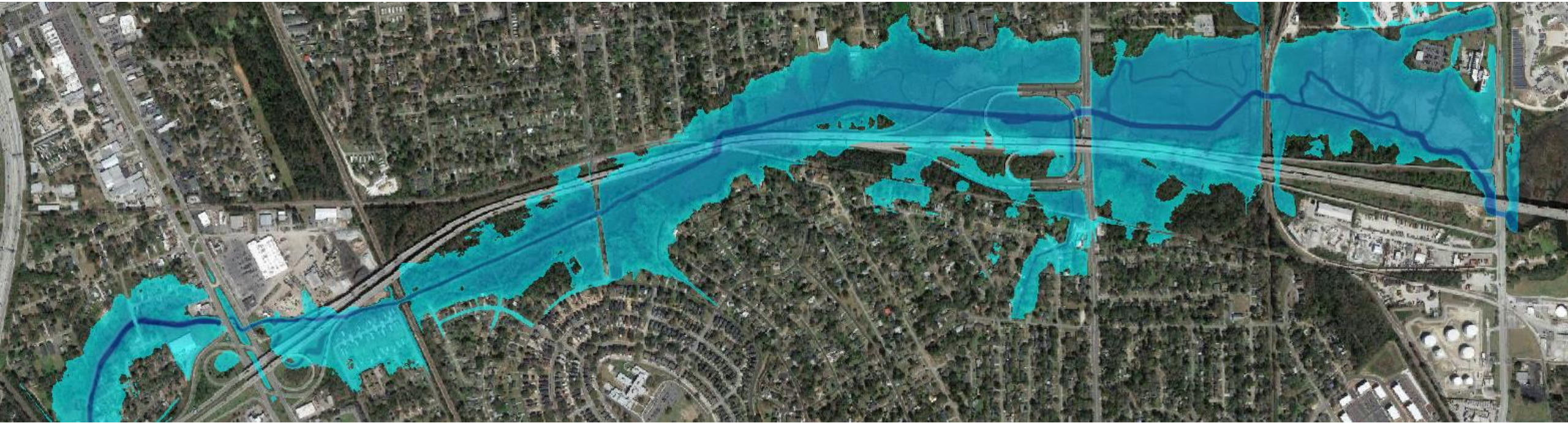


DAVIS & FLOYD

SINCE 1954

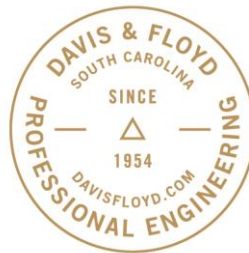


A Case Study for Filbin Creek: Dispelling Rumors in the Floodplain

South Carolina Association for Hazard Mitigation Conference March 2020

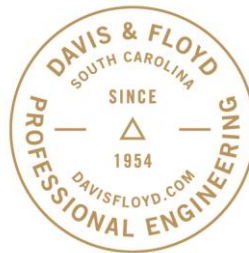
CONTENT

Introduction to Filbin Creek Development/NFIP History Extreme Weather Events Public Perception and Demands Analysis of Hydraulic Conditions Results and Conclusions



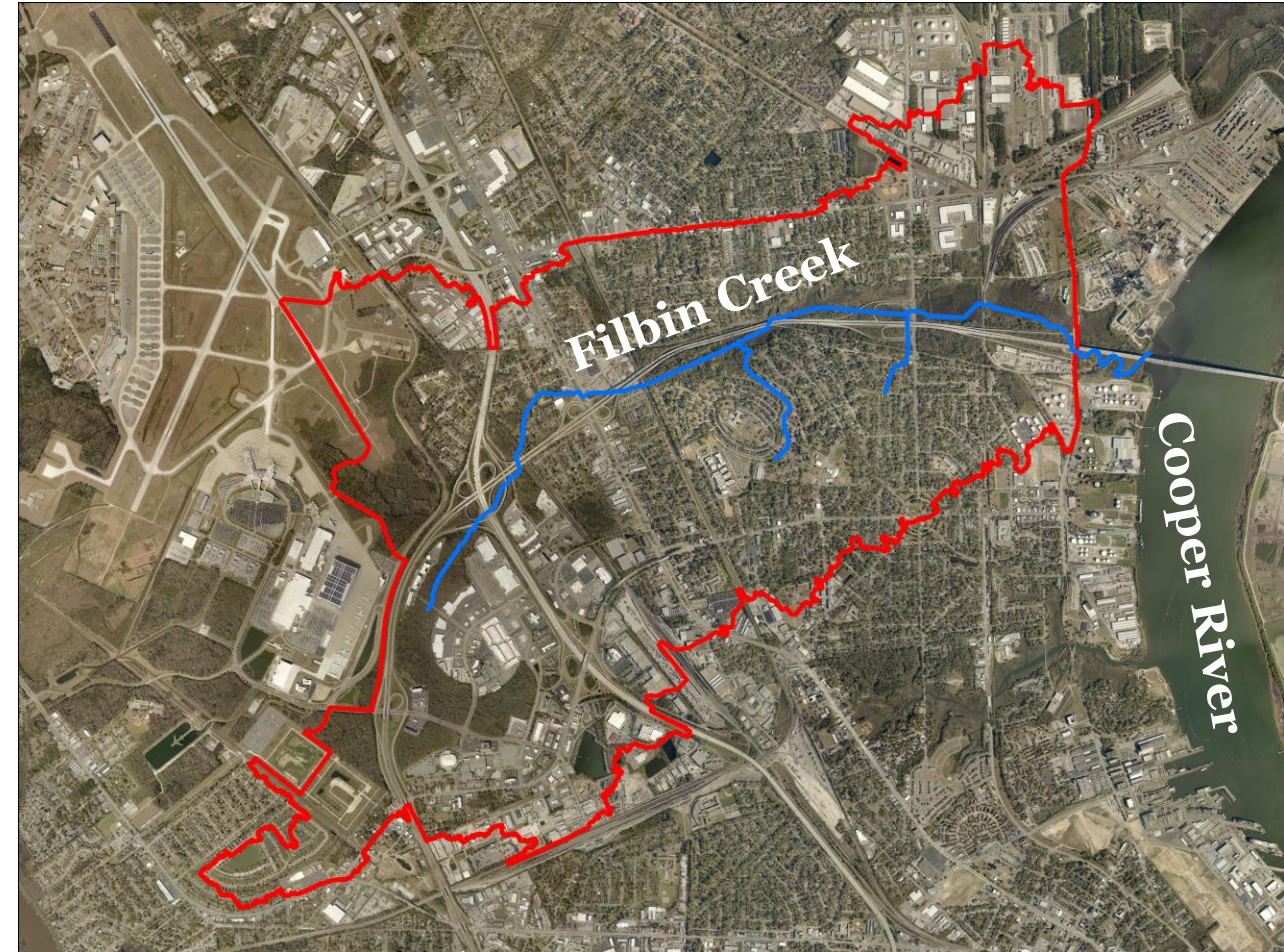
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Introduction to Filbin Creek

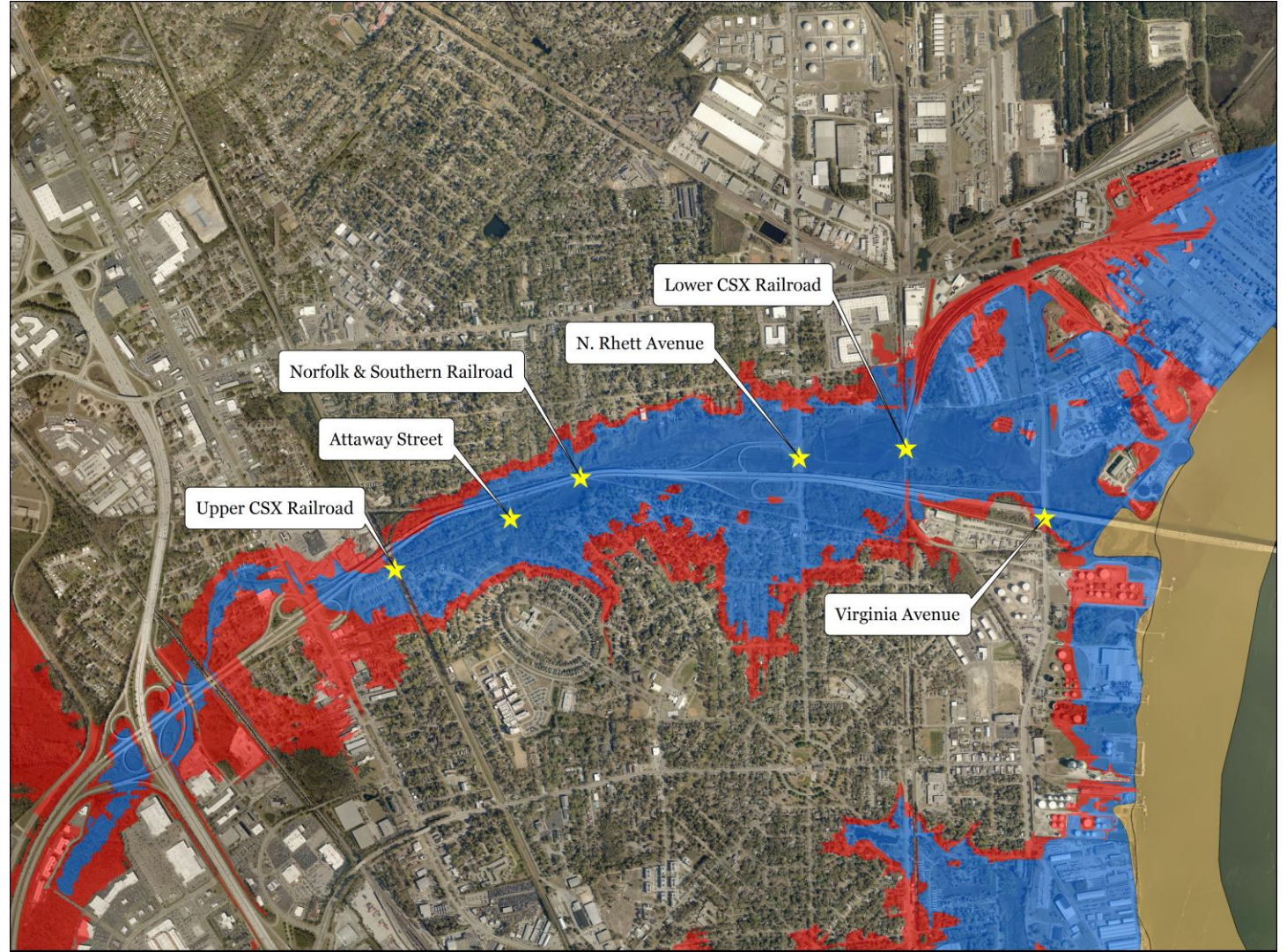
- Located In North Charleston, SC
 - ~4,600 Acre Urban Watershed
 - Outfalls to the Cooper River
 - Has experienced flooding/drainage issues throughout its development history.



