2017 Valley Mede Drainage Study: Plumtree Branch and Little Plumtree Branch

November 15, 2017

Prepared for: Maryland Department of Transportation State Highway Administration and
Howard County Stormwater Management Division

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McCormick Taylor

Discussion Items

- Background
- Existing Conditions and Hydraulic Model
- Conceptual Improvements
- Concluding Thoughts

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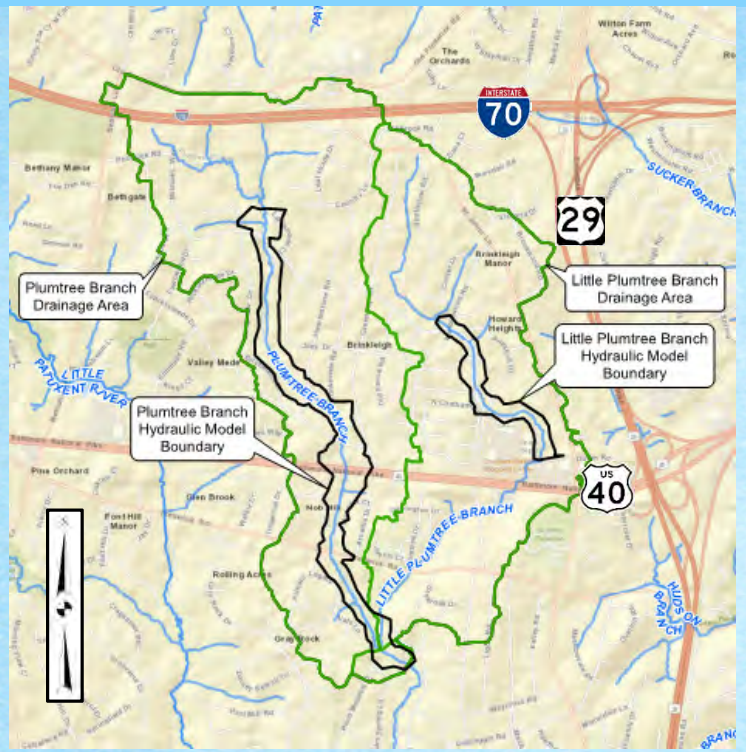
Background

What does the flood model do?

- Determines quantity of water through the reaches
- 12,000 linear ft on Plumtree Branch; 4,000 linear ft on Little Plumtree Branch
  - Amount, depth, velocity of water
  - July 30, 2016 Storm
  - “Standard” storms like the “100-year”



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Background

What is the “100-year Storm”?

- Has a 1% chance of happening in a given year (1 in 100)
  - 10 year storm has 10% chance (1 in 10)
  - 50 year storm has 2% chance (1 in 50)
- Can certainly happen more frequently
- The “1% Storm” is about 8.5 inches in 24 hours

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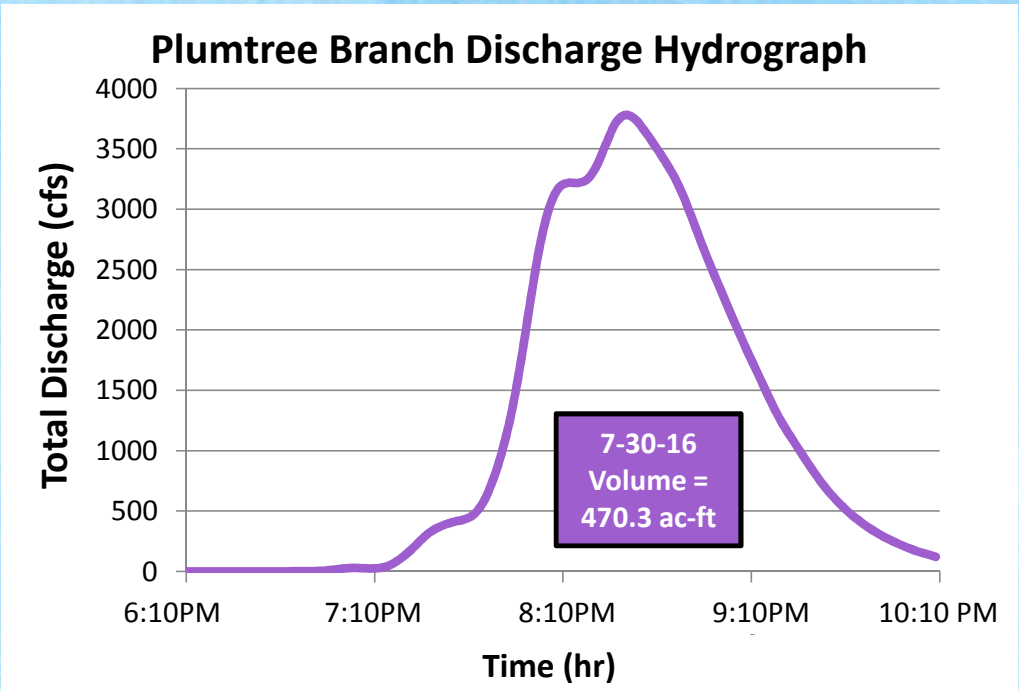
Background

What is a “Hydrograph”?

- Demonstrates the peak flow over time of a storm event
- Distribution of flow intensity
- Peak flow in cubic feet per second (cfs)
- The area under the curve is the total storm volume in cubic feet (20.5 million!)…
- …or, often expressed in “acre-feet”



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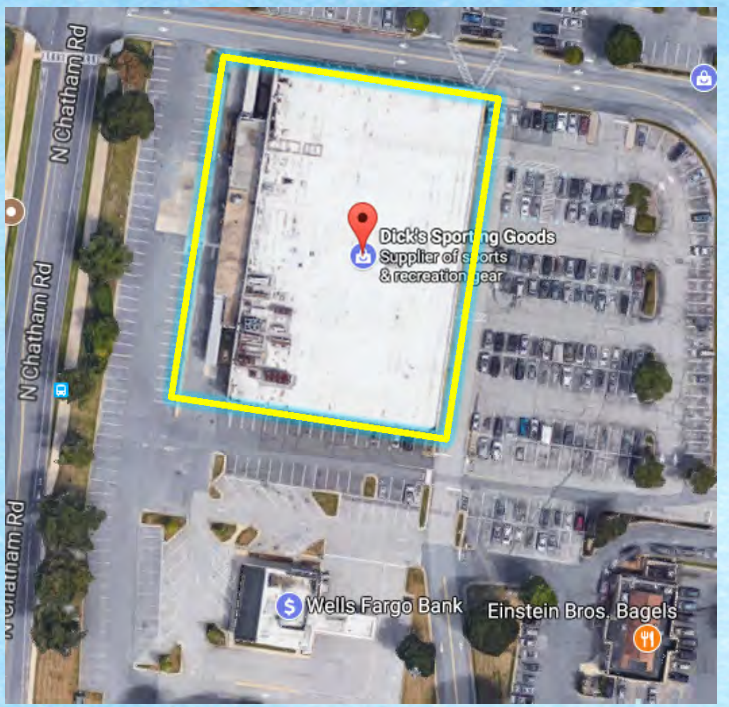
Background

How much is an acre-foot (ac-ft)?

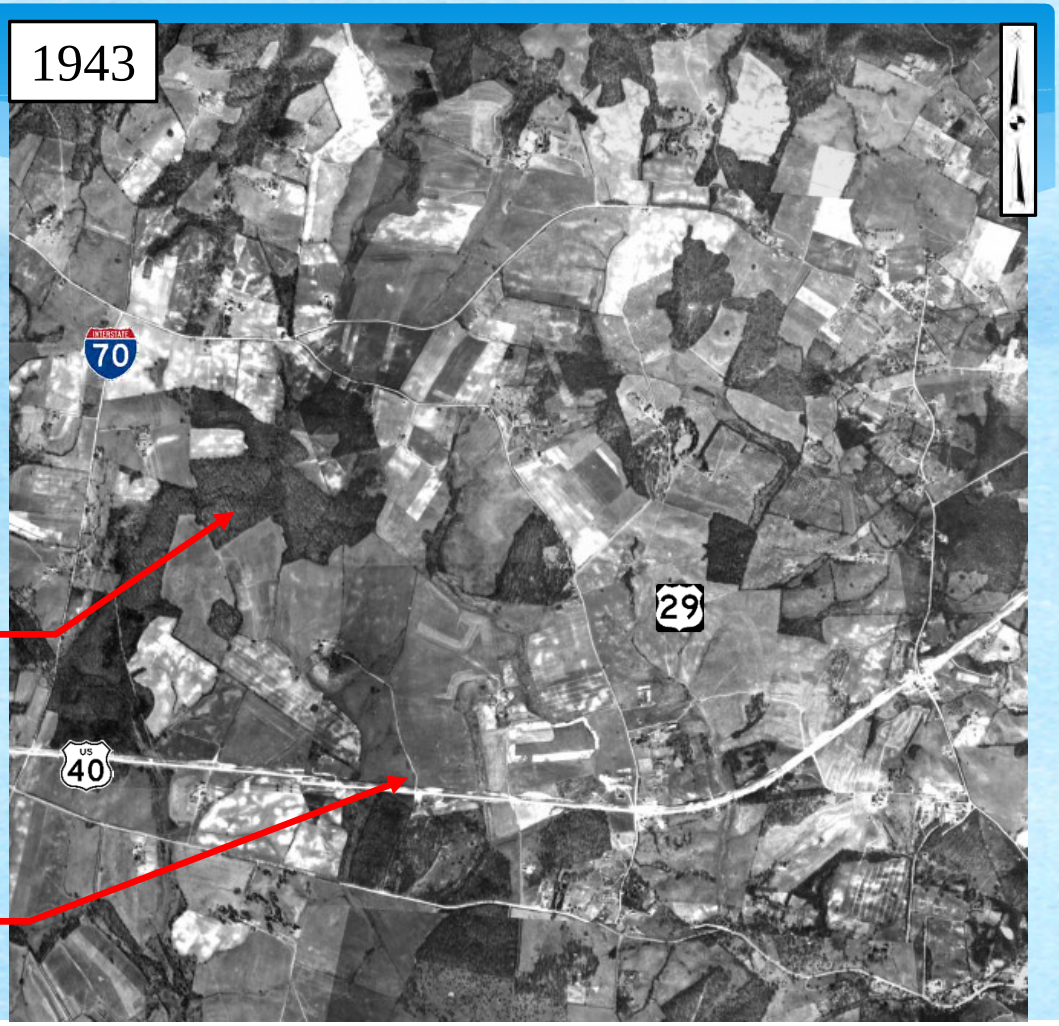
- 1 foot of water over a 1 acre area (43,560 cubic feet)

For example…

- Dick's Sporting Goods (Chatham Station Shopping Center)
- Approximately 1 acre in size
- 1 foot of water over Dick's = 1 acre-foot



Neighborhood History



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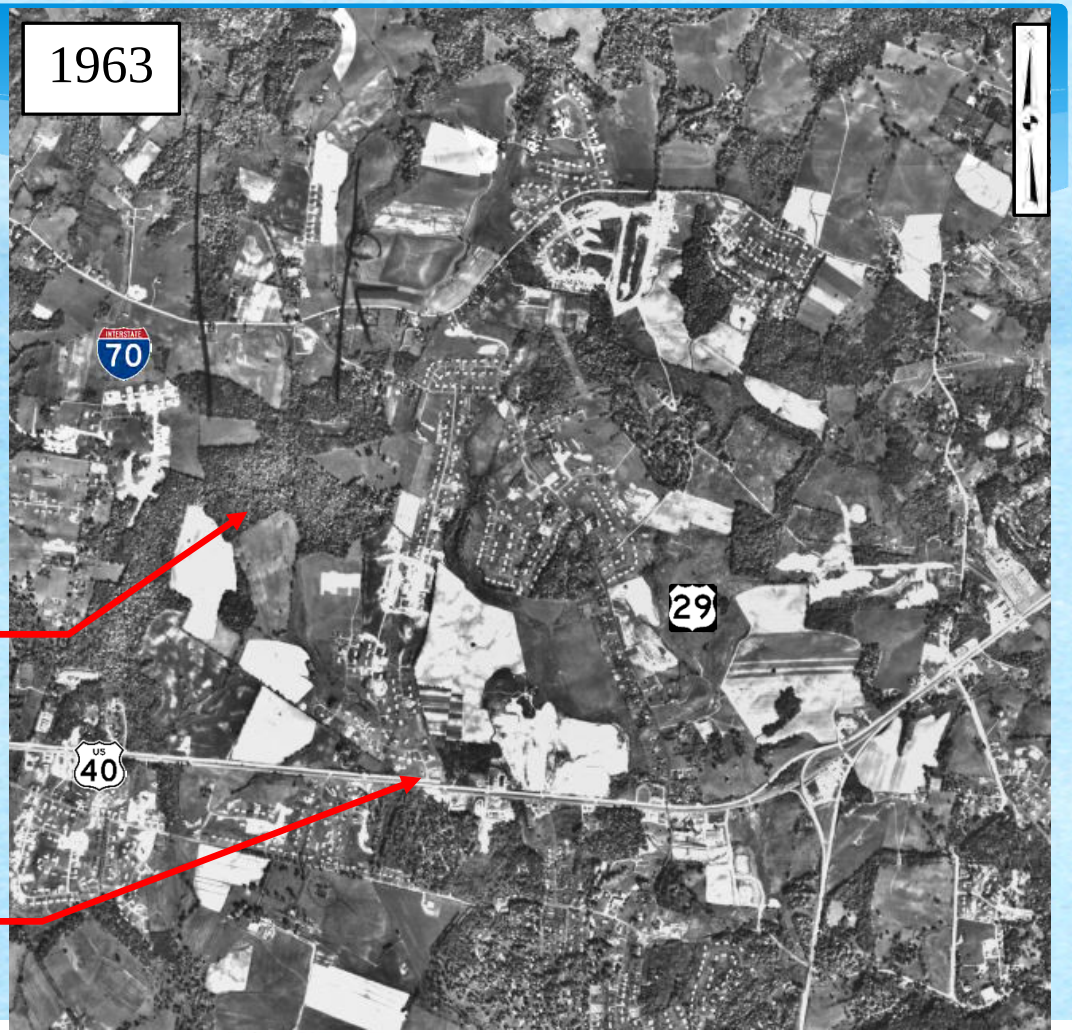
Neighborhood History



