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PFAS

AND OTHER EMERGING POLLUTANTS OF CONCERN:

WHAT DOES THIS MEAN FOR **PRETREATMENT?**

PLANT SPOTLIGHT

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DATA STREAM: CHANNELING WASTEWATER INSPECTION INFORMATION TO KEEP YOUR SYSTEM FLOWING SMOOTHLY

By Abby Owens, City of Plano, and Stephen Johnson, PE, Freese and Nichols, Inc.

INTRODUCTION

For years, City of Plano crews collected data on the condition of sewer mains and logged data into a work order system. But the information was not integrated into other systems that could be used to create a coordinated long-range plan for system maintenance. As a result, City staff got a jolt when they started developing elements of a Wastewater Master Plan: An analysis showed that 150 miles of pipes were assumed to be in poor condition due to their age and material. The real number was only half that much, but data gaps and lack of integration had created the impression that the problem was much worse.

To transform all that valuable data into actionable insights, the City used its Wastewater Master Plan to integrate inspection and maintenance data into a desktop risk-based assessment. Multiple data systems now are talking to each other, providing a more accurate view of maintenance needs and a stronger framework for a sustainable, collaborative plan. And the City was able to work within its existing software instead of having to invest in new technology.

This experience shows how a growing city can improve its asset management by developing a prioritized work plan along with a business process to maximize its investment in people, tools and technology.

THE CITYSCAPE

Plano today calls itself the City of Excellence: It combines multiple aspects of a thriving community that's an attractive place to live as well as a good location for major companies such as Frito-Lay, Toyota and Liberty Mutual Insurance.

Located just north of Dallas, the City covers 72 square miles and has about 285,000 residents. But it reached that size primarily through explosive growth from 1980 to 2000. The population increased 75% during each of those two decades. That means that thousands of miles of infrastructure was installed during that time and now requires maintenance, repair or replacement.

Plano's $2 billion of infrastructure includes 607,000 assets across 40 types.

- 1,800 miles of streets/alleys
- 1,000 miles of sanitary sewer mains
- 1,500 miles of water mains
- 860 miles of storm mains

To address infrastructure needs, Plano's Public Works Department and Parks and Recreation Department collaborated in 2016 to invest in Cartegraph as a work order and asset management system.

As part of the City's asset documentation efforts, in-house crews have conducted routine inspections for 10-inch and smaller sewer lines over the past five years. These activities were tracked and logged through Cartegraph, but the detailed inspection data was housed in GraniteNet. With no connection between the two systems, the data didn't reach its full potential. Unless a significant issue arose, the inspection was considered complete, and the crews moved on to the next task. The process worked well as far as it went — but it yielded limited insight into the overall condition of the sewer system.

THE CHALLENGE

Too many data sources without a unifying plan created a lot of data that couldn't be analyzed to determine conditions or remaining useful life of the sewer mains.

The system had plenty of data input:

- The City's internal PACP inspections for small diameter lines
- Quick-scan inspection conducted during routine cleaning with an assigned pass/fail score
- Contractor-led inflow and infiltration (I/I) studies, including smoke testing and CCTV inspections throughout the City
- Rehab and relining activities
- GIS rehab and replace data
- Contractor-led PACP inspections for large-diameter lines

When records and data relating to the condition of the sewer system were used for a risk-based assessment (RBA), as part of the City's recent Wastewater Master Plan, the results indicated that about 15% of the pipes (150 miles) were in poor condition — and most of them were rated "very poor," based on the latest information available in GIS. It turned out that connecting Cartegraph work order data to GIS told a different story: Staff had been lining pipes, but their work wasn't reflected in the GIS records.

That discovery led to important discussions about the essential nature of integrating data to provide the best guidance for the City's asset management journey.

THE CLEANUP

The Wastewater Master Plan provided the framework for a coordinated, integrated solution.

The Master Plan represented the City's first step toward creating a comprehensive assessment of the collection system and included:

- Flow Monitoring and I&I Characterization
- Population and Wastewater Flow Projections

- Wastewater Model Development and Calibration
- Wastewater System Performance Analysis
- Wastewater Collection System Renewal Planning
- Community Investment Program and Wastewater Modeling Services Report

The data gap was discovered during the Wastewater Collection System Renewal Planning portion of the project. After this gap became apparent, Freese and Nichols worked with the City's Engineering and Public Works staff to identify and integrate the available information, creating a more complete view of the collection system.