Introduction to Filbin Creek

- Lower Reaches of Filbin Creek Crossed by 6 bridges/culverts.

Filbin Creek	
Structure Name	Structure Type & Description
1. Virginia Avenue	(5) 84" Culverts w/ Flap Gates
2. Lower CSX Railroad	73' Bridge
3. N. Rhett Avenue	90' Bridge
4. Norfolk & Southern Railroad	(3) 7' x 3.5' Box Culverts
5. Attaway Street	60' Bridge
6. Upper CSX Railroad	70' Bridge



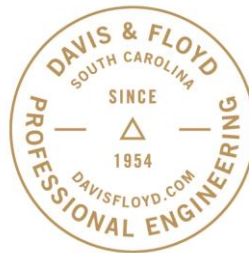
Introduction to Filbin Creek

- Filbin Creek Outfalls to the Cooper river through five (5) - 84" culverts under Virginia Avenue
- Tidal backflow checked by flap gates



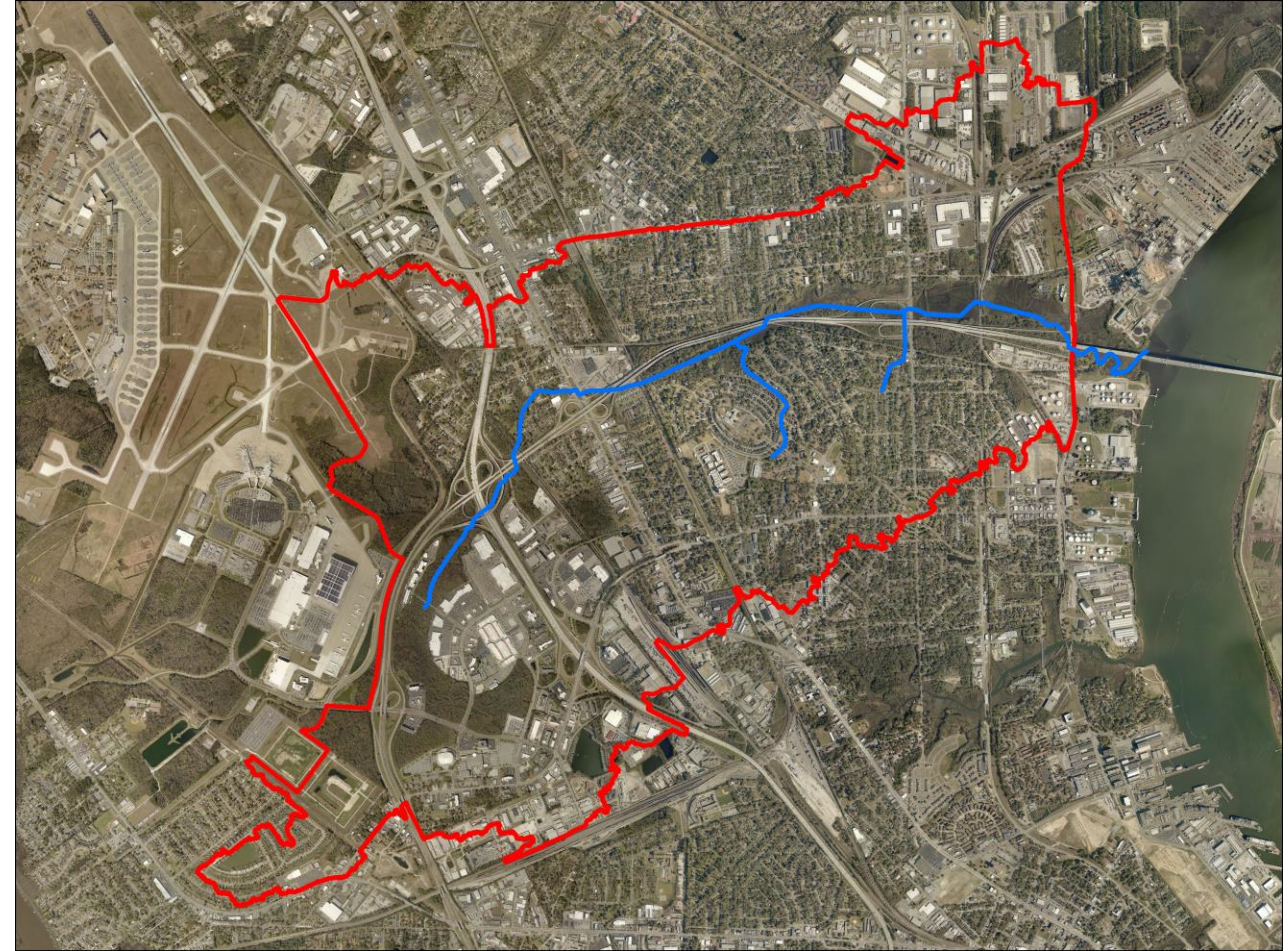
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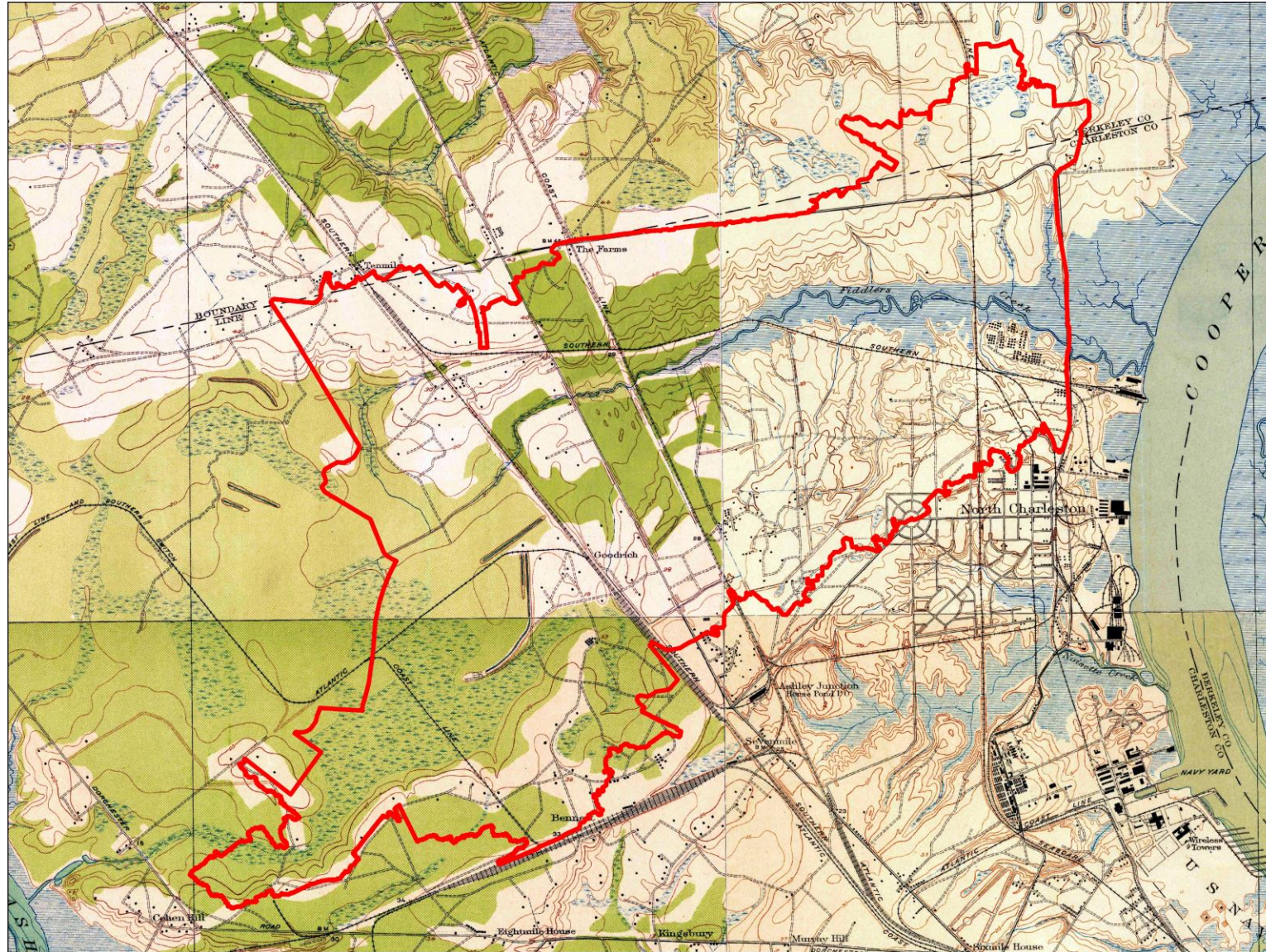


