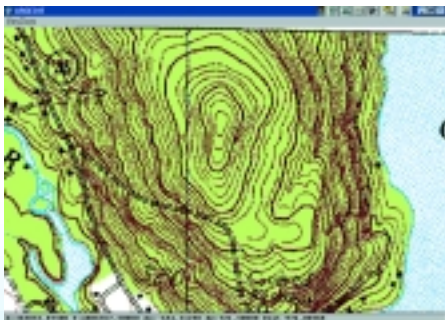


Produce Accurate Digital Contour Lines

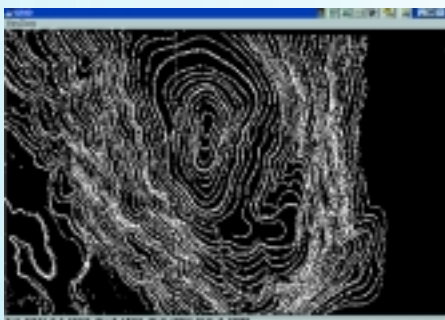
Using Raster Graphics

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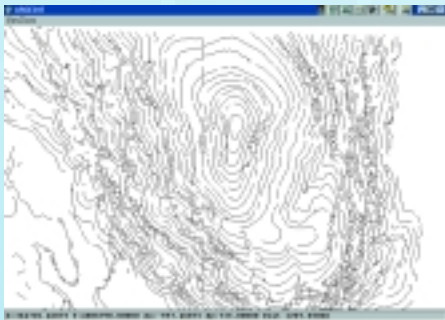
This Maine water district found an efficient and cost-effective method for completing a digital contour line data set needed for a phosphorous pollutant model. The district used ArcInfo and the ARC GRID extension with digital raster graphics (DRGs) from the U.S. Geological Survey (USGS) to create accurate digital contour lines.



DRG files were used to create digital contour lines to complete a data set.



In ARC, IMAGEGRID was used to convert the DRG file to a grid.



After converting the grid to a line coverage it was cleaned up.

The Portland Water District (PWD) provides 171,000 people in the Greater Portland area with clean water from Sebago Lake. PWD's GIS department supports the Sebago Lake Watershed protection program, which maintains the pristine quality of the lake. The district is developing a phosphorous pollutant model that requires slope data derived from digital contour lines. Though most of the digital contours were downloaded from the Maine Office of GIS, the data set contained gaps. The GIS department first considered digitizing contour lines from USGS topographical sheets by hand, but a better method utilizing DRG files was devised.

A DRG is a scanned image of a USGS standard series topographic map. The image inside of the map neatline is georeferenced to the surface of the earth using coordinates in Universal Transverse Mercator (UTM) projection. The image, compressed as a TIFF 6.0 file employing GeoTIFF 0.2 specifications, is between five and 15 megabytes in size. DRGs were developed to collect, review, and revise other digital data, particularly digital line graph (DLG) data.

The following methodology was used to create digital contours from DRG files.

1. In ARC, use IMAGEGRID to convert the DRG file to a grid.
2. In GRID, determine the cell values of the contour lines in the grid using CELLVALUE.
3. Next, isolate these cells into a new grid using the following CON statement: OUTGRID1 = CON(INGRID = VALUE, 1, 0). OUTGRID1 now contains two cell values—contour lines with a cell value of one and all other cells with a value of zero. Background cells were given a value of zero instead of NODATA because the next step requires that background cells have a zero value.
4. In ARC, use GRIDDESPECKLE to eliminate extraneous data or noise that could cause editing problems.
5. In either ARC or GRID, use GRIDLINE to convert the grid representing raster linear features to a line coverage. The best results were obtained using the following command:

```
GRIDLINE INGRID OUTGRID POSITIVE  
THIN NOFILTER ROUND # {THICKNESS}
```

An adjustment of the THICKNESS option may be needed.

The resulting line cover will have dangling nodes and intersecting arcs, especially in areas that contain steep slopes.

6. Use the command GENERALIZE with fairly high weed tolerance and the BENDSIMPLIFY option to remove the dangling nodes and intersecting arcs.


7. Use FREQUENCY to determine how many arcs of a certain length are present. PWD discovered that arcs less than 20 meters long could be deleted, eliminating most of the small arcs that crossed over contour lines.

8. Once the coverage is generalized and unnecessary arcs deleted, select all the arcs and UNSPLIT them in ARCEDIT. SNAP the gaps between arcs by setting the SNAPPING distance slightly less than the length determined using FREQUENCY.

9. With these steps completed, the coverage can be edited to create complete arcs using the DRG as a backdrop.

10. Once the coverage is error free, prepare the cover for dissolving by adding a new item and giving all of the arcs the same item value. PWD added the item units and gave every arc a value of feet. Once the coverage is dissolved, the elevation of each arc can be added.

PWD found this process took two to three weeks and was an inexpensive and accurate alternative to digitizing contour lines from map sheets or purchasing digital contours. In mountainous areas, hand digitizing contour lines is sometimes not possible because the lines are just too close together. Extracting contours from DRGs allows placement of contours exactly where they belong, even in sloping areas. The accuracy of the digital contour lines created from the DRG files approaches the accuracy of USGS topographic sheets and is superior to the accuracy of files created through hand digitizing contour lines.

DRG data for one or more quads is available on CD-ROM from the USGS. The DRG quad names are taken from the USGS topographic maps from which they were scanned. This public domain data may be sold or distributed for free by anyone and links to other sites offering DRG files are available at the USGS Web site. 

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