Esri News
for Water & Wastewater
Summer 2016

Technology Transforms St. Johns County Water Utilities

By Tom Tibbitts, GISP PSM, Information Systems Coordinator, St. Johns County Utilities

St. Johns County Utilities provides water, sanitary sewer and reuse water services to 42,000 accounts and 100,000 residents in coastal northeast Florida. This is within dispersed and detached service areas characterized by historic communities, new development, high growth, expansion and the acquisition of aging private utilities. St. Johns County Utilities is developing into a medium urban utility with increased expectations. Daily requirements include operating 20 treatment plants, 13 storage tanks, servicing 1,350 miles of distribution and collection mains, capital improvement management, new development review, customer service, and billing.

While keeping standards of cost-effectiveness, prized water quality, and high customer satisfaction, St. Johns County Utilities faced new challenges from expanding capacity, replacing infrastructure, and meeting new regulations for water reuse and availability requirements. These challenges required a variety of solutions, including mobile solutions that provide key information from centralized services to enable the insight, collaboration, and decision support needed to grow while maintaining cost-effective services. These solutions would transform the way we operate and serve our customers.

Our solutions were influenced by the success of our existing Cityworks Asset Management Solution. This mobile solution, implemented in partnership with Jones Edmunds and Associates, provides Esri-based map services and integrates the utility infrastructure layers with work order, customer service request, asset expenditures and inventory management. This asset management system is used by each treatment plant, the Warehouse, Engineering, Billing, and Customer Service; and each of the Distribution, Lift Station and SCADA field crews using Toughbooks and mobile Wi-Fi. This enables the utility staff to manage preventative maintenance, react quickly towards repairs, and collaborate seamlessly. The impact was increased productivity and a greater thought towards geographic information and mobile technologies in our project approach.

For our new challenges, St. Johns County Utilities focused on several solutions to support our goals, including Esri mobile applications and emergency response tools, an asset condition assessment and capital planning program, advanced hydraulic modeling for system analysis, and fleet logistics tools. To accomplish these initiatives St. Johns County Utilities teamed with Esri and its partners. Solutions were designed within the five patterns of GIS for water utilities which includes asset management, planning and analysis, field mobility, operational

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Esri Water Conference 2016: GIS, Networking, Water Tours, and More

By David Totman, Industry Manager, Esri Global Water Practice

Esri held its second annual Esri Water Conference from February 9 to 11, 2016, in Austin, Texas. The conference was attended by a wide range of professionals from industries such as water, wastewater, storm water, and water resources. The atmosphere was dynamic, bringing together the supply and demand sides of water, creating a one water community.

The conference kicked off with a great Plenary Session! Attendees heard presentations from the Esri Water Practice, Austin Water, Philadelphia Water, University of Texas, and the Metropolitan Sewer District of Greater Cincinnati. Following the Plenary Session, we started the afternoon with a partner focus session and then moved into paper presentations, wrapping up with technical sessions. In addition to presentations and sessions, the conference included a Hands-On Learning Lab, data health checks, a usability lab, and two tours.

Austin Water Utility provided staff and expertise for two amazing tours: Water Treatment Plant #4 and Wildland Conservation. The Water Treatment Plant #4 tour brought attendees to a new, state-of-the-art treatment plant facility. You can take the tour virtually in this story map: esriurl.com/wtp4storymap. The Wildland Conservation tour explored environmentally important and rugged terrains of Austin's Water Quality Protection Lands. Learn more about the tour in this story map: http://bit.ly/WildlandTour

On the last day of the conference, Esri hosted the University of Texas Flood Symposium. The three-hour symposium featured experts from the University of Texas, KISTERS, and Esri. Dr. David Maidment, University of Texas, Water Resources Center professor, discussed how the new National Water Model will work for flood forecasting. KISTERS presented real-time water monitoring. Harry Evans, senior research fellow and former Austin Fire Department chief of staff, led a discussion around a prototype map template for flood emergency response, and Esri experts demonstrated solutions for flood: esriurl.com/solutionsforflood. There is a lot of excitement about the new tools being developed around flood.

I would like to thank all 307 attendees and our Water Conference sponsors for supporting Esri and for being stewards of our most precious resource: water. I look forward to seeing you at the 2017 Esri Water Conference!

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ITpipes quickly shows a return on investment when it comes to condition assessment inspection organization, review and planning rehab or CIP, and overall program management. Assets with critical needs are immediately identified and located using ITpipes' automated integration with Esri.

ITpipes web, mobile and desktop solutions can be used for any asset type. All hardware is supported, including CCTV, sonar, acoustic, laser, 3-D, standard video cameras, side-scanning and more.

For inspections, ITpipes saves time and effort in the field or office. Using a tablet, smartphone, or PC, users assign inspections by prepopulating information from GIS or AMS or starting from GIS. Input forms are highly configurable, and as an end result, schedulers and planners have the exact reports desired. As inspections are completed, ITpipes Sync distributes data agency-wide.

