

# Intro to ArcGIS

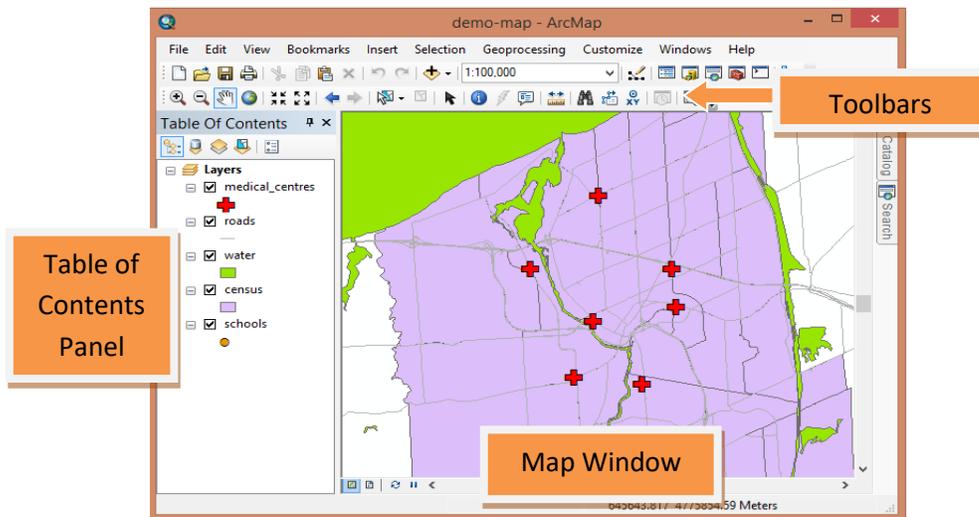
## What is "GIS"?

Geographic Information Systems (GIS) is a tool used to display, create, and analyze spatial information to help solve real world problems. It combines the graphics that make up a map with data tables of associated attributes. Based on a fictitious case of flu incidence in St. Catharines, this tutorial uses GIS functionality to identify the source of the outbreak for notifying officials.

## Section 1: Introducing ArcGIS

1. Download and unzip the workshop data to your local storage from:  
<http://www.brocku.ca/maplibrary/Instruction/IntroToArcGIS.zip>
2. Run ArcMap. HINT: Click the Windows button then start typing *ArcMap 10.5.1*
3. Under Existing Maps, click *Browse for more...* and navigate to the extracted "IntroToArcGIS" folder, and open **demo-map**.
4. **SAVE** this under a different name if you wish to preserve the original. (HINT: File > Save as)
5. Maximize the window to fill the desktop.

The ArcMap interface is made up of toolbars, a map window and a table of contents.



6. The toolbar is used to change the view extent, zoom level and pan.

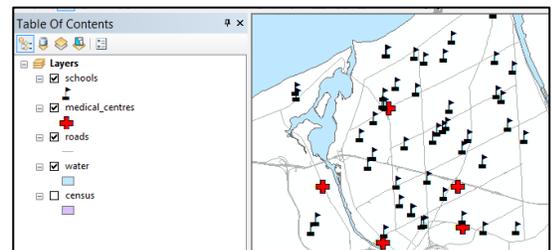


## The Table of Contents

Just under the heading are five options, giving the user the choice of how the layers behave and are displayed.

