



Hazen

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Water Infrastructure

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water environment solutions

SUMMER 2018

Popular media portrayals aside, sustainability is more than just solar panels, recycling, and electric car-charging stations. It's a holistic approach to optimizing return on infrastructure investment that encompasses the social, environmental, and economic impacts of projects.

THE VALUE OF *Sustainable Water* INFRA STRUC TURE



The key to implementing sustainable solutions is evaluating and designing with efficient and reliable technologies, while also leveraging the financial incentives that often subsidize the most sustainable solutions.



Sustainability approaches redefine “cost” to include lifecycle assessments of risk, longevity, adaptability, and environmental benefits in addition to traditional capital and O&M values.



Using these principles, we can arrive at effective water infrastructure solutions that also enrich the local community.



Hazen and Sawyer has delivered sustainable planning and design services to our clients since our founding. While large, high-profile projects can often present opportunities to reap rewards from a sustainable approach, smaller, less-visible projects also offer ample opportunities. Each project is different, with a wide range of variables to consider. Engaging utility staff, local government, and residents enables the project team to identify sustainable solutions to enhance infrastructure and benefit the community for years to come.

Cocoplum Pump Station & Force Main

How the Envision framework enhanced the project delivery process and overall design outcome.



LEADERSHIP

The owner worked closely with multiple City departments and residents to refine the final design.

QUALITY OF LIFE

Locations along and adjacent to the project site were improved for use as a public asset.



RESOURCE ALLOCATION

The project will reuse/repurpose more than 90% of excavated materials from the project site.

NATURAL WORLD

Careful measures were identified to protect sensitive environmental areas during construction and operation.

RISK & RESILIENCE

The impacts of flooding and sea level rise will not affect the site accessibility and reliable operation of the facility.

Sustainability rating systems, such as Envision and LEED, enable us to identify and incorporate comprehensive sustainability measures into our designs. The goal of Envision is to help designers identify opportunities to incorporate sustainable approaches in the planning, design, construction, and operation of infrastructure projects. It allows for improved technical performance in parallel with social, environmental, and economic improvements.

The City of Coral Gables' Cocoplum Pump Station and Force Main Upgrade project included mechanical, electrical, and structural upgrades of the station and force main to better accommodate peak flows and increase system reliability. The project leveraged the Envision Sustainable Infrastructure Rating System framework

during planning and design to identify and incorporate elements that would provide community, environmental, and economic benefits. These criteria address a project's impact on the surrounding community and environment, technical considerations regarding materials and processes, and other critical choices spanning the project's lifecycle.

Use of the Envision framework, which aligned with regional use of Envision for planning and design, facilitated discussion with a broader group of stakeholders across City departments to identify project synergies. The overall design approach was strengthened by accounting for the full spectrum of environmental, social, and economic impacts.

West Park Equalization Facility



The unique challenges of Nashville's West Park Equalization Facility project led the team to apply the Envision framework during the project design phase. Nashville Metro Water Services, charged with eliminating unpermitted discharges from its wastewater collection system, implemented a strategy that included wastewater storage within the system during periods of wet weather. The storage project design for the West Park Facility originally called for a second tank on the existing pump station site. However, updates to the flood zones made in response to Nashville's historic 2010 flooding made the original location unsuitable. The alternative remote location would have required multiple tanks and additional equipment.

The project team partnered with Metro Parks and Recreation to utilize park property within the nearby West

Park, which featured existing recreational facilities that were in need of improvements and not meeting the needs of a rapidly growing surrounding community. Relocating this project to the park allowed the cost savings to be used to fund much needed park upgrades and new recreational facilities. The project's inter-agency collaboration resulted in both valuable park improvements and cleaner rivers and streams.

Upon completion of the 60% design package, Hazen performed an Envision audit to measure the project's sustainable design features against the rating system's quantifiable metrics. While the project rated highly, it also allowed the team to identify opportunities for an even more sustainable design. The project was later given an Envision Platinum award, the highest level possible.

