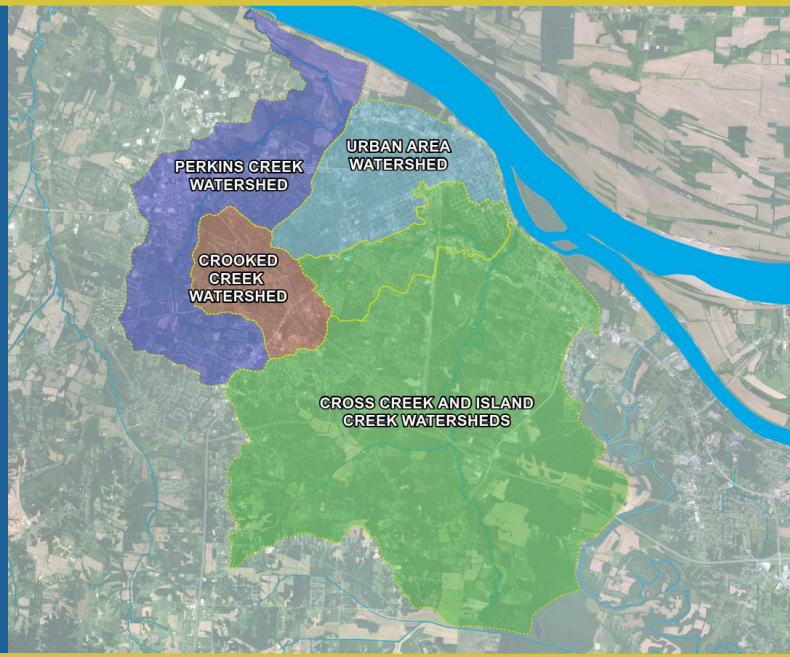
CITY OF PADUCAH

Comprehensive Stormwater Master Plan (CSMP)

City Commission Meeting

Project Update

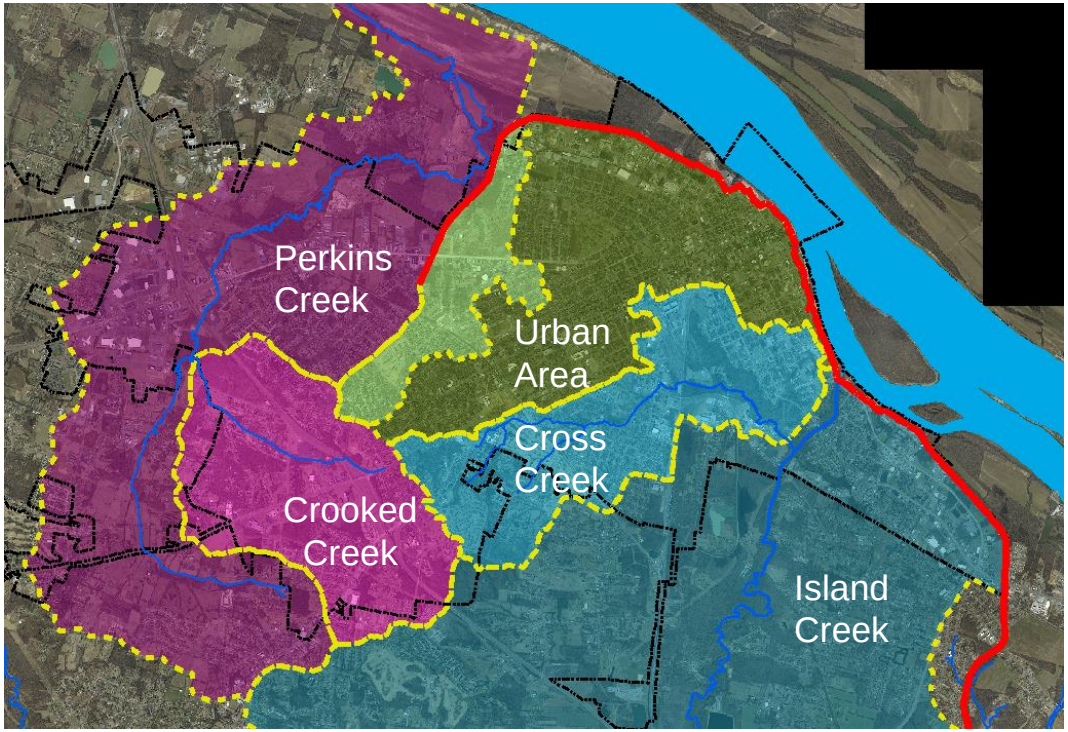
Tuesday, December 12, 2017
5:30 p.m.



STRAND ASSOCIATES®

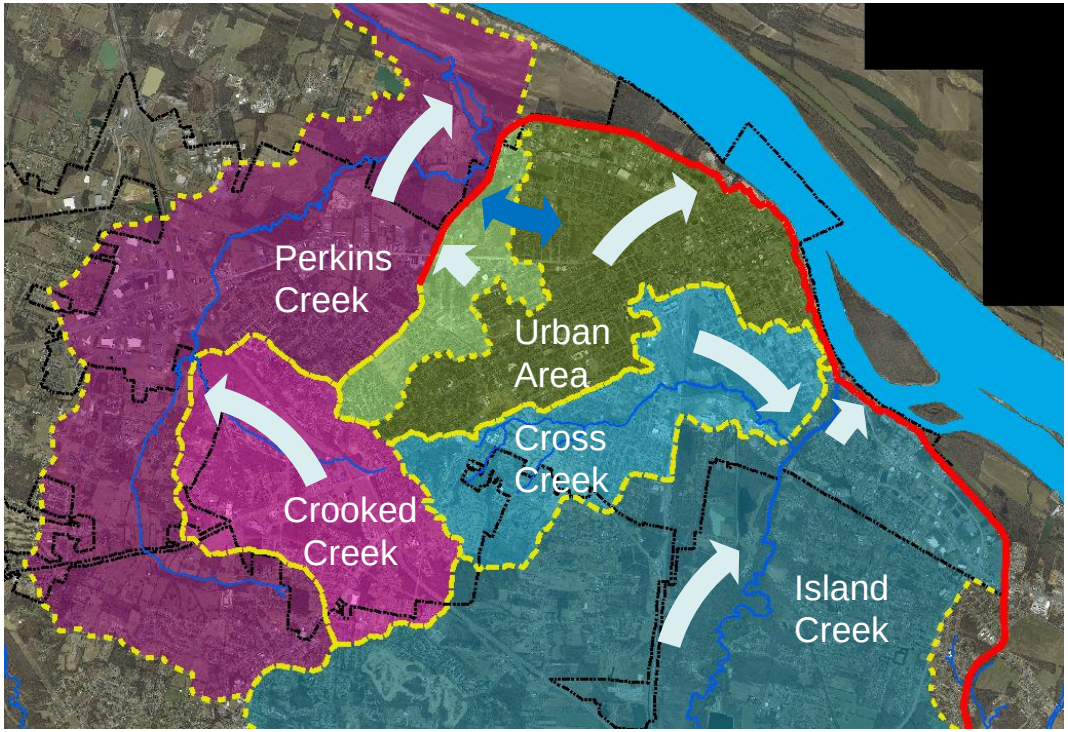
BFW BACON FARMER WORKMAN ENGINEERING & TESTING, INC.

Understanding of Local Challenges Key to CSMP Success



- 3 Major Watersheds – 5 Total
- River/Creek Flood Influences
- Floodwall/ Pump Stations
- Flat Topography Downtown
- Steep Topography in Upland Areas
- Combined Sewer System

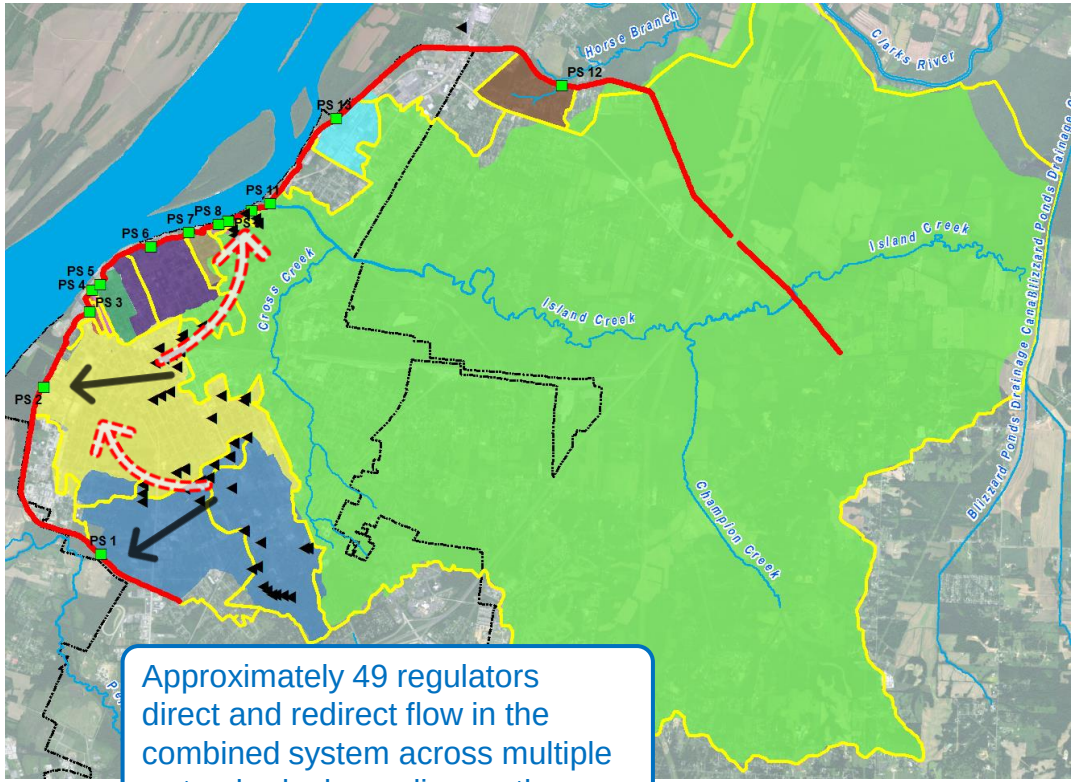
Major Watershed Characteristics Influence Study Approach



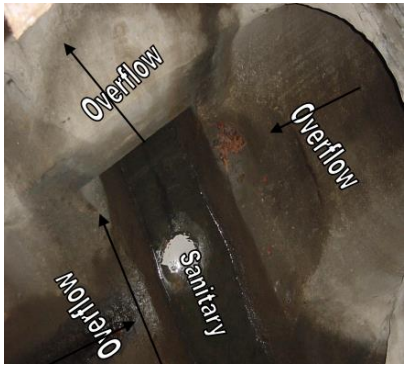
- Natural Channel Conveyance Systems
  - Bridges/Large Culverts
  - Floodplain
  - Natural Flood Storage
- Closed Pipe Conveyance Systems
  - Combined Sewers
  - Separate Storm Sewers
  - Urban Area

Understanding the Existing System

Urban Area Flood Pump Station and Regulator Operation



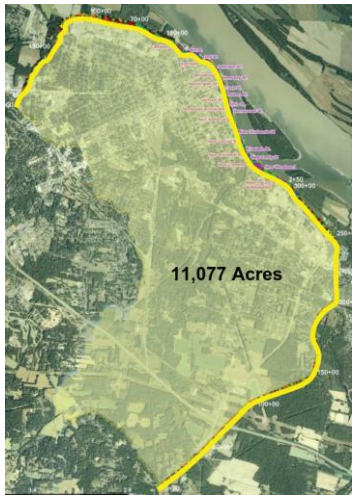
Approximately 49 regulators direct and redirect flow in the combined system across multiple watersheds depending on the wet and dry weather flow.



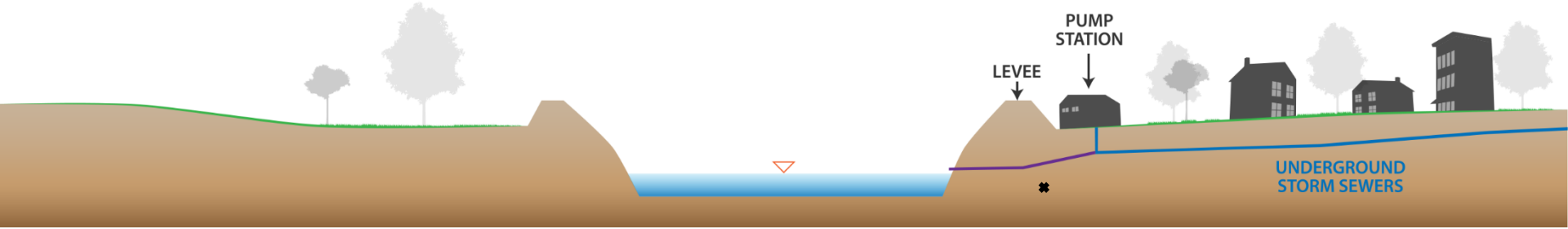
Pump Station	Approximate Area Served
No. 1	1,239 Acres
No. 2	1,198 Acres
No. 3	14 Acres
No. 4	18 Acres
No. 5	74 Acres
No. 6	280 Acres
No. 7	45 Acres
No. 9	12 Acres
No. 11	18,770 Acres
No. 12	182 Acres
No. 13	144 Acres

Understanding the Existing System

Floodwall is a Critical Stormwater Management Element



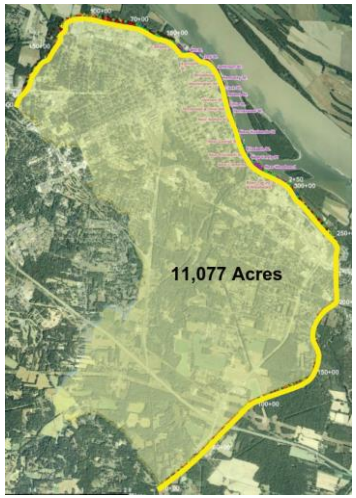
Floodwall Protection:
~11,000 acres
~20,000 people
~$1.2 billion in assets



SYSTEM OPERATION BELOW OHIO RIVER STAGE 27.5 FEET

Understanding the Existing System

Floodwall is a Critical Stormwater Management Element



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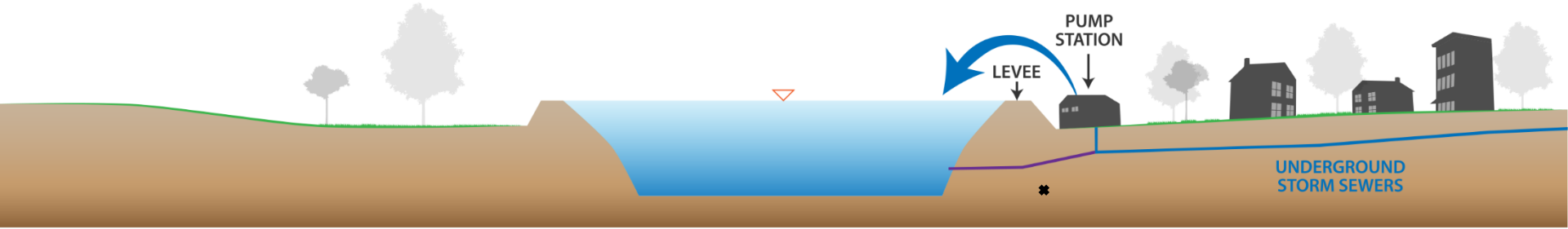
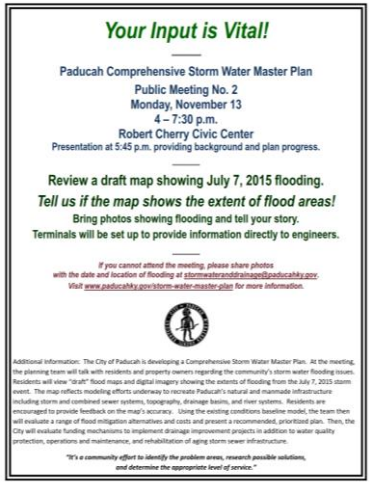


SYSTEM OPERATION ABOVE OHIO RIVER STAGE 27.5 FEET

Community Outreach and Citizen Feedback Informs Problem Area Identification

- Public Information Advertisements and Online Survey Access
- Public Meeting #1
  - Attendees – 65
  - Questionnaires Received – 48
- Public Meeting #2
  - Attendees – 32
  - Questionnaires Received – 13
  - Flyers Distributed Prior to Meeting – 700
- Structures/Parcels Impacted by Modeled 2015 Flooding – 804
  - Additional 933 within 10 foot buffer



Your Input is Vital!

