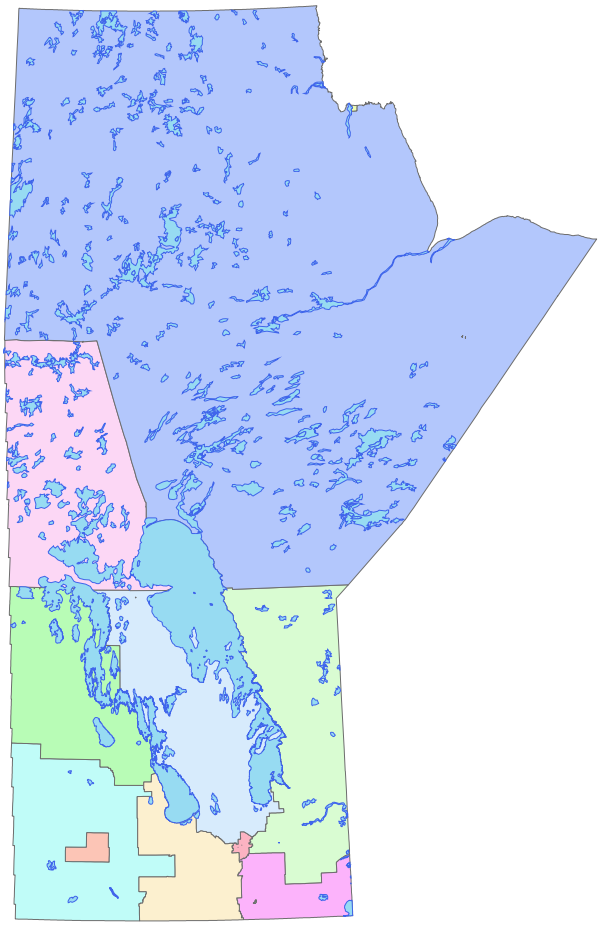
ArcGIS Workshop Supplementary Notes

Manitoba Centre for Health Policy

Charles Burchill

2005



ArcGIS Desktop Workshop Supplementary Notes
Charles Burchill, 2005
Based on ArcView 3.3 Workshop Notes by C. Burchill and Laurel Jebamani

The following notes were developed for a one day workshop on the use of GIS, specifically for the presentation of maps using ArcGIS 8.2, at the Manitoba Centre for Health Policy. Charles Burchill developed and gave the workshop; Laurel Jebamani organized the first version of these notes based on the content of the workshop. The purpose of the workshop was to provide an introduction to GIS for MCHP staff.

There are a series of map and data files that are required for doing the outlined examples and activities. The required files are listed at the end of this document. All of the files are available from Charles Burchill for use as instructional tools within the University of Manitoba. A number of files included are not mentioned in this document – files in the FNTS (First Nations) and SCHOOL directories. These files are used for extra examples found in the instructor's notes and other workshops.

These notes are not meant as a replacement for the ArcGIS Desktop manual. If necessary you can borrow Charles Burchill's personal copy of the ArcGIS Desktop and extensions manuals – please ask to borrow the manual and return it when you are finished. Since ArcGIS is licensed from the University of Manitoba a manual was not provided.

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Introduction

GIS: Geographic Information Systems, Geographic Information Science, or Geographic Information Studies.

What is a GIS?
In the strictest sense, a GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations. GIS practitioners also regard the total GIS as including operating personnel and the data that go into the system. The first GIS was developed in the mid 1960s (1963) as the Canadian Geographic Information System (CGIS) associated with the Canada Land Inventory.

MCHP has been doing GIS analysis since the start of the centre and before. Much of the research repository data is based on geographic data already through postal and municipal codes. MCHP has looked at location of residence, location of service, migration and changes in residence. More recently education measures tied to RHA and Winnipeg areas, child inequality measures, and neighbourhood socio-economic characteristics by community centre areas. Most of this work was done without ever looking at a map, but it is all geographically based. RHA and other health regions are all geographic units. Income quintiles and other SES measures are based on the geographic location of individuals and household income by neighbourhoods. In other words GIS is nothing new; however, presenting information as maps has not been extensively used and geo-locating and referencing has typically been done by hand.

Maps have been used and developed using SAS in the past at MCHP. This was often a long and painful process since the maps provided by SAS did not contain the base maps required for Manitoba. Creating, editing, and importing new maps into PROC GMAP was very time consuming. In addition, using and manipulating map data for presentation and basic analysis was difficult. More recently SAS has added a GIS component to its software package that makes the process of mapping much easier. While SAS/GIS software has many of the components of GIS packages like ArcGIS, MapInfo, and GRASS it is still quite limited.

Content

This workshop covers data presentation using maps and getting data into and out of ArcGIS. We will also cover adding some your own data from tables. The primary tool used in this workshop will be ArcMap.

GIS for this workshop is limited to presentation of geographic information using maps. This workshop will not be covering creating or editing of maps, geocoding addresses, spatial statistics, use of raster/bitmap images, network analysis or other advanced techniques. This is intended as a workshop to provide an introduction to the use of ArcMap and some GIS concepts it should not be considered a complete introduction to GIS.

Tools

ArcMap 8.2 from ArcGIS Desktop ESRI (Environmental Systems Research Institute) will be used for this workshop. There are a few factors which make ArcView or ArcGIS the most appropriate choice for this workshop: The UofM has a site licence for ArcGIS, it is widely used and supported, and it is primarily a vector based application which works well for our needs. Until recently we have not used ArcGIS 8.2 very much because it requires more powerful computers than were generally available. A free package called ArcExplorer available from ESRI that will allow users to display but not edit or manipulate maps or tables. There are a wide variety of other GIS packages for sale and for free: MapInfo, EpiMap, Idrisi, GRASS, etc…

Tools Within ArcGIS

Map – display and presenting maps (Relates most to ArcView 3.3)
Catalog – Manage storage, locations, defaults, creating new files, meta-data
Toolbox – transformations, statistics

Products

	ArcView	ArcEditor	ArcInfo
View shapefiles and coverages	✓	✓	✓
View geodatabases	✓	✓	✓
Create/Edit shapefiles	✓	✓	✓
Create/Edit coverages		✓	✓
Create/Edit personal geodatabases	✓[1]	✓	✓
Create/Edit multi-user geodatabases		✓	✓
Create/Edit feature-linked annotation		✓	✓
View feature-linked annotation	✓	✓	✓
Direct support of many raster formats	✓[2]	✓[2]	✓[2]
Data conversion and management	✓[3]	✓[3]	✓[3]
Includes ArcInfo Workstation			✓
License type	Single-use and floating	Floating only	Floating only
Operating Systems	Windows NT, Windows 2000, and Windows XP[4]	Windows NT, Windows 2000, and Windows XP[4]	ArcInfo Desktop supports Windows NT, Windows 2000, and Windows XP[4]. ArcInfo Workstation adds UNIX support.

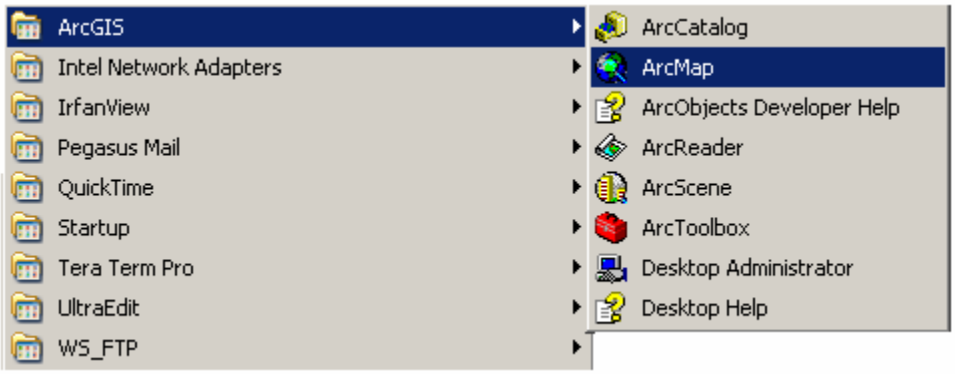
[1] ArcView supports simple features (points, lines, polygons, and static annotation) in a personal geodatabase, not rules and relationships.
[2] ArcView and ArcEditor support more than 25 raster formats. ArcInfo supports more than 30 raster formats.
[3] ArcToolbox in ArcView and ArcEditor contains 36 basic data conversion tools. ArcToolbox in ArcInfo contains more than 170 data management, analysis, and conversion tools.
[4] ArcGIS Desktop supports both Windows XP Home Edition and Windows XP Professional.

Creating a Map and Basic Use of ArcMap

The following section deals primarily with displaying maps using ArcMap. The ArcMap application consists of a map display window for viewing spatial data, a table of contents listing layers shown in the display, and a variety of tools for working with spatial data. Similar to most current windows applications ArcMap can be modified to meet your specific needs with regard to available tools, tool bars, and other preferences.

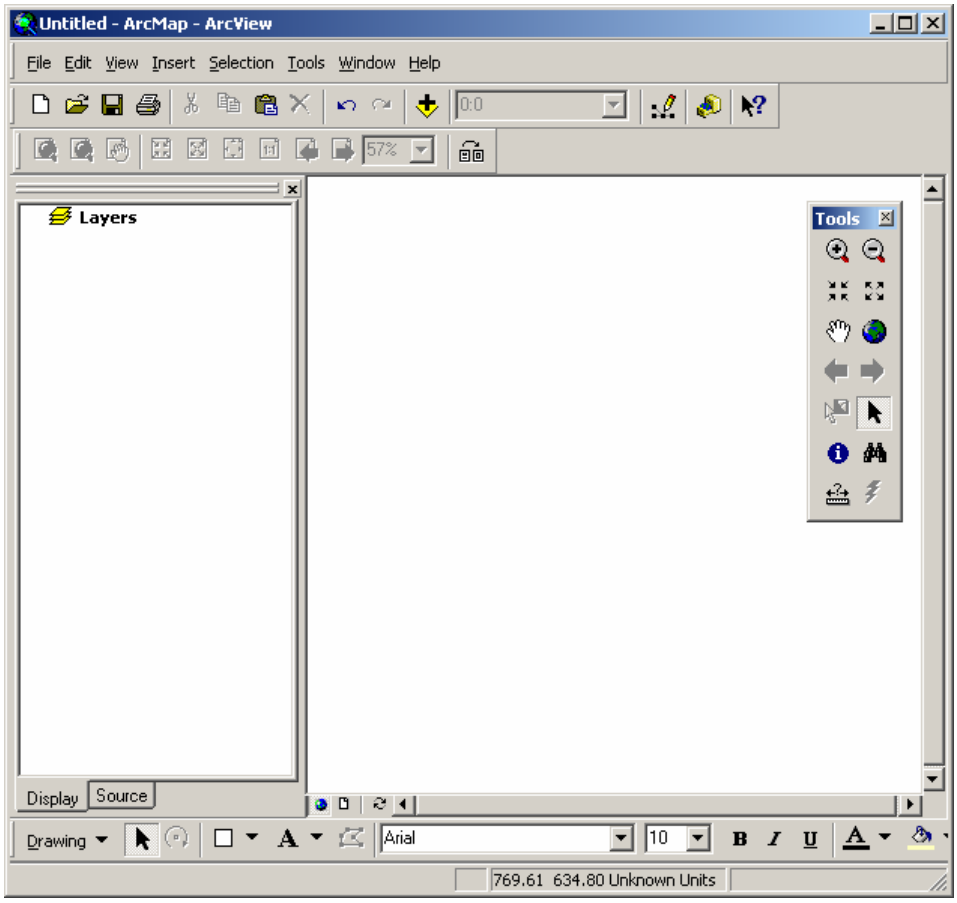
Starting ArcMap

From the Start menu, go to Programs, ArcGIS, ArcMap.



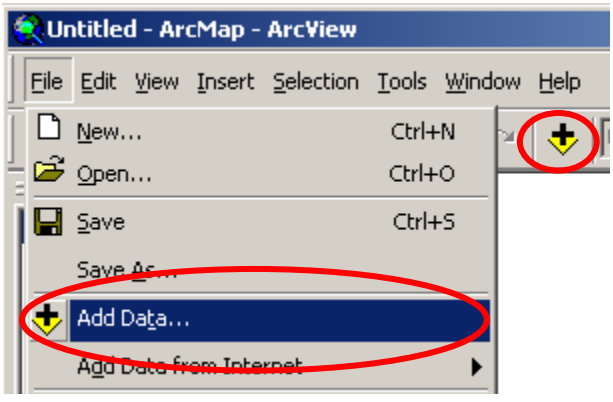
Data View & Frames

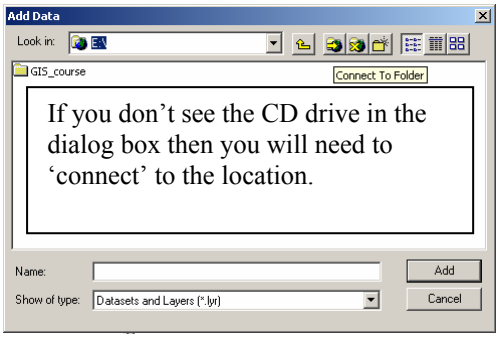
In ArcMap, you begin with a map document. This is a collection of all tables, data frames, layers, charts, and scripts. When working with a map document it is important to remember that it does not contain any of the spatial or tabular data. The document is a collection of pointers to data files and instructions on how to combine or display those files as a unit. The first component of a document we will be dealing with is called a Frame. A frame is, essentially, your map or one view of the world; ArcMap can have multiple frames all placed in one layout or view. It is where you look at and manage much of your mapped data. When you open a new document in ArcMap, your view will simply be a blank page.



From here, you add layers. Themes are the components of your map, and work in layers. There are four basic kinds of themes; polygons, lines (arcs), points, grids (raster). Map files used by ArcView include ArcView Shape files (.shp), ArcInfo coverage files, CAD files such as AutoCAD (.dxf), and raster or bitmap images.

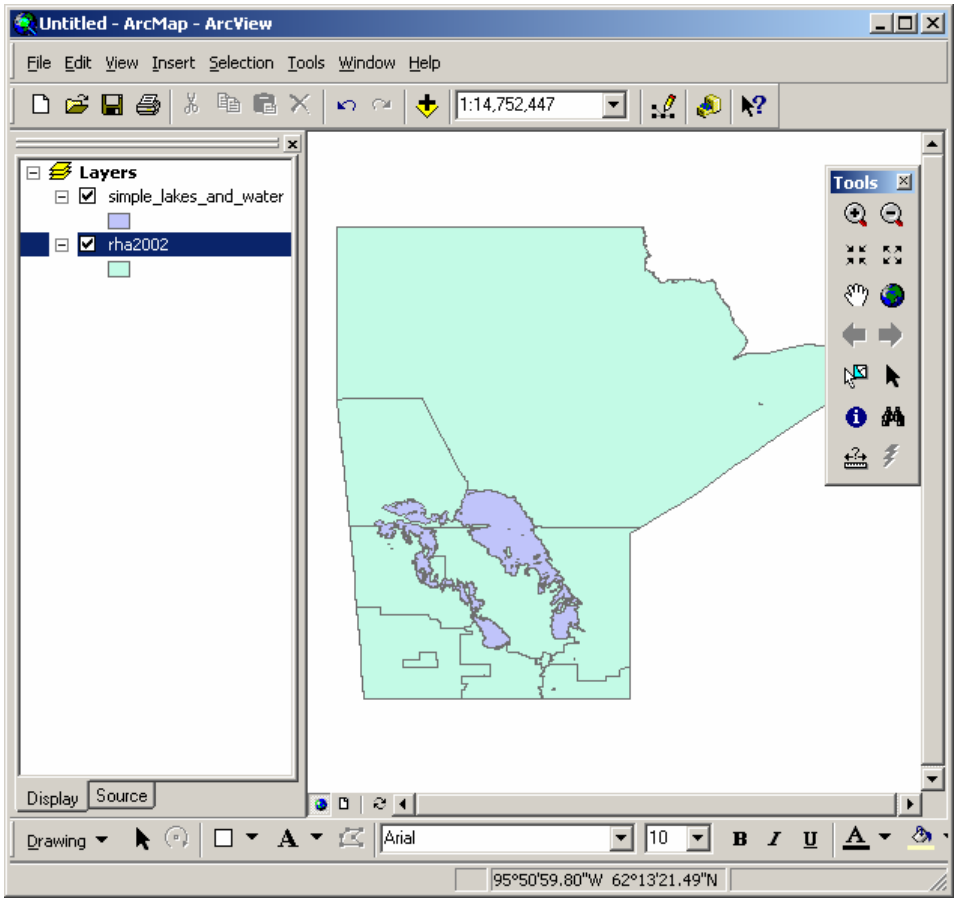
If you want to add a map of Manitoba to your view, you would click on the "add data" button on the toolbar or select from the File menu.





Open the shape file D:\gis_course\rha\rha2002.shp. This shows you a polygon layer containing the outlines of the Manitoba RHA boundaries. The outer boundary of this

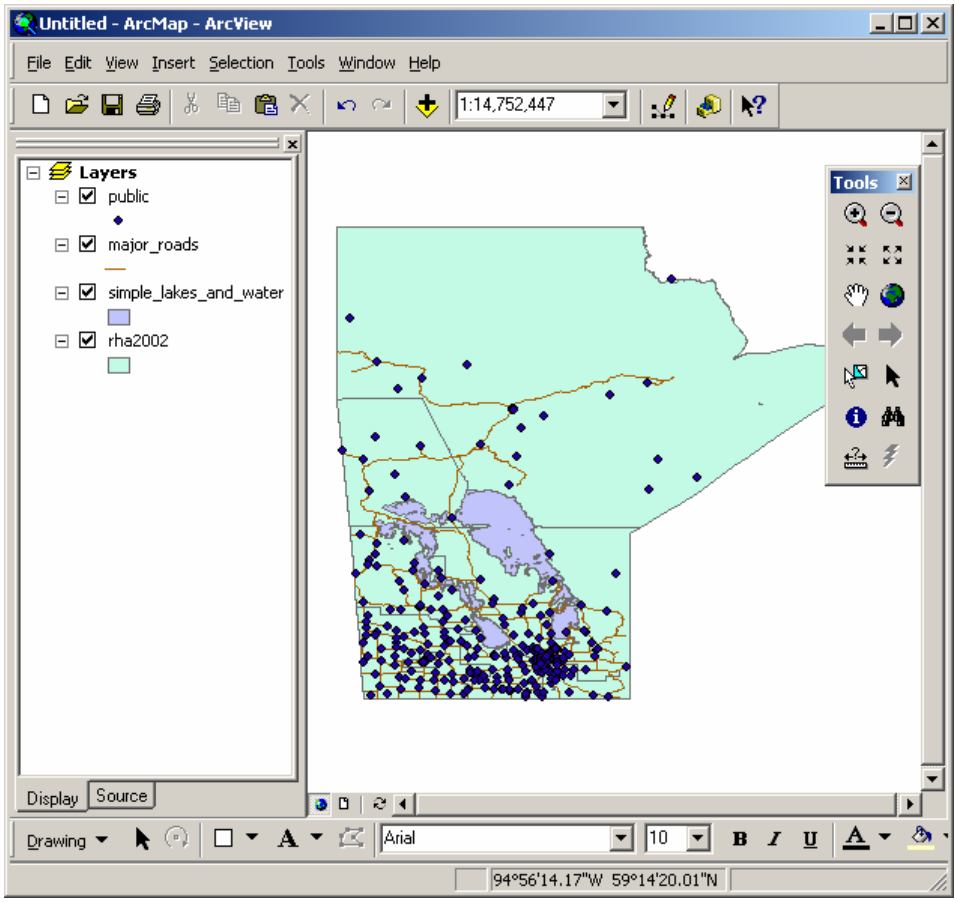
theme is roughly in the shape of Manitoba. Click on "add data" again, and open D:\gis_course\simple_lakes_and_water.shp. Multiple shape files can be selected when adding views by holding down the shift key when selecting files. A single shape file can be added to a view multiple times to show different attributes of the same features. The left frame of your view is called the table of contents and it is used to keep track of your themes. Each layer is displayed, by default, with a legend below the layer name. Check (click on) the boxes to display the layer in your view. You should now have a view that looks something like the image below.



As you add layers, they show up in the view in layers and are listed in the table of contents. The first layers form the bottom layers, while the most recent layers form the top layers. It is important that the themes with the largest polygons are added first, so that they form the bottom layers. This actually applies to all types of themes. To understand why, try adding simple_lakes_and_water.shp before rha2002.shp, activate them both, and see what your view looks like. You can fix this by "dragging" your rha.shp layer to below the lakes and waters layer.

Once you've added your polygons, the next layers to add are arcs. (This is in keeping with the wisdom of adding largest featured layers first and smallest layers last.) Arcs are lines, commonly road systems on our maps. To add roads to your Manitoba map, click on "add data" and open D:\gis_course\rha\major_roads.shp.

The smallest layers (and thus the last to be added to our view) are called points. These are usually locations of hospitals, schools, community centres, or other discrete locations. We will add public schools to our map, by clicking on "add data" and opening D:\gis_course\rha\public.shp. Your map now has four themes, or layers: first the rha boundaries (a polygon), next the lakes (a polygon), next the major roads (lines), and finally, the locations of public schools (points). If you have all of your layers turned on at once, you should have a view that looks something like the figure below.



