

Effectiveness of stormwater management practices in protecting stream channel stability

2: Stormwater Management Assessment, under Theme A:
Effectiveness of Restoration Programs at the Watershed Scale

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Acknowledgment Slide

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How can we develop land and protect streams?

1. Do Maryland stormwater regulations protect channel stability?

While the 2000 and 2007 regulations reduce the impact of urban development, neither protect channel stability long term.

2. Why?

3. How can the regulations be improved?

Paying for good stormwater management now means you don't pay to fix things later.



Before we talk research...

Maryland stormwater history in brief...

Before many of you were born (1984)

- No statewide stormwater regulations
- Local regulations largely focused on flood control

Before some of you were born (1984-2000)

- Statewide stormwater regulations for peak flow control
- Local regulations to treat runoff from first ½" of rainfall

2000-2007: Unified stormwater sizing criteria (USC)

- Water quality volume - capture and treat runoff from 1" of rainfall
- Channel protection volume – detain runoff from 1-yr, 24-hr design storm

2008+ Environmental site design (ESD)

- Required better site planning and use of LID/GI before traditional stormwater ponds
- Changed method for calculating required storage/infiltration volume, resulting in reduced storage

*Thanks Stew
Comstock!!*



How do streams “work”?

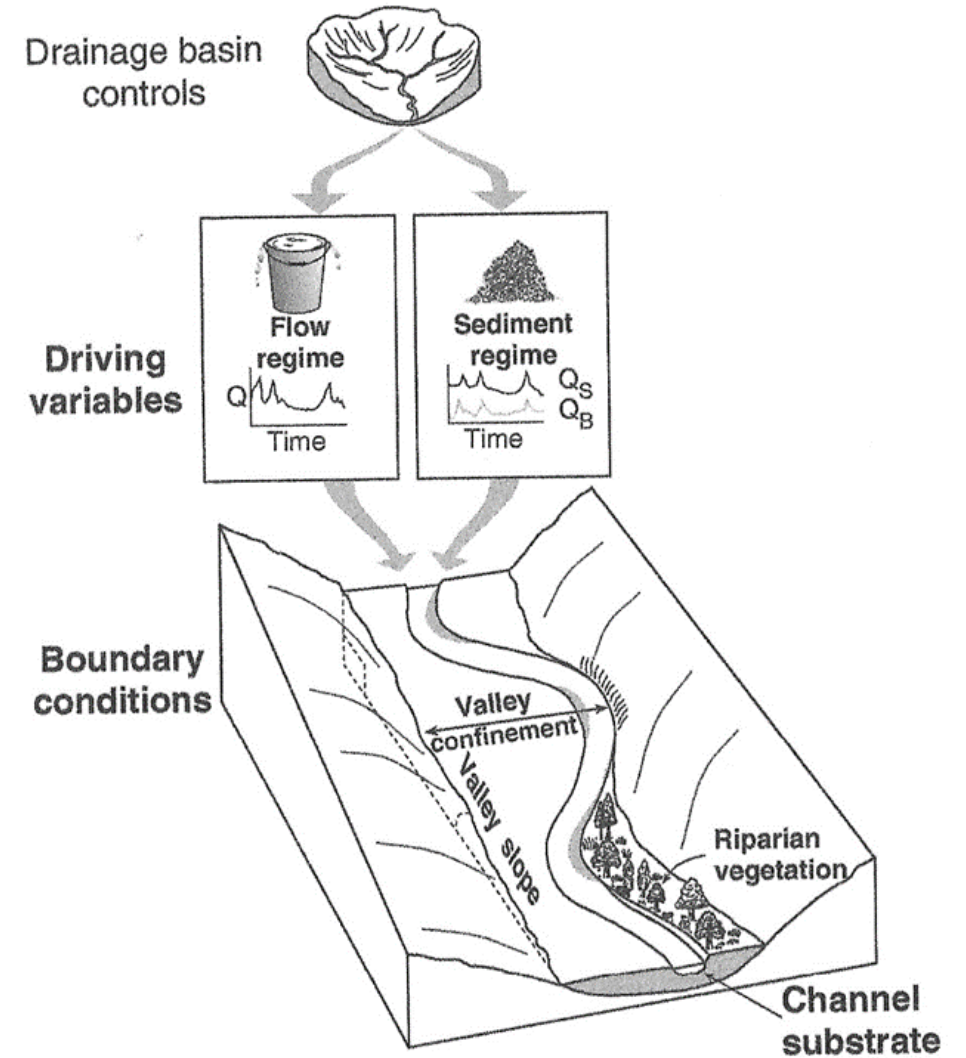
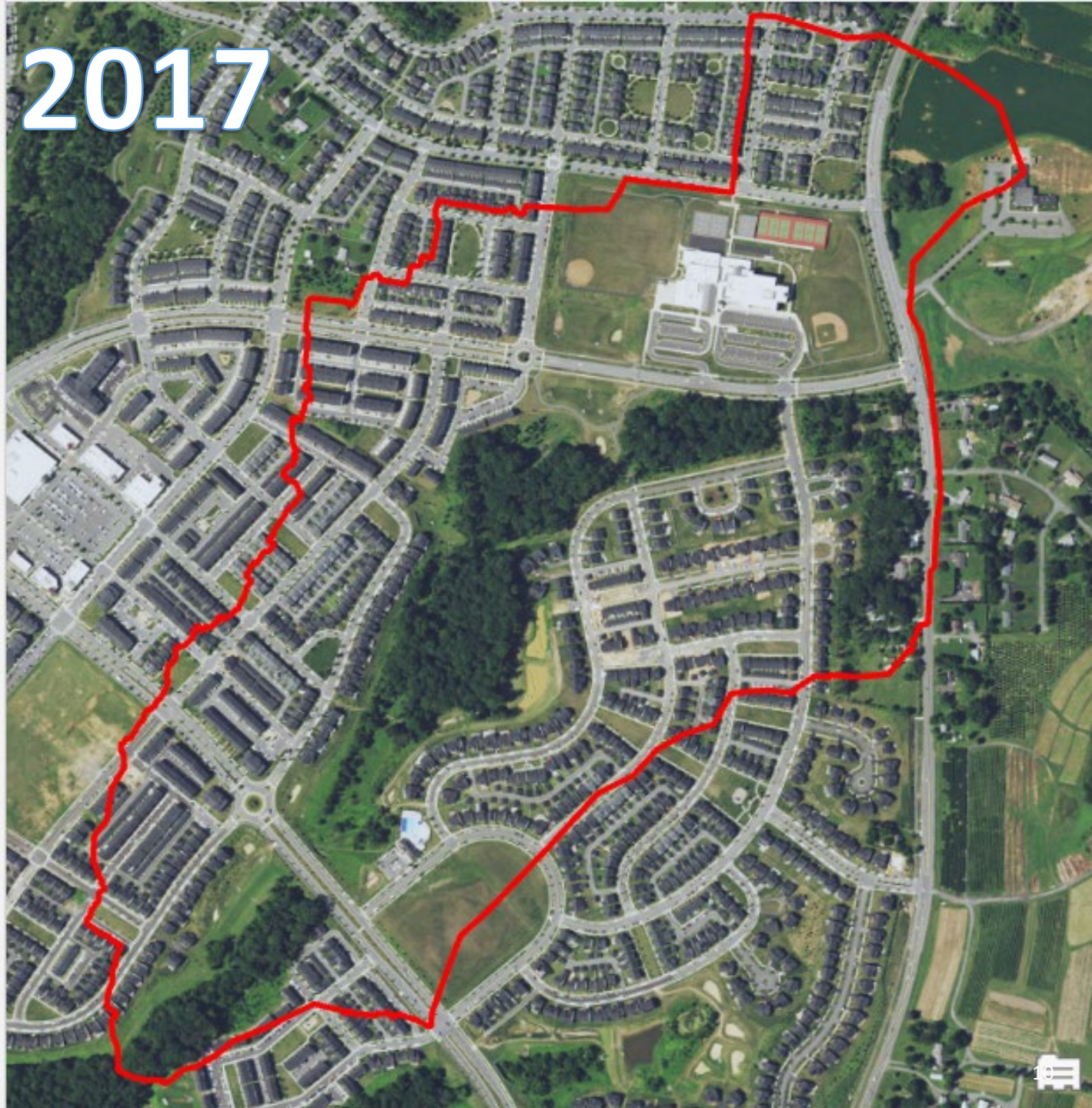


