by Dan Byers

GPS mapping — moving systems into the digital era

The Kansas Rural Water Association (KRWA) is willing to go the extra mile to assist cities with water system, wastewater system, or rural water district (RWD) GPS mapping projects. Speaking from experience, I have been filthy dirty, soaked from head to toe, while performing GPS data collection. Whether it is 20 degrees or 120 degrees, KRWA can be counted on to provide the expert technicians willing and able to finish the project.

Dan Byers records an elusive mapping point in a cornfield on the south side of St. Marys, Kan. Two weeks earlier, Dan couldn't easily find the manhole in the unharvested corn. After harvest he returned to map the point into the new city digital map.

Where to begin?

I am excited to be a part of KRWA mapping services. The decision for cities and RWDs to move their systems into the digital era is one that will have to eventually be made. With so much information retrievable only from the memories of a few people, "sooner" would be better than later. Every day that passes is one step further from having good information available to all who need it. How is that possible? First, because the operator who "knows where everything is" is in reality, one day past yesterday in remembering "where everything is" and second, information that should have been correctly logged yesterday may have been put off or forgotten.

Data collection is only the first step in getting an updated set of maps. Data collection by KRWA involves technicians who travel with the system operator to record the desired system attributes. This is the hard part of the process. Not only do data collectors have to work in the elements provided by Mother Nature, they also have to access a weather forecast in order to miss any rainstorms. Data collection cannot take place during rainstorms, but as soon as the rain ends, it's back to it. From experience, it is not very much fun tromping around in the mud with wet feet all day long, but it has to be done. KRWA is willing to go that extra mile for your system.

From points to "shape" files

Once data collection is completed, the next step in the mapping process is to transfer all data recorded during the process and place those points on top of an aerial photo. This sounds like a relatively simple process and can be, if everything goes right, but many factors have to be taken into consideration.

Many different types of aerial photos are available. Free aerial, grey scale photos are available from an Internet Web site that were taken in 1991 and 1992. These have a one-meter resolution. The photos are great for a utility wanting a new set of maps, but there is much more value to be obtained from newer photos.

Newer photos taken in 2002 are available (but not all are free of charge) on request from any county appraiser's office for a small fee. They are also one-meter resolution and would be fine for producing a new set of maps that clearly show countywide changes from the previous ten years.

Some cities and counties in the state have chosen to obtain their own aerial photography. These photos may also be available at the county

appraiser's office. Sometimes they are available in color and have either a one-foot or even six-inch accuracy. They will cost more to use, but the benefits that more accurate photos provide are substantial. County appraisers are even using the accuracy of the newer photos to display property lines. Water and wastewater utilities prefer these higher resolution photos because at six-inch resolution, it's possible to see a two-year old trench line going through a field! The possibilities are endless with this new technology, but a determination must be made as to what is the best answer for a city's or RWD's needs. Many people want higher resolution aerials, but in some areas, they are not yet available.

Many people ask the question, "If we use the one-meter photos now and better aerials are available later, can we use those then they become available?" The answer is yes. In the process, the new photo is added as another layer on the digital file, and the old layer (one-meter photo) is eliminated.

Once a decision has been made as to which photography is best, the Geographic Information System (GIS) part comes into play. The GIS database is the most valuable part of the mapping process. System maps cannot be generated until a digital file is created. The digital file developed can and should become the management tool for the entire utility. The digital file is published to a compact disk containing all information recorded during data collection and is laid on top of the aerial photo. Viewing the entire utility from the computer can certainly be done. The digital file is run by a version of ArcExplorer or ArcReader. The software provides the ability to pan across the screen or zoom in if a closer look at a road intersection is needed. Even a measure of how far a meter or hydrant is from the center of the road is easily made. The best part of this software is that it's available free of charge. Navigation through the entire utility is also possible by using a personal data assistant or PDA. I will explain this later.

How much information to include in the datafile is entirely arbitrary? The ability to use the "identify" feature is another powerful tool of the software. Some systems include a minimal amount of information such as

Dan Byers and Dave Ronsse, St. Marys, Kansas, waste water plant supervisor, review the corn field map point recorded earlier in the day.

reference ID, and the type of attribute viewed. Other systems, however, utilize this "identify" feature to the fullest extent. For example, a user can identify a feature to find the exact coordinates, address, installer name, date installed, feature number, elevation, type of pipe material, and pipe size. Almost anything can be included in this database, even digital photos or scanned images of easements.

The best part about the process is that once data is collected, a user will always know where the desired features are. It is possible to purchase and use a PDA to upload the digital file and take it to the field. The user then has the ability to navigate back to any point previously logged. Any data changes made may be downloaded to the system computer at the end of the day so the newest data is available daily for field use.

Mapping: KRWA or do it yourself?

The price of GPS units has become more affordable in the last five years. Accuracy is also much improved. So a user may ask, "If I need to buy a GPS unit to navigate back to a point, why not buy my own data collector and do it myself?" Then, the user may also conclude, "We can go to Cabelas or even Wal-Mart and buy a decent GPS receiver for less than $300."

The answer to these questions is quite simple. But before I answer, let me explain some of the realities involved.

Price is the first thing to consider. A sub-meter GPS data collector may be purchased for $7000. To assure the sub-meter accuracy, it will cost another $800 per year, per unit, for differential corrections from a service provider. Other needed items include: a $1,500 handheld data collector to record all log information; a $140 autosync cable to communicate with the handheld; receiver batteries at around $100 to power the unit; and mounting hardware at around another $100 to attach both antenna and receiver. Before collecting the first data point, the price has risen to around $9,640.

Once data collection is complete, additional purchases are necessary. A computer, mapping software, software training, high-resolution plotter and numerous expensive consumables quickly add another $17,500 to the price of the project.

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necessary to produce good quality maps. The Kansas Corporation Commission helped the KRWA with grant funding to set up a mapping demonstration project. KRWA Mapping Services now has the equipment and technical experience to produce the professional quality maps needed in today's system environments. Cost recovery is the goal of the service, not charging excessive prices.

Getting back to my earlier question in the article, "Why can't you use that $300 GPS unit from Wal-Mart to map your utility?" The answer is that the $300 GPS units available use the wide area augmentation system. Their signal sensitivity is diminished in dense tree cover, in valleys, and often is disrupted by atmospheric conditions. These signal variations may put you 1,500 feet away from the original location. The units were designed for open land and marine application. While suitable for marking your favorite fishing hole but not suitable for mapping grade applications.

KRWA is expanding its mapping program to provide increased training and technical support. The training sessions that were conducted this summer were very beneficial in helping many municipal and RWD personnel better understand this technology and its applications.

Although KRWA provides GIS/GPS mapping as a service, it does not compete with other mapping services. The labor costs to the Association are the same as for any utility doing their own mapping. KRWA's approach is somewhat different. With KRWA Mapping, the utility owns the data — not KRWA. The data is then available for all community projects down the road. KRWA'S services are not only available during the mapping process but also in five, 10 or 20 years. Mapping is a long-term effort and as technologies change, KRWA technicians will be there to integrate the current project with those community projects of the future.

I hope you will attend future training opportunities on GIS/GPS mapping that KRWA will provide. If your city or RWD wishes to have a presentation at a board or council meeting, give us a call and we can schedule a time that is convenient.

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