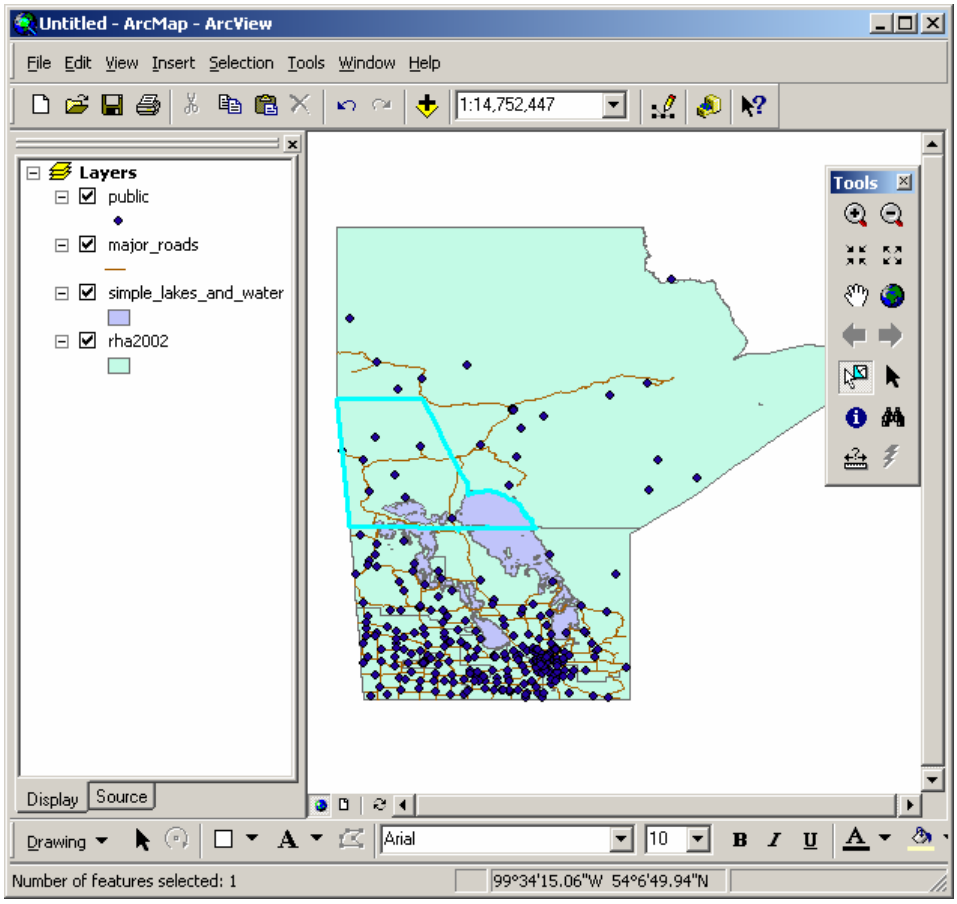
If you want to get a better look at the southern part of the province, where there is the largest concentration of public schools. You can zoom to any part of your view by clicking on the "zoom in" button:

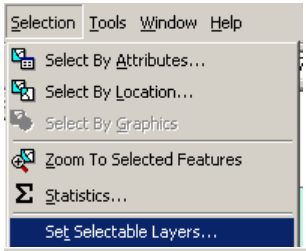
When you take your cursor over your view, you should have a little magnifying glass instead of an arrow. You can zoom in two ways: clicking the mouse while the magnifying glass is in the view will zoom into the map (and re-center the map to where the magnifying glass was positioned). If you want to zoom in more quickly, click and drag the magnifying glass to create a box around the area you want to zoom into. If you want to look at Winnipeg only, make a small box around the Winnipeg area, and see how your map looks. The "zoom out" button, just to the right of

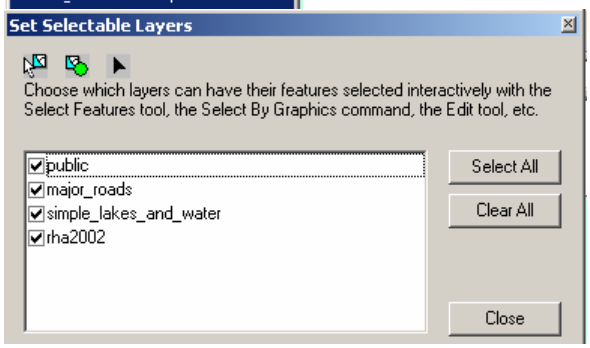
the “zoom in” button, works exactly the same way, except zooming out instead of in.

If you want to re-center your map but leave the scale the same, use the “pan” button  . The cursor is now a hand, with which you can grab your map and drag it around until it is positioned where you want it.

The button immediately to the left of the “zoom in” button is the “select feature” button  . This button looks like it has a small arrow and half filled box. You can use this button to select different parts of your map. The selected portions will be highlighted with a blue outline.



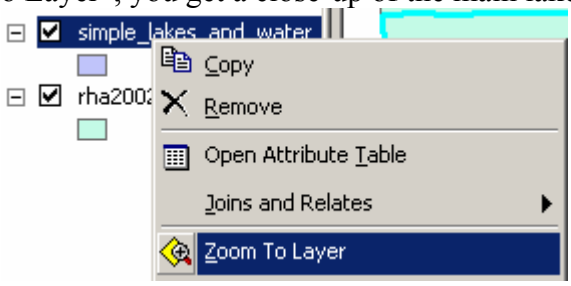




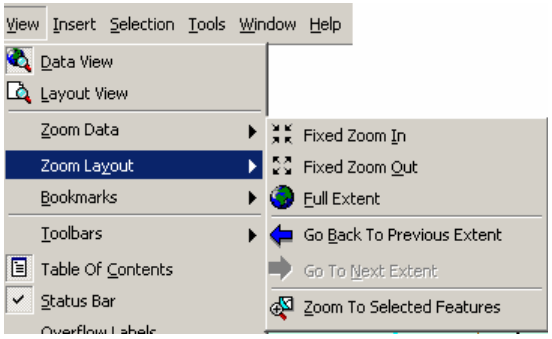
You can select or work with multiple layers at one time. Notice that, in the above view, the layer for rha.shp to the left of the map is highlighted. To limit the layers that are selectable use the Selection menu items 'Set Selectable Layers'. To select more than one feature at once, hold down the shift key and click on each feature that you want or drag a box around the features you want to select. The "select feature" button works similarly to the zoom buttons, in that you can either click on the map (whichever portion of the feature you click on will be selected), or click and drag a box around what you want selected (any portion that falls partly within the box will be selected). You can clear the selected portions of a theme by selecting 'Clear Selected Features…' from the 'Selection' menu.

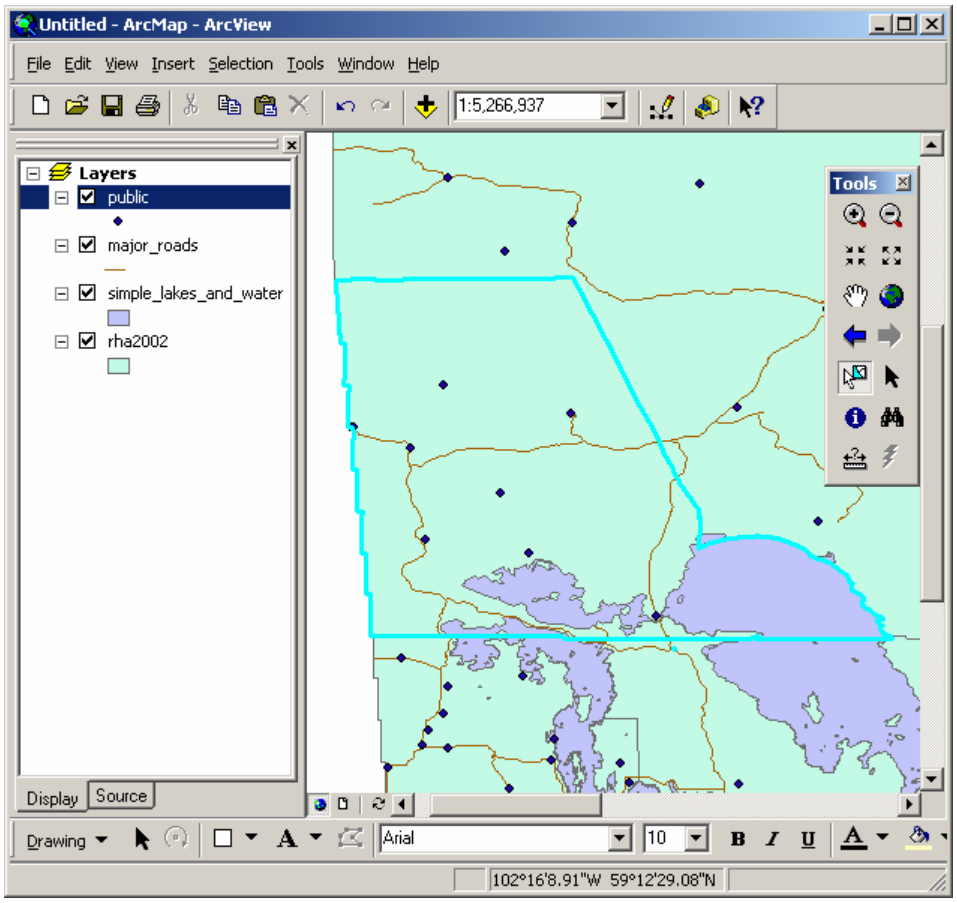
In the tool bar there are a number of other zooming buttons. Zoom in, Zoom out, and "Zoom to full extent". The last item looks like a small globe and will take you to a view of your entire map.

If you want to zoom to the active layer then right click on the layer of interest in the table of contents and select 'Zoom to Layer'. This will take you to a view of just that theme. If you highlight Simple_lakes_and_waters.shp and click on "Zoom to Layer", you get a close-up of the main lakes of Manitoba.



If you want to zoom to a selected feature then you can select 'Zoom to Selected Features' from the Selection menu or from the view menu. This item will zoom in on whatever portion(s) of the map are currently selected for the active theme. If you select Nor-Man, as in the earlier example, and click "Zoom to selected", you would get something like the following picture.





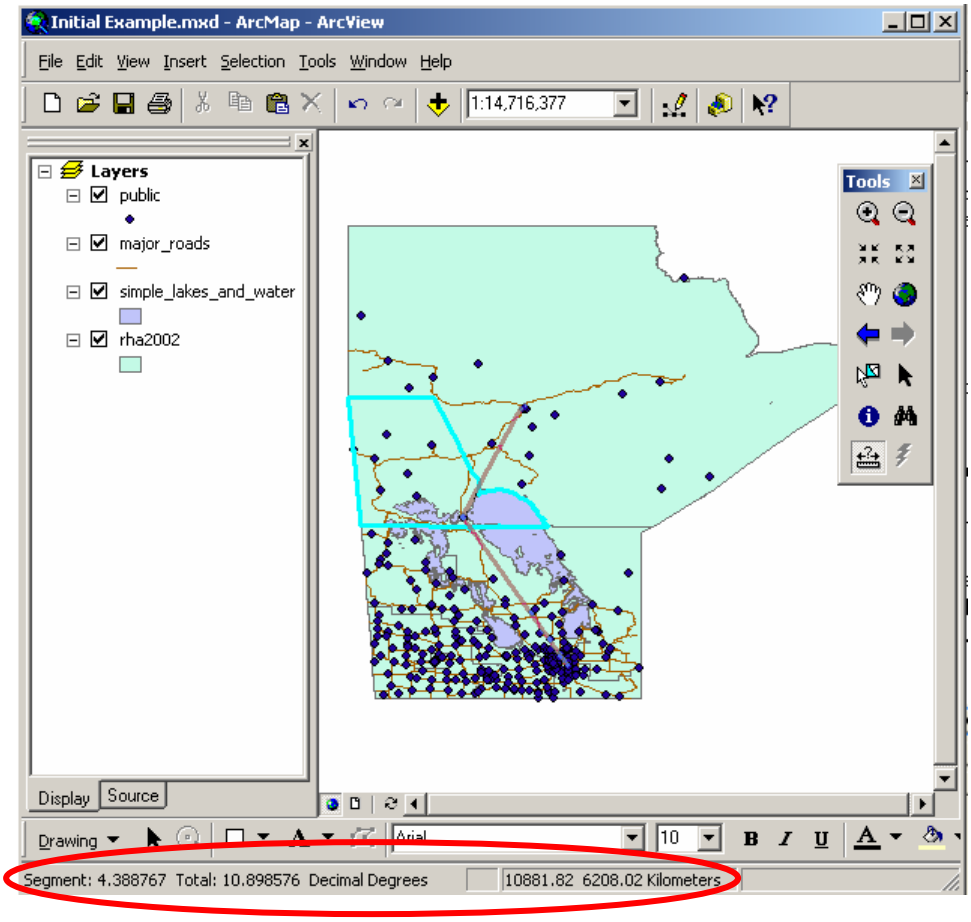
Notice the scale on the upper right side. It tells you the scale of the current view. You can change the zoom of your map by entering the scale by hand. Currently, the scale is approximately 1:5.2 million. If you zoom to full extent, the scale is approximately 1:14 million. Large scale will give you lots of detail in a small portion of your map – you can zoom to a specific street in Winnipeg if you want. Small scale will show you a large area with little detail (such as all of Canada). .

Within ArcMap all features in a theme have associated information. This information can be displayed by clicking on the information button ( ), then clicking on the feature (e.g. a specific polygon) of interest.

It is possible to measure distances in ArcView, using the "measure" button.

When you click on the button, the cursor changes to a ruler. If you want to measure the distance between Winnipeg and Thompson, click on Winnipeg in your View. Then move your ruler to Thompson. You'll notice that a line appears between Winnipeg and wherever you move your icon. The distance between your two points will be displayed in the bottom left-hand corner of your screen. If you want to know the approximate road distance between Winnipeg and Thompson, you can change the direction of your "ruler" by

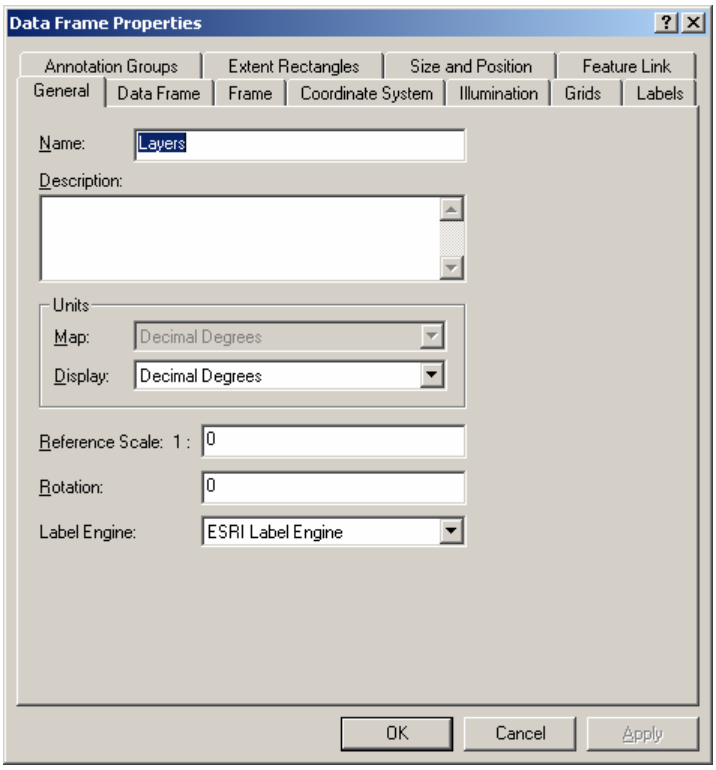
clicking at the point you want to change direction, and then continuing with a new line. The display tells you the total distance as well as the distance of your current line. The distance is measured in the distance units set in the frame properties window.



Note that the distance measure is displayed in base measurement unit for the frame by default. To change it to kilometers, go to Data Frame Properties under the View menu, and change distance units to kilometers.

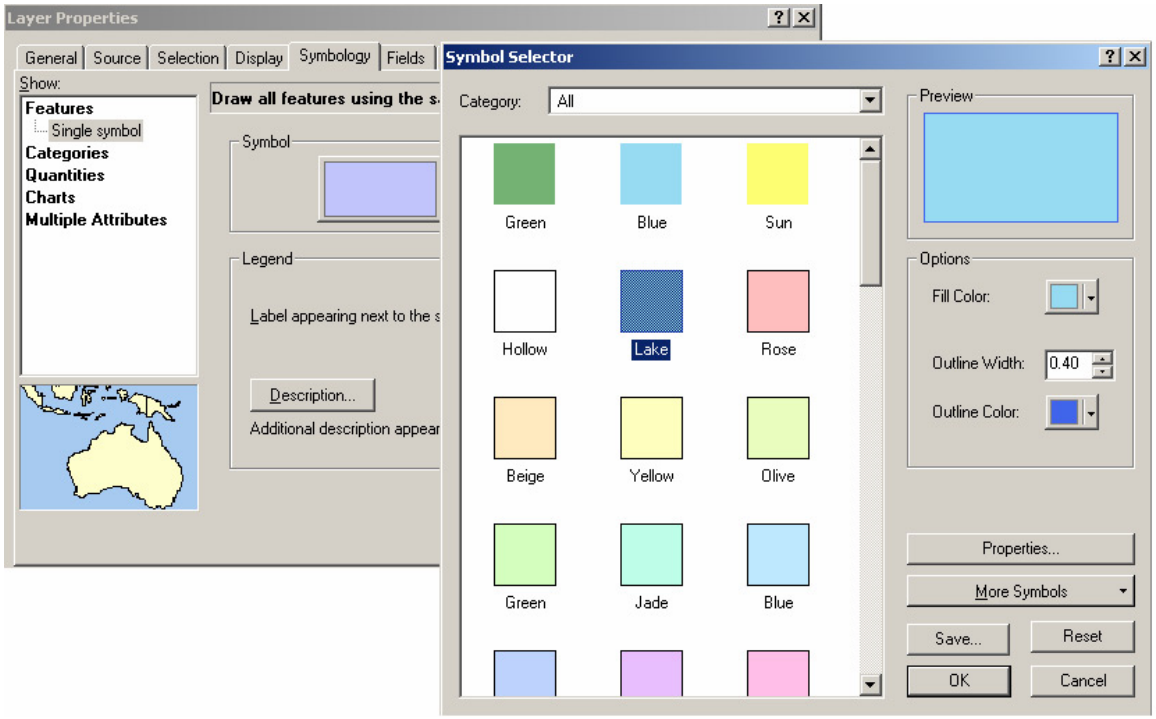
Frame Properties

The properties will allow you to change a number of other settings for the frame. You can change the name of the frame. Similar to the themes you can have multiple frames in a single project. These frames can display different areas of the same province, the whole country or even the world. You can change the background color or even the projection (what ever that is…). Add Grids (measurement) and Graticules (Lat/Long) to indicate measurement locations and distances.

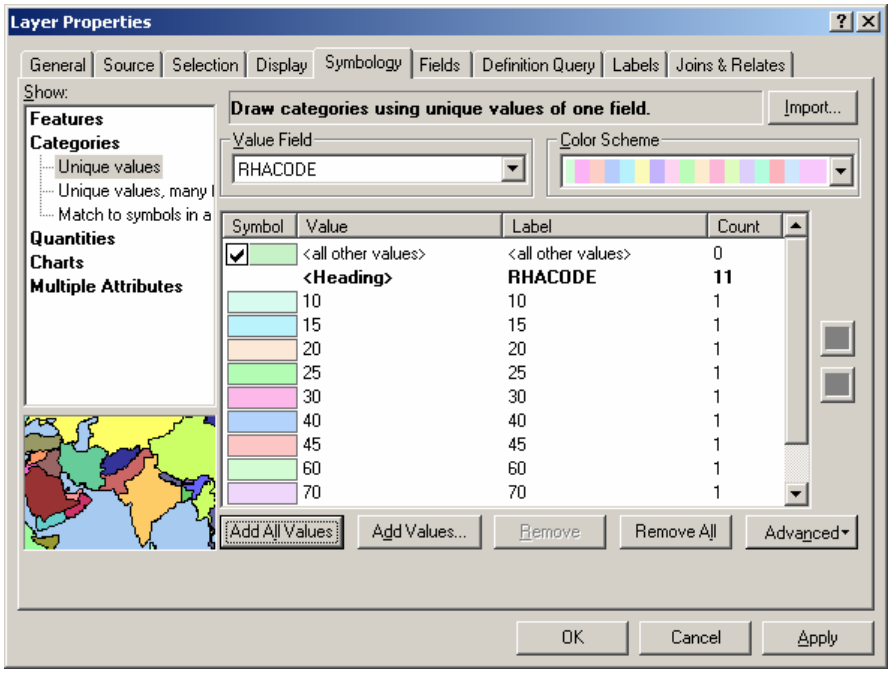


Changing the Look of your Map

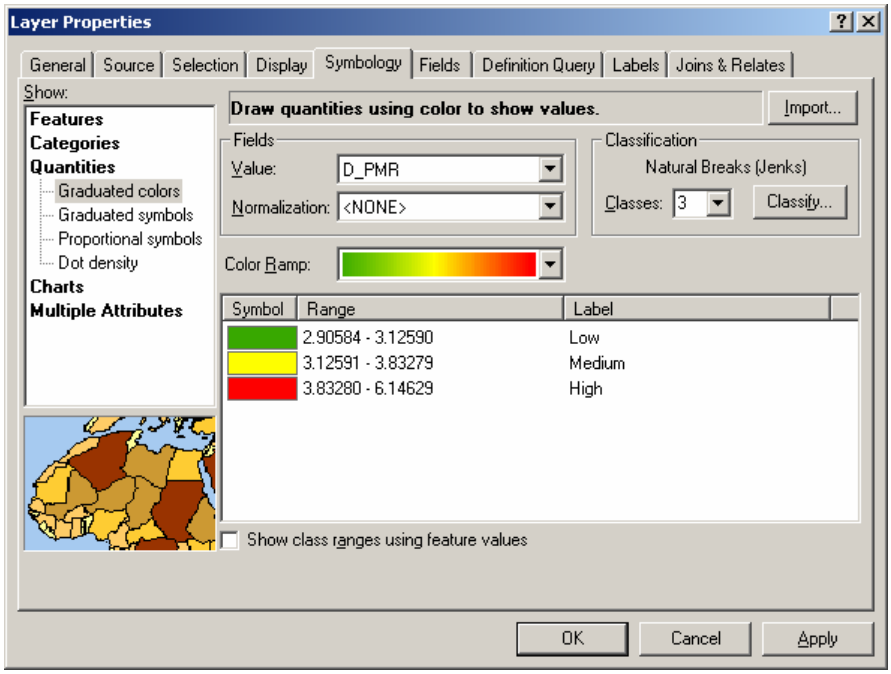
Your lakes are probably some colour other than blue right now. To change them to blue, click on the lakes symbol (or fill) in the table of contents. A dialog that allows you to change the fill and pattern should open. Alternatively double-click the lakes title in the table of contents. This will open the layer properties where many more things can be changed including the symbology. Click on the fill color to select the fill and border. Lakes are often represented as a light blue with a darker blue outline.



