




**College of Engineering**  
UNIVERSITY OF WISCONSIN-MADISON

May 21, 2020

TO: Karl Scholz, Provost  
William Karpus, Dean, Graduate School

FROM: David A. Noyce, Executive Associate Dean 

RE: Review of the Master of Engineering in Civil & Environmental Engineering—  
Environmental Engineering Named Option

At its April 15, 2020 meeting, the College of Engineering Academic Planning Council (APC) unanimously recommended for approval the attached review and self-study of the Master of Engineering in Civil & Environmental Engineering—Environmental Engineering Named Option.

The review committee found the program is meeting the prescribed student learning objectives, has attracted a diverse student group, and the enrolled students rate the program as meeting or exceeding expectations.

The review committee did provide a few recommendations:

- Track students' career outcomes as well as track those students that discontinue the program.
- Review the number of transfer credits allowed; consider reducing the number to increase revenue but still allow enough flexibility to attract students.
- May need to add staff if enrollment increases in order to retain quality of service.
- Develop a specific Graduate Student Handbook for the Master of Engineering online programs, separate from the department's graduate student handbook.

The College APC also suggested that the program identify the minimum enrollment number needed to continue the program and develop a plan to sunset the program if necessary.

On behalf of the College of Engineering, I accept the APC's recommendation to approve this program review.

Attachments: Review Committee Report  
Department Self-Study

cc: Jocelyn Milner, APIR  
Karen Mittelstadt, APIR  
Parmesh Ramanathan, Associate Dean, Graduate School  
Jenna Alsteen, Graduate School  
Chris Brace, Assistant Dean for Graduate Affairs, College of Engineering  
William Likos, Chair, Dept. of Civil and Environmental Engineering  
Vicki Bier, Chair, Program Review Committee

# **Report for the 5-Year Review of the Masters of Engineering in Environmental Engineering**

March 17, 2020

## **Review Committee Members**

- Vicki Bier, Professor, Industrial and Systems Engineering (Chair)
- Christopher Choi, Professor, Biological Systems Engineering (Graduate Faculty Executive Committee Representative)
- Brian Pflieger, Professor, Biological and Chemical Engineering Chemistry
- Anita Thompson, Professor, Biological Systems Engineering

## **Review Process**

The committee was formed on November 22, 2019, and directed to “analyze program quality and student learning, affirm ways that the program is working well, and implement improvements.” These charges also directed the committee to “focus on evaluating the quality and function of the academic programs,” with special emphasis placed on evaluating “the academic programs and the student experience.” The committee began by reviewing the 5-Year Self-Study Report concerning the Master of Engineering in Civil & Environmental Engineering—Environmental Engineering Named Option, in addition to the Annual Assessment Report. The committee gathered additional information by taking the following steps:

- Performing one-on-one interviews with three faculty members who teach extensively in the program;
- Meeting as a committee with the Chair of Civil & Environmental Engineering (Prof. William Likos) and the Program Director (Jane Carlson);
- Meeting as a committee with the program’s Student Services Coordinator (Cheryl Loschko);
- Conducting telephone interviews with three graduate students currently enrolled in the program; and
- Reviewing program statistics collected and published online by the Graduate School.

The Student Services Coordinator, who is a staff member in the College of Engineering, assists graduate students with matters that include advising, procedures and goals, and degree progression. The three graduate students who were interviewed included a foreign-born woman currently working in the U.S., a U.S.-born man who was an alumnus of Civil & Environmental Engineering, and a U.S.-born woman who had graduated from another program. In this way, the committee gathered both foreign and domestic viewpoints concerning gender and ethnic diversity. The students were selected by the program director. However, during the interviews, they were asked to provide a broad perspective, one representative of all students.

After reviewing the Self-Study and Graduate-School data, the committee generated a detailed list of questions and topics designed to guide discussions with the administrators, the coordinator, the faculty, and the students. The one-on-one interviews with faculty members were conducted for 20-40 minutes each, in February and March, depending on the availability of each faculty member. On December 12, 2019, the committee met with the Chair for 30 minutes and the Program Director for 60 minutes, and on February 21, 2020, with the Student Services Coordinator for 20 minutes. During February and March, the members of the committee held discussions and with the students (by telephone/Skype), for 15-40 minutes each.

## **Data**

The Civil and Environmental Engineering Department offers an M.E. program in Environmental Engineering (online). The program is relatively new (initially proposed in 2013 with its first students enrolled in fall 2015).

## **Size**

The M.E. program in Environmental Engineering is relatively small, having an enrollment of 25 students in both fall 2018 and fall 2019. The program's director estimates that a minimum of 10 students will ensure a positive cash flow, and that additional advising assistance would likely be needed if enrollment were to exceed 30 students.

**Time to Completion (M.E.).** Most students in the program also work full-time. They typically take one or two classes per semester and therefore require about three years to complete the program, which comprises 30 credits. Occasionally, a student will withdraw for a semester or two for personal reasons or will progress more rapidly if not working full-time.

**Career Outcomes.** The amount of data needed to assess outcomes rigorously has not yet accumulated. It can be said that many students continue in their current jobs, some with promotions to roles of greater responsibility; some students also use the program as a

springboard to other, presumably better jobs. Some students also go on to pass the Fundamentals of Engineering Exam and/or become licensed Professional Engineers.

**Graduate Program Ranking.** The Online Master of Engineering in Environmental Engineering was recently ranked highly (#13 out of 30 online programs in civil/environmental engineering) (<https://www.bestmastersdegrees.com/top/online-masters-civil-environmental-engineering>).

**Staffing and Administration.** The Chair of Civil & Environmental Engineering (currently Prof. William Likos) provides general oversight for the program. However, day-to-day operations (including student recruiting and admission) are managed by the program director. The Student Services Coordinator provides academic advising to graduate students in the program, and helps with occasional questions as they arise (e.g., how to re-enroll after a student has left the program for some period of time).

## **Interviews**

The one-on-one meetings with members of the faculty and the discussions with administrators, staff, and students provided first-hand accounts regarding the program and thus provided insight beyond that gained from the data and information gleaned from the Self-Study. The tenor of all the interviews was positive. None of the interviewees identified any major flaw. When encouraged to elaborate, they did provide the following comments and suggestions:

### **Comments by Faculty, Administrators, and Staff**

- Teaching in the program does not reduce a faculty member's availability and prevent them from helping to meet other needs of the department, such as service responsibilities, or reduce offerings of regular classroom courses.
- Discretionary funds have been useful, enabling faculty members to purchase on-line teaching-related equipment (including computers).
- The program has a reasonably diverse student body, with a good gender balance in particular, relative to other M.E. programs of the same kind.
- The students have the opportunity to get to know each other and work together online through collaborative presentations, forums, etc.
- Most students make reasonable progress towards their degrees. A few had to leave the program due to circumstances beyond their control (hurricane, illness, etc).

