Esri News
for Water
Fall 2017

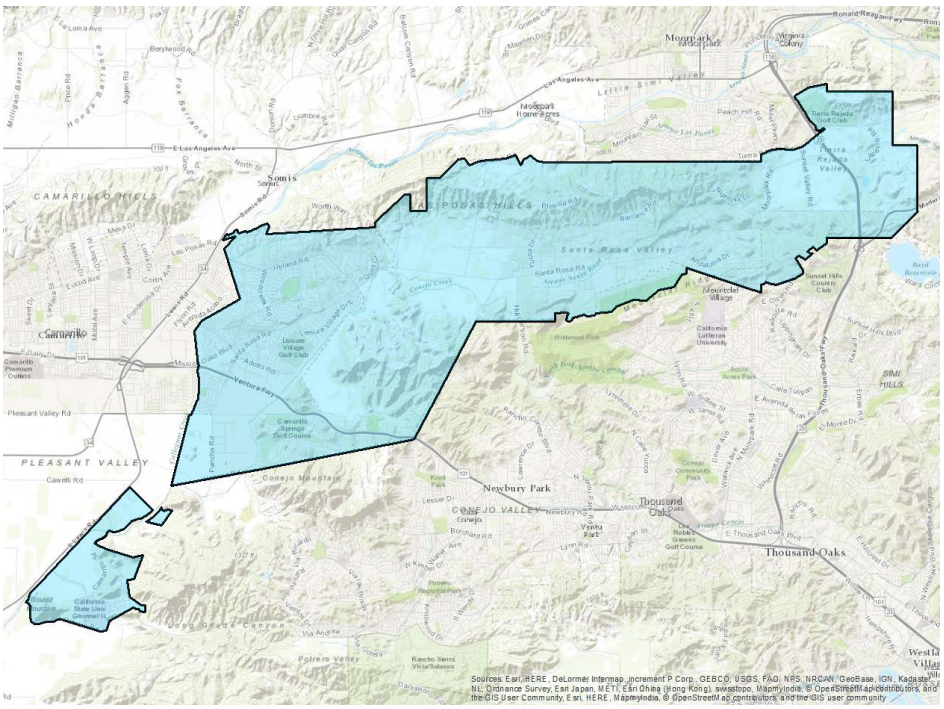
Implementing GIS Solutions at Camrosa Water

Jon Hanks, GIS/Engineering Technician
Camrosa Water District, Camarillo, California

It's Easier Than You Think!

Located in the Santa Rosa Valley, approximately 60 miles from the densely populated urban center of Los Angeles, Camrosa Water District provides potable and nonpotable water and sanitary services to around 30,000 customers, ranging from single-family residences to large commercial farms. The district's mission is to provide services to the community that are reliable, affordable, responsive, and of high quality. In accomplishing this, the district makes extensive use of Esri software to direct and assist field staff and to guide efforts in water-use efficiency as Camrosa endeavors to be a prudent steward of local water resources.

Prior to 2016, Camrosa had made use of ArcGIS for Desktop for many years, but we were not using the software to the fullest extent. In August 2016, the district signed an enterprise license agreement with Esri that provided the district with a full range of products and extensions, including access to ArcGIS Online. I saw this as an opportunity to adapt the software to our district's specific needs through the development of various web-based applications. First, I developed an application that is an interactive meter and parcel location map for customer service staff use. Esri technology made this development relatively simple; it took just about two weeks to develop and roll it out. Subsequent to this first venture, in January 2017, I designed a web map for use with Collector for ArcGIS that directs and tracks the installation of new automated meter reading (AMR) technology. The following month, the operations and maintenance department began using a maintenance tracking application to log maintenance and repair work on infrastructure. In March, applications for tracking leaks and analyzing water usage went live, and I've got more applications in the works, which will focus on emergency preparedness and water quality sampling.



↑ Camrosa Water District is an independent special district encompassing 19,300 acres of the Santa Rosa Valley and a portion of the city of Camarillo.

The rapid implementation of the software has been possible, in large part, due to the ready-made solutions offered by Esri. The solutions can be used as is, tinkered with, customized, or simply as inspiration for apps made from scratch. The process is straightforward and easy for anyone familiar with ArcGIS

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Desktop, from creating the MXD file to publishing in ArcGIS Online. Once the data is published, Web AppBuilder for ArcGIS provides an excellent means of creating web apps tailor-made to the project at hand.

One of the most important uses of Esri's software for our district utilizes the Collector mobile application. For any utility, being able to quickly and accurately locate infrastructure is of the utmost importance, and Camrosa has been able to meet this need through this application. Collector makes it simple for GIS personnel in the office to share the most up-to-date information with operations personnel in the field,

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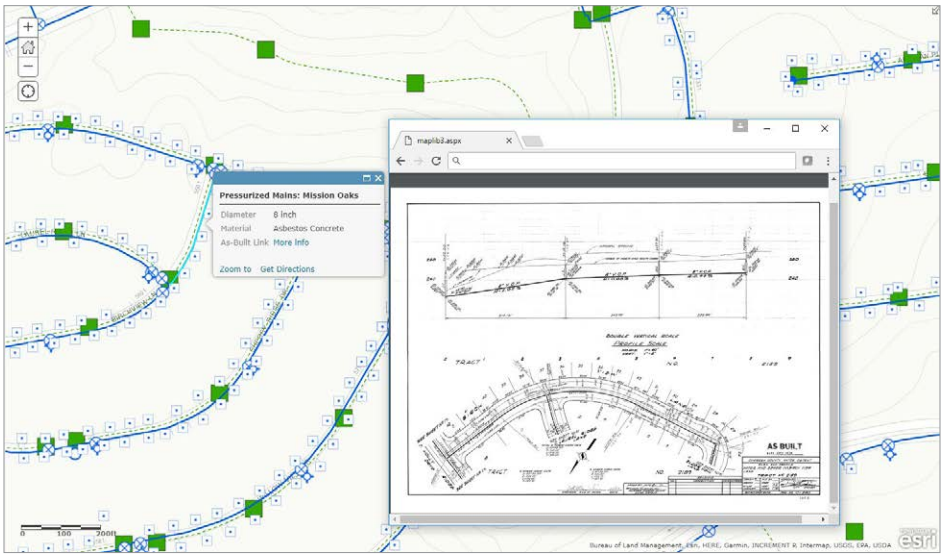

↑ As-built lookup system linked to main lines using hyperlink attribute fields—Staff can access as-built drawings through the web or via Collector for ArcGIS at any time.