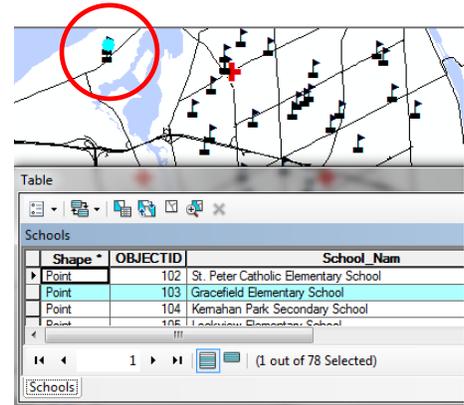


7. Below this panel, the layers are listed. Check the box beside a layer to turn it off or on. Notice that the schools layer does not display when all layers are checked on. The schools layer is covered by the census layer.
8. To change the order of layers to make them all visible, list data by **Drawing Order**. Select **schools** (click on the word) and click and drag it to the top, above medical centres. The school points now display.
9. From the Table of contents, click the point symbol for schools to access the *Symbol Selector* dialogue box. Scroll down and select a school symbol. Click OK to return to the map.
10. To change the colour of a symbol, for example waterbodies, right click the symbol and select a blue colour. Turn off the **census** layer.
11. Your map should look similar to the following image:
12. **SAVE** your map!



**Section 2: The connection between attributes and map features**

1. Right-click the schools layer. Select *Open Attribute Table*. If necessary, move the table down so the map is visible.
2. Select a record by clicking the gray box to the left of the table. The feature is highlighted on the map by a cyan coloured dot. If necessary, use the menu tab **Selection > Pan to Selected Features**.
3. To go back to the previous extent, click .
4. Click the *Select Features* tool  from the toolbar, then click one of the school symbols on the map. The selected school will appear highlighted by a cyan dot.
5. To see the associated table record you may have to click the *Show selected records* button  at the bottom of the attribute table window.
6. Click *Show all records* .
7. Click the *Clear Selected Features* button  on the toolbar to de-select all features.
8. Close the attribute table by clicking the X in the upper right corner of the table.



**Section 3: Isolating elementary schools using attribute query**

A powerful function of GIS is to create subsets of data using Structured Query Language (SQL). ArcGIS offers intuitive dialogue boxes to facilitate this technique.

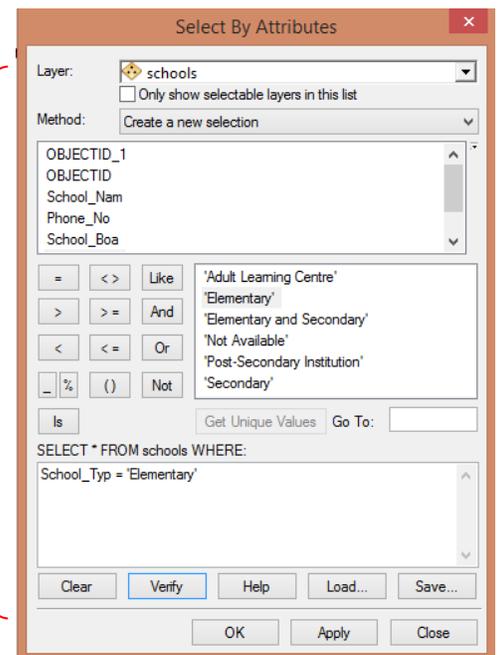
1. From the **Selection** menu go to **Select By Attributes...**

This dialogue box enables us to create a *query definition*. Make the following selections:

- **Layer:** schools
- **Method:** Create a new selection
- Double-click **School\_Typ** (scroll) and see it added to the query window.
- Click the **equals** sign =
- Click **Get Unique Values** to see the available school types and double-click **Elementary**.

2. Click “Verify” to confirm the query is acceptable. If there is a problem, double-check the selections at each step.
3. Click OK to the Verify results window then click OK to run the query. Each of the elementary schools is selected in the map window by a cyan dot.

4. Right-click the schools layer and click **Selection > Create Layer From Selected Features**. A new layer of the selected features appears in the Table of Contents. Click *Clear Selected Features*  to de-select all features.
5. To re-name the new layer, click on the layer name, **schools selection**, then click a second time. Type “Elementary Schools” and hit *Enter* on the keyboard.

