Monitoring Stormwater Control Measures -- Green Infrastructure

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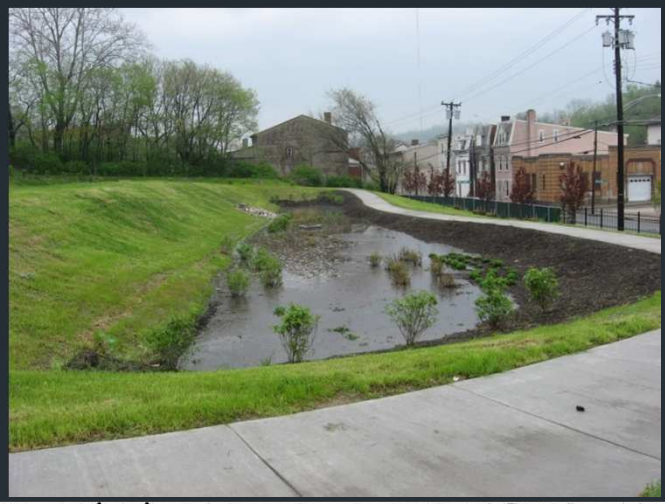
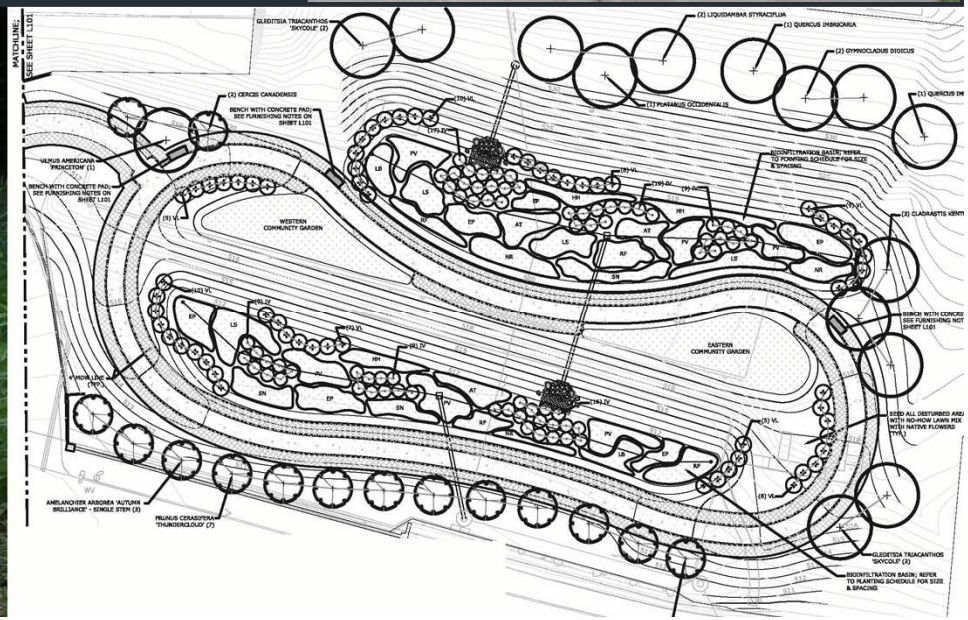
Stormwater Control Measures (SCM)

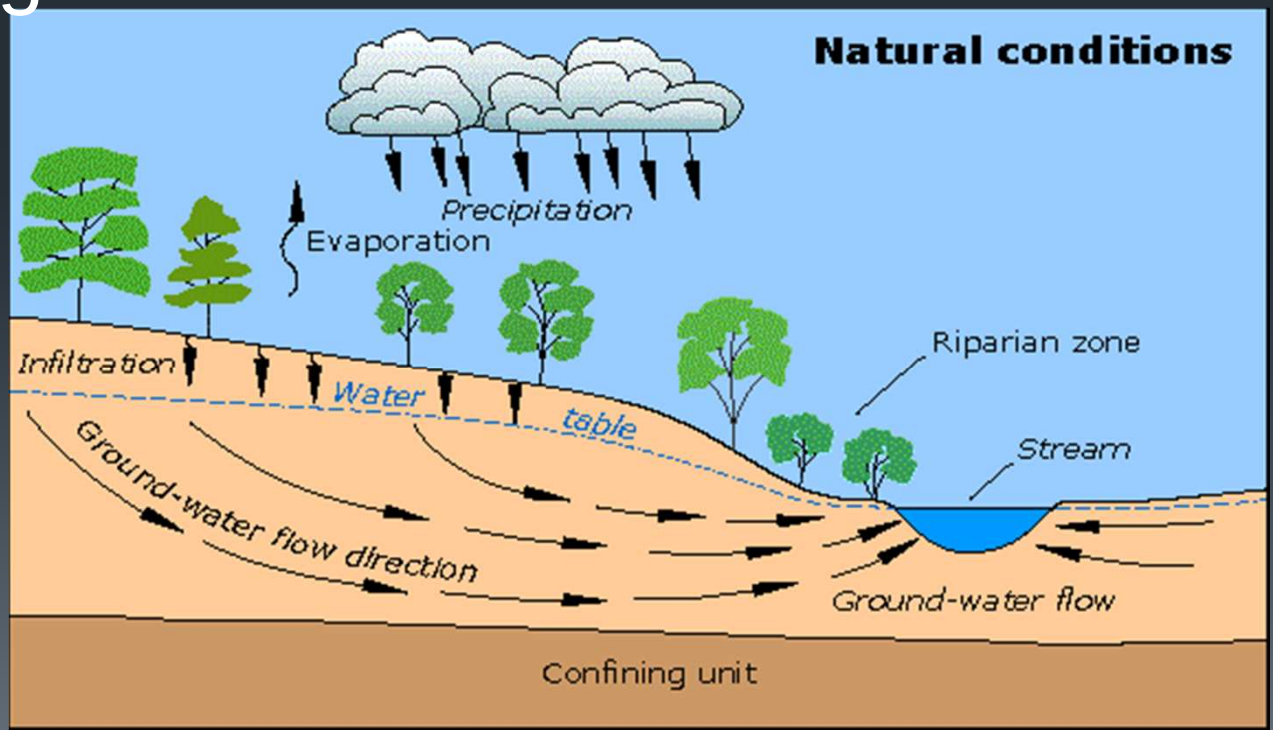
- Green infrastructure & Best Management Practices
- SCMs are designed to reduce or delay stormwater runoff and improve water quality
- There is growing interest in GI SCMs; however, there are relatively little high-quality data available on their operational characteristics





The Plan

- Measure as much of the water budget as possible
- Determine efficiency of different SCMs by comparing water IN vs. water OUT



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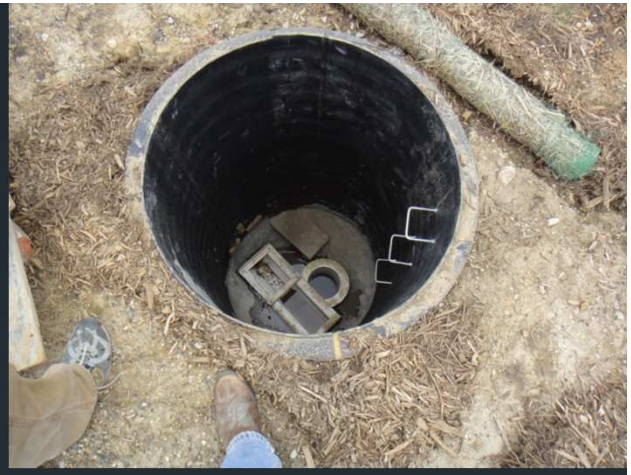
The Challenges



- Urban settings → everything happens fast
- Most flows are relatively small (<1cfs)
- Pipe-flow
- Local weather conditions
- Soil conditions
- Groundwater
- Multiple types of monitoring at each site