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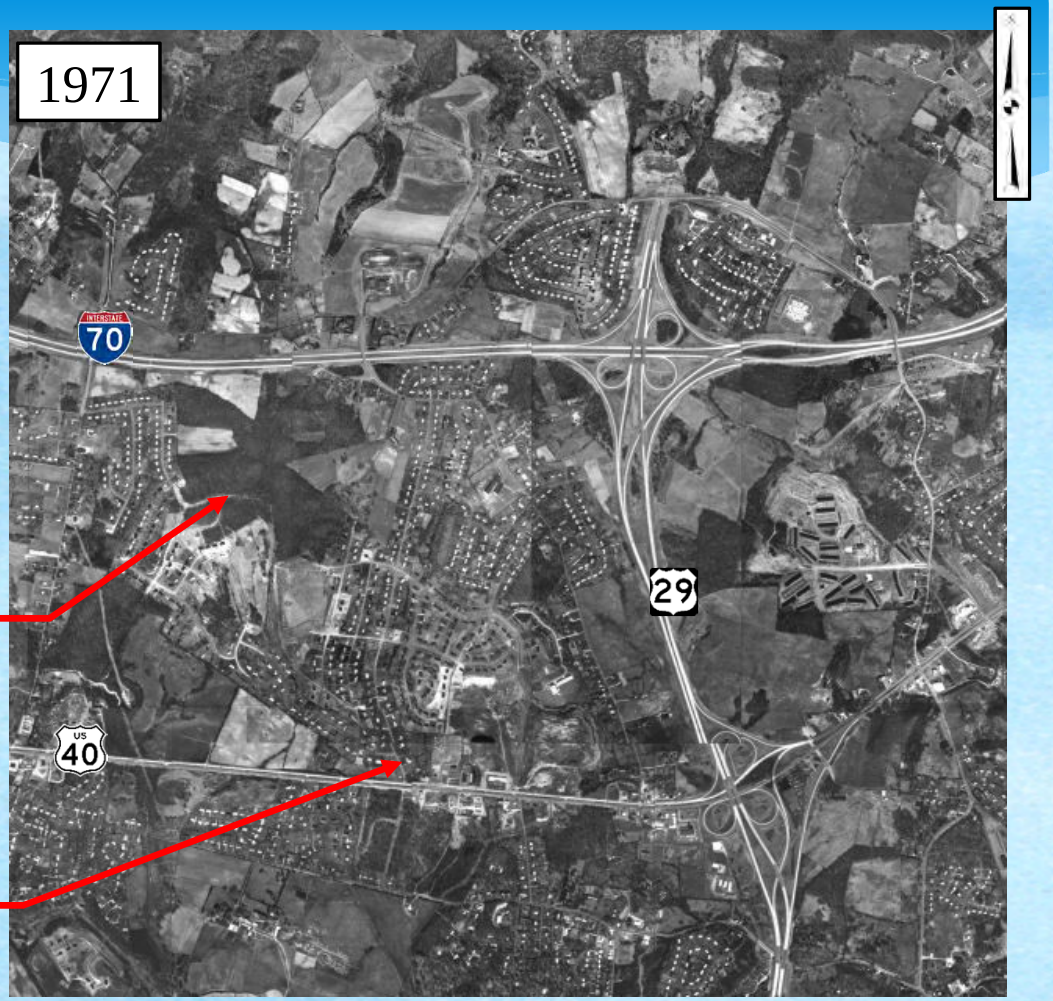
Neighborhood History



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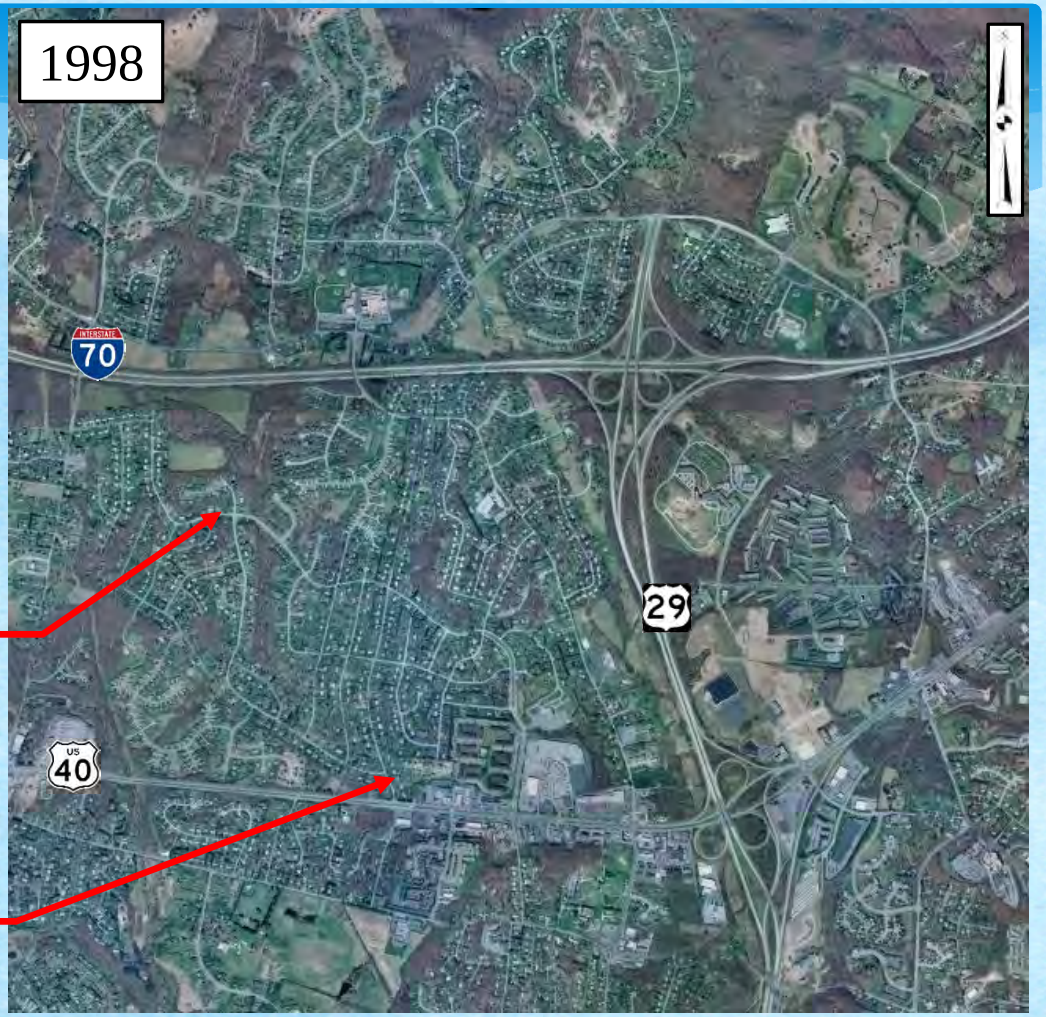
Neighborhood History



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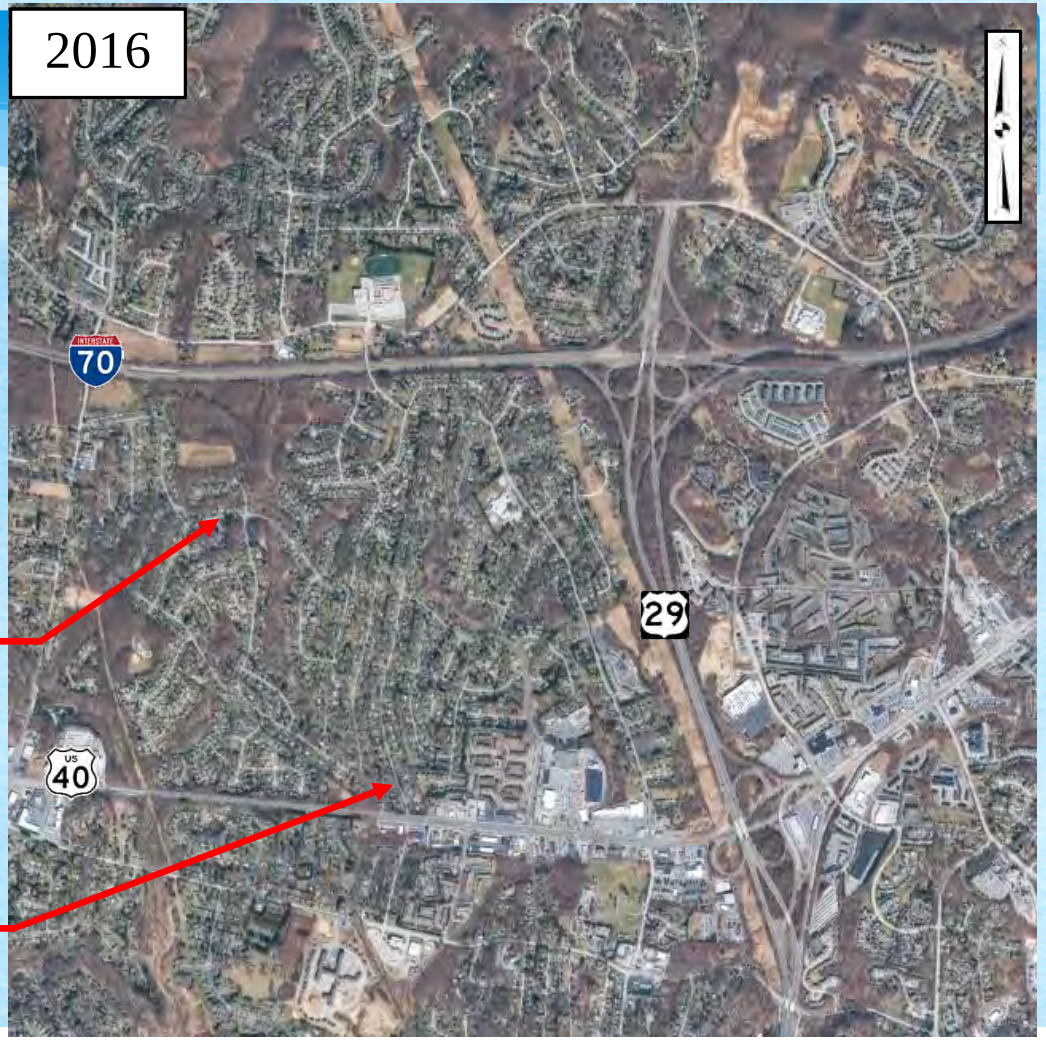

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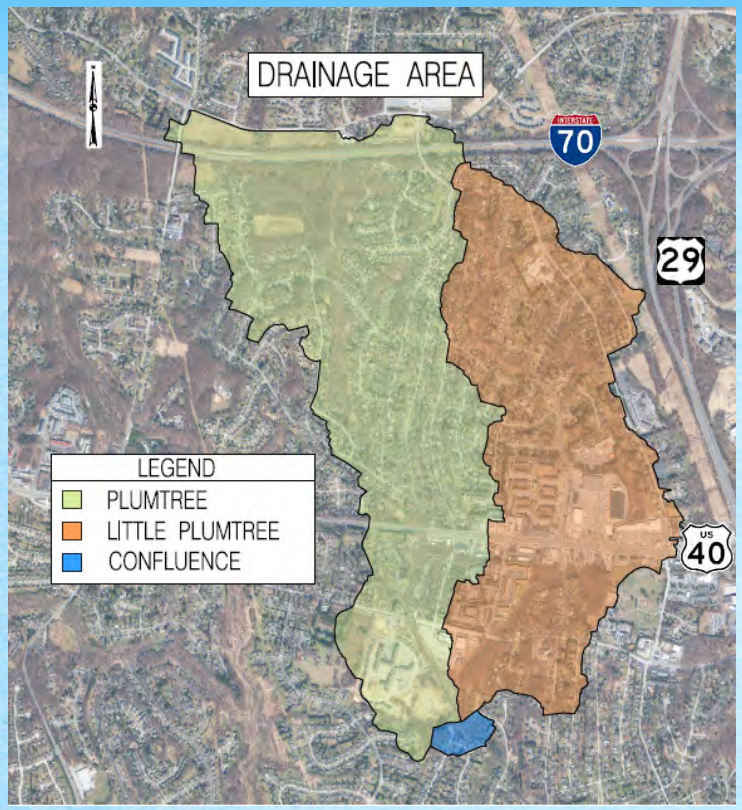
Watershed Hydrology

- Entire Watershed – 1.98 sq.mi. (37% impervious)
  - Plumtree Branch – 1.10 sq.mi.
  - Little Plumtree Branch – 0.86 sq.mi.
  - 10 Sub-areas for routing
- Peak Flow Determination
  - Calibration using Fixed Region Regression Equations
  - Ultimate land use based on zoning



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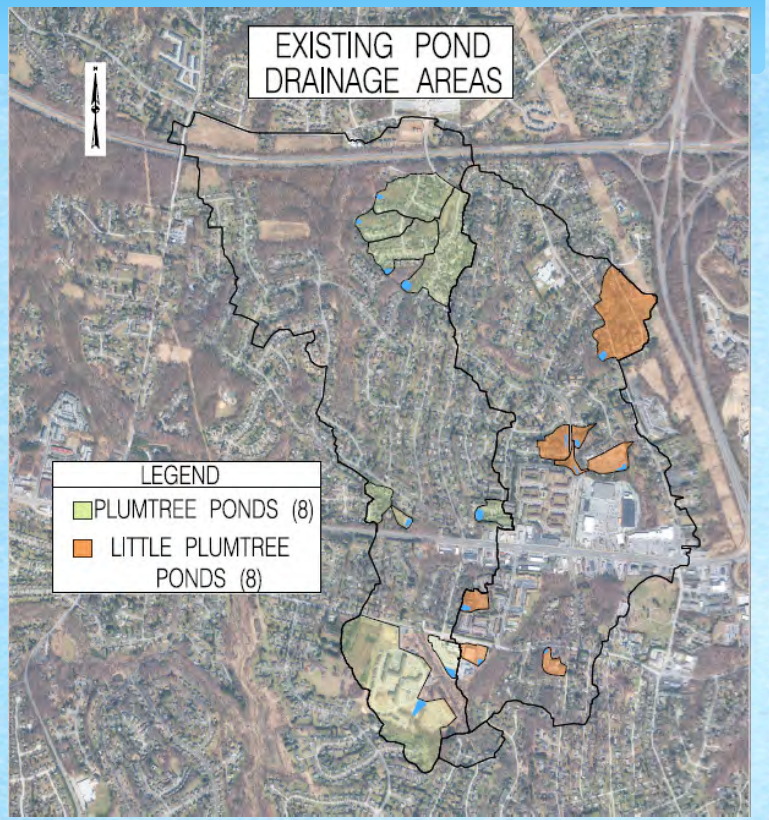
Watershed Hydrology

