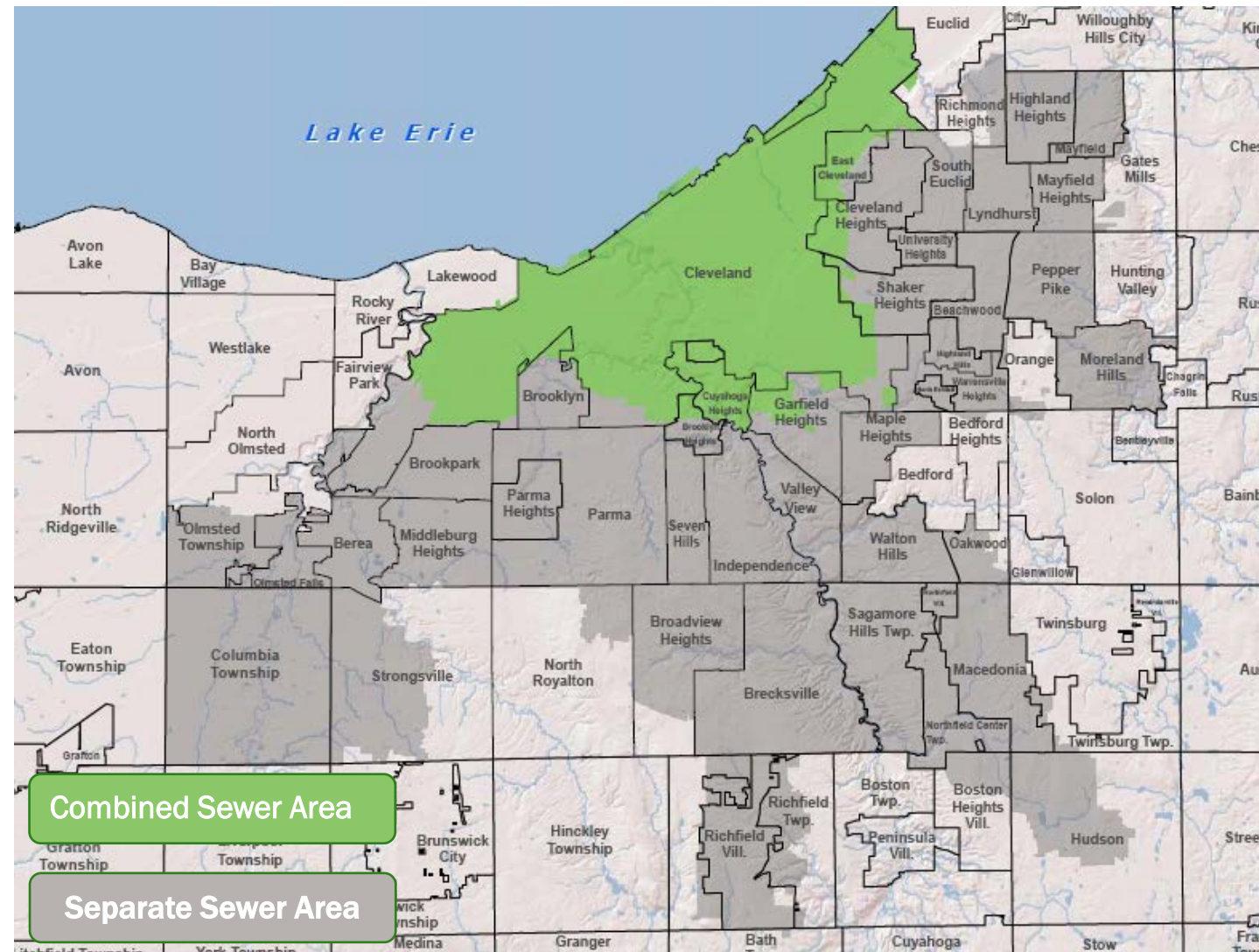


Outline

- Overview/Objectives
- Project Tasks/Approach
- Results
- Observations/Lessons/Deliverables

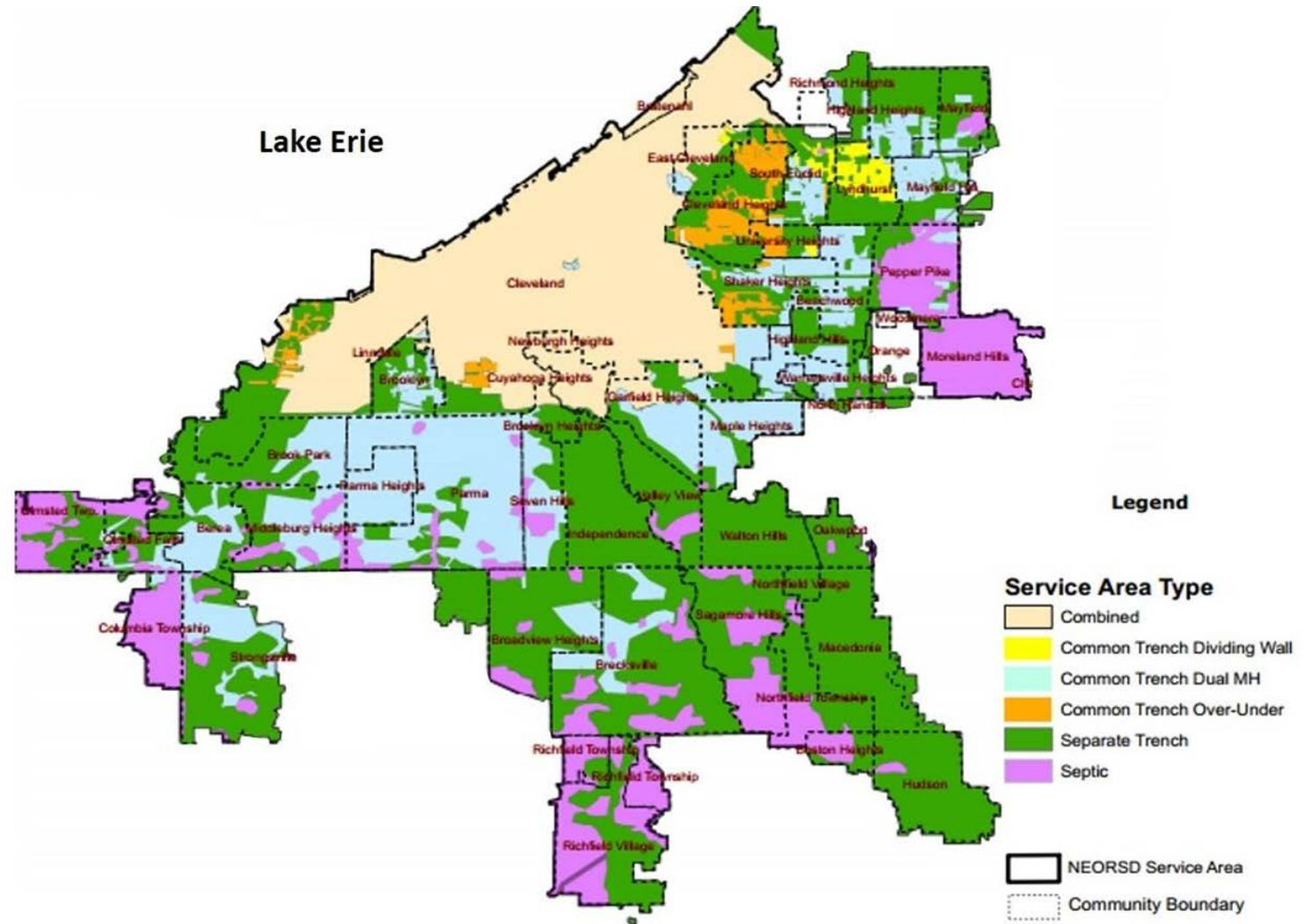
Northeast Ohio Regional Sewer District (NEORSD) Overview

- 355-square-mile total service area
 - 85 SM combined sewers
 - 270 SM separate sewers (76%)
 - 300 miles of interceptor sewers; 3 WWTPs
- 61 member communities
- \$3B Project Clean Lake CSO control program (2011-2036, 98% control of CSOs)



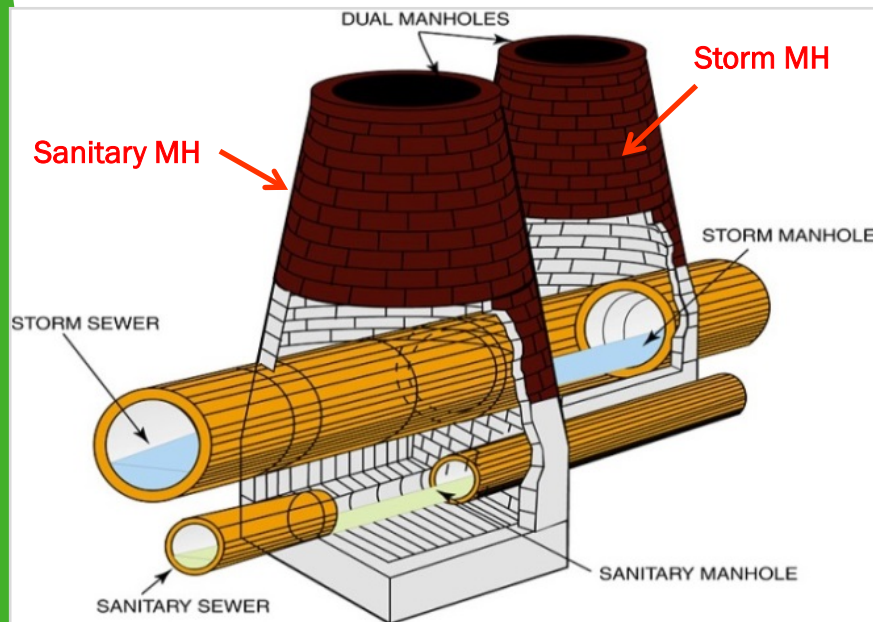
NEORSD Separate Sanitary Sewer System Areas

- Highly variable, aging systems
- Basement backups (BBUs)
- SSOs
- Other water quality issues
 - Common trench sewers
 - Illicit discharges
 - Failing septic systems

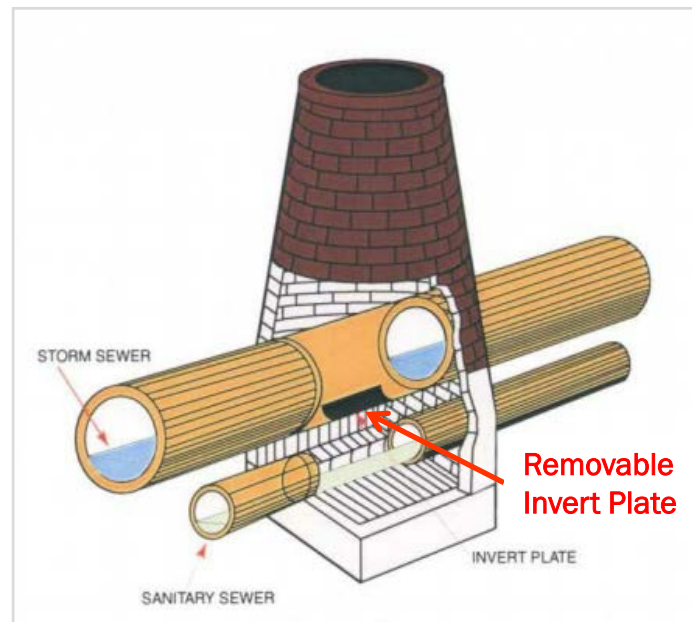


Common Trench Sewers

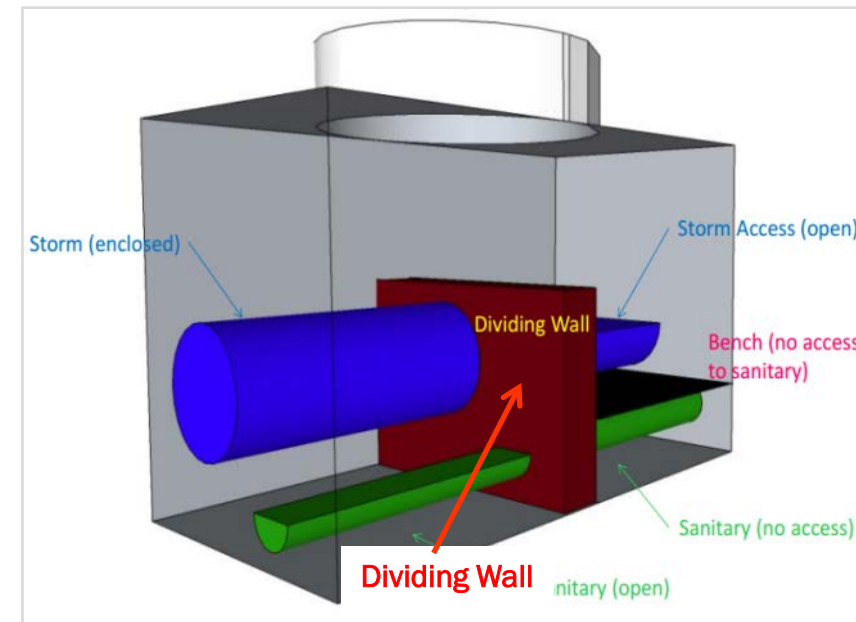
Common Standard Manhole, 500 miles



Over-Under (Invert Plate), 60 miles



Dividing Wall, 20 miles



- Constructed in NE Ohio primarily before 1980
- High I/I
- Sewage crossflows to storm sewers
- Difficult O&M and repairs

LSSSES Objectives (Planning Level Study)

- Use existing information and new information and analysis to characterize sewer system performance and problems.
- Develop, optimize and prioritize planning level solutions for community implementation.
- Document approach, findings and solutions in ArcGIS Online (AGOL) and supporting community reports.
- Support community understanding and implementation efforts.
- Support community participation in District's Member Community Infrastructure Grant Program (MCIP).