Development History

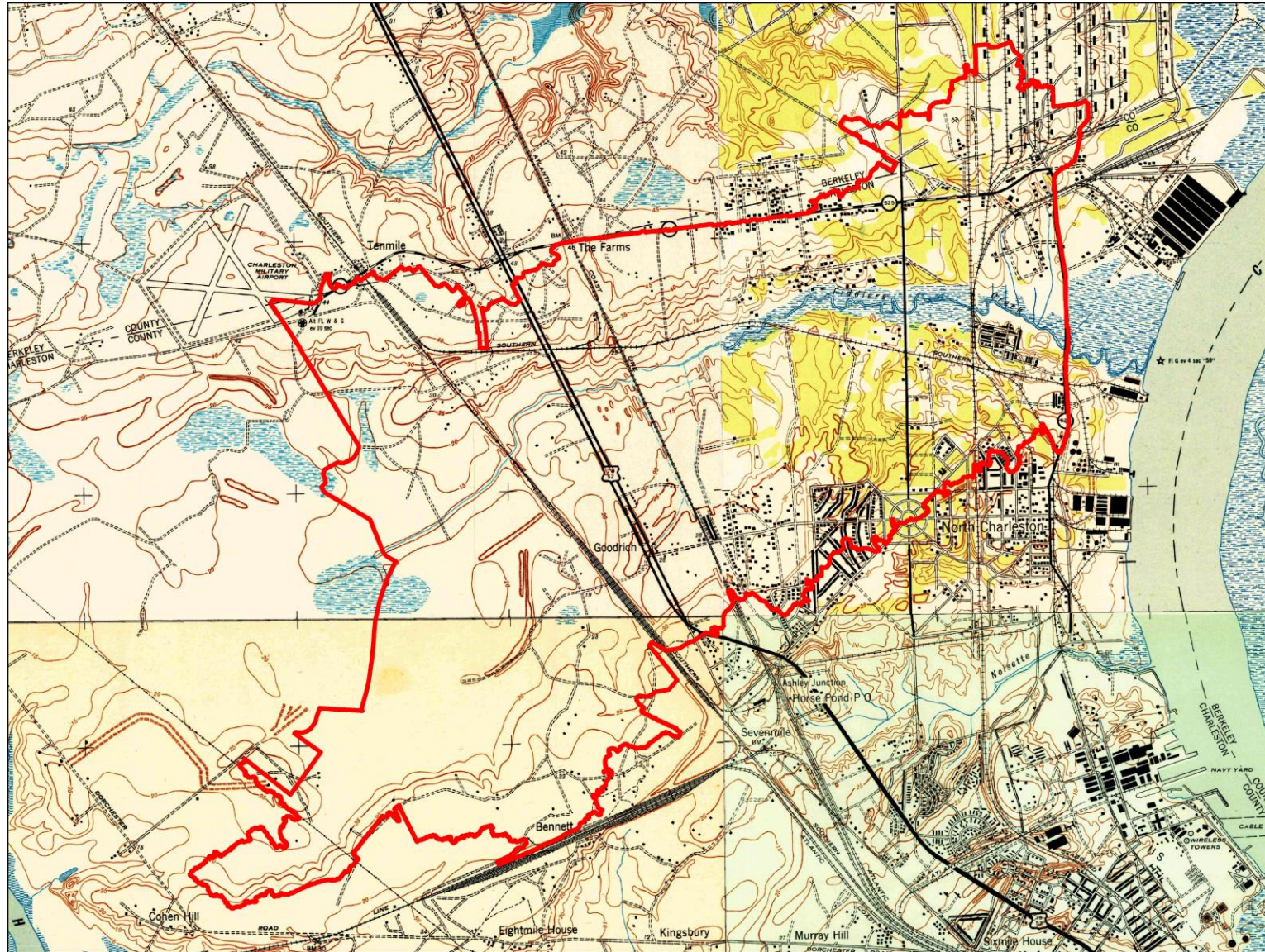
- Developed beginning in the 1920's
- Areas Adjacent to Filbin Creek fully developed by the 1980's



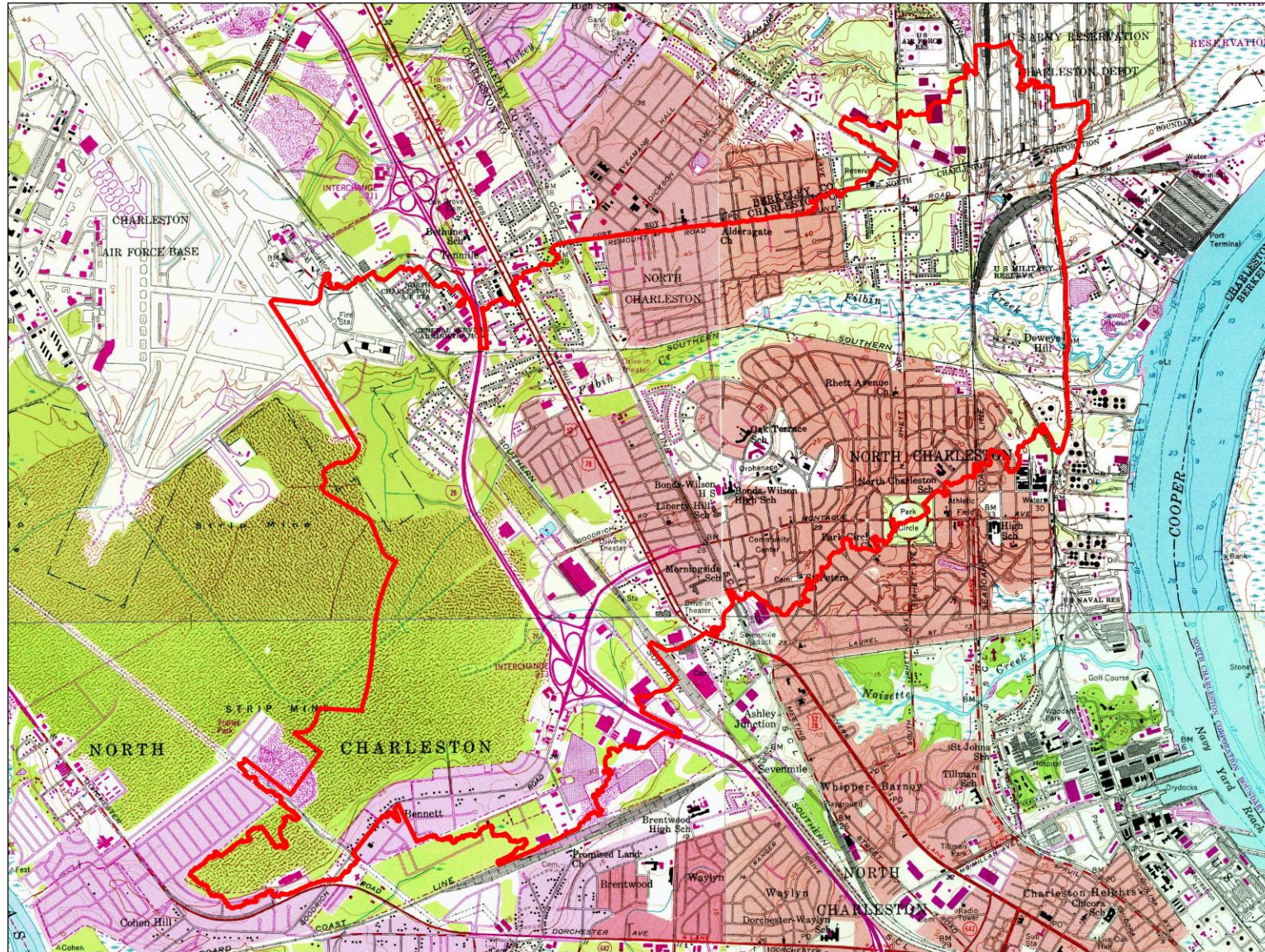
Development History (1919)



Development History (1943)



Development History (1979)



Development History (2017)



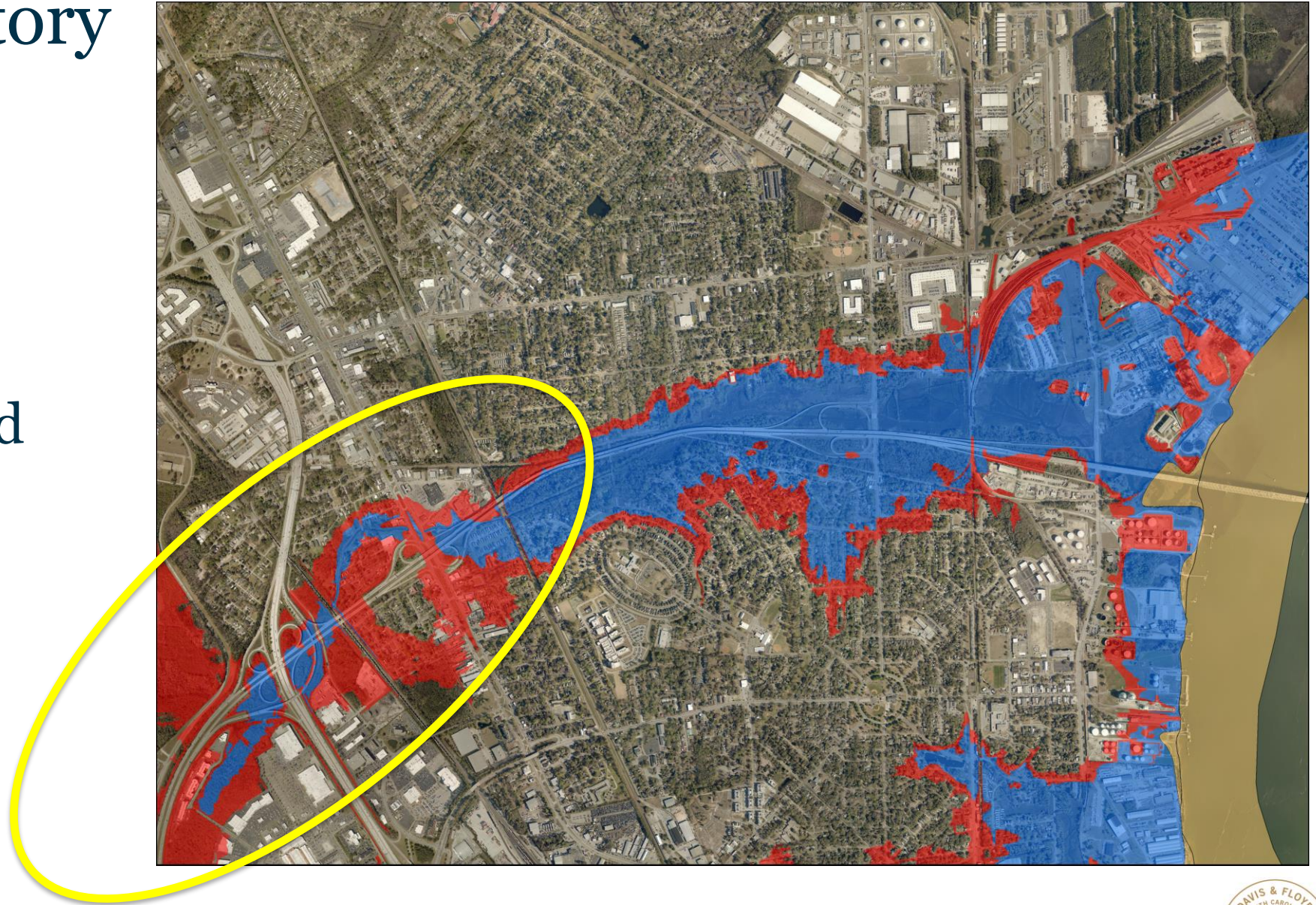
NFIP History

- NFIP Authorization
 - Authorized by the National Flood Insurance Act of 1968
- Purpose
 - To share the risk of flood losses through flood insurance
 - To reduce flood damages by restricting floodplain development



