In late 2002, Crawford's crew did smoke testing on the sewer system and recruited city council members to walk along with them.

"They came out with clipboards and cameras, walking the streets and yards to find leaks," says Sawyer. "Involving them was invaluable for when we had to go ask for money. It was lots more effective than numbers on a spreadsheet."

The testing let everyone know there were significant deficiencies in many lines, and the project moved into planning for the televising stage. The city had inspected some mains 20 years earlier, but it wasn't a comprehensive survey, and the quality of the video was uneven.

"We wanted to have a vision of the future based on being proactive, so we knew our first priority was to find out what we had underground," Crawford says. "Our first project was to televise the sewer mains." The estimate cost $125,000, but only $90,000 had been budgeted. The Economic Development Fund grant ultimately covered the cost.

The winning bidder for Phase 1 work was DownUnder Municipal Services LLC of Kalamazoo, Mich. The resulting digital video was priceless in assessing the system and setting repair priorities.

"We found sagging, broken and clogged mains," Sawyer says. "We found a one-block section where groundwater was leaking into a main through abandoned laterals that hadn't been properly bulkheaded off. Eighty percent of our sewer mains were clay tile with a joint every 2 feet. There were lots of bad joints and crumbling grout. We found mains we didn't know we had, and discovered that some we thought we had didn't exist."

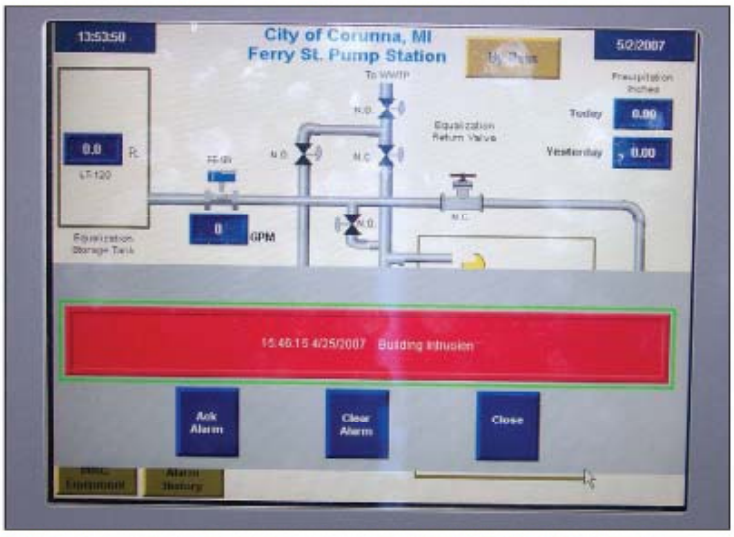
In planning for Phase 2, Sawyer and Crawford investigated rehabilitation technologies: conventional replacement, pipe bursting and cured-in-place pipe (CIPP) lining. In 2003, Crawford went to a trenchless technology show and saw a lining demonstration. Sawyer and Crawford also asked other communities what they were using.

Making the fixes

Insituform Technologies USA Inc. had done a small CIPP project for Corunna and came in as part of a competitive block grant bid on Phase 2. Crawford and Sawyer had expected to line about 4 miles of sewer main, but the bids allowed them to line 6 miles, a full one-third of the system.

"We have a few more segments that need to be done," says Sawyer. "We're talking with a few neighboring communities to see if we could get some economies of scale. Another third of our system is either in good condition or needs traditional work."

Corunna replaced four manholes, grouted 45, and lined two. Another 24 were rehabilitated through adjustments such as raising to grade, replacement, or sealing chimneys. Replaced and new manholes received custom lids cast by East Jordan Iron Works and bearing the city's name.



The computerized Ferry Street Pump Station uses the RSView 32 monitoring package from Rockwell Automation. A laptop computer equipped with PC Anywhere software from Symantec turns pumps on and off remotely.

In the end, Insituform cleaned and inspected 30,967 feet of 6- to 18-inch mains and installed CIPP liners. The company also cleaned and inspected 440 service laterals, in the process finding many sewer mains with dead ends that had no manholes. "These are very difficult to clean, and you need a manhole to install Insitu-form lining," says Crawford. "So we installed about eight new manholes in those areas."

Meanwhile, Corunna removed and replaced four manholes, grouted 45, and lined two. Another 24 were rehabilitated through adjustments such as raising to grade, replacement, or sealing the chimney. Compeau Brothers Excavating of Rockford, Mich., exposed the structures using a small backhoe. Kim Construction of Steger, Ill., made traditional mortar repairs.

New lid assemblies cast by East Jordan Iron Works were installed. Replaced and new manholes received custom lids bearing the city's name. Since the city bought in bulk, the custom die came at no extra charge. Rebuilt manholes did not receive custom lids. The difference helps the city track which manholes have been rehabilitated. "The new lids are hard to steal, too," adds Crawford.

Lateral televising

Insituform crews televised laterals in areas where they had lined the mains, using a Lateral Evaluation Television System (LETS) camera from Aries Industries Inc., which can travel 1,500 feet down a main line and send a tractor-mounted launch unit 150 feet up the lateral.

To televise laterals in other areas, Terra Contracting, a division of DownUnder Municipal Services, used explosion-proof CCTV units from Pearpoint Inc. with tractor-mounted pan-and-tilt camera heads.

"The purpose of this secondary video was to identify laterals we didn't need," says Sawyer. "We took that opportunity to bulkhead off those unnecessary laterals by not reinstating them once the liner cured." We anticipated that we might inadvertently eliminate service to someone who needed it, but that didn't happen.

"We did have two where we weren't sure if we should leave them closed," Sawyer recalls. "Even through dye testing and other inspections, we just couldn't be sure if they might be drains or something important, so we erred on the side of caution and left them open." A state grant covered the cost of this video.

"We now have a complete video inventory of our entire system," says Sawyer. "This allows us to do the whole project at once, instead of piecemeal with many different contractors. That benefits I&I across the system.