Paducah Comprehensive Storm Water Master Plan
Public Meeting No. 2
Monday, November 13
4 – 7:30 p.m.
Robert Cherry Civic Center
Presentation at 5:45 p.m. providing background and plan progress.

Review a draft map showing July 7, 2015 flooding.
Tell us if the map shows the extent of flood areas!
Bring photos showing flooding and tell your story.
Terminals will be set up to provide information directly to engineers.

If you cannot attend the meeting, please share photos with the date and location of flooding at stormwateranddrainage@paducahky.gov. Visit www.paducahky.gov/storm-water-master-plan for more information.

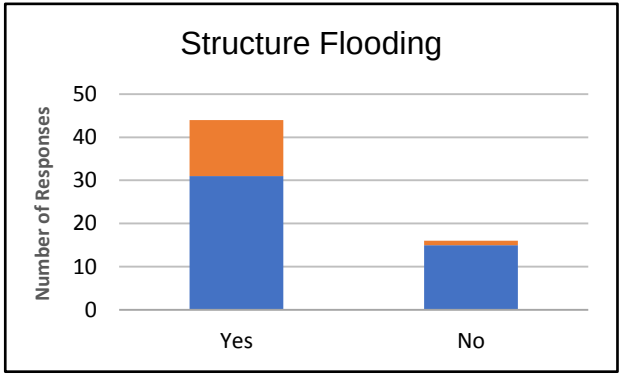
Additional Information: The City of Paducah is developing a Comprehensive Storm Water Master Plan. At the meeting, the planning team will talk with residents and property owners regarding the community's storm water flooding issues. Residents will view "draft" flood maps and digital imagery showing the extents of flooding from the July 7, 2015 storm event. The map reflects modeling efforts underway to recreate Paducah's natural and manmade infrastructure including storm and combined sewer systems, topography, drainage basins, and river systems. Residents are encouraged to provide feedback on the map's accuracy. Using the existing conditions baseline model, the team then will evaluate a range of flood mitigation alternatives and costs and present a recommended, prioritized plan. Then, the City will evaluate funding mechanisms to implement drainage improvement projects in addition to water quality protection, operations and maintenance, and rehabilitation of aging storm sewer infrastructure.

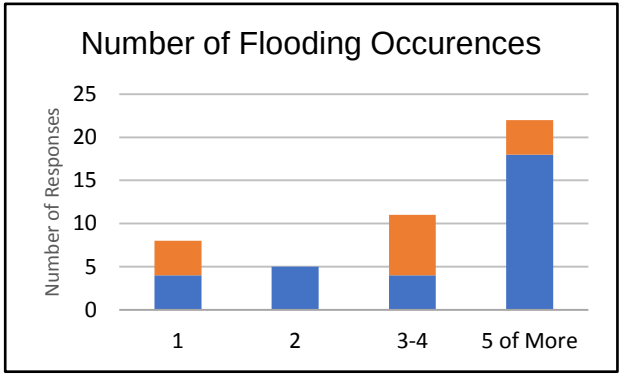
"It's a community effort to identify the problem areas, research possible solutions, and determine the appropriate level of service."

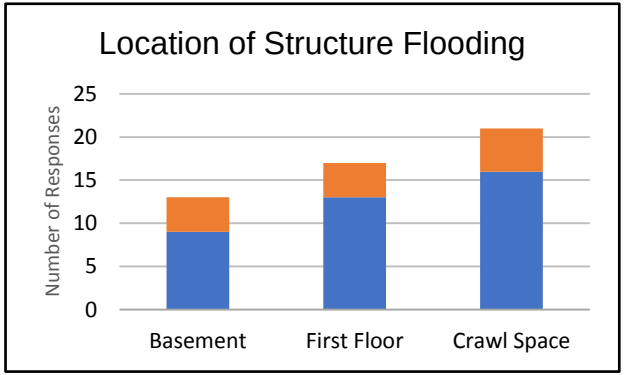
CSMP Survey Results

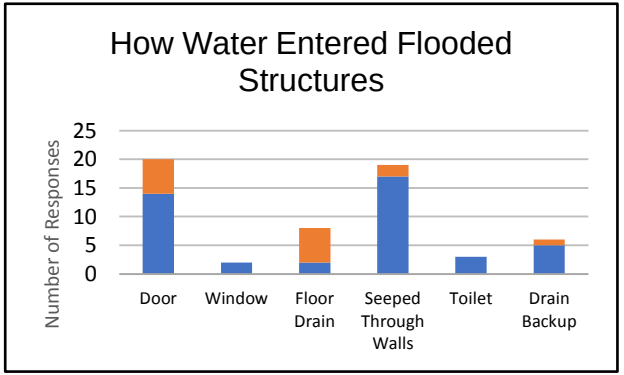
Compilation of Data Received To Date

- 61 questionnaires completed
  - 48 from Public Meeting No. 1
  - 13 Additional from Public Meeting No. 2

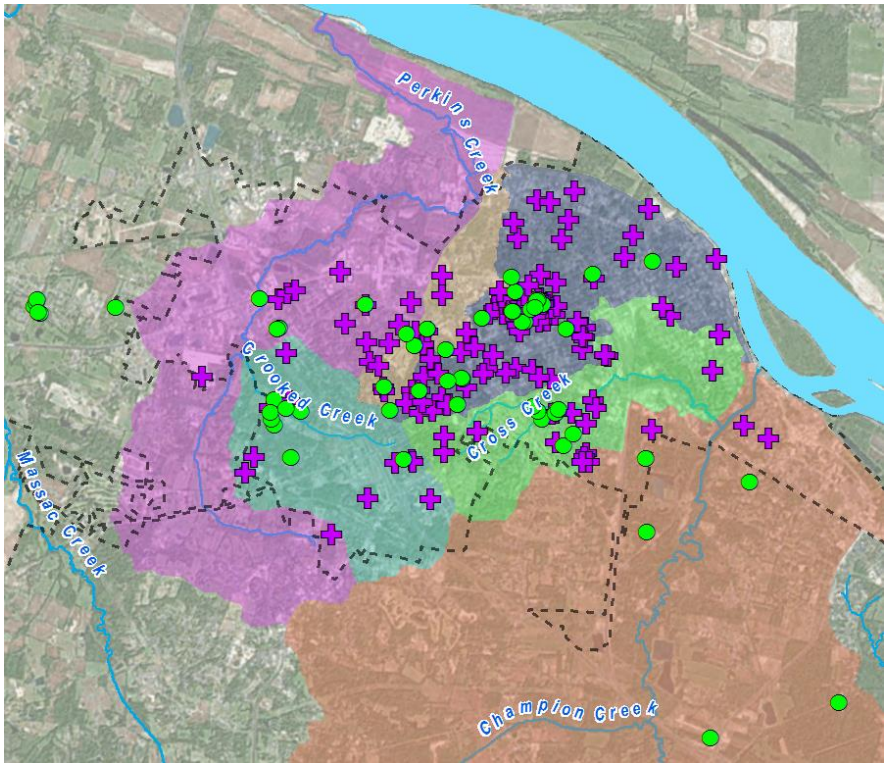








Past and Present Drainage Complaints Help Target Problem Area Identification

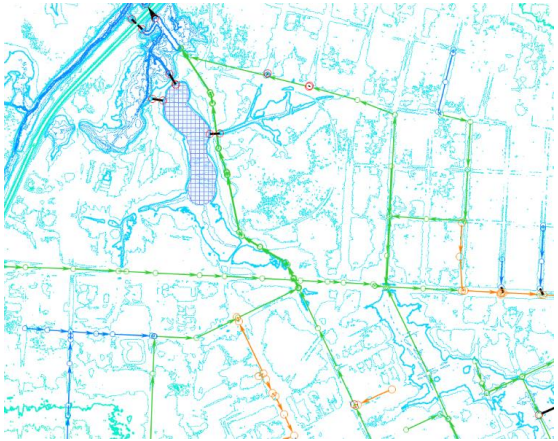


Legend

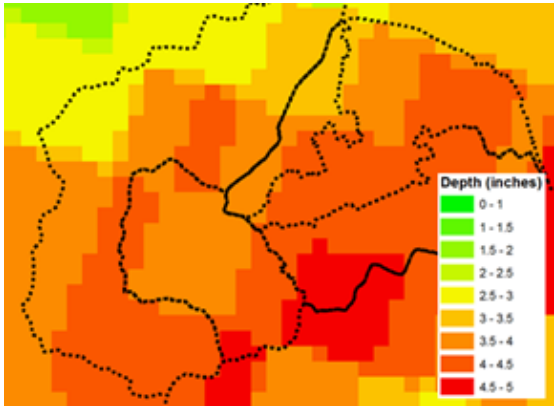
- 2017 Drainage Questionnaire
- Drainage Complaints (2007 - 2016)
- Cross Creek
- Island Creek
- Perkins Creek
- Perkins Creek - Urban Area
- Urban Watershed

Urban Area Stormwater Modeling

- XP-SWMM 2D Modeling
  - Combined an existing JSA sewer model with City GIS databases
  - Conducted field surveys to bridge data gaps
  - Integrated LIDAR topographic data for flood mapping
  - Utilized Nexrad imaging data for rainfall distribution



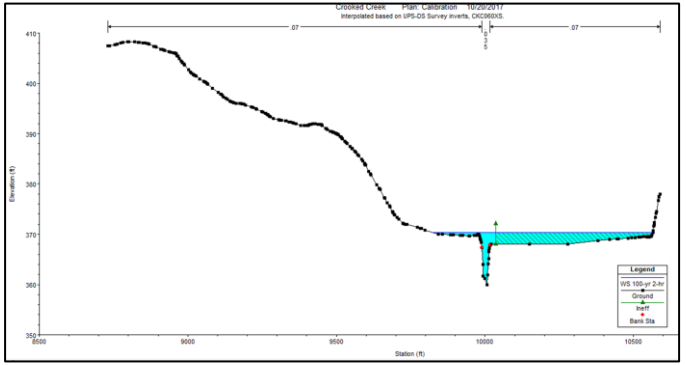
- XP-SWMM 2D Results
  - Provides more accurate representation of flood storage areas and volumes
  - Improves simulation of overland flood conveyance routes
  - Includes dynamic, real-time visual flood mapping tool

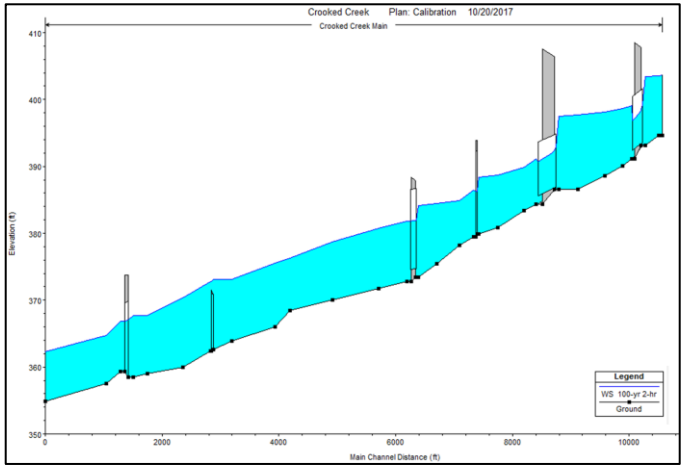


Open Channel Stormwater Modeling

- HEC-HMS Modeling
  - Started with 2014 FEMA Effective Model
  - Added Detailed Watershed Hydrology
  - Incorporated existing detention and floodplain storage areas
  - Utilized Nexrad imaging for rainfall distribution

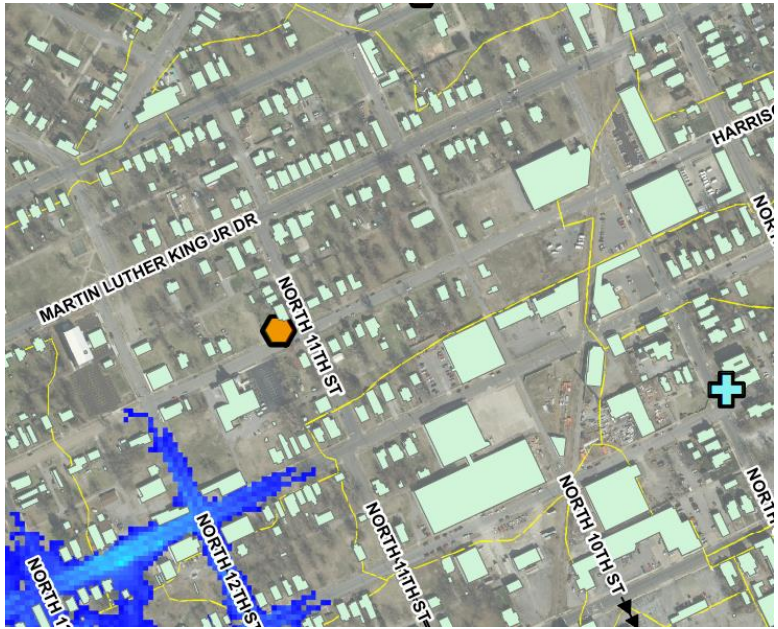
- HEC-RAS
  - Started with 2014 FEMA Effective Model
  - Corrected/Modified bridge characteristics and cross section geometry based on field survey
  - Calibrated the model to the July 7, 2015 storm event



