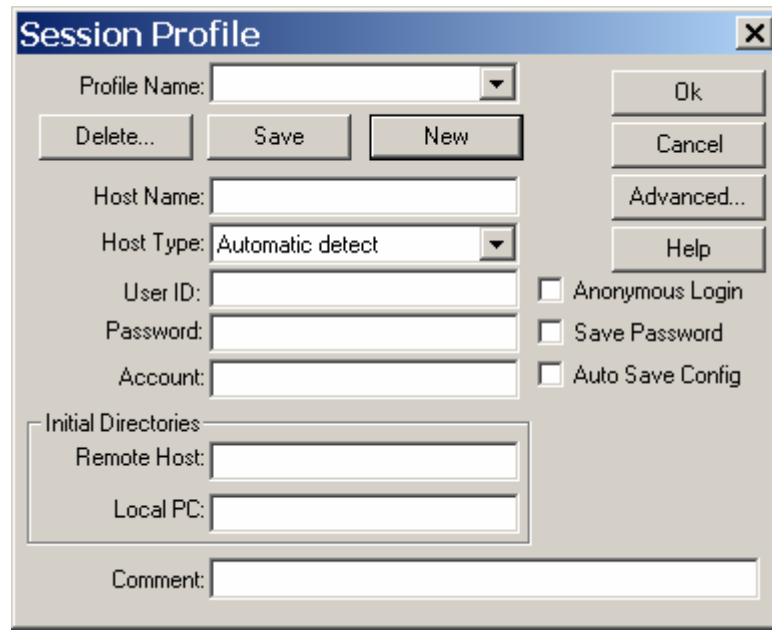# A Second Look at DLG's

What is a DLG

A *dlg* is a digital line graph and contains much of the line information shown on 1:24,000; 1:100,000; or 1:250,000 scale "hard copy" topographic map. For many if not most geologists, dlg's will be the most useful dataset. These data have been produced for some time by the USGS and many software packages (including SURFER) have the capability of reading them).

Although originally produced and distributed by the USGS, dlg's are available from a number of federal, state, and commercial sources. We have already looked at one, the state of Ohio (exclusively 1:24,000 scale). A number of you have found similar sites on websites for other states. Ohio has 100% coverage of the state by 1:24,000 dlg's. It is important to note, however, these dlg's are in the older, more convenient "original" ASCII format (you can read them with any text editor) and is described in detail in this pdf. Some, but by no means all, of the dlg's are available in SDTS format from either EROS or from commercial sites such Geocommunity (for which you all now have accounts). The original and the SDTS formats are quite different and must be handled differently.

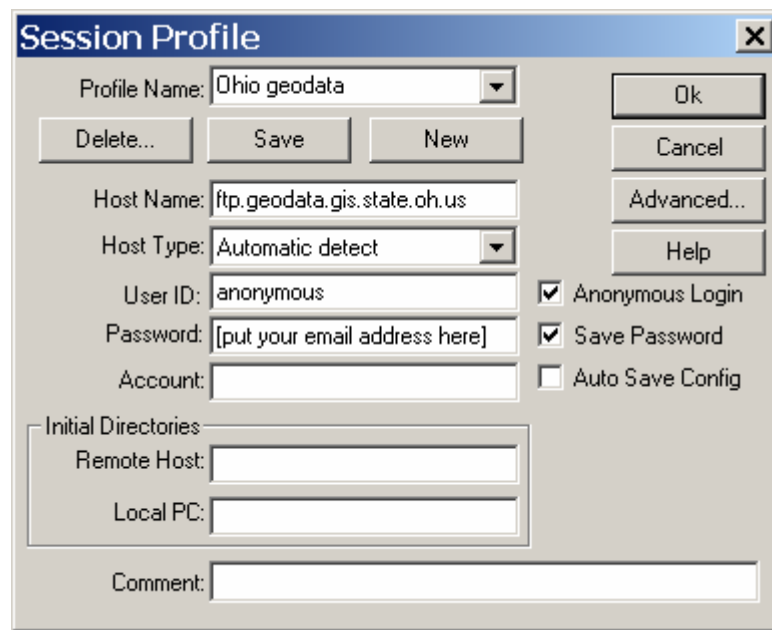## Downloading dlg data

From Ohio

We already downloaded data from Ohio's website in our first class by copying them directly from the browser. Let's do it more efficiently this time by using an FTP client available free from UC, *ws_ftp* (which should be on all 3rd floor lab machines). When you first fire it up, it should look something like this (click the "New" button if it doesn't)

Fill it in to look like this (obviously replacing [put your email address here] with your email address) and press the "Save" button.

Pressing the "Ok" button should give you this screen:
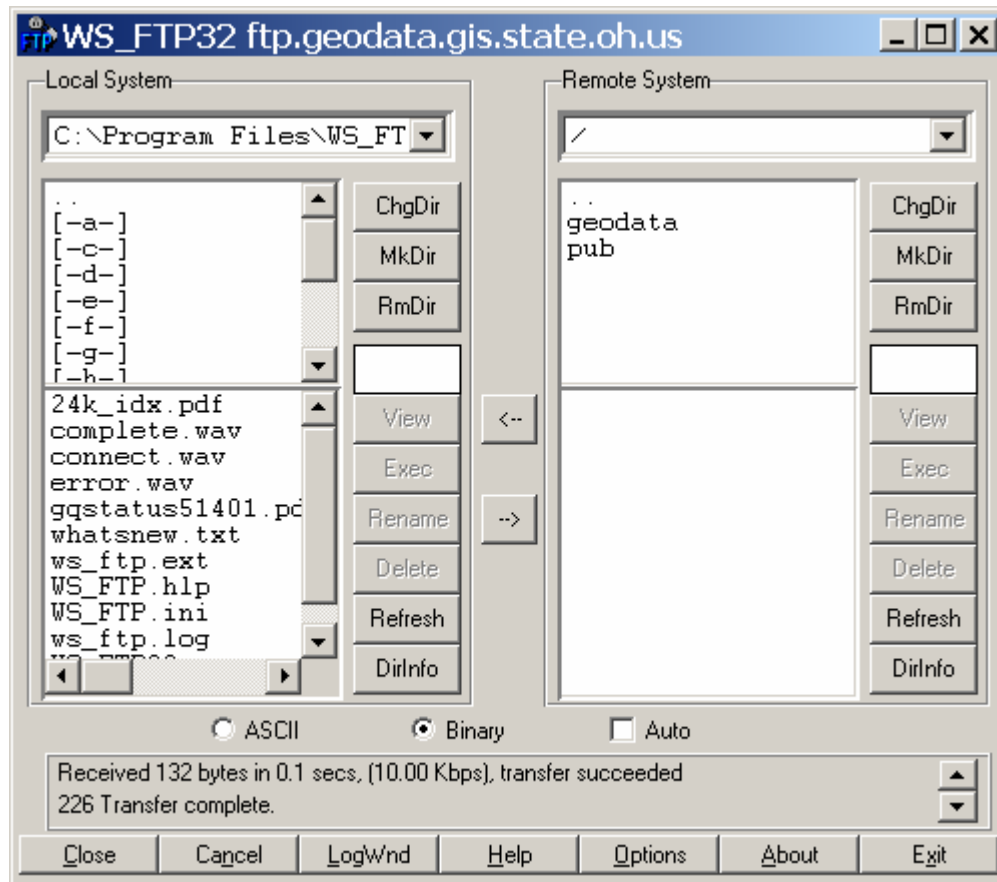
In the left panel, click on the D drive symbol [-d-] and navigate to a convenient folder or make a new one by pressing the "MkDir" button. In the right panel double click on "geodata" then "dlg" then "24000". Click once on "dlg_index.txt" in the lower panel on the right side and click the "View" button.

```
DSPE28 - Notepad                                                    _ □ ×
 File  Edit  Format  Help

DLG file name is derived as follows:

    file prefix + format + DLG layer + file extension

file prefix:        from the table below
format:             All DLGs distributed through DAS are in optional format
                    so the layer format is always the letter 'o'
geodata identifier: BD - digital line graph (DLG) boundaries
                    HY - dlg hydrography
                    PL - dlg public land survey
                    RD - dlg roads
                    RR - dlg railroads
                    MT - dlg miscellaneous transportation
                    HP - dlg hypsography (contours)
file extension:     is always .dlg (after decompressed)


Example: The file name for the hypsography layer for the Belfast quadrangle
in Adams county is cw328ohp.dlg

file prefix:        cw328
format:             o
geodata identifier: hp
file extension:     .dlg


All DLGs on this site are NAD 27.



-----------------------------------------------------------
ADAMS COUNTY
                                                File
Map Name                 FTP Directory          Prefix
-----------------------------------------------------------
BELFAST                  HILLSBORO              CW328
BLUE CREEK               MAYSVILLE              HT114
BUENA VISTA              MAYSVILLE              HT122
BYINGTON                 HILLSBORO              CW330
CONCORD                  MAYSVILLE              HT121
```
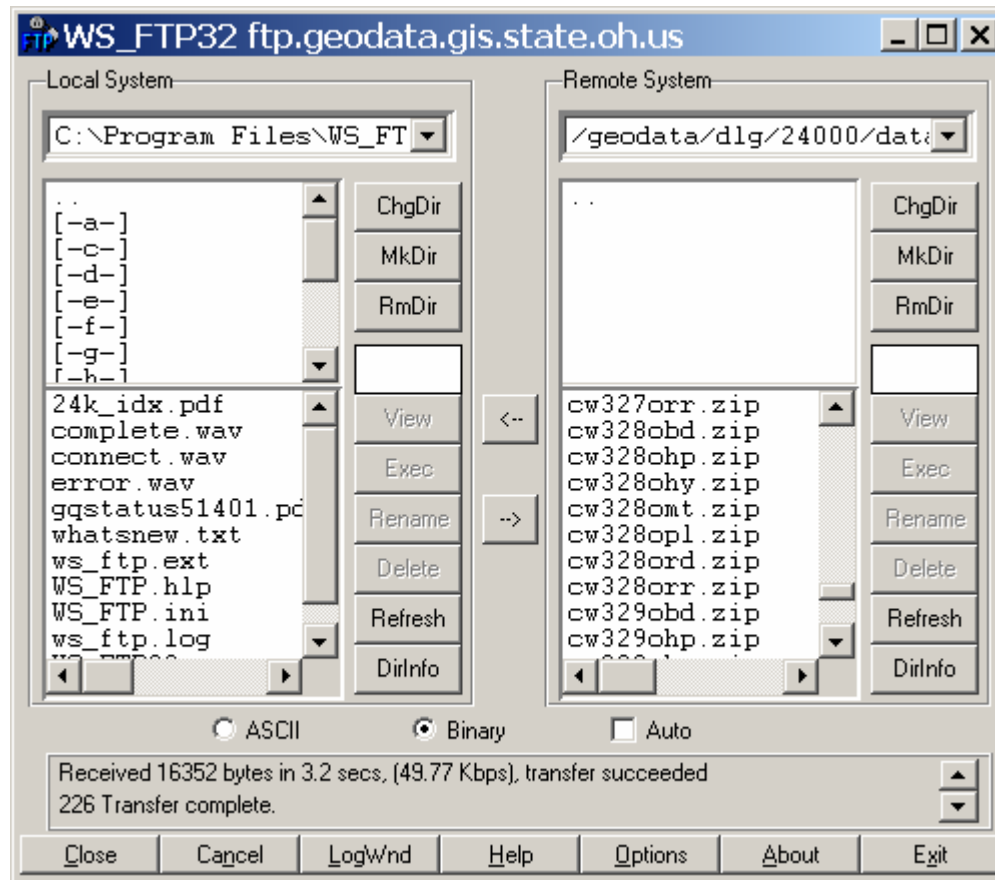
Here you find the complete dlg coverage for each state. As demonstrated in class, this document shows the directory and file label of each quadrangle. So, for instance, the Belfast quad is in the files labeled CW328 in the Hillsboro directory. Let's take a look. Double click on "data" in the upper right-hand panel, scroll down the "hillsboro" and double click it (may to a minute to list the files in that directory). Scroll down the CW328

```
WS_FTP32 ftp.geodata.gis.state.oh.us                _ □ X

┌Local System──────────────┐    ┌Remote System─────────────┐
│ C:\Program Files\WS_FT ▼ │    │ /geodata/dlg/24000/data ▼ │

  . .              ▲   ChgDir      . .               ChgDir
  [-a-]                MkDir                         MkDir
  [-c-]
  [-d-]                RmDir                         RmDir
  [-e-]
  [-f-]
  [-g-]            ▼
  [-h-]
  24k_idx.pdf      ▲   View    <--  cw327orr.zip ▲    View
  complete.wav                     cw328obd.zip
  connect.wav          Exec        cw328ohp.zip       Exec
  error.wav                        cw328ohy.zip
  gqstatus51401.pd     Rename  --> cw328omt.zip       Rename
  whatsnew.txt                     cw328opl.zip
  ws_ftp.ext           Delete      cw328ord.zip       Delete
  WS_FTP.hlp                       cw328orr.zip
  WS_FTP.ini           Refresh     cw329obd.zip       Refresh
  ws_ftp.log       ▼               cw329ohp.zip ▼
  ◀          ▶      DirInfo        ◀          ▶       DirInfo

        ○ ASCII        ● Binary        □ Auto
  ┌─────────────────────────────────────────────────┐
  │ Received 16352 bytes in 3.2 secs, (49.77 Kbps), transfer succeeded ▲│
  │ 226 Transfer complete.                                             ▼│
  └─────────────────────────────────────────────────┘
  Close │ Cancel │ LogWnd │ Help │ Options │ About │ Exit
```

