An overview of EPA stormwater research

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United States Environmental Protection Agency

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25 YEARS OF ESTCP
2019 | Enhancing DoD's Mission Effectiveness

Outline

- Brief history of EPA stormwater research at ORD
- Research Action Plan 2012-2015
  - General overview
- Research Action Plan 2016-2019
  - General overview
- Research Action Plan 2020-2022
  - New research direction.

Disclaimer: The views expressed in this presentation are those of the author and do not necessarily represent the views or the policies of the U.S. Environmental Protection Agency

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Acknowledgements

- Steve Acree
- Cherri Adair
- Doug Beak
- Jake Beaulieu
- Jason Bernagros
- Mike Bollman
- Michael Borst
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- Yongshan Wan
- Dale Werkema
- Mark White
- Many Others
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- Alessandro Ossola

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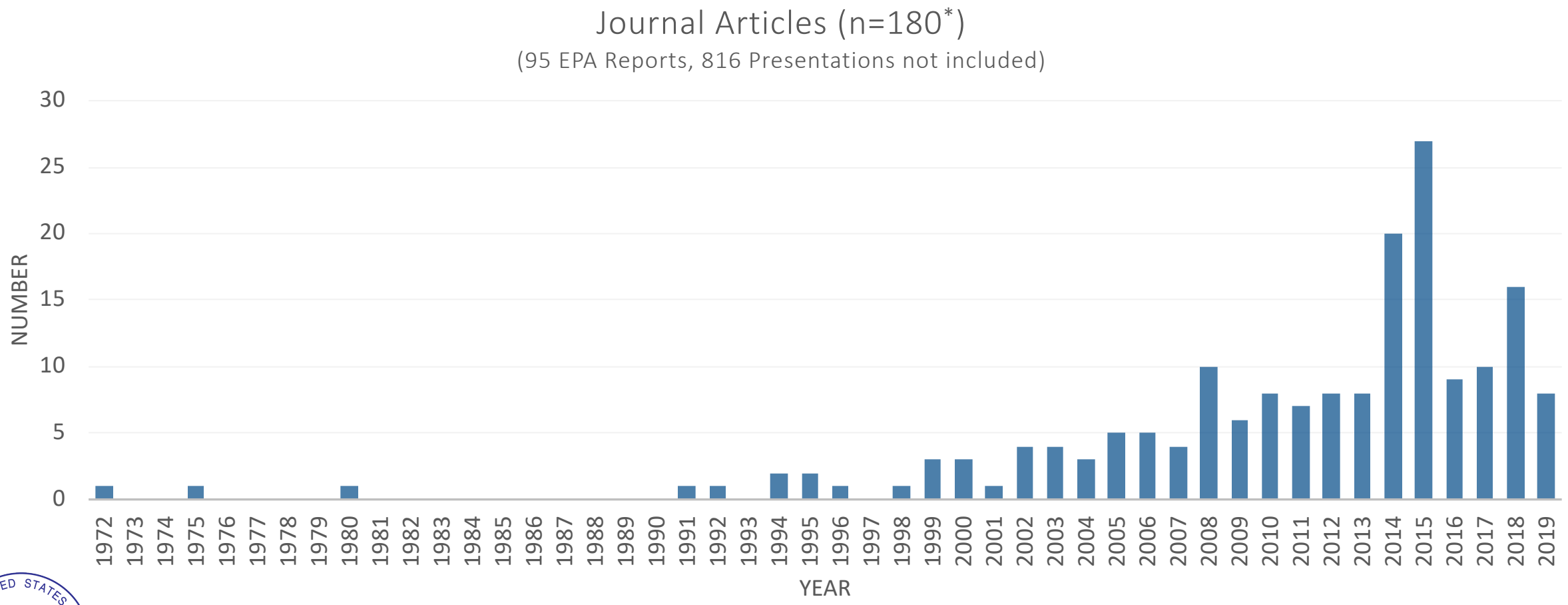
Publications (1970-current)