Editorial Note

As you have most likely noticed, the name of this newsletter has been changed from *Esri News for Water and Wastewater* to *Esri News for Water*. This may seem like a minor change, but it's not. It represents a shift in how Esri is responding to the water industry. With today's weather extremes, ranging from drought to flood, water demand must be managed in concert with supply. You may be thinking that this is obvious; during a drought, the lack of water turns everyone's attention to a sustainable water supply to meet demand, but too much water from floods causes other problems, from infrastructure damage to water quality concerns from overland pollutants. And while I'm on the topic of water quality, groundwater depletion from drought also causes subsidence fissures, where pollutants from the surface have direct pathways to the aquifer.

The number one topic in times of drought is water conservation, as it should be. But having worked at a water utility, I dare say that water conservation is also a difficult business model, because it requires you to encourage your revenue-generating customers to use less product. Of course, we all must conserve water, especially in the desert but also almost anywhere in the United States, where we have some of the highest per capita water consumption rates. In addition, we need tools that help water utilities better manage the financial challenge of rising costs and declining revenues.

Underlying all this is the burden of aging infrastructure, which impacts both water utilities and water resources organizations. From dams that are more than 100 years old to cast iron pipes and clay sewers, organizations find themselves having more need than funding. We didn't improve our grade from the American Society of Civil Engineers (ASCE) American Infrastructure Report Card very much from 2013 to 2017, so we need to optimize what few resources we have available. I am personally involved in the ASCE Grand Challenge (http://www.asce.org/grand-challenge/) and encourage all of you to learn more about it.

On many occasions, I have said that we need to manage water from leaf to faucet, or from toilet to river, yet it all boils down to this balance of managing supply with demand—drought versus flood, water quantity versus quality, and costs versus revenues. And the behemoth is aging infrastructure, which requires us to address the holistic water cycle, just like the hydrologic cycle you may have learned about back in grade school. We at Esri are working hard to integrate the rich scientific tools in our Arc Hydro toolbox with the operational efficiency of the maps and apps in the ArcGIS for Water Utilities solution suite. Our progress, the innovation from our partners, and your successes will be highlighted in this integrated newsletter, Esri News for Water. I'm looking forward to great content from everyone as we manage One Water.

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↑ A web interface allows staff to view and analyze leak information recorded in the field via Collector.

while a redlining tool based on Esri's Map Change Request solution allows field personnel to communicate any corrections that may be needed when a data discrepancy is encountered. Use of hyperlinked fields for major assets, such as main lines, allows personnel to quickly retrieve as-built drawings while in the field, providing the most detailed information available. This feature has been especially popular with operations personnel who, prior to the implementation of Collector, had to trek back to the office and retrieve paper copies when as-built drawings were required. This flexible, easy-to-implement system has greatly increased the utility of the GIS, making it mobile and truly accessible. This ability has proved so crucial that the district invested in tablets for all operations personnel, enabling them to utilize the technology while out in the field.

In addition to assisting the day-to-day operations of the district, Collector and ArcGIS Online have proved useful in aiding water-use efficiency efforts. Although California's drought state of emergency is officially over, Camrosa continues to be committed to wise stewardship and the development of local water resources. Tracking and predicting leaks, identifying areas where more efficient water use is possible, and reaching out to customers to help them use water wisely are all key components of this effort. Collector is used by operations personnel to log leak locations, while office staff can utilize the ArcGIS Online web interface to view the location of recorded leaks and analyze problem areas that need preventive maintenance.

Being proactive about reducing water loss is only one element of the overall effort to use water efficiently. Another piece of the puzzle is helping customers be efficient and reduce overwatering.

To this end, in 2015, Camrosa conducted a district-wide study that relied heavily on the ArcGIS Spatial Analyst extension for ArcMap. In an effort to meet conservation goals, Spatial Analyst was used to analyze high-resolution aerial imagery of the entire district, classifying different terrain types and focusing on irrigable landscape areas in residential parcels. This provided the district with a good approximation of each parcel's irrigable area, which could then be used in calculating how much water each parcel would require for outdoor irrigation.

After making allowances for average indoor use and water loss, an expected outdoor use could be determined for each parcel. The results made it possible to identify parcels where consumption was unusually high. This enabled targeted customer outreach to help those customers reduce their usage, thereby lowering their monthly bills and preserving resources simultaneously.

↑ Water conservation study—Pictured, from left to right: aerial images, an irrigable area calculated with ArcGIS Spatial Analyst (bright green), and an interactive web app illustrating results

"As a longtime user of the ArcGIS Desktop product, Camrosa is now leading the way forward with the use and integration of Esri ArcGIS Online and ArcGIS Server products. This model has allowed for rapid development of spatial tools and accessibility for field operators through the use of cloud-based services while maintaining on-premises control of the district's data structures"

Joe Willingham,
Planning and Data Systems Manager

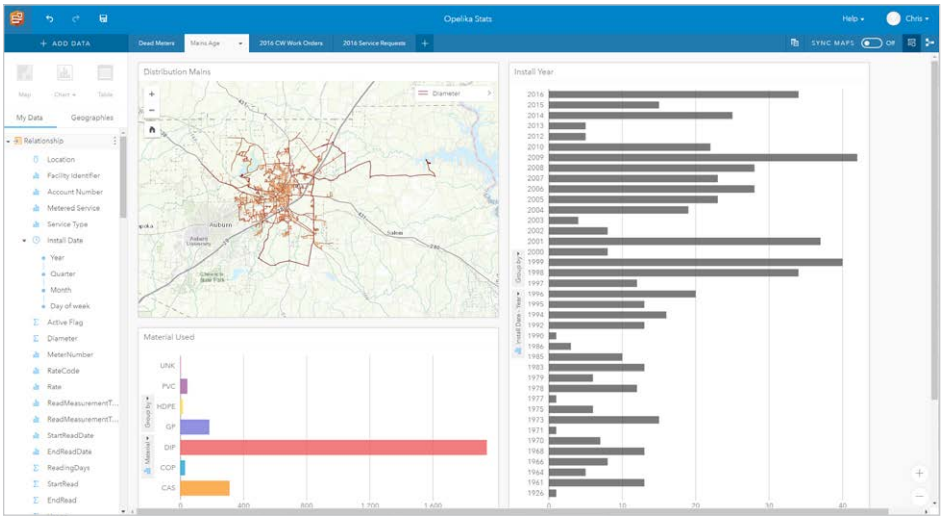
Dead Meters, $300,000 and Insights for ArcGIS

Opelika Utilities, in Opelika, Alabama, serves nearly 20,000 customers. The utilities' mission is to assert a broad, long-term view of water needs for Opelika's citizens and industries while ensuring that facilities, sources, and manpower are providing pure and plentiful water, now and for the future. With a focus on improving operational efficiency, Opelika Utilities began taking a closer look at potential revenue loss and solutions to help increase revenue. While many utilities are concerned about water loss due to leaky infrastructure, losses of this kind at Opelika Utilities are well below industry standards. Instead, nonoperational (dead) meters are the primary cause of nonrevenue water. Opelika Utilities staff had no way of knowing how vast of a problem they had on their hands.

