STREAM BUFFERS VS. THE IMPERVIOUS COVER MODEL: REVISITED

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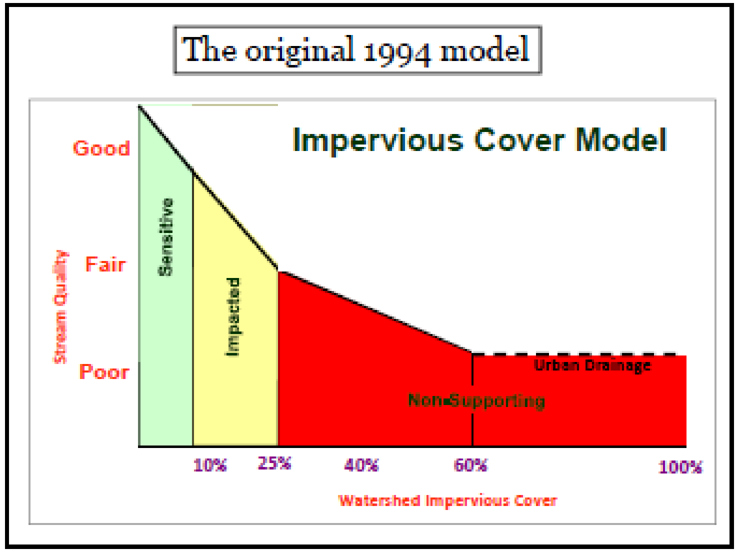
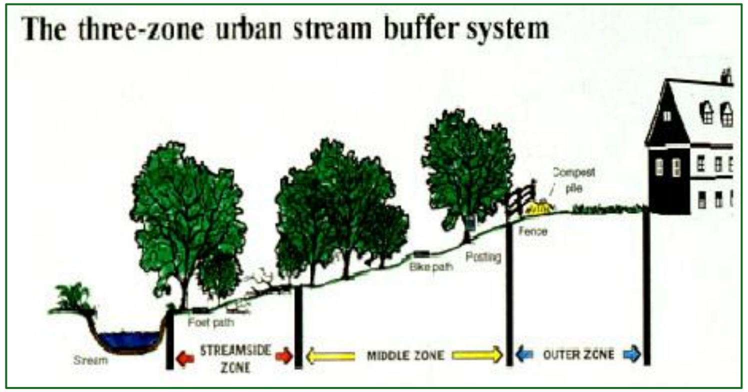
Overview

- 1st Gen Watershed Management
  - *Setbacks vs. Imperviousness*
- The Science
  - Urban Stream Risks
  - Riparian Buffer Benefits
- Next Gen Watershed Policy
  - Integrated Setbacks in a Watershed Approach

THE CONVENTIONAL WISDOM

- **The Impervious Cover Model** (Schueler, Fraley-McNeal, and Cappiella, 2009; Schueler, 2018)
  - A proxy for <u>multiple</u> urbanization impacts
    - Greatest correlation in numerous studies
  - Applied to 1st - 3rd order streams only
    - 75% to 80% of streams in E. KS watersheds
  - In <u>newly developing</u> watersheds
- **C. 2003 – 2008 in the KC Region:**
  - Developed stream setback ordinances
    - Varied: minimal to the 1% floodplain
  - APWA 5600 added <u>default</u> stream setbacks
    - 40 - 120 feet / 40 – 5,000+ acre drainage areas





https://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool3_Buffers/BufferZones.htm

URBAN STREAM RISKS

- We have *learned a lot* since 2008!
  - Structures in FEMA 1% (“100-year”) floodplains have a 26% chance of flooding over a 30-year mortgage
    - Thousands of occupied structures in floodplains
    - Storms are intensifying and precipitation is increasing
    - Informing improved 2-D watershed modeling
  - People <u>outside designated flood zones</u> receive 33% of disaster relief despite filing only 25% of total claims
    - And very few are even insured!
  - Ephemeral streams <u>~60% of total stream discharge</u>
    - Based on a study of <u>millions</u> of U.S. Streams