* Oct 2019

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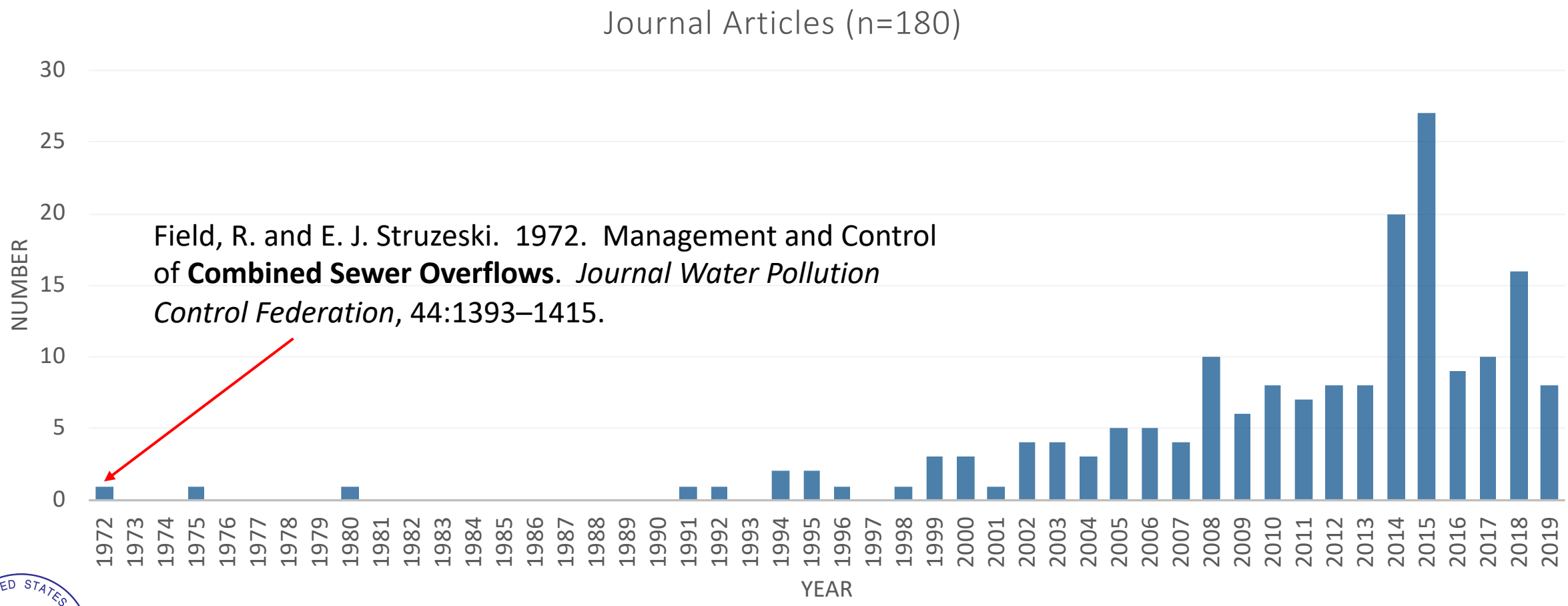
Publications (1970-current)