For years, Opelika Utilities had employed a manual process to identify potential dead meters and extremely high/low monthly meter readings. Once a month, an office team member would spend an entire day reviewing the meter reports. This meant painstakingly reviewing—line by line—daily Microsoft Excel reports of more than 14,000 readings. Due to this daunting manual process, there was a high probability of significant amounts of information being overlooked, including revenue loss. Staff needed an automated way to review meter readings, analyze them, and automatically generate work orders so that nonoperating meters could be attended to.

In 2016, Opelika Utilities partnered with GISinc to connect geographic information system (GIS) technology and Cityworks with the billing system, utilizing back-end processing scripts to develop a report of meter reading discrepancies. The scripting process was labor-intensive on the hosted servers and took hours to complete. But the effort proved to greatly improve the process, which led to an estimated increase of annual revenue of over $100,000.

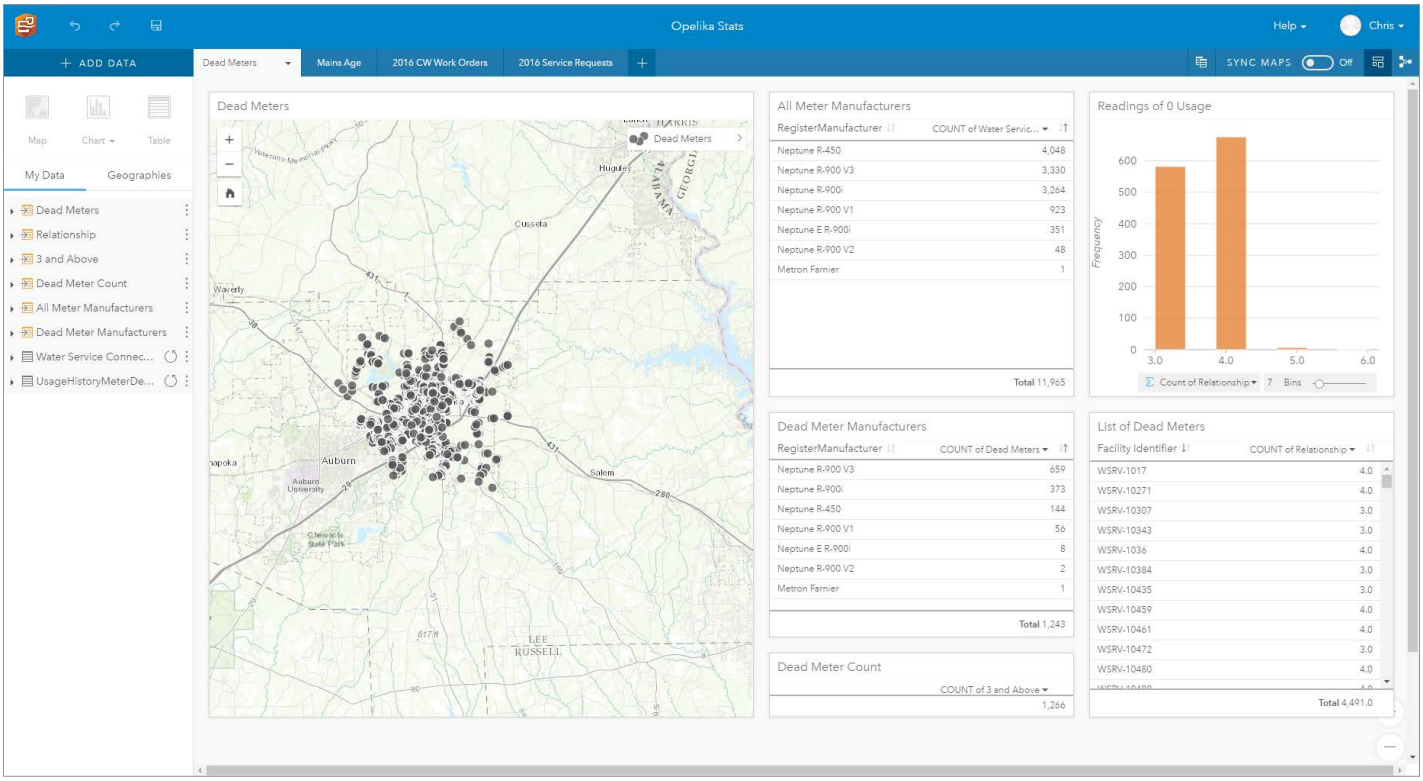
In April 2017, Opelika Utilities and GISinc staff traveled to Esri's Philadelphia office to participate with the Esri water team in a Business Intelligence Summit. Armed with literally hundreds of thousands of records of data (service connection, meter usage, work order history, etc.), staff learned that they could connect all the data using Insights for ArcGIS.



↑ Looking at Opelika Utilities' pipe age and material can help facilitate future capital improvement planning (CIP) projects and budgets.

The results were so astounding that Opelika Utilities' general manager, Dan Hilyer, almost fell on the floor. Out of 14,000 meters, 21 percent (3,000) were dead. "It's information that no manager wants to hear, but information that we need to know," said Hilyer. This translated into an estimated $25,000/month revenue loss ($300,000/year). Because the losses were so much higher than expected, Alan Lee, Opelika Utilities' capital projects manager, knew there was a larger problem. Using Insights for ArcGIS and performing further analysis, staff identified a batch of dead meters that were from the same manufacturer, had the same model number, and were recently installed. The good news was that these meters were still under warranty; therefore, replacing them came at no cost to Opelika Utilities. "Insights for ArcGIS gives end users the power to filter data and see results without the requirement of being a computer programmer or Python scripter," said Lee. "Once the data is connected, it's all plug and play—very powerful software."

