

# DEQ Certification Class Presentations

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**July 2024**

# Module 5

## Minimum Standard 19 Channel and Flood Protection

# Module 5 Contents

5a. Overview of Minimum Standard 19

5b. Managing Water Quantity

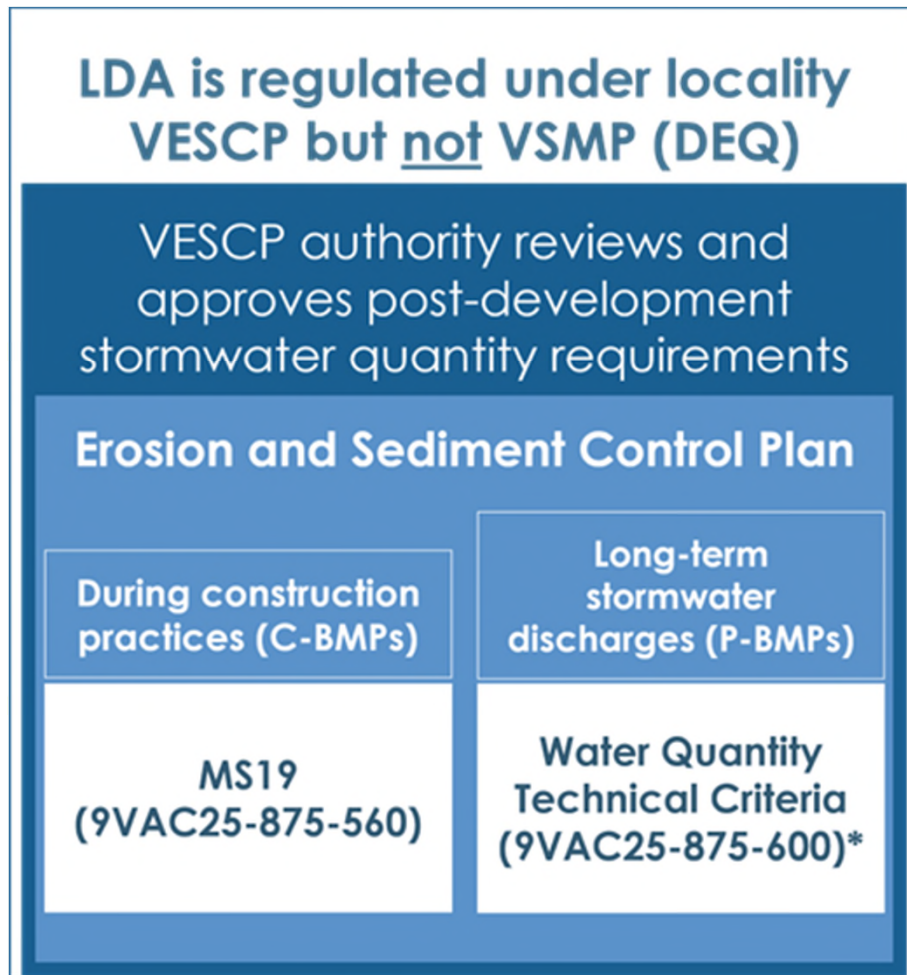
5c. Post-Development Requirements for Plans  
Approved After July 1, 2014

5d. MS-19 Post-Development Stormwater  
Management

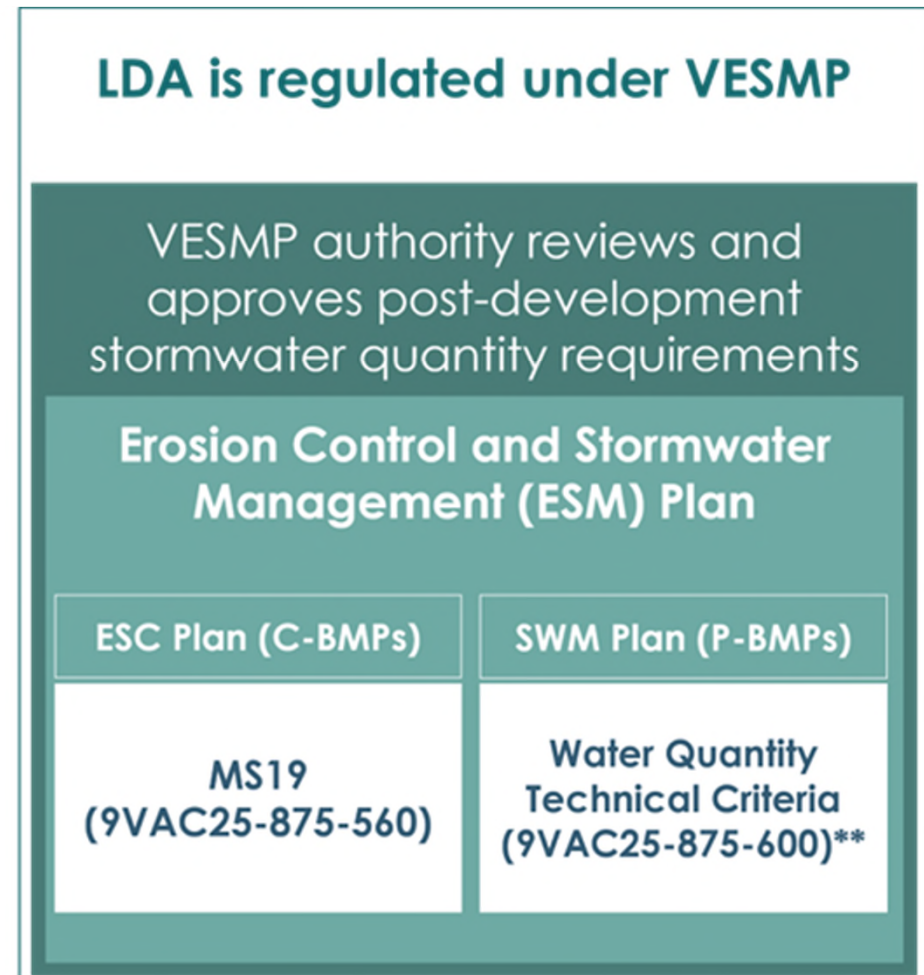
# Module 5a.