- The students seem to be able to cope with the stress of graduate school, but they sometimes struggle due to work-related conflicts.
- To meet their interests, the students in the program have adequate flexibility when choosing courses, particularly with regard to the many elective courses made available.
- The program's curriculum includes an adequate mix of electives, seminars, independent study, etc.
- The accelerated M.S. program offered by the department does not compete directly with the M.E. program.
- The program has the right core curriculum for its starting point. However, in the long term, the program may need to broaden the scope of its core requirements to deal with problems such as contaminated soils, hazardous waste, or water resource management.
- The program provides an advantage to undergraduate students on campus by exposing them to the work experiences of the M.E. students (e.g., through class discussions) .

### **Comments by Current Students**

- The program met or exceeded student expectations, learning goals, and career needs. The practical content of the courses was rated favorably. Students also reported that the course offerings met their needs.
- The program is challenging for those working full-time jobs, especially when their jobs involve business-related travel or important deadlines. However, the professors were good at accommodating these students.
- Working together online to complete projects and meeting in person during business trips helped a great deal. In-person meetings with other students and/or faculty members provided valuable help even if those meetings occurred only once a year. Students found working with other classmates with different career paths and knowledge to be enriching.
- Various online tools (such as WhatsApp, Google Drive, and Blackboard Collaborate) have proved useful.
- The program (as one student indicated) could be useful when making certain changes (e.g., from the oil industry to consulting in environmental engineering).

- One of the students interviewed chose the program because of UW-Madison's reputation, and because the student could not find another online program in environmental engineering.
- Faculty were available and helpful anytime the student had questions or concerns. Feedback was provided in a timely manner.

Aside from several minor criticisms, the interviewees indicated they were happy with the way the program was administered.

**Overall, the Masters of Engineering in Environmental Engineering is healthy, the quality of the students appears excellent, and student learning goals are being met. The Department should be commended for creating and expanding such a strong graduate program.**

The program's most notable strengths and also its concerns/challenges are summarized below, followed by recommendations. For the most part, the recommendations pertain to areas of concern that the program administrators should consider addressing, rather than those that represent significant flaws that must be corrected.

## **Program Strengths**

- **Program Administration.** The transition to Jane Carlson as the new Program Director seems to have gone extremely smoothly. The committee heard no concerns about her leadership, and she seems proactive in reaching out and keeping in touch with the students in the program. This policy is valuable in that it ensures intended student outcomes, achieves the program's goals, and helps to create a positive learning experience.
- **Faculty Involvement.** The faculty members who teach core courses in the program seem to be doing an excellent job. In particular, the review committee was impressed by how many of the program's independent-studies students have been able to function (in some instances, a single student has managed two and even three such courses). This outcome speaks to the faculty's commitment, since supervising independent studies is typically a task conducted in addition to other teaching duties.
- **Favorable Outcomes for Students.** Although it is too soon to rigorously assess career outcomes, the students who were interviewed expressed favorable opinions regarding the program, and many professed a belief that completing the program successfully would benefit them in their careers and help them to advance professionally.
- **Flexibility in Regard to Course Selection.** Although one faculty member speculated that permitting students to take a wider range of the courses available on campus might benefit them,

most members, and also most of the students who were interviewed, expressed satisfaction with the current graduate-level course offerings. The committee also believes that the number of courses now being offered enables students to develop course plans that meet their interests. Moreover, the schedule of course offerings (with many or most courses offered once per year) is sufficiently regular that it will not force students to delay in completing the program in a timely fashion. Besides, students can pursue independent studies, and/or transfer a number of credits (up to 14?) from another institution (the program at Johns Hopkins was frequently mentioned).

- **TA Support.** Both students and faculty members expressed appreciation for the level of TA support made available in the program. Most of the students interviewed deemed the level of TA support as adequate and believed the TAs helped them learn the material and make progress in the program. Certainly, because the TA/ student ratio is significantly higher for M.E. students than for on-campus students, the faculty members who teach significant numbers of M.E. students receive a higher overall level of TA support, which at least partially compensates for the extra workload involved in teaching both on-campus and off-campus students in a single course.

- **Adequate Course Materials to Support Online Education.** The committee was provided access to the Canvas pages for four courses offered over the last year. Each course was distinctly different, using a variety of platforms for providing lecture materials and assignments. The content and delivery of a sample of lectures viewed indicate that the quality is strong, consistent with in-person delivery. In addition, the students interviewed indicated that they also had opportunities to become acquainted with members of the faculty (especially via independent studies), and with some of their classmates (via group projects), even though the interactions were online.

- **Generally Positive Climate.** Online students and on-campus students will of course use different measures to assess “classroom climate,” but both groups indicated that the faculty has been supportive and respectful. Several students in each group reported that balancing the responsibilities associated with full-time work with those imposed by an online graduate program, but these students also indicated that faculty has been in general quite accommodating in its efforts to help them resolve such conflicts of interest.

- **Reasonable Levels of Student Diversity.** Although the engineering field as a whole faces challenges related to gender and racial/ethnic diversity, the M.E. program does not appear to be significantly less diverse than similar programs on campus. For example, roughly 30% of the students who have completed the program thus far were female. Similarly, the program includes a mix of undergrad alumni who chose to continue their education at the same institution (the University of Wisconsin-Madison), and students who completed their undergraduate studies at other schools

## **Program Concerns and Challenges**

- **Graduate Student Handbook.** Currently, the department has but a single Graduate Student Handbook. This can pose problems because the requirements for the online M.E. program (and the issues associated with online programs in general) differ significantly from those imposed on most of the other students enrolled in the on-campus graduate programs. Just for example, the Student Services Coordinator recently reported that students in the online program were much more likely than on-campus students to withdraw for a semester or two and then re-enroll later. The students interviewed did not believe this to be a problem because they were usually able to get their questions answered online or via a phone call. However, developing a handbook more closely aligned with the needs of the online M.E. program (providing one-stop shopping for course requirements and clearer more specific policies and procedures pertaining to such actions as arranging for independent study or re-enrolling after a break) would significantly benefit students and reduce the staff's administrative burden (especially if the program were to grow significantly).

- **Possible Need for Additional Staff.** The program currently has approximately two dozen students, which allows for a personal approach. If enrollment were to grow significantly (which might be financially beneficial), additional staffing and advising resources might be required to maintain this quality of service without putting undue burden on either the Program Director or the Student Services Coordinator. Moreover, the burden would fall especially on the Student Services Coordinator for the program, Cheryl Loschko, because she is also supporting a number of other graduate programs in the department that require significantly different procedures.

- **Consequences Associated with Program Flexibility.** As the members of the committee understand it, the program currently allows up to 14 of the 30 required credits to be earned at an institution other than the University of Wisconsin-Madison. While this policy appears to be consistent with the minimum expectations of the Graduate School, several committee members view it as unusually flexible and fear that it could undermine the program's revenue-generation goals. Therefore, the committee recommends that program leadership consider the feasibility of further restricting the policy to an extent that would not significantly impair recruiting efforts and the program's further development. Would allowing a student to transfer six credits from another program, for example, still give the student significant flexibility without jeopardizing the program's financial sustainability?

