water writes
northwest
Fall 2002

The City of Bozeman

By John Henderson
GIS Manager, City of Bozeman

The city of Bozeman, situated in beautiful southwest Montana, is home to one of the state's newest GIS programs. We began developing base layers such as parcels and road centerlines in the spring of 2000 with plans to expand the system enterprisewide. Only recently have we acquired the necessary data that will help us manage our assets more efficiently—in particular, mapping our water, wastewater, and storm water infrastructure in a dynamic spatial database that will help us become more effective in serving the public's needs in a growing environment.

The city of Bozeman remains one of the fastest growing cities in Montana. With a population of 32,000 and a growth rate of 40 percent in the last 10 years, it's easy to see the need for a more efficient way of managing infrastructure assets. The Water and Sewer Department services more than 7,000 connections and maintains approximately 110 miles of sanitary sewer mains and 145 miles of transmission and distribution water mains. Appurtenances to the water mains include in excess of 7,500 meters, nearly 1,300 fire hydrants, and innumerable valves.

At first glance, the current inventory maps depicting features such as sewer manholes, storm water inlets, and water valves looked great. Some were drawn in AutoCAD, most by hand. They detailed every asset with moderate

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Water/Wastewater 2002 Trade Shows

American Public Works Assoc.
September 22–24 Kansas City, MO

WEFTEC 2002
September 29–Oct. 2 Chicago, IL

URISA
October 27–30 Chicago, IL

New Jersey State League of Municipalities
November 19–21 Atlantic City, NJ

A Small City Builds ArcGIS Water Utilities Geodatabase From the Ground Up

By Mike Onzay
GIS Coordinator, City of Mercer Island
Joe Plattner
GIS Analyst, City of Mercer Island

Overview

The city of Mercer Island is located between Seattle and Bellevue on Lake Washington. It covers a 6.2-square-mile area and is home to approximately 21,000 residents. There are 30 parks and approximately 51 miles of trails. It is a densely populated community with a small business district.

The city owns and operates the water, sewer, and storm drainage utilities. The city buys its water from the city of Seattle and stores it in

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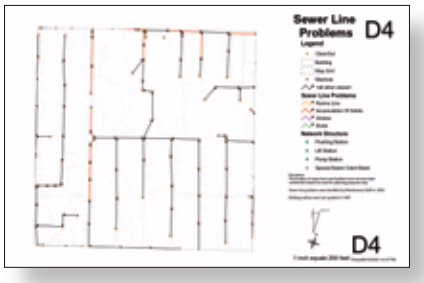

User Group

Do you know your **User Group** committees?

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City of Houston, Department of Water and Sewer, TX
Jon Henderson City of Bozeman, MT
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Sigi Sharp Washington Suburban Sanitary District, DC
Dave Ward Loudoun County, VA

