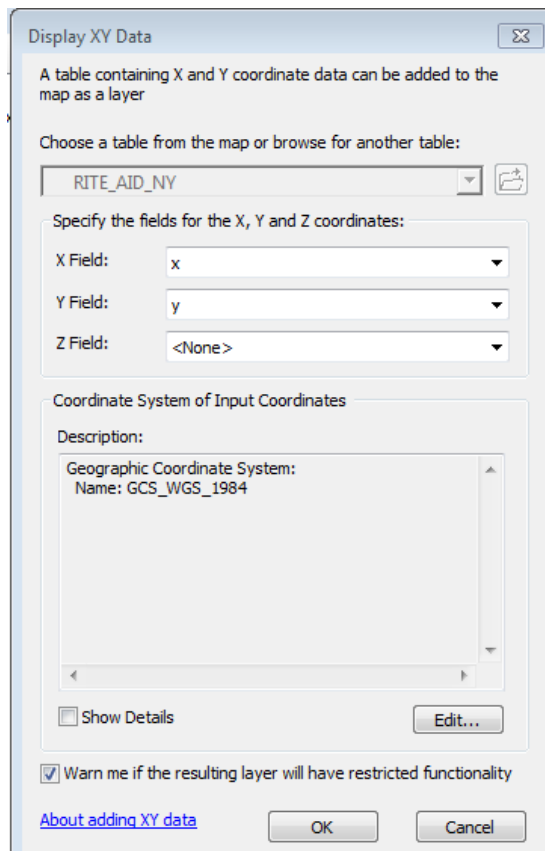
8. Right click on your *RITE AID\_NY.dbf* table and select **Display X|Y data**. **Do not click OK yet!**



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Note that the raw data from Business Analyst is geographically defined using latitude and longitude coordinates (decimal degrees), Y and X respectively. The software recognizes the correct fields for X and Y coordinates. **However, the software automatically chooses the coordinate system of the input coordinates from your table based on the coordinate system for your data frame - you set this in the first step.**

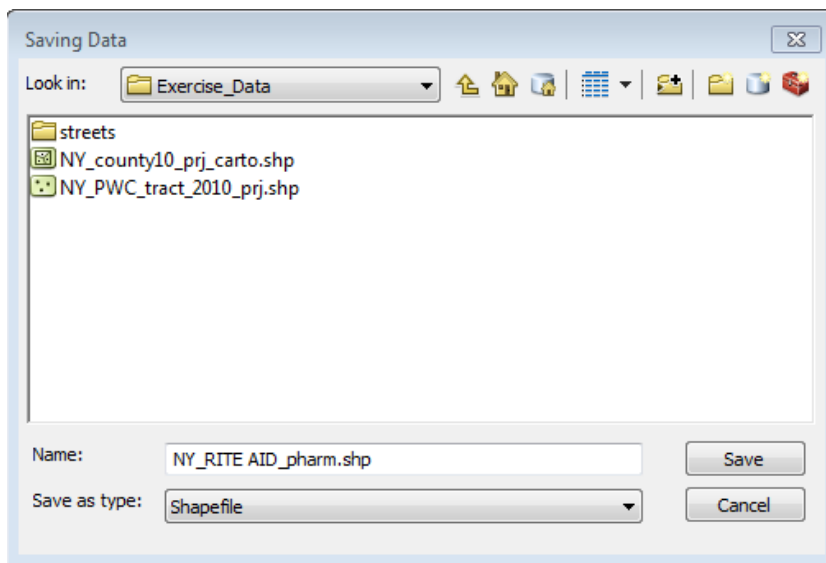
- You will need to let the software know to use a Geographic Coordinate System, WGS 1984, for proper georeferencing when displaying X|Y data. The X|Y coordinates in your table are in this system. Click on the **Edit** button to change the coordinate system of your input coordinates to match **Geographic Coordinate Systems > World > WGS 1984**.



Finally, click **OK**. You have now let the software know that these are Geographic Coordinates.

- Your 634 RITE AID pharmacies should now be displayed.
- Right click on your 'event' class and export to a new shapefile.
- Using the same coordinate system as the data frame, name the shapefile: NY\_RITE AID\_pharm.shp** and save it in your Exercise\_Data folder. Saving this exported data with the same coordinate system information as your *data frame* will project the data to the appropriate projected coordinate system.