- Existing Stormwater Management
  - 16 ponds
    - 8 Ponds in Plumtree
    - 8 Ponds in Little Plumtree
  - 0.3 sq mi of drainage area (15% of watershed)
  - 10 ac-ft of storage



Watershed Hydrology

- Multiple Storm Scenarios
  - 100-year (a.k.a. 1%) 24-hour storm is the baseline
  - 10-year also examined
  - Recreated the 7/30/16 event (6.6 inches in ~3 hours)

- Used storm data from 7/30/16 to create and check the model
  - NWS rainfall data (3 minute intensity)
  - Same rainfall and distribution developed for Ellicott City
  - Storm Reports and Survey

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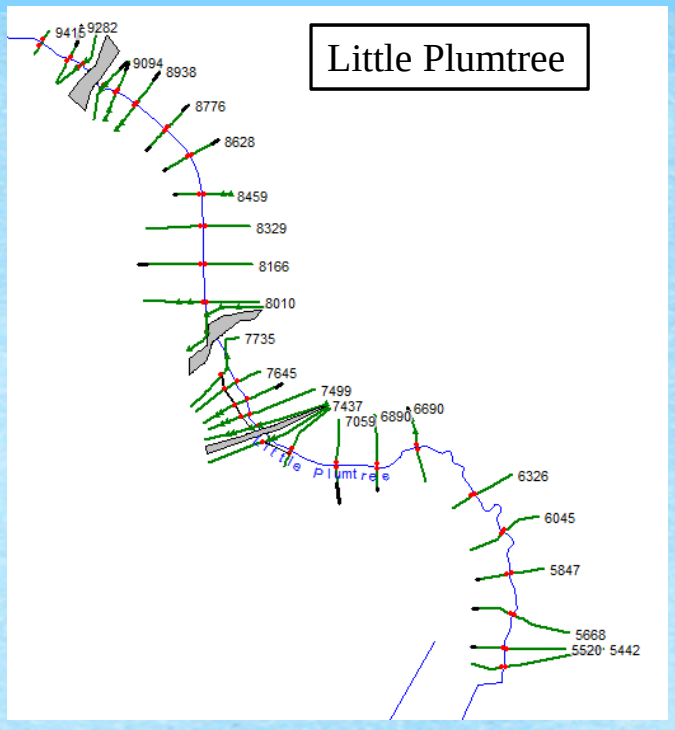
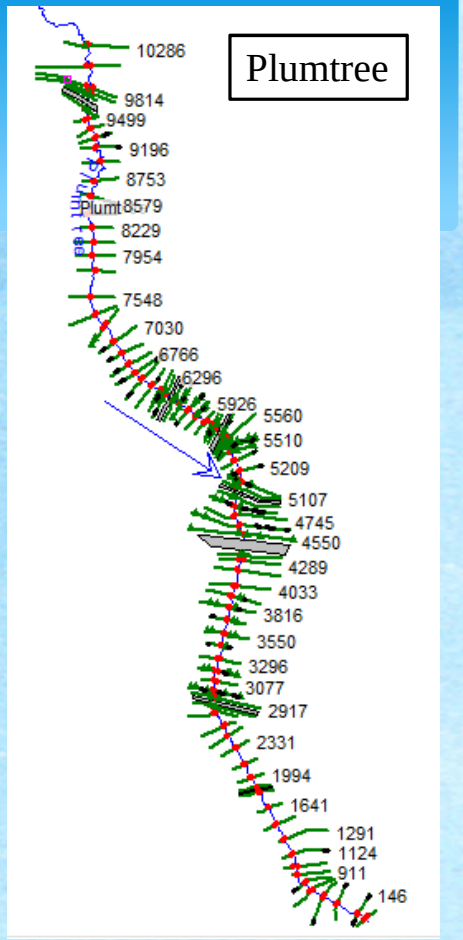
Hydraulic Modeling

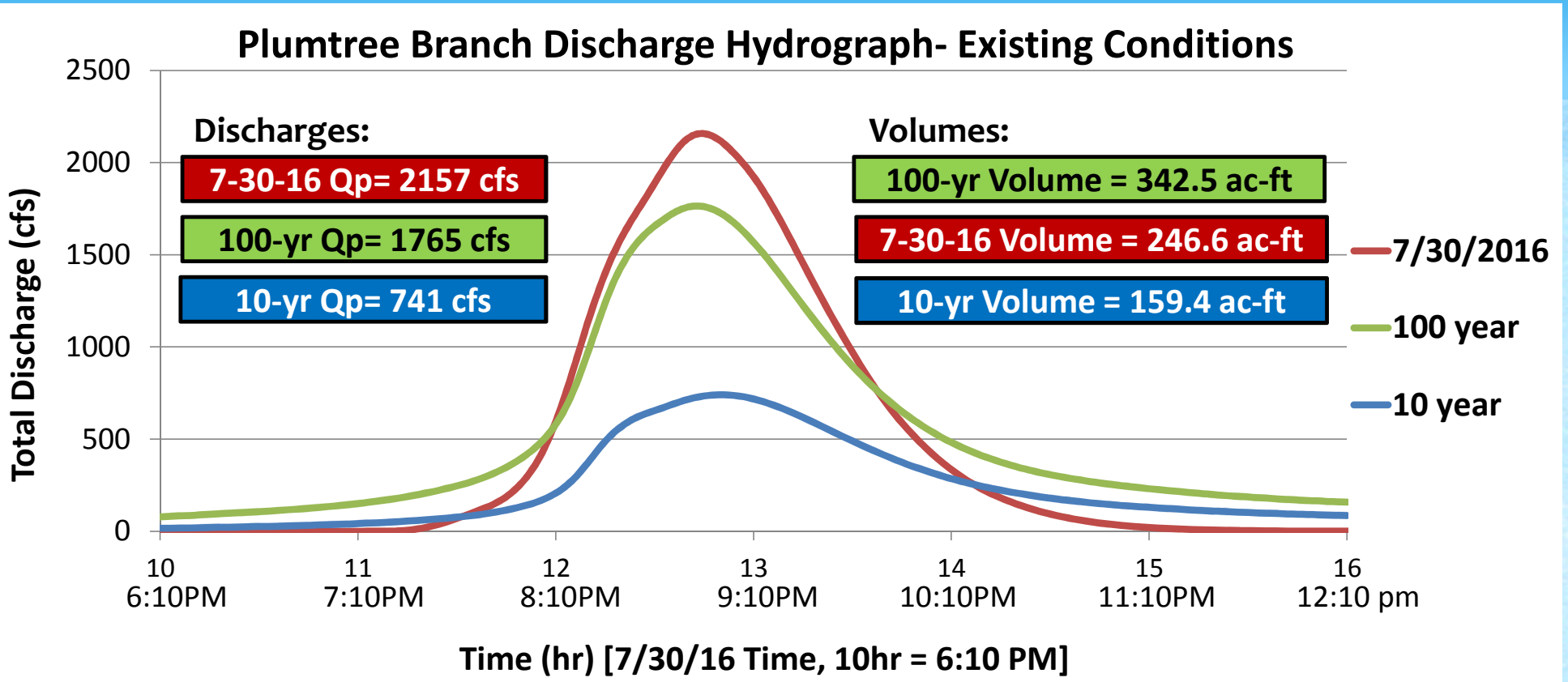
1-D Hydraulic Models (HEC-RAS) on Plumtree Branch and Little Plumtree Branch

- Each reach modeled independently
- Flow change locations along each channel





Storm Event Hydrographs – Plumtree Branch



Hydraulic Analysis – Plumtree Branch

100-yr Existing and 7/30/16 Storm Events

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Channel Zones – Plumtree Branch

Zones for Analysis Summary

- Zone 1: Upstream study limit to Hearthstone Road
- Zone 2: Hearthstone Road to US 40
- Zone 3: US 40 to Downstream study limit

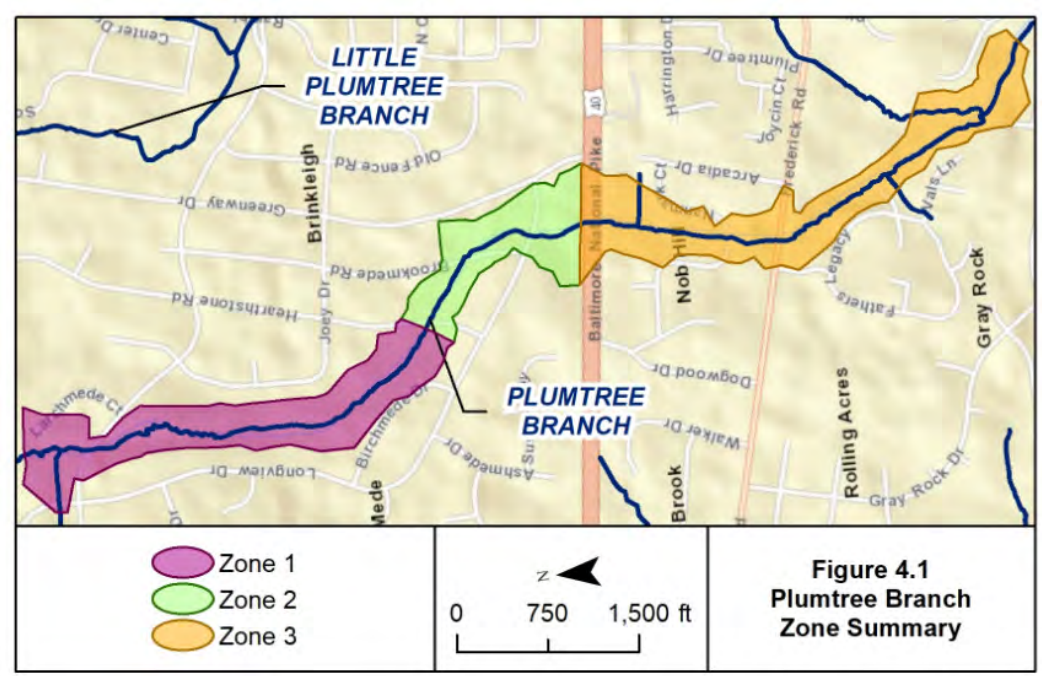


Figure 4.1
Plumtree Branch
Zone Summary

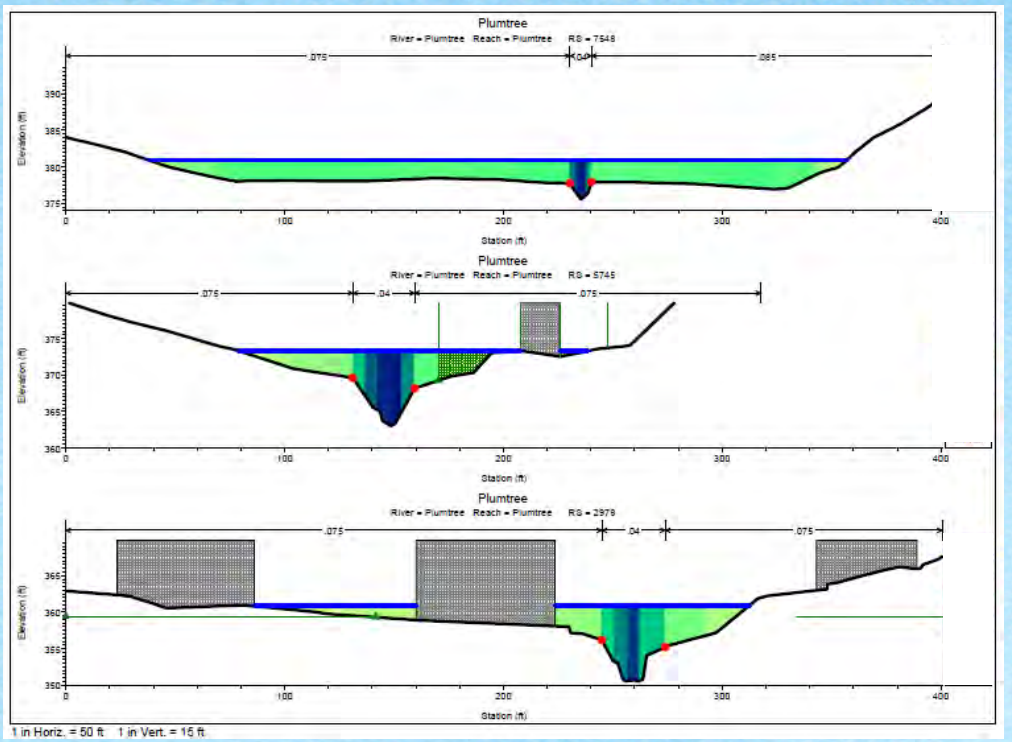
HEC-RAS Cross Section View - Plumtree Branch

100-yr – Existing

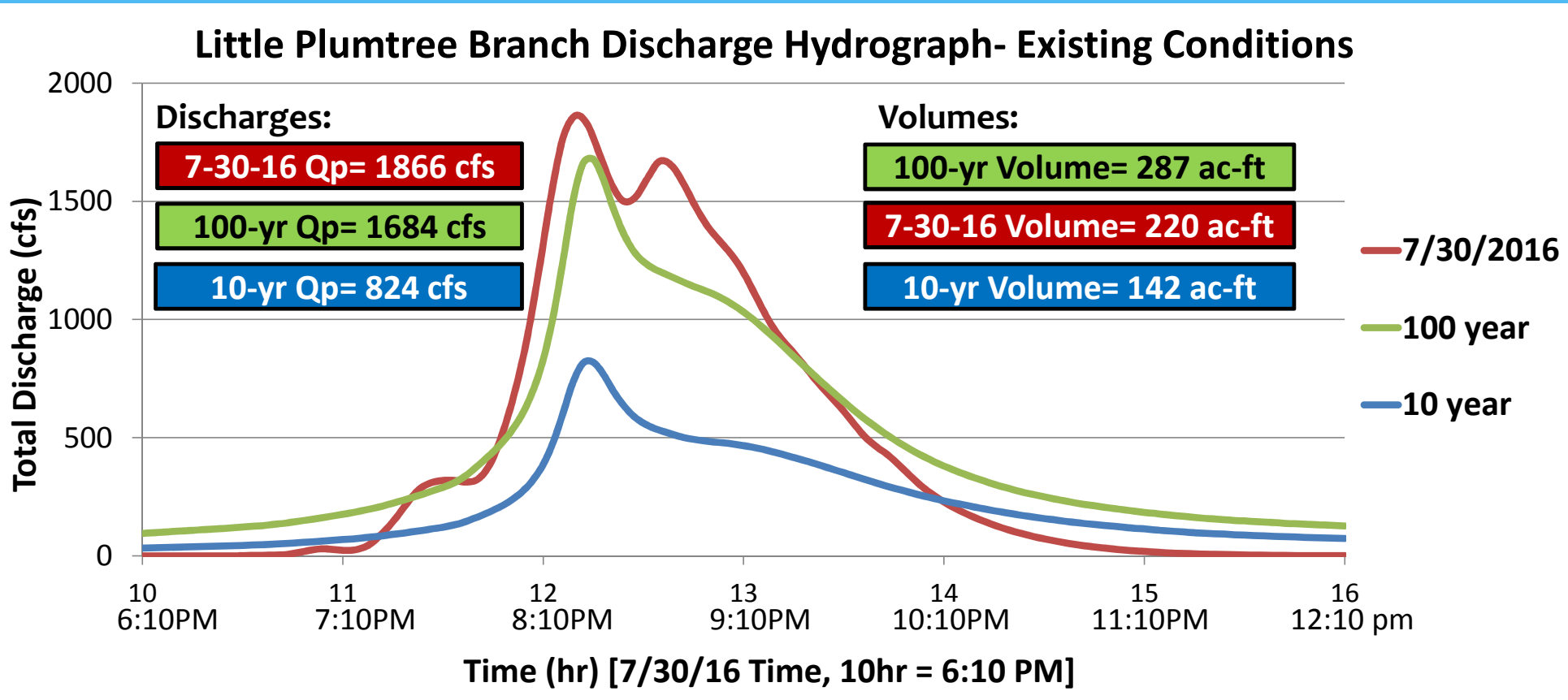
Zone 1
Cross section approximately 1300 ft upstream of Hearthstone Rd.