Sources: Brinkerhoff and others, 2024; FEMA, 2019

BUFFERS AND STREAM QUALITY

- Aquatic macroinvertebrates are most impacted by
  - Straightening streams
  - **<u>Length & continuity</u> of natural stream buffers**
  - **Sedimentation and loss of in-stream cover/leaf litter**
  - Density of stormwater inlets/outfalls

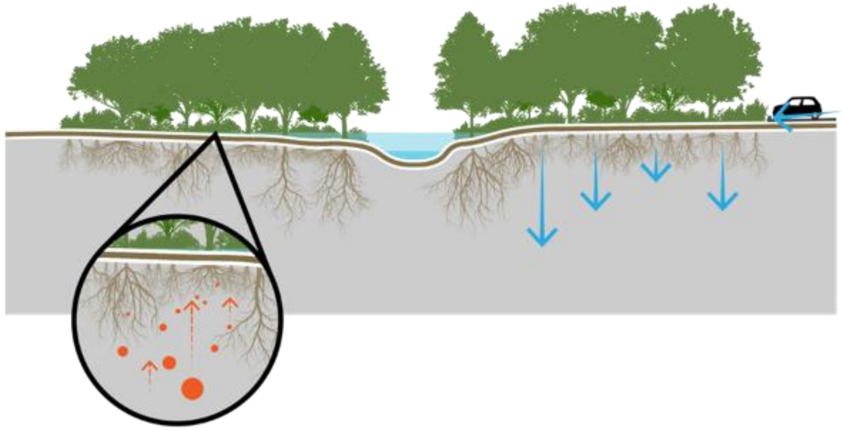
- Stream buffer **losses <u>from development</u>** *drive* most negative impacts
  - More than stream discharge and outfall density
  - Feedback loops increase discharge, erosion, incision, and sedimentation
  - <u>Any</u> buffer loss causes negative impacts
    - No minimum "threshold" – agriculture masks prior impacts

Sources: Schueler, Fraley-McNeal, & Cappiella, 2009
Rasmussen et. al., 2012

RIPARIAN BUFFER BENEFITS

+ Finding Reflect Well Known *Fundamental Processes*
  - **Buffers are <u>a resisting force</u> against urbanization impacts:**
    - **Increased discharge (volumes, <u>depths</u>, durations, <u>velocities</u>)**
    - Increased flashiness, floodplain velocities, and **bank shear stresses**
    - **Bank erosion and failure ➡ sedimentation and riffle embeddedness**
    - Increased water temperatures (from runoff and direct solar heating)
    - Macrohabitat degradation (overbank vegetation, pools, **riffles**, & runs)
    - **Flushing of macro and micro woody vegetation and nutrients**

