Energy Currents

ESRI • Spring 2007 GIS for Energy

In This Issue

Grow That System: Doing It Right with GIS

Utilities that initially use geographic information system (GIS) technology for facility management soon discover applications for customer service, business operations, and more. What is a utility's GIS potential? Ease of integration and options for scalability are helping many companies derive much more from their GIS technologies.

Saint John Energy is an electric distribution utility that is growing the capabilities of its GIS. The utility serves 36,000 customers in Saint John, New Brunswick, Canada. The company's network claims 13 substations and 84 feeders within its service area of 333 square kilometers. It uses ESRI GIS software for facilities and business management.

Prior to implementing its GIS, Saint John Energy's spatial data was paper-based. The utility needed an easy-to-use method for migrating data to a digitized system. It worked with ESRI Canada Limited to create a data collection tool that ran on a Windows CE device. Using this tool, staff was able to add more than 200,000 attributed data points to the utility's database including x,y locations for poles, transformers, fuses, streetlights, and meters.

The utility continues gathering additional field data, integrating with other corporate systems, and ramping up its field collection suite of tools. Three years after the GIS project was launched, Saint John Energy partnered with the City of Saint John to acquire 15 cm (6-inch) pixel aerial photography. This imagery is extremely useful for planning and decision making.

Distribution map overlay on aerial imagery.

GIS is used for a host of activities at Saint John Energy, from citing substations through assessing insurance claims, by combining aerial photography with padmount transformer or pole locations. Other applications include planning new infrastructure and locating existing underground infrastructure.

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ESRI on the Road

CIS Conference
May 21–24, 2007
Orlando, Florida
www.cisconference.org

CIRED 2007
May 21–24, 2007
Vienna, Austria
www.cired2007.be

IRWA Annual International Education Conference
June 17–20, 2007
Sacramento, California
www.irwaonline.org

2007 ESRI International User Conference
June 18–22, 2007
San Diego, California
www.esri.com/uc

Milsoft Users Conference
June 19–21, 2007
Westminster, Colorado
www.milsoft.com/events.php

APPA National Conference 2007
June 23–27, 2007
San Antonio, Texas
www.appanet.org

MAXIMO World
July 22–25, 2007
Orlando, Florida
www.maximoworld.com

World Energy Engineering Congress (WEEC) 2007
August 15–17, 2007
Atlanta, Georgia
www.energycongress.com

Electric and Gas User Group (EGUG) 2007
October 8–11, 2007
Nashville, Tennessee
www.esri.com/egug

To register for ESRI events, visit **www.esri.com/events**.

Career Opportunities at ESRI For Professionals in the Utilities Sector

Account Manager—An energetic, driven professional is needed to join ESRI's utilities sales team to perform business development activities and advance relationships with existing partners in the electric, gas, and water/wastewater markets.

Consultants/Project Managers—Professionals with proven project management success are needed to lead projects in the energy and water/wastewater markets. Support ESRI software users throughout the entire implementation life cycle and help them translate real-world needs into practical, state-of-the-art, GIS technology-driven solutions.

Petroleum Industry Manager—This creative, energetic individual will work with ESRI's well-established petroleum clients worldwide. This role will focus on helping to broaden the applicability of ESRI's software solutions within the wider petroleum sector by developing, executing, and managing a comprehensive business development and marketing plan.

Petroleum Industry Solutions Specialist—A creative, dynamic professional with significant industry knowledge is needed to work with ESRI's well-established petroleum and pipeline clients worldwide and help broaden the applicability of ESRI's software solutions within the wider petroleum sector. This individual will be responsible for developing, managing, and executing a comprehensive industry marketing plan to support sales and revenue objectives.

Product Marketing Manager—An individual with a unique combination of marketing experience and GIS knowledge is needed to market ESRI's developer solutions to developers worldwide who create mapping and GIS applications. Serve as an external and internal evangelist working with sales, development, and key customers to develop product positioning and increase product success in the market.

Technical Marketing Research Analyst—An independent thinker with strong analytical skills is needed to perform ad hoc market research and product comparisons and support activities related to marketing, pricing, feature analysis, and product positioning.

Utility Technical Marketing Analyst—Use your technical knowledge and excellent communication skills to build and deliver highly competitive benchmarks and event demos for ESRI's sales and marketing staff. In addition to developing and supporting custom applications for ESRI's utility industry, this team performs research and development on the latest ESRI products.

Learn more about these positions and apply online at www.esri.com/careers.

Electric and Gas User Community to Meet in San Diego

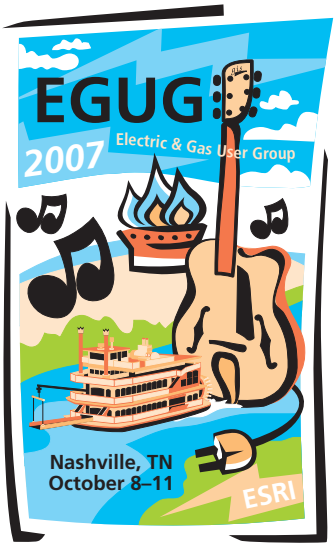
The 2007 ESRI International User Conference will provide learning prospects specifically tailored to the needs of electric and gas GIS software users via an electric and gas track of papers presented by real-world users. The conference will be held in San Diego, California, June 18–22, 2007. In addition to offering many networking venues, ESRI and its business partners will host the summer meeting of the Electric and Gas User Group (EGUG) during the conference on June 19, 2007. Learn more about successful projects from others who work in your industry. For more information about the conference and user group meetings, go to www.esri.com/uc.

Two Opportunities to Share Your Knowledge

The community of ESRI software users working in the energy industry continues to grow. The help users provide one another at user group conferences is invaluable. Some of the most advantageous learning opportunities are provided by people like you who are willing to speak about their GIS successes and challenges. Help grow the understanding of GIS technology for your industry by sharing your knowledge.

ONE: The annual Electric and Gas User Group (EGUG) meeting is a venue for GIS software users to gather and learn from each other. EGUG will meet in Nashville, Tennessee, October 8–11, 2007. The EGUG officers have been planning this year's event and are developing tracks for presentations. The deadline for abstracts is August 3, 2007. Learn more about being an EGUG presenter at www.esri.com/egug.

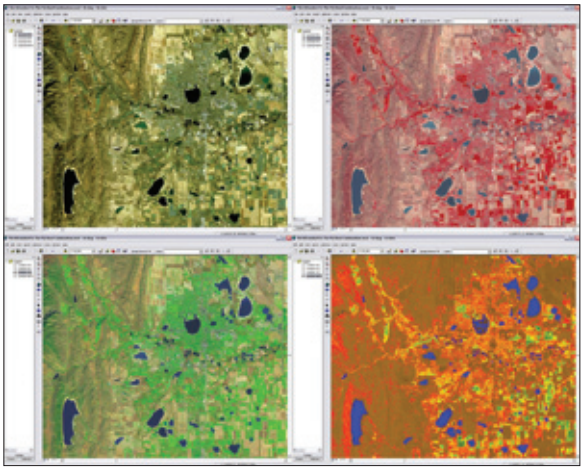
TWO: Participate in the ESRI International User Conference in 2008 by presenting a paper about your real-world GIS experience with electric, gas, or pipeline projects. Along with technical workshops, the conference offers tracks for the energy community. These tracks provide a wealth of information and create opportunities to develop your user network. For more information and to submit your papers online via the ESRI International User Conference paper submissions form, go to www.esri.com/uc/2008/papers.



Tools of the Trade

ArcGIS Image Server 9.2 Redefines Dynamic Imagery

ArcGIS Image Server 9.2, ESRI's much-anticipated new solution for fast and dynamic image distribution, is now available.



Four different representations of Landsat 1G imagery served directly by ArcGIS Image Server.

Geospatial imagery is most valuable when a large number of users can access and use it as quickly as possible. ArcGIS Image Server provides the unique ability to quickly and seamlessly serve and process large volumes of imagery enterprise wide. This allows organizations to maximize the value of their imagery and increase productivity.

"There has been an explosion in the amount of available image data, and conventional solutions for managing, processing, and distributing these large quantities of geospatial imagery have broken down," says Peter Becker, ArcGIS Image Server product manager. "ArcGIS Image Server solves these problems by merging the traditionally separate steps of image processing and distribution."

ArcGIS Image Server is particularly beneficial to users who need to deploy imagery enterprise wide to a variety of clients as well as those who perform dynamic image processing for better image visualization. Users can publish GIS-ready imagery directly to a large number of clients. In addition, server-based processing enables imagery to be quickly published as multiple image services.

ArcGIS Image Server is integrated with ArcGIS Server, which allows data to be distributed to Web-based, mobile, and Open Geospatial Consortium, Inc. (OGC)-compliant clients. In addition, users can publish seamless mosaicked image services from multiple image datasets directly to applications. These services can be published in different projections, enhancements, and representations, eliminating data redundancy and extra storage requirements. Metadata containing important image information, such as acquisition date and sensor attributes, is easily accessible.