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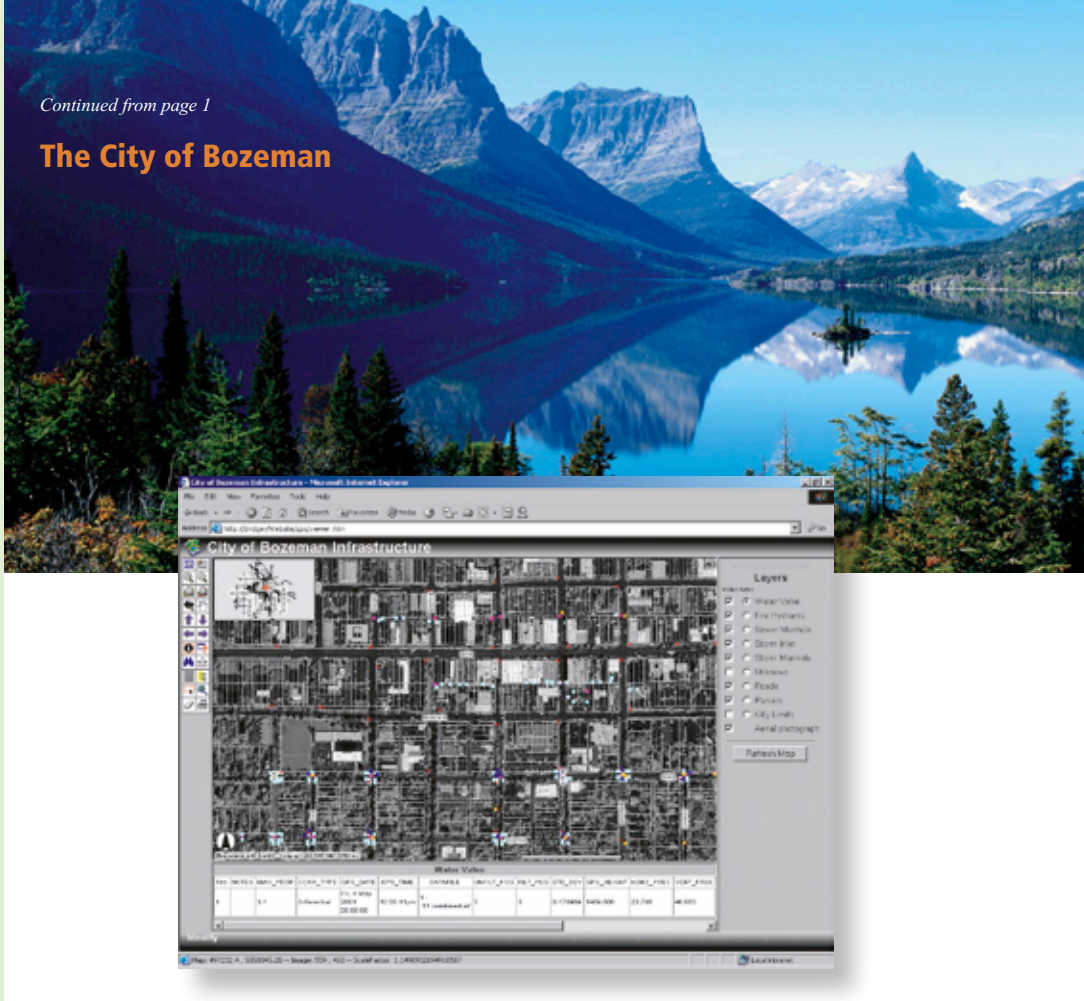
The City of Bozeman



accuracy and were helpful to many departments. With the advent of GIS, it became obvious that we could begin associating information such as maintenance and installation records with such spatial data. We began to look at our needs and quickly realized there were endless possibilities to such a marriage.

It started with locating all 1,300 fire hydrants in the field and recording their positions with a GPS. We got great results while maintaining the hope for a complete network of all infrastructures. We were immediately able to link this point data with an existing Access database using ArcGIS™. The Gallatin County 911 Center is also able to benefit from this data with CAD access to the points as well as information about the flow of each hydrant. The project was a success, so we turned our efforts toward the future.

Within the last year, we mapped nearly 8,000 points representing water and sewer assets. The collection procedure was very rigorous with many accuracy and precision guidelines. Because the city itself doesn't actually conduct any design or new construction of infrastructure, we collected the data accurately within a meter or less. The data will be used for inventory maps and as a general accounting tool for asset management. It is our ultimate hope to have a truly survey-accurate representation of the network for even more possibilities in the future!

Our goal is clear. We want to be able to utilize the link between the geographic data and tabular data about each feature. This type of live connection enables us to query and plan much more efficiently. Instead of thumbing through multiple source maps, our service men and women will be able to pull up all the necessary information with the click of a button. Using ArcIMS®, we've already designed a simple query tool for updating maintenance information.

We are extending this capability now by implementing ESRI's Water Model. We are currently in the process of designing the geodatabase around our point data. The Water and Sewer Department will now be able to maintain a more accurate account of its assets while saving

time searching for inventory information. Other departments will directly benefit from this data as our Engineering and Building Departments are also planning interfaces to the information.