Remember that there'll be seven files corresponding to

geodata identifier: BD - digital line graph (DLG) boundaries

- BD – boundaries (city, park, etc.)
- HY -hydrography
- PL -public land survey (township, range, section)
- RD -roads
- RR -railroads
- MT -miscellaneous transportation (pipelines, power lines, airports, etc.)
- HP -hypsography (topographic contour)

Select them all using shift-click and press the [<--] button between the left and right panels to download the data to the selected directory.


From the Federalis

For the time being, at least, some dlg dataset may be downloaded from the EROS GEODATA site. There are a number of ways this can be done with a browser but, again, it can be done much easier with an ftp client. I say "for the time being" because this site also used to distribute dem datasets but then shifted this task to

commercial vendors. Because these same vendors also distribute dlg's, it wouldn't surprise me if eventually all distribution of these datasets was transferred to commercial vendors. Currently it's much easier to download these data from EROS.

Start up ws_ftp (click "close" if it's already open), click "Connect" then "New". Fill in the panel to look like this and click "Save"


Using the same procedure discussed above, navigate to /pub/data/DLG/LARGE_SCALE by double clicking "DLG" then "LARGE_SCALE" in the upper right-hand panel. Double click on "B" in the upper right-hand panel and prepare to wait while the directory is listed (could take a minute or more). Listed here are all the available dlg's for the US that begin with the letter *B* (there're a lot). Scroll down to Belfast_OH and highlight it by clicking once. Navigate to the directory to which you want to download the data using the left-hand panel and the procedure used previously. Again, press the left-pointing arrow to download the data. This time you'll be warned that you're downloading a directory. Press the "Ok" button.
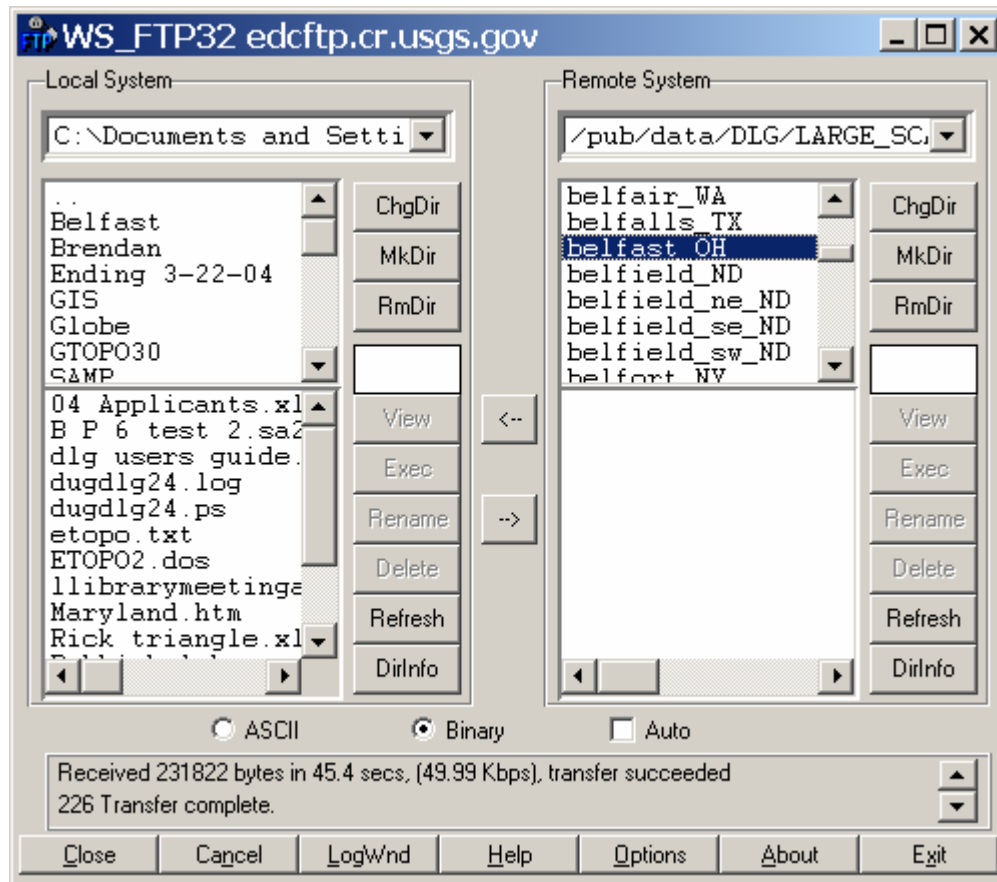
Making the dlg readable by ArcMap

Okay, you've now downloaded the same dataset in two different formats: the original and SDTS dlg formats. With some work using the ESRI ArcToolbox you could get these data into a format readable by ArcMap… or you could take the much easier route and use Global Mapper. Let's use two adjacent quadrangles. Download the Sinking Springs quad too.

Load the hypsography sheets for the two adjacent quads into Global Mapper.
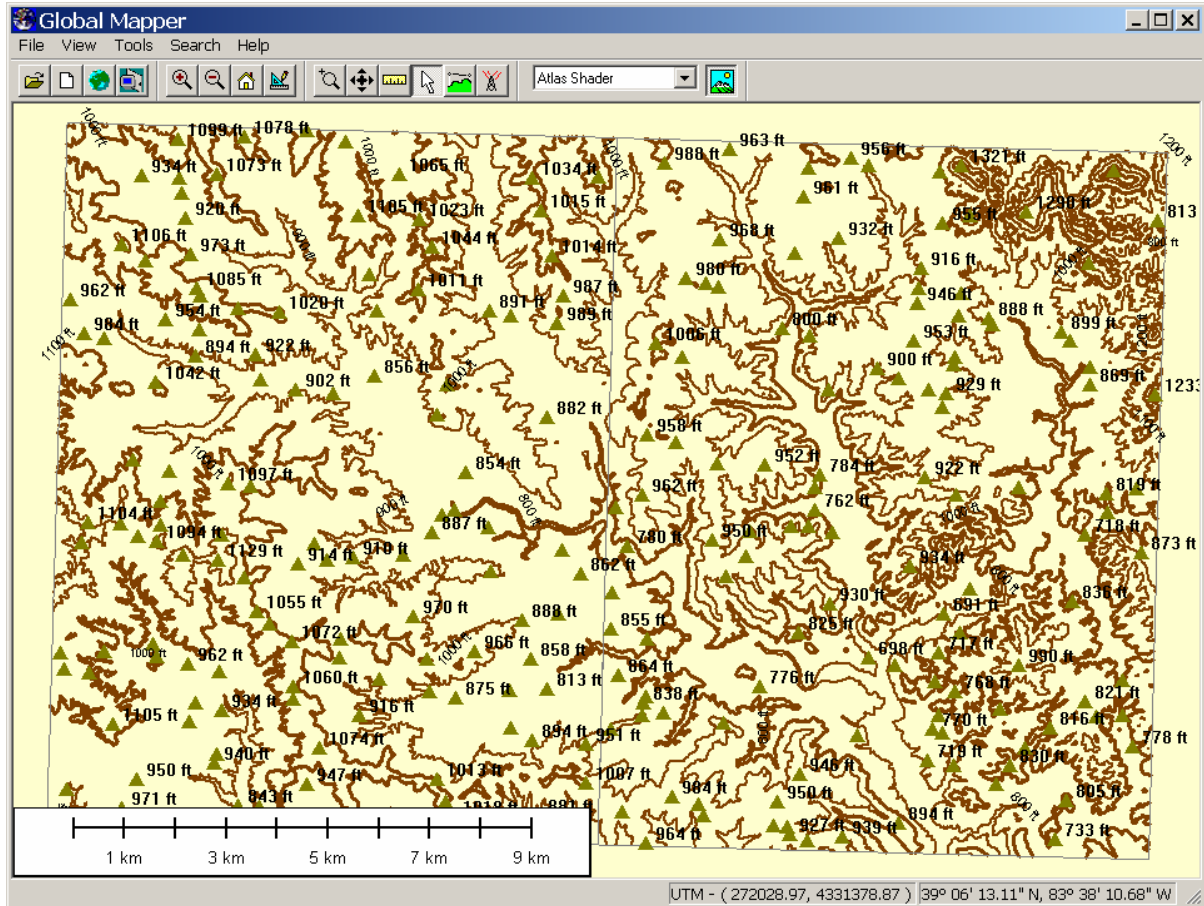
Export the data as a polyline shapefile (there're point data as well but we won't use it). Note that these two quads will be merged and exported as one theme… this obviates the need for merging them in ArcMap (an easy but time consuming process).