Zone 2
Cross section approximately 75 ft upstream of Brookmede Rd.

Zone 3
Cross section approximately 90 ft upstream of Frederick Rd.

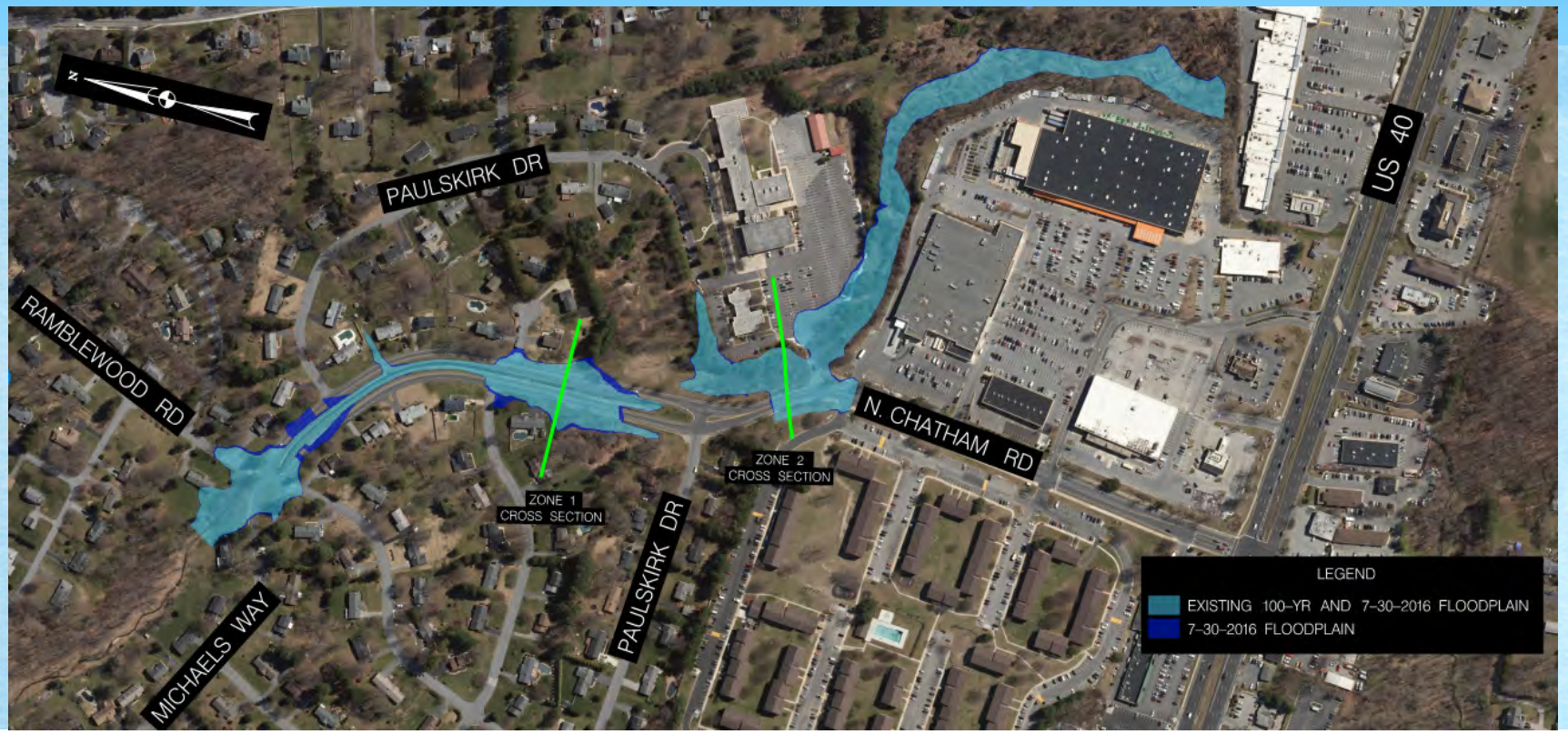


Storm Event Hydrographs – Little Plumtree Branch



Hydraulic Analysis – Little Plumtree Branch

100-yr Existing and 7/30/16 Storm Events



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Channel Zones – Little Plumtree Branch

Zones for Analysis Summary

- Zone 1: Upstream study limit to N. Chatham Rd
- Zone 2: N. Chatham Rd to Downstream study limit

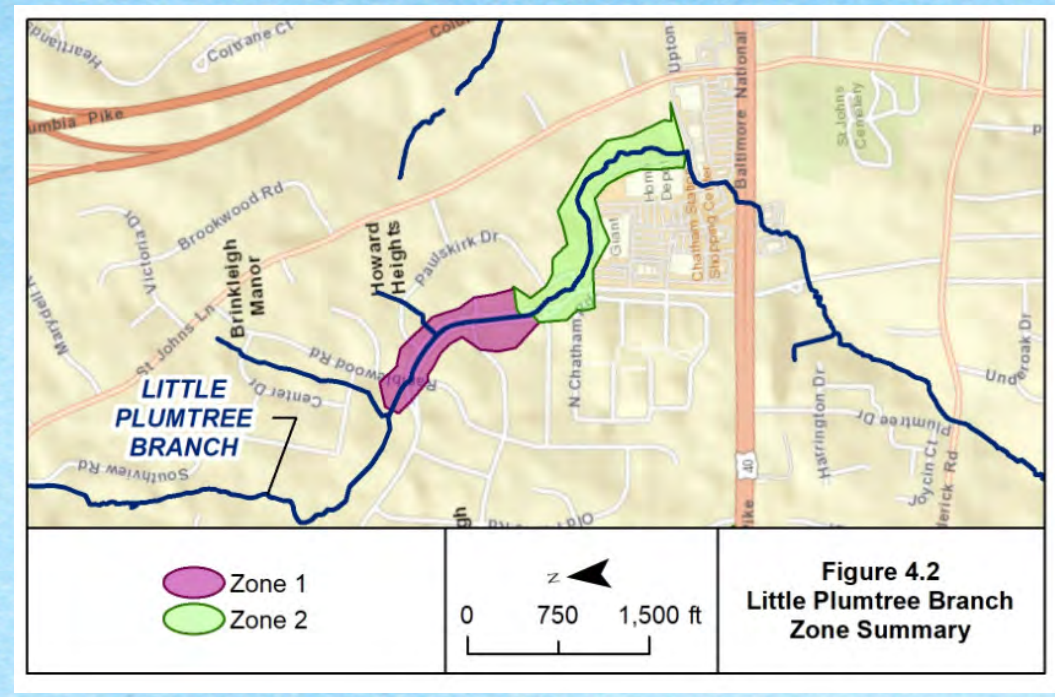


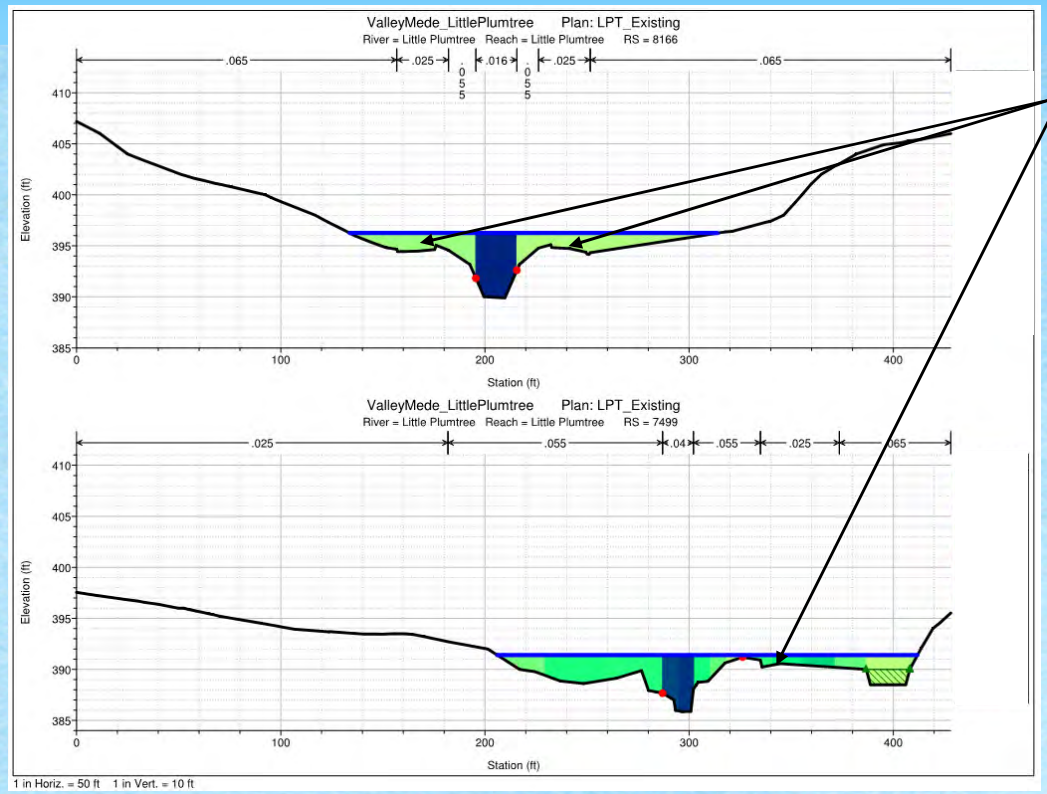
Figure 4.2
Little Plumtree Branch
Zone Summary

HEC-RAS Cross Section View – Little Plumtree Branch

100-yr – Existing

Zone 1
Cross section approximately 170 ft downstream of Joey Dr.

Zone 2
Cross section approximately 300 ft downstream of N. Chatham Dr.



N. Chatham Road

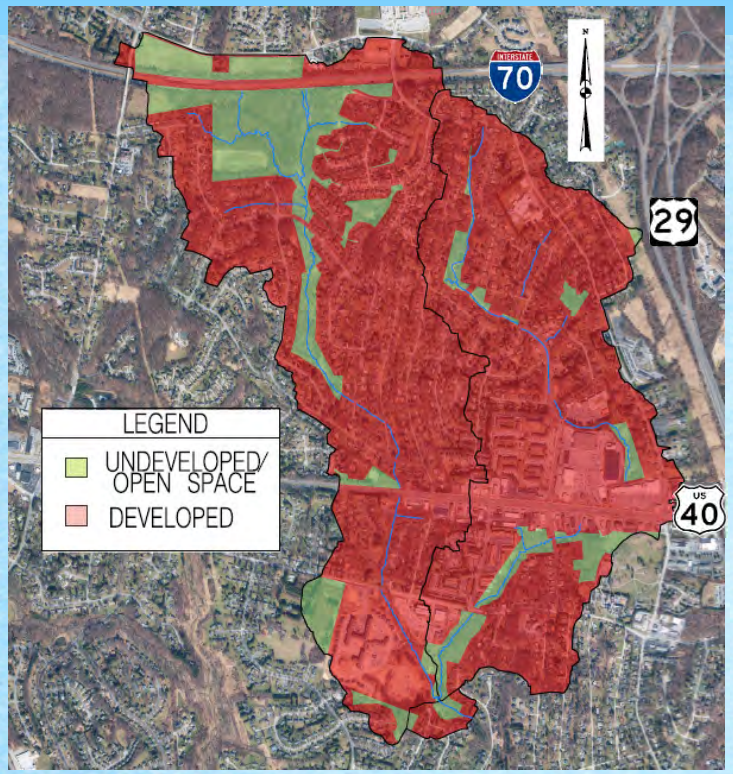
Part 1 - Questions

QUESTIONS ON MODELING AND EXISTING CONDITIONS?

