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# BUILDING THE FUTURE from a foundation of construction community support

rofessor Awad Hanna's office door is always open to students. So, Hanna was happy to offer guidance when, late one recent evening, a fourth-year undergraduate in the Construction Engineering and Management program came seeking job advice. The senior faced a difficult dilemma: He had five great offers in hand and was struggling to decide which to accept.

Hundreds of students have confronted similar tough choices since Hanna and Professor Jeffrey Russell established the program during the early 1990s.

"I owe all of my success that I've had as a project engineer to Dr. Hanna and the CEM program," says Hannah Baumann, a spring 2015 graduate. "I waited after class to talk to him about finding an internship in estimating. He shook my hand and asked me to email him my resume. I interviewed with J.H. Findorff two weeks later, and the rest is history."

### Badgers make their mark in Madison and beyond

A combination of rigorous coursework, real-world internship experiences, and personal advising gives CEM students solid foundations of knowledge and soft skills necessary to become industry leaders. "They are running big projects," says Hanna. "I cannot name one local company that doesn't have key people who are UW-Madison CEM graduates."

Graduates also go on to manage massive endeavors around the country. The Boldt Company snapped up class of 2014 alumna

Sarah Tenpas to oversee construction of a new hospital campus in downtown San Francisco. She credits her success to her time on campus and her leadership role for the Construction Club, a student-run organization whose members are CEM/CEE undergraduates.

"I'm so proud of the education UW-Madison provided me," says Tenpas. "Because of the program, I am beginning my career at an amazing job that challenges me every day to use the leadership skills I developed at Madison."

#### Breaking down boundaries

Women have historically faced barriers in the male-dominated construction industry. The CEM program has always empowered female students to overcome obstacles and excel in the profession. (Continued on page 7)

CEM alumna Alex Beletic (front left), with the team she leads at the Hanford nuclear cleanup site. Jeff Russell and Awad Hanna are also pictured (front, right).



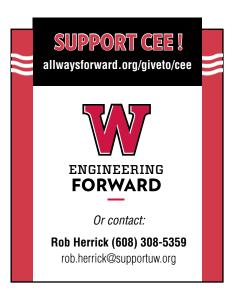


David Novce

Greetings to our alumni and friends! It is hard to believe that we just concluded yet another successful academic year where does the time go? It is once again my privilege to share with you good news

about our faculty, staff and students.

As you'll read throughout this newsletter, our faculty, staff, students and alumni are making an impact on a local and global scale in teaching, research, extracurricular activities, and through their careers. Our recent graduate program rankings reflect our excellence: In environmental engineering, our program



jumped eight spots to 12<sup>th</sup> in the nation, while our civil engineering program moved up to 14<sup>th</sup>. At the undergraduate level, we are ranked 12<sup>th</sup> for civil engineering. These rankings reflect the all-around strength of our department. In particular, we are unique because of our comprehensive nature: We excel in the core areas of civil and environmental engineering and have national and international leaders in each of these core areas. As a result, this synergy allows us to produce a rich educational experience for our students, who are in very high demand from industry because of their solid technical background and broad knowledge of the discipline, coupled with excellent problem-solving abilities and a strong work ethic.

In the 2015-16 academic year, we had approximately 330 undergraduate students and 180 graduate students. I am excited to say that we expect our undergraduate enrollment to exceed 400 students in fall 2016 semester! Our students take advantage of extracurricular opportunities through our numerous student organizations, where they learn how to think independently, work in groups, and develop as leaders through their participation. I'm excited to report that both our ASCE concrete canoe and steel bridge teams won their regional competitions and did well in their national competitions. As you'll read in this issue, alumni of our Construction Engineering and Management program are enjoying success and some credit that success to their involvement with Construction Club. Our current Construction Club students organize a very professional banquet that draws nearly 400 attendees and celebrates the construction industry. Each year at the banquet, I am reminded about the quality of our students and truly am impressed at how mature they are. All of our students are focused on their futures, their field excites them, and they are articulate and driven. They're busy with their coursework, yet always excited to be involved—and when the department hosts alumni or industry speakers, our students are eager to jump in and help coordinate those events as well. We're fortunate to have such an incredible group of students that takes advantage of the opportunities available to them!