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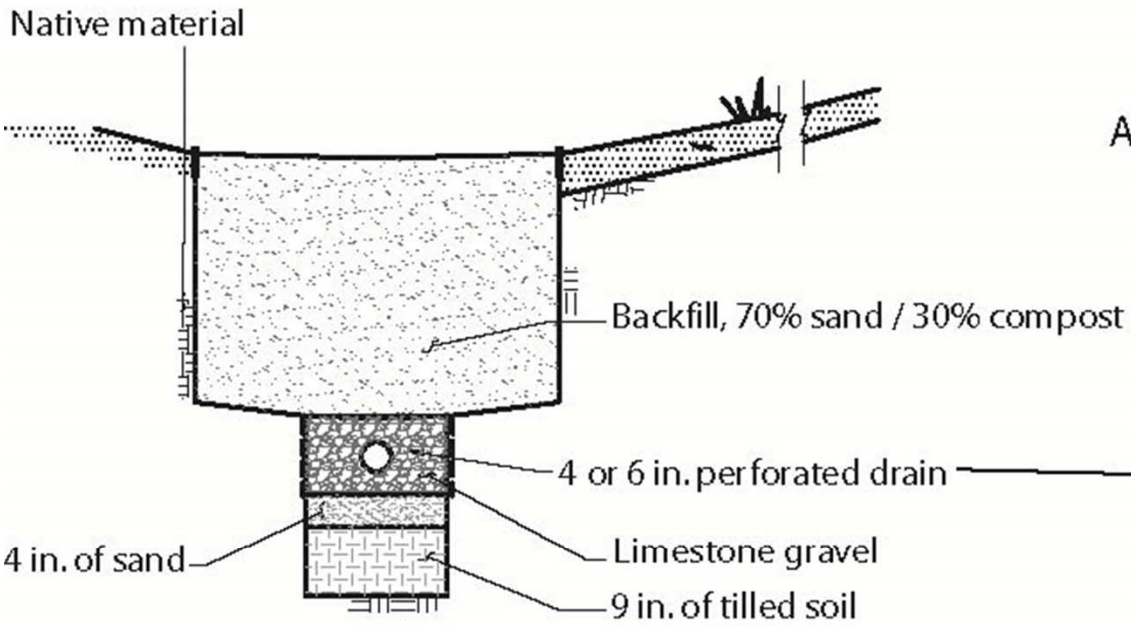
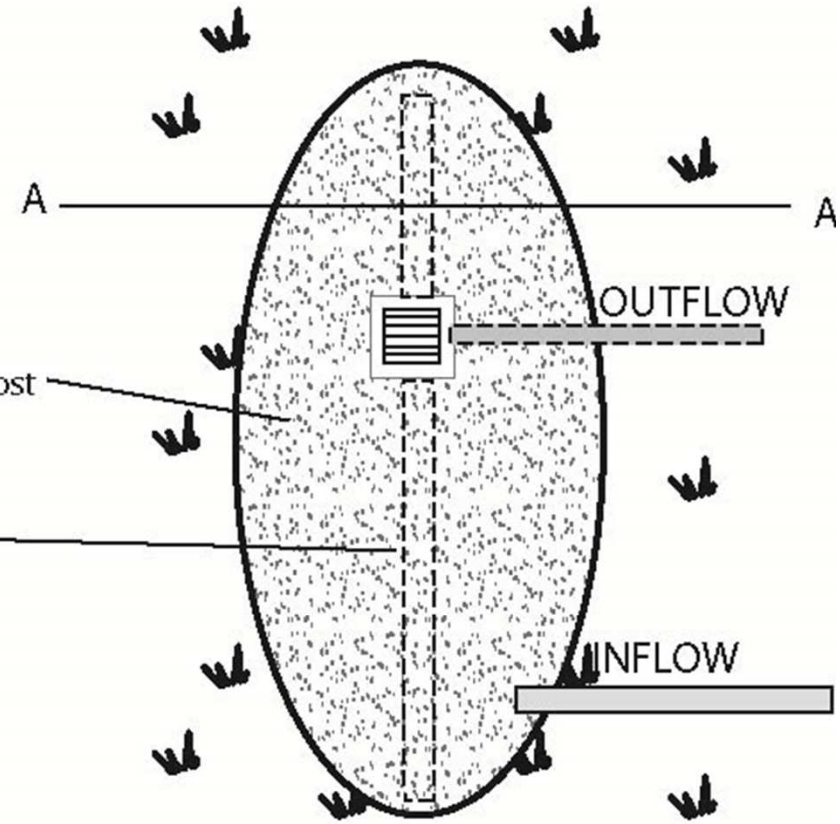
Typical construction