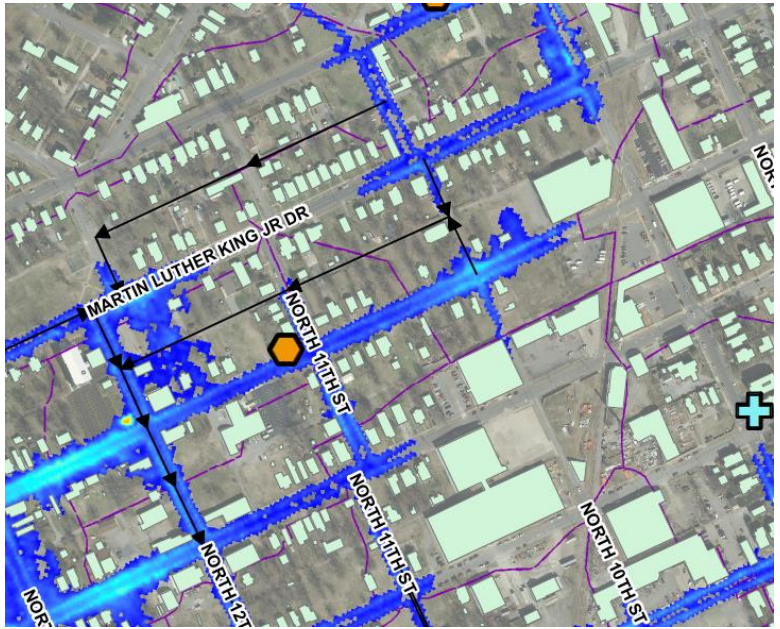


Flood Mapping Calibration Efforts Provide Foundation for Alternatives Evaluation

Input Aids Calibration Efforts



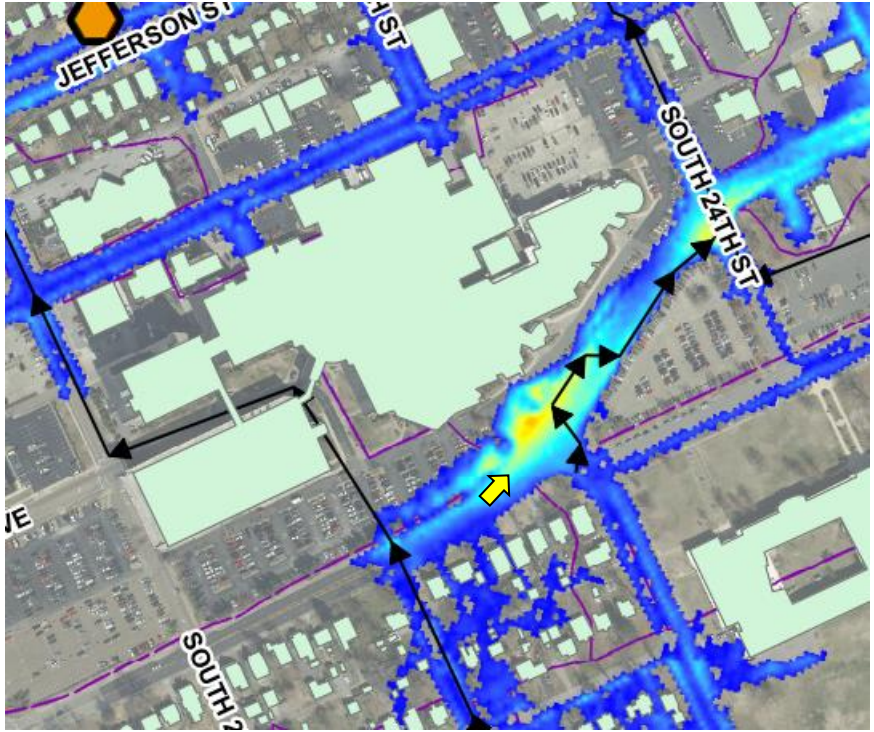
Initial flood mapping output.



Updated flood mapping output based on specific review comments.

Preliminary Flood Mapping Calibration Evaluation

Photographic Evidence Supports Calibration Efforts

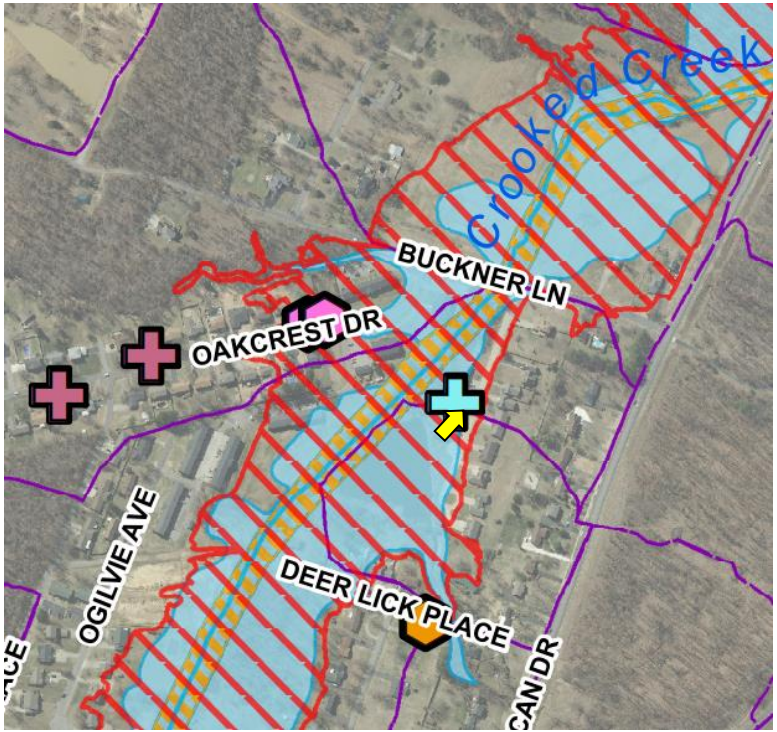


Initial flood mapping output shows flooding at the Hospital entrance.

Photo evidence corroborates model output.

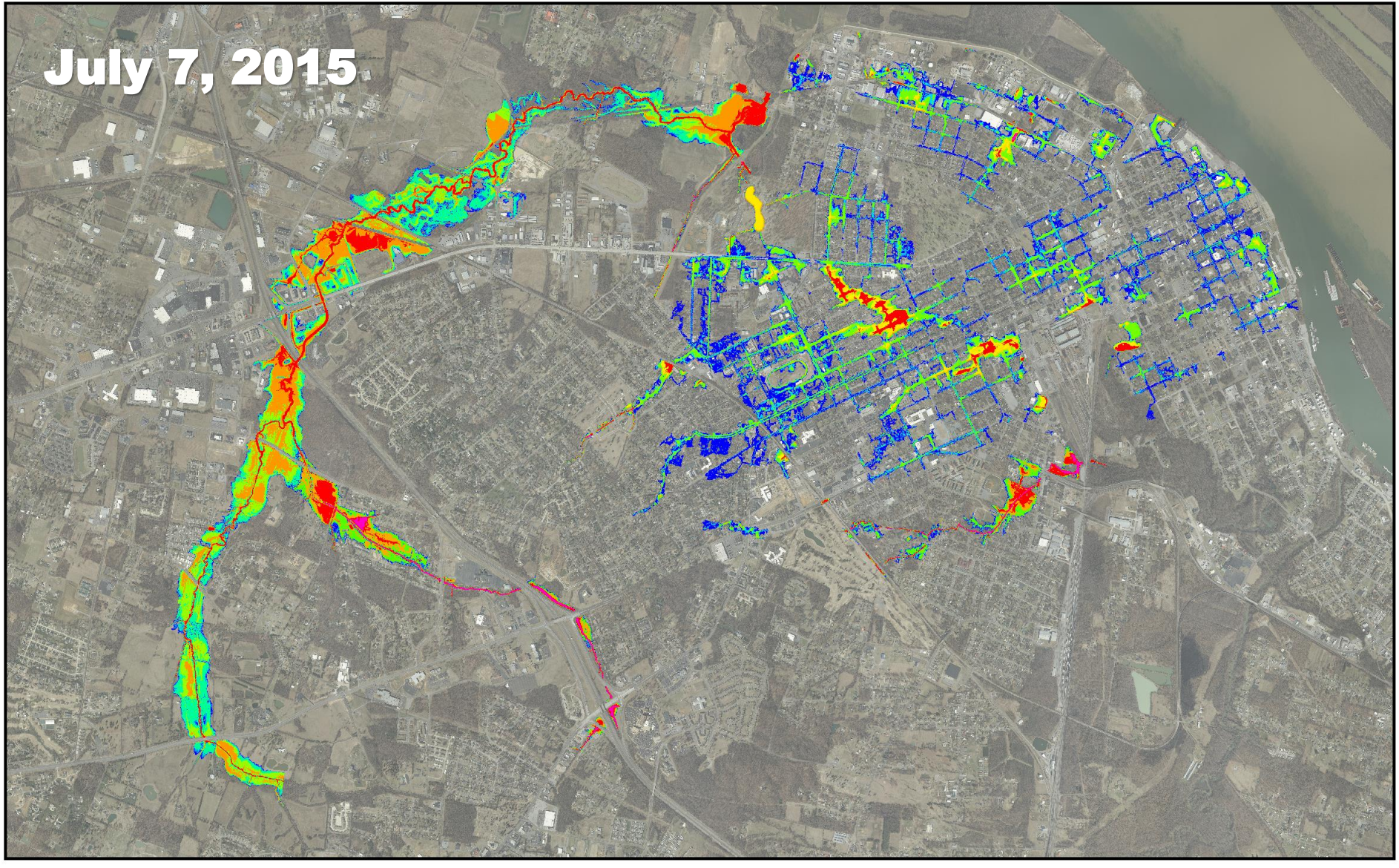
Preliminary Flood Mapping Calibration Evaluation

Photographic Evidence Supports Calibration Efforts

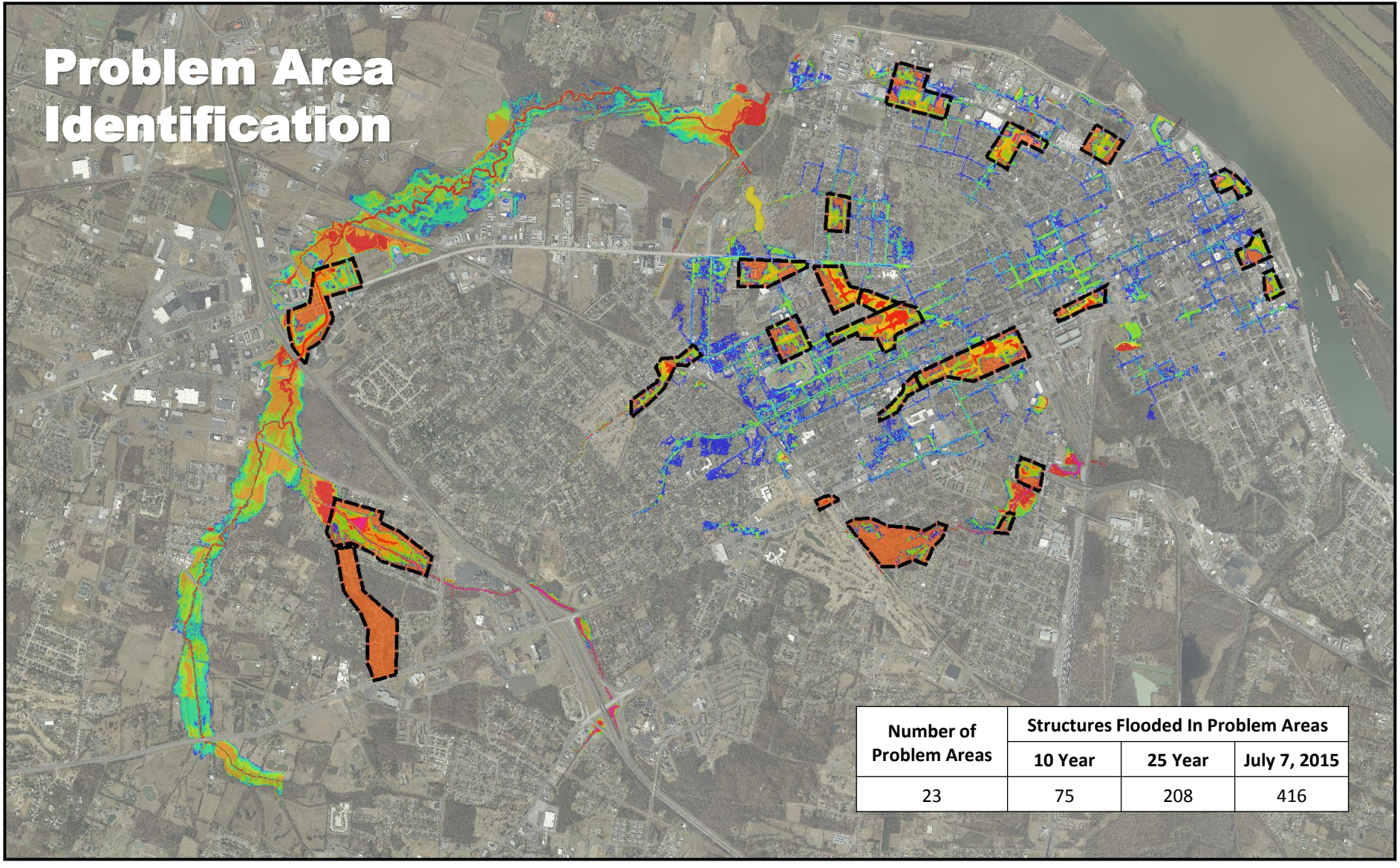


Initial flood mapping output shows flooding along Buckner Lake Circle.

Photo evidence corroborates model output.

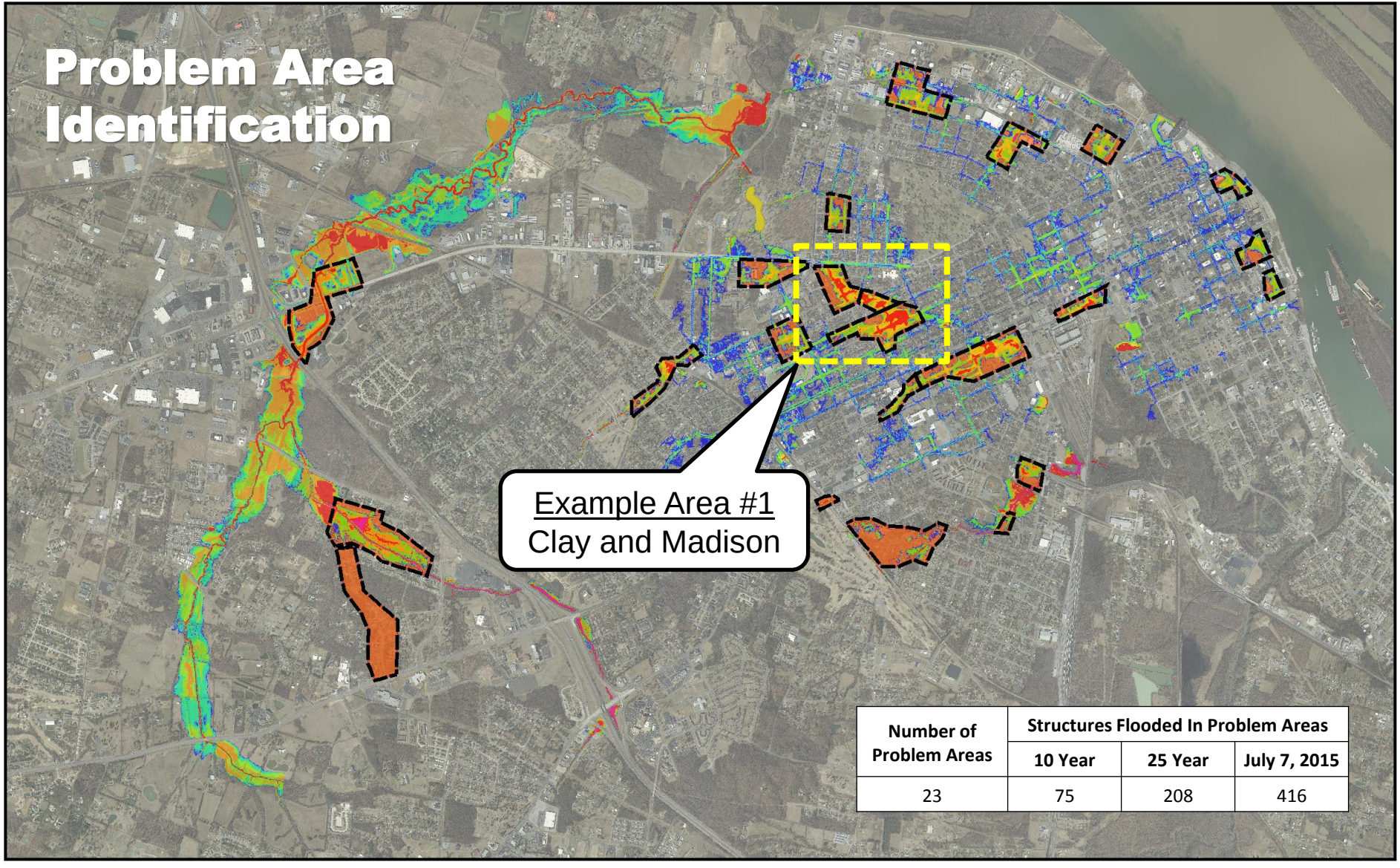

July 7, 2015

Problem Area Identification



Number of Problem Areas	Structures Flooded In Problem Areas		
	10 Year	25 Year	July 7, 2015
23	75	208	416