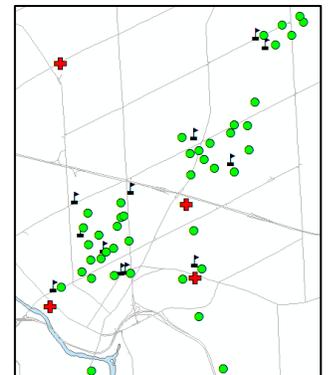


6. Apply a 'school' symbol to the **Elementary schools** layer and change the colour. (HINT: Click the dot symbol to access the symbol selector.)
7. Turn off the original **schools** layer.
8. **SAVE** your map!

#### **Section 4: Putting your data on the map – displaying x,y data**

Tabular data can be mapped provided there is location information associated with it, such as an address, postal code or geographic coordinates, etc. This tutorial uses geographic coordinates to map the location of flu patients.

1. Click the **Add Data** button .
  2. The HOME location should reflect the folder that you opened the map document from. Double-click to access the IntroToArcGIS folder.
  2. Double-click **IntroToArcGIS.gdb** and select *Flu\_patients*. Click **Add**.
  3. The **Table of Contents** view changes to "List by Source"  since the table doesn't have any symbols associated with it.
  4. Right-click *Flu\_patients* and select *Open*. Notice the **LONGITUDE** and **LATITUDE** fields. Each flu case will be mapped based on these values.
- | Flu_patients |            |             |            |           |
|--------------|------------|-------------|------------|-----------|
|              | OBJECTID_1 | Type        | LONGITUDE  | LATITUDE  |
| ▶            | 1          | stomach flu | -79.25662  | 43.133522 |
|              | 3          | stomach flu | -79.25347  | 43.13762  |
|              | 4          | stomach flu | -79.261407 | 43.138368 |
5. Close the table view. HINT: click the X in the upper right corner of the table.
  6. From the Table of Contents, right-click the *Flu\_patients* table and select **Display X,Y data**.
  7. In the resulting dialogue box, select LONGITUDE for the X Field and LATITUDE for the Y Field.
  8. Under the section **Coordinate System of Input Coordinates**, click **Edit...**
  9. Enter the search term **NAD 1983** and click the search button .
  10. Double-click the folder **Geographic Coordinate Systems**, then **North America**.
  11. Select  **NAD 1983** and click OK.
  12. Click OK to run the **Display XY Data** tool.
  13. A new layer will appear in the Table of Contents called **Flu\_patients Events** and the patients are now visually represented by dots on the map.
  14. The new layer is a temporary file. To save the file, right-click **Flu\_patients Events** and select **Data > Export Data**.
  15. In the Export Data dialogue box, click the browse button . Navigate to your storage space, provide a name (*Flu\_points*), change the Save as type: to shapefile and click Save.
  16. When prompted to add the data as a layer, click yes.
  17. A default symbol is used. Change this symbol to something more visible; and change the name to **Flu cases**. HINTS: click dot symbol to access symbol selector; slowly double-click the name to change it.



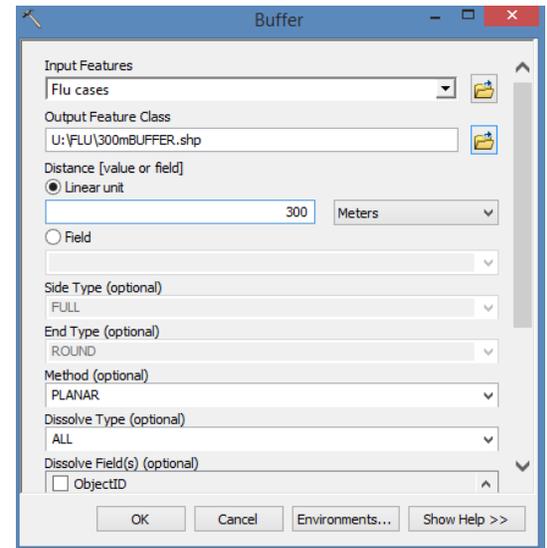
*NOTE: The patient data is a fictitious representation of flu cases for demonstration purposes only.*

\*Before continuing, change the **Table of Contents** view back to **List by Drawing Order**. HINT: Click the button  below the **Table of Contents** panel title.