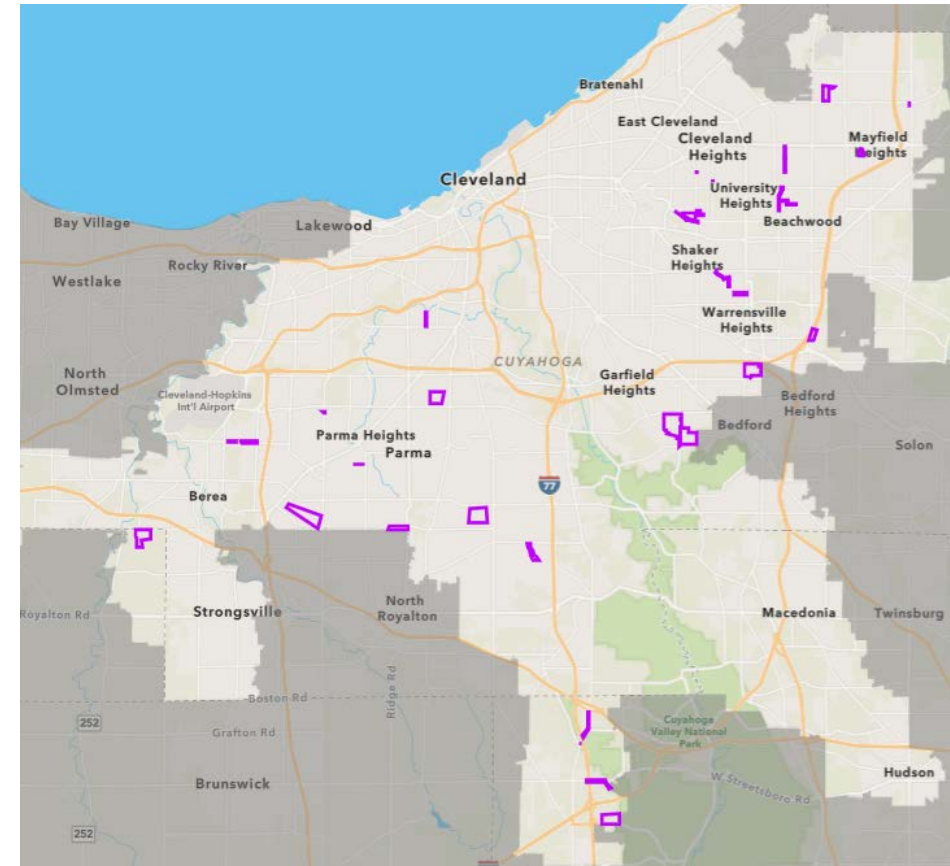
Member Community Infrastructure Program (MCIP)

2017 – 2021 – completed or in progress

- \$32.5 million invested - 54 sewer improvement projects
- Leveraged \$55.5 million in member community contributions
- Remediation of over 1,600 basement flooding locations
- 11 SSO/CSOs mitigated or controlled
- 3 wastewater treatment plants eliminated
- 1,600 individual septic systems converted to sewer service
- 161,000 LF of new sewers

2022 MCIP - authorized

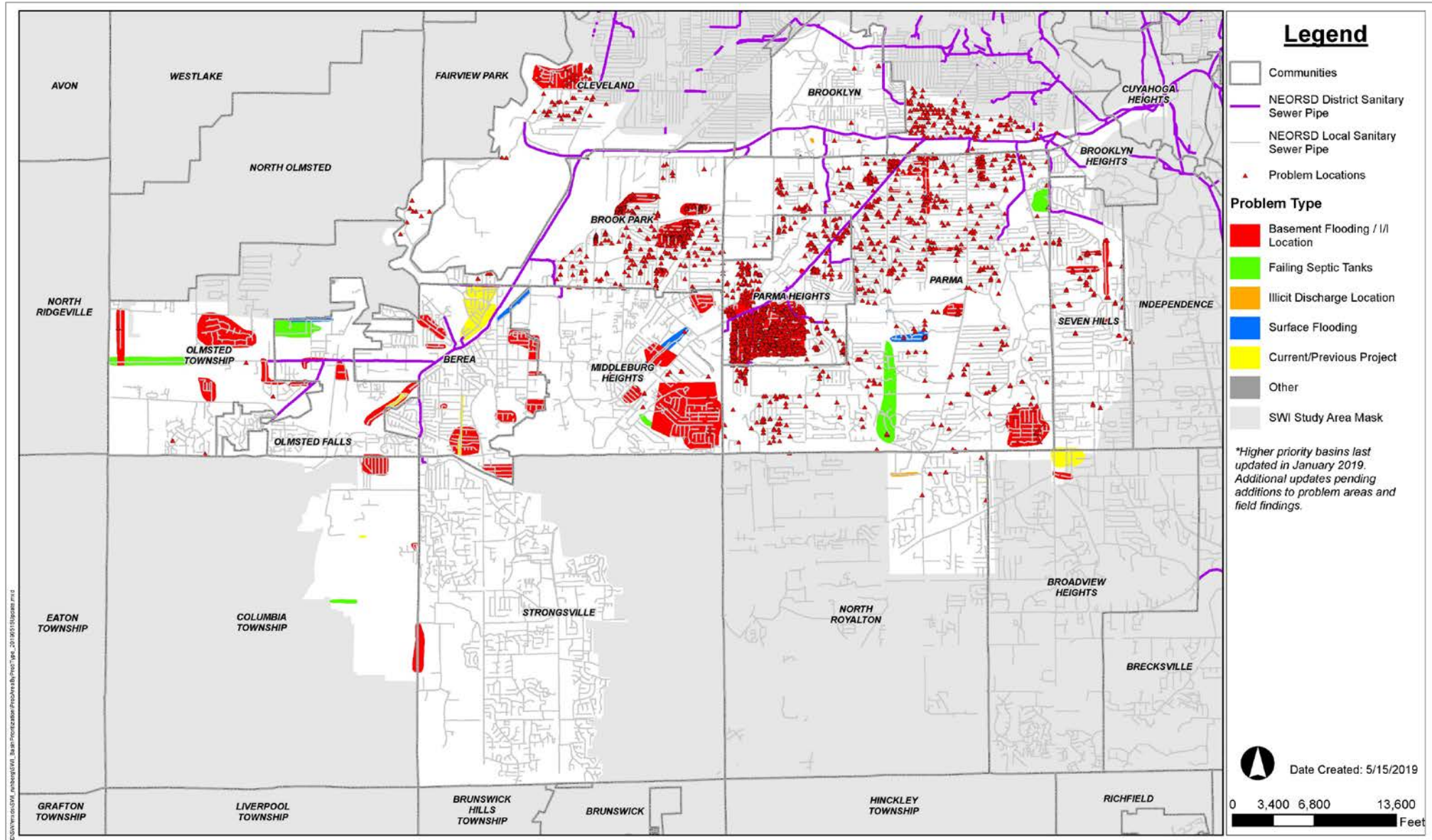
- \$15 million - 20 additional projects
- Remediation of additional 575 basement flooding locations,
- 14 SSOs controlled,
- 73 septic systems converted to sewer service
- 37,000 LF of new sewers



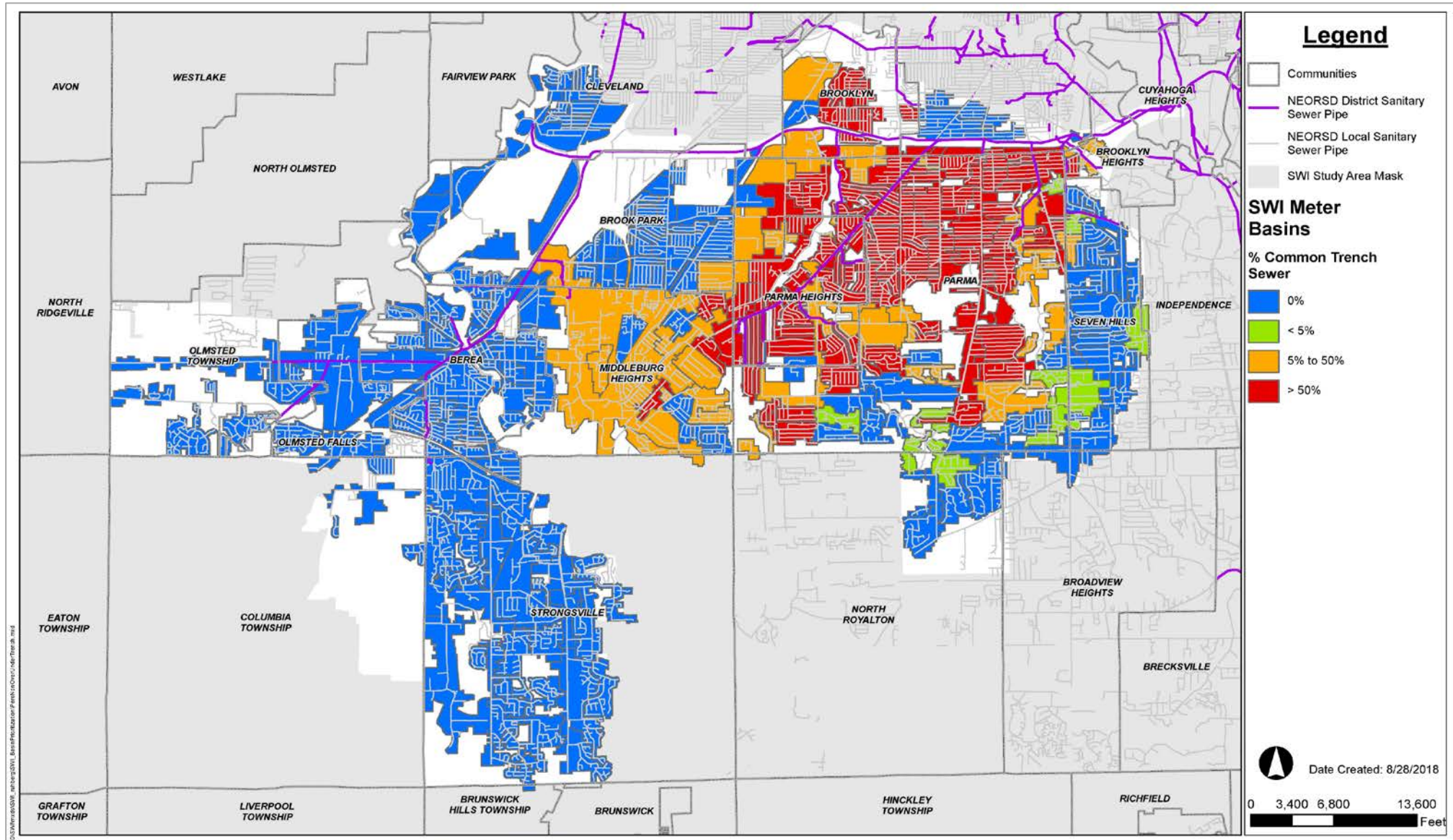
LSSSES Tasks Overview

Task	Task Objectives	Approach
1. Local system assessment strategy	Prioritize study area for monitoring and inspection of significant problems	<ul style="list-style-type: none">• Analyze existing information to prioritize likely problem areas• Confirm information with communities• Initial micromonitoring to screen calibration monitoring locations
2. System inspection and condition assessment	Inspect 5-10% of the total system to determine condition and relate to performance	<ul style="list-style-type: none">• Micromonitoring (550 locations)• Smoke and dyed water testing• CCTV inspection• Public sewers and private service laterals
3. System evaluation	Model the system to relate condition and performance, and identify problems	<ul style="list-style-type: none">• Model calibration monitoring (260 locations)• Model calibration and problem ID (SSOs and BBUs)• Confirm information with communities
4. Prioritized capital solutions	Develop, optimize and prioritize planning-level capital improvements for community review and implementation	<ul style="list-style-type: none">• Use costs and results from previous improvement areas to develop alternatives and model post-construction performance.• Use screening alternatives to provide starting point for analysis• Develop/optimize solutions using the calibrated model and costs

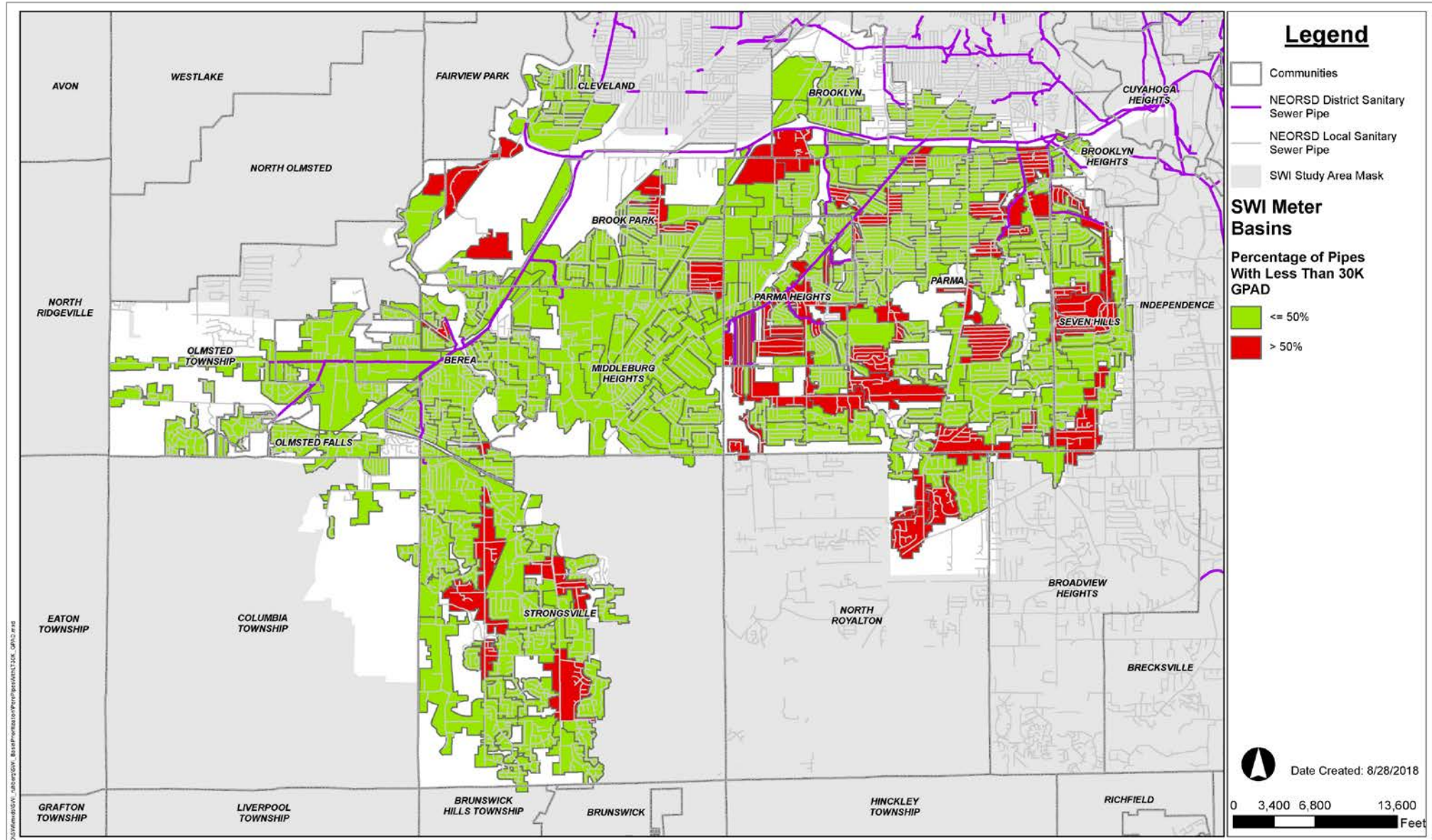
Local System Assessment Strategy – Reported Problems



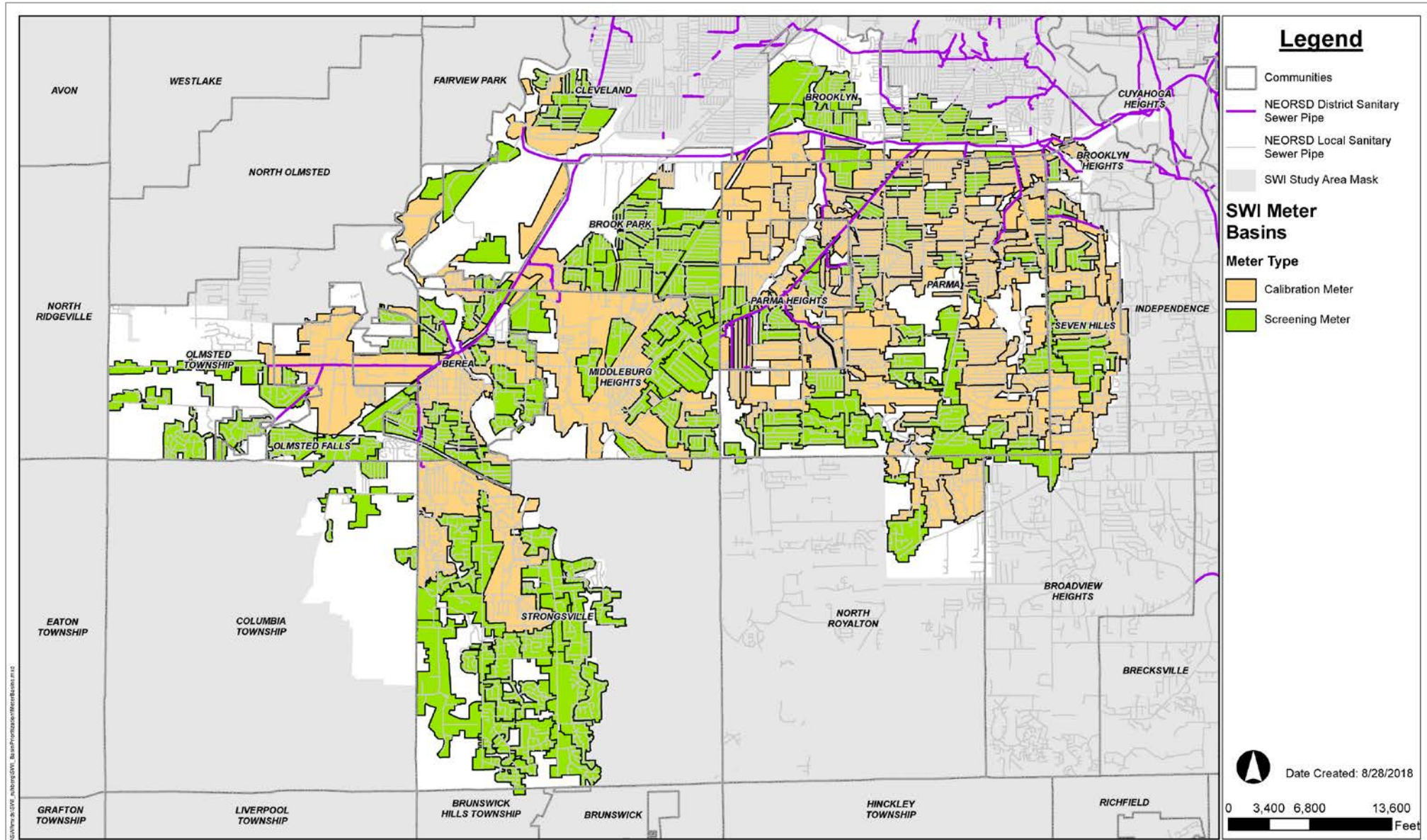
Local System Assessment Strategy – Sewer System Type