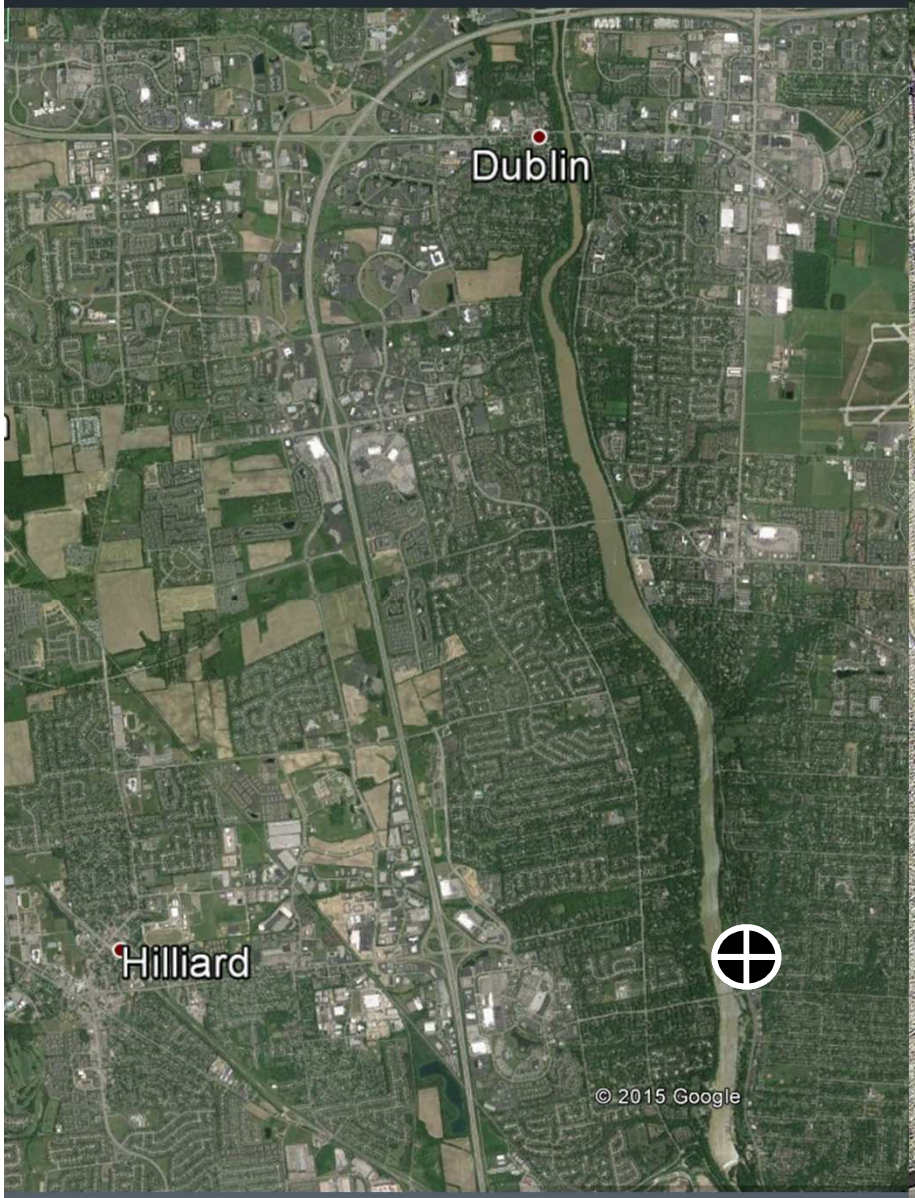


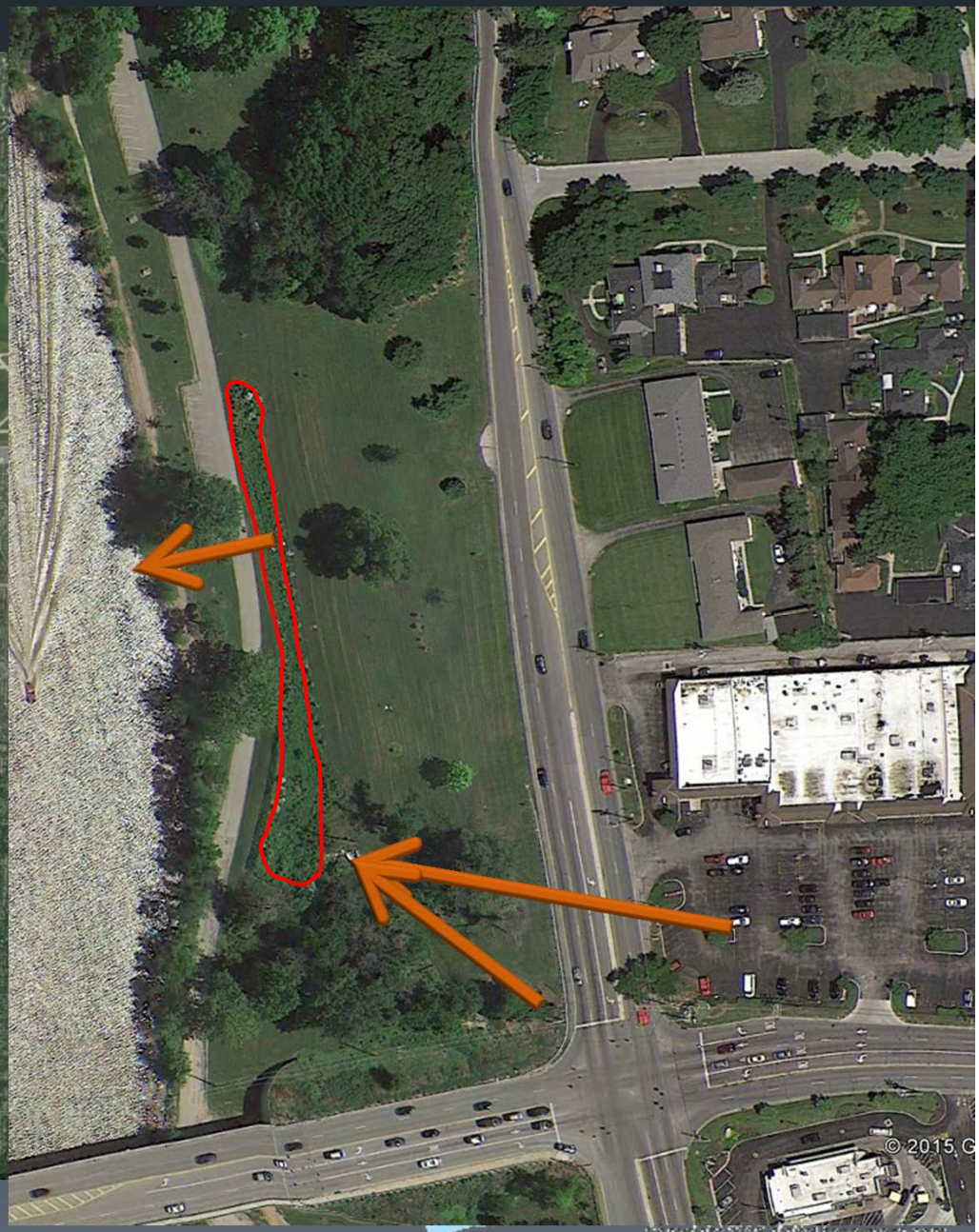
Typical rain garden detail section A-A'



Plan view of bioswale-rain garden system

Griggs Reservoir





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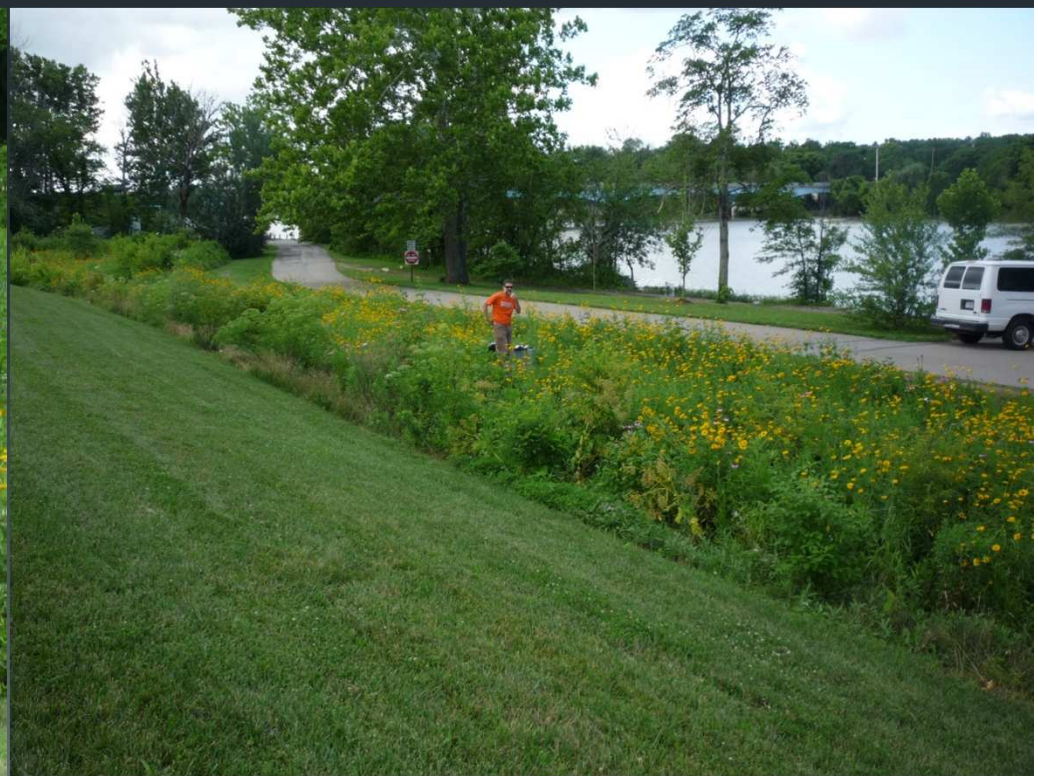
Griggs Reservoir Rain Garden

- Rain garden with an area of 8,500 ft^2
- Receives water from ~26 acres of urban (mostly residential) landuse
- 1 ft. of gravel covered by 1 to 2 ft. of engineered soil
- Subsurface drains connected to an overflow



