Hazen

Jones Falls Sewershed
Comprehensive Evaluation

News & Information

Q2 2024 ISSUE
SUMMER UPDATE

INTRODUCTION

Jones Falls Sewershed Needs Analysis

Baltimore County and their Engineering Consultant, Hazen and Sawyer, are nearing completion of a Draft Report with a focus on possible strategies to further protect the environment and citizens of the County long term through 2070.

The following needs are being evaluated and will be incorporated into the Draft Report:

1. Future capacity needs analysis driven by planned development, potential redevelopment, and possible future connection of unserved areas of the sewershed, including nearly 1,000 existing septic systems throughout Jones Falls.
   UPDATE: Future Capacity Analysis is Complete.

2. Strategies needed to further protect the environment, residents, and businesses and reduce the possibility of potential sanitary sewer overflows (SSOs) and potential basement backups.
   UPDATE: A phased approach to implement possible strategies has been developed and is incorporated into the Draft Report that's being completed with a focus on infiltration/inflow reduction where possible initially, followed by capacity enhancement strategies.

3. Best Management Practices for continued proactive operation and maintenance of the sanitary sewer system.
   UPDATE: A section of the report has been drafted outlining potential best management practices that cover both large and small diameter pipelines. There are also strategies to continually monitor the system allowing for proactive maintenance of the system. The County has historically been a leader in continuous sewer system monitoring (flows and levels).

4. Options to improve long-term sustainability and resiliency.
   UPDATE: The sewer system is being evaluated under possible climate change conditions to assess the sensitivity the sewer system may have to these possible future climactic changes.

5. Assist in the development of Capital Improvement Program (CIP) strategies to address needs/challenges at year 2025, and at 20-year and 50-year planning horizons.
   UPDATE: A flexible series of infilatration/inflow reduction, capacity improvement, and enhanced asset management strategies have been outlined and prioritized. Costs for each strategy have been developed to aid the County in CIP planning through the 50 year planning horizon.

What Area Does the Jones Falls Sewershed Encompass?

The Jones Falls Sewershed includes approximately 1,124,000 linear feet (LF) of gravity sewers ranging from 6- to 42-inches in diameter and approximately 6,200 sewer manholes and structures. The area served by this sewershed is shown in below.

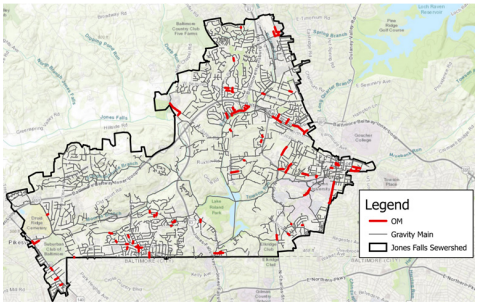


Figure 1: Jones Falls Sewershed

A needs analysis is being developed that outlines possible strategies for near-term and long-term improvements in the Jones Falls Sewershed.

The Draft Analysis will be available soon and include strategies that will both protect the environment and residents/businesses.
Our Engineering Consultant is finalizing possible strategies outlined in the report, which will be included in the Draft.

Baltimore County remains firm in meeting commitments and achieving long term planning goals as outlined.

Commitments:

- Maintain proper sanitation so communities can continue to thrive and prosper.
- Continue prioritization of clean water access.
- Conduct planning projects that are necessary for the County to meet future utility challenges and build upon past improvements.
- Revitalize utility infrastructure to meet forecasted population and employment growth.

Planning Goals:

- Enhance resiliency and sustainability through properly planned infrastructure strategies.
- Preserve and protect the environment through projects that improve water quality.
- Focus planning efforts on assessment and improvement of the existing sewer system.
- Track and prioritize needed sewer system strategies and proactively repair/replace/ infrastructure where needed.

Project Accomplishments through Q2 2024

Project accomplishments made through the most recent quarter, which build upon prior accomplishments include:

Data Review

Comprehensive review of over 17,500 available historical records.

Field Data Gathering/Reconnaissance

Completed a Hot Spot Analysis associated with SSO, basement backup, and work order data.