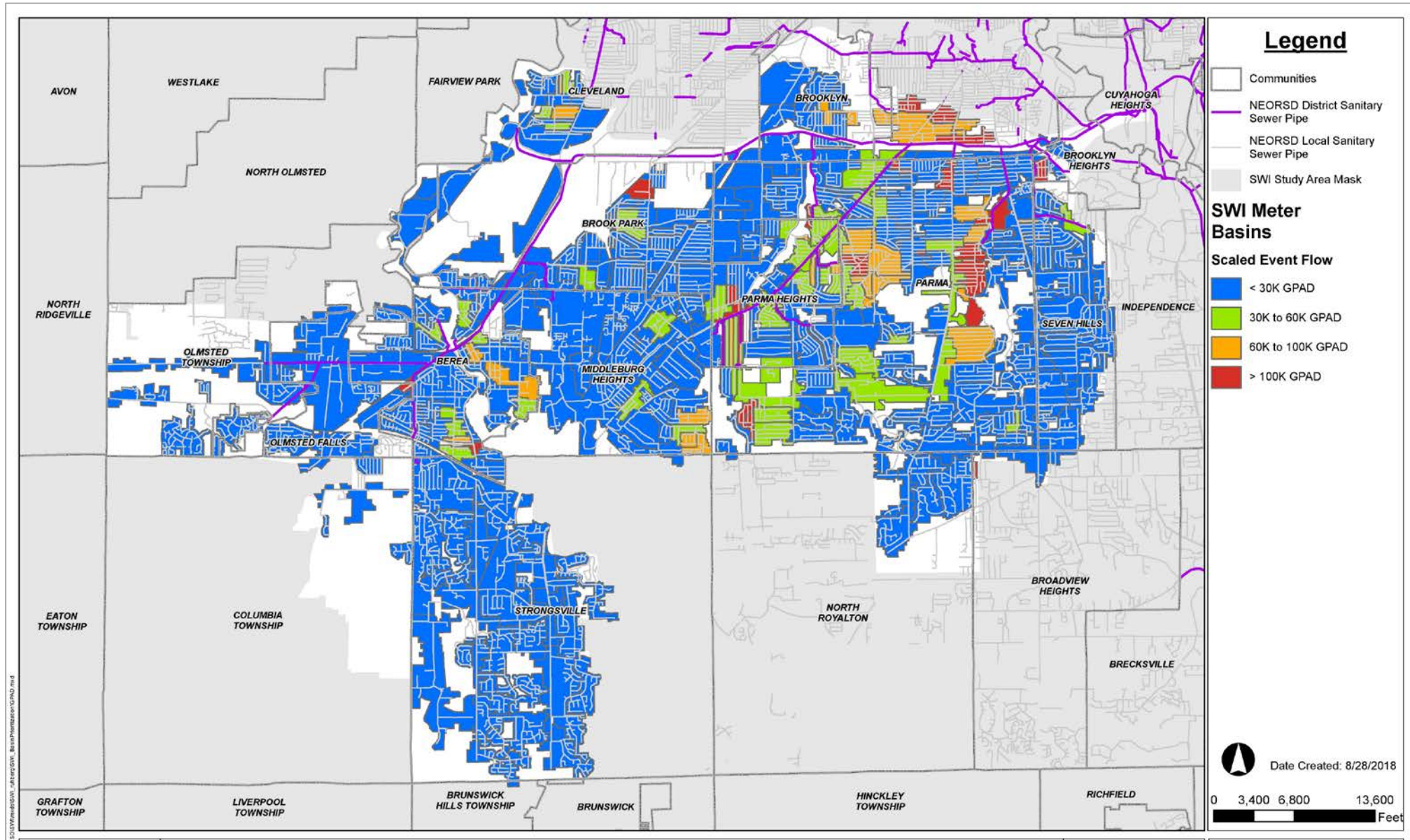
Local System Assessment Strategy – Existing System Capacity



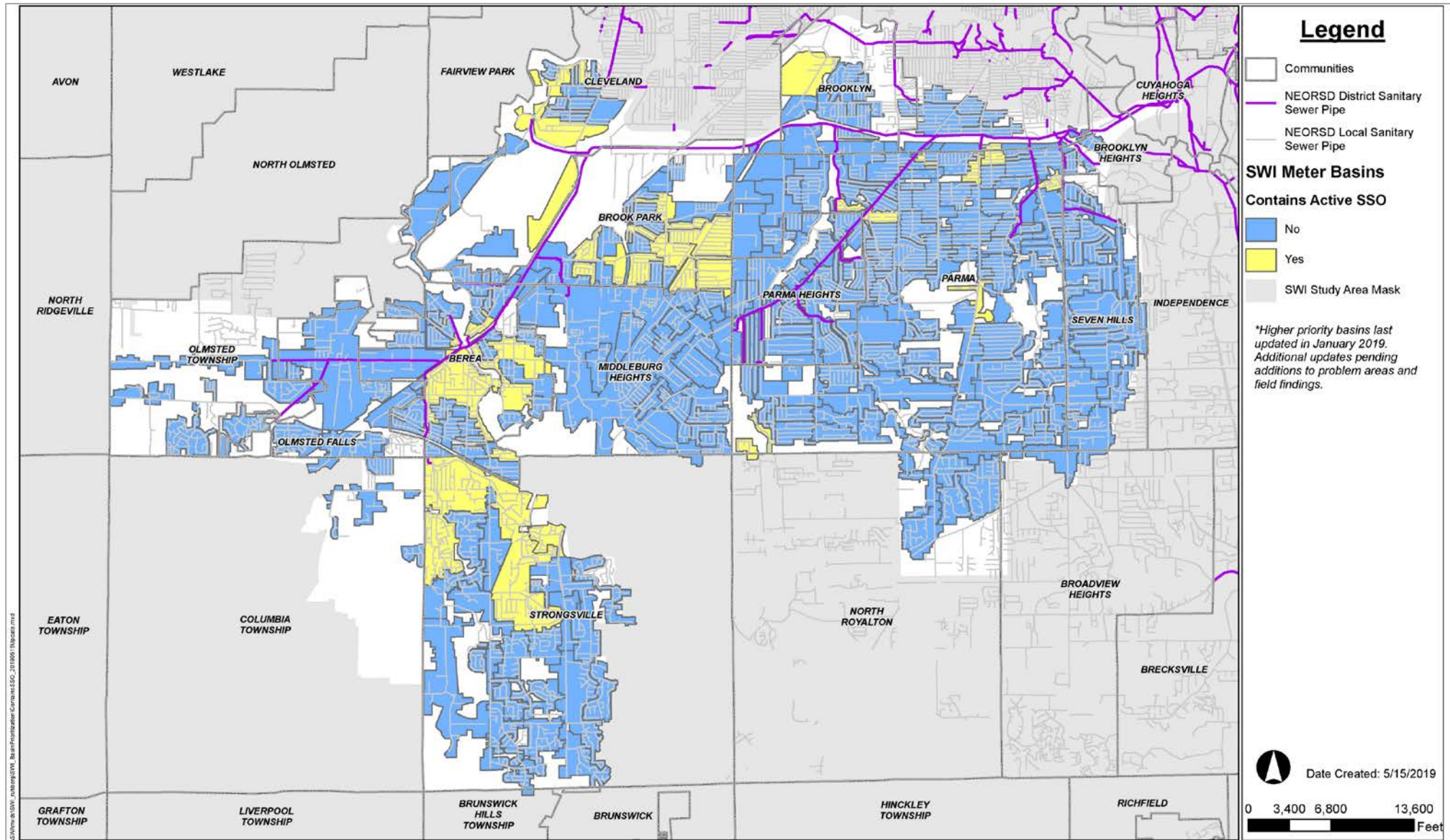
Local System Assessment Strategy – Initial Monitoring



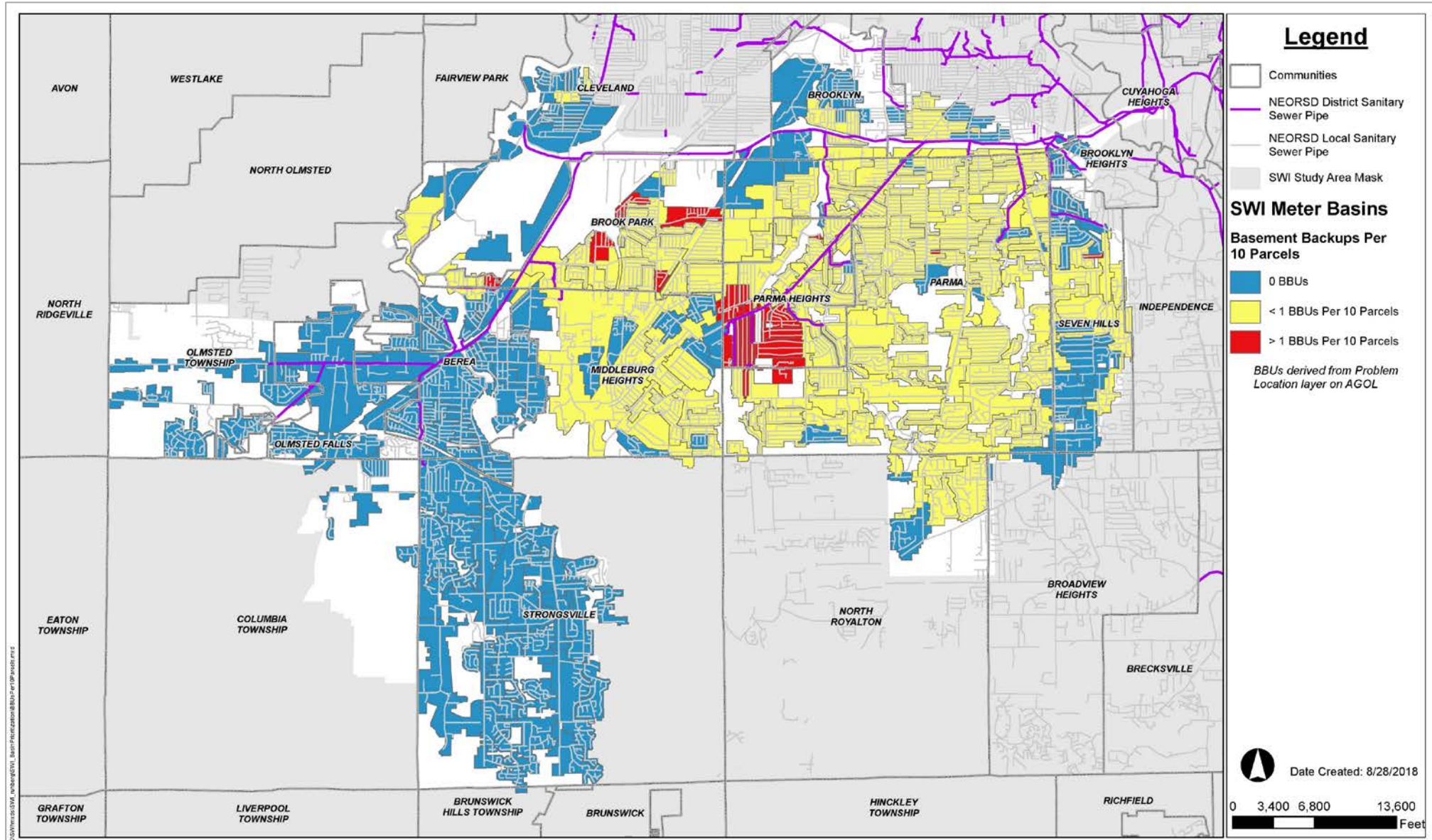
Local System Assessment Strategy – Peak Flows



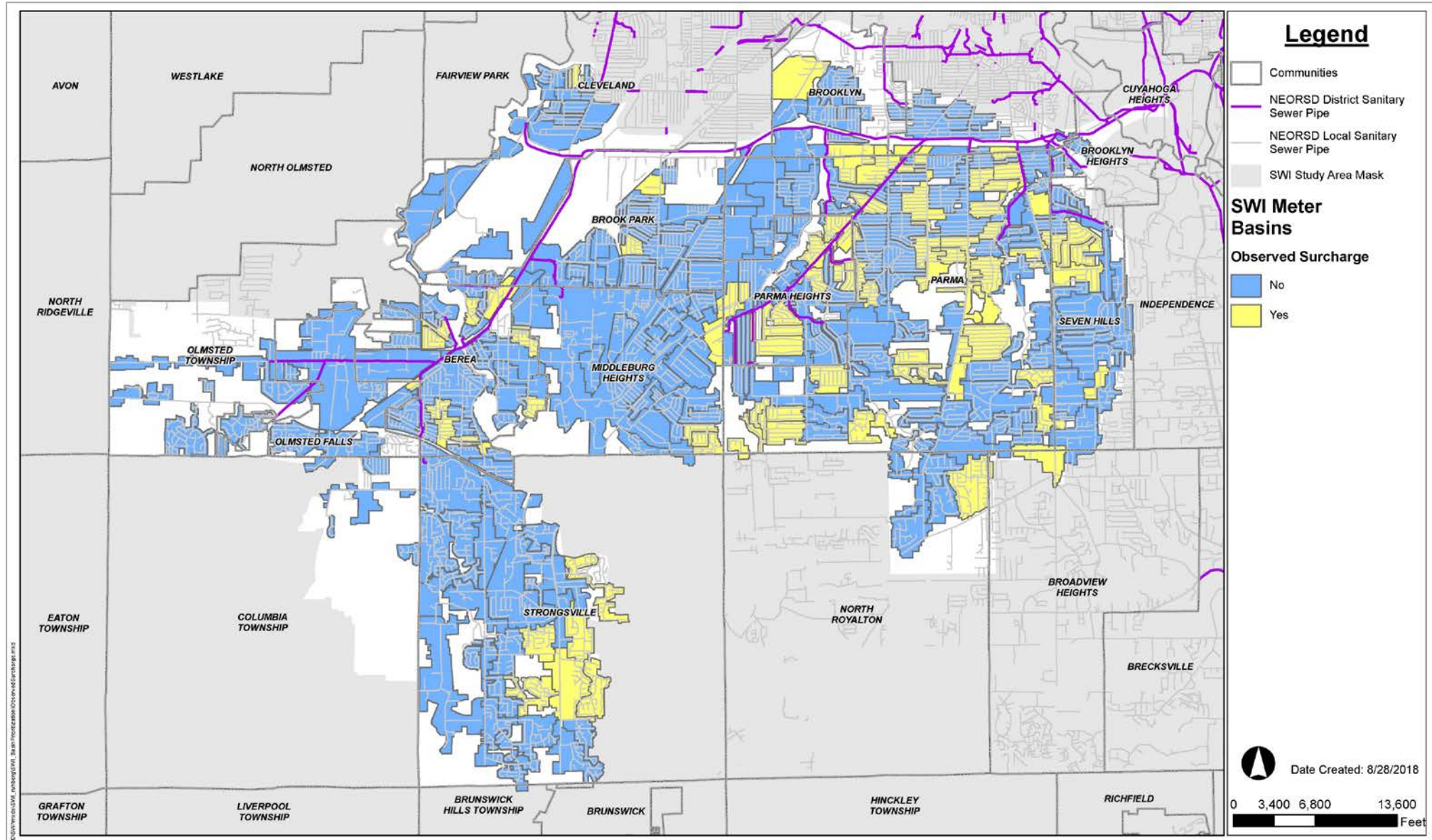
Local System Assessment Strategy – Active SSOs