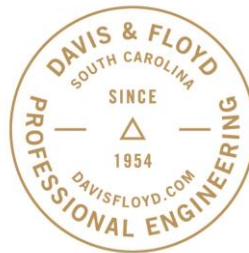
Local NFIP History

- North Charleston Flood Studies
 - First Effective in 1986
 - Revised/Updated in 2004
 - Map Modernization Maps to be adopted....



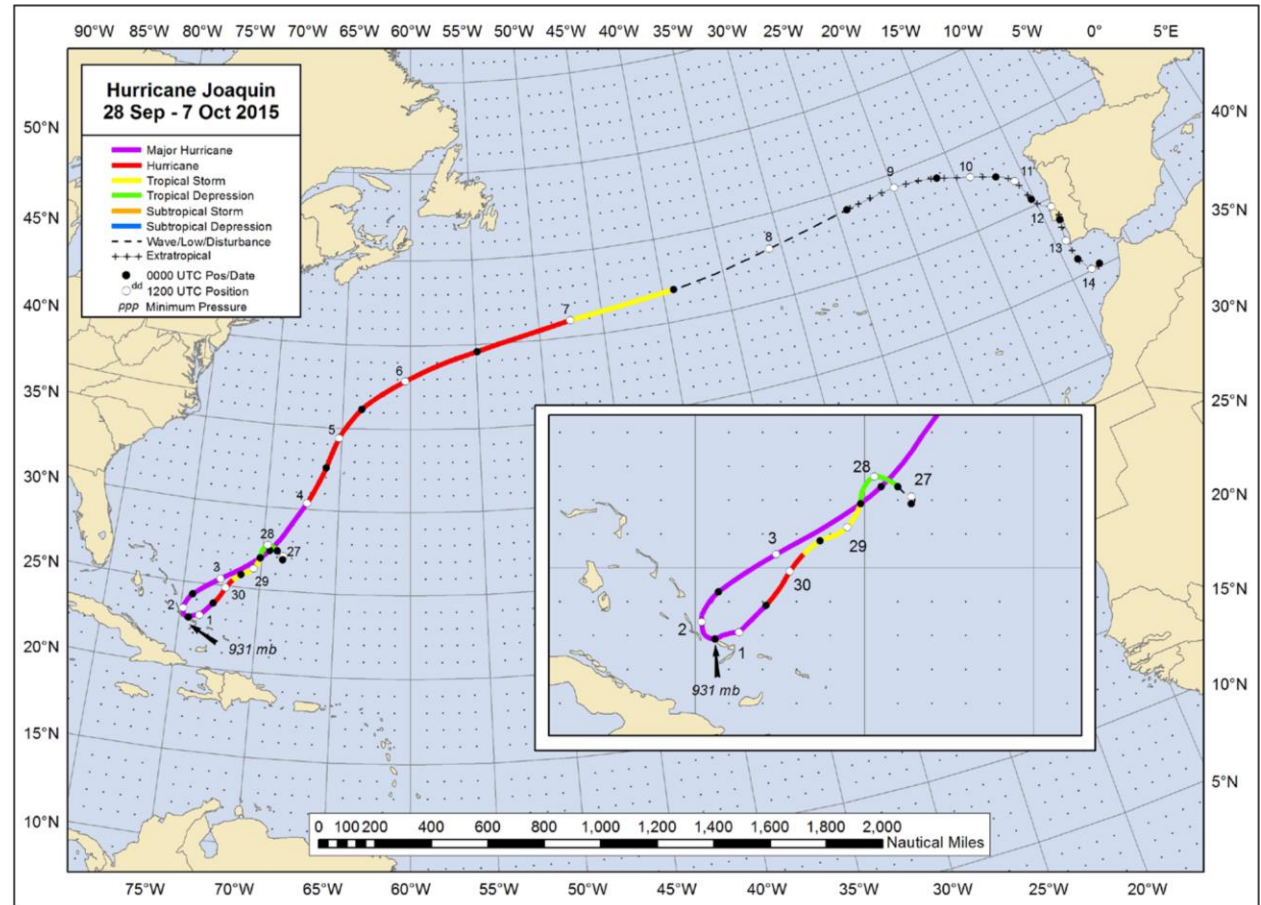
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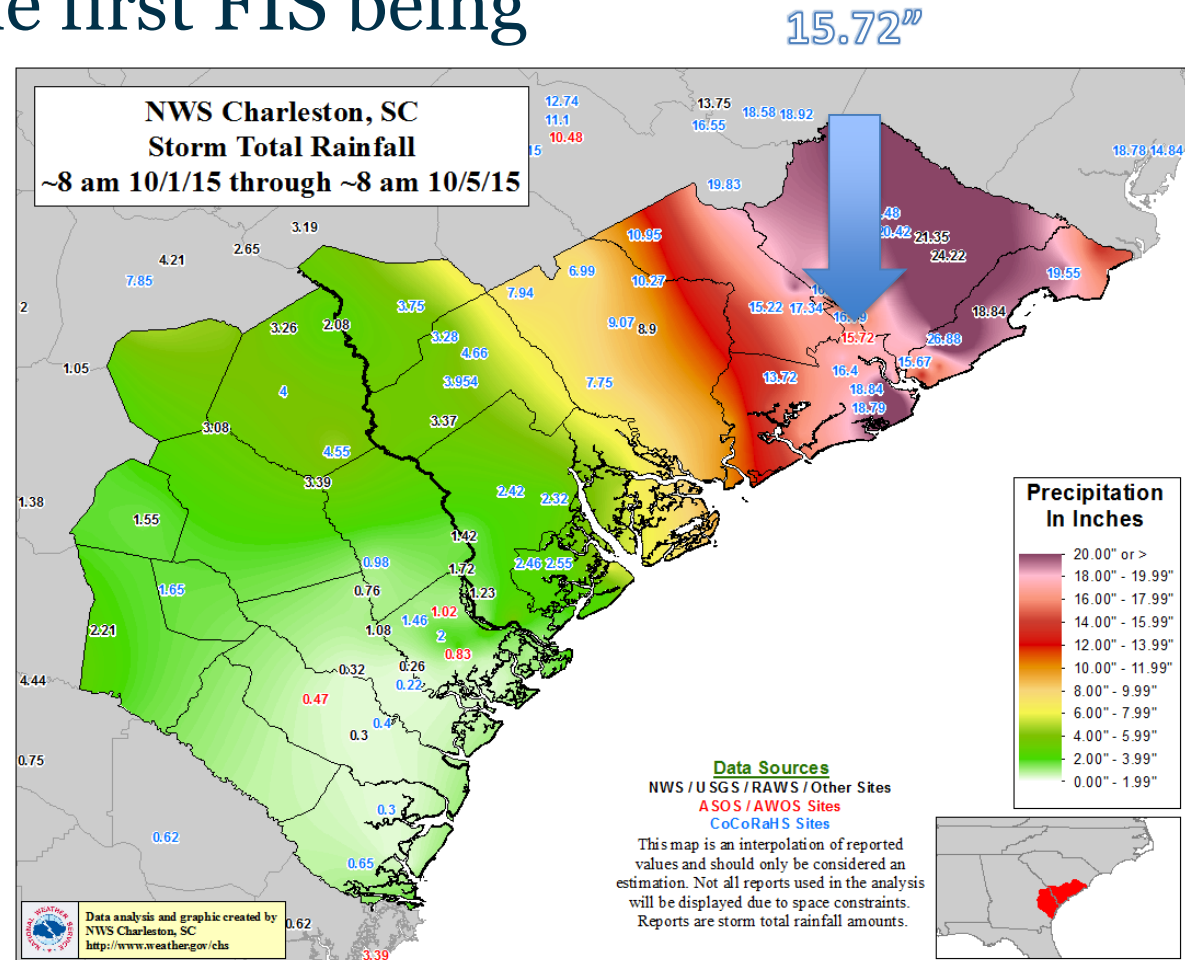
Extreme Weather Events

- Most of the development within the Filbin Creek watershed occurred prior to the first FIS being completed in 1986.
- Enter Hurricane Joaquin and the resulting 2015 floods...



