Implementing a Utility Geographic Information System for Water, Sewer, and Electric: Case Study of City of Calhoun, Georgia

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ABSTRACT

This paper describes the design and implementation of a Geographic Information System (GIS) for the Water, Sewer, and Electric Departments for the City of Calhoun, Georgia. The objective of this paper is to explain how the design and implementation of a GIS for the City of Calhoun was established in order to efficiently manage their utility distribution systems and replace the existing CAD system. It also provides other small municipalities with an understanding of what it takes to design and implement a utility GIS. The design and implementation were divided into a set of phases that were carried out to ensure a successful completed system. The methodology used in the development of the GIS has been acquired through reviewing and evaluating other similar systems that involve utility data. The utility departments have relied on inaccurate CAD data for years. The departments all agreed that a more accurate and up to date system would help manage their assets. The conclusion of this paper demonstrates the improved efficiency after implementing the GIS compared with the previous CAD system.

INTRODUCTION

Most utilities throughout the United States and abroad are planning or implementing an automated mapping-facilities management-Geographic Information System (GIS) according to Cannistra (1999). Over the years many organizations have come to realize that GIS not only helps manage the existing utility infrastructure, but can also help aid in the design for future expansion (Shamsi 2002, Croswell 1991). The utility industry is a major consumer of GIS because of the fact that almost all utilities can be spatially referenced. For example, more than 80% of all the information that is within water and wastewater utilities is geographically referenced (Shamsi 2005). Utility organizations not only use GIS for the spatially referenced data, but also for any information that could be used to help carry out further analysis if needed. A GIS allows utility operators and managers to not only determine where their assets are located but analyze attributes about those assets (Hughes 2006). The majority of the utility organizations reside in municipal governments. Traditionally, utility organizations managed their systems by paper maps.

Many municipal governments provide its citizens with public utilities whether it be electric, water, sewer, telecommunications, or gas. The size of the utility system depends on the size of the area and the population it serves. The local governments over the years have typically managed these utility systems by hard copy paper maps. The hard copy paper maps were usually produced by using a computer aided design system (CAD). The CAD system has helped the utility organizations throughout the years with managing their assets, but lacks the ability to provide the organizations with database technology. The database technology that is incorporated into GIS has greatly extended the ability to effectively manage the utility assets. Many non-profit and municipalities are drawn to a GIS because it has the ability to combine large amounts of data.
from different sources and on different media, order them into layers or themes, and analyze or display various relationships (Sieber 2000).

GIS is able to provide the utility organizations with endless amounts of information about their assets, whether it is spatial or non-spatial (Environmental Systems Research Institute, ESRI, 2003). Utility organizations spend a large amount of money and time on maintaining their infrastructures. By using GIS, these organizations are able to greatly reduce the amount of time and money involved on maintenance. Many of the organizations incorporate their work order and billing systems into the GIS, which saves even more time and resources. The organizations are able to use one system to effectively manage all their utilities. Whether as a means of data dissemination or acquiring new data, data sharing has become an essential element of local government GIS processes (Tulloch and Harvey 2007).

The City of Calhoun, GA has always utilized a CAD system to manage their utilities. The utility departments realized that the data in the CAD system was not accurate. The city started researching ways to improve their data and efficiency within the departments and wanted a centralized system that could be accessed across all departments in the city. While researching, the city found GIS and decided that it was the type of system they wanted to implement.

OBJECTIVE

The GIS implementation process for a municipal government’s utility system can be very complex, expensive, and time consuming, depending on what the organization is prepared to manage with the system (Uhrick and Feinberg 1997). The research objective is to review, explain, and provide an example of the implementation process for the water, sewer, and electric utilities within the City of Calhoun, GA. These utility areas are very common among a large percentage of the local governments in the United States. The implementation process involves determining the needs of each department and constructing an implementation plan to help track and determine the outcome of the overall system (Tomlinson 2003). The research also reviews the database development process for each of the utility departments.