#### Steel Bridge @ nationals

In May 2016, our Steel Bridge Team placed 8<sup>th</sup> out of 48 teams from across North America in the ASCE national student steel bridge



competition. The students scored highly in several categories, including lightness  $(2^{nd})$ , construction speed  $(5^{th})$ , display  $(4^{th})$ , and efficiency  $(6^{th})$ .

Looking to the future, we hope to increase the number of faculty in our department so that we can grow in our key research and teaching areas. Faculty support—not only professorships, but also faculty scholar awards that help us recognize and retain our younger faculty—is a priority, as well as fellowships that help support the important research our graduate students are undertaking as they prepare for careers in industry or academia. Discretionary funds, which we can use wherever there is a gap in funding or an immediate need, also are important to the department. We use discretionary funding often to help our students take advantage of opportunities such as travel to competitions and conferences, inviting speakers to campus, for professional development and networking events, and to support our faculty and staff.

I am proud to say that our alumni have supported—and continue to strongly support—these and other fund-raising efforts. In fact, over the past year, we have had an 89-percent increase in the number of alumni gifts to our annual fund! What's amazing is that these gifts come from less than 10 percent of our alumni. Imagine the impact that would be made if each CEE alumnus were to make a gift, no matter the size. Please consider CEE in your future charitable giving; visit allwaysforward.org/giveto/cee to make a gift online.

Finally, I can't tell you how much we appreciate your interest, confidence and involvement in our department! Strong alumni and industry support helps make a difference in the quality of the research we do and the education we deliver. If you're in the Madison area, please contact me. I'd be happy to meet with you or give you a tour of the department and our engineering campus. Better yet, join us on Sept. 16 at our 20<sup>th</sup>-anniversary CEE Golf Outing! And if you'd like to stay in touch from afar, I recently joined the social media ranks. You can follow the department on Twitter at @UWMadisonCEE and me personally at @DANoyce.

Best wishes and ON, WISCONSIN!

and a. Nape

David Noyce, PhD, P.E.

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## Wildly successful CEE capstone course exposes students to real-life engineering problems

he civil and environmental engineering senior capstone course is a firsthand guide to the life of a real engineer. Every semester, students within the program are presented with a relevant and challenging problem, and asked to come up with a solution.

Professor Greg Harrington helps coordinate the class every semester, with Adjunct Professors Charles Quagliana and Mark Oleinik. As the semester begins, they form 10 to 15 teams based on students' specific skills and engineering backgrounds, so that each group member brings a different perspective to the table. This helps the students gain an understanding of what the average engineering project is like: many minds working through one problem.

"If we're trying to design a water treatment system, that would normally involve an environmental engineer and a hydraulics engineer to design the treatment and pumping systems, but also structural and geotechnical engineers to design the building and foundation to go along with that," Harrington says. "The idea is to get students working with students of different disciplines within civil engineering, and I think that's relatively unique in our capstone experience."

Each student group also works with one to two industry mentors who help guide and advise them throughout the course. These

mentors are working professionals who join students on campus for an hour and a half each week, and also make themselves available via email and phone. Often CEE alumni, they are passionate about helping the students and were looking for a way to give back after benefitting from the capstone course themselves.

Before the semester starts, Harrington and his colleagues scout out companies and governmental agencies throughout the Midwest that can serve as the students' clients, proposing and requesting ideas for projects for their capstone students. Students often work with these clients directly to define the problem, and then develop at least three alternative ways to meet project goals within certain fundamental and regulatory constraints. "It's a very open-ended experience in which the students learn by doing," says Harrington. "Rather than passive learning, when they sit in a room and the professor tells them what they need to know, here they are actively pursuing the knowledge. So it's a lifelong learning skillset that they're developing."

The CEE students worked with have Epic, in Verona, Wisconsin; and Taliesin Preservation, the Frank Lloyd Wright home in Spring Green, Wisconsin; among others. This is the fifth year they've worked with Taliesin—and Madison Water Utility has been a partner in the course

for even longer. Other clients, both from government and industry, include the Army Corps of Engineers, Madison Water Utility, Madison Metropolitan Sewerage District, and the UW System. "Students say it's a lot of work," Harrington says. "But I tell them at the start of the class, 'I'm not here to get great evaluations from you at the end of the semester. What I'm here to do is have you come back three years from now and tell me it was a great experience."