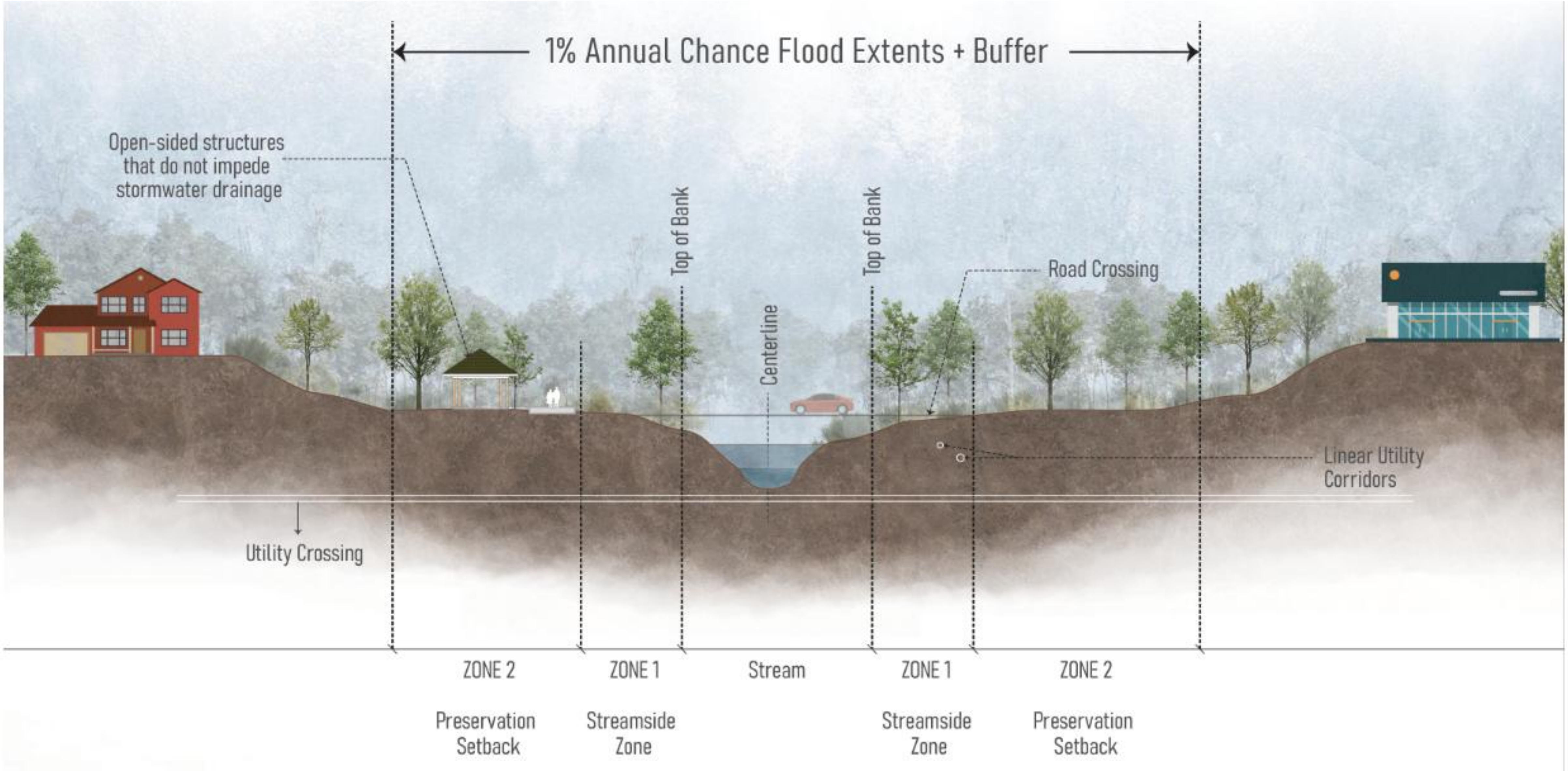
Source: "Effects of urban development on stream ecosystems in nine metropolitan study areas across the United States" (USGS Circular 1373 [Coles et. al., 2012])



RIPARIAN BUFFER BENEFITS

- **"<u>Protecting stream buffers and reducing sediment</u> are the most important policies"** (Rasmussen et. al., 2012)
- Fully vegetated floodplains reduce discharge by up to 20% (Scott, 2012; Hutchenson et. al., 2020)
    - Reduce discharge for the 10%, 4%, and even 1% storms
    - With dense native vegetation across the 1% floodplain or conveyance
    - <u>Narrower buffers</u> and <u>turf grass</u> *provide little benefit*
- Continuous headwater stream setbacks maximize stability & quality (Rasmussen et. al., 2012; Hutchenson et. al., 2020)
    - Where <u>50% to 75% of headwaters streams are protected</u>
    - Provide significant benefit even without downstream protection
        - <u>Or add to *cumulative* reductions</u> in discharge, stability, & quality

