How Effective is Green Infrastructure for Stormwater Management?

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Calumet Stormwater Collaborative

MPC – August 7, 2015

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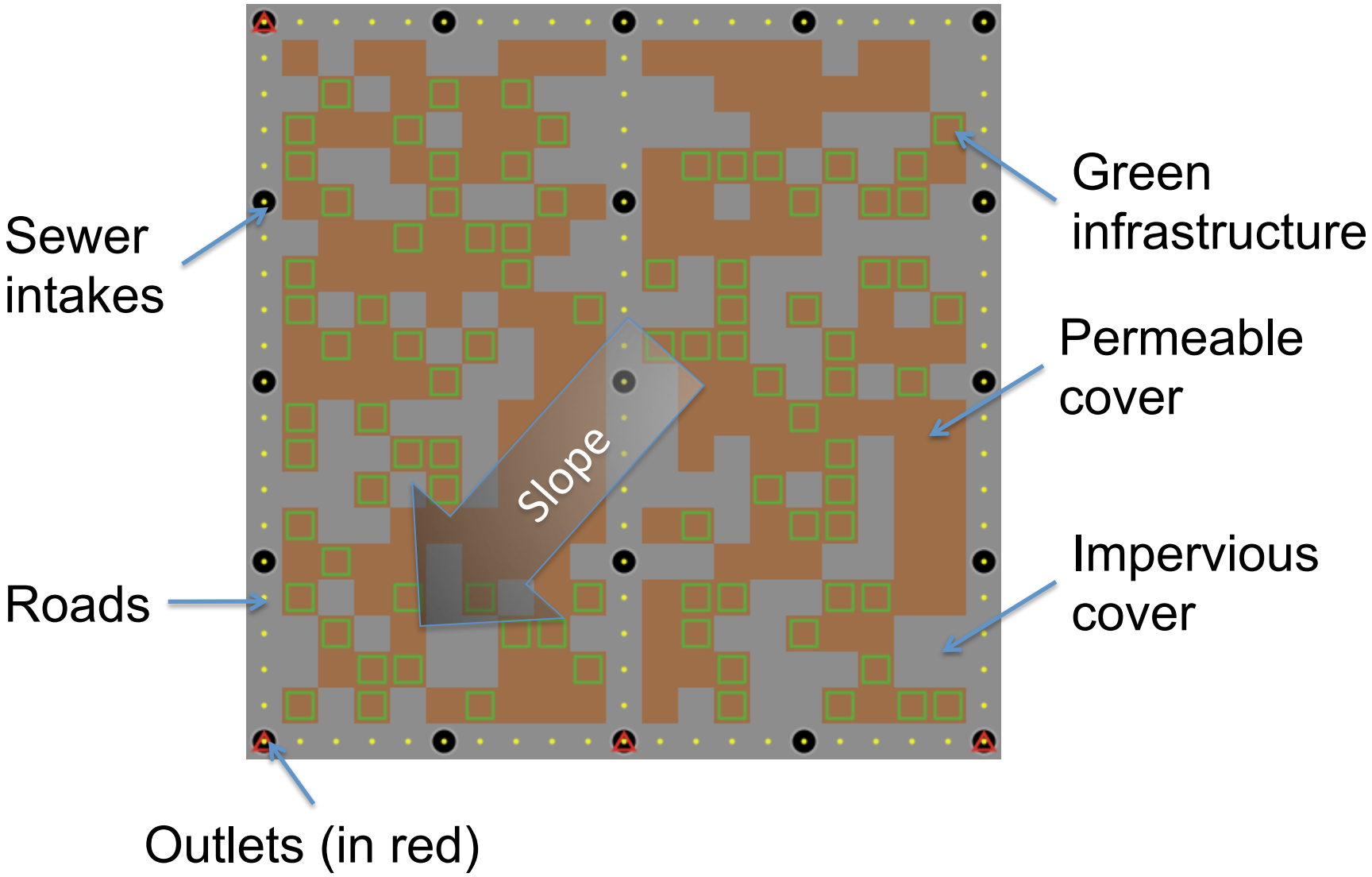
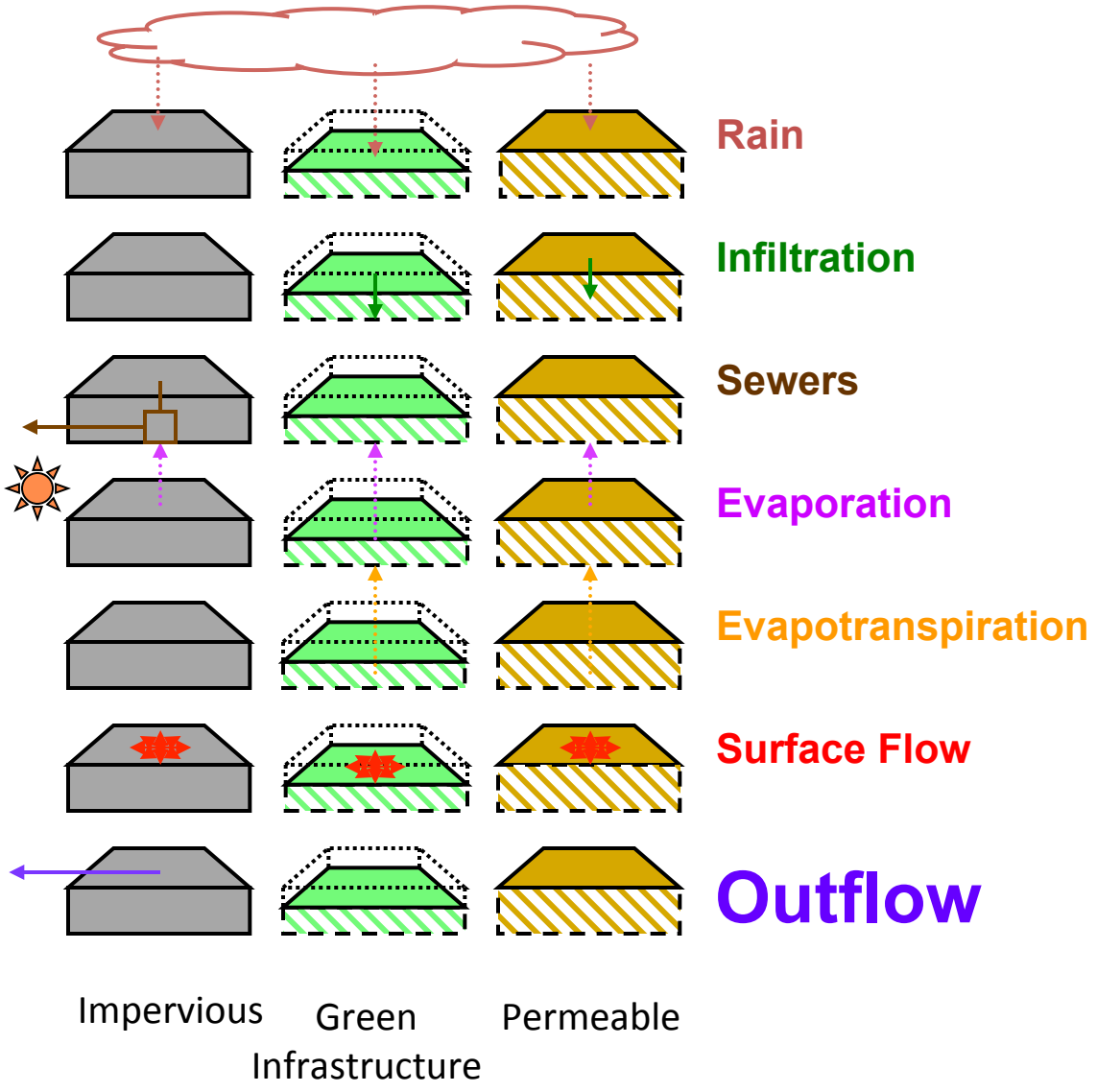
Motivations and questions

