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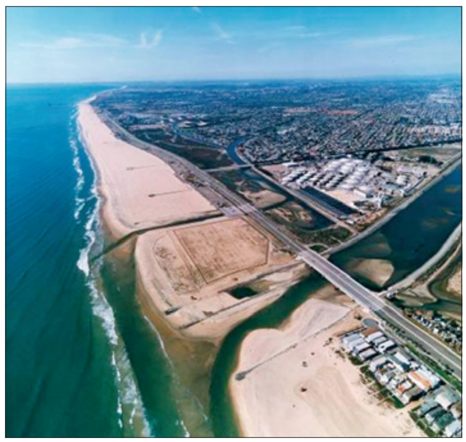
GIS for Water/Wastewater

In This Issue

Enterprise GIS in Wastewater Management

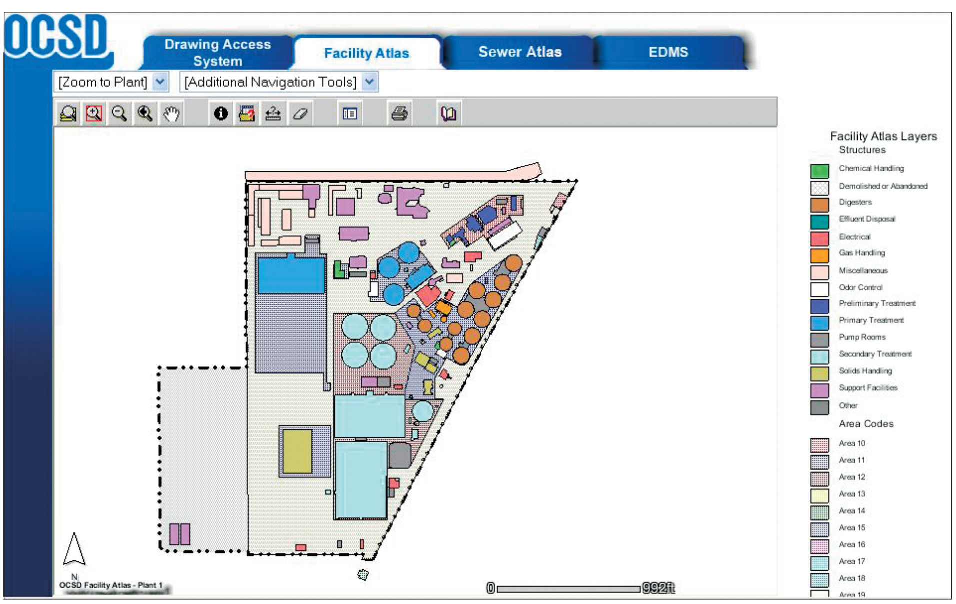
Steve DeWilde, GIS Coordinator, Orange County Sanitation District

The Orange County Sanitation District (OCSD) operates wastewater treatment plants in Fountain Valley and Huntington Beach, California. These plants receive residential and industrial/commercial wastewater from approximately 2.5 million inhabitants and 579 permitted industrial sources located within a 471-square-mile service area. OCSD's mission is to collect, process, and recycle or dispose of the treated wastewater while protecting human health, preserving coastal resources, and protecting air quality in accordance with federal, state, and local laws and regulations. The wastewater treatment plants receive and process influent volumes averaging 250 million gallons per day (MGD). Once treated, OCSD discharges the effluent to the ocean through a submarine outfall located in 200 feet of water depth and 4.5 miles offshore of Huntington Beach.



Orange County Sanitation District

OCSD has implemented an enterprise geographic information system (EGIS) program coordinated from within the Information Technology (IT) Department. The program has grown and developed into an organizational structure in which departmental users view, analyze, and maintain GIS datasets in the effort to improve business processes and decision making.



Plant and facility atlas

Background and Environment

OCSD first began discussing geographic information systems back in the early 1990s. In fact, OCSD's electronic document management system (EDMS) recorded a piece of correspondence in the Engineering Department that recommended bringing a system on board in 1991. The effort began in 1997 with a budget line item for a GIS program of $4 million. In the late 1990s, discussions occurred and requirements were gathered to digitize "design and build" project documents, including construction drawings, into an EDMS.

This effort was driven by the need to capture a soon-to-be-retired staff member's encyclopedic knowledge of treatment plant facilities. The initiative became the first GIS-related project undertaken, and it ambitiously integrated the new EDMS with the new GIS. The systems deployed included ESRI's ArcInfo, ArcSDE, and ArcIMS. It utilized Autodesk Map to capture and attribute CAD features and convert them to shapefiles, then ArcInfo to load those shapefile features to ArcSDE. The EDMS used FileNET software to store and retrieve scanned images and native file formats. The intranet-based GIS applications accessing this information were called the (Plant) Facility Atlas and the (Engineering) Drawing Access System.

From 2001 to 2004, OCSD collection system manholes, sewers, and related features were digitized. This was an asset-mapping effort, designed to spatially enable the computerized maintenance management system (CMMS). In fact, many of the data attribute fields came from the CMMS. The data and tools delivered to OCSD were on the

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Fitting the Pieces Together with GIS

You've Built Your GIS—Now What?

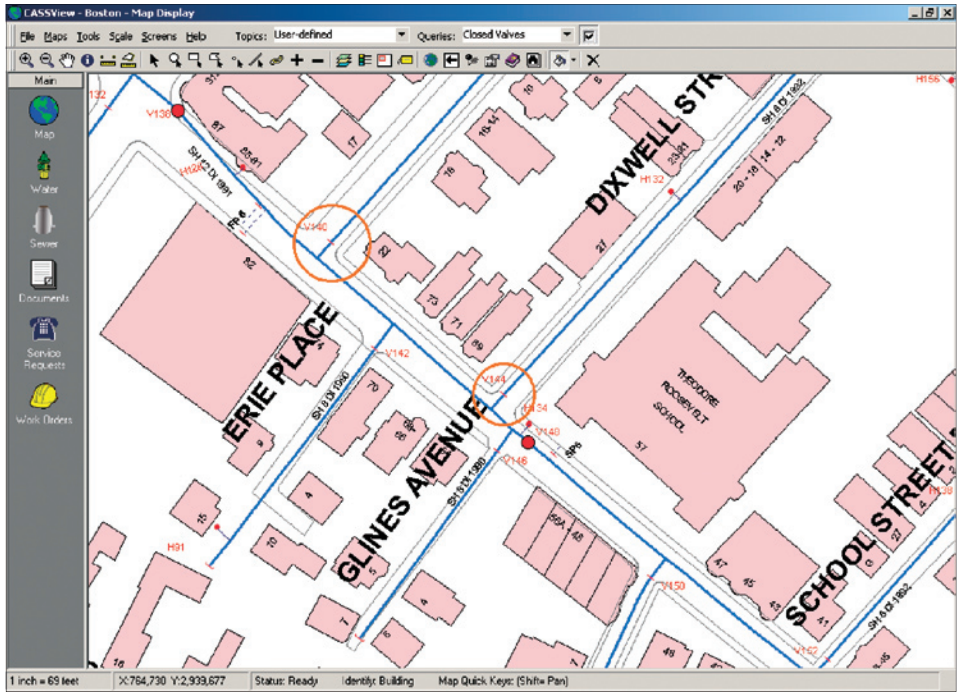
Why Integrate?