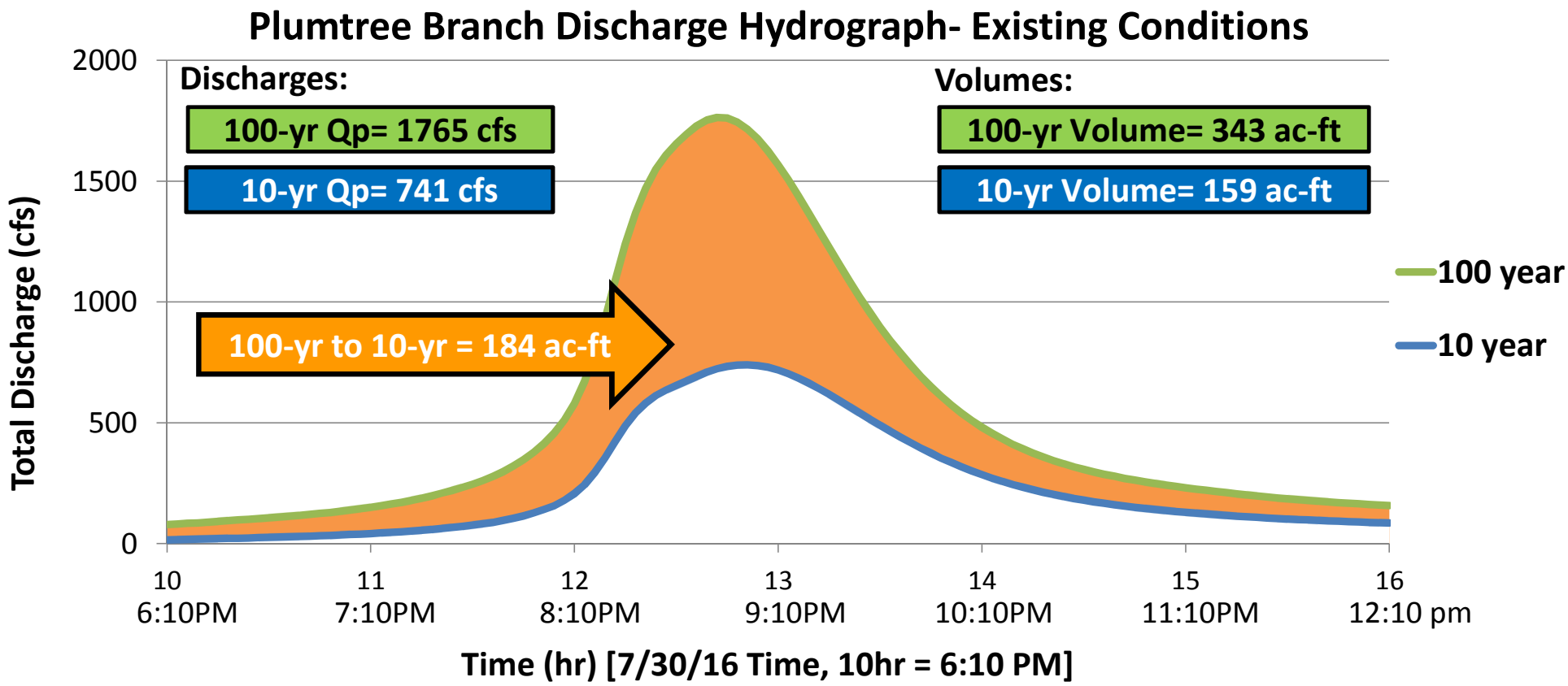
Mitigation Strategy

Improvement Concepts on Plumtree Branch and Little Plumtree Branch

- Stormwater Management (SWM) Improvements
  - Large online storage ponds
  - Existing SWM pond expansion
- Capacity and Conveyance Improvements
  - Converting culverts to bridges
  - Additional culverts or bypass pipes
- Mitigation Options Modeled:
  - Plumtree Branch: 9 Options
  - Little Plumtree Branch: 4 Options



Storm Event Hydrographs – Plumtree Branch



Modeling Results – Plumtree Branch

100-yr Existing and 10-yr Existing

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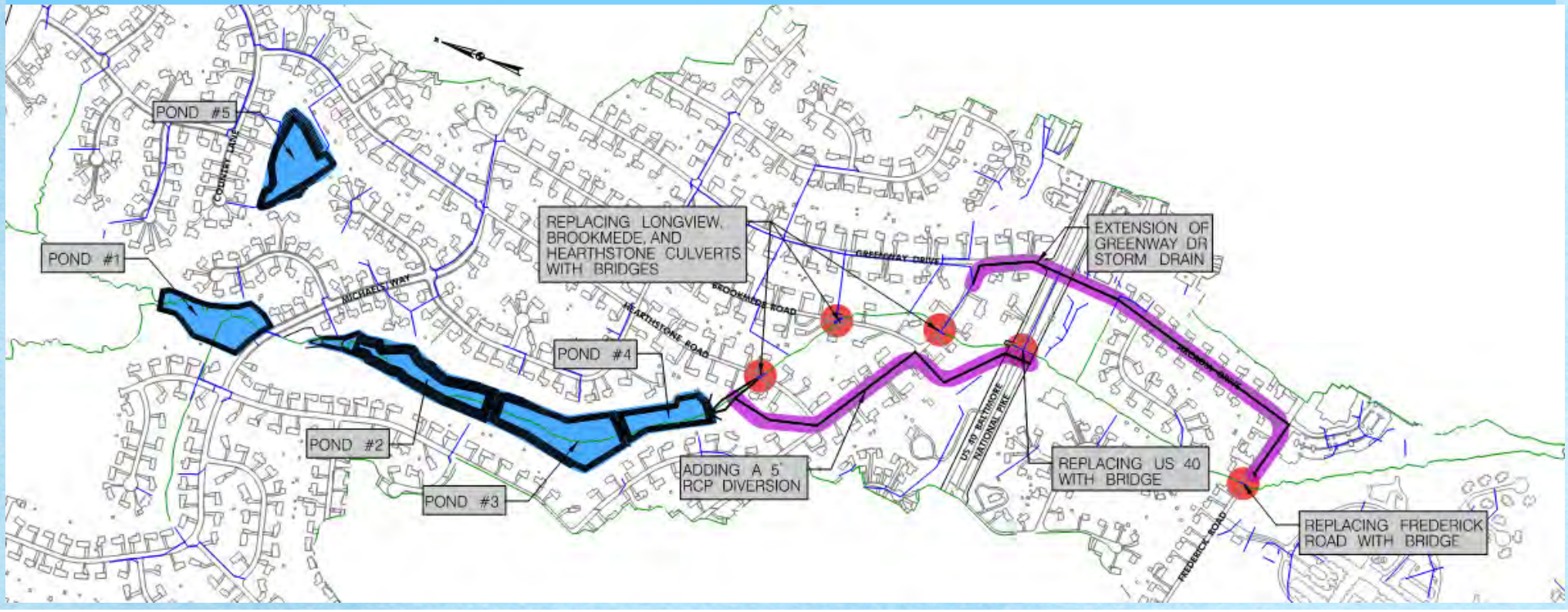
Mitigation Concepts – Plumtree Branch



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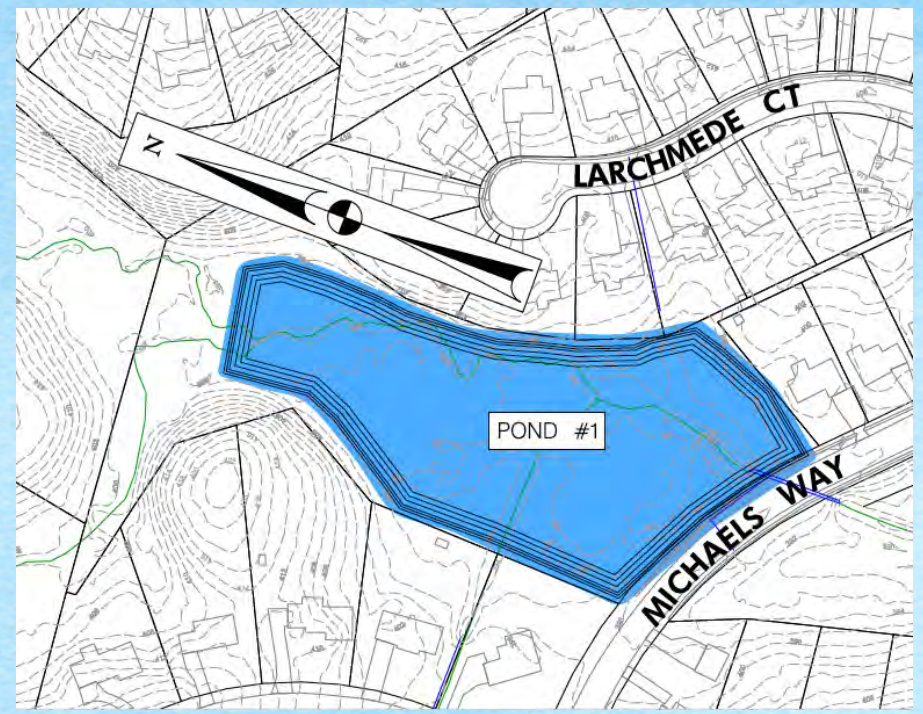
Potential Storage: Plumtree Branch

Large Scale SWM Ponds

- 1 large online facility above Michaels Way- 23 ac-ft (Pond #1)
- 3 large online facilities below Michaels Way – 132 ac-ft (Ponds #2-4)
- 1 off-line facility retrofit near Country Lane – 23 ac-ft (Pond #5)



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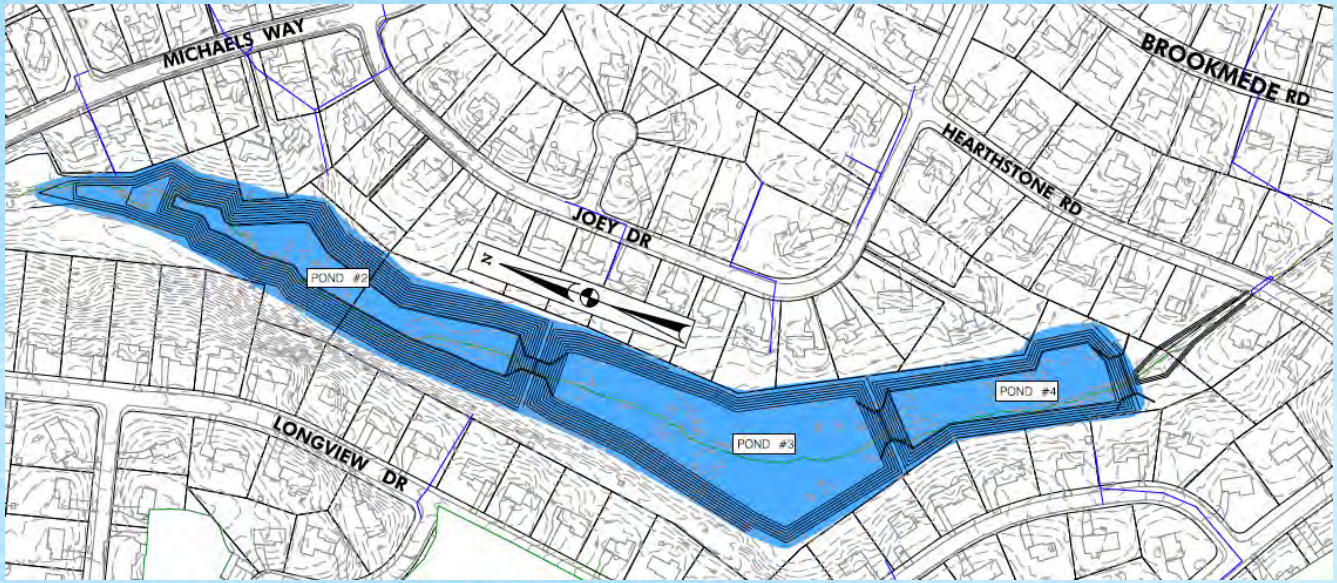

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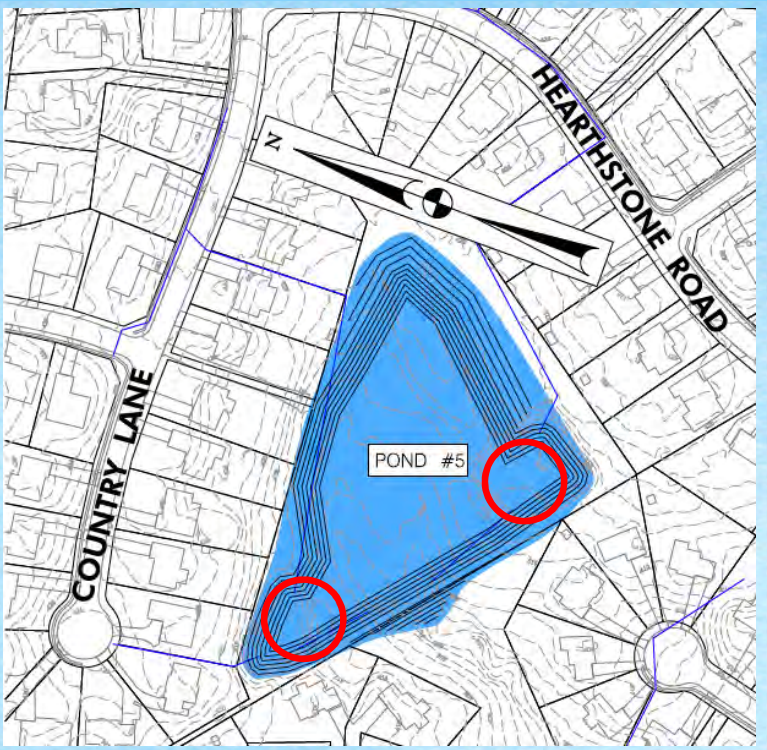
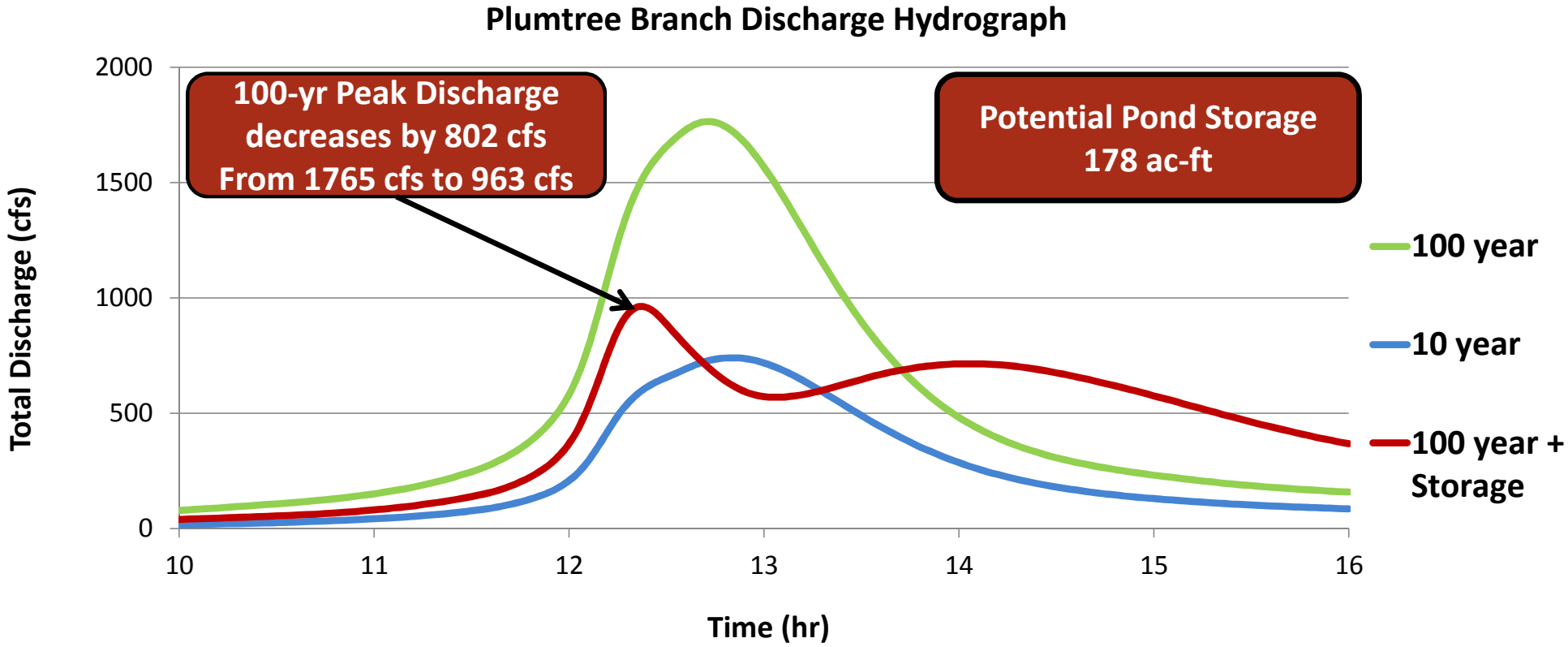


