

# UNIVERSITY PARTNERSHIPS FOR STORMWATER OUTREACH & INSTRUCTION

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# **AGENDA**

### **INSTRUCTION & RESEARCH**

- Stream restoration
- Green infrastructure
- Pollinator habitat
- Student involvement

### **EXTENSION**

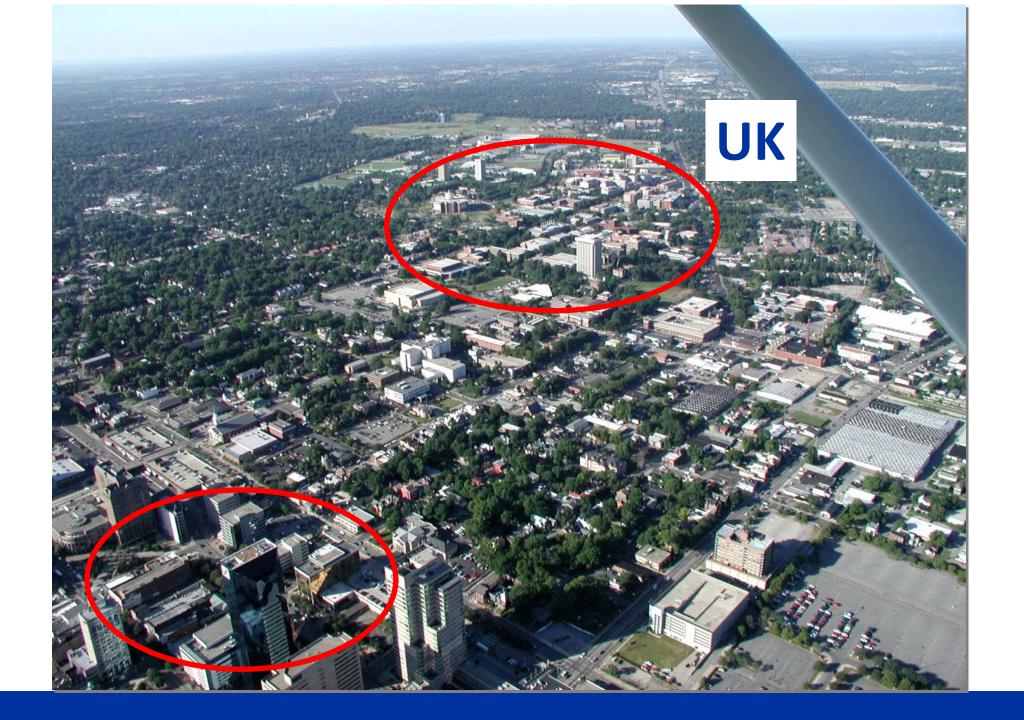
- Friends of Wolf Run
- Backyard Streams
- KYH2O
- Water Week
- Resources





