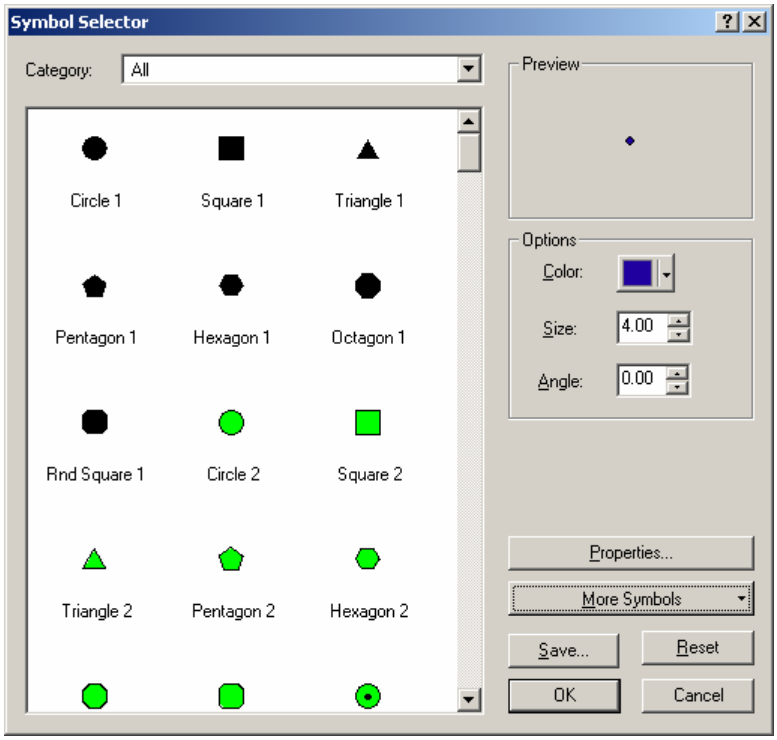
You can also have different values of a theme take on different colours. For example, within the RHA.shp theme, you could have each RHA take on a different colour. Open the layer properties by double clicking on the layer name or selecting Layer Properties from the context sensitive menu. In the layer properties under symbology select categories in the dialog box with the unique values option. Click on the "add all values" button to enter the RHA values.



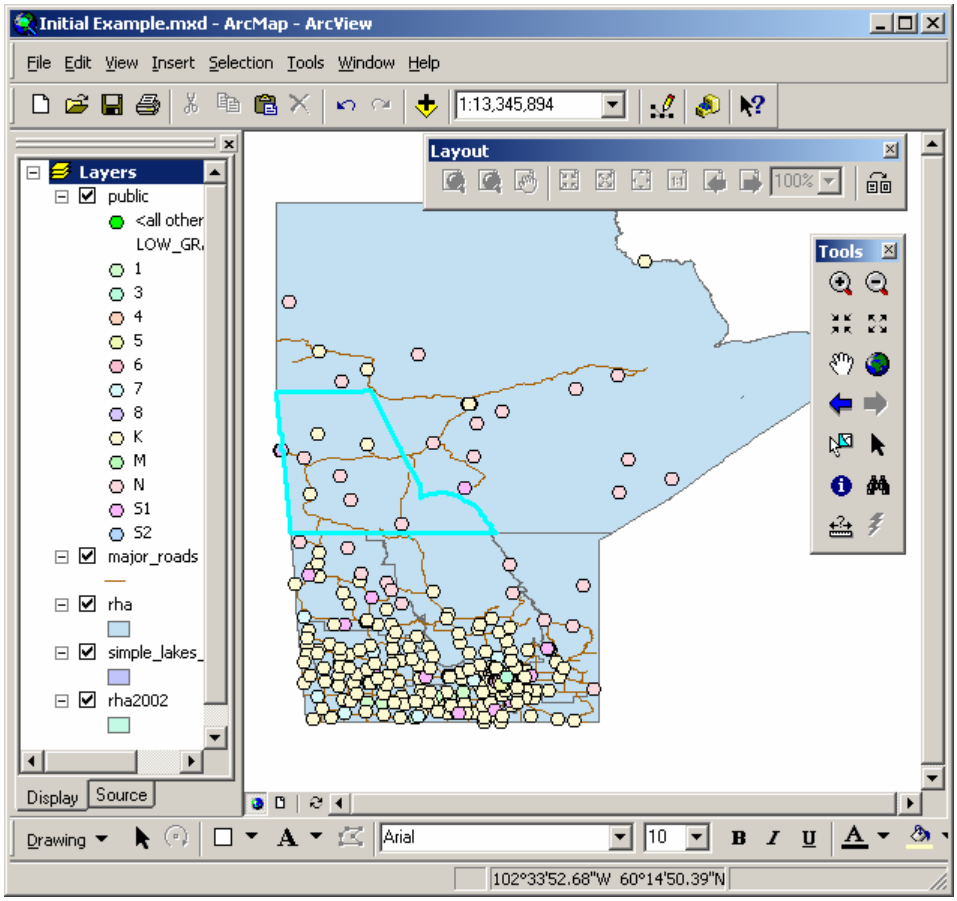
Another option is to display numeric values as quantiles with a continuous gradient in the colour. You could group your RHAs by premature mortality rate by choosing "Quantiles", and then choosing D_pmr as your classification field. Again, you are given a choice of colour schemes, each colour representing a PMR category.



Polygons are, obviously, not the only themes that can be edited. Double-click on your roads legend, and you can change the size of your lines. Points can also be edited, not only by colour, but also by size, shape and symbol.



You can use the options for multicoloured themes for points as well. If you wanted to group your schools by the lowest grade taught at the school, you would choose Unique Value under legend type, and then choose Low_Grade under values field.



Notice how long the legend for public schools has become – you can't even see the legends for your other themes any more. To fix this, click on the minus (-) beside the layer in the table of contents. You should now only have a label for the schools, and you should be able to see the legends for your other themes again.

If you want to export your map and have labels for your features directly in your view, you can create them using the label menu item from the context sensitive menu or by setting up the labels in the layer property. You can also add the labels individually by clicking on the "Label" button under the 'A'.

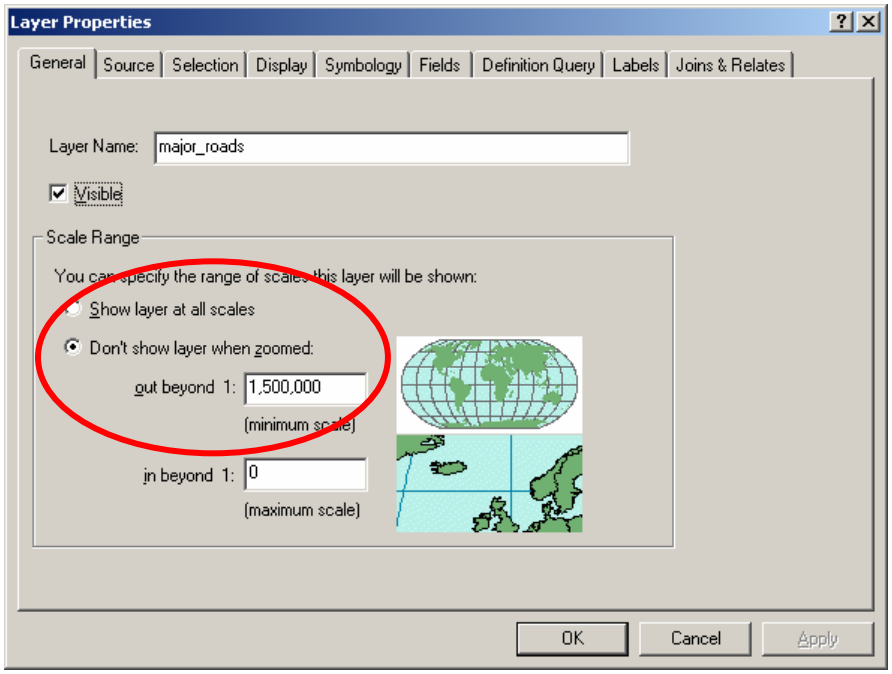
Options for label styles and placement position are found in the layer properties.

The layer properties, as you have seen already, allow you to change the properties of each layer. You should give your layer theme an appropriate name since you can use the same

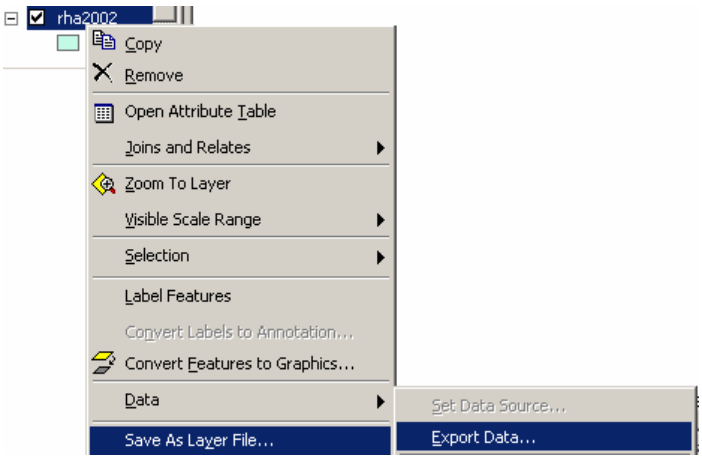
shape file a number of times in a single view. This name will also be used for legend titles and attribute tables (which will be mentioned below). This name does not change the original shape (shp) file or name on your computer.

You can give the theme a definition and add comments to it under Definition. A definition (e.g. ([SLI] = "1")) will be applied to your whole view. Selections, conversions, and other processing will only be applied to the features defined in this definition.

The General tab also allows you to specify the minimum and maximum scale at which the themes will show up. This is useful for road networks, postal code points, or in our example, public school points, when viewed at too small a scale; they clog up a lot of Southern Manitoba. Try changing the maximum scale (out beyond) for public.shp to 1.5 million then zoom in and out around this scale.

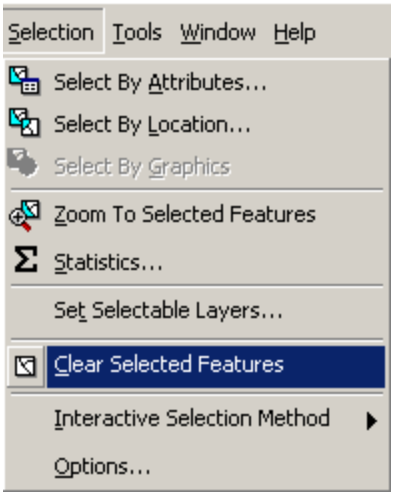


You can take selected portions of your theme and save them as new shape files. If you wanted to create a map of Northern Manitoba, you could select Nor-Man and Burntwood, and then under the, choose export data from under the context sensitive menu for the RHA layer. You can then save them with a new name, such as north.shp, for future use in new maps.



If you did not want to change your shape file you could limit your layer using the definition property

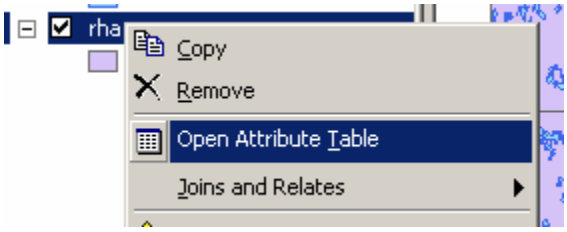
```
"RHACODE" = '70' OR "RHACODE" = '80' OR "RHACODE" = '90'
```



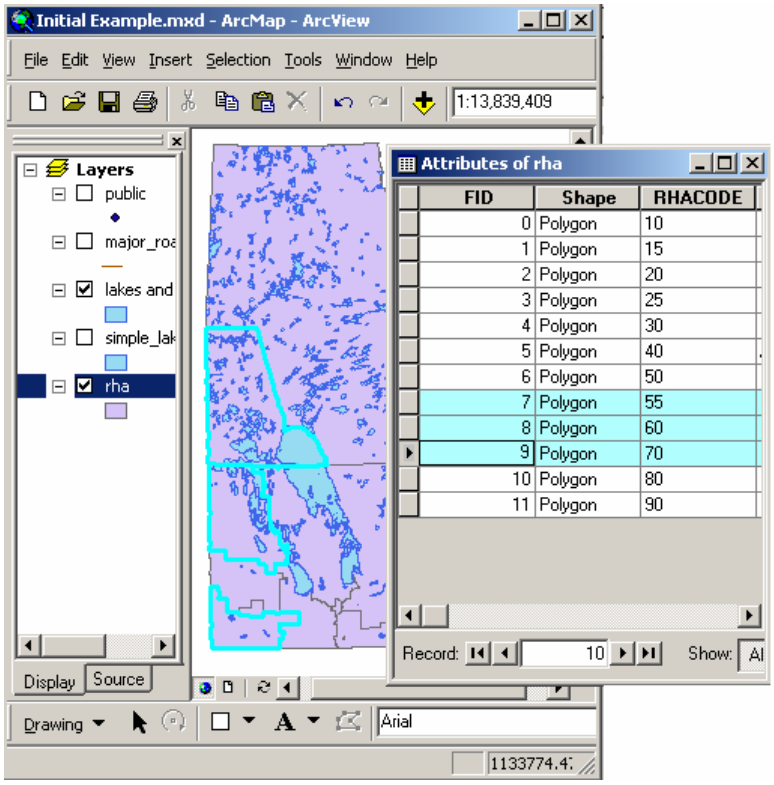
To unselect the selected features on your map, select the "Clear Selected Features" from the "Selection" menu. It will remove the selections from all portions of the map.

Tables

Every layer in ArcGIS has an associated attribute table. To view these tables select "Open Attribute Table" from the context menu for the layer in the table of contents. Attribute tables are the actual dbf (dbase IV) files associated with each shape file. When supporting tables are joined to an attribute table it only applies to the associated layer even when you have included the same shape file multiple times.



Select the RHA theme and select "Open Attribute Table". You will notice that now, when you select parts of your theme, they will be highlighted on the theme table as well. If you select parts of the attribute table the corresponding features in the theme will be selected.



Standalone tables can also be added as Dbase IV (dbf), MS Access, delimited text (txt) files. In general you will only add these tables if they have a field that can be joined to an existing theme attribute file. Adding your own data will be covered later in the workshop. When importing text files you may have to create or edit a 'schema.ini' file that identifies the contents, layout, and delimiters of the file. ArcGIS will generate a schema file in every directory with a file it might be able to read. This file will be filled with a guess at the format.

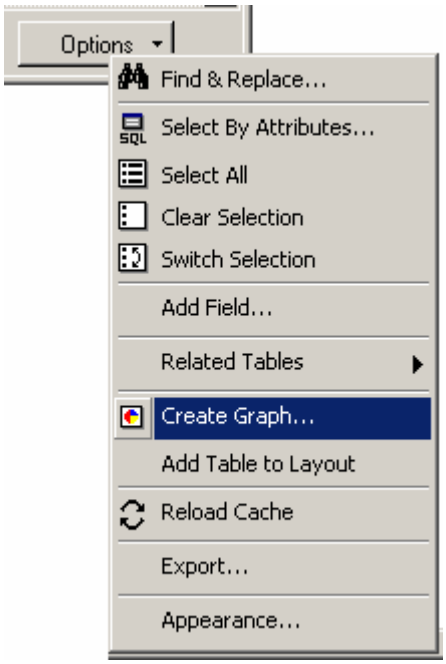
Example of the schema file in the RHA directory.

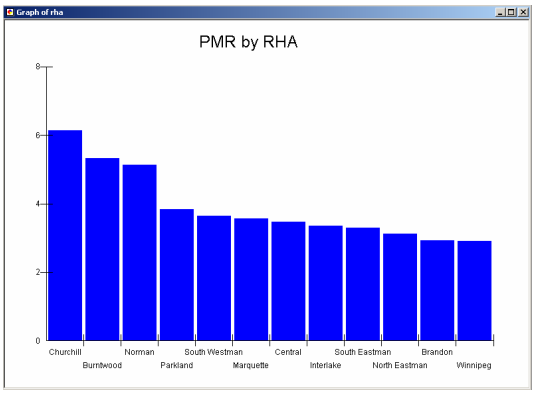
```
[hosp.txt]
Format=CSVDelimited
[nursing_stations.txt]
Format=CSVDelimited
```

Attribute tables associated with shape files can be opened outside of ArcGIS. Try opening the dbf file associated with the RHA shape file (or theme). Open Excel then open the file D:\GIS_course\rha\rha.dbf. Remember each shape file has several other files associated with it. DBF files are an example of one of these. You can edit and change the dbf file without using ArcGIS. Be careful not to change the number of records or ArcGIS may stop reading the shape file. If you change the dbf file while ArcGIS is running (this is generally a bad idea) you may have to close and re-open the project.

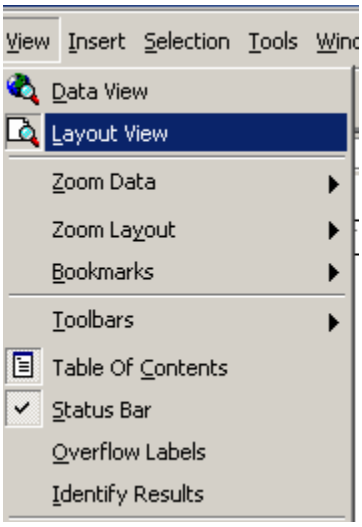
Charts

ArcGIS has a limited set of charts (bar, histograms, pie, etc…) that can be created from tables for presentation purposes. If you are interested in creating more complex charts the data should be exported into a package that does charting and graphing. To generate a chart open the appropriate attribute table (e.g. the rha attribute table) then select "Create Graph". The graph can be viewed on the screen or added to the layout view (below).





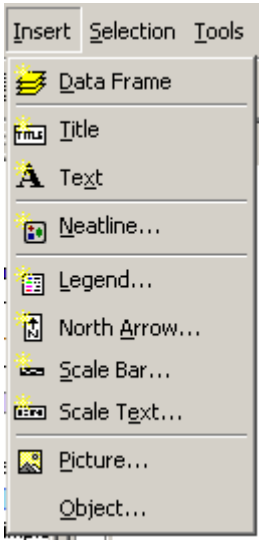
Layout View & Multiple Frames



To this point most of the work that we have done with the GIS is in what is called Data View. ArcGIS will allow you to generate specific layouts that include multiple frames (views) of the data, charts, tables, etc…

Layout view is selected from the view menu. A layout lets you assemble all the components you want to appear in a map including multiple frames (or data views), scale bars, charts and other text.

In Layout view there are other options that are specific to the layout view. These are available through the layout tool bar. Many of these buttons have similar functions to those in the view window except they apply to the layout and do not change what is actually in the view. For example the zoom in/out and pan options change the amount of the page that you see but what gets printed in the end is still what is inside the page boundaries.

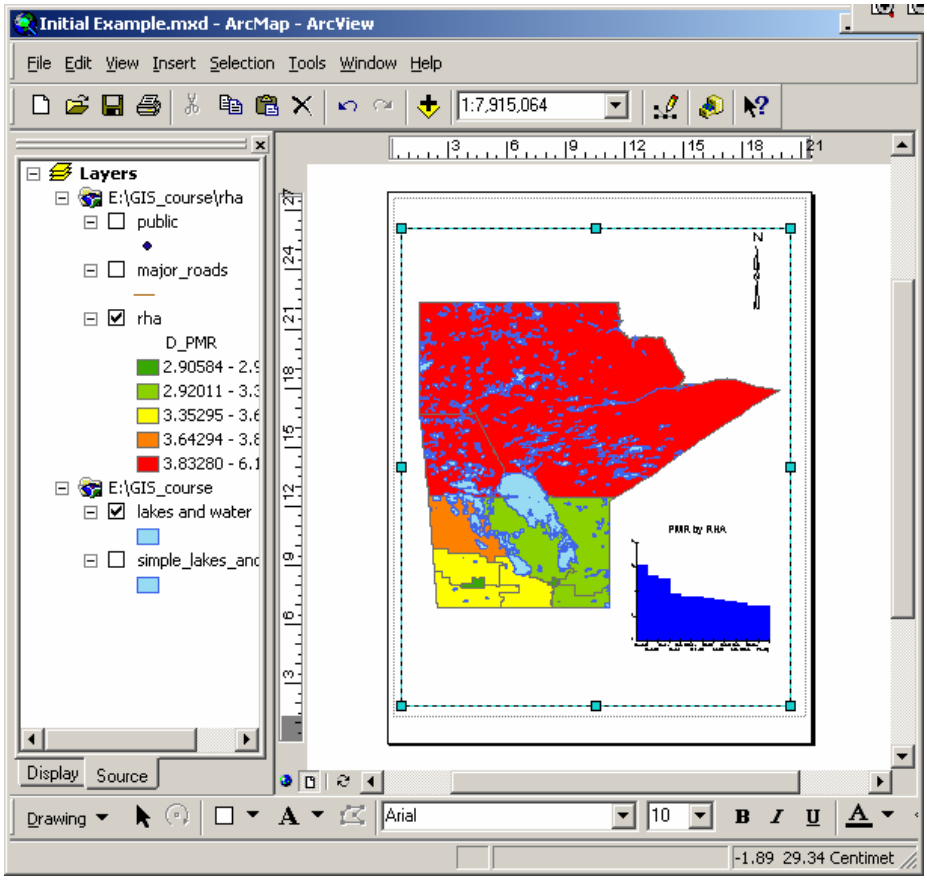


A new set of items are available from the insert menu that will allow you to add frames that contain existing data frames, tables, charts and pictures. Select the type of frame you want to add and drag out a square in the layout window.

