OVERCOMING SOCIAL AND TECHNICAL BARRIERS FOR THE BROAD ADOPTION OF SMART STORMWATER SYSTEMS

1737342

Branko Kerkez, University of Michigan

IRG Track 1

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SOUTH
39
MILE
3
.8

OAKLAND COUNTY MICHIGAN

MACOMB COUNTY MICHIGAN

CITY OF TOLEDO OFFICIAL SEAL

CITY OF ANN ARBOR MICHIGAN

GLWA

Huron River Watershed Council

WASHTENAW COUNTY MICHIGAN 1826

OAKLAND COUNTY MICHIGAN

MACOMB COUNTY MICHIGAN

CITY OF TOLEDO OFFICIAL SEAL

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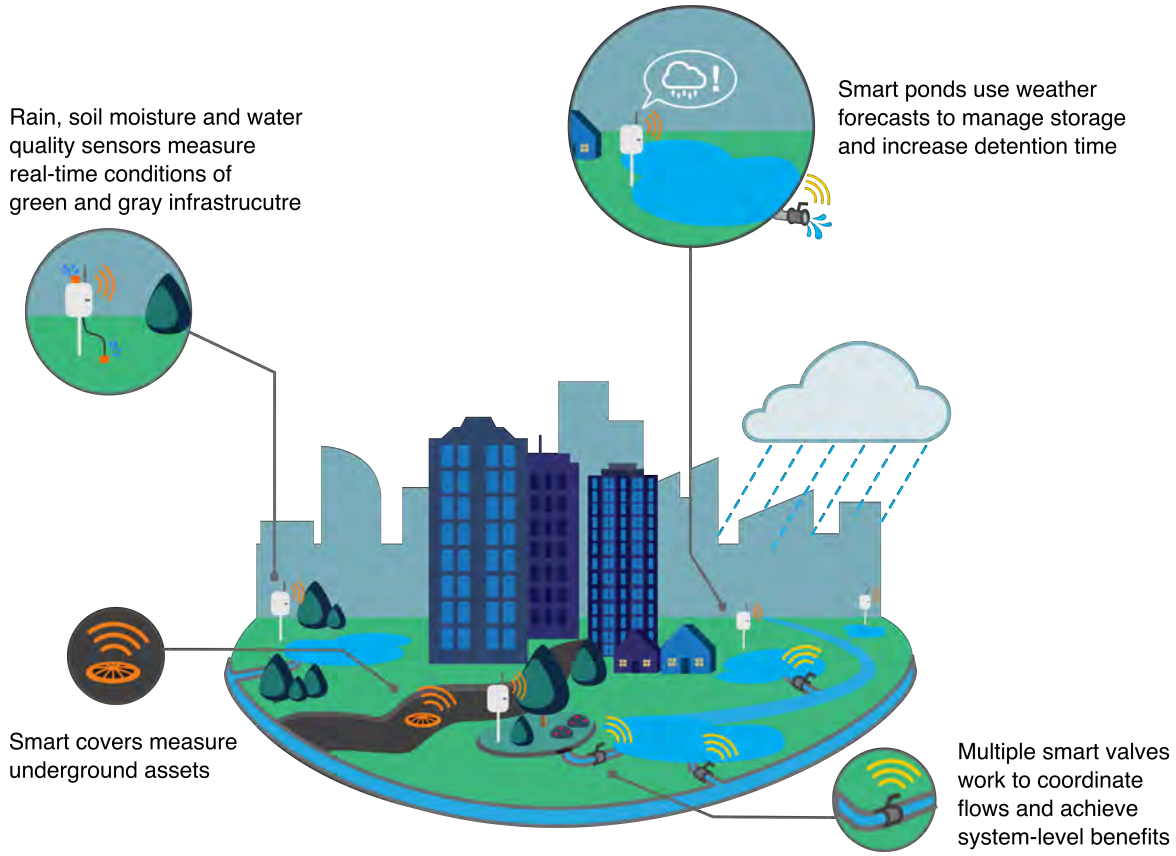
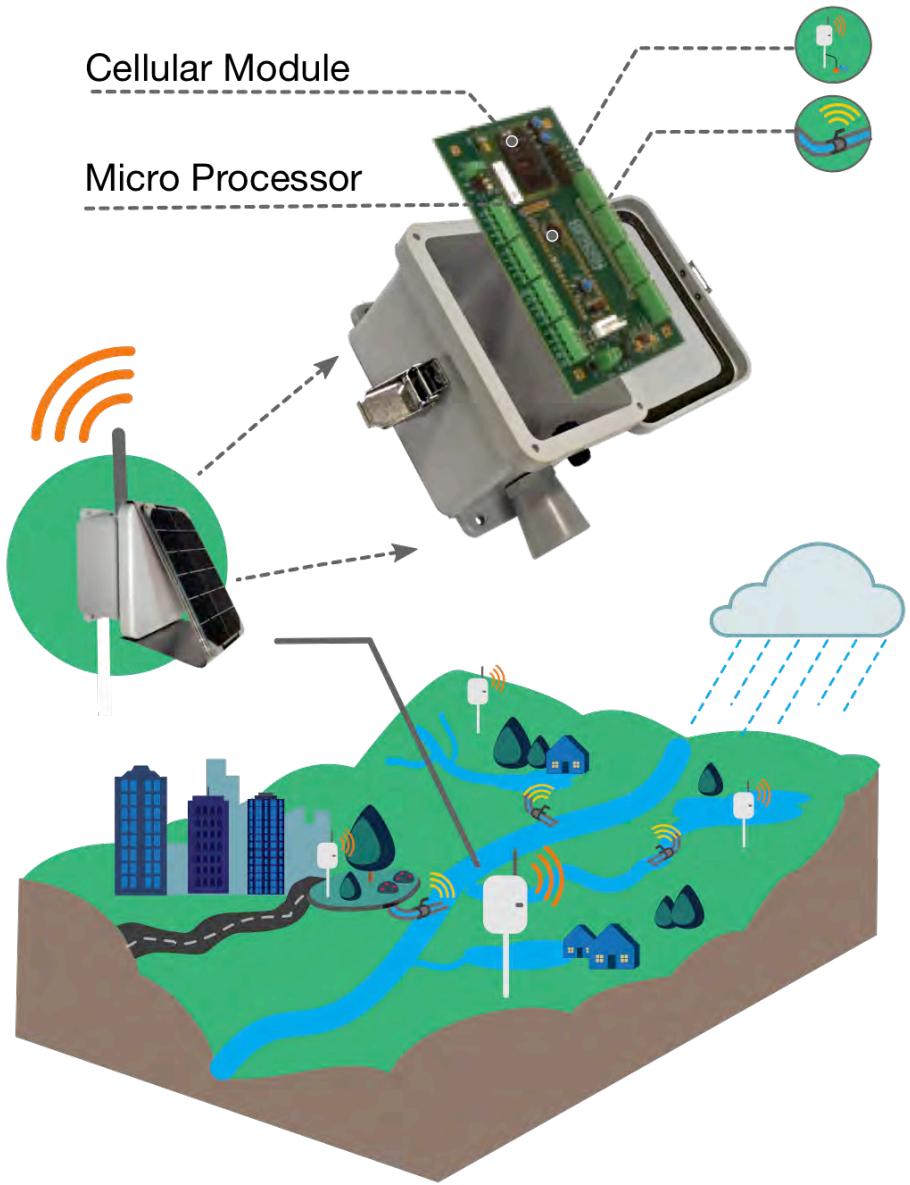


