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

By: Amy Hribar, P.E.
Cara Lyons, P.E.
McCormick Taylor

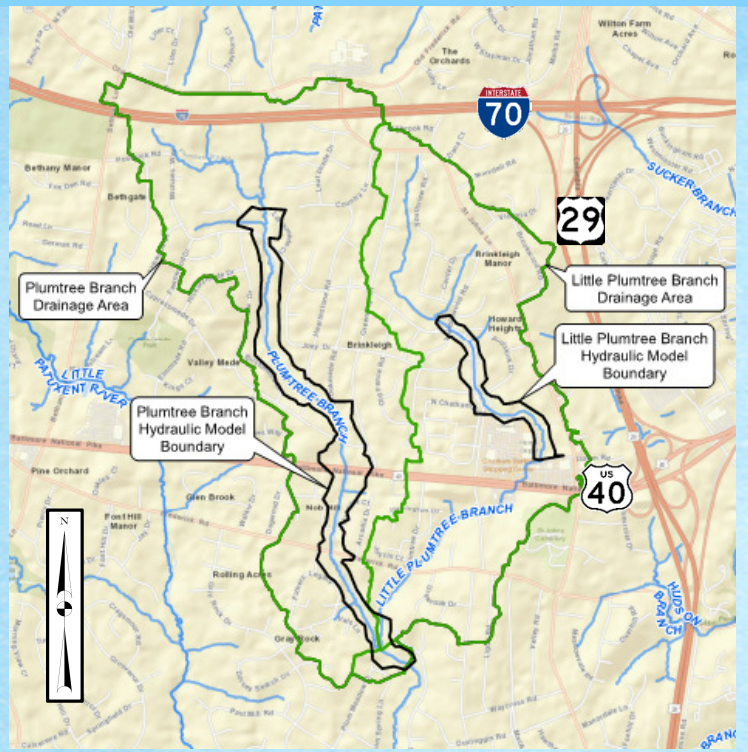
Discussion Items

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

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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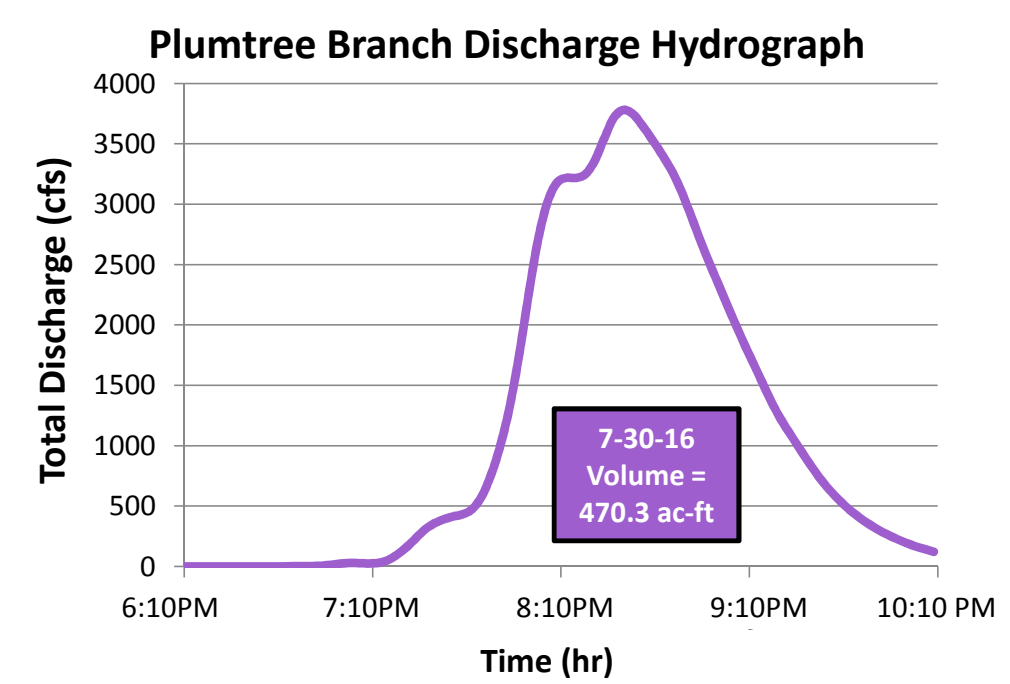
Background

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”



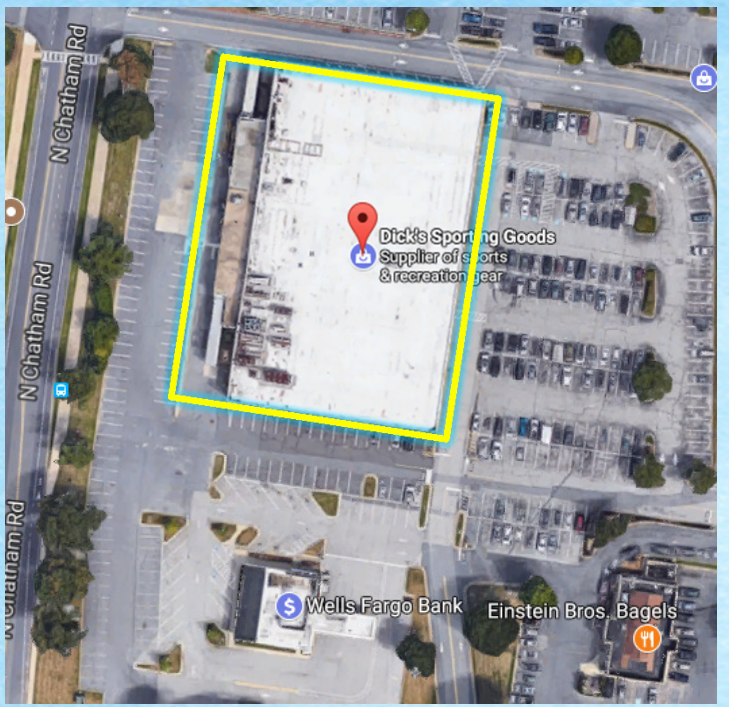
Background

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



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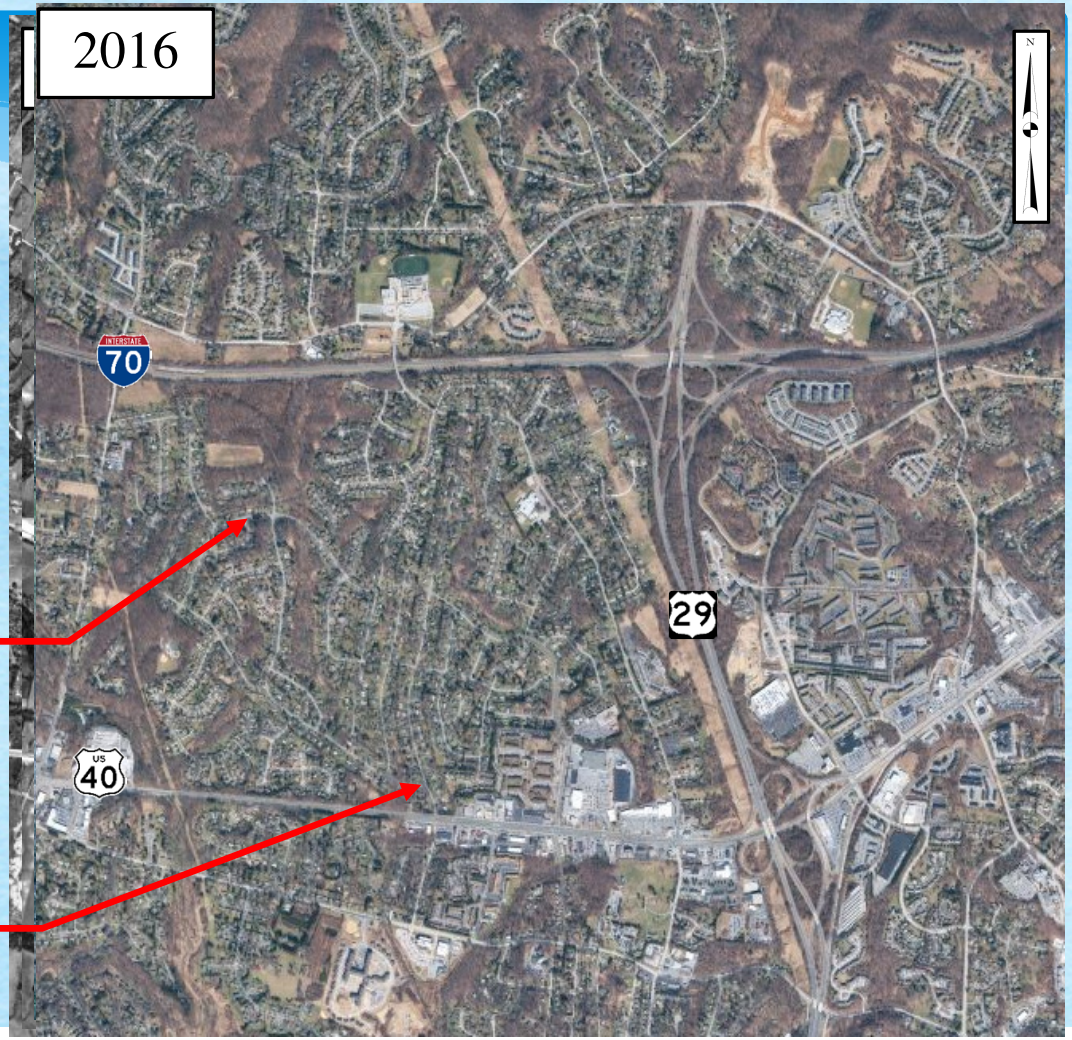
Neighborhood History



Michaels Way

Greenway Drive

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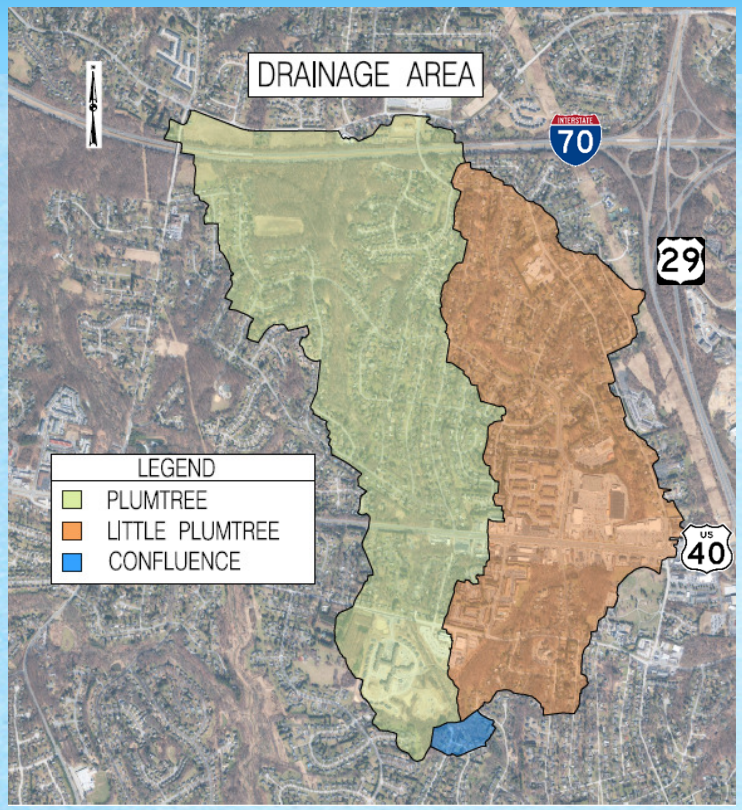
Watershed Hydrology