Hydraulic Model Expansion

Complete a gap analysis of the existing sewer system model to assess needs and determine ways the model could be improved upon to better estimate the impacts that wet weather has on sewer system operations.

Based upon the model gap analysis, field surveys of 106 manholes to update the hydraulic model were completed.

Completed a flow, level, and rainfall monitoring data analysis to determine areas that exhibit high rainfall dependent inflow and infiltration (RDII). These areas respond more dramatically to wet weather *(Red areas shown in Figure 2)*.

Selected additional flow monitor locations to improve model calibration.

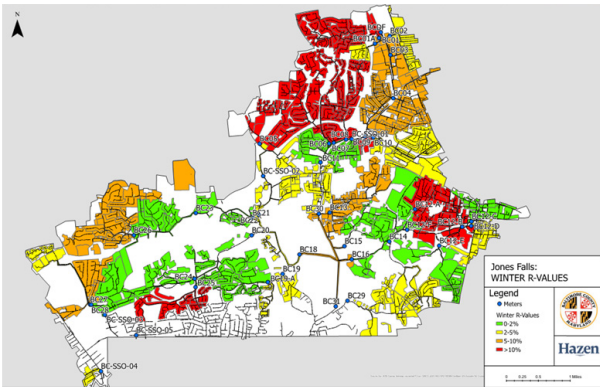


Figure 2 :
Winter High RDII Areas within the Jones Falls Sewershed

Baltimore County continues to monitor the flow in the sewer system and deployed 26 additional flow monitors, which provided the project team with 1 year of new flow monitoring data to work with. Sewer system flow monitoring and data gathering will continue to further refine dry weather, wet weather, and high groundwater flows. Expanding the sewer system model to include all sewers in the sewershed allows for a more detailed sewershed wide analysis. The original model was only required to include pipes 10-inches and larger. The number of manholes in the model increased from 1,513 to 6,715 while the number of pipes increased from 1,342 to 6,919.

Sewer System Modeling Validation

Expanded model calibration/verification with new flow monitoring data was completed using data collected through Fall 2022.

Stakeholder Engagement

Met with the following stakeholders in the sewershed to better understand potential increases in residential and employment populations: GBMC, St. Joseph Medical Center, Sheppard Pratt, Towson University.

Dashboards

Development of a series of Project Dashboards that are being used to present evaluation findings. These have been expanded to encompass the entirety of the evaluation *(Figure 3)*.

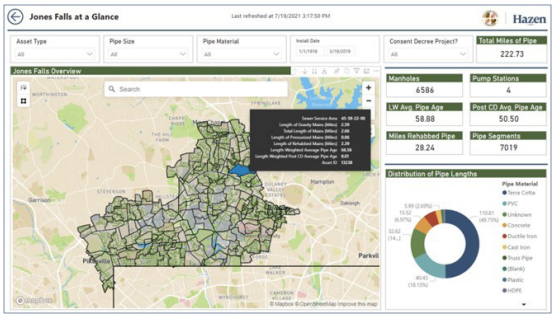


Figure 3

Environmental Investigations

Environmental investigations using GIS, in and near all large water features within the sewershed (Lake Roland, Jones Falls, etc.) began in Fall 2021 and were completed in Fall of 2023. *Figure 4* is a map of all the water features included in the analysis.

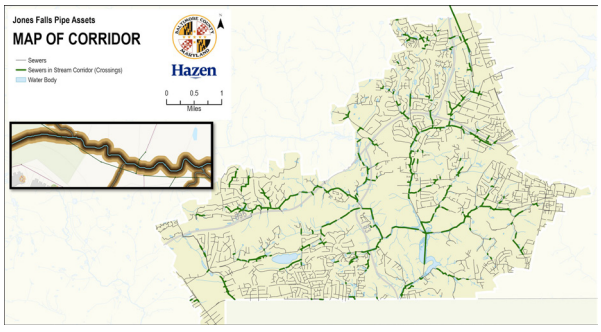


Figure 4

Climate Change

Assessed the possible impacts climate change may have on rainfall within the sewershed, including more frequent and higher intensity storm events. The projected change in annual precipitation due to climate change is shown in Figure 5.