Reviewers then have instant access to inspections through ITpipes, GIS or enterprise apps. Reviewers in ITpipes have full spreadsheet-style reporting with dynamic mapping. Features such as automatic ranking, prioritization for repair, remaining useful life, and more, help define budget needs quickly, and dispersing projects for assignment can be done easily from ITpipes with Esri.

If you're looking to get actionable intelligence from all those inspections, look into ITpipes.

Modeling with Cityworks

GIS has changed the way we understand the world around us. Intuitive modeling tools provided public agencies with the ability to view, manage, and manipulate the assets they care about—infrastructure, property, and facilities. Recognizing the powerful capabilities of the GIS and the inherent value of the geodatabase as the authoritative asset inventory, Cityworks introduced a new and innovative approach to asset management.

Built on the ArcGIS platform by Esri, Cityworks is easily applied to anything modeled in a geodatabase. Public agencies, utilities, and special districts that care for infrastructure facilities, airports, marinas, botanical gardens, emergency response, urban forests, and more, are in touch with reliable and accurate data and geographic analysis tools that help managers make informed and timely decisions.

From the largest city to the smallest water district, the challenge is the same—functional and dependable systems that are safe and reliable. Proactively scheduling maintenance; acting quickly and efficiently on customer issues; and managing the regulatory requirements of permitting, licensing, and related business processes are tall orders in today's economy. Discover why so many agencies around the world choose Cityworks—Empowering GIS for Public Asset Management.

Increasing Efficiency from Castle Rock to Redding

Let's talk about water and wastewater infrastructure. It's important; it's expensive; and it can be challenging to manage. But technology can make it easier and more efficient.

Take Redding, California for example. When a car hit a fire hydrant in 2014, it triggered a leak that resuspended mineral sediments and discolored the water. The city needed to quickly track, intercept, and flush the dirty water before it reached the reservoirs. Fortunately, their infrastructure was documented in both Cartegraph and Esri.

The team used the systems together to map citizen complaints, spatially illustrating the problem for responding crews. "Cartegraph's live database updates enabled us to quickly deploy the crews to flush the appropriate hydrants and prevent the dirty water from reaching our reservoirs," explained Terri Webster, GIS Analyst.

Meanwhile, the crew in Castle Rock, Colorado is taking advantage of mobile technology. Using ArcGIS maps to locate assets and Cartegraph for iPad to conduct on-site inspections, crews are becoming more efficient.

In 2014, it took the team a year to inspect 930 fire hydrants. With Cartegraph and Esri, they inspected 831 in just six months. "That's about a 40 to 50 percent increase in productivity," said Utilities Mapping Specialist Matt Daniels.

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Today's water utilities are faced with increasing pressures, including water supply, efficiency, workforce, infrastructure, and the bottom line. But every problem has a solution. Neptune Technology Group knows, because *our people have answers*.

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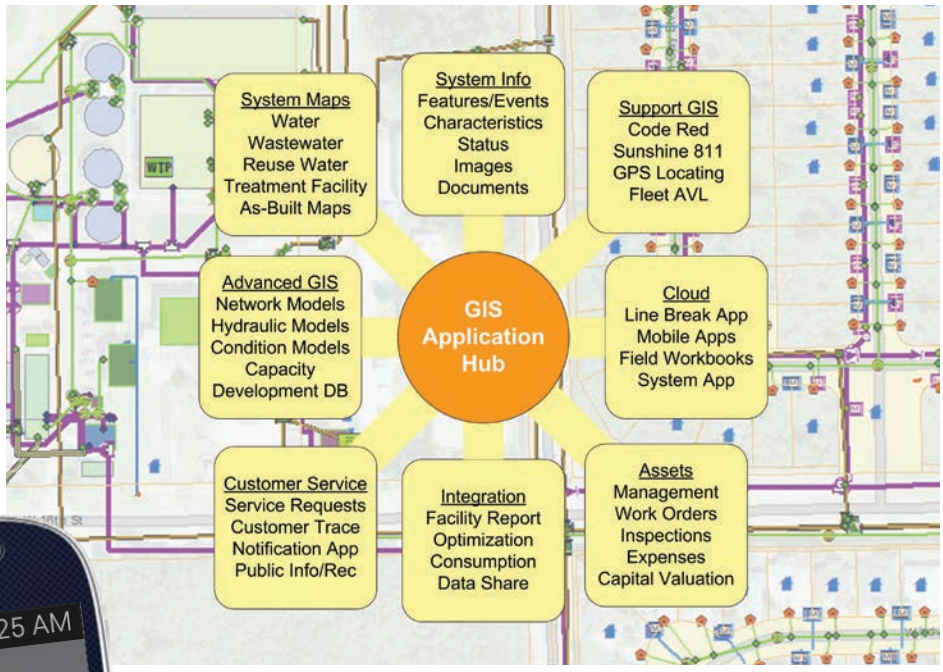
Technology Transforms St. Johns County Water Utilities