STUDY AREA

The City of Calhoun, Georgia, is located about 60 miles northwest of Atlanta and is in Gordon County which covers approximately 356 square miles with 2.5 square miles consisting of water. There are approximately 53,000 people living in Gordon County with roughly 14,000 residing within the city limits of Calhoun (Gordon County 2008). Figure 1 shows the location of Gordon County and the City of Calhoun. Major carpet and flooring industries account for the majority of the work force in the city.
The City of Calhoun was established in 1852, and is governed by a mayor and four council members. The general administration of Calhoun includes the functions of the mayor and council, city administrator, finance, tax administrator, human resources, and risk management. The public works consist of Highway and Streets, Recycling Center, Animal Control, and Cemetery Departments. The public safety and development are the Police, Fire, and Community Development Departments. The City of Calhoun utilities consist of the Water, Sewer, Electric, Telecommunications, Engineering, and GIS Departments.

The Water, Sewer, and Electric Departments were the areas of concentration for this research. The Water Department serves over 20,000 customers in Calhoun and Gordon County. There are a total of about 800 miles of water mains throughout the county. The purpose of the Water Department is to provide clean, pure drinking water to customers and to protect health; to maintain the water distribution system, adding new lines and connections; to add new customers, and to provide proper pressure and clean water at all times.

The Sewer Department serves approximately 6500 customers. The sewer infrastructure is made up of approximately 3000 manholes, 9 lift stations, and 150 miles of sewer line. Some of the maintenance involved includes the department responding to approximately 300 utility locate
requests each month. The closed circuit television or CCTV crew performs inspections on approximately 2500 linear feet of main line sewer each month. The Jet/Vacuum crew cleans approximately 6000 linear feet of main line sewer each month.

The Electric Department serves approximately 5000 customers throughout the city. The Electric Department handles approximately 1000 service calls annually. The department estimated that there are approximately 5700 poles in the electric system. The electrical system consist of 88 miles of primary overhead wire, 30 miles of primary underground wire, 90 miles of secondary overhead wire, and 25 miles of secondary underground wire. The department also maintains a number of the street and security lights. There are approximately 1000 street lights and 200 security lights. The goal of the Electric Department is to employ properly trained personnel and to secure a safe environment for those employees and the community. This will insure that the distribution system service is maintained at the highest level of quality and reliability. The Electric Department is committed to customer satisfaction and a state-of-the-art approach to power supply.

The Water, Sewer, and Electric GIS was developed and implemented by following three phases, adapted from suggestions by Tomlinson (2003) and Harmon and Anderson (2003). The first phase of the project was to conduct a needs assessment for each of the departments. The second phase was geodatabase design. The third phase is data development and conversion. The phases used for the project were performed once the hardware and software were installed and configured. The City of Calhoun already had a server available for the GIS implementation. A Microsoft SQL Server Enterprise license was purchased and installed on the server. The ESRI software that was installed for the implementation included ArcGIS Server Advance and a number of ArcINFO seats in each department. ArcSDE, which is bundled with ArcGIS Server Advance, was also installed and configured. The advance version of ArcGIS Server provided the ability to develop a web mapping application that each department can easily access and use.

**NEEDS ASSESSMENT OVERVIEW**

The list below identifies the steps that were taken to complete the needs assessment for each of the departments:

- Interviewed the staff within each department to identify the current document workflows and conditions.
- Established an overall set of goals and objectives for each of the departments.
- Gained an understanding of their business processes and identified redundancy within these processes.
- Evaluated the existing data and data formats currently being used.
- Identified applications that the departments can benefit from.
- Determined the number of users that will be accessing the system from the departments.

**Water Needs Assessment**

The needs assessment meeting with the Water Department identified a number of functions and processes that will be achieved with the implementation of the GIS. The list below outlines the major functions and processes identified.

- Preparing maps for work orders
- Integration of billing data
- Future planning for system expansion
- Asset inventory
- Hydrant locations
- Water main isolation
- New meter locations
- Meter replacement scheduling
- Linking meters, valves, to the parcels they serve
- Water distribution and usage analyses
- Pressure zone mapping
- Water main break reporting application
- Crew routing
- Maintenance tracking and inventory
- Web mapping application for easy access to data

The statistics in table 1 show an average of the Water Department’s operations during any given month. Table 2 lists the estimated number of features within the water system during the time of the assessment. The statistics in table 2 provided an overall evaluation of the amount of data that was involved in the implementation.