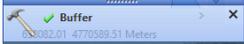
### Section 5: Creating a “buffer” for further analysis

To identify elementary schools in proximity to the clusters of flu patients a boundary must be identified on which to base a spatial query.

1. From the **Geoprocessing** dropdown menu, select **Buffer**. It may take several seconds to load the tool.
2. Fill the dialogue box as follows:
  - **Input Features:** Flu cases
  - **Output Feature Class:** browse to student directory and provide a name including the extension “300mBUFFER.shp”. Click Save.
  - **Distance:** 300 metres
  - **Dissolve Type:** ALL



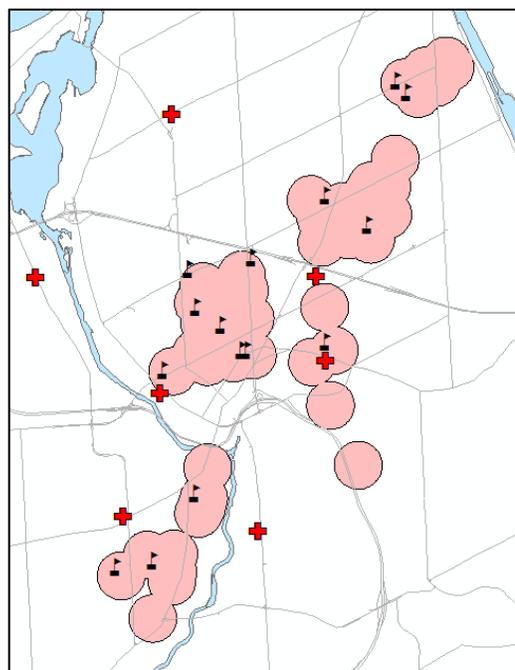
3. Click OK. The process may take several seconds. A notification window pops up in the bottom right of the window when the process is

complete. 

4. The new layer is added to the map. Turn off the **Flu cases** layer to better visualize the buffer boundary.

The buffer layer represents a proximity boundary of 300 metres from all confirmed flu cases. Using this boundary, we can identify elementary schools to phone regarding the flu outbreak.

5. SAVE your map!

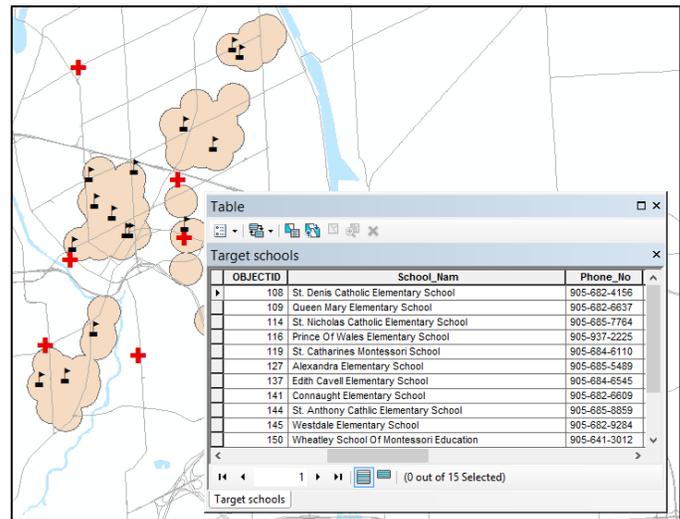
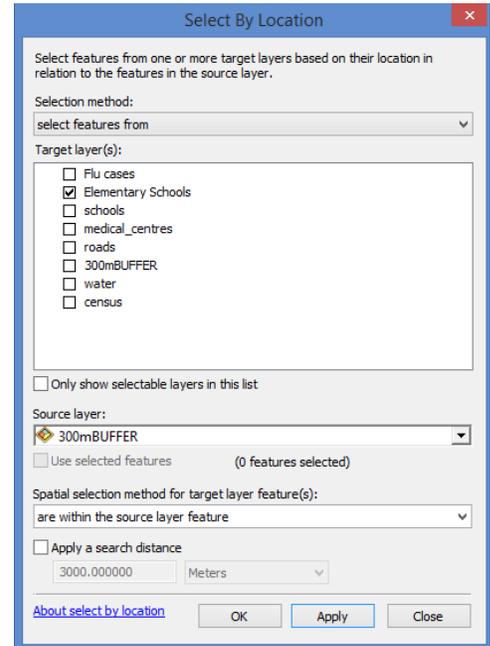