ArcGIS Image Server offers these key features:

- Open access from various GIS and non-GIS clients (e.g., CAD)
- On-demand, dynamic server-based processing for image display
- Scalability that supports extensive volumes of imagery as well as many users
- Integration with ArcGIS Server for data distribution to Web, mobile, and OGC-compliant clients
- Quick and seamless access to imagery and associated metadata

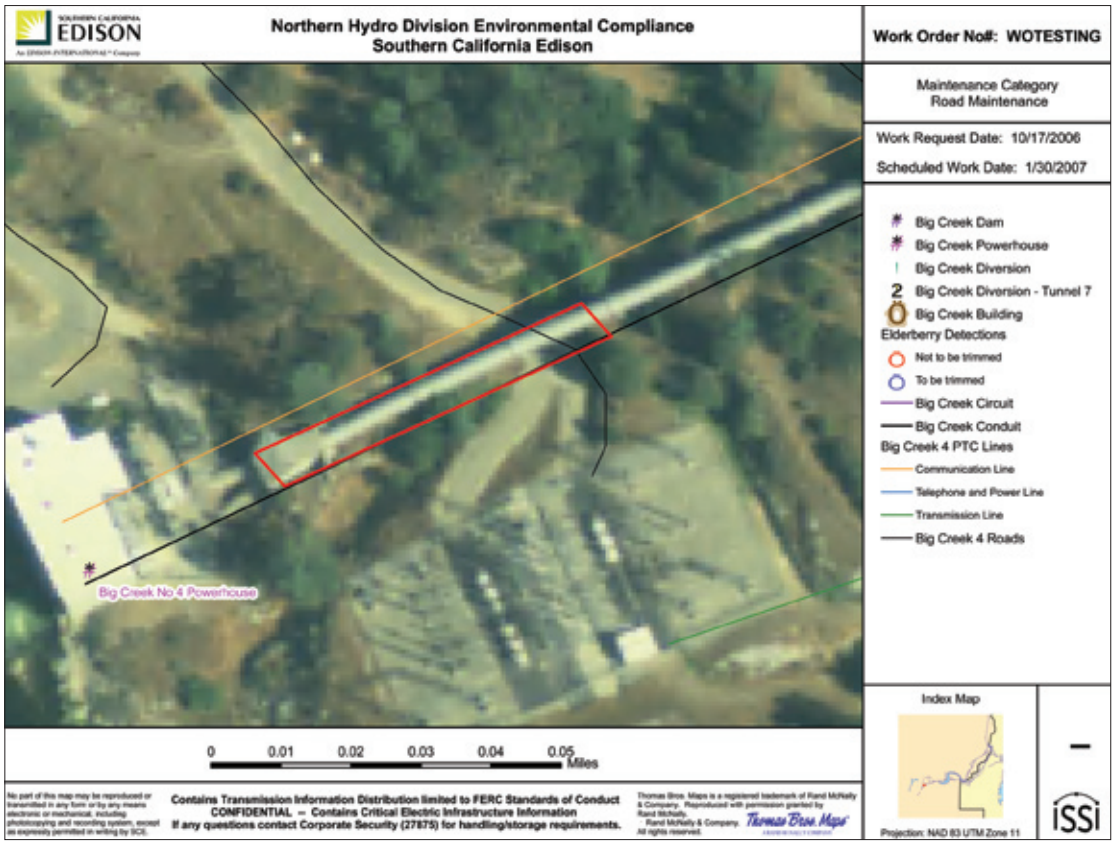
Users can add capabilities to ArcGIS Image Server using extensions. The Orthorectification extension allows users to dynamically orthorectify raw imagery using image properties and an elevation surface. With the Seamline extension, users can create and edit seamlines for overlapping image mosaics.

For more information about ArcGIS Image Server 9.2, visit www.esri.com/imageserver.

Spatial Analysis Guides Environmental Action

By Katherine Everett, Senior GIS Analyst, Integrated Spatial Solutions, Inc.

The Southern California Edison (SCE) Big Creek Hydroelectric System generates 90 percent of the power company's hydroelectricity, contributing 20 percent of its total electricity generation. This helps serve more than 4.2 million customers in a 50,000-square-mile service area. The Big Creek system, composed of nine powerhouses, 24 generation units, and a series of tunnels and diversions, has a generation capacity of 1,000 megawatts. Part of the operation and maintenance of these facilities involves complying with state and federal regulations regarding the use of the natural resources in and around these assets.



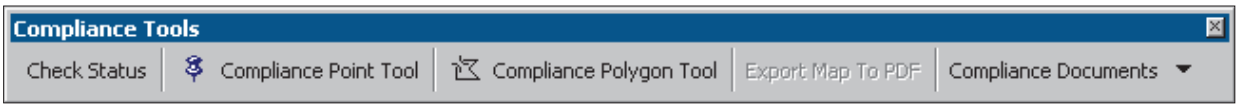
Work order request shows avoidance protection area for environmental management.

Operational licenses of the Big Creek Hydroelectric System facilities were set to expire beginning in 1999 through 2009. Big Creek 4 Powerhouse was the first operation to go through the Federal Energy Regulatory Commission (FERC) relicensing process. The traditional relicensing process requires the licensee to submit information about the project area including protection, mitigation, and enhancement procedures to be performed upon approval of the license. All power and nonpower uses of the water resources must be considered by the licensee such as fish and wildlife habitat, water flow, protection of recreation opportunities, and the preservation of environmental quality.

Big Creek 4 Powerhouse was granted a 36-year license in December 2003. Terms of the license renewal include conditions on which the project area must be operated. One of the terms specifically indicates that no threatened or endangered species or their habitats may be jeopardized by operation or maintenance activities, and before these activities are to be performed, the Fish and Wildlife Service must be consulted. Furthermore, a Noxious and Invasive Weed management plan and a Valley Elderberry Longhorn Beetle management plan must also be implemented in the project area. In accordance with the relicensing terms, a GIS tool was developed for the Big Creek 4 Powerhouse project area.

Integrated Spatial Solutions Incorporated (ISSI) developed a GIS tool for SCE's Northern Hydro Division as part of a larger compliance program. The tool, specifically created for GIS software users working on the Big Creek hydroelectric project, includes several components and is a VBA-customized ArcGIS application that contains Big Creek-specific data. The GIS component was meant to help managers identify areas of concern when coordinating the implementation of specific operation and maintenance activities. The tool uses geographic information about the FERC responsibility areas and special-status species and habitats. This data is combined with specific operation management activities to alert managers to the specific avoidance protection measures. It identifies any need for consultation with the Fish and Wildlife Service before an activity is to be performed.

During the relicensing process, SCE used an outside environmental consulting firm to compile data for the compliance tool. The data came from various federal sources such as the California Natural Diversity Database, Sierra National Forest, United States Forest Service, and United States Fish and Wildlife Service as well as internal SCE facility data. Avoidance protection measure data was compiled based on articles in the license renewal for the project area. Multiple ring buffers were created in ArcSDE using ArcToolbox to maintain the content of the data within the buffer files. Buffer distances were applied based on the different types of data within the project. Avoidance protection measures were also delineated and com-



Compliance tool buttons allow the user to create a shape for the area where maintenance work is to be done and retrieve the appropriate avoidance protection measures.

piled by the consultants and used to create the Avoidance Protection Connection Table in SDE to connect the geographic data with operation management activities for the project area.

Compliance Point/Poly buttons are the main focus of the toolbar. These buttons allow the user to create a shape in the area where maintenance work is to be performed and retrieve the appropriate avoidance protection measures. If the shape intersects the FERC responsibility area or the buffer files, then a form opens that contains a list of maintenance categories and activities from which the users select. Buffer selection results and the maintenance category and activity selection are used to determine which avoidance protection measures apply.

If a work order number and the scheduled work date are entered, then the user may create a map of the work extent and an HTML list of all the applicable avoidance protection measures listed by activity. The Export to PDF button allows the user to create a saved version of the work order map for documentation. Both the map and HTML files are created using the work order number as the file name to maintain documentation of the compliance process.

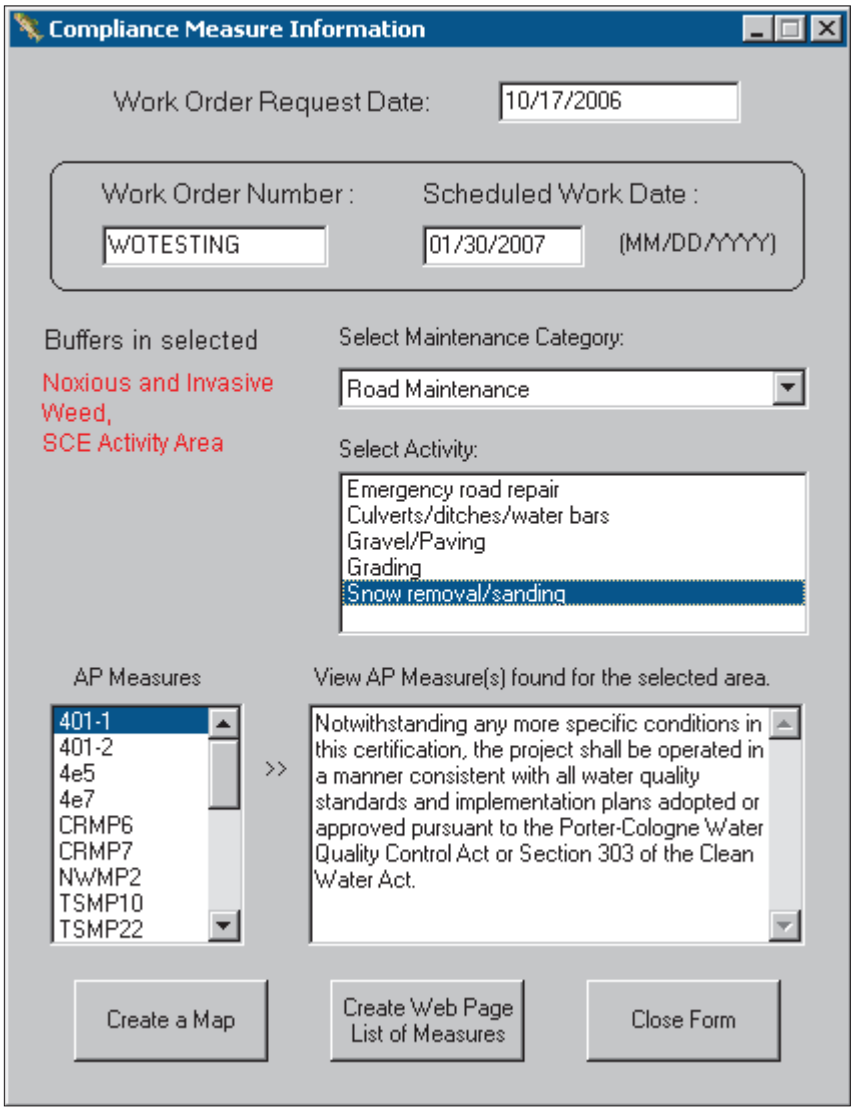
Work order number and scheduled work date are required to make sure that, at the time of the work, the most recent data has been consulted. Anytime a work order number and date are entered, they are saved to a table along with a work request date. The Check Status button checks the update date of the project buffer data and the Avoidance Protection Connection Table. If any of the data has been updated since the work order was requested and the scheduled work date has not yet occurred, then a list of work order numbers is generated and displayed in a form for the user.