Processing dlg with Arcmap

Open the shapefile with ArcMap.
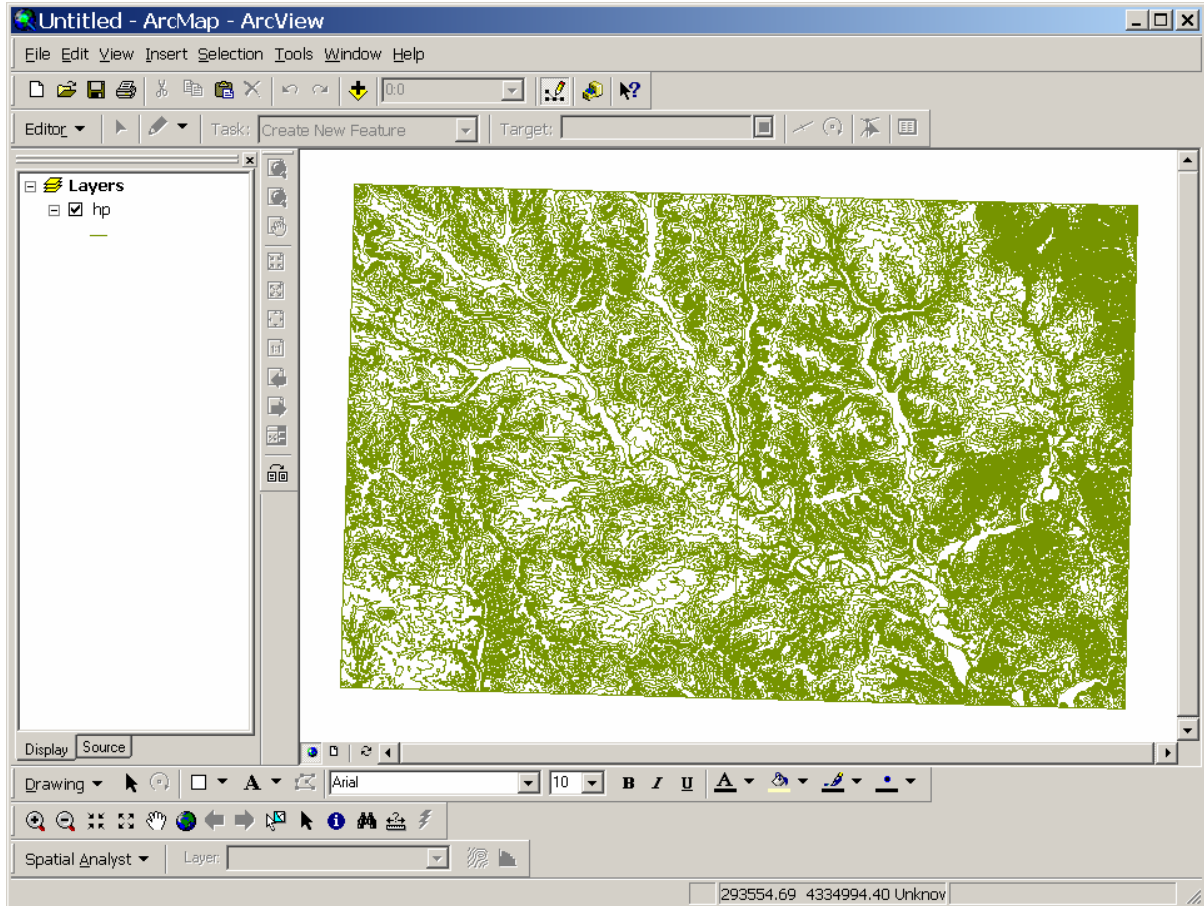
Notice that one of the exported polylines is the edge line around the sheets. Let's get rid of it. If the "edit" toolbar is not visible, make it so using View>Toolbars. On the editor toolbar, pull down to "start editing". Using the edit bar selector, you could click on every unwanted line segment and press delete (but you'd go nuts or blind long before you'd finished). There's a much easier way. Right click on the theme label in the left-hand panel and select "Open Attribute Table".

FID	Shape*	NAME	LAYER	ELEVATION	DLGMAJ_0	DLGMIN_0	DLGMAJ_1	DLGMIN_1	DLGMAJ_2	DLGMIN_2
161	Polyline	920 ft	INTERMEDIATE CONTOUR	920	20	200	22	920	0	0
162	Polyline	860 ft	INTERMEDIATE CONTOUR	860	20	200	22	860	0	0
163	Polyline	880 ft	INTERMEDIATE CONTOUR	880	20	200	22	880	0	0
164	Polyline	940 ft	INTERMEDIATE CONTOUR	940	20	200	22	940	0	0
165	Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	22	960	0	0
166	Polyline	940 ft	INTERMEDIATE CONTOUR	940	20	200	22	940	0	0
167	Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	22	960	0	0
168	Polyline	1000 ft	INDEX CONTOUR	1000	20	200	22	1000	0	0
169	Polyline	980 ft	INTERMEDIATE CONTOUR	980	20	200	22	980	0	0
170	Polyline	880 ft	INTERMEDIATE CONTOUR	880	20	200	22	880	0	0
171	Polyline	1020 ft	INTERMEDIATE CONTOUR	1020	20	200	22	1020	0	0
172	Polyline	1000 ft	INDEX CONTOUR	1000	20	200	22	1000	0	0
173	Polyline	920 ft	INTERMEDIATE CONTOUR	920	20	200	22	920	0	0
174	Polyline	900 ft	INDEX CONTOUR	900	20	200	22	900	0	0
175	Polyline	1080 ft	INTERMEDIATE CONTOUR	1080	20	200	22	1080	0	0
176	Polyline	940 ft	INTERMEDIATE CONTOUR	940	20	200	22	940	0	0
177	Polyline	1020 ft	INTERMEDIATE CONTOUR	1020	20	200	22	1020	0	0
178	Polyline	1040 ft	INTERMEDIATE CONTOUR	1040	20	200	22	1040	0	0
179	Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	22	960	0	0
180	Polyline	980 ft	INTERMEDIATE CONTOUR	980	20	200	22	980	0	0
181	Polyline	1060 ft	INTERMEDIATE CONTOUR	1060	20	200	20	611	22	1060
182	Polyline	1040 ft	INTERMEDIATE CONTOUR	1040	20	200	22	1040	0	0
183	Polyline	1060 ft	INTERMEDIATE CONTOUR	1060	20	200	22	1060	0	0

Record: 1   Show: All Selected   Records (1 out of 2854 Selected.)   Options

Pull down to "Select by Attributes" under "Options"

Select by Attributes

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

Method : Create a new selection

Fields:
"FID"
"NAME"
"LAYER"
"ELEVATION"
"DLGMAJ_0"
"DLGMIN_0"
"DLGMAJ_1"
"DLGMIN_1"
"DLGMAJ_2"
"DLGMIN_2"

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

SQL Info...

Unique sample values:
611
780
800
820
840
860
880
900
920

Complete List

SELECT * FROM hp WHERE:

"ELEVATION" = 0 AND "DLGMAJ_0" = 0 AND "DLGMIN_0" = 0 AND "DLGMAJ_1" =0 AND "DLGMIN_1" =0

Clear   Verify   Help   Load...   Save...

Apply   Close

Click or type "ELEVATION" = 0 AND "DLGMAJ_0" = 0 AND "DLGMIN_0" = 0 AND "DLGMAJ_1" =0 AND "DLGMIN_1" =0 and press "Apply". Close the select attribute windows and the attribute table. Notice that all the edge lines are now selected (show in light blue).
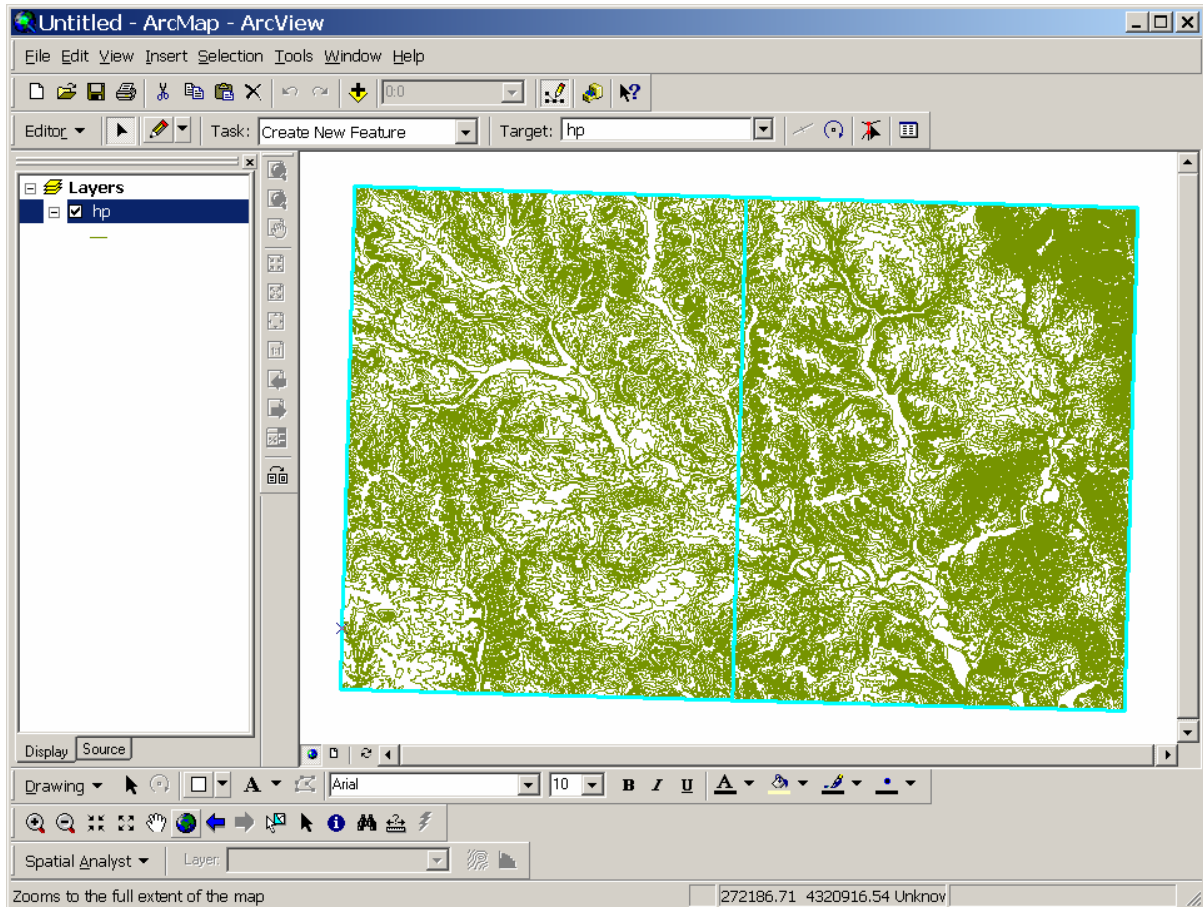

If you are currently editing, you may hit "Delete" and all those selected lines will be deleted (if not, pull down Editor>Start Editting"). Pull down on the editor to "stop editing" and save the cleaned up dataset.