Flow monitoring

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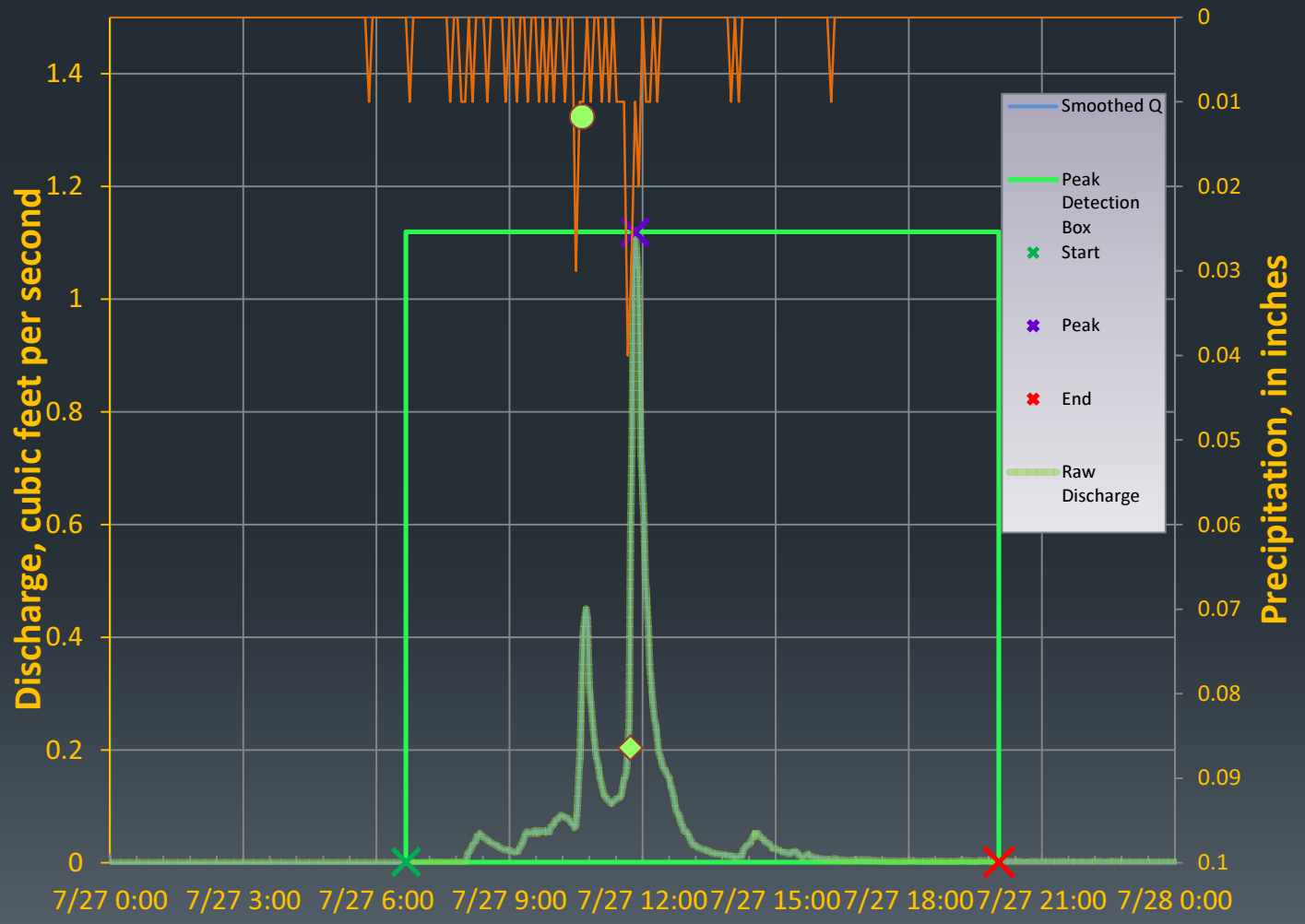
Flow IN



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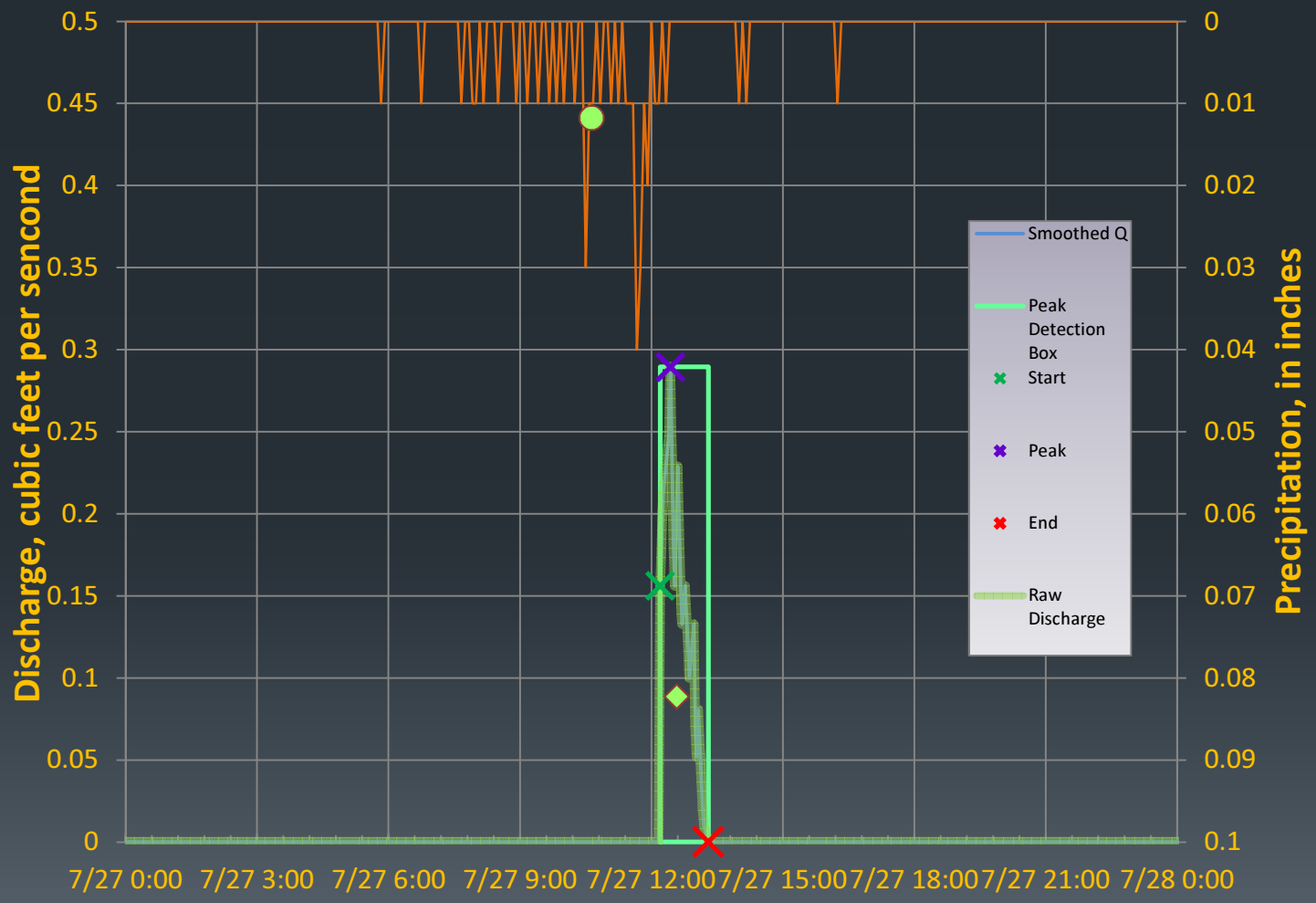
Flow OUT