Figure 8.1 The driving variables and boundary conditions that control the form of a channel reach.

Ok, let's talk research...

Tributary 109 to Little Seneca Creek served as a case study

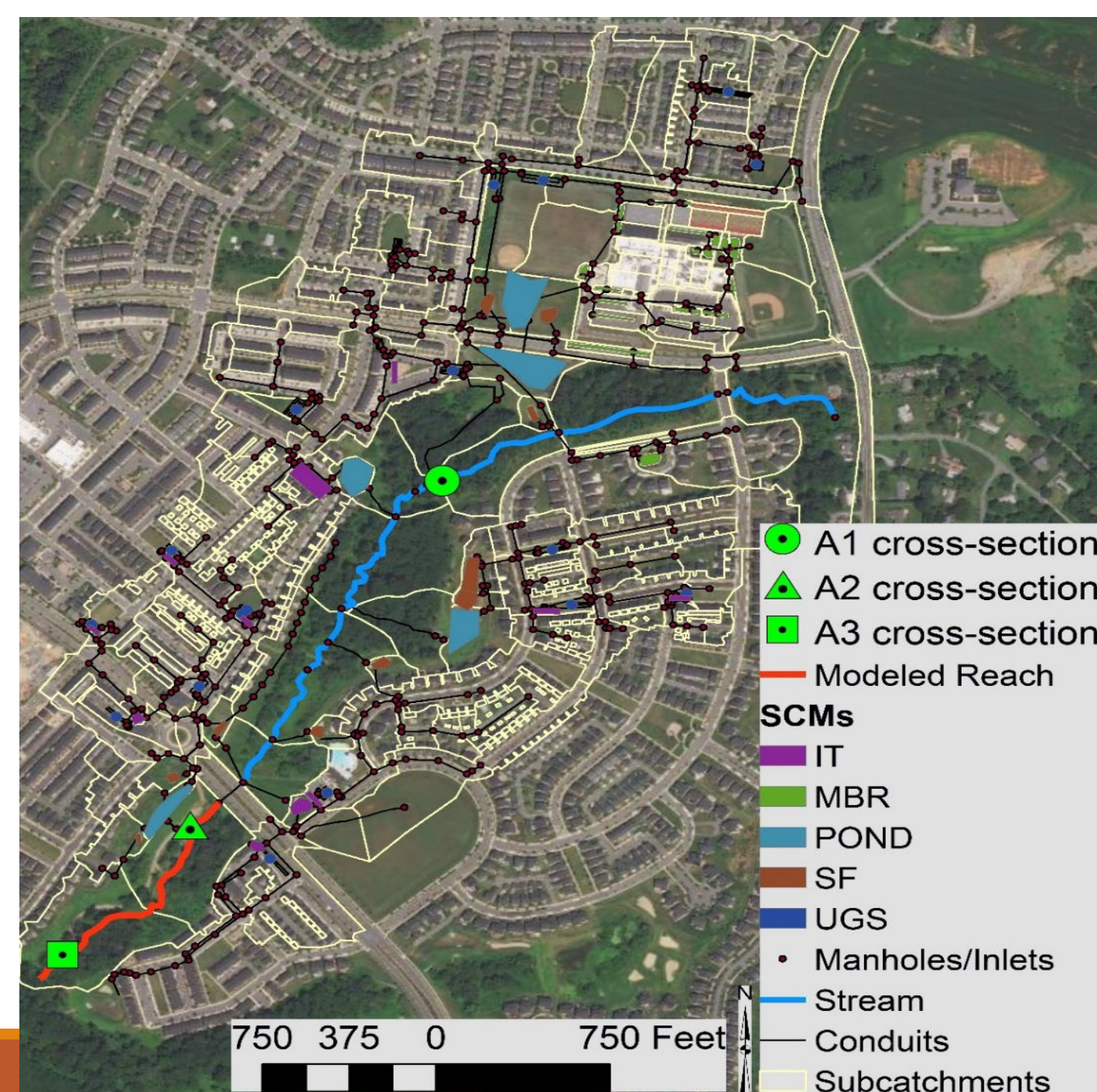
- 0.3 mi² drainage area, 44% TIA
- Developed 2006 - 2016
- USGS stream gage (2004)
- USGS rain gage
- Montgomery County data
 - Cross sections
 - Longitudinal profiles
 - Pebble counts
- Multiple lidar datasets