A solid finish! At the 2016 ASCE Concrete Canoe National Competition, June 8-12 at the University of Texas at Tyler, our Concrete Canoe team represented the department well, earning 5th place overall and placing highly in several individual



categories: design paper  $(10^{th})$ , oral presentation $(2^{nd})$ , final product  $(4^{th})$ , final summary  $(5^{th})$ , women's sprints, women's slalom/endurance,  $(8^{th})$ ; men's sprints  $(2^{nd})$ , men's slalom/endurance  $(8^{th})$ , co-ed sprints  $(4^{th})$ , race points  $(7^{th})$ .

hen it rains, it doesn't always pour. Drenching deluges—and light drizzles alike-send water rushing into streams and rivers. Determining whether flooding will wash away a region depends not only on the severity of the current tempest, but also whether the ground already was saturated by previous rains and whether the storm hits a pristine watershed or an area paved over through urbanization.

In order to accurately predict and avoid devastating floods, scientists need accurate weather data and powerful computational tools to simulate the outcomes of storms. Daniel Wright, who joined the department in January 2016 as an assistant professor, hopes to refine and apply predictive tools based on satellite rainfall data and climate and weather model projections to predict flood risk both in the upper Midwest as well as internationally in the developing world.

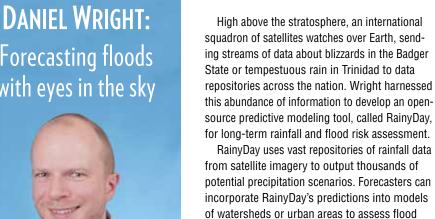
Multiple factors interact to determine whether

a region is at risk from floods. Geography and geology form the overall shape of the land that water washes across. Human structures such as dams, roads and buildings further divert the flow. Wright studied floods in urban environments during his PhD training at Princeton University to better understand how bucketing rain can overwhelm the built environment. "If you pave over everything and don't do anything to mitigate the impacts, the water has nowhere to go but to flood homes and roads," says Wright.

The tools he uses to predict precipitation can inform decisions about infrastructure to minimize risk. Wright not only hopes to help major metropolitan centers avoid disaster, but he also wants to prevent floods from wreaking havoc in rural regions and the developing world.

Wright's passion for providing assistance internationally stems from time spent in the Peace Corps before beginning his PhD program. During his Peace Corps service in Bolivia, he designed and built small-scale water systems for rural farming communities. After completing his graduate training, he continued working globally as a disaster risk management analyst for the World Bank, where he observed firsthand the devastating destructive effects of flooding in third-world nations.

While working for the World Bank, Wright studied how floods and hurricanes pose risks to the national infrastructure for small Eastern Caribbean islands like Saint Lucia, Saint Vincent, and Grenada. He helped governments and consultants build up public works and urban planning departments to improve their resiliency to disasters. One challenge that remote island nations face in accurately forecasting flood hazards is a lack of climate and weather data. Poor countries and remote areas lack the resources to collect detailed precipitation records. Wright later went on to develop a tool to overcome this obstacle during his postdoctoral work at NASA's Goddard Space Flight Center by using satellite imagery to obtain detailed measurements.



municipalities and insurance companies. Wright collaborates with researchers at the University of Iowa to study Midwestern rainfall and flood risks. He looks forward to working with resource mangers and hydrologists at UW-Madison, including civil and environmental engineering colleague Paul Block and colleagues in the atmospheric and oceanic sciences department, to investigate state and local water issues. Ultimately, however, Wright takes a global view, hoping that weather scientists across the world

hazards. Wright hopes to use the tool to generate

first-of-their-kind long-term risk profiles for entire

river systems, which could inform decisions for

"One of the nice things about the RainyDay tool is that it uses satellite data, and satellite data has global coverage, so you can use it in parts of the world where you don't have any other information, like in developing countries," Wright says.

will make use of the resource.

He is currently pursuing partnerships to develop a web-based application so that anyone can access Rainy Day at any time.

Wright plans to bolster Wisconsin's worldwide reach in climate impacts and forecasting science by fostering collaborations among local researchers and his former colleagues at the World Bank and elsewhere. He looks forward to working with UW-Madison student chapter of Engineers Without Borders. Rain or shine, the new assistant professor aspires that both his technical tools and outreach efforts will help people across the globe.