## **Recommendations**

- **Monitor and Assess Career Outcomes for Students.** The program should find ways to stay in touch with its alumni and monitor their career outcomes (e.g., keep track of who was promoted or changed jobs after completing the program).
- **Monitor Students who Disenroll.** It might be helpful to create a formal method for tracking students who decide not to enroll for a semester or two but still intend to complete the program at a later time.
- **Reduce the Number of Credits that Can Be Transferred from Other Institutions.** The CEE department and the M.E. program should seek to determine whether the number of outside credits permitted could be reduced without harming student recruitment and progress.

## **Other Observations by Committee and Interviewees**

- **Course Flexibility.** Although one faculty member suggested that students might benefit from being given greater flexibility when selecting courses, such a measure might not be practical; many faculty members may not be prepared to adequately accommodate online students in their courses.
- **Compensation to Faculty.** The current approach of providing limited discretionary funding plus generous TA support seems a reasonable compromise, given the difficulties associated with providing direct compensation during the academic year.

## **Conclusions**

**The committee appreciates the effort by the faculty and staff to create this program and maintain its vibrant nature. We hope that the program continues to grow and provide positive outcomes for students.**

# 5-Year Self-Study Report for Master of Engineering in Civil & Environmental Engineering – Environmental Engineering Named Option

Date submitted: November 18, 2019

Primary Contacts:

Jane M. Carlson, P.E., ENV SP, Adjunct Professor and Program Director, [jane.carlson@wisc.edu](mailto:jane.carlson@wisc.edu), (608) 334-3402.

William Likos, Gary Wendt Professor and Chair, [likos@wisc.edu](mailto:likos@wisc.edu), (608) 890-2662.

Department(s)/Academic Unit(s): Civil & Environmental Engineering (CEE) Department

School(s)/College(s): College of Engineering

## A. Response to previous program review recommendations

*Summarize recommendations from the previous program review and how they were acted upon.*

*This section is not applicable. This is the first (5-year) self-study report for the program. The program was initiated in 2015 with the first cohort of students matriculated in September 2015.*

## B. Overview of the Program

*Describe the mission and goals of the program and how its structure (both of the program and of its governance) support them. Consider the following questions:*

- Provide current degree/major requirements as approved.  
*The M.Eng. named option in Environmental Engineering is a fully online degree that includes a full curriculum of courses incorporating the latest research and practices in water supply, wastewater reclamation and reuse, resource recovery, and urban storm water management. The M.Eng. degree has been developed to give the practicing environmental engineer and scientist the skills needed to meet contemporary and future challenges. For more information about the online M.Eng. degree, see the program [website](#). Degree requirements are listed here: <https://guide.wisc.edu/graduate/civil-environmental-engineering/civil-environmental-engineering-meng/civil-environmental-engineering-environmental-engineering-meng/#requirements> The program follows the minimum degree requirements of the graduate school. The program requires 30 credits, of which 16 must be earned at UW-Madison (residence credits). There are a total of 16 credits that are required to be from program courses. Other online CEE and Engineering Professional Development (EPD) courses may be taken as electives if they have the Graduate Level Coursework attribute.*
- How does the mission of the program fit with the home department/unit, the school/college, and the mission of the university?  
*The following is an excerpt from the February 2013 MEng EnvE program proposal, which was submitted in response to the College of Engineering's (COE's) Request for Proposals to Develop*

*New Distance-Delivered Graduate Engineering Offerings: "... BS graduates are seeing increased financial pressures to enter the workforce immediately following their baccalaureate program. Distance-delivered programs are becoming increasingly attractive to students therefore, and owing to the factors ... a distance-delivered professional degree offered by a high-ranking and well-respected institution such as ours should be highly marketable, assist us in meeting our educational mission, and help foster more effective ties between the research and professional practice communities."*

*Following are important goals for the MEng EnvE program as stated in the 2013 proposal: "(1) Provide the foundational academic training necessary for practicing Environmental Engineers to meet the increasingly complex and difficult environmental challenges faced by society. (2) Provide breadth and depth in Environmental Engineering knowledge and skills to students from other engineering and related science fields. (3) Along with the student's baccalaureate degree, satisfy the educational component of the "Body of Knowledge" within the framework defined by the American Academy of Environmental Engineers. (4) Meet the needs of program graduates for licensure under the National Council of Examiners for Engineering and Surveying Model Law, and the regulations of the various states and territories. (5) Help develop future generations of Environmental Engineering leaders. (6) Assist the College of Engineering in meeting its strategic goals. (7) Foster ties between the Department of Civil & Environmental Engineering, and the college, with the professional practice community."*

*The mission of the program is also consistent with the vision of the Department of Civil and Environmental Engineering, as articulated in the 2020-2025 CEE strategic plan: "To be recognized as a global academic leader in scholarship and learning by our peers and stakeholders, with recognized excellence and international leadership in the themes of mobility, water, and building, with integrated cross-cutting areas of energy, infrastructure, and the environment." In particular, the MEng contributes directly to the department vision of achieving excellence in theme areas of water and the environment.*

- What are the approved learning outcomes for each of the programs being reviewed (i.e. bachelor's, master's or doctoral degrees)?

*The curriculum was designed to meet the Master of Science learning outcomes as described within the American Academy of Environmental Engineers Environmental Engineering Body of Knowledge<sup>1</sup> (BOK) document. These outcomes are listed below.*

1	<i>Demonstrate a Strong Understanding of Mathematical, Scientific, and Engineering Principles in the Field.</i>
2	<i>Demonstrate an Ability to Formulate, Analyze, and Solve Advanced Engineering Problems.</i>
3	<i>Demonstrate Creative, Independent Problem-Solving Skills</i>
4	<i>Apply the latest Scientific and Technological Advancements, Advanced Techniques, and Modern Engineering Tools to these Problems.</i>
5	<i>Recognize and Apply Principles of Ethical and Professional Conduct.</i>

<sup>1</sup> <http://www.aaees.org/publications/eebodyofknowledge.php>

- What is the program's structure? For example, is it a single program or does it have informal tracks/concentrations, formal named options or certificates? *It is a named option, Environmental Engineering, under the Master of Engineering in Civil & Environmental Engineering. There are no other named options under MEng-CEE. There are no specific tracks/concentrations, although students may choose more courses in select areas such as hydraulics and hydrology, solid and hazardous waste, wastewater treatment, and so on.*
- Describe any substantial and structured collaborations with other programs, such as dual, double or joint degrees and benefits of these arrangements? *There are no dual, double, or joint degrees offered. However, students in the MEng EnvE program may take elective online courses offered by Engineering Professional Development (EPD), and EPD students may take MEng EnvE courses, with permission of advisors and instructors. This has been beneficial in offering more options for various student interests, and also helps some students complete their master's program on a shorter timeframe.*
- If the program is not the only program within the home unit, what are the other programs? If there are several programs in the same academic home, how are they related to one another and what impacts do they have on student learning? *Other graduate programs in the Civil & Environmental Engineering Department include PhD, MS with thesis, and professional (accelerated) MS. MEng EnvE students may choose from several online elective courses that are offered to both on-campus and online program students, allowing formation of project teams from various backgrounds and levels of experience (since the MEng program students often have professional experience). The online MEng EnvE program provides additional electives to on-campus students, which may be of particular interest to accelerated MS students who obtain their degree in 12 months and may not be able to enroll in the on-campus courses that they prefer, e.g., if an on-campus course is only offered once every two years.*
- How do the program's governance model, program committees, and membership criteria lead to active faculty engagement? How does succession planning work for leadership? *The program is governed by the MEng EnvE Executive Committee appointed by the CEE Department Chair. This committee is made up of the CEE Department Chair, the CEE Graduate Program Associate Chair, CEE faculty, and a Program Director from EPD. The MEng EnvE Program Director is appointed and supervised by the Department Chair. The first Program Director, Michael Doran, worked with the Department Chair and new Program Director in advance of his retirement to provide a smooth transition to the new Program Director. It is anticipated this model will be followed in the future.*

### C. Program Assessment and Evaluation

*Summarize the assessment plan used to evaluate the extent to which students are meeting program learning outcomes and how the program is engaged in a coherent process of continuous curricular and program improvement.*

- Provide annual assessment reports.