APWA 5600 UPDATE



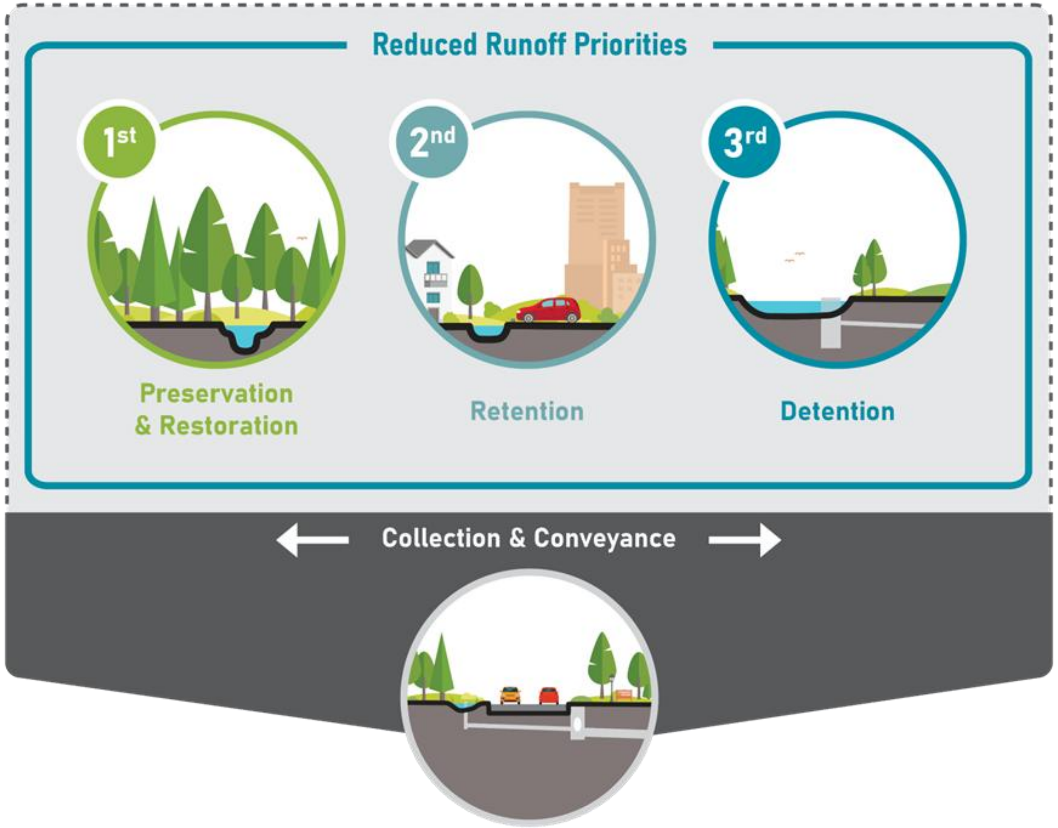
Stream Setbacks and Preservation

- Zone 1 (Streamside Zone): Most stringent protections
- Zone 2 Preservation Setback: More uses (linear utility corridors, trails, and open-sided structures) with native vegetation

Drainage Area Range	Zone Width	Exceptions
40+ acres	Zone 1: 25 feet from top of bank Zone 2: 1% flood extents plus 25 feet	None
20-40 acres	Zone 1: 10 feet from top of bank Zone 2: 50 feet from Zone 1 or 1% flood extents plus 10 feet (whichever is greater)	Channel modifications allowed where setbacks make property *substantially undevelopable*, by providing *equivalent* natural channel design and setbacks
10-20 acres (recommended)	Zone 1: 5-feet from top of bank Zone 2: 45-feet from	Channel modifications allowed, either natural or engineered

Stream Setbacks and Preservation

- Fully integrated preservation, restoration, and runoff reduction
- <u>Preserved</u> streams with predominantly native vegetation do not count as “development” and *reduce detention and runoff retention requirements*
- Streams <u>restored</u> with native vegetation and natural channel design help meet *runoff retention requirements*



Thank You!

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