<table>
<thead>
<tr>
<th>Table 1: Average Monthly Statistics for Water Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Customers Served</td>
</tr>
<tr>
<td>Number of Service Calls</td>
</tr>
<tr>
<td>Number of Leaks</td>
</tr>
<tr>
<td>New Meters added</td>
</tr>
<tr>
<td>Meter Repairs</td>
</tr>
<tr>
<td>Number of Utility Locate request</td>
</tr>
<tr>
<td>Average number of new pipe in feet added</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Feature Statistics for Water Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Water Lines in Miles</td>
</tr>
<tr>
<td>Number of Meters</td>
</tr>
<tr>
<td>Number of Hydrants</td>
</tr>
<tr>
<td>Number of Valves</td>
</tr>
<tr>
<td>Number of Pump Stations</td>
</tr>
<tr>
<td>Number of Tanks</td>
</tr>
</tbody>
</table>

The assessment also identified the number and type of users of the GIS. The department stated that one person would be responsible for creating and updating the data while there would be at least five or more people using the system at any given time. The format and use of the existing data was also discussed. The data is in CAD format and is not based on a coordinate system and is not to any kind of scale. The attribute information for the CAD data is in the form of labels in the drawings. The CAD drawings are old and outdated. The locations of the water mains were sketched in from employees’ memory over the years. The valve and hydrant drawings were developed using field sketches. The department stated that the drawings are inaccurate and have been pieced together over the years and they would like access to updated
data for the electric and sewer throughout the city and county. Having access to landowner and parcel information would also be helpful when planning new construction. The water data needs to be updated on a daily basis. The overall goal of the Water Department is to have easy access to accurate and updated information on their entire water system.

**Sewer Needs Assessment**

The assessment for the Sewer Department identified a number of functions that could benefit from the implementation of a GIS. The list below shows some of the examples discussed during the needs assessment. Table 3 shows some of the more important monthly statistics on the functions of the Sewer Department. The numbers in table 4 give an idea on the number of features that make up the sewer system.

- Access to accurate system mapping
- Integration of billing data
- Work order mapping
- System modeling
- Crew scheduling
- Inflow and Infiltration planning
- Planning future expansion of system
- Maintenance tracking and inventory
- Sewer distribution analysis
- Inspection reporting tools
- Web mapping application for easy access to data

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Customers Served</td>
<td>6500</td>
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<tr>
<td>Avg. # of Service Calls</td>
<td>27</td>
</tr>
<tr>
<td>Number of Utility Locate request</td>
<td>300</td>
</tr>
<tr>
<td>Amount of pipe camera inspected</td>
<td>2500</td>
</tr>
<tr>
<td>Amount of pipe cleaned in feet</td>
<td>6000</td>
</tr>
</tbody>
</table>

**Table 4: Feature Statistics for Sewer Department**

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manholes</td>
<td>3000</td>
</tr>
<tr>
<td>Sewer lines in Miles</td>
<td>150</td>
</tr>
<tr>
<td>Lift Stations</td>
<td>9</td>
</tr>
<tr>
<td>Monitor Locations</td>
<td>17</td>
</tr>
<tr>
<td>Wet Wells</td>
<td>9</td>
</tr>
<tr>
<td>Cleanouts</td>
<td>500</td>
</tr>
</tbody>
</table>

The sewer data is similar to the water data except that roughly 35% of the manholes in the system have been located using real-time kinematic global positional system (RTK GPS) by the Engineering Department. The attributes of the manholes and pipes are in the form of labels in the CAD system. A number of subdivision drawings have been submitted by developers in CAD.
format and placed in the overall CAD system drawing. All lift stations and wet wells have been located using GPS. The remaining 65% of the manholes and pipes is not accurate. The department uses AutoCad for all of their mapping and information needs. The Sewer Department would like access to updated data for the Electric and Water Departments for planning new construction. They would also like to have access to parcel information for easement purposes. The department would like to have the data updated daily as projects are completed in the field. The data will be maintained and edited by one person and accessed by a number of people within the city. The overall goal of the Sewer Department is to have accurate and up to date data on their system and easy and quick access to the data.

Electric Needs Assessment

The needs assessment for the Electric Department began with identifying processes within the department that could benefit from a GIS. The list below shows a number of the processes indentified. The statistics in table 5 show the average monthly number of items that occur on a normal basis for the department. Table 6 lists some of the more important features in the electric system data to give an idea of the size of the system.