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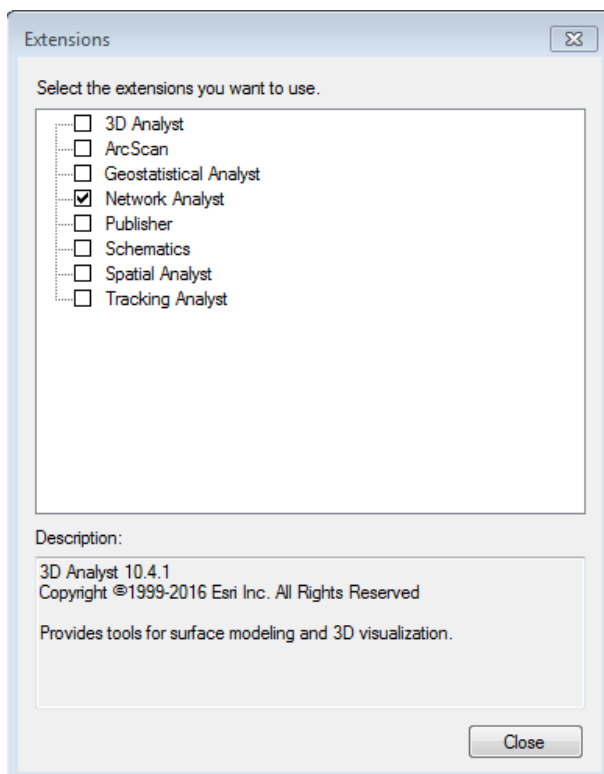


Add the the new shapefile *NY\_RITE AID\_pharm.shp* to your project.

13. You can now remove the *RITE AID\_NY Events* as well as the *RITE AID\_NY.dbf*.

### Setting up a Network Analysis

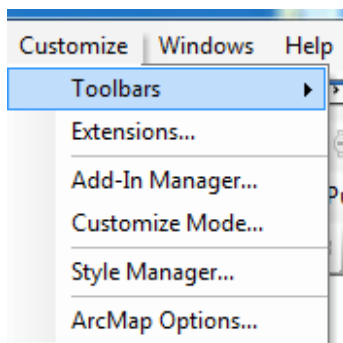
1. Turn on the **Network Analyst** extension. Go to **Customize > Extensions**.



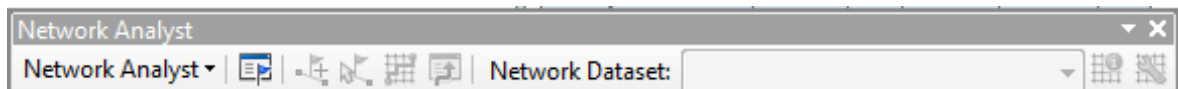
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2. Activate your Network Analyst toolbar. Go to **Customize > Toolbars > Network Analyst**.

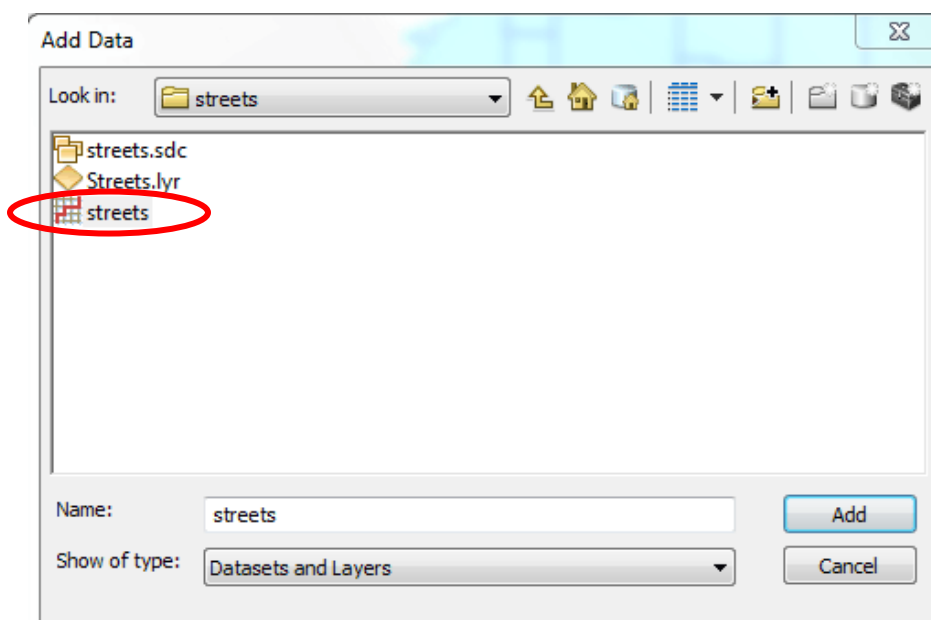
**Note that you need to make sure that you have activated the extension prior to adding the toolbar - the software will allow you to add the toolbar to a project even if the Network Analyst extension is not activated (it will not work though).**



The toolbar looks like this:




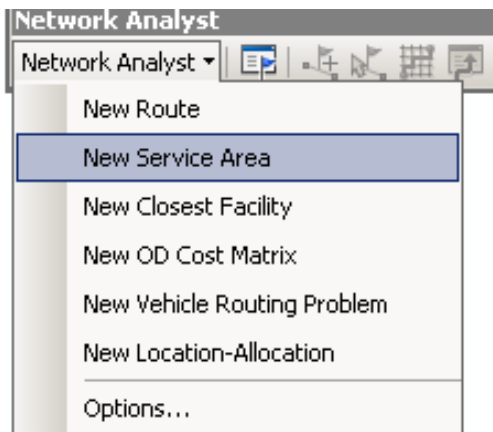
3. Add your Streetmap USA network dataset *streets*. It is located in the streets folder. Choose **Yes** to add all feature classes that participate in the network dataset. **Note:** This is a nationwide dataset so it may take a long time to download. Be forewarned, it is large. The .sdc format is un-editable, but it means you will not need to create your own network dataset.



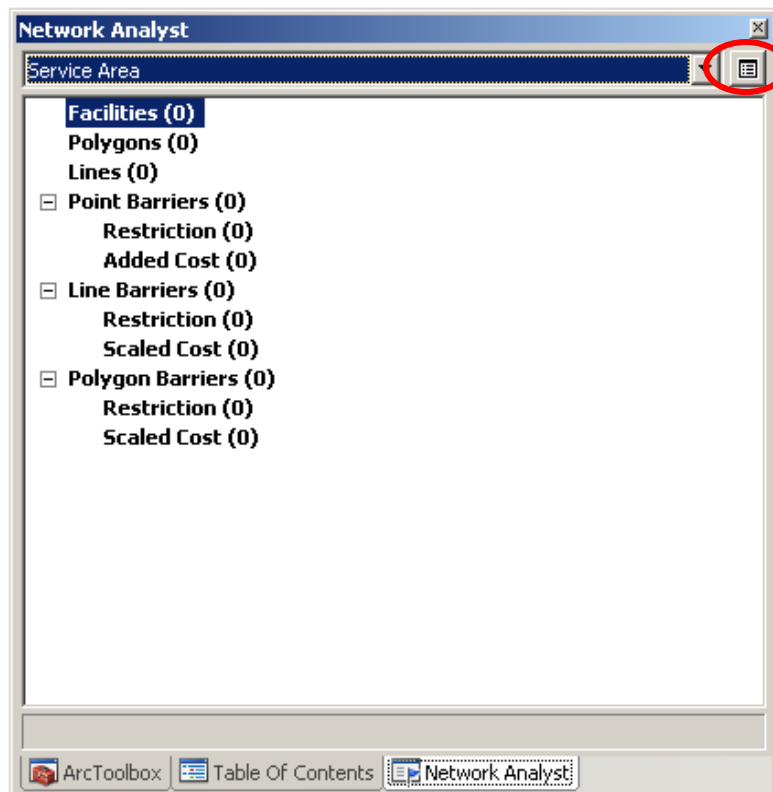
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You should see a detailed road network begin to fill in. You can turn these off by un-checking them in the TOC to speed things up a bit.

4. If your network analyst window is not visible, make it visible by left clicking on  in the toolbar.
5. In the Network Analyst toolbar, click **Network Analyst > New Service Area**.

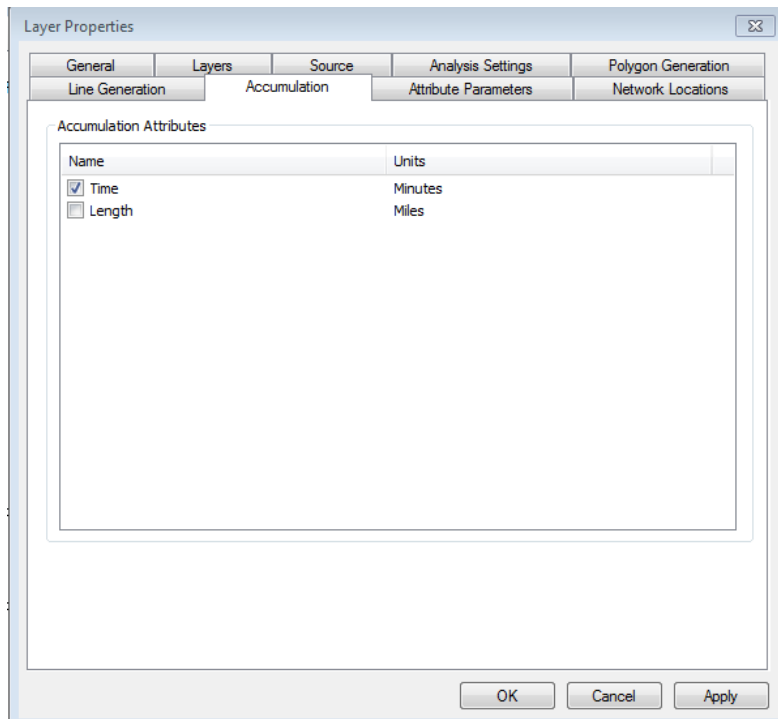


6. To adjust your service area properties and analysis settings, click on the **Service Area Properties** icon in the Network Analyst window (on the upper right-hand side).