There are a number of frame properties available in the properties for each frame that can be explored on at your leisure. After a data frame has been added you can add scale bars and legends that correspond to the view – if you have multiple views you can chose which view the scale and legends are associated with. Legends will only display what is still shown as a legend (that is not hidden) in the table of contents in the view. When working with multiple frames make sure that the one you are working with is the active frame in the table of contents.

Like any frame or object in other vector based programs frames can be moved and layered. Occasionally when a frame is moved the layout display will not refresh correctly. Click on the refresh view button at the bottom of the screen.

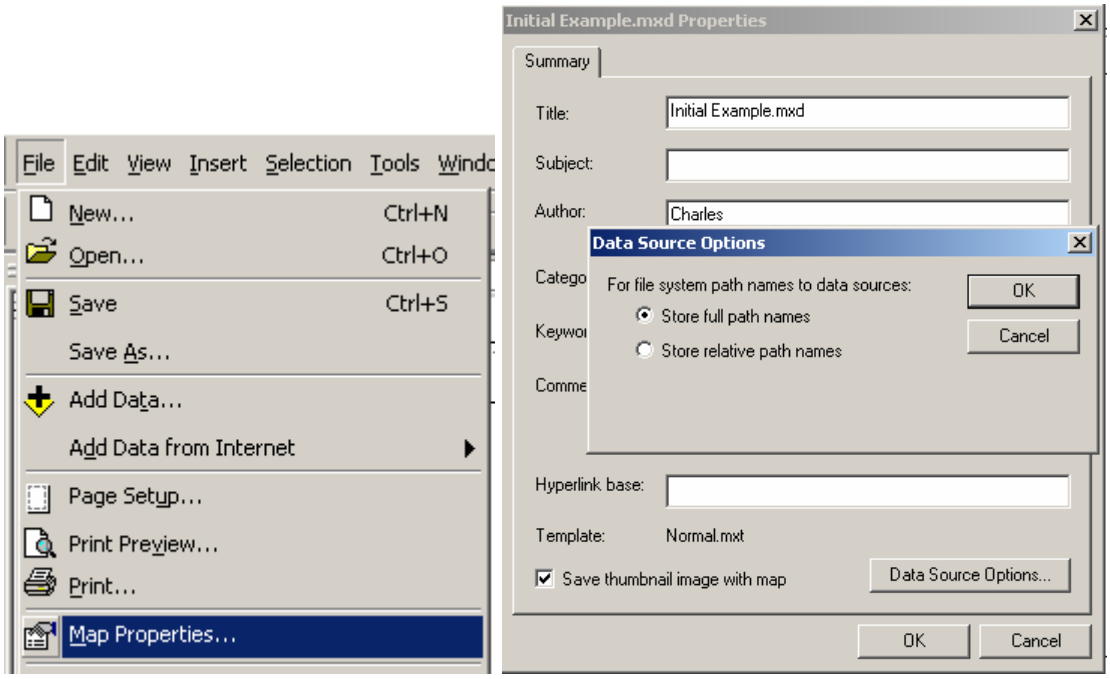
The page size of the layout and properties can be configured by selecting Page setup… File menu.



When printing or saving files you should include the following information: date, data source, projection, scale. In a prime example of do what I say not what I do I have not included this information on any of the figures in this document.

Saving Map Documents

A map file (or .mxd) file is saved by selecting 'Save' or 'Save As…' from the File menu. A map file contains only pointers to the actual tables and shape files on your computer. All of the views, layers, colours, joins, charts, layouts arrangement, etc… are defined within the map file. This means when you re-open a project file all of the joins, and legends must be re-generated at that time. Saving a map file does not modify existing data. By default the map file contains absolute path names to each of the tables and shape files. This means if you move any of your shape files, tables, or change the name of any directories you will need to find them again when you try to open the project. When you open a map file, objects that are not found have an exclamation point (rha) beside them. You can re-assign the source location through the layer properties under the Source tab. If you want to use relative path names there is an option in the map properties found under the file menu.



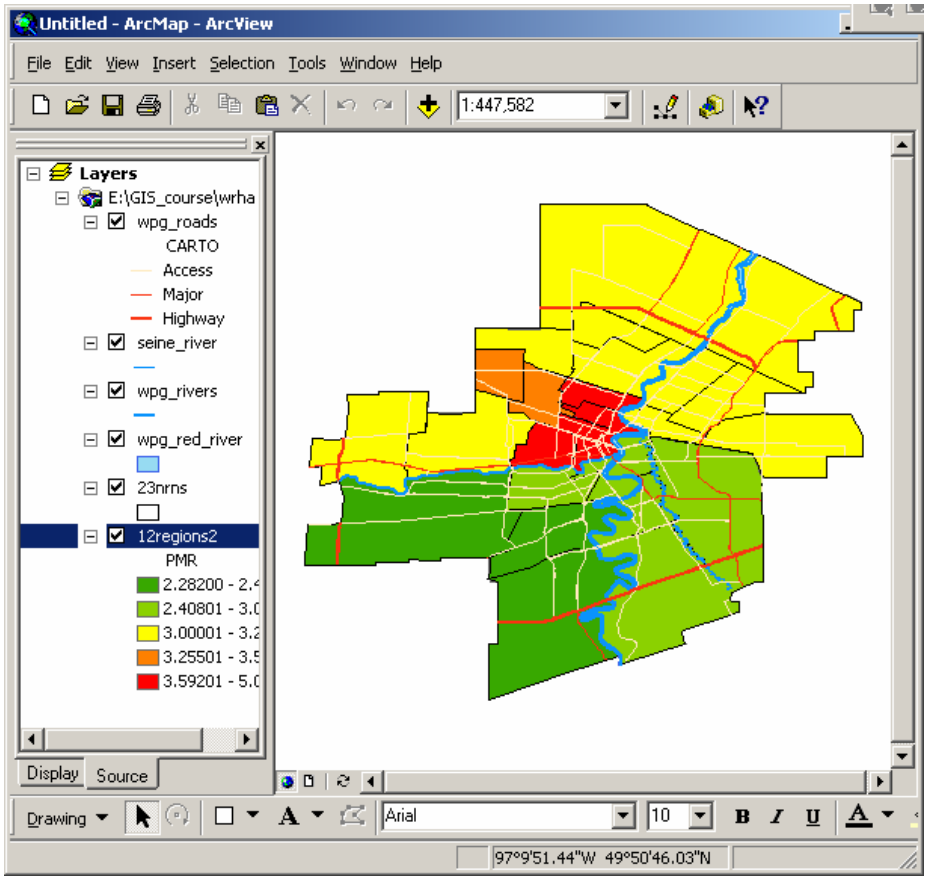
Save the current file as RHA.mxd (we will be going back to it later).

Activity 1. Basic Mapping of WRHA

Create and save a new map called WRHA that shows the 12 CA regions (12regions2) of Winnipeg with Rivers (wpg_rivers, wpg_red_river) and roads (wpg_roads) added. The appropriate files are located in D:\GIS_course\wrha for shape files. Change the color of the rivers to blue. Change the colors of the major roads based on the Carto field (1- Residential streets, 2 – Access roads, 3 – Major through ways, 4 – Highway, 5 - path/lane).

You might want to change the maximum scale so the roads only show up on larger scale maps (e.g. 1:50000)

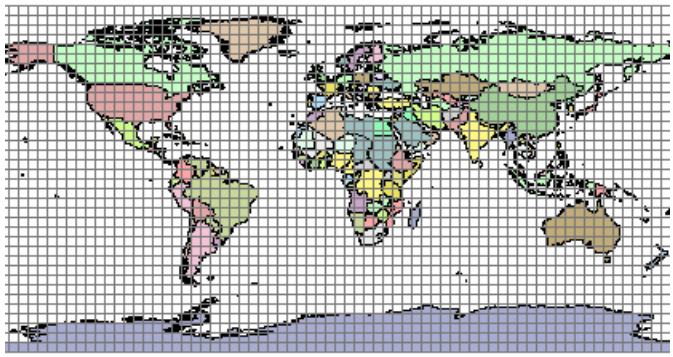
Try mapping premature mortality (PMR) values for each CA. The PMR values are already coded into the shape file.



Projections

Open the RHA map file that was saved before the last activity. In our View, Manitoba looks expanded at the top. This is because decimal degrees are used as if they are in Cartesian space (simple X/Y co-ordinates). However, the actual distances between lines of longitude get smaller as the latitude increases. When the map is flattened, the top (often near the North Pole) expands. This is a typical problem with trying to represent a globe on a flat surface.

Earth as a Sphere

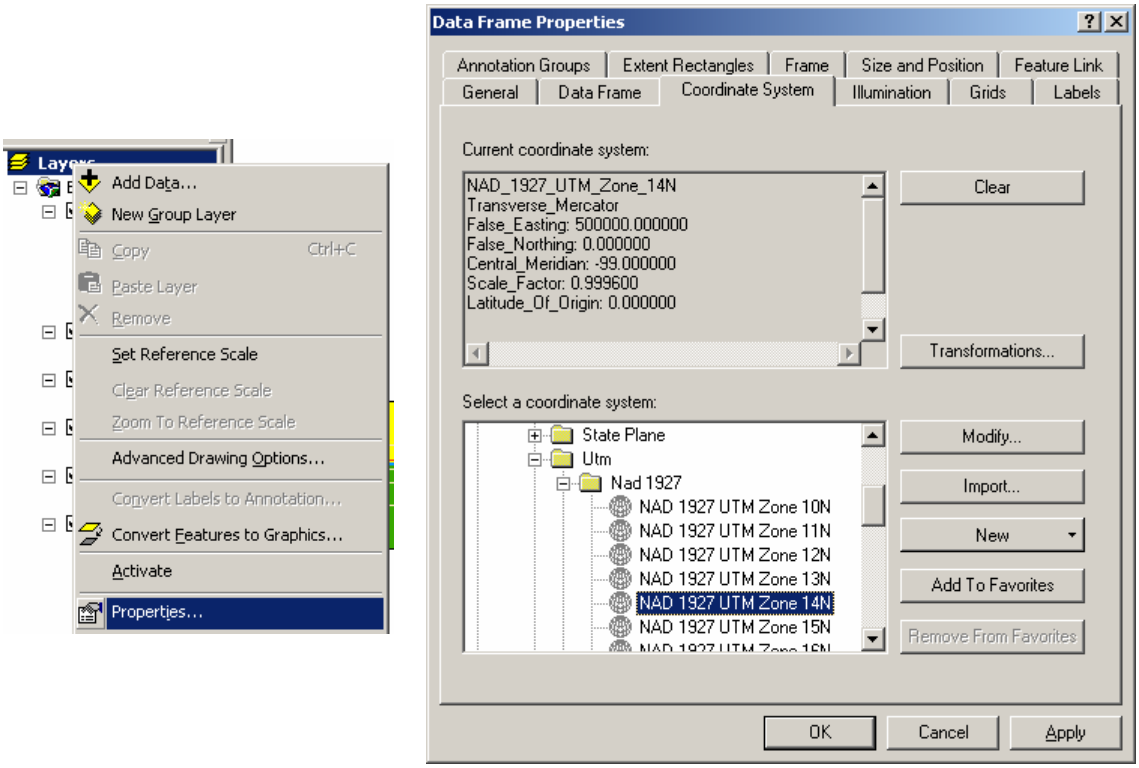


Cylindrical Projection or Plate Carrée

Projections are used to fix this problem. Most of the data at MCHP is stored in decimal degrees and needs to be projected. Some data that you will obtain will be projected already – e.g. the conversion has been made already and the underlying data saved in projected units (e.g. meters). Generally decimal degrees provide a wider range of options but there are problems when trying to measure some scales, distances, bearings, areas, or trying to change projections, share your data with other people or software applications. Most simple mapping applications such as EpiMap do not have the ability to re-project data and will only display geographic files as they are provided.

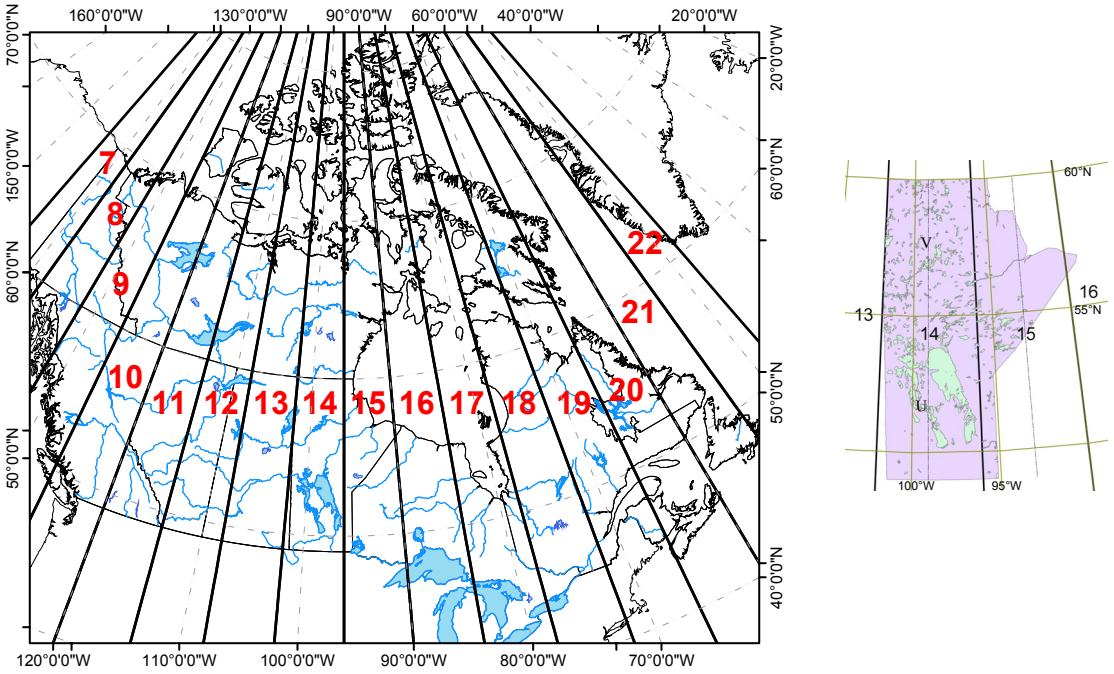
When projecting a map there are a wide range of things to consider. I will not go into all of the subtleties during this course suffice to say that if you want Manitoba to look normal it must be projected. If you are interested in further information see the following WWW site: http://www3.deasy.psu.edu/projection/index.html

To set the projection for your map, go to the frame properties and look under the Coordinate System tab. Under the coordinate system select `Predefined>Projected Coordinate Systems>UTM>Nad 1927>NAD 1927 UTM Zone 14N.`



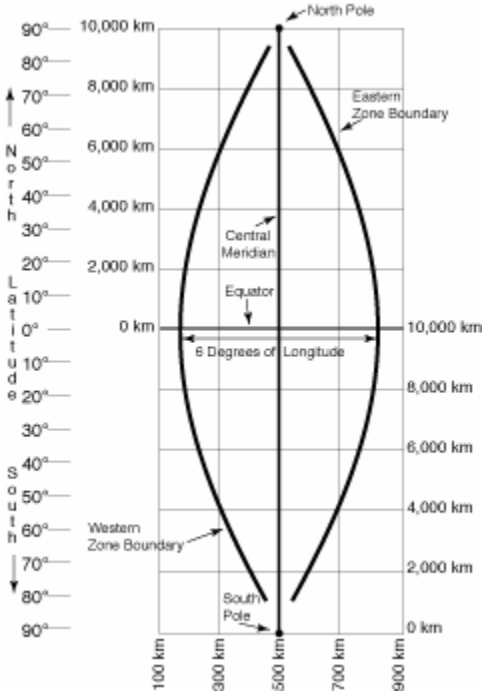
The usual projection used for Manitoba is UTM Zone 14 (NAD 83 or 27), although there are others. Manitoba does cross three zones (14, 15, 16) so the east, and especially the north east of the province will have more distortion, but zone 14 gives a reasonable approximation across most of the province and is suitable for our needs. If you plan on doing large distance/bearing calculations in the east/north east of the province you may want to consider another projection. Which projection you use will depend on your data

needs and data source. Make sure you know the datum that was used to create the data. This is a question to ask if someone is providing any map data. ArcGIS can use data projected in multiple formats, ArcGIS will allow you to use different projections at the same time and as long as they are based on the same datum they should line up correctly.



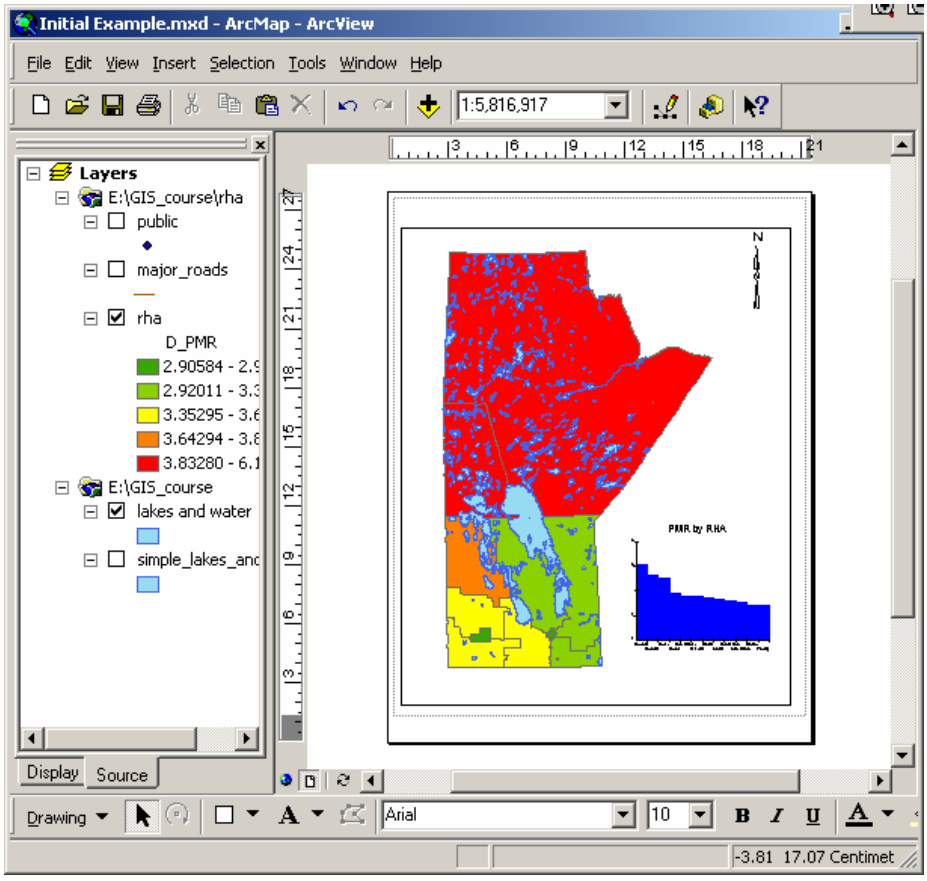
Here is what the ArcView Help file has to say about UTM (Universal Transverse Mercator):

UTM - For the Universal Transverse Mercator System, the globe is divided into sixty zones, each spanning six degrees of longitude. Zones are numbered from west to east starting at 180˚ longitude (the mid Pacific Ocean). Each zone has its own central meridian. This projection is a specialized application of the Transverse projection. The limits of each zone are 84° N, 80° S.
Method of projection - Each UTM zone has its own central meridian from which it spans 3 degrees west and 3 degrees east of that central meridian. The cylindrical methodology is the same as that for the Transverse projection. Note that the position of the cylinder rotates systematically around the globe. X- and y-coordinates are recorded in meters. The origin for each zone is the Equator and its central meridian. To eliminate negative coordinates, the projection alters the coordinate values at the origin. The value given to the central meridian is the false easting, and the value assigned to the Equator is the false northing. For locations in the Northern Hemisphere, the origin is assigned a false easting of 500,000, and a false northing of 0. For locations in the Southern Hemisphere, the origin is assigned a false easting of 500,000 and a false



northing of 10,000,000.
Lines of secancy - Two lines parallel to and approximately 180 km to each side of the central meridian of the UTM zone.
Linear graticules - The central meridian and the Equator.
Properties
Shape Conformal. Accurate representation of small shapes. Minimal distortion of larger shapes within the zone.
Area Minimal distortion within each UTM zone.
Direction Local angles are true.
Distance Scale is constant along the central meridian, but at a scale factor of 0.9996 to reduce lateral distortion within each zone. With this scale factor, lines lying 180 km east and west of and parallel to the central meridian have a scale factor of 1.0.
Limitations - Designed for a scale error not exceeding 0.1 percent within each zone. This projection spans the globe from 84° N to 80° S. Error and distortion increase for regions that span more than one UTM zone.