The RBA is a product of the pipe's criticality (consequence of failure) and condition (likelihood of failure). A high criticality pipe in poor condition represents a high risk to the system and should be closely monitored or replaced. For the criticality and condition assessment, the following factors were considered:

Criticality — considers environmental considerations, access issues and customers served. For instance: Is the pipe close to a body of water? Is the asset hard to reach because it's along a major roadway? Does it serve a major development or public services such as a hospital or fire station?

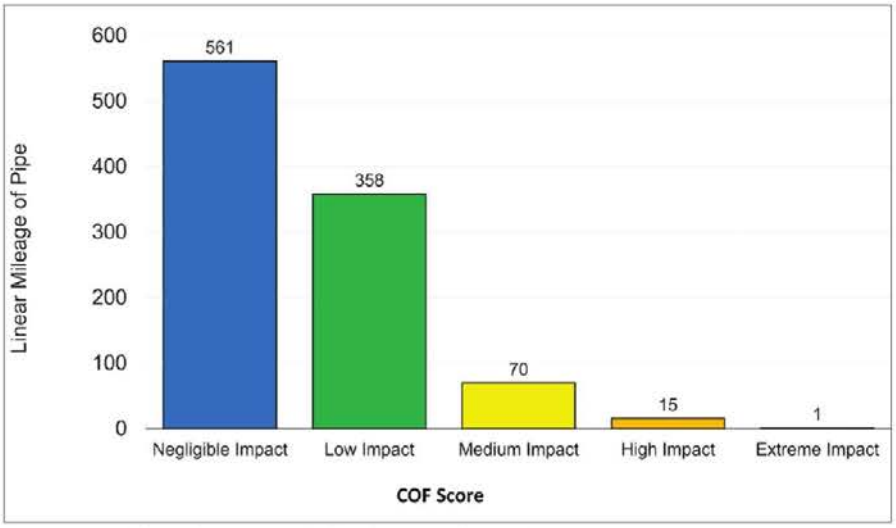

Figure 1. A risk-based assessment (RBA) measured criticality.

The results of this assessment are shown on Figure 1 (RBA Criticality) and are consistent with the results expected. A large portion of the City's system is small-diameter lines located in residential areas, driving down the overall criticality.

Condition — follows a hierarchy of available information: Inspection data, asset age or material, or rehabilitation age or material. If an inspection has been completed, the NASSCO PACP structural index is used for the condition score and overrides the GIS age and material data.

The first presentation of the condition results indicated that almost 150 miles of the collection system were in poor or very poor shape, as shown on Figure 2 (Power BI Dashboard). These results left the team questioning the scoring process and available data.