Make technology accessible to stormwater managers



Measure

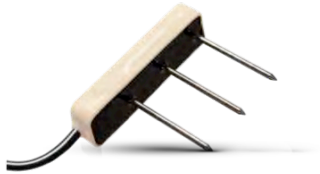
Control

Rain

Valves

Depth

Gates

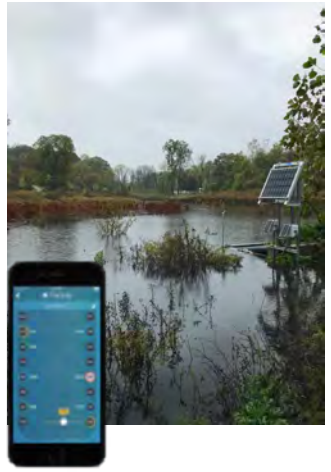


Soil Moisture

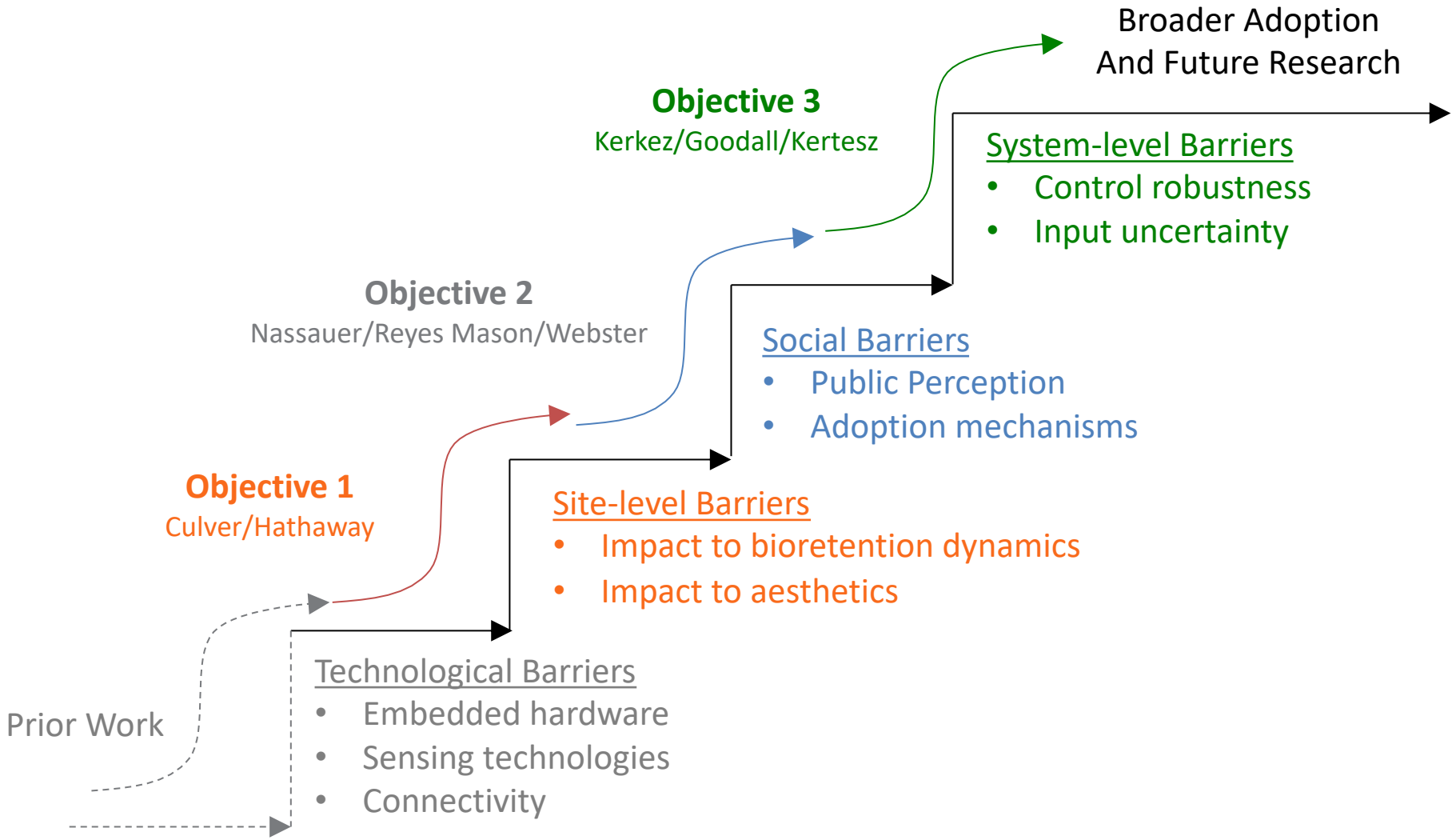
Water Quality

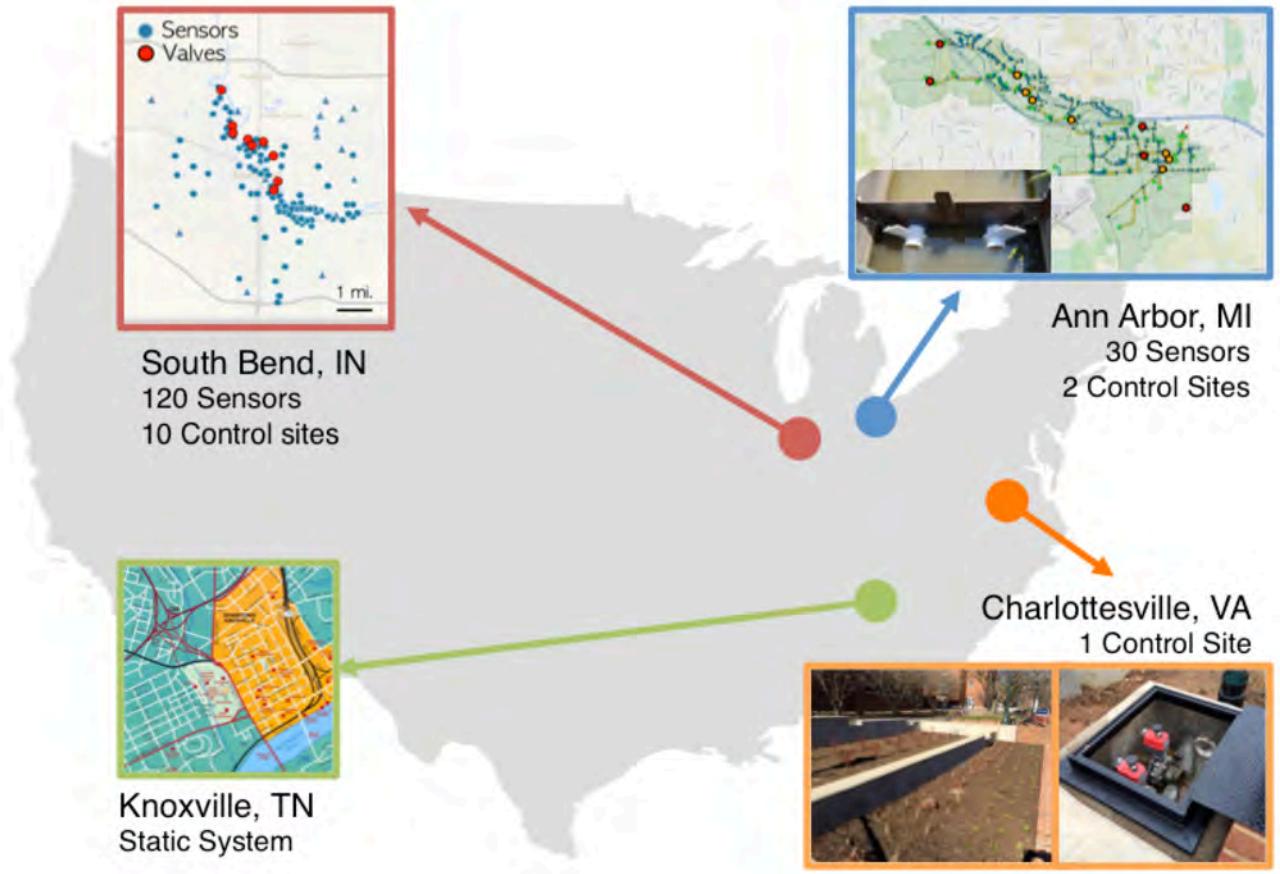
Automated Samplers


Cell Strength
40
30
20
10
0
3/27
3/30
4/2
4/5
4/8
4/11
4/14
4/17
4/20
4/23
4/26
4/29
5/2
ARB005
ARB012
ARB013
ARB001
ARB002
ARB010
ARB007
ARB008
Battery: ARB001
4.21 V
Battery: ARB007
4.19 V
Battery: ARB008
3.37 V
Stream Depth
2.0 K
1.5 K
1.0 K
500
0
Depth (mm)
3/27
3/30
4/2
4/5
4/8
4/11
4/14
4/17
4/20
4/23
4/26
4/29
5/2
ARB013
ARB012