continued from cover

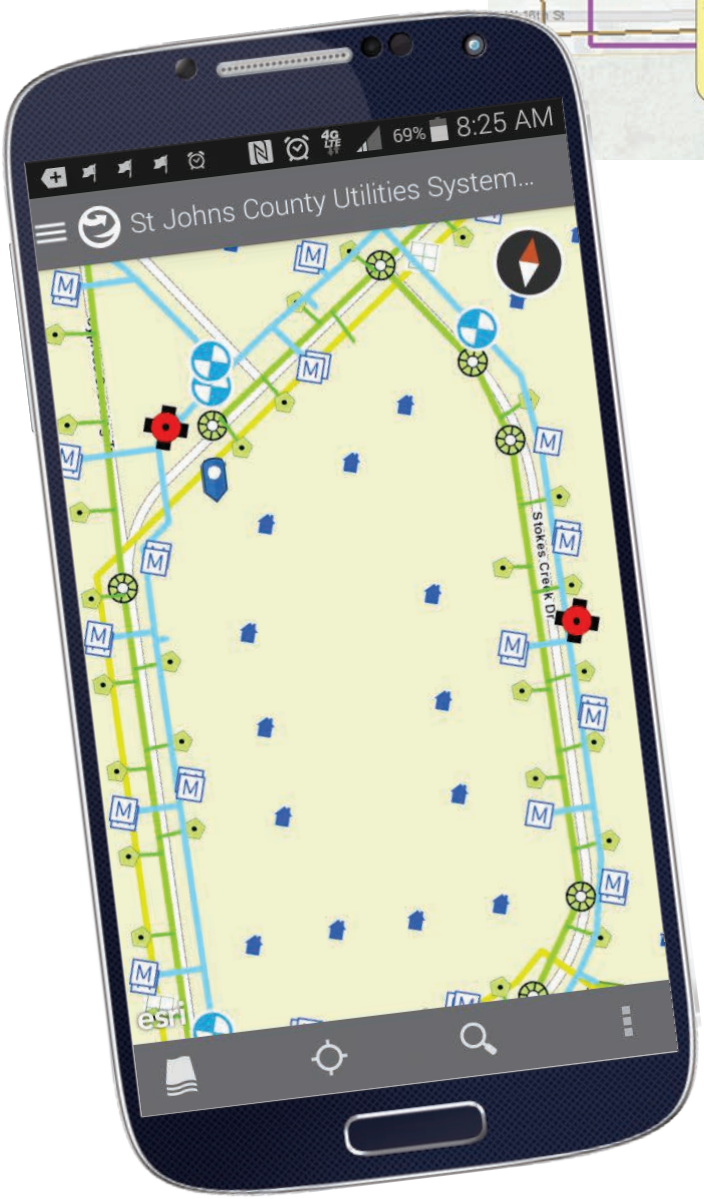
awareness and constituent engagement (esri.com/library/whitepapers/pdfs/implementing-arcgis-for-water-utilities.pdf).

Esri's ArcGIS Online provided a platform that would reach our mobile users in new ways, connect with our partner agencies and let us quickly share information with our customers. Web AppBuilder for ArcGIS and Story Map sites (sjcutilitis.maps.arcgis.com), using Esri's ArcGIS Web Adapter for IIS, are employed to distribute ArcGIS Online products to county staff, contractors, and business partners,



↑ Key information from centralized services enables insight, collaboration, and decision support.

← Access to data enables the utility staff to manage preventative maintenance, react quickly towards repairs, and collaborate seamlessly.



providing secure access to the data they need, whenever they need it. Our first project was very successful in gathering and sharing crucial information about smoke-testing activities for our inflow/infiltration reduction program. ArcGIS Online was used to quickly share the status and results of the testing, keep staff aware, notify homeowners and property managers of testing in their area, and coordinate with contractors and 911/Communication Centers from the Fire and Rescue Department and the Sheriff's Office. These tools would also be used for public project notices, improvement project updates, water quality, service area, system maps, and—for our contractors—meter replacements and tower site analysis.

ArcGIS Online also provided solutions for our water line breaks, service outages and "boil water" notices, using tools from Esri's ArcGIS for Water Utilities for emergency response (http://solutions.arcgis.com/utilities/water/emergency-response). These solutions also help staff investigate and identify water leaks, quickly isolate breaks, perform network traces, and identify affected customers. By partnering with GIS Inc., we were able to quickly configure these and other, customized tools, tailor specific configurations, and then release the apps for our staff.

A condition assessment through GIS-based analysis would best help the utility evaluate aging infrastructure, including acquired deteriorating utilities, and prioritize replacement strategies. A likelihood-of-failure score was derived through GIS

analysis of pipe and manhole characteristics—including age, material, diameter, failures, repairs, and rehabilitations—and risk was identified using spatial analysis from soil type, upstream events, and network relationships along with Cityworks scores for preventative maintenance and inspections. A consequence-of-failure score was calculated based on the potential impact of a failure—the calculation took into account customer location density, roadways, wetlands, and critical facilities including nursing homes, schools, hospitals and high-density centers. Identifying our most at-risk assets through likelihood- and consequence-of-failure scores helps to redefine the capital planning cycle and determine prioritization of inspections, maintenance, repair, rehabilitation, engineering design and financial projections. St. Johns County Utilities teamed with WK Dickson & Co, to use Esri and Cityworks technology to meet the challenges of becoming a utility of the future.