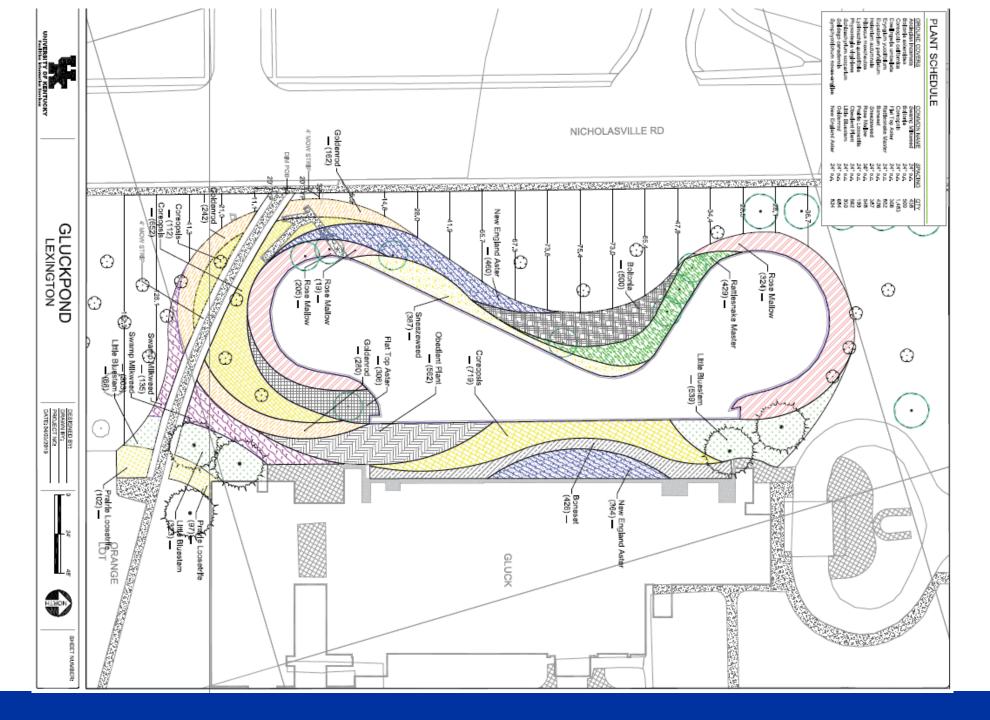






















### Transforming a Detention Basin Overlying Bedrock into a Rain Garden: How Well Does is Perform Hydrologically?

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<sup>1</sup>Department of Biosystems and Agricultural Engineering <sup>2</sup>Faculty Advisor



### **HOW IT STARTED**

A large portion of the University of Kentucky's Agricultural Campus is located in the headwaters of Wolf Run, which is a 303(d) listed stream. As a holder of an MS4 (municipal separate storm sewer systems) permit, the University of Kentucky through the Environmental Management Department is continually seeking ways to reduce the impacts of UK's stormwater while educating its citizens (e.g. students, staff and faculty). Through a graduate-level low impact development (LID) course taught by Dr. Agouridis, a stormwater management plan was developed for a 9.3 ha subwatershed of the Agricultural Campus. This plan included the conversion of a non-functioning detention basin into a rain garden.

After hearing of this plan in the spring of 2013, the Tracy Farmer Institute for Sustainability and the Environment (TFISE) secured funding from UK's Office of Sustainability and the Lexington-Fayette Urban County Government (LFUCG). Working with Dr. Brian Lee and Corey Wilson of UK's Landscape Architecture Department a design was developed in the summer of 2013. With support from the Administration in the College of Agriculture, Food and Environment (CAFE), the rain garden was constructed in the fall of 2013 by faculty, staff and students from the Biosystems and Agricultural Engineering Department



### WHY IT'S IMPORTANT

Urbanization converts pervious areas such as forests and pastures into impervious ones such as parking lots and buildings. Because of this, runoff volumes and peak flows increase while infiltration rates and water quality decrease. These changes all negatively impact downstream ecosystems. One way to reduce stormwater quantity and quality impacts is through a rain garden which is a shallow depression that uses amended soils and vegetation to promote infiltration and evapotranspiration.





Source: Corey Wilson, Landscape Architecture

### **DESIGN, CONSTRUCTION & PLANTING**

The rain garden contains a forebay, three basins, and a rock-lined swale. Stormwater enters the forebay from a 38.1 cm pipe where it then flows into the two upper basins. Overflow from Basin 1 enters Basin 2 via a rock-lined walking path, which also serves as Basin 1's spillway. Overflow from Basin 2 flows to Basin 3 via a rock-lined swale. Overflow from Basin 3 exits the rain garden via a 30.5 cm pipe where it eventually flows to Wolf Run.

The project was constructed using two backhoes, three skid steers, one dump truck, and lots of manual labor. A Trimble robotic total station was used to stake-out the design and check elevations during construction. Soils (clay loam texture) in each basin were excavated and amended with washed coarse sand and leaf compost (2:1:1 of soil, sand, compost) resulting in a sandy loam texture. About 30.5 cm of course woodchips were placed on top of bedrock before filling the excavated basins with amended soil. Hardwood mulch and coarse wood chips were used to top-dress the basins.







### **METHODS**

Inflow and outflow were monitored using ISCO 4250 flow meters (one per pipe). The flow meters recorded water level and velocity in the pipes. Discharge was computed using the area-velocity method. Water level and temperature in each basin was monitored using wells and In-Situ Level Trolls. Rainfall data were obtained from USGS gage which is located 2.3 km from the site. Statistical comparisons between In transformed inflow and outflow were made using paired t-tests.

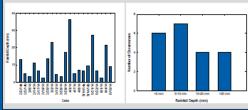




### RESULTS: RAINFALL

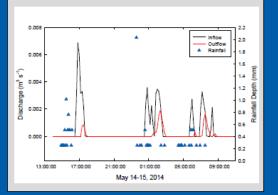
A total of 21 storm events were observed for which rainfall, inflow and outflow data were all collected between January 1st and June 15th of 2014. Over half of the inflow producing rain events were less than 10 mm.