- IEPA 2009 – 2010
- Landscape design principles
  - How much?
  - Where?
- Publication:
  - Zellner et al. (in review) "Exploring the Effects of Green Infrastructure Placement on Neighborhood-Level Flooding via Spatially Explicit Simulations"

Landscape Green Infrastructure Design (L-Grid)

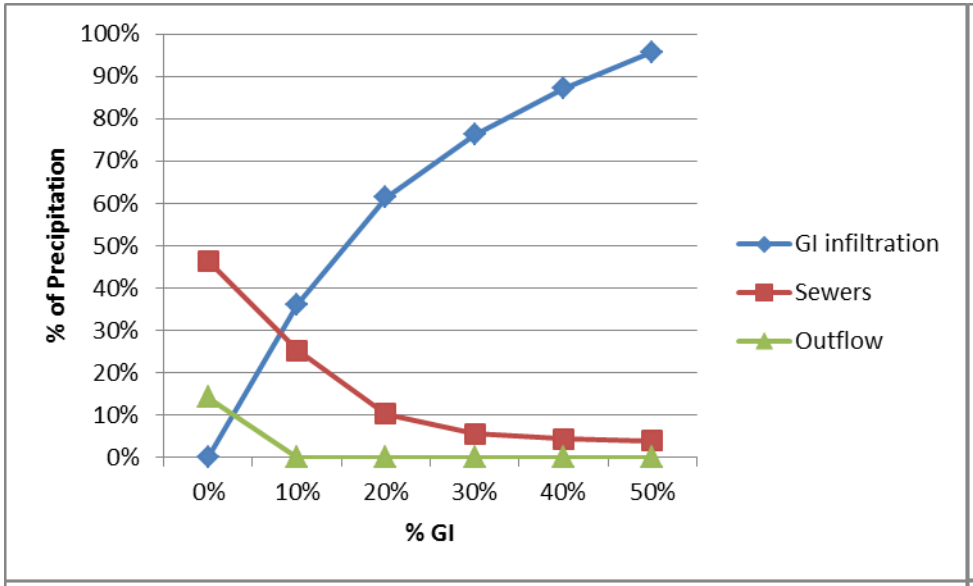


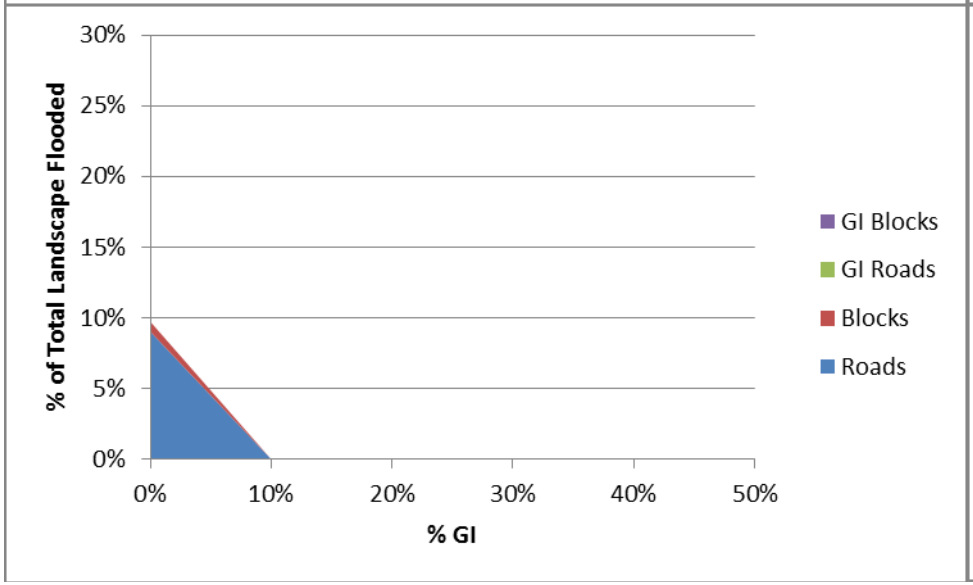
L-GrID processes



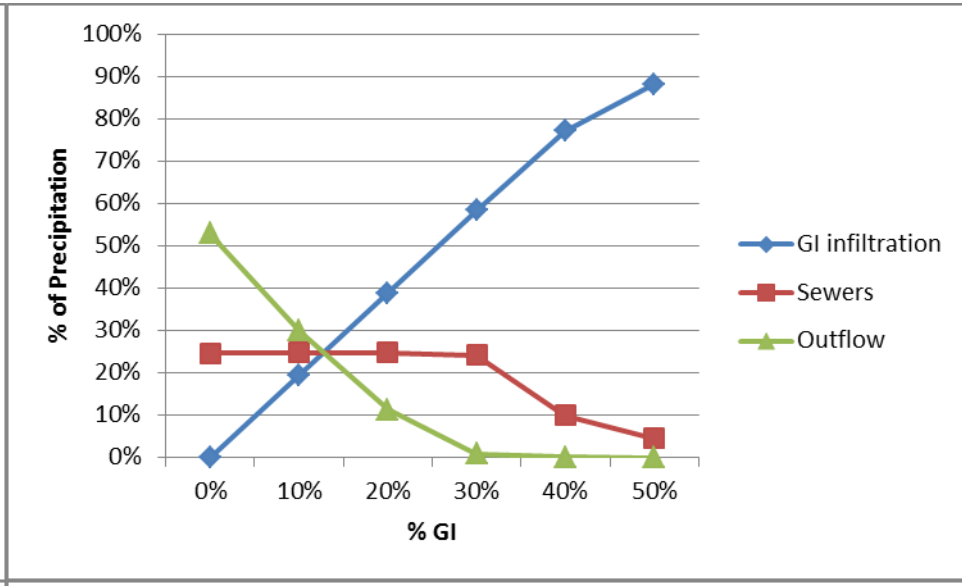
How much?

