



Fairfax County Flood Response Strategy

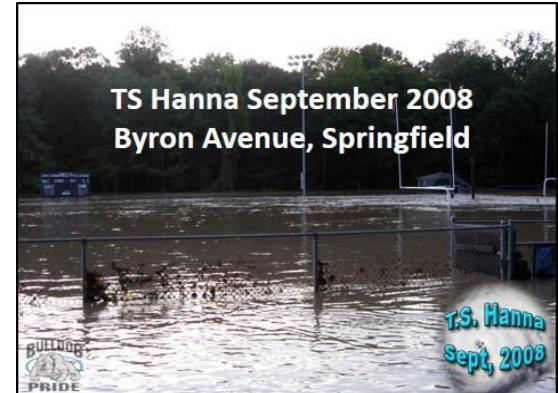
Options to Address Flooding and Improve Stormwater Management

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Fairfax County Significant Rainfall Events



Whether forecasted tropical storms or sudden downpours, significant rainfall events have impacted all parts of Fairfax County



History of Stormwater Management in Fairfax County

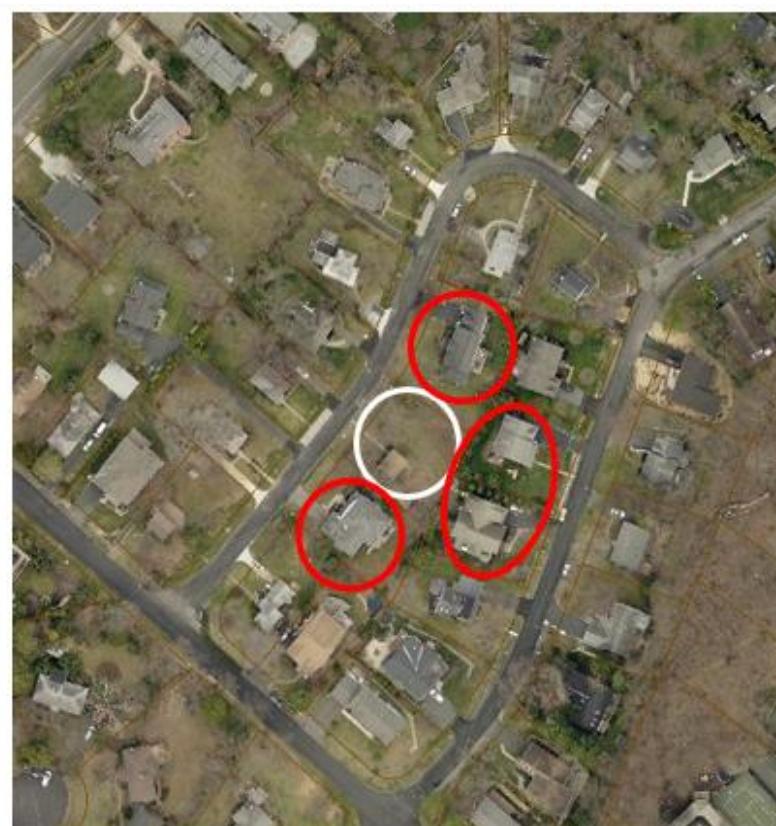
Year	Challenge	Solution
1940s	Nuisance Flooding	Stormwater Conveyance Pipe System
1960s	Stream Degradation from Pipe Discharges	Pro-Rata Share to Fund Off-Site Needs
1970s	Construction Site Erosion Degrading Streams	Local Erosion and Sediment Control Program
1970s	Floodplain Encroachments	Development Restrictions in Floodplain
1980s	More Efficient, Cost Effective, & Comprehensive Stormwater Management	Master Drainage Plans Water Supply Protection Overlay District and BMP Requirement Regional Stormwater Management Plan Detention Requirements
1990s	Increased Water Quality Protection	NPDES-Municipal Separate Storm Sewer System (MS4) Permit Stormwater BMPs Requirement Chesapeake Bay Preservation Ordinance and Resource Protection Areas
2000s	Stream Protection	Stream Physical Assessment Watershed Management Plans
	Increased Water Quality Regulations	Stormwater Tax
	FEMA Flood Insurance CRS Program	Improved from Rating of 8 to 6 (up to 20% discount)
2019	Climate Change ?? Intense Localized Storms	Here to Discuss



Challenges from Redevelopment



Aerial Imagery
1990



Aerial Imagery
2017



Options to Address Flooding Concerns

Option	This option will help address flooding of:			
	Yard	Road	Structures	Structures in Floodplain
Enhance overland relief protection/floodproof home	✗	✗	✓	□
Improve <u>stormwater conveyance system</u>	✓	✓	□	✗
Upsize stormwater conveyance system	✓	✓	✓	✗
Upgrade existing road culverts	□	✓	□	✗
Property acquisition	□	□	✓	✓
More stringent requirements for infill development	□	□	□	✗
Administrative/Financial provisions	□	□	□	□