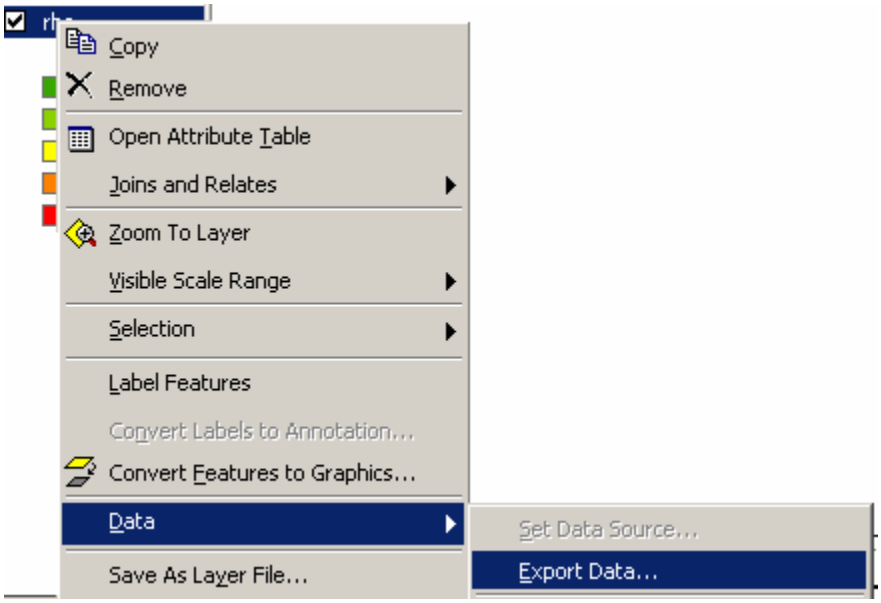
After you've projected your map, remember to change the map units to meters under the general tab (this should be set since meters is the unit for UTMs) and the Distance measure to kilometres or what ever measurement you prefer for distances. Your map should now look more like the familiar shape of Manitoba.



The issue of projections and projected data usually arises when you get data and you don't know the units or projection that it was saved in. For example, most of our data

uses decimal degrees projected into UTM but many groups use data stored as meters already projected in UTM.

Convert one of the projected themes in the current project to a new shape file. Only the selected features in the theme will be saved into the new shape file. Note that ArcGIS will ask if you want to save in original format (decimal degrees) or projected units. Typically you will want to save in decimal degrees. There are times when you want to calculate distance or areas in a specific way, or export the geographic file to another application (e.g. MS Map or EpiMap) in these cases you will need to save the shape file in projected units.



When adding imported data to your view, you may run into a problem in which not all parts of your map line up. This could be because some of your data is already projected, while some of it is still in decimal degrees or the two data sources were generated using different datums. While ArcGIS will allow you to combine in one data view multiple projections, sometimes the projection is not known and there will be problems. If you know the projection information it can be added through the use of ArcToolbox.
If there is a mismatch you typically can only 'see' one theme or another. The other problem with different datums is more difficult to see (and correct). The difference between the North American Datum (NAD 83) and NAD 27 for Manitoba is small and generally will not be noticed when working the provincial level. This is not true when working at a small area (e.g. Winnipeg) level. If you want to convert the data from one projection to another you will need to use the Projection Utility supplied with ArcGIS and available through ArcToolbox. The Health Regions provided by Health Canada (next example) is an example of a file that has been saved in a projected format. After you have imported the ArcInfo file try to add the file to one of your existing views. Both should line up correctly since ArcInfo files store the projection information with the data.

Here is what the ArcView help files say about datums:

A datum is a set of parameters defining a coordinate system, and a set of control points whose geometric relationships are known, either through measurement or calculation. One part of defining the coordinate system is the spheroid used to approximate the shape of the earth.

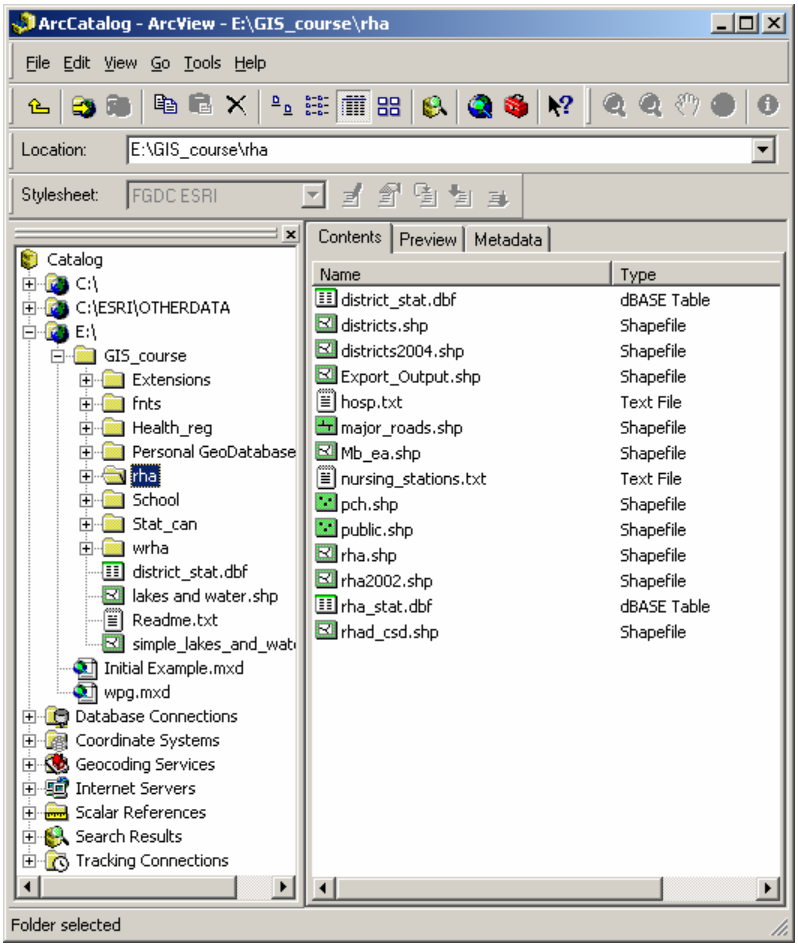
A spheroid is defined by a radius and an eccentricity. These two constants are used as inputs to the equations which calculate a projected coordinate from a coordinate in decimal degrees. When a projection is created, it is associated with a default spheroid so that these constants will be available. This default spheroid varies from projection to projection, but is usually the SPHERE for small-scale projections and CLARKE 1866 for large-scale projections.

Certain predefined projections (for example, those stored in default.prj in ArcView's etc directory which are displayed as "standard" projections in Projection Properties), are associated with specific spheroids based on their use. For instance, the "State Plane - 1927" projections are associated with the CLARKE 1866 spheroid (with the exception of Michigan), the "State Plane - 1983" projections are associated with the GRS 80 spheroid, the "New Zealand National Grid" projection is associated with the INTERNATIONAL 1909 (also known as the INTERNATIONAL 1924) spheroid, the "Great Britain National Grid" projection is associated with the AIRY spheroid, and the National Grids of Malaysia, Singapore, and Brunei are associated with the EVEREST spheroid.

When a projection associated with a certain spheroid is used, ArcView assumes that the decimal degrees data being projected was collected in a datum based on that spheroid. So while ArcView has no knowledge of datums per se, it does know about spheroids, which are part of the definition of a datum. Therefore you do need to know what datum your data is in, and set the spheroid of the projection accordingly. This can be done either through the Projection Properties dialog or by using Avenue.

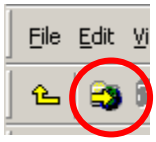
Using ArcCatalog

ArcCatalog is used for managing geographic data. You can copy, move and delete data. There are options to preview existing files and attributes. Built into ArcCatalog is the ability to create and update basic metadata for geographic files. This is also the place where you create new data files. The ArcCatalog application includes a catalog tree display, similar to windows explorer, preview window and several tool bars. In the catalog tree each data type (geodatabase, coverages, shape files, CAD files, rasters, and TINs) has its own unique icon.

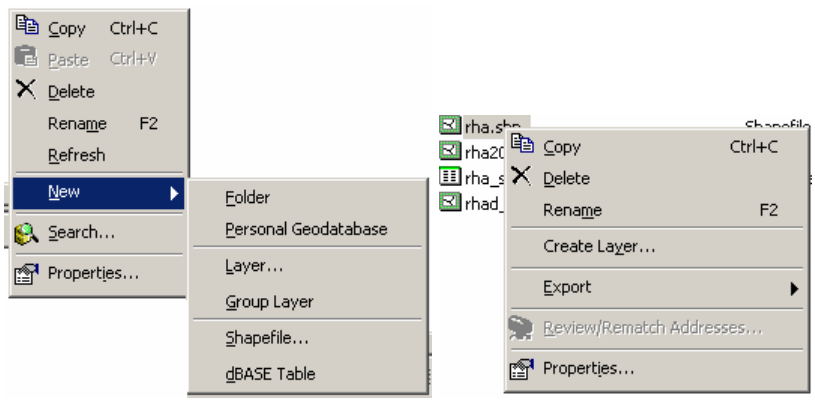


Preview and Metadata

The catalog tree shows the available data sources both locally, and remotely. When looking at folders on the local system you must attach or connect to the folder to make it available as a local data source – in this way the 'Add Data' option in ArcGIS is different than the usual Windows open dialog box.

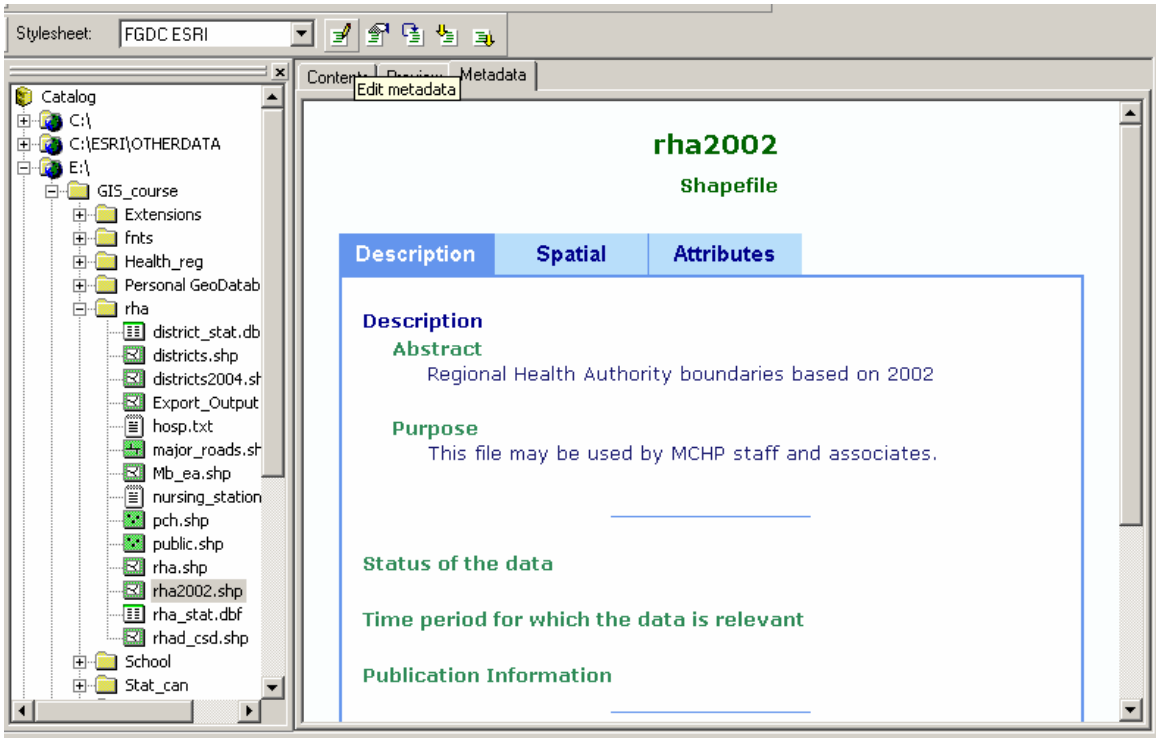


The Contents window will allow users to select file properties, export, creating new files, new directories, and geodatabases. If both ArcMap and ArcCatalog are open data sources can be dropped from ArcCatalog into ArcMap.



There is also a preview option that will allow you to see the geography and attribute tables.

Metadata for each file can be easily created and updated for every geographic data source from within ArcCatalog. A standardized template for editing and updating metadata is provided and when files are moved within ArcCatalog the Metadata is transferred with the data. Meta data is saved as XML files in the same directory as the data source or within the associated GeoDatabase. Meta data files can also be exported for use elsewhere.



GeoDatabases

A geodatabase is a relational database that contains spatial and non-spatial objects. The geodatabase supports the storage and management of geographic information in standard database management system tables (ESRI Press). A complete coverage of GeoDatabases is beyond this workshop but there has been another workshop developed at MCHP for working with GeoDatabases.

There are two broad types of GeoDatabase available to ArcGIS. At MCHP only the personal GeoDatabases are available at this time.

- Personal
  - MS Access format (Microsoft Jet Engine)
  - Multiple users but only one editor at a time
  - Suitable for small workgroups
  - Best performance with fewer than 250 000 objects
  - No Raster data
- Multi-User (ArcSDE application server)
  - RDBM system such as Oracle or MS SQL server
  - Raster Images
  - Geocoding services

Internet Servers

ArcGIS can query and use geographic data available on the internet. Many of these services cost money but there are a few that are free and have some very useful base information. In Canada the most common is www.geographynetwork.ca.

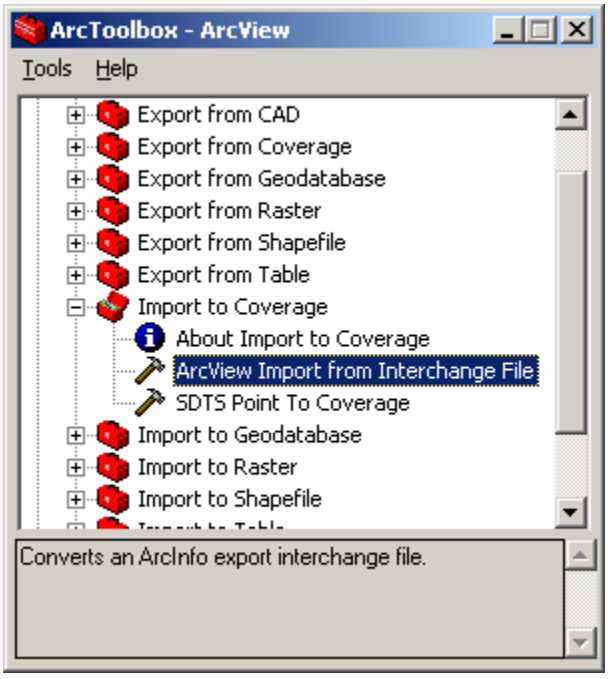
Once attached to an internet service you can add the geography information off of the net (from image services or feature services) or make local copies of some files (only from feature services).

Geocoding services

ArcGIS will allow you to convert address information to spatial information using indexed geocoding services. These typically are shape files that contain road networks and address information. Setting up and using Geocoding services is an important facility but it is beyond what we have time to do during this workshop. If you have street address data and need to convert it to spatial information see the online help or talk to Charles about setting up a Geocoding service.

Using ArcToolbox

ArcToolbox is a set of utilities that is available for users to do a variety of tasks from conversion of file types to spatial analyses. In this workshop we will only look at importing ArcInfo export files and setting/changing projection information. ArcToolbox can be opened by clicking on the toolbox ( ) or by selecting it from the Start>Programs menu.



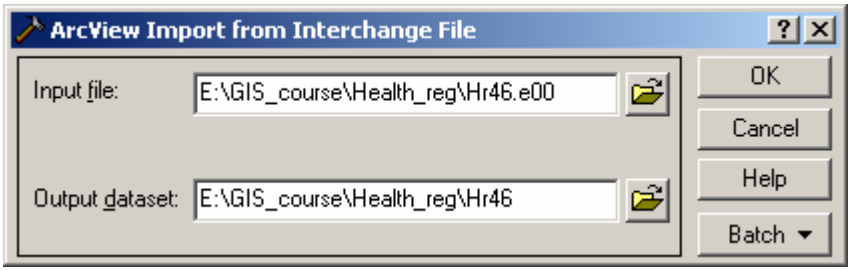
Importing ArcInfo export (E00) files.

ArcInfo export files, with the extension .E00, are used by most groups to transfer ArcInfo data from one location to another. These file contain ArcInfo coverages. A coverage file is a special group of files used by ArcInfo. An ArcInfo coverage can contain more than one class of features. A polygon feature may also contain line features (arc) which store information about the boundaries between each polygon. To the user looking at the coverage file from Windows coverages appear to be made up of two directories - the coverage directory (e.g. hr46) and an information directory (info). The group of files make up an Arc/Info coverage and includes a wide range of information including label points, polygons, lines (that make up the polygons), ticks, network information, projection, etc... Because coverage files are made of multiple parts they are not easy to transfer between systems so data providers create an Arc/Info export files when they want to move a coverage. Generally you will want to use ArcCatalog to move and edit GIS data sources.

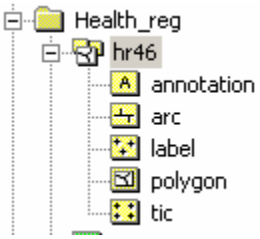
Most Arc/Info files that are available on the WWW or through the DLI (Data Liberation Initiative) are in Arc/Info export format (E00). These files have to be imported or

converted from the single file export format to the multiple file coverage. When you open an imported coverage file, two new directories will automatically be created – the coverage directory and the information directory.

The import program used to convert Arc/Info export files back into coverages is run from ArcToolbox by selecting Import to Coverage > ArcView Import from Interchange File.



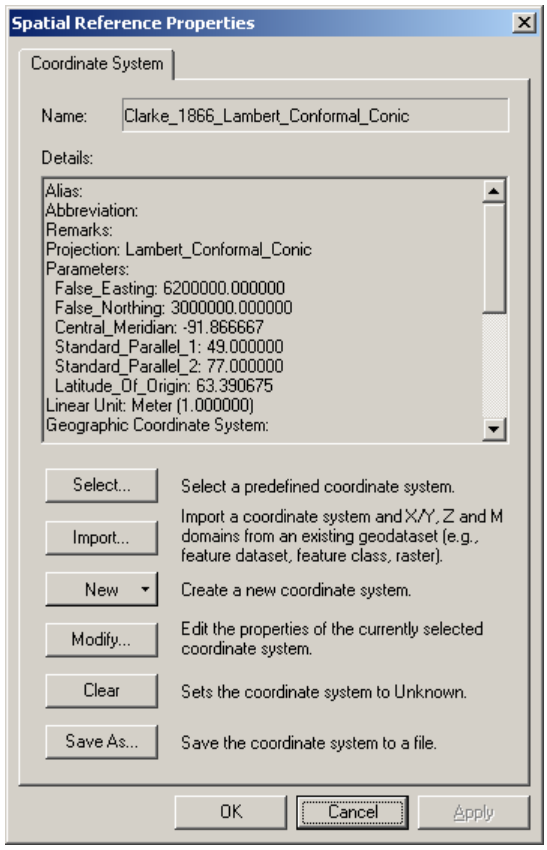
Because coverage files are made of multiple parts you will need to open just the part of interest. When viewing a coverage file from within ArcMap, Add Data or in ArcCatalog it will appear to have multiple parts (polygon, arc, annotation, label, point etc.). Many CAD files will show up in a similar fashion.

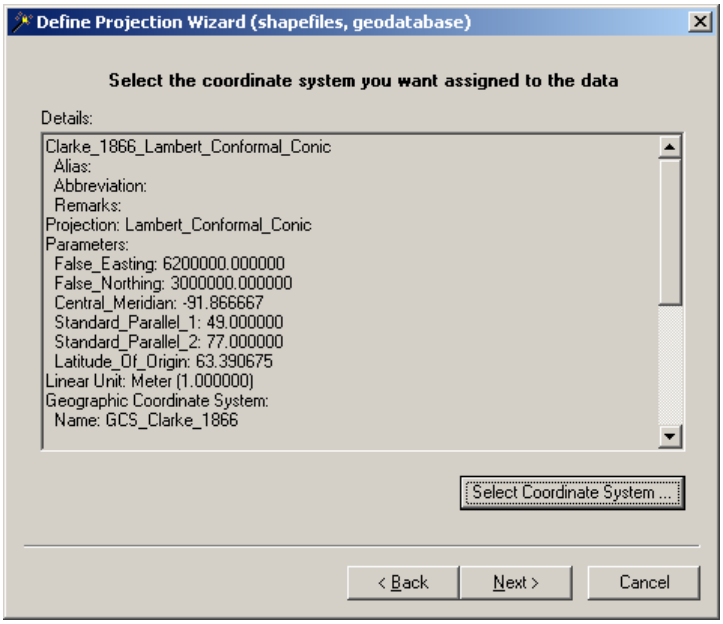


Adding/Changing Projections

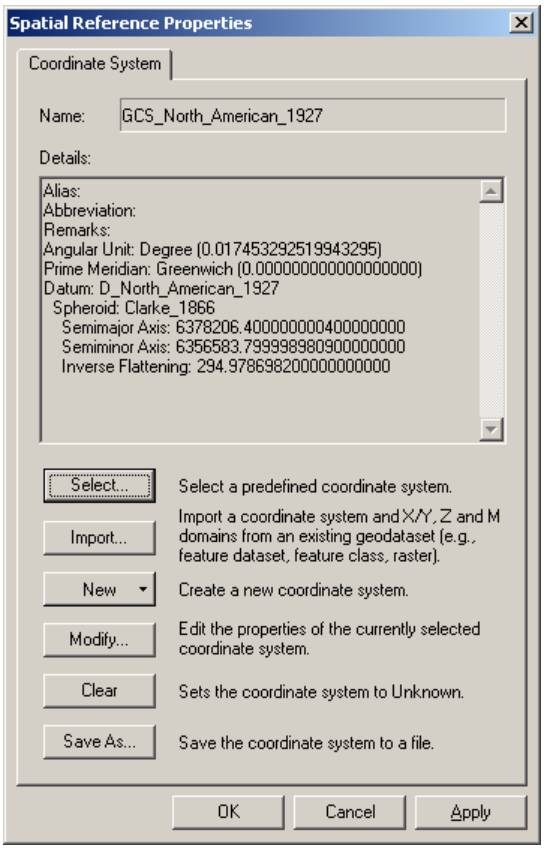
If you know the projection or type of data that is contained in a shape but it does not appear correctly with other shape files it is often useful to define the projection. This will allow ArcGIS to recognize the file and, within some limits, display multiple geographic data sources that are stored in different projections.