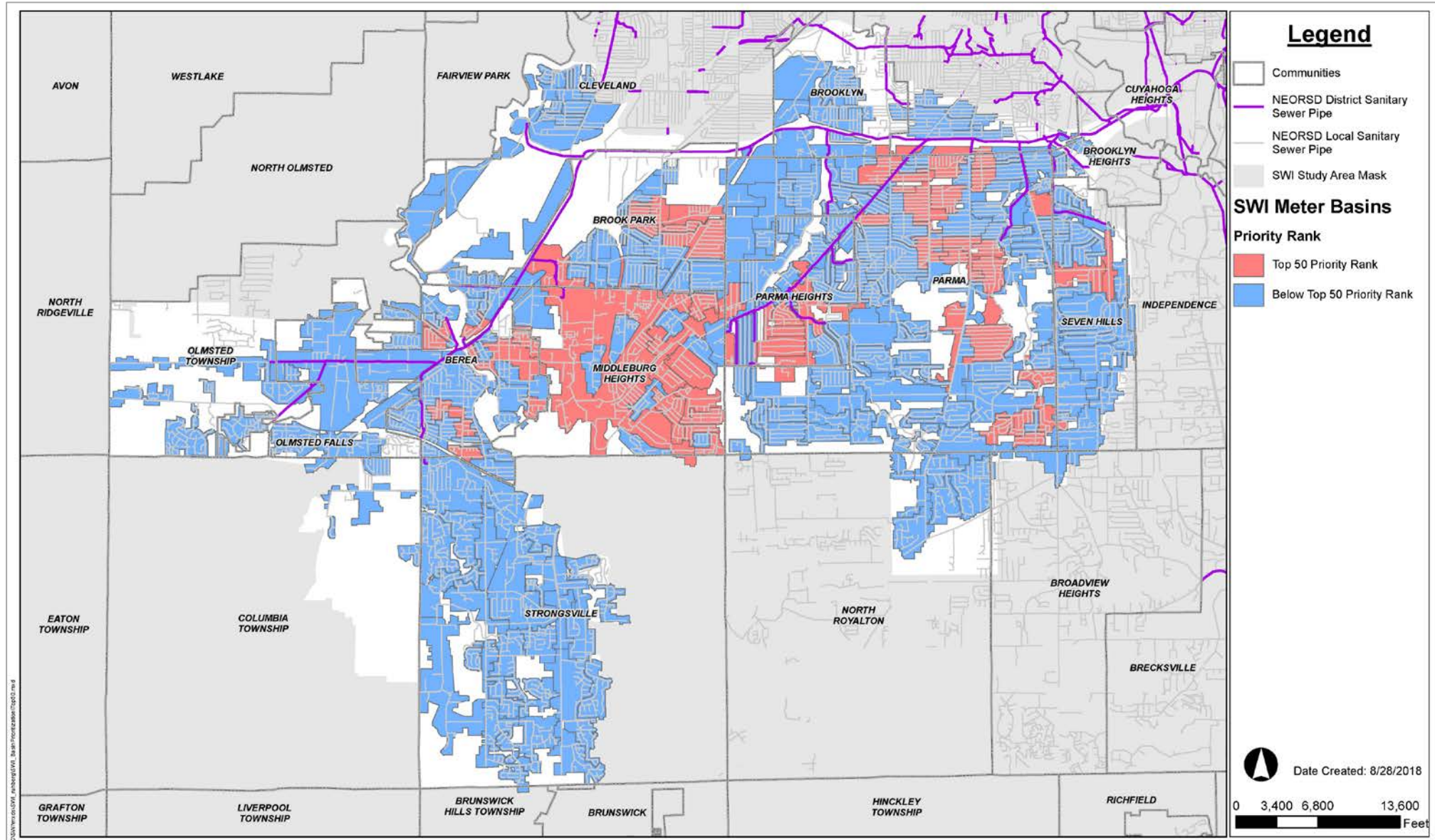
Local System Assessment Strategy – Basement Backups



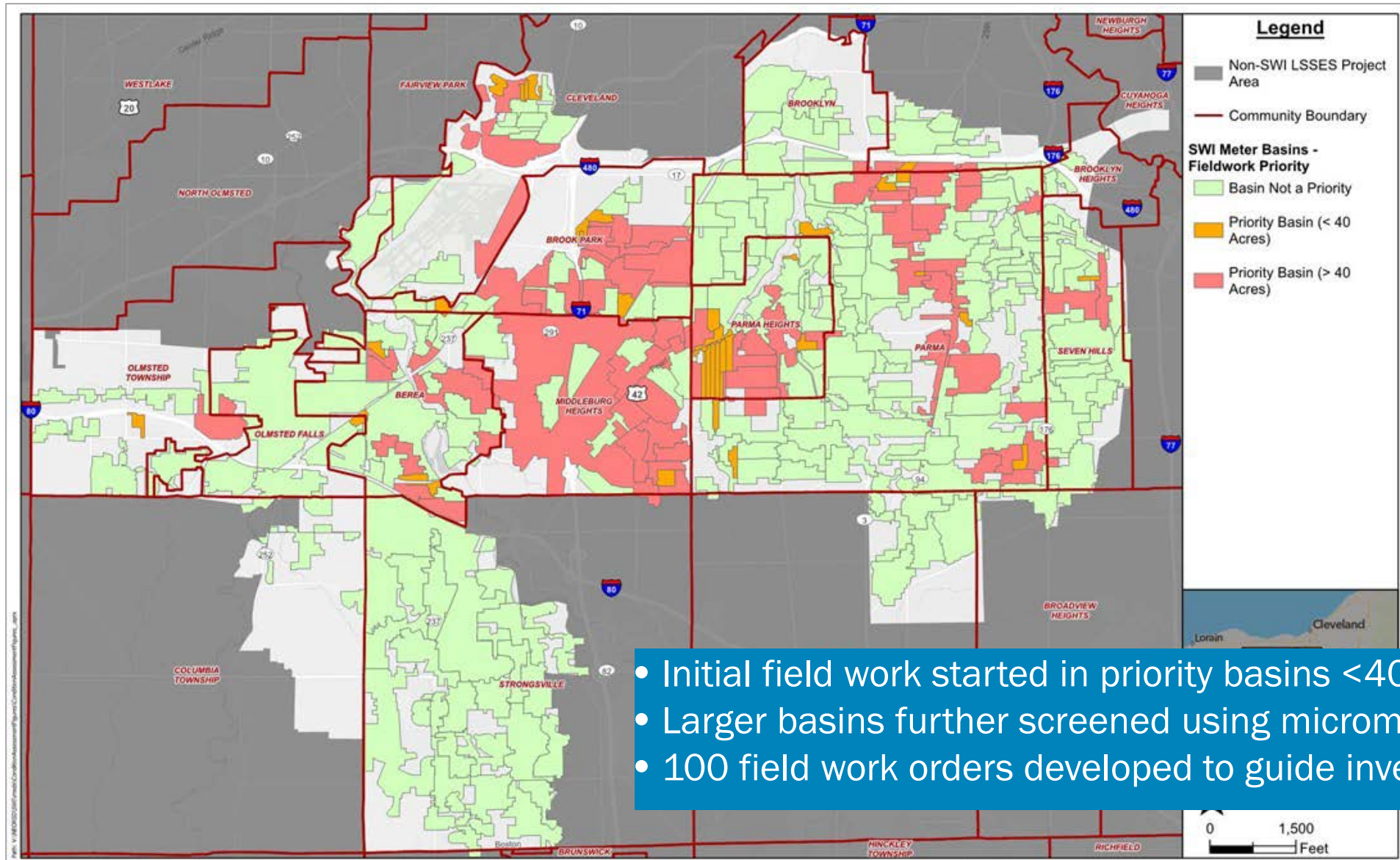
Local System Assessment Strategy – Observed Sewer Surcharging



Local System Assessment Strategy – Initial Priority Map



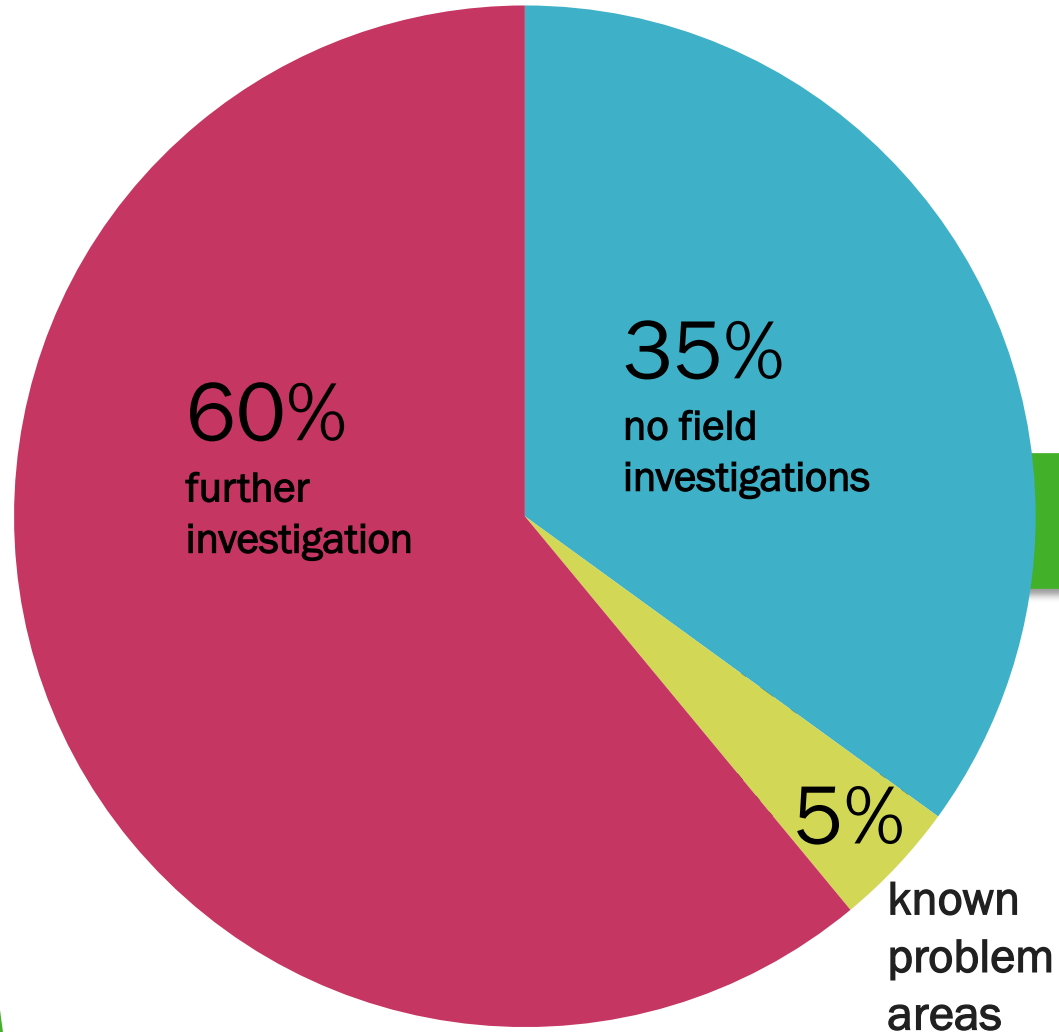
Local System Assessment Strategy – Final Priority Map



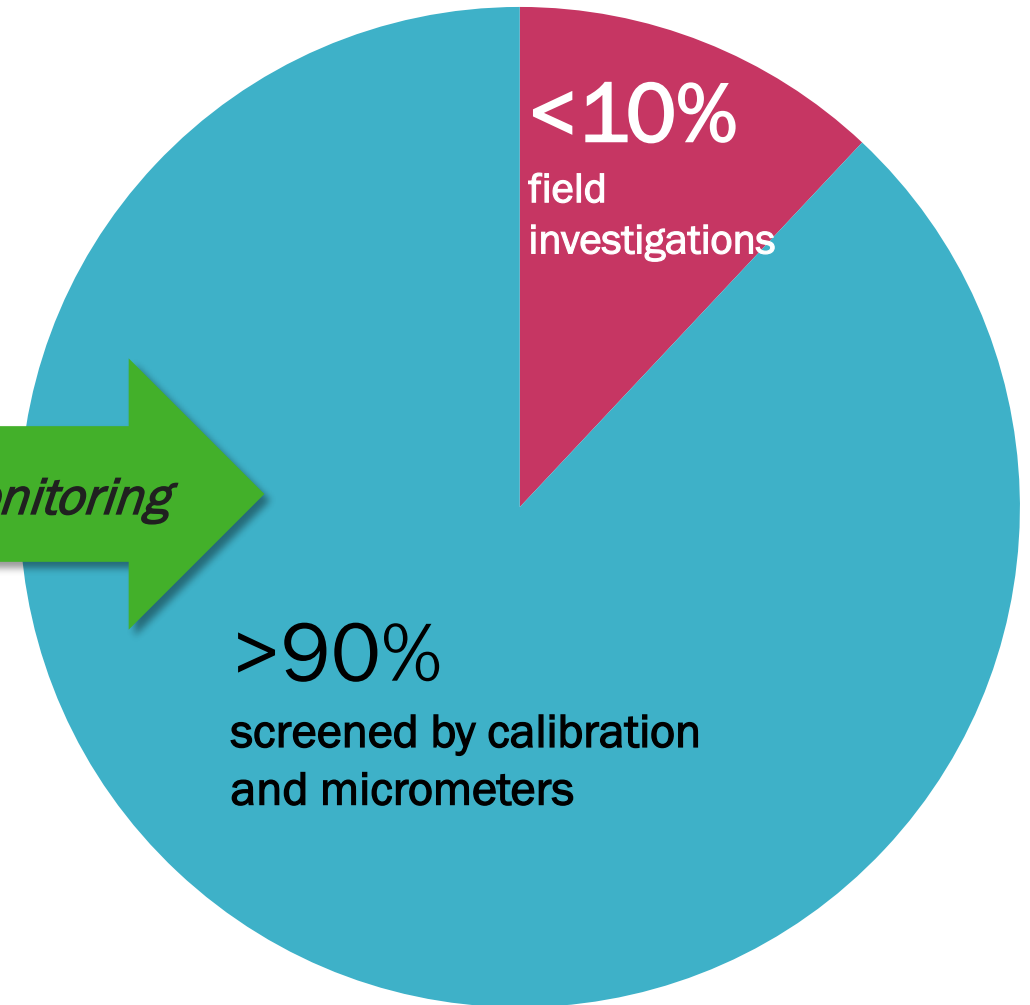
- Initial field work started in priority basins <40 acres
- Larger basins further screened using micromonitoring
- 100 field work orders developed to guide investigations