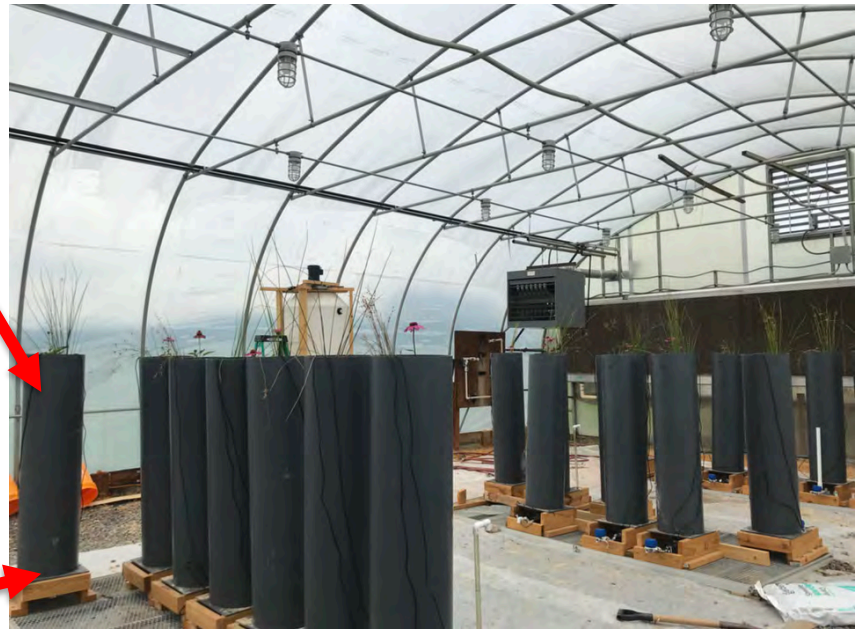
Knowledge gaps and barriers



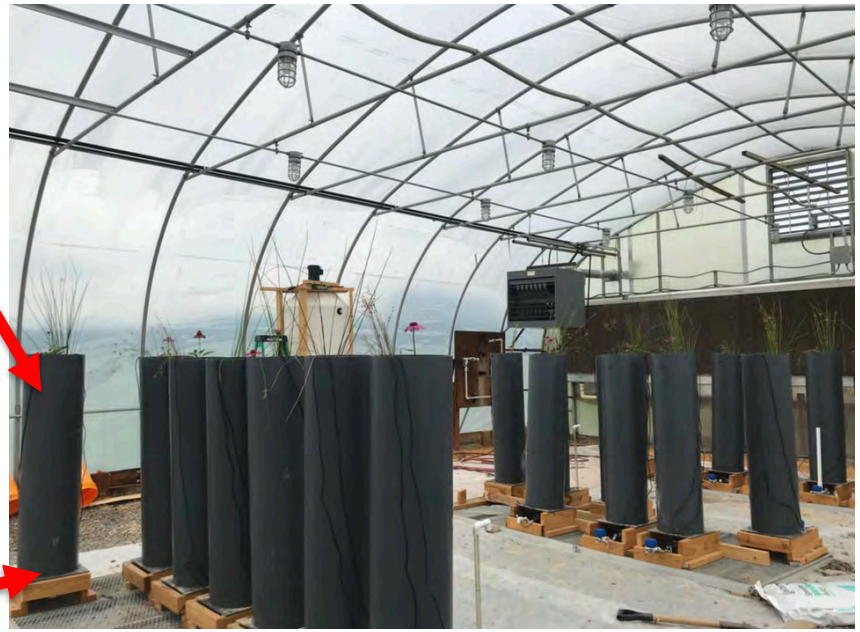

Sensors
Valves
1 mi.
South Bend, IN
120 Sensors
10 Control sites
Ann Arbor, MI
30 Sensors
2 Control Sites
Charlottesville, VA
1 Control Site
Knoxville, TN