If you are like most water/wastewater utilities, you've invested several years and many dollars designing and populating your GIS. Chances are you've probably even developed a viewing interface for your employees and perhaps your customers. Congratulations, you've accomplished an important first step! Now the fun begins: putting that data to good use. While in data maintenance mode, you have the luxury to step back and consider how your GIS can add value to the tasks your organization currently performs and possibly enable you to accomplish things you never even imagined.

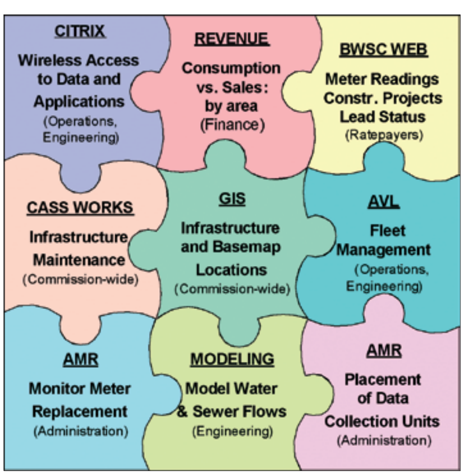
The Boston Water and Sewer Commission (BWSC) developed its GIS between 1992 and 2000, with the bulk of the data creation occurring in 1997 and 1998.

- 1992—Feasibility Study
- 1994—Pilot Study/Application Needs Assessment
- 1995—Aerial Photography
- 1997—Data Model Design/Data Conversion
- 1998—Release of the BWSC ArcView GIS Viewer
- 1999—Application Needs Assessment/ Application Strategies
- 2000—GIS WEB Viewer Development

Since 2000, BWSC has used GIS to support its operations not only in traditional and anticipated ways, such as asset management and hydraulic modeling, but also in creative and unexpected ways such as managing a citywide meter replacement project and analyzing possible causes of unaccounted-for water. Before GIS, BWSC departments gathered data for projects then stored it away, seldom reusing it or sharing it with other departments because there was no easy way to do so. BWSC's GIS, along with its Oracle databases, now provides a common platform for departments to share data, fitting together various puzzle pieces of information and opening up new possibilities for improving operations.



Shutting down valves for the hydrant-flushing program



BWSC's big puzzle

Integration Examples

Since 2000, in addition to providing access to GIS information via data viewers, BWSC has effectively utilized its GIS in a variety of projects that have helped serve customers more efficiently.

Work Management—Work management is a natural candidate for integration with GIS. In 2002, BWSC deployed RJN Group's CASS WORKS work order management software and GeoNorth's associated CASSView map-based work order viewing interface. When clerks create service requests and work orders in CASS WORKS, each record is geocoded to one or more locations based on either the associated water/ sewer feature(s) or, if there are none as in the case of a leak investigation, based on the problem address. As a result, users can click on a structure in CASSView and retrieve the history of all work performed on that asset. In addition, when a customer calls with a complaint, clerks can easily search the area around the specified address for similar work orders. A common GIS platform makes these analyses possible.

Plan Corrective Maintenance—BWSC staff are able to use the link between work history and GIS structures to diagnose problems and plan corrective maintenance. For example, the night clerk who receives a complaint from a customer without water can use CASSView to highlight closed valves in the area of the complaint. The clerk may then right-click on any of those valves to determine exactly who closed them and when. If they are closed for a construction project, it is quite possible that the customer is on bypass and that something has gone wrong with the bypass pipe. Based on the information in the work order, the clerk can arrange for immediate repair of the bypass pipe.

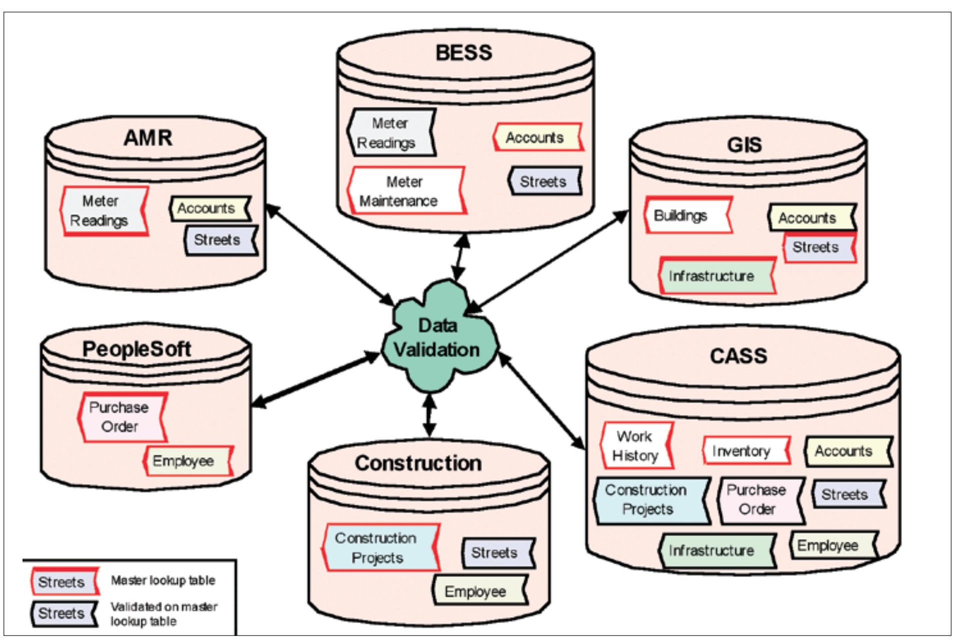
Valve position information is also useful when planning the hydrant flushing program. The figure above illustrates an area where a hydrant flushing plan calls for shutting down valves 140 and 144. The supervisor planning the hydrant flushing reviews the closed valves in the area and realizes that shutting valves 140 and 144 will leave several streets without water. As a result, the supervisor reschedules the flushing to occur after the valves have been reopened.

Plan Preventive Maintenance—Using the same technology, GIS helps BWSC plan its preventive maintenance (PM) activities. For example, every catch basin has a cleaning interval assigned to it. The default is 30 months for standard catch basins and 15 months for shallow catch basins. The PM manager has the ability to increase or reduce this interval for each structure based on the observed amount of debris removed during cleaning. BWSC's ArcView viewing interface has a function that analyzes each catch basin in a selected tile and highlights in red those due to be cleaned. BWSC staff and contractors use these maps to determine which basins to clean and help them plan an efficient route.