System Inspection and Condition Assessment Prioritization

Desktop Evaluation

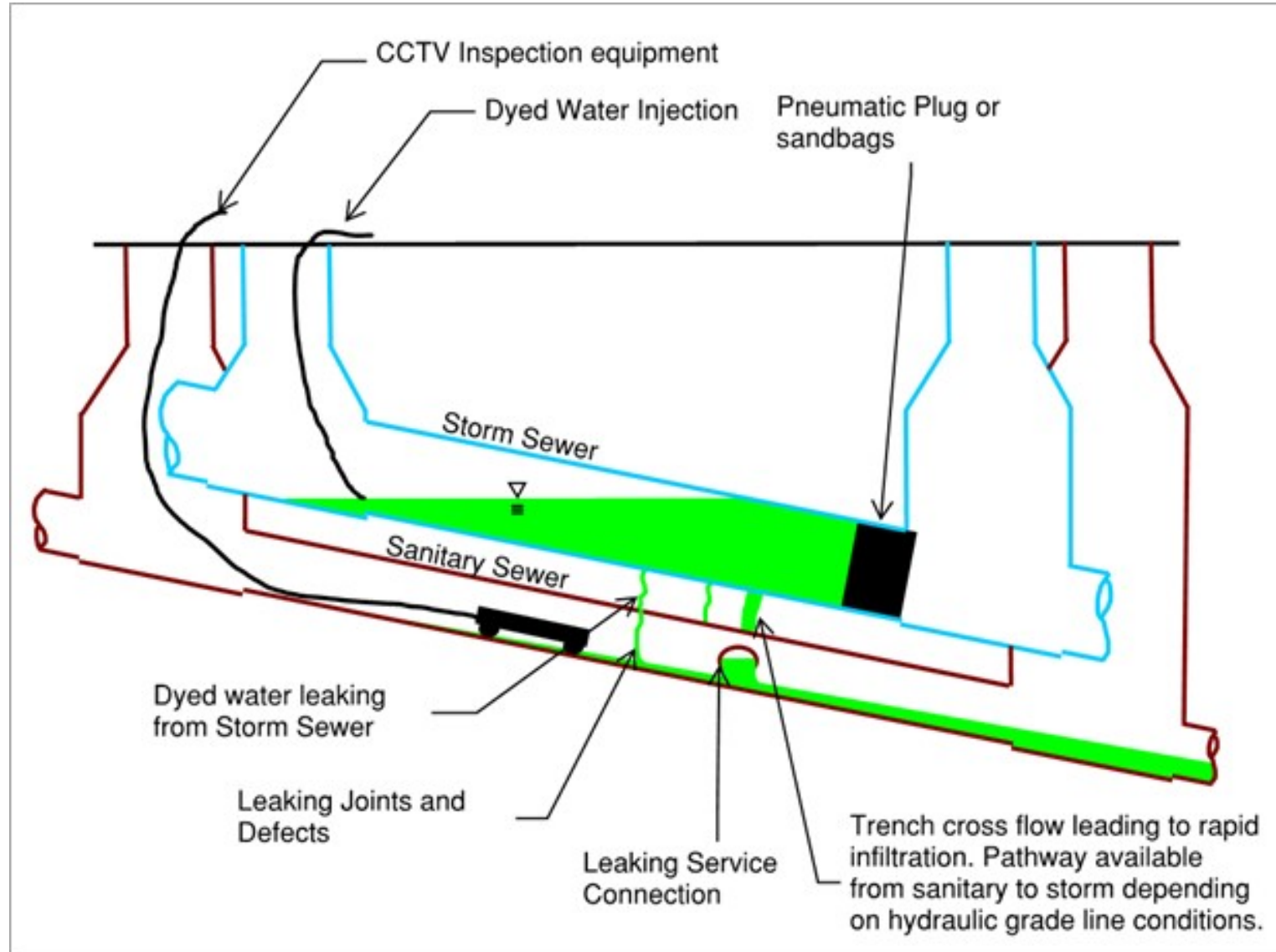
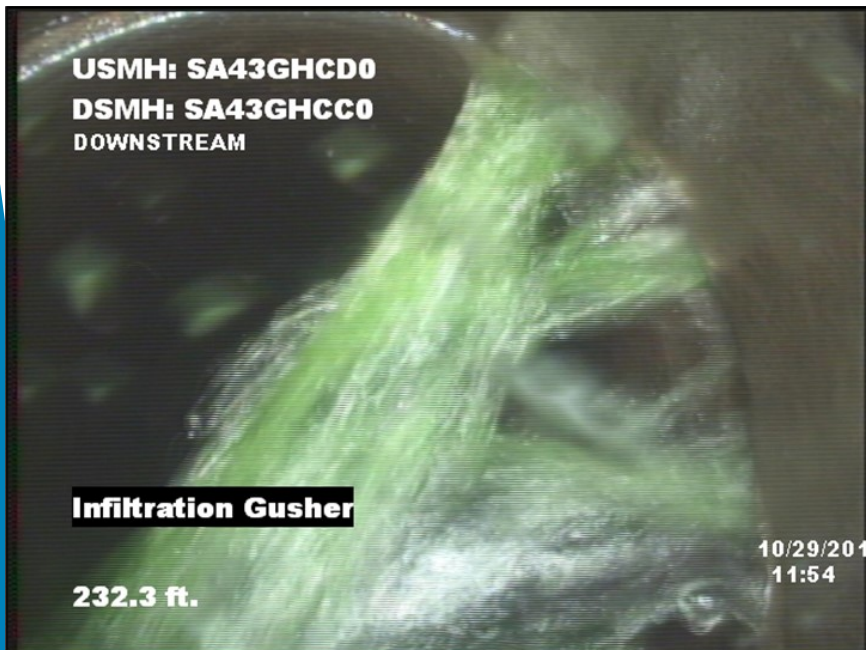


Prioritization Target



Micromonitoring

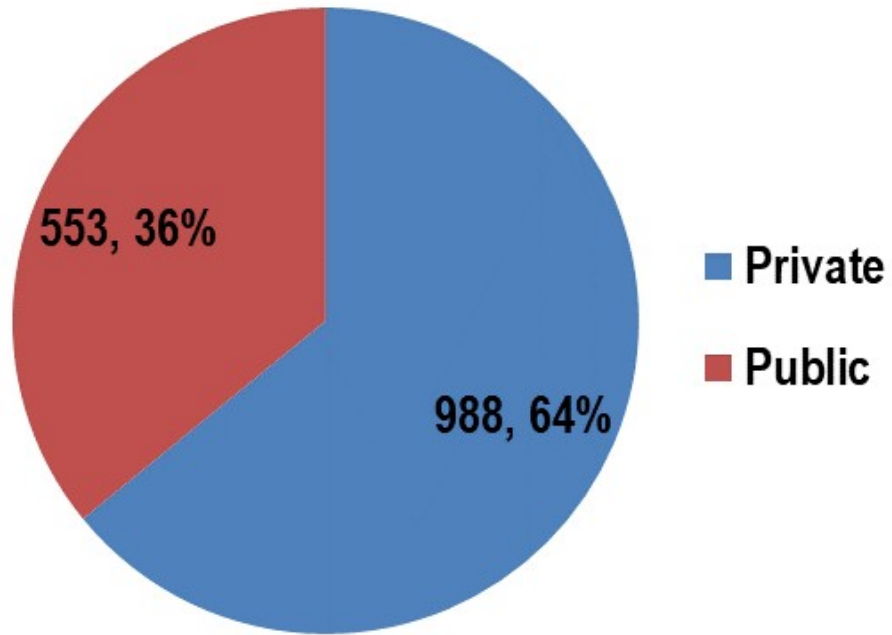
System Inspection and Condition Assessment - Testing



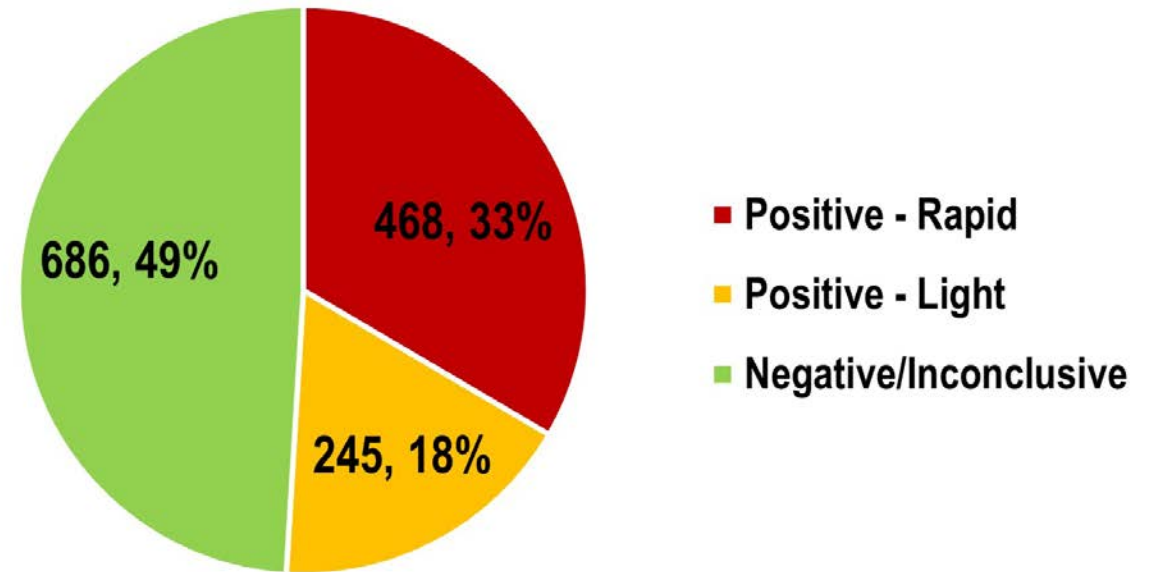
System Inspection and Condition Assessment

Private Property Testing

Smoke Testing Defects by Property Type

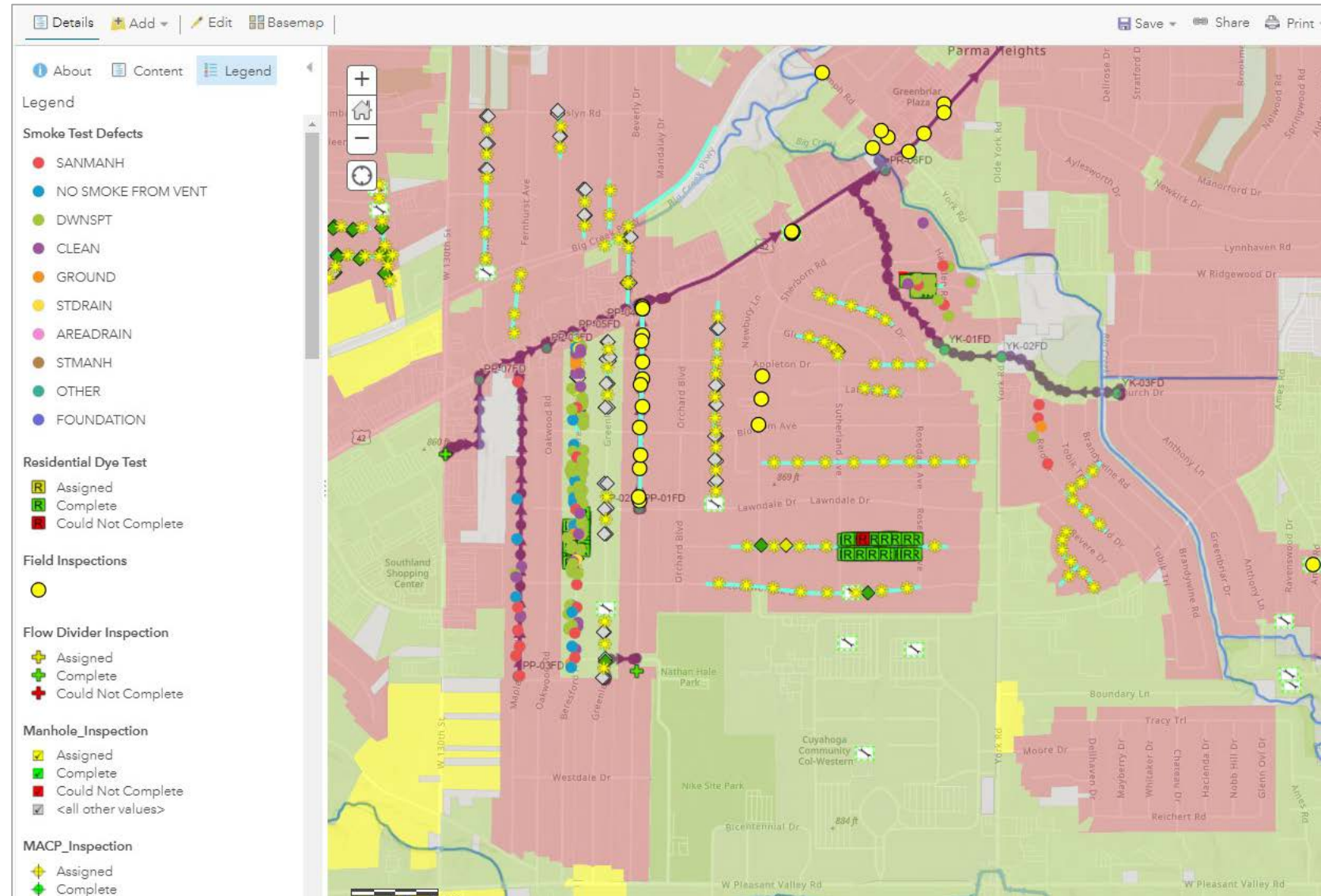


Individual Downspout Connectivity Results

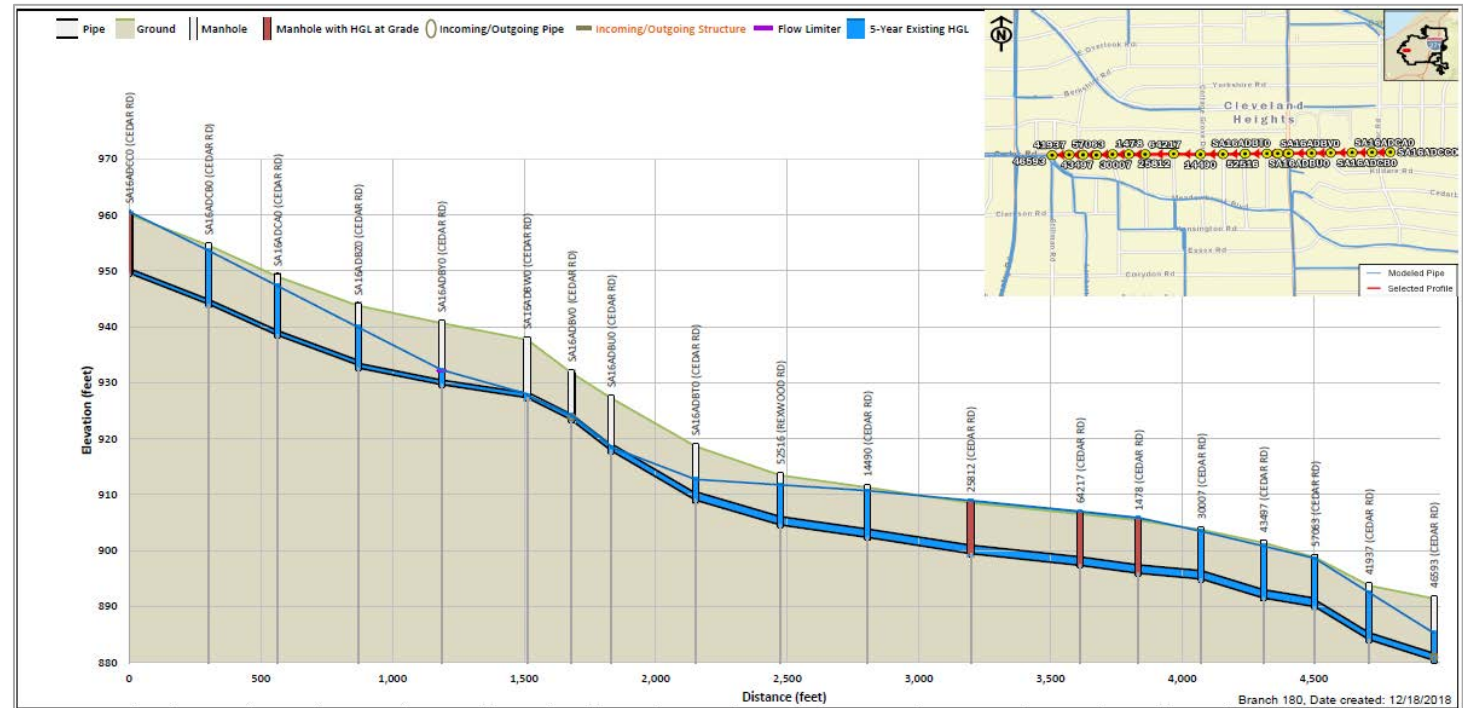
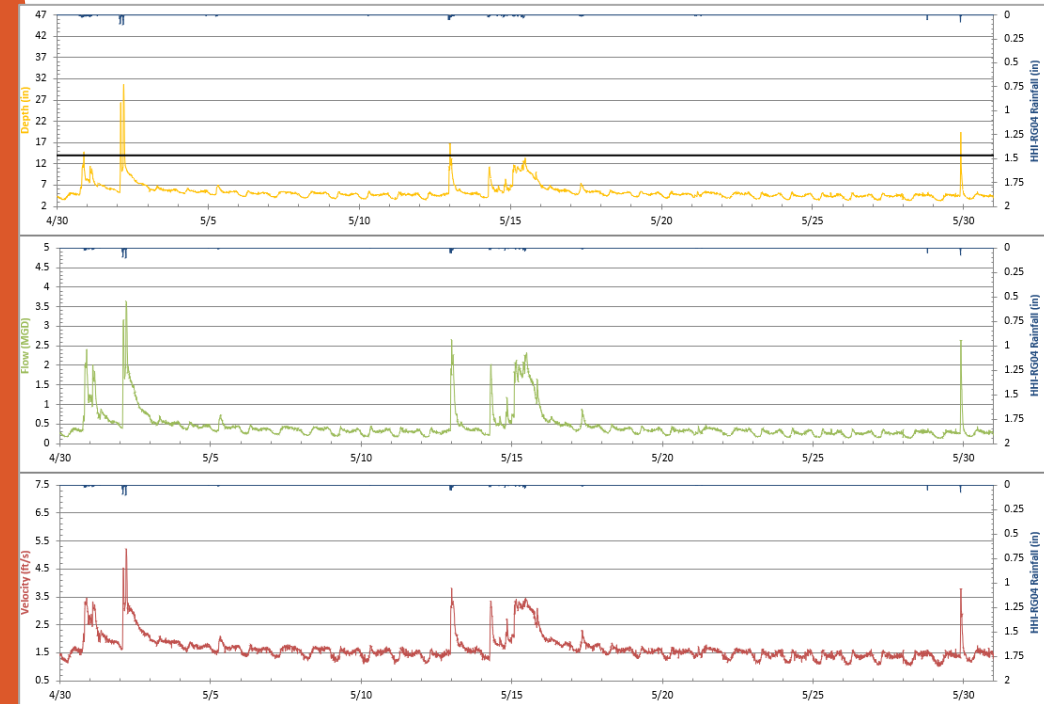