The Compliance Documents menu on the toolbar contains links to documents related to the project license: General Regulatory Requirements, U.S. Fish and Wildlife Permit, Valley Elderberry Longhorn Beetle Training Manual, and Water Best Management Practices. It also contains a link to the Northern Hydro Special-Status Species Information Program documents, which will bring up a form listing all the special-status species PDFs available by scientific or common name.

Currently, this project is a pilot project for the Big Creek 4 Powerhouse FERC Relicensing Project Area. In the future, as the rest of the SCE hydroelectric facilities undergo the relicensing process, SCE will expand the project to its entire Big Creek Hydroelectric System.

Information about the Big Creek Hydroelectric System FERC licensing can be found at www.sce.com/PowerandEnvironment/PowerGeneration/BigCreekHydro.

Learn more about ISSI GIS at www.issi-gis.com.



SCE GIS users generate avoidance area protection buffers for the utility's Noxious and Invasive Weed management plan.

Deploying Graphic Work Design as a Value-Added Extension to GIS

By Will Shepard, Ph.D., PMP, Project Manager, Enspiria Solutions

Addition of graphic work design (GWD) to a utility's GIS can bring significant benefits. GWD is a natural, value-added extension to a corporate GIS. GWD packages allow designers and engineers to specify construction and maintenance activities through a medium that is comfortable for them: drawing. These packages are typically built on top of the corporate GIS, facilitating data entry into the GIS, shortening as-built drawing entry times, and streamlining business processes.

Although asset management GIS applications are focused on maintaining assets already present, graphic work design facilitates system design and planning for new assets. GWD adds a layer to the spatial facilities model present in the GIS and couples the GIS features with compatible units (CUs) that add material, equipment, and labor costing components. Just as GIS software users draw existing assets in data layers in the AM/FM/GIS, GWD users draw proposed features into the same GIS data layers. When CUs associated with GIS features are brought along to aggregate costs for the planned work, the result is a seamless GWD/GIS solution, which contains existing infrastructure and proposed facilities development that maintains access to GIS tools.

GWD streamlines design and as-built business processes, positively impacting workflows and workloads. In the design process, the user enters facility data one time into the GIS, which then produces design layouts. It also propagates costing components via CUs to other systems including the work management system (WMS) and materials management system (MMS). As-built drawing times are shortened because the design is already present in the GIS. Updates are required only to reflect changes to the design.

To gain maximum value from adding or upgrading GWD systems, utilities must address technical and social considerations. Key technical considerations include the amount of detail in the GIS versus GWD, GIS data model impact on the GWD CU library, and integration of additional systems with GWD. Social considerations include GWD's effect on workflows and business processes as well as the distribution of labor and the role of the labor organization in adoption of GWD.

Prior to implementing GWD, a utility needs to examine the detail present in its GIS as related to the requirements for GWD. A GIS is built on a conceptual data model where components are represented as discrete objects such as poles, pads, conductors, transformers, fuses, and switches for the electric utility and mains, services, valves, and fittings for the gas utility. As a model, the GIS focuses most heavily on those discrete objects that can be mapped (or are major components of such mapped objects). For example, an electric utility implementing

its GIS may choose not to map a secondary network for purposes of simplicity. When GWD is implemented, however, the need to be able to populate secondary and service CUs may necessitate the addition of those elements to the data model.

Inversely, the GIS data model design may have an impact on the way the compatible unit library is modeled. GWD systems typically provide the user with options about whether or not to link CUs to GIS records. Extending the above example, the electric utility may choose instead to create secondary and service CUs that are not linked to GIS features to avoid adding additional data model elements to the GIS (along with requisite data collection efforts for the data not currently present in the system). This may introduce its own issues; for example, how will the length of secondary and service conductors be entered into the GWD?

Integration of additional systems—such as WMS, MMS, or CIS—with GWD optimizes its deployment value. Such systems integration must be considered in the design of the GWD compatible unit library. For example, a work management system might define attributes not on individual CUs but rather on CU classes: The class of gas pipes may share the same attributes, but GIS may model mains and services as discrete objects. These factors may require either additional attributes to adequately map between the two systems or management of the attribute discontinuity in the integration components. The WMS may also have considerably more granularity than the GWD; for example, the WMS may require individual CUs for all the various components that make up a fitting (such as gaskets or bolts), while the GWD does not maintain this level of detail. Many work management systems will define some sort of macro CU, which will allow the GWD to simply pass the fitting CU and have the WMS explode into the individual components. Here, too, there are issues to be considered; for example, do users need to be able to substitute components from the GWD (such as a 6-inch bolt for a 4-inch bolt), and if so, how?

Utilities have well-defined business processes that allow them to efficiently conduct day-to-day operations. They must consider how GWD will impact the way those processes are carried out. Field data collection is one example. Many utilities obtain the most accurate facility location information via GPS in the field. This is often done during as-built processing, since the facilities are installed and can themselves be used as references for the collection activity. Introduction of a GWD means that spatial representation with real-world orientation is available much sooner. Thus, the utility may determine that GPS field collection should be done during the design phase instead of the as-built phase, altering application of the workflow.

For GWD to add maximum value to GIS, it is also important to determine what effect the organization of labor will play in adoption of GWD and, inversely, the effect GWD will have on the distribution of labor. Many utilities are unionized, with separate job functions for CAD entry and design. GWD blurs the line between these job functions so that engineers now enter design data directly into the GIS. Although this certainly streamlines processes and reduces the amount of work required at as-built time, contractual implications need to be addressed before GWD can be successfully adopted.

Utilities can deploy graphic work design as a value-added extension to GIS. Thoughtful and deliberate consideration of the various technical and social factors will significantly enhance the benefits obtained from GWD.

Morphing Information Systems Means More Uses

By Barbara Shields, ESRI staff writer

Isolated proprietary information systems have gone the way of slide rules. GIS technology, once found only on the disconnected desktops of the engineering department, is now accessible to many users throughout the utility. The "agar" for this evolution is a concoction of standardization that has led to interoperability between systems, sophisticated infrastructures that allow for greater accessibility to systems and databases, and developer toolkits that have vastly increased the industry's customized task-related tools. GIS has morphed into a central nervous system that has greatly improved utility companies' workflows. Many workers do not even think about their company's GIS software; they just use it to get their jobs done.

ESRI works with the National Rural Electric Cooperative Association (NRECA) to develop geospatial data standards and encourage interoperability between systems. NRECA, ESRI, and MultiSpeak have developed a common data model for software regularly used by municipal and cooperative electric distribution facilities.

Northeastern Rural Electric Membership Corporation (NREMC), a major electric utility cooperative in northeastern Indiana, has implemented an advanced field tool that includes ArcGIS mobile technology. The mobile GIS leverages existing GIS investments for greater efficiency and productivity. It makes spatial data and functionality available to field crews and other utility staff working remotely and includes the ability to view, search, trace, route, and link with GPS.

Middle Georgia Electric Membership Corporation (MGEMC) embarked on a data collection and conversion process to upgrade its aging CAD system to ESRI's GIS software. As the engineering department grew more comfortable with the consistency and accuracy of the GIS data, the cooperative sought to improve the information that other departments within the utility used in their daily work. This improvement came in the form of electronic maps that provide all MGEMC personnel in the office and the field with up-to-date mapping data and customer information. Today, all employees have access to GIS and customer data to help them make better and faster decisions and improve service to the utility's 6,300 members.

Truckee Donner Public Utility District in California is a showcase of utility-oriented GIS implementations. Between 80 and 85 percent of the company's personnel are now using GIS in their everyday operations. The northern California utility's GIS is built with ArcGIS software and contains spatial and nonspatial databases. Recently, the utility implemented an intranet solution that brings the entire district's data sources together.

The City of Lexington, North Carolina, has a comprehensive GIS plan for its public utilities. Its GIS includes an ArcGIS Engine field editing tool, ArcGIS online software ArcIMS for organization-wide dissemination, and ArcGIS Desktop software for data maintenance. The system has greatly improved customer service. For example, before GIS was implemented, basic tasks associated with adding new customers were labor intensive and expensive because employees had to drive to a site to do the research, mark the lines, and develop a plan. With GIS in place, much of the work can be completed in the office.

The City of Painesville, Ohio, uses GIS to comply with government reporting guidelines. The municipal services include water, electric, storm water, and sewer services. The city has set up a system for government regulation compliance using ArcGIS. To meet government requirements, Painesville uses a publicly available materials cost index history. This cost is input into the GIS model along with other tables containing infrastructure information. Tables are related to each other using common identification features. GIS connects the tables to a basemap to produce infrastructure map data layers. Painesville's GIS also supports asset management for electric operations, system maintenance, and capital improvement planning.