Now let's use appropriate colors for the contour lines. For these maps the contour interval is 20 feet. Let's make every fifth contour line heavier (*i.e.*, make every even 100 foot contour line different). Again open the attributes table and, as we did last week, and add a new field labeled "BOLD" using the "Options" pull down.
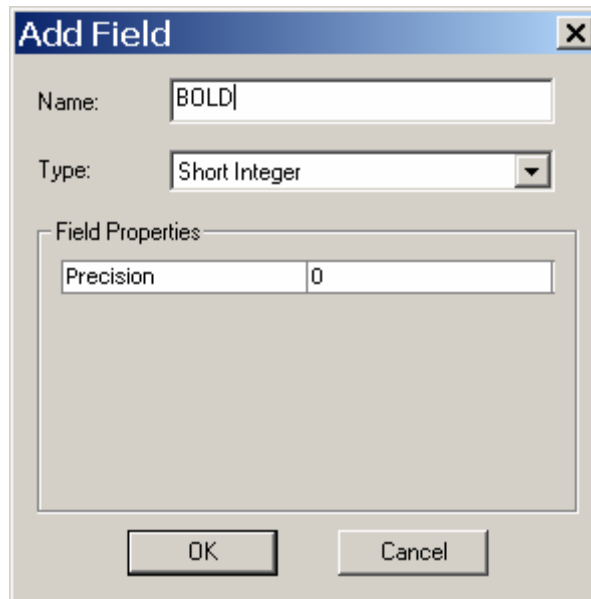
Once this field has been added, left click on the heading and select "Calculate values…". Either type or click [ELEVATION] mod 100 = 0. 'mod' determines the "remainder" of a division. In other words 5 mod 2 is 1 and 950 mod 100 is 50. So, if *a number* mod 100 is 0, it must be evenly divisible by 100.
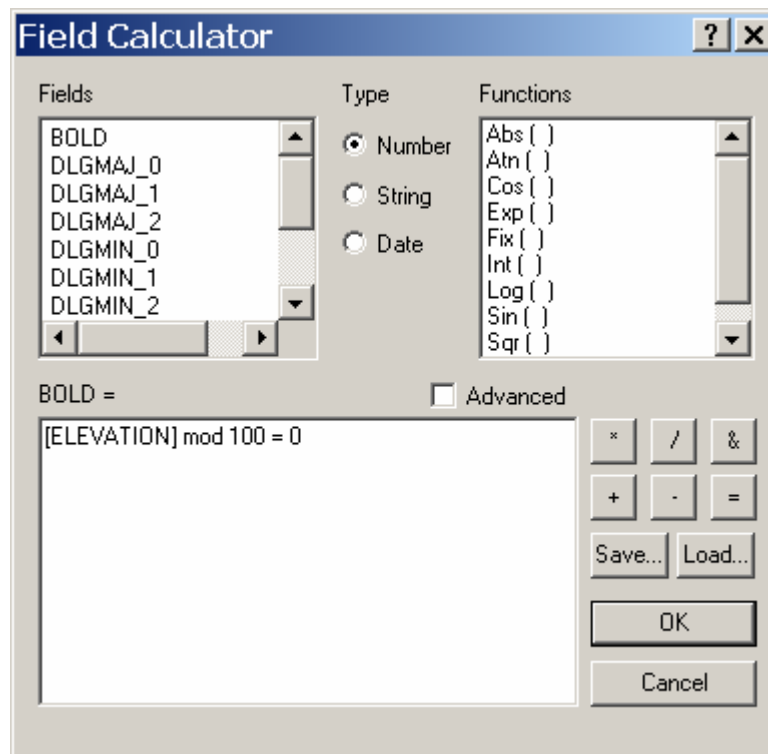
Note that every elevation that's an even multiple of 100 has a "BOLD" value of -1 (true) and number not an even multiple as 0 (false).

Attributes of hp

Shape*	NAME	LAYER	ELEVATION	DLGMAJ_0	DLGMIN_0	DLGMAJ_1	DLGMIN_1	DLGMAJ_2	DLGMIN_2	BOLD
Polyline	900 ft	INDEX CONTOUR	900	20	200	22	900	0	0	-1
Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	20	611	22	960	0
Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	20	611	22	960	0
Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	20	611	22	960	0
Polyline	900 ft	INDEX CONTOUR	900	20	200	22	900	0	0	-1
Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	20	611	22	960	0
Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	20	611	22	960	0
Polyline	1120 ft	INTERMEDIATE CONTOUR	1120	20	200	22	1120	0	0	0
Polyline	960 ft	INTERMEDIATE CONTOUR	960	20	200	20	611	22	960	0
Polyline	1040 ft	INTERMEDIATE CONTOUR	1040	20	200	22	1040	0	0	0
Polyline	1020 ft	INTERMEDIATE CONTOUR	1020	20	200	22	1020	0	0	0
Polyline	1020 ft	INTERMEDIATE CONTOUR	1020	20	200	22	1020	0	0	0
Polyline	1120 ft	INTERMEDIATE CONTOUR	1120	20	200	22	1120	0	0	0
Polyline	1100 ft	INDEX CONTOUR	1100	20	200	22	1100	0	0	-1
Polyline	1080 ft	INTERMEDIATE CONTOUR	1080	20	200	22	1080	0	0	0
Polyline	1100 ft	INDEX CONTOUR	1100	20	200	22	1100	0	0	-1
Polyline	1120 ft	INTERMEDIATE CONTOUR	1120	20	200	22	1120	0	0	0
Polyline	1120 ft	INTERMEDIATE CONTOUR	1120	20	200	22	1120	0	0	0
Polyline	1120 ft	INTERMEDIATE CONTOUR	1120	20	200	22	1120	0	0	0
Polyline	1000 ft	INDEX CONTOUR	1000	20	200	22	1000	0	0	-1
Polyline	1120 ft	INTERMEDIATE CONTOUR	1120	20	200	22	1120	0	0	0
Polyline	1020 ft	INTERMEDIATE CONTOUR	1020	20	200	22	1020	0	0	0

Record: 0   Show: All | Selected   Records (0 out of 1646 Selected.)   Options

Close the attributes table and open the theme properties to the Symbology tab.

Layer Properties

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates

Show:
- Features
- Categories
  - Unique values
  - Unique values, many [...]
  - Match to symbols in a [...]
- Quantities
- Charts
- Multiple Attributes

Draw categories using unique values of one field.   Import...

Value Field: BOLD

Color Scheme

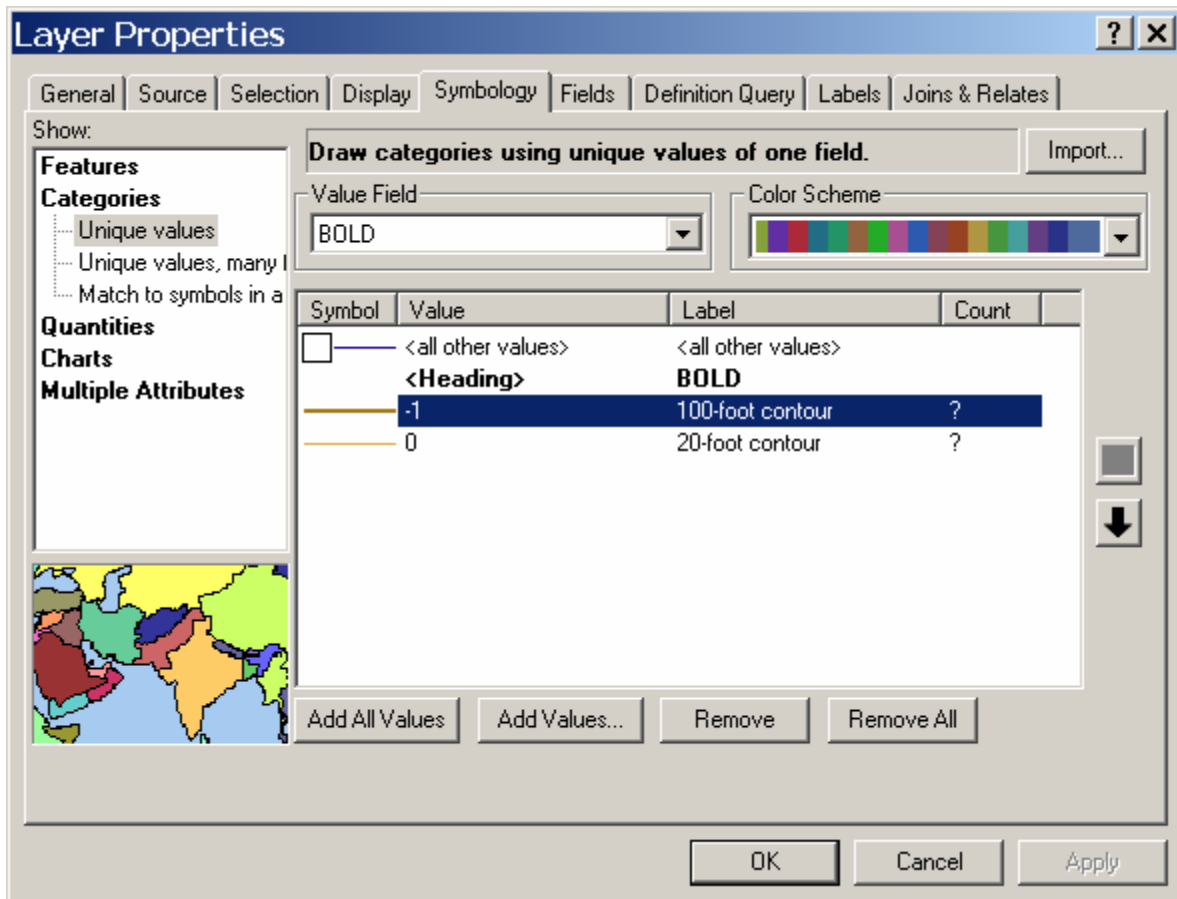| Symbol	Value	Label	Count
☑	\<all other values>	\<all other values>	0
	\<Heading>	**BOLD**	**1646**
	-1	-1	318
	0	0	1328