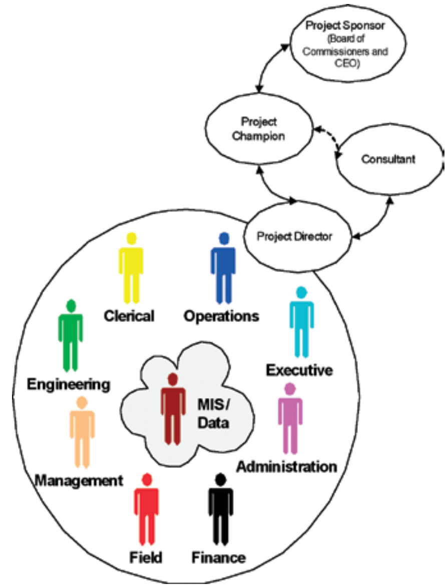
Automated Meter Reading (AMR)—In 2004, BWSC completed a program to replace all meters under two inches. In addition, fixed radio-based Meter Transmitter Units (MTUs) were installed on all meters, enabling BWSC to collect four meter readings per day on each meter. GIS proved to be a useful tool in managing two different aspects of this project.

Data Collection Unit (DCU) Placement—DCUs are designed to receive signals from MTUs transmitting within a one-mile radius. This design specification, however, is degraded if hills or buildings impede the airway between an MTU and DCU. BWSC developed a map showing the potential DCU locations (most on top of public schools) overlaid on 10-foot contour lines. During the meter and MTU installation, as the installation contractor worked systematically through the city, BWSC meter crews responding to customer calls anywhere in the city replaced the meter and installed the MTU while they had access to the building. In addition to preventing repeated requests for access, this strategy provided an unexpected benefit. By highlighting buildings based on whether any DCUs were able to successfully pick up their transmitted reading signals, BWSC was able to identify areas of weak DCU coverage and adjust DCU positions early in the project.

MTU Installation—During the meter replacement and MTU installation, it was sometimes unclear why MTU reading signals were not received. BWSC's GIS provided the ability to thematically map buildings by installation status and help determine the likely cause. Clusters of nontransmitting installations tended to indicate an area of weak DCU coverage as described above and could often be resolved by moving or adding DCUs. Isolated nontransmitting installations typically indicated poor MTU placement and were most often resolved by adjusting the location of the MTU. In addition, BWSC was able to use its CASS WORKS work order management system in conjunction with its installation tracking system to ensure that repairs and controllocates that could delay meter installations were completed in a timely manner. BWSC completed meter and MTU installation five months ahead of schedule, $1 million under budget, and with a greater than 99 percent success rate.



BWSC's data is shared and maintained among various departments.



BWSC's project management model

Lead Replacement—During the AMR meter replacement project, BWSC had installers record the service pipe material observed before the meter. Based on this information, BWSC prioritized customer outreach for its lead replacement program to those ratepayers observed to have lead in the private portion of their water service. In addition, having this information associated with the customer account and having the accounts associated with the building footprint in GIS enable BWSC to display the locations of lead services on maps, which serves as a tool to monitor the progress of the lead replacement program.

Unaccounted-for Water—All water utilities strive to reduce their unaccounted-for water, and BWSC is no different. In several areas of the city, it is possible to delineate on a map the exact area served by one or more Massachusetts Water Resources Authority (MWRA) meters. MWRA is the wholesaler from whom BWSC purchases its water. Using these areas, it is possible to select the buildings served by those meters and thus determine the associated water billing accounts. BWSC is now able to compare measured water consumption (sales) to MWRA purchases; the difference indicates how much water is being lost. To further refine the analysis, BWSC incorporates water use estimates for hydrant flushing, identified leaks, water main breaks, and construction bypasses. The results help to determine whether BWSC needs to boost its leak detection efforts, examine more closely the accuracy of the

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Enterprise GIS in Wastewater Management

Autodesk Map platform, using native and custom features and functions to capture attributes and create gridded map pages, both paper and electronic.

In spring 2005, the first version of the OCSD Sewer Geodatabase was completed. These feature classes and attributes were derived from the master CAD file delivered. GIS data rules were applied (feature geometry fidelity, similar or different class attributes or behaviors) to determine simple feature classes and an object table in the new geodatabase. These classes were modeled in Unified Modeling Language (UML) using the ESRI sewer UML as a guideline.

With a new sewer geodatabase implemented, reasonably up-to-date features were now served via the intranet-based Online Sewer Atlas. This ArcIMS image service displayed collection system features, basemap features, a custom geocoding index for searching addresses and intersections, other basic GIS Web service functions, and hyperlinks to scanned construction drawings and sewer atlas pages. The service also displayed low-resolution aerial orthophotos stored in ArcSDE raster format for fast retrieval.

2004 Enterprise GIS Strategic Planning

Throughout 2004, OCSD and Psomas consultants interviewed 120 staff members, compiled the results into a needs assessment aggregated into recommended applications and projects and delivered a document that has proven useful in guiding current and future efforts. Regional data-sharing opportunities also were compiled, inventorying sanitary and storm sewer data availability.

Major recommendations included five priority projects, mainly involving GIS and external system integrations; an organizational structure to support GIS; and a recommendation for current and future technical infrastructure needs.

Enterprise GIS Organizational Structure

The EGIS group in IT provides program coordination, database and application development services, and user training and support for OCSD staff. Additional responsibilities include updating GIS base reference data from third parties such as the parcel land base, street centerlines, land use, soils, and aerial orthophotos and creating geocoding services based on parcel and street centerline datasets across application platforms.

EGIS supports a variety of departmental GIS activities including

- Fats, oils, and grease monitoring
- Flow-tracing analysis to determine pollutant sources and interagency monitoring responsibilities
- DigSmart GIS for Underground Service Alerts (USAs)
- Ocean and seafloor mapping and monitoring
- Air quality monitoring
- Asset GIS feature data maintenance
- Asset corrosion and risk analysis
- Collection system maintenance work assignments

User departments, including Engineering, Operations, and Technical Services, view, analyze, map, and often maintain GIS data. Engineering provides GIS feature and attribute data maintenance for OCSD assets, using CAD design drawings and staff input as the source for treatment plant and collection system asset updates. Engineering also provides cartographic services and updates the hydraulic model with GIS data. Other departments provide and maintain geographically related data for sewer trouble spots, sanitary sewer overflows, odor- and spill-complaint locations, sensitive receptors (senior centers and child care) for air quality, and other data relevant to OCSD business.

This organizational structure has allowed for effective communication in a GIS context between departmental users. Maps, map documents (MXDs), and data can be shared between ArcView users. Unnecessary work process bottlenecks, such as map requests that used to take days to complete, can now be addressed by trained and empowered users able to view, query, and analyze GIS and related data in ArcView or intranet map services.