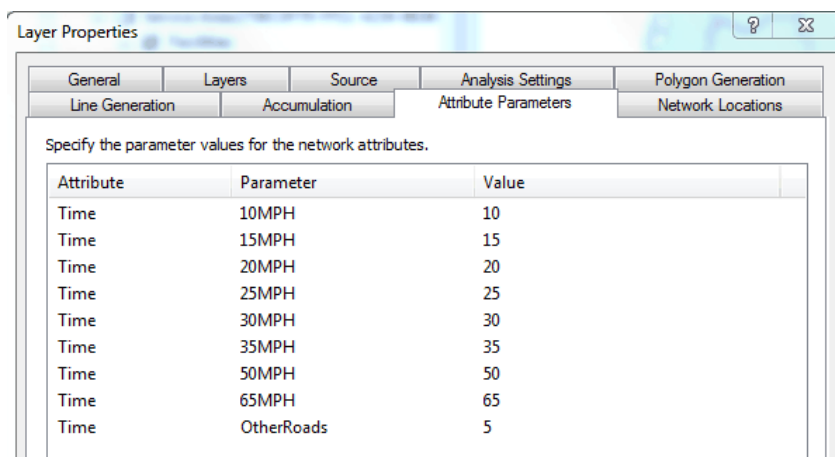


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- Under the **General** tab, name this service area layer: *RITE AID 15 minutes NY state*. Click **Apply** rather than OK.
- Under the **Accumulation** tab, check **Time**. This will calculate time as the cost of moving through the network for your analysis. Click **Apply** rather than OK.



- Take a look at your **Attribute Parameters** tab. You can see that the time attribute is informed by speed limit parameters for your network.

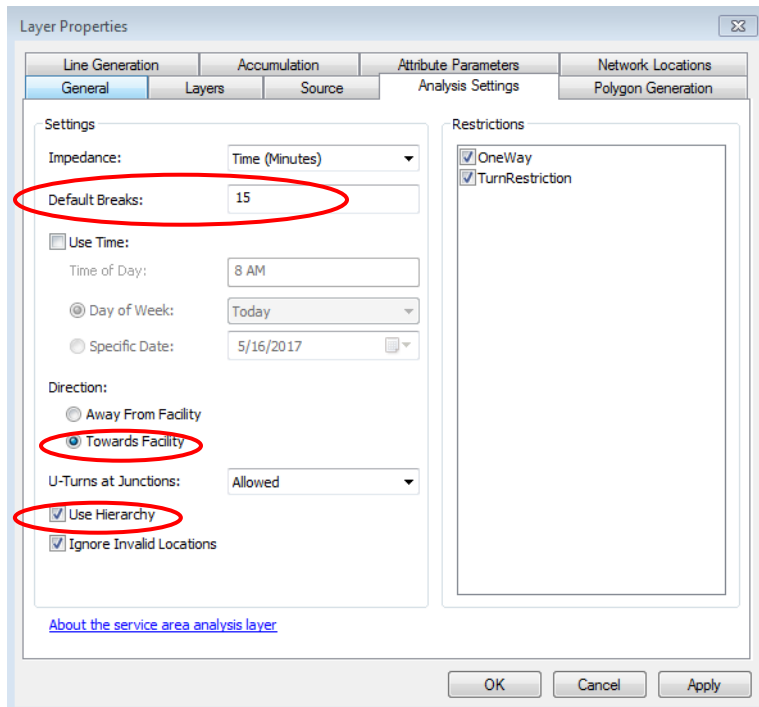


- Under the **Analysis Settings** tab you should see that your impedance or cost will be measured in time (minutes). Set your default break as **15 minutes**. Set your direction as **Towards Facility**. In this analysis you will **Use Hierarchy** and go with defaults for the remaining options on this tab.