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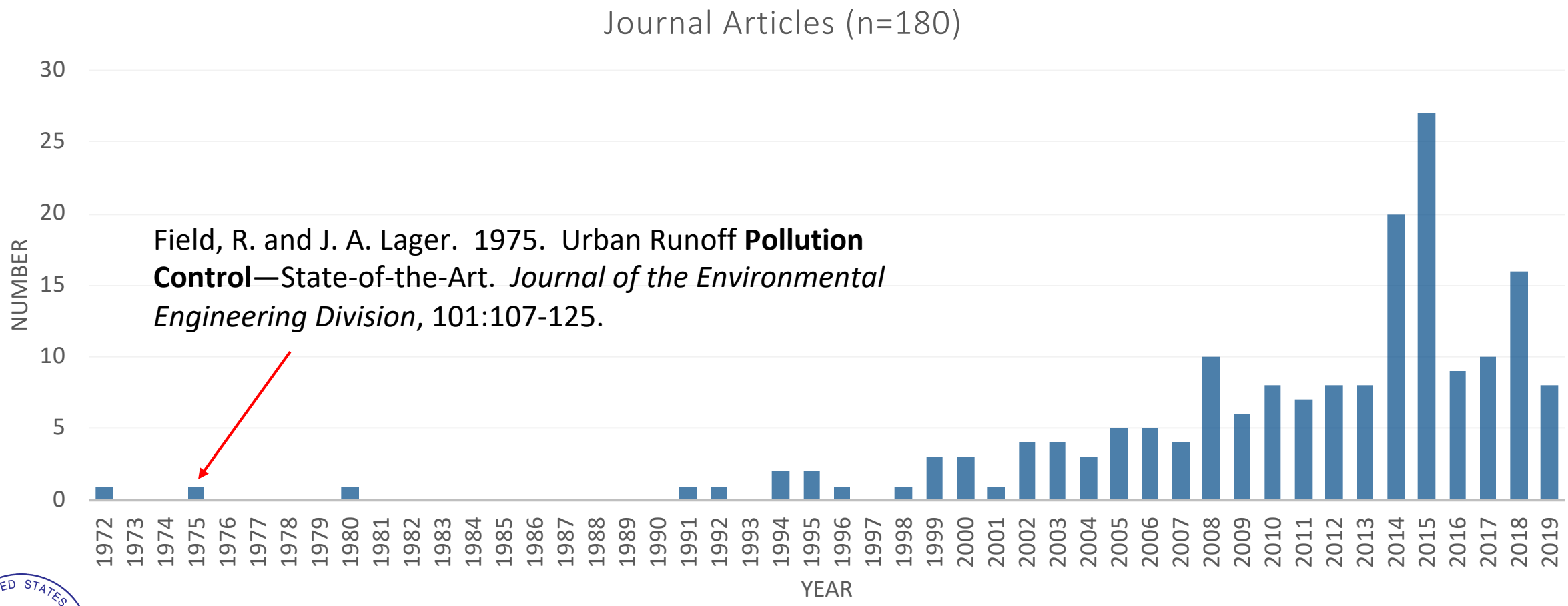

Field, R. and J. A. Lager. 1975. Urban Runoff **Pollution Control**—State-of-the-Art. *Journal of the Environmental Engineering Division*, 101:107-125.