- 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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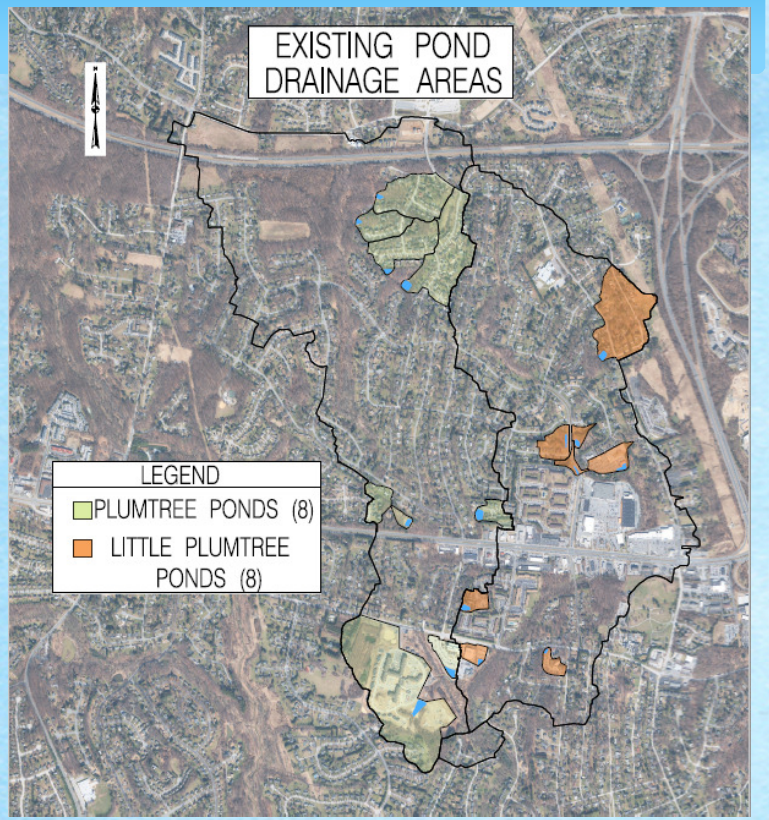
Watershed Hydrology

- 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



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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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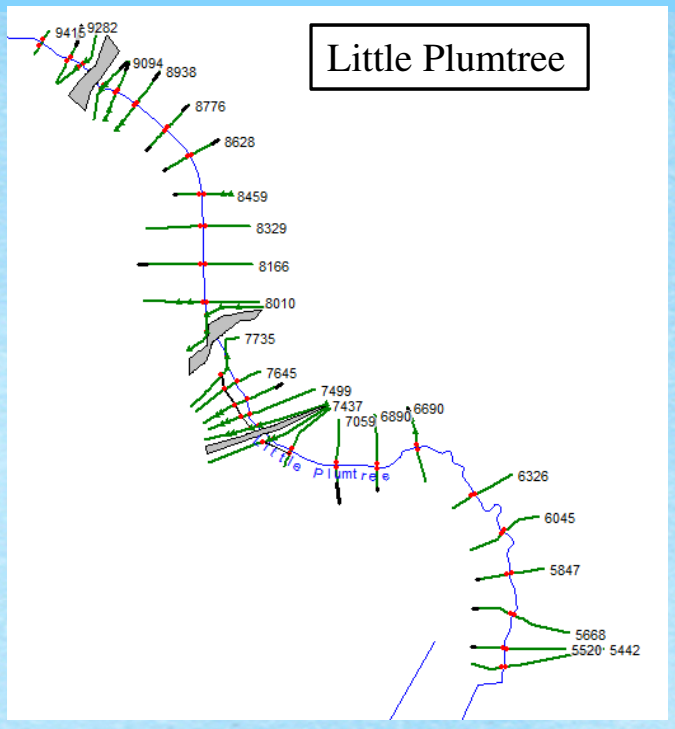
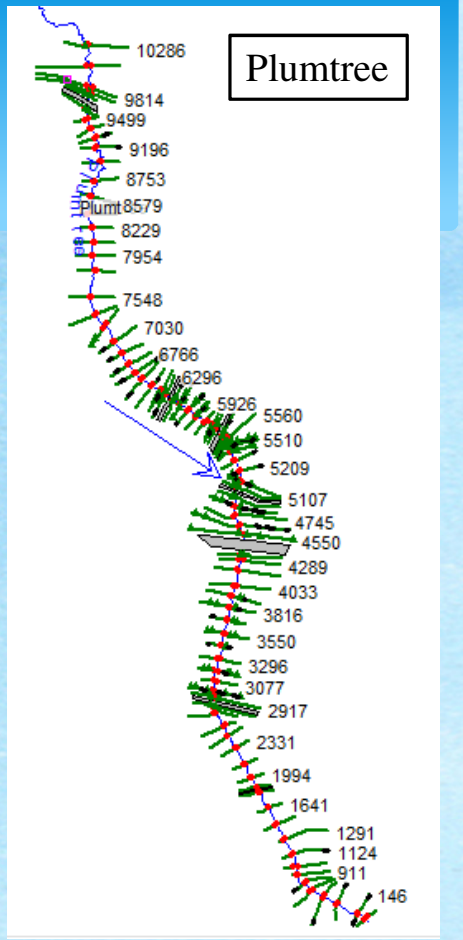
Hydraulic Modeling

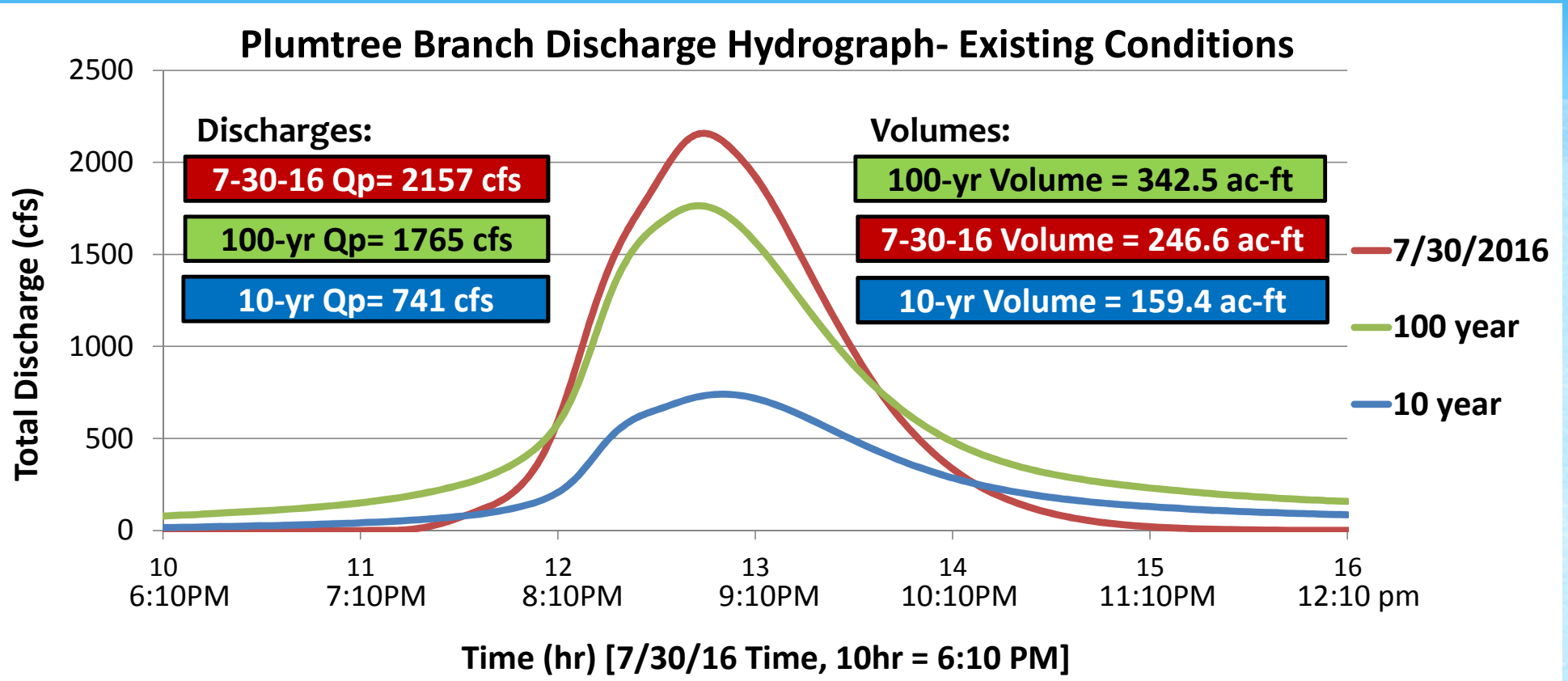
1-D Hydraulic Models (HEC-RAS) on Plumtree Branch and Little Plumtree Branch