The Engineering Division is implementing hydraulic water modeling tools. This shared model provides better understanding of the water network, pressure points, and activities to support decision making. This model is built on Innovyze's InfoWater, a GIS integrated water distribution modeling and management software application. By integrating with our geodatabase model, staff will be able to build a sustainable full system model, make regular updates, and provide more accurate and complete information of our water system.

The expanded reliance on GIS and these new programs requires dependable and accurate geographic data for analysis, and is the basis of investing in reviewing our workflows; applying industry best practices; and implementing Esri's ArcGIS Data Reviewer, Task Assistant Manager, and ArcGIS Workflow Manager. Building the quality of our data and streamlining the processes to maintain it ensure the reliability of our advanced analysis applications.

Our Engineering Division has started to use Esri and Cityworks to help streamline capital and development projects through management, scheduling, and inspection tools. Currently, GIS-integrated inspections entail evaluation of manholes and—through our pretreatment program—commercial grease traps. Direct access to the geodatabase through map services saves time and empowers our mobile staff. Our Engineering Division foresees similar benefits for our mobile staff by managing capital projects overviews and sharing the information with constituents through ArcGIS Online, and for development review and managing project tasks, schedules and inspections. These solutions also support asset management by helping to identify and record data as it is constructed.

As solutions are implemented, the utility is able to envision GIS tools for other needs. The St. Johns County Utilities Integrated Water Resources Plan (IWRP) anticipates that the service area population will double—to 190,000 residents—by 2040. The IWRP identifies water resource limitations and the need for alternative water sources—including expanded water reuse systems for irrigation—and reducing water usage through a public conservation awareness program. The utility is considering tools for raising public awareness of water consumption and conservation techniques, along with analysis and design tools to reach our goals of reducing water waste.

St. Johns County Utilities is using GIS and other technology to solve the challenges the utility faces, due to expansion and limited resources, while maintaining quality water products and excellent customer service. This provides a balanced approach that will enable comprehensive and adaptive management to be successful well into the future. Our water utility plans to continue investing in technology that helps to provide reliable and accurate information and supports our commitment to providing high-quality service to our residents. Esri is a valued partner in that commitment to excellence.

↓ Esri's ArcGIS Online provided a platform that would reach our mobile users in new ways, connect with our partner agencies and let us quickly share information with our customers.

GIS Sets the Stage for Effective Flood Response in San Bernardino County

By Barbara Leigh Shields, Esri Writer

↑ County flood control crews sandbag a location to prevent further flooding of private property.

The El Niño conditions warming the Pacific Ocean threatened to drench California communities, compelling agencies to modernize flood management technologies. The County of San Bernardino Department of Public Works recently replaced its slow, manual processes and paper records with Esri technology. The geographic information system (GIS) software improves location-based analysis, real-time situational awareness, and incident response.

The largest county in the United States, San Bernardino County has diverse geography ranging from a steep mountain range to the vast expanse of the Mojave Desert. A storm rolling through the region can create dangerous flash floods. The GIS team designed a flood management solution to collect and integrate pertinent data and quickly create up-to-date, data-rich applications in Esri Operations Dashboard for ArcGIS and Collector for ArcGIS. GIS provides location information to managers in the Department Operations Center (DOC) and responders in the field via any type of mobile device.

"Esri GIS technology quickly gets essential information to the DOC to improve flood response," said Ryan Hunsicker, GIS manager. "The Esri platform helps us manage dispatch activities and provides near real-time maps showing [the] positions of our field staff along with the locations of any concern that they encounter along their storm patrol routes."