✗ Little Benefit
✓ Positive Benefit
□ Sometimes Helps (site and design dependent)



Existing Development

Enhance Overland Relief Protection

- Provide overland relief path to meet current design standards
- Include a factor of safety to address changing climate patterns
- Place path in an easement on plat
- Can be coupled with floodproofing

Advantages

1. Overland relief paths tend to have greater capacity
2. Easements would more readily identify flow path to future owners
3. Less disruptive than many alternatives

Challenges

- 1) Water still flows across property and in roads
- 2) Large areas on properties in easements
- 3) Resident actions occasionally block flow paths - fences
- 4) Enforcement
- 5) Floodproofing costs vary widely

This option will address flooding of:			
Yard	Road	Structures	Floodplain
✗	✗	✓	<input type="checkbox"/>





Existing Development

Improve Stormwater Conveyance System

- Install a stormwater conveyance system where none exists
- Improve inadequately sized pipes and open channels

Advantages

- 1) Conveys the high frequency, low magnitude storms
- 2) Provides defined paths for waterflow
- 3) Can provide protection to structures during routine storms

Challenges

- 1) Significant rain events overwhelm system
- 2) Concentrated flow at end of pipe can cause erosion
- 3) Moves problem downstream
- 4) Identifying land for detention areas
- 5) Can require extensive land acquisitions
- 6) Existing utility conflicts
- 7) Limited space between homes
- 8) Cost – Franklin Park >\$800/LF

This option will address flooding of:			
Yard	Road	Structural	Floodplain
✓	✓	□	✗



Older neighborhood with no stormwater management vs. newer subdivision





Existing Development/New Development/Redevelopment

Upsize Stormwater Conveyance System

- Upsize existing system to above current design standards to convey larger storms

Advantages

1. Conveys more storms in pipe or paved channel

Challenges

- 1) Construction on developed properties
- 2) Significant Utility conflicts
- 3) Cost – one project is \$2800/LF
- 4) Events can still overwhelm the system
- 5) More concentrated flow downstream

Storm	Pipe Diameter	Cost
2-Year	33"	\$200
10-Year	42"	\$300
25-Year	48"	\$350
100-Year	54"	\$430

Storm Sewer Pipe Sizing for a 12-Acre Residential Subdivision

This option will address flooding of:			
Yard	Road	Structures	Floodplain
✓	✓	✓	✗





Existing Development

Upgrade Existing Road Culverts

- Upgrade existing road culverts to meet or exceed current design standards
- Includes VDOT maintained infrastructure – requires change to existing Board Policy

Advantages

- 1) Protects roads
- 2) Reduces upstream backups
- 3) Reduce vehicle flood losses

Since FY2016, Fairfax County and VDOT have partnered on 51 projects totaling \$4M in state funds to address stormwater drainage problems

Challenges

- 1) Utility conflicts
- 2) Land acquisition
- 3) Current Board Policy
- 4) May require stream stabilization at the outfall
- 5) Cost – Several estimates about \$1M/crossing

This option will address flooding of:			
Yard	Road	Structures	Floodplain
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





Existing Development

Property Acquisition

- Voluntary acquisition of homes with repetitive flood loss
- Apply for FEMA Repetitive Loss Program
- Use property to provide floodplain storage or stormwater detention

Advantages

- 1) Eliminates structures that flood
- 2) Potentially use vacant property for detention or water quality

Challenges

- 1) Vacant properties require maintenance
- 2) Very few homes would qualify for FEMA hazard mitigation grants
- 3) Costs
- 4) Disruption to owners
- 5) Purchase and demolition

This option will address flooding of:			
Yard	Road	Structures	Floodplain
<input type="checkbox"/>	<input type="checkbox"/>	✓	✓





Redevelopment

More Stringent Requirements for Infill Development

- Detain 2.5 inches from new impervious area
- Extend the limit of overland relief review and if relief is inadequate, require on-site detention
- Limit the amount of allowable impervious cover on residential lots

Advantages

- 1) Development helps fund improvements
- 2) Reduces cumulative impact of development

Challenges

- 1) Improvements are incremental as development occurs
- 2) Applies only when permits are required
- 3) Space for onsite detention
- 4) Releasing stored water
- 5) Homeowner maintenance

This option will address flooding of:			
Yard	Road	Structural	Floodplain
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>





New/Redevelopment

Administrative/Financial Provisions

- Create an overlay district with development restrictions for flood prone areas
- Restrict basements in floodplains and adjacent to overland relief paths
- Remove grandfathered permitted use and special exceptions uses in both minor and major floodplains and increase setback requirements
- Encourage homeowners outside of the FEMA floodplain to purchase flood insurance and install floodproofing measures
- Educate homeowners on keeping overland relief path free of obstructions
- Map minor floodplains (drainage areas between 70 and 360 acres)

This option will address flooding of:			
Yard	Road	Structures	Floodplain
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Advantages