Problem Area Identification



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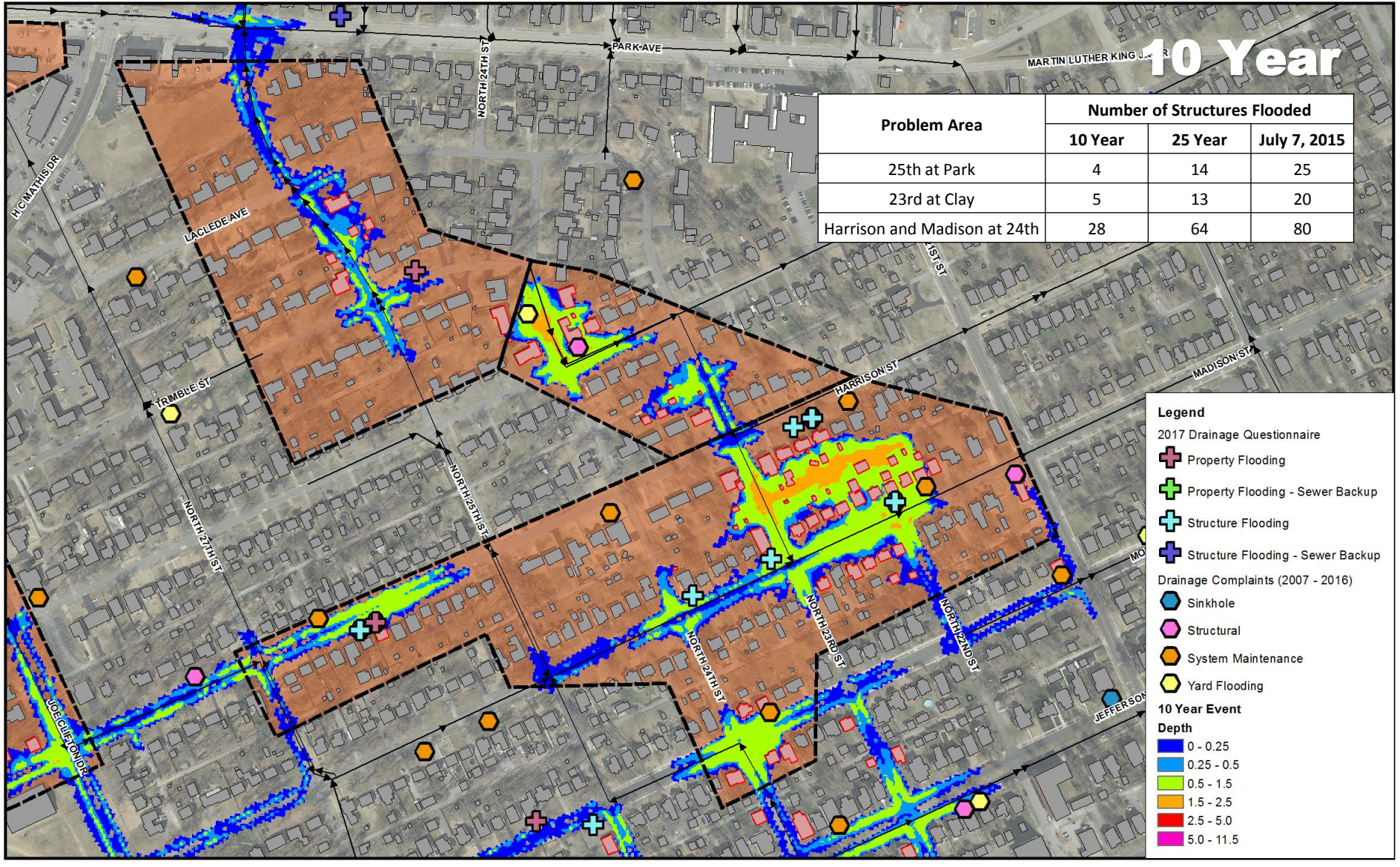
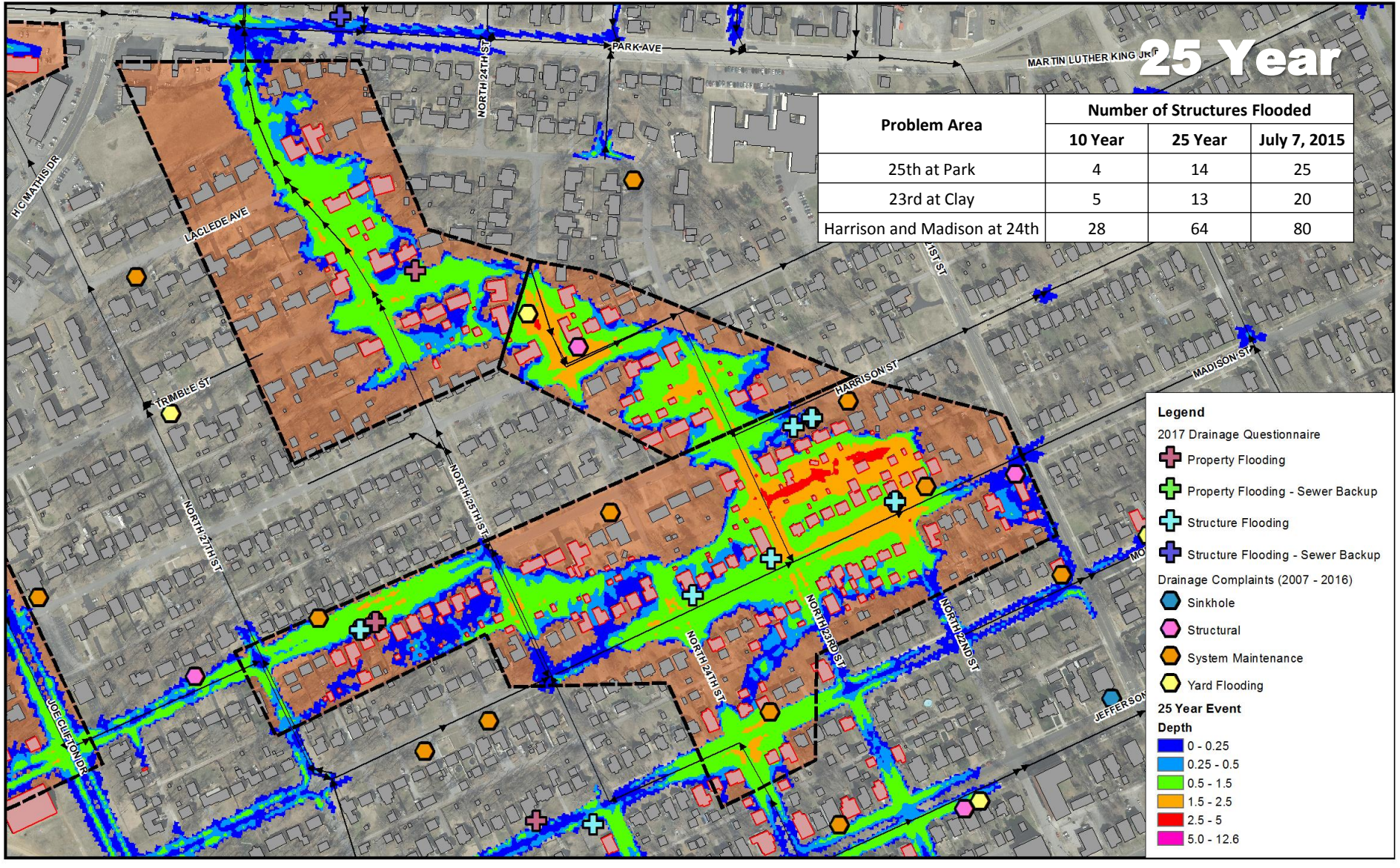
23	75	208	416

10 Year

Problem Area	Number of Structures Flooded		
	10 Year	25 Year	July 7, 2015
25th at Park	4	14	25
23rd at Clay	5	13	20
Harrison and Madison at 24th	28	64	80





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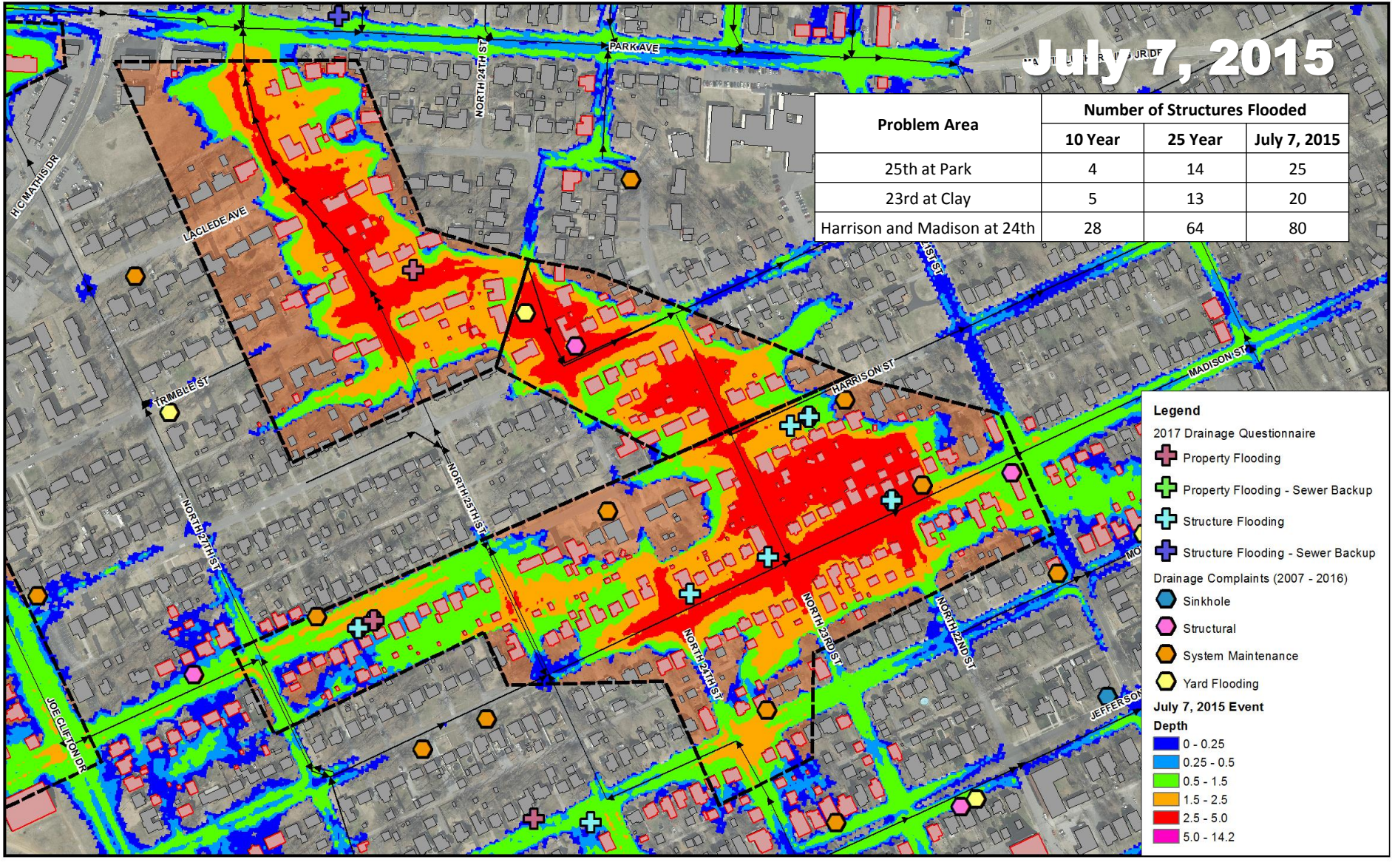
July 7, 2015
Problem Area
Number of Structures Flooded
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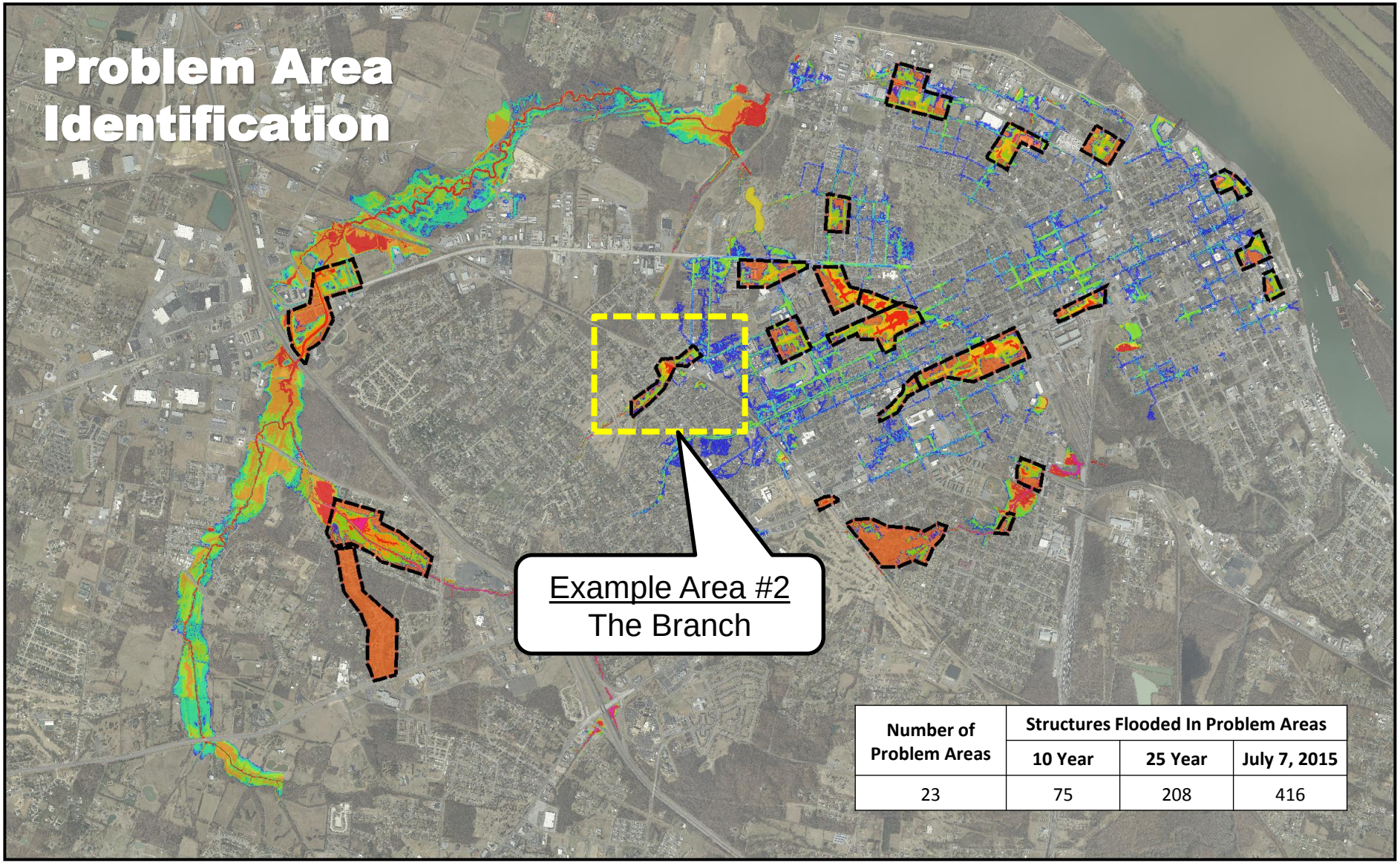
28
64
80
PARK AVE
NORTH 24TH ST
HC MATHIS DR
LACLEDE AVE
TRIMBLE ST
HARRISON ST
MADISON ST
NORTH 25TH ST
NORTH 27TH ST
NORTH 23RD ST
NORTH 24TH ST
NORTH 22ND ST
JOE CLIFTON DR
JEFFERSON
Legend
2017 Drainage Questionnaire
Property Flooding
Property Flooding - Sewer Backup
Structure Flooding
Structure Flooding - Sewer Backup
Drainage Complaints (2007 - 2016)
Sinkhole
Structural
System Maintenance
Yard Flooding
July 7, 2015 Event
Depth
0 - 0.25
0.25 - 0.5
0.5 - 1.5
1.5 - 2.5
2.5 - 5.0
5.0 - 14.2