**Section 6: Selecting elementary schools within the buffer**

- From the **Selection** dropdown menu, click **Select by Location**.
- Enter the following specifications:
  - Selection method:** select features from
  - Target layer(s):** check Elementary Schools
  - Source layer:** 300mBUFFER
  - Spatial selection method for target layer feature(s):** are within the source layer feature.
- Click **OK**. Notice the selection of schools highlighted with cyan dots within the buffer zones.
- Create a new layer from the selection.  
(HINT: Right-click the **Elementary schools** layer and choose **Selection > Create Layer From Selected Features**)
- Change the symbol and name to the new selection, i.e. Target schools.
- Turn off other school layers.
- Open the attribute table from Target schools.

We now have a selection of schools to contact regarding the flu outbreak.

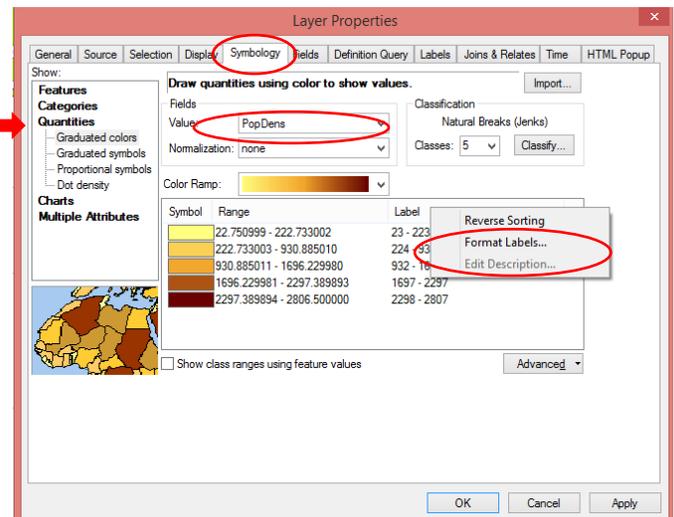
- SAVE your map!



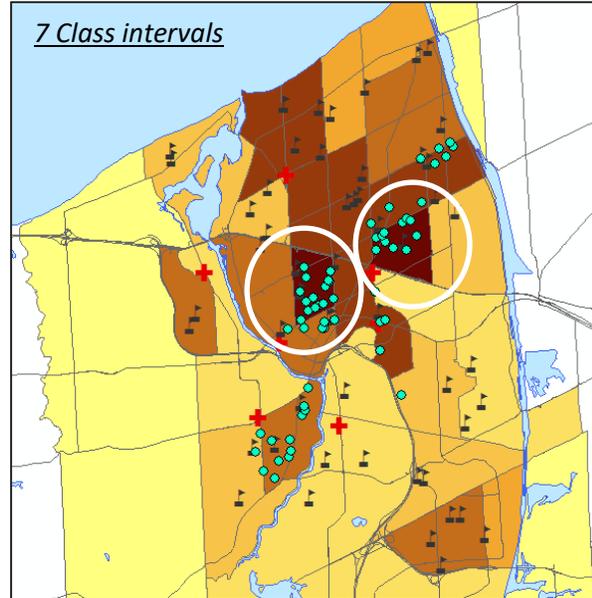
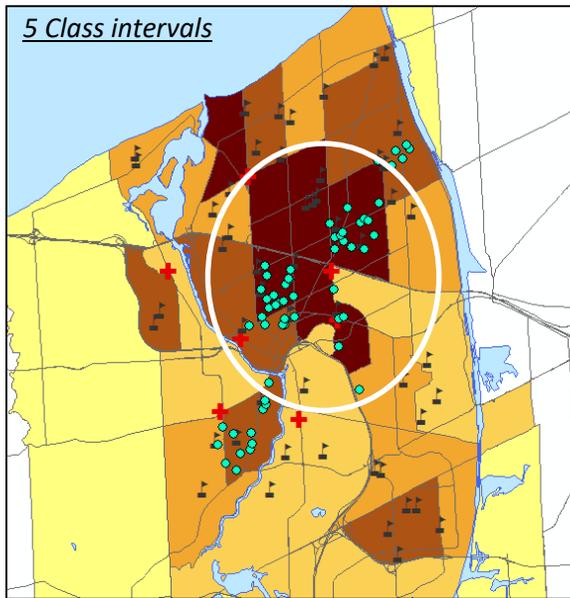
**Section 7: Census Mapping (optional)**