Statistic	Depth (mm)	Duration (h)	l <sub>avg</sub> (mm h <sup>-1</sup> )
Minimum	2.3	0.3	1.1
Maximum	36.3	19.3	14.8
Mean ± Std. Dev.	11.1±9.2	3.8±4.3	4.5±3.5
Median	6.9	2.6	3.4



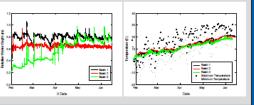
### **RESULTS: INFLOW & OUTFLOW**

Results of the paired t-tests indicated that significant reductions in discharge volumes and peak discharges were achieved as were significant increases in discharge durations. Over the study period, discharge volumes decreased by 47.0%, and discharge peaks decreased by 47.0%, and discharge durations increased by 88.9%. Small reductions in discharge volumes are due largely to three main factors: (1) presence of bedrock, (2) nearly equal inlet and outlet pipe inverts, and (3) clay loam soils surrounding the rain garden. These constraints mean water is frequently present in the center of the basins, particularly Basins 1 and 2. The presence of limited vegetation is also a factor with regards to evapotranspiration during the growing season.



### **RESULTS: INFILTRATION RATES & TEMPERATURE**

Infiltration rates varied between 0.1 and 4.4 mm h<sup>-1</sup> across the three basins. The mean infiltration rate in Basin 1 was 1.5 mm h<sup>-1</sup> (median=1.0 mm h<sup>-1</sup>); it was 0.5 mm h<sup>-1</sup> (median=0.6 mm h<sup>-1</sup>) for Basin 2. Both Basins 1 and 2 are located immediately below the inlet and up-gradient of the rock-lined swale. For Basin 3, which is located down-gradient of the rock-lined swale, the mean infiltration rate was 0.7 m h<sup>-1</sup> (median=0.5 mm h<sup>-1</sup>). Water levels tended to fluctuate most in Basins 1 and 2 and least in Basin 3. Temperatures in all three basins were reflective of air temperatures.



### CONCLUSIONS

Despite the constraints of bedrock and nearly equal inlet and outlet pipe inverts, both of which cannot be moved, the rain garden did offer stormwater quantity improvements. Significant reductions in discharge volumes and peaks and significant increases in discharge durations were seen. Unlike a typical rain garden, surface water is almost always present in the center of the basins meaning wetland plants are needed. It is expected that the further addition of plants will help remove water through evapotranspiration during the growing season.



### **WHAT'S NEXT**

Future plans for the rain garden include the installation of stone seating, a handicap accessible trail, signage, and of course more plants. Additional funds are needed for detailed water quality sampling. The rain garden will serve as an outdoor classroom for students and the community.

### **ACKNOWLEDGEMENTS**

This project would not have been possible without the support of TFISE, LFUCG, UK's Office of Sustainability, and numerous faculty, staff and students from CAFE. Special thanks is extended to Alex Fogle and Evan Wesley for their help in equipment installation and data collection



# RESEARCH

Provides answers to complex issues facing our nation and our world

# **EDUCATION**

Strengthens schools and universities to train the next generation of scientists, educators, producers and citizens.

# **EXTENSION**

Takes knowledge gained through research and education to the people who need it the most.

# THE LAND-GRANT UNIVERSITY MISSIONS

Image: https://nifa.usda.gov/how-we-work

# NEED: RESOURCES FOR RESIDENTS





# FRIENDS OF WOLF RUN PARTNERSHIP











Many urbon homeowners are not sure what to did about the stream in their backpard. White owers at Piece can faster acre of 81 What plants are good for my attentionable? These common questions lead to come confusing distinct. This website is designed to help homeowners to backgraft streams appreciate this recourse, protect personal property, and improve water questing and habitus.



Interested in becoming a Curtified Biologist Stream Steward? This strike course is congressed on 12 modules designed to help harmoniem understand him to sprinted moly interesting the bookyard streams. Learn how fundamental stream processes are related to channel shape, now extremedate impossit streams (congressed with present beds) and belastic endow with embody, one pretent response streams exceptions, what premiss are required to recting streams, how learnst landscapes refusions extreams, and there to beard or a interesting interesting.

#### Interested? Register to Become a Certified Backyard Stream Steward!

Interested in learning more but not ready for the online course? Use the links below to occess relevant publications and webinars.

Hole questions or comments about backgord streams? Precise reach out to Amando Gunibert. Ph.D. jamando guniber (fjully edu) and Camer Agounds, Ph.D. P.E. M.P.P. (camer agounds)@Uy edu.