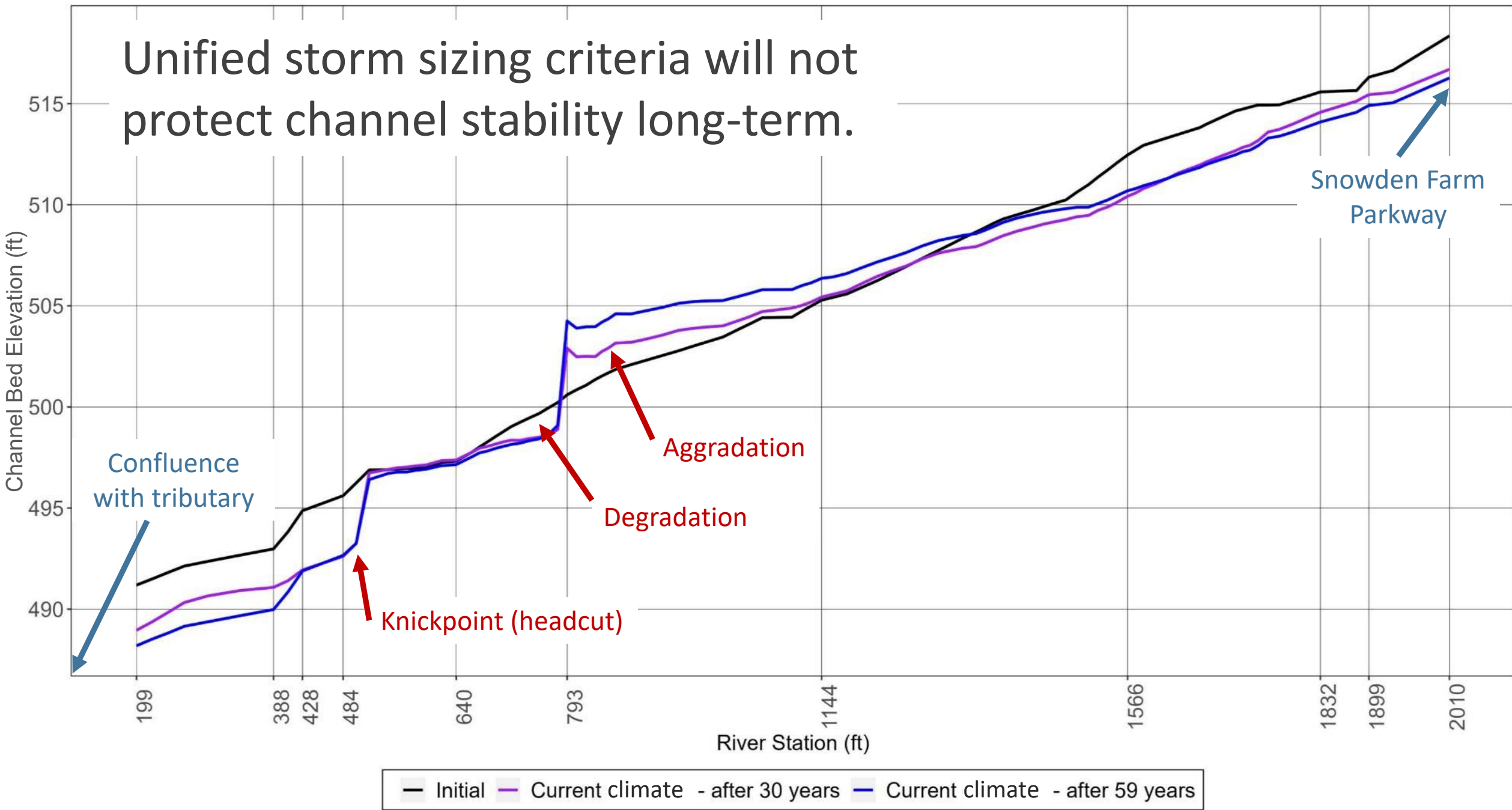
Stormwater system was designed to meet the 2000 Unified Stormwater Sizing Criteria (USC):

- 5 ponds
- 26 micro bioretention (MBR)
- 10 infiltration trenches (IT)
- 11 sand filters (SF)
- 18 underground storage facilities (UGS)