Since this technology is new to Bozeman as well as other communities in Montana, we collectively decided, among many people and disciplines, to form a Montana Water/ Wastewater GIS Users Group. The first meeting will take place this summer where connections will be formed between the water/wastewater community and GIS users. Through the help of each other, we strive to more efficiently and effectively manage our infrastructures to better serve the public.

For more information, contact

Jon Henderson
GIS Manager
City of Bozeman
Phone: 406-582-2385
E-mail: jhenderson@bozeman.net
Web: www.bozeman.net

GIS Day 2002—Join Our Worldwide Celebration

GIS Day™ is an international grassroots event held to promote geographic literacy in our schools, communities, and organizations. On November 20, 2002, companies from around the planet will join together to help teach the world about geography and the power of GIS technology. Principal sponsors include the National Geographic Society, the Association of American Geographers, the University Consortium for Geographic Information Science, the United States Geological Survey, the Library of Congress, Sun Microsystems, and ESRI. Visit www.gisday.com to find out more and to register your event today.

User Group

Do you know your **User Group** committees?

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Northeast Partner Council

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Rick Harmon American Water Works Association, CO

Water/Wastewater User Group Committee

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A Small City Builds ArcGIS Water Utilities Geodatabase From the Ground Up

two four-million-gallon reservoirs. A sanitary sewer lake line runs around the perimeter of the island (approximately 14 miles) in the lake to collect and convey the wastewater. The lake line includes 12 lift stations (two are owned by King County). The wastewater is then conveyed south to King County's wastewater treatment facility in the City of Renton.

Before GIS was truly implemented in the late 1990s, all mapping was done by hand. In addition to the three utility layers, other geographic data such as addresses, building outlines, road edges, and parks were also drafted by hand. In 1991, the city obtained digital data compiled from aerial photography.

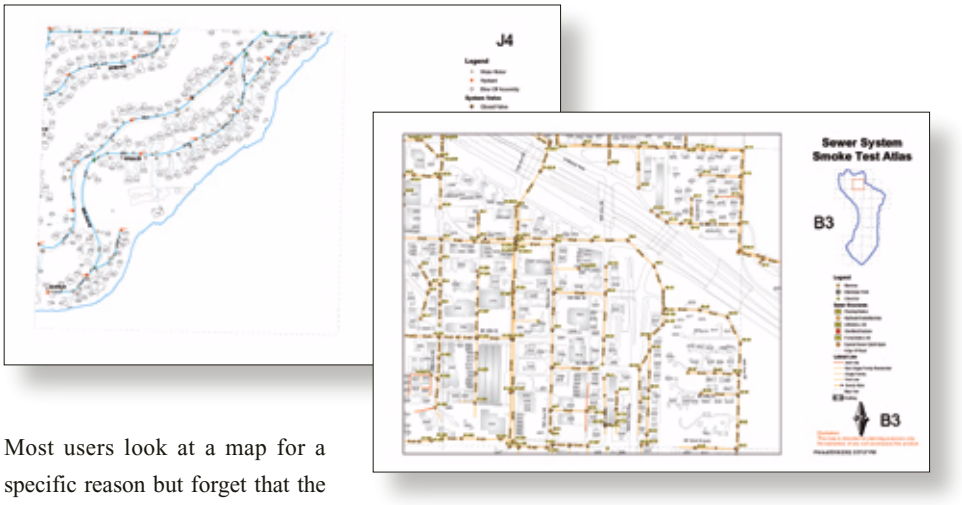
Currently, the utility layers are stored in an ESRI® ArcGIS 8 geodatabase. Eventually, all of the data will be in a geodatabase. Basic attribute information for the water system features is complete. The sewer system is 75 percent complete and work on the storm drainage system is just beginning.

History

In the 1980s, the city used two full-time staff members to maintain the maps of each of the utilities plus the other layers that made up each map (address, property lines, road network, etc.). Each map layer was composed of 40 quarter section sheets.