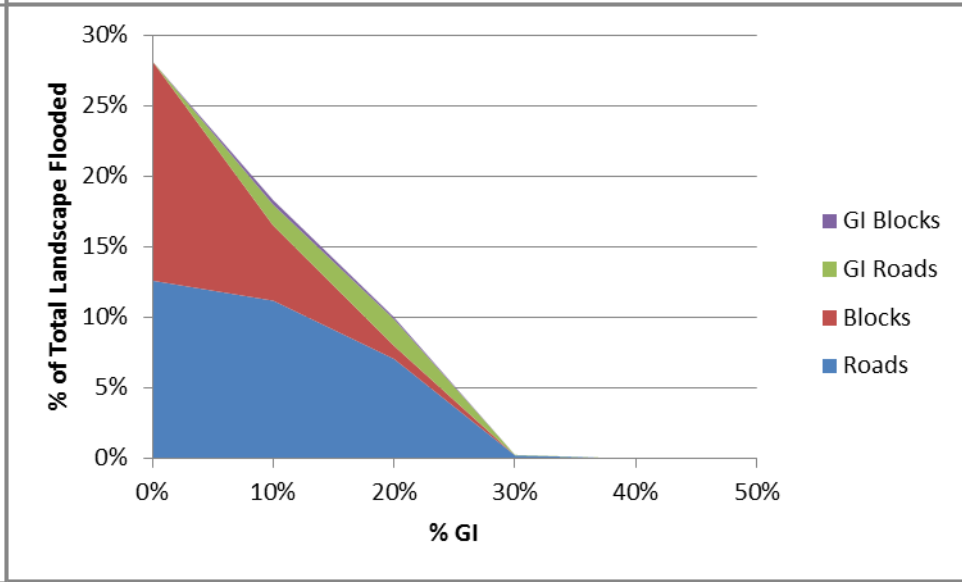
5-year storms



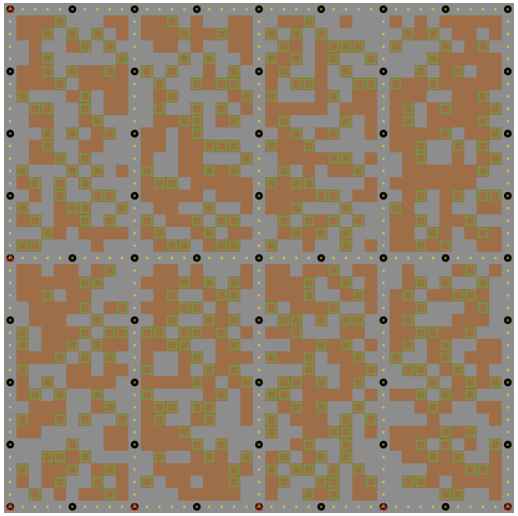


100-year storms

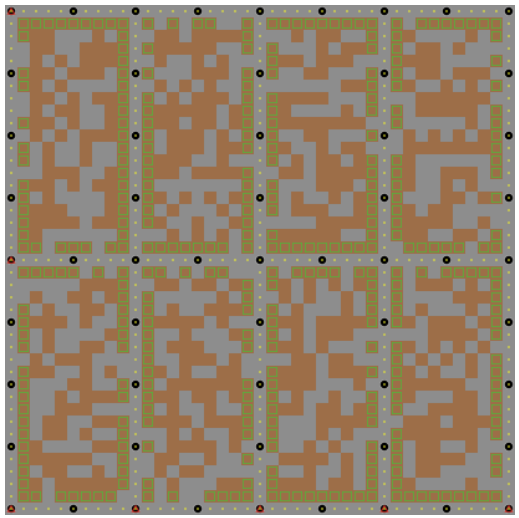




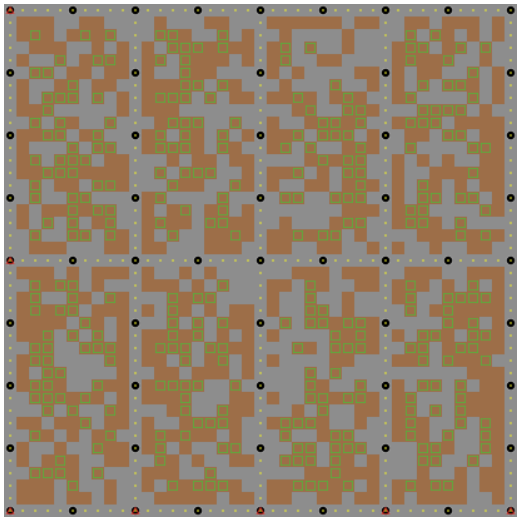
Where?



