Save Money with GIS at the Heart of Your Asset Management Program

Problem at Hand

The Water Department from Anytown, California, USA is experiencing unprecedented challenges during the current drought. Successful water conservation measures have already begun to erode their revenue stream, now exacerbated by water restrictions due to the drought. In addition, they have aging infrastructure causing water loss through system leaks and continued bad press with major water main breaks. Retirement rates of their existing workforce make prioritizing infrastructure projects a challenge due to loss of institutional knowledge. Fortunately, they implemented a groundwater recharge program years ago and predict a sustainable water supply based on the newly projected reductions in use.

As a municipal water agency they cannot simply give themselves a raise by easily increasing water rates. To maintain financial viability with decreasing revenue they can however reduce costs. Best management practices from the American Water Works Association suggest implementing an asset management program for effective, aka cost efficient infrastructure management. Since the days of the first International Infrastructure Management Manual (IIMM), asset management standards and protocols have evolved from the European Publicly Available Specification 55 (PAS 55) to the most recent International Standards Organization 55000 (ISO 55000). A full treatise on how Geographic Information System (GIS) supports the individual components of ISO 55000 resulting in cost savings is beyond the scope of this article, yet at the heart of asset management are two principles:

1) What assets do you have? and
2) What are you doing to them? Or better yet, how are they performing?

Given the current fiscal challenges of Anytown, CA they are not in a position to immediately implement state of the art enterprise asset management solutions. What they have is an existing billing system, work order system, and a mixture of paper blueprints, CAD drawings, and a moderately complete GIS of their assets.

So What is the Solution?

Anytown, CA can make best use of what they have and implement the latest tools from their GIS which include new office and field solutions made possible by state of the art Cloud technology with configurable maps and apps inspired by best management practices from industry. One of the first challenges of implementing asset management is determining if the asset registry is complete, accurate, and contains the necessary information to solve business problems. A GIS built for making maps falls short of one built to provide information products supporting management decisions. Also, consider that the information contained in your GIS will evolve over time as your asset management program matures.

Here is a simple illustration to understand this. Let's say you have been counting cars before implementing "asset management". You have very accurate data going back 10 years. The data is complete and accurate based on your business need at the time. However your new asset management program is trying to optimize a business process that requires you to know the color of the cars as well. This does not invalidate your 10 years of data, but it does force you to change your GIS and add color as an attribute allowing you to collect new data moving forward. Once you collect new data and develop a trend, you can extrapolate probable guesses as to the color of cars going back in time as long as you understand some degree of error in the guess. Do not be surprised by this revelation, it will happen and is part of the process.

A GIS-based asset registry should contain the following:

- Traditional GIS features of points (valves, hydrants, manholes, etc.), lines (water mains, gravity mains, etc.), and polygons (tanks, reservoirs, etc.) representing various asset classes.
- A GIS natively contains X and Y location, do not forget Z as 3D is becoming more of the norm in analysis and visualization.
- A unique asset ID that is carried amongst multiple enterprise systems.
- Feature classes should be sub-typed into transmission, distribution, etc. based on the functional aspect of the asset. Popular belief is to abstract function based on size or diameter, however consider an 8" sewer main (typically a local collector) acting as a collector or trunk given its increased slope and capacity to carry more effluent as an outfall from one basin to another.
- Attributes that capture the engineering properties (e.g. size, diameter, material, etc.)
- Install date is a must! Guess to the nearest year/vintage if you have to.
- Manufacturer and manufactured date is helpful in recalls and warranty claims.
- Temporal data such as operating pressure, inspection date, condition, etc. may be stored in the GIS, yet enterprise asset management systems can be better optimized for that type of information.
- Metadata such as location accuracy and attribute accuracy, per feature if necessary. Attributes may be very accurate on a manhole, yet without survey grade invert elevations slope calculations and capacity/flow modeling will contain errors.
- The added overhead of maintaining a geometric network containing multiple feature classes is useful in complex system tracing.
- For retrieving archives, it is not uncommon to scan old blueprints and paper documents and link them to project polygons defining the scope of the document. This way clicking on the map can quickly bring up infrastructure information that has not yet been entered into the GIS.

GIS Across the Organization

Of the two principles in asset management; 1) what do you have? and 2) what are you doing? A GIS containing the data above answers question 1 and provides a competent asset registry. The key to any asset registry is keeping it up to date with real-time data, *and* having the procedures in place to effectively maintain it. A registry that falls out of date will cause problems in prioritizing future infrastructure projects. There are new tools available that provide template editing capabilities, meaning streamlined workflows that automatically build assemblies of assets, such as a hydrant assembly including the hydrant, isolation valve, lateral, and junction tee at the water main. These tools

drastically cut the data creation and maintenance portion of the As-Built process. With a GIS, you can increase efficiency of workflows across the organization to maintain the accuracy of the asset registry, for example;

- Capture best engineering and operations practices in the GIS through configurations of certain assemblies or anomaly areas of the system from the institutional knowledge and experience of seasoned workers about to retire. This is your last chance to capture this information digitally for future recollection when they are gone.