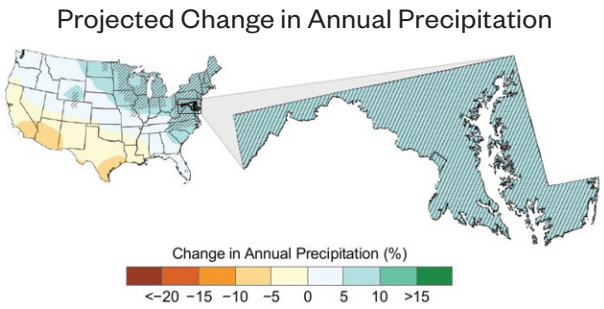


Figure 5

Mobile GIS

Implemented Mobile GIS to streamline data gathering. It replaces maps and redundant data entry, allowing gathered data to be immediately shared within the project team.

Population Estimates

Developed future population estimates, both residential and employment, which will contribute to future wastewater flows within the sewershed. Also evaluated the impact that potential re-development and build-out within the sewershed could have on sewer infrastructure. Projected population growth from 2020 to 2070 is shown in Figure 6 by location - the darker the red the higher the projected growth.

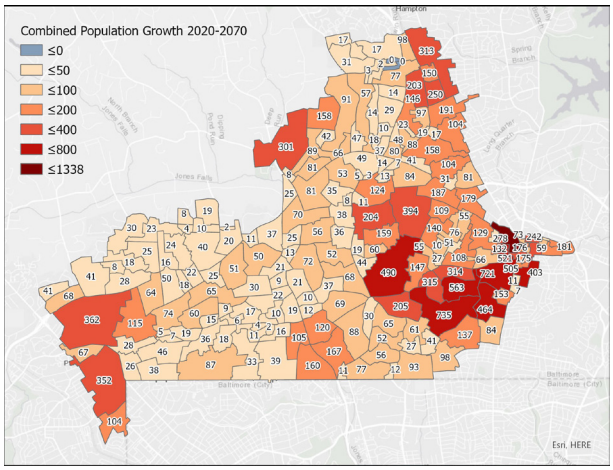


Figure 6

Water Meter Billing

Distributed water meter billing information to the sewer system model for increased accuracy in sewer system modeling.

COF Criteria	Social			Financial	Environment
	Vibrant Communities	Workforce Empowerment	Equitable Decision Making	Government Accountability	Sustainability
Environmental Impact	x		x		x
Transportation Impact	x	x	x	x	
Critical Facilties	x		x		
Diameter		x		x	x
Pipe Accessibility				x	x

Figure 7

Consequence of Failure Criteria

Developed Consequence of Failure Criteria (shown in Figure 7), which were used to assess and prioritize each strategy within the sewershed. These criteria include Social, Financial, and Environmental impacts.

Future Innovation Areas

Baltimore County and Hazen held workshops to discuss future innovations. The goals of these possible future innovations are shown below.

Identify

Identify innovation options that offer the County the most value.

- Leverage existing data
- Utilize the County's Tools (CityWorks, InfoWorks, etc.)
- Address known concerns within the sewer system (RDII, energy usage, etc.).

Assess

Assess the return on investment for potential use elsewhere in the sewer system.

- Pilot/test and assess results

Position

Position the County as a leading utility in sewer system design, operation, and maintenance.

Flow Monitoring

Flow monitoring data from 32 flow monitors has been analyzed for the data collected from November 2021 through October 2022 providing 1 year of new data. Flow data has been imported in the HazenQ software, integrated with previously collected 2018 flow data. Connectivity diagram has been updated to include new locations as shown in Figure 8. Flow data has been reviewed for quality.