In 1990, the city decided to use GIS to update and maintain its geographic data. The updating of the hard-copy maps was stopped, and it took another nine years before these maps were maintained again. This gap can be explained by the seven years the city spent trying unsuccessfully to implement its GIS. In addition, it wasn't until the fall of 1997 that Mercer Island hired a GIS coordinator.

Updating the utility maps and all of the other layers at the same time was more than a one-person job.



Most users look at a map for a specific reason but forget that the background information, such as pavement edges and addresses, take just as much time to create and maintain. In January of 2000, the city hired a full-time GIS analyst.

Database Design

As the analyst worked through learning all about ArcGIS 8 and the frustrations that new software can sometimes bring, the GIS staff began to try to figure out what to do with the new water utilities ArcGIS data model. The model was a great starting point—a general framework—to what a system might look like. Knowing nothing about how the real-world systems were constructed, the GIS staff talked the city engineer and the utility engineer into meeting every couple of weeks to work through each system. The GIS staff understood the basics of relational database design and knew that building a detailed data dictionary would pay off in the long run (especially for creating metadata).

Being ignorant about how the utility systems worked and what the features inside it were called, the GIS staff asked many questions. The model included features that were not in the city's system such as wastewater treatment plants. In some cases, the model left out important facilities. For example, the model did not include blow-off valves, so these features were added. The meetings included long discussions of how to define each feature in the system. The documentation that came with the model was very thin, and many times the group tried to figure out what the authors of the model intended.

The group was also sensitive to the fact that many of the field staff used certain terms or phrases to describe these features. In some cases, the engineers and the field staff had different names for the same object. The group also talked about how the features were connected to other features.

In each successive meeting the group would review what had been discussed and agreed upon at the previous meeting. Often, an item would be revisited and discussed again. Even though it made the process longer, the design group felt that this was okay because it was all part of the learning experience. The most important aspect was that in the end there was consensus.

The design of the water system model took an entire year to work through because it was one long learning experience, not only for the GIS staff but also for the engineers who learned that GIS is not just a tool to make pretty maps. Eventually, the group got the hang of how to ask questions, how to decide what was important to track in each system, and what attributes were important. The group also learned how the features in the system were connected to each other and began to understand how powerful connectivity rules could be used. Last year, the sewer model design was finished, and the storm drainage model design was completed in four months. Based on the knowledge gained from the last two systems, the group decided to revisit the water model this summer to refine it.

Implementation

Just before the GIS coordinator was hired in 1997, a local firm was hired to scan and convert the water and storm drainage maps into ArcView® shapefiles. Even though the data was

seven years out of date, it was digital and it gave the GIS coordinator a little breathing room to show how GIS could be used for creating different kinds of maps quickly and easily.

In 1999, King County digitized the city's sewer maps as part of its project to model its service area. Also, in early 2000 the city obtained high-quality digital orthophotos with six-inch pixel resolution. The addition of the photos helped the GIS staff to realize that the location of the represented features was often incorrect. In many locations, the hand-drawn features did not overlay on the photos correctly (e.g., utilities that should have been in the street were in fact running through houses on the photo).

As the databases were designed, the shapefiles were updated with information gleaned from several sources. The city's paper files about these systems were in file cabinets, on rolled up maps, in closets in unused buildings, in attics, in people's memories, etc. Finding this information was critical because it often provided the answer to gaps in the existing maps. However, there are still many areas where there is contradictory information. For now, these are flagged with the hope of future resolution.

As the data models became more detailed, staff found that using ArcCatalog™ was limiting the ability to make easy changes to the geodatabase. Staff decided to purchase Visio Enterprise. It was a difficult decision because of the high cost, high learning curve, and the knowledge that only 10 percent of the software's capabilities would be used. However, it is far easier to customize the model and make new changes. For example, because objects have inheritance, when adding a new attribute that is the same for all feature classes, the UML is changed in one or two places. Using ArcCatalog, manual changes had to be made in 15 or more feature classes.

For the water system, it was a gradual transition to the geodatabase. Once the valid values for each attribute of a feature class were determined then it was converted into the geodatabase. For both the sewer and storm drainage systems, the complete model was developed and then converted to the geodatabase before data was entered.