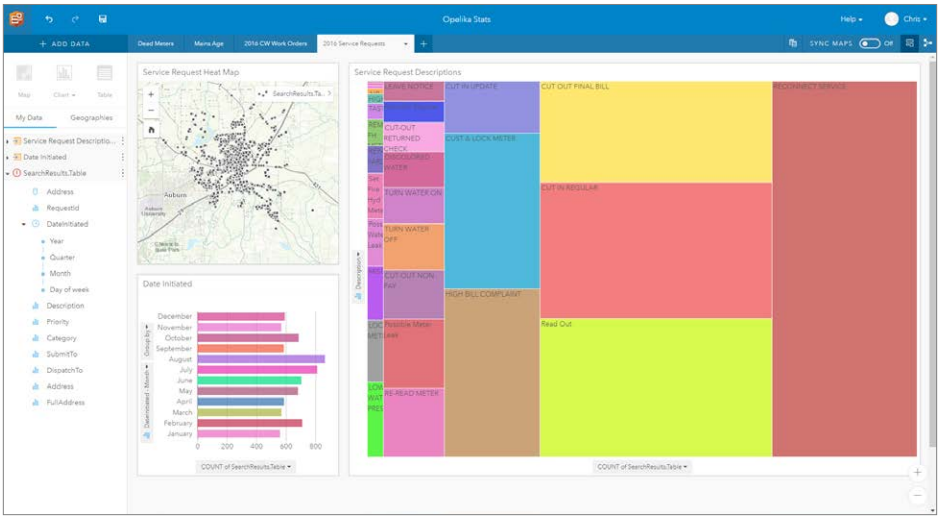
Some of the next steps included GISinc working with Opelika Utilities to streamline the process by adding visualization and integration with Operations Dashboard for ArcGIS, Collector for ArcGIS, and Cityworks. Additionally, Opelika Utilities is identifying its next big project and data to push through Insights for ArcGIS. "This is another example in the long line of value-added, return-on-investment examples Opelika Utilities has stood up over the years," said Kevin Stewart, director of sales at GISinc. "They illustrate what can happen when you combine powerful technology from Esri with the desire to improve operational efficiency and a vision of location-enabled business. This exemplifies why [Opelika Utilities was] also a 2017 Esri Special Achievement in GIS Award recipient at this year's Esri



↑ Connecting meter usage to meters in Insights for ArcGIS illustrated how pervasive of a dead meter problem Opelika Utilities had and which manufacturers and models were the biggest problems. The map shows all the potential dead meters, with manufacturers identified on the cards.

[User Conference]. Congratulations, and well deserved!"

This project is a reminder of a simple truth about meters: all meters will die. This could be a result of manufacturer defect, meter age, or damage. At some point, every meter will stop working and require maintenance or replacement. The power of connecting your meter usage with service requests can help your organization identify the extent of your dead meter problem. This is a repeatable process and solution every water utility in America should employ. The Esri water team and GISinc are here to help and are collaborating on a solution/service bundle for dead meter identification. Stop the revenue loss today!



↑ The Cityworks analysis helps Opelika Utilities with resource planning by month for specific types of service requests.

ArcGIS Helps Irish Surveyor Monitor Europe's Last Remaining Peatlands

Ireland—the name is synonymous with lush green wetlands and raised bogs, sometimes also called peatlands. But in a country noted for its lush greenery, only one percent of the national raised bog landscape remains in a near natural state.

"Ninety-nine percent of these areas have been lost due to drainage associated with peat cutting or conversion to agricultural land," said Dr. Patrick Crushell, director and senior consultant of Wetland Surveys Ireland (WSI). "It's a big battle to conserve peatlands in Ireland. We have pressure from Europe to conserve."

For good reason: Ireland's bogs are Europe's last remaining peatlands and represent some of the world's best examples of peatland biodiversity. They also provide an ecosystem for purifying water and help balance the watershed supply naturally by mitigating flood consequence through water absorption.

Monitoring the 1 Percent

Monitoring the health of the wetlands requires extremely accurate vegetation data collection over a long period for comparison purposes.

Surveyors like WSI monitor the growth or recess of certain indicator species, such as *Sphagnum* mosses, which are good indicators that a peatland is healthy or drying out.

"Certain species are good indicators of a wet, healthy bog," Crushell said. "A high cover of these species implies the area has sustained its water table—and sustained it throughout the year. It implies it's in good condition, or not drying out."

Recently, the Irish Wildlife Service began requiring WSI to provide submeter accuracy for its vegetation monitoring.

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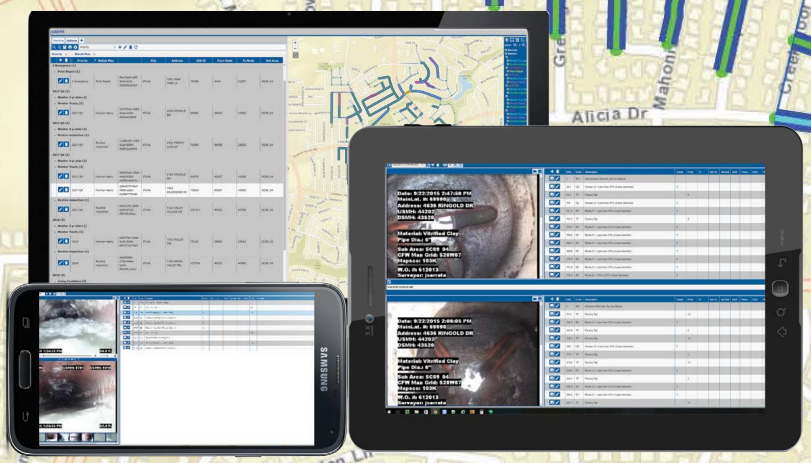

