GIS NEWS

Summer 2002

HIGHLIGHTS

MEETINGS & EVENTS

July 30, 2002
Dakota County GIS Users Group Meeting. Dakota County Western Service Center, Conference Room L139 from 10:00 a.m. to 12:00 p.m. View the complete agenda at **http://dakotanet/survey/events/gisusers.htm**. RSVP to **Julie.Daugherty@co.dakota.mn.us**

October 2-4, 2002
Minnesota GIS/LIS Consortium12th Annual Conference and Workshops, Duluth Entertainment and Convention Center, Duluth, MN View conference and workshop details at **http://www.mngislis.org/conf2002/conf2002.htm**

Contacts

If you would like to write an article for the Spotlight section of the GIS News newsletter and share how you use GIS in your department, call or email Randy or Julie.

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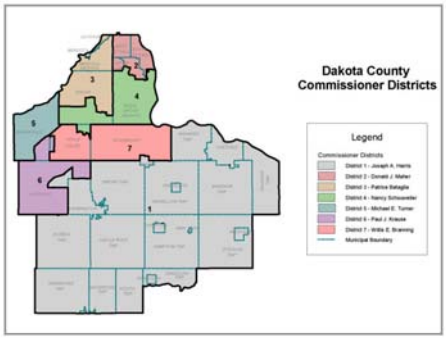
GIS 101

Redistricting Wrap Up
by Julie Daugherty

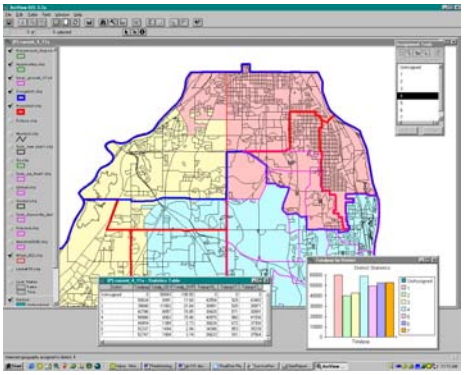
The 2002 Redistricting process has finally been completed. Government employees in the cities and at the county spent many hours on this effort. The path that brought us to this point was long and complex…



New Commissioner Districts

The first step towards redistricting was the compilation of the Census 2000 data by the Census Bureau. According to the U.S. Constitution, the Census has one fundamental purpose – to ensure that representation of each state in the U.S. House of Representatives is apportioned fairly, according to population. The Census Bureau is required by law to supply redistricting data (consisting of the population) to the President by December 31 of the year of the census. After the representation for each state is calculated (using a method of equal proportions) the task of creating new congressional and state legislative districts falls into the hands of each state.

Since the earliest days of the nation, the state legislatures have been responsible for redrawing the boundaries of both congressional and legislative districts to reflect population shifts. The Minnesota State Legislature had until March 19 to finalize their plans. Minnesota currently has 8 U.S. congressional representatives, and since our state has grown at approximately the same rate as the national rate for the past four decades, Minnesota has maintained its eight seats in the House of Representatives since 1960. While the total number of seats hasn't changed, the House district boundaries have, to reflect the shifts in population concentrations around the state. The legislature proposed several plans to redraw the congressional districts and the state legislative districts, which are based on the U.S. House district boundaries. When it became apparent that the legislature would ultimately be unable to agree on a plan, the State Supreme Court stepped in and created the final plan for congressional and legislative redistricting. At 1:00 on March 19, 2002, the court unveiled the new state plans and that is when redistricting at the city and county level began in earnest.



Screenshot of the Redistricting Application

Government agencies within Dakota County have been preparing for Redistricting since the summer of 2001. Many meetings were held from August 2001 through March 2002. These meetings included representatives from the cities within Dakota County, Treasurer-Auditor Department staff, and staff from the Office of GIS. The Office of GIS provided each city with a CD in August 2001 with their redistricting population data, block level shapefiles and information on using the Districting Extension for ArcView 3.2. Training on the use of the data and the extension was also provided. Also in August, mock state plans were distributed to each city to allow the cities and the county to do a trial redistricting – a run–through – to prepare for the actual release of data. Once the data was released on March 19, each city was provided with a copy of the official plan and true redistricting began. Because of the ease of using the Districting

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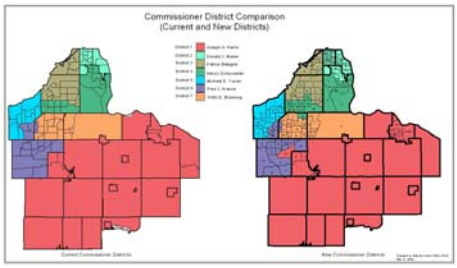
Extension and the prior training and preparation, each city was able to quickly create different precincts or wards and immediately see the results of their boundary changes – not only the physical change, but also the change in population and the change in potential voter population. Cities were also able to measure the distances between their polling places and the edges of their precincts or wards.