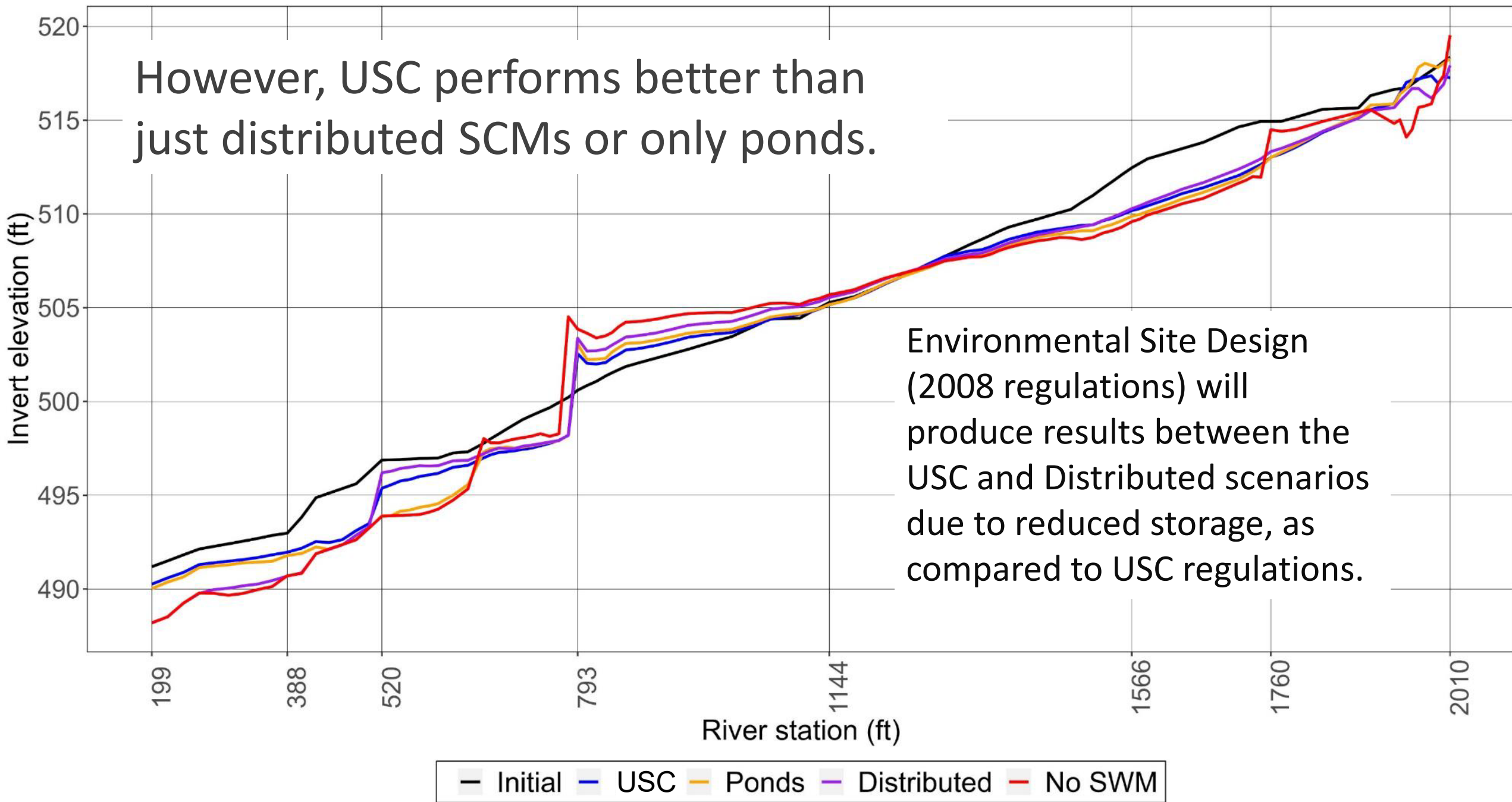
“Distributed” stormwater control practices



Unified storm sizing criteria will not protect channel stability long-term.



However, USC performs better than just distributed SCMs or only ponds.



Environmental Site Design (2008 regulations) will produce results between the USC and Distributed scenarios due to reduced storage, as compared to USC regulations.

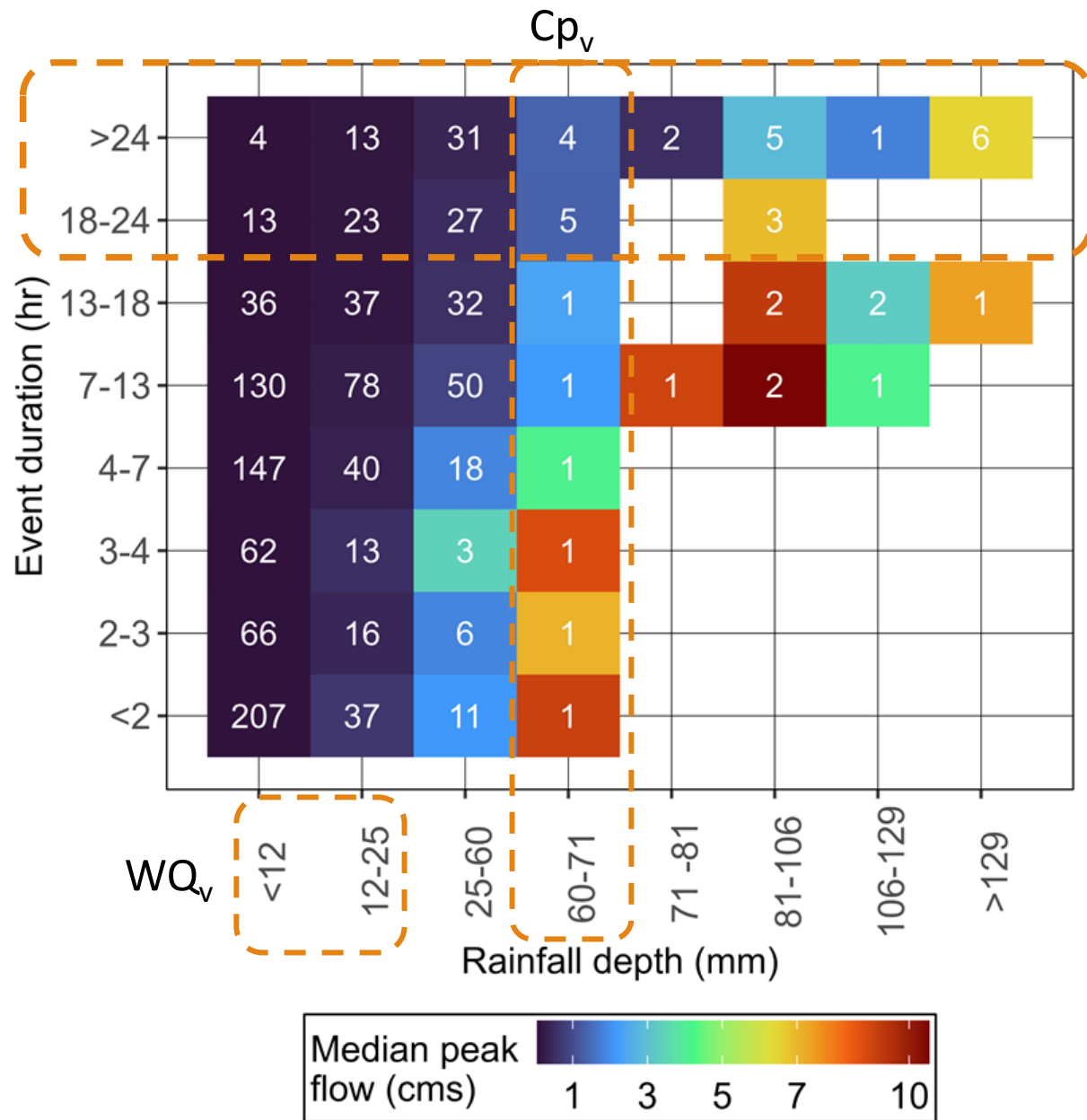
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- 1141 individual rainfall events
- 81% of the storm events had depths <1"
 - **The water quality volume will treat the majority of storm events**
- Wide range of runoff rates from the 1-yr recurrence interval storm event (Cp_v)
 - **Regulations and extended detention design standard focus on detaining runoff volume, not reducing peak flows**
- 24-hr duration storm events produce lower peak runoff than shorter-duration, higher intensity storms
 - **In small, urban watersheds, runoff depends most on rainfall intensity, not rainfall depth over 24 hrs**