Inside ArcToolbox select Data Management-> Projections -> Define Projection Wizard (shapefiles, geodatabase). Select the Health Canada RHA shape file saved from the hr46 coverage polygons. You might get a warning that a projection has already been defined. Click on the 'Select Co-ordinate System' button and Import the co-ordinate system used by the hr46 coverage file. If you know all of the projection information you can assign this by hand but by taking a quick look at the data fields you will quickly see this can be quite complex.





Most of the data at the centre is stored in decimal degrees and can have the projection information set as North American Datum 1927 (Geographic Co-ordinate Systems -> North American -> North American Datum 1927). Geographic data associated with the 2001 census and most other sources can be assigned to North American Datum 1984 or WGS84.

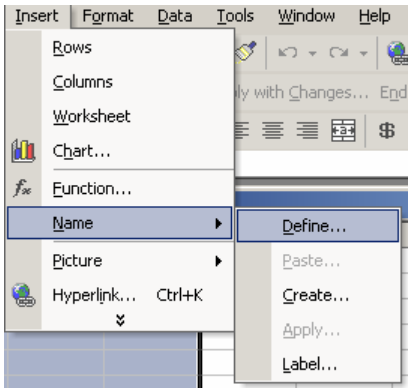


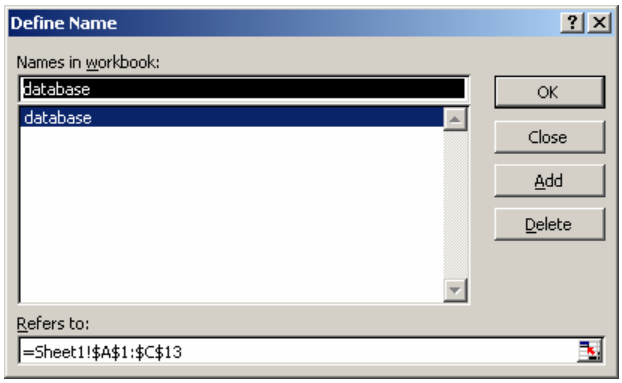
Adding Non-Spatial Data

Along with creating tables based on your map's themes, you can add already-existing Dbase IV (dbf), Access (mdb), or comma/tab delimited text (txt) files to your project. Using the Add Data button in ArcMap, open the D:\gis_course\rha\rha_stat.dbf file. This table of statistics will be added to your Project.

MS Access files are read through the Microsoft Jet Engine. There are a few limitations on using MS Access files. Select queries created in MS Access must be saved as a table. Other types of databases and remote tables can also be accessed through an OLE DB provider and ODBC.

I often use Excel to edit ArcView attribute or dbf files, even those associated with shape files since the table editor in ArcView is not very friendly. This is especially true if you want to convert field type (character to number), or add and edit fields/records. If you want to use Excel for editing the Dbase (dbf) files make sure you have defined the database range in the worksheet before saving. The database region is defined using the Insert>Name>Define menu. The cells should be appropriately formatted in excel as well – **avoid using 'General' formatting.**





Microsoft Help for Excel has this to say about saving Dbase files:

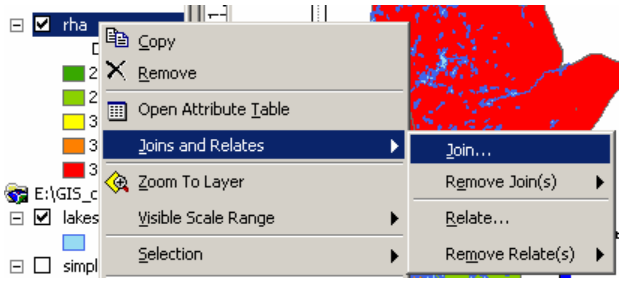
> **Only data in the named range or current region is saved** When you save an Excel worksheet in dBASE (DB2, DB3, or DB4) format and the worksheet contains a range named "Database," only data in the named range is saved in the dBASE file. If you add new records after naming the range, you must redefine the database range to include the new records before you save the sheet in dBASE format.
>
> If there is no range named "Database" on the sheet, only data in the current region is converted. If the first row of data contains text, Excel uses it as the header row to define field names. If the first row contains all numbers, Microsoft Excel creates field names such as N1, N2, and so on.
>
> **Make sure character strings are shorter than column width** When saving data in dBASE format, Excel assigns a data type to each field (column of data) that is based on the field data in the first record of the database range or current region.
>
> If a field in the first record contains text, that field is assigned the character data type, and any numbers contained in the field in other rows become character strings. The column width of the field determines the string length; character strings longer than the column width are truncated in dBASE. To prevent losing data, select the range you want to convert in Excel, and apply a monospaced font such as Courier. To size the columns to show all the data, point to **Columns** on the **Format** menu, and then click **AutoFit Selection**. Numeric data fields cannot contain text; any text in a numeric data field becomes null.
>
> **Use a number format other than General** If decimal numbers have the General number format, the decimal places are truncated in dBASE. Before you save the data in dBASE format, apply a different number format to all data in that field. On the **Format** menu, click **Cells**, and then click the **Number** tab. In the **Category** box, click **Number** or **Scientific**, and then specify the number of decimal places you want.
>
> **Change time data to text data** Fields that contain time data cannot be converted. Before you save data in dBASE format, you can change time data to text data by using the TEXT worksheet function. For example, to change the time 12:34 PM to text data, use the function =TEXT("12:34", "hh:mm AM/PM").

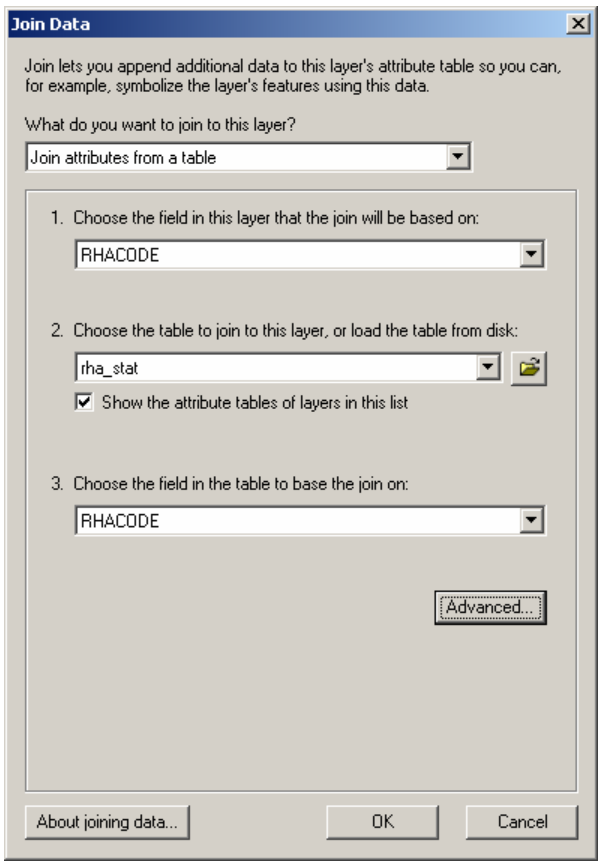
Quote comma (csv) and Tab separated files can be used. ArcGIS will attempt to read the format of the text files and generate a schema.ini file. The first line in these files must contain the names of the fields. The type of the field, unless all values are in quotes, is determined by the content of the field. This can sometimes cause problems when you want a character string field that contains only numbers. If you cannot join two tables

based on a field that appears to contain the same information in two tables check the type (character/numeric) of each field. Character fields are left justified, numeric fields are right justified.

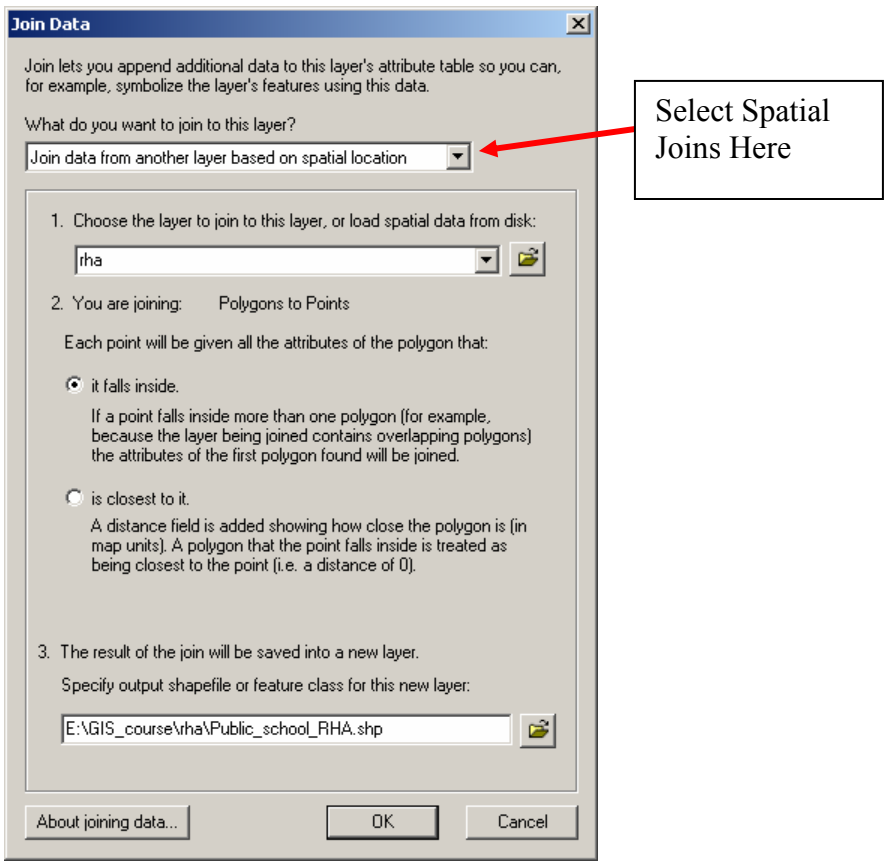
When bringing data from SAS the simplest method would be to save the file in DBF format using PROC EXPORT or PROC DBF, or as comma separated files using the _lotus macro. Most programmers at MCHP are familiar with the _lotus macro for saving comma or tab delimited files. The advantage to using the _lotus macro is titles and program information can be added. Extra titles and/or comments would have to be removed since ArcGIS would not understand what to do with those records.

You can merge your tables using the join feature of ArcMap. The name of the common field does not need to be the same but the content must be the same. Typically you will want to add imported tables to a layer attribute table. Once tables have been joined the new fields will be available for mapping.



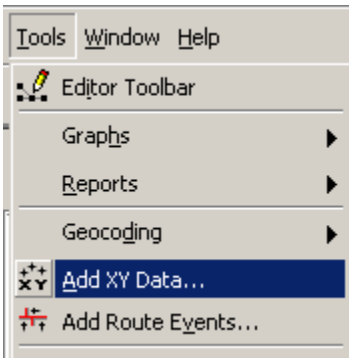


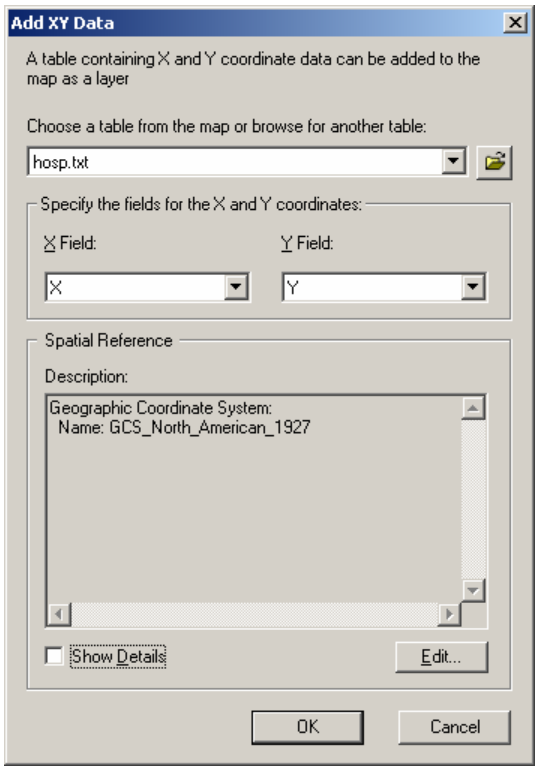
Spatial joins can be used to add RHA information to other themes (public schools for example). In fact, almost any two attributes tables can be joined with a spatial join. The exception is joining a point or line theme into a polygon theme. The spatial join can be used to measure distance between points – if you join two attribute tables of points or lines, the spatial join table will give you a column with the distance in map units to the closest point from the original table. If the underlying table contains a join you will need to remove it if you want to join the table to another. The underlying table in any given join cannot already be joined to anything. You can remove all or specific joins to a table by selecting remove from the join menu.



There is a related option within ArcMap for relating two tables. Unlike joining tables, relating tables simply defines a relationship between two tables. The fields of the source table are not appended into the fields of the destination table. After a relate is created, selecting a record in the destination table will automatically select the record(s) in the related or source table. Relates allow a one-to-many relationship to be established between two tables.

Just as layers can be used to generate tables in ArcGIS, tables can be used to generate layers, as long as the table has X and Y (longitude/latitude) coordinates. In this case we will be creating a point layer. Line and Polygon layers can be created as well from tables but the process is more complicated and will not be covered in this course. Under the tools menu choose 'Add XY Data' and open D:\gis_course\rha\hosp.txt file. For table, choose hosp.txt; for X and Y coordinates, choose X and Y. Click OK, and you should now have a new theme called hosp.txt.





If you want to generate a theme from a table without X and Y coordinates, you can join it to a table with coordinates such as a postal code table. Open the shape file D:\gis_course\stat_can\sli_1.shp. Open Tables in the project window, and add D:\gis_course\rha\nursing_stations.txt. Now join the two tables (nursing_stations and attributes of sli_1) by postal code. When you join a larger table to a smaller table only those records from the active table are retained (see the help information for alternatives). Your nursing_stations.txt table now has X and Y coordinates, and you can create a nursing station layer through "Add XY Data" using Long and Lat as your X and Y coordinates.

Note: In ArcView Version 8.2, to "Add XY Data", you must first export the nursing_stations.txt table to a database file (dbf). Use the exported dbf to "Add XY Data" using Long and Lat as you X and Y coordinates.

Activity 2. Adding Data to WRHA

Open the WRHA map file and add the hospital locations (wpg_hosp) from the WRHA directory (D:\GIS_course\wrha) and the PCH shape (pch) from the RHA directory. Select only the Winnipeg PCHs and convert to a Winnipeg PCH shape (wpg_pch). Remember to set the selectable layers to only the PCH layer or you might select more than you expect.

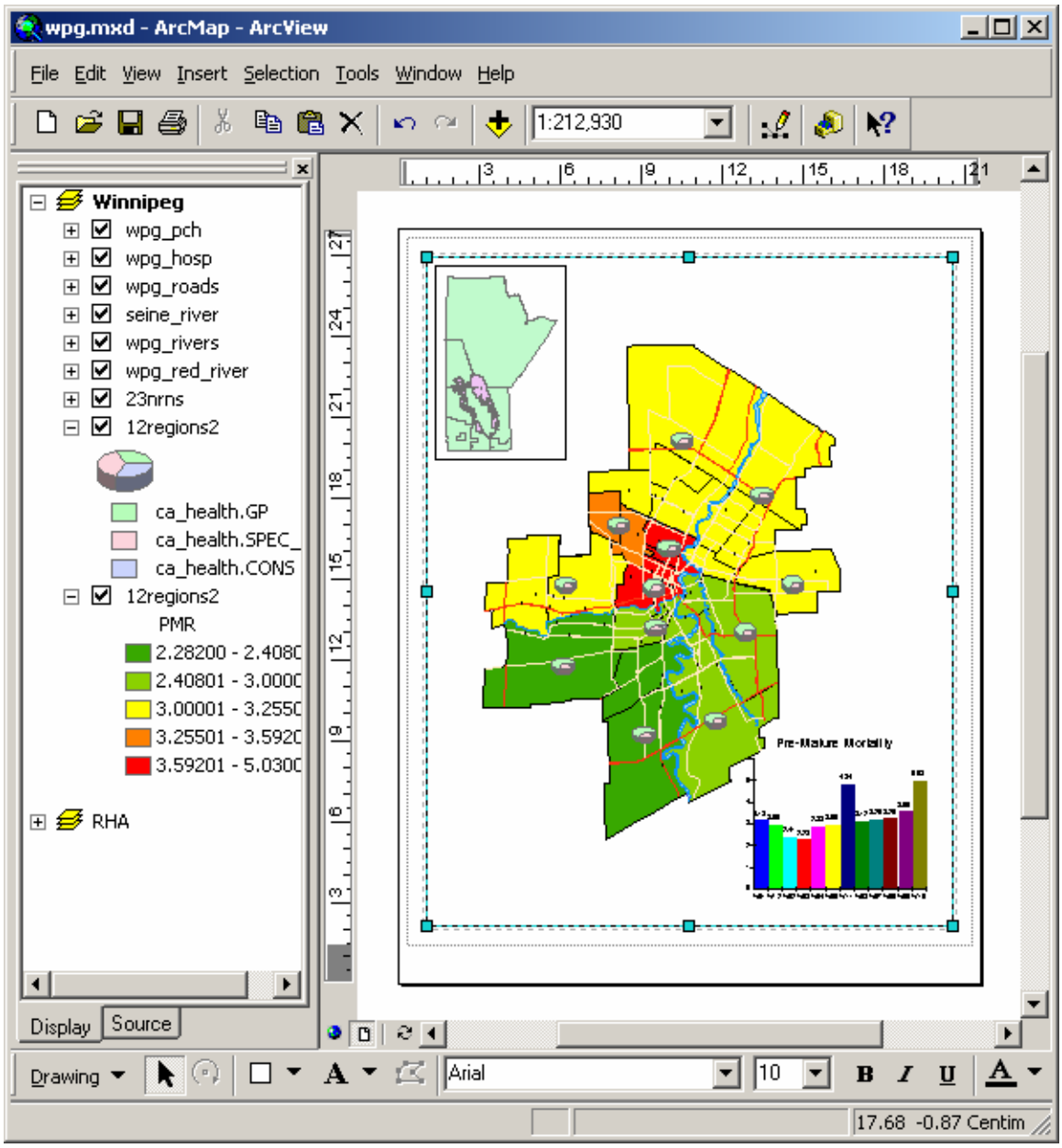
Open the ca_health data in excel just to see how the file is formatted the close the file without saving.

Join the health measures table (ca_health) and social data (ca_social) to the community area geographies. Try mapping various values using different options for categories. Create a map of Winnipeg with a pie chart of GP, Consults, and Spec Visits for each CA

Add a second Winnipeg CA theme and map the PMR.

Add a second view that contains the Manitoba RHA areas using an appropriate projection.

Modify the map in layout view with a chart of Winnipeg PMR, Manitoba RHA, and Winnipeg CAs with PMR and physician pie charts.