Potential Hydrograph – Plumtree Branch



Potential Conveyance Improvements: Plumtree Branch

Conversion of Cross Culverts to Bridges

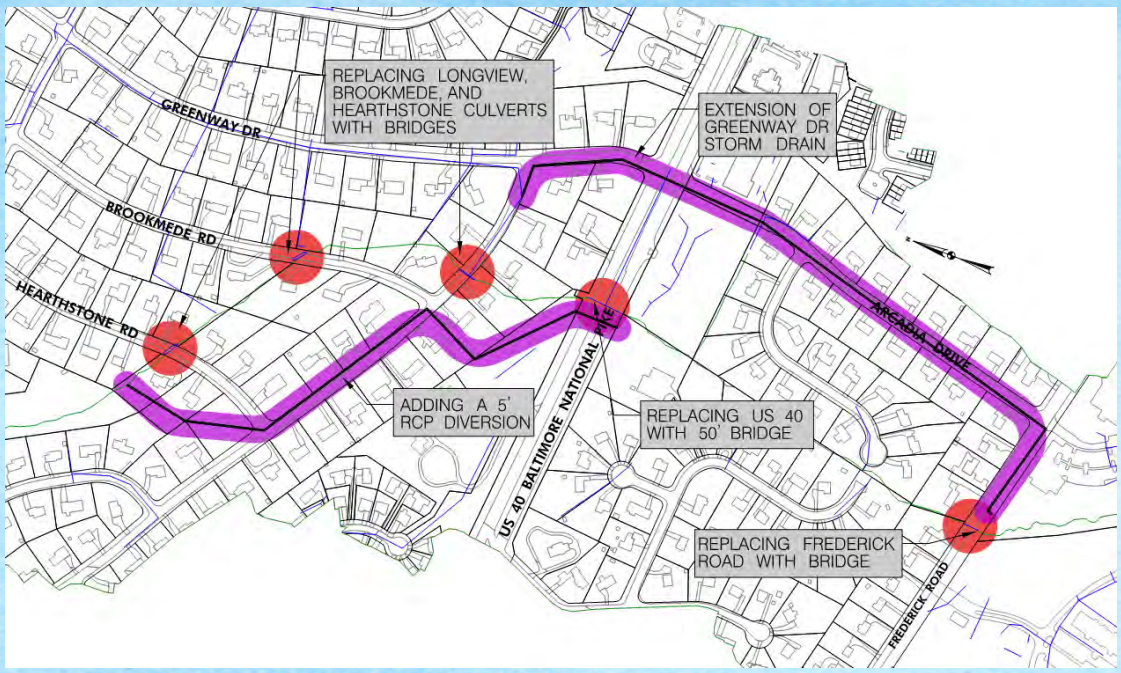
- Structures at Hearthstone Road, Brookmede Road, Longview Drive, US 40, and Frederick Road

Diversion Pipe

- 5’ diversion pipe from Hearthstone Road to US 40

Storm Drain Extension

- 5’ Culvert extension from existing network along Greenway Drive to Frederick Road

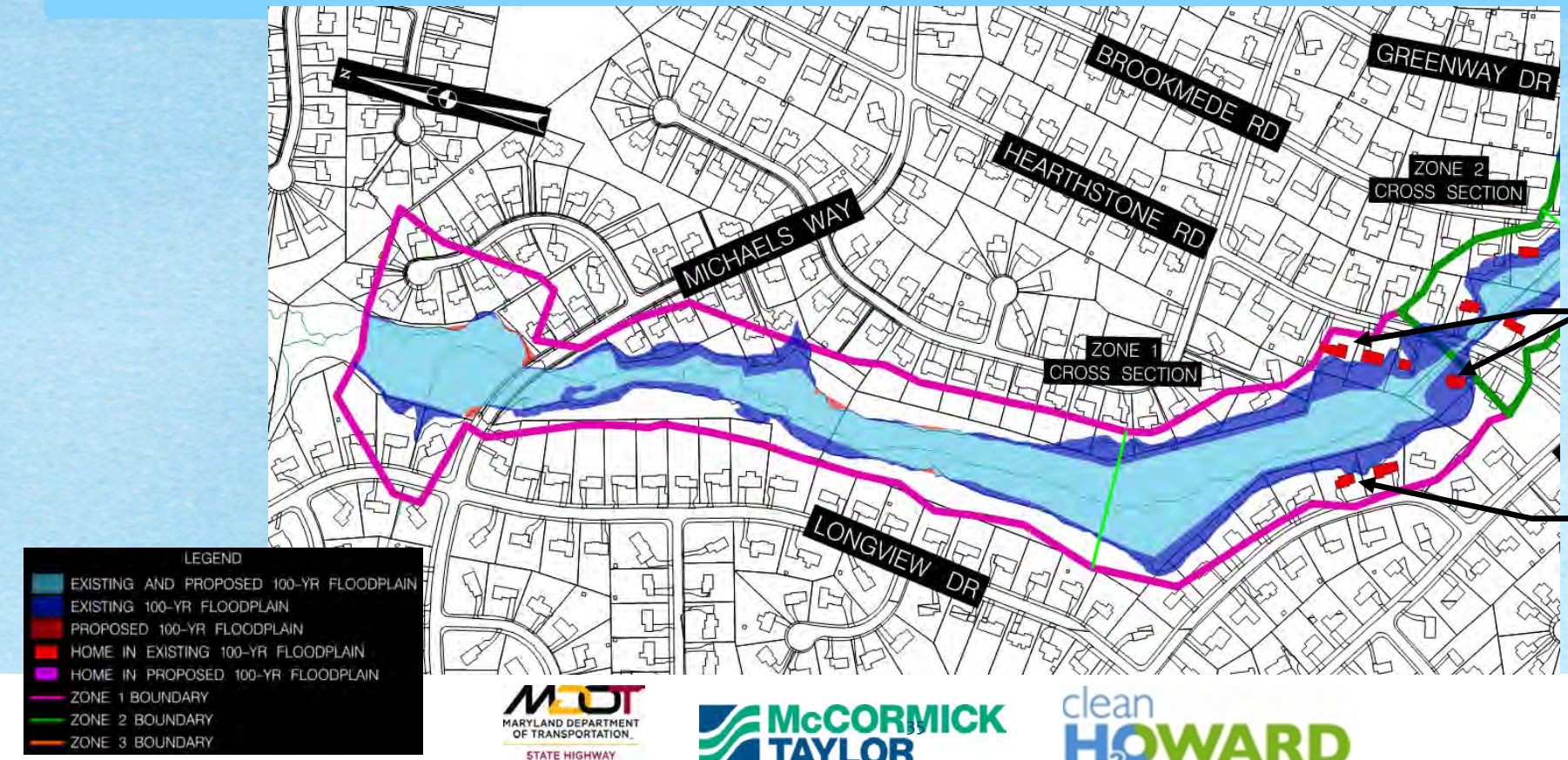


Modeling Results – Plumtree Branch

100-yr Storage and Conveyance Improvements and 100-yr Existing

Modeling Results – Zone 1

100-yr Storage and Conveyance Improvements and 100-yr Existing



3214 to 3230 Hearthstone Rd

3225 and 3229 Hearthstone Rd

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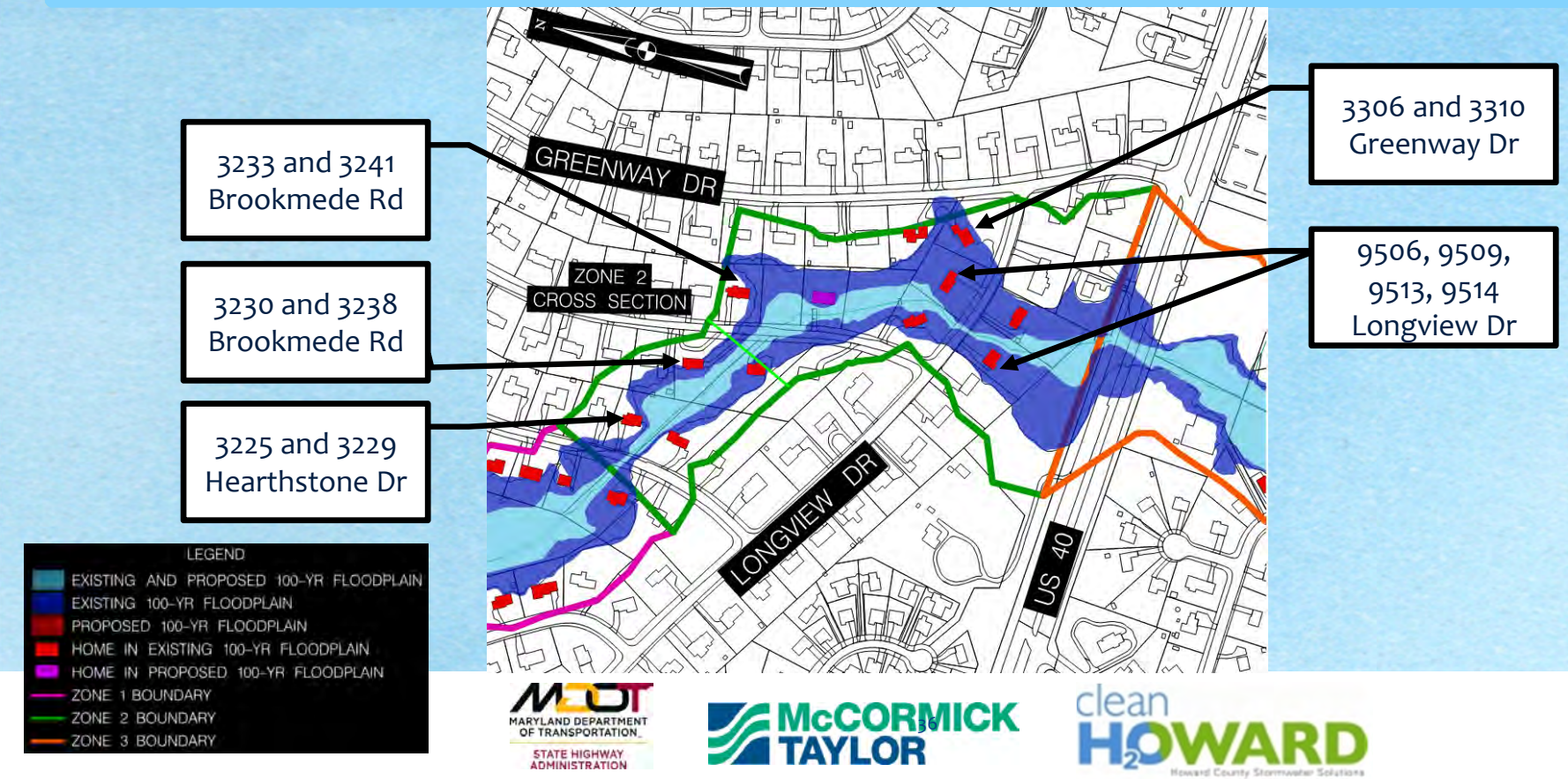
Modeling Results – Zone 2