Currently, the maps are at the point that internal staff will ask for the GIS maps first. People have confidence in the data. This confidence has opened the door for feedback from the field staff. The value and need for accurate data by the GIS professionals was envisioned long ago, and with the support of management and prudent planning this vision is playing out.

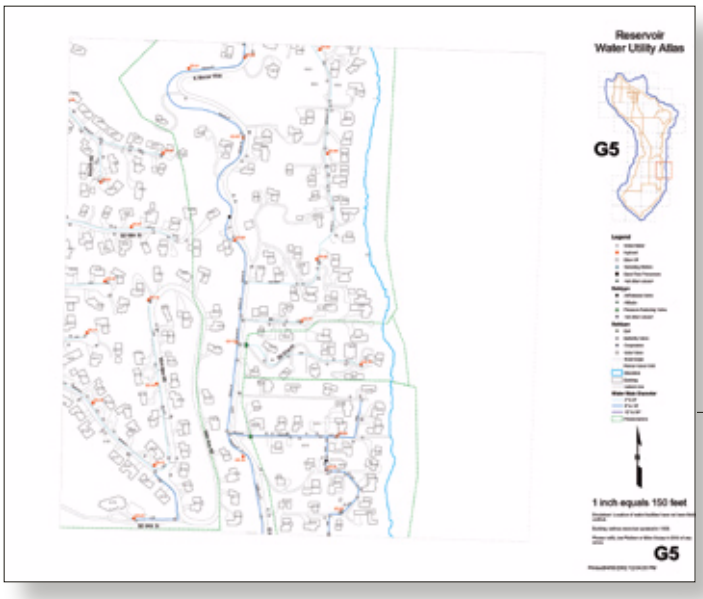
One current project will map the right-of-way boundaries using legal descriptions tied to a surveyed grid. The second project will locate all surface utility features in the right-of-way. Besides providing highly accurate locations, the utility feature project will provide an inventory of what is out there today—not 12 years ago.

Conclusion

Building the geodatabase from the ground up has been challenging. It represented a fundamental shift from the traditional way of storing spatial features in coverages and shapefiles. It was a mental shift that took time. It required learning all about geodatabases, how to ask the right questions, and how to translate the answer into objects in the data model.

Mercer Island has a long way to go; however, the foundation that has been created with the water utilities ArcGIS data models and ESRI software will serve the city well into the future. The design team is confident that in the next couple of years the city will have one of the best GIS databases.

Authors *Mike Onzay*
GIS Coordinator, City of Mercer Island
Joe Plattner
GIS Analyst, City of Mercer Island



Statistics

Pipe in length (approx)	
Water	126 miles
Sewer	112 miles
Storm	unknown

• Valves	2300
• Sewer manholes	2600
• Catch basins	4300
• Storm manholes	600
• Hydrants	1117

User Group Update

Looking for an active GIS user group to meet other GIS professionals, keep in touch with happenings in the local GIS community, or get answers to those burning questions such as "Why does software always crash before crucial deadlines instead of after them?" Join the Central Puget Sound GIS Users' Group in its monthly meetings and get on the e-mail list. The group is open to GIS professionals and students in all industries and on all software platforms. You don't have to be a GIS guru to participate.

Recent programs have included presentations on the HAZUS damage estimation software from the USGS, integration of GIS into enterprise information systems, use of GIS for maintenance management applications, and redistricting.

The group has a mailing list of more than 400 GIS professionals, and meetings are attended by anywhere from 20 to 50 people.

Meetings are held on the third Tuesday afternoon of each month. For more information or to put your name on the list, contact Dick Thomas at **dick@sammplat.wa.org**.