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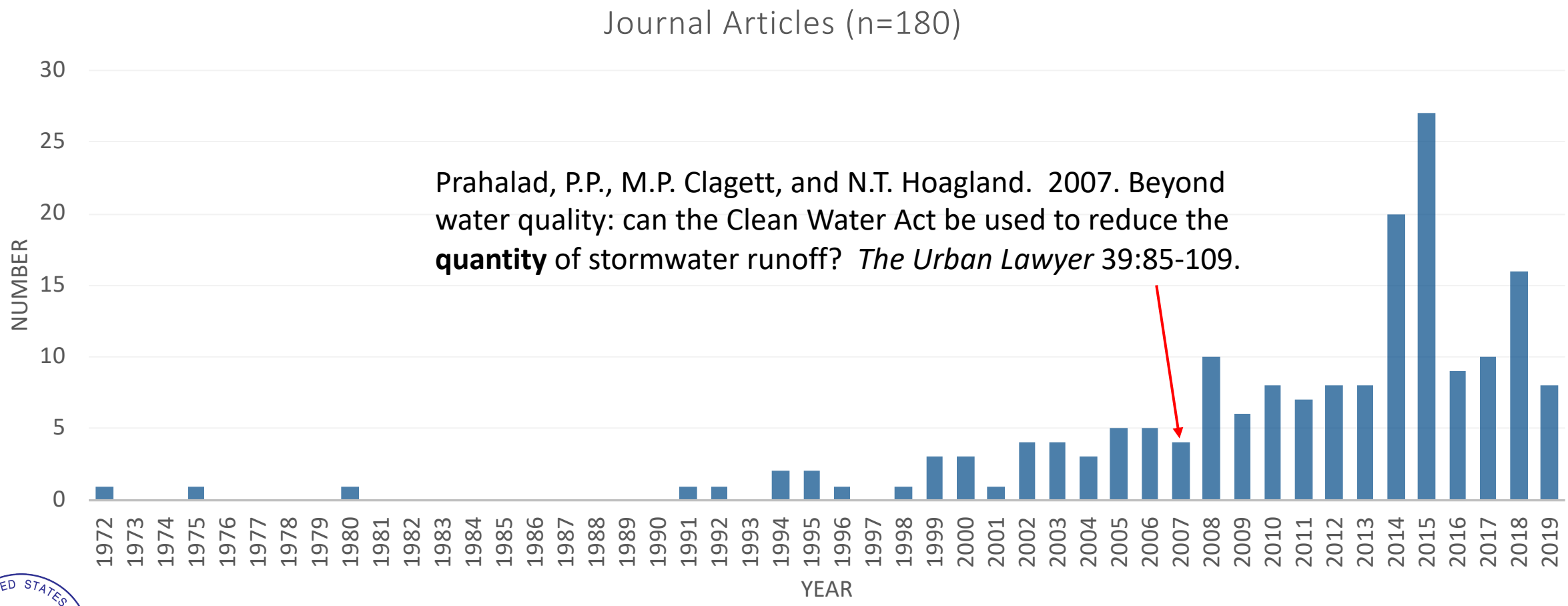
Publications (1970-current)



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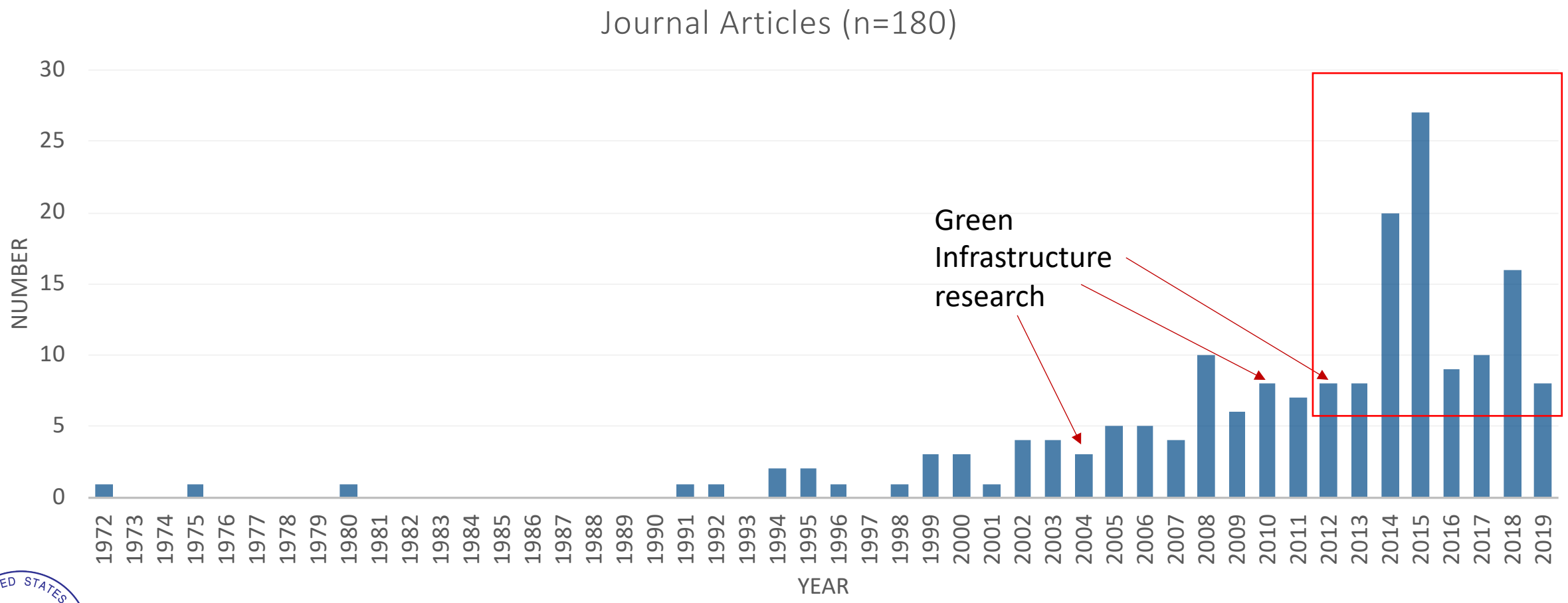
Publications (1970-current)