Problem Area Identification



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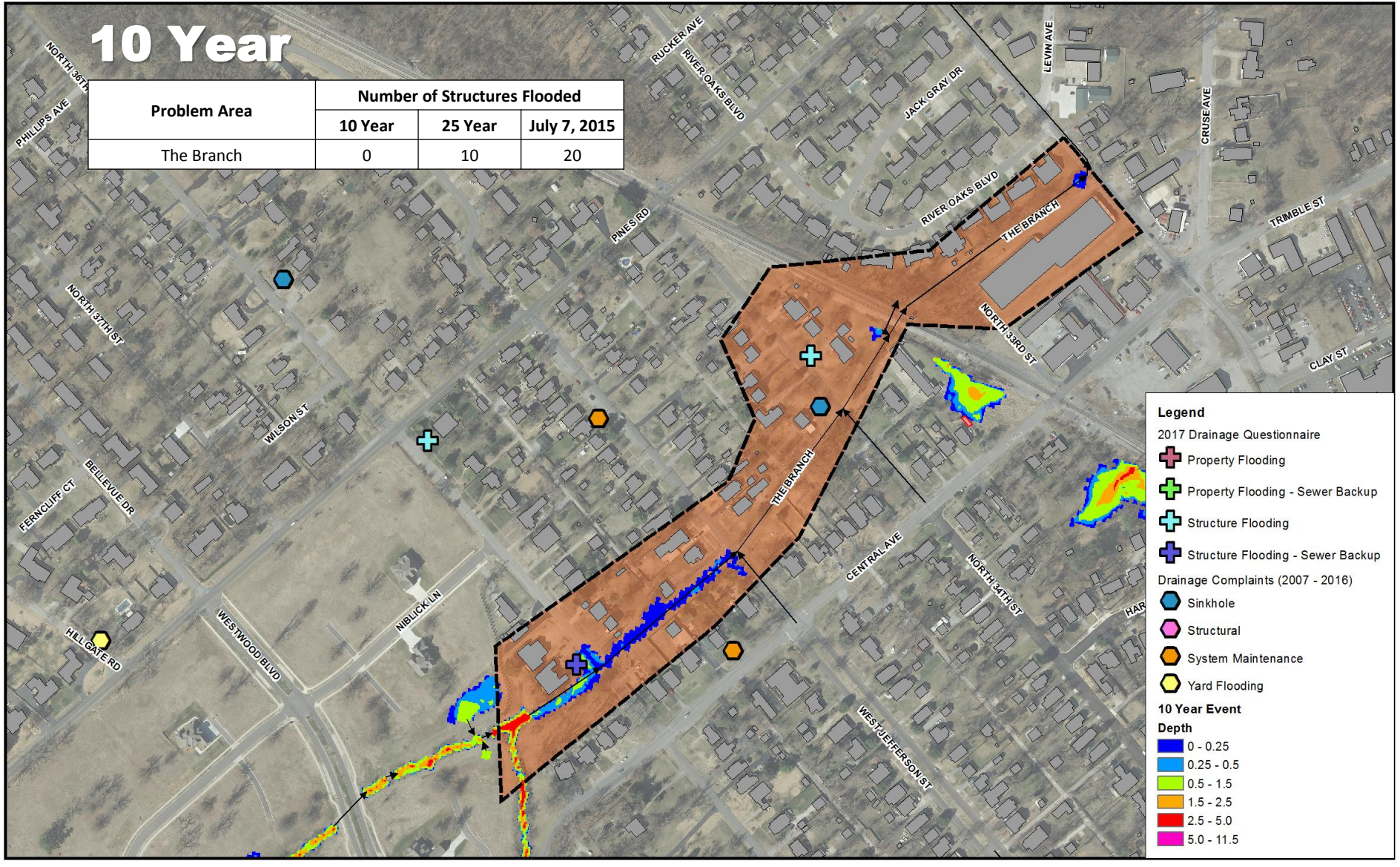
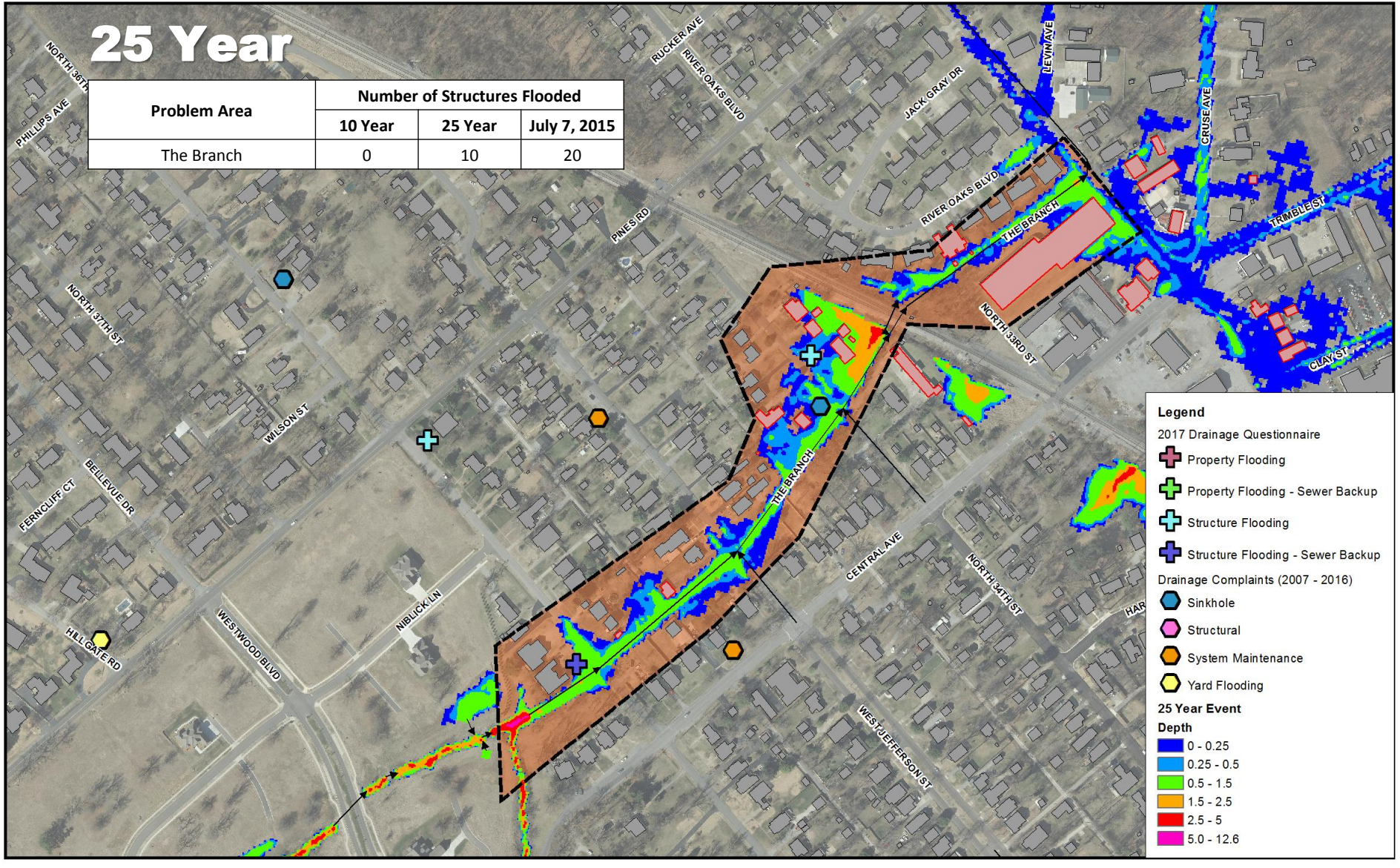
10 Year

Problem Area	Number of Structures Flooded		
	10 Year	25 Year	July 7, 2015
The Branch	0	10	20



25 Year

Problem Area	Number of Structures Flooded		
	10 Year	25 Year	July 7, 2015
The Branch	0	10	20



July 7, 2015

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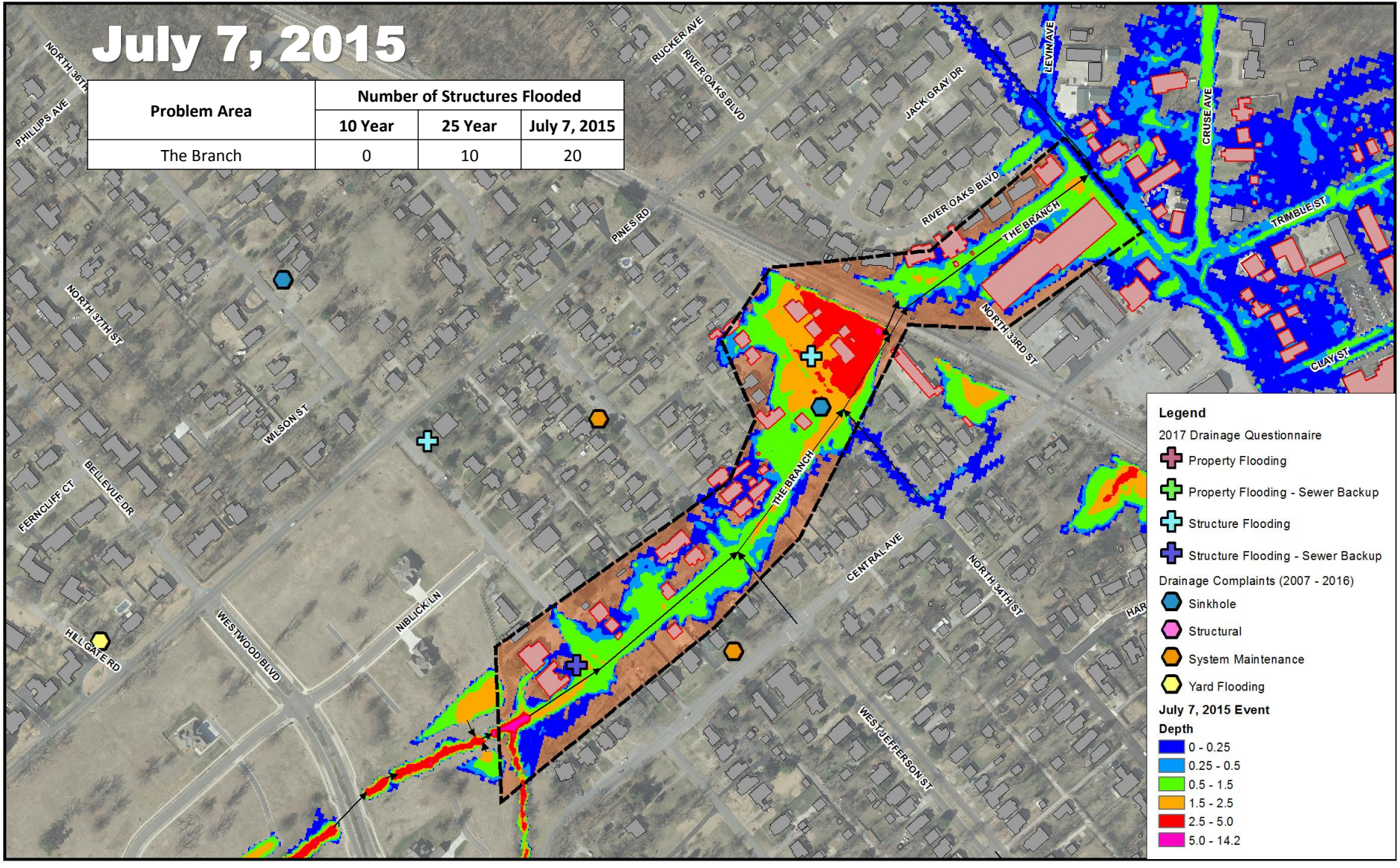