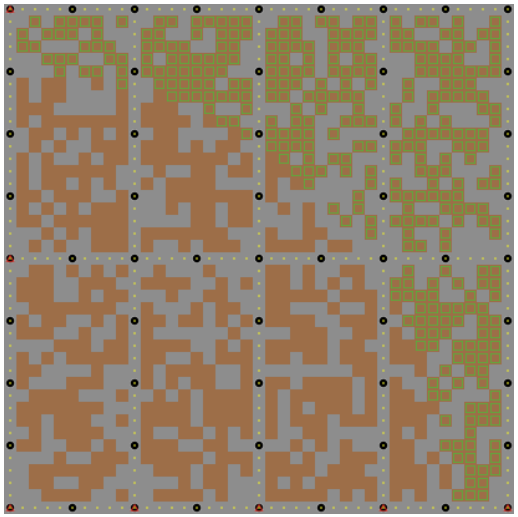
random



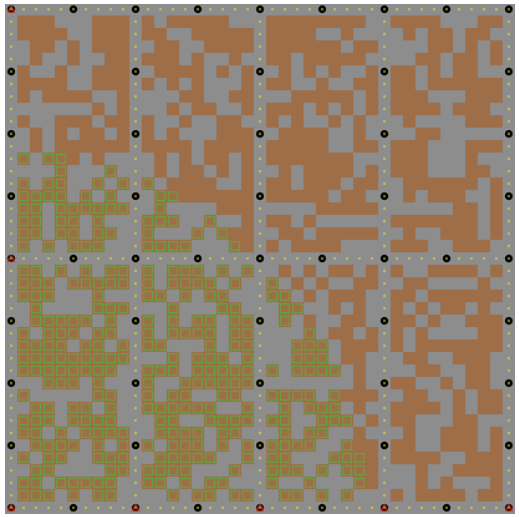
adjacent to roads



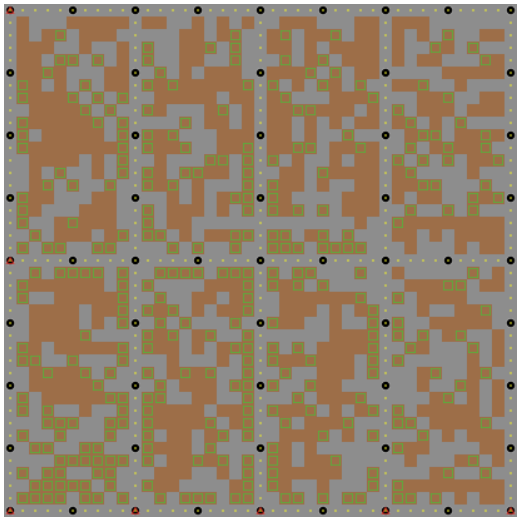
away from roads



upstream



downstream

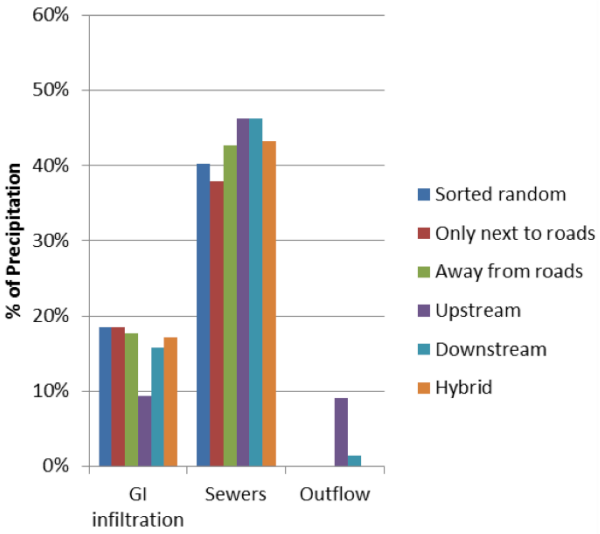


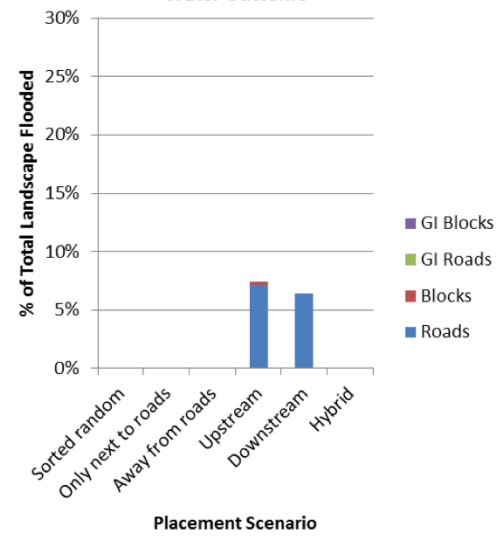
hybrid

Where?