Add All Values | Add Values... | Remove | Remove All

OK   Cancel   Apply

Double click on the line to the left of the -1 (line corresponding to 100-foot contour lines) and select the bold "index" contour line.
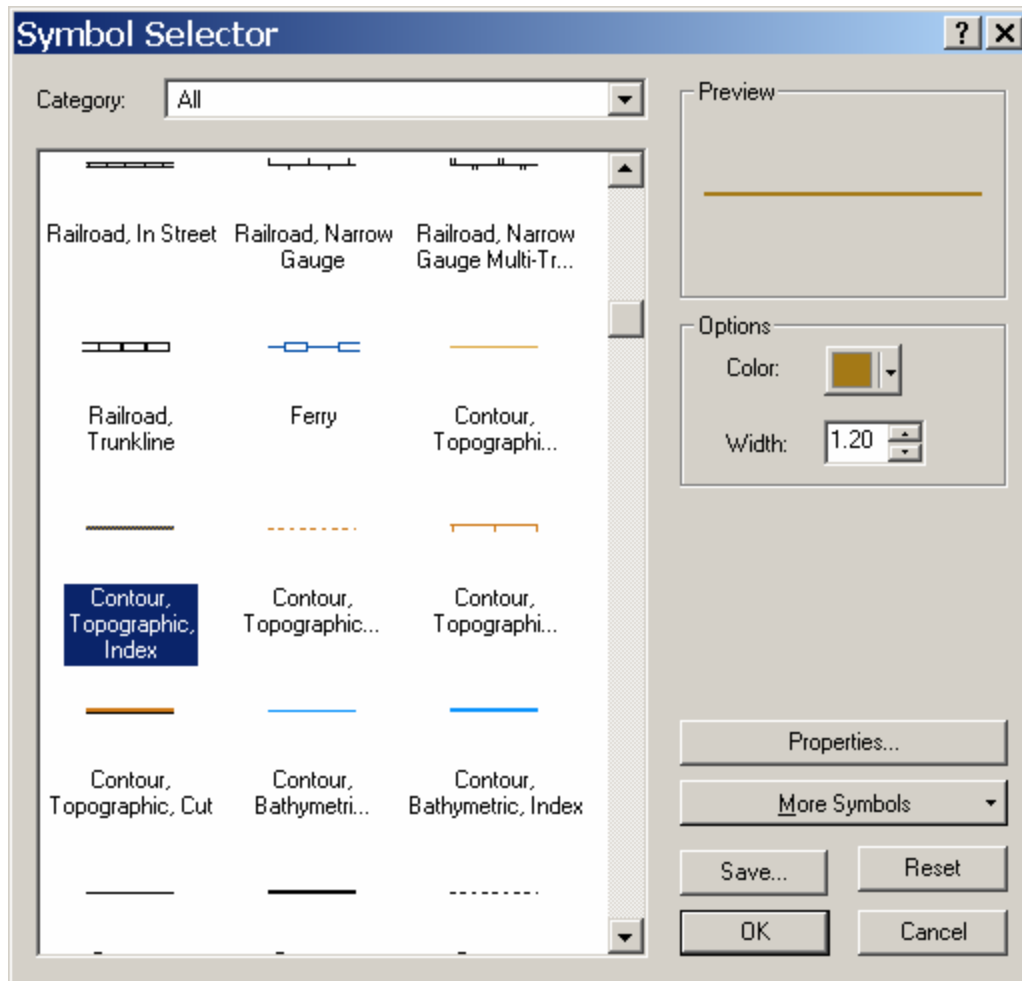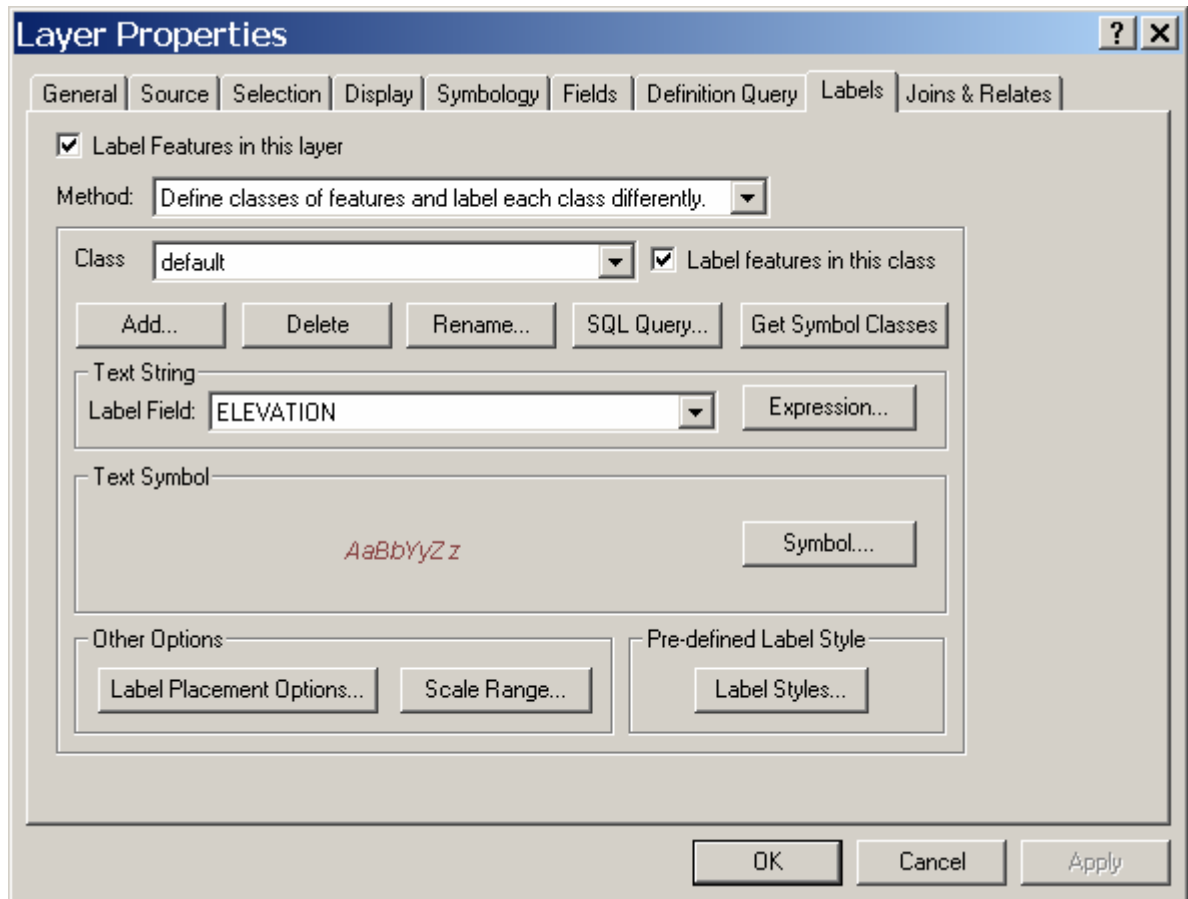
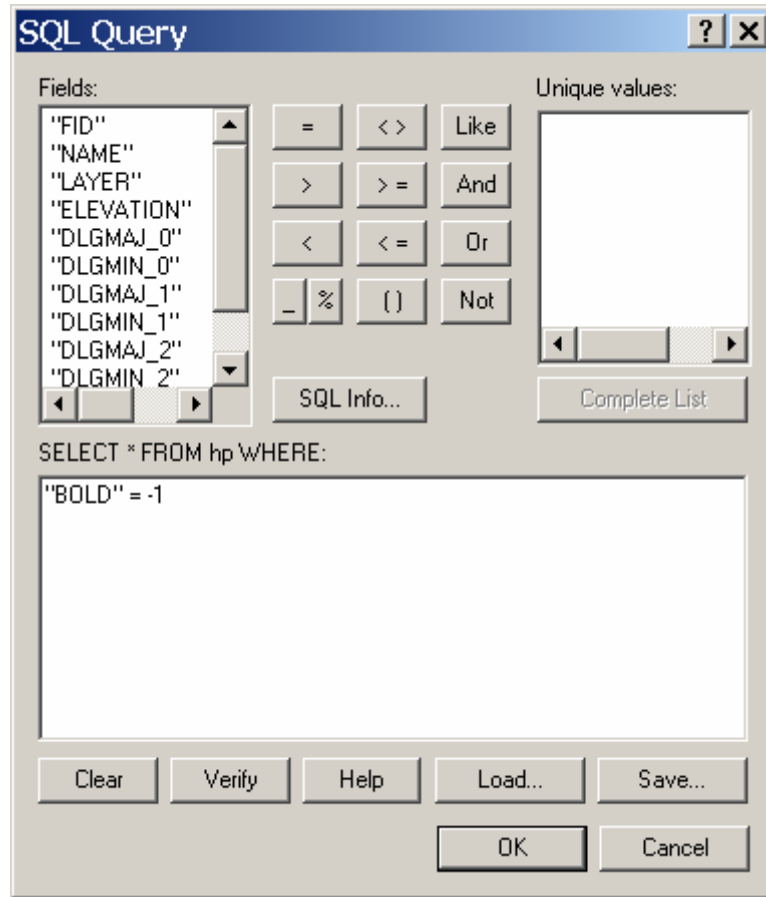Use the same procedure to specify "Contour Topographic, Intermediate" for the intermediate contours