## Overview of Minimum Standard 19

# Post-development Channel & Flood Protection



\*Unless §62.1-44.15:55.F applies



\*\*Unless 9VAC25-875-490 or §62.1-44.15:34.F-G apply

# Module 5b.

## Managing Water Quantity

# During Construction and Post-Development prior to July 1, 2014

- *Water quantity requirements in MS19 a-c*
  - *Post-development for plans approved prior to July 1, 2014; and*
  - *During construction for all plans*

# General Provisions

- Use *existing* watershed characteristics and *ultimate* development conditions
- Maintenance required
- Discharge to a channel with energy dissipaters
- Verify adequacy of on-site channels
- Parcels within developments to be considered as a single project



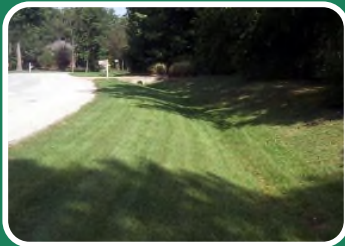
*During Construction - All plans*  
*Post-Development - Plans prior to July 1, 2014*

## Concentrated Runoff



### Natural Channel

- 2-year storm (erosion and capacity)



### Man-Made Channel

- 2-year storm (erosion)
- 10-year storm (capacity)



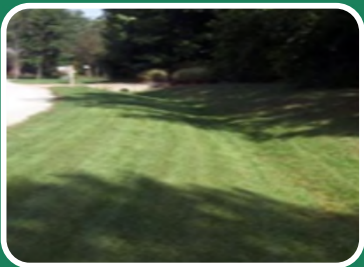
### Stormwater Infrastructure (Pipes)

- 10-year storm (capacity)

*During Construction - All plans*

*Post-Development - Plans prior to July 1, 2014*

**If Existing Channels or Pipes are Not Adequate,  
Improve**



### **Man-Made Channel**

- 2-year storm (erosion)
- 10-year storm (capacity)



### **Stormwater Infrastructure (Pipes)**

- 10-year storm (capacity)

*During Construction - All plans*

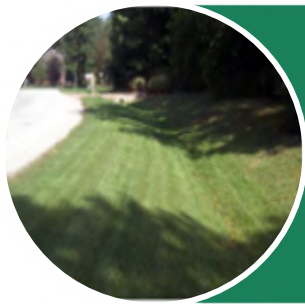
*Post-Development - Plans prior to July 1, 2014*

## If Existing Channels or Pipes are Not Adequate, Develop Site Design



### **Natural Channel**

- Stormwater discharge does not increase for 2-yr storms



### **Man-Made Channel**

- Stormwater discharge does not increase for 10-yr storms



### **Provide Combination**

- Channel improvement
- Stormwater detention
- Other measures to prevent erosion

# As a Plan Reviewer...



Important to ensure the plan details any channel or pipe/pipe system improvements (including stormwater detention practices) and that appropriate notes included to guide inspections.

*During Construction - All plans*  
*Post-Development - Plans prior to July 1, 2014*

**↑ Sheet Flow**



**Stable  
outlet**



**Adequate  
channel**



**Adequate  
pipe/storm  
sewer  
system**








**Detention  
facility**

# Module 5c.

Post-development Requirements for  
Plans Approved After July 1, 2014



# Post-Development After 7/1/14

Plans approved after July 1, 2014 (except if grandfathered)	Water Quantity Part V, Article 3 Energy Balance + Flooding	Water Quality Part V, Article 3 Runoff Reduction, Pollutant Removal
LDA*:		
$\geq 1$ acre		
$\geq 10,000$ ft. <sup>2</sup>		
$\geq 2,500$ ft. <sup>2</sup> in CBPA		

\*May be more stringent (district or locality)

# Verifying Site Characteristics

- Site inspections
- Topographic surveys
- Soil maps or studies
- Calculations consistent with good engineering practices



# Design Storms and Hydrologic Methods

- The VESM Regulations water quantity requirements use the 1, 2, and 10-year storms
- Use *existing* watershed characteristics and *ultimate* development conditions
- Use of NRCS Synthetic 24-hour rainfall distribution and models
- Allowance for Modified Rational Method for drainage areas  $\leq 200$  acres

# Part V, Article 3 Stormwater Quantity

## Channel Protection

### *Section B*

- Criteria depends on natural, manmade, or restored conveyance system
- 1 year storm used for Energy Balance
- 2 year storm is used to analyze for *erosivity*

AND

## Flood Protection

### *Section C*

- Criteria depends on existing flooding conditions
- 10 year storm analyzed for *capacity*

## Sheet Flow

### *Section D*

Disconnected impervious area or physical spreading of water from a level spreader  
Increased volumes of sheetflow have to be analyzed  
If satisfied, no further water quantity controls are required

# Plans Approved After 7/1/14

## Channel Protection from Concentrated Runoff



Natural

EB



Man-made

EB  
or  
2-yr



Restored

EB  
or  
Design

# Plans Approved After 7/1/14

## Channel Protection from Concentrated Runoff to a **Natural Conveyance System**



Natural

EB

- When a site outlets to a natural channel, it must meet Energy Balance:
  - Post-development discharge rate and runoff volume from the 1-year storm is managed to be similar to pre-development
  - Usually achieved by reducing post-development runoff volume

# Plans Approved After 7/1/14

## Channel Protection from Concentrated Runoff to a **Manmade Conveyance System**



Man-made

EB  
or  
2-yr

- Pipes, ditches, vegetated swales, or other system constructed by man:

- Convey the 2 year storm without causing erosion of the system

*to the limits of analysis*

**OR**

- Energy Balance



# Plans Approved After 7/1/14

## Channel Protection from Concentrated Runoff to a **Restored Conveyance System**



Restored

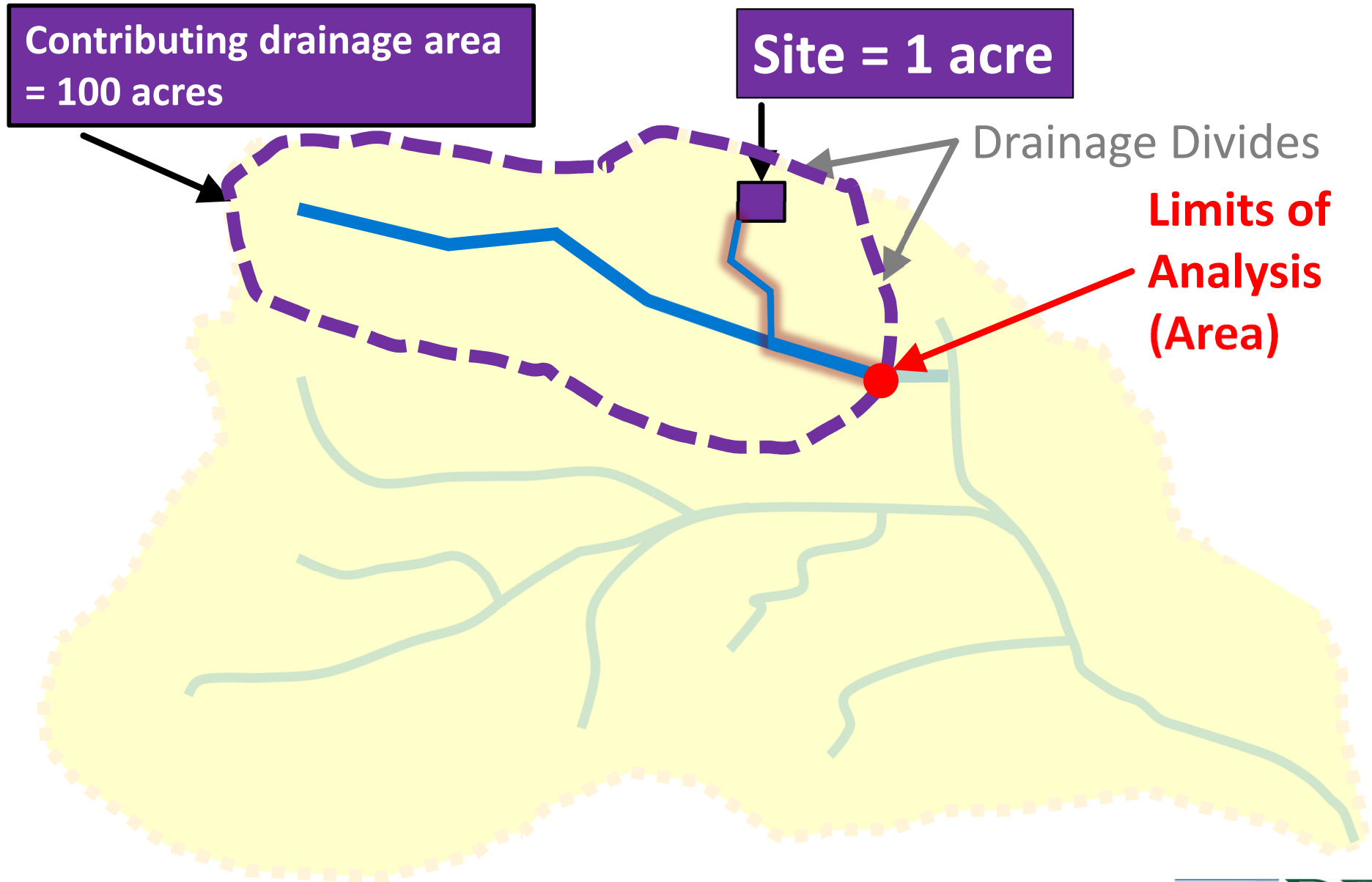
EB  
or  
Design

- A restored conveyance system includes the main channel and flood prone area:
  - Development and peak flow consistent with design parameters of the restored system to *the limits of analysis*
- OR
- Energy Balance

# Limits of Analysis for Channel Protection

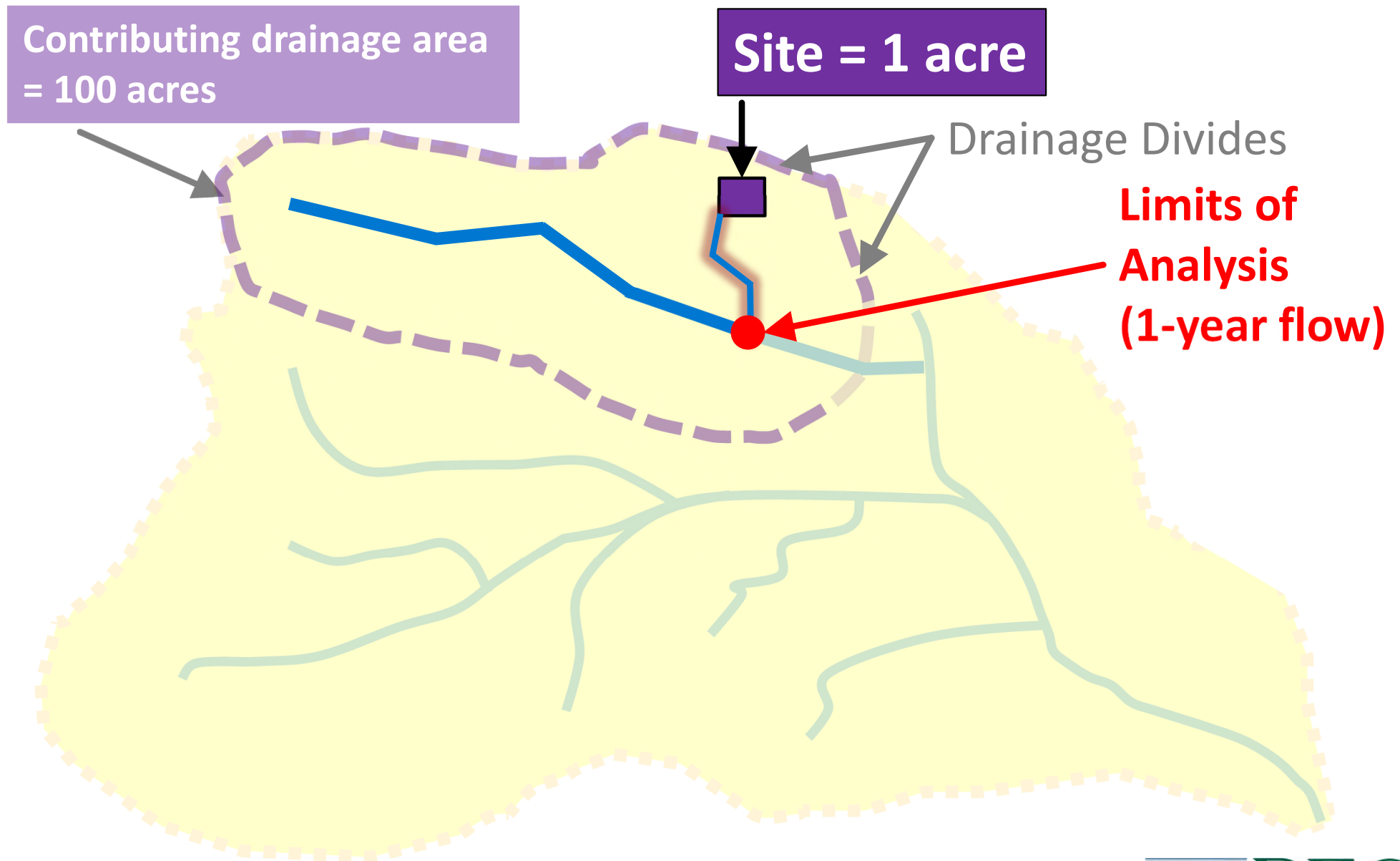
- How far does designer need to analyze receiving conveyance system?
- Not applicable when utilizing energy balance
- Based on watershed area or peak flow rate