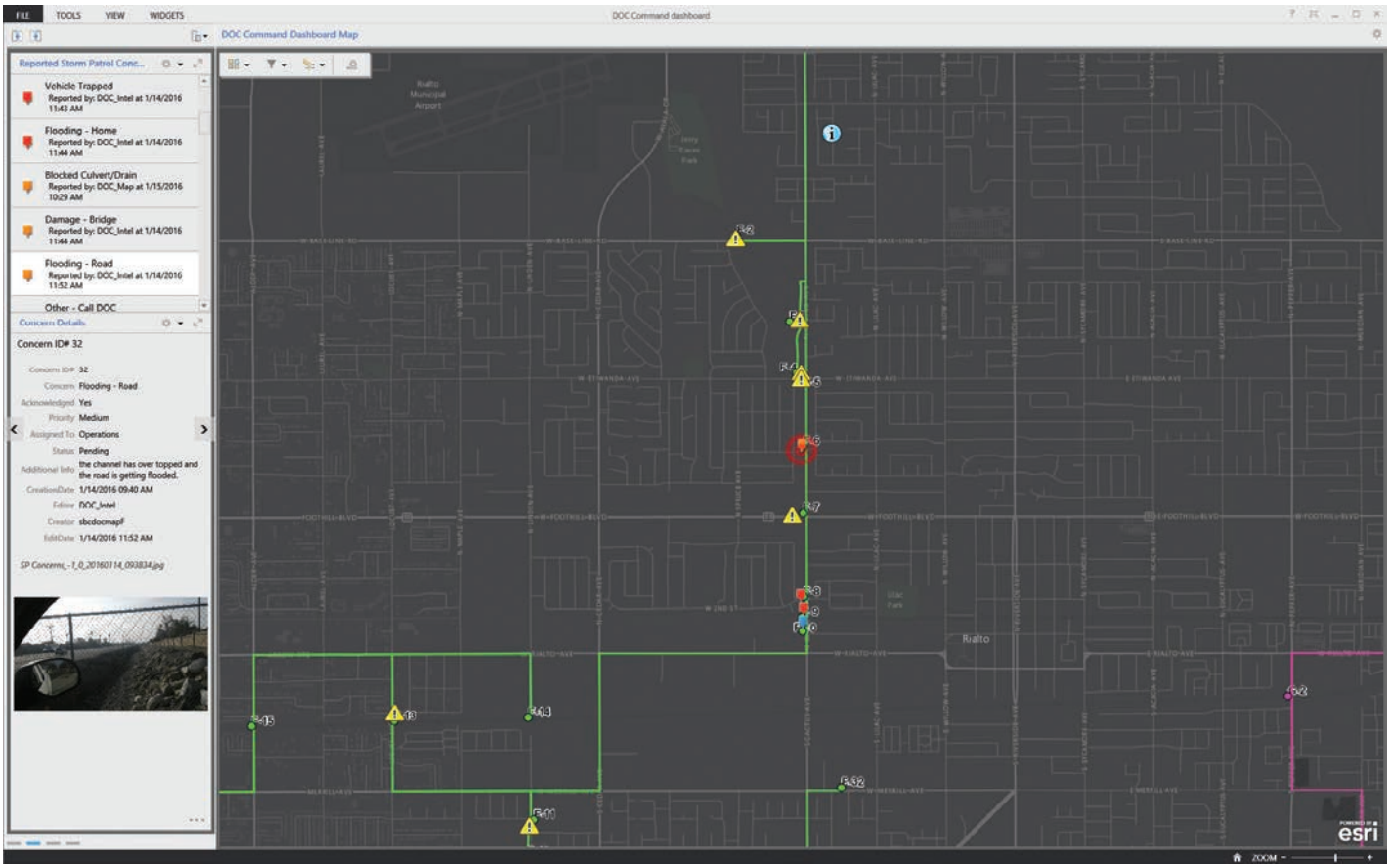
The district uses the Esri ArcGIS Online platform and Operations Dashboard tools to plan response, show flood data on a live map, and disseminate critical information between the DOC and field responders. GIS processes county and field data to show incident information. The county's GIS team uses Collector to create data collection apps for people working in the field and a dashboard for managers at the DOC, who review, assess, and direct field operations.

During a flood, district managers can rely on GIS to see critical data such as flood levels, water flow blockages caused by debris, and the impact on infrastructure. Whenever an incident occurs, all activity is projected from an Operations Dashboard app onto a big screen in the DOC. With updates at 30-second intervals, the map shows the flood control basin's remaining water capacity. It also shows field observations, provided by several roaming assessment teams, that describe conditions that pose a danger to flood control facilities.

GIS also shows, in near real time, the location and status of response vehicles and road closures. Map symbols indicate the severity of conditions that pose a threat to life or property. Furthermore, GIS displays information disseminated by other agencies such as San Bernardino County Fire and the National Oceanic and Atmospheric Administration (NOAA).

When it starts to rain heavily, the public works department wants eyes on the ground. It dispatches storm patrol teams to observe and report damaged facilities, eroding channels, and basin water levels. The teams follow designated routes and log their observations. Predetermined storm patrol assignments are mapped in GIS to show the route each storm patrol team is to drive. Dashed lines indicate a storm route that is potentially hazardous and is only to be driven during daylight hours. These routes may include nonpublic and flood-control roads not found on a conventional map.

"We didn't have a way to collect or tabulate data very effectively or disseminate it to the DOC," Annesley Ignatius, deputy director of public works, explained. "Although the flood patrol



↑ The DOC Operations Dashboard application shows detailed information about a concern that was recorded along a designated storm patrol route.

crews would be contacted every hour to provide their observations, we couldn't get their complete observations and effectively compile it. Rather, we had to wait for them to turn in their logs at the end of their shifts, as much as 12 hours later. Now, the mobile app instantly delivers that data from the field location to the DOC."

"Esri tools give us the ability to digitally collect data, analyze it in the DOC, and act on it in the field," Ignatius continued. "GIS shows us what is actually happening in the field in real time. Furthermore, field data is available for future use."

Using ArcGIS Online and Collector for ArcGIS, the GIS team built a web app for recording observations. It sends field data to the GIS platform for inclusion on the command center map. Field crews access the app from their county-issued tablets and drive the map's prescribed route. Stopping at indicated points, staff complete the observation for each

"GIS shows us what is actually happening in the field in real time."

↑ Flooding incidents are a serious threat to life and property, and the county flood control district is committed to preventing them.