- 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

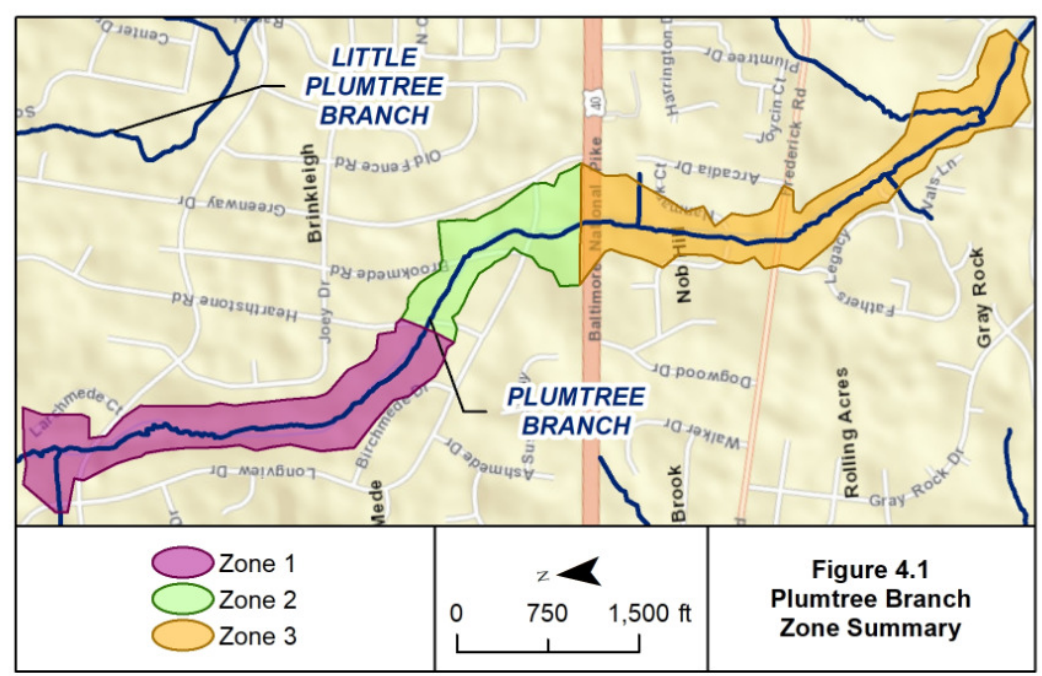


Figure 4.1
Plumtree Branch
Zone Summary

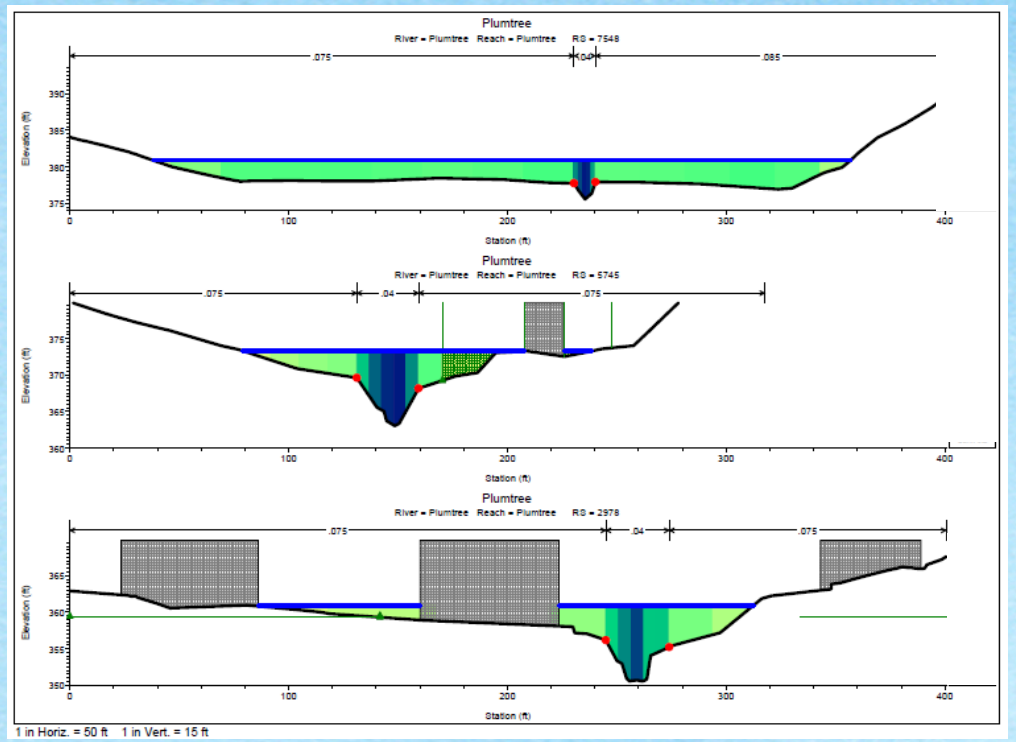
HEC-RAS Cross Section View - Plumtree Branch

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.



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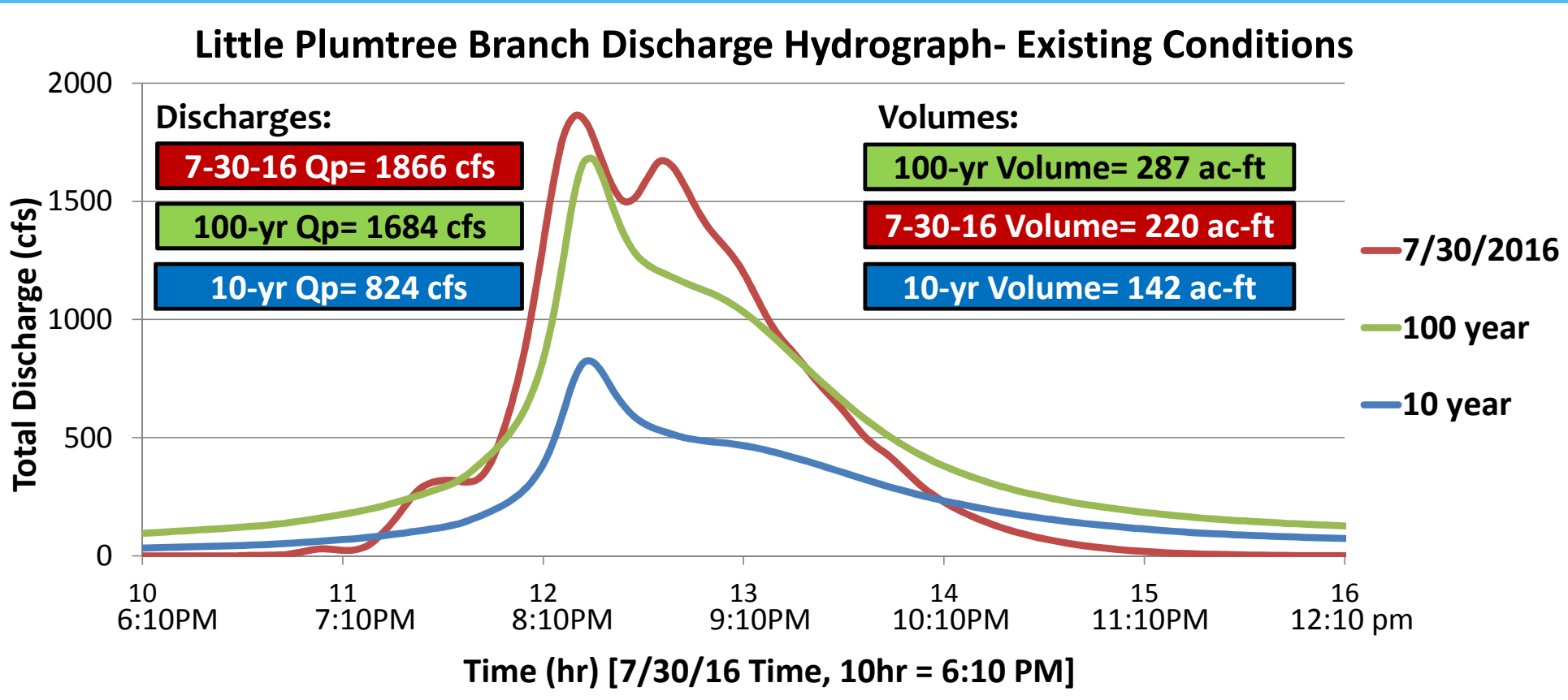
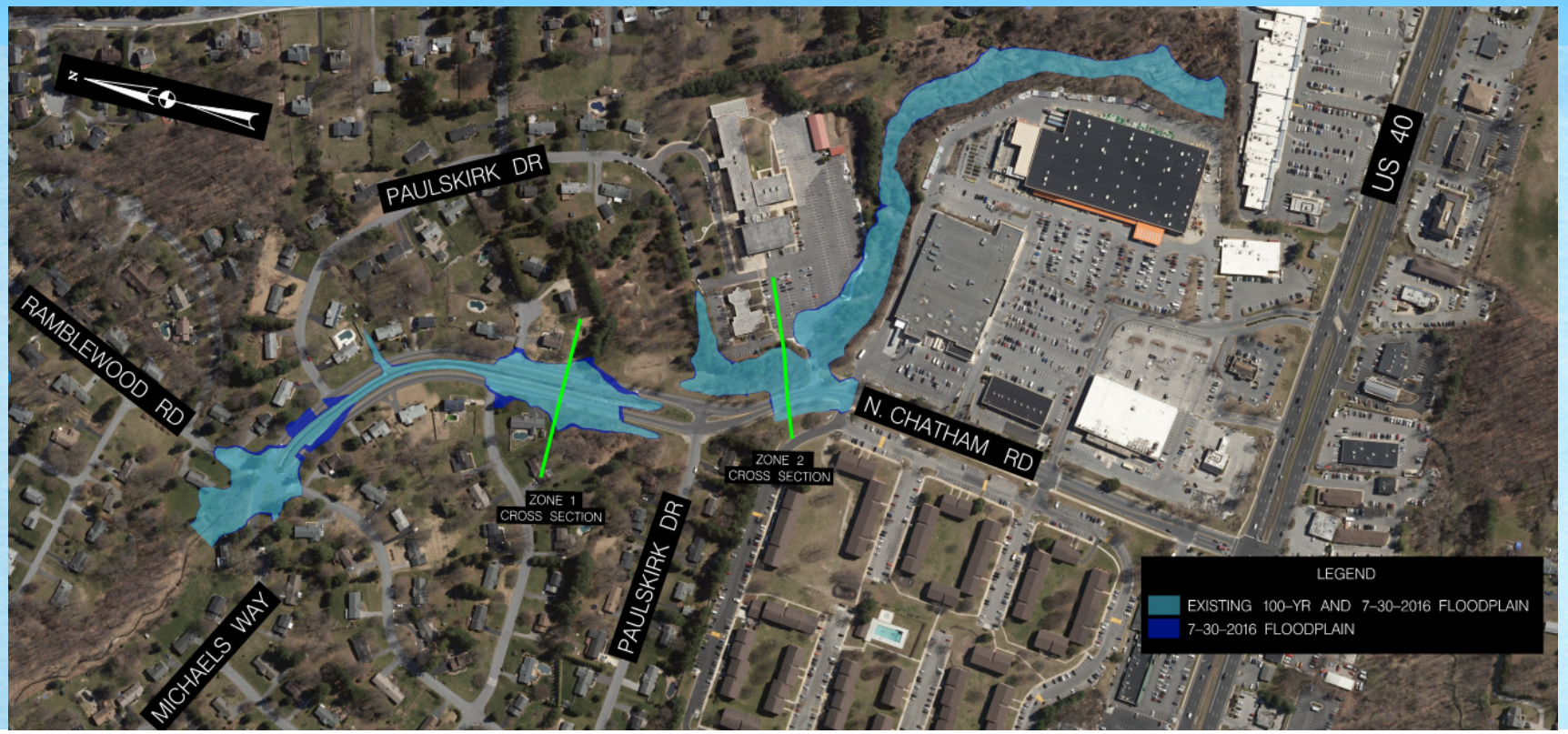
Storm Event Hydrographs – Little Plumtree Branch