Demographic mapping can add enhancement to the analysis.

- Turn off the **300mBUFFER** layer.  
Turn on the **Flu cases** and **census** layers (check the boxes).
- Double-click the **census** layer and select the "Symbology" tab.
- From "Show:" select Quantities > Graduated colors
- From "Fields:" select Value > PopDens (This field contains population density values)
- Select a colour ramp.
- Click the "Label" header and choose Format Labels...  
Reduce the number of decimal places to zero, click OK.  
NOTE the number of classes defaults to 5. We will change this in the next part.
- Check your properties with the image on the right.
- Click OK to apply the symbology to the map.



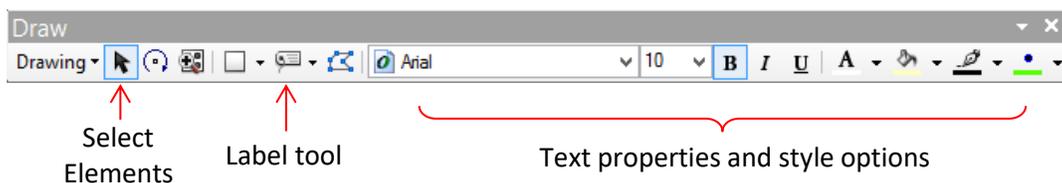
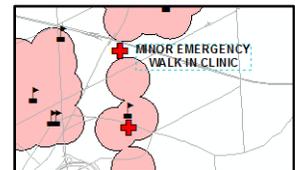
Population density represents the number of people per square kilometre. Dark areas indicate higher population density. Access the layer properties again (HINT: double-click the census layer in the Table of Contents) and change the number of class intervals to 7. Click OK. Notice the change in the display of the data. The distribution of flu incidents clearly shows occurrence in the more densely populated areas of St. Catharines.



**Section 8: Labels**

The attributes associated with a layer may be used to *label* features.

1. From the Customize dropdown menu, select Toolbars > Draw.
2. Click the little black triangle beside the **Text** tool to reveal additional text options.
3. Select the **Label** tool . This tool uses a pre-defined attribute field to label features on the map.
4. Click a red cross representing a medical centre.
5. Click the **Select Elements** tool then double-click the newly added label.
6. Select the **Text** tab. The text may be modified here. For example, place the cursor in the middle of longer lines of text and hit enter to place the label on two lines.
7. Click OK to see the results. You may need to click and drag the label to an appropriate location near the feature.
8. With the label selected, make appropriate style selections from the **Drawing** toolbar such as BOLD, text SIZE and colour.