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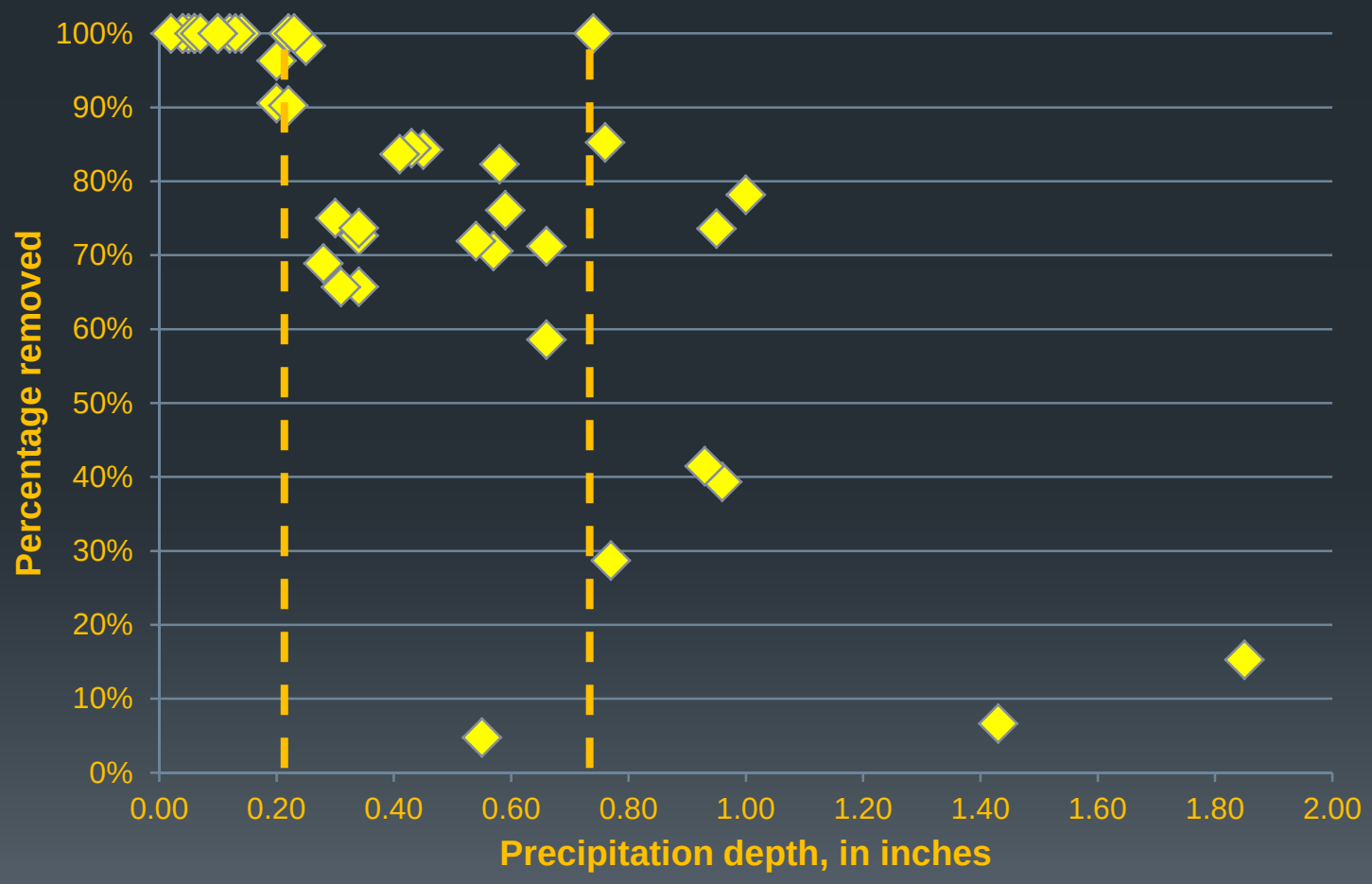
Percent removed and event size



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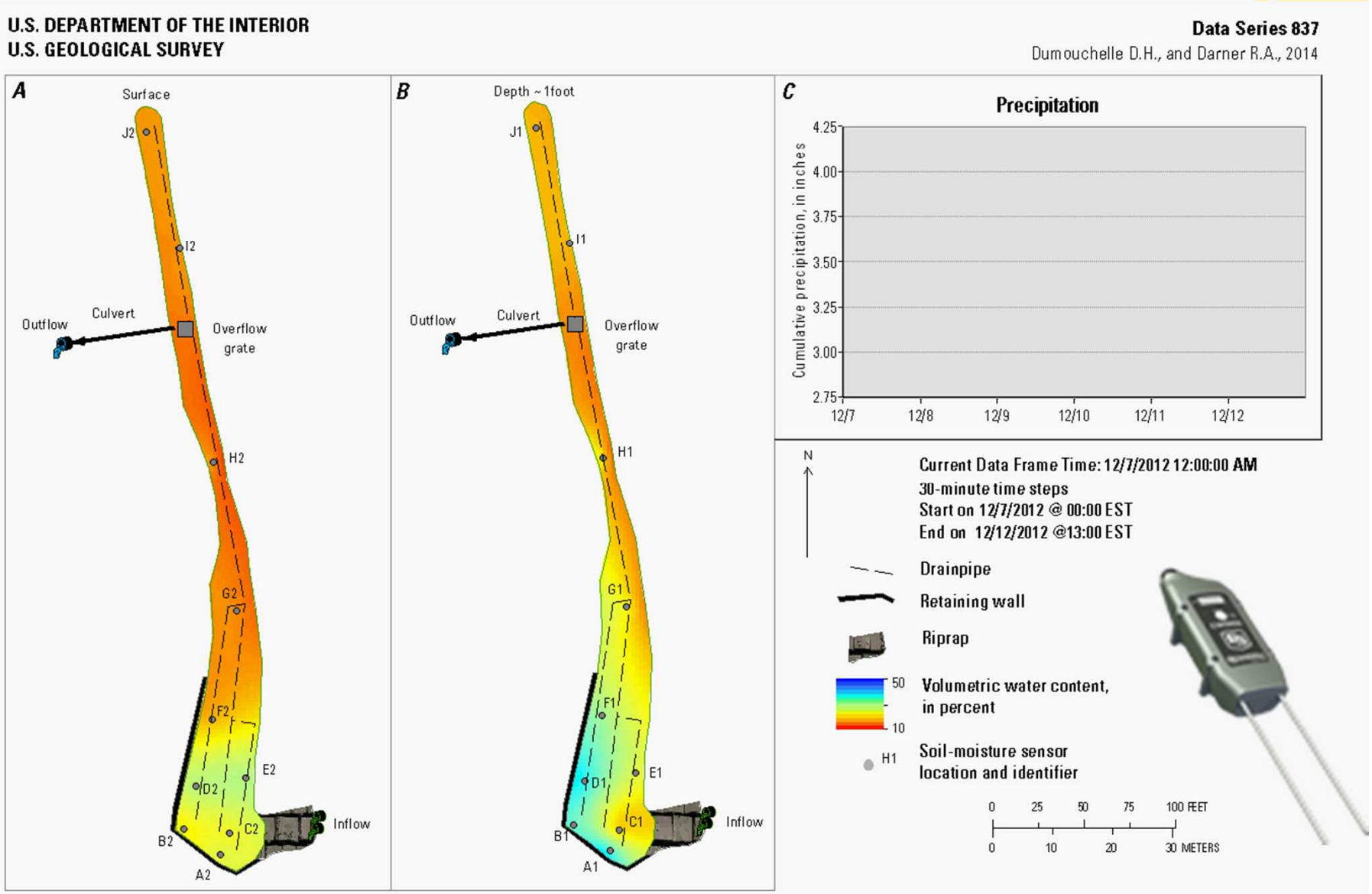
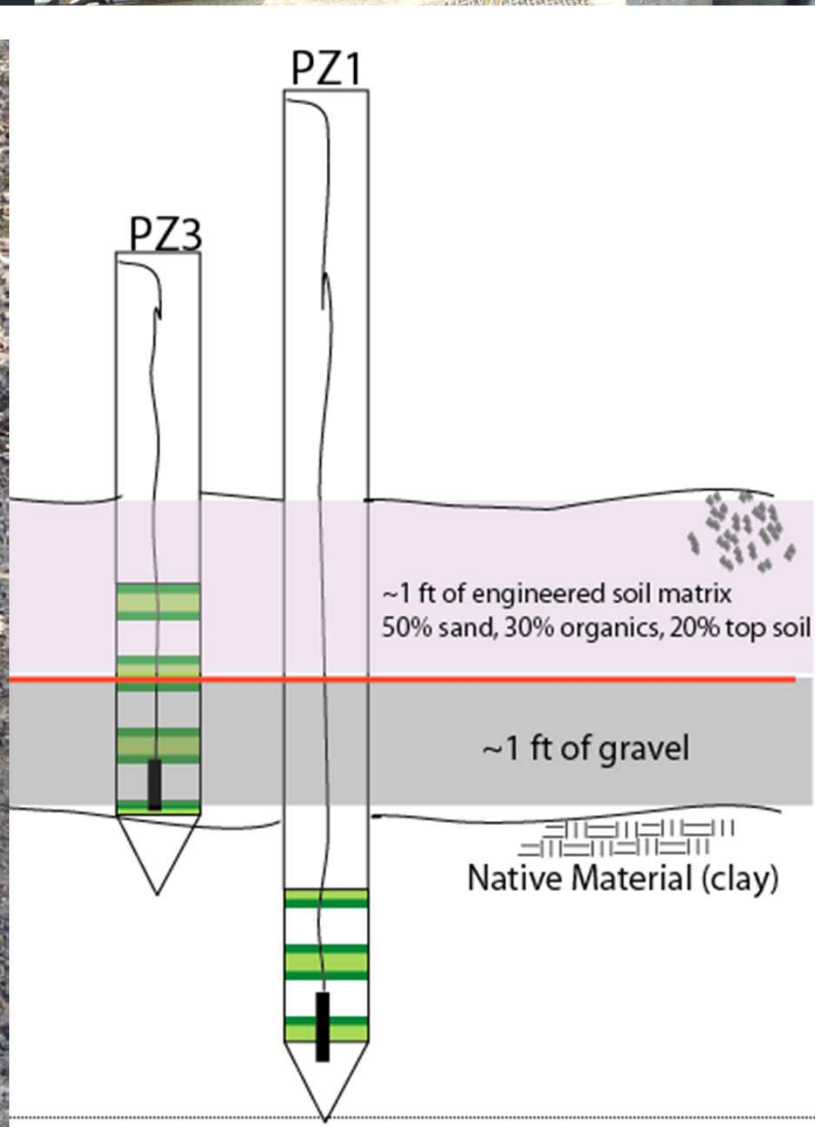
Soil Moisture Animation