The emerging GIS is simply making work more productive and utilities better equipped to meet the needs of their customers and members.

Middle Georgia Electric Membership Corporation ArcGIS software allows linemen and customer service representatives to search and browse the utility's entire service territory.

Truckee Donner Public Utility District uses ArcGIS to create multilevel joins that show information from multiple databases in one common viewer interface. Any database is capable of being queried and having a related spatial feature viewed within the map interface.

Continued from page 1

Grow That System: Doing It Right with GIS

Saint John Energy is increasing its revenue stream by having mapped joint-use attachments connected to its poles, which enables the appropriate parties to be billed on a monthly basis. It has also mapped the locations of city streetlights and customer rental lights and applied the appropriate billing codes and customer account numbers as attributes to the lights for billing purposes.

GIS data has proven effective for creating network connectivity between substations and their related meter locations in the field; conducting network traces; and finding the number of customers per substation, feeder, and transformer.

Recently, Saint John Energy implemented an Advanced Metering Infrastructure (AMI) pilot project with Tantalus Systems Corporation. This system allows the acquisition of near real-time customer meter data. After integrating AMI data with networked meter locations, the GIS then symbolizes various data streams from the AMI system such as outages. This application improves customer service. For example, a meter experiencing an outage relays its outage status to a communications tower, which then relays that information to the AMI server. The AMI server recognizes the outage, which is seen by the GIS through an Open Database Connectivity (ODBC) connection to the AMI server. The outage is instantly symbolized on the outage management system map in the engineering and operations departments. Other information such as voltage sag and swell, last read, outage start time, and outage end time can be symbolized in near real time.

Asset inventory processes have also been a proving ground for automation. Saint John Energy uses GIS software to help manage its stores department. Upon inputting the department's receipt of all new and removed transformers, the application tracks the nameplate information of all transformers including their properties, location (pole number or address), and status.

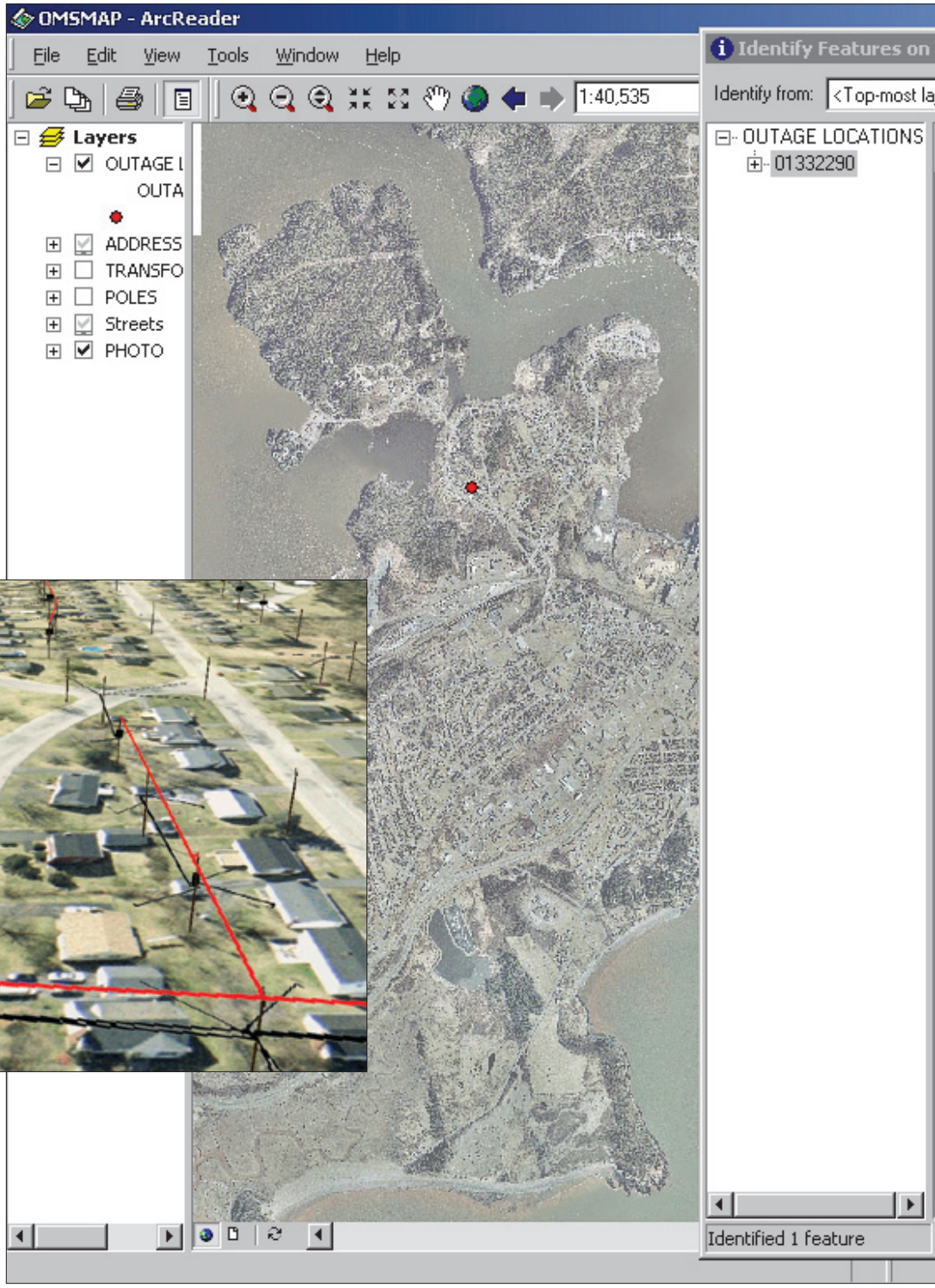
Moving toward greater integration, Saint John Energy recently selected Telvent Miner & Miner's Designer line application. Designer will replace two nonintegrated line design tools currently used for detailing and design with a single, integrated process. This solution will automate the generation of cost estimates and bills of materials. Implementation of Designer and an associated work management system will integrate and streamline the flow of information among the field, engineering, operations, stores, and Saint John Energy's Great Plains accounting applications. The enterprise approach presents more opportunities for effective and efficient management processes at Saint John Energy.

Thanks to Bob Bernard, GIS specialist of Saint John Energy, for this article. See this issue of *Energy Currents* Map Gallery for examples of Saint John Energy applications (page 10).

Saint John Energy's Growing GIS

Making full use of its GIS potential, Saint John Energy in New Brunswick, Canada, showcases its many applications for electric distribution operations.

This image was created using ArcGIS 3D Analyst. The utility poles are shown based on the GPS locations of the poles acquired in a 2001 field survey. This imagery is utilized in planning and locating existing infrastructure as it relates to maintenance and facility upgrades.



In 2006, Saint John Energy began an Advanced Metering Infrastructure (AMI) pilot project. Meters send data to a communications tower, which in turn communicates with the AMI server. The GIS has an ODBC connection to the AMI server via the networked Account Locations layer. When the AMI server detects an outage condition, it becomes symbolized in the ArcReader OMS map as an outage. As illustrated, the AMI system brings with it a significant amount of data that can be utilized in a mapping application as simple as ArcReader.

Saint John Energy technicians use GIS to map underground infrastructure. Points and lines show the locations of underground primary and secondary padmount transformers and underground enclosures. This data is useful for locating the infrastructure for maintenance and upgrade purposes.

Special Acknowledgment
Bob Bernard
GIS Specialist
Saint John Energy

the Map

yer>

Location: 2,530,534.55 / 7,362,842.23 Meters

Field	Value
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DON_PERIOD	0
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END_TIME	
FACE_PLATE_DIGITS	5
FEEDER	4D7
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INSTALL_KWH_READING	
KH_VALUE	800
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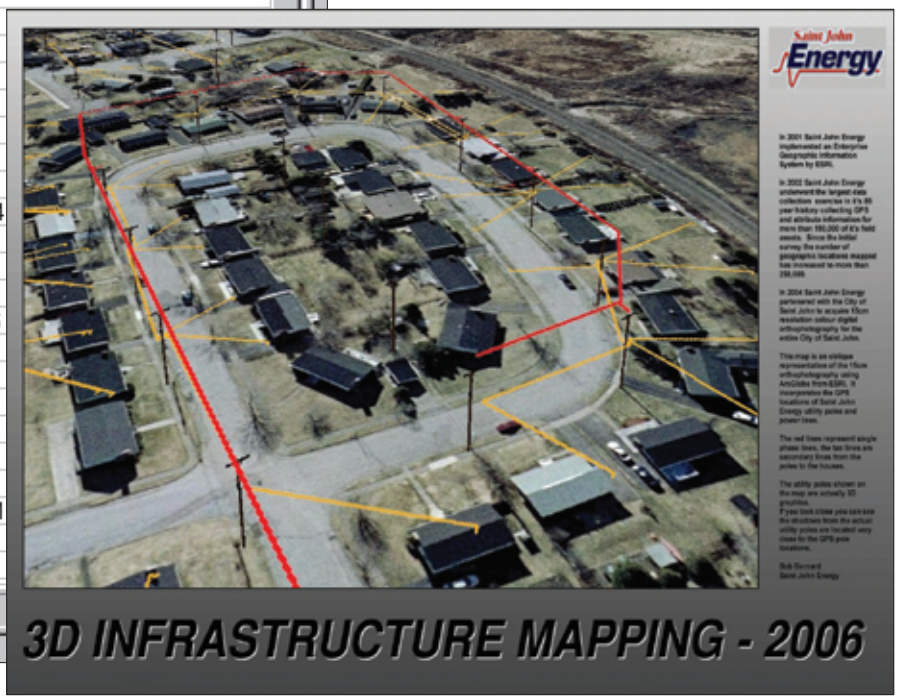


A distribution infrastructure map was created using ArcGIS 3D Analyst extension's application called ArcGlobe. It illustrates the locations of Saint John Energy's infrastructure as they relate to the aerial photography of the city that was flown in 2002. This image illustrates the locations of utility poles, primary overhead, and secondary overhead.