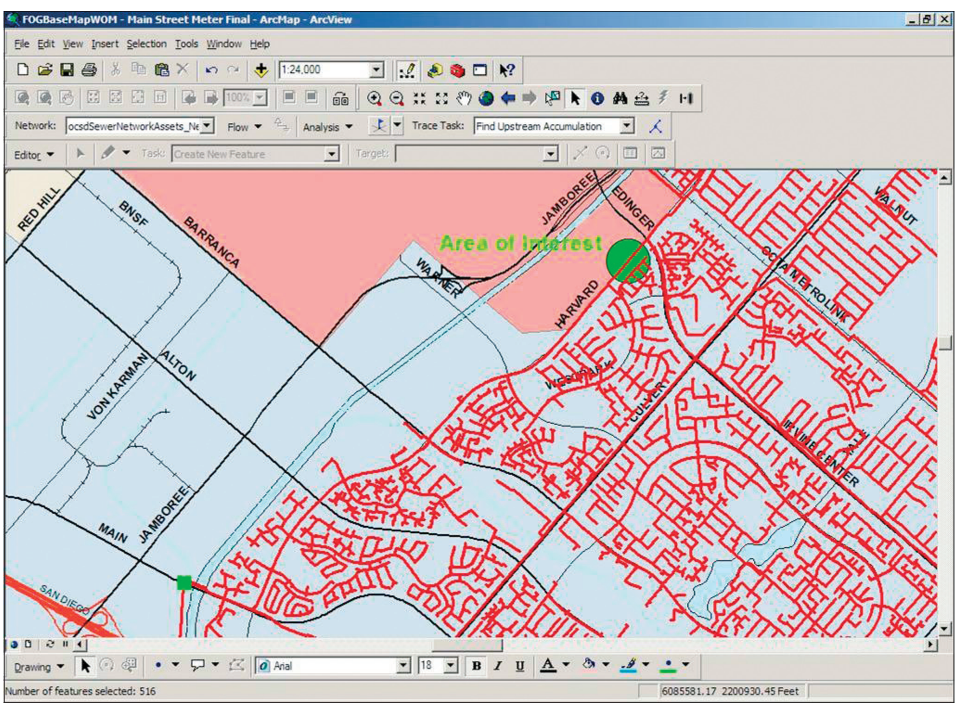
Application and Database Framework

Early in the strategic planning process, IT added two experienced GIS professionals. In the subsequent two-plus years, OCSD has expanded GIS Web services, ArcGIS Desktop, and mobile GPS/GIS usage.

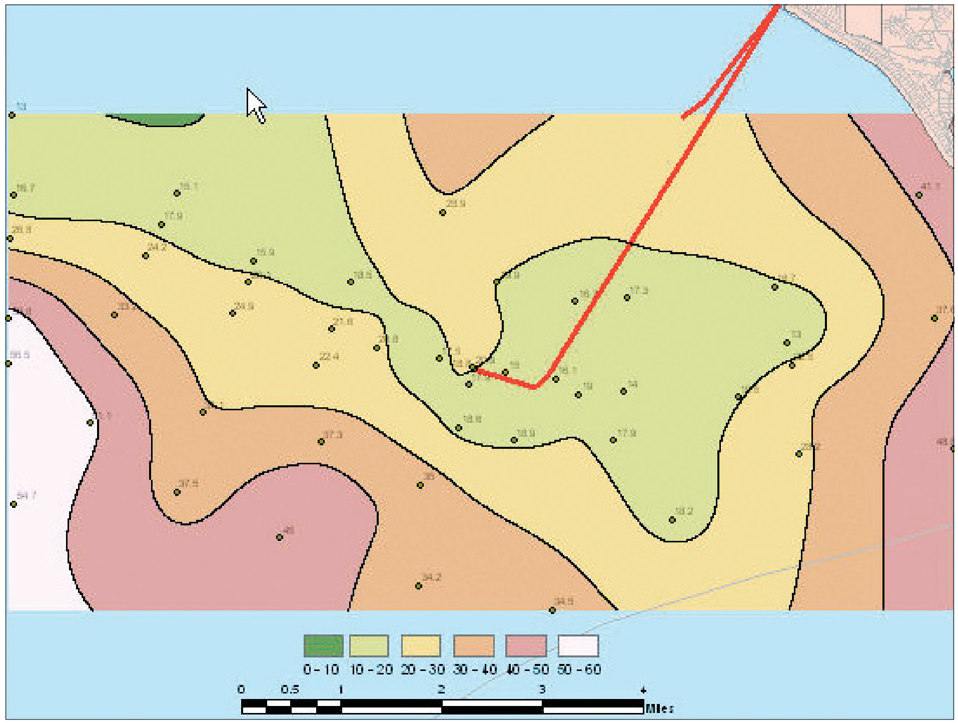
OCSD now has 22 ArcView users distributed throughout six of its eight departments, 2 ArcEditor users in the Engineering Department, and 3 ArcInfo users/data administrators in both IT and Engineering. ArcGIS Desktop users have been trained through in-house staff, ESRI instructors on-site, and *Introduction to ArcGIS* training manuals. Tutorial data is posted to a network file server. Enterprise GIS intranet pages communicate program objectives and activities, training opportunities, and available data. These staff members have increased the level of GIS expertise in each department.

ArcPad has been used on three Trimble GeoXT (soon upgrading to the GeoXH model) mobile GPS units in the collection systems maintenance group for the past two years, first supporting the USA program in marking buried assets for excavation protection utilizing Bergmann Associates' DigSmart extension to ArcView. Later, it became a tool for capturing asset location and attribute discrepancies in the GIS data. The Technical Services Department is also experimenting with mobile GIS for tracking monitoring locations and field attribute capture.

The intranet community of users includes approximately 200 staff members who can view collection systems, plant facilities, and quick and easy locator map information. The ArcIMS map services are used for locating assets, viewing barriers and providing a locator map to maintenance



Network trace at OCSD



Chromium spline

activities, locating chemical treatment sites, and much more.

The priority system integration projects identified in the 2004 Strategic Plan were GIS-Computerized Maintenance Management System (CMMS), GIS-Complaints, and GIS-Permits. An essential interface was deployed in summer 2006 that integrates sewer connection permits with geography. The application allows public counter staff to create, store, retrieve, print, and geographically view permits granted to residents, developers, and public agencies. The interface is built as an ArcView custom extension by the EGIS programmer with several years' experience using ArcObjects. This effort will provide quality data for future permit integrations.

GIS data is managed from three environments as well. At the top level, the ArcSDE/Oracle RDBMS contains enterprise-wide GIS data, centrally managed by an enterprise administrator and one departmental administrator. Feature metadata is available on the EGIS intranet pages and in ArcCatalog. Many of these datasets are served to intranet GIS users via ArcIMS map services. All datasets are accessible to the ArcGIS Desktop user community.

The second tier of enterprise-managed data is file based and network server shared. These datasets have metadata tracked within a Microsoft Access database. Typical data found here includes shapefiles and other GIS or CAD files used for map production including shoreline buffers for cartographic enhancement, other agency asset data, or reference data beyond OCSD jurisdiction (e.g., shapefiles of roads or highways for all of California). This file-based repository allows for GIS data sharing between desktop users without incurring the overhead required for ArcSDE administration.

The final managed GIS data tier is work-in-progress data used for a mapping or analysis project that may not have wide use or application outside the immediate project. These datasets are usually on a local hard drive and not shared with other users. Any metadata tracking is solely at the discretion of the data creator.