# Limits of Analysis (Channel Protection by Area)



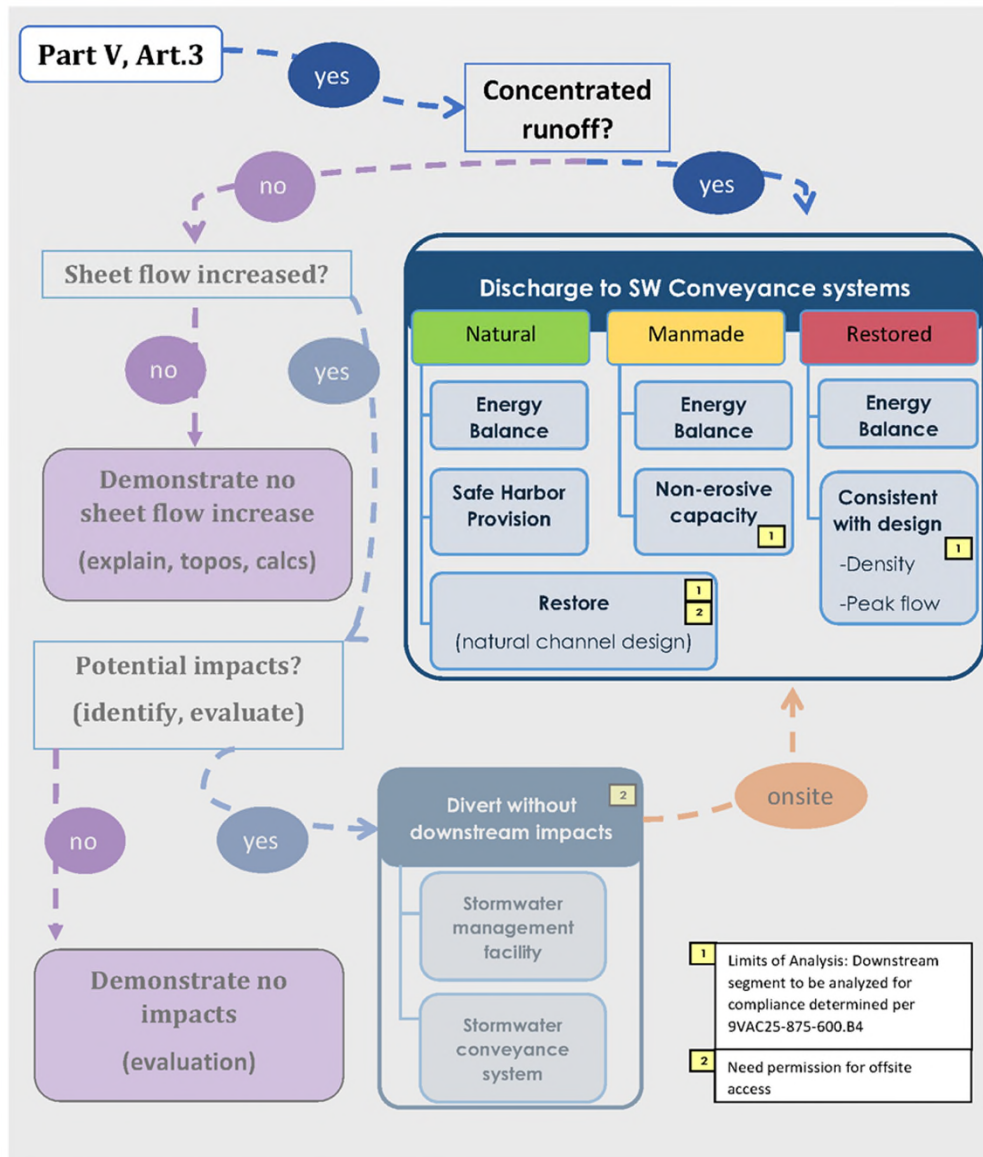


# Limits of Analysis (Channel Protection by Flow)



# Stormwater Quantity Requirements

## Channel Protection (9VAC25-875-600.B)



## Channel Protection

- Concentrated runoff
- Sheet flow (covered in 5c)

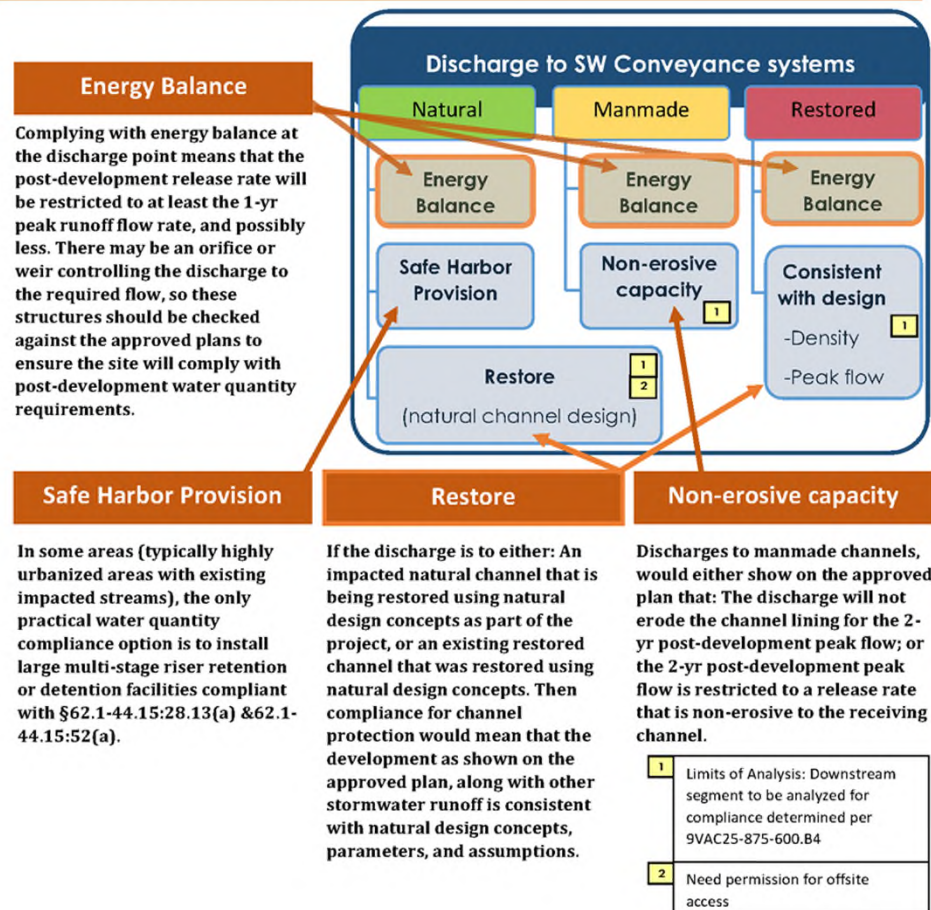
# Stormwater Quantity Requirements

## Channel Protection (9VAC25-875-600.B)

### Part V, Art.3

When concentrated runoff is discharged from a site, it must be discharged to a stormwater conveyance system:

Every point of discharge will comply with one of these 7 options, depending on the type of channel receiving the discharge



## Channel Protection

- Concentrated runoff
  - Every point of discharge must comply with one of 7 options

# Plans Approved After 7/1/14

## Flood Protection

### No Flooding:

#### Demonstrate:

- No 10-yr flooding now
- No 10-yr flooding after development

(detention/improvements)

to Limits of Analysis

### Local Flooding:

Must eliminate flooding by:

- on-site detention
- system improvements
- combination

to Limits of Analysis

OR:

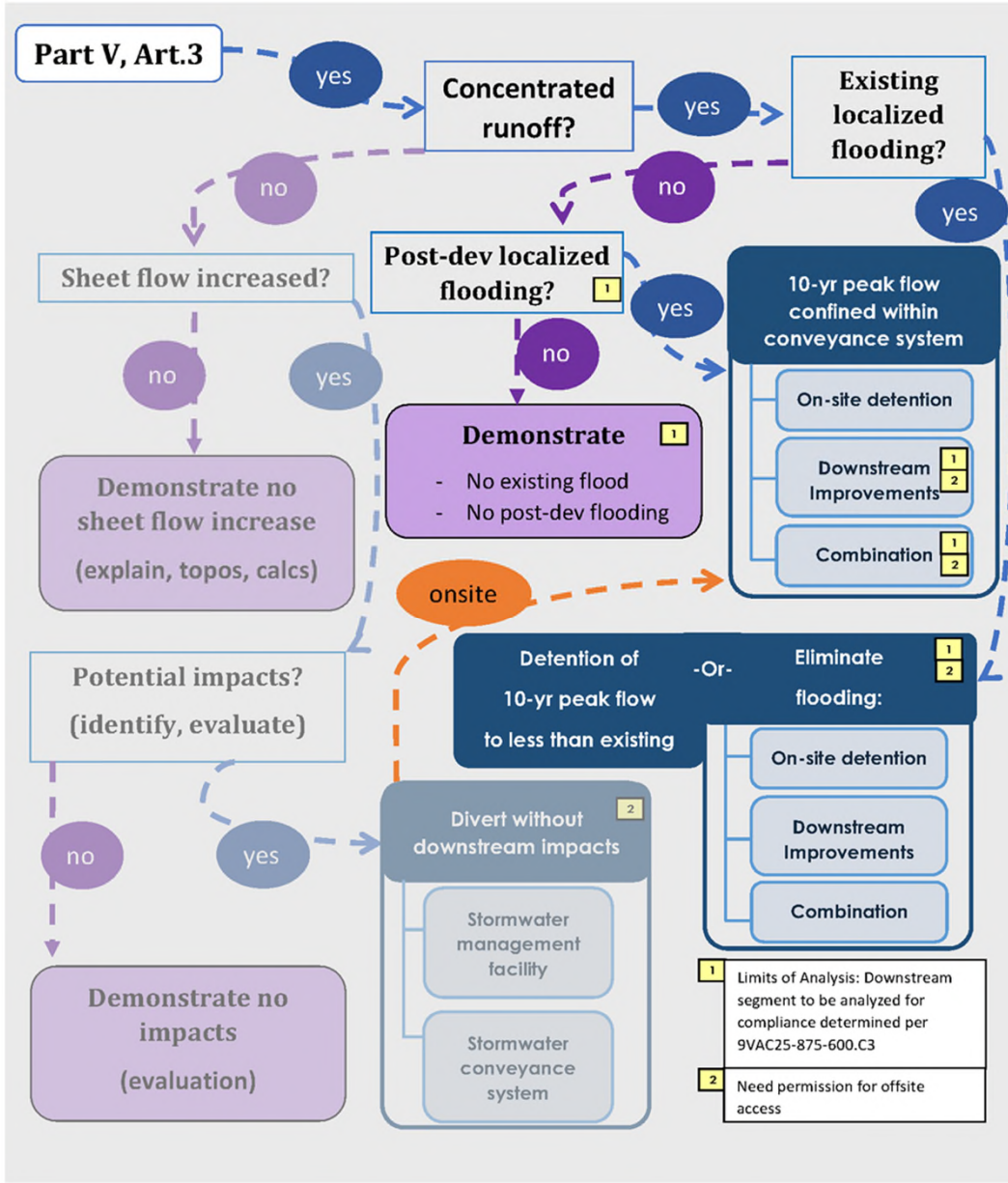
- Detention of 10-year peak flow to less than existing

~no Limits of Analysis (post)~



# Stormwater Quantity Requirements

Flood Protection (9VAC25-875-600.C)



## Flood Protection

- Concentrated runoff
  - Flowchart showing compliance options

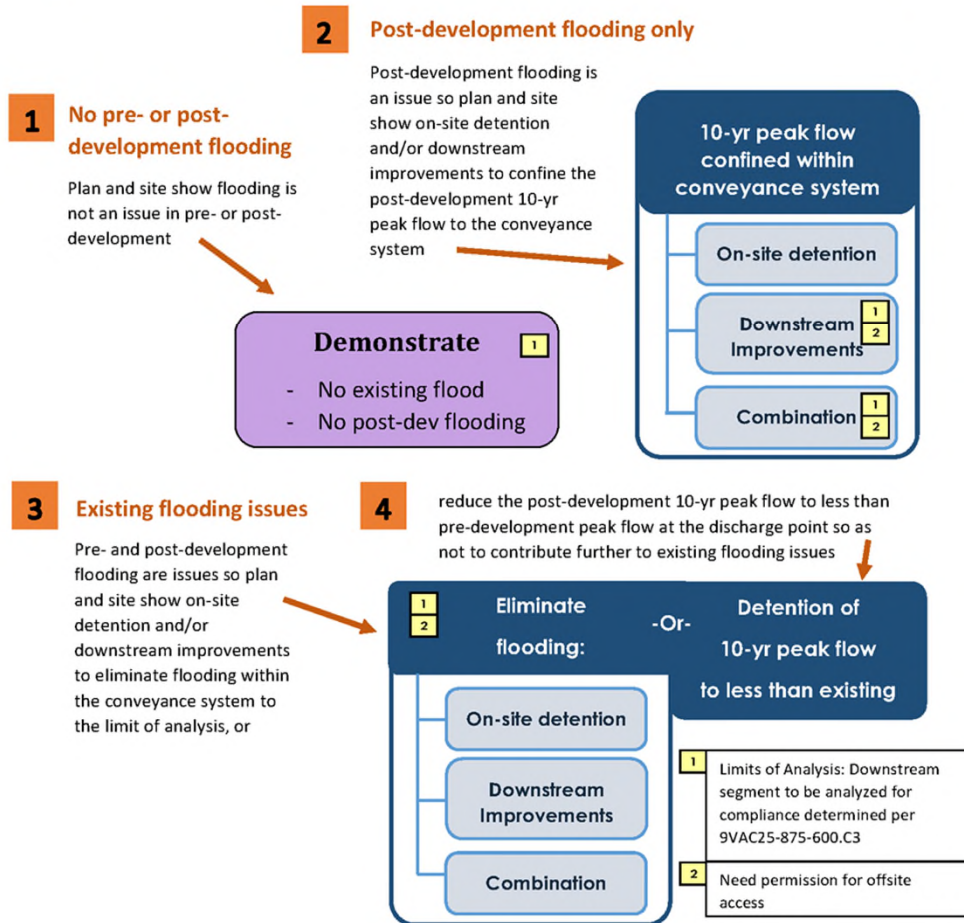
# Stormwater Quantity Requirements

## Flood Protection (9VAC25-875-600.C)

### Part V, Art.3

When concentrated runoff is discharged from a site, it must be discharged to a stormwater conveyance system:

Every point of discharge will comply with one of these 4 options, depending on whether or not existing flooding occurs and/or if post-development flooding will



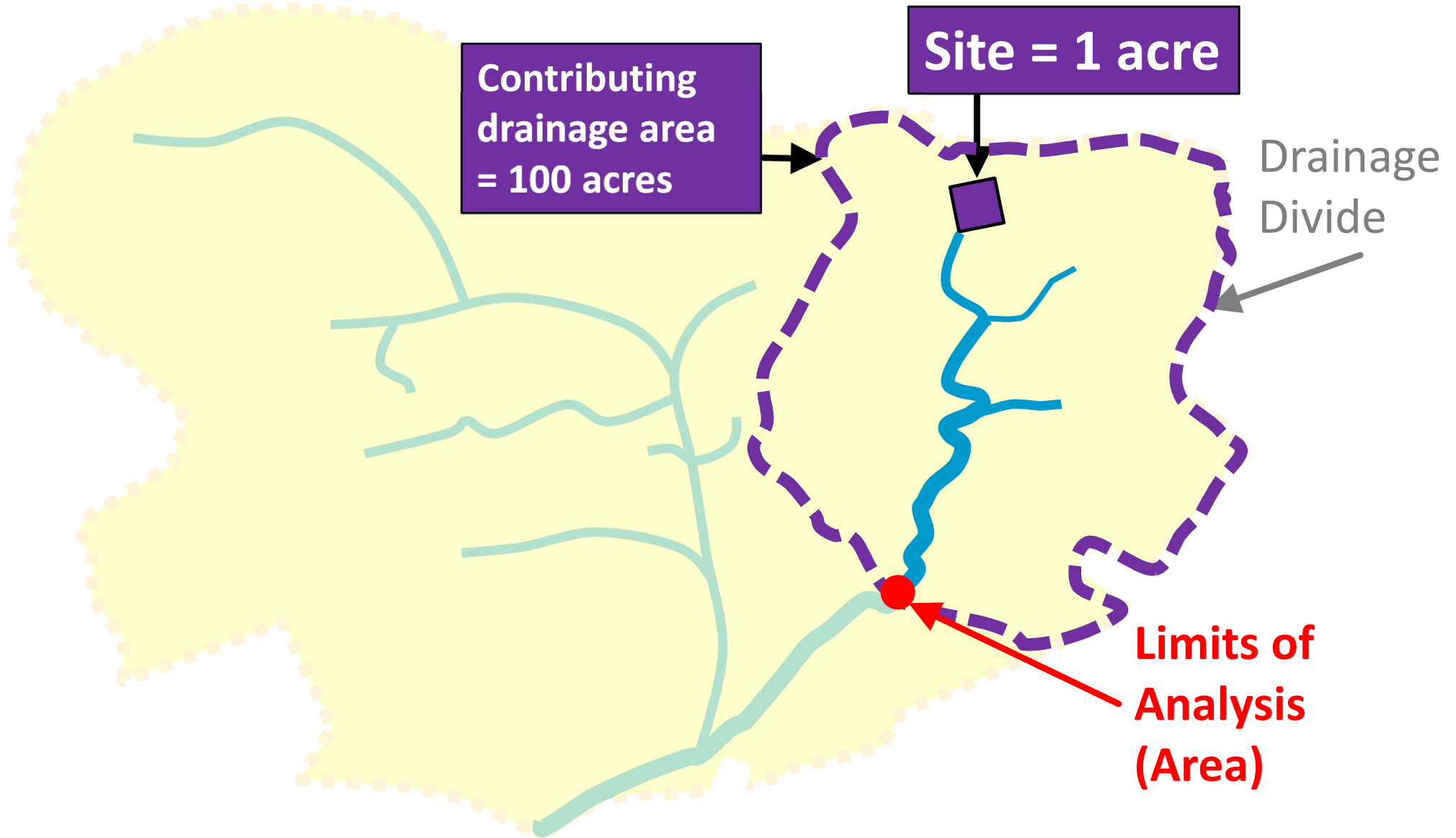
## Flood Protection

- Concentrated runoff
  - Every point of discharge must comply with one of the 4 options

# Limits of Analysis for Flood Protection

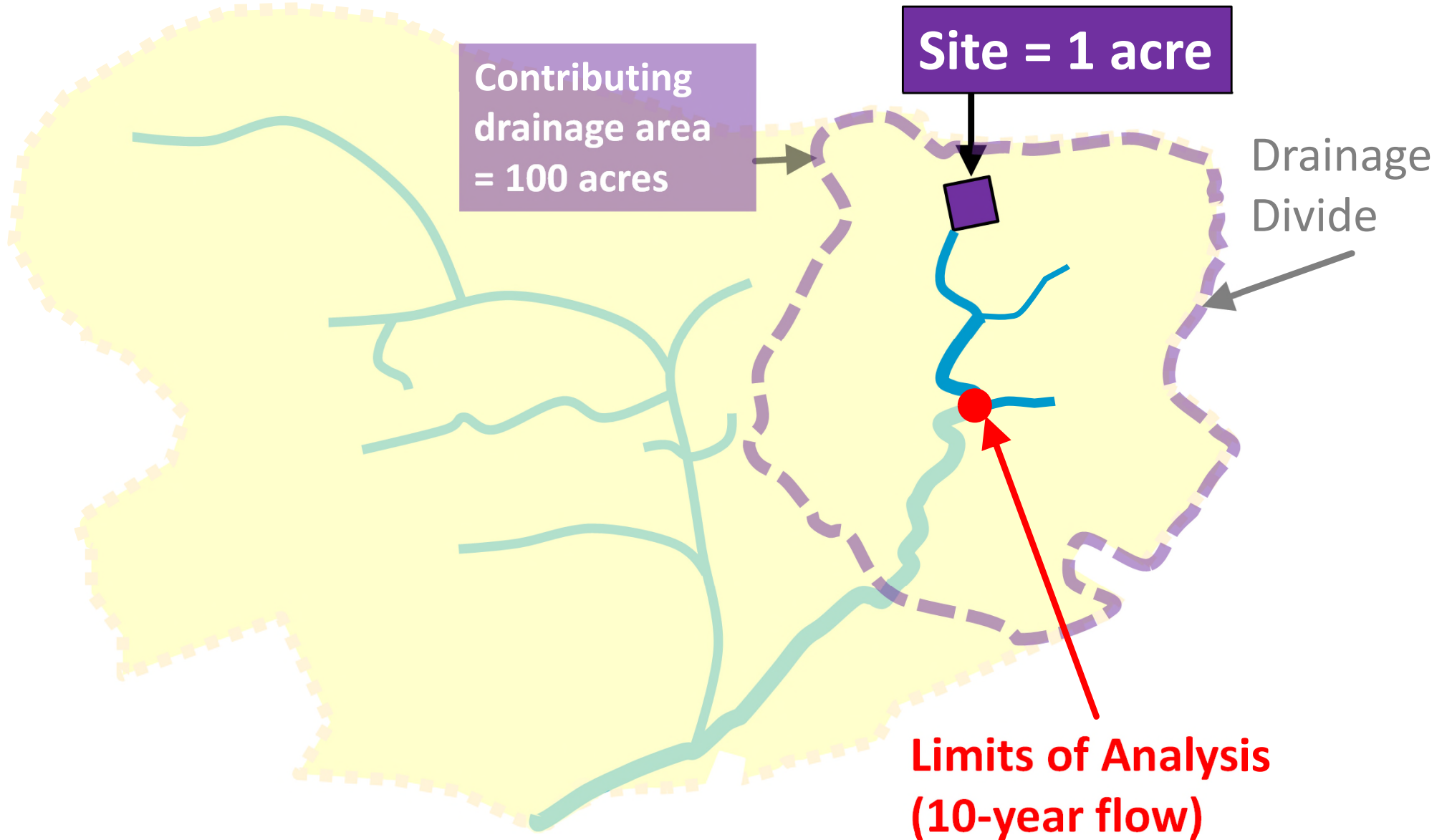
- How far does designer need to analyze receiving conveyance system?
- Based on watershed area, peak flow rate, or discharge to a flooded area
- Not applicable when site discharges to an **existing flooding** condition and the 10-year post < pre is being used to comply