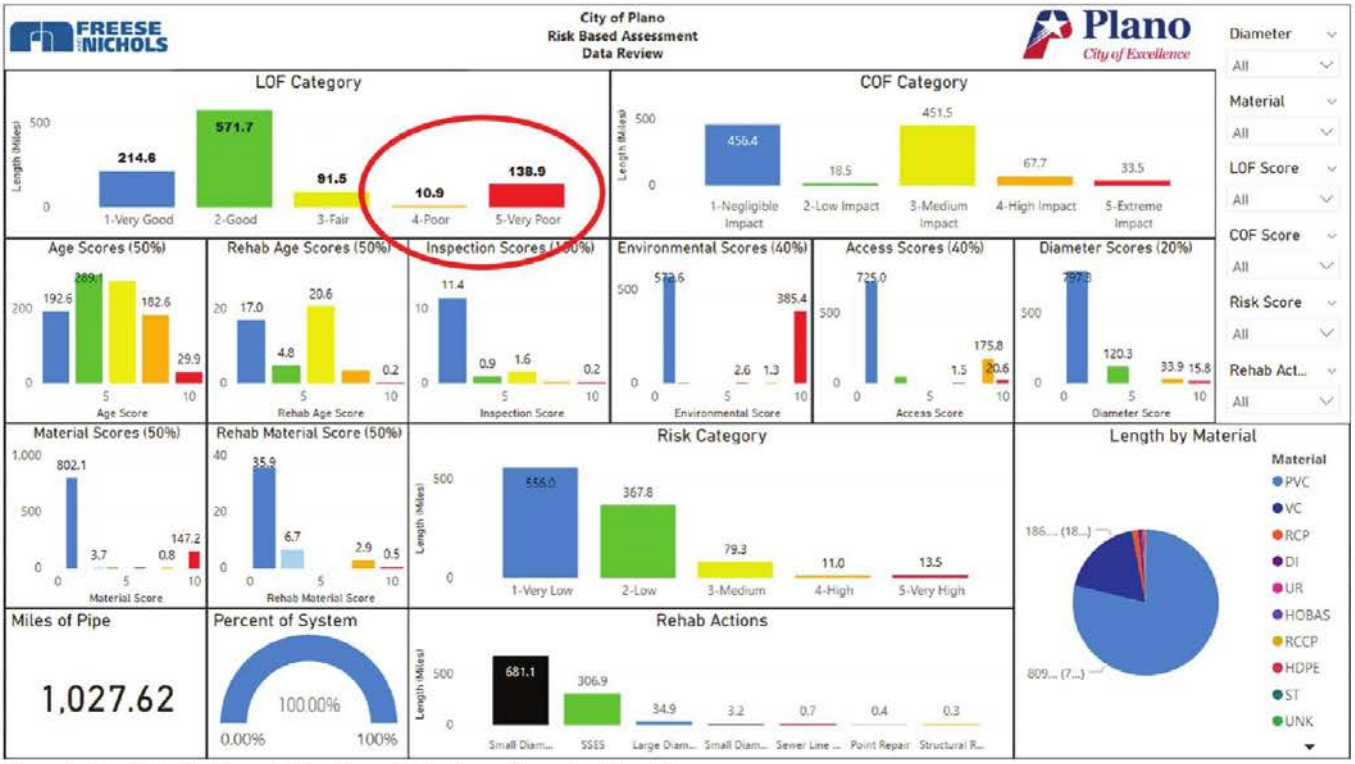

Figure 2. Results in the Power BI dashboard raised questions about the data.

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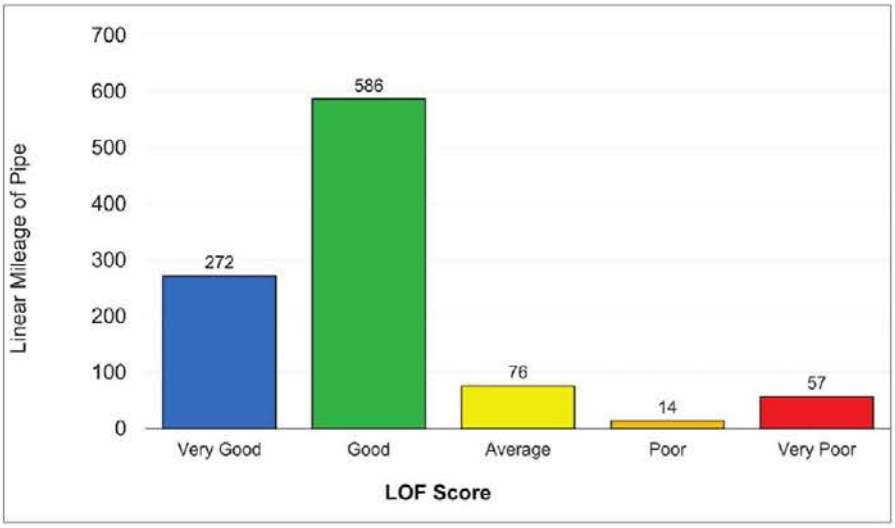

Figure 3. The RBA condition graph shows results with data gaps corrected.

After additional review, the City discovered their recent rehab activity was not integrated into GIS, so it was not available for the RBA model. Correcting this data gap cut the amount of poor and very poor pipes in half, as shown on Figure 3 (RBA Condition Graph), and better matched the expected results.

CARTEGRAPH:

After seeing the capability of the RBA model as a prioritization tool, the City wanted to integrate the framework into their existing processes. The scoring and methodology from the condition assessment portion of the RBA model could be recreated in Cartegraph — helping the City use their available data without investing in additional software.

CONDITION METHODOLOGY:

The age and material data already were populated in Cartegraph, and the team built degradation curves for the various materials to calculate an estimated condition score. Cartegraph also was used to track rehabilitation work and to reset the estimated condition score of lines involved in relining projects.

Review of available PACP data in GraniteNet identified the relevant inspection data to import into Cartegraph for a measured condition score. Comparing the condition assessment from Cartegraph with Freese and Nichols' RBA condition assessments showed very similar condition score distributions, with most of the system in good or better condition as shown on Figure 4 (Condition Score Comparison). This provided a high degree of confidence in the process.

CRITICALITY METHODOLOGY:

The criticality assessment evaluated various parameters, including a pipe's location and diameter, to create a score. This assessment could not be recreated in Cartegraph, but because it rarely changes, the results could be imported into the system from the Master Plan RBA model.