Neuse River Resource Recovery Project



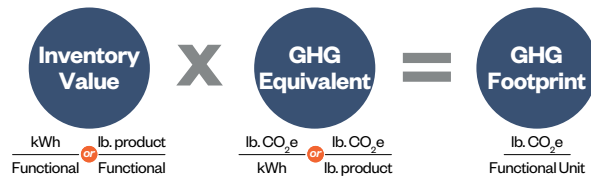
Whether it's greenhouse gas quantification, carbon footprinting, or energy profile modeling, Hazen has successfully used many methods of environmental accounting to quantify performance improvements that lend credibility to project choices. These quantifications, in turn, foster community engagement and support.

Now, more than ever, community engagement and acceptance is a critical component of any significant public works project. The development of public facing website dashboards is a compelling, yet low investment, platform for ongoing communication of project advancement and long-term performance.

As part of the City of Raleigh's Neuse River Resource Recovery Facility Bioenergy Recovery Project (BRP), we developed a greenhouse gas calculator. The City plans to use this tool for reporting purposes as well as an input to the decision making process. Benefits of the Bioenergy Recovery Project include green energy production: biogas is cleaned, converted to renewable natural gas, and used in the City's bus fleet or sold to a third party for revenue. The BRP will also produce high-quality, low-odor Class A biosolids products which can be readily marketed and distributed for beneficial uses.

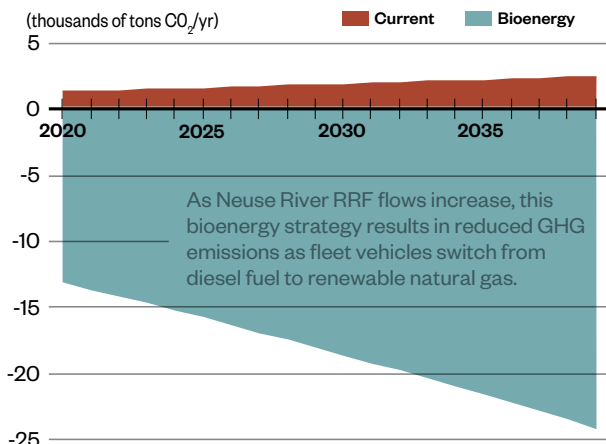
Greenhouse Gas Calculator

Functional Unit: 1 lb. (dry) pre-processed biosolids



Annual GHG Production Projection

(thousands of tons CO₂/yr)



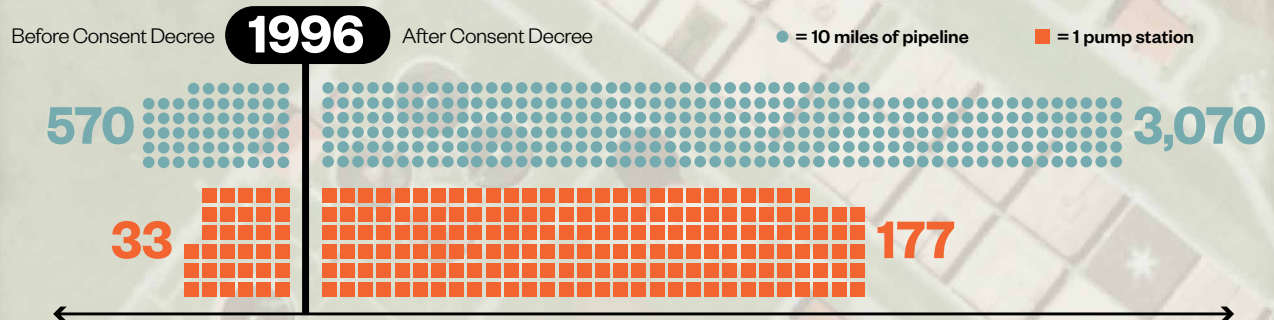
Typical passenger car emits an estimated 5.5 tons of CO₂e per year.



Successfully Implementing A Collection System Asset Management Program

Faced with frequent sanitary sewer overflows, limited resources, and Consent Decree compliance, Jefferson County (AL) implemented a customized asset management program that uses comprehensive data analysis to prioritize the right projects, maximizing return on investment.

Jefferson County Environmental Services Department Collection System:



Jefferson County Environmental Services Department (JCESD) in Birmingham, Alabama, serves a population of approximately 478,000 people and owns and operates approximately 3,070 miles of sanitary sewer lines, 177 pump stations, and 81,702 manholes as part of its sewer collection system. Before 1996, however, the County only owned and operated 570 miles of trunk sewers and 33 pump stations, with all other assets owned and operated by 21 different municipalities. A 1996 Consent Decree required the County to take over all of these disparate systems and to eliminate overflows, placing an enormous burden on County staff and resources.