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2012-2015

- Develop effective **integrated green and gray approaches at the sewershed/watershed scale**
  - **CSO mitigation** through multi-scale **implementation of green infrastructure** in communities
  - Impacts on **CSO/SSO and wastewater system capacity**
  - **Adaptive management** green infrastructure and sustainable stormwater management w/in environmental justice urban communities
  - Green Infrastructure Stormwater Management: A Philadelphia Case Study (STAR)

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2012-2015

- **Green Infrastructure BMP performance and metrics**
  - Place-based and experimental **monitoring of green and gray** infrastructure BMPs, and BMP treatment trains
  - Case studies focused on **GI role in maintaining aquatic life use, habitat endpoints at watershed scale**
  - Sustainable Chesapeake **community-based approach** to stormwater management using green infrastructure
  - Sustainable Chesapeake (Grant): A Collaborative Approach to Urban Stormwater Management (STAR)

2016-2019

- Green Infrastructure **Models and Tools**
  - GI **Model** Research
    - SWMM, SWAT, VELMA, HSPF, SWC
  - GI **decision support tools** - (including gap analysis, development, and evaluation components)
    - DASEES, GIWIZ, GITAR, SUSTAIN, WMOST
  - National Center for Sustainable Water Infrastructure Modeling Research (**STAR**)
    - promote research and development of computational models focused on answering key questions related to planning, managing and operating water resource systems
    - develop a sustainable water infrastructure modeling community and lead cutting edge research in the field of sustainable water infrastructure

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2016-2019

- Green Infrastructure Models and Tools
  - **Extramural** Research on Life Cycle Costs of Alternative Water Infrastructures

2016-2019

- Support increased adoption of green infrastructure into community stormwater management plans and watershed sustainability goals: Information and Guidance through **Community Partnerships**
  - **Integrating GI into Communities**
  - Impacts of green infrastructure on **groundwater resources**
  - Assessment of risks posed to natural **wetlands** used for wastewater and stormwater management

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2020-2022

- **Planning, Implementing, and Monitoring** Stormwater Management Practices
  - Recommendations for **planning, monitoring, and managing** stormwater
  - Recommendations for stormwater management **implementation and performance**
- Stormwater Management as a Resource for Enhanced Recharge, Capture, and Use
  - Recommendations for water system **recharge** to aquifers
  - Recommendations for stormwater **capture and decentralized use**

Conclusion

- Clean Water Act
- Regulatory drivers
  - National Pollutant Discharge Elimination System (NPDES) requirements
  - Water quality standards requirements
  - Total Maximum Daily Load (TMDL) requirements
- Stormwater management research goals
  - Continue to reduce CSOs
  - Manage stormwater
  - Use stormwater for augmenting water resources

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GI Field Research

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Permeable Pavement / Green Roofs / Rain Barrels

JAWRA
JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION
AMERICAN WATER RESOURCES ASSOCIATION

Technical Paper

Chloride Released from Three Permeable Pavement Surfaces after Winter Salt Application†