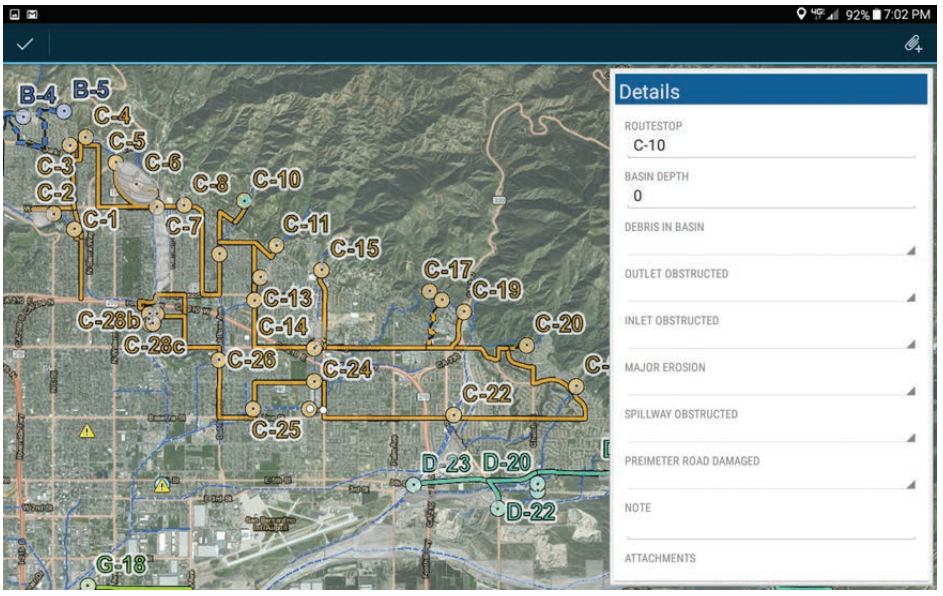
↑ An outlet of a flood control facility has overflowed and pours mud and water onto city streets.

point as described by the map's pop-up window.

"Each stop has multiple observations, and we want to record each operation at the same point throughout the shifts," Hunsicker said. "Collector for ArcGIS made it very easy to design the app. Once we decided on the questions to ask at each of the stops for patrol crews, I put them into the app template. The app is simple to use and captures the data we want and with fewer errors."

For each stop, the app displays a set of yes-or-no questions about obstruction, flooding, flow backup, rain intensity, and so forth. If the patrol crew members answer yes to any item, they take a photo depicting the problem and write comments about it in the app's note box. The crew can also stop at unassigned points and report incidents such as a felled tree blocking a road. The app geotags the log entry and returns the information to the platform.

> "The app is simple to use and captures the data we want and with fewer errors."



← Collector for ArcGIS allows the storm patrol team to log an observation at a predefined storm patrol stop location.

At the DOC, incoming information is noted in the corner of the map. The team sends a note back to the patrol crew confirming that the information was received. Managers decide what response to take and dispatch a work order, such as, "Send a bulldozer to this location to clean up this debris."

Once the work crew has completed a task, that information is input into the app and the task is denoted on the map as being complete. Documentation of the task—from observation to assignment to completion—ensures that incident response is prompt.

ArcGIS Online archives all incident data related to a flood. The public works management team can use a time slider to review incident data and see how the sequence of events unfolded, which can then help staff learn how to manage incidents more effectively and mitigate damage in areas that are prone to flooding.

The department of public works is very optimistic that the Collector and Operations Dashboard apps—working together with the flood control district's GIS data, policies, and procedures—will streamline the process of ensuring the safety of San Bernardino County residents from floodwater. With the real-time capabilities of the Esri ArcGIS platform, managers at the DOC immediately have the information they need to make decisions on how to react to and mitigate floods that occur within the county.

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Preparing Your Stormwater System for Historic Rainfall and Flooding

By Dan Hartman, Public Works Director, City of Golden and Kate Ernst, Marketing Manager, Cartegraph

It's a familiar concern for stormwater professionals: Is my system prepared to handle the next storm? What if it's a 100-year flood? A 1,000-year rainstorm? Reason for such concern hit Colorado in September 2013, wreaking havoc across 2,000 square miles of the Front Range of the Rocky Mountains. Torrential rains, far exceeding previous records, caused widespread flash flooding that damaged or destroyed about 20,000 homes and commercial buildings, 485 miles of roads, and 50 bridges, according to the National Oceanic and Atmospheric Administration.

The 17 affected counties included Jefferson County, home of the city of Golden. While not in one of the

hardest-hit areas, Golden experienced a year's worth of precipitation in less than a week. Nonetheless, "the amount of damage we incurred was very minor," says public works director Dan Hartman, who attributes the damage control—at least in part—to the effectiveness of the city's Cartegraph Operations Management System (OMS), integrated with Esri's ArcGIS platform.

Challenge

That level of preparedness was not always in place. According to Hartman, when he took his position in 1988, Golden was "a wait-for-a-break-and-respond organization." Assets were not quantified, and there was no ongoing reinvestment program. This situation made it difficult to maintain stormwater and other types of systems at the operating level for which they were designed. Setting his sights on developing an investment plan, Hartman began to implement a rudimentary asset management system.