Success Stories

The ultimate success of an enterprise GIS depends on its users. In this regard, selective deployment of ArcView Desktop has paid off very well for OCSD. Staff receiving ArcView was chosen based on business need and personal interest, with particular attention given to divisions with related data to apply to geography. Six of OCSD's eight departments now have ArcView users.

With training and support, these users have

- Performed asset risk analysis by spatially representing pipe age, material, and soil characteristics
- Assigned maintenance activities by performing attribute queries on pipes within a diameter range and in a particular drainage area
- Determined interagency monitoring responsibilities for point-source dischargers with network tracing
- Linked CCTV observations to sewer line features
- Geocoded child and senior care centers from Health Department data and overlaid these on an air quality surface model created with the Spatial Analyst extension
- Created seafloor sediment pollutant concentration maps using the point-to-raster interpolation functionality within Spatial Analyst

Summary

Key to the OCSD enterprise GIS program is the integration of external data systems, which maximize opportunities to visualize information. These links are extremely beneficial to effective decision making. Foundational elements, both data and application development tools, have priority in managing and implementing enterprise GIS. The strategic focus of the EGIS staff has been to acquire and implement the sewer geodatabase, Orange County's parcel land base, high-quality aerial orthophotos, and a GIS Web services software development tool. These four cornerstones allow for effective, efficient, and far-reaching deployments of location-based information for wastewater management.

The OCSD is on its way to completing this foundation. The sewer geodatabase and high-quality orthophotos are in place. OCSD acquired the GIS Web services development tool in summer 2006. EGIS staff will then work with user departments to integrate the CMMS with GIS, displaying map asset features within the browser, linkable to maintenance work orders, histories, and perhaps sewer line inspection videos. OCSD hopes to acquire the parcel land base later this year as well.

As other GIS and external datasets become available and stable, additional Web services will be created. These will link odor, spill, and property damage complaints; county assessor data; permit data; and lab results to geography.

Coordinating enterprise GIS efforts from IT allows a comprehensive, agency-wide view, considering system integration needs and opportunities from both end user and system administration perspectives. Ideally, an agency following this model will find skill sets that blend extensive GIS experience with understanding of IT principles and practices to design, implement, and support a framework of operation. Effective GIS management is achieved through an awareness of staff, political, budgetary, and technology opportunities and challenges. The Orange County Sanitation District has been successful in its enterprise GIS implementation to date and will reap even more benefits in the future.

GIS Improves Construction Management

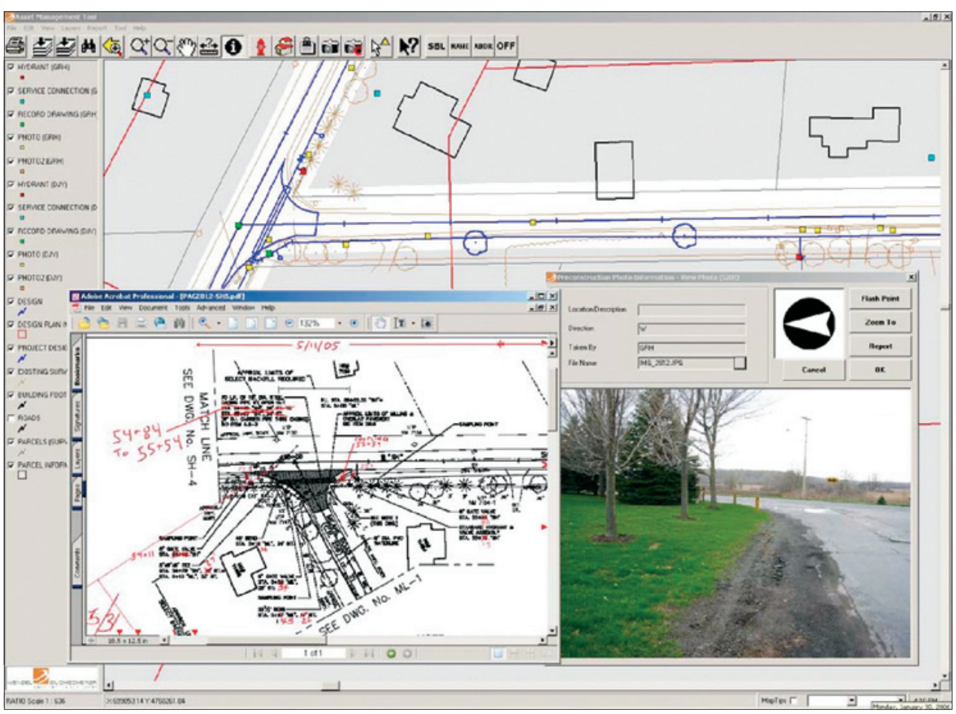
The Town of Newstead is located in the northeastern corner of Erie County in western New York. It is a rural community with more than 40 percent of the area devoted to agriculture. This agriculture characteristic is the town's basic heritage dating back to its founding in 1823. During the past few decades, the Town of Newstead has struggled with its identity. It is striving to provide services to its residents and grow at a controlled rate while maintaining its rural character. A decade ago, the Town Board took several measures to help guide Newstead's future. It developed its first Town Master Plan, bought vacant land through grant money for future public use, started to expand water service to additional areas, and purchased the rights to various abandoned railroads in the town.

The desire to provide a safe and dependable water supply to existing and future town residents has led to the creation of 10 water districts. Newstead sought the help of its town engineer, Wendel Duchscherer Architects & Engineers, in the improvement of the existing water system and the installation of new infrastructure needed to facilitate this expansion. The Erie County Water Authority was also contracted for lease management services to provide operation and maintenance services for the water system infrastructure. The most recent, and most extensive, expansion was for Water District No. 10. This water district includes approximately 60 percent of the land area of the town. Due to the size of the water district and the cost of providing water to these residents, a phased approach was taken for the installation of the water infrastructure. Phase 1 is currently ongoing and includes the construction of 28 miles of waterline along the most populous roads within the water district. Phase 2, an additional 9 miles of waterline, is in the planning stage with an estimated construction start date of summer 2006. The complexities of managing such a large construction project in many different areas of the town has led Wendel Duchscherer to evolve common construction management practices and look to new technologies and the ideals of GIS to improve its communication and data-sharing capabilities.