Richard E. Thomas
GIS Coordinator
Sammamish Plateau
Water and Sewer District

1510 228th Avenue SE
Sammamish, WA 98075
Phone: 425-392-4931, ext. 228
Fax: 425-391-5389
E-mail: dick@sammplat.wa.org

Announcing the Formation of the Montana Water/Wastewater GIS Users Group

Two months ago, a group of professionals from all sectors of the water/wastewater market assembled in Helena to discuss current and future issues regarding the use of GIS in water/wastewater system management. With an incredible turnout and constructive discussion on many topics, it was concluded that we should form a user group to address the needs of this growing industry. ESRI has teamed up with our group to supply the necessary support and resources we will need to pull it off successfully.

And so the Montana Water/Wastewater GIS Users Group is born (I'll spare you the acronym!). My name is Jon Henderson, and I am the GIS manager for the City of Bozeman. I will be heading up this group as we are currently involved in implementing ESRI's geodatabase model for this type of asset management within our Water and Sewer Department. It is my hope that we can assemble a diverse group of individuals and agencies to help each other with issues pertaining to the use of GIS in water/wastewater. The mission of this group is "to provide a forum for discussion on the use and benefits of GIS in the water and wastewater industries as a means to enhance the quality of life through properly managed data and infrastructure."

For further information, please contact

Bryant Ralston
ESRI's Montana Representative
Phone: 406-825-0180
E-mail: bralston@esri.com

or

Jon Henderson
GIS Manager
City of Bozeman
Phone: 406-582-2385
E-mail: jhenderson@bozeman.net

GeoNorth, LLC

Partner News
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GeoNorth, LLC

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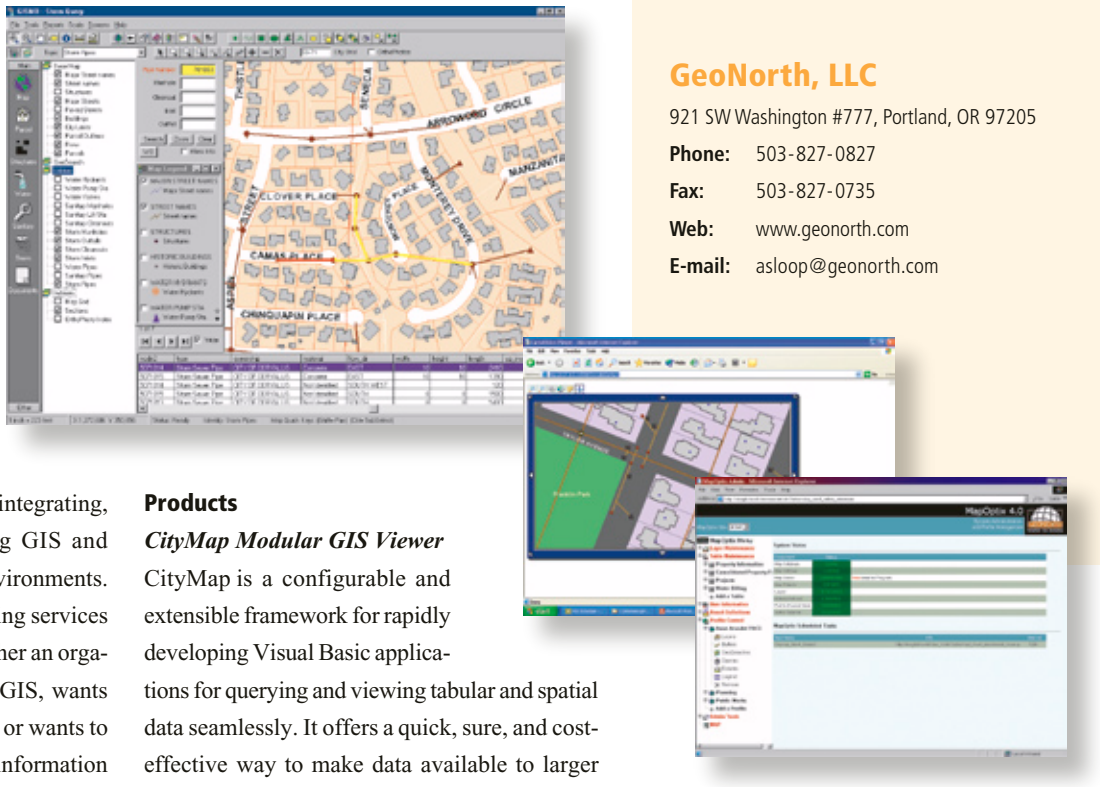