Why do Maryland stormwater regulations not protect channels?

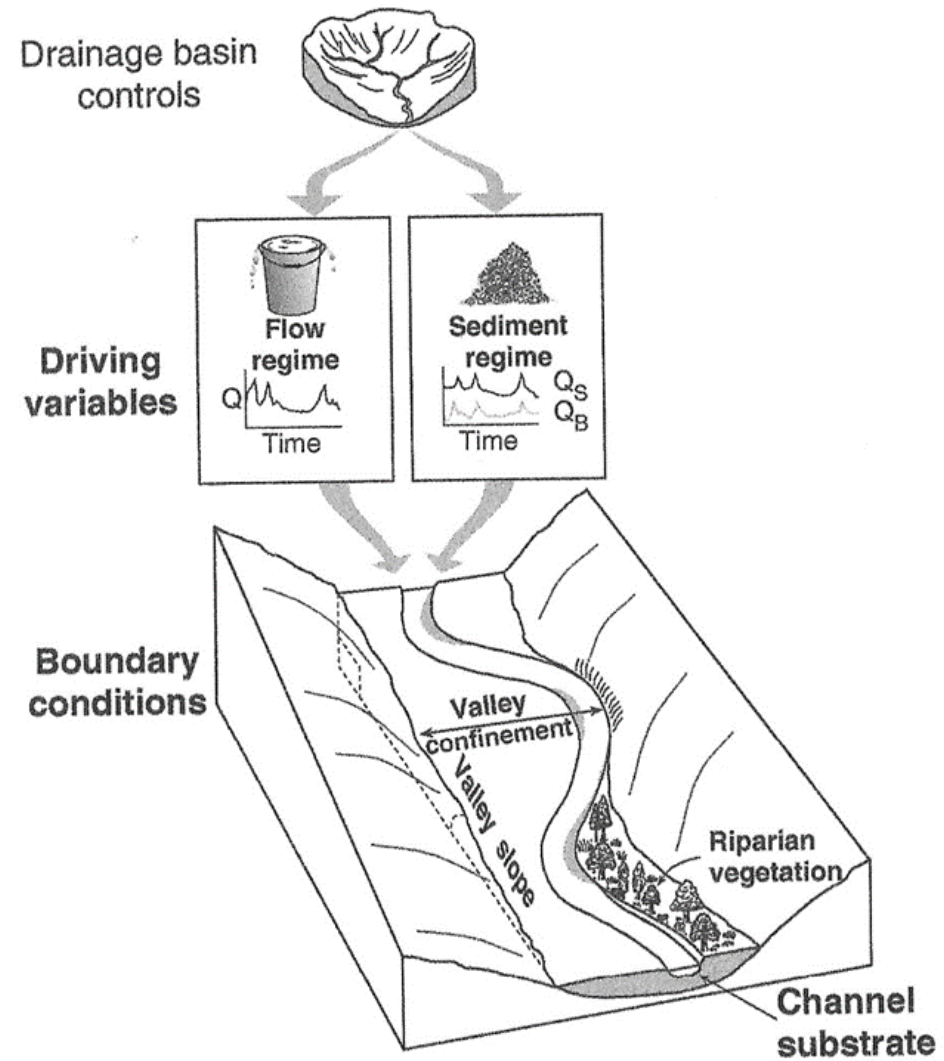


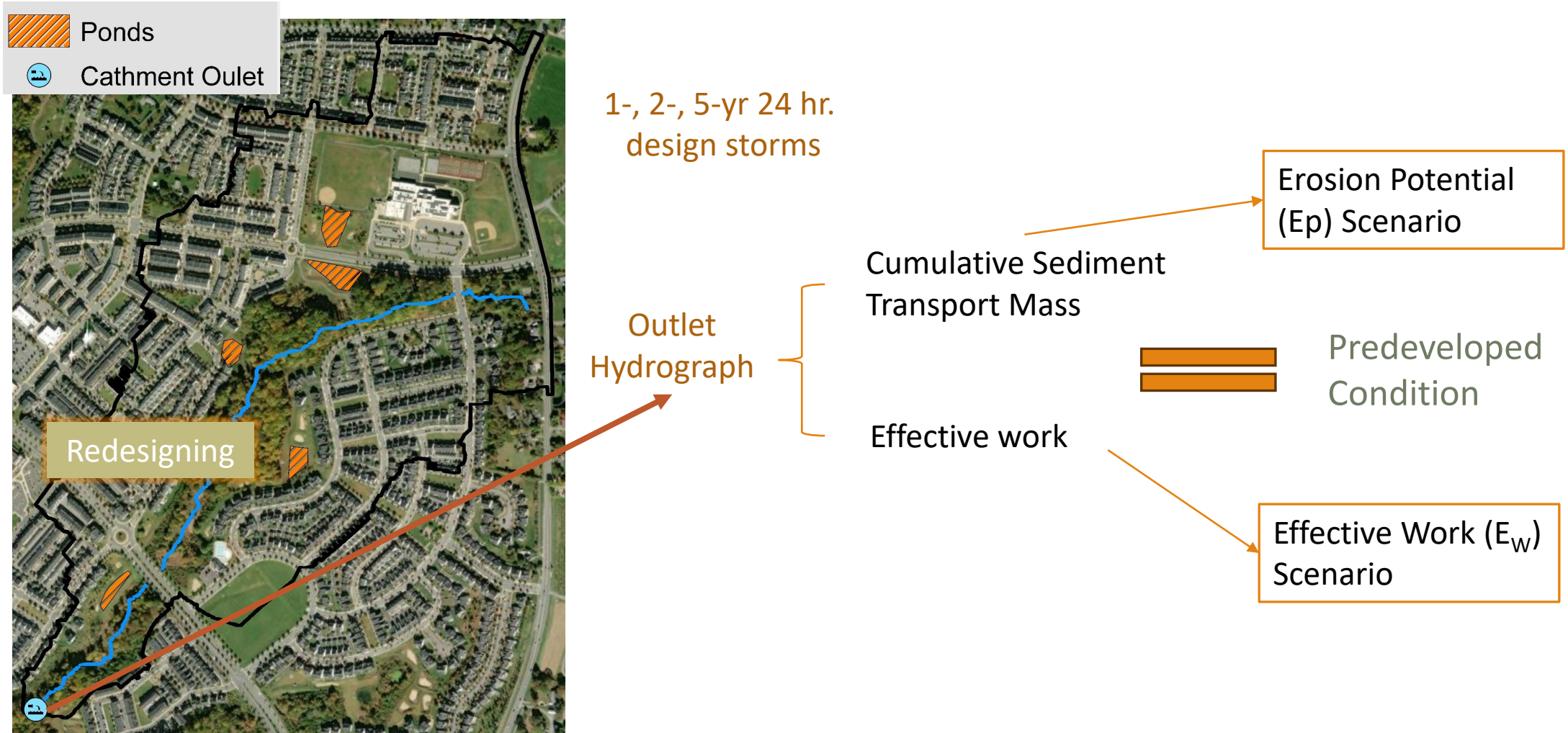
Figure 8.1 The driving variables and boundary conditions that control the form of a channel reach.