It's starting to look like a real map (note that I changed the labels in the table of contents)!
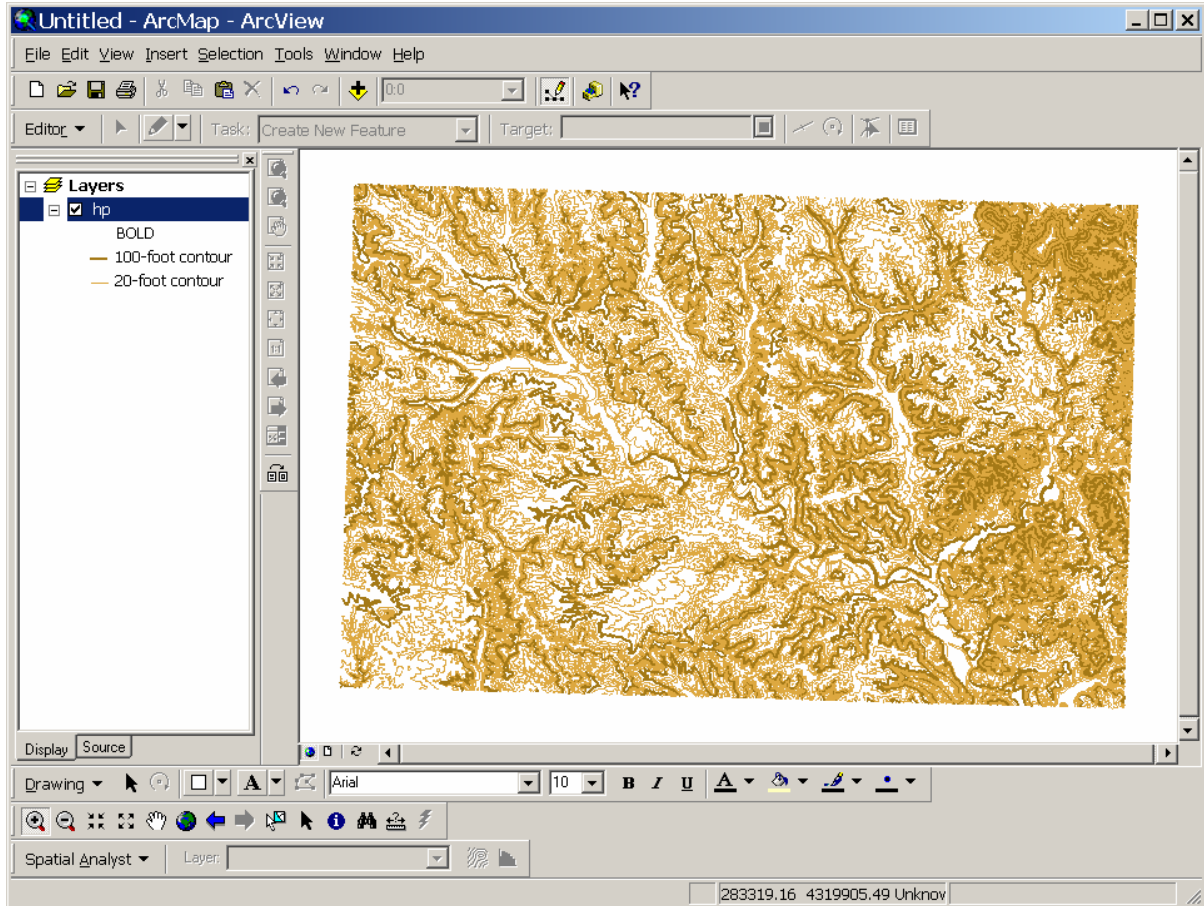
Now let's label the contour lines (only the 100-foot lines). Open the theme's
properties and select the "Labels" tab. Enter the values shown below.

Layer Properties

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates

☑ Label Features in this layer

Method: | Define classes of features and label each class differently. ▼

Class | default ▼   ☑ Label features in this class

[Add...]   [Delete]   [Rename...]   [SQL Query...]   [Get Symbol Classes]

Text String

Label Field: ELEVATION ▼   [Expression...]

Text Symbol

AaBbYyZz   [Symbol....]

Other Options   **Pre-defined Label Style**

[Label Placement Options...]   [Scale Range...]   [Label Styles...]

[OK]   [Cancel]   [Apply]

Click the "SQL Query" button and type or click ""BOLD" = -1".

Click "OK" then click the "Label Placement Options" button and enter the values shown below.
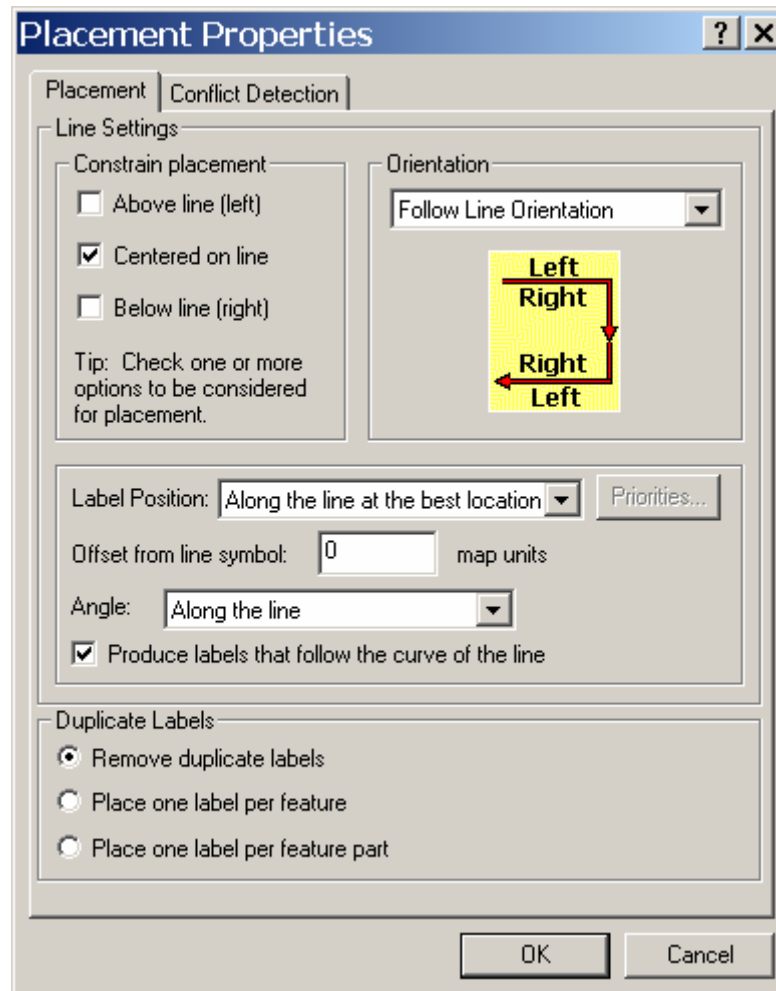
Click "OK" then click the "Label Styles…" button and enter an appropriate lettering style for the contour labels.
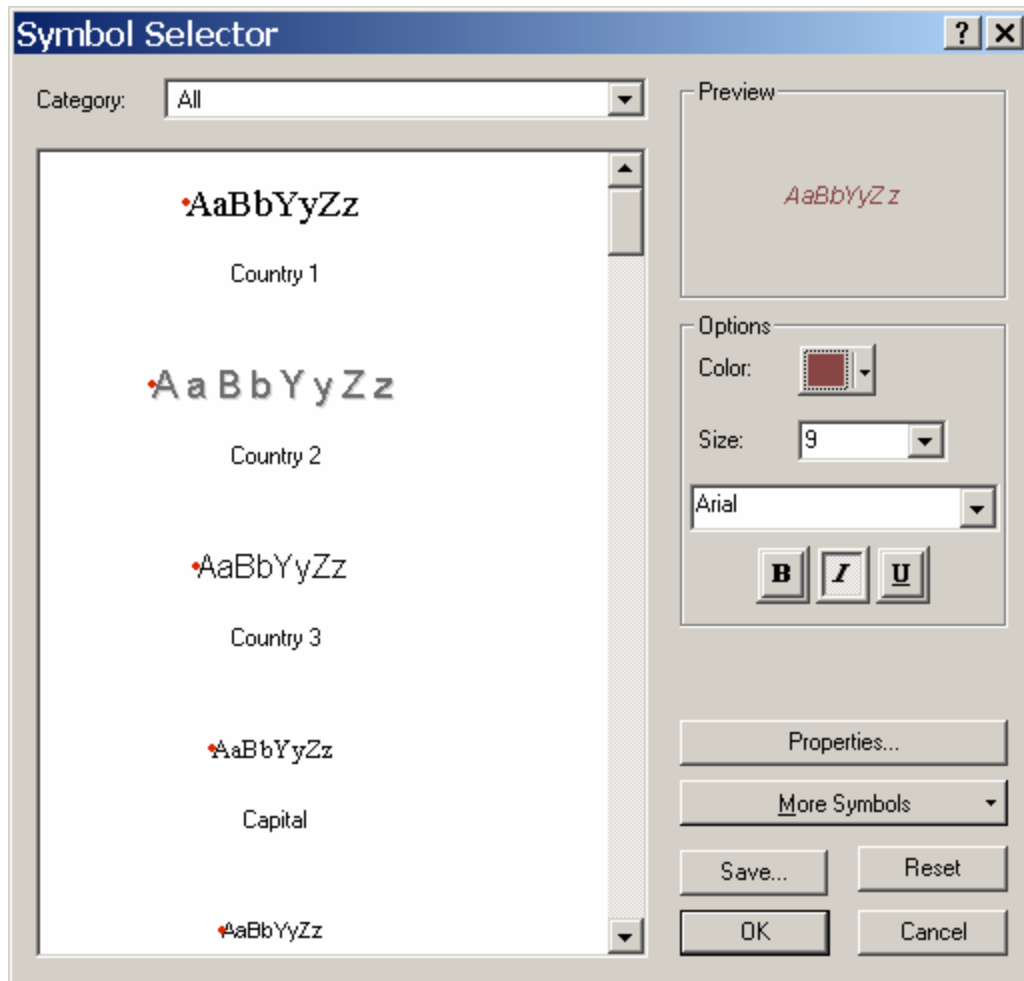
Click "OK" until you get back to the main menu and you should see something like this.
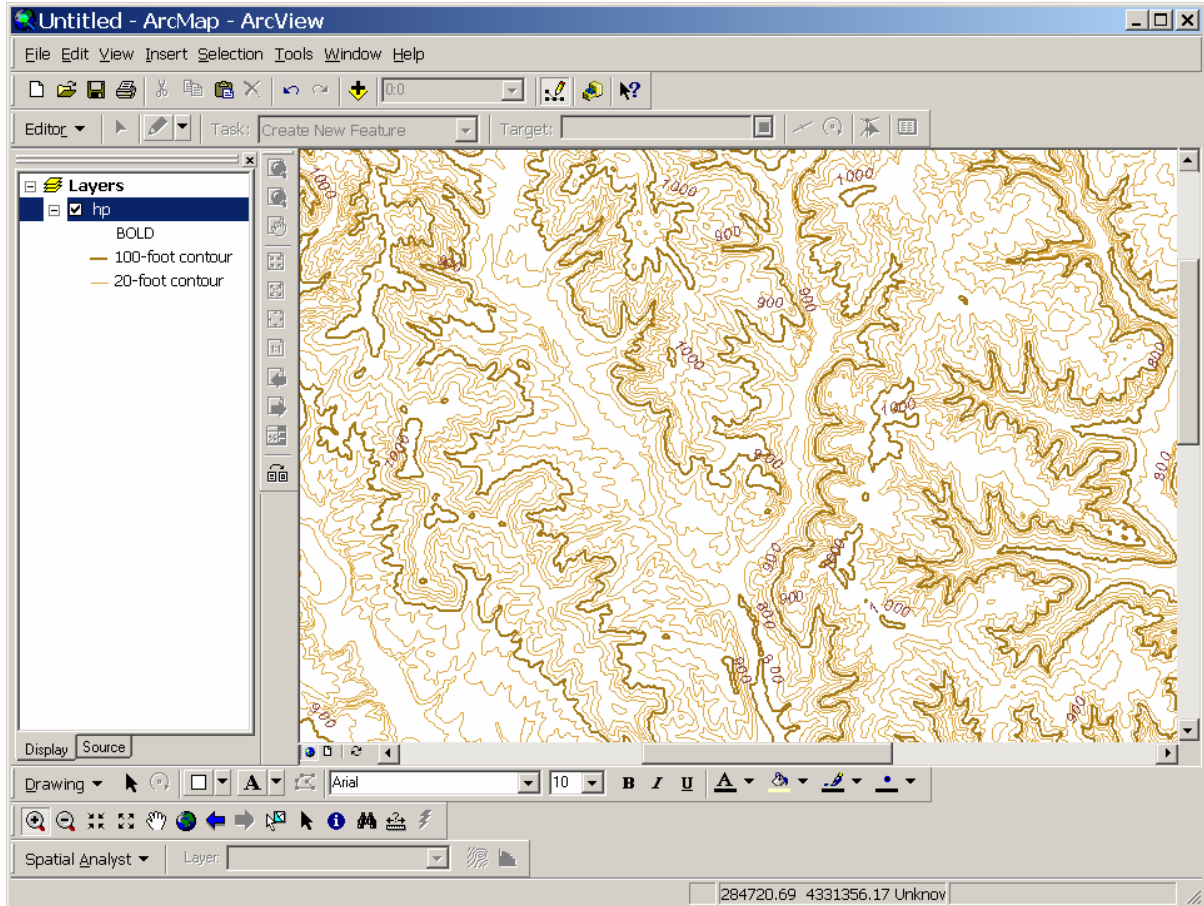
What's that you say? It doesn't look so good? Well, it was done automatically. You can do it better manually. Go back to theme properties and click the label tab but this time make sure "Label Features in this layer" box is unchecked. Close the