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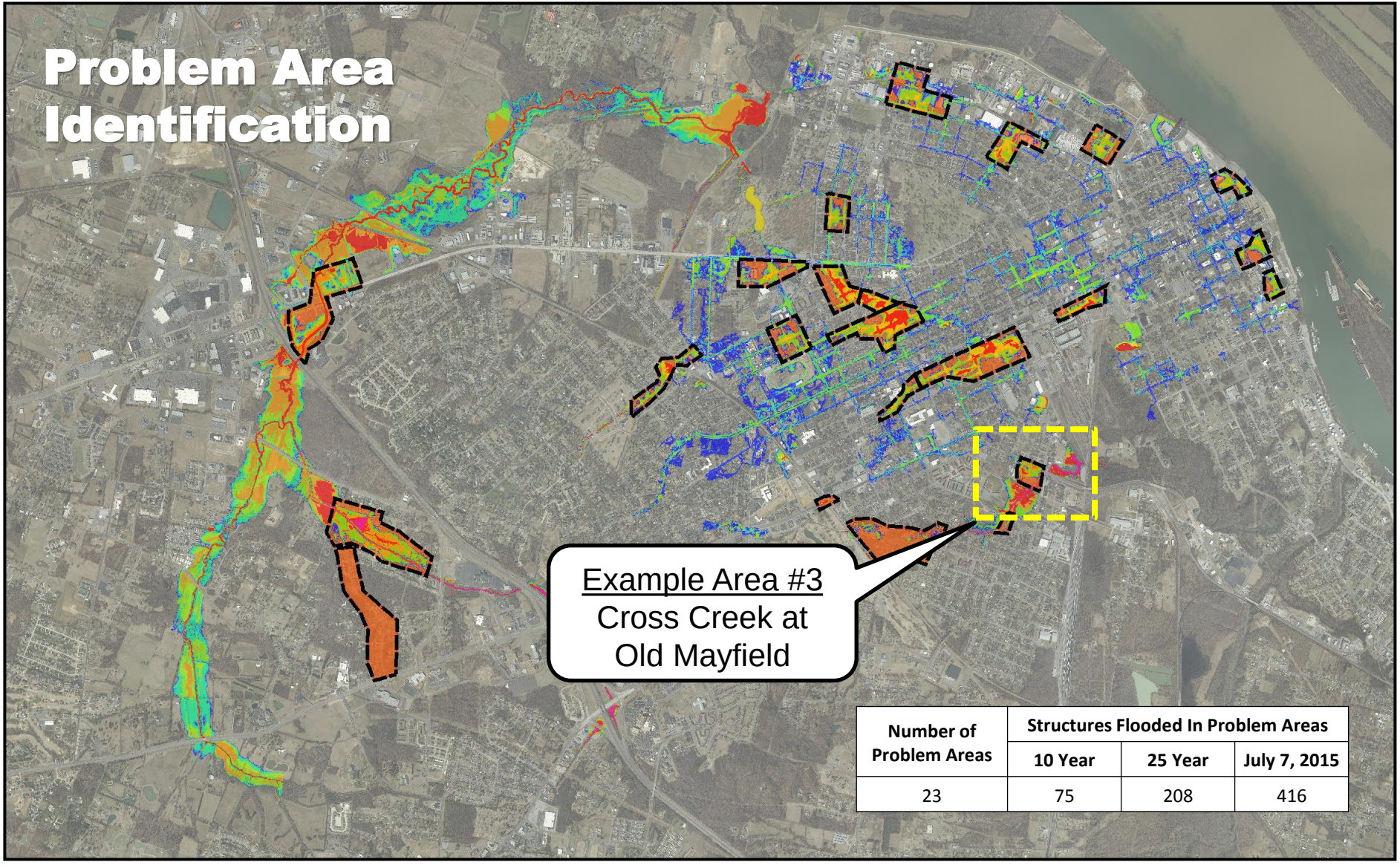

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10 Year

Problem Area	Number of Structures Flooded		
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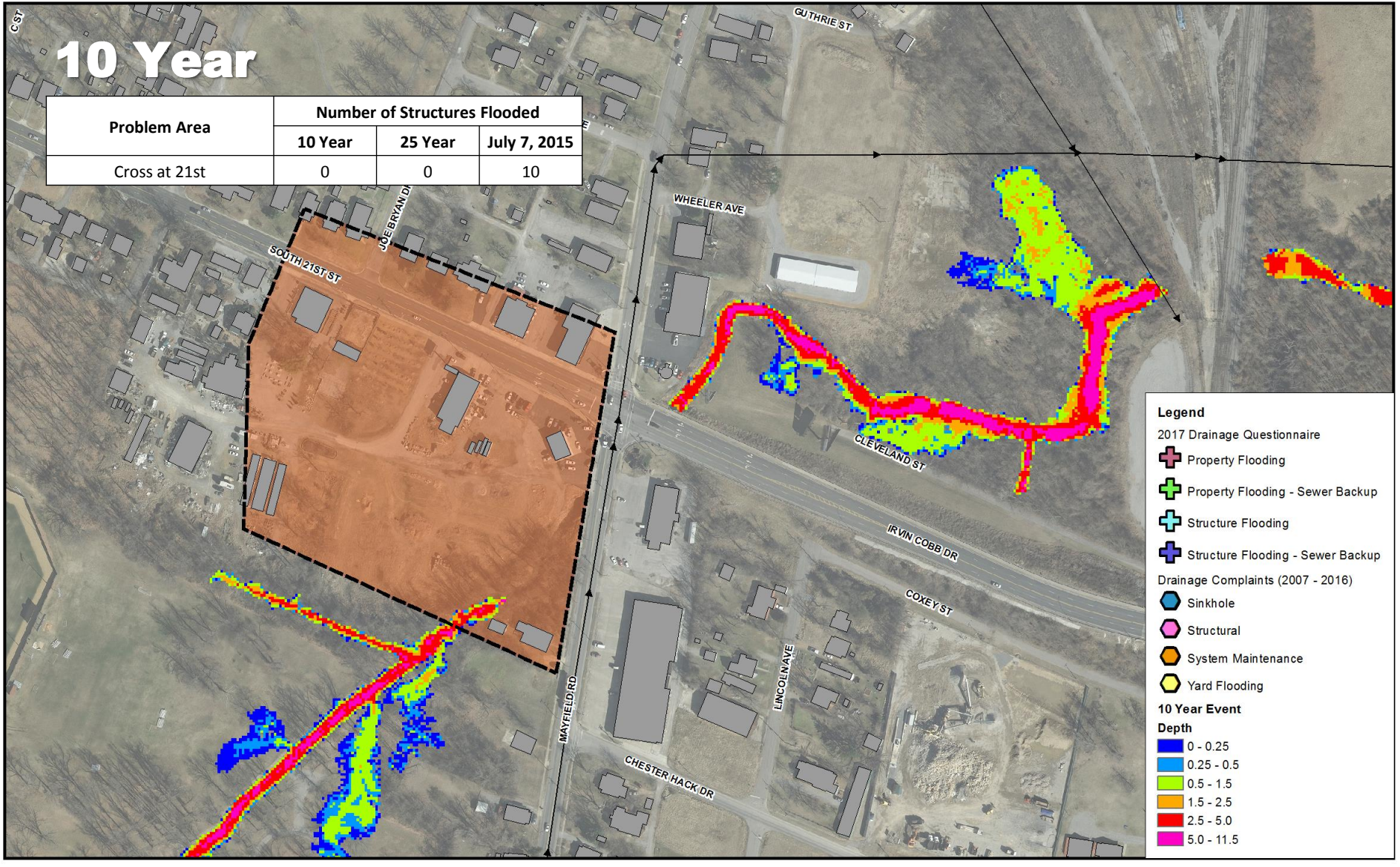
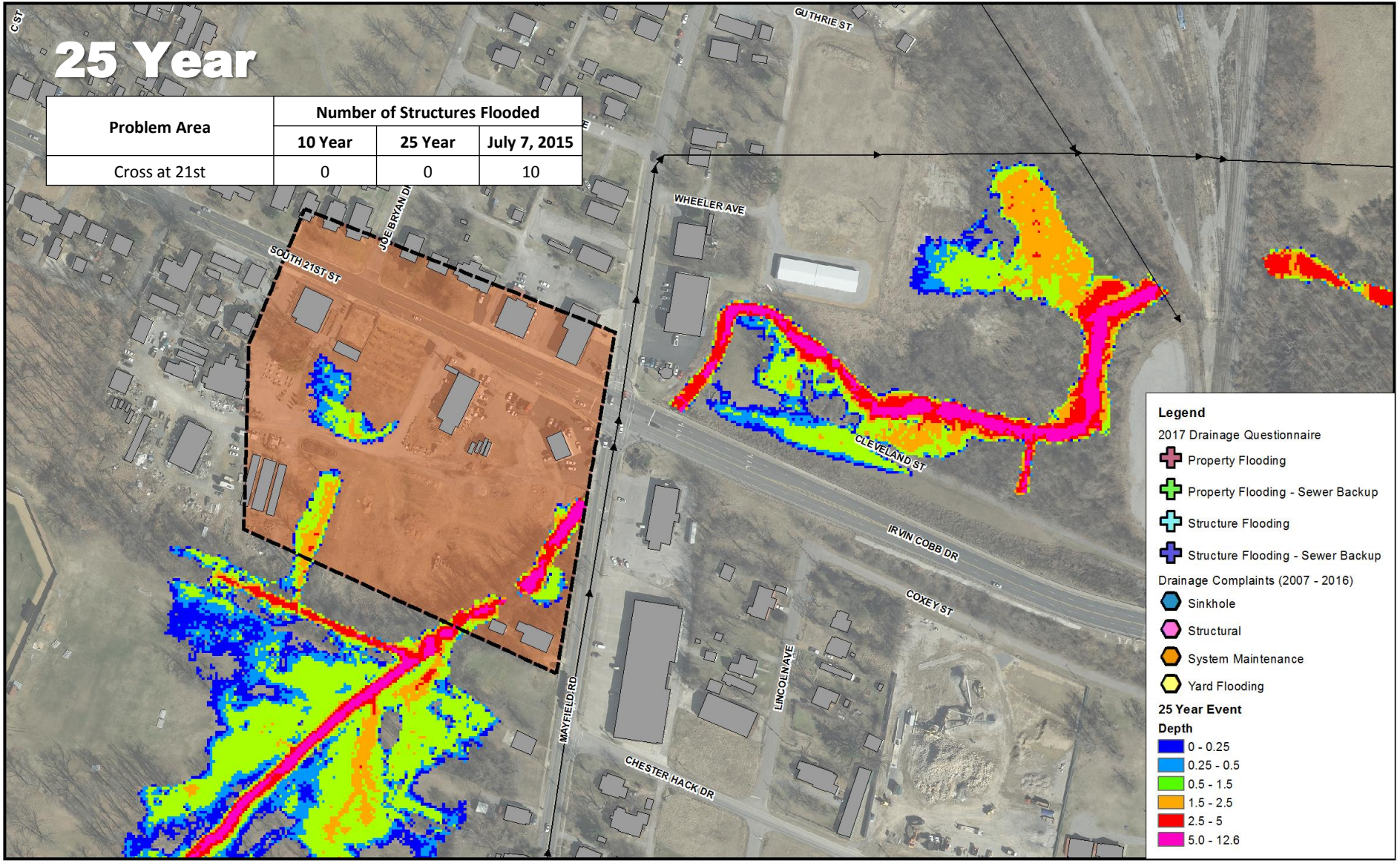
Cross at 21st	0	0	10



25 Year

Problem Area	Number of Structures Flooded		
	10 Year	25 Year	July 7, 2015
Cross at 21st	0	0	10



July 7, 2015

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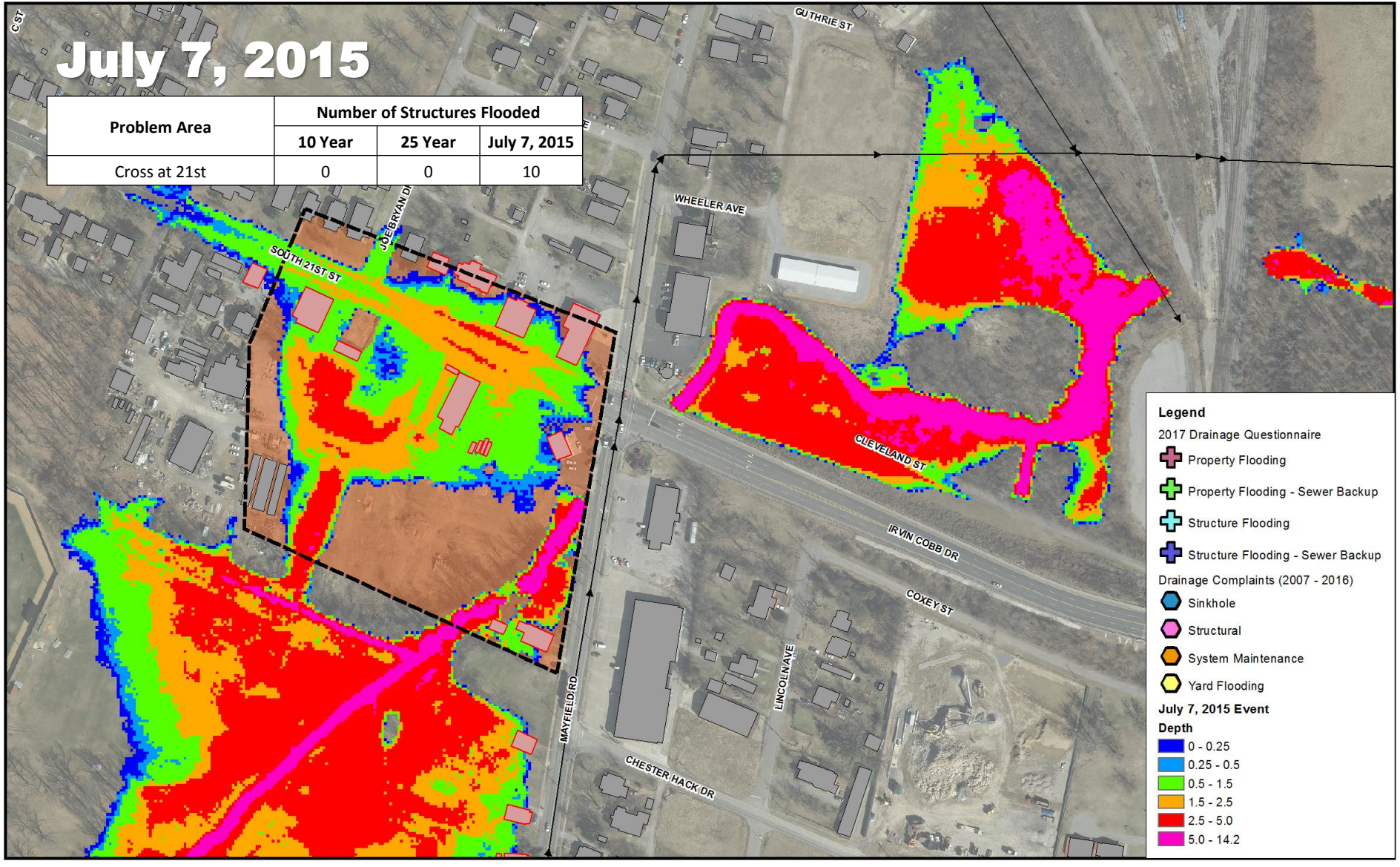