Plan for Migration Supports CAD to GIS Changeover

Georgia Power, a Southern Company

GIS technology offers data analysis capabilities and a range of functionality that clearly distinguishes it from computer-aided drafting (CAD) systems. The tiled maps were useful in their day, but now utility companies need information systems that integrate with their other business and operating systems. The speed of GIS for accessing data and generating maps is significant and immediately affects return on investment. Therefore, many utility companies have migrated their CAD-based systems to GIS. The process of migrating data from CAD to GIS can be daunting, but there are some workaround strategies that have proven successful for migration and minimized disruption of work routines.

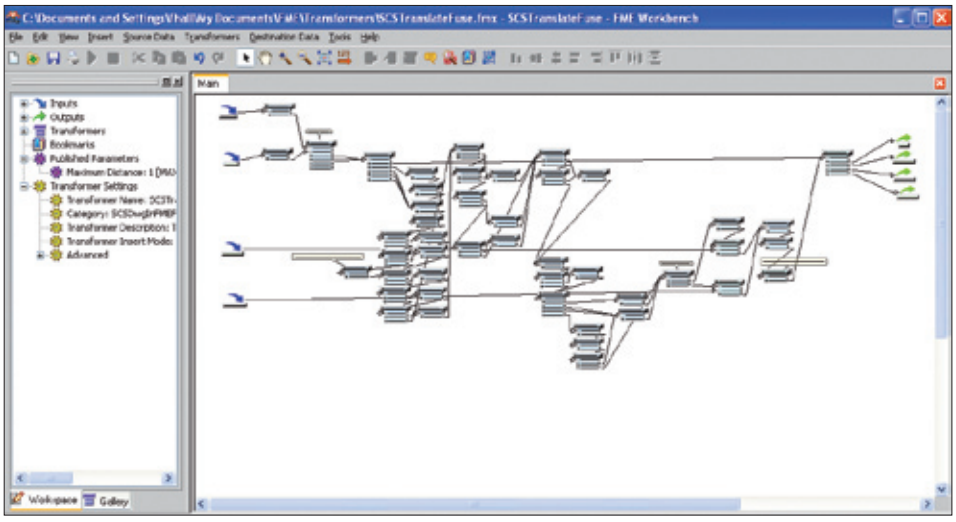
Georgia Power is one of four operating companies that make up Southern Company, a super-regional energy company that serves the southeast region of the United States. In 2003, Southern Company began a GIS venture called project enterprise GIS. Southern Company wanted to consolidate technologies rather than pay for four different operating environments.

Georgia Power looked forward to the more robust environment ESRI's ArcGIS software and the Telvent Miner & Miner (TM&M) platform would bring. This core technology was also desirable because it would allow the company to move into the mobile environment. The challenge of implementing GIS would be migrating Georgia Power's CAD-based data system and rolling out the new environment to each division.

The CAD system contained 120,000 map tiles including 4,627 primary maps of the primary distribution system, which were used for the company's trouble and control centers. The set also included 2,085 circuit maps. In addition, the system interfaced with a number of operation systems including Smart Drawing, which is a versioning process; DistView, which is a Web application that supports most of Georgia Power's asset management efforts; CYME, which is used for system analysis and load projection; and TCMS, which is the outage management system. All these systems had to be maintained during the implementation and data migration phase.

For the starting point of its GIS implementation project, Georgia Power decided it wanted its starting data model to resemble the ESRI electric data model as closely as possible. Rich Faglier, Distribution Support supervisor at Georgia Power, explains, "We felt the ESRI ArcGIS platform would save us money on future developments and allow us to use standardized interfaces."

The system Georgia Power has been using is Automated Mapping and Construction (AM/C), a customized system based on AutoCAD software. The business processes supporting AM/C are inefficient because of underlying limitations within the CAD system. Faglier described one of the system's problems: "In the AM/C world we have connectivity, but it is not truly electric connectivity. We know where everything is, but we do not know the order in which it is connected."



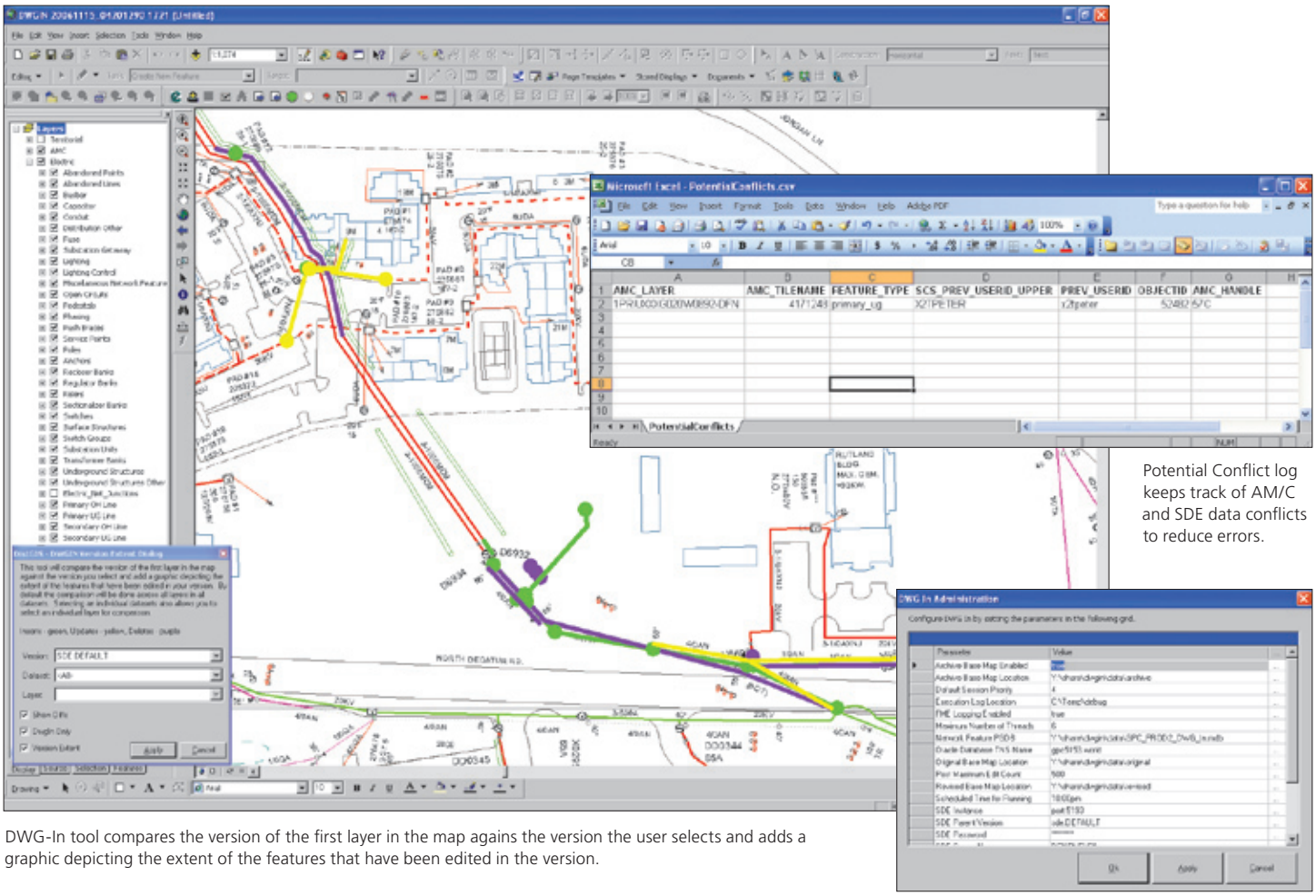
To migrate CAD-formatted maps to the target ArcSDE database, Feature Manipulation Engine translations were developed that transform CAD objects into ArcSDE features.

The company's new distribution information system is DistGIS. This system is built on ESRI's GIS software and adds TM&M tools such as Designer, a graphic design tool, and Feeder Manager, a tracing tool. The target environment for the migration is ArcGIS/ArcSDE 9.1 and ArcFM 9.1.

In planning the project, a primary concern was what to do about maintaining data during the implementation phase. Georgia Power worked with ESRI's business partner Enspiria, an Osmose Company, to plan the project approach. Georgia Power needed a tool that could maintain the data electronically in a programmatic environment as opposed to using a double posting technique. Double posting techniques had been considered, but management concluded that because of the size of the project, it would be more cost effective to develop a tool that would automate posting. Enspiria met the need by developing the DWG-In tool.

DWG-In is a one-way replication mechanism that supports migration processes from AutoCAD to the target ArcSDE database. AutoCAD formatted maps are translated and transformed using Safe Software's Feature Manipulation Engine (FME). FME translations were developed that would transform the AutoCAD objects into ArcSDE features. DWG-In is an application created to manage the FME translations, personal geodatabases, and logging required for visibility into the process.

Because of the relationships of the various features, FME writer limitations, and Telvent Miner & Miner customizations, it was decided that all features were written into a nonnetworked, non-Telvent Miner & Miner personal geodatabase that mimicked the final ArcSDE data model. As part of DWG-In, a post-processor was developed that would transfer the features



DWG-In tool compares the version of the first layer in the map agains the version the user selects and adds a graphic depicting the extent of the features that have been edited in the version.