Zoom: 3

- Manhole
- Mainline
  - Monitor 2 yr plan
  - Routine inspection
  - 1 Emergency
  - Point Repair
  - 2017 Q2
    - Monitor 2 yr plan
    - Monitor Yearly
  - 2017 Q3
    - Monitor 2 yr plan
    - Routine inspection
  - 2017 Q4
    - Monitor 2 yr plan
    - Monitor Yearly
    - Routine inspection
  - 2018
    - Monitor 2 yr plan
    - Monitor Yearly
    - Routine inspection
  - 2019
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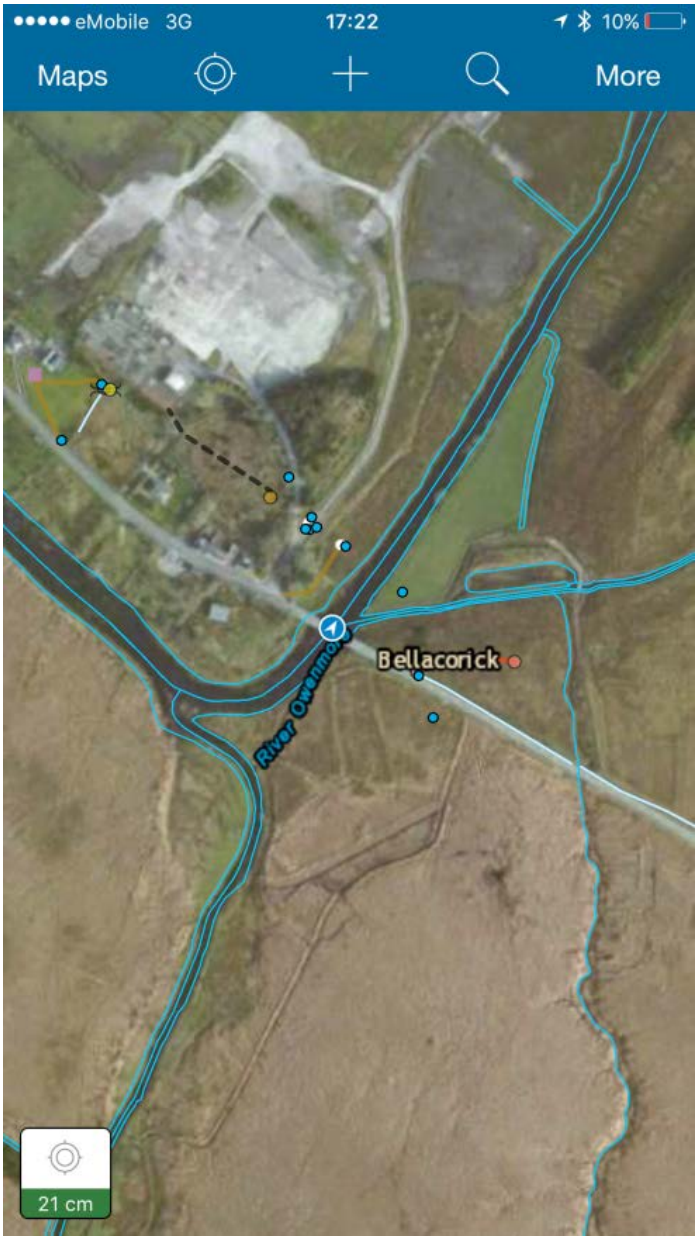


↑ Screen Capture of Collector for ArcGIS Being Used on an Apple iPhone Device

"Having accurate information is important to provide the evidence base required to convince the policy makers we need to conserve these last remaining areas," Crushell said. WSI had used all-in-one monitoring devices in the past, but these proved to be expensive and had to be replaced every few years.

"They weren't future proof," Crushell said.

WSI looked for a more sustainable solution, one that would let the field personnel take advantage of the devices and software they already used, along with providing a future-proof investment.

A Tried and True App, Collector for ArcGIS, Gathers a Lot of Data on Irish Wetlands

For the past five years, WSI had been using iPhones and iPads with Collector for ArcGIS to record field data. The staff were already familiar with the Collector interface and particularly liked being able to easily input a large quantity of text notes into Collector.

"It's much easier to type our many notes into Collector than any other device we tried," Crushell said.

WSI had a strong preference for continuing to use Collector on the organization's iOS devices.
"There's a lot of reasons I enjoy using Collector in comparison to all-in-one devices," Crushell said. "You don't have to replace your device every few years. The software is continuously updated [and] the fact [that] it works on any device in our pocket, with the touch screen of an iPhone that's less cumbersome than some other devices. And Collector itself offers such an ease with which we can create forms on the devices."

In addition, Collector works in disconnected environments, which offers a huge advantage in Ireland's peatlands.

"In peatlands, you're in the middle of nowhere most of the time," Crushell said. "With Collector, we can take our data offline and view our aerial imagery. We're doing that all the time because the cell phone coverage isn't very good in Ireland. But you can always take the GIS data offline, so it means you can record on your device and sync it at the end of the day."

The only downside was that the iOS devices' internal GPS provided location data no more accurate than within five meters. To continue monitoring bogland for the Wildlife Service, WSI needed a solution that provided submeter accuracy.

"The government department has insisted that the monitoring data be collected using submeter accuracy," said Crushell.

WSI looked for a solution that could override the iOS devices' native location data and communicate with Collector.

A Bull's Eye with the Arrow 100

After extensive product research, WSI tested the Arrow 100 GPS receiver in a weeklong trial survey of remote blanket bogs in western Ireland. The Arrow 100 is made by Canadian company and Esri Silver Tier partner Eos Positioning Systems, a provider of extremely high-accuracy GPS/GNSS receivers

and related apps. WSI worked with Eos's UK distributor, MGISS, to acquire the receivers.

The Arrow 100 is a small, portable receiver that draws high-accuracy location data from the European Geostationary Navigation Overlay Service (EGNOS), a free European satellite-based augmentation system (similar to a wide area augmentation system [WAAS] in the United States). The Arrow 100 receives a differential correction signal from EGNOS, sends this to the iOS device via Bluetooth, and automatically overrides the device's native GPS with data that is far more accurate.

Indeed, during the trial survey, field personnel consistently reported a level of accuracy between 0.2 and 0.7 meters. In practical terms, this means the team could measure the location of, say, *Sphagnum* moss and return weeks, months, or even a year later with the certainty that they were within a meter of the exact spot that was surveyed before.

"The level of accuracy—knowing you're within a meter of the point you recorded before—gives you a higher degree of confidence," Crushell said. "Five meters would skew our results quite seriously. The accuracy eliminates a level of uncertainty in our monitoring."

In addition to accuracy, WSI noticed that Collector and Arrow 100 communicated easily through Bluetooth, and the battery lasted all day.

"This saves us a fortune," Crushell said. "It was fantastic for us to get submeter accuracy and not need new hardware or software. The beauty is, this solution is future proof. I don't have to replace the technology in a few years."

Today, WSI continues monitoring the health of the bog ecosystem with Collector, iOS, and Arrow 100, ensuring progress in the fight to conserve Ireland's last remaining wetlands.

"Overall, we are very happy with the operation of the solution," Crushell said. "Though the cost was significant, it is more affordable than purchasing a stand-alone device with such capability that runs on its own proprietary operating system and software. That option would not have created an ROI [return on investment] for us."