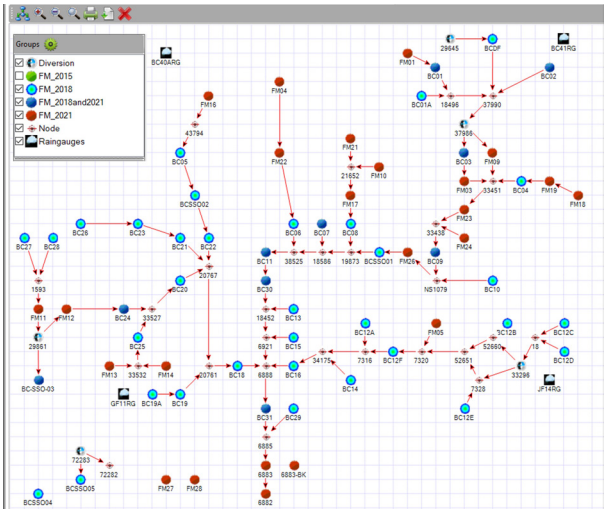


Figure 8

Rainfall

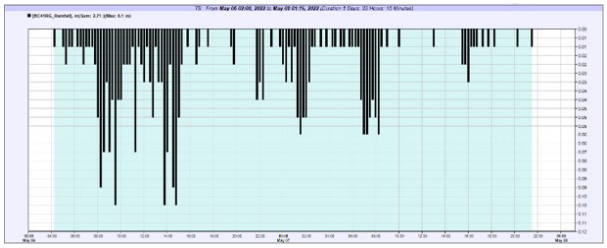


Figure 9

Rainfall data (shown in Figure 9) from multiple rain gauges has been analyzed using the data collected from November 2021 through October 2022 providing 1 year of new data. Rainfall has been imported in the HazenQ software and return period calculated.

Dry Weather Flow (DWF) Calibration

DWF Calibration was completed. The predicted model results now match closely with observed flow monitoring data from 2018 through Fall of 2022. As can be seen in *Figure 10*, during dry periods the red and blue lines fall on top of one another.

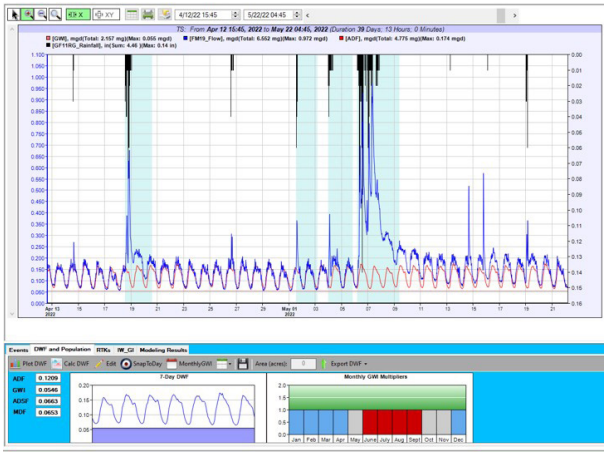


Figure 10

Stream Asset Prioritization

Developed Framework: Existing approach modified to fit Baltimore County; New COF category introduced - Public Health/Environmental Impact

Completed Desktop Analysis: LOF and COF factors decided upon and calculated; Risk scores assigned to all assets; Areas of interest identified with all levels of risk as shown in Figure 11.