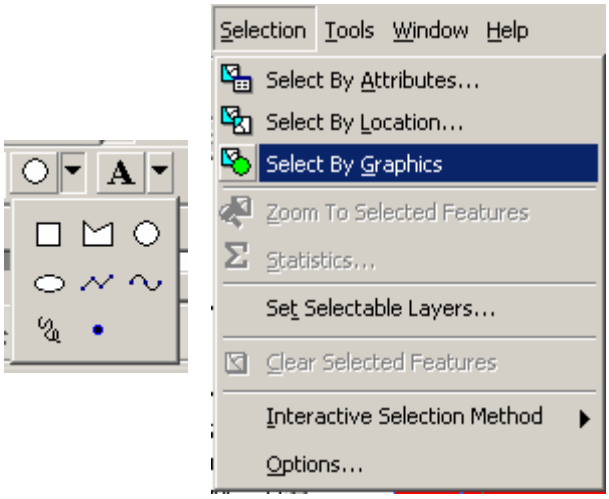


Selecting Data

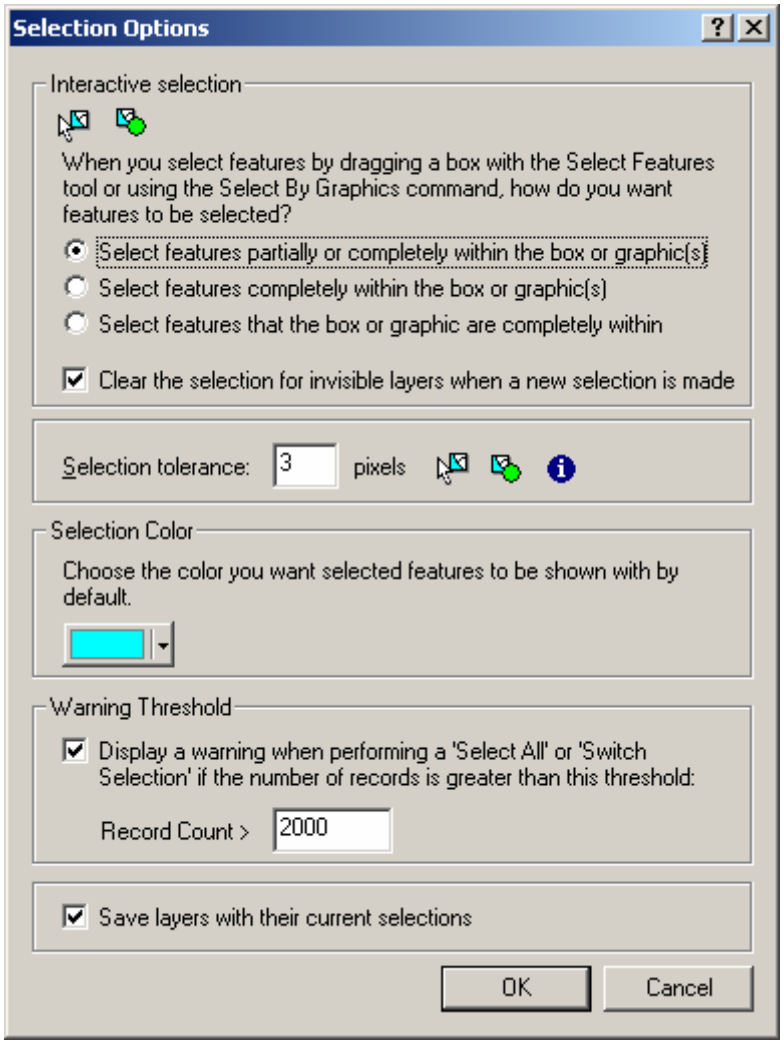
At the beginning of the workshop you saw how you could select features in a theme using the 'Select Features' tool or by selecting records in an attribute table. Within any GIS application you can also select features based on some type of spatial association. Open the RHA.apr project.

Graphics

On the toolbar, there is a drop-down menu which can be used to draw graphics on your map. Any features in the selectable layers can be selected using the 'Select by Graphics' menu item under the Selection menu.

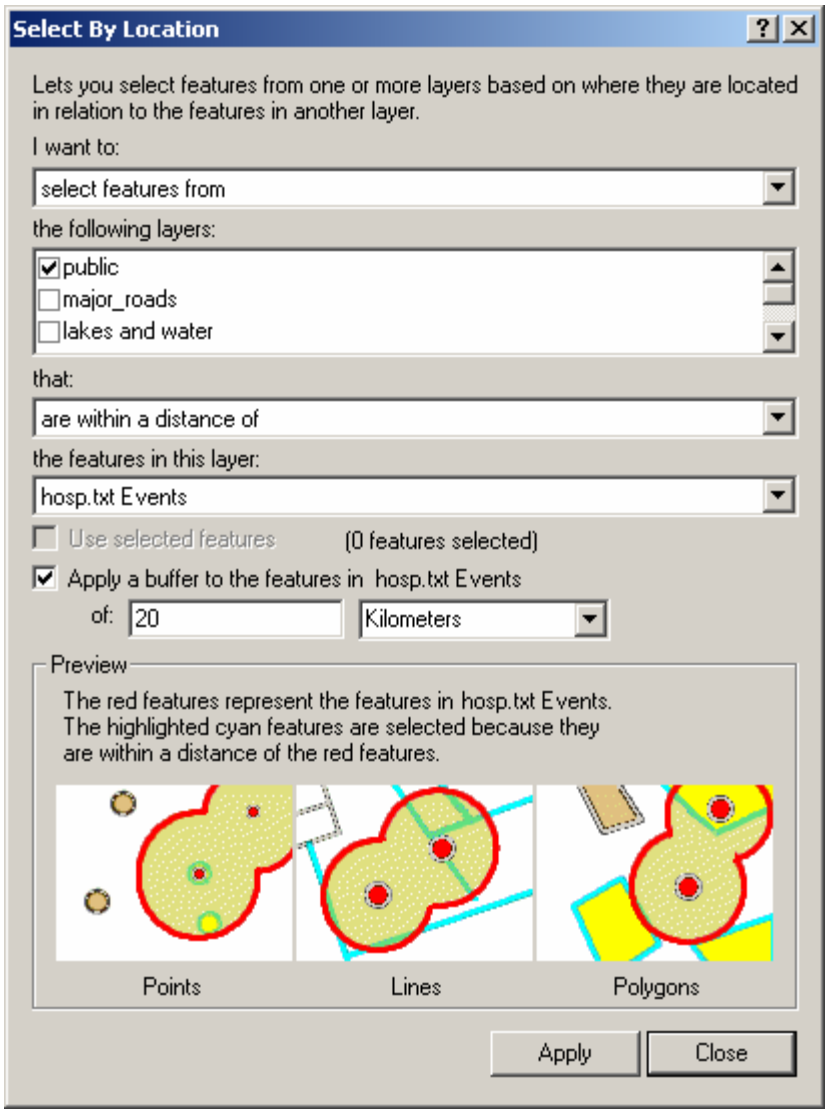


Choose the circle and click and drag to draw a circle on your map, wherever and whatever size you want. (Where you click will determine the centre of the circle.) The centre and radius of the circle will be displayed in map distances on the lower left of the ArcView window. You can also define the specific X/Y centre and radius for a selected graphic circle using "Size and Position…" under the Graphics menu. Once you have drawn the circle, you can choose "Select by Graphics" and any features of the selectable layers inside or partially inside the circle will be selected by default. How items are selected can be changed using the Selection options.



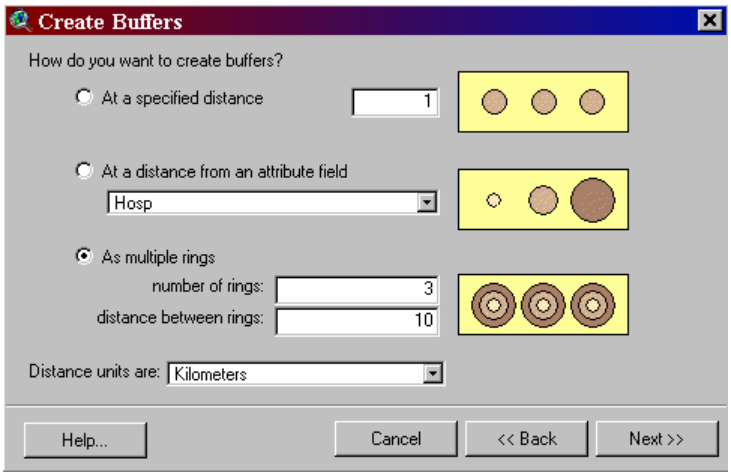
Distance

ArcGIS can be used to find points of a given layer that occur within a specified distance from another layer using ‘Select by Location’ under the Selection menu. To find all public schools within 20 kilometers of a hospital complete the ‘Select by Location options as below.

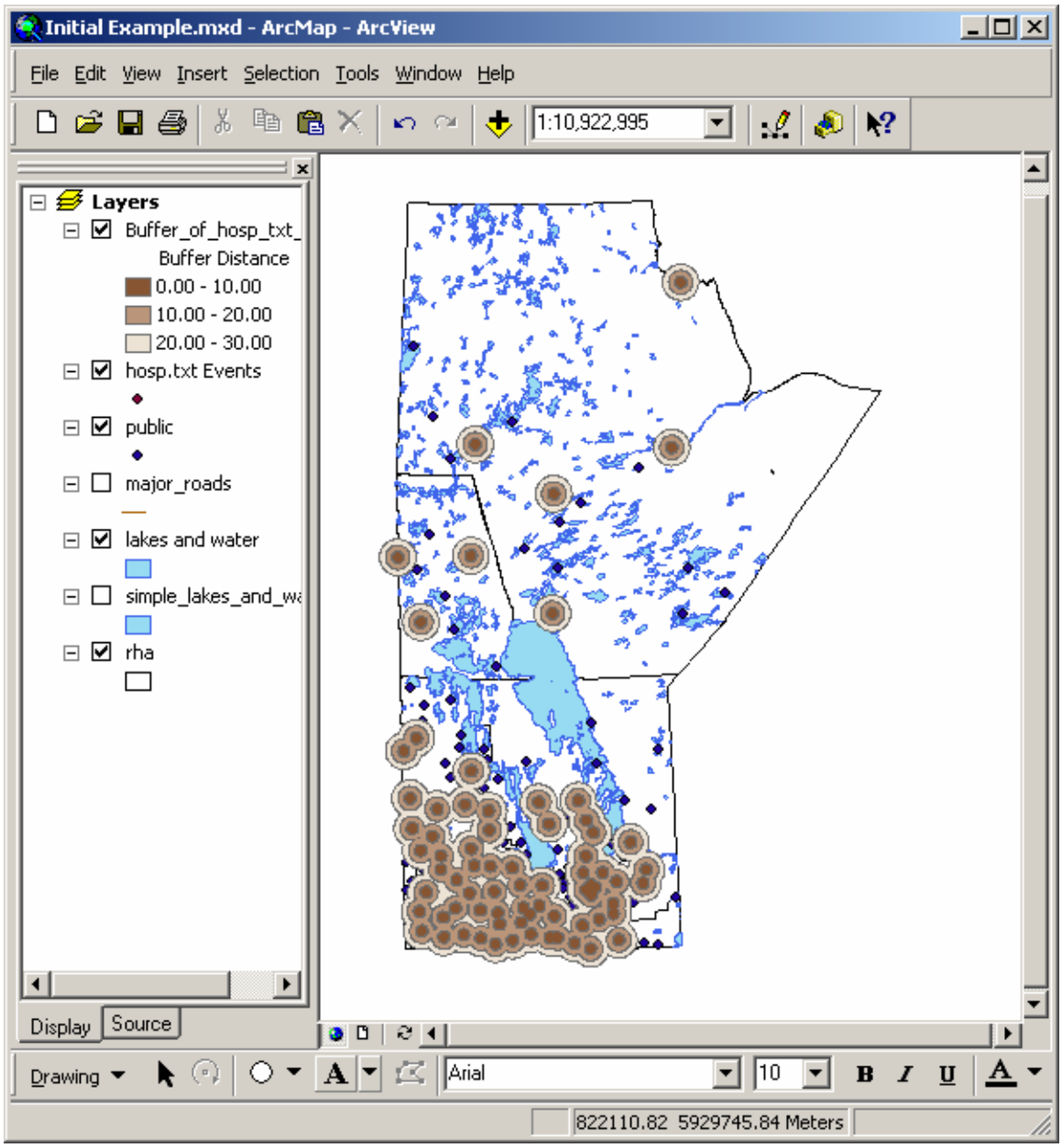


Your map should now highlight all schools within 20 kilometers of a hospital.

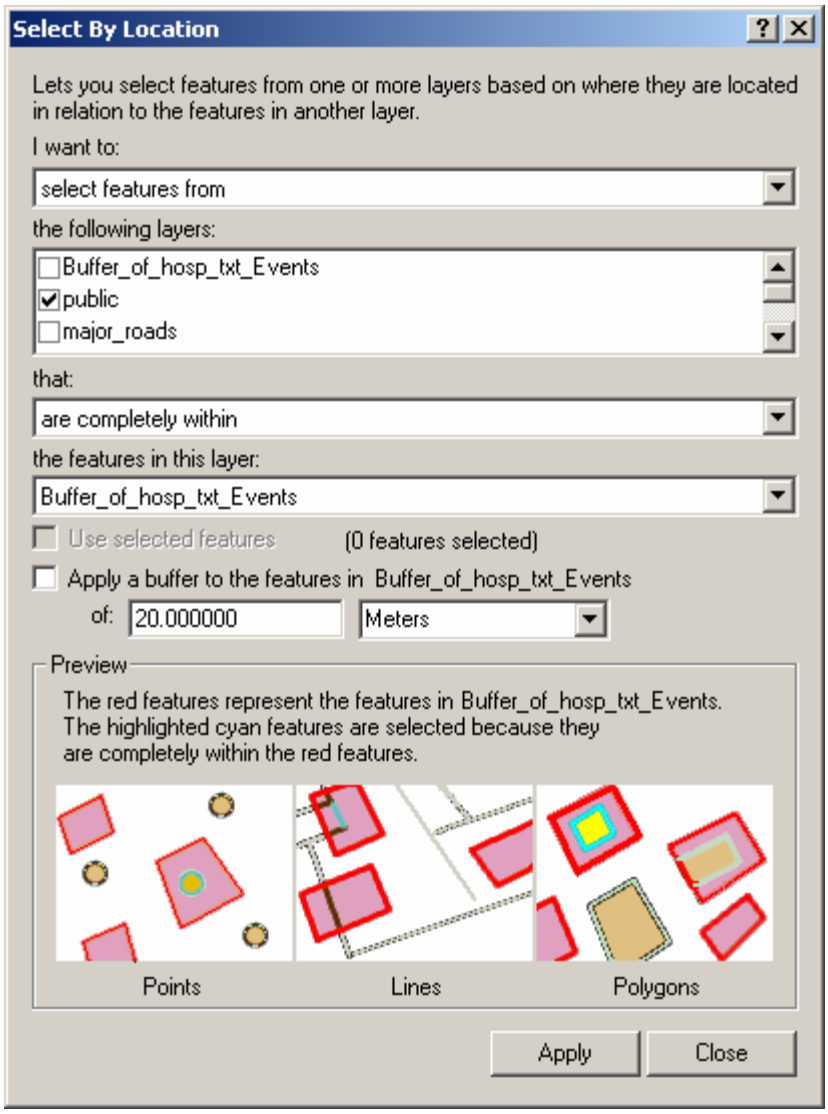
A similar effect can be achieved by creating buffers around hospital points. Under the tools menu, choose ‘Buffer Wizard’. Choose to buffer the features of the layer hosp.txt and click Next. At the next screen, choose to create multiple rings (three, with a distance of 10 km between each ring). Then click Next.



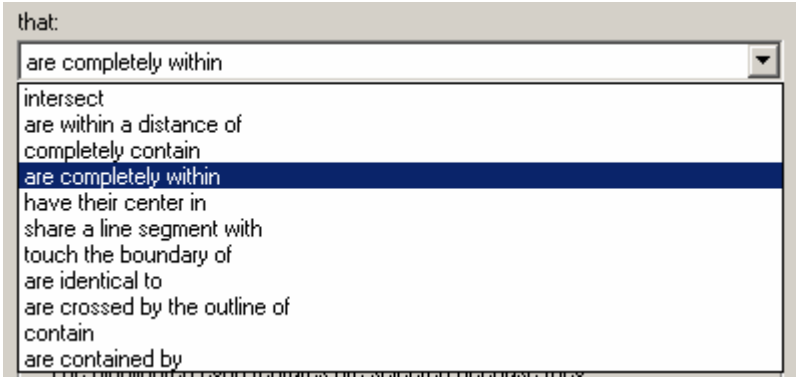
At the next screen, you can choose whether or not you want the barriers of the buffers to dissolve when they overlap. Once you've chosen that, save the buffer as a new theme. When you click on Finish, a new theme will be created called Buffer of Hosp.txt. Pull the theme down so that it's not covering the points.



To select all public schools within 30 kilometers of a hospital, first clear the previous selection. Go to Select by Location under the Selection menu. This time, choose to select features of the active theme that are completely within the selected features of your Buffer layer. When you click on New Set, all public schools that fall within your buffers will be highlighted.



Obviously, buffers are not necessary for determining distance from points, but they offer another option for doing it. Using another layer (a buffer in this case) for selecting data gives you many more options such as those listed below. This is especially important when selecting polygons or lines based on the features of another theme.

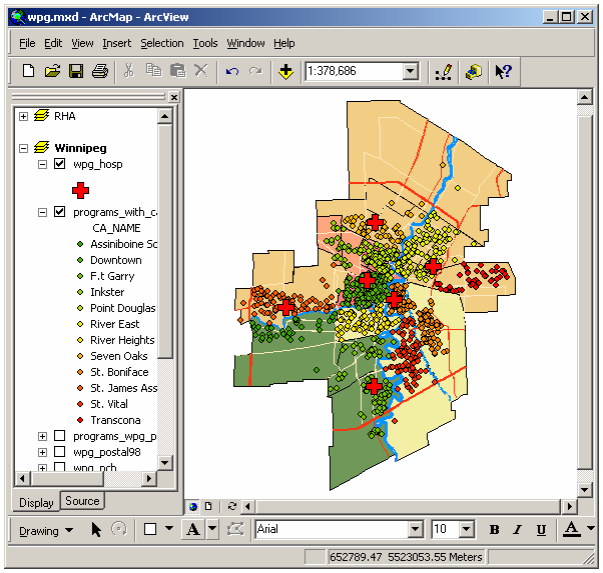


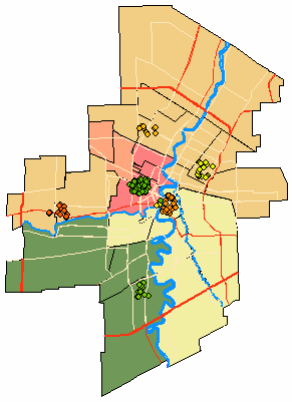
Activity 3. Selecting Data within WRHA

A. Determine the programs that are within 1km of hospitals.

Add the program data (programs.dbf) table to the WRHA project. Using the postal code on the program file and the 1998 Winnipeg postal code locations (wpg_postal98), georeference each of the programs to a specific location using a join on postal code. You should realize that a number of programs do not have an associated postal code.

Join the Winnipeg CA areas to the program data so each program is identified with an individual community area. Change the symbol colours or shape to confirm that each program falls inside the appropriate community area. Identify all of the programs that fall within 1km of hospitals using the select by theme option. Save the selected programs into a new shape file.



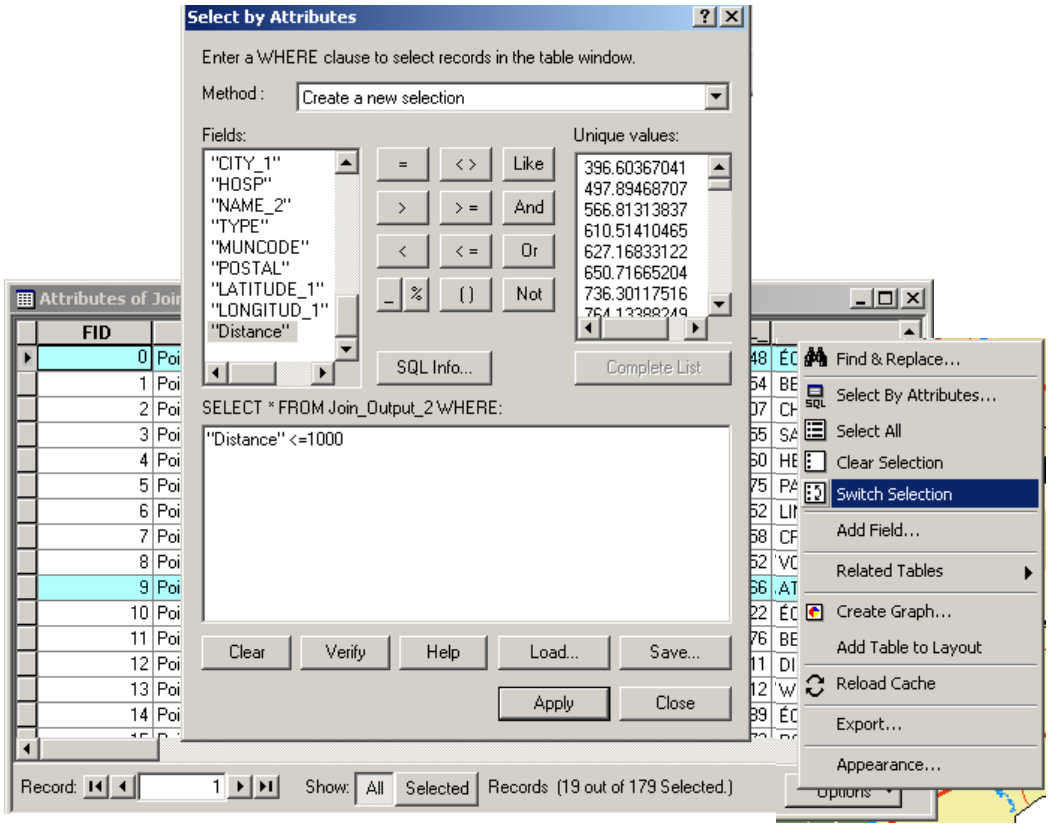


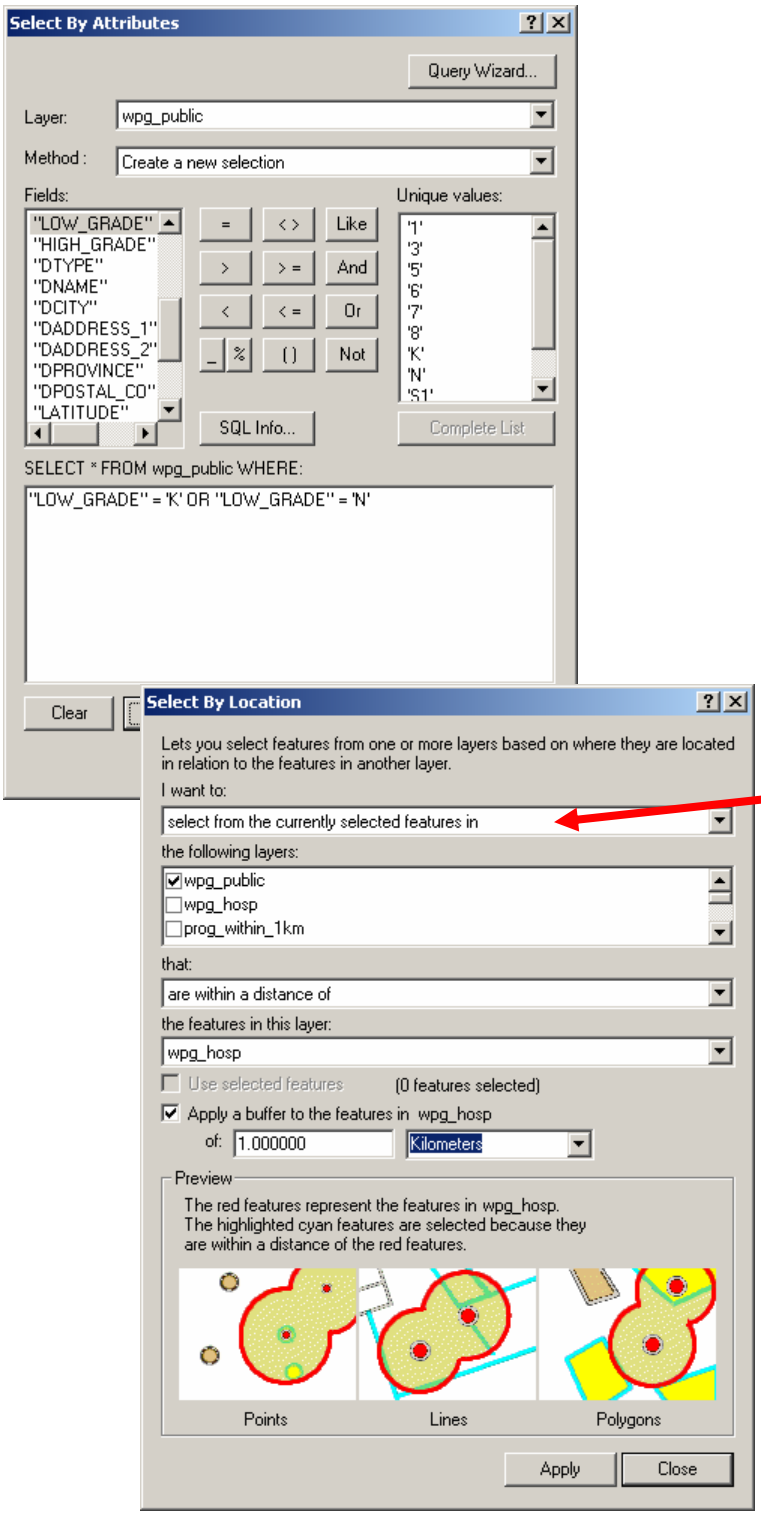
B. Calculate distance from schools with Kindergarten classes to nearest hospital