Potential Conflict log keeps track of AM/C and SDE data conflicts to reduce errors.

Facts viewer tool.

from the temporary personal geodatabase into the final enterprise geodatabase managed with ArcSDE. Processing the features separately allows better control over error handling and the configured TM&M autoupdaters. For each map tile that is translated, a specific version or Telvent Miner & Miner session is generated. Based on the number of edits that occurred in the AutoCAD file and providing there are no errors, no unmatched updates, no potential conflicts, and no failed features, these sessions are transitioned into the Pending Post state. An additional tool for batch reconciling and posting sessions within the Pending Post state automatically posts changes to the default, thus automatically updating the default version and reflecting the changes that are occurring in the AM/C environment.

In addition to the FME limitation of not writing network features to the SDE database, FME also did not recognize the TM&M licensing safeguards. Initially, Enspiria built an FME Reader used within DWG-In to solve the license issue. This solved the problem until Microsoft released a security patch that was causing the custom FME reader to report a memory reference error. Since the original design had been modified to not write features directly to ArcSDE but rather to a non-Telvent Miner & Miner personal geodatabase, it was now possible to remove the custom reader that was reporting the memory reference error and use an SDE reader instead of a personal geodatabase reader. One of the benefits of this change is that the application has reduced the performance time for migrating a tile from 20 to 6 minutes.

During the year-and-a-half migration, the company's distribution system continues to change. The team is faced with the problem of how to make those changes without disrupting the migration process. Since manual review of the scrub postprocess is made within the SDE environment, it is important that the AM/C-maintained data not be overwritten or invalidated. Also, it is possible that somebody might edit features in the AM/C rather than the SDE database. Either way, conflicts would be generated. The project team wanted to know about these conflicts. A conflict log was the answer. People could go to the log and review the features to make certain data entries were not lost. Logs were also created for failed features and unmatched updates and deletes.

Since quality control is so important, the team wanted to verify that the data attached to the construction print actually made it all the way through AutoCAD and into the GIS. A normal process of reconciling and posting conflicts is to run a validation review, which serves as an additional quality check. The quality of the data ensures that Georgia Power will have a robust system.

To aid in the review, Enspiria also created a version difference tool to ensure DWG-In is doing its job correctly. The tool allows the team to open a session in the TM&M session manager; compare changes in this version to the changes in the default version; and then

Continued on page 18

Upload, Download Hydro on the Go

Rapid Capture Application Supports Field Data Collection

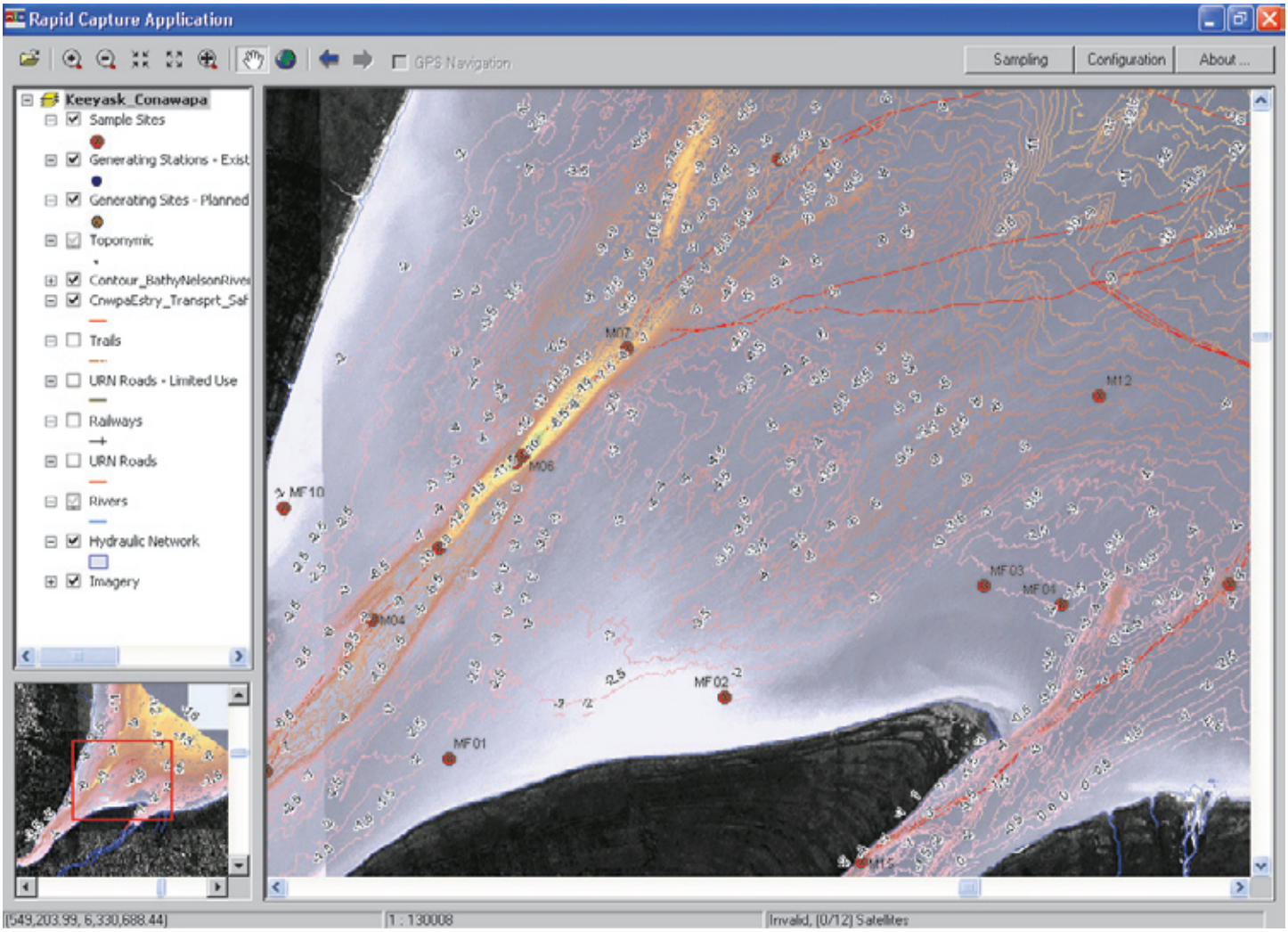
Manitoba Hydro's hydro power planning department has created a field data capture application using an online GIS development service. Rapid Capture supports the collection of samples and the monitoring of erosion and sediment transport in the future power generation project areas of Wuskwatim, Keeyask, and Conawapa (including the Nelson River estuary).

Manitoba Hydro is the province's major energy utility, headquartered in Winnipeg, Manitoba, Canada. The company serves 510,000 electric customers throughout Manitoba and 258,000 gas customers in various communities throughout southern Manitoba. Virtually all electricity generated by the provincial Crown corporation is from self-renewing water power.

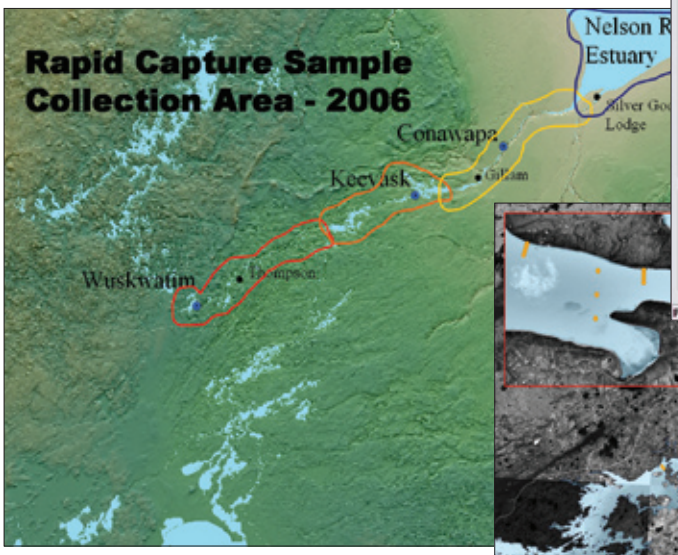
Field crews use a mobile GIS application to collect water, bed load samples, and other associated data (temp, turbidity, dissolved oxygen, etc.) needed for analysis as part of the environmental assessment requirements for the planning, construction, and operations of future power generation projects. Data collection and analysis are required to understand current conditions and the potential impact of future development.

In the past, field crews used handwritten field notes to record information about a particular site. Because of a high potential for human error during the transfer of data from the field notes to electronic format, office staff were required to perform extensive quality control. To ensure consistency and minimize errors, Manitoba Hydro decided to implement an application that would automate collection processes and provide a standard format for all crews to use when capturing data.