Comparison of Old and New Commissioner Districts

The cities had until April 30 to finalize their precinct or ward boundaries. Since the county commissioner district boundaries are based on the cities' precincts and wards, redistricting efforts at the county level could not begin until after those boundaries were established. These finalized precincts/wards were now plugged into the Districting Extension at the county level to begin the process of looking at and possibly altering the current commissioner districts. Unlike the city precincts, the county commissioner districts had definite rules on how much population could be contained in each district. The commissioner districts must be as close as practicable in population size, they must be compact, and they must be contiguous. There are also guidelines in place that make it necessary for any commissioner who has more than a 5% constituency change to run for election. Thanks to the simple yet powerful ArcView Districting Extension software, different scenarios were created very quickly and easily. Population numbers and calculations were recalculated and redrawn on the fly as various precincts were added to or subtracted from the existing districts. In 1992 when the commissioner districts were redrawn, they were done so in a manner that anticipated and accommodated for the future growth of the county. Because of this, commissioner districts required very little modification in 2002 in order to follow the guidelines.

There are many more rules and regulations that define how redistricting is done, and a lot of history behind the most recent effort. If you are interested in learning more about redistricting in Minnesota, a good place to start is the Secretary of State's web page at http://www.commissions.leg.state.mn.us/gis/html/newplans.html.

Department Spotlight

Handheld GIS Solutions in Environmental Management

by Steve Scott

Handheld GIS solutions such as ArcPad loaded onto a Compaq iPAQ, shown below, are a huge technological leap that allow County staff to take GIS data and technology into the field. ArcPad, loaded onto a hand held computer, allows staff to view images and GIS data representing the locale being inspected and to display and query multiple data layers including photographs and documents. It's editing capabilities provide the user with the ability to map conditions warranting enforcement actions such as illegal disposals, spills and releases, unsealed wells, or unlicensed hazardous waste generators.

Compaq iPAQ with ArcPad

Using wireless technology, users are able to download pertinent data sets from the web-based application while in the field, or they can download the required data sets prior to leaving the office. The availability of the GIS data and attributes in the field allows for these data sets to be easily and accurately updated. Once the user is finished editing data in the field, modifications and additions can be uploaded into the source databases in the office. This feature eliminates the need for the tedious task of manually updating databases.

When used in conjunction with a GPS receiver, ArcPad allows for basic navigation and GPS data capture. Recently, the EM Department staff had the opportunity to explore these capabilities while investigating the past land use of a large industrial site located in the County. This site was once called the Gopher Ordnance Works (GOW), which is presently the University of Minnesota Rosemount Research Center. GOW produced gunpowder and chemicals for two years during WWII. The site covered some 11,500 acres and contained 858 buildings. During 1944 to 1945, approximately 81,000 tons of chemicals and gunpowder were produced at the facility. Given this past land use, as well as the disposal practices and the likely spills and leaks that occurred during the entire period (1942-1947) that the facility existed, we suspect that contamination is present in many areas of the present 8,000-acre property. Identifying the likely locations of this contamination however, is a difficult task.

Using ArcPad and GPS technology, County GIS data, a 1945 aerial photograph of the area, and a registered as-built plan of the facility, EM staff were able to navigate to the features that were observable on the photograph and noted as "Burning Ground" on the as-built plan. The result was an unqualified success. Not only did department staff identify the area used to burn non-spec product, our field investigation also discovered a previously unknown cache of drum hoops and lids, indicating additional areas of disposal that are possibly of hazardous waste. These areas were mapped and will later be used to relocate the sites on subsequent visits.

This technology offers the Department the possibility of greatly enhancing our locational accuracy of features such as wells, the areal extent and characteristics of sites or releases, facility and complaint inspections, and improve the field verification of existing data. This technology is very cost effective and will greatly leverage our access to the extensive GIS data developed and maintained by County staff.