System Inspection and Condition Assessment – ArcGIS Online (AGOL)

- Field data recorded in AGOL or linked for larger files, video, etc.
- Allows efficient overlay and correlation of data and analysis results
- Documentation for approved system users

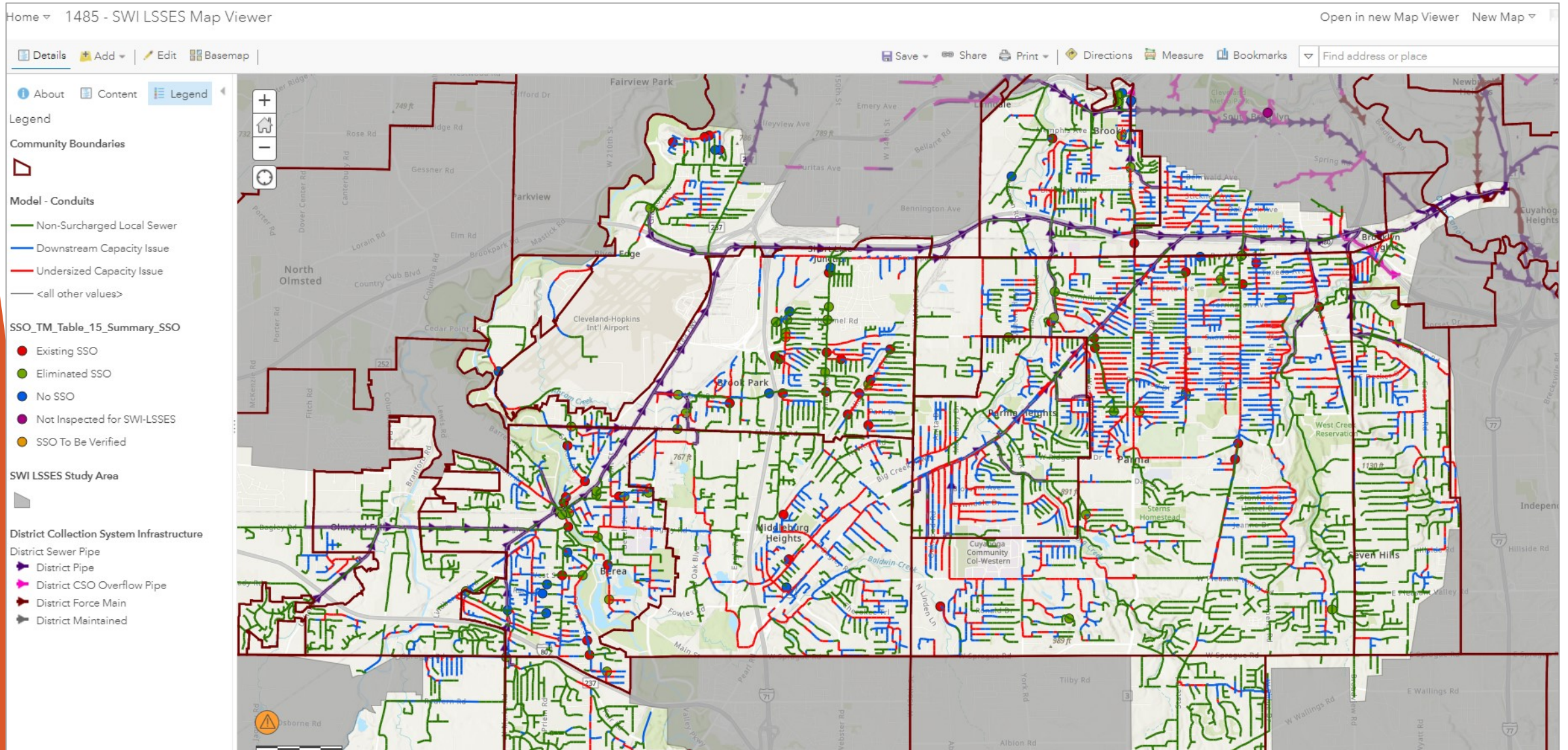


Local System Evaluation – Monitoring and Analysis

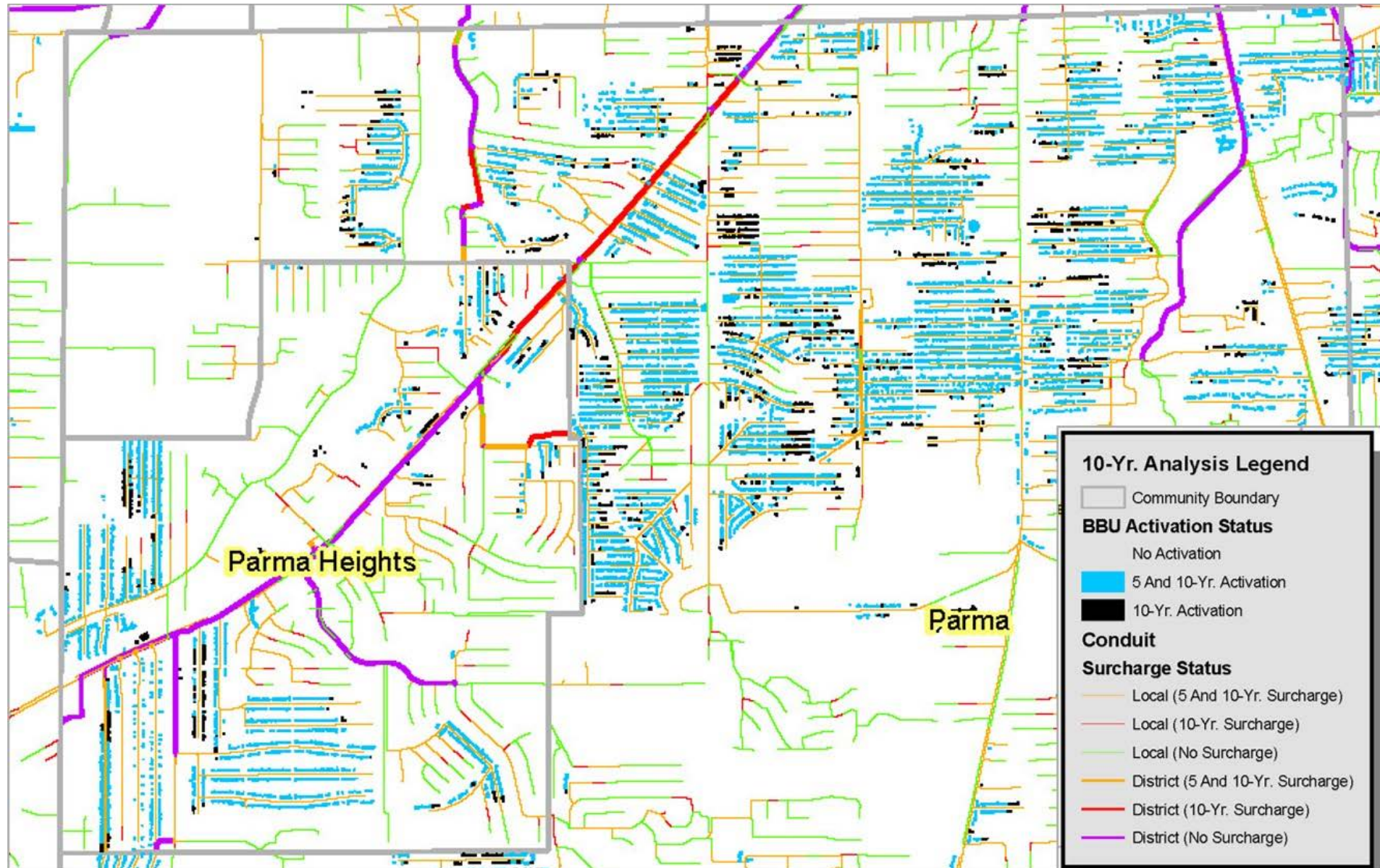


- Calibration monitoring (260 locations)
- Rainfall monitoring (27 locations)
- Model calibration
- Hydraulic performance assessment – HGL profiles in AGOL
- Problem identification

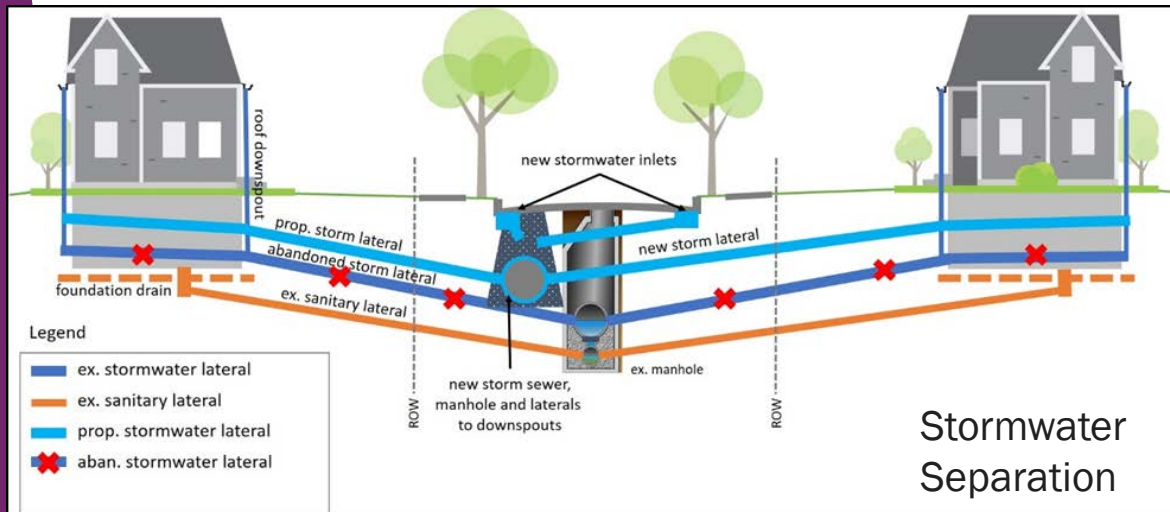
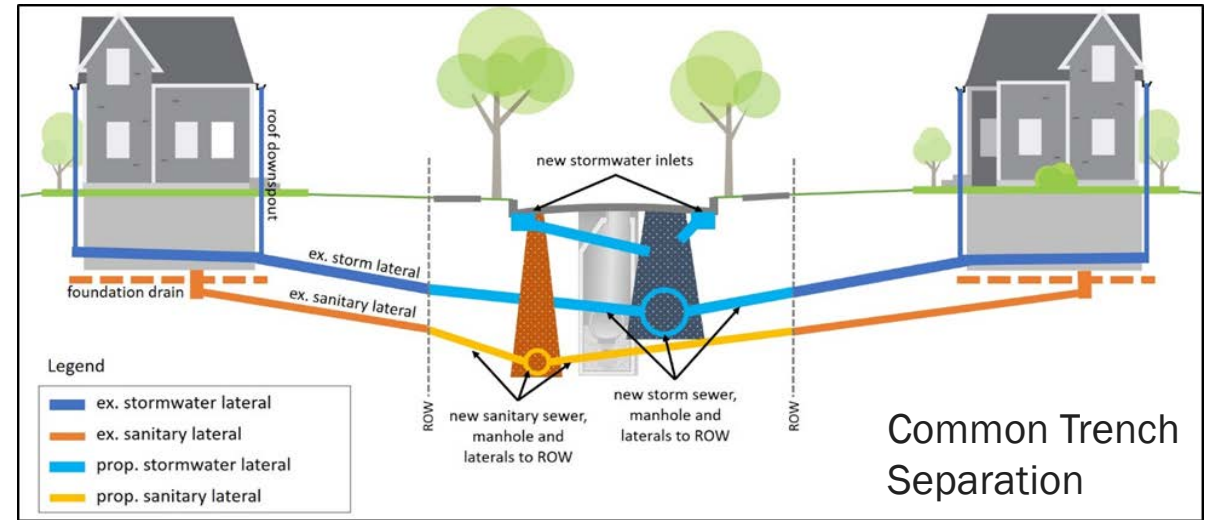
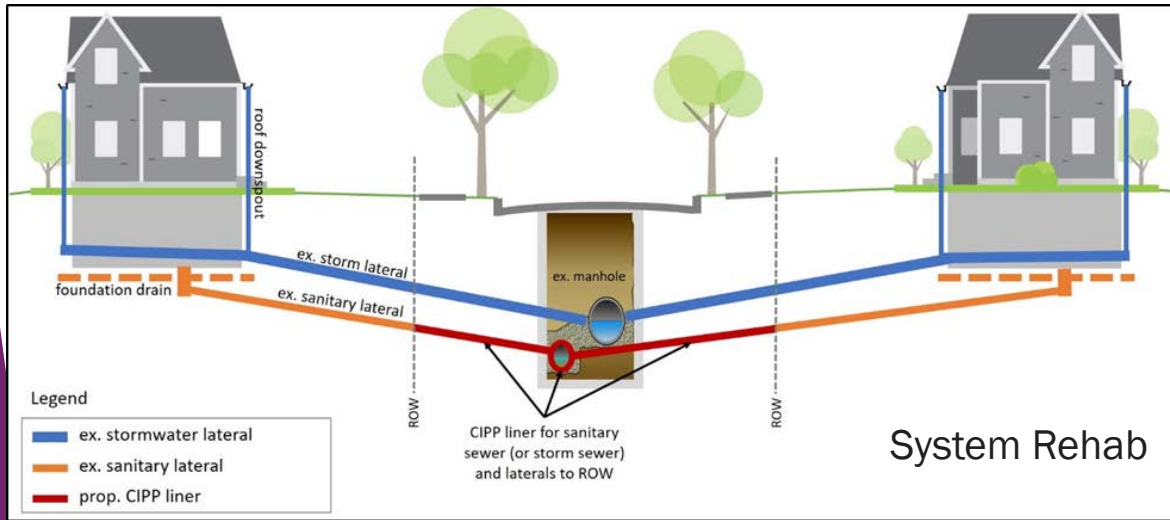
Local System Evaluation – Projected Surcharging & SSOs