Many of the acquired systems had not been maintained well and were not constructed to proper standards. Within the 3,100 miles of sewer collection system, JCESD experienced significant and frequent blockages due to grease, roots, rags, and various debris in the sewer lines. These blockages caused and exacerbated sanitary sewer overflows (SSOs) in the system and resulted in home back-ups. In order to maximize the productivity and effectiveness of County crews until the needs of the integrated system could be determined and implemented, it was critical that the County develop a system to prioritize areas to clean to proactively prevent blockages.

Asset Management Approach

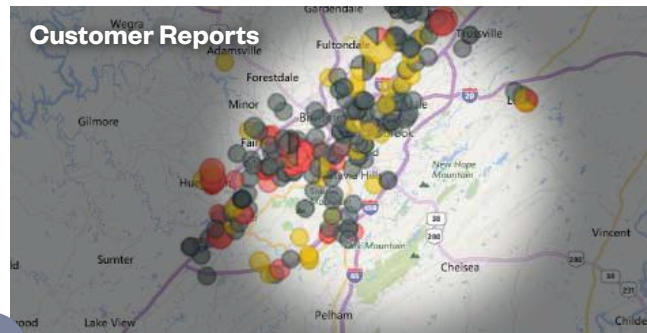
To get the most out of its investments and to prioritize repairs throughout the system, the County decided to implement a customized asset management approach. This approach identifies priority rehab and repair needs, establishes a

cleaning and maintenance schedule for the entire system, and provides a method to address current and future compliance issues established by Federal and State regulators. Using knowledge gained from the asset management program, the

County developed a three-year CIP that includes directing condition assessment activities, scoping and procurement of engineering services, and schedule delivery.

Prioritizing Projects

The Cleaning Prioritization and Frequency Optimization Tool establishes a hierarchy of priorities to guide cleaning activities throughout the sewer system. The tool integrates an enormous amount of data from several sources, including:



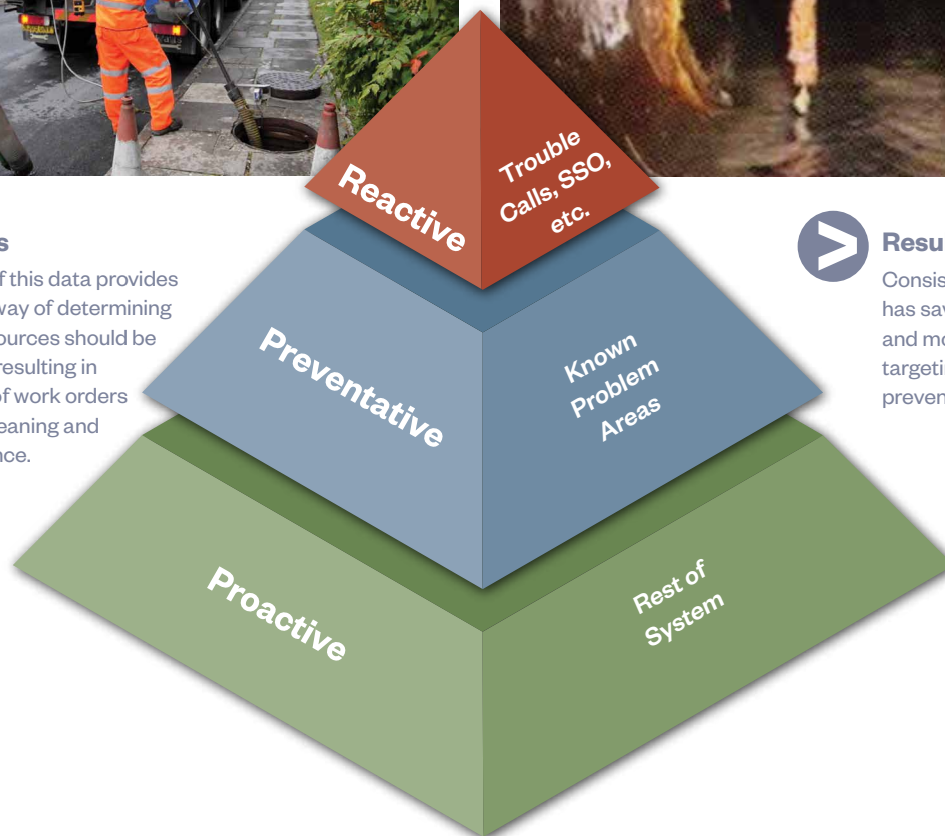
Analysis

Analysis of this data provides a reliable way of determining where resources should be allocated resulting in issuance of work orders for pipe cleaning and maintenance.



Results

Consistent use of the tool has saved the County time and money by efficiently targeting resources to prevent blockages.



The Program Toolbox

The asset management program relies on a suite of customized tools to accomplish all of these challenging objectives. GIS-based risk analysis tools guide decisions about which parts of the system are in most urgent need of repairs, reducing the number of breaks and SSOs. When imminent repair is not needed,

CCTV inspection equipment and software provide detailed analyses for focusing rehab efforts. Specialized software for manhole inspections guide efforts to assess more than 81,000 manholes across the system and determine repairs. Cleaning frequency prioritization and optimization software helps di-

rect efforts to reduce grease buildup and improve system maintenance. Other modeling and risk assessment software packages address a multitude of decisions that must be made daily to ensure that repairs occur at the optimal time and rehab is completed when needed.

SL-RAT

Sewer Line Rapid Assessment Tool (SL-RAT) uses active acoustics to find blockages. SL-RAT is a cost-effective assessment tool for use before and after cleaning.