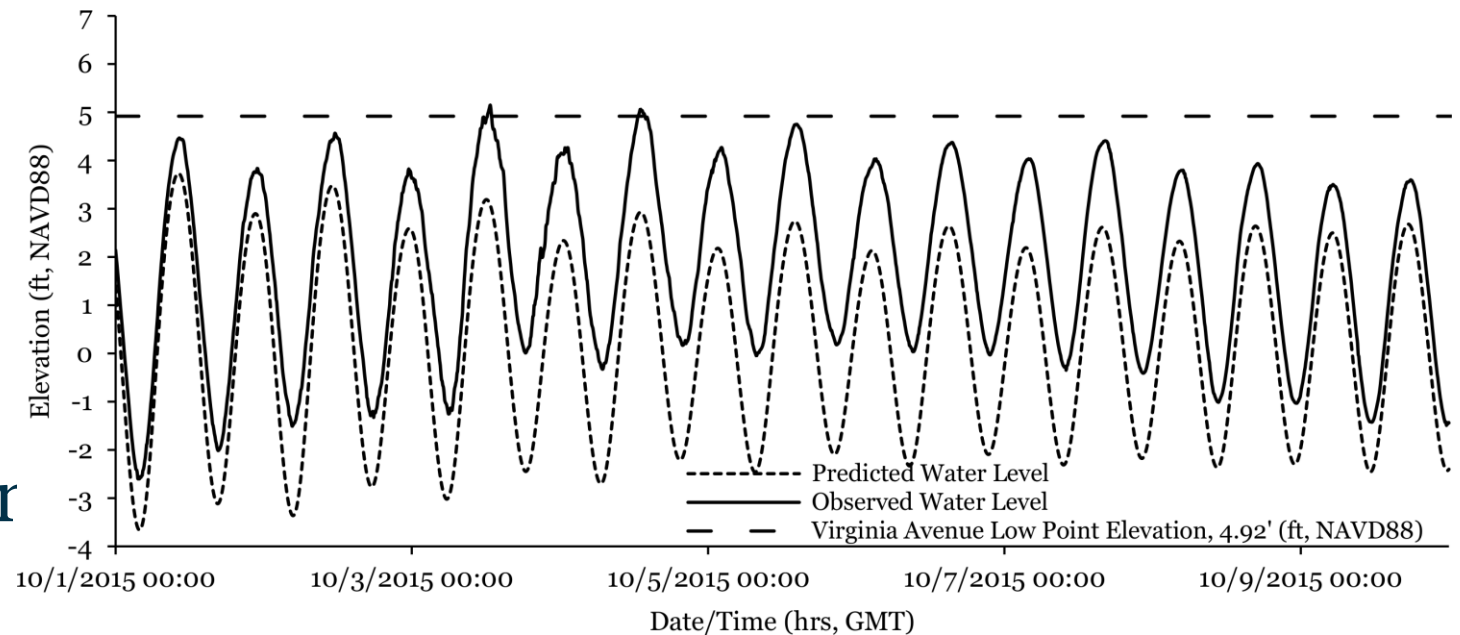
Extreme Weather Events

- Most of the development within the Filbin Creek watershed occurred prior to the first FIS being completed in 1986.
- Enter Hurricane Joaquin and the resulting 2015 floods...
 - Approximately 15.7" of rain



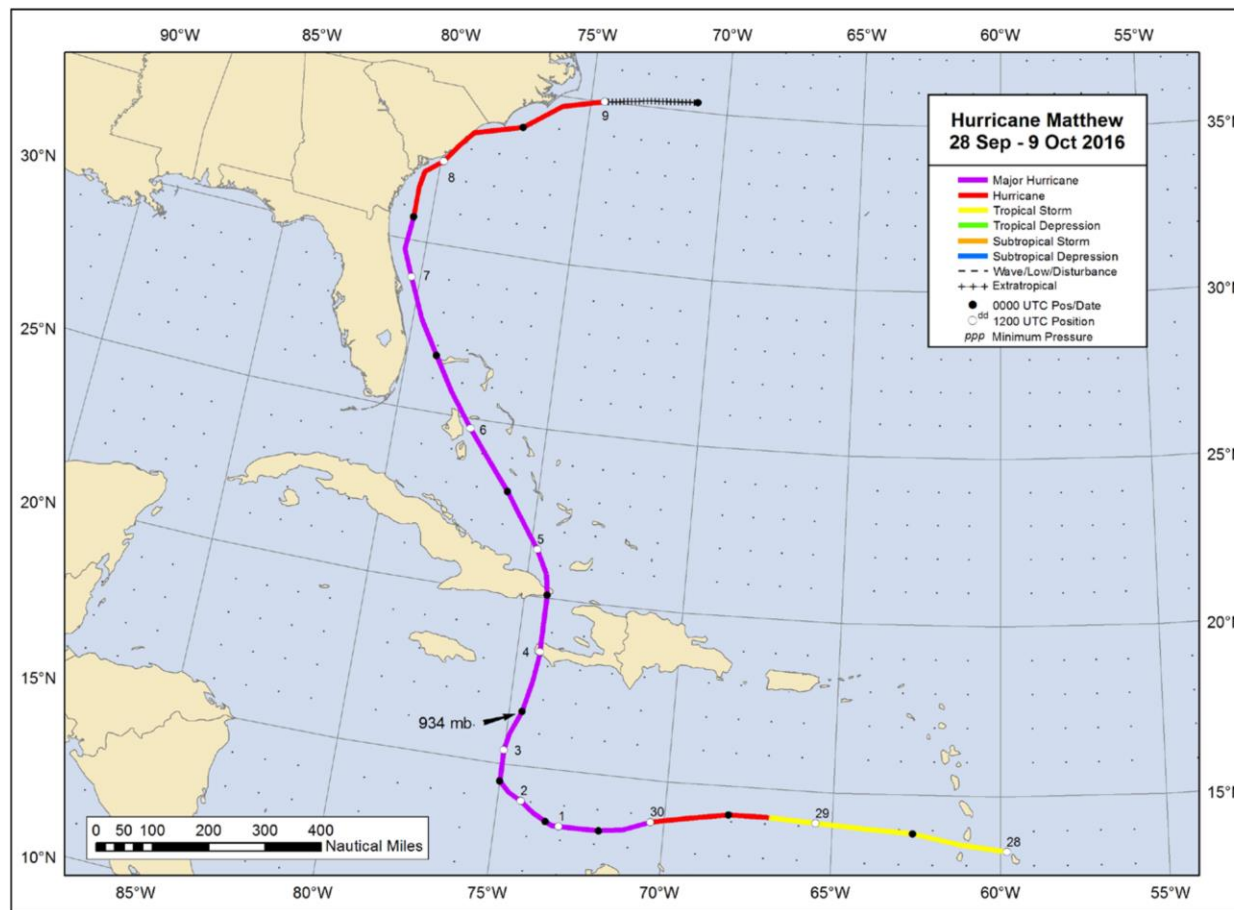
Extreme Weather Events

- Most of the development within the Filbin Creek watershed occurred prior to the first FIS being completed in 1986.
- Enter Hurricane Joaquin and the resulting 2015 floods...
 - Approximately 15.7" of rain
 - 2' Storm surge (elevation of 5.15' NAVD)



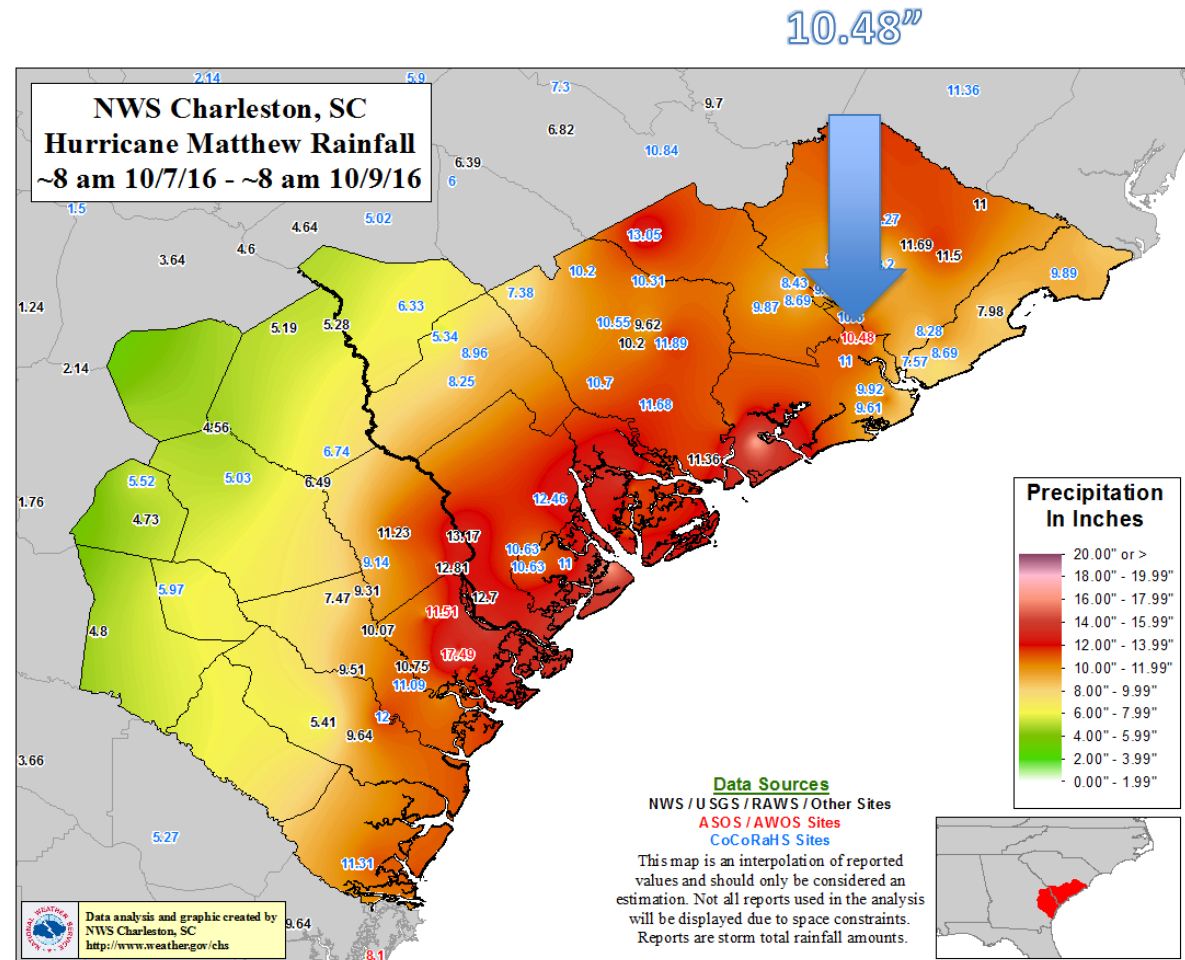
Extreme Weather Events

- Don't forget Hurricane Matthew...