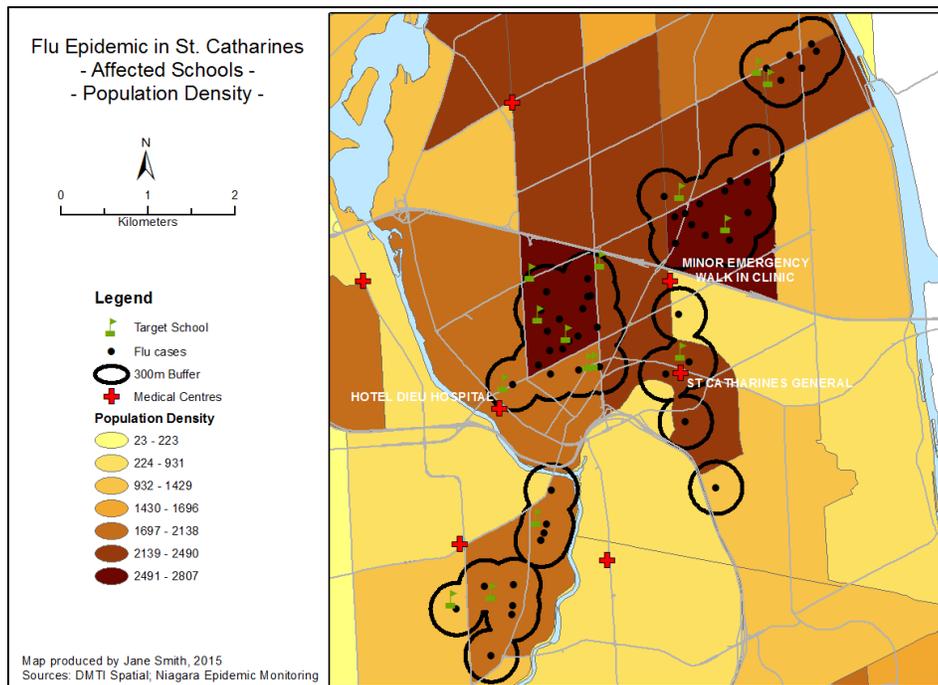
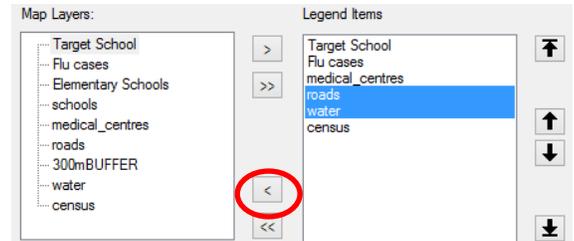
9. Alternately, use the **Text** tool to add custom text to the map.
10. SAVE your map!

**Section 9: Observations and layout**

Spatial correlations between clusters of flu cases, elementary schools and medical centres are evident when visually displayed on a map.

Your final map should include: a title, legend, north arrow, scale bar, labels as you see appropriate, author (your name), date created and a data source statement.

1. From the **View** dropdown menu, select **Layout View**. This is a sort of ‘print preview’ where layout elements can be added such as title, north arrow, scale bar or source statements.
2. Explore the **Insert** menu to add the map layout elements. Specifically, select **Insert > Legend**.
3. From the first window of the Wizard, layers listed in the right panel will be included. The default listing includes any layer that is turned on.
4. Select items not necessary (roads, water) and click the **remove** button  .
5. Click **Next** to continue through various options for the legend.
6. Click OK to the final window to return to the map. Additional options are available after the legend is made.
7. Explore adding other map elements from the Insert menu.
8. Using the selection tool  click a map element (legend, map window, title, etc.). Shift the elements around to create a pleasing layout. Double-click an element to view additional properties.
9. With an element selected, use the selection handles to resize the element.
10. **SAVE** your map!



**Section 10: Saving the map**

**\*NOTE: The map document can only be accessed where the data files are also accessible (i.e. your X:\ drive)**

For printing purposes, it is best to save the map as a PDF file, select **File > Export Map**. Select PDF as the file type and provide an appropriate storage location and filename. The map can also be exported as a jpg and inserted into WORD or PPT.