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

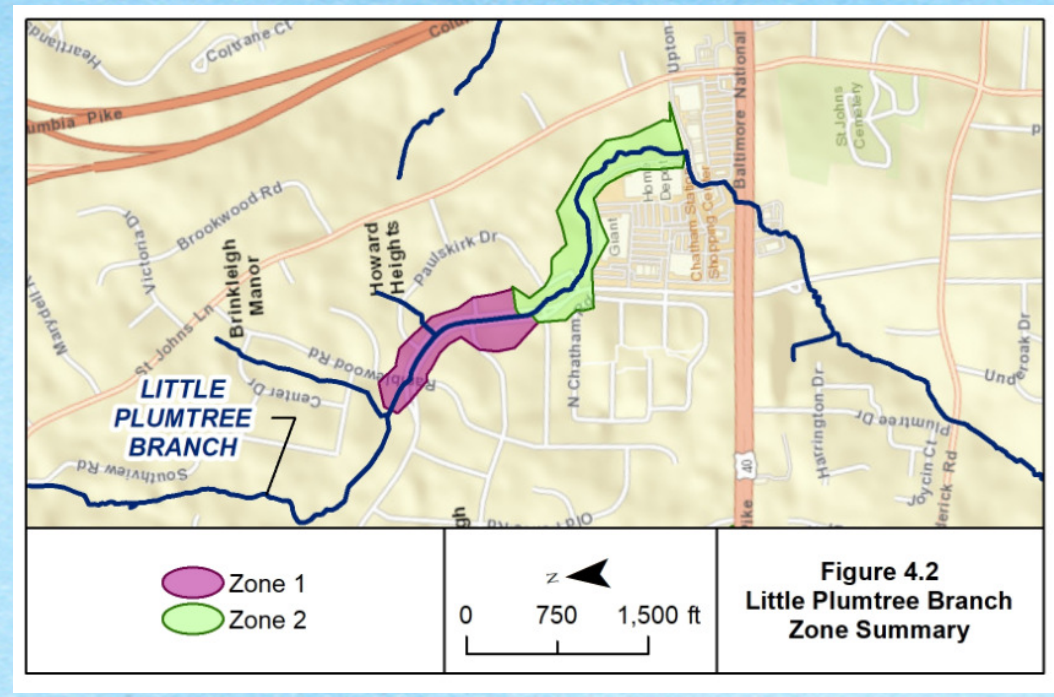


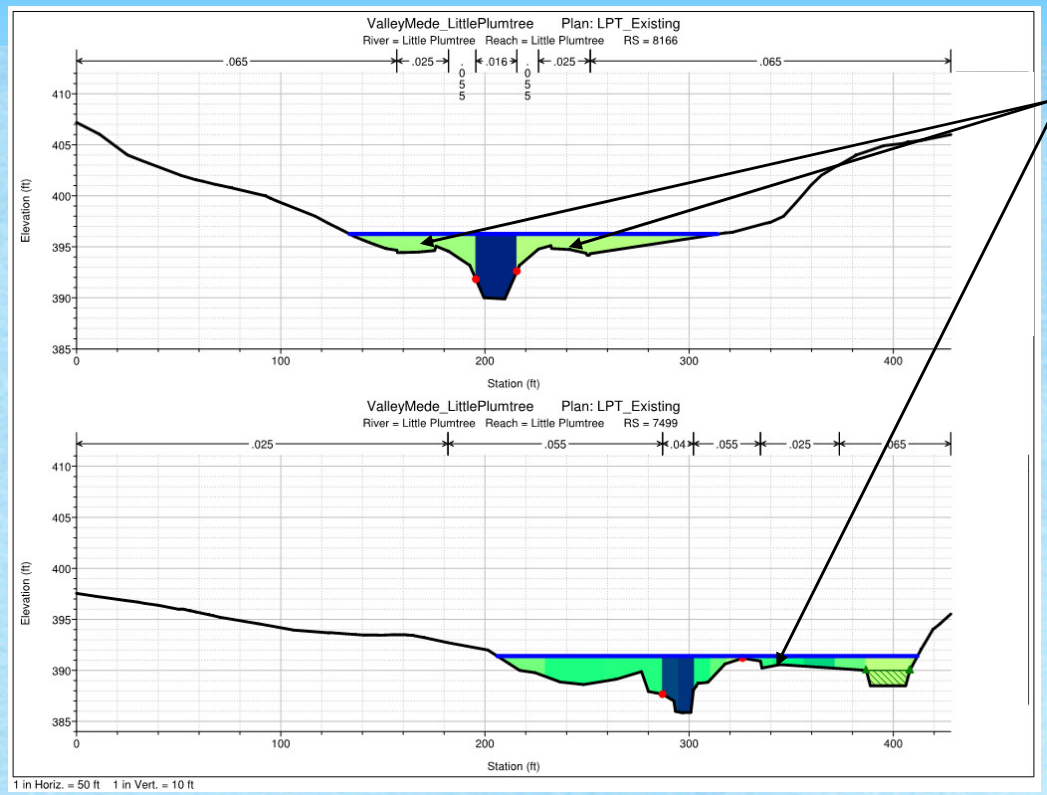
Figure 4.2
Little Plumtree Branch
Zone Summary

HEC-RAS Cross Section View – Little Plumtree Branch

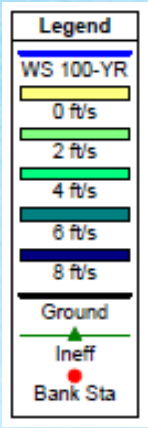
100-yr – Existing

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



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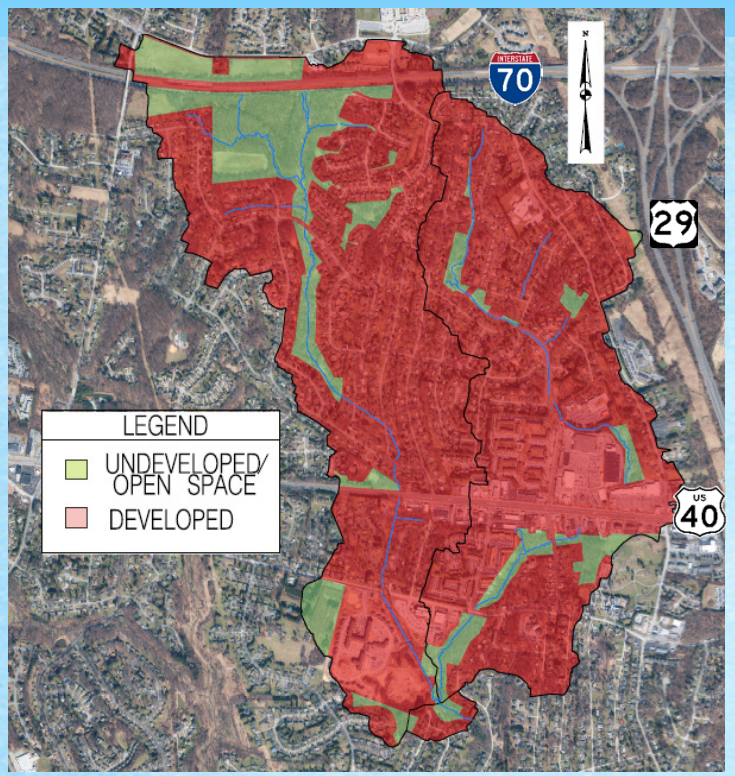
Part 1 - Questions

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



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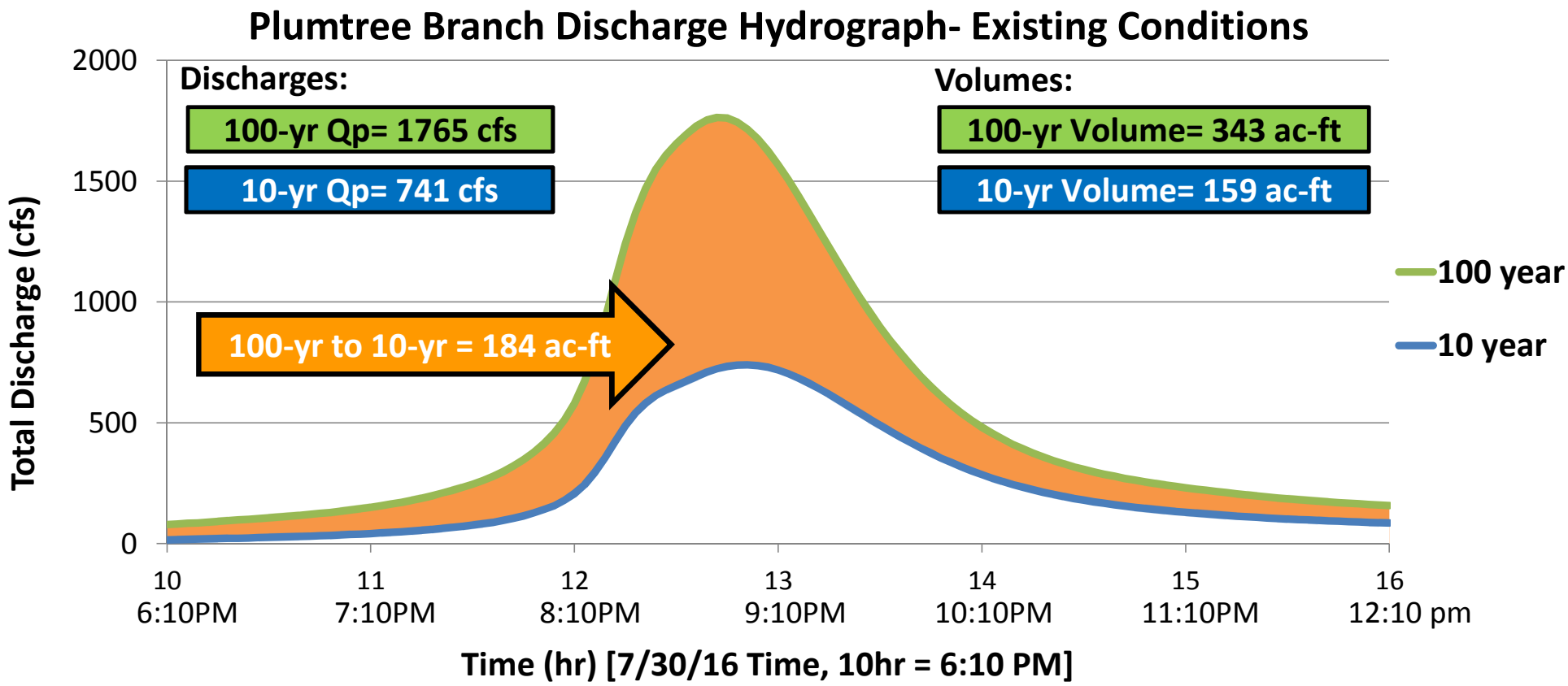
Storm Event Hydrographs – Plumtree Branch