*The November 2018 annual assessment report is attached.*

- What has the program learned through assessment of learning outcomes? Provide key evidence. *In reviewing the detailed assessment information provided by the CivEngr 823 mentors during a direct assessment, the students were not able to clearly demonstrate their understanding and capabilities in two areas because of course content limitations:*
  - *design and implementation of data collection programs, and evaluation of results*
  - *demonstration of understanding of the need for and a commitment to lifelong learning.*
  
- What changes have been made as a result of assessment? *Students who take CivEngr 822 learn design and implementation of data collection programs and evaluation of results. Not everyone in the program takes this course. Additional changes are still being considered for CivEngr 823 or 821 in the future to capture the remaining program students. CivEngr 929 was modified to incorporate a seminar on professional development and lifelong learning. In addition, CivEngr 821 – Biological Treatment Processes, has been modified based on input from Adjunct Professor Steven Reusser, retired from Madison Metropolitan Sewerage District, to incorporate education on secondary settling, which is integral to biological treatment, and state-of-the-art processes for nutrient removal and biosolids digestion. Professor Reusser co-taught CivEngr 821 in Spring of 2019 and will do so again in Spring of 2021 after making a few additional improvements to the course.*
  
- What are the emerging changes in the discipline? What is being done and can be done to move forward and seize emerging/future opportunities? *Engineering tools are continuing to develop. One area is in biological wastewater treatment process modeling. We have applied for a UW-Madison grant to develop an online, 1-credit course in biological process modeling. We are targeting AY 2022 for this new course. In addition, CivEngr 821 was modified as described above. CivEngr 929 seminars provide an opportunity for all program students to learn about emerging changes in the discipline. TAs are encouraged to speak on their research topics, and practitioners are often invited to discuss recent projects. We also encourage students in the program to discuss their own professional experience where it fits with the course learning objectives. Students can study emerging issues and technologies in CivEngr 699. All students in the program complete a team environmental engineering design project with a professional mentor in CivEngr 823 and have the opportunity to explore emerging trends.*
  
- If relevant to the program, how do leaders within industry, business, government, or non-profit organizations become involved in offering advice and perspectives on the program and the curriculum? *The program was developed with the aid of an external advisory committee appointed by the CEE Department Chair and made up of professionals from industry, business, academia, and government. The Program Director intends to convene a meeting of the external advisory committee in Fall 2019, during which input will be sought on the recommendations from the outcomes assessment, a proposed new course in biological process modeling, and a few other specific areas of the curriculum. Other opportunities for leaders in the industry to become involved were discussed in the previous bullet.*

#### D. Recruiting, Admissions, and Enrollment

*Analyze current practices and trends to determine if enrollment levels are consistent with plans and program resources. Discuss relevant program data in the context of the following:*

- Are admissions practices and enrollment levels consistent with plans, program resources, and career outcomes?

*The informal program goal is matriculation of 10 – 12 new students a year and we have met that goal thus far. Figures 1 through 6, attached, show total applicants and enrollment figures. Approximately 10 total students are desirable for positive cash flow, although this number could be lower if expenses are further reduced (e.g., by not hiring TAs). The program currently has 23 total active students. The CEE Department is interested in increasing enrollment in this and other graduate level programs. Program resources are sufficient for 30 total students or more. Additional student advising assistance would likely be required if enrollment exceeds 30 students. This will be further assessed as part of the 10-year Self Study. Note that career outcomes are difficult to assess since most of the students in the program already have careers in environmental engineering or related fields.*

- What effort has the department/academic unit or program made to enhance student diversity (traditionally underrepresented groups in field)? Have those diversity efforts been successful? *The CEE department have made specific efforts to enhance student diversity in addition to what Campus, the College of Engineering, the Division of Continuing Studies, and the Graduate School provide. the CEE department Chair and Administrator have led diversity and inclusion initiations through training programs for faculty and staff, required training for search and screen committee members, diversity focus in hiring, enhanced mentoring options for faculty, chair's graduate student advisory committee, and additional social and department events. Program diversity is shown in Figures 7 through 10, attached. The Program Director attended the Fall 2019 Teaching Academy Retreat on Inclusive Teaching Practices and intends to incorporate some of those successful practices into her courses.*
- If applicable, what do trends in application volume, admits, and enrolled students signal about program strength? For graduate programs, does the program directly admit students? If so, how does the program ensure student integration and success beyond the admitting advisor? *Trends in program applications, admits, and enrollment are shown in the attached Figures 1 through 6. These numbers signal that the program is steady and strong. The program uses the Graduate School online application process. Once the application is complete, the Program Director conducts a telephone interview of the applicant to further assess their likelihood of success in the program. A CEE Department applicant review committee, on which the Program Director is a voting member, reviews each applicant and makes recommendations to the Graduate School. This process appears to be working well, as evidenced by the number of active program students (23) and graduates (13).*

#### E. Advising and Student Support

*Discuss the process by which students get regular advising and accurate program information. Reflect upon the following:*

Undergraduate: - N/A

- Who does advising in for the program? Describe how advisors are hired/selected. How are students transitioned between advisors when personnel changes?
- Describe how students are assigned to advisors. What is the ratio of advisors to students? How often do you expect students to meet with an advisor?
- What other responsibilities do the advisors have in the unit?
- What material is available on your website or in print to support advising of undergraduates? How is that information kept up to date and accurate?
- What training and professional development is expected and/or supported for advisors? Do advisors make use of the Advisor Gateway and the Advisor Notes System? How are advisor performance reviews conducted?
- How is the impact of advising assessed? Is your advising in alignment with the Guiding Principles and Core Competencies for Academic Advising?