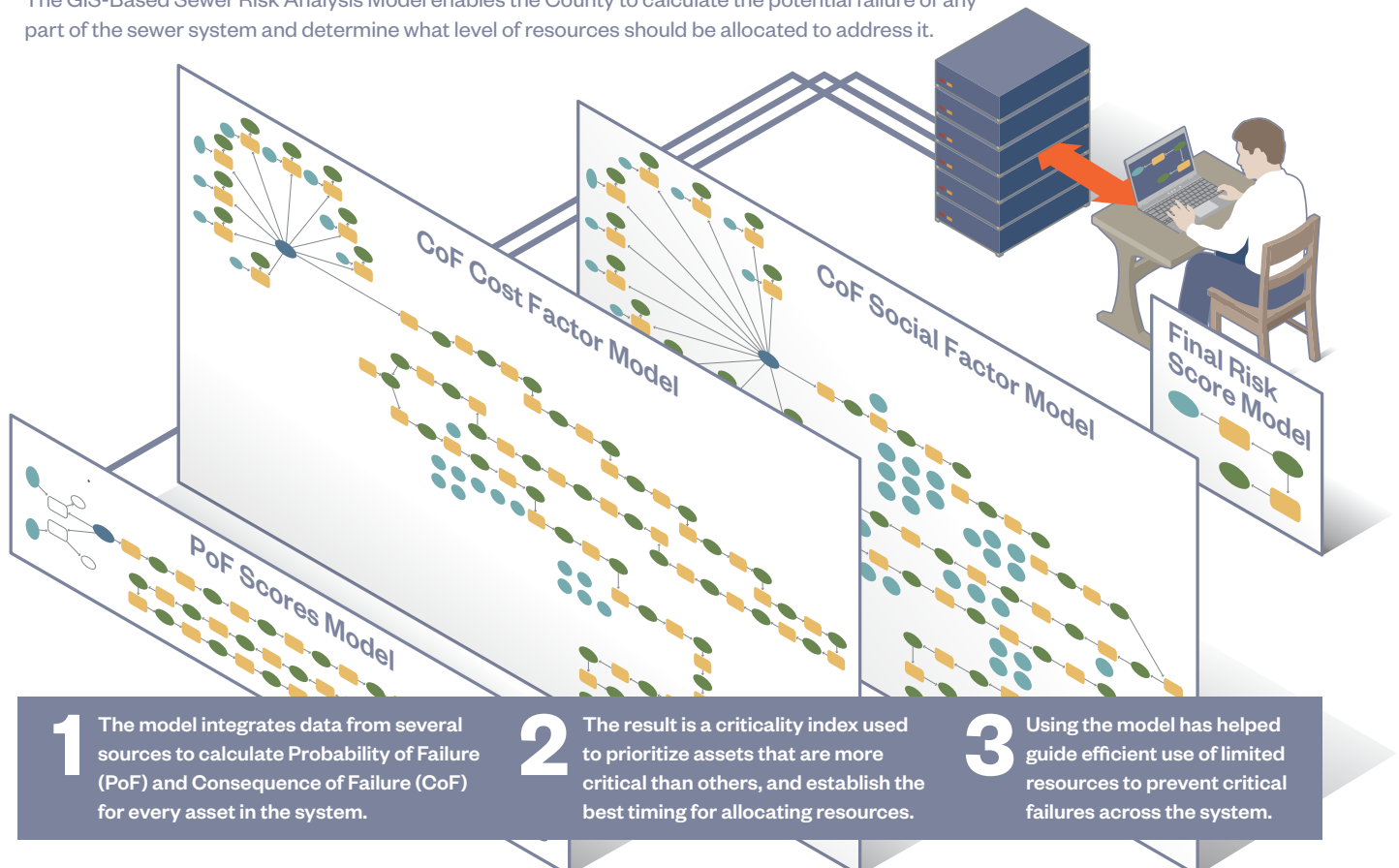
CCTV

Closed Circuit Television (CCTV) is a practical and widely-used inspection method that enables detailed evaluations of pipe segments.



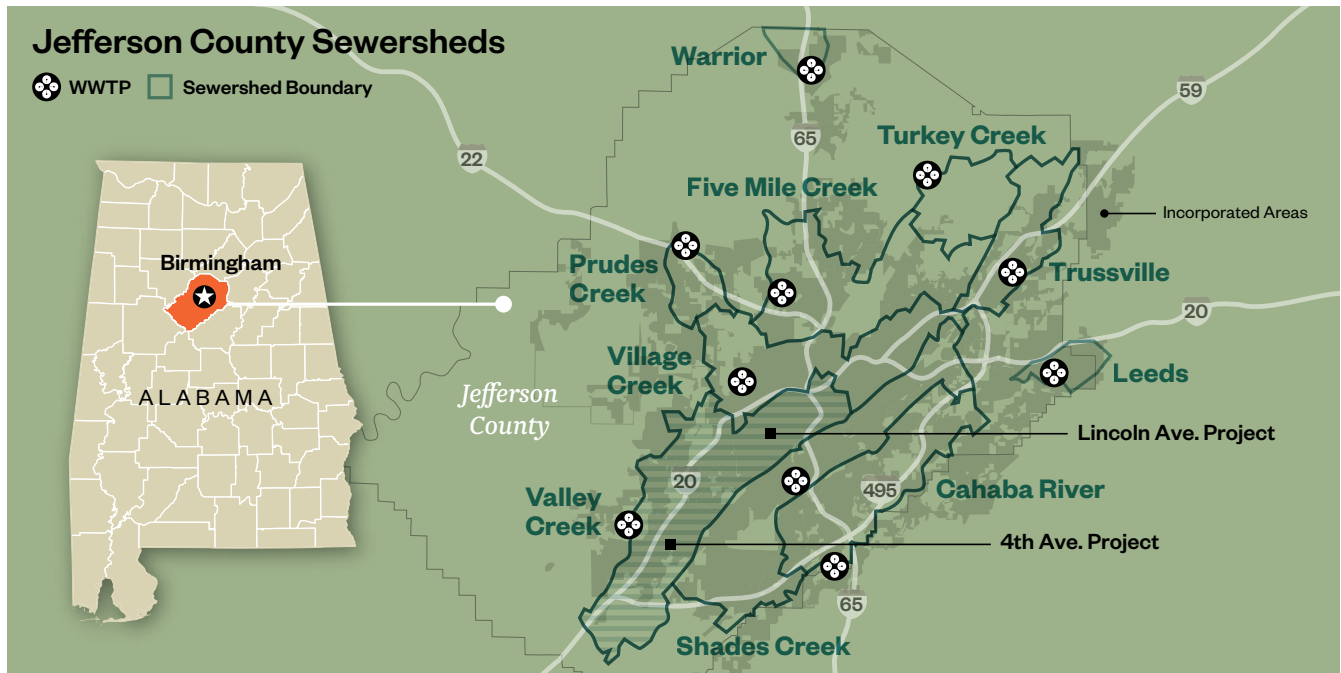
Sewer Risk Analysis Model

The GIS-Based Sewer Risk Analysis Model enables the County to calculate the potential failure of any part of the sewer system and determine what level of resources should be allocated to address it.