Visualization 2. Animation of changes in soil moisture in the rain garden at the Griggs Reservoir site, Columbus, Ohio, December 2012.

Groundwater



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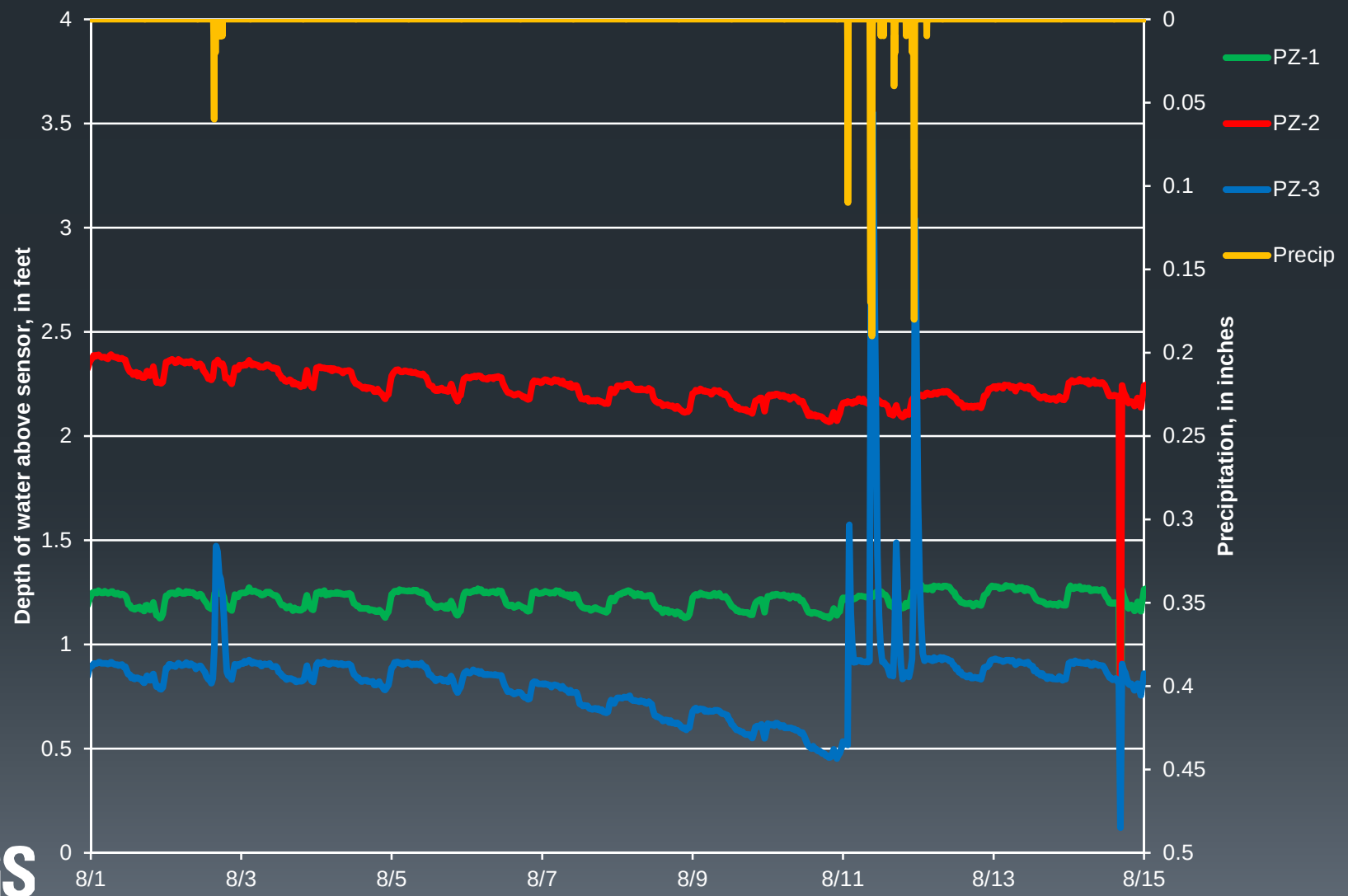
Groundwater



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Current Events

- Initial data and soil moisture animation
- Modifications to the system
- Possible water quality samples

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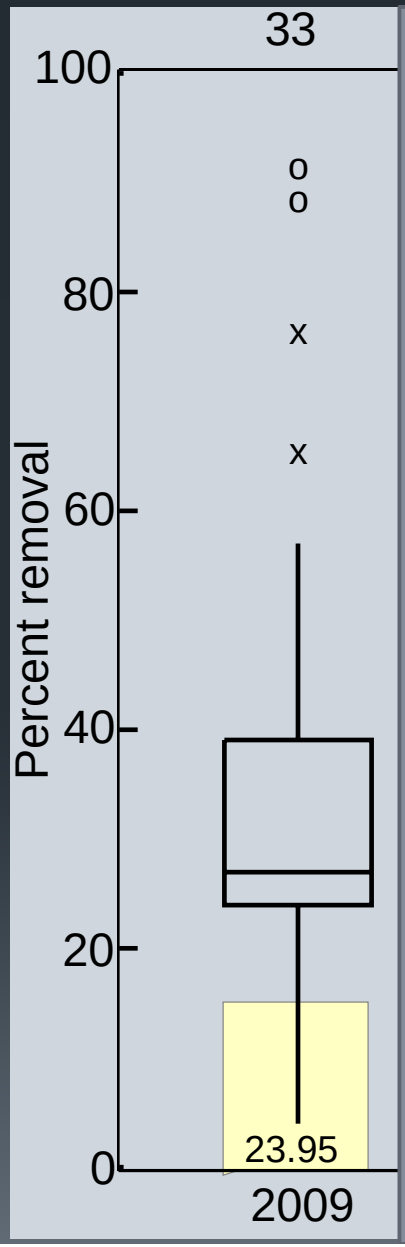
Cleveland, OH

Cawrse and Assoc.