↓ Patrick Crushell Using Collector for ArcGIS and the Arrow 100 in the Field

Pipeline Inspection Software Streamlines Business Processes at Ace Pipe Cleaning

Darrell Gadberry, Gadberry Consulting, LLC

Ace Pipe Cleaning (APC) began offering sewer line cleaning in Kansas City, Missouri, in 1954. A subsidiary of Carylon, APC is a full-service water, wastewater, and stormwater inspection, cleaning, and trenchless rehabilitation company. Headquartered in Kansas City, APC now has four additional offices that serve 13 states.

In 2011, APC field staff from the headquarters in Kansas City began using ITpipes pipeline inspection software for data collection. Impressed with the software's ability to expedite field inspections, APC expanded its software capabilities in 2016 to automate data organization and include integration with Esri GIS mapping systems. In 2016 alone, APC managed projects that included over 1.1 million feet of pipe inspection, and the benefits of automating processes and working with maps have been significant, saving the company man-hours, streamlining workflows, and increasing efficiencies.

Sync and Organize Inspections

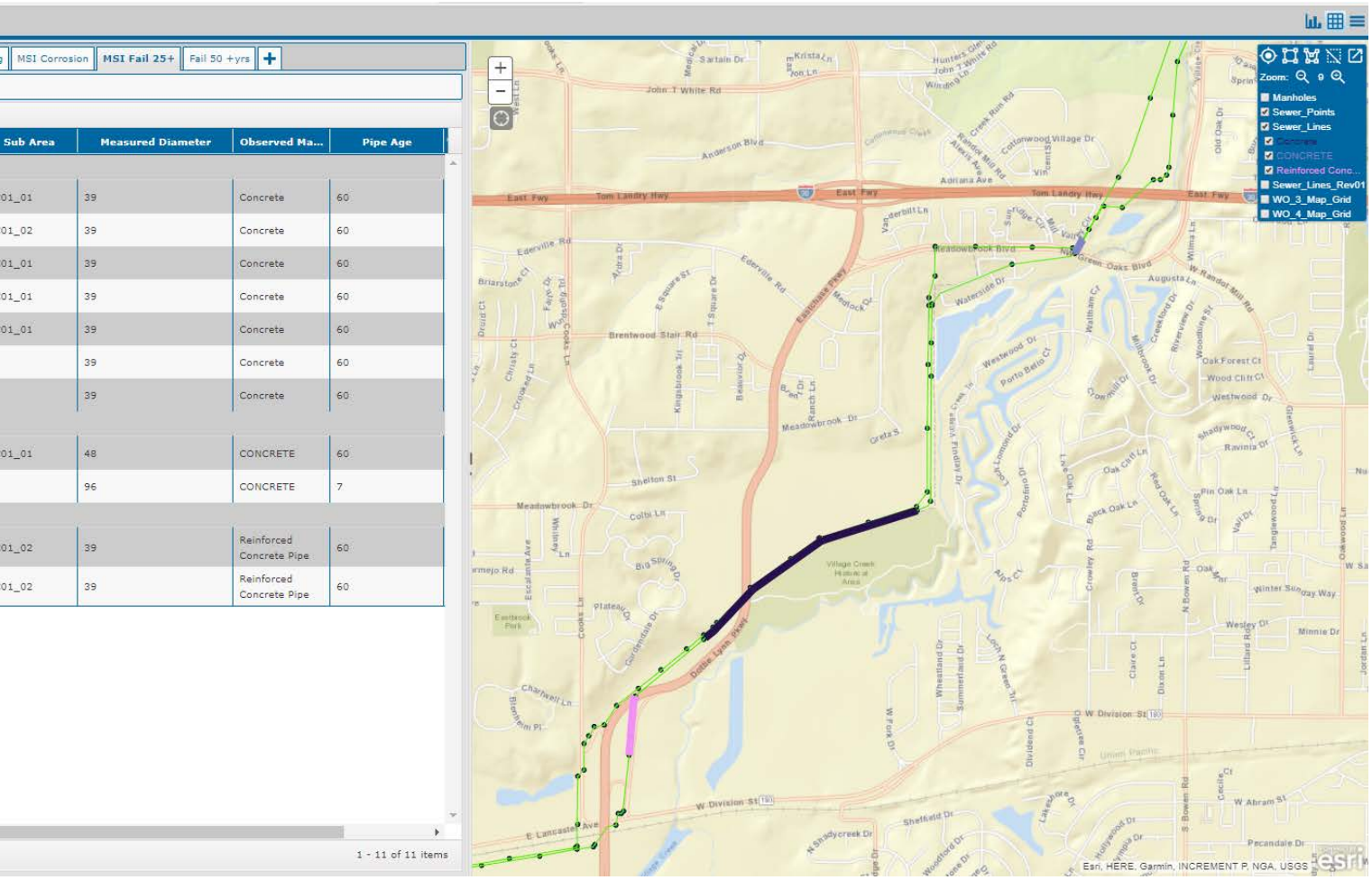
APC has a reputation for providing flexibility, reliability, and the highest quality in pipe inspection services and deliverables. Using closed circuit television (CCTV), APC is now able to provide comprehensive cleaning inspections for review and reporting purposes with cloud-based storage options. Managing data previously consisted of hard drives and flash drives moving back and forth from CCTV units to the office. Now APC's inspectors connect inspection units to the network, and as soon as an asset inspection is completed, the inspection is synced right from the truck and made available to all users instantly. In addition, work schedules are communicated to the field inspectors for daily assignments. With this "set it and forget it" mentality, APC data specialists are notified when trucks don't sync inspections to the cloud, data is missing, or other discrepancies arise. This minimizes time spent on the back end of tasks that used to take data specialists many hours each week to complete. These tasks are now automated and happen behind the scenes, simplifying the process for APC to provide services and impressive deliverables. This automated data organization and streamlined management have also resulted in more time for quality control on inspections and deliverables.

Integrate Inspections with GIS

In addition to inspections being automatically organized and more readily available, APC staff decided to integrate ArcGIS Online into their workflows to provide even more impressive deliverables. With ArcGIS Online now used by many of their clients, APC staff can tie directly into a city's existing map, eliminating the need to regularly request map updates, get paper copies, etc. On projects, APC regularly performs manhole inspections; CCTV sewer, stormwater, and waterline inspections; rehabilitation; point repairs; and more. Although tracking all these in the inspection software allows comprehensive drill-down reporting and querying, adding GIS gives location-based information and enables APC and its clients to make better-informed decisions faster.