Prioritized Repairs

The County comprises multiple watersheds, with the Valley Creek watershed being the largest and most populous. In the Valley Creek watershed, SSOs had long been a significant quality-of-life burden on local residents. Therefore, the primary focus of the early stages of the asset management program was to fortify the infrastructure in this watershed. Two particular sites within Valley Creek had among the most regular SSOs and were prioritized for repair at the onset of the program.



4th Avenue



The 4th Avenue sewer-replacement project in Bessemer increased the capacity of an undersized sewer that overflowed after heavy rains. The completion of this project eliminated SSOs from spilling into Valley Creek several times a year.

Annual number of SSOs avoided:

8

Lincoln Avenue



The Lincoln Avenue sewer-replacement project in Birmingham's West End neighborhood eliminated sewer segments that were difficult to maintain, increased the capacity of a sewer, and prevented SSOs from spilling into Valley Creek.

Annual number of SSOs avoided:

10

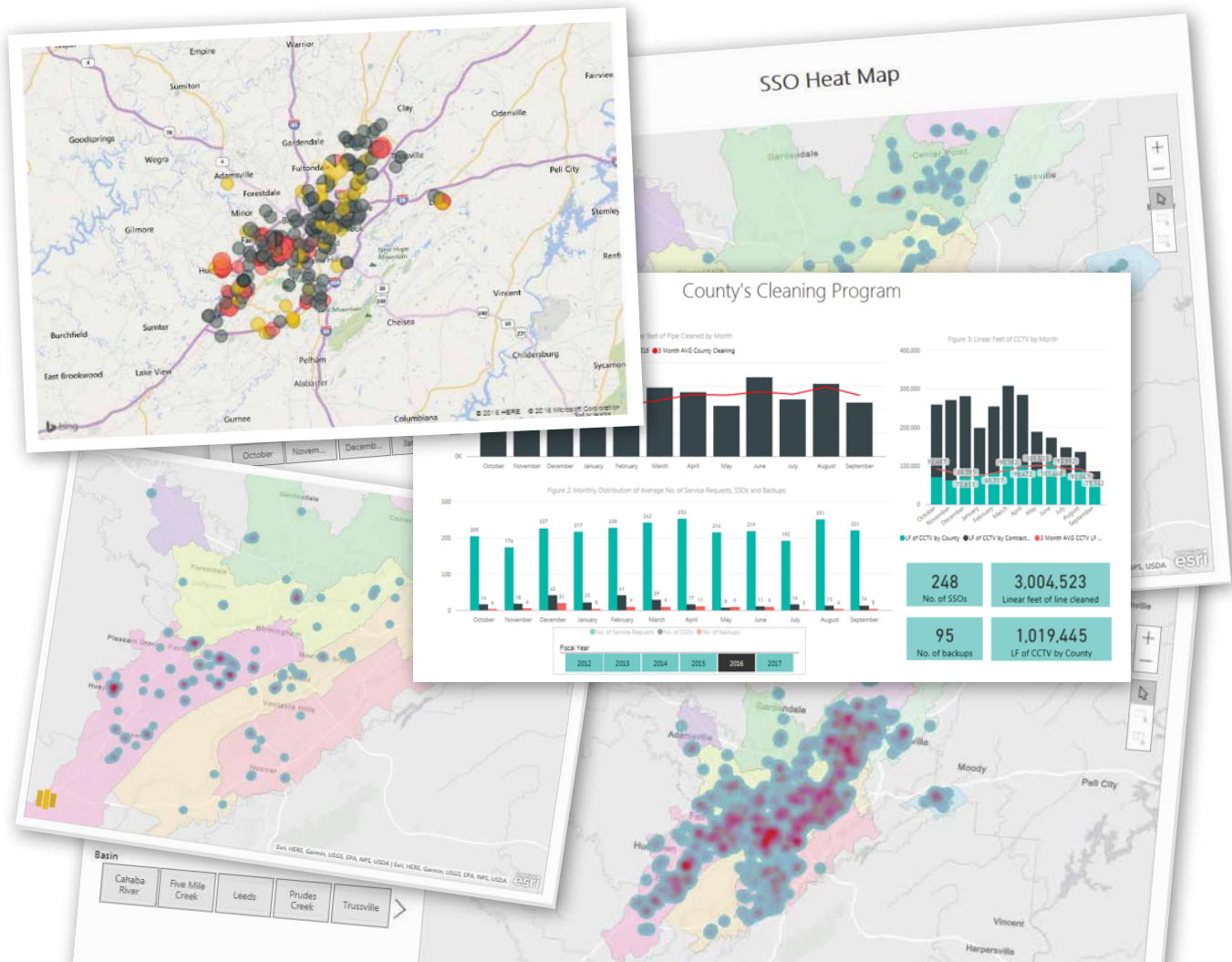
Tracking Program Performance