Combining the condition and critically assessments in Cartegraph identified one major basin as a priority for future inspections. The same basin was also identified from the Master Plan as the priority for future inspection work, further increasing confidence that the data integration process is providing reliable insights for long-term planning.

THE COURSE OF ACTION:

Planning for the upkeep of a sewer system looks more like a continuous circle rather than a finite line. The story doesn't end after the first pipe inspection. Every pipe should be reevaluated regularly to monitor its performance.

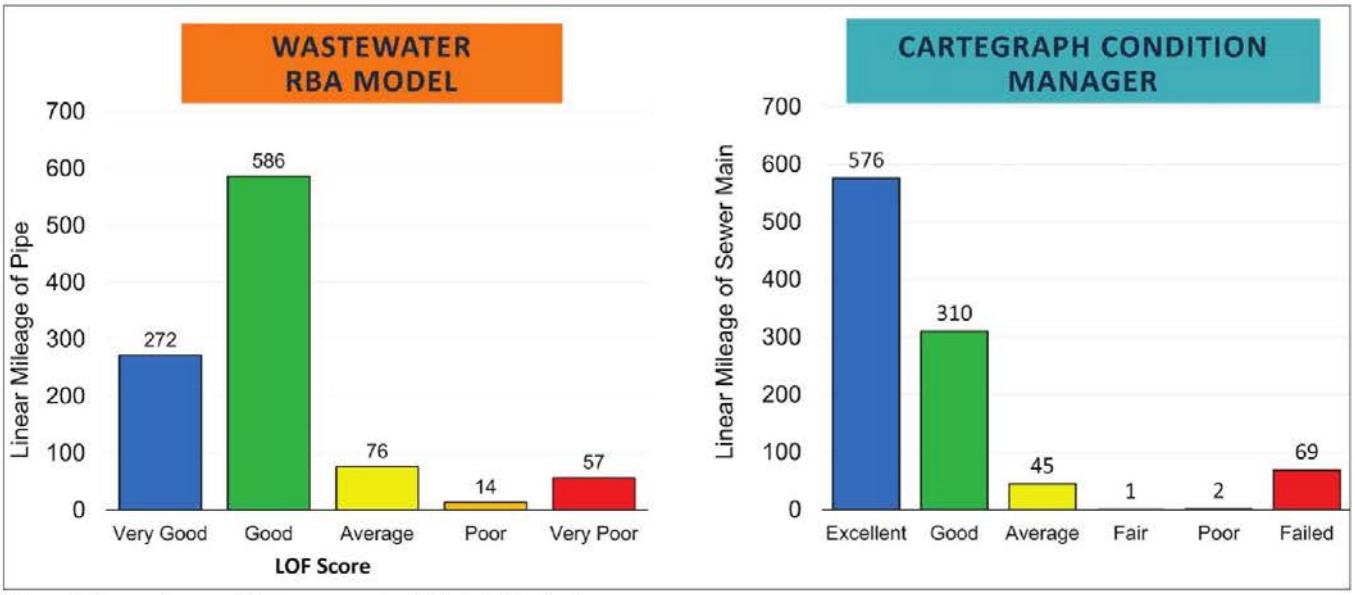

Figure 4. Comparing condition assessments yielded similar findings.