- Work order mapping
- Integration of billing data
- Inventory
- New electric utility expansion
- Improved location of utilities in the field
- Locate trouble calls and outages
- Provide better customer service
- Crew routing
- Electrical distribution analysis
- Linking meters to the parcels they serve
- Maintenance tracking
- Web mapping application for easy access to data

The electric data is in CAD format with no coordinate system or scale. The attributes for the electric features are in the form of labels on the CAD drawings. The CAD data is updated on a daily basis by making the changes to the system drawings. Work crews are given a work order with a printed out CAD map explaining what work needs to be done. Once the work is completed, it is noted on the CAD drawing and work order in the field. The work order and drawing are then given back to the CAD operator to make changes in the CAD drawings. The Electric Department would like to have access to parcel, water, and sewer data to help support the planning of new construction. The electric GIS data will need to be updated on a daily basis. The department will use one data maintainer and editor to perform the daily updates. The main goal for the Electric Department is to have accurate and updated data on the electric system with easy access to it.

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers Served</td>
<td>5000</td>
</tr>
<tr>
<td>Avg. # of Service Calls</td>
<td>80</td>
</tr>
<tr>
<td>Number of Outages</td>
<td>35</td>
</tr>
<tr>
<td>Number of Locates</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5: Average Monthly Statistics for Electric Department
<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>5700</td>
</tr>
<tr>
<td>Transformers</td>
<td>1700</td>
</tr>
<tr>
<td>Meters</td>
<td>5030</td>
</tr>
<tr>
<td>Miles of Primary Wire</td>
<td>120</td>
</tr>
<tr>
<td>Miles of Secondary Wire</td>
<td>120</td>
</tr>
</tbody>
</table>

**GEODATABASE DESIGN**

The second phase of this project, geodatabase design, began with reviewing each of the department’s existing CAD data structures. Databases will be implemented in relational database as it is used in most GIS (Zeiler 1999, Harmon and Anderson 2003, Arctur and Zeiler 2004). The feature classes were determined by meeting with the departments on a number of occasions to decide which features should be included in the system. The feature dataset figures and attribute field tables listed below are for each department’s dataset. A number of the attribute fields noted in the design were actually labels in the CAD data for the features. Some of the attribute fields were added items that the departments would like to start keeping track of in the future.

The planimetric data (e.g., roads, buildings, parcels and bridges) that each department uses was available from the Gordon County GIS Department. Aerial photography from 2005 was also already in place for Gordon County and the City of Calhoun. The spatial reference of each dataset is based on the existing planimetric and aerial photography data. The coordinate system used for the geodatabase is the Georgia West State Plane and the projection used is the Transverse Mercator. All the data sets will be based on the State Plane Coordinate System.

The water geodatabase design was developed based on the information gathered during the needs assessment and the existing CAD data. The attributes for each of the feature classes in the water geodatabase were determined by examining the existing CAD layer labels. Attributes were added to the features in the areas where the department wanted more information than what was available in the CAD drawings. Figure 2 shows the entity relationship (ER) diagram. According to this ER diagram, tables are created for the following entities (Longley et. al. 2005, Bolstad 2008): tanks, pump stations, water mains, valves, abandoned water lines, laterals, leaks, fittings, backflow points, backflow fire taps, hydrants, and water meters.
The development of the sewer geodatabase was also developed based on the existing CAD data and information that was obtained during the needs assessment. Figure 3 shows the entity relationship diagram for the sewer dataset. According to this ER diagram, tables are created for the following entities: service laterals, clean outs, gravity mains, lift stations, manholes, abandoned lines, wet wells, abandoned points, monitor locations, and service mains.
The electric geodatabase design was also created by reviewing the existing CAD data and determining what feature classes and attributes needed to be added. Figure 4 shows the entity relationship diagram for the electric dataset. According to this ER diagram, tables are created for the following entities: support structures, dynamic protective devices, PF correcting equipments, switches, primary OH electric lines, anchor guys, primary UDG electric lines, open points, bus bars, span guys, fuses, surface structures, transformers, secondary OH electric lines, secondary UDG electric lines, street lights, and electric meters.
The third phase of this project is data development and conversion. The City of Calhoun and Gordon County have existing aerial photography that is tied to the Georgia State Plane Coordinate System. The aerial photography overlaid with Gordon County's planimetric data serves as the base map foundation for the GIS. The Gordon County GIS Department has already completed the majority of the basemap dataset work with the construction of the parcel data and attributes associated with the data.
The City of Calhoun’s Engineering Department has already completed a number of feature locations throughout the city. The department has a GPS base station installed for locating utilities with RTK GPS. By using the RTK GPS, the features located are highly accurate to within a few inches. Some of the features located by the Engineering Department include wastewater manholes, utility poles, and street centerlines. The features were located with RTK GPS on the Georgia State Plane Coordinate System. The Sewer and Water Departments have already begun using the location data and aerial photography. This data will be very helpful in referencing other data throughout the city for the GIS.