Schedule and Track Projects Using GIS

Before using GIS with ITpipes, an operator would start a shift by checking the map. This was often a large paper map on a wall with areas highlighted to show progress on a project; meetings would be held around the wall. APC has eliminated the possibility of duplicate inspections by providing operators with online access to projects straight from the field. All inspections completed are available immediately and easily accessible, so the operator doesn't

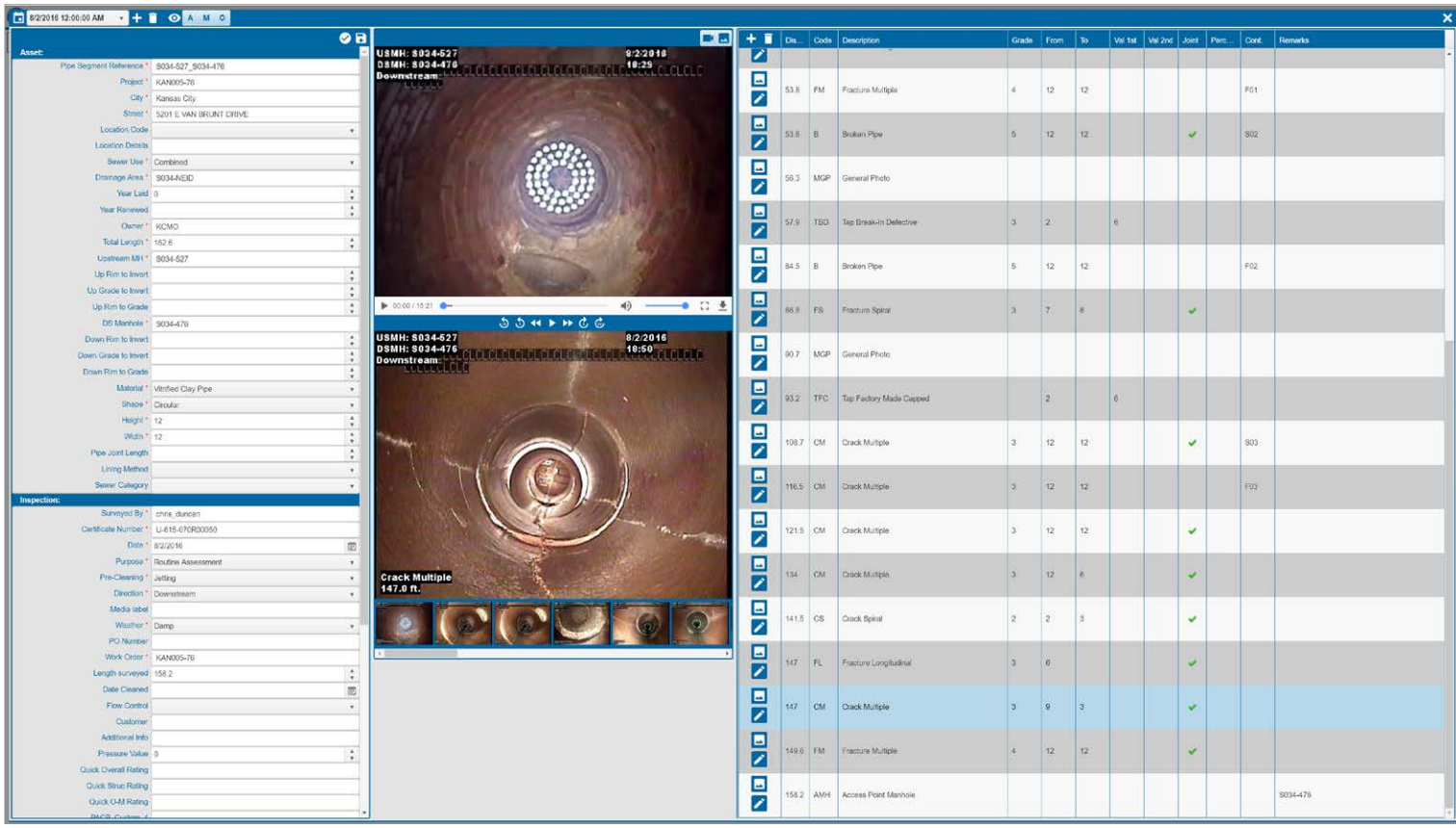


↑ With drill-down filtering, users can easily show pipes with an expected RUL of 25–50 years to provide to a client. This is based on multisensor, laser, and sonar inspection details and calculated using pipe wall thickness, deterioration rate, and original pipe manufacturers' failure specs.

repeat work that's already been done. Now, operators simply take a quick look at their PC screen or mobile device to see what's been done or needs to be done on the project.

In addition, management and supervisory staff can view the project on an office computer or even a smartphone, seeing what's happening in the field. Field supervisors can also create schedules for the team with a simple click in the software. "In the past," said Joshua Lynch, Ace Pipe Cleaning data technician, "time sheets were physically completed by operators and submitted at the end of the day. A full-time employee devoted to data entry needed to manually enter the information into the system. Now, that full-time data entry employee can focus on other activities, and operators don't need to spend time filling out time cards; operator activity is shown instantly in the inspection software."

All activity on the project is available in real time, so project managers can see progress and what's left to be done not just on inspections but also on a pipe cleaning or rehabilitation project. And while handwritten time cards used to be reviewed and consolidated at the completion of a project, now the project can be finalized and packaged for the client with just a single click.



↑ With dual screens, users can view the asset location—with plotting of observations color-coded to highlight severity and coordinating images as shown below—and simultaneously review comprehensive inspection detail in Esri's ArcGIS Online inside ITpipes Web inspection software.