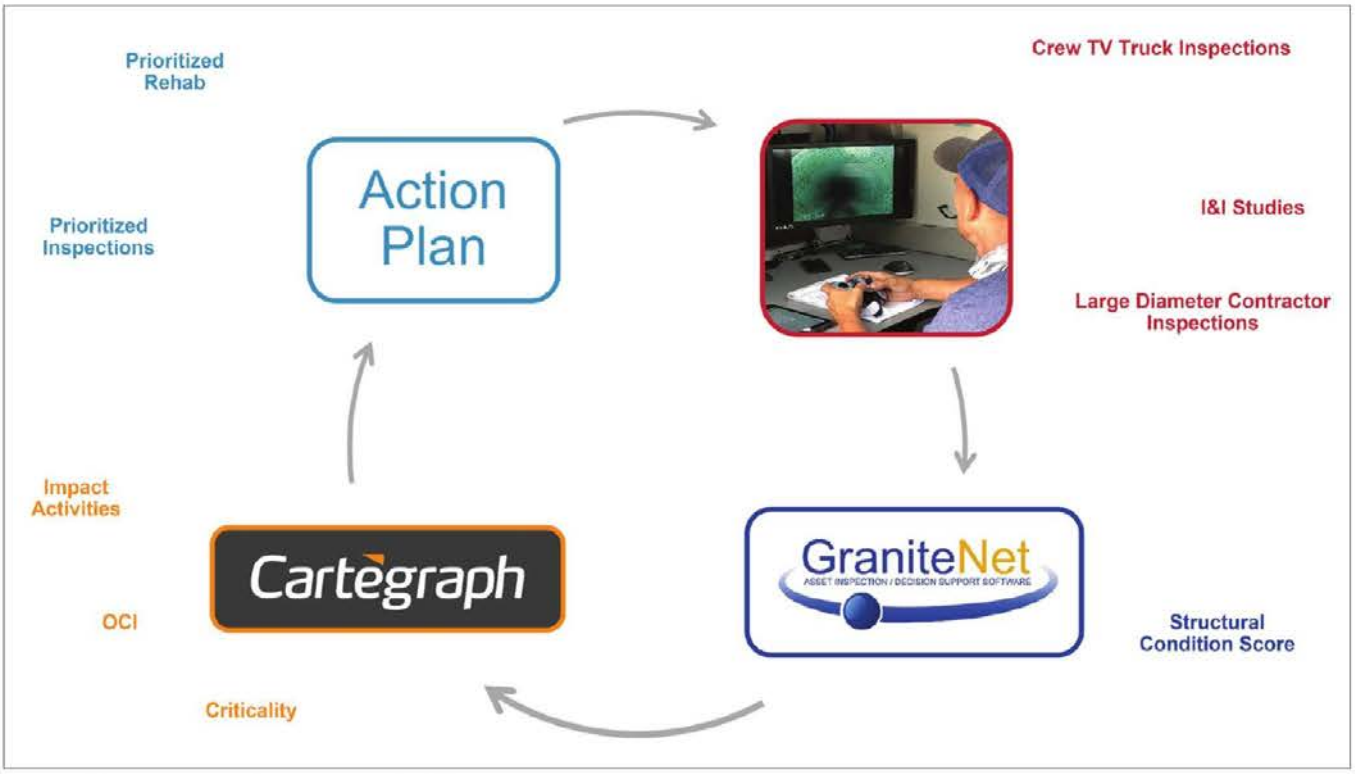

Figure 5. Evaluating the collection system should be an ongoing process.

Based on the lessons learned from this experience, the City has identified a process to regularly reevaluate the whole collection system as shown on Figure 5 (Evaluation Circle).

The key elements of this assessment include:

- Collecting data through ongoing City and contractor-led CCTV inspections
- Integrating the inspection data into GraniteNet to evaluate each pipe's structural condition
- Evaluating pipe condition and criticality against ongoing maintenance and planned activities in Cartegraph
- Reprioritizing the pipes for future inspection and maintenance activities

It is important to remember that every pipe is different, and multiple factors could impact its condition, performance and life span. Even with a robust data system, field verification is part of the equation.

The integration of these data processes continues to yield new insights into the City's collection system. In one instance, Plano's data showed a particular pipeline was marked as failed in Cartegraph because it was old and made of clay.

Along with continuing to incorporate more data sources into its assessment, Plano also is evaluating parameters to ensure that the process maximizes investments.

However, the inspection showed that it had been rehabbed — the work simply hadn't been logged. Now, the condition score of this pipe is updated with the new information, and the condition score is shown as excellent.

As the data integration process continues to mature, the City is identifying additional data to consume. The next data group to incorporate are City-conducted Level 1 manhole inspections and contractor-led Level 2 digital manhole inspections. Along with continuing to incorporate more data sources into its assessment, Plano also is evaluating parameters to ensure that the process maximizes investments in people, technology, and infrastructure.

ABOUT THE AUTHORS

Abby Owens is Public Works Strategic Planning & Compliance Manager for the City of Plano, Texas. Her interest in local government comes from a drive to work with residents to improve the services and programs the City provides. She has a passion for data analysis and problem-solving. She leads the asset management programs and Cartegraph implementation for the City of Plano Public Works Department.

Stephen Johnson, PE, is a Senior Project Manager in Freese and Nichols' Water/Wastewater Master Planning Group. He has experience in water and wastewater master plans, physical and desktop condition and risk-based assessment programs, water and wastewater CIPs and impact fee programs. He has experience working with multiple hydraulic modeling software packages and a variety of data management programs such as Innovyze products, ITPipes, GraniteNet and Cartegraph. He is the Assistant Project Manager for the City of Plano's Wastewater Master Plan. ●

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