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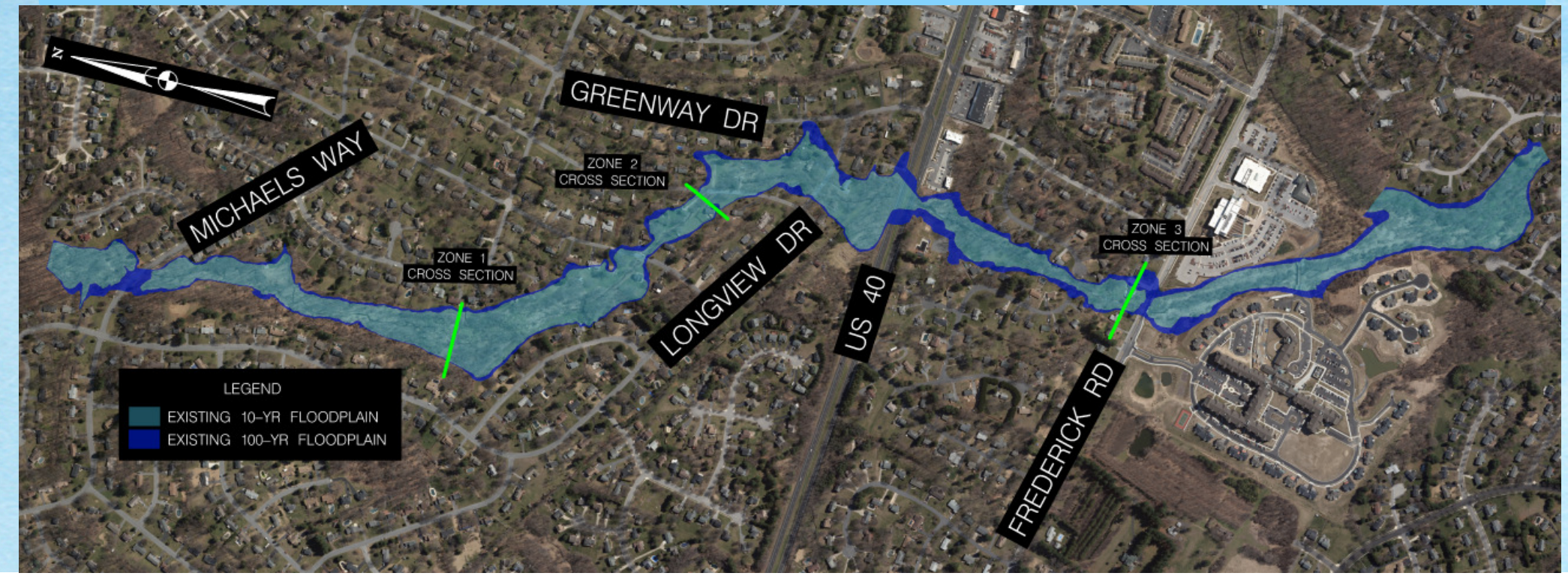
Modeling Results – Plumtree Branch

100-yr Existing and 10-yr Existing



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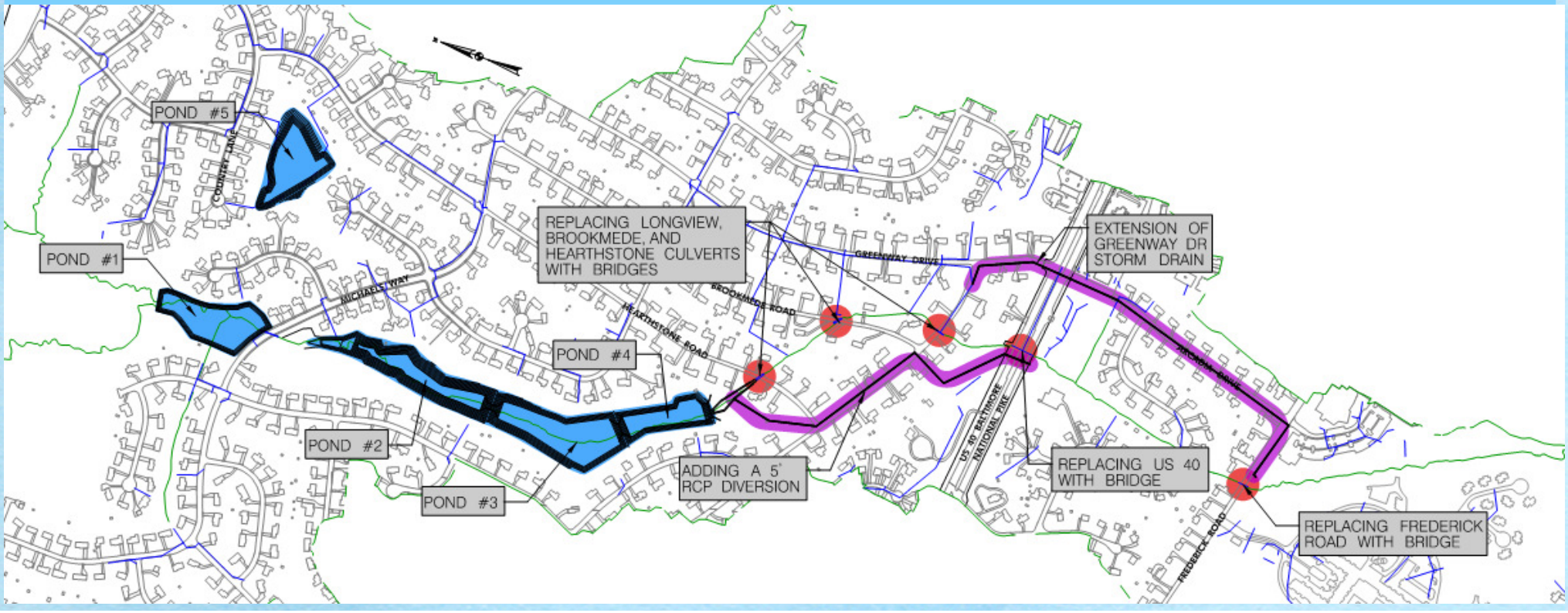
Mitigation Concepts – Plumtree Branch



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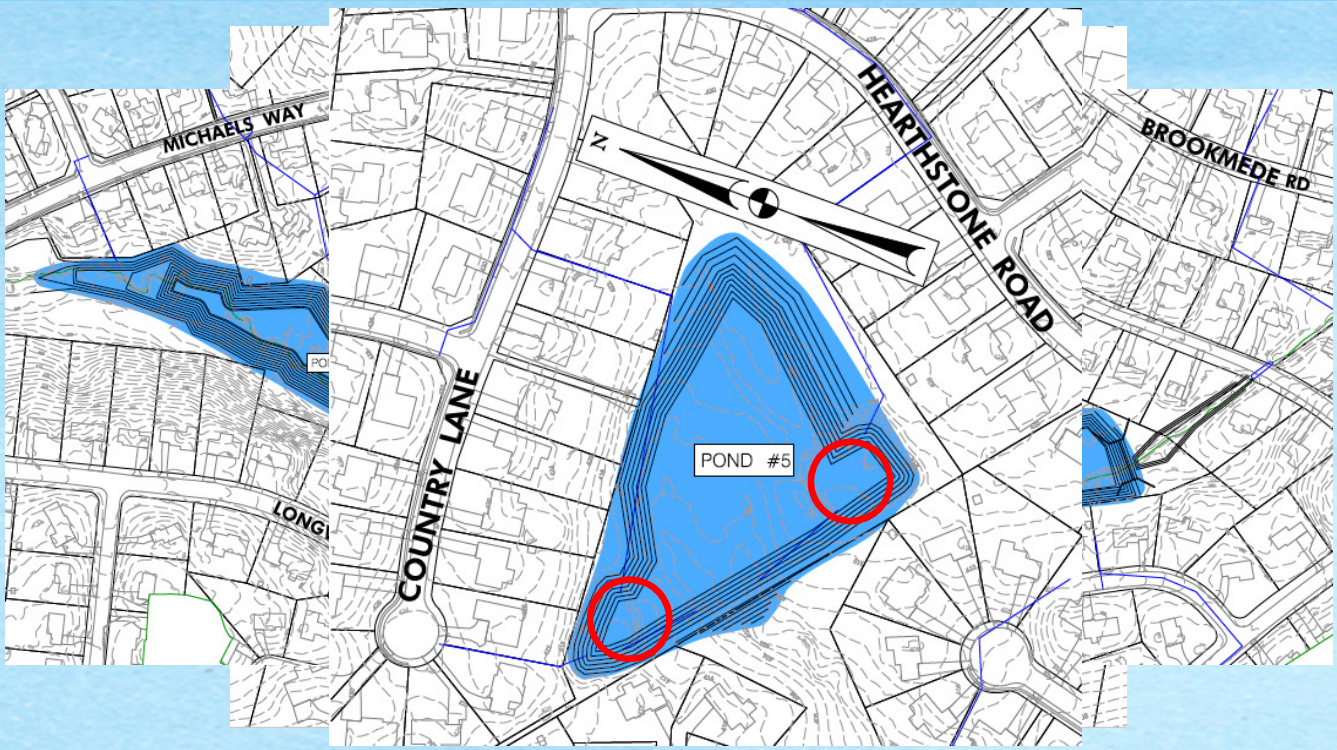
Potential Storage: Plumtree Branch

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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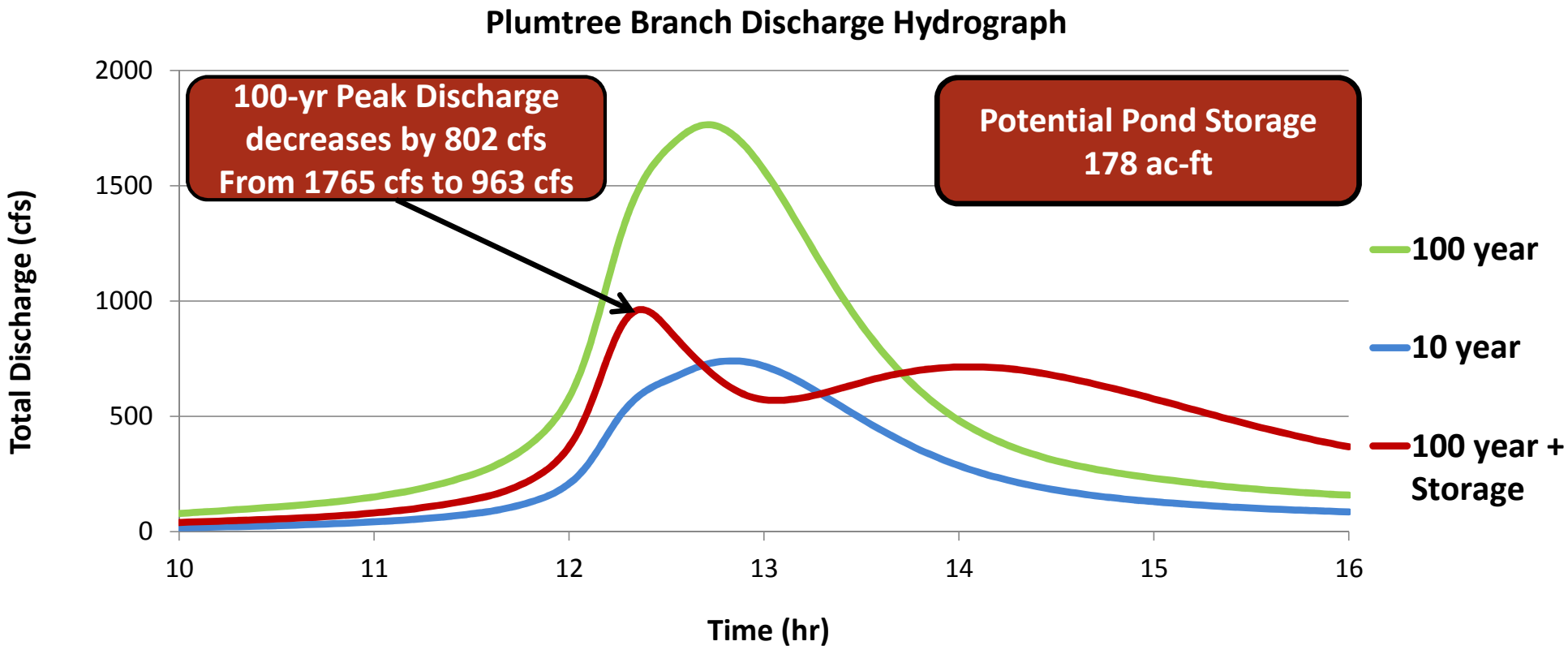
Potential Hydrograph – Plumtree Branch