Desktop GIS

Collecting Data from Aerial Photography

by Joe Sapletal

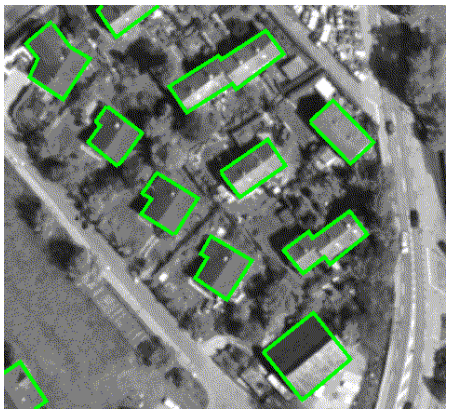
Photogrammetry is the process by which aerial photography is used to digitize physical features such as buildings, road edges, water bodies, and elevation information describing the terrain. That digitized data then becomes the GIS basemap that is used in many maps and applications. To see the list of the physical features in the County's GIS basemap visit http://www.co.dakota.mn.us/survey/data/num_physical.htm.

The updating process is lengthy and goes on year-round. Annually, new construction building permits and the last year a PLS section (each covering approximately one square mile) was updated are analyzed to define a set of sections that are most in need of updating. Based on the number of building permits, estimates on the number of hours needed to set up, collect, verify and store the data for each section are determined. Based on the priority of a section and the time needed to update each, a practical number of sections are selected to be flown for updating.

Sections chosen are flown during a time of the year known as "leaf off" early in the spring after the snow melts but before the deciduous trees produce leaves. "Leaf off" conditions also occur in the fall after the leaves have fallen. In Dakota County flying is done in the spring; waiting until the fall risks having snowfall too soon after the leaves fall from the trees. The photography can be taken from a variety of heights ranging from 3,000 feet all the way up to 20,000 feet. Generally, the photos taken for data collection at Dakota County are from 3,000 feet. At this height, the photogrammetric technician is able to easily see fire hydrants, manholes, small signs and other small utility features. This height also allows for greater accuracy when collecting other features. Dakota County follows the United States National Map Accuracy Standards to produce highly accurate data that is useful to its GIS users and to the public and private entities that use the data. Based on this standard 90% of this data is accurate to within +/- 2 feet horizontally and +/- ½ foot vertically.

Stereodigitizing Station

The aerial photography used for database updating is captured using a precision, large-format camera that uses 9-inch film. These 9-inch pictures are converted to digital images using an extremely precise scanner. The digital images are then loaded into a computer where they go through a mathematical process that precisely registers the images to each other and to the real world. You may have seen the white x's painted on the roads and sidewalks around Dakota County that are used as survey control points. The mathematical process uses these points to align the images to one another. Following this process, the data collection phase begins. Two overlapping images and a special pair of glasses are used to create a 3-dimensional or 'stereo' display. This method works by forcing each eye to view an image individually, similar to a how a 3D movie works. The technician can then see the surface in the area of interest rise and fall with changes in elevation. Buildings and utility poles appear to project from the monitor.



Feature Collection

Existing basemap data are extracted from the database and overlaid onto the new photography. Using new construction building permits as a guide, areas of emphasis are defined. The majority of the time required to update a section as a whole is dedicated to the areas of emphasis. Other areas are checked for new additions to homes such as decks, patios, pools, etc.. Dakota County collects over forty different features during the updating process. After the data collection is completed and the work is reviewed the data is stored back into the basemap database where it is distributed to GIS users.

If you are interested in viewing the 3-dimensional imagery in action, please stop by the Office of GIS for a brief demonstration.

Dakota COUNTY

Tech Talk

Querying in ArcView 3.x and ArcMap 8.x

By Scott Laursen

Trying to find items in a shapefile's attribute table that match specific criteria is one of the most common tasks that a GIS user performs. Whether trying to find one particular piece of property in the County's parcel database or trying to extract all of the Avenues in the City of Eagan, most everyone at some point or another has needed to query a shapefile's attribute table to find specific values. ESRI has made it easy to search databases in both ArcView 3.x and in ArcMap 8.x. By accessing easy to use interfaces that employ Structured Query Language, or SQL, users can create expressions that identify exactly what criteria they are looking for in their data.