- 1) Lower cost
- 2) Does not move problem downstream
- 3) Flood insurance provides a proactive approach

Challenges

- 1) What defines flood prone?
- 2) Overlay district does not address current issues
- 3) Potentially restricts use of land
- 4) Potentially impacts structure



Stormwater Management Project Priorities

The County currently prioritizes stormwater management projects based on the 1997 Policy for Prioritizing Stormwater Control Projects for Funding Consideration:

1. Mandated by state and federal regulation and projects that address critical/emergency dam issues
2. Structural damage by flood water or being undermined by severe erosion
3. Stormwater quality improvements in conformance with the Chesapeake Bay initiatives or VPDES permit
4. Severe streambank and channel erosion
5. Moderate or minor streambank and channel erosion
6. Yard flooding
7. Road flooding

2006 Board adopted – “Road projects not related to protection of streambeds or banks or water quality will not be funded out of the stormwater and watershed budget.”



Stormwater Design Storms

10-Year, 2-Hour Design Storm

- Total estimated precipitation= 2.56 inches
- Average residential roof size= 2,000 square feet
- Total Rainfall Volume= 3,200 gallons
- Number of 55-gallon rain barrels= 58
- Cistern size= 18 ft x 30 ft x 6 ft (like an in-ground pool)
- 70-acre neighborhood estimated rainfall volume= 3,535,000 gallons
- Equivalent to more than 5 Olympic Size Swimming Pools



	Intensity	Duration	Rainfall
Recommend	10-Year	2-Hour	2.5"
	200-Year	30-Minute	2.5"
High Risk Dam Standards		24-Hour	34"
7/8/2019 Storm	>1000-Year	30-Minute	3.6"
	1000-Year	1-Hour	5.3"
Comparisons	100-Year	30-Minute	2.3"
	100-Year	2-Hour	4.0"
	100-Year	24-Hour	8.4"



Policy Discussion

1. Review/Define County's Role

- Floodplains- traditionally very limited –exception Huntington and Belle View (tidal flooding)
- When no stormwater infrastructure or easements – traditionally very limited –exception neighborhood improvement projects (Patton Terrace)
- When there are improvements, easements and infrastructure, - evaluate for improvements after an event that impacts structures, may include enforcing or constructing overland relief –exception Hayfield Farms
- Roadway flooding not funded with Stormwater Funds

2. Priorities-

- Allow stormwater funds to be used to fund stormwater improvements for roadways
- Current priorities are focused on structures
- Should yard flooding be a higher priority?
- Should keeping residential roads open be a higher priority?

3. Managing Risk –

- Potentially any design can be exceeded by a storm
- When upsizing pipes use 100-year storm?
- Require new development/redevelopment to capture 2", 4" or 6"? Or storm size?



Policy Discussion -Recommendations

A. Overland relief -

- Allow yards to be used for overland flows
- Allow roads to be used for overland flows
- Require overland relief paths to be designated on plats
- Map minor floodplains (between 70 and 360 acres)
- Utilize floodproofing practices where feasible – on structures that have experienced flooding
- Restrict basements in floodplains and adjacent to overland relief paths

B. Design Recommendations

- When upsizing pipes due to flooding, design to the 100-year storm
- Develop standards that require new impervious surfaces, including by right infills, to capture 2.5"

C. Review cost versus provided protection-

- Upsizing pipes is frequently more expensive than purchasing the houses that flooded
- Upsizing pipes between houses is disruptive and risky
- Few options exist to protect structures in floodplains
- Consider purchasing when solutions are more expensive

D. 6. Encourage the use of flood insurance



Additional Information

For additional information, please contact

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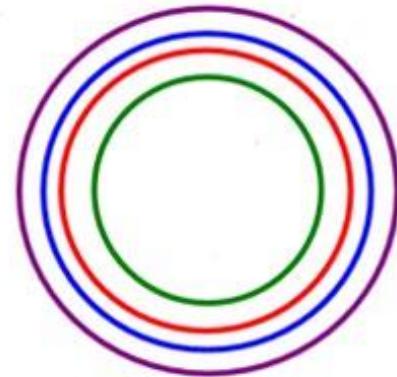


Existing Development/New Development/Redevelopment

Upsize Stormwater Conveyance System

Challenges

- What storm should the system contain? When does the project cost outweigh the assumed risk?
- Extensive land acquisition
- Significant utility conflicts
- Increased risk/liability working around homes
- May be infeasible to daylight pipe



Storm Sewer Pipe Sizing for a 12-Acre Residential Subdivision

Storm	Pipe Diameter	Cost
2-Year	33"	
10-Year	42"	
25-Year	48"	
100-Year	54"	



**Storm duration can considerably effect a community's potential to flood.
A storm that produces 4.12 inches over 12 hours is considered a 10-year storm.
A storm that produces the same amount of rain in 60 minutes is a 500-year to 1,000-year storm.**