GeoNorth, LLC, an ESRI Strategic Alliance Partner, specializes in providing practical, integrated, and flexible GIS solutions to help governments and utilities operate more efficiently and effectively. Using extensive industry-specific knowledge and the latest tools from ESRI and other leading technology companies, GeoNorth provides custom and turnkey systems for creating, maintaining, integrating, querying, viewing, and publishing GIS and tabular data in desktop and Web environments. It also offers comprehensive consulting services to make any project successful, whether an organization is just getting started with GIS, wants to enhance existing GIS capabilities, or wants to GIS-enable and integrate traditional information systems.

GeoNorth's GIS start-up services include

- Education to raise knowledge and awareness of GIS throughout the organization
- Assessment of user and organizational needs and goals
- Assessment of existing resources and capabilities
- Building consensus about project goals and specifications
- Developing implementation plans
- Developing application prototypes

Many organizations that have invested in developing GIS data and traditional information systems haven't fully realized the benefits of these investments because they lack appropriate applications for accessing the data. In these cases, GeoNorth can evaluate the organization's goals, resources, and capabilities, then recommend strategies to leverage previous investments and increase access to data. Following are descriptions of several GeoNorth products that can facilitate this. These can provide immediate benefits and be customized if needed.

Products

CityMap Modular GIS Viewer

CityMap is a configurable and extensible framework for rapidly developing Visual Basic applications for querying and viewing tabular and spatial data seamlessly. It offers a quick, sure, and cost-effective way to make data available to larger numbers of users within an organization and in the field through a single interface. Screens can be turned on/off for specific groups of users. Optional modules are available for querying various external databases (e.g., CASSWORKS, Stantec, MAXIMO, Azteca), associating files (e.g., as-built drawings, inspection notes) with GIS features, generating reports and mailing lists, viewing associated metadata, and creating custom map layouts. The CityMap framework uses MapObjects® 2.1 for map rendering and GIS data access.

MapOptix Internet Data Publishing System

MapOptix is a turnkey system for publishing GIS and database information on the Web—and controlling who has access to it—without programming. It extends ArcIMS to enable quick and easy integration of GIS and utility databases and greater control over content and functionality provided to specific users. MapOptix is built with ColdFusion, works with any ODBC database (e.g., CASSWORKS, Stantec, MAXIMO, Azteca), has a scalable and extensible architecture, and does not require a browser plug-in or applet.

CartaVision ArcGIS Project Publishing Application

CartaVision is an off-the-shelf product for publishing ArcGIS projects (.mxd files) to the Web in seconds. Maps are published using the cartography and display rules defined in the .mxd file. The Web server is built-in so no other software is required. CartaVision is ideal for publishing ArcGIS maps or adding interactive mapping to a Web site quickly, easily, and inexpensively.

QueryPal Tabular Data Integration Extension

QueryPal is an ArcGIS extension that enables users to query GIS and external databases (CASSWORKS, Stantec, MAXIMO, Azteca, etc.) seamlessly in ArcMap™. It includes wizards and an administrative interface for connecting to data sources and configuring queries. It is designed to facilitate access to maintenance management and other enterprise information systems through an industry-standard GIS interface.

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For more information about **ESRI** GIS solutions for water/wastewater applications or for a reseller near you

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Visit ESRI's Web site at
www.esri.com

Send inquiries to Lori Armstrong, water/wastewater industry solutions manager.

The formation of a Montana GIS user group fills a big void in the Montana water/wastewater utility industry. Montana is such a large state with utilities often widely scattered geographically. The opportunity to communicate and share information through a user group will help bring the Montana water/wastewater utilities closer together.

Jennifer Wicks
Mountain Water Co.
Missoula, MT

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