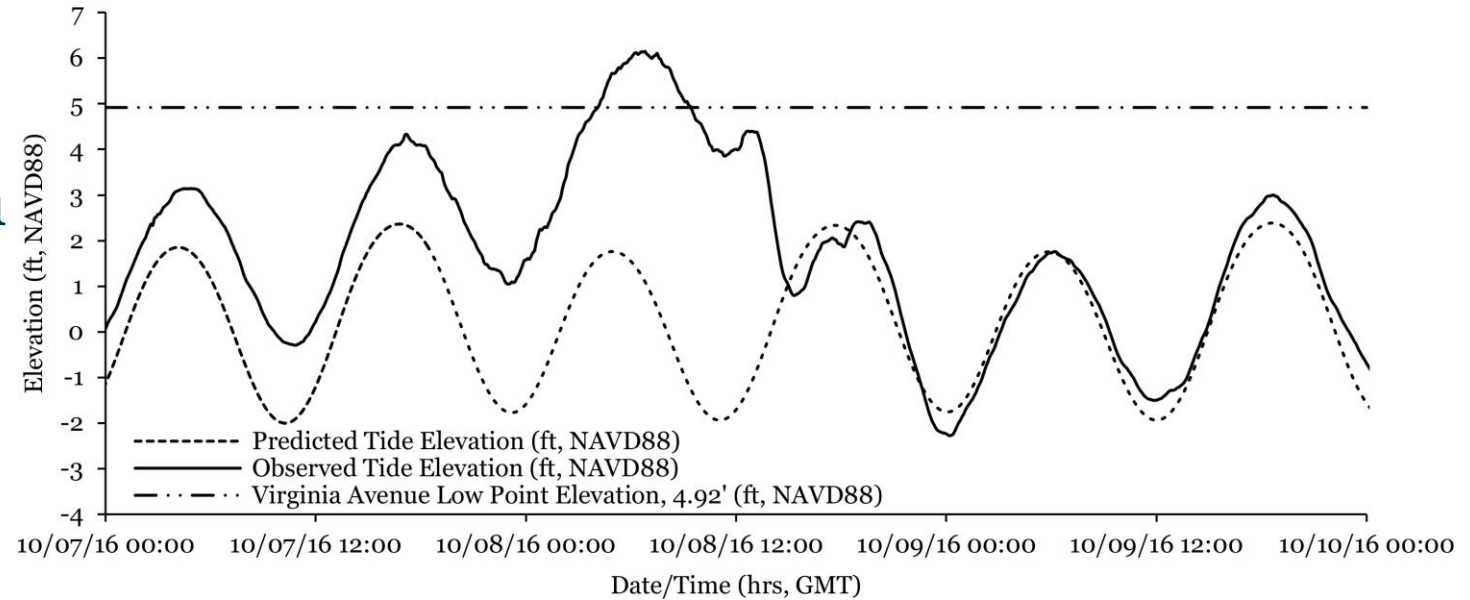
Extreme Weather Events

- Don't forget Hurricane Matthew...
- Approximately 10.5" of rain



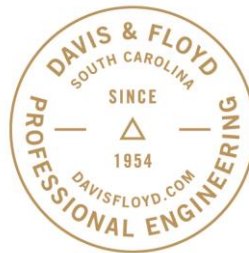
Extreme Weather Events

- Don't forget Hurricane Matthew...
- Approximately 10.5" of rain
- 5' Storm surge (elevation of 6.15' NAVD 88)



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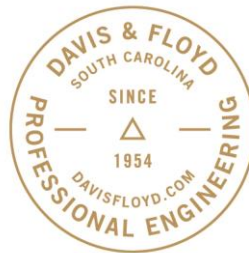


Public Perceptions and Demands

- Perceptions
 - Never flooded before
 - This bridge is too small
 - Development has caused the flooding
 - The channels and pipes are not being maintained
- Demands
 - Identify responsible parties!
 - Perform maintenance!
 - Make infrastructure improvements (to what must be broken!)

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Analysis of Hydraulic Conditions

- Following the flooding associated with Hurricane Matthew, the Public demanded action of the City
- Scope of study
 - Identify and evaluate conceptual improvements that may have the potential to alleviate flooding
- Project steps
 - Field reconnaissance
 - Identify maintenance issues
 - Inventory major hydraulic structures
 - Develop a model of Filbin Creek
 - Study conceptual improvements

Analysis of Hydraulic Conditions

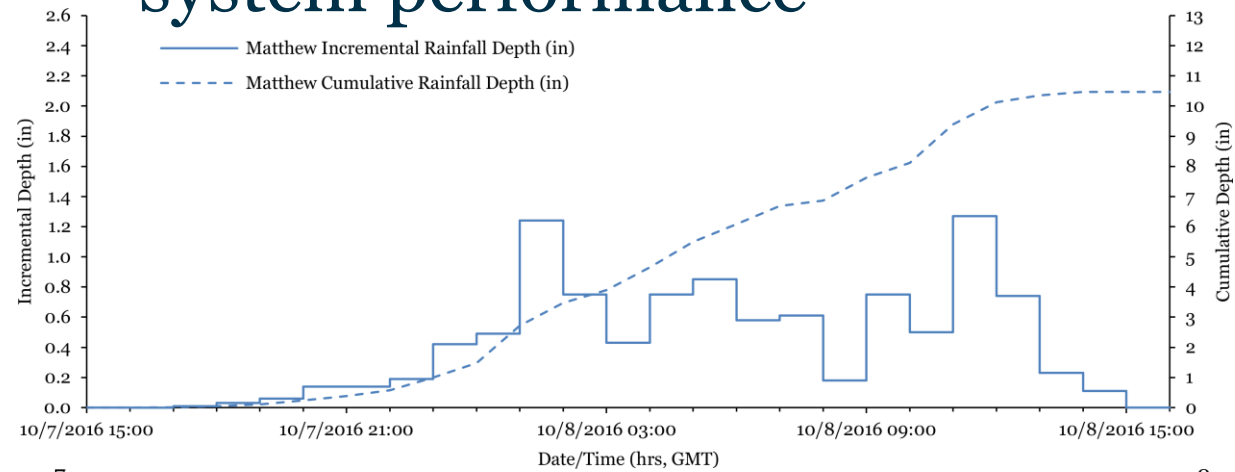
- Field reconnaissance
 - Identify any maintenance issues
 - Virginia Avenue (Remember the Flap Gates?)



- What's wrong with this picture?

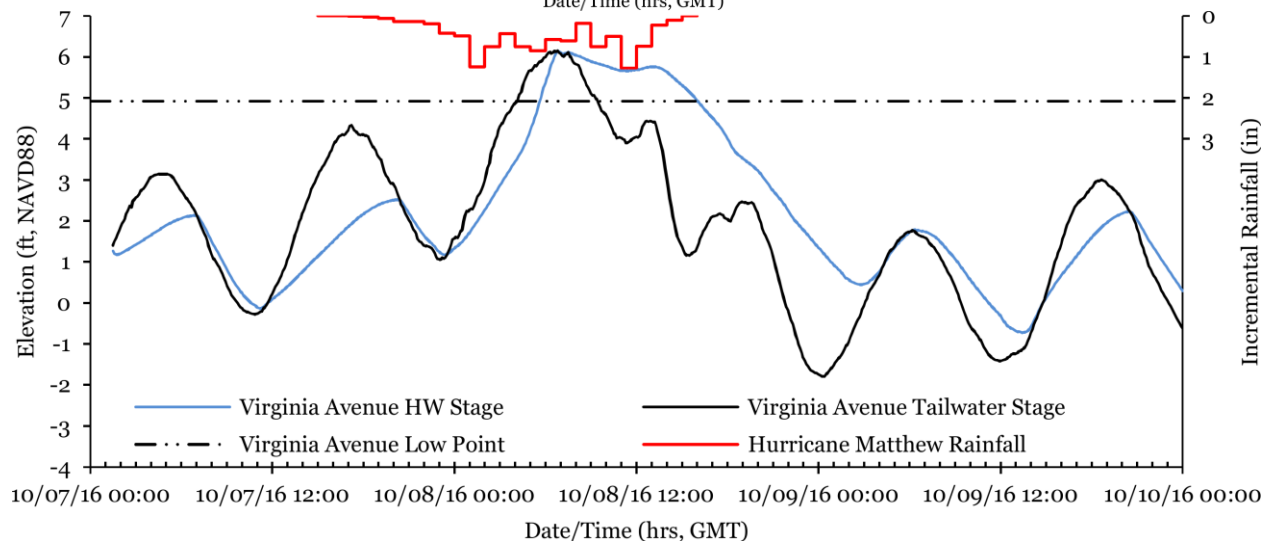
Analysis of Hydraulic Conditions

- Develop a model of Filbin Creek
 - Model Hurricane Matthew rainfall and tidal stages and assess system performance