To track overall program performance, Jefferson County now uses Microsoft Power Business Intelligence (Power BI) to integrate data characterizing an enormous number of assets. Monthly program reports, accessed through Power BI, track key performance indicators and ensure effective implementation of the CIP and collection system performance.

County staff can access and interpret the dashboards without the need for hiring additional technical staff or consultants. The resulting analyses enable the County to

allocate limited resources where they are most needed and most effective.

The Power BI reporting framework is providing a transparent and defensible perspective on the sustainability and cost effectiveness of the asset management program. This perspective empowers County staff with new insights on how to best to regulate spending and prioritize projects that will decrease the number of SSOs and home backups. A data management plan keeps these dashboards effective, updated, and active in the long term.



To date, the asset management plan has reduced SSOs and resulted in the repair/replacement of 15.7 miles of sewer and the rehabilitation of 14.7 miles of sewer.



As of the end of 2017, 24 asset management projects have been completed or are under construction, with another 21 projects under design or awaiting bidding.

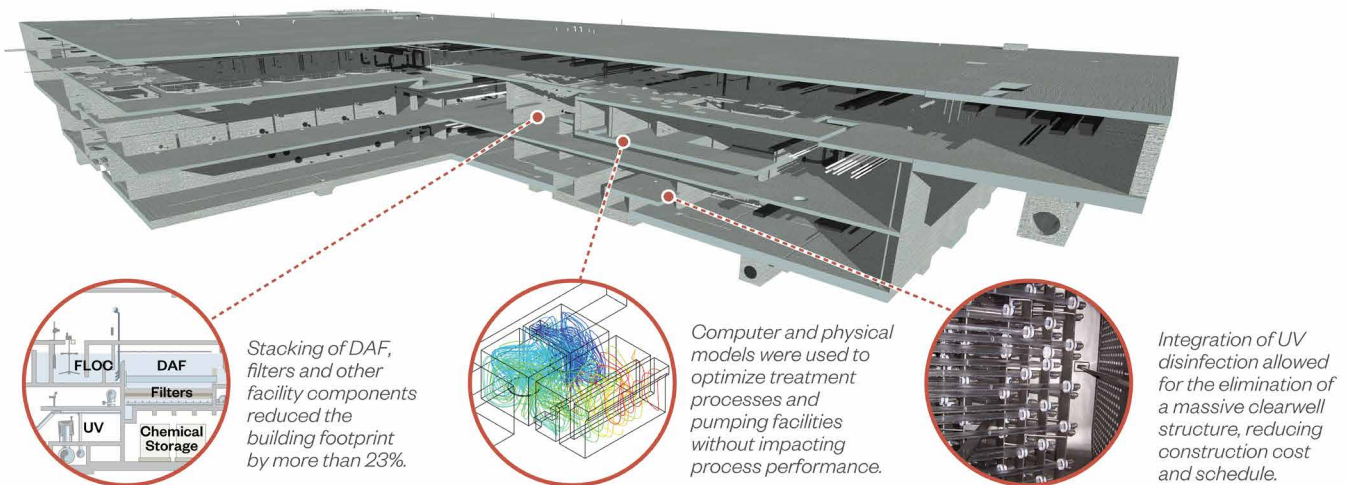
For more about JCESD's Asset Management Program : Stephen H. King, PE BCEE sking@hazenandsawyer.com