100-yr Storage and Conveyance Improvements and 100-yr Existing



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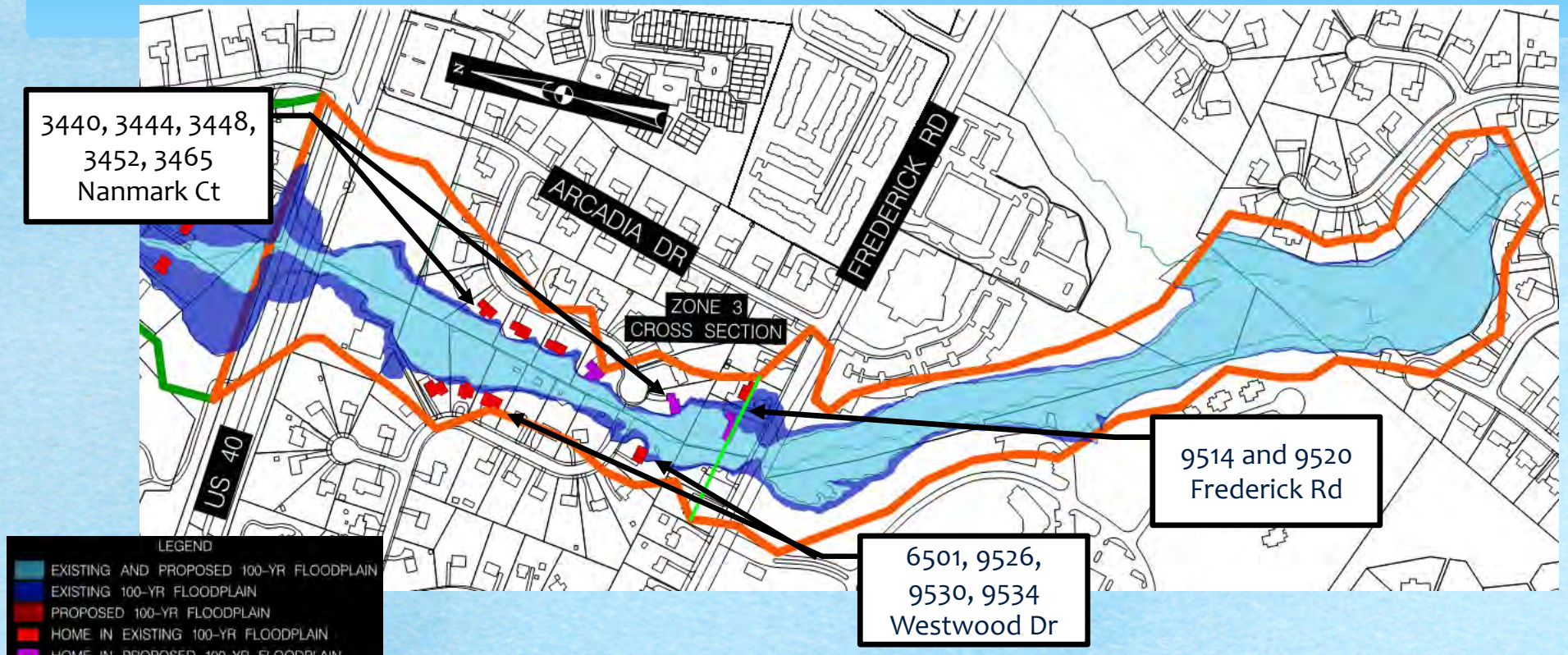
Modeling Results – Zone 3

100-yr Storage and Conveyance Improvements and 100-yr Existing



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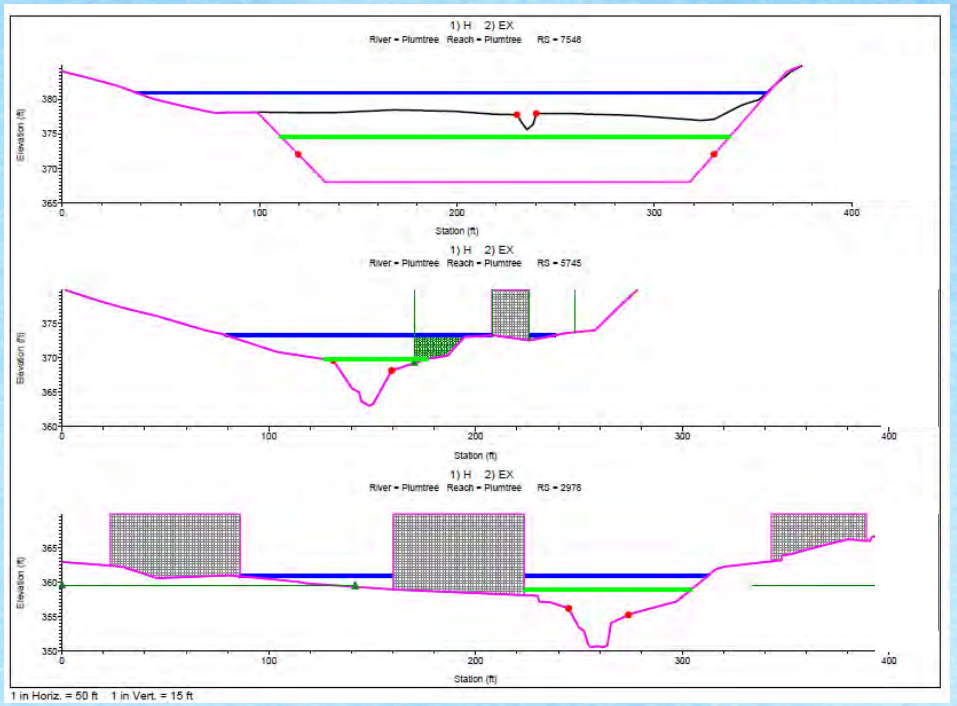
HEC-RAS Cross Section View - Plumtree Branch

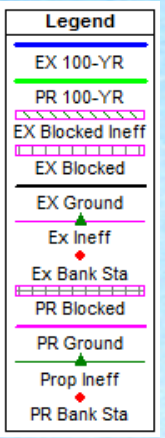
100-yr Storage and Conveyance Improvements and 100-yr Existing

Zone 1
Elevation Reduction: 6.3 ft
Width Reduction: 91 ft

Zone 2
Elevation Reduction: 3.5 ft
Width Reduction: 92 ft

Zone 3
Elevation Reduction: 2 ft
Width Reduction: 82 ft





Localized Storm Drain Improvements – Plumtree Branch

- Case Study of the 2016 Valley Mede Flood Event
- Modifying existing storm drain (increased capacity, outfall locations)
- Limited stormdrain easements

3229 Birchmede Dr.

3209 Birchmede Dr.

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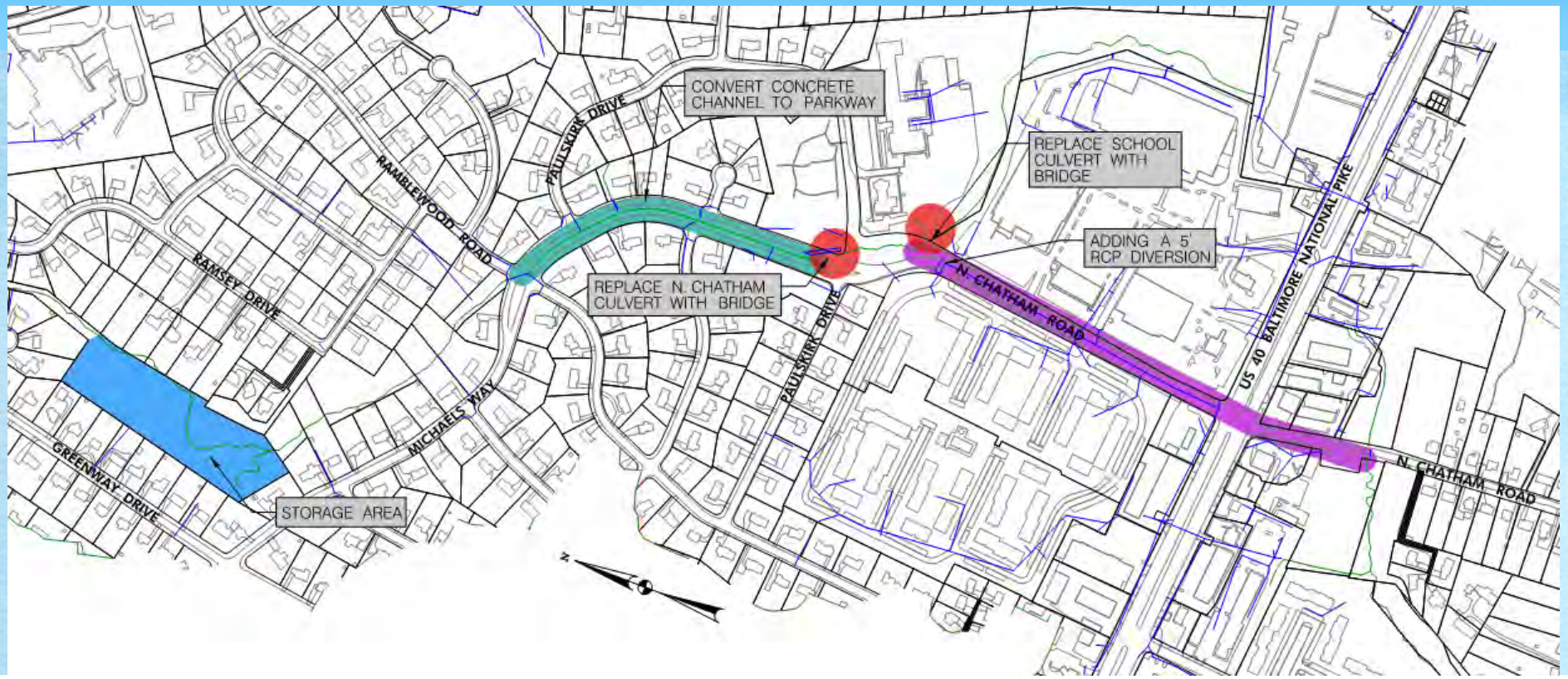
Mitigation Concepts – Little Plumtree Branch



Potential Conveyance Improvements – Little Plumtree Branch

Conversion of Cross Culverts to Bridges

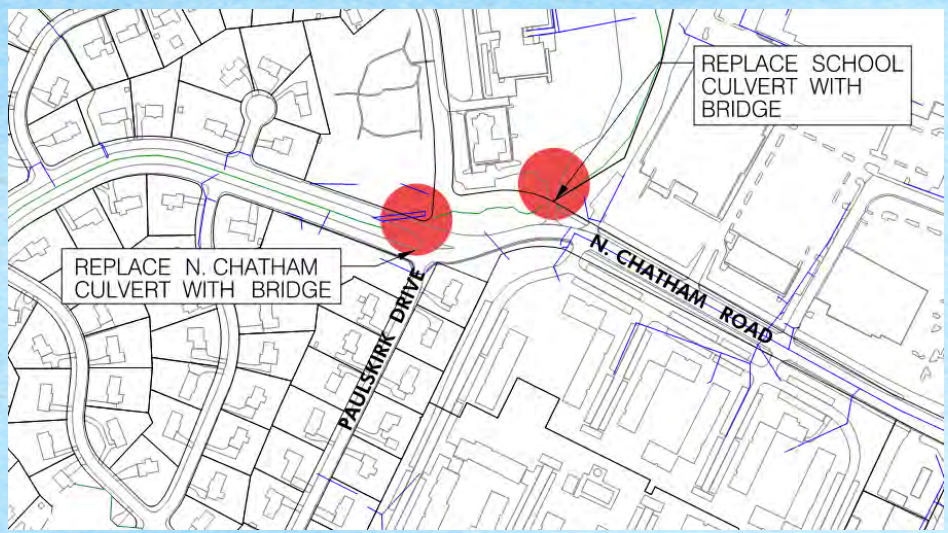
- Structures at N. Chatham Road and Private School/Church Entrance

Diversion Pipe

- 5’ diversion pipe from N. Chatham Road culvert to below US 40

Parkway

- Conversion of open concrete channel along N. Chatham Road to a closed system parkway with pedestrian path on top



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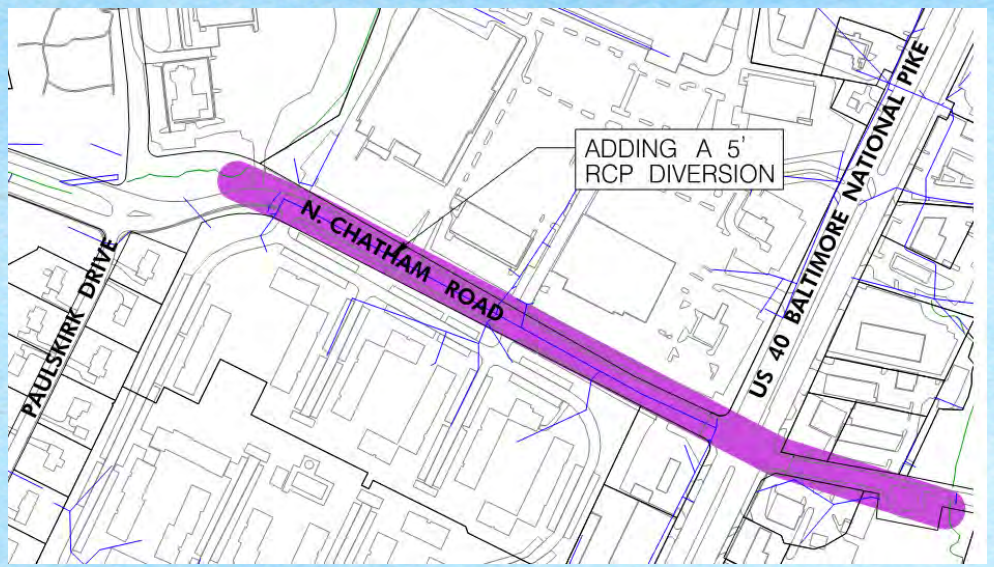