# Limits of Analysis (Flood Protection by Area)

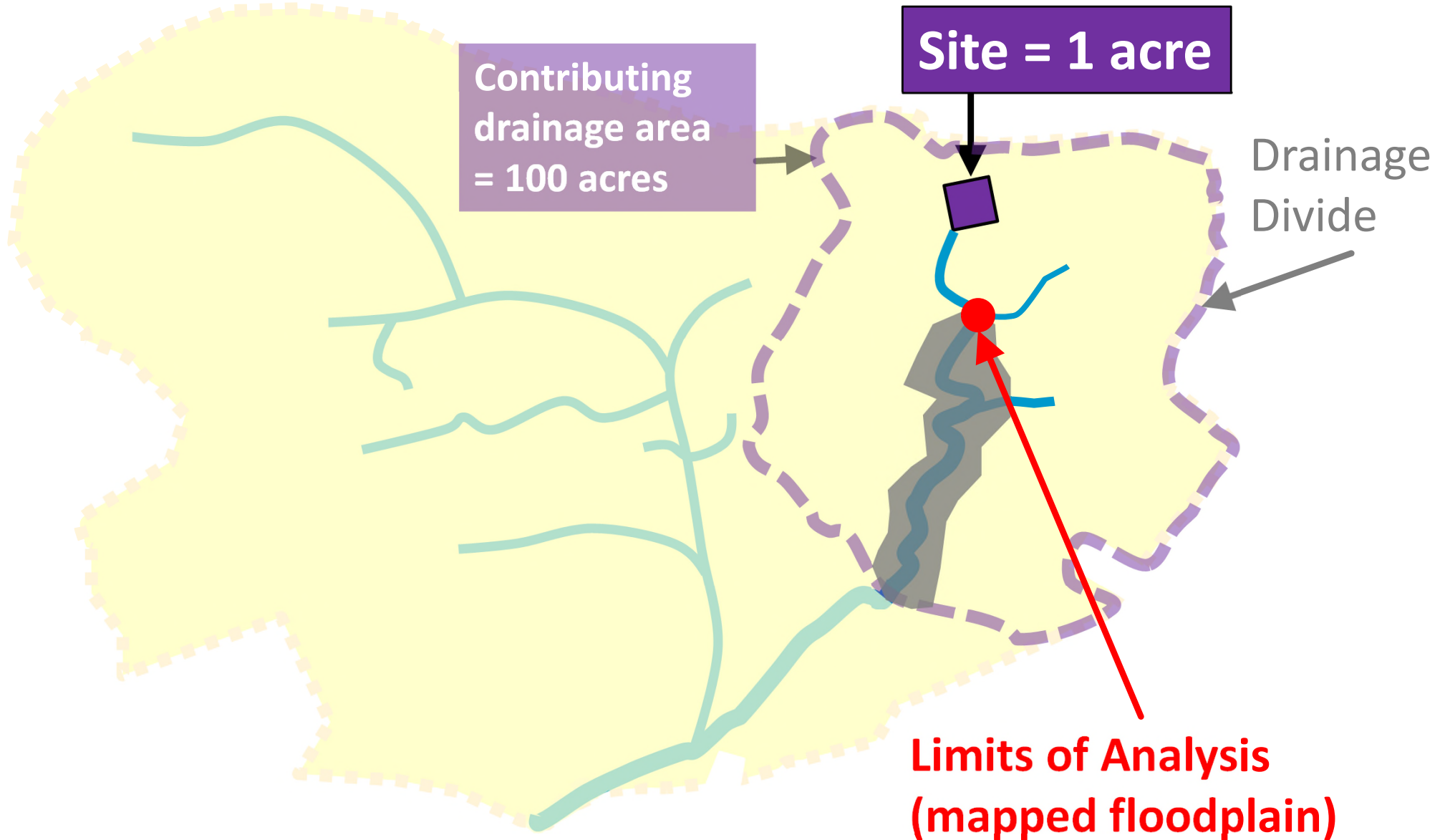




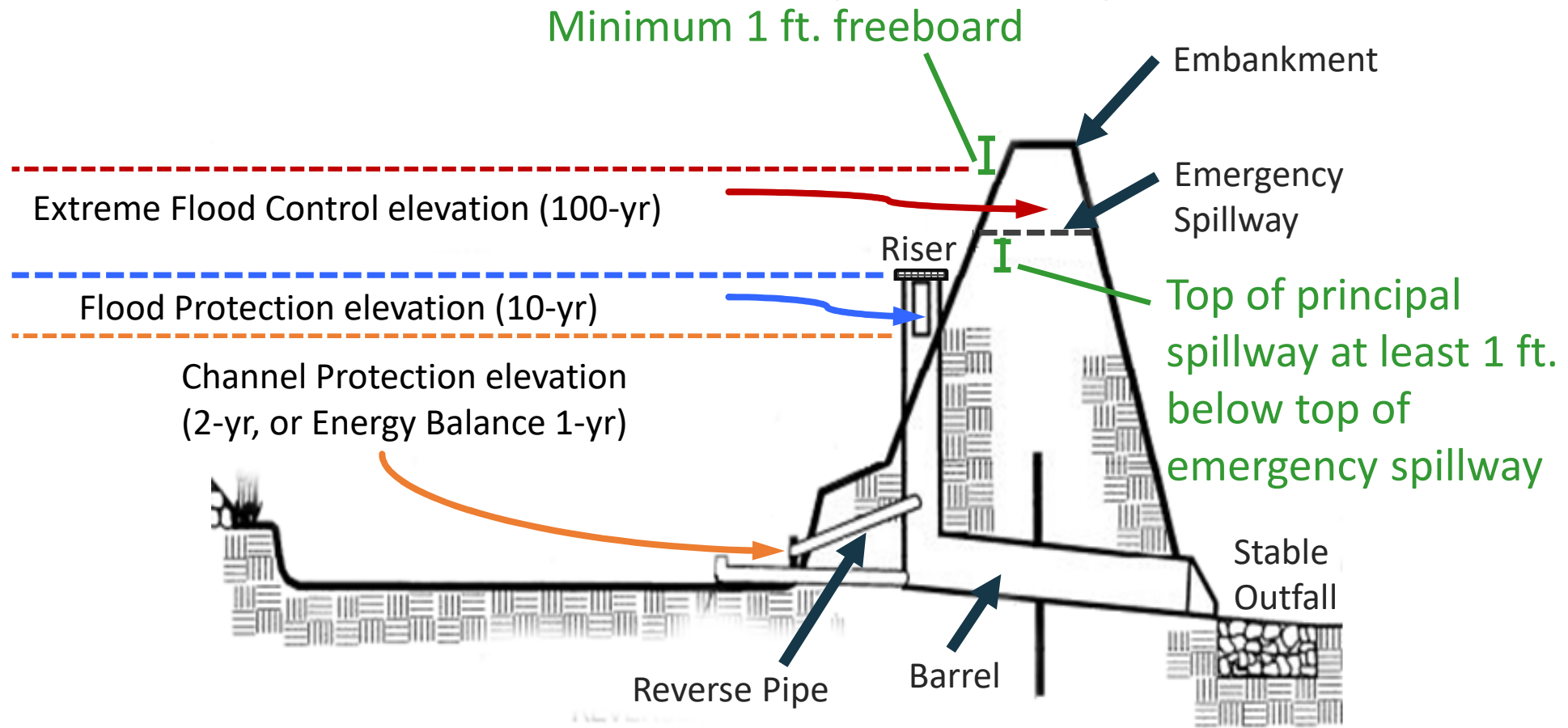
# Limits of Analysis (Flood Protection by Flow)



# Limits of Analysis (Flood Protection if floodplain)



# Stormwater Management Pond Schematic (Profile)



Water quantity compliance on approved plan/installed pond achieved via size of riser pipe, size of riser orifice(s), size of outflow pipes, and barrel size.

**The plan details should correspond with sizes and elevations shown with the water quantity evaluations for both channel and flood protection.**

# Plans Approved After 7/1/14

## Sheet Flow



- ↑ volumes of sheet flow must be identified and evaluated
- ↑ volumes of sheet flow creating impacts must be diverted to a stormwater management facility or conveyance system

# Stormwater Quantity Requirements

## Sheet Flow (9VAC25-875-600.D)

Part V, Art.3

yes

Concentrated  
runoff?

When sheet flow is  
discharged from a site:

no

1

Post-development sheet flow  
runoff is expected to be the  
same as pre-development

### Discharge to SW Conveyance systems

When sheet flow is converted to concentrated flow on-site via one of the diversion options on the left, the concentrated flow from the site must be discharged to a stormwater conveyance system and comply with channel and flood protection requirements shown on the previous page. Flood protection requirements shown separately.

If offsite options are used with the diversion options on the left, permission for offsite access by an owner/operator and inspectors is required.

Demonstrate no  
sheet flow increase  
(explain, topos, calcs)

2

Or, increases in  
post-development  
sheet flow runoff  
are not expected  
to be harmful

Demonstrate no  
impacts  
(evaluation)

3

Or, potentially  
harmful increases in  
post-development  
sheet flow runoff will  
be diverted

Divert without  
downstream impacts

Stormwater  
management  
facility

Stormwater  
conveyance  
system

onsite

2 Need permission for offsite  
access

## Sheet Flow

- Channel/Flood Protection
  - 3 options for compliance with sheet flow requirements

# QuickPoll

If a site is 22 acres of disturbance, then what size is the drainage area needed to satisfy limits of analysis by area?

- a. 220 ac.
- b. 22 sq.mi.
- c. 2,200 ac.
- d. 220 cfs
- e. 2.2 sq.mi.

# Module 5d.

## MS-19 Post-Development Stormwater Management



9VAC25-875-560.19.a	<i>Concentrated runoff leaving development site shall be discharged directly to adequate natural or manmade channel, pipe, or storm sewer system. Where runoff discharged into pipe/pipe system, downstream stability analyses at outfall of pipe or pipe system must be performed.</i>