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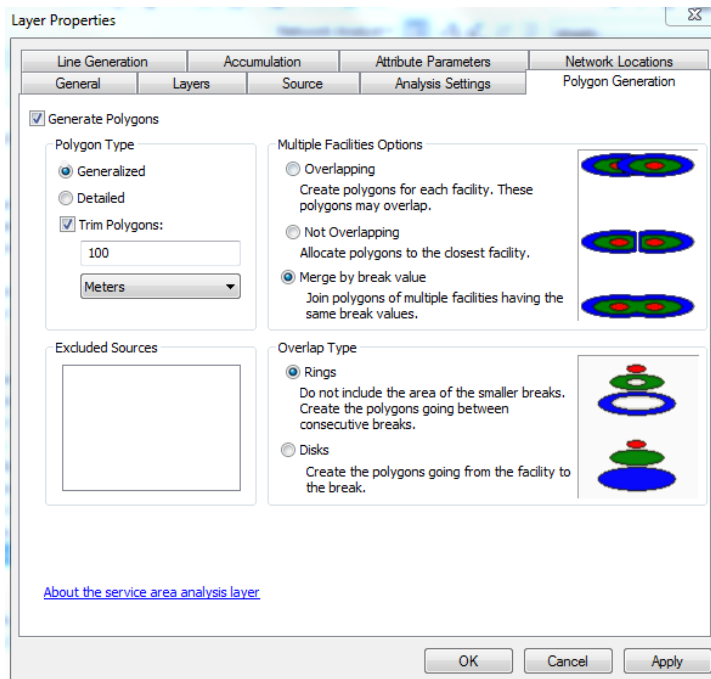
Click **Apply** rather than OK. (NOTE: **Hierarchical analysis** is a heuristic method for solving drive time by favoring travel on larger roads (e.g. highways) over small roads (e.g. local streets). Network Analyst can compute service areas more quickly when using a hierarchical analysis, but it is less exhaustive than a non-hierarchical analysis. The [About network analysis with hierarchy](#) help page has more information.)



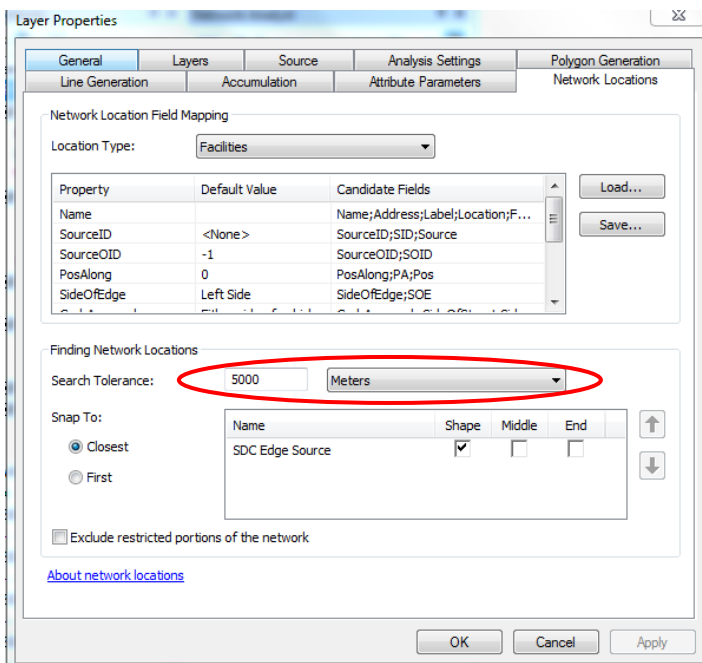
The screenshot shows the 'Layer Properties' dialog box for a Network Analyst layer. The 'Analysis Settings' tab is active. In the 'Settings' section, 'Impedance' is set to 'Time (Minutes)', 'Default Breaks' is 15, 'Use Time' is unchecked, 'Time of Day' is 8 AM, 'Day of Week' is 'Today', and 'Specific Date' is 5/16/2017. Under 'Direction', 'Towards Facility' is selected. 'U-Turns at Junctions' is set to 'Allowed'. In the 'Restrictions' list, 'OneWay' and 'TurnRestriction' are checked. The 'Use Hierarchy' checkbox is checked, and 'Ignore Invalid Locations' is also checked. A link 'About the service area analysis layer' is visible at the bottom left. The 'Apply' button is highlighted.

- Under the **Polygon Generation** tab, keep all the defaults with the exception of **Multiple Facilities Options**. Select **Merge by break value** and click **Apply** rather than OK.

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- Under the **Network Locations** tab, check the tolerance for locating the RITE AID stores on the network dataset. Stay with the default **Search Tolerance** of **5000 meters** (i.e. locations up to 5000 meters from a road *will be located* on the network).