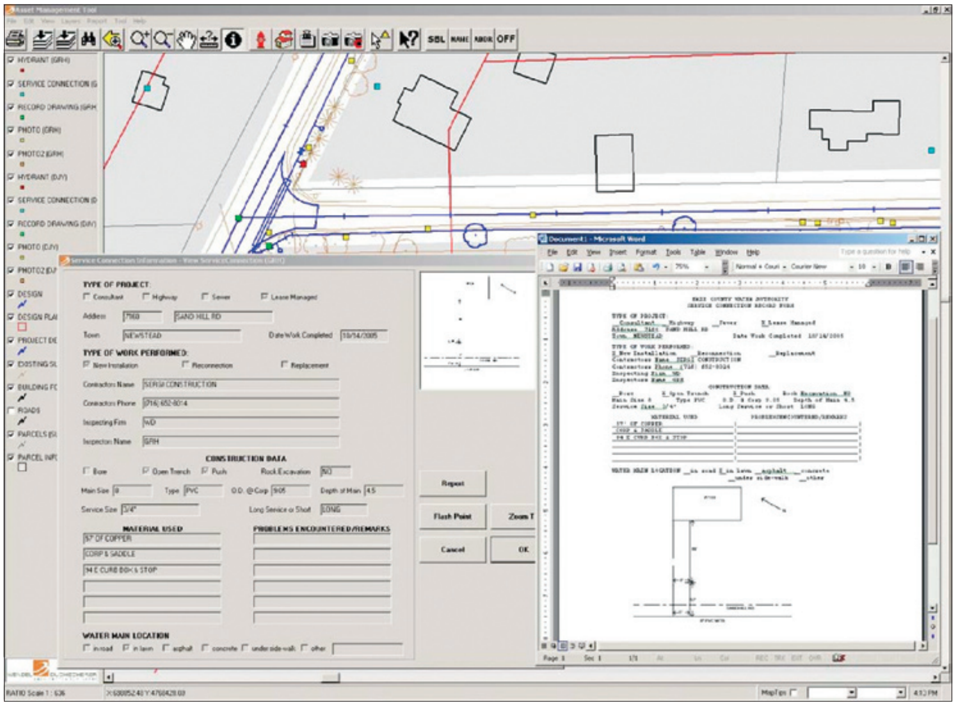
A construction project is replete with problems that occur when poor and inefficient communication exists between owners, engineers, contractors, and the public. Even in today's technologically advanced society, daily field activities and record-drawing information are still recorded manually and delivered weeks or months later. This lack of communication and data sharing has a direct impact on claims, public relations, and project cost containment. To lessen these problems and inefficiencies, a streamlined and efficient solution was developed for getting the knowledge of the field crew into the hands of Wendel Duchscherer engineers and Town of Newstead staff within the same day.

All documentation is now controlled through a geographically driven interface using ESRI MapObjects software alongside Primavera Expedition, a Web-enabled project management software. By taking advantage of advances in technology and engineering, the field inspector's reports and sketches were turned into electronic forms to be filled out and stored on Tablet PCs. To ensure a smooth transition from paper to digital form and minimize training for field inspectors, the standard hydrant and water service inspection paper forms were re-created via database inputed forms to provide easy, organized access to all collected information. Each form, sketch, or documented progress photo was inputted through a customized MapObjects application combining Newstead basemap information with CAD design plans of the water project. Documentation input of all inspected features is initiated by clicking on the desired location in the created map window. Other information, such as daily field reports, material installed by the contractor, and correspondence, is recorded through Expedition. To fully utilize and combine the capabilities of each application, a migration of the existing program to ArcObjects for a seamless integration with Expedition is currently being designed.

This blend of technology, engineering, management practices, and GIS concepts simplified the transfer and reduced unneeded duplication of information between all parties by organizing the data through linked points on the design plans and providing wireless data transfer from the field. Each involved party, including the Town of Newstead supervisor and



Construction management tool showing documentation and viewing of design changes and pre/postconstruction photos during installation of waterline in Newstead



Construction management tool utilized by town staff, project managers, and field inspectors for filling out and creating reports of service connections during construction

Highway Department superintendent, Wendel Duchscherer construction managers and engineers, as well as each construction field inspector, is provided with the same MapObjects interface for tracking construction progress and viewing the documented in-field design and construction issues. This allowed Wendel Duchscherer's construction managers and town staff to understand construction issues and progress much more easily as well as improve communication between staff and concerned residents.

The project has delivered a more connected project team; town staff; and most important, town residents. The end result has shown that, with enhanced communications and data-sharing capabilities, the Town of Newstead and Wendel Duchscherer were able to reduce claims, provide better public relations, and improve overall project cost containment.

The authors would like to thank the Newstead Town Board for making the development and use of this solution a success. For additional information, contact Wendel Duchscherer's project manager, Daniel Seider (dseider@wd-ae.com), or GIS manager, Nathan Carter (ncarter@wd-ae.com), at 716-688-0766.

"The user group puts me in contact with other GIS professionals throughout the country. The benefit of sharing the experiences with other users allows us to enhance our practices and also learn what not to do. In addition, I now have an appreciation for the sport of curling."

David Raffenberg
Information Technology Assistant Manager
Greater Cincinnati Water Works, Ohio

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Northeast
Barbara MacFarland, Chairman, The Metropolitan District (MDC), CT

Never Too Small for Progress

By Bob Mitchell, Director, Inlet Beach Water System

Michell Carter, GISP, GIS Coordinator, Metric Engineering, Inc.

Overview

Inlet Beach is a small, unincorporated coastal community located in the Florida Panhandle between Panama City and Destin, Florida. This 500-acre community located on the crystal white beaches of the Gulf Coast is the home of approximately 900 residents.

Inlet Beach Water System (IBWS) is a consumer-owned nonprofit utility company. As late as 1986, IBWS was a 200-connection system with a two-year waiting list for a water meter. By 2003, IBWS had grown to 400 water meters and faced the challenge of adding a sewer system to accommodate the demands of developers. In the last three years, IBWS has grown to 940 connections with sewer service available to every customer.

Prior to the development of a GIS database for the community of Inlet Beach, utility information was maintained on traditional paper and Mylar maps. Some of these maps were 20 years old and were hand drawn over county tax maps. The maps detailed most assets with a reasonable degree of accuracy, but they were becoming increasingly difficult to manage due to the rapid growth of the community and the need to continuously update feature locations. In 2001, IBWS attempted to inventory the system features by their GPS coordinates. However, budget contraints limited its ability to hire trained personnel and purchase all the hardware and software they would need to collect data and relocate features accurately.

In 2005, IBWS director Bob Mitchell met Martin Copping, GIS solutions manager for Metric Engineering, Inc., at the annual Alabama/Florida Rural Water Association conference and expressed his vision of creating a more efficient way to manage the utility system, convert all of his company's engineering data into a digital format, and be able to share this digital data with his staff and other agencies in the county. This vision became a realistic and attainable goal through the development of a custom ArcPad application for field data collection and the implementation of Metric Engineering's GISLite™ Solution.

Database Design and Implementation

Before any fieldwork began, the Metric Engineering GIS Solutions team met with the IBWS staff and completed a user needs assessment. Utilizing ESRI's Water Utilities Data

Field data collection by Inlet Beach staff

Model as the foundation, the GIS Solutions team modified this data model to meet IBWS requirements and incorporated it into the geodatabase.

After the data model was created, the process of locating every hydrant, valve, meter, manhole, and pump station began. The collected data was verified and the GPS coordinates were recorded. This was accomplished by using a customized ESRI ArcPad application on a Trimble Recon handheld PC with a Trimble Pathfinder® ProXH™ GPS. The ArcPad application was customized using ESRI's ArcPad Application Builder and VBScript, so that the data could be checked in and checked out of the geodatabase, seamlessly imported into the GIS, and then shared through GISLite. GISLite is a hosted solution that is built on ESRI's ArcGIS Server technology. It provides IBWS users with Web-based access to the utilities data without necessitating a large investment in hardware, software, and personnel—thus working within their budget constraints.