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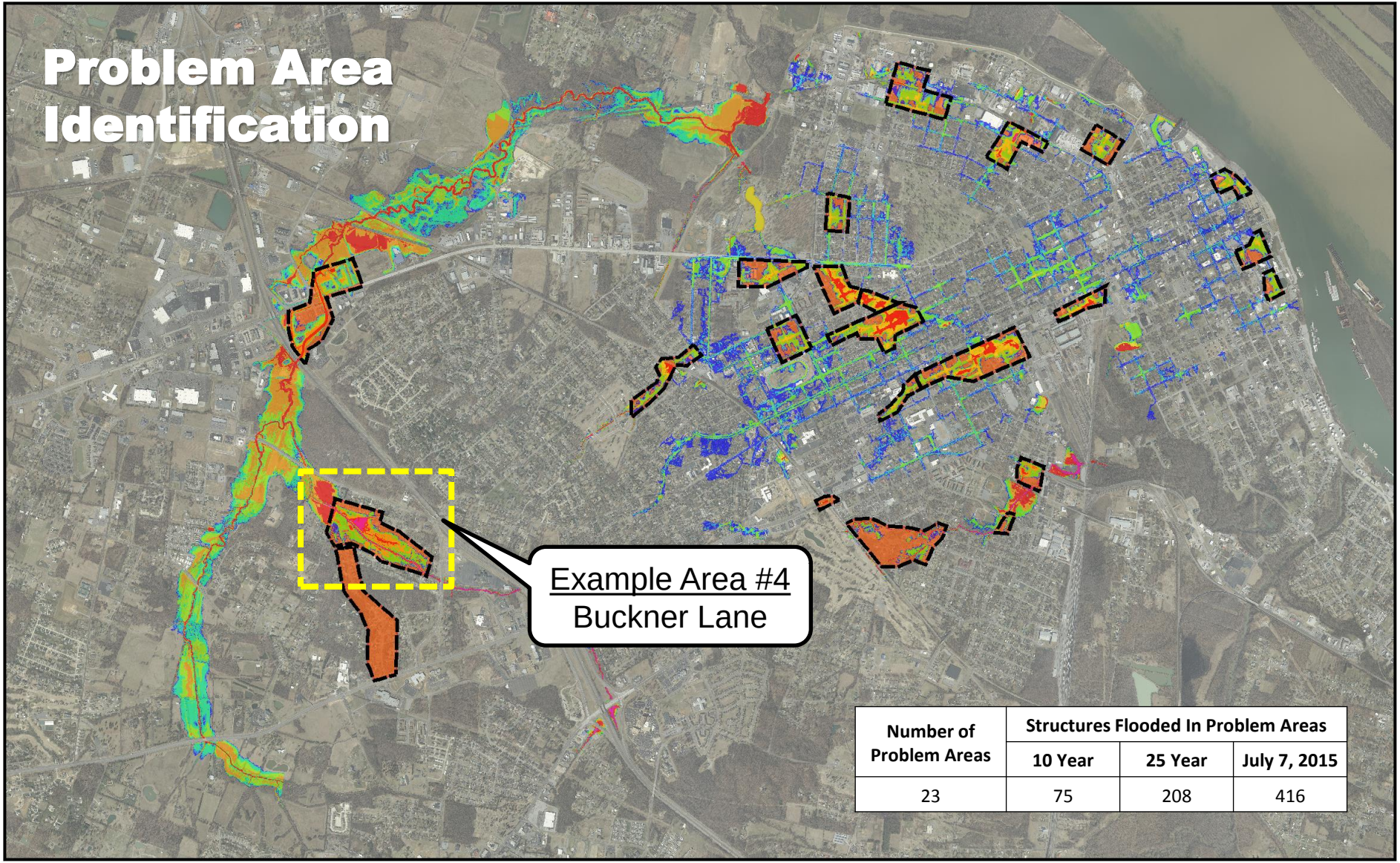

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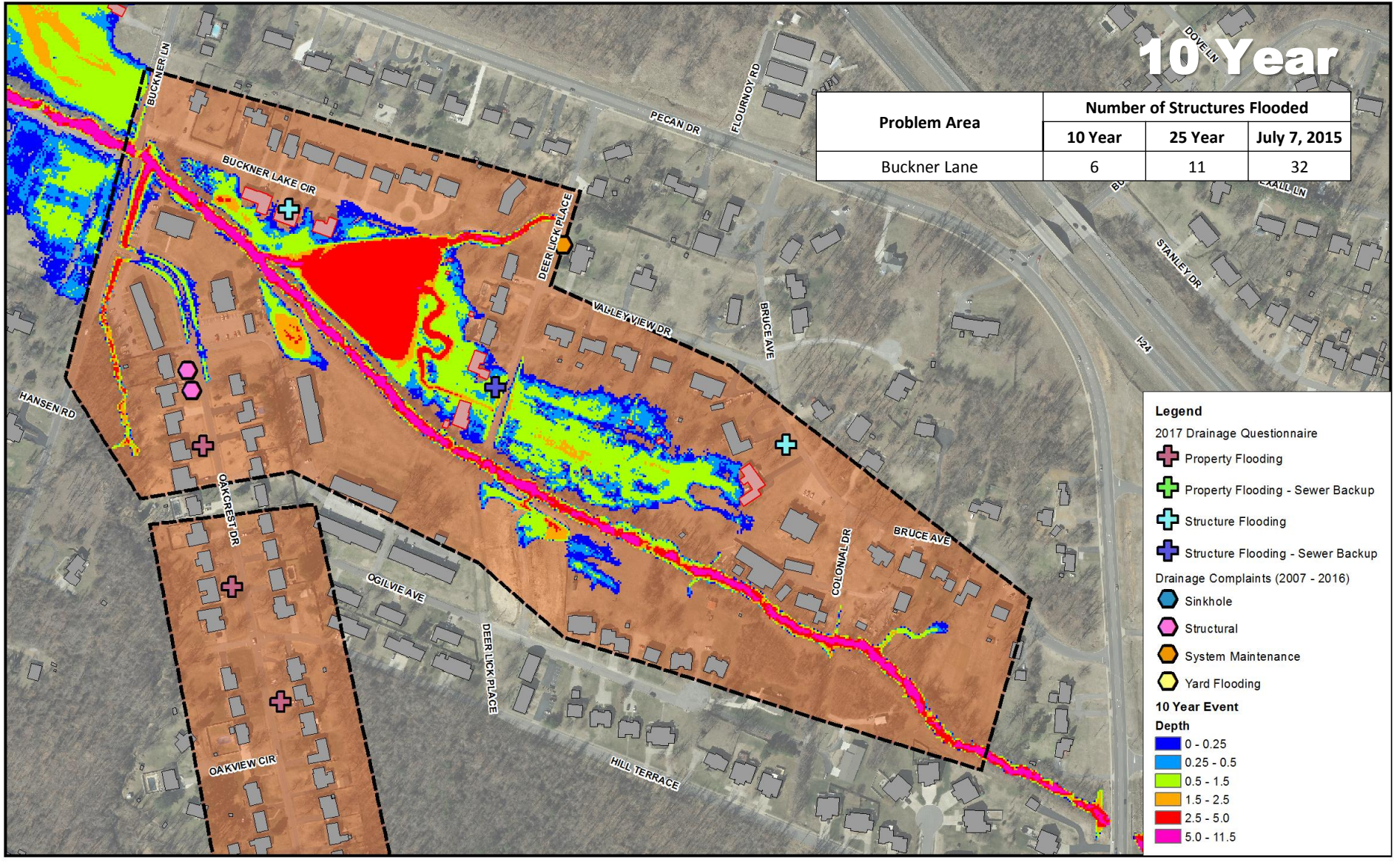
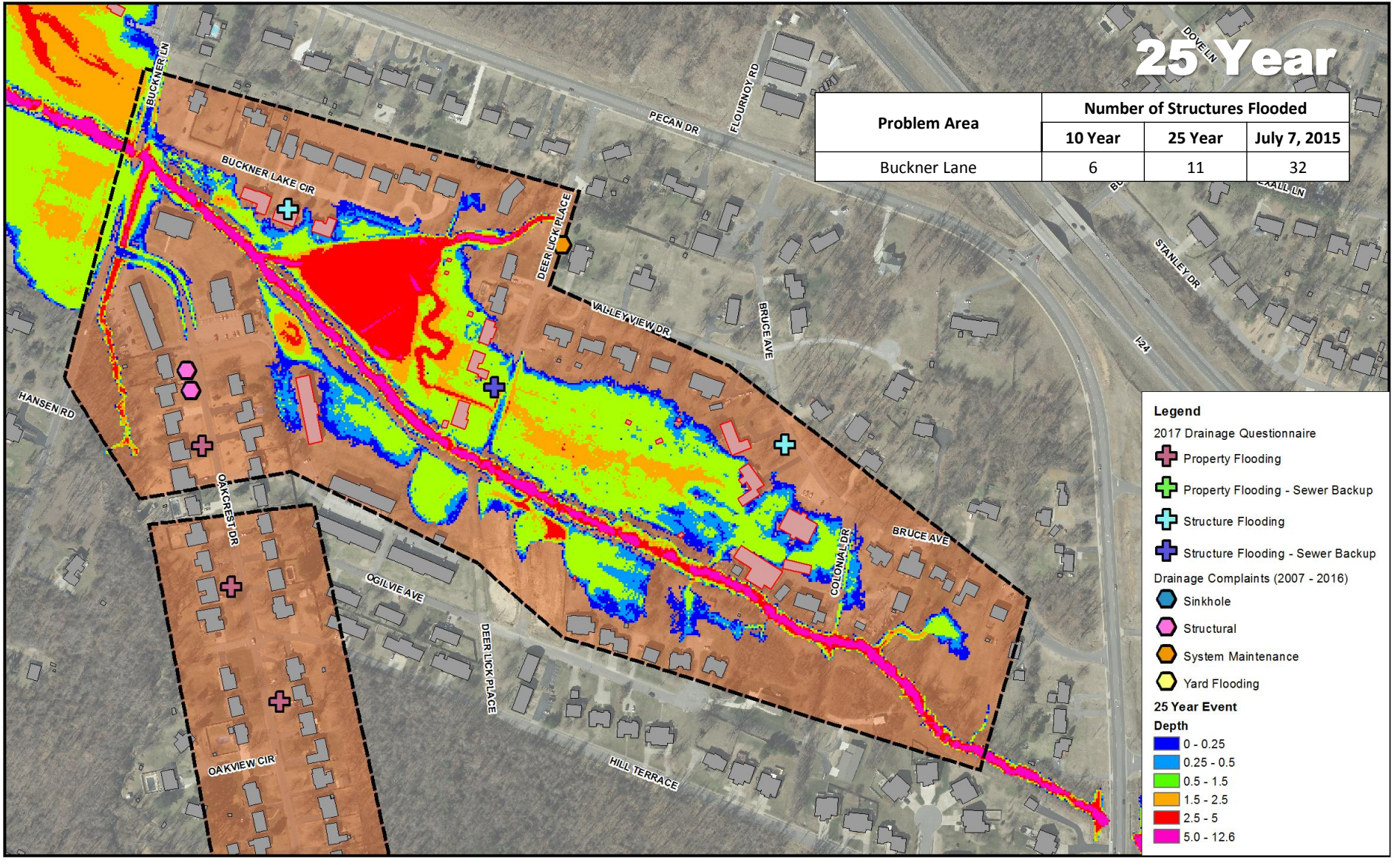
10 Year

Problem Area	Number of Structures Flooded		
	10 Year	25 Year	July 7, 2015
Buckner Lane	6	11	32





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July 7, 2015

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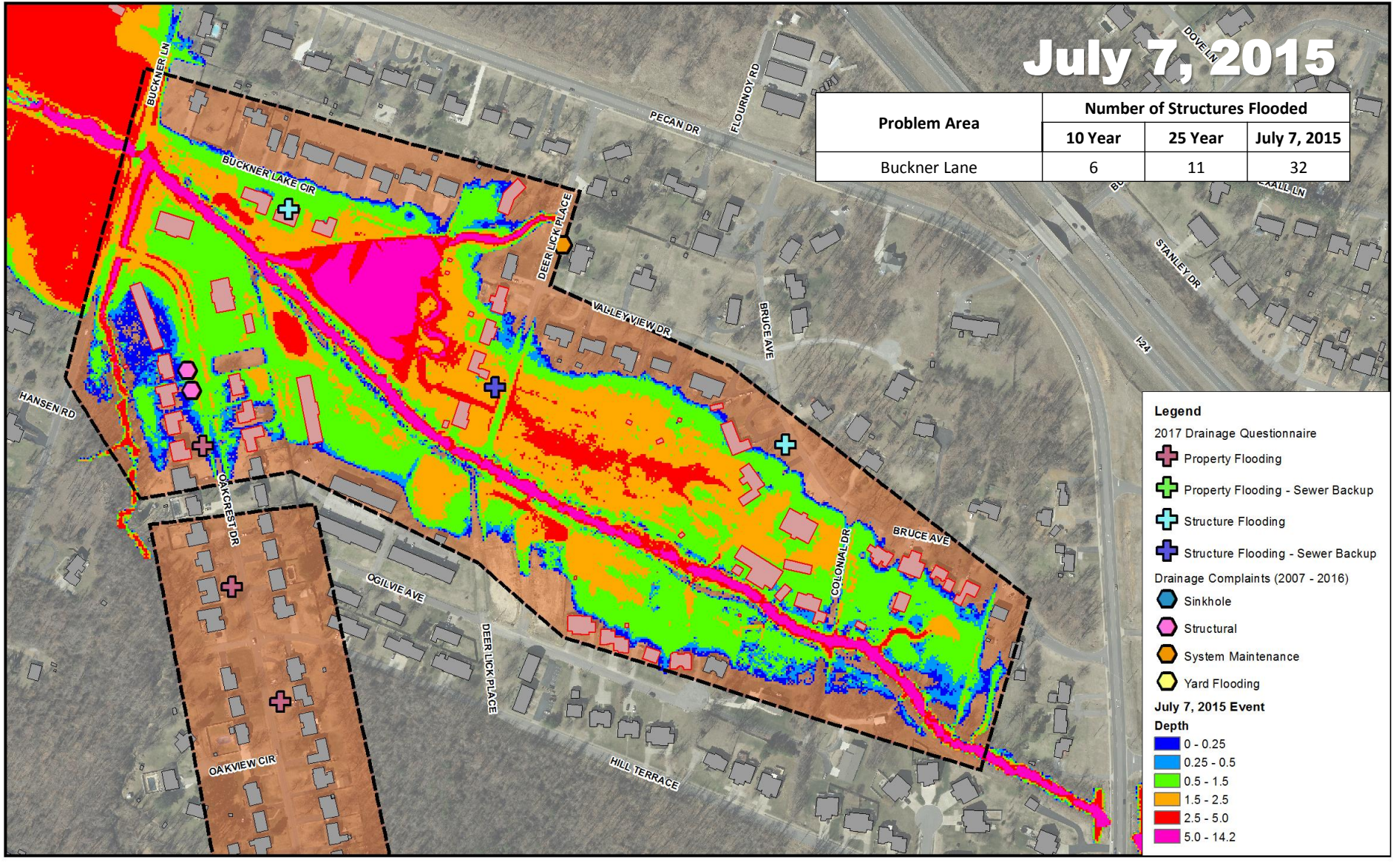
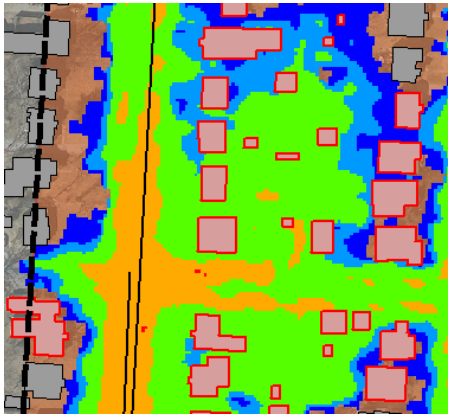