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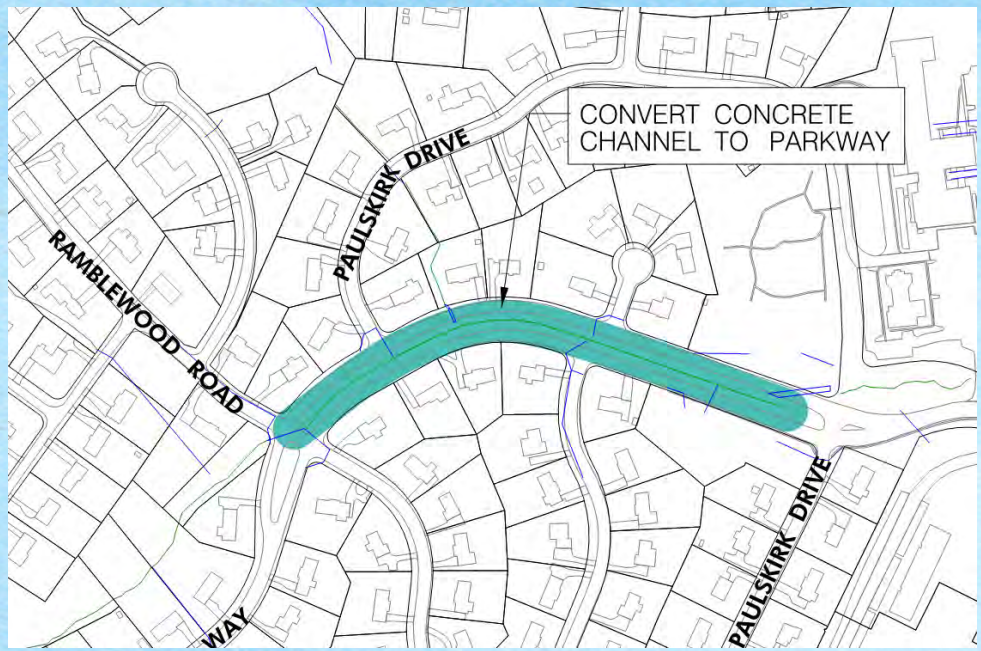
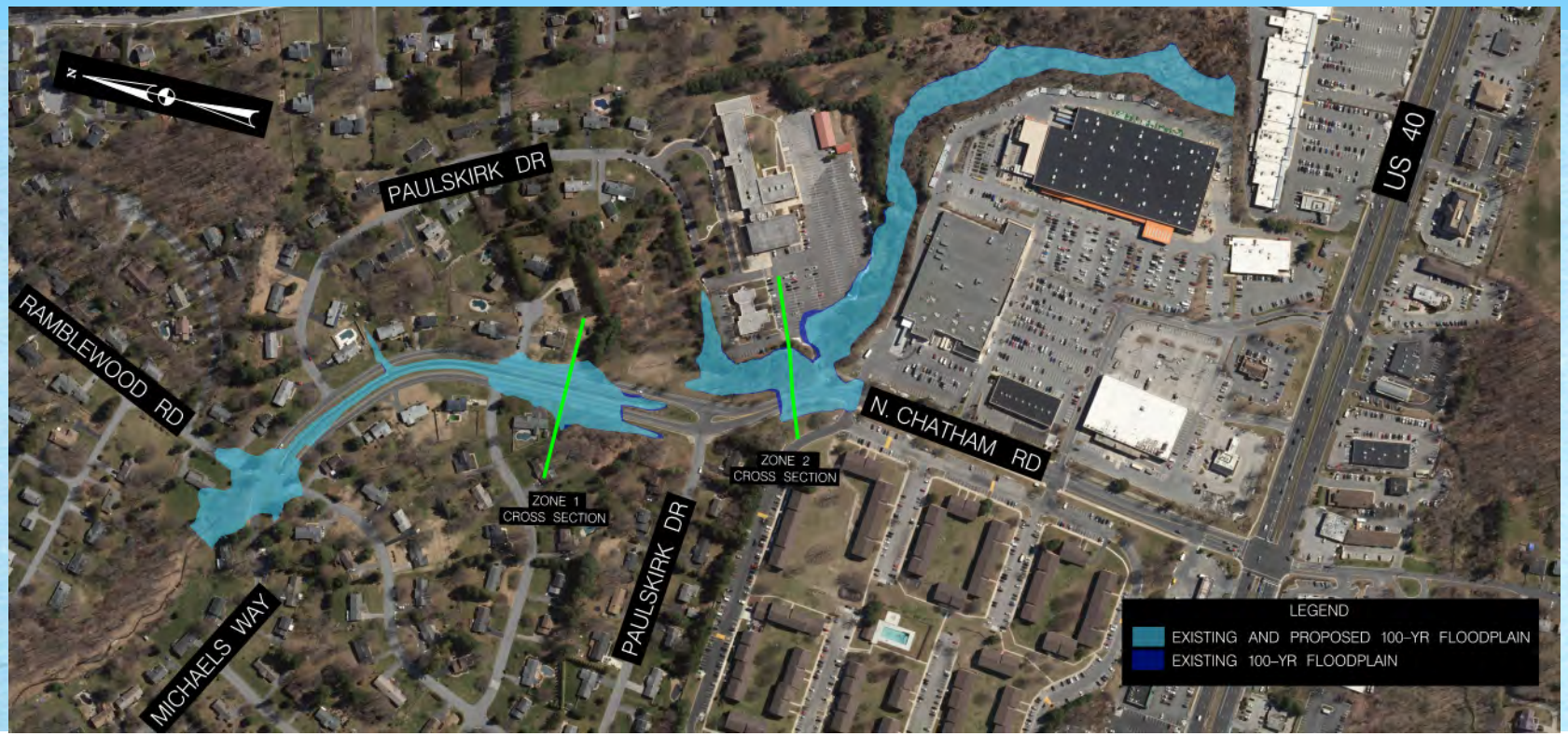


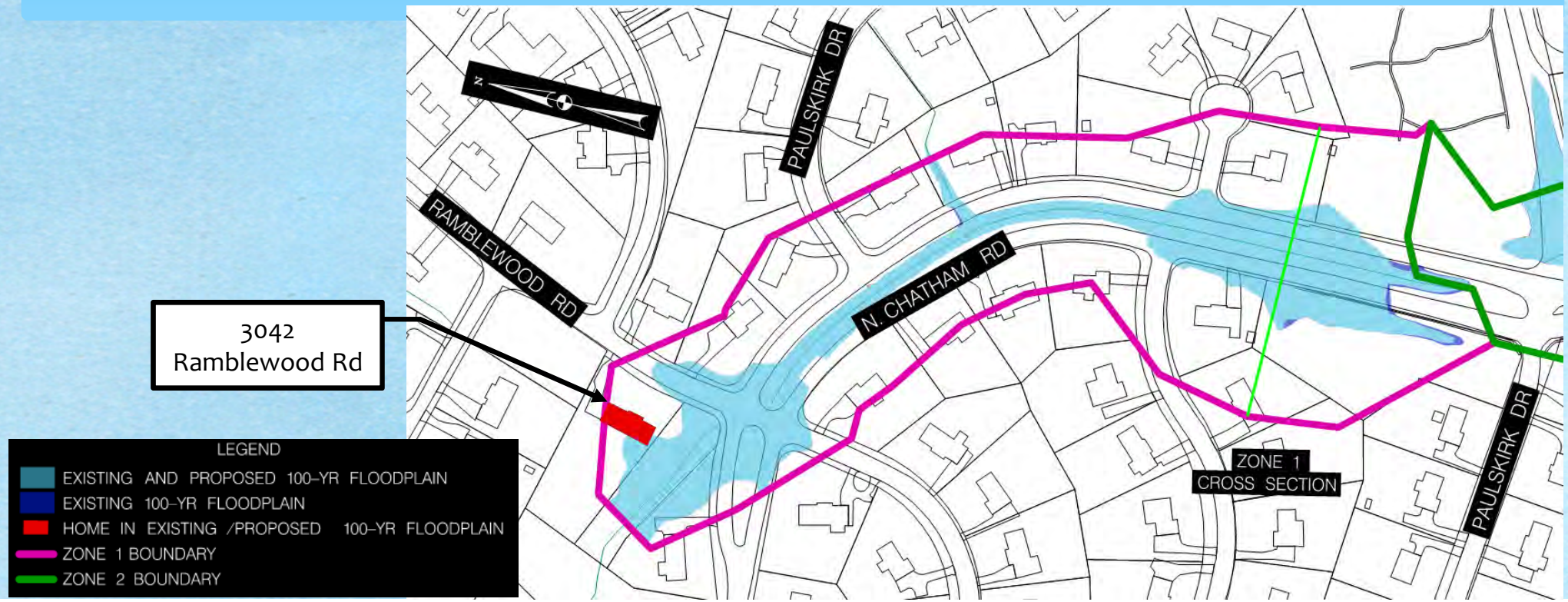
Modeling Results – Little Plumtree Branch

100-yr Conveyance and 100-yr Existing



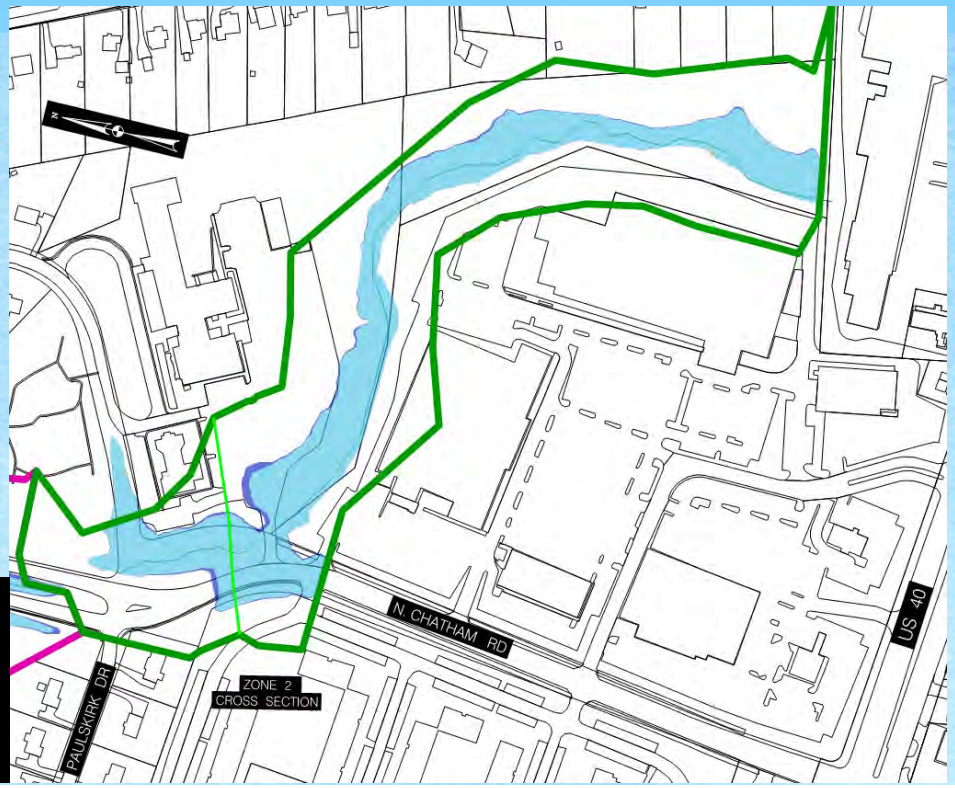
Modeling Results – Zone 1

100-yr Conveyance and 100-yr Existing



Modeling Results – Zone 2

100-yr Conveyance and 100-yr Existing



LEGEND

- EXISTING AND PROPOSED 100–YR FLOODPLAIN
- EXISTING 100–YR FLOODPLAIN
- HOME IN EXISTING /PROPOSED 100–YR FLOODPLAIN
- ZONE 1 BOUNDARY
- ZONE 2 BOUNDARY

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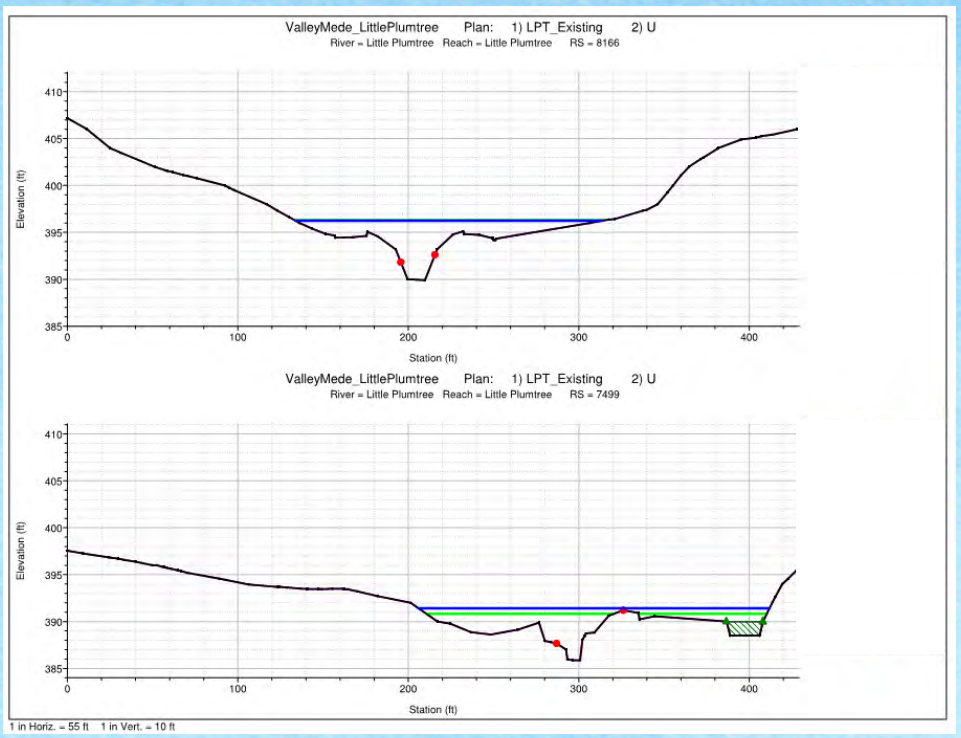
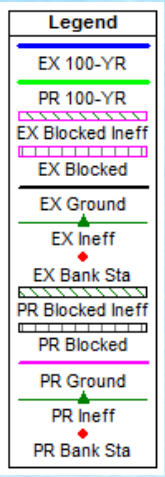
HEC-RAS Cross Section View - Little Plumtree Branch

100-yr Conveyance Improvements and 100-yr Existing

Zone 1
Elevation Reduction: 0 ft
Width Reduction: 0 ft

Zone 2
Elevation Reduction: 0.6 ft
Width Reduction: 6 ft





Localized Storm Drain Improvements – Little Plumtree Branch

- Case Study of the 2016 Valley Mede Flood Event
- Modifying existing storm drain (increased capacity, outfall locations)
- Open channel and storm drain flow

N. Chatham Rd at Paulskirk Dr.

Paulskirk Drive at N. Chatham Rd.

Pond Expansion

Storm Drain Relocate

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

McCORMICK TAYLOR

clean HOWARD
Howard County Stormwater Solutions

Watershed Approach and Cost Summary

- 15 hydraulic models with varying results
- Plumtree ($37.4M)
  - 5 Structures - $18M
    - Hearthstone Rd – $2.5M
    - Brookmede Rd – $2.5M
    - Longview Dr – $2.5M
    - US 40 – $7.5M
    - Frederick Rd – $3M
  - 5 Ponds - $14M
  - Hearthstone Diversion - $1.3M
  - Greenway Storm Drain Extension - $1.7M
  - 12 Localized Storm Drain Improvements - $2.4M
- Little Plumtree ($36.6M)
  - 2 Structures - $5M
    - N. Chatham Rd - $3M
    - Church Entrance - $2M
  - Diversion - $4.4M
  - Parkway - $26M
  - 6 Localized Storm Drain Improvements - $1.2M

Concluding Thoughts

- Plumtree
  - Reductions in water surface elevations and roadway overtopping
  - 27 of 31 homes removed from 100-year floodplain impacts
- Little Plumtree
  - Negligible reductions in water surface elevations and roadway overtopping still occurs
- Localized improvements
  - Small storm drain projects
- Mitigation options are conceptual and will have a large impact on the community. Further discussion is needed with the community.

Questions?

What can we help explain better?

For comments and questions please email:
stormwater@howardcountymd.gov

To download presentation and report:
www.howardcountymd.gov/swm