The water and sewer distribution system is of interest to many departments. By posting the collected data at regular intervals to the GISLite Web site, any IBWS staff member, decision maker, and municipal staff with a Web browser can access the data for each structure of the water distribution system whether at the office, at home, or in the field 24/7. GISLite also enables IBWS staff to perform analysis and produce reports. Since the project has begun, more than 1,500 features have been field verified.

Conclusion

IBWS has seen immediate benefits from implementing GISLite; these include elimination of duplicate drawings, easier reproduction of maps, and use of real-time data to make better decisions. Further, the water company will now be able to maintain a more accurate account of its assets, save time searching for inventory information, and share GIS data within the department and with the county through a user-friendly Web interface 24 hours a day, 7 days a week. "We can solve our real-world, everyday problems, like knowing which valves to shut off during a main break and who will be affected. No more need for looking through paper drawings and plans at the office," said Mitchell.

While the GIS program moves forward, the community of Inlet Beach continues to make progress with the field data collection and enhancements to the GIS. Mitchell continued, "The ability to use GIS as a tool to help meet our needs is now more than just a vision; it is a part of Inlet Beach's daily business."

Contacts for Information

Bob Mitchell, Director, IBWS
850-231-4498 and ibws@earthlink.net
or
Martin Copping, GIS Solutions Manager, Metric Engineering, Inc.
786-251-2356 and mcopping@metriceng.com

Team Water/Wastewater would like to congratulate City of Portland, Oregon, Water Bureau; Orange County Sanitation District, California; Acquedotto Pugliese SpA, Italy; and Servicio de Agua Potable y Alcantarillado de Lima, Peru, for the Special Achievement in GIS awards they received at the 2006 ESRI International User Conference.

Jeff Amero, City of Cambridge, MA
Gilbert Osei-Kwadwo, Fairfax County Wastewater Management, VA
Nancy Pullen, Boston Water and Sewer, MA
Sigi Sharp, Washington Suburban Sanitary District, DC
Dave Ward, Loudoun County, VA

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Sasa Tomic, Wallingford Software, TX
Nicole Schmidt, GBA Master Series, MO
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Pete Brandstetter, City of Albany, OR
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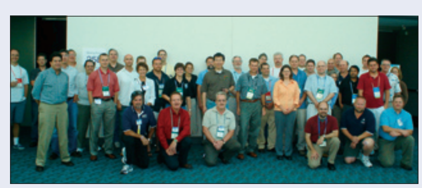
Lesley Roddam, Walt Disney World Corporation, RCES, FL
Joel Watson, Spartanburg Water System, SC
Victoria Wing, Columbia County, GA

Southeast Partner Council
Dale Dunham, Geographic Information Services, AL
Michah Callough, ARCADIS, SC
Michael Gilbrook, HDR, FL
Andy Moore, CH2M HILL
Mark Nelson, Jones Edmunds & Associates, Inc., FL

AWWA Liaison
Ed Baruth, American Water Works Association, CO

WEF Liaison
Nan Tucker, Water Environment Federation, VA



Impress Software Solutions, Inc.

Impress Software Solutions, Inc.'s Impress for GIS is a packaged integration application that allows the efficient and cost-effective integration of SAP and ESRI ArcGIS to streamline EAM processes.

For water utilities and other organizations that rely heavily on IT to manage a set of geographically dispersed assets, Impress for GIS is a solution specifically optimized for bridging SAP with ESRI's ArcGIS. It automatically links SAP assets with GIS features and keeps the asset information in sync with other systems, dramatically reducing data administration costs. Leveraging Impress for GIS, service organizations can easily access and manipulate SAP asset information and work management processes directly from the familiar confines of the GIS.

An ArcGIS/SAP integration is a complex one, often requiring the bidirectional transfer of asset data as well as the need to continuously link asset data in both real time and batch transfers. Impress for GIS is designed to address these requirements and can be implemented in a fraction of the time a custom integration requires while providing the peace of mind of a certified and supported solution. Impress for GIS enables ArcGIS customers to

- Increase workforce productivity by streamlining processes and providing easy access to key SAP information and processes from the map.
- Improve customer service by arming field service organizations with insight to make better decisions, accelerate repair time, and improve asset performance.
- Enhance business analytics by enabling spatial analysis of SAP information to strengthen decision making and improve resource planning.
- Lower total cost of ownership by accelerating implementations, lowering maintenance costs, and using a solution fully supported by Impress software.

Impress for GIS is organized into two application modules:

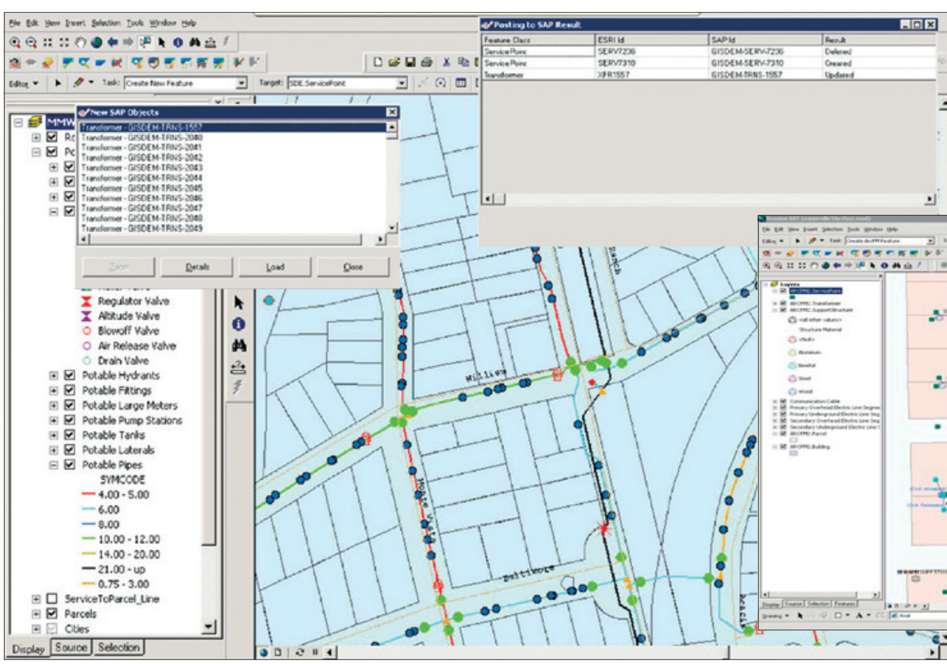
- The Asset Data Management module automatically synchronizes asset-related information between SAP and GIS to ensure both systems remain up-to-date and accurate. It also allows GIS users to access and manipulate SAP data including asset creation, modification, and deletion. GIS users can view asset information, previously only accessible from SAP, from the map to facilitate the diagnosis and repair process.
- The Maintenance and Operations module enables access to SAP work management data and processes from the GIS. GIS users can create work orders and notifications, update status information, and assign orders and notifications to features on the map. In addition, they can analyze SAP work order information with a point-and-click search using multiple user-defined criteria. This information can be rendered on the map and color-coded for spatial analysis and at-a-glance viewing to improve decision making.