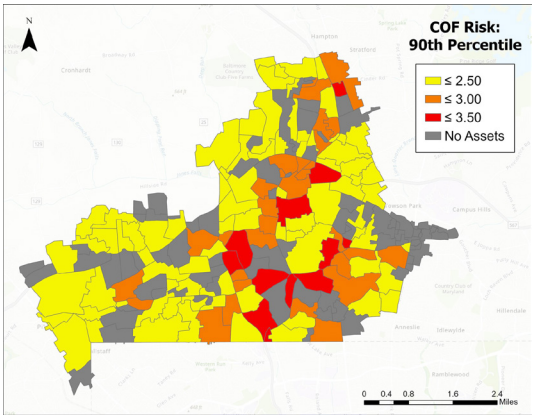


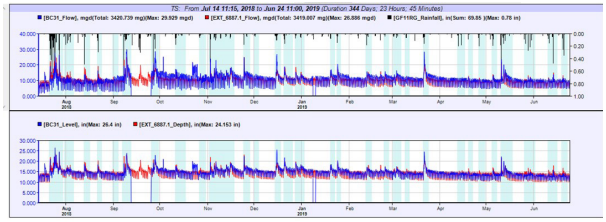
Figure 11

Wet Weather Calibration

Following dry weather calibration, wet weather calibration (comparison of observed to predicted flow) was undertaken to calibrate the sewer system model to real historical storm events. Model was calibrated at meter locations by assessing flow, volume, depth, and timing. Calibration criteria is shown in Figure 12 with example calibration results shown in Figure 13.

Hydraulic Characteristic	Calibration Criteria
Peak Flow Rate	-15% to +25% of measured, or ±0.1 mgd
Flow Volume	-10% to +20% of measured, or ±0.1 mg
Maximum Depth	Unsurcharged: within ±15% of observed or ± 0.3 ft Surcharged: -0.3 ft to + 1.6 ft of observed
Shape	The shape of the modeled both metered curves should be similar for both flow and depth
Timing	The timing of the peaks, troughs, and recessions of modeled and metered curves should be similar for flow and depth, and occur within one-hour from observation

Figure 12



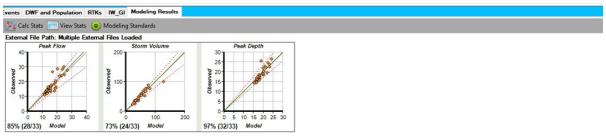


Figure 13

Historical and Synthetic Storms

Model results from historical storm events were compared against model results from synthetic design storm events to evaluate how closely the historical storm even flows align with predicted flows from synthetic design storm events. Storm curves are show in Figure 14.

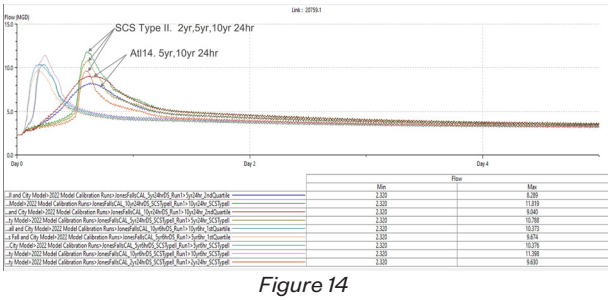


Figure 14

RDII (Rainfall Derived Infiltration and Inflow) Evaluation

Completed an evaluation of areas within the sewershed that, based on flow monitoring, exhibit the highest response to wet weather. These areas (in red in Figure 15, also refer to tabular data in Figure 17) may be locations where a strategy of comprehensive rehabilitation to reduce inflow and infiltration may be applicable and cost effective.

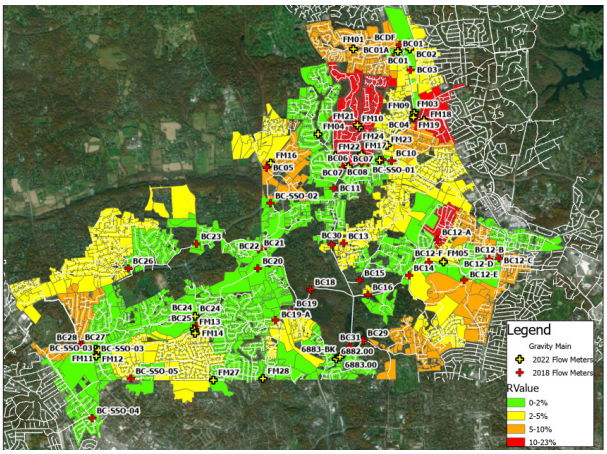


Figure 15

Potential Investigation Areas

Identified areas within the sewershed where rehabbed mains (purple lines in *Figure 16*) were completed in areas with high R-Values. Flow metering was done in these areas to quantify rehabilitation results.

