Rezatec

Eden Prairie: Driving water distribution network improvements with geospatial AI

Water SAT – Pipeline Risk

Overview

The City of Eden Prairie sits 12 miles southwest of downtown Minneapolis in the State of Minnesota, United States. With a population growing to just over 64,000, the City has been recognized as a great place to work and raise a family for many years and is consistently ranked among MONEY magazine's "Best Places to Live". City leaders want to know the sentiment of the community before making decisions and planning for the future, which leads to high engagement and satisfaction with residents.

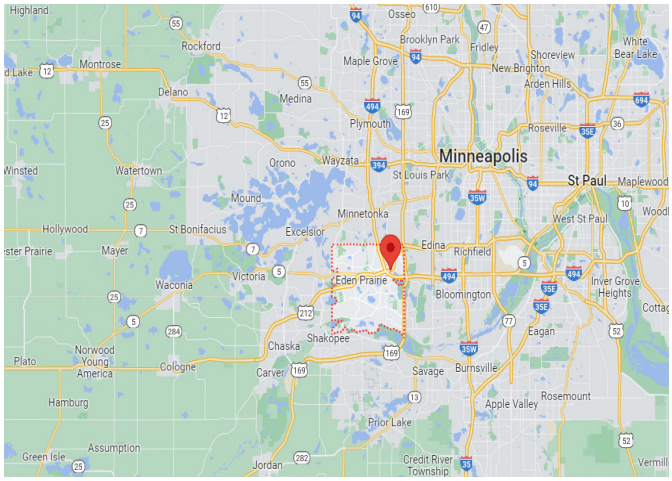
Rick Wahlen, Utility Operations Manager, leads the City's Utilities Division which is responsible for all the water, wastewater and stormwater systems within the community. Rick's division undertakes infrastructure planning and maintenance, and the care and upkeep of everything that involves utility support to residents and businesses.

"As a government organization that exists to serve our community, we're constantly thinking ahead and looking at how we can improve our services to provide value for our taxpayers," explains Rick. "And that's an important cornerstone of our 'invest now, spend less later' strategy," explains Rick.

The trouble with water

In the United States people have become accustomed to the fact that water is cheap, unlike gas and electric utilities with much higher rates which are tolerated by consumers.

A lot of communities struggle to raise water rates to the point where they can afford to self-maintain their systems in the future and pay for expensive underground repairs.



"In Eden Prairie we have a plan that allows us to raise water rates incrementally each year to be meet the needs of the community, and our residents are on board with that," says Rick. "We have a thorough, deliberate and intentional capital improvement planning process enabling us to set aside dollars from the revenues we collect from our customers. It's what our residents expect, they're accustomed to it and it's working very well for us."

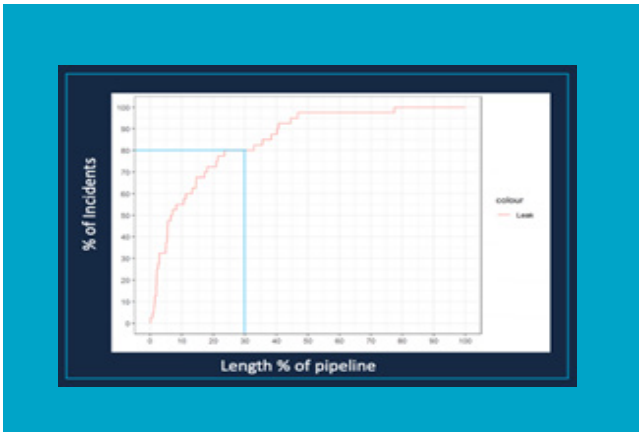
"We're still a young enough community that we could be money well spent and money ahead by just waiting for a break and then fixing it when it occurs. But that's not how we operate, and it would catch up with us before long. We want to be proactive and we would much rather replace a pipe at the end of its projected useful life, rather than waiting until it pops a leak, disrupts service and costs three times as much to fix in the middle of the night on a Saturday."

Leak detection v. proactive cap ex planning

Planning for and maintaining a water distribution system comprising almost 20,000 service connections and 398 miles of water distribution network, the Utilities team turned to Rezatec's Pipeline Risk geospatial AI product to predict where and how likely failure will occur in the system to inform the City's replacement project planning and ensure their capital improvement dollars are best utilized.

Rezatec's geospatial AI platform uses satellite data, internal GIS data sets, and external data including soils and topography. It combines this with historic incident data recorded over three years by the City's team to correlate Rezatec's AI algorithms. The greater the number of variables within the data, the more accurate its predictions become. It fuses this data with the most advanced algorithms in the industry to analyze and provide insights for Eden Prairie's entire water distribution network. Rezatec's predictive AI tells the City's Utilities team the top areas of their network that are at the highest risk of failure, providing a likelihood of failure and a predicted cost of failure. The platform data is updated and added to every year providing a historical view and a more accurate predictive analysis going forward as the AI model learns Eden Prairie's environment.

"The initial analysis revealed potential distribution system failure locations at an anticipated 80% accuracy," explains Rick. "That's data we've never had before and it's a really powerful boost to our confidence. Over time as we continue to feed more data into the platform, the AI model will fine tune its learning of our environment and predictability will become even more accurate."