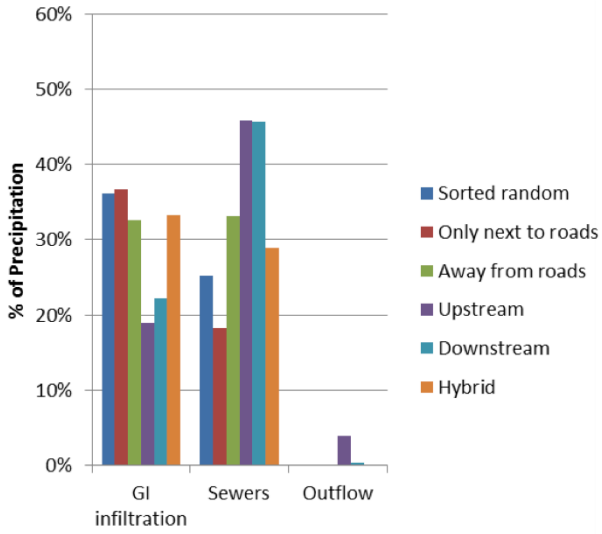
5-year storms

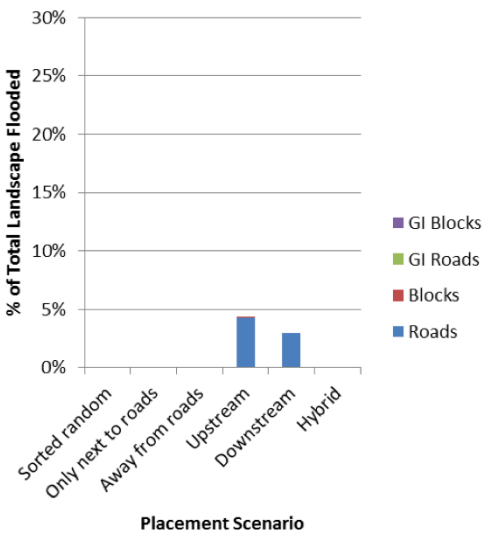
5%



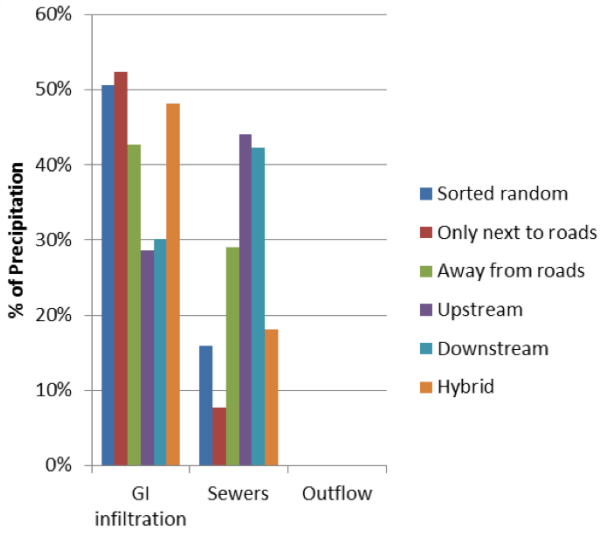


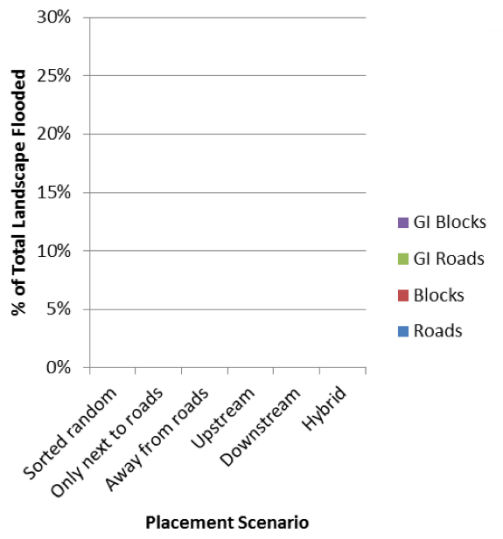
10%





15%

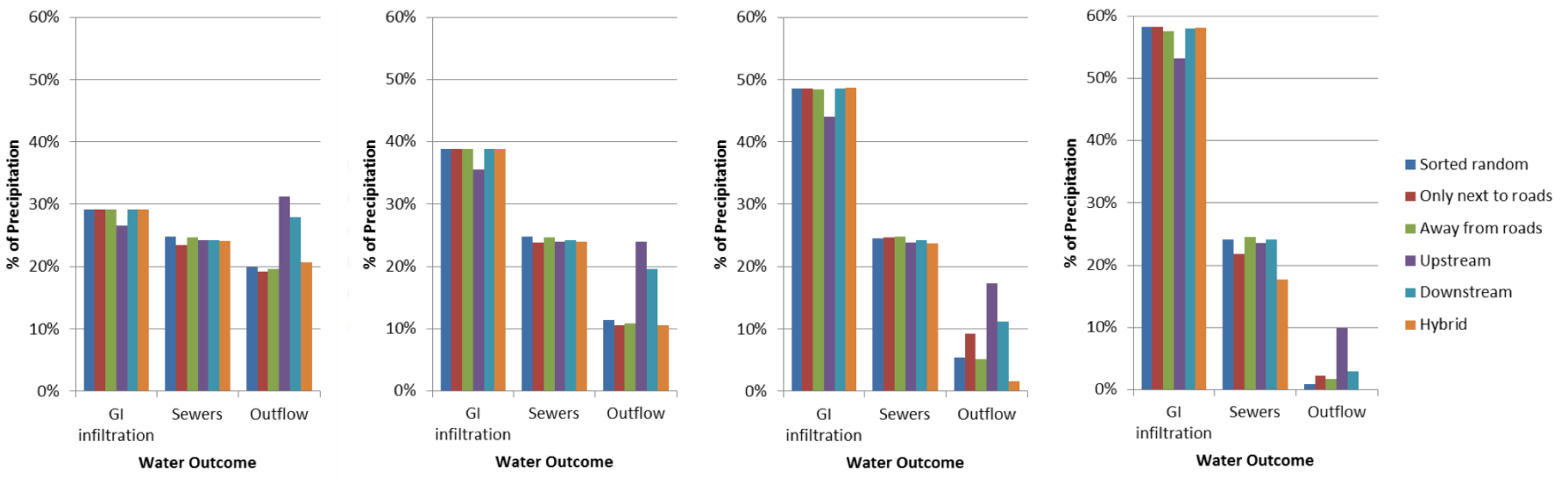


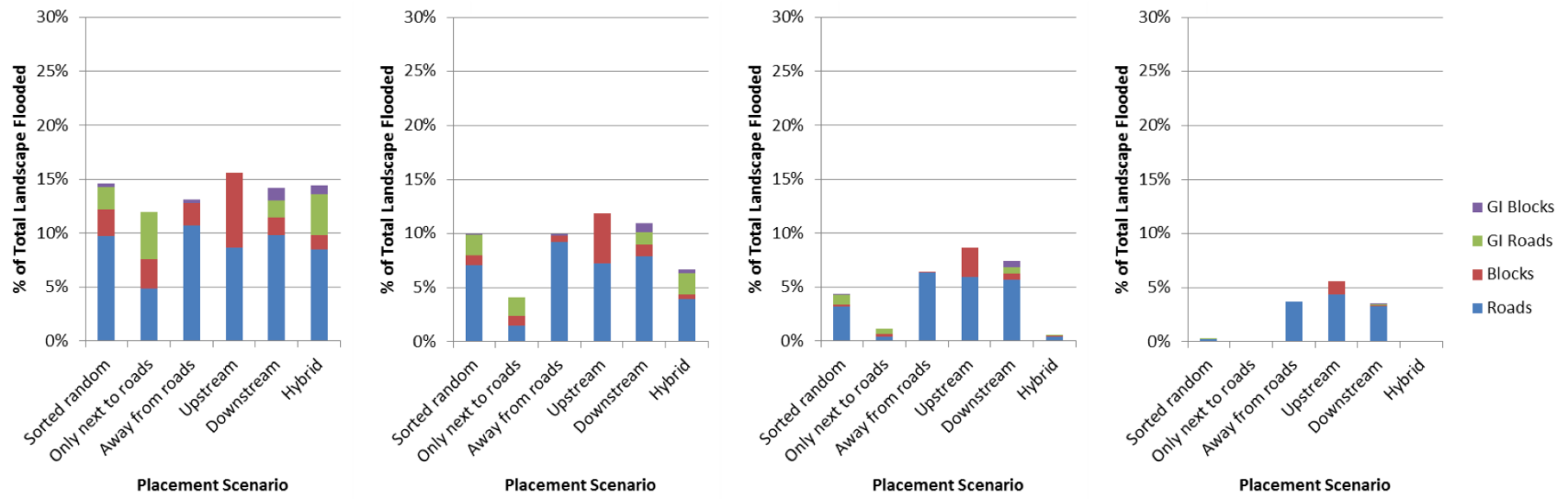


Where?

100-year storms

15% 20% 25% 30%





Design principles

- Thresholds
- Dispersed over clustered
- Advantage of curb cuts
  - Keep water in roads
  - Detention
  - Installation in public property and maintenance
- Hybrid in larger storms
  - Build on curb cut layout
- When all else fails, try random