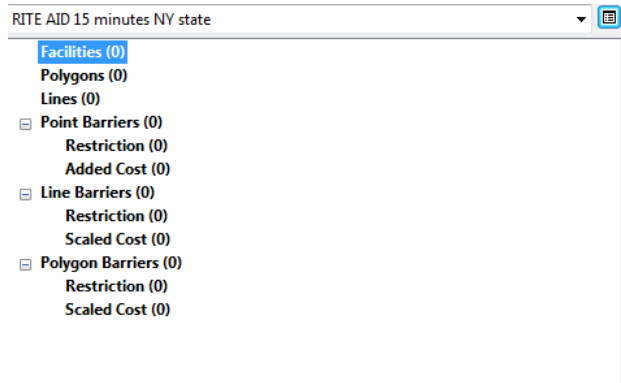


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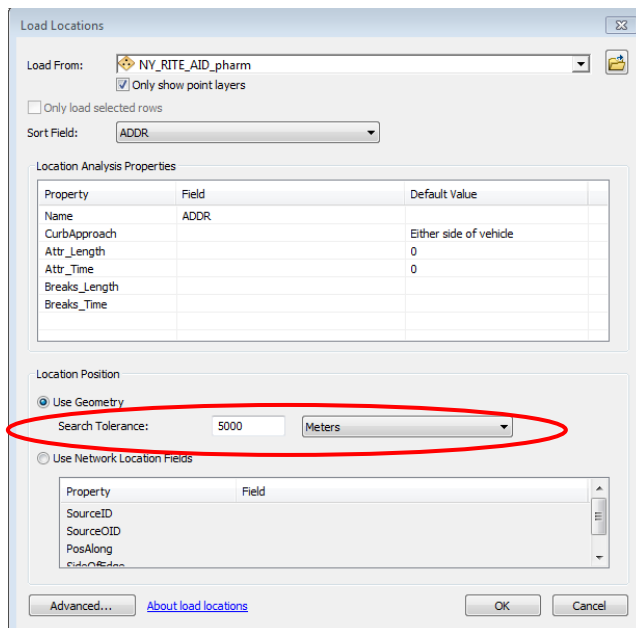
**Note:** You may need to adjust this since how well the locations load depends on the condition of the network dataset and the quality of your geocoded data. Stick with the defaults for the rest of the settings for now. Click **Apply**, then **OK**.

- Right click on **Facilities** in the Network Analyst window and select **Load Locations**.

The RITE AID pharmacies are the **Facilities** that you will be creating service areas for.



- Make sure that your shapefile *NY\_RITE AID\_pharm.shp* is the data to be loaded and select **ADDR** as your **Sort Field**. You can sort by any of the attributes in the table, but it is a good idea to use a unique identifier. For the **Name** Property select **ADDR** field as well; this will identify each facility by its address information. The Search Tolerance used in **Network Locations** tab should be reflected here.

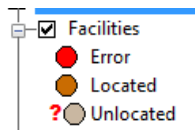


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- Click **OK**. You should see 634 facilities located in your Network Analyst window. The RITE AID pharmacies have been loaded and located when possible on the network dataset indicated by an mustard colored circle (yours will likely be a different color).

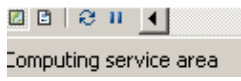


If any of your locations were not located or have errors you will see a red circle, or a lighter mustard circle with a question mark in your TOC.



### Solving the Service Area Problem

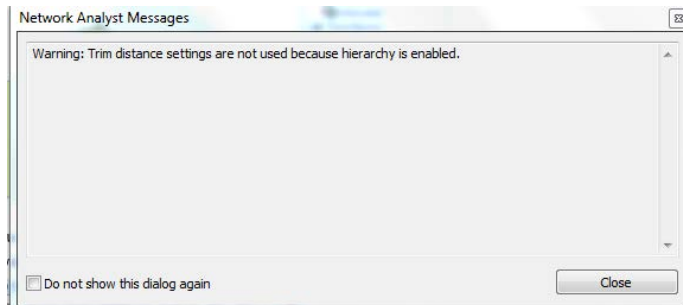
- You have set up your analysis and loaded the facilities - now you can solve. Remember, you want to create a network-based area that represents a 15 minute drive time to any RITE AID for your area of interest. Click on the Solve icon  to run the analysis. This may take a bit of time (remember that this is a very large network dataset).
- While you wait, take a look around. Take a look at the lower left-hand side of your screen. If you

see this: , it's a good sign. Some indication of progress on the lower right-

hand side of your screen is also a good thing: . Now is also a good time to stretch out, and ask any questions you may have.