Static System

Objective 1: Lab Scale

Objective 1: Lab Scale



Objective 1: Lab Scale



Objective 1: Site Scale

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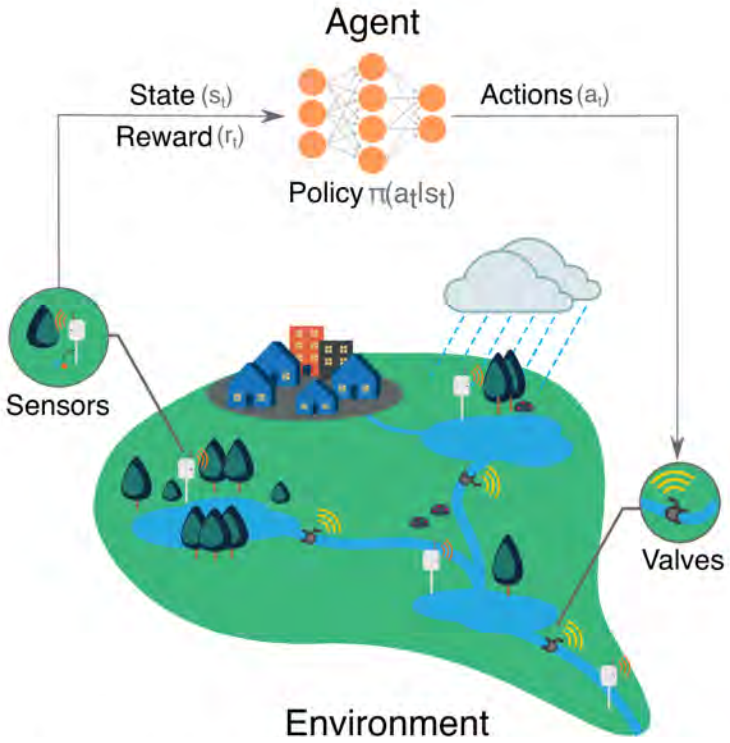
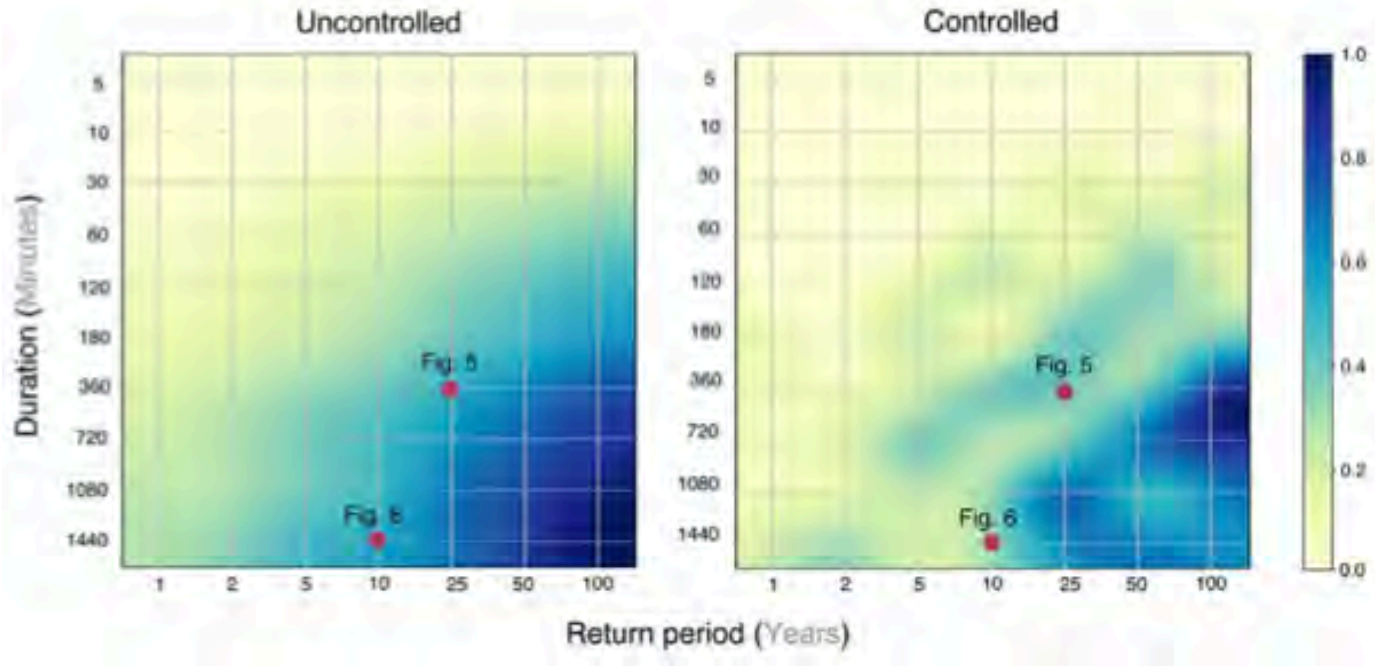
Objective 2: Social Barriers