## Tsunamis from the sky

s if worrying about life-threatening rip currents, seiches, storm surges and rogue waves on the Great Lakes wasn't enough, now researchers are learning more about yet another cause for concern: meteotsunamis.

Often mistaken for seiches, meteotsunamis are single waves similar to, but smaller than, tsunamis caused by earthquakes or land-slides—mini-tsunamis, if you will. However, instead of being caused by seismic activity, meteotsunamis are formed by strong storms that move over the water.

The term "meteotsunami" is a contraction of "meteorological tsunami," which translates from Latin and Japanese as "a harbor wave caused by weather." Storms at the right speed and intensity, moving over water that is the right depth, can cause a wave front. Once the wave shoals and breaks on shore, it can reach nine to 18 feet tall.

Unlike seiches, which occur when water in the entire lake basin sloshes back and forth repeatedly, meteotsunamis are a one-time moving wave front; but like seiches, their water level changes can cause loss of life and property. In fact, Professor Chin Wu and Adam Bechle discovered that several historical disasters attributed to seiches were actually caused by meteotsunamis. They also found that spring is a prime time for this relatively unknown phenomenon to happen, especially in Lake Michigan, and they are working on ways to forecast meteotsunamis to avoid loss of life and property.

Wu estimates that on average, about 80 meteotsunamis larger than one foot occur in the Great Lakes every year, with about five meteotsunamis per year larger than two feet.

Wu and Bechle, a postdoctoral research associate, and David Kristovich from the Prairie Research Institute at the University of Illinois at Urbana-Champaign, analyzed 20 years of water level records from Lake Michigan to make this determination. The levels are recorded every six minutes at 10 locations by the National Oceanic and Atmospheric Administration (NOAA). The researchers compared possible meteotsunami events with radar imagery to assess whether the water level changes were caused by storm fronts. Their results were published in the *Journal of Geophysical Research: Oceans*.

"We found that the largest meteotsunamis in Lake Michigan occur down by Chicago at Calumet Harbor," says Bechle. "The peak of activity was in the late-spring, early summer time period. That surprised us because most of the damaging events recorded in newspapers happened in June and July, which had us thinking more meteotsunamis would happen mid-summer."

Bechle says most meteotsunamis happen during April through June—the beginning of the season for convective thunderstorms, which may cause meteotsunamis. "There's a strong association between convective thunderstorms and meteotsunamis,"

Bechle says. "It's not a definitive cause, but they occur very close in time to each other."

The depth of the water the storm blows over is also a factor in creation of a meteotsunami. The deeper the water, the faster the storm needs to move for a meteotsunami to form. Shallower water, like that near Calumet Harbor, takes slower storm speeds to form, which are more common.

The shape of the lake basin in that area is another factor conducive to meteotsunamis.

"If you look at Lake Michigan, the east coast of the lake is a bit concave, like a satellite dish," Bechle says.

"So when a storm moves from west to east across the lake, the waves will hit the east side of the lake and get reflected back to Chicago. It's almost like it focuses the wave energy down into that southern area. We think that's why we see a lot bigger events than other places along the middle of the lakeshore."

The researchers have developed a mathematical formula that can be used to forecast meteotsunamis and they are working with Eric Anderson at NOAA's Great Lakes Environmental Research Lab in Ann Arbor, Mich., to establish a forecasting center to provide meteotsunami warnings. "Forecasting a meteotsunami is very difficult," Wu says. "You have a short time period to work with, and the information is variable and needs to be gathered in real time. We are developing a holistic approach that takes all the data from the atmosphere and water to develop a model that can provide a warning."

Until the forecasting center comes online, Bechle sums up what to look for. "If you see a fast-moving squall coming at you from across the lake, especially Lake Michigan, be on the alert for a possible meteotsunami."





### Applying Wisconsin asphalt expertise in Qatar

hen participating in the daunting task of completely rebuilding the transportation infrastructure in Qatar, a wealthy nation in the Arabian Peninsula, Hussain Bahia was forced to consider the major challenges of applying his asphalt research expertise to a harsh climate and a lack of local resources.

"There's a tremendous difference between how I think as a researcher, and how I think as a person with a technical team involved in delivering the actual roads and construction," he says.

Since the project's inception, Bahia, the Vilas Distinguished Professor in civil and environmental engineering and head of the UW-Madison Modified Asphalt Research Center (MARC), has completely rewired his view of how transportation-related projects are implemented.