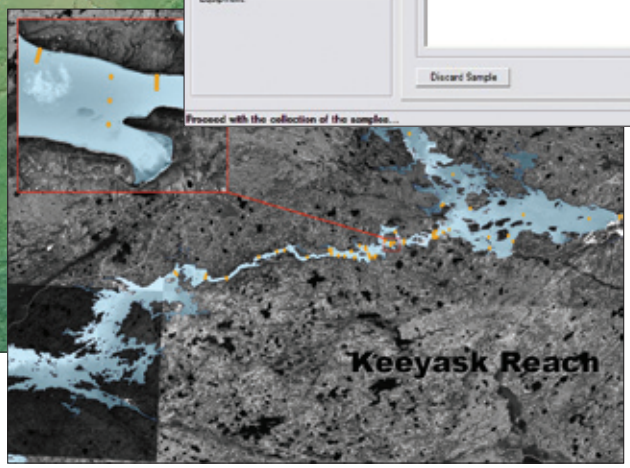
The ArcGIS Engine Developer Kit from the ESRI Developer Network (EDN) was used to prototype and build the application. Using this application, Manitoba Hydro was able to further leverage ESRI products including ArcGIS Desktop and ArcIMS for its data capture project. EDN is a subscription service that provides

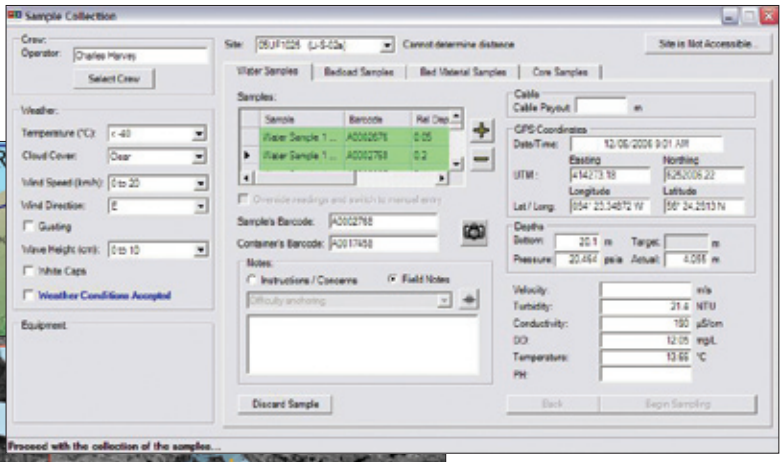


Estuary sites where samples are taken are displayed on the navigation interface/map.



Riverine teams and estuary teams use the GIS field application Rapid Capture to collect data from 630 sites along 500 km study area within a six-month period. This map shows team collection areas.





Interface with ArcGIS Engine Rapid Capture application is used for siting and collecting required samples.

Field data collectors use PC tablets to attach geospatial data to collected samples of water, bed material, and bed load. They also input associated data of temperature, turbidity, dissolved oxygen, and so forth.

software developers with an effective way to prototype and build geographic and mapping applications.

"Using the Rapid Capture application, our field crews are able to be more efficient with their sampling," said Ben Schmidt, GIS and Special Studies, Manitoba Hydro. "When we receive the data back in the office, we have greater confidence in it than we did in the past. The information coming from the field is consistent, and we do not need to spend time reviewing field notes and trying to understand what is happening at a location."

The Rapid Capture application provides field crews with a Tablet PC-based application that includes standardized menu options that contain the type of sampling being performed. Data accuracy has significantly increased because most of the data collection is now automated. Further, the application performs quality control on the incoming data by verifying that it is within a predetermined range.

The Rapid Capture application uses Wi-Fi hot spots in remote locations where, on a daily basis, field crews upload the data they have collected and also download current changes created in the sampling program. Because the application is integrated with GPS as well as orthophotos and bathymetric data, field crews can use it to better understand their surrounding environment. It also supports safe navigation between sites. ArcIMS is used in the office to monitor the location of the field crews via the tablets sending small messages with crew identification and current location through a satellite phone.

Samples collected in the field are labeled with a bar code, and that data is scanned, located, and identified in the GIS. Using the bar code reduces human error. The bar code number and attached data are forwarded to the lab, and before the sample case arrives, the lab already knows what to expect and can schedule the appropriate lab resources to handle the analysis. The resulting lab report also contains the bar code, and the GIS can perform a join based on this identifier.

Since its implementation in the spring of 2006, the Rapid Capture system has almost doubled the amount of data being collected by field crews.

For more information, visit www.esricanada.com or call 1-800-447-9778.

ESRI Developer Network Supports Embedded Design

ESRI Developer Network (EDN) is an annual subscription-based program that cost-effectively provides software developers with the resources needed to build a wide range of custom GIS solutions. The objectives of the EDN program include providing developers with tools that increase productivity and foster a collaborative environment, reduce the cost and complexity of GIS development, and provide maximum opportunities for development on the ArcGIS platform. For more information about EDN, go to www.esri.com/edn.

ESRI Developer Network™

Nicor Gas Improves ArcGIS for Distribution Integrity

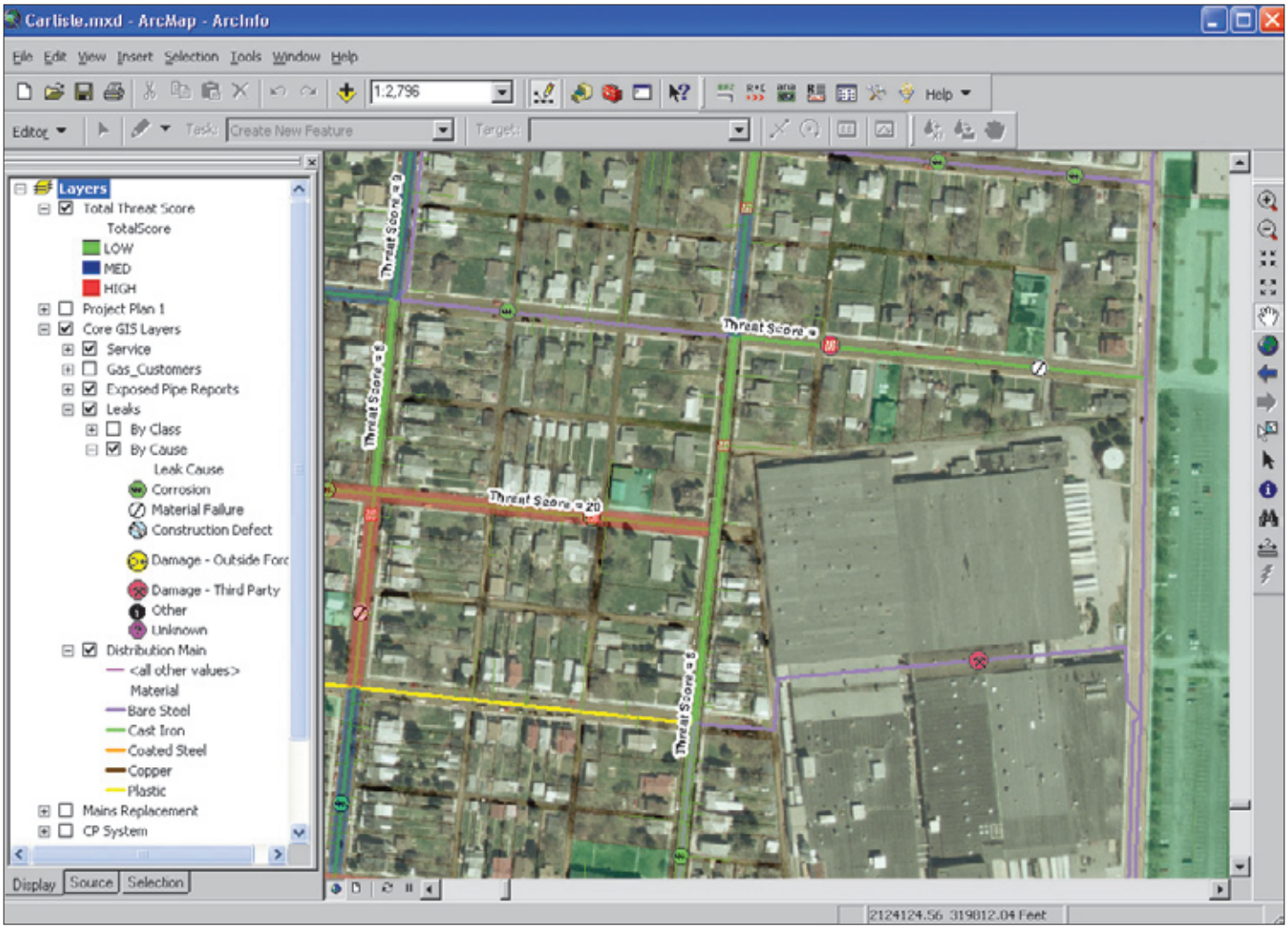
By Phil Eggen, Nicor Gas, and Brett Beaver, Advantica

The Pipeline Inspection, Protection, Enforcement, and Safety (PIPES) Act was signed into law by President Bush on December 29, 2006. As part of this law, the Pipeline and Hazardous Materials Safety Administration (PHMSA) must publish minimum standards for distribution integrity management programs for gas distribution pipelines. These new regulations require operators of natural gas distribution pipelines to implement an enhanced safety program similar to those already in place on hazardous liquids and natural gas transmission lines. The key elements an operator should consider for distribution integrity are