**Water System Data Conversion and Development**

The existing CAD data for the water system is based on an assumed coordinate system, which is not on a defined coordinate system. A field inventory of the valves and hydrants was completed in order to accurately place the lines. The water line attributes were populated by using the existing CAD data. The valve diameters were field verified while doing the RTK GPS locations. By using the aerial photography, planimetrics, and the RTK GPS valve and hydrant data, the water dataset was populated in GIS. A large amount of the line locations came from meetings involving the water crews that actually installed the lines or who have done repairs on the lines.

The water meters were located using a hand held GPS in which the data had to be differentially corrected using post-processing software. The hand held GPS unit produced accuracy within a foot compared to inches of the RTK GPS. The hand held unit was used because of the obstruction of trees and bushes that are usually around meters. The RTK GPS needs at least the visibility of 4 satellites in order to get a fixed location. The locations of the meters were incorporated into the procedure of meter replacements for the Automated Meter Reading (AMR) system. During the AMR project, each meter had to be changed out with a new meter, and a GPS location was taken and attributes noted.

Figure 5 shows an example of the water CAD drawings the department has been using for many years. The map displays water main locations with hydrants and valves. The drawing was creating without using any scale. The GIS map in figure 6 shows the newly acquired data in the same area on the State Plane Coordinate System. The GIS map not only shows the water main, hydrant, and valve locations, but also the meter locations. The backflow fire taps and backflow points were also added to the water dataset. The backflow features allow the Water Department to keep track of testing dates and history on each backflow location.
Figure 5. Example Water Map in CAD Not to Scale

Figure 6. Example Water Map in GIS
Sewer System Data Conversion and Development

The sewer data was much easier to convert and develop than the water because of the size of the system. The sewer system only serves the residences within the city limits. Around 35% of all sewer manholes were already located using RTK GPS and attributed by the Engineering Department. Also a number of developers over the past few years have submitted drawing plans on subdivisions in the State Plane Coordinate System showing the location of the sewer installed.

A field inventory took place that located and attributed the remaining 65% of the manholes. During the field inventory each manhole was located with RTK GPS which provided accurate and precise location and elevation. The elevation data for each manhole had to be accurate for modeling purposes in the future. The manhole covers were removed and a measurement of the depth was taken. The material of the pipe and condition of the manhole was also noted during this time.

The CAD map in figure 7 shows an example of a sewer drawing. The CAD drawing displays the manholes and gravity mains. The CAD drawing was created without any scale. Figure 8 shows an example of the same area in GIS. The GIS map not only shows the manholes and gravity mains but also the lateral lines which are displayed in yellow.

![Figure 7. Example Sewer Map in CAD Not to Scale](image-url)
Electric System Data Conversion and Development

The electric data like the water and sewer existed in CAD format only with assumed coordinates. The attribute information for all the electric data was in the form of labels in the CAD system. The data conversion began with georeferencing all the poles and then applying the attributes based on the CAD data. The aerial photography provided enough detail to pick out poles and lines in many of the areas. Poles had to be located by GPS in the areas where they could not be identified from the aerial photography.

The development of the GIS began with adding each layer of data one at a time by circuit. The electric system is made up of 3 substations and 18 different circuits. After the poles were referenced and located, the other features were added. The feature classes that make up the electric datasets are mostly attached to poles except for surface structures and underground transformers. All of the features associated with the underground lines were located in the field with GPS. The phasing of the primary lines was field verified by visiting each of the three substations and tracing out the circuits. A number of phasing errors were identified during this process and were changed in the GIS.