Post-Baccalaureate:

- How are advisors assigned and matched to students? How many advisees does each faculty member have? *The Program Director is the primary academic advisor for students in the program. The Program Director and Graduate Student Services representative, Cheryl Loschko, are assigned as advisors automatically. Students may request a different advisor from the CEE Department if they have a previous (undergraduate) relationship or preference; however, this is uncommon. The ratio of advisors (Program Director) to students has been approximately 1 advisor to 20 or 25 students.*
- How often are program contacts and student handbooks updated and made available online? Is the handbook inclusive of program learning goals, program requirements as well as a program-level grievance procedure? *The web site is updated whenever there is a change in program contacts or courses. The Program Director distributes a program-specific Student Course Planning Guide PDF document to each new student that provides details to supplement the information available on the web site, such as brief descriptions of each course, course instructors, and when each course is offered. This document is updated approximately every two years. The Graduate Student Services coordinator is presently working to post graduation warrant application forms online. The Program Director has a longer-term goal of developing a program-specific student handbook using the template that is currently in development. Until then, students may reference the Graduate School web site for program requirements and procedures, or the CEE graduate handbook:*  
<https://www.engr.wisc.edu/app/uploads/2019/08/CEEGraduateStudentHandbook2019.pdf>
- How are students transitioned between advisors when personnel changes? *Students were informed of the planned change in advisor when the program director transition was underway, and both the old and new Program Directors were listed as co-advisors during the transition period.*
- How often and in what manner is satisfactory progress monitored? Do students receive written annual feedback on their academic progress? *Students are expected to “meet”*

*(online, by phone, or by email) with the Program Director soon after acceptance to the program to develop an individualized course plan from matriculation through graduation. The Program Director reaches out to program students at least once a semester to advise on the online courses and sections that are available for the upcoming semester. Students are routinely encouraged to e-mail or meet by phone or online with the Program Director/advisor if they have any questions, and many of them do so at least once a year. In addition, the Program Director occasionally reaches out to students who appear to be struggling in their courses or who are late enrolling in courses, to see if they need help.*

- *How is the impact of advising assessed? The impact of advising may be assessed through the Graduate School exit surveys or the Division of Continuing Studies (DCS) Advance Your Career (AYC) exit surveys may be used for this. However, thus far, there have not been sufficient responses to generate a report with feedback to the program. An Engineering Alumni Qualtrics survey was recently developed by DCS-AYC and the Program Director and sent to the 13 program alumni, the results of which may help assess the impact of advising and provide other useful information for the program.*

F. Program Community and Climate

*Where applicable, evaluate exit survey and climate survey data. Describe the efforts taken to foster overall program diversity, a climate of respect and inclusion, and a sense of community by considering the following:*

- *Discuss efforts to welcome, orient, and retain new students. What is offered to connect students within the program, as well as with the greater campus community? The Program Director reaches out to all new students to check that they are comfortable using the Learning Management System and logging on to their first class. The Program Director works with each new student to develop an individualized course plan as previously described, and throughout their program answers questions and provides recommendations on appropriate courses and course load, depending on individual student needs and interests. The Graduate Student Services specialist for CEE, Cheryl Loschko, sends an onboarding email to all students to welcome them to UW-Madison Graduate School and provide useful information on graduate school policies and requirements. Cheryl also sends a course enrollment email every semester. Students in the program receive “Grad Connections bi-Weekly for Online Students” e-newsletters from the Graduate School. Students are encouraged to form study groups, routinely participate in discussion forums and work on team projects in their courses, and occasionally work as part of a joint on-campus/online project team.*
- *What efforts are there to enhance faculty/staff representation of traditionally underrepresented groups in the field? How does the unit rate its ability to attract and retain a diverse faculty/staff? The new Program Director is female. Other program faculty/staff are from the CEE Department, which makes efforts to attract and retain diverse faculty/staff. See additional information under the previous student diversity topic. This area will be reviewed in more detail in the 10-year Self Study report.*

#### G. Degree Completion and Time to Degree

*Referencing relevant data and campus goals, describe efforts to help students make timely progress to degree. Include the following in your discussion:*

- Use institutional data sources to examine and evaluate progress to degree metrics and comparison to peers. *Most program students are full-time working professionals. Those who are employed full-time typically take 3 to 6 credits a semester and require 2.5 to 3.5 years to complete the program. At least one current student does not work full time and is working through the program at a faster pace; she is on track to complete the program within 2 to 2.5 years.*
- What efforts have been made to improve progress to degree performance and completion rates? *Efforts are made by the Program Director and faculty to reach out to students who are obviously struggling in the program. Students are sometimes advised to take a lighter course load if needed. A few have dropped the program and then re-applied at a later date because of workload or personal reasons. The Graduate School's proposed leave policy, which will waive the reapplication fee in some of these cases, should help our students who have dropped out to reenroll and complete the program when they are able to.*
- Do students from educationally underrepresented groups (racial/ethnic minority, low-income, first generation in college) succeed in the program at rates comparable to other students? How are equity gaps addressed? *Current enrollment includes underrepresented groups, as previously noted. However, the number of students completing the program to-date is relatively low, making it difficult to assess this area. Out of the 13 students who have completed the program, four are women and one is an international student. This area will be assessed in more detail and reported in the 10-year Self Study.*

#### H. Career Services and Post-Graduation Outcomes

*Evaluate student career outcomes, exit survey, and alumni survey data, and reflect upon how these outcomes are consistent with program goals.*

- What do students do after graduation? How does the program prepare them for careers or further academic training? *As noted previously, there is not enough data from exit surveys to assess this area. This will be assessed and reported for the 10-year Self Study, using exit survey and alumni survey data. We do know from contacts with alumni that students after graduation tend to continue in their current professional positions and in roles of increasing responsibility. Students have reported passing the Fundamentals of Engineering Exam and succeeding with Professional Engineering licensure.*
- What career resources are available to students? *The Grad Connections bi-Weekly for Online Students e-newsletter provides resources. The Program Director has also provided job shadow opportunities and leads for students seeking engineering positions in Wisconsin and has served as a reference for some of the students.*
- What is the range of student career outcomes, and are these outcomes consistent with program goals? Does the program track the career progression of its graduates? *The alumni survey currently underway will provide additional data for this area, and future alumni surveys may be used to track career progression. From ongoing contacts we believe the following*

*is true for our 13 alumni: six are consulting engineers in private practice, one is a Director of Public Works for a city, one is a Director of Engineering for a sanitary district, one is an environmental engineer for a water and wastewater agency, one is an environmental engineer for a county public works department, one is an environmental engineer for a major petroleum company, one is an environmental engineer for a state regulatory agency, and one works for a lighting firm.*

- I. Overall Analysis of the Self-Study and the State of the Program: outline key findings from the self-study, including primary program strengths and challenges, and priorities the program has identified for improvement. *Overall, the program is strong. The direct assessment (see 2018 report attached), indicated all students assessed met or exceeded College of Engineering Master of Science learning objectives. Program alumni have leadership positions in the field of environmental engineering. We appear to be attracting and retaining a high percentage of women and other groups that are underrepresented in engineering. The program has healthy enrollment and generates positive cashflow. Priorities for improvement include maintaining or slightly increasing enrollment to the higher end of the goal (i.e., 12 students a year); adding the new 1-credit biological process modeling course, convening the external advisory committee to recommend at least one more 1-credit course in a contemporary area of environmental engineering, and gathering better program assessment data by encouraging participation in exit surveys and alumni surveys.*