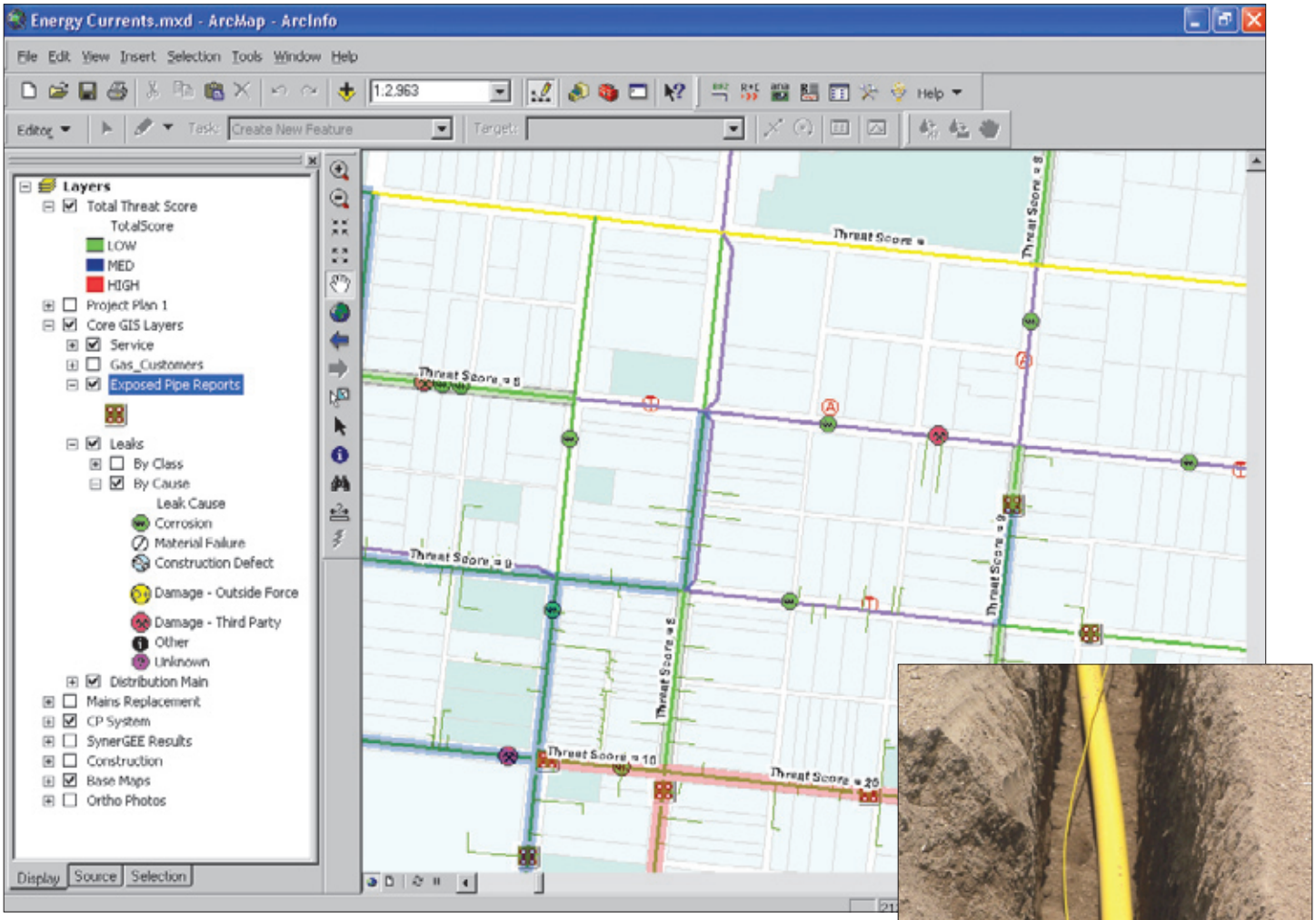
- Develop and implement a written integrity management plan.
- Know the infrastructure.
- Identify threats, both existing and of potential future importance.
- Assess and prioritize risks.
- Identify and implement appropriate measures to mitigate risks.
- Measure performance, monitor results, and evaluate the effectiveness of its programs, making changes where needed.
- Periodically report a limited set of performance measures to its regulator.

One of the core aspects of distribution integrity that traverses all these key elements is risk management. Risk management is a three-step process that incorporates identifying risks to the distribution system, determining how those risks can be mitigated, and monitoring those risks into the future.

Nicor Gas already uses ArcGIS to manage its distribution system. As a preemptive measure, it added Advantica's Mains Replacement Prioritization (MRP) application, taking a proactive approach to the proposed distribution integrity rule. Several of Nicor Gas' key objectives for improving its current risk management and main replacement processes in-



Nicor Gas GIS overlays the MRP results with the land base to perform spatial analysis between the identified potential pipe replacement projects and the surrounding land base: business districts, hospitals, schools, proximity to waterways, and highways.



In addition to the spatial analysis performed on the land base, Nicor Gas can support the decision-making process by displaying critical information about the gas distribution facilities.

cluded simplifying the process by integrating or reducing data sources, implementing an industry-standard approach to main replacement decision making, and implementing a solution that would enable better decision making in evaluating risk and main replacement options.

MRP is an ArcGIS extension application that provides risk analysis and main replacement decision support functionality. It uses ESRI's geodatabase for data warehousing. By leveraging ArcGIS, MRP provides the engineers with an integrated solution to the Nicor Gas leak management system, ALARM, and employs standard ArcGIS functionality to thematically map and report on a wealth of data that serves to drive the company's decision-making process.

The new streamlined process has made it easier for users to mine data and has eliminated the company's previous manual data collection processes. Pipe and leak information that was once annotated on paper maps is now warehoused in a standard database that is centralized for multiuser access.

When making asset replacement decisions about what assets to replace and when to replace them, Nicor Gas will have all facility data located in one place rather than spread across multiple applications. A centralized database with pipe condition and ranking results combined with land base and other Nicor Gas asset information leads to improved decision making by engineers who can easily see the entire picture at once.

About Nicor Gas: Nicor Gas provides natural gas to more than two million customers in northern Illinois and the suburbs of Chicago. The Nicor Gas system annually transports more than 494 million dekatherms (494 Bcf) of gas through more than 32,000 miles of main. Of the distribution main that Nicor Gas operates, the material composition varies among steel, cast iron, and plastic. Its service territory naturally places much of its distribution system within close proximity to areas of dense population, commercial buildings, and industrial centers.

Nicor Gas uses GIS to generate

- Exposed pipe reports
- Graphitized pipe reports
- City paving and moratorium zones
- Leak history
- Network analysis results
- Test point readings
- Pipe attributes—material, pressure, size, age

APDM Corner

Make the Best Decision for Pipeline Data Platform

By Chad Zamarin, Colonial Pipeline Company, and Debra Rohrer, NiSource

The selection of an enterprise data management platform is a significant business decision with long-term implications that increasingly drive or limit a company's future success. When selecting a platform, decision makers should consider factors including (1) existing infrastructure and data management systems, (2) short- and long-term business needs and desired functionality, (3) current and future product availability, (4) broad industry support, and (5) short- and long-term cost implications. In many cases, the ArcGIS Pipeline Data Model (APDM) proves to successfully balance the short- and long-term needs of users with the cost of implementation.

Common data management issues often faced by organizations include data redundancy, data segregation versus integration, multiple data formats, multiple data reference systems, labor intensive data maintenance, poor data quality control, limited security, and costly customization. An effective enterprise data management platform must be one that helps solve these issues while empowering an organization to effectively implement, maintain, and expand new technology. Stakeholders, whether employees, owners, regulatory agencies, or the public at large, are increasingly demanding actionable information. Integrity management, combined with increased public awareness, presents the pipeline industry with new, evolving, and complex challenges. This study explores a process for navigating the business decisions associated with implementing a new platform or upgrading an existing system to meet those challenges. In many cases, APDM can be the ideal solution.

For more information about this study, contact Craig Wilder, APDM Steering Committee chair, at Craig.Wilder@bp.com. For more information about APDM, visit www.apdm.net.

Migration from CAD to GIS Improves Gas Company's Facilities Management

TECO Peoples Gas, the largest natural gas utility in Florida, is standardizing GIS technology across all 15 of its operating centers. To improve its facilities management, Peoples Gas, a business unit of TECO Energy, is migrating all of its facility information systems from CAD to ESRI GIS software.

The new GIS will enable Peoples Gas to bring systems that were once disparate onto one software platform, which will make it easier for the company to access its facility database information. For example, field technicians will be able to locate network information faster, and field crews can be dispatched with even greater efficiency than before. The company's GIS includes ArcGIS Server, ArcEditor, and ArcInfo licenses.

ESRI's business partner UAI is migrating all Peoples Gas existing MicroStation data to ESRI/UAI format and providing services for integration of GIS data from various local agencies in 29 Florida counties and parcel-based geocoding of existing customer locations. Following conversion, UAI's ESRI-based UtilityCenter solution and its associated modules will be installed for use by personnel for field engineering and gas system network modeling, facility locating, trouble call management, crew dispatch, system maintenance, and compliance reporting for the Public Service Commission and other government agencies.

UAI will work with Peoples Gas to integrate existing third-party systems and supplement its existing pipeline integrity management plan by using ArcGIS software-based tools to analyze geographic data within potential impact zones for high-consequence area determination.

Peoples Gas' Mark Haney, general manager of Engineering Services, stated, "This GIS conversion project is a direct result of our efforts to achieve even higher levels of safety, standardization, and efficiency. The dedicated efforts among our statewide operations teams, corporate staff, and GIS service providers are helping make our vision a reality."

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Plan for Migration Supports CAD to GIS Changeover

highlight inserts, updates, and deletes. The team can navigate and check edits directly.

The DWG-In tool was a huge success. Georgia Power anticipated that the migrated data would have an accuracy rate of 80 percent, but it was much higher. After initial application testing, the tool was put into the production environment. A 10-member postscrub team familiar with the migration rules spent a month checking versions and outputs, comparing them to the data migration rules. After a month of scrutinizing review, the team members said, "We cannot check any more; we are tired of not finding anything."

With all the tooling and processes in place, production data conversion is under way. The team migrates several hundred tiles per day. During this migration phase, Georgia Power is still running a portion of its legacy application. Interfaces are being rewritten that apply to the new production system even while the company is in the throes of the migration process. By maintaining the existing AutoCAD AM/C system during this phase, the team has been able to disassociate the two databases and keep its operating processes going. Once the migration is finished, Georgia Power will not keep its CAD system. It will move completely into the ESRI GIS environment.

Special thanks to Rich Faglier, Distribution Support supervisor at Georgia Power, a Southern Company, and Faye Hall, senior software engineer at Enspiria Solutions, for providing the information for this article.

Learn more about Enspiria Solutions, an Osmose Company, at www.enspiria.com.

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