Michael Borst, Robert A. Brown

First published: 21 October 2013 | https://doi.org/10.1111/jawr.12132 | Cited by: 16

Journal of Sustainable Water in the Built Environment / Volume 1 Issue 1 - February 2015

Technical Papers

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DETAILS

Rainwater Collection and Management from Roofs at the Edison Environmental Center

Thomas P. O'Connor, M.ASCE; and Mohamed Amin

Authors

Thomas P.
Environmenta
ORD/NRMRL/
Woodbridge A
(correspondin

Journal of Environmental Engineering / Volume 139 Issue 10 - October 2013

Technical Papers

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Assessment of Clogging Dynamics in Permeable Pavement Systems with Time Domain Reflectometers

Robert A. Brown, A.M.ASCE; and Michael Borst

Stormwater Pollution

JOURNAL ARTICLE

Trace Metal Accumulation in Sediments and Benthic Macroinvertebrates before and after Maintenance of a Constructed Wetland

Thomas P. O'Connor, Swarna Muthukrishnan, Kristen Barshatzky and William Wallace

Water Environment Research

Vol. 84, No. 4 (APRIL 2012), pp. 370-381

Biogeochemistry

October 2014, Volume 121, Issue 1, pp 107–126 | Cite as

Effects of urban stream burial on organic matter dynamics and reach scale nitrate retention

Authors | Authors and affiliations

Jake J. Beaulieu, Paul M. Mayer, Sujay S. Kaushal, Michael J. Pennino, Clay P. Arango, David A. Balz, Timothy J. Canfield, Colleen M. Elonen, Ken M. Fritz, Brian H. Hill, Hodon Ryu, Jorge W. Santo Domingo

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Modeling GI

ORIGINAL RESEARCH ARTICLE
Front. Built Environ., 23 October 2018 | https://doi.org/10.3389/fbuil.2018.00058

Modeling Urban Hydrology and Green Infrastructure Using the AGWA Urban Tool and the KINEROS2 Model

Yoganand Korgaonkar[1*], D. Phillip Guertin[1], David C. Goodrich[2], Carl Unkrich[2], William G. Kepner[3] and I. Shea Burns[1]

Hydrol. Earth Syst. Sci., 22, 2615–2635, 2018
https://doi.org/10.5194/hess-22-2615-2018
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Article | Peer review

Research article

Drainage area characterization for evaluating green infrastructure using the Storm Water Management Model

Joong Gwang Lee[1], Christopher T. Nietch[2], and Srinivas Panguluri[3]
[1]Center for Urban Green Infrastructure Engineering (CUGIE Inc), Cincinnati, OH 45255, USA
[2]Office of Research and Development, US Environmental Protection Agency, Cincinnati, OH 45268, USA
[3]Independent Consultant, Olney, MD 20832, USA

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Large-scale BMPs \ Parcel-level GI

ELSEVIER

Journal of Hydrology

Volume 519, Part C, 27 November 2014, Pages 2584-2595

Effects of distributed and centralized stormwater best management practices and land cover on urban stream hydrology at the catchment scale

J.V. Loperfido [a], Gregory B. Noe [b], S. Taylor Jarnagin [c], Dianna M. Hogan [a]

Hydrological Processes

RESEARCH ARTICLE | Open Access

Effectiveness of landscape-based green infrastructure for stormwater management in suburban catchments

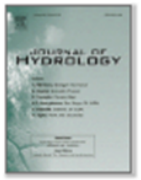
Sean A. Woznicki, Kelly L. Hondula, S. Taylor Jarnagin

First published: 09 May 2018 | https://doi.org/10.1002/hyp.13144 | Cited by: 4

ELSEVIER

Journal of Hydrology

Volume 485, 2 April 2013, Pages 177-187



Catchment-scale hydrologic implications of parcel-level stormwater management (Ohio USA)