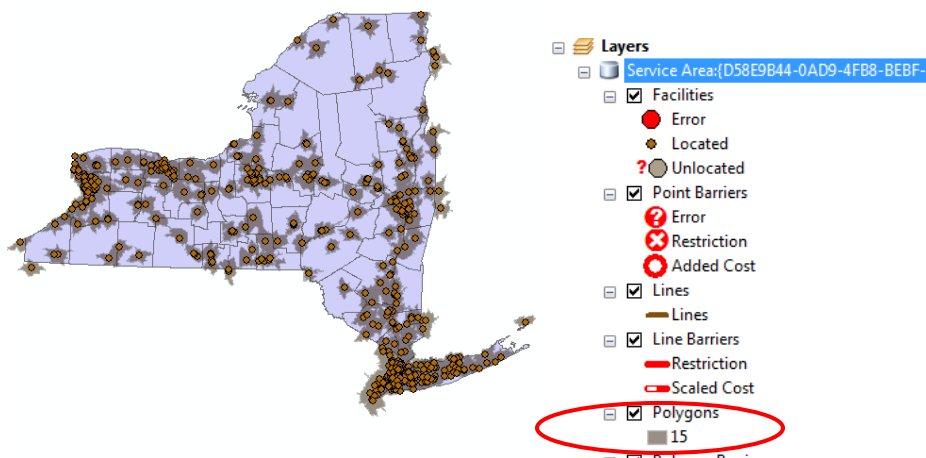
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3. When the solving is complete you should see something that looks like this:



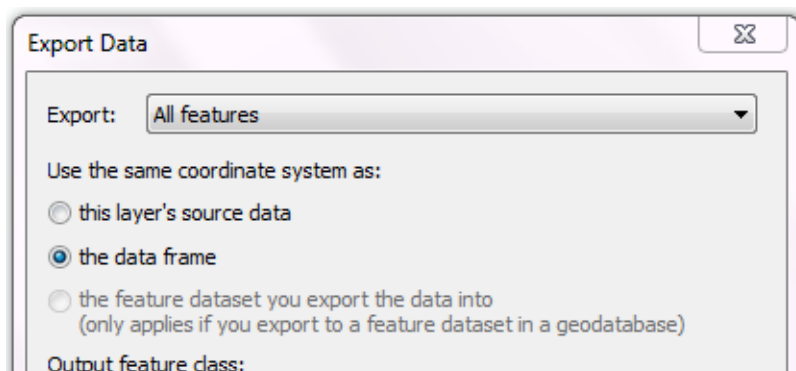
Because you used a hierarchical solve trim settings are not a factor- just an FYI

Here are the results of your analysis:



4. In your table of contents you will see the results of your analysis. Export the polygon for your analysis to a new shapefile by right clicking on the layer in your TOC and choosing **Export Data**.

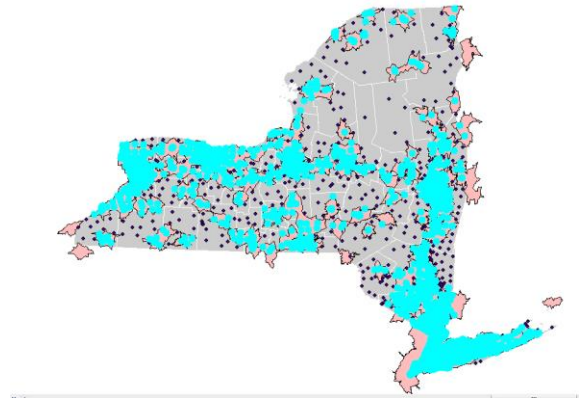
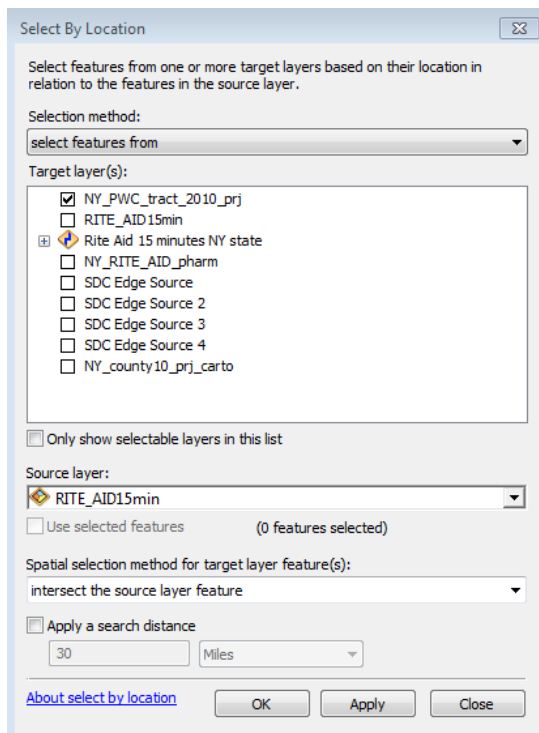
Use the same coordinate system as **the data frame**. Name the file *RITE AID15min.shp*.