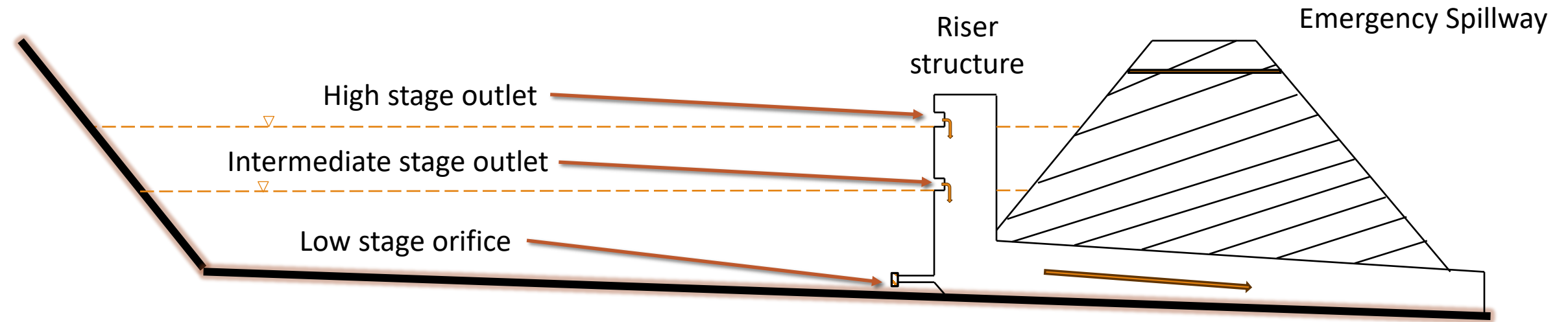
Our recommendations:

- Keep ESD
- Eliminate “Reduced Runoff Curve Number Method” for Cp_v
- Bring structural practices back
- ***Size structural practices based on sediment target instead of runoff detention time***

