

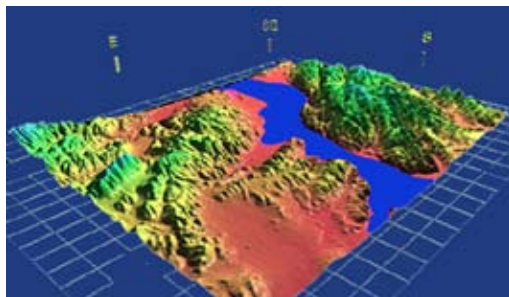
"Dedicated to creative, responsive, quality solutions for those we serve."

## Mapping and Database Solutions

Geographic information systems (GIS) have emerged as an essential tool in the daily life of most agencies. A GIS is an integrated information management tool that combines layers of information to assist users in making complex decisions. Today's GIS solutions allow agencies to develop and maintain usable and up-to-date maps, improve data integration between departments, simplify complex decision-making processes, and provide tools to the general public to improve customer service.

Several common applications for GIS include:

- ▼ Creating detailed maps of utility infrastructure systems like sanitary sewer, water, and storm water systems.
- ▼ Querying data and creating detailed maps to answer management, engineering, operations and maintenance (O&M), and public inquiries.
- ▼ Maintaining and sharing database information with different departments in an agency.
- ▼ Organizing, evaluating, and managing studies and capital improvement programs (CIPs).
- ▼ Creating Web-based applications that allow the general public to access information and create maps over the Internet.

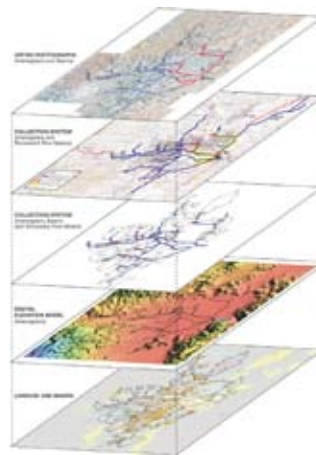


*Three-dimensional projections allow for the display of GIS data in a way that stakeholders can understand.*

Carollo Engineers is an industry leader in developing advanced GIS applications for agencies. We can assist in developing a new or expanding an existing GIS to improve organizational efficiency and promote data integration throughout your organization. This allows you to focus your efforts on solving problems and serving your constituency.

### Building a GIS from the Ground Up

GIS development begins by building a digital base map, which forms the foundation on which additional layers of information are digitized. Typical GIS base layers include street rights-of-way within a specified area such as a city's incorporated boundary. Georeferencing the base layer in the proper coordinate system is a critical part of this effort.



*Building GIS is a complex process requiring experience, attention to detail and understanding the specific needs of each client.*

After the GIS base layer has been developed, additional layers of information are digitized to accurately represent spatial information. Some typical GIS layers include incorporated limits, land use and zoning, street rights-of-way, sanitary and storm sewers, water systems, watersheds, water bodies, wetlands, soil classifications, and elevation data.

Carollo is experienced with many GIS software products that enhance existing systems, as well as developing maps and databases from the ground up. We can help you simplify the development process and ensure that your layer-building efforts allow for future enhancements.

### Expanding an Existing GIS

GIS is not an end in itself—it is a powerful tool for decision making that requires frequent updates. Many organizations have GIS departments that are overloaded with daily requests and cannot keep pace with growing demands. Carollo can help. By providing value-added services such as data collection, quality control, integration, and display enhancements, Carollo can assist you in improving organization efficiency and customer service.

**Data Collection.** Carollo routinely assists agencies in collecting data to start or supplement their GIS. Common data collection efforts include using Global Positioning System (GPS) technology to locate the coordinates of facilities, collect elevation data, associate digital photographs, and quickly document current facility condition.

**Data Quality.** The usefulness of a GIS is defined by the quality of the data. Carollo provides rigorous quality control procedures to check existing data and populate new databases. We apply industry-standard data models to assure the highest quality possible when importing outside data sources.



*WebGIS leverages both existing resources and provides easy-to-understand maps on demand.*

**Data Integration.** Sharing data is essential for an effective GIS. Carollo can help agencies integrate data between engineering, planning, management, and O&M departments. Sharing database information in this way helps eliminate repeated or conflicting information. For example, if an agency maintains separate databases for customer information and billing records, a new address posted to the customer information database will automatically be updated in the billing records database.

Integration also includes exchanging information between software packages such as computer maintenance management systems (CMMS) and modeling software. Our experience with CMMS and modeling software, coupled with our knowledge of the complexities of GIS data integration, allows us to work with clients to achieve a “no surprises” result.

**Data Display.** At the forefront of GIS is the use of 3-D projections and distribution of GIS data over the Internet. Three-dimensional projections, enhanced by animation techniques, allow GIS managers to display data in a way that stakeholders can understand. Providing GIS maps and data over the Internet (WebGIS) leverages both existing resources and provides easy-to-understand maps on demand. WebGIS allows everyone with Web access in an organization to create his/her own maps without the need to purchase or learn GIS software. Carollo uses the same Web-based technology for our clients' GIS maps and data that the U.S. Geological Survey uses for their nationwide databases.

### **Experience Counts**

Carollo has developed GIS systems and customized applications for many clients. First, we work with our clients to identify the level of GIS that will best suit their current needs. We then provide assistance in planning and implementing the GIS.

We have provided a few examples of Carollo's recent projects involving GIS below.

**City of Kansas City, Missouri - Storm Water Master Plan.** The Water Services Department contracted with Carollo to complete a storm water master plan for three Kansas City watersheds. GIS services include collecting information/digital photographs on pipelines and catch basins, river cross-sections, bridges, and sites with excess erosion. Work includes coupling this information with existing and future land use/land cover, digital elevation data, river center lines, and watershed boundaries, and checking information against historic FEMA flood data. Integration of these data into a GIS format allows for efficient transfer of information into hydrologic, hydraulic, and water quality modeling software. Modeling output imported back into the GIS provides Kansas City with a comprehensive product that is easily updated and can be used for regulatory approval.

**City of Carnation and King County, Washington - Wastewater Treatment Plant Predesign.** Carollo assisted the City of Carnation in siting a future wastewater treatment facility using GIS techniques. Work involved gathering and overlaying multiple GIS data sources in ArcView GIS. GIS data sources included digital elevation models, land use, soil type, watershed delineations, and FEMA floodplains. Carollo developed a preliminary list of wastewater treatment plant sites by intersecting the GIS data and applying selection criteria chosen by Carnation.

**Vallejo Sanitation and Flood Control District, California - Sanitary Sewer Overflow Elimination Program.** Carollo has used several GIS software packages throughout this seven-year sanitary sewer overflow elimination program. The Vallejo Sanitation and Flood Control District (VSFCD) maintains a MapGuide GIS by AutoDesk to manage their extensive database and a WebGIS portal. Carollo converted the MapGuide GIS databases into shape files and imported these into ESRI ArcView GIS. The conversion provided the transfer mechanism for importing database information into the MOUSE hydraulic model by DHI. Carollo populated VSFCD's sewer system GIS layer with newly constructed pipelines and added several new GIS layers used for the analysis of sanitary sewer overflows. VSFCD now uses ArcView GIS to keep the hydraulic model up to date and document capital improvements.