properties box and select the label tool () from the labeling pull down menu. The dialog below will appear; fill it out as shown.
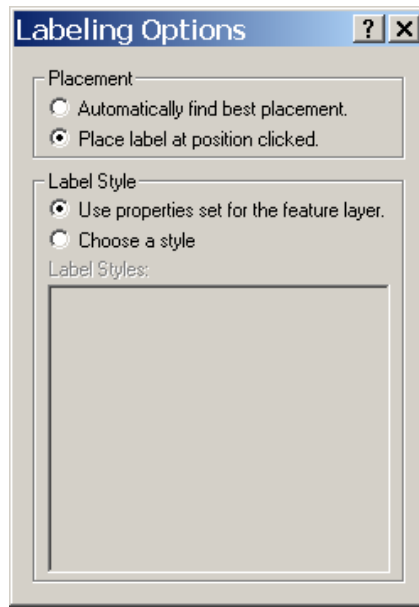
Clicking on the bold 100-foot contour line should produce an elevation label at the point clicked. Use [icon] to move and rotate the label respectively as necessary.

### Producing a shaded relief map Arcmap

Shaded relief maps may be produced from an elevation matrix dataset (e.g., a DEM) using the Spatial Analyst and 3D Analyst extensions. They may also be produced directly from a hypsometry dlg (although the process is not as simple or straightforward as producing them directly from a DEM). The first thing to check is that both these extensions are enabled. Pull down Tools>Extensions… and make sure the dialog box appears as below.
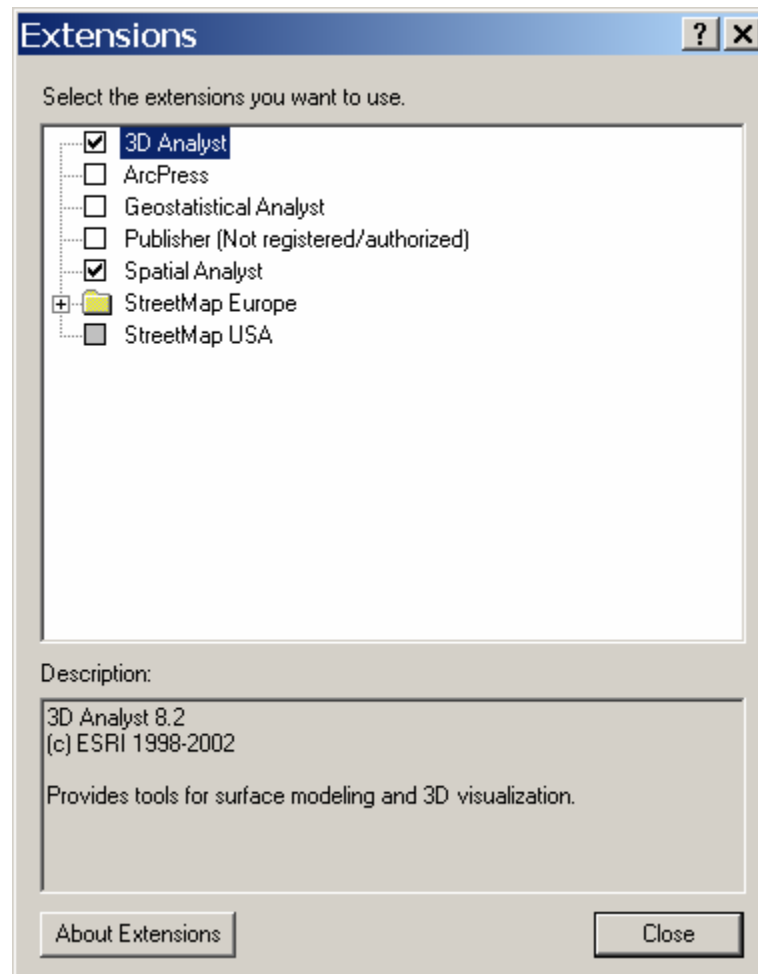
Pull down View>Toolbars and make sure that the Spatial Analyst and 3D Analyst toolbars are visible. Create a *triangular irregular network* (TIN) by pulling down 3D Analyst>Create/Modify TIN>Create TIN From Features… and fill out the dialog box as shown below (note: depending on what you named the topography theme, a name other than "hp" may appear). Needless to say (I hope) the location to which this dataset is to be written will differ on your machine.
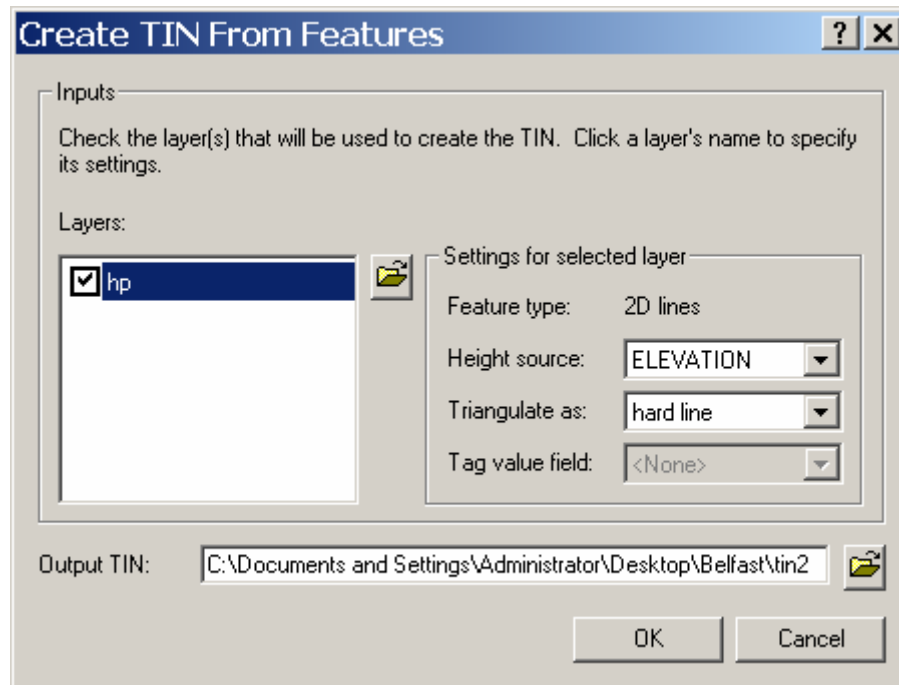
Click "OK" and wait (and wait…depending on the map and the size of the area covered, this will take a long to very long time to complete… five to ten minutes).
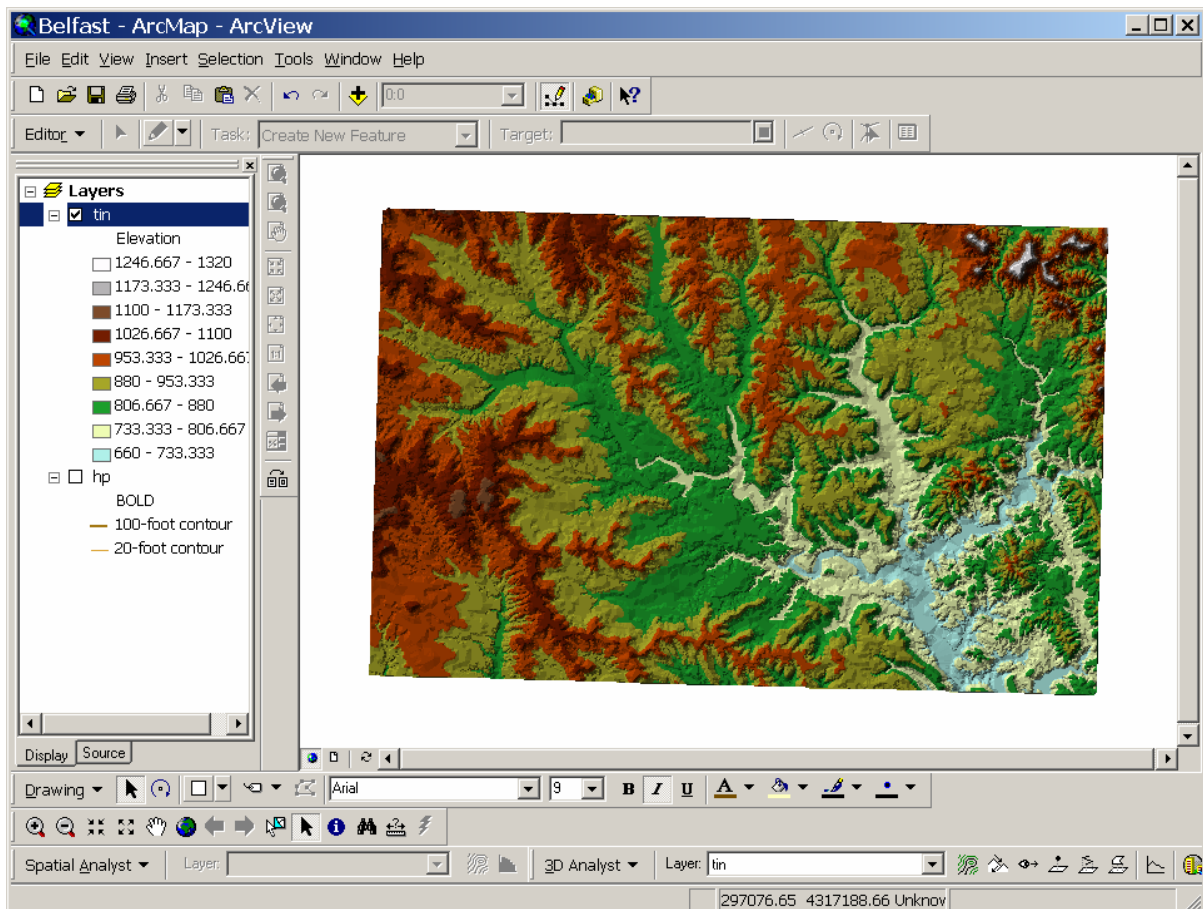
The resulting shaded relief map is decent (particularly if not viewed too closely). The tin may be converted to a raster which processes much faster. Pull down 3D Analyst>Convert>Tin to Raster and fill out the dialog as follows (again, the name and location of your dataset will be different).
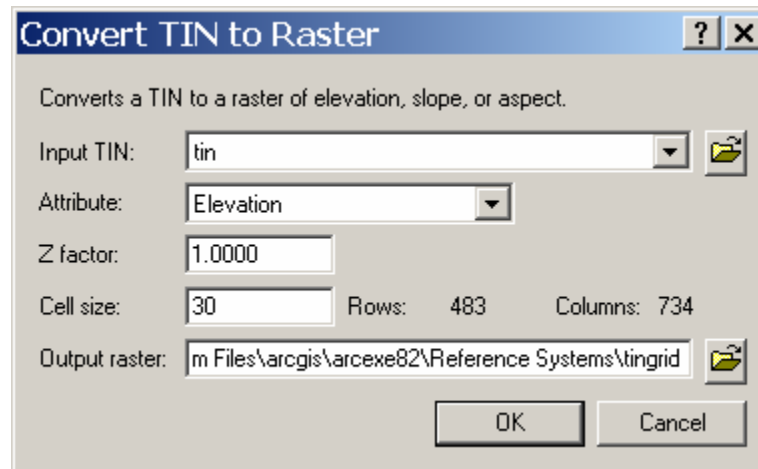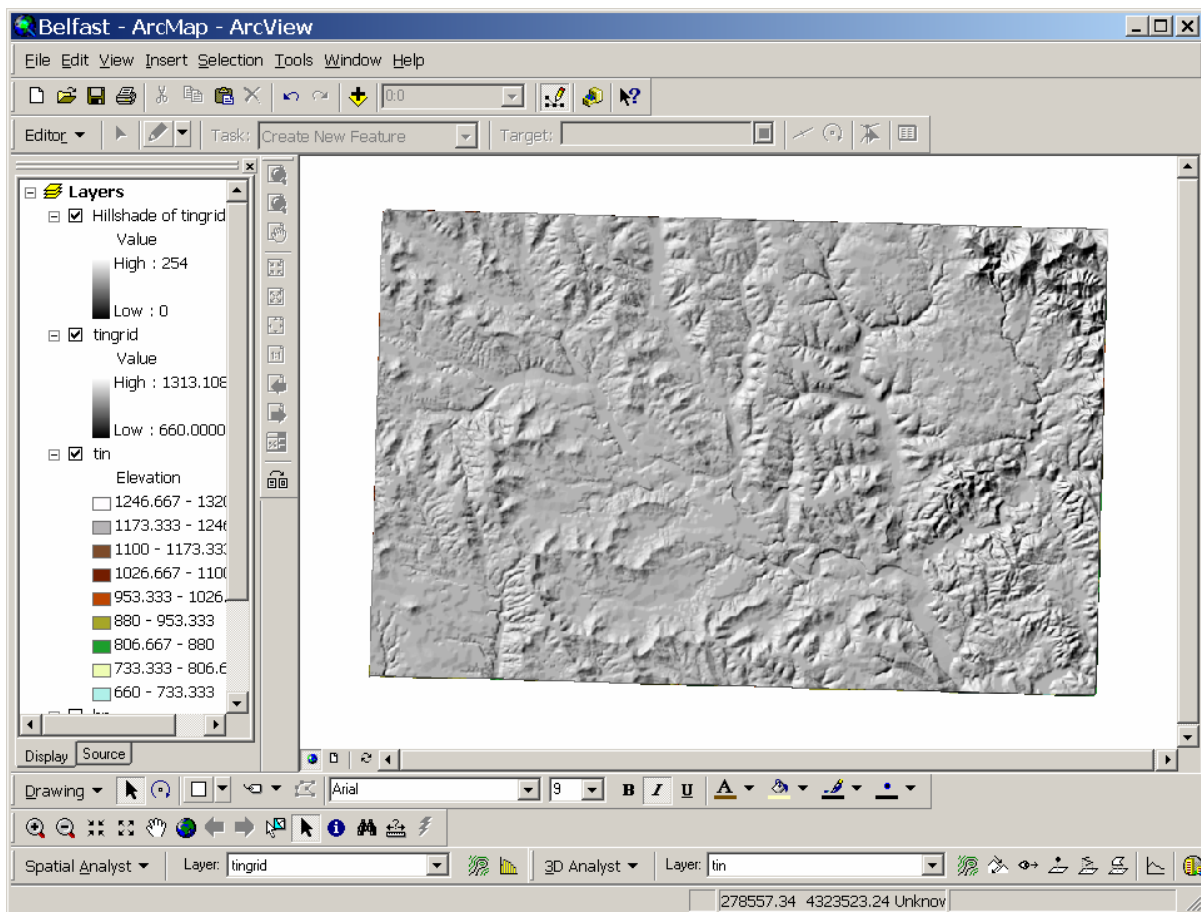