Access Inspections with GIS

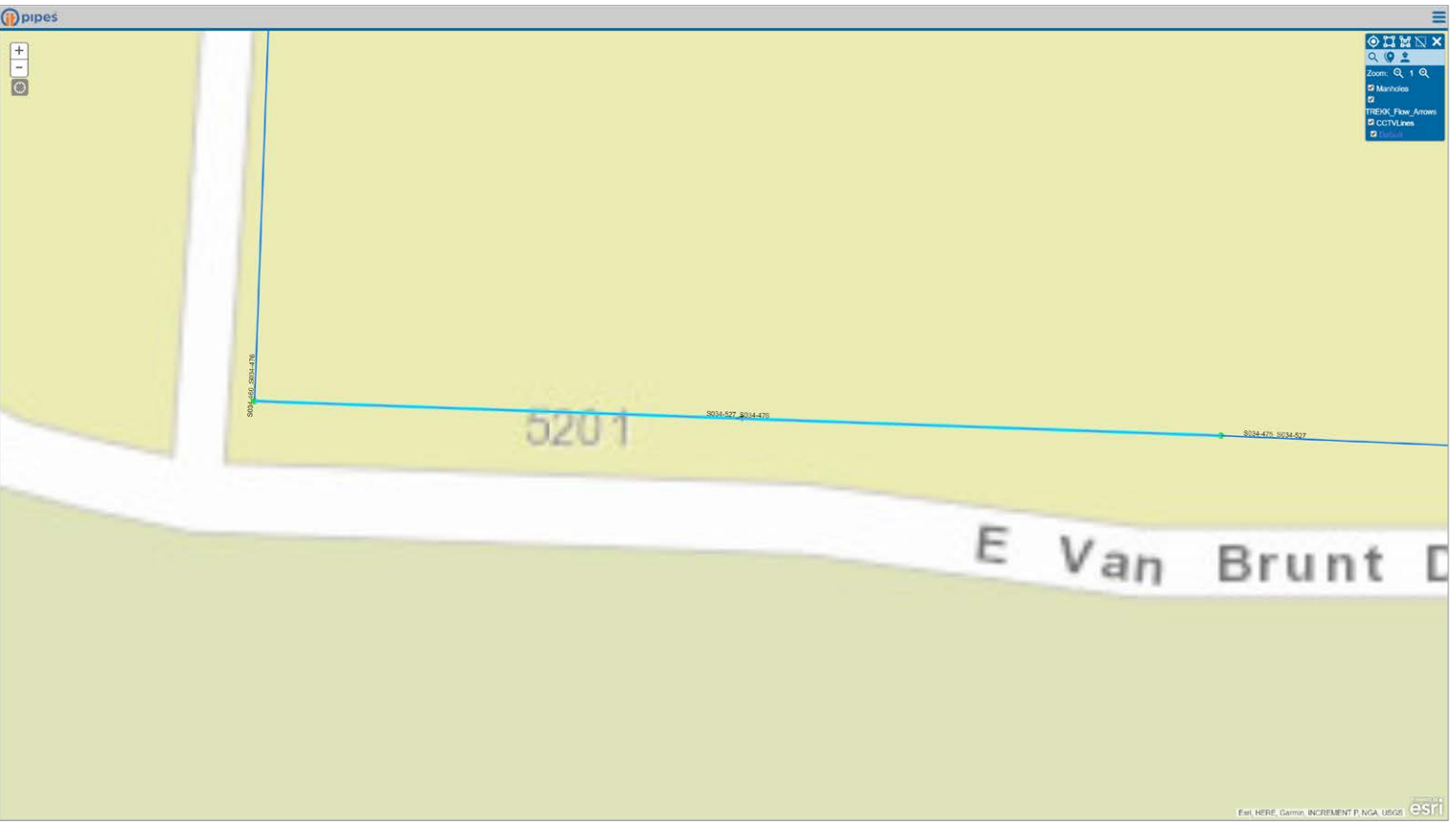
Collected data is accessible in the cloud instantly, all in real time except larger videos, such as sonar or laser, which are uploaded overnight. Integration with ArcGIS Online allows city staff to easily access the details of a project through their map versus seeing a list of inspections performed. The client no longer has to wait until the end of a project or call to check progress status or find out about a specific asset or problem. Immediate, easy access to this level of detail through the maps assists city officials with planning and keeps all parties up-to-date.

Because of the instant availability of inspection results and project progress, particularly on a long and involved project, clients can smoothly adjust their work plans for operations and maintenance or structural repairs. If, for example, a pipeline is found during a cleaning project to be deteriorating to the risk of collapse, APC and its clients can react immediately, changing the project to a rehabilitation project instead of continuing to clean a line that needs to be fixed. APC provides several types of pipe rehab, and incorporating mapping access online and showing the location detail make it easier for clients to decide what type of rehab to use for a specific pipe problem.

Use Reporting Tools in GIS

Using cloud-based software, all details needed for pipe inspection and rehabilitation planning are quickly and easily accessible with powerful reporting tools. These tools provide unlimited drill-down reporting and querying capabilities, with the user able to select what details are displayed. A user working on a rehab may choose to see all lines marked "rehab planned," the severity of the overall pipeline, remaining useful life (RUL) of the pipe, and other criteria. When building the report, the map legend and color-coding automatically reflect the drill-down reporting. Seeing lines color-coded with location detail makes it easier for APC and its clients to plan projects and organize crews, especially as the color-coding is constantly updated while work is completed. In addition, APC performs many projects with multisensor inspection hardware, such as laser or sonar. Using the inspection software with GIS, clients and APC can easily see assets mapped and color-coded by RUL, material type within the RUL, and other factors, to make informed decisions. Location awareness makes determining high-risk sites and planning for those sites a much simpler process.

Adding ArcGIS Online to inspection software management has consistently saved man-hours, increased efficiencies, and streamlined processes for Ace Pipe Cleaning. This includes efforts



from timekeeping and scheduling to creating client deliverables and follow-up planning of rehab and maintenance work. APC offers its clients online access to comprehensive inspection information and an in-depth analysis of the project with accurate and complete accounting. The company is currently using these workflows in the Kansas City metro area and Fort Worth, Texas, and is in the process of expanding the use of the software to its offices in St. Louis, Tulsa, and San Antonio.

Return on Investment

In January 2016, Ace Pipe Cleaning, ITpipes, and GC began the design and implementation of the processes outlined herein. From the onset, they dedicated the necessary staff and time to ensure a successful implementation.

By the end of November 2016, the new workflow was fully implemented and in use for more than eight months. The integration of Esri's ArcGIS Online with ITpipes met and exceeded APC's expectation. GC conducted formal interviews with APC's Kansas City staff to identify key milestones. First and foremost was 100 percent acceptance and use from management and office and technical staff down to the operators in the field. GC documented a return on investment (ROI) of realized, measurable savings in labor hours representing over $190,000 for just the Kansas City office in the first eight months.

The implementation team has completed the setup and rollout of Esri's ArcGIS Online and inspection software in the Fort Worth location and scheduled rollout for their remaining APC offices and inspection vehicles. This standardized their inspection process, with each office mirroring the other, allowing for consistency throughout the organization.

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