William Shuster, Lee Rhea

Test models

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JOURNALS BOOKS MAGAZINE AUTHOR SERVICES USER SER

Journal of Hydrologic Engineering / Volume 24 Issue 1 - January 2019

Technical Papers

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Comparison of Measured and Simulated Urban Soil Hydrologic Properties

L. A. Schifman, Ph.D., A.M.ASCE; and W. D. Shuster, Ph.D.

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Wetlands for Stormwater and Wastewater Management

ECOLOGICAL APPLICATIONS
ECOLOGICAL SOCIETY OF AMERICA

Article

Depressional wetlands affect watershed hydrological, biogeochemical, and ecological functions

Grey R. Evenson, Heather E. Golden, Charles R. Lane, Daniel L. McLaughlin, Ellen D'Amico

First published: 13 February 2018 | https://doi.org/10.1002/eap.1701 | Cited by: 14

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Groundwater State of Science

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Stormwater Pollution

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Environmental Science & Technology

Article

Cite This: *Environ. Sci. Technol.* 2019, 53, 10070−10081

pubs.acs.org/est

Urban Stormwater: An Overlooked Pathway of Extensive Mixed Contaminants to Surface and Groundwaters in the United States

Jason R. Masoner,[*,†] Dana W. Kolpin,[‡] Isabelle M. Cozzarelli,[§] Larry B. Barber,[∥] David S. Burden,[⊥] William T. Foreman,[¶] Kenneth J. Forshay,[⊥] Edward T. Furlong,[¶] Justin F. Groves,[⊥] Michelle L. Hladik,[#] Matthew E. Hopton,[⊗] Jeanne B. Jaeschke,[§] Steffanie H. Keefe,[∥] David P. Krabbenhoft,[×] Richard Lowrance,[⊥] Kristin M. Romanok,[+] David L. Rus,[$] William R. Selbig,[×] Brianna H. Williams,[+] and Paul M. Bradley[○]

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Adaptive Management / Ecosystem Services

Water Resources Research

Research Article

Situating Green Infrastructure in Context: A Framework for Adaptive Socio-Hydrology in Cities

L. A. Schifman, D. L. Herrmann, W. D. Shuster, A. Ossola, A. Garmestani, M. E. Hopton

First published: 09 October 2017 | https://doi.org/10.1002/2017WR020926 | Cited by: 13

Cities Environ. Author manuscript; available in PMC 2019 Jan 1.
Published in final edited form as:
Cities Environ. 2018; 11(1): 1–15.

PMCID: PMC6161840
NIHMSID: NIHMS1506410
PMID: 30275925

The Provision of Urban Ecosystem Services Throughout the Private-Social-Public Domain: A Conceptual Framework

Alessandro Ossola, Laura Schifman, Dustin L. Herrmann, Ahjond S. Garmestani, Kirsten Schwarz, and Matthew E. Hopton

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Planning-related Stormwater Management

ELSEVIER

Journal of Environmental Management

Volume 236, 15 April 2019, Pages 571-580

Research article

Development of a scenario-based stormwater management planning support system for reducing combined sewer overflows (CSOs)

Xin Fu [a], Haynes Goddard [a], Xinhao Wang [b], Matthew E. Hopton [a]

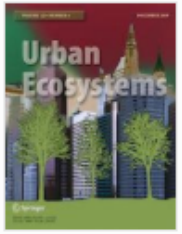
ELSEVIER

Science of The Total Environment

Volume 689, 1 November 2019, Pages 1149-1159

A runoff trading system to meet watershed-level stormwater reduction goals with parcel-level green infrastructure installation

Xin Fu [a], Matthew E. Hopton [a], Xinhao Wang [b], Haynes Goddard [a], Haiqing Liu [b]



Urban Ecosystems

December 2019, Volume 22, Issue 6, pp 1139–1148 | Cite as

Developing a framework for stormwater management: leveraging ancillary benefits from urban greenspace

Authors | Authors and affiliations

Fushcia-Ann Hoover, Matthew E. Hopton

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