Potential Conveyance Improvements: Plumtree Branch

Conversion of Cross Culverts to Bridges

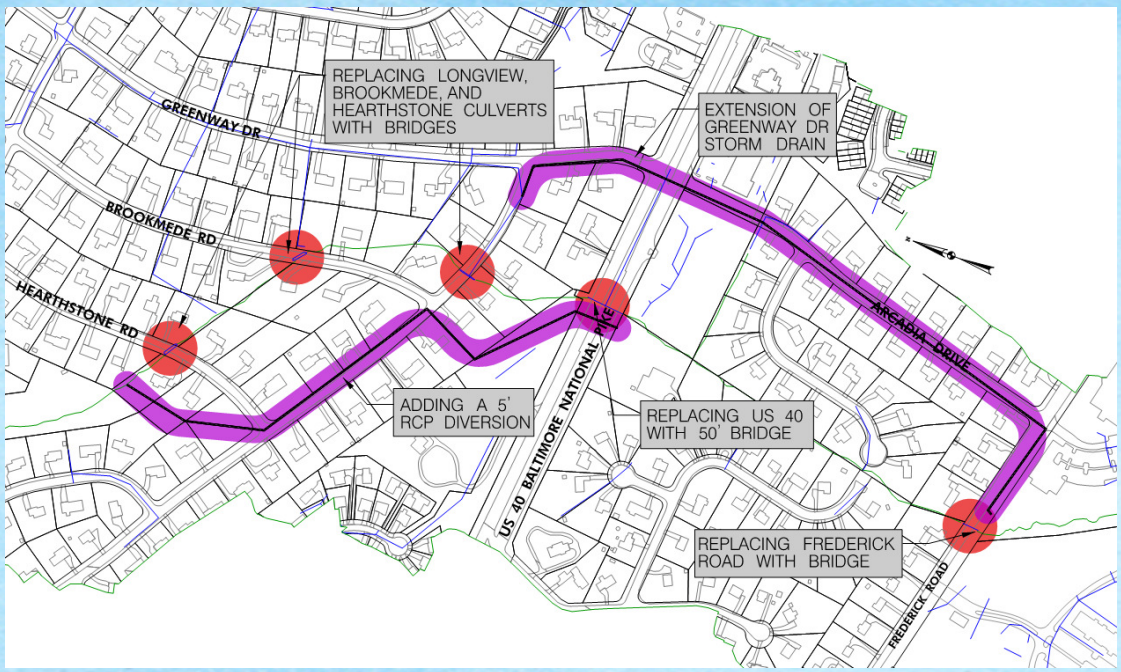
- Structures at Hearthstone Road, Brookmede Road, Longview Drive, US 40, and Frederick Road

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



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Modeling Results – Plumtree Branch

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

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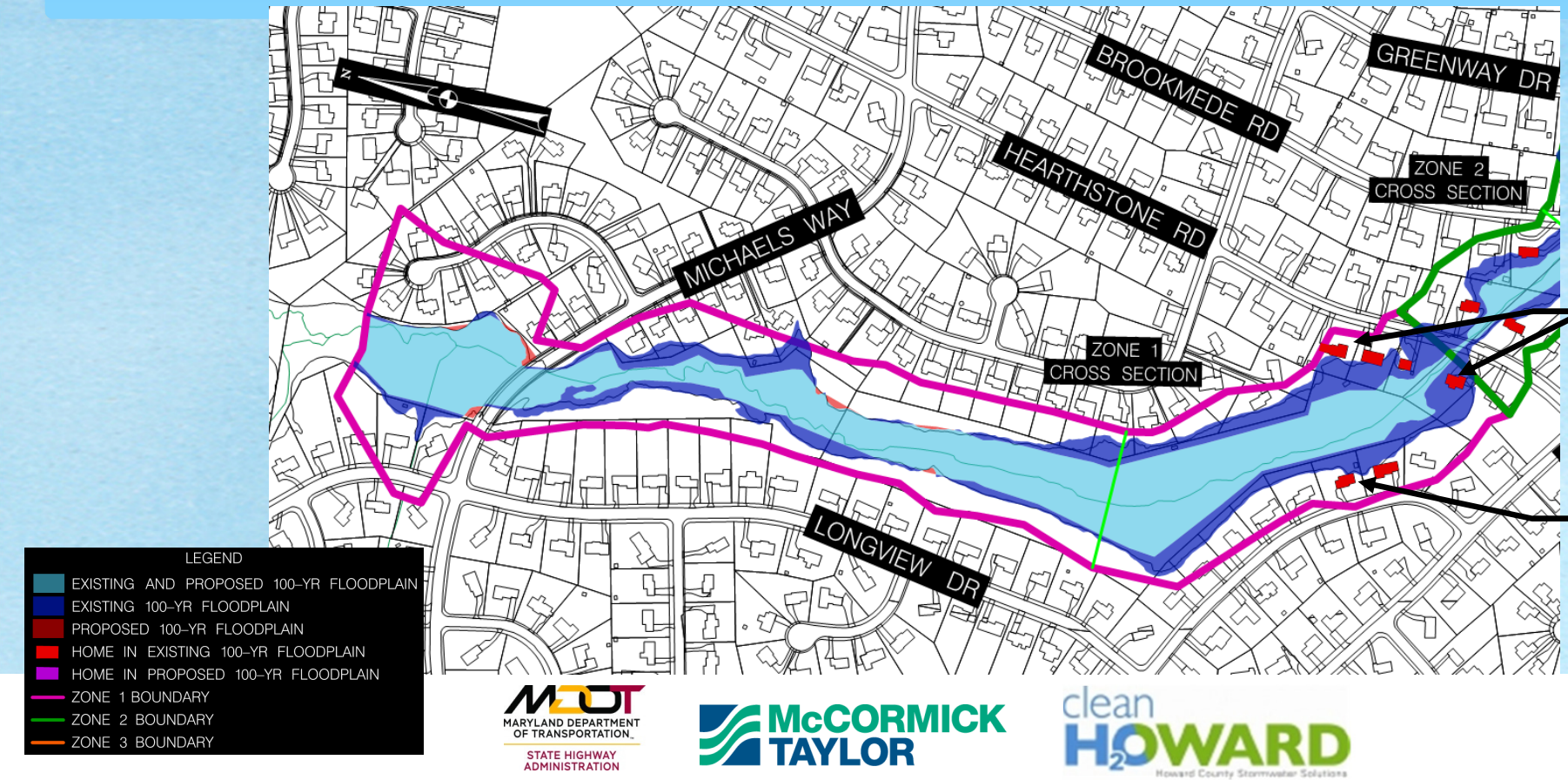
Modeling Results – Zone 1

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



3214 to 3230 Hearthstone Rd

3225 and 3229 Hearthstone Rd

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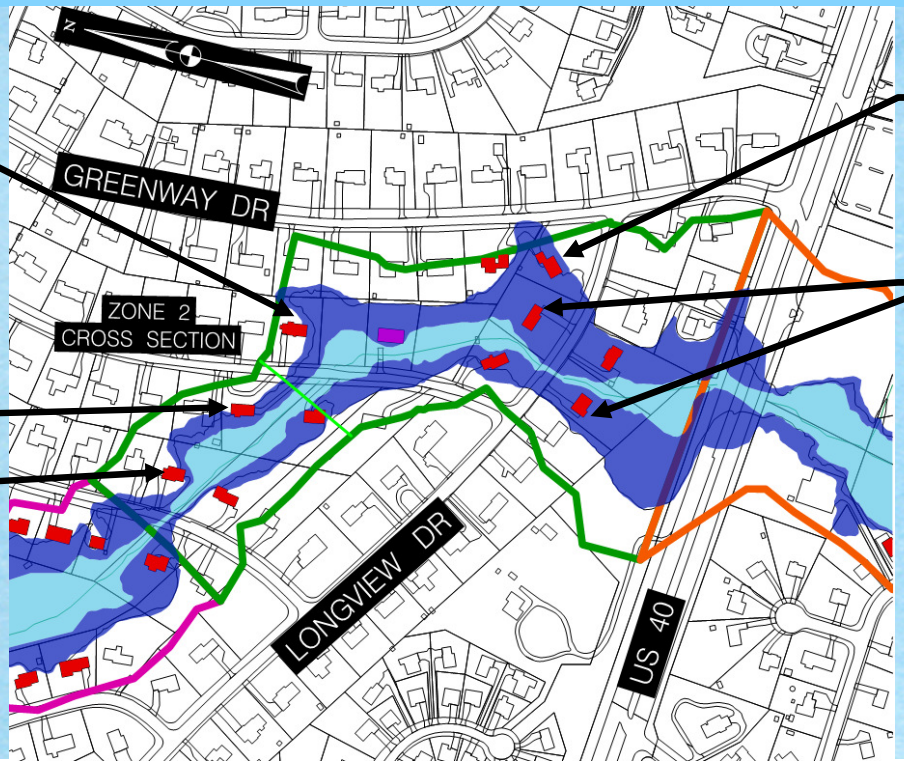
Modeling Results – Zone 2

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



3233 and 3241 Brookmede Rd

3230 and 3238 Brookmede Rd

3225 and 3229 Hearthstone Dr

3306 and 3310 Greenway Dr

9506, 9509, 9513, 9514 Longview Dr

LEGEND

- EXISTING AND PROPOSED 100–YR FLOODPLAIN
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- HOME IN EXISTING 100–YR FLOODPLAIN
- HOME IN PROPOSED 100–YR FLOODPLAIN
- ZONE 1 BOUNDARY
- ZONE 2 BOUNDARY
- ZONE 3 BOUNDARY