The first step was to update the existing meticulous, hand-drawn maps of city systems. Those maps showed 32 miles of water distribution lines and 38 miles of sewer lines but included no record of the stormwater system. Hartman commissioned aerial surveys, which revealed that the systems were nearly twice as large as what the hand-drawn maps showed: 79 miles of water lines and 72 miles of sewer lines. Also identified were 66 miles of storm pipes and 11 miles of storm channels. City staff then utilized Esri's ArcGIS software to digitize the location of these assets. These new digital maps allowed the public works team to start capturing and storing critical asset data.

Solution

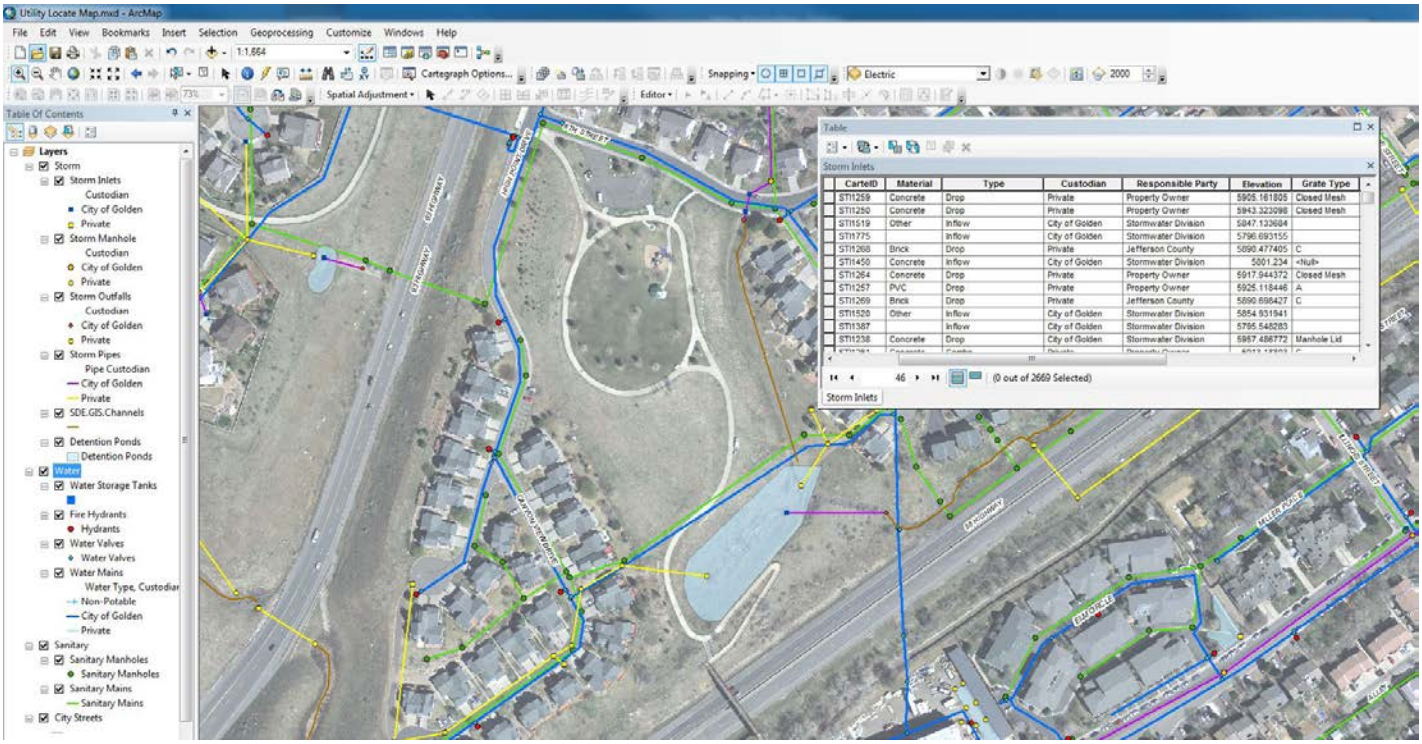
In 1999, Golden transferred that data into the Cartegraph system and, for the first time, was able to integrate geographic information system (GIS) technology with asset and work management systems. All of the city's assets were recorded in what then became a robust database, says Hartman. "We used basically every module—water, wastewater, stormwater, streets, trees, signs, etc." With a clear picture of the location, dollar value, condition, and life expectancy of every asset, Hartman could more easily make realistic projections for the annual investment required to maintain the system.

The stormwater team now conducts detailed annual inspections of the city's thousands of storm inlets, manholes, outfalls, detention ponds, pipes, and channels. In addition, drive-by inspections are made after storms in order to discover any resultant stoppages. These regular inspections keep the system prepared for whatever Mother Nature throws its way.

Golden recently transitioned to Cartegraph's new platform, OMS, a web-based application that integrates with ArcGIS through editable feature services published using ArcGIS for Server. This mobile-friendly technology brings mapping, asset management, and work management tools to the field, which streamlines workflows and data entry.