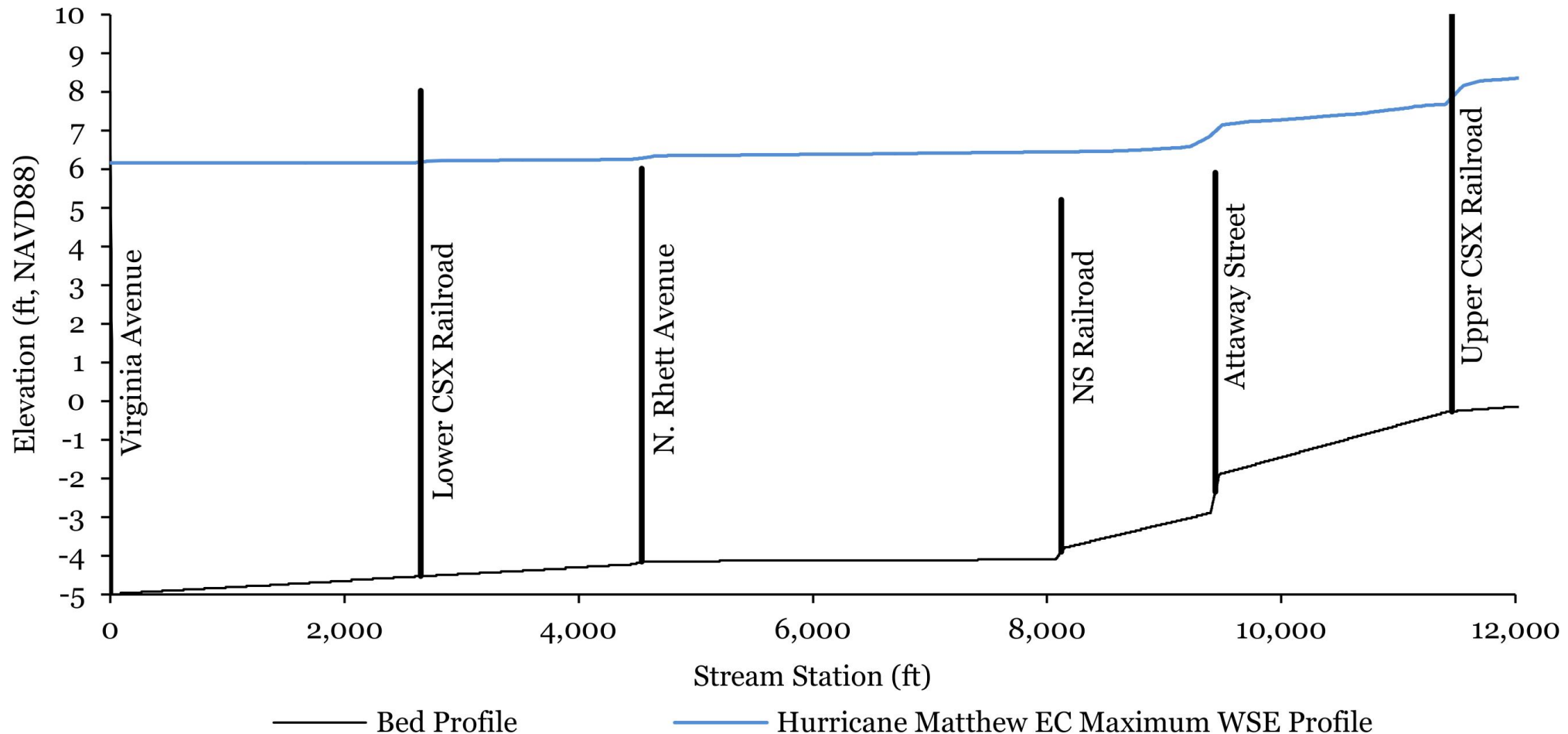
- Data Sources

- Gage Data (Where Available)
- NOAA Tide Data
- Recorded Rainfall Data
- Topographic Survey
- City Records of Damages
- Field Investigation



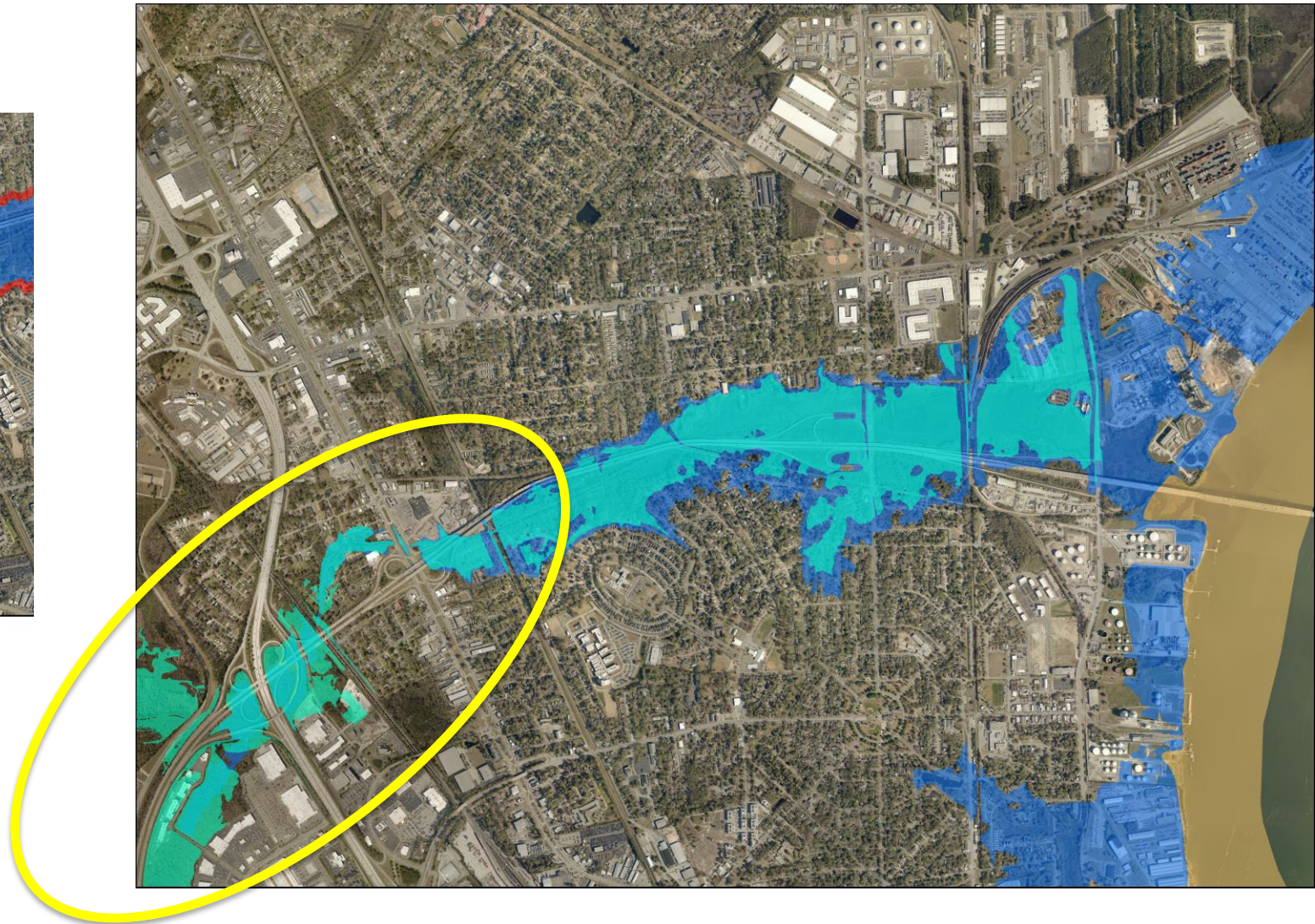
Analysis of Hydraulic Conditions

- Develop a model of Filbin Creek
 - Existing conditions performance Hurricane Matthew