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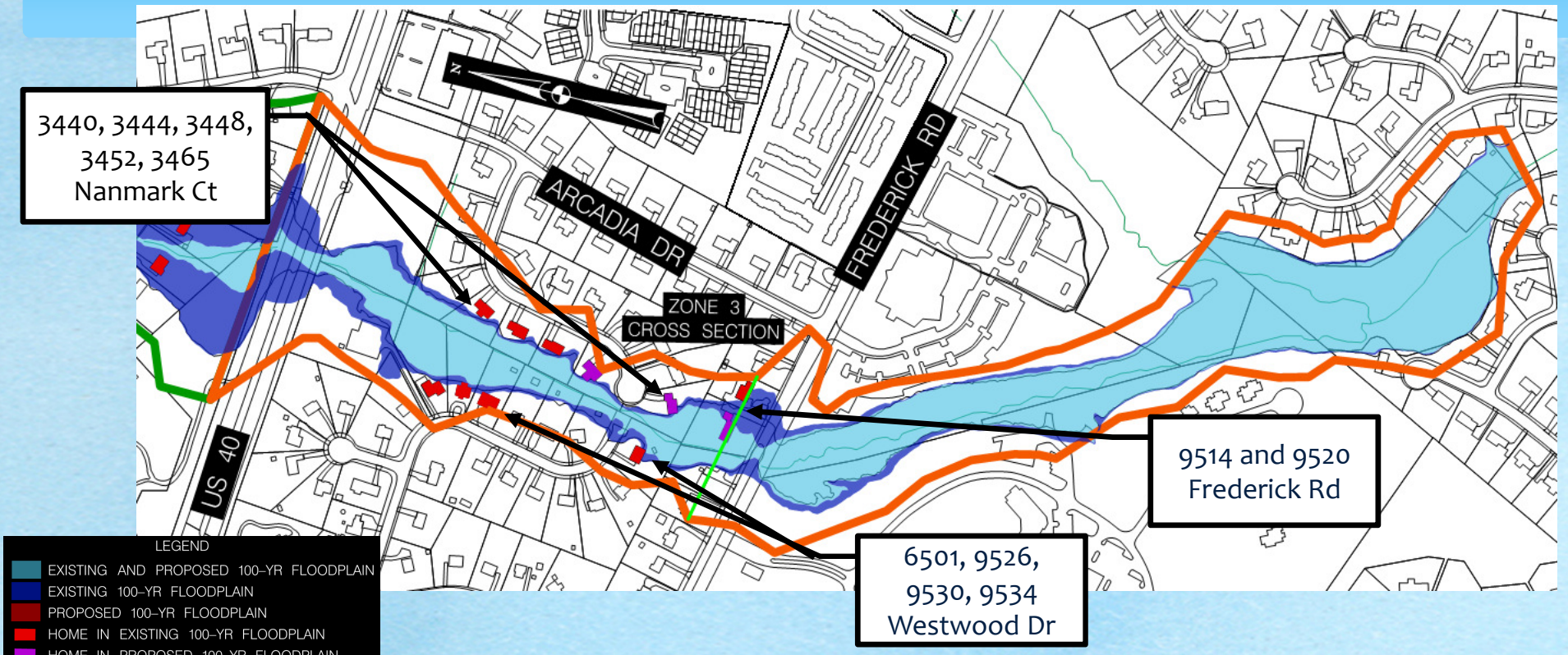
Modeling Results – Zone 3

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



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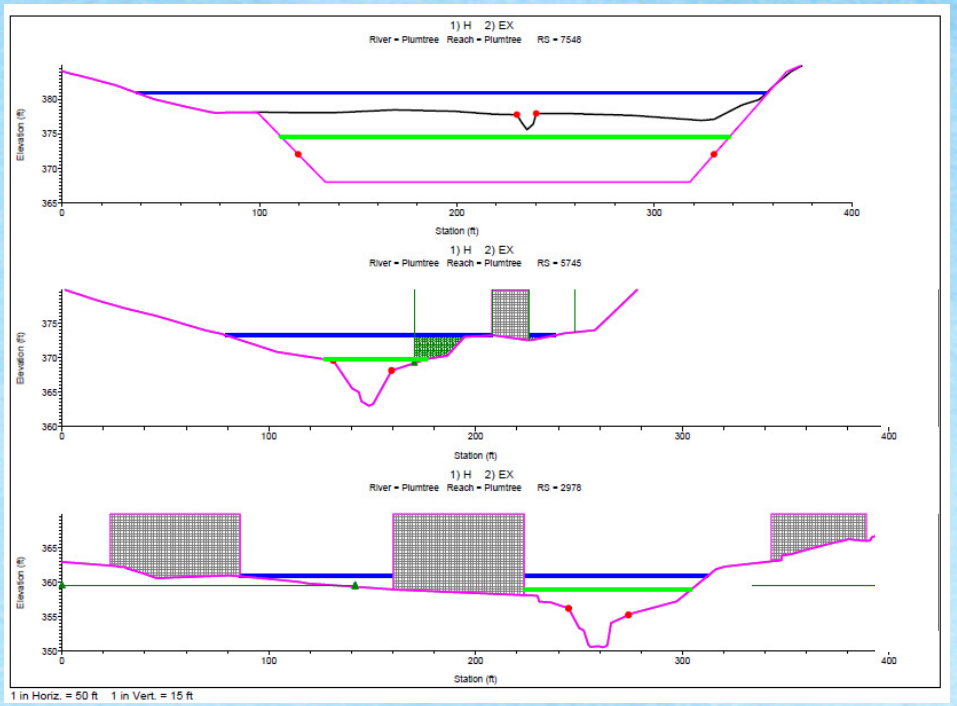
HEC-RAS Cross Section View - Plumtree Branch

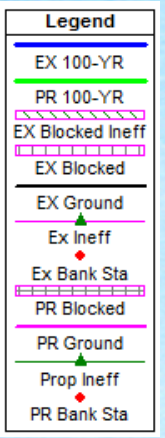
100-yr Storage and Conveyance Improvements and 100-yr Existing

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





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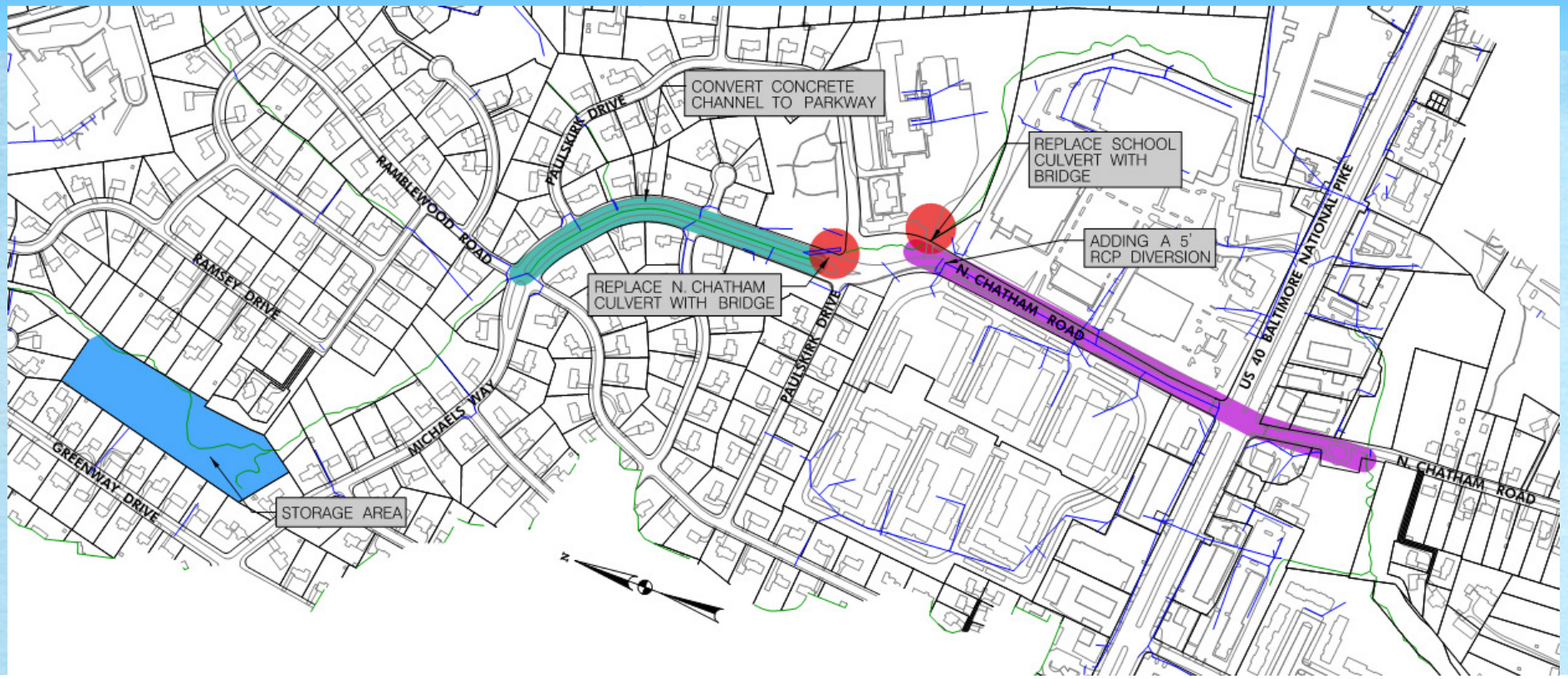
Localized Storm Drain Improvements – Plumtree Branch

- 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.

Mitigation Concepts – Little Plumtree Branch



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Potential Conveyance Improvements – Little Plumtree Branch

Conversion of Cross Culverts to Bridges

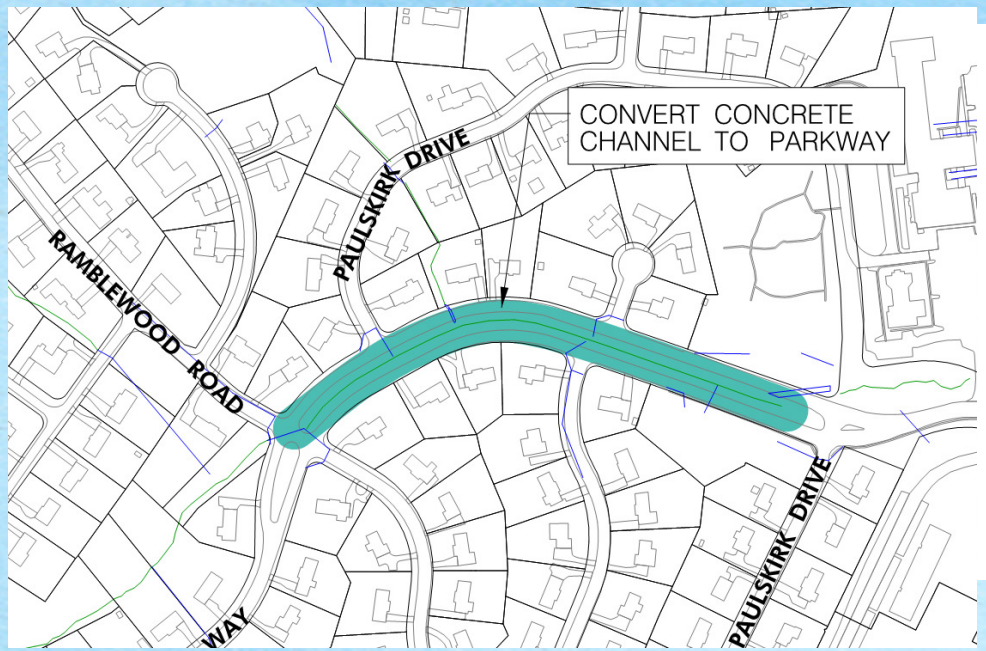
- Structures at N. Chatham Road and Private School/Church Entrance