1000 Residents Surveyed

Objective 3: Control algorithms





Mullapudi, Abhiram, et al. "Deep reinforcement learning for the real time control of stormwater systems." *Advances in Water Resources* (2020): 103600.

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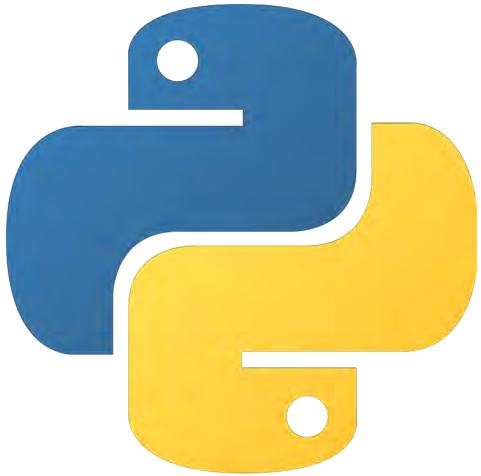
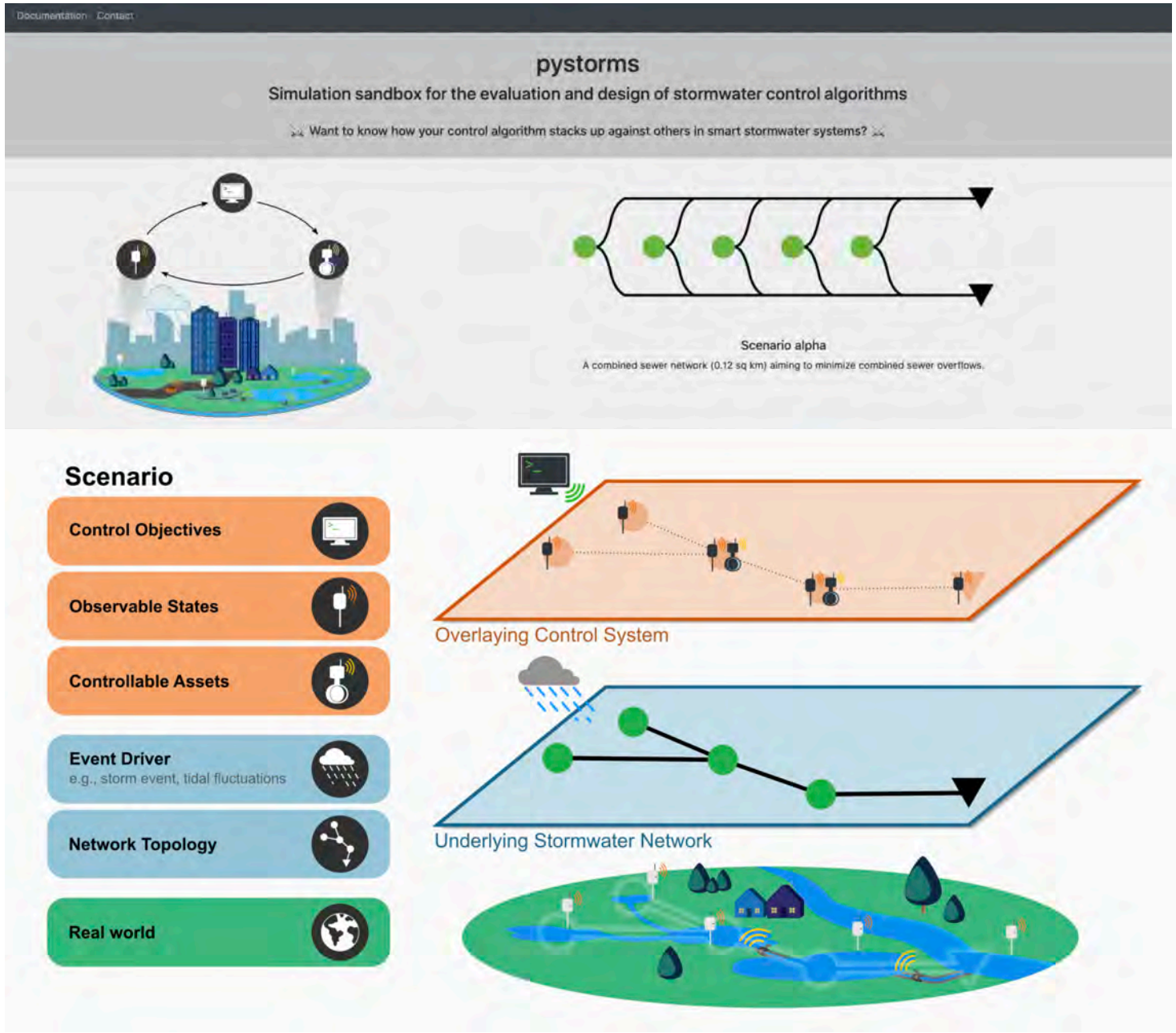
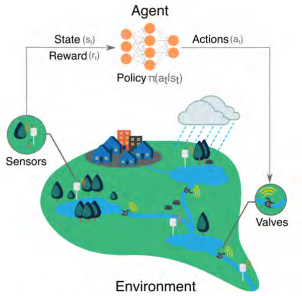