Corrosion? It's the pits!

Eden Prairie's early community planning team in the 1970s adopted a construction standard requiring state-of-the-art materials, choosing ductile iron pipe for its strength, resilience and long 100 years-plus lifecycle. This standard remained in place throughout the explosive growth of the community in the 1980s and 1990s. The challenge for today's Utilities team is the City is located in a glacial moraine environment, which includes a variety of sub-surface soil conditions that can have a major impact on the maintenance of buried metallic pipeline systems.

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Rick Wahlen, Utility Operations Manager, Eden Prairie

"At a wall thickness of 1/4 inch, our ductile iron standard for watermain materials was believed to be more durable and longer-lasting than plastic pipe, and structurally superior to cast-iron and concrete pipe products. The metallurgy of the pipe makes it far more flexible and resistant to subsurface sheer forces than cast-iron, and at the time cement-lined ductile iron was clearly among the best options available. Its structural resistance to soil movement, temperature change and other physical forces make ductile iron a remarkable pipe material," says Rick. "Even though the pipe is far better than the older cast-iron product there is less of it to resist corrosion. The strength of the pipe allows it to be constructed thinner and lighter, which unintentionally becomes a factor in a corrosive environment. Our glacial moraine geologic environment is a jumble of discontinuous soil types, including many hot-soil pockets that can lead to corrosion pittings eventually penetrating the pipe wall. We're seeing random failure in fairly new pipe when we really shouldn't."

With between 6 to 20 breaks per year, which peaked at 54 in 2020, Rick's team has been fixing these leaks as they occur, documenting their location, taking measurements, and collecting pipe and soil samples to determine any patterns. However, no definitive trend has emerged to enable the team to figure out where failures will happen next. "The one thing we could not predict is where a corrosion pit is going to occur in the wall of a pipe.

Where is a pipe going to start leaking? With Rezatec, we now have a basis for when to make those decisions," says Rick.

"The AI analytics evaluate soil condition and pH, soil movement, moisture content, temperature differentials and all those factors that correlate to leaks that are already starting. Failure history, pipe attributes and other locally known factors are included in the analytics. We believe this should help us to get ahead of failure, replacing pipes and valves before there is a leak. Not only does it lead to minimal disruption of service for our community, but it should help us to plan our capital expenditures and upgrades much more accurately," he adds.

Investigative technologies can be cost-efficient

According to Rick: "The major effort, cost and uncertainty comes in trying to look for precursors of breaks compared to the relatively inexpensive cost of fixing leaks as they occur, which averages around $8,000 per failure."

"Identifying failure sites before they actually occur typically relies on penetrative technologies like magnetic resonance imaging which highlights the pipe's condition and whether an external corrosion pit is developing from inside."

"That technology is awesome," adds Rick. "But at around $50,000 per mile, we can't afford to do the whole town. It's just not cost-effective. Also, you might expose a section of pipe for a repair but not be aware the valve bolts 2 feet outside of that section are corroded and ready to break, or if a pipe segment just outside the repair zone is similarly damaged and soon to fail."

"Rezatec's technology provides a comprehensive view of our entire system and helps us to understand where our network is likely to fail. It's the most logical, best first place to start. Then, following Rezatec's assessment, we could use some of the more pinpointed definitive pipe condition detection technologies based within the areas showing a high likelihood of failure."

"If we can examine specific segments of targeted pipe throughout the town, instead of entire blocks hoping to find weak spots, we can plan for and direct the use of investigative technologies in a much more focused and cost-effective way," he continues.

Making the invisible visible

The application of AI technology on a large number of data sets has thrown up additional insights, providing the Utilities team with a new set of challenges. "The most surprising thing is that the analytics are pointing us toward a likelihood of failure in the next year of portions of the system that previously have never been perceived as having an issue," explains Rick.

The team is working with Rezatec to understand the characteristics within the data and the algorithm that highlights these unobserved areas. "There are quite a few places in town that could deserve some additional attention that were not on our radar based on past experience. So now we have to decide how we are going to attack those areas and put together a reasonable plan for us to methodically approach these potential leak sites in a way that we can accomplish within our available resources," he says.

"All of us in the water utilities sector struggle with finding enough financial resources to take care of our systems. And sometimes the thought of investing in another new technology is perceived as taking money away from your limited repair budget. But we must consider that by having a greater understanding of the invisible portion of your system, we can recover many of those costs through more efficient and more targeted repairs in the future. I am hopeful this first year of implementing this AI analysis that we will more than offset the cost of our Rezatec investment in short order."

"Avoiding emergency repairs, we could easily save 30% on the cost of a repair project by using predictive analytics and proactively being right about where the failure will occur, rather than waiting for it to happen after hours on weekends and holidays. Plus those emergency repairs don't fix the whole problem area. They only fix that little bit of pipe that springs a leak," concludes Rick.

"Rezatec's technology provides a comprehensive view of our entire system and helps us to understand where our network is most likely to fail."

Rick Wahlen, Utility Operations Manager, Eden Prairie