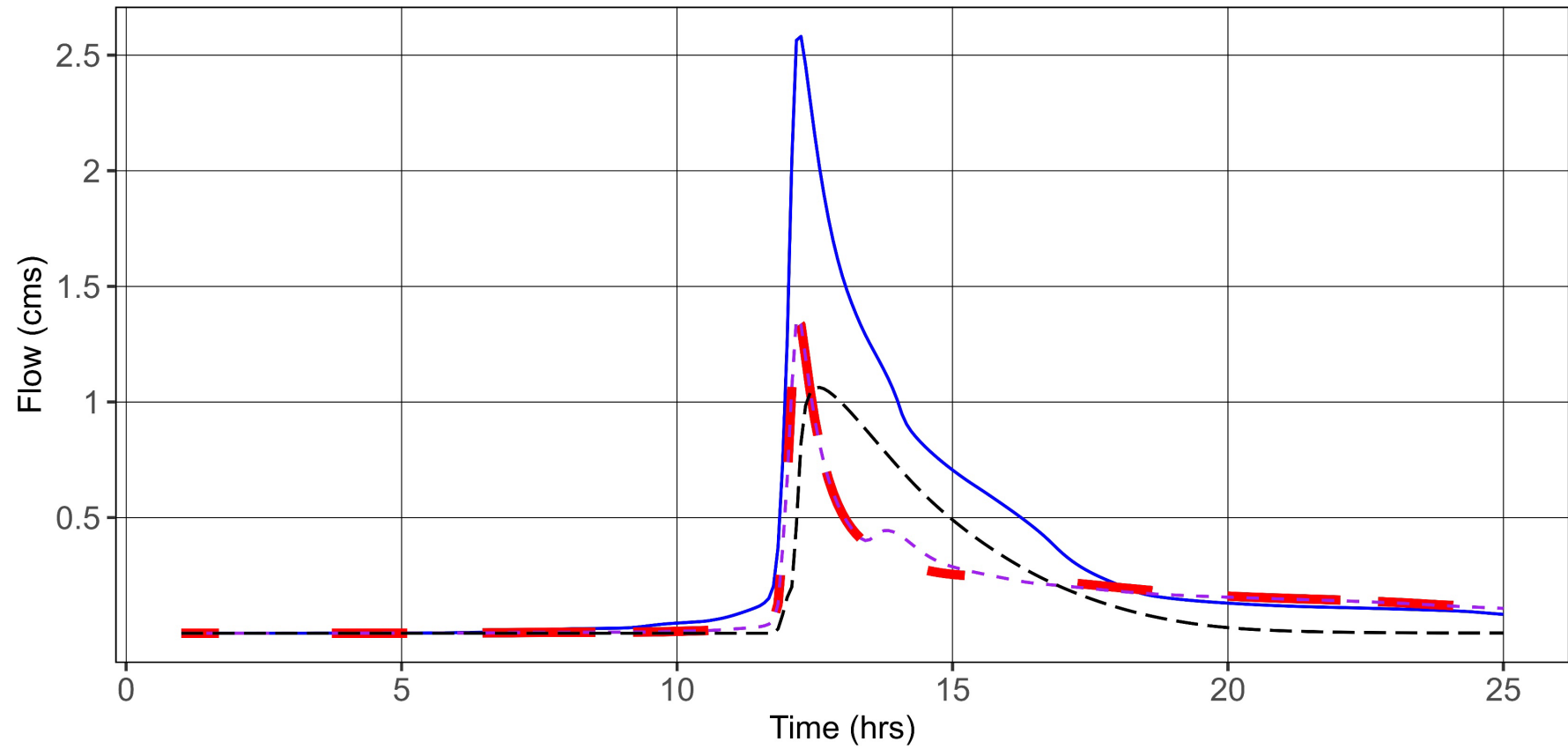
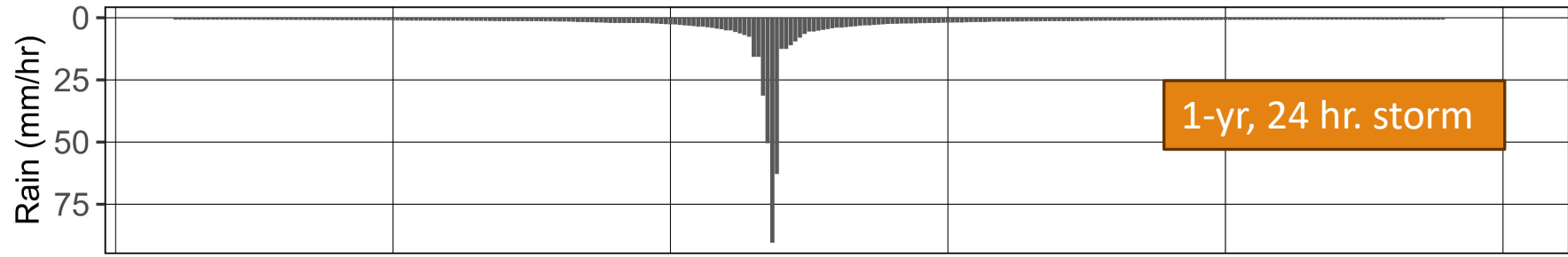
We evaluated two different design criteria for stormwater storage that focus on sediment transport.



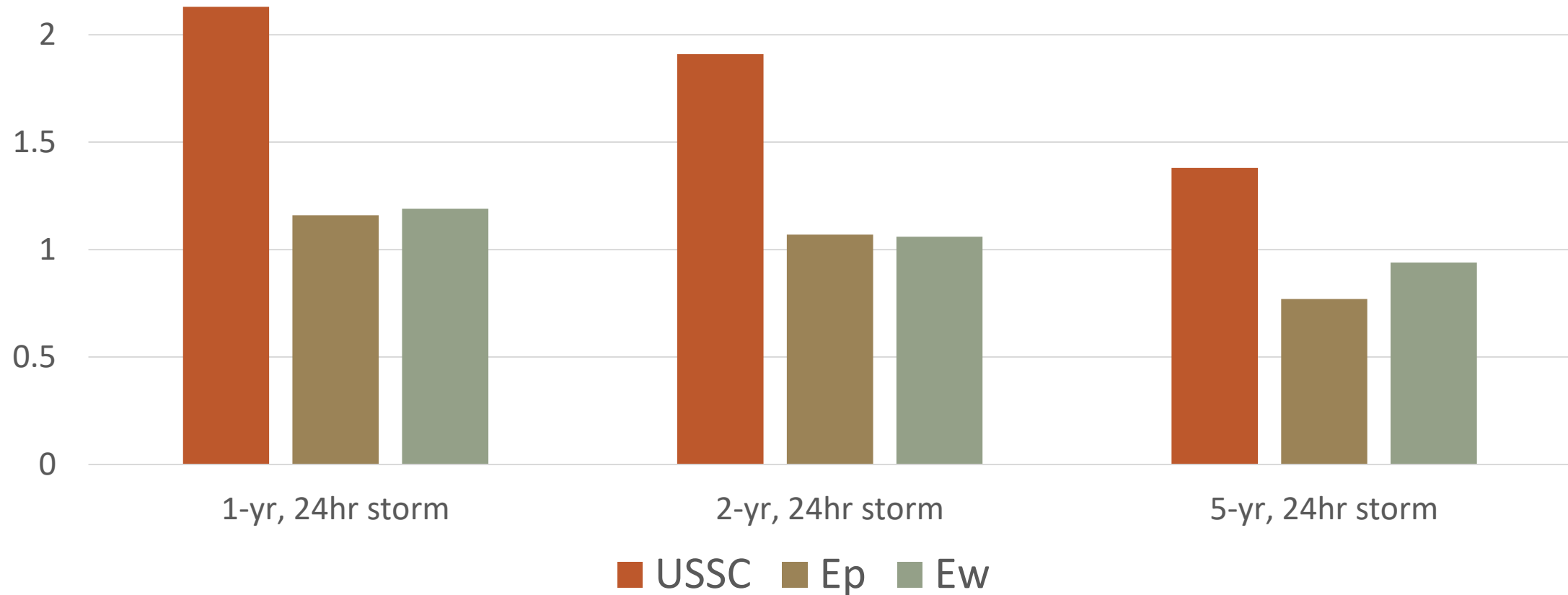
The pond outlet structures were changed to meet E_p and E_w design targets.