One major barrier to progress in Qatar is transporting materials used for road construction. Because Qatar does not produce asphalt locally, and has very few quality rocks, the asphalt has to be imported from neighboring countries such as Bahrain, and all rocks are shipped from the United Arab Emirates. "There's the challenge of combining the extensive experience of engineers under the bureaucratic control of government agencies," Bahia says.

Since he arrived in Qatar nearly two and a half years ago, his goals, as well as the way

in which they are accomplished, have altered dramatically: The number of road construction projects in the country doubled—yet Bahia and his team completed a system that allows them monitor the projects' quality; every layer of every road is tested and checked.

Most importantly, says Bahia, he was able to influence national specifications for transportation infrastructure the form of two new amendments, which illustrate and include many of the ideas that he and his students have developed at UW-Madison. One amendment is for

modified asphalts (his favorite research topic) and the other for advanced pavement design (a topic he teaches in civil and environmental engineering every year).

While Bahia and his team of engineers—including a number of his students who provide assistance and answer questions from a distance—are working on quality assurance, a number of consulting firms are managing the project, including AECOM, Parsons International, and KBR Inc.

"We interact on many levels, and that brings a lot of very interesting experience in terms of exchanging ideas, and trying to match the expected delivery time with the highest quality," Bahia says.

The project's challenges have informed the way he views the implementation of his

asphalt research at UW-Madison. "Although it's exciting to have research on materials, it's as important, if not more important, to look at the method of delivery of these materials as part of the research," he says. "It changed my thinking about the most important

considerations when designing tests and materials, and how I simulate things like delivery with limited skilled labor and demanding weather."

Bahia also plans to transfer to the classroom many of the things he has learned throughout the project. "I'm excited to get our students learning more about the actual delivery and

quality assurance, since most of our students will be employed by contractors, and won't be in the lab." he says.

Through this multifaceted project, Bahia has been able to make lasting connections with engineers abroad, and is engaged in an ongoing discussion with his colleagues about training engineers at UW-Madison.

"People need to know that the University of Wisconsin will be around to advance science and improve practice for a long time," Bahia says. "When the people here in this region see the work we do and ideas we have developed, they recognize our impact as an educational institution."



Hussain Bahia





CEM graduate Sarah Tenpas works as a production engineer at the downtown San Francisco Van Ness and Geary Campus Hospital.

"The site that I'm on is 30 men with 30 years experience and me and it's my job to make sure that they're doing it correctly. At first it was intimidating. I didn't want to make anyone mad and being the only girl made it harder," says class of 2015 alumna Samantha Hribar, who works for J.P. Cullen & Sons Inc. as a site engineer. "But the CEM program helped me transition to the working world. They gave me so many connections to professionals so I knew what to expect."

Hanna actively encourages female students to assume leadership roles in the Construction Club and other student-run organizations. Thanks, in part, to his encouragement, the UW-Madison CEM program has one of the highest percentages of female graduates from the College of Engineering. "I know that Professor Hanna and UW-Madison made me a stronger woman," says Rugaya AlSabah, who received her PhD

in construction from UW-Madison. In recognition of her achievements and leadership, she was selected to be the official presenter at Kuwait University's 2015 Commencement.

#### Unmatched excellence

Because of their high-demand skills, Badgers outperform candidates from any other institution, according to an internal review conducted by Minneapolis-based M.A. Mortenson Company, which historically hires the largest numbers of CEM graduates. And a recent external assessment of the program by a panel of CEOs and academic faculty ranked the CEM program as one of the top in the nation due to its rigorous curriculum, active research, and close relationships with the construction industry. "One of the most unique things about our CEM program is that we have unprecedented industry support," says Professor David Noyce. "We've developed a family of participants from the private sector who not only support us financially, but provide student advising and support, attend events, and build strong connections with our program."

That industry support network includes 10 adjunct faculty members and innumerable company frontrunners acting as guest-lecturers. Students learn about integrated project delivery and lean construction from industry experts such as John Nelson, the former CEO of Affiliated Engineers, and Dave Kievet and Tom Boldt, the president and CEO of The Boldt Company, respectively.

Recruiting requests for students from the CEM program inundate Hanna's email inbox. Badgers arrive on site ready to do outstanding work, because they learned excellence and independence at UW-Madison. "The CEM program helped so much," says Hribar. "I can not thank Dr. Hanna and all of the faculty enough, not only for teaching us, but for teaching us how to find our own answers."