2017 | AWARDS



Croton Water Filtration Plant

ACEC National Grand Award Winner



The four-story, 290-mgd Croton Water Filtration plant, located in Bronx's Van Cortlandt Park, will provide New York City with a safe and reliable water source for generations to come. The plant was built entirely underground, requiring deep rock excavation and tunneling for conveyance tunnels. The project team demonstrated a high level of innovation, including:

The 290-mgd plant will provide New York City with a safe and reliable water source for generations to come.

use of stacked dissolved air filtration/flotation tanks (the largest in the world), followed by ultraviolet light disinfection (one of the largest in the world); state-of-the-art digital automation architecture and systems; and utilization of extensive Computational Fluid Dynamics and physical modeling throughout the design. Hazen (in joint venture with another firm) was the design engineer.



ASCE Long Island Branch Project of the Year

Bay Park Perimeter Flood Wall and Berm

The flood protection barrier is part of the larger Bay Park STP Hurricane Sandy Recovery Program, of which Hazen is the program manager in joint venture with another firm.

The perimeter flood protection barrier was designed primarily as a vegetated berm for visual appeal, low cost, and ease of constructability. In lieu of a berm in areas with property limitations, a concrete flood wall was installed. The wall incorporates

features such as architectural finishes and decorative metal screen lattice gates, improving aesthetics for the surrounding community. Bay Park STP is located in East Rockaway, NY.



CMAA Metro New York/New Jersey Honorable Mention Project of the Year

Gowanus Facilities Upgrade – Flushing Tunnel Modernization and Wastewater Pump Station Reconstruction

To modernize and increase the capacity and reliability of the Gowanus Flushing Tunnel, the new Flushing Tunnel Pumping System was upgraded by replacing the existing 7-foot diameter propeller with an average flow of 154 mgd with three axial flow pumps and new intake/discharge chamber capable of pumping at a rate of up to 252 mgd. The wastewater pump station upgrade from 22 mgd to 30 mgd required the installation of a new CSO Screenings and Level Control System upstream of the pump station, consisting of six hydraulically-actuated bending weirs, continuously raked uptake bar screens, oscillating baffles, and a new CSO overflow extension. The tunnel and pump station upgrades, for which Hazen was the construction manager and the prime consultant, will improve water quality of the Gowanus Canal and reduce CSO events.



Florida Region Design-Build Institute of America Best Overall - Water/Wastewater Category

Intracoastal Waterway Crossings at Las Olas Boulevard

This project included construction of 1,220 feet of 20-inch diameter water main crossing and 1,220 feet of 16-inch diameter force main crossing of the Intracoastal Waterway (ICW), using high-density polyethylene pipe installed via horizontal directional drilling (HDD) at a depth of about 60 feet below water surface. The successful completion of the project allowed the City of Fort Lauderdale to meet Florida Inland Navigation District (FIND)'s deadline for lowering this critical water main in advance of FIND's dredging. The addition of redundancy in the sewer force main network will also support economic development for many years to come. Hazen served as designer for the design-build contractor.

Learn more about these and other topics on our website.

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The 2,020-mgd Catskill Delaware Ultraviolet Disinfection Facility, the largest in the world, serves nine million customers at a fraction of the cost of a filtration plant.
[Drinking Water »](#)



Our extensive operations support experience drives the design perspective we bring to direct and indirect potable reuse facilities in that emerging market.
[Water Reuse »](#)



The 60-mgd F. Wayne Hill facility converts phosphorus to a fertilizer and reduces energy costs using FOG, co-thickening, and combined heat and power facilities.
[« Wastewater](#)



News & Publications

Portland's East End Wastewater Treatment Facility Now Online

Jun 25, 2018 | News

2018 Nutrient Removal and Recovery Conference Presentations

Jun 06, 2018 | News

National Infrastructure Week: DEP Celebrates "Holing Through" First Section of New Release Tunnel

May 22, 2018 | News

WEF Webcast: Envision for Sustainable Water Infrastructure

Apr 23, 2018 | News

HORIZONS
water environment solutions

On the Cover:
Tropical lily pond.

Hazen

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