Things to consider

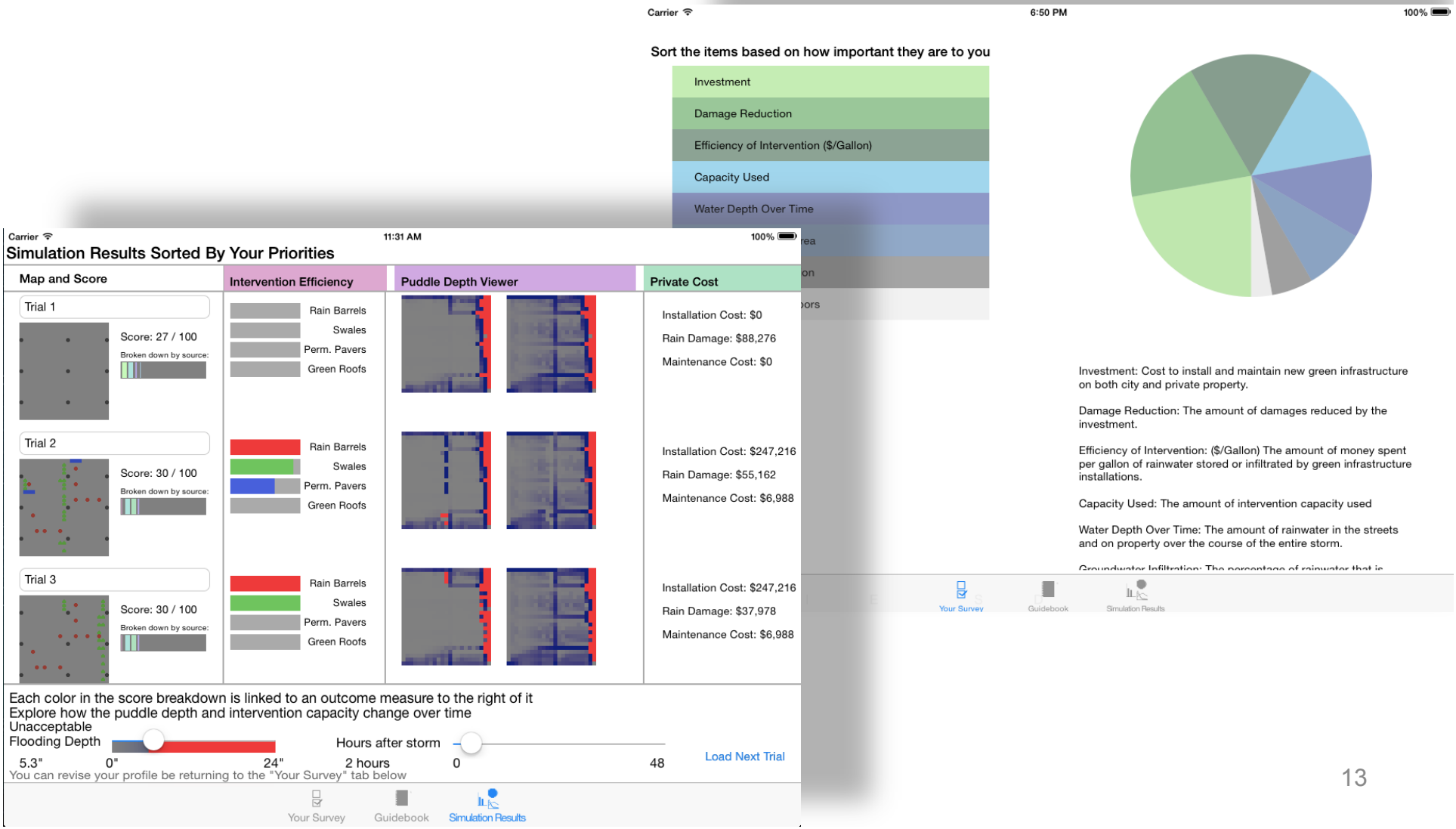
- First you model, then you monitor…
- Variable landscapes and GI types
- Simulation alone cannot give best solution
  - Tradeoffs
  - Costs and distribution
  - Spatial constraints
  - Diverse stakeholder interests

Seeing water flow, seeking compromise

- Solution building AND compromise
- Awareness of preferences
  - elicitation, recognition, point of departure
- Addressing diverse needs
  - metrics, evaluation, exploration
- Publication:
  - Zellner et al. (in progress) “A Participatory Simulation Protocol for Stormwater Management and Planning”

Participatory modeling

Mobile interfaces



Facilitation

- Canonical profiles before their own
- Accompanying worksheets and boards
- Strategies for exploration
- Opportunity for synthesis
- Connection to region

Learning, innovation, compromise

- Transparency of assumptions and tradeoffs

  Jo: "Oh wow, that's much better…for you."

  Nina: "I guess it matters what your priorities are!"

  Kevin: "Damage was reduced by 87%…but we were over budget by 1.2 million."

- Systematic exploration

  "Let's start by going crazy, putting a lot of stuff on here, and then pare back from there."

  "We can run multiple simulations, so let's run this one and then try that"

- Gesturing and mental modeling

  Following the flow

  Imagining different performance

- Green infrastructure cannot locally solve the problem

  "Perhaps we need to think of moving the houses out of there"

  Green AND gray infrastructure

  Coordination with other communities

Opportunities

- First you model, then you monitor…
  - Design principles
  - Rapid evaluation
  - Field experiments
- … then you act!
  - Participatory modeling as a point of entry
    - to the problem,
    - to other tools,
    - to diverse interests
  - Collaboration
  - Funding

Acknowledgments

- Leilah Lyons, Charles Hoch, Josh Radinsky, Max Dieber, Andy Johnson, Emily Minor, Jen Weizeorick, Dan Milz, Carl Kunda, Ethan Brown, Lissa Domoracki, April Schneider, Kelsey Pudlock, Curtis Witek, Tia Shelley, Brian Slattery, Lisa Cotner, Ben O'Connor
- Chicago region stakeholders
- John Watson, MWRD
- Howard Reeves, USGS
- Al Wehrmann, Yu-Feng Lin, Scott Meyer, ISWS
- Tim Loftus, CMAP
- Urban Planning and Policy, Great Cities Institute, Institute for Public and Civic Engagement (UIC), UIC Chancellor Discovery Fund
- National Science Foundation CI-TEAM program.

Thank you!

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