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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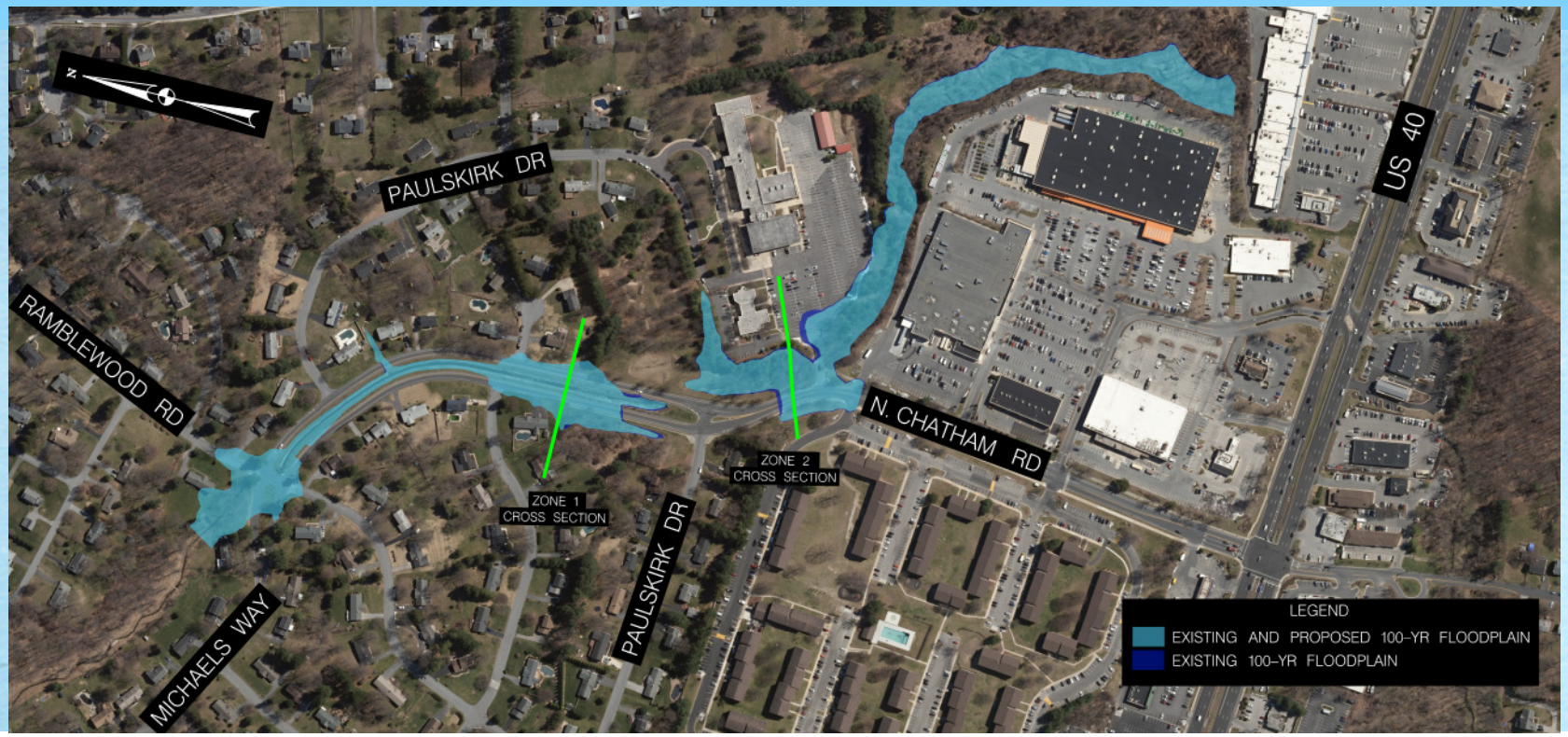
Modeling Results – Little Plumtree Branch

100-yr Conveyance and 100-yr Existing



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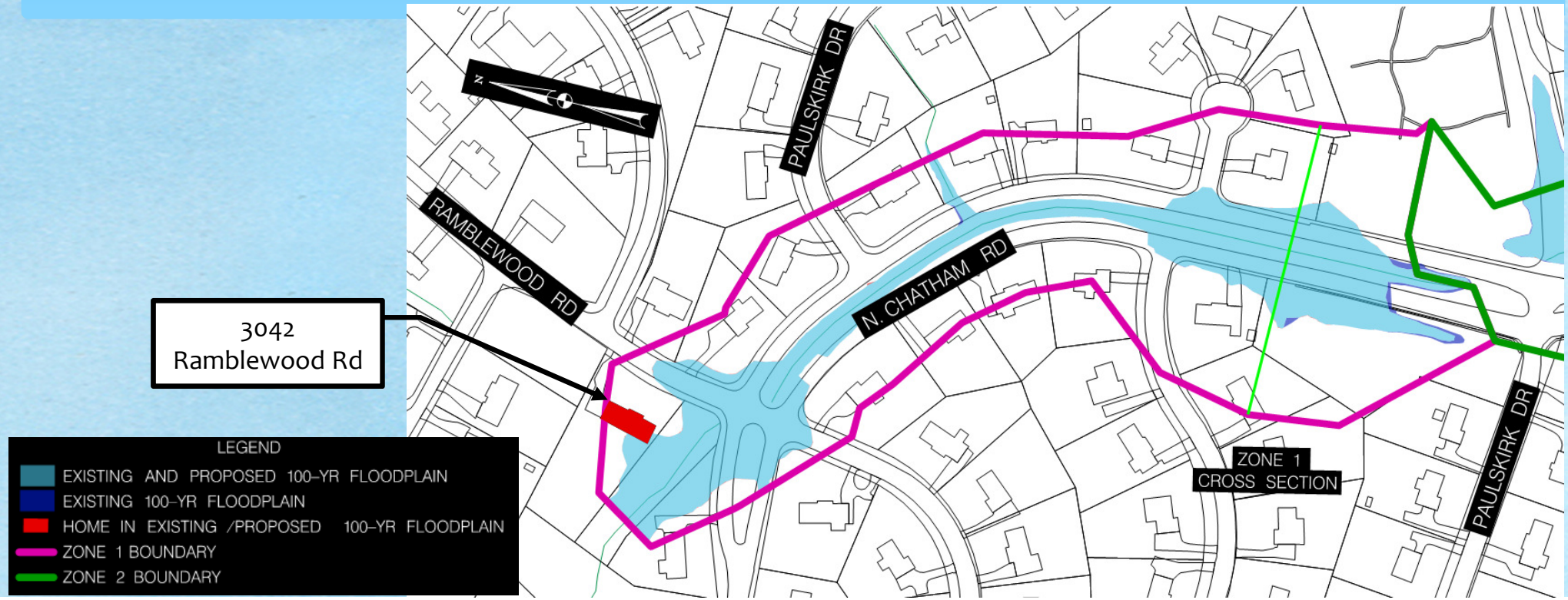
Modeling Results – Zone 1

100-yr Conveyance and 100-yr Existing



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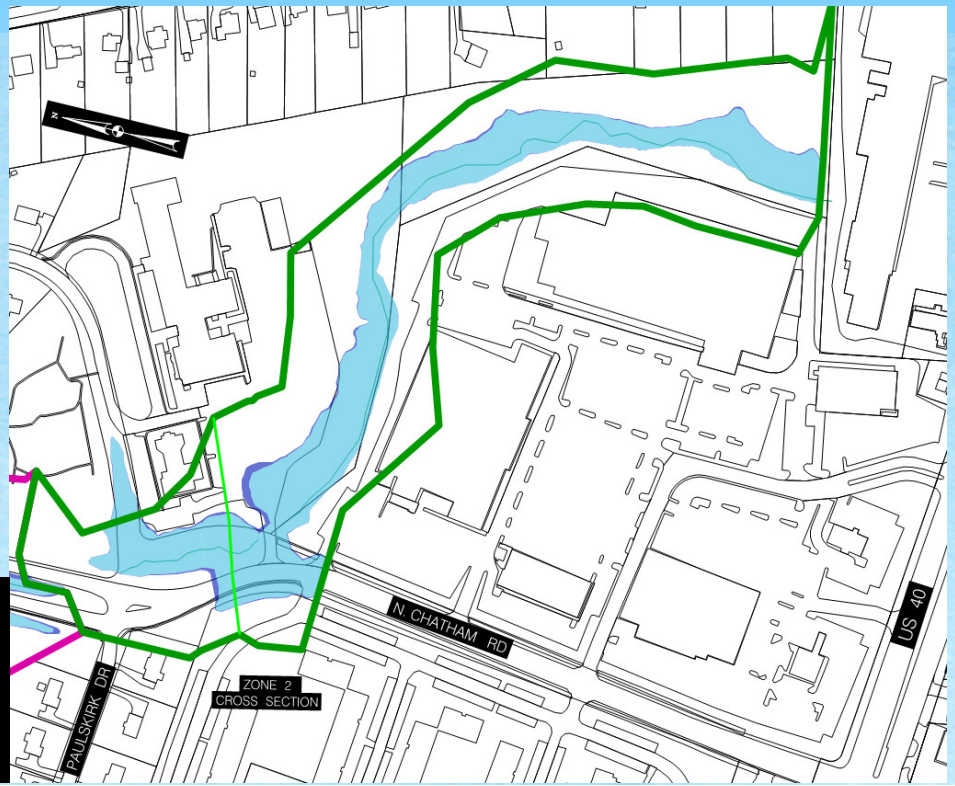
Modeling Results – Zone 2

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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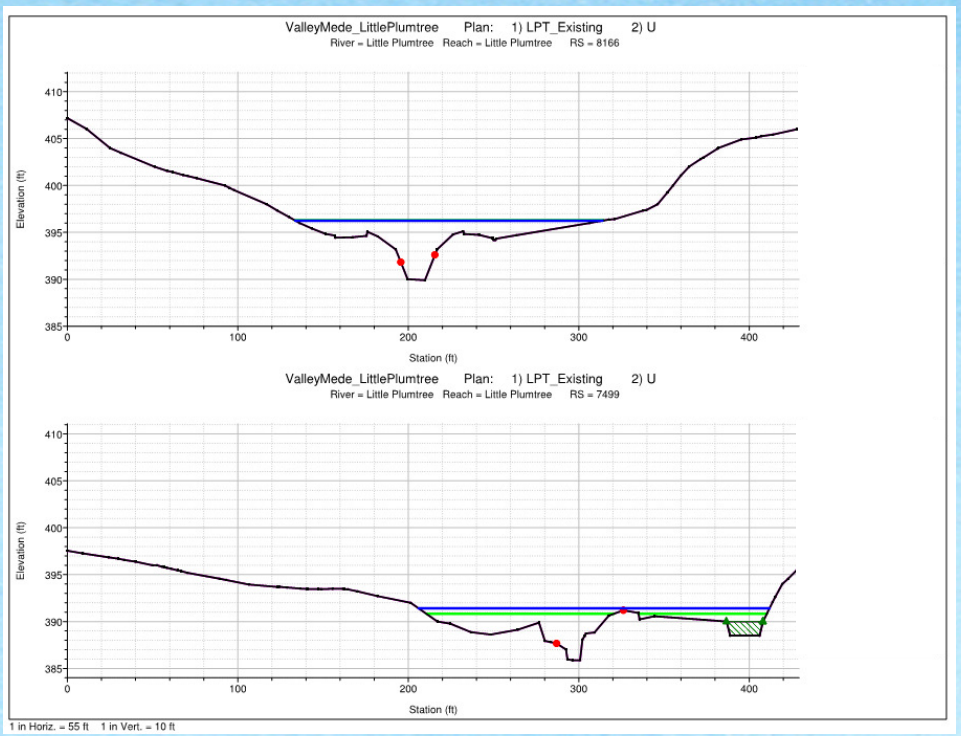
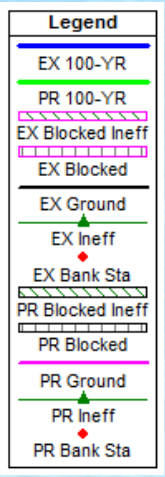
HEC-RAS Cross Section View - Little Plumtree Branch

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





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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

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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

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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

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