- Pervious pavers on parking lot with underdrains
- Roof runoff diverted to rain garden with overflow drain

Cleveland, OH

Cawrse and Assoc.



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St. Francis

Cincinnati, OH

- Stepped RG with an area of ~6,000 ft^2
- Receives water from parking lot
- 1 ft. of gravel covered by 2 ft. of engineered soil
- Subsurface drains connected to an overflow

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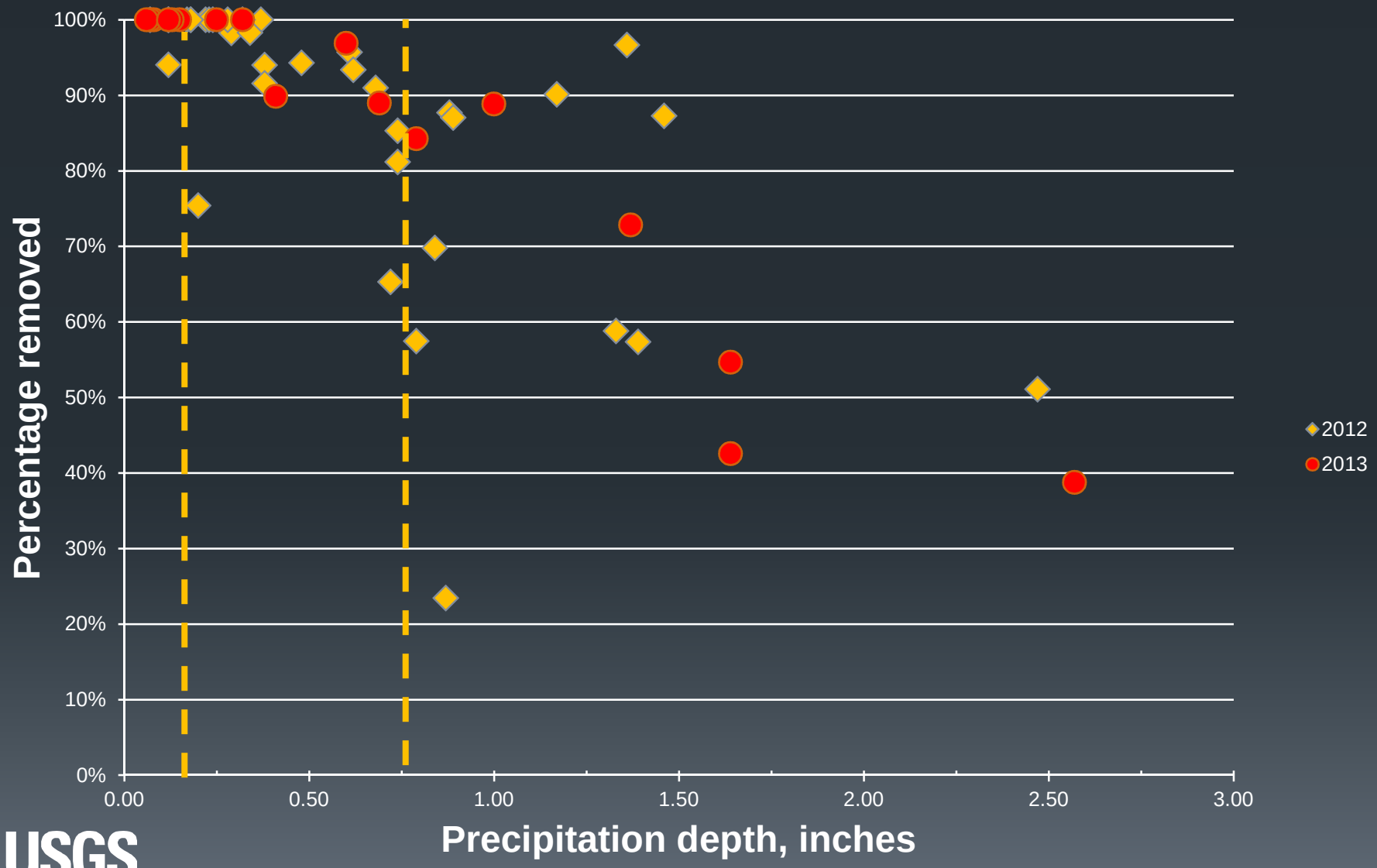
St. Francis

Upper Rain Garden



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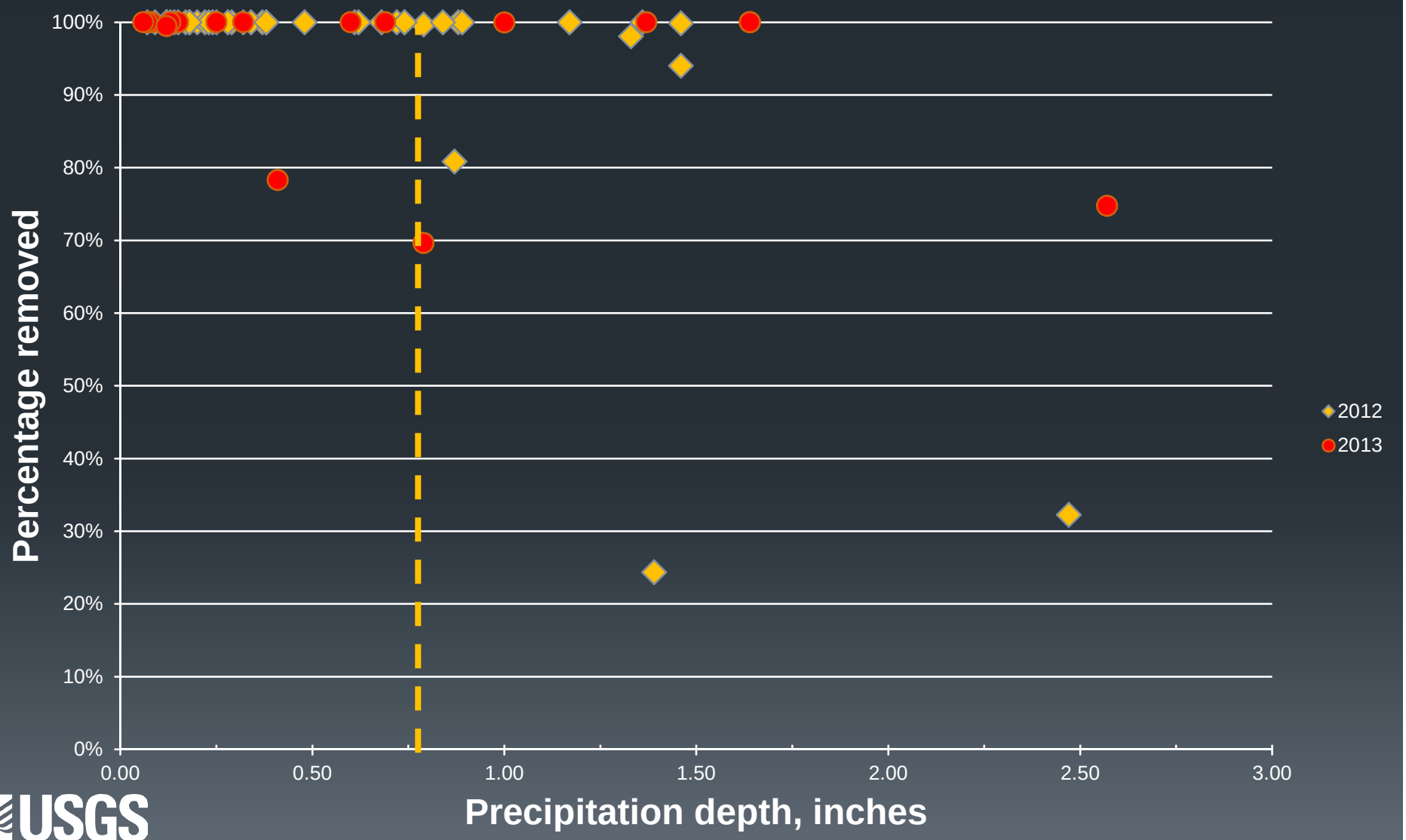
St. Francis