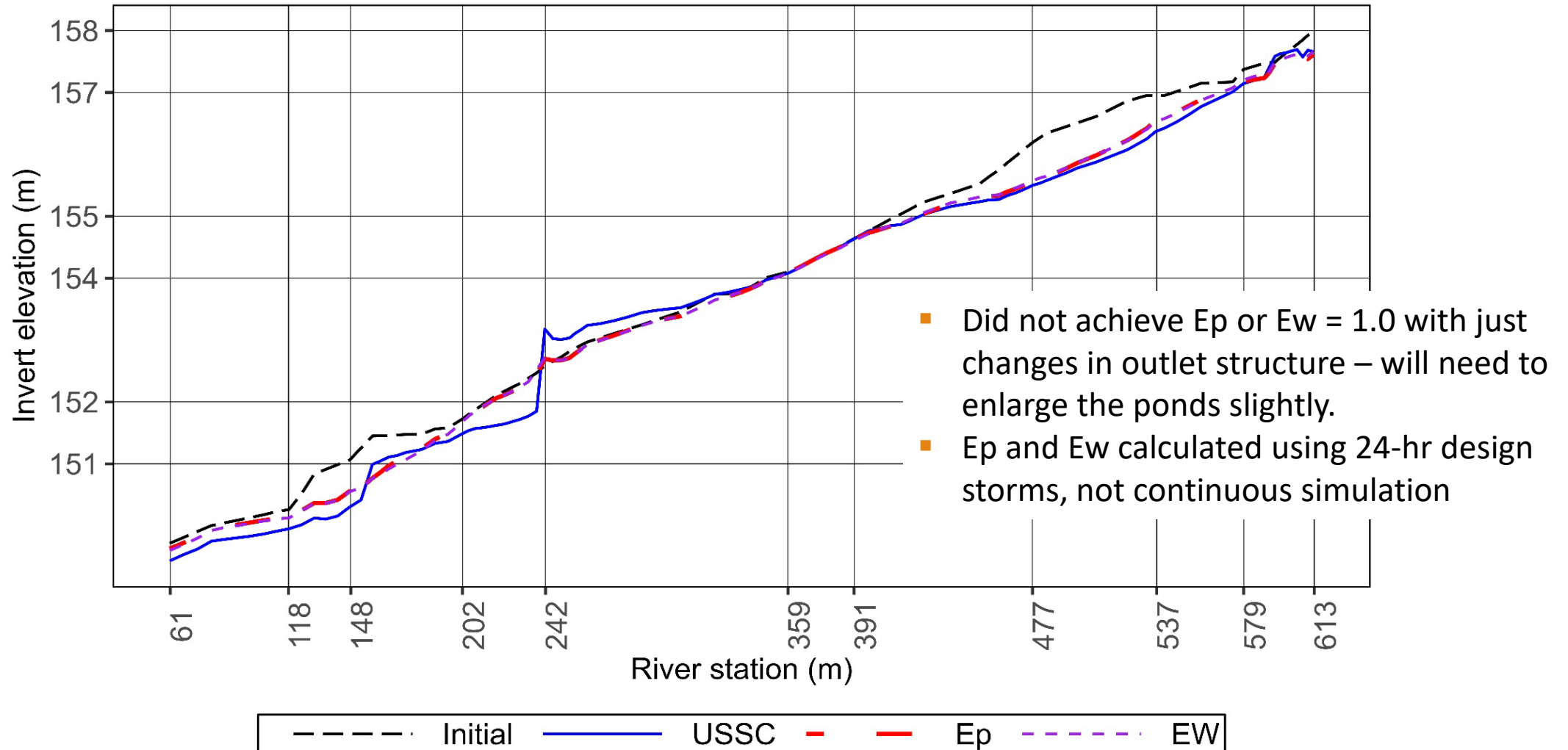
Scenario	Riser structure height increased
E_p	5 ponds
E_w	2 ponds



Ratio of sediment transported after development to before development



Designing SCMs based on sediment transport considerations significantly reduces channel disturbance



Paying for good stormwater management now means you don't pay to fix things later.



Summary

- Unified stormwater sizing criteria (and environmental site design) is an improvement over conventional stormwater management, but will not protect channel stability.
- To protect channel stability, stormwater management needs to be designed to meet sediment transport or effective work targets.
- Stormwater storage is needed to manage high flows.
- An investment in good stormwater management now will mean fewer repairs to sewer lines, culverts, and bridges and improved stream physical integrity

What are the take home
points?

What does this mean for me?

TRANSLATION SLIDES BY STEWART COMSTOCK, MDE WATER &
SCIENCE ADMINISTRATION

What does this mean for me?

- The Unified Sizing Criteria implemented in 2000 were a step in the right direction
- Environmental site design (ESD) is productive, the reduced curve number method (2009) is less effective
- Runoff is more dependent on shorter duration, higher intensity storms; not the 24 hour events typically used for stormwater management design.
- An ounce of prevention is worth a pound of cure (B. Franklin)

What does this mean for me?

What do I take from this if I am a practitioner:

Traditional (e.g., ponds, quantity management) SWM is not effective at controlling channel erosion; a combination of infiltration, ESD, and storage practices may be needed.

Future designs may need to consider sediment transport or effective work targets.

What do I take from this if I am a regulator:

New regulations for channel erosion control or “Cpv” should consider local conditions, shorter duration storms, and sediment transport and effective work

This will require more watershed-based criteria

You are done!

Thank you for your hard work to do the research, communicate it clearly to the audience, and translate this into something the audience can do with the information in their work tasks.