Local System Evaluation – Projected Basement Backups



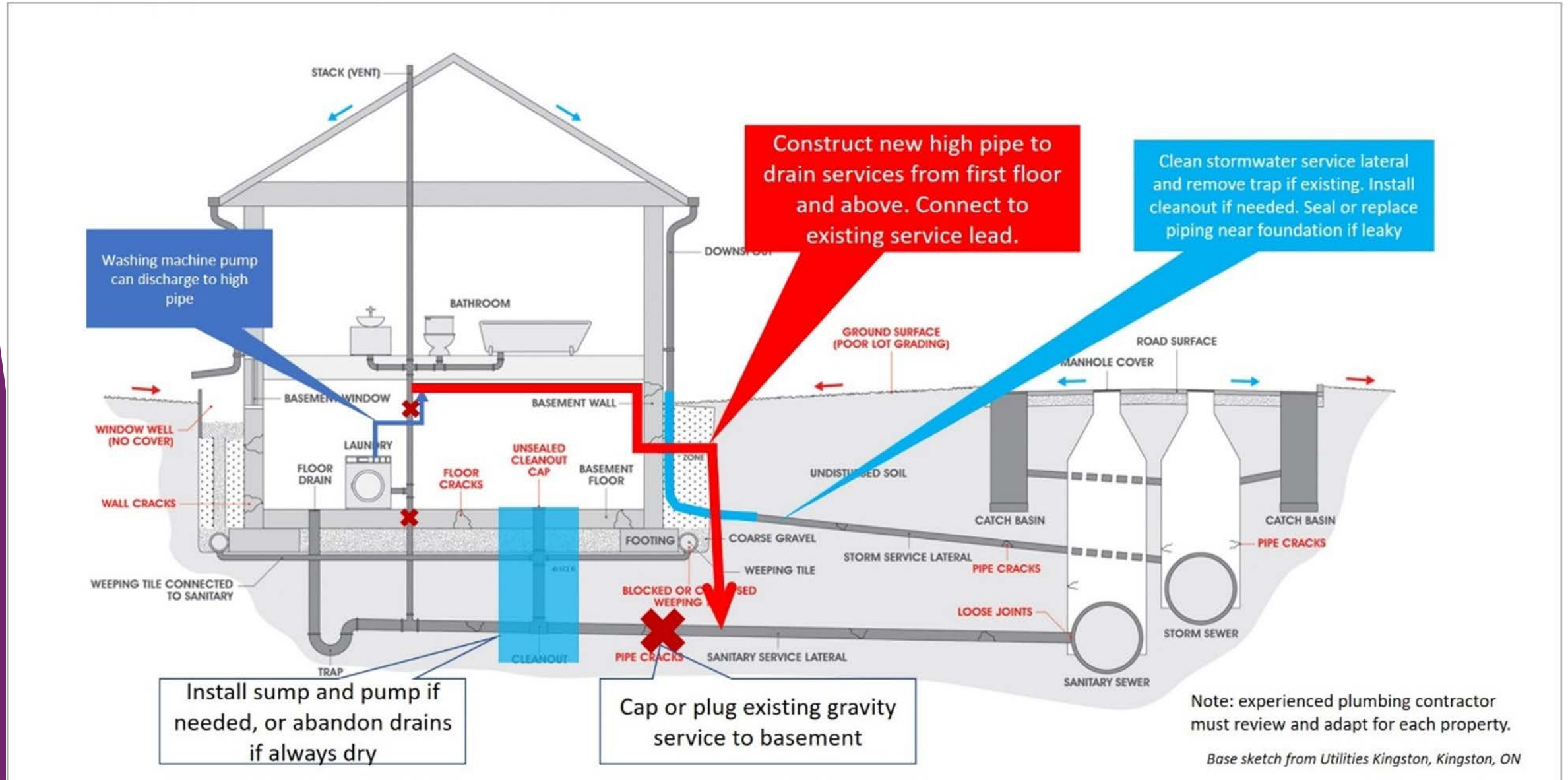
Prioritized Capital Solutions – Standardized Improvement Options



Other options include

- Increased capacity or new flow path to sewer with capacity
- Private I/I rehabilitation
- Local storage of peak flows
- Integrated solutions/GI stormwater mgmt.

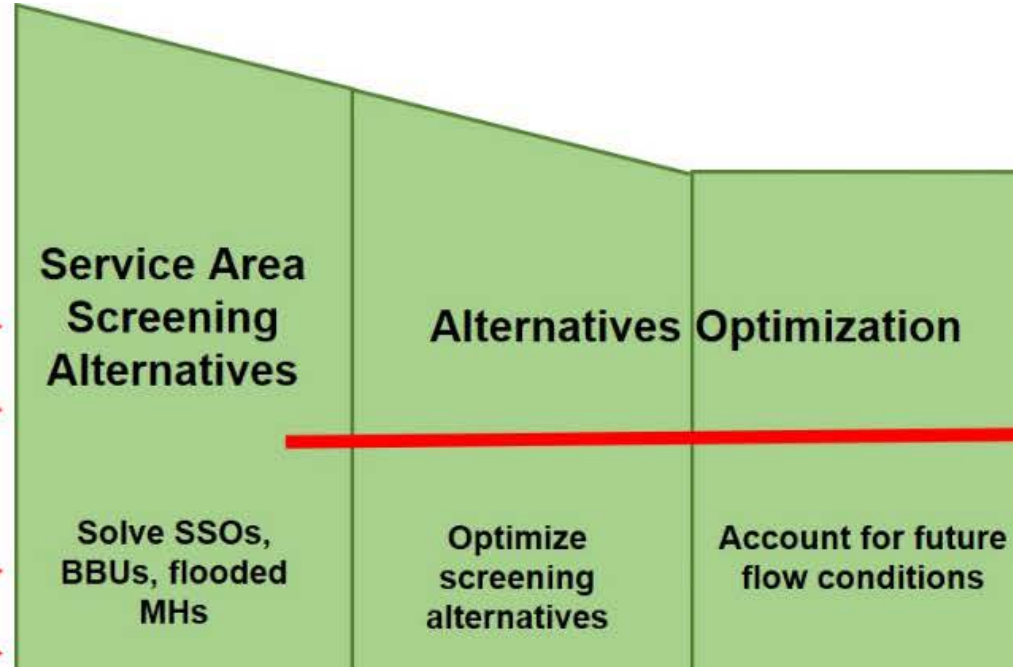
High Pipe Concept for Isolated Basement Backups



Prioritized Capital Solutions – Alternatives Optimization

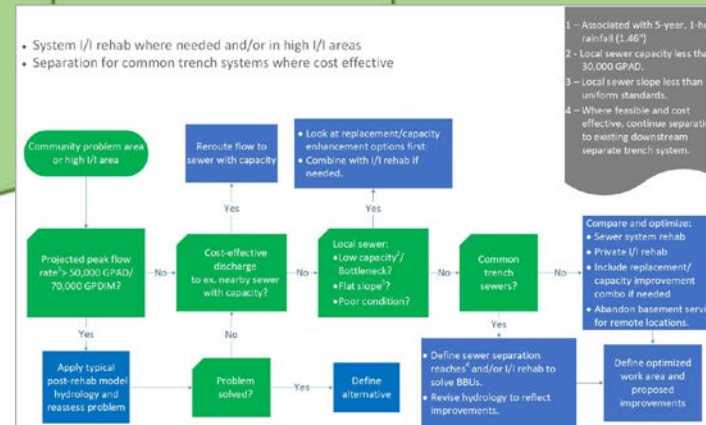
System Improvement Options

- System optimization and O&M →
- Public sewers I/I remediation →
 - Common Trench
 - Separate Trench
- Capacity improvements →
- Private property I/I remediation →
- Storage →



Suggested Improvements

Alternatives based on 5-year, 1-hour rainfall (Also analyzed for 10-year rainfall)



Standardized Process

Prioritized Capital Solutions – Improvements Prioritization

1

Known problems

- Community reported problems (generally BBUs)
- Known SSOs active during 5-year rainfall

2

Areas of excessive I/I

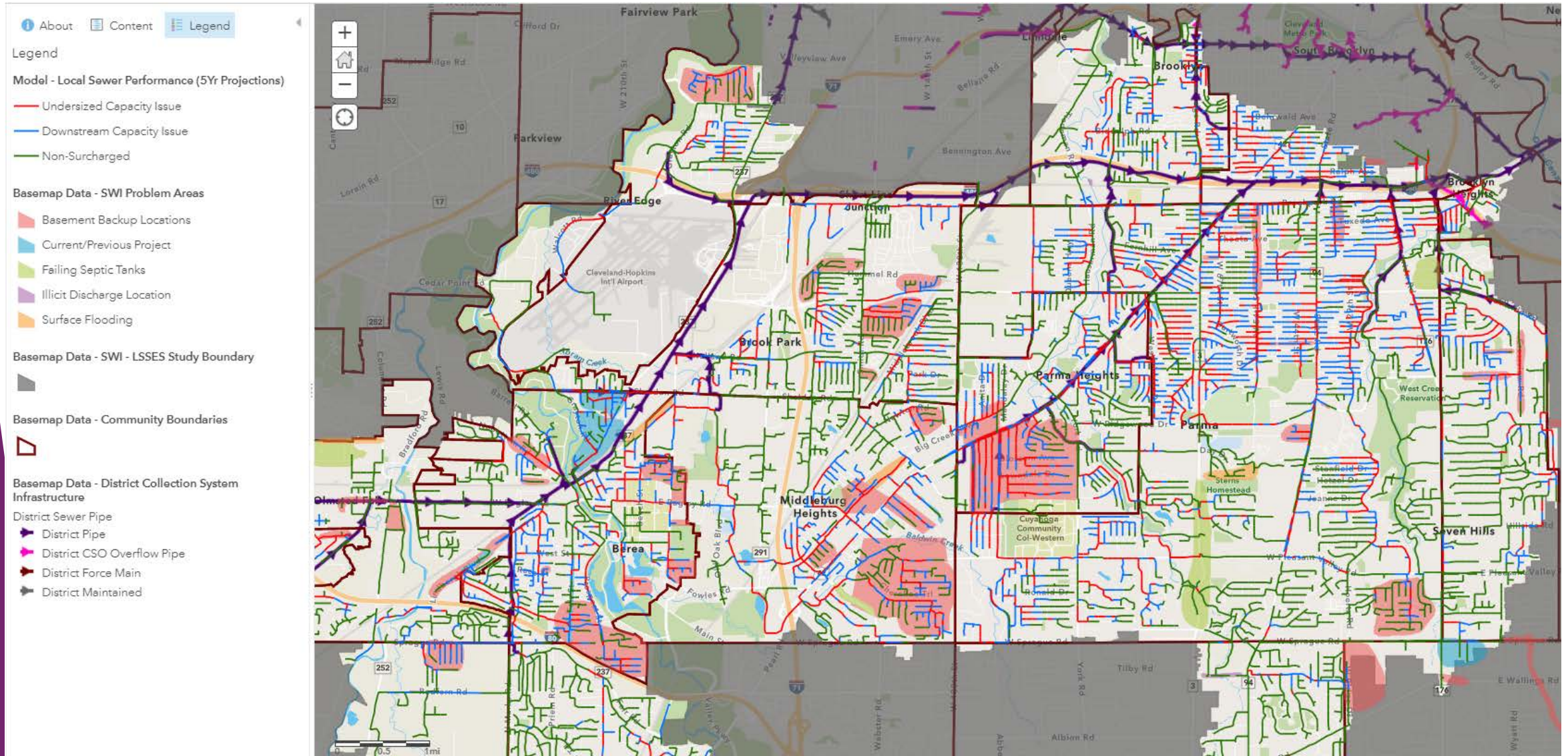
- Separate over/under common trench systems
- Sewage/stormwater cross-flow pollution
- Difficult O&M

3

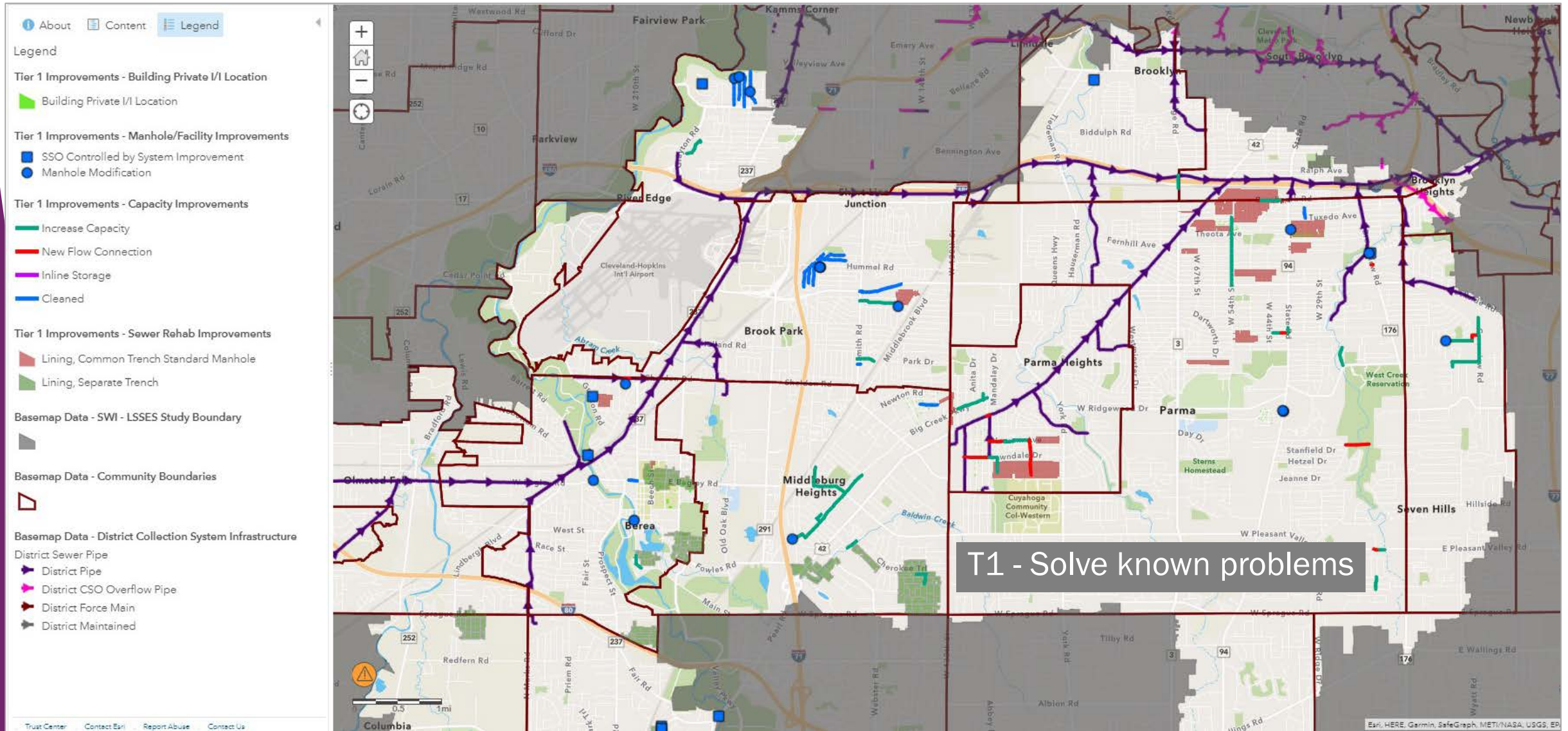
Projected problems

- Model predicted BBUs, flooded MHs
- Sewage/stormwater cross-flow pollution
- Aging infrastructure