Before beginning your query in ArcView 3.x, make sure that the layer you want to search is active by clicking on it in your View's Table of Contents or by making the layer's attribute table window active. You can start your search by going to Theme > Query to bring up the query window if you are in the View window or by going to Table > Query if you are

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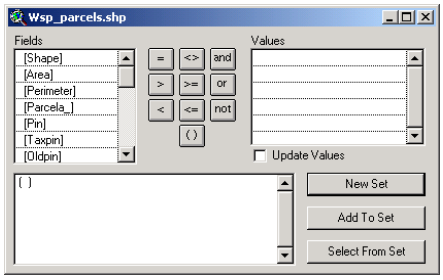
in the attribute table window. (You can also get to the query window by hitting the Query Builder button, which looks like a hammer with a question mark next to it.) This window will open:

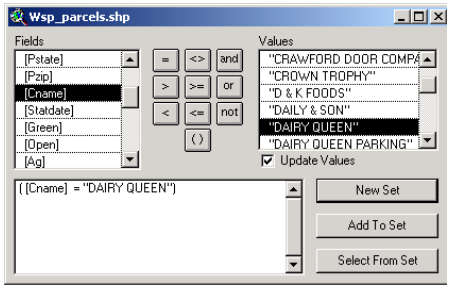


You will be using this interface to build an equation specifying your search criteria. The first required element in your equation is the field name. You may type the field name between the parentheses in the equation window if you wish, but the "Fields" table lists all of the fields in your shapefile's attribute table. Double-click on the one you want, and it will be inserted.

If you choose to type in your own field name, you must enclose it in square brackets as it appears in the "Fields" table. Next, you will need to enter an operator. The standard operators shown can be used in any equation, whether your field values are numbers or text characters. Basic Boolean operators ("and", "or", and "not") and standard mathematical operators are available for use in more complex searches. Click once on the operator that you wish to use (or enter it manually).

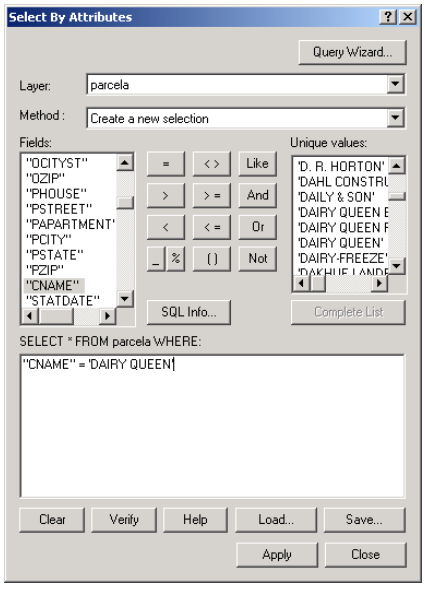
Next, enter the value that you wish to find. If you are searching a numeric field, just type the number in. Text strings need to be placed inside quotation marks. Case does not matter; spelling does. The program will search for the exact string of characters that appear inside the quotation marks, including spaces, so if you misspell a word you will not find what you are looking for. Wildcard characters are available; the question mark replaces a single character, while the asterisk replaces multiple characters.

Another option is to use the "Update Values" box, which is only available when your attribute table has fewer than 32,766 records. If you click this box on and then click once on a field name under the "Fields" column, the unique values from that field will be listed in the "Values" column. Double-clicking on your desired value will insert it into your equation.



Finally, clicking on one of the buttons in the bottom right corner of the window will start your search. Select "New Set" if this is your initial search, "Add To Set" if you want to add additional values from a second search to the list of values from your first search, or "Select From Set" if you want to select a subset of values from an existing selection.

Querying in ArcMap 8.x is similar to the process in ArcView 3.x. There are some cosmetic changes, but the main difference is that you have more options available to you. Start your query by going to Selection > Select by Attributes…. Here's what the query window looks like:



Your query statement is built in the same manner as it was in ArcView 3.x, by selecting a field name, operator, and value from the available options. The "Update Values" box has been changed to the "Complete List" button. The "Method" drop down list is now where you choose whether to create a new selection set, expand an existing set, or extract a subset from an existing set. Hit the "Apply" button to execute your search.

The first new option available is the "Layer" drop-down list. It lists the open shapefiles and allows you to select which one to search. Field names are now enclosed in quotations rather than square brackets. Wildcard text characters are now an underscore for a single character and a percentage sign for multiple characters. There is a new Boolean operator, "Like", which should be used when searching for a text string containing wildcards. Using an equals sign with wildcards will cause the wildcard character to be treated as an actual text character. There are new buttons at the bottom of the window, including "Verify", to check for syntax errors, "Save…", which lets you save the equation for future use, and "Load…", which allows you to insert a saved equation into the equation window. Finally, there is a "Query Wizard" button, which builds your equation for you by stepping you through a series of prompts.

Searching for attribute table information can be an intimidating and time-consuming task if you don't understand how to use the query builder. Understanding the procedure for building a query makes the process less daunting. With a little bit of practice, you too can create well-crafted queries that will save you time and effort.

Dakota COUNTY

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