Central Kentucky Backyard Stream Guide Cooperative Extension Service | Agriculture and Natural Resources | Family and Consumer Sciences | 4-H Youth Development | Community and Economic Development

PUBLICATIONS
ONLINE COURSE
WORKSHOPS

WWW.UKY.EDU/BAE/BACKYARDSTREAMS







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### **Backyard Streams Program**



Many urban homeowners are not sure what to do about the stream in their backyard. Who owns it? How can I take care of it? What plants are good for my streambanks? These common questions can lead to some confusing answers. This course is designed to help homeowners with backyard streams appreciate this resource, protect personal property, and improve water quality and habitat.



### Welcome to the Backyard Streams Program!

Welcome to the University of Kentucky Cooperative Extension Service's Backyard Streams program. This program is comprised of 12 online modules that are designed to help homeowners understand how to protect and manage their backyard streams. After successfully completing each module, you will become a Certified Backyard Stream Steward.

To learn more about our Backyard Stream program, visit www.uky.edu/bae/backyardstreams & .



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Coming Up



3 View Calendar

Nothing for the next week

# BACKYARD STREAMS COURSE TOPICS

- Backyard Stream Basics
- Challenges for Urban Streams
- Fluvial Geomorphology 101
- Ecosystem Services 101
- Streambank Erosion 101
- Riparian Buffer Vegetation 101

- Stream Restoration 101
- Stormwater 101
- Low Impact Development 101
- Permitting 101
- Karst 101
- Watershed Assessment 101



WATER PODCAST

https://kyh2o.podbean.com/





### MON, 9/17 TO FRI, 10/19: SHOE DRIVE TO SAVE LIVES

Donate new and gently used shoes to WaterStep to fund safe drinking water projects. Collection bins are located at Ag Science North, Barnhart, WT Young Library, RGAN, Newman Center, JSB, MMRB

Lead: Dr. Carmen Agouridis (UK BAE) waterstep.org

Project

Water Education for Teachers

KENTUCKY

Divison of Water

### TUES, 10/16: PROJECT WET

Become a Project WET Educator Good Barn 9:00 AM to 4:00 PM \$55 Registration; Lunch and Snacks Provided

Project Leads: Carmen Agouridis (UK BAE), Amanda Gumbert (UK CES), & Malissa McAlister (KWRRI)

www.projectwet.org | register: https://www.ukv.edu/bae/cpd



### MON, 10/15: WATERSTEP

Mark Hogg Founder/ CEO) & Greg Heitzman (BlueWaterKY) Gatton Student Center, Room 330AB, 6:00 PM to 7:00 PM Food and Refreshments provided at 5:30 PM Lead: Dr. Carmen Agouridis (UK BAE) waterstep.org



2018

October 15-19th



### TUES, 10/16: BEFORE THE FLOOD

Screening and Discussion from 5:30 to 8:00 PM Food and Refreshments provided @ 5:00 PM Location W.T.

Location W.T.
Young Library, AA
Auditorium
Panel Discussion
Led by Shane
Tedder (UK Office
of Sustainability)
beforetheflood.com



### WED, 10/17: CAREER PANEL

Gatton College Room 435UV, 12:30 PM to 1:30 PM Lunch provided at 12:00 PM Leads: UK Water Professionals and Dr. Carmen Agouridis (UK BAE)



### THURS, 10/18: SEMINAR "ENGAGING IN PLACE"

Susan Seacrest, Founder of Groundwater Foundation Location: MMRB Room 102, 4:00 PM to 5:00 PM Refreshments at 3:30 PM Leads: Drs. Alan Fryar & Ryan Thigpen (UK EES)



### FRI 10/19: CATCHMENT CLEANUP

Service Opportunity for the UK Community UK South Campus, Farm Rd. between Good Barn and Gluck 3:00 PM to 6:00 PM, Refreshments provided. Leads: Dr. Carmen Agouridis (UK BAE) and BAE Student Branch

# LEARN MORE ON THE WEB

- Publications
  - Search <a href="http://www2.ca.uky.edu/agcomm/pubs.asp">http://www2.ca.uky.edu/agcomm/pubs.asp</a>
- Videos
  - UK Watershed Protection and Restoration (YouTube channel)
  - Cat's CATchment
    - https://vimeo.com/85960433
- Social media
  - Facebook: @UKYBioenvironmental, @UKWaterWeek
  - Twitter: @BAE\_XStreamTeam
- Podcast
  - https://kyh2o.podbean.com/
- Email: <u>carmen.agouridis@uky.edu</u> or <u>amanda.gumbert@uky.edu</u>

# **CONTACT US**





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