9VAC25-875-560.19.b	<i>Requirements for verification for channel protection/flood protection adequacy of natural/manmade channels or 1% rule.</i>
9VAC25-875-560.19.c	<i>When existing natural or manmade channels/pipes not adequate: Requirements for channel/pipe(s) improvements or site design with non-erosive/non-flooding discharges. VESCP/VESMP approval required. Improvements to offsite areas need access permission.</i>
9VAC25-875-560.19.d	The applicant must provide evidence of permission to make improvements
9VAC25-875-560.19.e	All hydrologic analyses must be based on existing watershed characteristics and ultimate development condition.
9VAC25-875-560.19.f	Maintenance plan for stormwater detention options required: <ul style="list-style-type: none"> <li>• Must be approved by VESCP/VESMP authority</li> <li>• Include maintenance requirements of facility and person responsible</li> </ul>
9VAC25-875-560.19.g	<i>Outfall from a detention facility shall be discharged to a receiving channel, and <u>energy dissipaters shall be placed at the outfall of all detention facilities as necessary to provide a stabilized transition from the facility to the receiving channel.</u></i>
9VAC25-875-560.19.h	All on-site channels must be verified to be adequate.
9VAC25-875.560.19.i	<i>Increased volumes of sheet flows ...</i>
9VAC25-875-560.19.j	Developments consisting of individual lots or parcels must be considered as a whole: <ul style="list-style-type: none"> <li>• Residential, commercial, or industrial</li> <li>• Hydrologic parameters in engineering calculations must reflect ultimate development condition</li> </ul>
9VAC25-875-560.19.k	Measures used to protect properties and waterways must be employed to minimize impacts on physical, chemical, and biological integrity of rivers, streams, and other waters of the state.
9VAC25-875-560.19.l	<i>Any plan approved prior to July 1, 2014,...</i>
9VAC25-875-560.19.m	Plans approved on and after 7/1/2014 must comply with flow rate capacity and velocity requirements of the ESC Law and MS-19 via compliance with water quantity requirements in VESMA and attendant regulations (9VAC25-875-600)...
9VAC25-875-560.19.n	Compliance with water quantity minimum standards in 9VAC25-875-600 satisfies the requirements of MS-19.

# Module 5d.

## • Guide to MS-19 and Stormwater Quantity Requirements



# Q&A



Managing Water  
Quantity and MS-19



Post-Development  
AFTER 7/1/14



Channel and Flood  
Protection



Sheet flow vs  
concentrated flow