Figure 9 shows an example of a CAD electric drawing. The CAD drawing was drawn similar to the water and sewer with no scale. The map in figure 10 is an example of the new GIS data developed for the same area. The symbology remained as close to the old cad drawings as possible for the field crews.
RESULTS AND CONCLUSION

The implementation and development of the utility GIS was completed in a three-year time frame. The system is continuously being updated with new layers of data. The development
of the GIS is a never ending, ongoing project because of the applications, tools, and analyses each department requests. The GIS today is being used by all departments on a daily basis. The system has become a tool that the departments depend on to carry out their daily functions and decision making. The GIS provides these departments with the ability to analyze and manage their entire infrastructure. The system provides each department with linked data from the billing, work order, and AMR systems. The locations of the features are very accurate and precise compared to the old CAD mapping techniques used. The data is now stored in a geodatabase which provides an unlimited amount of information to be linked to the features in their infrastructure.

The two main types of benefits gained from the GIS are efficiency and effectiveness. Efficiency benefits occur when a GIS is used to do a task that was not previously done with GIS and the output quality is same, but done at a lower cost. The effectiveness benefits result when a GIS is used to improve the quality of an output or to produce the output that was not previously available (Gillespie 2000).

Compared to the old CAD system, the GIS has improved the efficiency of the departments greatly by reducing the amount of time needed to carry out daily processes. A few examples of the time saved by using the GIS are listed below by departments.

Water Department

- The CAD drawings had no meter locations. The GIS now provides the department with accurate location of all meters for replacement purposes.
- Address lookup for work orders saves time for the work crews when responding to a service call. The CAD system provided no physical address data.
- Real time reading of meters allows the Electric and Water Departments to view the reading by clicking on the meter in the GIS. Prior to the AMR and GIS implementation, meter readers were used in the field to record readings.
- The Water Department is now able to easily perform consumption analysis by using the readings from the meters in GIS.
- Water valve isolation of system when leaks occur was a huge problem before the GIS was implemented. The location of the valves in the CAD drawings was not accurate, which wasted a lot of time in the field trying to locate them.
- Mapping of leaks in the GIS now provide the Water Department with the location of future rehabilitation of certain pipes in the system.
- Management of backflow testing for businesses was managed by a long paper trail in the past. The GIS now provides the Water Department with locations of all the backflows and links to the test results.
- Utility locate requests are now being done mostly in the office using GIS instead of in the field.

Sewer Department

- Inflow and Infiltration project is managed based on data from GIS. The drainage basins were developed by using a combination of elevation and feature data. The department had no inflow and infiltration mapping in the past.
- GIS provides the crews with physical address lookups for work orders. Prior to GIS the crews had to use paper street maps with no house numbers.
- Inspection videos are now attached to each pipe segment allowing quick access to
viewing.
- The sewer CAD drawings had no locations of the service laterals in the system. The GIS now has a number of service lateral locations that were identified by reviewing the inspection videos.
- The CAD drawings had no monitor manhole locations. The GIS has all monitor manhole locations with data attached.
- Utility locate requests are now being done mostly in the office using GIS instead of in the field.

Electric Department
- Daily mapping of work orders in the past with the CAD data was not accurate which led to time wasted in the field. The GIS has provided the crews with accurate mapping that can be relied upon in the field.
- The department now has the ability to read the meters from the GIS instead of having to read them in the field.
- Measuring distances for proposed lines in the office instead of in the field has saved the department a lot of time.
- Physical address data in the GIS has helped the crews quickly identify the location of outages.
- Utility locate requests are now being done mostly in the office using GIS instead of in the field saving time and resources.

The focus of this research has been to review, explain, and show an example of how a GIS was developed for the City of Calhoun utility departments. This research showed how the GIS helped improve the efficiency within each of the utility departments for the City of Calhoun. The implementation process outlined in this research can provide other cities and municipalities with the knowledge and foundation to develop their own GIS. This research can provide individuals with a reference to implement a utility GIS from the beginning to the end. Using the GIS to manage the City of Calhoun’s utility data has allowed more flexibility over the previous CAD system when analyzing data. The management of the utility data has become much more efficient compared to previous management with CAD. The utilities departments of the City of Calhoun have embraced GIS and look forward to advancements to the system.
About the Authors

Davie Crawford graduated from Northwest Missouri State University’s online Master of Science in GIS program in 2012. He currently works as the GIS manager for the City of Calhoun, GA.

Ming-Chih Hung is an Associate Professor of Geography/Geographic Information Science in Northwest Missouri State University. His major research interest is GIScience (e.g. GIS, remote sensing, GPS, cartography, visualization) and urban environments.

References