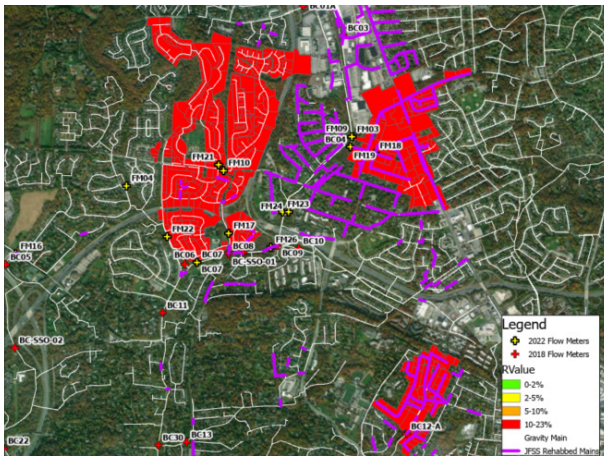


Figure 16

Model Calibration Area	Model R-Value	Max Potential I&I Reduction
BC07	10.6%	40%
BC08	15.3%	50%
BC12A	11.3%	40%
FM10	11.7%	40%
FM17	10.9%	40%
FM18	22.6%	60%
FM19	18.4%	55%
FM21	10.1%	40%

Figure 17
Areas with R-Values greater than 10% may benefit from Infiltration/inflow reduction efforts.

Performance Criteria

Performance criteria to measure success of potential strategies to protect customers and the environment were developed.

Design Storm: Historical Storm Evaluation

Evaluated 10 years of historical storm events to assess capacity of the system and identify areas where strategies may be needed to improve capacity, reduce Infiltration and Inflow, and identify areas for future study. Series of rainfall curves are shown in Figure 18.

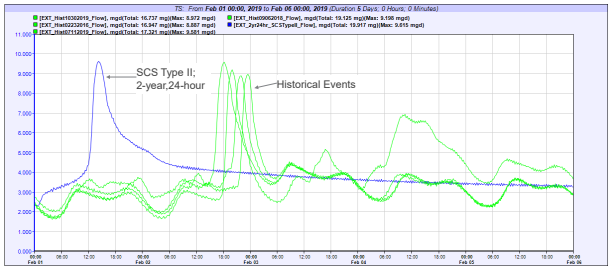


Figure 18

Future Flow Results

Capacity analyses were completed to identify needs and strategies to improve capacity, reduce infiltration and inflow, and identify areas for additional study and analysis.

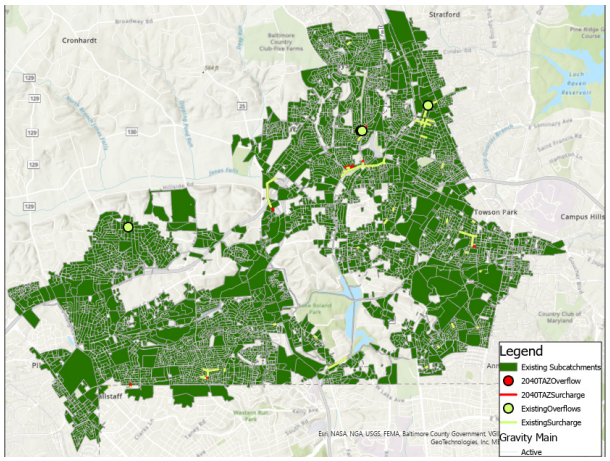


Figure 19

Potential Sewershed Strategies Identified

Using the calibrated sewer system model a series of possible sewershed strategies were developed and prioritized. These strategies are outlined within the Draft Report for further consideration. A table outlining how each sewershed strategy was categorized is shown in *Figure 20*.

Category	Description
A	Problem area contains model predicted overflow(s) and/or surcharge and flow data confirms overflow(s) and/or surcharge.
B	Problem area contains only model predicted overflow(s) and/or surcharge. Recommend additional metering to confirm.
F	Problem area contains only model predicted overflow(s) and/or surcharge that occurs due to future development.

Figure 20

Looking Ahead

What to expect going forward?