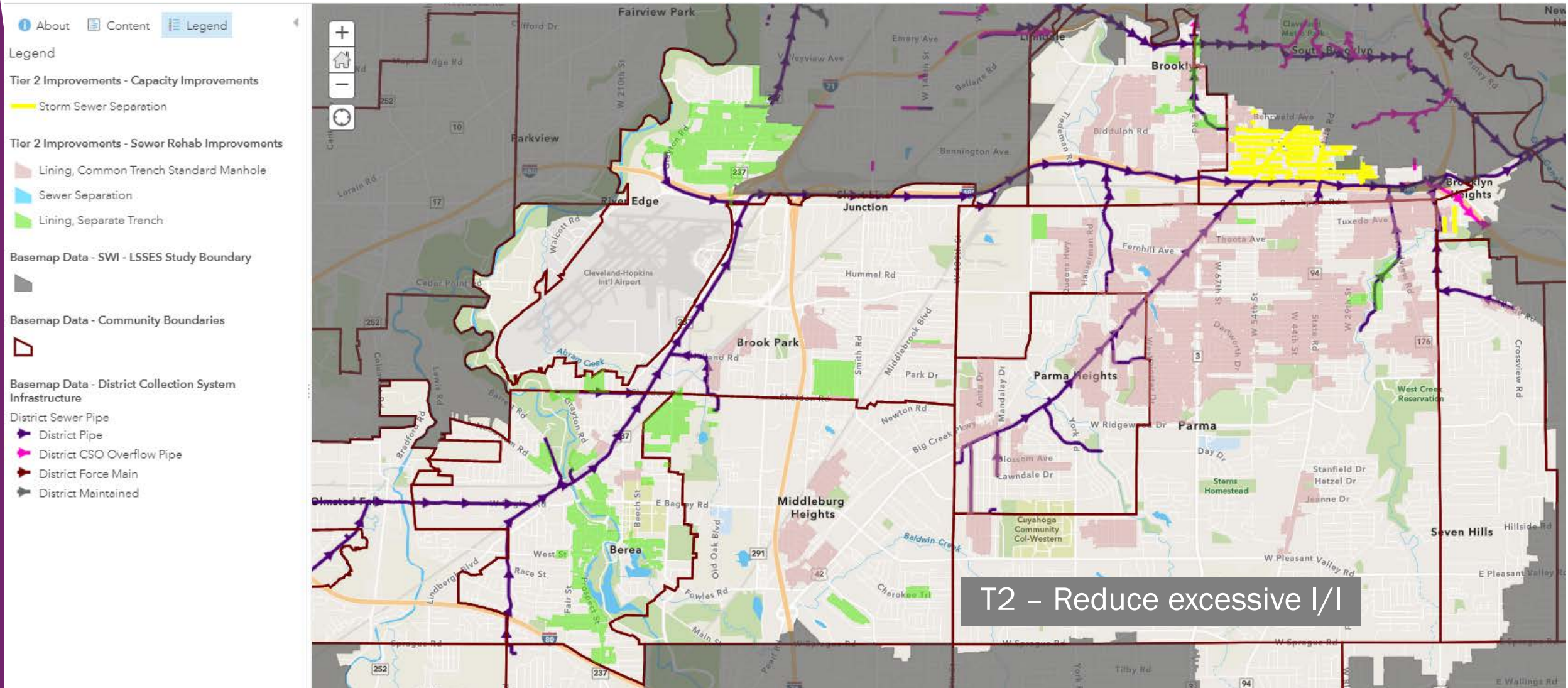
Prioritized Capital Solutions – Existing conditions



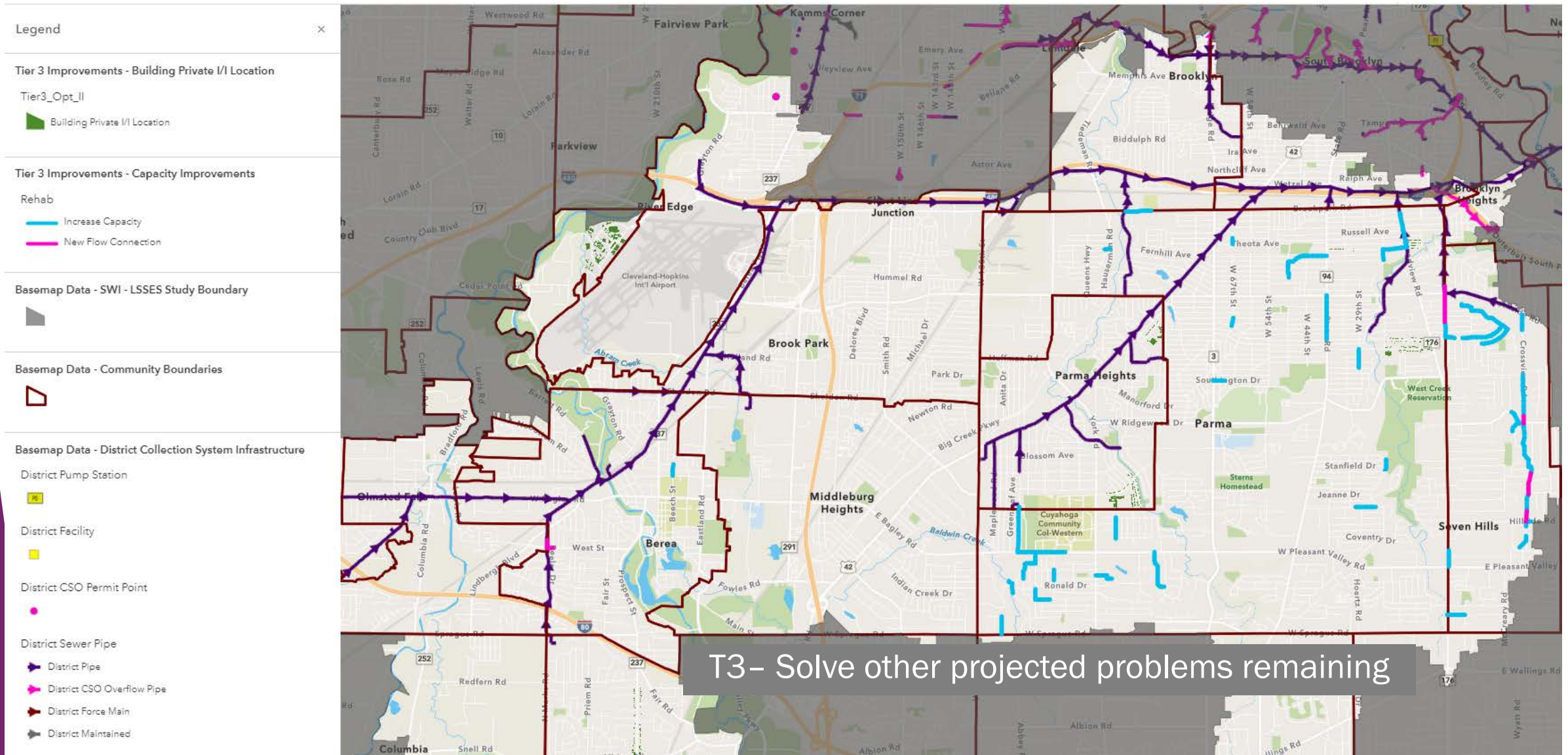
Prioritized Capital Solutions – Tier 1 Improvements



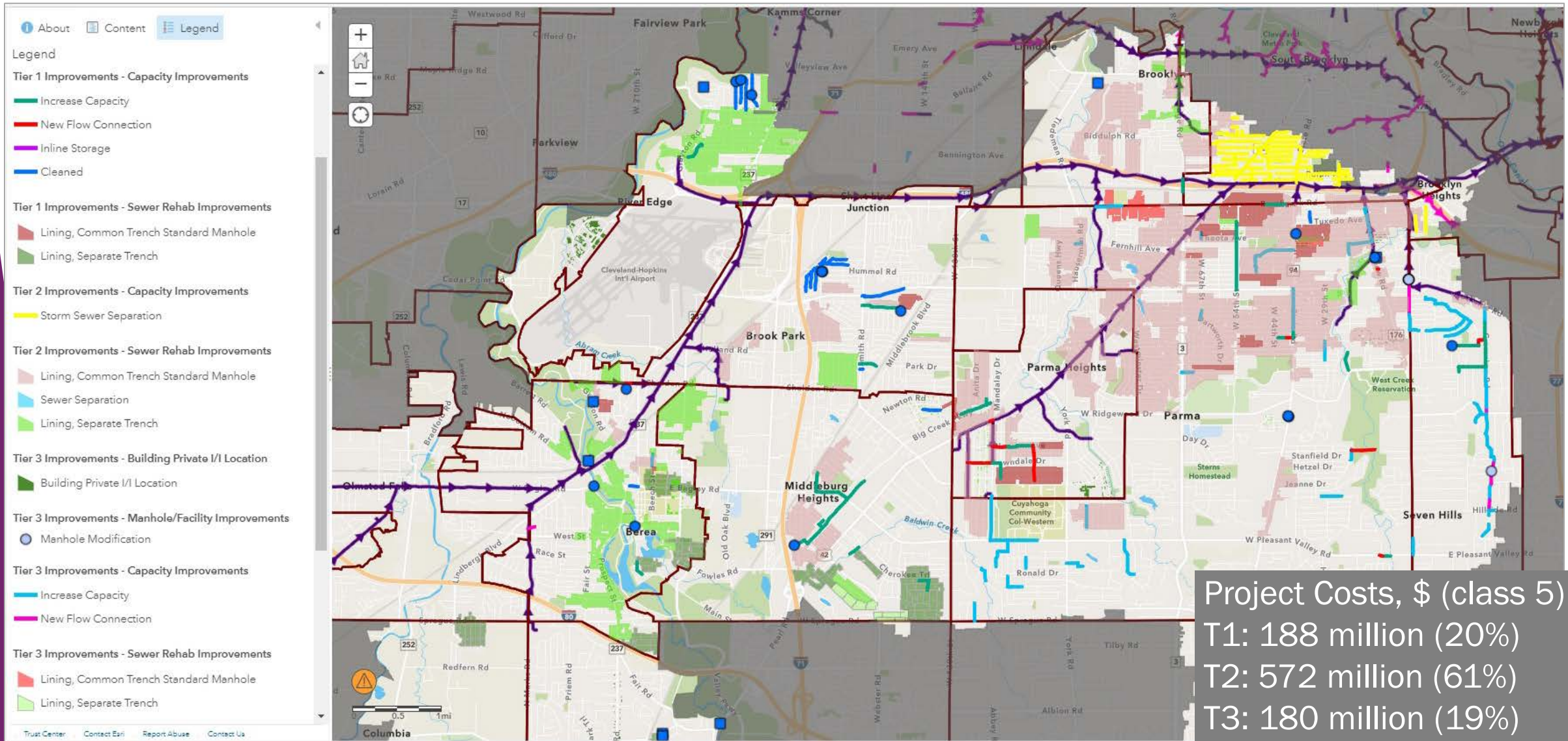
Prioritized Capital Solutions – Tier 2 Improvements



Prioritized Capital Solutions – Tier 3 Improvements

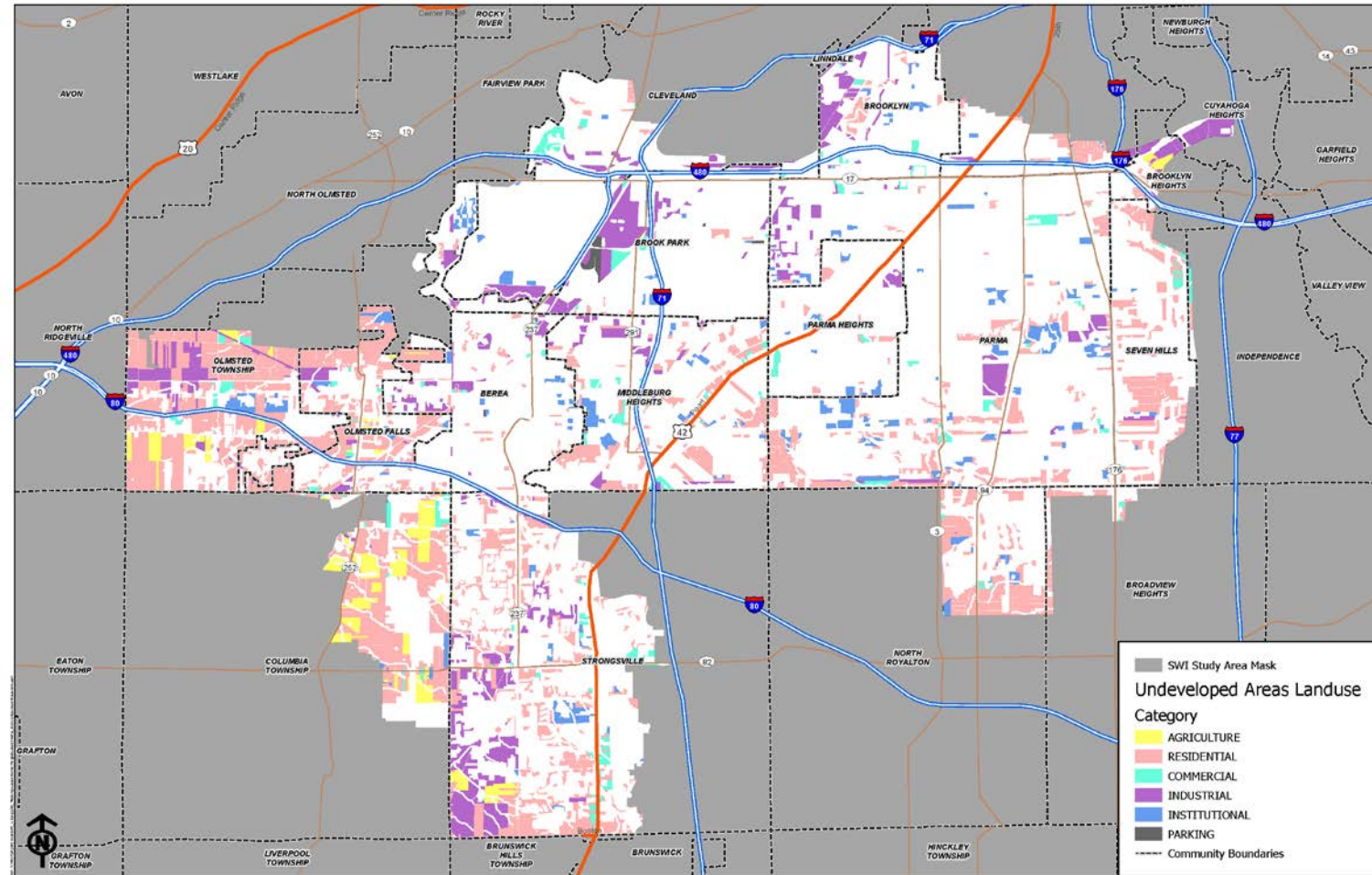


Prioritized Capital Solutions – Tiers 1, 2 & 3 Improvements



Future Conditions Analysis – Potential Development Impacts

- Identified developable land areas
- Assigned to nearest base model nodes using GIS
- Assigned dry and wet weather flows based on monitoring in recent development areas
- Analyzed impacts using base and improved system models
- Identified potential capacity problem areas



Observations/Lessons for LSSES Planning Projects

- Identify and use existing data and community information to prioritize where and how to target field investigations.
- Coordinate with local communities throughout the project to share information and results.
- Use AGOL to plan and implement field investigations and document findings.
- Develop efficient analysis tools and a standard process for alternatives development and optimization (separate presentation is available).
- Use recent local project cost data for cost estimating and standardize unit costs for typical improvements.
- Integrate all data collected and study results in AGOL for community and District use.
- Document and meet with communities to discuss results.

Major Project Deliverables

- Project library, gap analysis and data deliverables memo and spreadsheet
- Project progress meeting slides and minutes
- Prioritization Approach TM
- **Community work plans and 100 Field Work Orders**
- Sanitary Sewer Overflow TM
- **Condition Assessment TM and investigation data, videos, etc.**
- **ArcGIS Online (AGOL) fieldwork planning and tracking**
- Flow Monitoring Plan and Report
- Model Development and Calibration Report
- InfoWorks model files
- Analysis tools including model results display, basement backup analysis and cost tools integrated with InfoWorks hydraulic model results
- Hydraulic Capacity Assessment Report
- **Community Reports and AGOL summarizing fieldwork, results and proposed improvements**
- **Master spreadsheets for each community summarizing results, proposed improvements and costs**
- **Community meetings slides and notes**
- Project Summary Report

(red = provided to communities)



**Northeast Ohio
Regional Sewer District**

Thank You

- Brown and Caldwell
- ADS Environmental
- Armak
- C&K Industrial Services
- CVE
- Hazen and Sawyer
- HESCO
- KEM Associates
- KS Associates
- Onyx Enterprise
- R2O Consulting/WRCE LLC
- SE Blueprint



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