History of the Impress for GIS Product

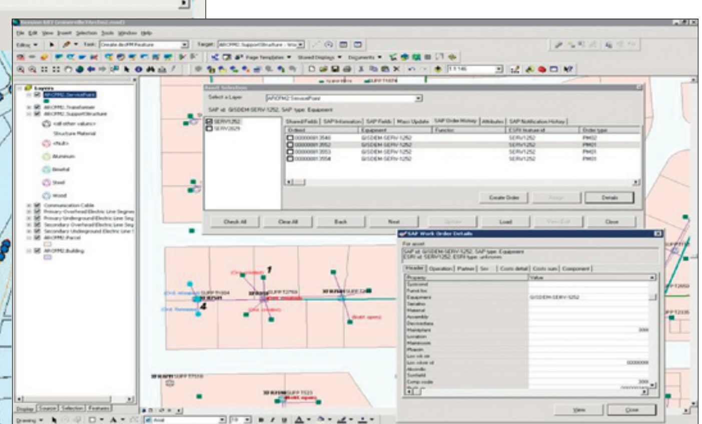
Impress for GIS was created in response to growing demand by ESRI customers for a reliable and cost-effective integration solution. Marin Municipal Water District in California's Bay Area, for example, is a veteran GIS user that has relied on systems from ESRI for more than a decade. During its GIS implementation, the water district built a custom integration between its mapping system from ESRI and SAP. The district invested more than a year of work and considerable resources building this custom interface, but after the initial rollout, each change or addition to either the SAP or ESRI system required a custom project involving both contractors and the district's IT department to maintain the integration. The ongoing support and maintenance of the interface proved to be costly and time consuming, prompting the water district to seek a commercially available solution. At the recommendation of ESRI, the district chose to work with Impress Software. Through working with Impress, the water district found that a packaged solution to a critical problem required fewer resources (people, time, and money) and was robust enough to fully address its integration requirements.

For more information about integrating SAP and ArcGIS, contact

Impress Software Solutions, Inc.
460 Totten Pond Road, Suite 200
Waltham, MA 02451
Phone: 781-419-5600
Fax: 781-419-5666



Synchronize SAP assets and GIS features.



Spatially analyze work order statistics.

Fitting the Pieces Together with GIS

continued from page 3

wholesale meters, or perhaps close a bypass pipe that may have been left open.

Identification of Missing Accounts—To perform many of the analyses listed above, it was necessary to establish a link between the buildings on the map and the account numbers that uniquely identify consumption, billing, and service material. While performing the research necessary to establish acute building to account links, BWSC identified several locations where water was being used but no account had been established. This allowed BWSC to establish the appropriate accounts and begin collecting revenue for that consumption.

How Did BWSC Do It?

These are just a few examples of how GIS has helped BWSC integrate data and applications to benefit the organization. With access to more accurate and current data, BWSC has improved overall communication between departments and across the commission. These successes can be attributed to three key factors: reliable standards, effective organizational structure, and active participation.

Reliable Standards—They're not glamorous, and if used correctly, most people don't even realize they exist, but standards are critical for integrating data across an organization. When BWSC rolled out its GIS, a review of commission databases would have shown different street lookup tables for various databases in different departments. GIS used one set of street names and abbreviations, the billing database used another, and several small Access databases used no street name validation at all. Similarly, some databases referred to employees by first name then last name, others by initials, and others by last name then first name. Without data standards, BWSC found it impossible to answer questions such as "Tell me all the work we've ever done at a particular address" or "Tell me all the work completed by a specific employee" because the information was recorded in so many different ways.

Since that time, BWSC has identified which data to standardize and which departments are the "designated owners" responsible for the data maintenance. Street name information is managed by GIS staff. All street names have a unique code, and all references to street names are validated and stored using the street code. This arrangement ensures that the data is well controlled and guarantees that street name changes made in the master table are reflected in all other tables and applications since only the code is stored. Similarly, all employee names are defined once in a PeopleSoft database maintained by Human Resources. All references in other tables to BWSC employees are stored by their unique employee ID. The figure on page 3 (lower left) illustrates data that is shared among various departments and highlights which department is responsible for maintaining that data.

Effective Organizational Structure—Any project must have sufficient resources to be successful. These resources may take the form of institutional knowledge, hardware, software, consulting expertise, and/or dedicated project management. Therefore, it is critical that the people in the organization who have the authority to control resources be involved in the project and have a thorough, up-front understanding of the project costs and benefits. This is especially effective when it is possible to show a clear connection between the project's success and some visible measurement such as cost savings because of elimination of duplicate work orders, reduction in customer calls due to a well-designed Web page, or decrease in unaccounted-for water. In addition, these decision makers must be kept apprised of the project's status including any changes to the anticipated schedule and budget and the reasons for those changes. Before BWSC begins any project, it must be endorsed by the executive director and chief operating officer as well as any relevant department heads. It must also receive the approval of BWSC's three-member Board of Commissioners. In approving the project with a thorough understanding of the costs and benefits, BWSC's decision makers commit to providing the resources necessary to complete the project successfully.

BWSC has also found that data integration projects spanning departments must be assigned to a project manager that is not a member of any of those departments. The commission's organizational structure has project managers reporting directly to the chief operating officer, making it possible to coordinate resources from all stakeholding departments without generating resentment among those departments.

ArcView interface that analyzes each catch basin and highlights those due to be cleaned

Active Participation—The final key to integration success is active participation. BWSC's project management model requires active participation from all affected groups from field personnel to office personnel, from clerks to management. If a group's workflow will be affected by a project or if its institutional knowledge is needed, then a representative of that group must participate in the project team.

Employees who participate on project teams are more likely to make the best use of the resulting applications and share their enthusiasm with their coworkers. Employees who see their suggestions implemented in applications are more likely to generate ideas for new uses of data and participate in their development. A review of BWSC project teams would illustrate a broad diversity of participating members from line staff to executive management and spanning all departments.

Although it takes time, reliable standards, effective organizational structure, and active participation can result in an exciting upward spiral, allowing organizations to capitalize on their investment in data: Project participants who see their suggestions reflected in successful applications are more likely to make use of those applications. Staff who utilize applications to perform their jobs more easily and effectively generate widespread interest and use throughout the organization. Widespread use of integrated data and applications by people performing diverse jobs generates discussion and ideas for new uses of data. New ideas are implemented with active participation from stakeholders—continuing the upward spiral. Organizations and their employees and customers all reap the benefits.

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Send inquiries to
Lori Armstrong, Water Resources
Industry Solutions Manager
larmstrong@esri.com

105294
43.3M12/06sp

ESRI
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