When complete, the raster will look like this.
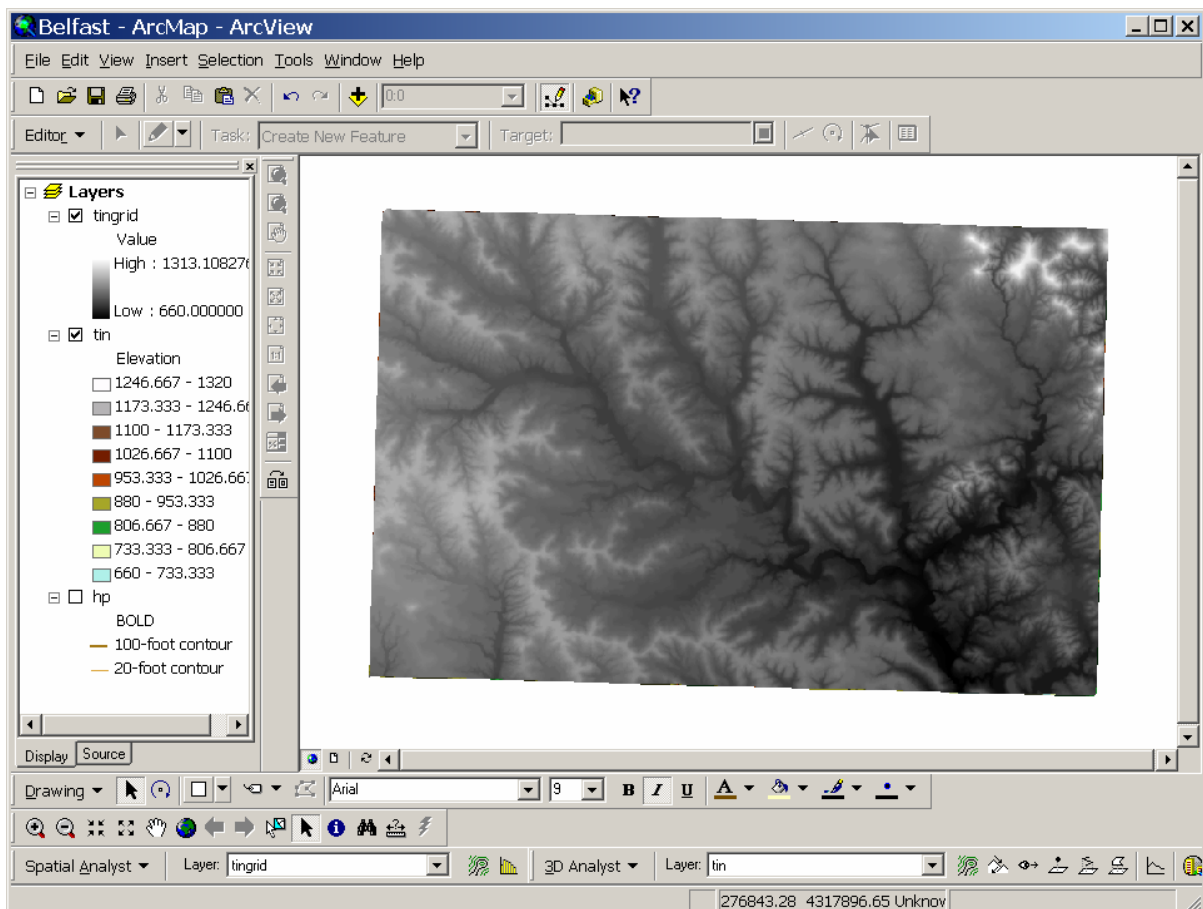
Select 3D Analyst>Surface Analysis>Hillshade… and fill out the dialog as follows.
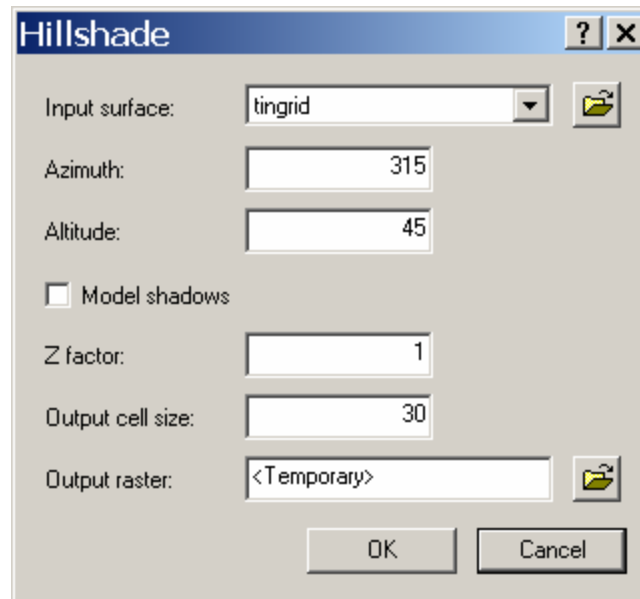
Shaded relief map should be produced quickly this time.

Remove all themes from the project except hillshade and the contour lines (right click in the table of contents and select "Remove"). .Click and drag the contour line theme in the table of contents to the top of "Layers" (i.e., immediately above the

hillshade layer. Get the properties for the hillshade them (the same way you've done several times already) and click the "Display" tab. And turn up the transparency to 50% so it doesn't interfere so much with the contour lines. You should now have a presentable shaded relief map.