#### Gary Wendt establishes professorship and expands diversity scholarship

Ithough Gary Wendt (BS '65) spends most of his time in Florida, his presence resonates across UW-Madison's campus through a long history of philanthropy. A scholarship he established to promote diversity in the College of Engineering has already helped 99 students pursue their degrees.

Now, Wendt will support even more future scholars as they achieve their educational dreams. He will expand his namesake scholarship and, through a historic matching gift from UW-Madison alumni John and Tashia Morgridge, create a named professorship. The Gary Wendt Professorship in Civil and Environmental Engineering will support a professor who encompasses UW-Madison's deep commitment to high quality instruction and innovative research. In particular, Wendt

hopes this faculty member will provide cutting-edge solutions to environmental problems, such as phosphorus runoff from fertilizers into streams and rivers.

of both genders.



Recognizing that financial burdens prevent too many students from reaching their potential, Wendt established a scholarship bearing his name in 2002. Originally conceived to promote women pursuing engineering education, subsequently its scope expanded to help minority students

Ahraaz Qureishi, who received his BS degree in civil and environmental engineering in 2013, credits the award for setting him down the path to his current position at



Pierce Engineers. "The Wendt Diversity Scholarship not only helped to pay for books and tuition, but it also gave me peace of mind to know I could focus solely on schoolwork. For me, this made the award worth more than just its monetary value," he says.

Wendt receives letters every year from each of the scholarship recipients, giving him a way to reconnect with campus through the students. His advice to graduating seniors is to have focus on their passions, but not at the expense of being open to new experiences. "Take a job and work at it to expand yourself," Wendt says. "Working hard and keeping an open mind at the beginning of your career will help you get into your core interests."

And ... he recommends that incoming freshman make sure to study their calculus.



Join alumni, industry colleagues, faculty, staff, and students as we celebrate the 20th anniversary of the Civil & Environmental Engineering Golf Outing, September 16, 2016.

This day of fun and fund-raising will include an after-party with dinner, drinks, live music, networking, our famous auction, exciting raffle prizes, and Bucky Badger!



Department of Civil & Environmental Engineering 1415 Engineering Dr. Madison, WI 53706

## Ken Potter retires after four decades of active involvement in Wisconsin's water issues

n early 2016, Professor Ken Potter retired after almost four decades of teaching at UW-Madison. Throughout his career, Potter conducted research that has affected water and climate-based projects far and wide.

For details / registration info, visit:

www.golf.cee.wisc.edu

One project was the manual *Design Guidelines* for Stormwater Bioretention Facilities, which Potter developed in conjunction with the UW-Madison Water Resources Institute in 2006. It is unique in that it enables homeowners to take a direct role in maintaining the health of their water resources—and gives them the essential knowledge to do so. By following this manual, residents can learn how to build a garden that will help replenish local aquifers, absorb water and reduce drainage and flooding issues, all the while creating a beautiful yard.

Professor Steve Loheide, who has worked with Potter on projects related to hydrology,

lauds Potter for his broad influence in the field. "Ken is known across the country for his career-long passion for translating the best science into practice, as evidenced by his tireless service on 14 National Research Council committees convened to improve decision-making on topics including flood control, disaster protection and restoration of aquatic ecosystems," Loheide says.

And, Potter's tenacity for public outreach, and his passion for community involvement and wellbeing, have been fundamental to his career, says Professor Chin Wu. "Ken is not only doing the research, he's doing the research to impact societal life,"

Potter has continued to focus on groundwater infiltration and how it is affected by the proliferation of urban life. An ongoing project involves Wisconsin's Driftless Area, a hilly region in Garfoot Creek, in Dane County. Along with fellow researchers, he has developed criteria for sound conservation practices, observing how changes in climate increase water infiltration. He has also played an important role in stormwater management policy at UW-Madison, providing necessary insight into campus redevelopment in order to better deal with runoff.

Wu says. "It's not just for the publication—he's looking at how the whole society can benefit."

He will continue to engage in the community conservation discussion post-retirement, educating people on the potential harm that increased urbanization could have to the Yahara River Watershed, in terms of flood risk and water pollution. "It's better to keep the science out there," Potter says. "We have to remind people of what we understand."