## **Additional Considerations for Graduate Students**

J. Funding

*Discuss the program's student funding data and mechanisms, along with any goals for providing funding guarantees. Include a discussion of funding issues, such as:*

- How is the program ensuring PhD students have adequate funding and taking steps to provide a multi-year funding guarantee upon admission? Are there opportunities for graduate students to secure individual extramural support? What efforts are made to ensure PhD students have funding? *Not applicable; the program does not have PhD students.*
- To what extent is the program making use of funding for diversity efforts? *We are not aware of any available UW-Madison funding for students in the program. We have purchased a number of application fee waivers that can be used for students in need at the discretion of the Program Director.*

K. Professional Development and Breadth

*Discuss the professional development opportunities of graduates and consider the following:*

- How does the program encourage students to participate in professional development opportunities that will enhance their skills and support their career goals? *The environmental engineering "capstone" design course, CivEngr 823, addresses this topic during one of the units. Professional mentors are assigned to each student team in this course, and the mentors can also reinforce professional development opportunities. Students are also required to view and report on at least one seminar on professional development and lifelong learning as part of CivEngr 929. The Program Director has distributed information about ISI Envision, the Water Environment Federation, on-campus seminars and opportunities for local online students,*

*and other information and resources to the students. This area may be assessed further once exit survey data are available.*

- What resources and guidance are available for exploring academic and/or non-academic careers? *The Grad Connections bi-Weekly for Online Students e-newsletter provides resources. The Program Director and other faculty have also provided advice, leads, and information to program students regarding career options and opportunities.*
- How is the program using Individual Development Plans, which are recommended for all graduate students and required for those with NIH funding? *Students in the program do not have NIH funding. Students are asked to work with the Program Director to develop an individualized course plan for themselves as described previously.*
- What opportunities and funding are available to attend and present at professional meetings? *No funding is available through the UW-Madison or the program for this purpose; however, some of the program students are funded by their employers to attend and present at professional conferences. One student worked with adjunct professors in the program to develop an abstract, presentation, and peer review response as part of an independent study effort.*
- To what degree does the program offer teaching experience and teaching-related professional development to graduate students? *The program does not provide teaching experience to the online MEng EnvE students. However, teaching assistants from the CEE Department are regularly hired by program instructors to help with courses that have more than around 8 MEng EnvE students enrolled. Some of these TAs have gained experience teaching a class or giving a portion of a lecture, in addition to helping to answer questions in the online forum, grade assignments, and interact in other ways with the online program students.*
- How does the typical graduate's program ensure exposure to breadth training? Does the program require a doctoral minor for doctoral students or evaluate other breadth requirements? *MEng EnvE students are exposed to breadth during their graduate studies in various ways. In general, students take courses not only in their area of most interest, but also in other areas within the CEE department and in EPD. Students are also required to enroll in a seminar course (CivEngr 929), giving them exposure to a wide variety of topics through presentations by speakers of various backgrounds and expertise. All students take the "capstone" design course (CivEngr 823) and interact with mentors from the profession, and many students take a 1-credit or more course in mentored independent study (CivEngr 699). These two courses give students valuable experience in developing a project and in writing, communication, and formal presentation skills.*

# 5-Year Self-Study Report for Master of Engineering in Civil & Environmental Engineering – Environmental Engineering Named Option - FIGURES

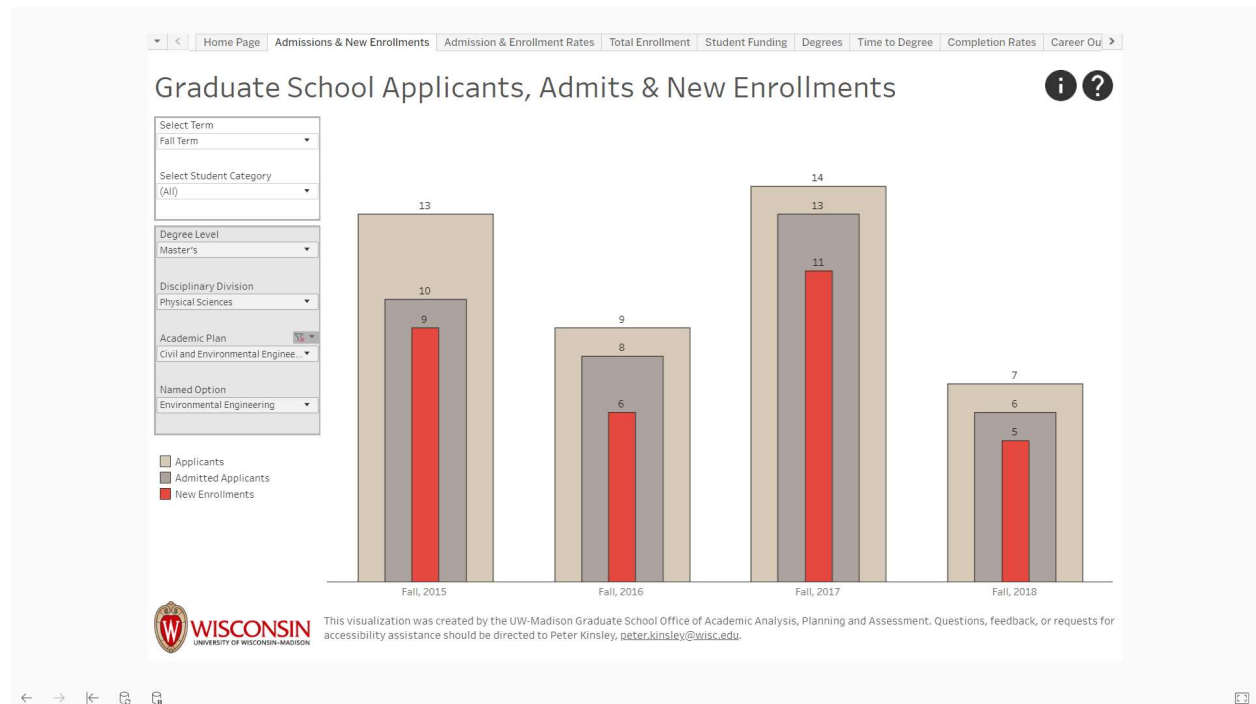


Figure 1 - Applicants, Admits, and New Enrollments for Fall Terms Since Program Inception