Given that this project is intended to identify the sewer system needs over a 50 year period, it is important to cover all possible aspects of what the sewer system could become by the year 2050 (~30 year period) and 2070. The below tasks have all been completed to a draft level and will be included in the Draft Report. All potential sewershed strategies align with the County's vision to enhance the sewer system and protects its customers and the environment.

- Capacity assessment using the calibrated model under future flow conditions.
- Development of a framework/strategy for future CIPs.
- Development of Asset Management Program features that allows for proactive protection of the environment, residents, and businesses. The asset management framework was developed in collaboration with sewer system model capacity assessments and observed field data to provide a comprehensive risk-based program *(see Figure 21)*.
- CIP needs to including current conditions, conditions through year 2030, and conditions out to year 2050.

Upcoming Project Tasks

Continue stakeholder engagement to account for the unique dynamics within the Jones Falls Sewershed, including community interests and potential residential and employment growth over the next 50 years. These will be incorporated into the Final Report.

Finalization of a series of dashboards that visulally tell the story of how the sewershed evaluation was completed and the associated outcomes.

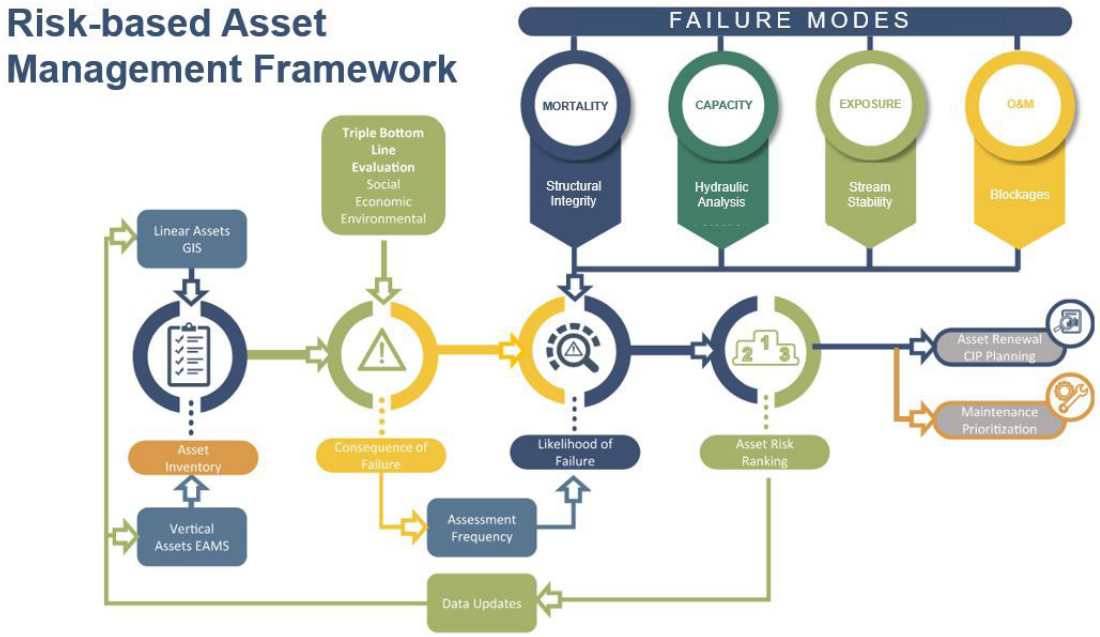


Figure 21

Enhanced Environmental and Citizen Protection Strategy Updates

The draft report is being updated to ensure it aligns with the County's vision for enhanced environmental and citizen protection. Baltimore County will continue to provide updates on the project, on a regular basis. Data continues to be gathered through flow and level monitors located throughout the sewershed for continual monitoring purposes, as Baltimore County is committed to protecting the environment. Look forward to discussing the strategies that have been identified for flow reduction, capacity improvement, and enhanced system operations.

Fall 2024 Update to Follow!

While this study was developed for the Jones Falls Sewershed, it was intended to establish a framework of potential strategies that could be applied anywhere in the County.