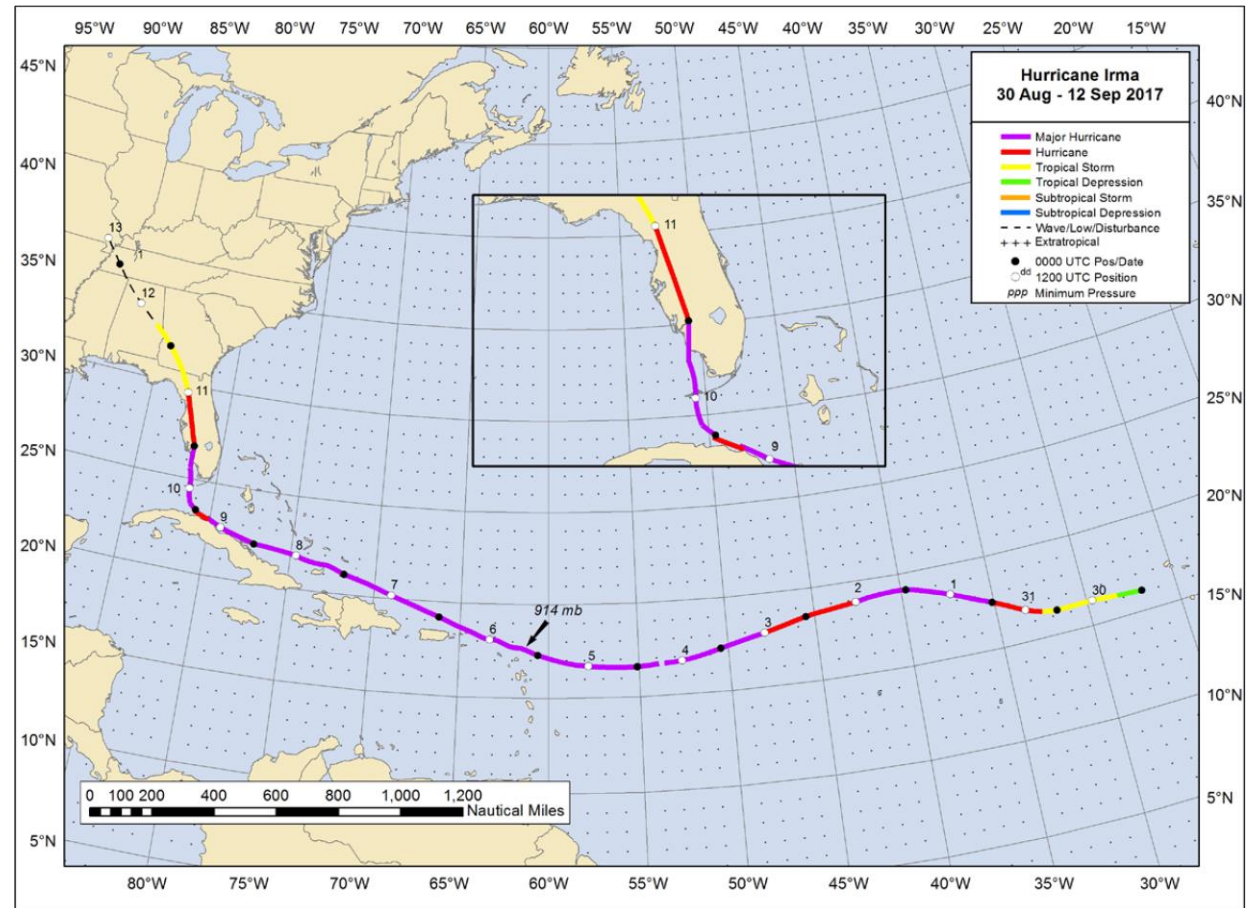
Analysis of Hydraulic Conditions

- Hurricane Matthew inundation relative to the Floodplain



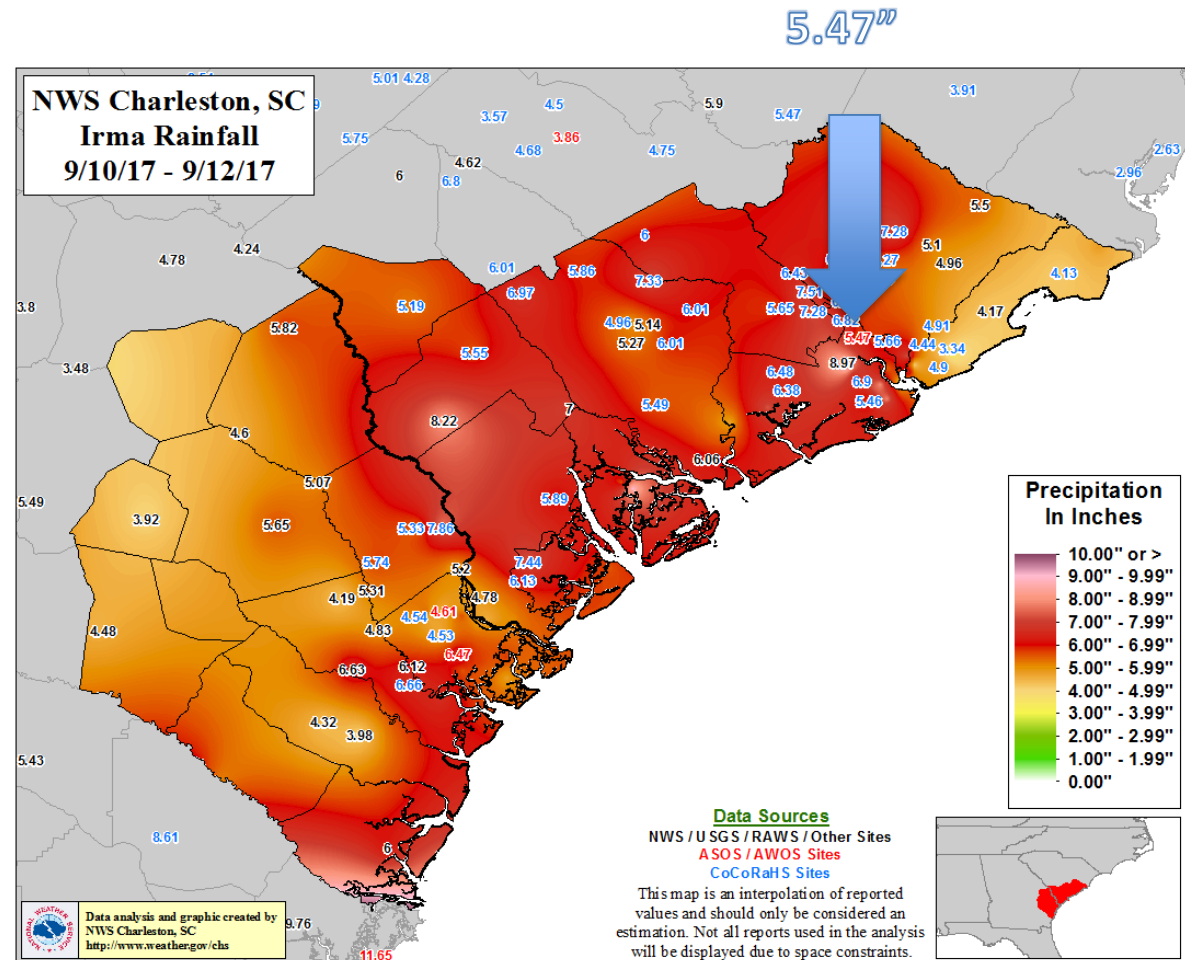
Extreme Weather Events

- And Finally Hurricane Irma...



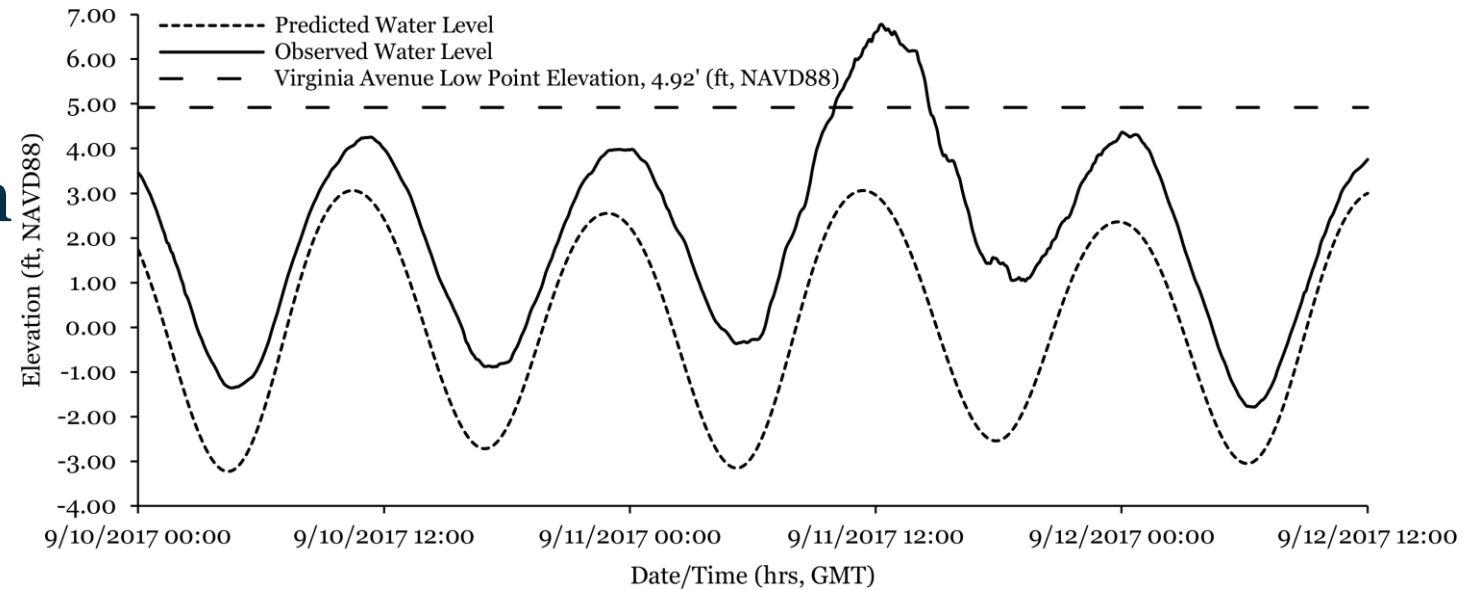
Extreme Weather Events

- And Finally Hurricane Irma...
- Approximately 5.5" of rain



Extreme Weather Events

- And Finally Hurricane Irma...
- Approximately 5.5" of rain
- 4' Storm surge (elevation of 6.78' NAVD 88)



Analysis of Hydraulic Conditions

- Locations identified for possible improvement
 - Virginia Avenue Culverts
 - Replace broken flap gate
 - Double the number of 84" culverts from 5 to 10
 - Norfolk & Southern Railroad Culverts
 - Replace the three 7' x 3.5' box culverts with a 60' trestle
 - (The original 54' trestle was replaced with the current culverts)
- Channel downstream of Attaway Street
 - Remove debris and obstructions to improve capacity

Analysis of Hydraulic Conditions

- 6 Scenarios Modeled representing varying combinations of improvements

Structure	Virginia Avenue		NS Railroad	Attaway Channel
Improvement	Replace Missing Flap Gate	Double Conveyance	60' Trestle	Clean out Channel
PC	X			
PC1	X	X		
PC2	X		X	
PC3	X	X	X	
PC4	X			X
PC5	X	X	X	X

Scenario	Benefit, Average WSE Reduction (ft)	Estimated Cost (\$)
PC	0.07'	\$50,000
PC1	0.12'	\$5,050,000
PC2	0.07'	\$5,550,000
PC3	0.11'	\$10,550,000
PC4	0.12'	\$550,000
PC5	0.17'	\$11,050,000

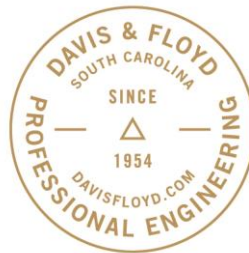
Analysis of Hydraulic Conditions

- Improvement Recommendation
 - Replacement of the missing flap gate at Virginia Avenue



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Results and Conclusions

- Results
 - Flooding for these events were the result of the combination of rainfall/runoff and storm surge.
 - Hydraulic structures were found to be adequate in capacity
- Conclusions
 - No practicable solutions to the flooding by way of:
 - Upsizing bridges and culverts
 - Performing maintenance
 - Other flood control measures or capital improvements

Rumors Dispelled

- How were the results and conclusions received by the public?
 - Public meeting with comments received
 - Not having an identified feasible solution was an unpopular outcome
 - Demands and expectations continue



And Some Rumors Continue

- We haven't had any major flooding since some maintenance (flap gate replacement) was accomplished....everything is fixed!
- Continuing development/redevelopment will only make things worse
- There must be a feasible solution to our flooding problems

Questions?