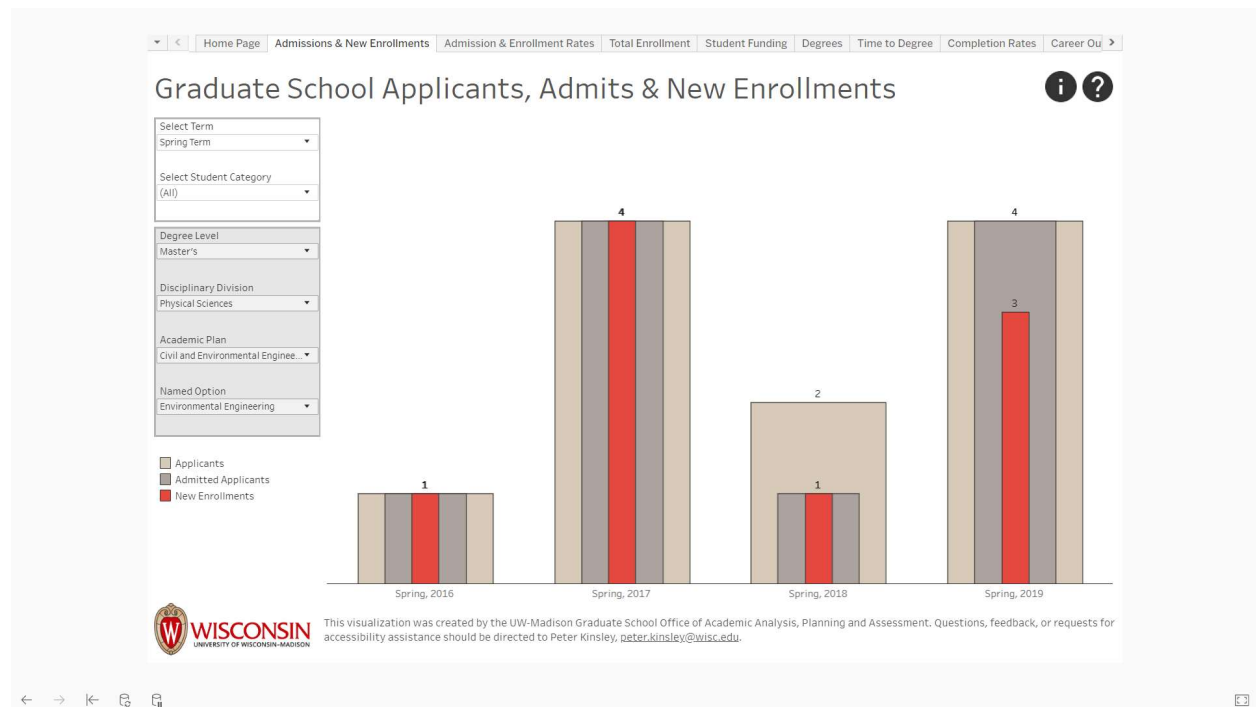


Figure 2 - Applicants, Admits, and New Enrollments for Spring Terms Since Program Inception

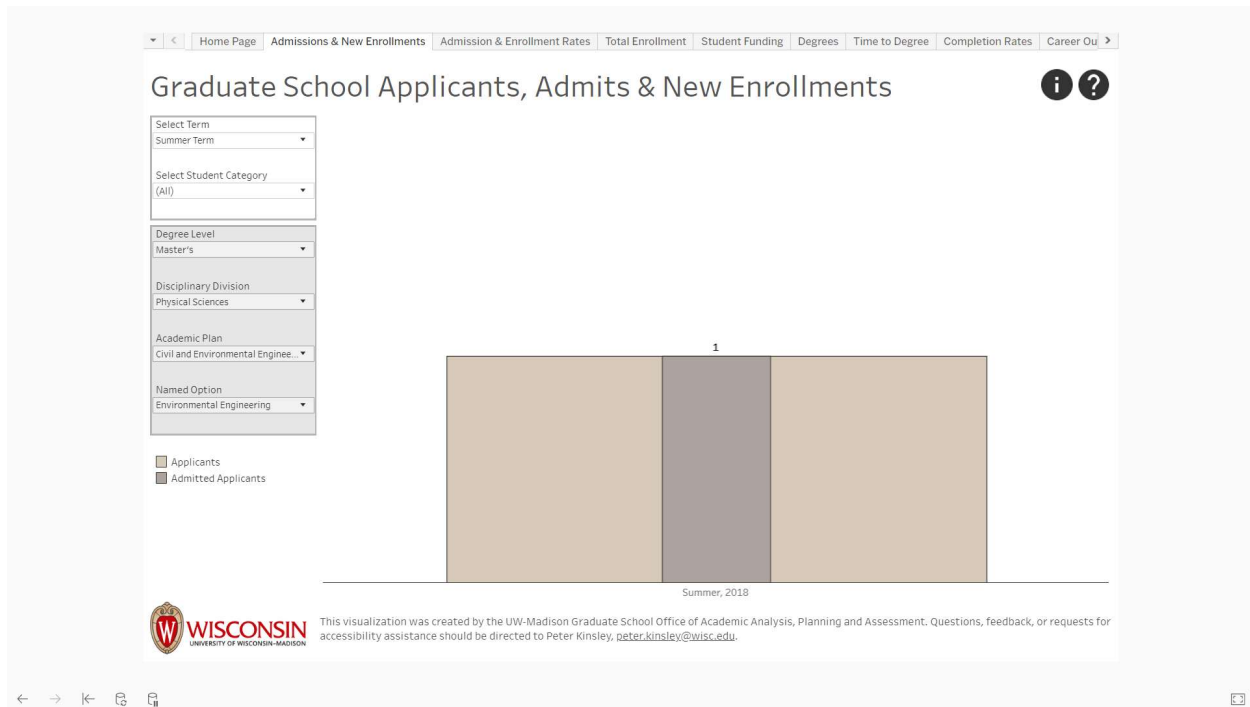


Figure 3 - Applicants, Admits, and New Enrollments for Summer Terms Since Program Inception