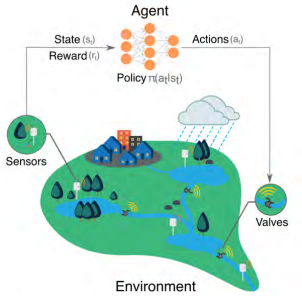


Evolution



We’ve learned that…

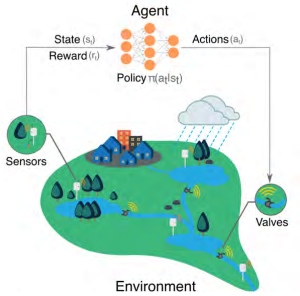
Evolution

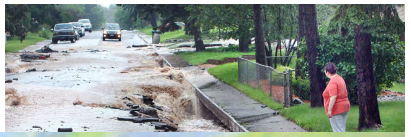


Social Acceptance

Engineered Outcomes

Evolution





Social Acceptance

Engineered Outcomes

Community Updates

Ann Arbor

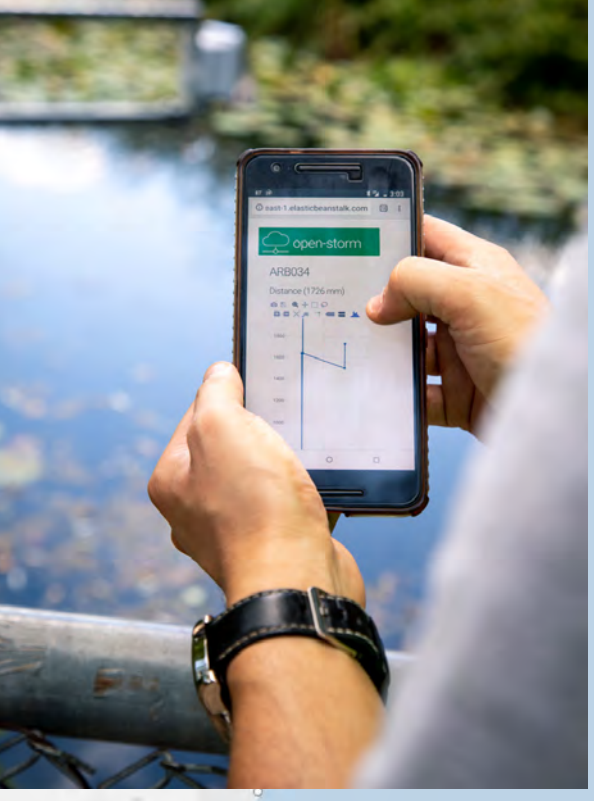
StateTech TOPICS STATES TIPS & TACTICS VOICES FEATURES VIDEO IT BLOGS MORE +

...e to know what's happening in real time and have it precisely measured," said Harry Sheehan, ...puty water resources commissioner, Washtenaw County Government.