↖ The 7th Place Bridge over Tucker Gulch after the September 2013 flood.

↓ Cartegraph's new platform—Operations Management System (OMS)—integrates with ArcGIS, bringing mapping, asset management, and work management tools to the field, which streamlines workflow and data entry.



↑ Field staff use Cartegraph on their mobile devices to conduct detailed inspections of the city's storm inlets, manholes, outfalls, detention ponds, pipes, and channels.

→ The 7th Place Bridge over Tucker Gulch prior to the September 2013 flood.

When performing inspections of the stormwater system, workers now use iPads to navigate to the inspection site, go through a detailed checklist, make necessary notes, attach photos, and document that the inspection has been completed. If staff discover an asset that's not up to par, they schedule the needed repairs by creating a task, on the spot.

When clearing channels, rebuilding detention ponds, fixing inlets, and performing other maintenance, workers log their data while in the field, providing a real-time record of the work completed, who performed it, how much time it took, and materials that were used.

"For stormwater, the key benefit of operations management is that it provides us with an organized approach to inspect, maintain, and repair our system," says Hartman. "It allows us to document that our system is functioning [at] the highest level it can."

Results

The record flooding of 2013 put Golden's stormwater system to the test. "The system performed well. The inlets were open and the detention ponds were clear, so they could do their jobs," says Hartman. "You can't start fixing those things when the rain starts."

As a result, Golden can be confident that the stormwater system can handle the maximum level for which the system was designed. "To the extent our system could protect us from damage, it did," says Hartman. "That is due in part to our regular inspections and the technology that helps us track the condition of the assets in the system."

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→ "Cartegraph integrates seamlessly with our existing data from ArcGIS. Everyone on our team – from the GIS professionals to the field crews – can create and update GIS data through the easy-to-use Cartegraph software."

Charles Osterman, GISP
GIS Analyst | Adams County, Colorado

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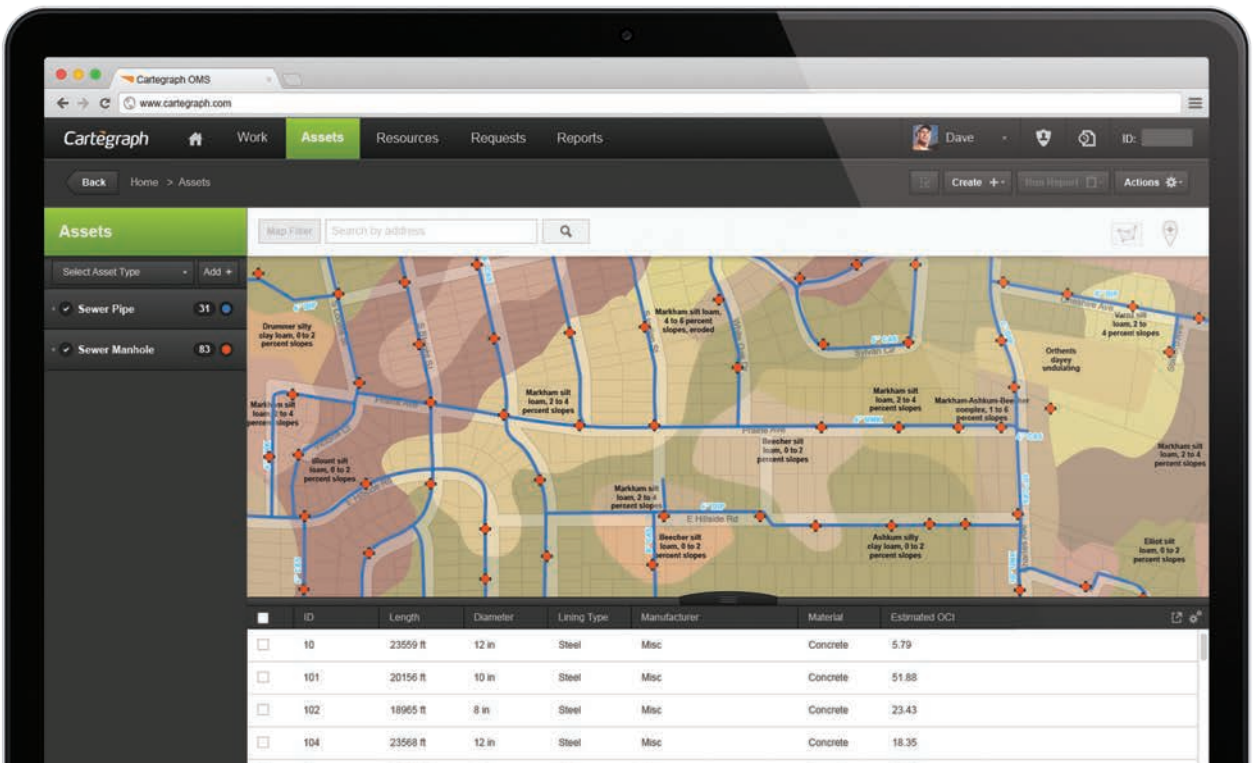
Update GIS data from the field with mobile technology



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