Add the Winnipeg schools (wpg_public) to the WRHA view. Query (Select by Attributes) the schools attribute table to identify those with kindergarten classes (low_grade='K' or low_grade='N'). Division 1 has some schools that start at nursery school (N) all of these schools also have kindergarten classes. You may also limit the data using the Definition property. Save this file as a projected shape file or the distance calculated in the join will be in the shape file units (decimal degrees – this is different than the spatial query above for some reason). Using the Join option for the new Kindergarten public schools do a spatial join with the hospital data. This will add a distance measurement for each school to the nearest hospital. In the attribute table query all kindergarten schools within

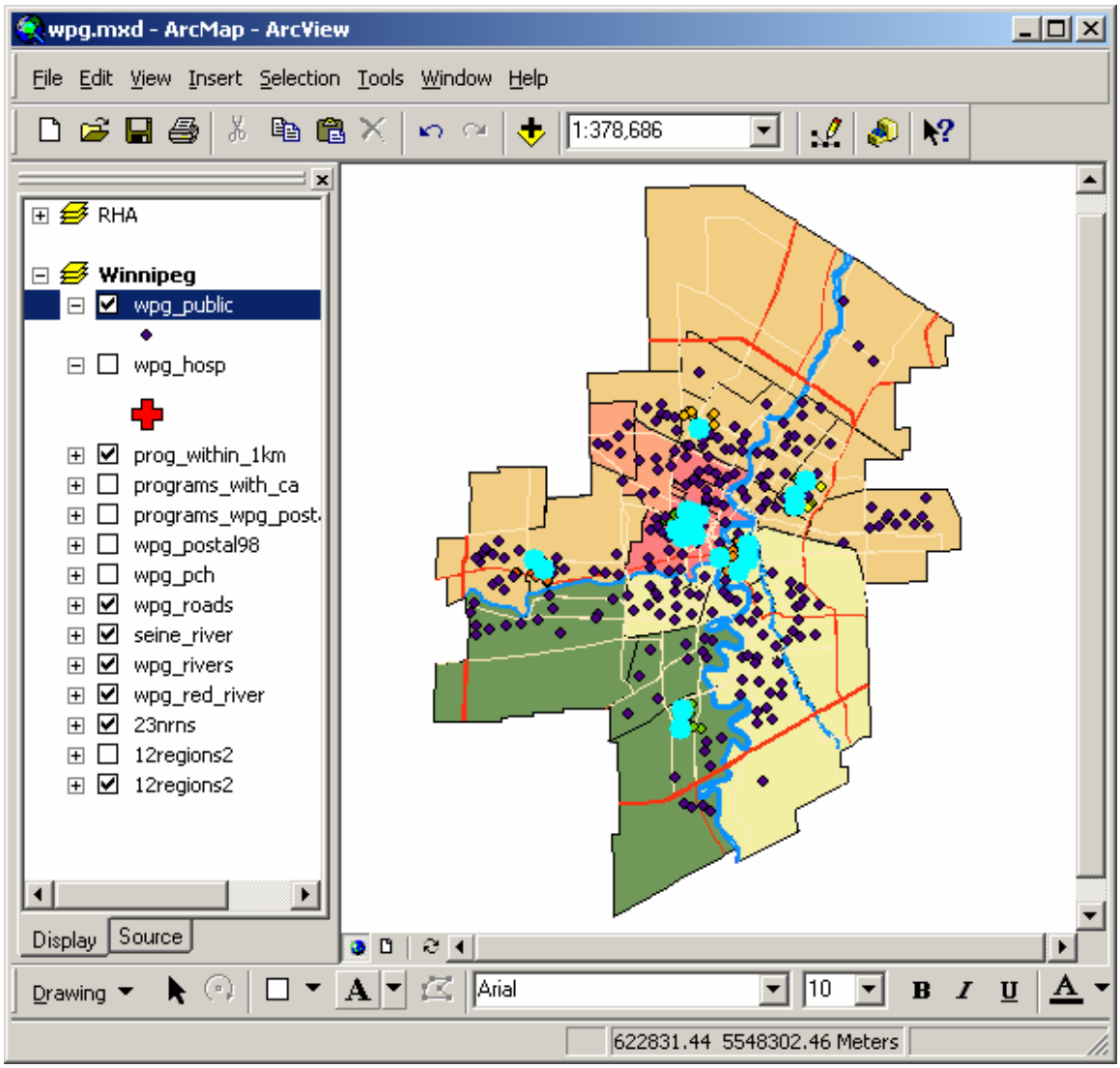
1km of a hospital. Convert this to a shape file. Try to reverse the selection so you get all the schools more than 1km from a hospital (hint: in the attribute table use the switch selection options menu item then select all of the kindergarten schools from that set).

You can do a similar selection using select by location options. An example is given below.





Note that this option is different so only selected public schools are included.

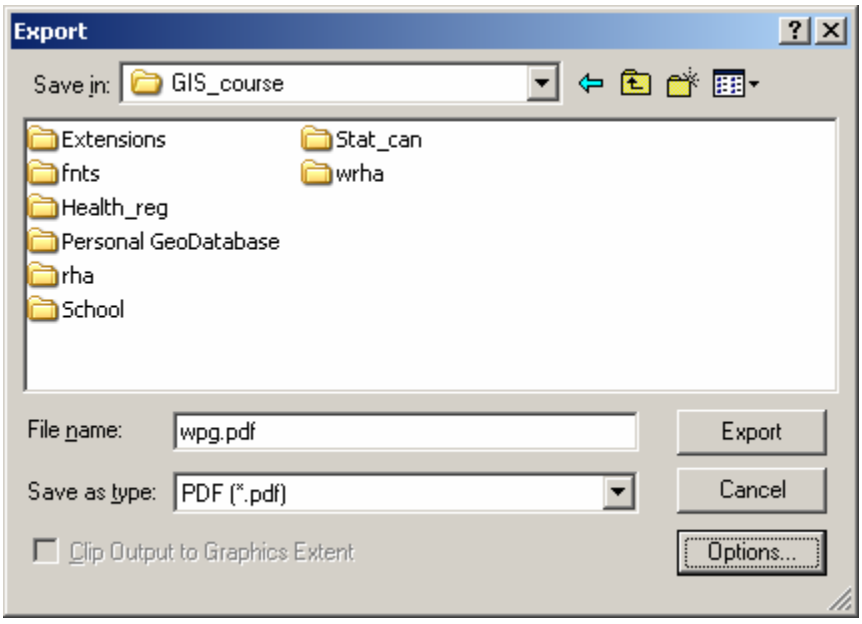


Exporting Maps

Often we want to use maps in PowerPoint presentations or papers and reports. If you do export the image make sure you save the map file so you can recreate the original image at sometime in the future. There are two basic options for transferring maps from ArcMap: 1. They can be copied using 'Copy Map to Clipboard' from the edit menu, 2. A copy of the map can be exported into a new format.

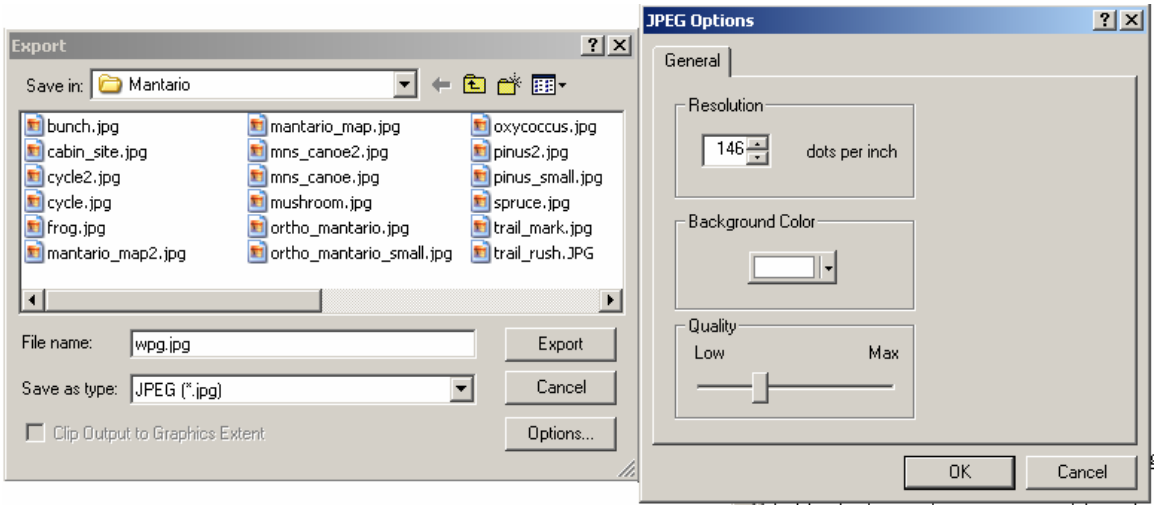
1. When copying the map it will be copied as an ESRI Map object with all of the detail and scalability seen in ArcGIS. The image can be pasted directly or, optionally, pasted as an enhanced meta file in the final document.
2. Export Map from the Edit Menu.
   a. If you are just sending maps to other people it is usually best to send the maps as PDF files. One of the nice benefits of PDF files beyond being transportable they are also searchable for text strings and generally not editable by the end user –

what you created is what they will get. ArcGIS will directly export maps to PDF files without having to go through a secondary PDF writer.



b. If you want to use a map in a PowerPoint presentation or other Windows package likely you will want to export the file as an enhanced meta file. Because EMF images are vector based they can be scaled in the importing program without loss of image resolution. EMF images can usually be ungrouped in a CAD or drawing package (even PowerPoint) so different parts can be resized, coloured or modified independent of the other parts of the map.

c. JPEG images are a raster format that is often used for presenting information on the WWW, used on a variety of platforms/programs, or can be modified in a graphics package such as PhotoShop. JPEG images are preferred for colour images that will be used on the WWW or some page layout programs.



Activity 4. Exporting a Map to Power Point

Export the WRHA map layout created earlier with the 12 and 23 regions. Make sure that a legend has been created for the 12 community areas. Add a scale bar and north arrow to the map. Export both a JPEG and EMF image. Read both of these into a different power point slide. Try resizing each image to see what happens to the quality of the image as it gets larger. Ungroup the EMF to see the different 'parts' that the map represents.

Further Information

What to ask for when getting data

Type of file:

ArcView Shape (SHP) Make sure you get all the parts
ArcInfo transport (E00)
CAD (DXF)
Personal Geodatabase

Make sure you get the projection, map units, and datum. Most of our data uses decimal degrees with NAD 27 or NAD 83. UTM projections with map units in meters for zone 14 are suitable for MB but generally we would rather project from decimal degrees.

If you get an unknown shape, coverage, or E00 file look for the .prj file or prj.adf file. These files can be read with a text editor such as Notepad and will give you an idea of the necessary projection information.

In some cases files will be posted as MIF (Map Info Transport files). These can be translated into ESRI formatted files if necessary but look for alternatives if possible. We do not have converters for other formats.

Presenting MB Data

Generally use UTM zone 14 using NAD 27 or NAD 83/WGS 84 (which ever is appropriate).

Albers Equal Area with the following criteria can also be used but this is a custom projection and should not be given projected to other people.
Central Meridian – 98.00
Standard Parallel 1 – 51
Standard Parallel 2 – 77
Latitude of Origin – 63

Spheroid – WGS84 (NAD83) for recent data (e.g. 2001 census)
Clarke1866 or GRS80 for older data (e.g. 1996 census)

More on Projections

http://www3.deasy.psu.edu/projection/index.html

Information on Schema files

http://msdn.microsoft.com/library/default.asp?url=/library/en-us/odbc/htm/odbcjetschema_ini_file.asp

Quick and Easy SCHEMA.INI (from: http://www.devx.com/tips/Tip/12566)

To create a SCHEMA.INI file for a text file quickly and easily, let the ODBC setup and drivers do it for you. Go to the Control Panel and start ODBC. Click on the Add button and select the Text driver. Click on the Options button and describe how to arrange the text file. If your text file has a header record, click on the Guess button, and the Column Names will be filled out for you. On the last screen, choose Cancel to avoid setting up the data source. Check the directory where the text file resides, and you'll find a new SCHEMA.INI file.

Defaults (Normal.mxt)

The default template (normal.mxt) can be found under the users profile under Windows.
C:\Documents and Settings\$USER\Application Data\ESRI\ArcMap\Templates

Data Sources

MCHP Network M:\Public\Geography\README.txt
University of Manitoba DLI – Contact Larry Laliberte or Gary Strike Dafoe Library
http://www.umanitoba.ca/libraries/units/datalib/gis/gis.shtml
Manitoba government through the Manitoba Land Initiative
http://web2.gov.mb.ca/mli/mli_data/index.html
GeoGratis – Canadian WWW site with some very useful information
http://geogratis.cgdi.gc.ca/frames.html
GeographyNetwork – ESRI supported site and search engine for geographic data much easier to use through ArcView 8. http://www.geographynetwork.ca/
GeoCommunity http://www.geocomm.com/sitemap/index.html
(http://www.gisdatadepot.com/catalog/index.html)
ArcScripts http://arcscripts.esri.com/ from ESRI http://www.esri.com/
Statistics Canada http://www.statcan.ca/english/freepub/82-402-XIE/free.htm

Data Used for the Workshop

All of the data used in this workshop is found on the supplied CD. Shape files are only listed as a single file in the following descriptions – remember shape files may include a number of associated files. Several of these files are old (e.g. districts and RHAs) newer files should be used from the MCHP M:\public\geography directory.

D:\gis_course

- Course Notes.doc – Course notes (this document)
- GIS Workshop.ppt – PowerPoint presentation used in the workshop
- Lakes and water.shp – A basic polygon shape file showing the larger lakes and rivers in Manitoba.
- Simple lakes and water.shp – A very simple polygon shape file showing only the largest lakes in Manitoba

D:\gis_course\Extensions – A small set of extensions used with ArcGIS
D:\gis_course\fnts – Maps and data used in the First Nations Deliverable

- Community.shp – Locations of First Nations Communities within Manitoba
- Disease.dbf – Rates of chronic diseases and injuries in Manitoba Tribal councils
- Mort.dbf – Mortality and life expectancy measures in Manitoba Tribal councils
- Reserves.shp – Polygon shape file of the Manitoba reserves
- Tc.shp – Tribal Council areas within Manitoba (note Northern Independent combined into one area for this workshop)
- Tc_names.txt – Tribal council names for individual codes. Comma separated file

D:\gis_course\Health_reg

- HR46.E00 – ArcInfo export file of the Manitoba Health regions as used by Health Canada. This file is projected into X/Y Cartesian co-ordinates (meters). Specifically: A Lambert projection in meters based on the clarke1866 (NAD27) spheroid. 49 degrees 1st standard parallel, 77 degrees 2nd standard parallel, -91˚ 52' central meridian, Origin 63˚ 23' 26.4300, 6200000 false easting (meters), 3000000 false northing (meters).

D:\gis_course\Place_names\

- ESRI Place Names – Place names from ESRI (geographynetwork.ca)
- Geogratis Place Names – Manitoba Place Names from Geogratis.
- MB Place Names – Place names from the Manitoba Land Initiative.

D:\gis_course\rha – RHA data for this workshop

- Districts.shp – RHA sub-districts for 2001.
- Districts2004.shp – RHA sub-districts for 2004-2005
- Districts_stat.dfb – Various statistics for RHA districts (2001 format)
- Hosp.txt – Hospital locations and types with X/Y (long/lat) included. Comma separated file.
- Major_roads.shp – Major Manitoba roads and highways
- MB_ea.shp – 1996 enumeration areas within Manitoba
- Nursing_stations.txt - Nursing stations within Manitoba with associated postal code and type of station
- Pch.shp – Locations of PCHs within Manitoba
- Public.shp – Locations of public schools within Manitoba including division, type, grade ranges
- Rha.shp – RHA boundaries 1997-2002
- Rha2002.shp – 2002-2005 RHA boundaries
- Rha_stat.dbf – Some basic health statistics for each RHA including SERI, Hospital sep/days, life expectancy (1997 format).
- Rhad_csd.shp – Census sub-divisions with RHA and RHA districts coded

D:\gis_course\school – Information on 1996/97 Manitoba School divisions

- Schoold.shp – school division boundaries
- Scores.dbf – Average scores for various subjects in Manitoba Schools (S4 Math, S4 English, Grade 3 Math)

D:\gis_course\stat_can – Statistics Canada Data

- Pccf46_NOV01.txt – Comma delimited version of November 2001 PCCF file
- Sli_1.shp – Single link points from PCCF file
- RHA-DA 2001.zip. - Correspondence file for MB RHA and 2001 DA http://www.statcan.ca/english/freepub/82-402-XIE/00503/corr.htm

- RHA-EA 1996.zip - Correspondence file for National health regions and 1996 EA http://www.statcan.ca/english/freepub/82-402-XIE/00503/corr.htm
- National_Health_Regions.zip - ArcView shape file for current national Health region boundaries. This file is saved in projected units (meters) – NAD83, Lambert Conformal Conic (See prj file for information).
- Manitoba RHA.zip - the current (2003) RHA boundaries in projected units.
- Manitoba RHA_D.zip - the current (2003) RHA boundaries in decimal degrees (NAD83).
- PCCF July 2004.zip – Limited PCCF for this workshop in DBF format based on July 2004 PCCF file for Manitoba.

D:\gis_course\wrha – Winnipeg Regional Health Authority information

- 12regions2.shp – 12 Community Characterization Areas of WRHA
- 23nrns.shp – 25 Neighbourhood Clusters of WRHA
- ca_health.dbf – Various health measures for 12 Community Characterization areas
- ca_social.dbf – Various neighbourhood social measures for 12 Community Characterization areas
- Com_Club.txt – Community Centre names and addresses in comma separated format
- Library.dbf – Library names and addresses in dbf format
- Parks_rec.shp – Parks and recreational areas within Winnipeg CMA
- Programs.dbf – Social and community programs within Winnipeg with addresses and postal codes
- Seine_river.shp – Seine River shape file
- Worship_address.txt – Places of worship within Winnipeg with addresses
- Wpg_bound.shp – Boundary of WRHA
- Wpg_ea.shp – Winnipeg enumeration areas includes average household income
- Wpg_hosp – Winnipeg Hospital Locations with hospital names and type
- Wpg_postal98.shp – 1998 PCCF
- Wpg_public.shp – Public schools within Winnipeg with name, address, postal code, grade ranges and type
- Wpg_rivers.shp – Arc (line) shape file of Major Winnipeg Rivers. Should be used with wpg_red_river polygon file
- Wpg_red_river.shp – Polygon shape file for Red River through Winnipeg
- Wpg_roads.shp – Winnipeg street network file used for geocoding
- Wpg_streams.shp – Smaller Winnipeg streams and rivers