Sheehan estimated that prior to installing Open Storm, it cost Ann Arbor ~~$22 per gallon~~ to drain storm water. That cost has dropped to **$16 per gallon**, roughly **saving the city $1 million in infrastructure costs** thanks primarily to the water valve, which costs only a few thousand dollars.

Detroit

Potential 100 MG Sewer Overflow Reduction $500M



Great Lakes Protection Fund

City of Toledo Official Seal

University of Michigan

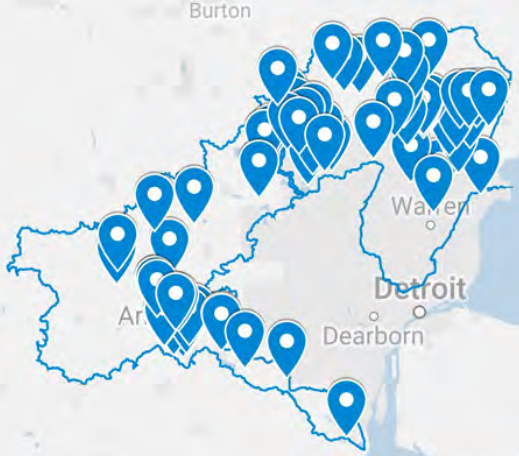
City of Ann Arbor Michigan

The University of Toledo

Huron River Watershed Council

Washtenaw County Michigan 1826

S&CC



Huron River Watershed Council

S&CC

S&CC

$2M+ Local & State support

I-Corps

$1M Startup Activity

S&CC

$2M+ Local & State support

Open-Source Community

I-Corps

New Courses & Workshops

$1M Startup Activity

Job Training

Graduate student award : 2020 American Society of Landscape Architects


OYUON

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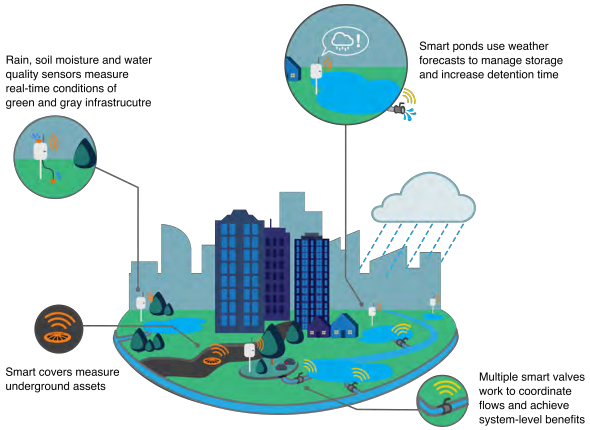

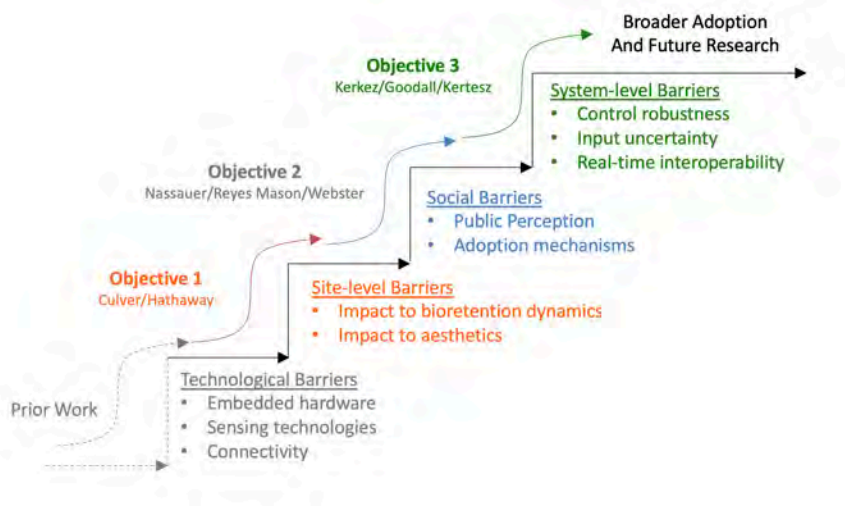

Flooding and Environmental Pollution

Fundamental Research Contributions

- Advances on algorithms for system-scale real-time control of water systems
- Discoveries on community acceptance and barriers to adoption
- Open source sensors and algorithms: **Open-storm.org**
- Python control toolbox to promote broader adoption by researchers
- Publication in top water journals and new editorial positions developed for smart water systems