Next Steps

Task 10 - Establish Ten Priority Areas for Alternatives Evaluation

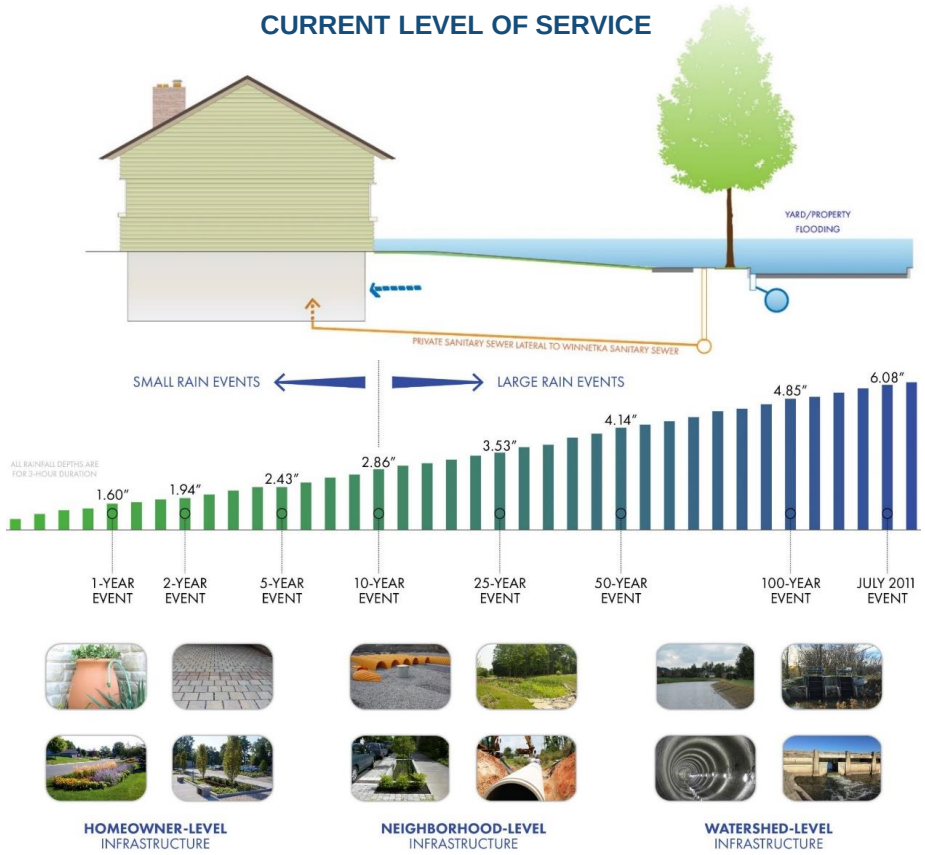
Selection Criteria

- Number/Concentration of Structure Flooding
- Property Damage Complaints
- Emergency Access/Public Safety Concerns
- Flood Frequency
- Problem Area Interdependency
- Complexity

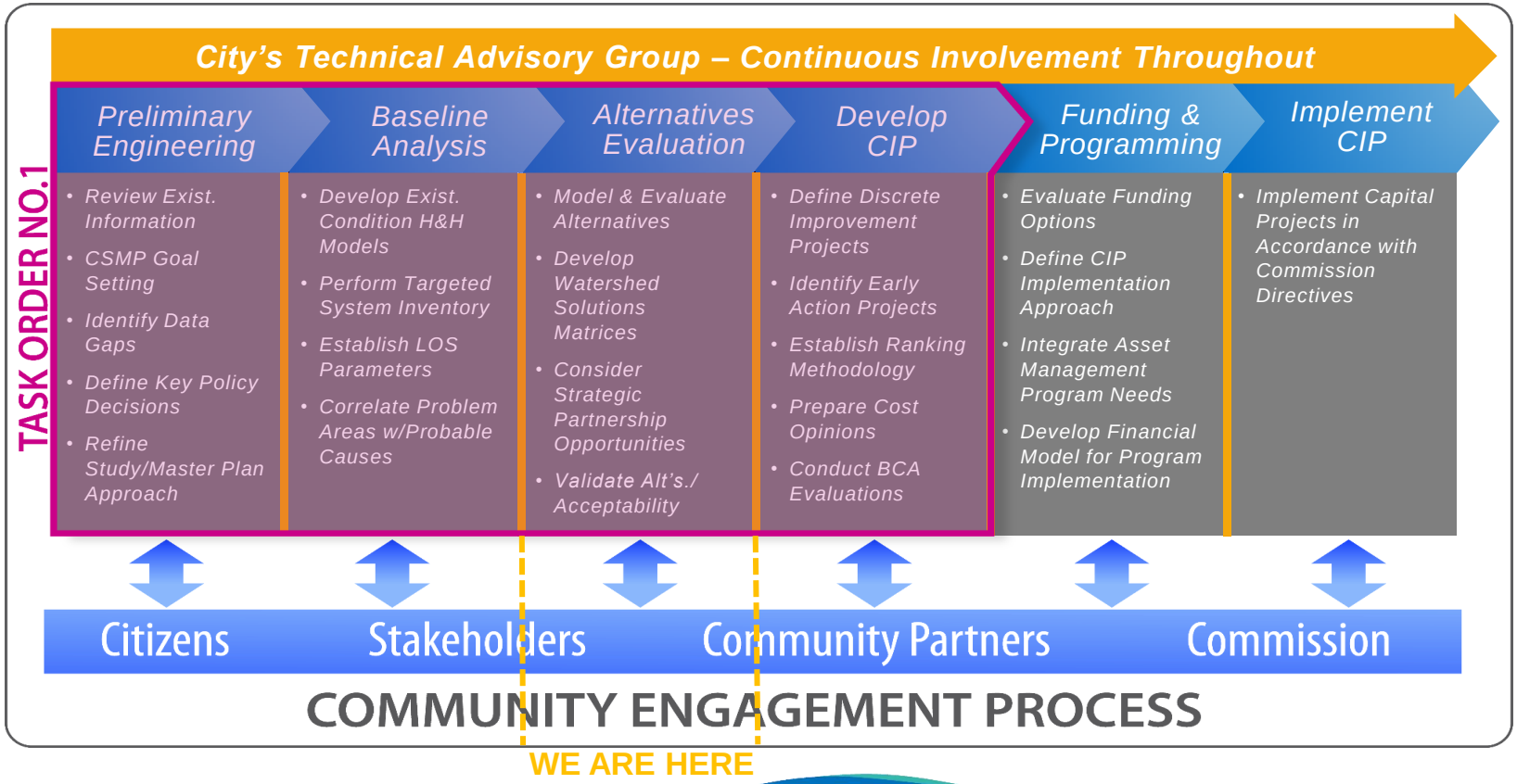


Next Steps

- Continue to Review And Refine Model Based On Public Feedback
- Initiate Discussion On Level of Service
- Review Spectrum of Control Scenarios With City
- Initiate Alternatives Evaluation
- Develop Preliminary Costs



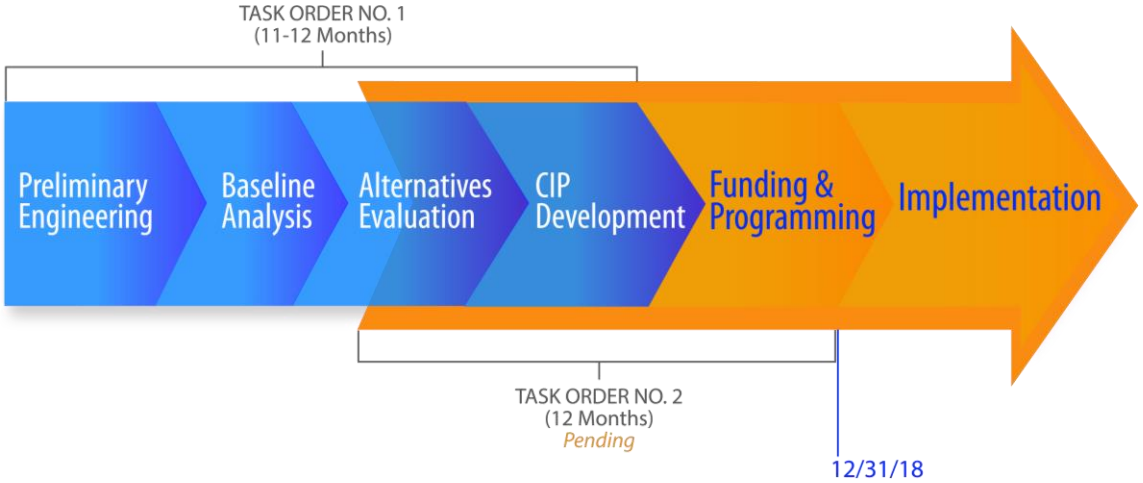
Project Implementation Overview



Schedule Overview

What are the Expectations for Schedule?

- Preliminary Engineering Evaluation
- Completion of Master Plan
- Identification of Early Action Projects
- Determination of Funding Approach
- Implementation of Master Plan Projects



Task Order 2 Scope of Services

Initiates Prior to Conclusion of Task Order 1

Proposed Scope of Services

- Determine Cost of Service to Implement Stormwater Management Program
  - Develop Operation and Maintenance budget
  - Develop Capital Improvement Program budget
  - Determine MS4 Compliance Costs
  - Evaluate staffing and equipment needs
- Stormwater Utility Study
  - Identify area, extent and level of service
  - Calculate impervious area within service area
  - Develop Equivalent Residential Unit (ERU)
  - Measure impervious surface of non-residential properties
  - Develop credit policy

Task Order 2 Scope of Services

Initiates Prior to Conclusion of Task Order 1

Proposed Scope of Services

- Public Outreach/Engagement Program
  - Meetings with Stormwater Advisory Committee (SWAC)
  - Meetings with City Council
  - Meetings with key stakeholders
  - Meetings with general public
- Development of Program Implementation Plan
  - Development of utility ordinances
  - Development of Master Account File
  - Staffing evaluation and budget development
- MS4 Program Audit
  - Revise storm sewer system design requirements
  - O&M Plan and facility audits
  - IDDE Plan

Task Order 2 Scope of Services

Initiates Prior to Conclusion of Task Order 1

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Staff/TAG	X X	X X		X		X		X		X		X	X
Commission			X X			X		X				X	X
SWAC	X			X				X				X	
Stakeholders												X	
Gen Public		X X								X			X

"Public Education and Community Outreach is key to successful implementation of CSMP."

Schedule Overview

What are the Expectations for Schedule?

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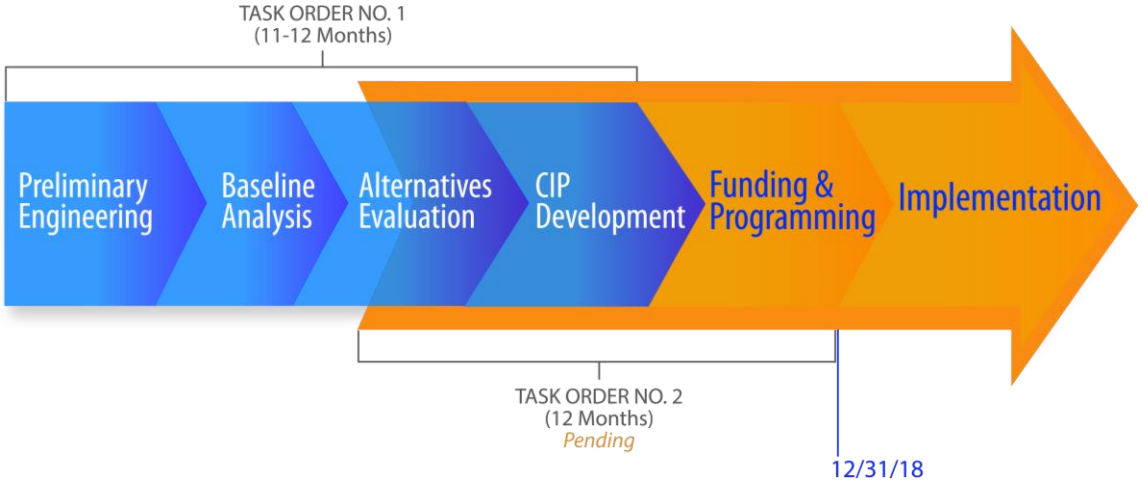
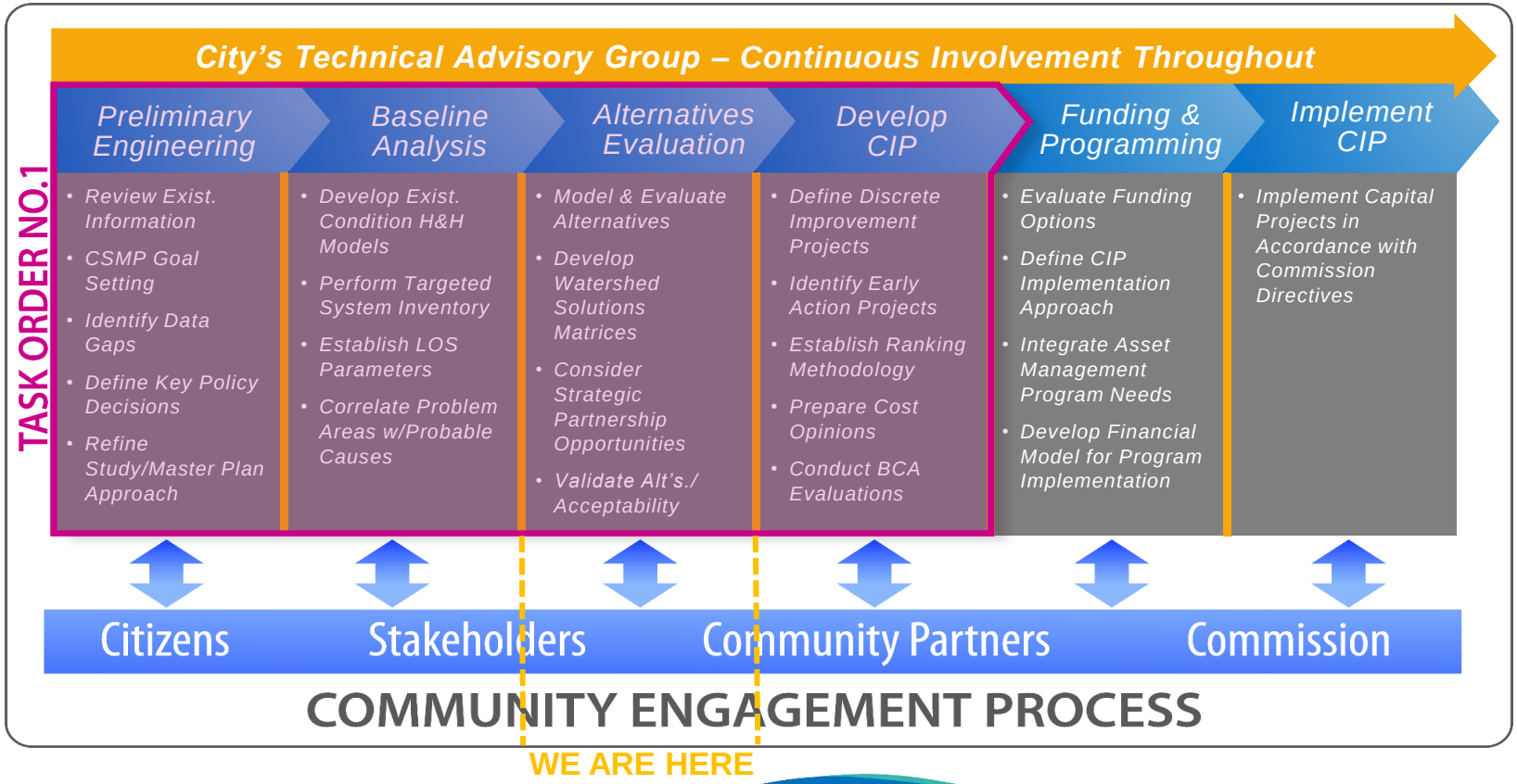


Project Implementation Overview



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