- Equip the field crew with best practices for updating real-time data. The accuracy of the asset registry is constantly tested by taking data from the office out into the field for validation and back into the office. There are free apps available for smartphones that use named user account identities in order to guarantee the security and integrity of the data collection over the Cloud. The apps use the same maps created in the office for enterprise use with little to no coding required for fast deployment.

- Empower office engineers to have the same capability, however, by using a free plugin to the most widely used engineering tool in the world, Microsoft Excel. This plugin uses the same map created for the field app such that engineers can share their spreadsheet data with GIS and/or field crews.

- Collaborate with Accountants to also use spreadsheets in financial applications bringing a new aspect and set of eyes to the asset registry.

How Do You Save Money with GIS?

Once armed with all your asset information, regardless of the data, automated systems leverage the components of a GIS platform and save labor dollars through more efficient workflows including, but not limited to:

- Real-time digital forms for data collection eliminate manual paper work and transcription errors.
- Efficient routing with turn by turn instructions, especially useful for new employees.
- Optimized and balance workloads by visualizing clusters for more efficient tasks across the service territory and eliminate unnecessary travel.
- Respond to emergency tasks more quickly by communicating and routing appropriate field crews.
- Equip field crew with GIS information to make better decisions on how to resolve the problem at hand from such turning off valves to depth excavation, thus eliminating unnecessary trips to and from the service centers.

Like any utility, Anytown, CA takes pride in doing the work right, yet armed with asset management principles and a GIS platform, strong analytical and visualization tools provide a focus on doing the right work such as, but not limited to:

- Respond and budget for main breaks. By mapping the work from their work order system on specific assets, a hotspot geospatial analysis shows clustering of water main breaks in corrosive soils when metallic mains reach a certain age. Extrapolating age from install dates on all mains and cross checking with corrosive soils across the service territory, budgets can be prepared in advance for future outbreaks.
- Environmental stewardship of water resources. By using spatial analysis to detect the nearest non-potable hydrants shows stewardship in cleaning sewer mains and re-using of precious water and decreases public concerns.
- Protect human lives with geospatial analysis. For example, an effective hydrant flushing and testing program needs to be optimized and geospatial analysis creates optimized routes for crews to perform the most efficient testing through internal or contract personnel. In addition, a manufacturer recall of a specific brand of hydrant allows crews to know when they are near these defective hydrants and can replace them while working on existing tasks, thus eliminating multiple mobilization costs of expensive equipment and trained staff.
- Improve infrastructure stability and capital improvement projects. Collecting and mapping asset condition allows infrastructure projects to be optimized based on the maximum good to the system. Having condition information overrides the assumptions based on age. Old assets do not necessarily need to be replaced while new assets may be in poor condition due to manufacturer defects, in-proper construction methods, or damaging in-situ conditions.
- Monitor and allocate your resources. Although they do not have a sophisticated hydraulic model developed for their water system, they do know how much water is consumed through their billing system. By comparing how much water is treated vs how much is consumed, they have an approximate idea on how much water loss is leaking out and have implemented a new configuration of the GIS platform that creates District Metering Areas (DMAs) and Sub-DMAs to narrow down specific areas of the system that are leaking.

What About Increasing My Revenue?

While the tools above help save costs there are also tools and datasets that may assist educating the public on the need to raise rates. In addition to data management, analysis, visualization, and field mobility, the latest GIS platform includes unparalleled collaboration tools and derivative datasets that bring new insight into your customer base. The ability to join disparate data for decision making simply by its common location. Bringing these all together could increase revenue by one or more of the following:

- Educate the public through a Storymap. Highlight existing infrastructure projects on a map with pictures and compelling stories. The relevance of projects are brought to the neighborhood level and residents can see the decision criteria which is based on engineering science and the delicate balance of the budget available vs. a capital need. Also, the cause and effect of the quality of life can be illustrated with a successful rate increase vs. status-quo.
- Leverage a dataset from the Living Atlas which shows 60+ Life Groups highlighting socio-demographics of your customers that could be configured to associate water consumption habits, openness to water conservation programs, and temperament to increased rates with a return on increased levels of service.

- Perform advanced analysis that takes your service territory into the third dimension, namely implementing differential rates and/or increasing rates due to extreme Cost of Service on customers living remotely or on hilltops above your normal pressure distribution zones.
- Use advanced analytical and visualization tools to model the current sustainable groundwater table in order to justify for increased development fees in well permits and/or need for more groundwater recharge projects
- Implement a configured dashboard for Executive Management in public meetings to show an unprecedented transparency and accountability that will result in increased customer trust and satisfaction.

Applying GIS is Saving Water and Money

While Anytown, CA is a fictitious community, the solutions presented are viable and are being implemented by your peers. Even with the rigor of ISO 55000, no two asset implementations are exactly the same, they adapt to meet the needs of the specific organization, system configuration, geography, and socio-economic makeup of the community. Having a configurable GIS platform with ready to use templates based on best management practices from your peers allows you to begin saving money right away. To learn more about how water utilities are using GIS, visit www.esri.com/water.