Lower Rain Garden



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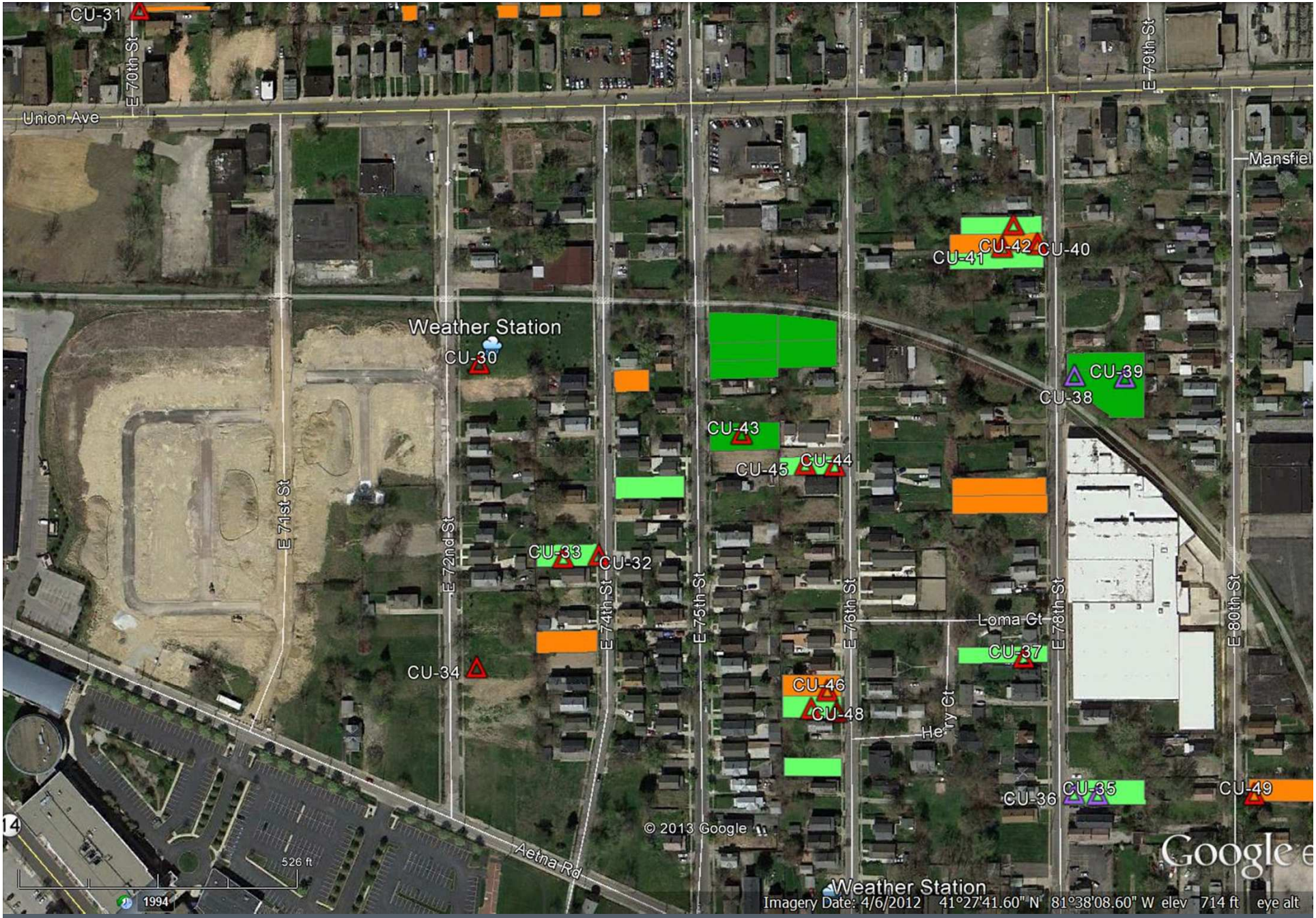
Cleveland, OH

Slavic Village

- Urban renewal project
- Influence of BMPs on water table
  - 4 regional wells
- Influence of BMPs on GW mounding
  - 16 local wells
- Effects on combined sewer overflows
  - Continuous pipe flow at two points
  - Dye tracer studies on two smaller pipes



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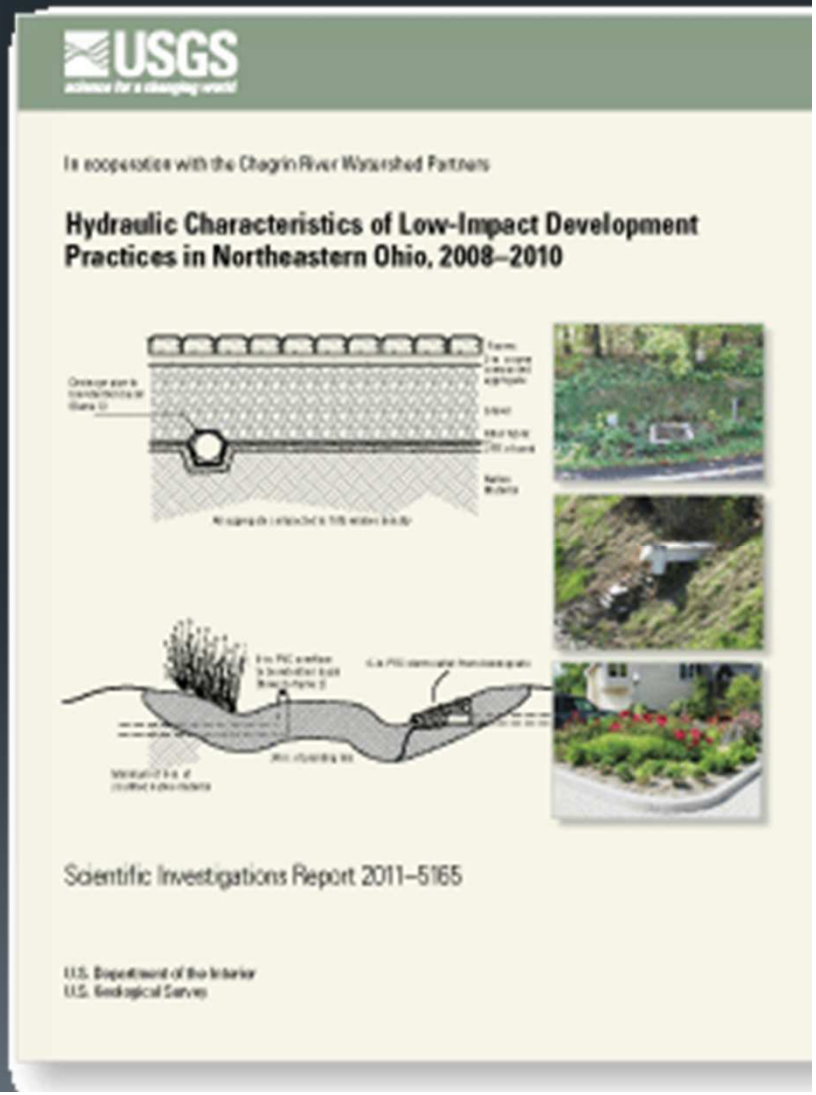
Reports

- USGS SIR 2011-5165
  - 2008-10
- USGS SIR 2015-5030
  - 2008-13
- USGS DS 837
  - Soil moisture animations

- radarner@usgs.gov



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