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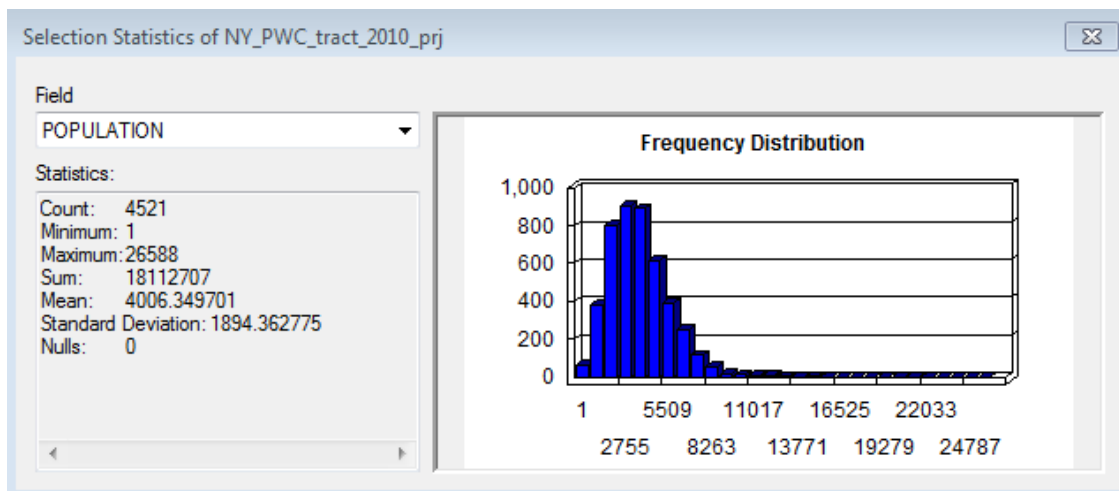
Add *RITE AID15min.shp* to your data frame when prompted.

- Add the 2010 population weighted census tract centroids for New York NY\_PWC\_tract\_2010\_prj.shp; adjust your display order so that your *RITE AID15min.shp* is below the tract centroids. If you are interested these population weighted centroids came from here: <https://www.census.gov/geo/reference/centersofpop.html>
- Click **Selection > Select by Location**. Spatially select all **census tract population weighted centroids (target layer)** that **intersect** in the 15 minute drive time polygon (**source layer**). You will assume that all block groups with their centroid within the 15 minute drive time polygon have populations that are within the 15 minute window to a RITE AID store. Click **Apply**, then **OK**.

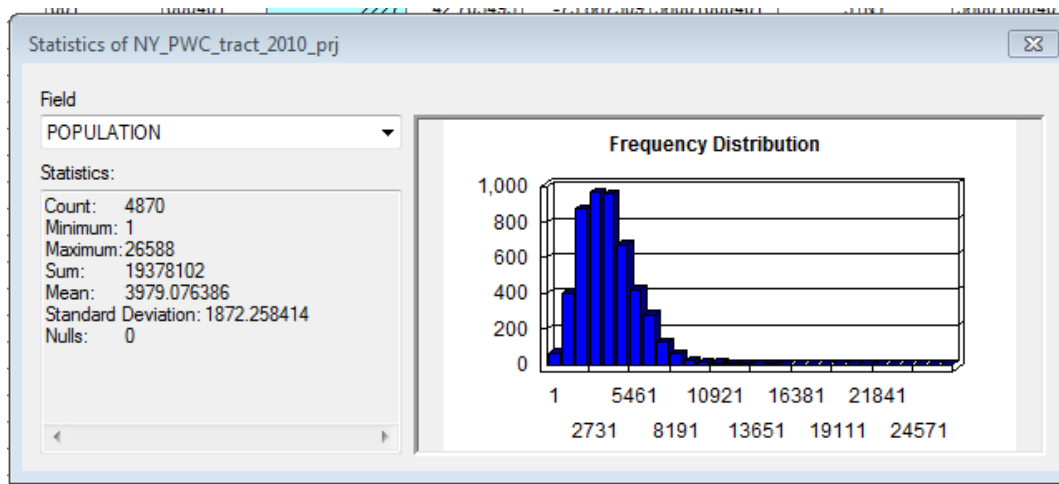


- Open the table for NY\_PWC\_tract\_2010\_prj.shp; you should see that 4,521 of the 4,870 tracts have been selected. Right click on the *Population* attribute field and select **Statistics** for these selected block groups. Take a look at the sum of the tract values for your selection. According to the 2010 Census there are 18,112,707 people in New York within a 15 minute drive time of a RITE AID Pharmacy.

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8. Now **Clear Selection** and take a look at the sum of the tract values for all of New York. The total population estimate in 2010 for New York was 19,378,102.



### Solution

It looks like ~93% of population for New York is within a 15 minute drive time to a RITE AID pharmacy.

### Discussion

1. Do you buy this?
2. What are some likely assumptions/caveats to this type of analysis?
3. Do you think RITE AID used location-based intelligence when locating its stores across the community?
4. How could you use a similar service area analysis in your work? What would you do differently?