Public Works

An effective BIM program can help sewer managers determine immediate and long-term capital needs, such as installation of new pump stations. Photo: Marblehead Water and Sewer Commission

Wastewater collection / By Dana Snow, Bill DiTullio, Pierre Mikhail, and Rod Lovely

Scrutinizing your sewer

Buried infrastructure management helps sewer managers keep a handle on system performance and costs. Marblehead, Mass., leads the charge in implementing this strategic planning method.

Achieving sewer success

Buried infrastructure management (BIM) can help you improve your sewer system while managing costs. Here are the steps necessary to implementing an effective BIM program (see chart on page 3):

1. Using GIS, create an up-to-date **map** of your sewer system, with detailed information on the physical characteristics of manholes and pipes.

2. Inventory the system with a date-stamped record of the condition of each asset and link it to the GIS map.

3. Identify immediate capital and O&M needs by assigning an overall O&M and structural condition grade to each manhole and pipeline.

4. Prioritize activity through risk assessment of the probability and consequence of failure for each asset.

5. Plan utility service level goals regarding financial abilities and goals. The outcome of the plan should be an optimized BIM program that leverages the utility's financial and human resources.

Aging infrastructure and changing operational conditions are deteriorating our nation's sewer collection systems. Limited availability of resources to address the problem also poses a monumental challenge. These dilemmas have driven utility managers to implement a "find and fix as you go" approach. This often directs resources and spending to repairs that may not improve system performance or improve the overall condition of the assets measured by the utility condition index (UCI).

Sewer utilities can improve performance and reverse the aging process by implementing buried infrastructure management (BIM), a systematic planning process that allows them to leverage resources to maximize the immediate and long-term benefits of every action. The outcome: improved performance and increased UCI.

The process leading to an optimized BIM program begins with accurate mapping and a current inventory of the service (i.e., maintenance requirements) and structural condition of each asset (such as manholes and pipelines). This identifies the location, physical characteristics (such as age, material, size, and function), and the service and structural condition of the assets, which in turn helps the utility identify segments that require immediate attention.

Then, assets can be ranked according to the probability and consequences of failure. Assets most critical to system operation will rate higher on the consequence scale; assets in poorer condition will have a higher probability of failure. Assets with both a high consequence score and a high probability of failure pose the greatest risk and should receive the most attention. Those with a high consequence score should be inspected more often as failure of these carries the greatest cost. This effort provides the basis for a prioritized list of maintenance and capital improvements that help achieve the desired level of service.

During planning, multiyear budget forecasting and assessment of how different levels of spending improve the UCI are performed to establish the scope of work and budget for each year. Maintenance activities are scheduled based on potential for blockage and the consequence of backups and overflows. The schedule of capital improvements considers factors such as how different budget scenarios affect the overall condition of the sewer system, and the overall capital needs of pipelines, structures, treatment, and pumping facilities. The outcome of this task is a focused maintenance management and capital program designed to achieve immediate benefits in performance and the UCI.

BIM IN ACTION

In 2002, the town of Marblehead, Mass., experienced sewer surcharging and basement backups in areas previously not identified as problematic. The Marblehead Water and Sewer Commission (MWSC) immediately sprang into action to establish a program to inspect, inventory, and assess the condition of its 87 miles of sewer pipe, 2000 manholes, and 29 pump stations.

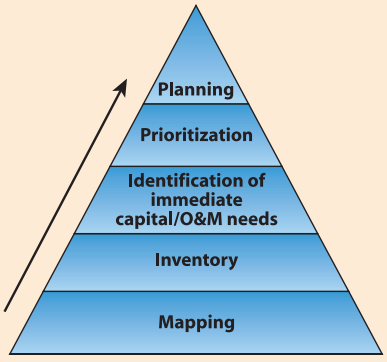
Recognizing the need to document the location and condition of its buried assets, the MWSC hired a consultant to prepare a GIS map of its collection system. Developed from existing as-built drawings and records, the commission substantially completed its electronic mapping by 2004. With the completion of the initial mapping efforts, the MWSC then hired InfraMetrix LLC of Wakefield, Mass., to develop a buried infrastructure inventory and assessment program and to demonstrate the program on the 187 manholes and 6.5 miles of pipe that comprise the Shorewood Road Pumping Station District's gravity sewer system.

Using truck-mounted zoom cameras and condition-assessment software, InfraMetrix located each of the district's manholes and inspected each manhole and pipeline. The physical characteristics—along with the service and structural condition of all of the MWSC's assets—were recorded on CD and evaluated in accordance with WRc defect codes, a standard methodology for describing internal sewer pipe conditions. Once the condition assessment was completed, InfraMetrix expanded upon the commission's GIS to include the video inspections, defect photos, and the service and structural condition ratings determined by certified Pipeline Assessment Certification Program (PACP) specialists. Having determined the maintenance requirements and structural defects, the commission performed cleaning and repairs to reduce the risk of costly emergency repairs and customer settlements.

Prior to the pilot, the MWSC was concerned that mapping, inventorying, identifying immediate maintenance and capital needs, and prioritizing asset renewal and replacement would be costly and could take many years using a traditional approach to collection system management. Once the pilot program was completed,

Five steps to achieving BIM

Deteriorating infrastructure is a problem common to sewer systems across the country. Buried infrastructure management (BIM)—a systematic, multistep approach—can help improve system performance and counter the aging process. Source: InfraMetrics LLC.



MWSC discovered that with new inspection technologies and software applications it could focus its limited funding and increase productivity, completing the process at a fraction of the cost and time.

In October 2005, the MWSC decided to expand the pilot program to include an inventory and initial assessment of an additional pumping station district and to integrate all of the collected data into its VUEWorks asset management software. The computer program gives the MWSC the ability to query the inspection data and videos by simply clicking on a pipe or manhole. The software works directly with the GIS mapping data and provides the capability to maintain the condition data, use the data for risk assessment, and use tools for capturing and tracking service calls and maintenance activities. MWSC staff can quickly produce detailed monthly reports on call activity. Service calls can then be used to develop work orders by the assistant superintendent. The manager can prepare work orders and reports based on the condition assessment and other real-time data. The effort required to manage paperwork and filing is significantly reduced since it is all handled automatically.

MWSC has since implemented 20% of its sanitary sewer system into the BIM program and plans to implement the remainder of the system within the next two years, completing the program by the end of 2008. The town has spent $265,000 for the program to date. About 35% of the collection system has been mapped, assessed, and programmed for cleaning and repairs. The project is running between $2 and $3 per foot for the services described above and is funded through user fees.

The MWSC currently uses the condition information to determine the probability of failure and to calculate risk to prioritize future action in the VUEWorks software. The consequence of failure to public health, environment, property, costs, and community also are being configured in the software. By using these methodologies to prioritize maintenance and capital expenditures, the MWSC will maximize the ratio of benefit to resource expended in the near term. As money is invested in the collection system the risks will be reduced, the overall UCI will increase, and less will be spent on reactive maintenance and insurance claims. **PW**

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