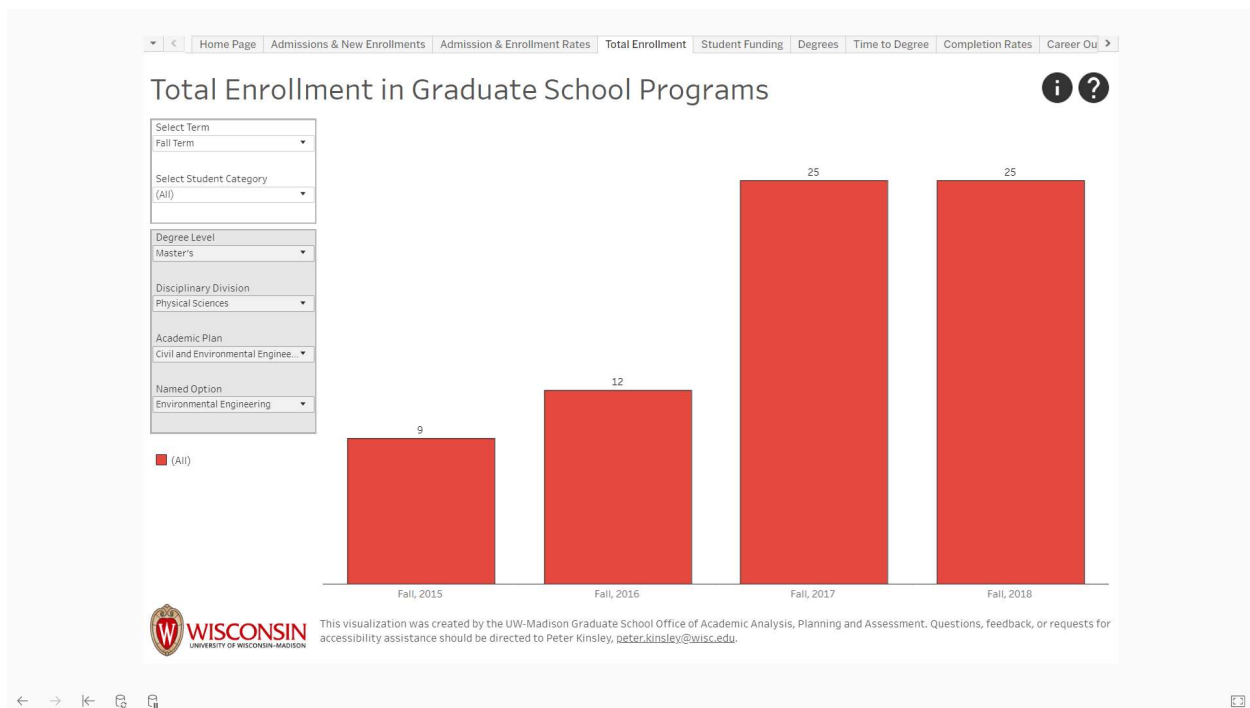


Figure 4 – Total Enrollment in Fall Terms Since Program Inception

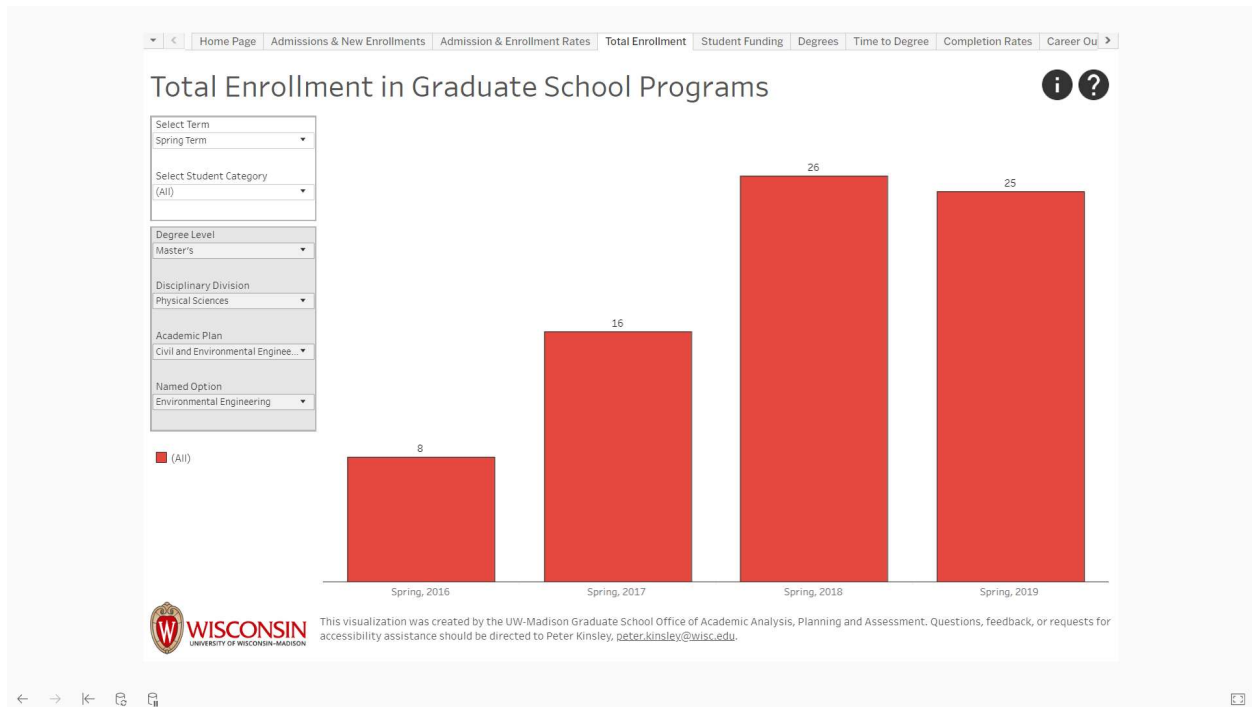


Figure 5 – Total Enrollment in Spring Terms Since Program Inception

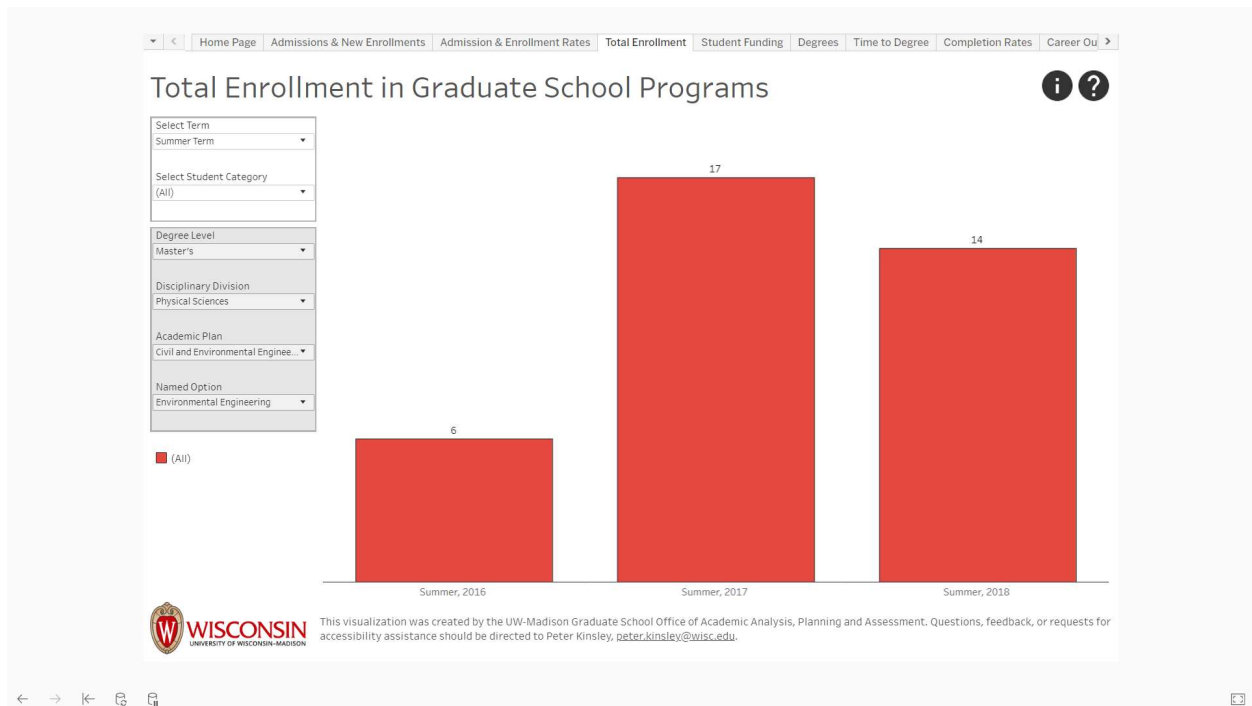


Figure 6 – Total Enrollment in Summer Terms Since Program Inception

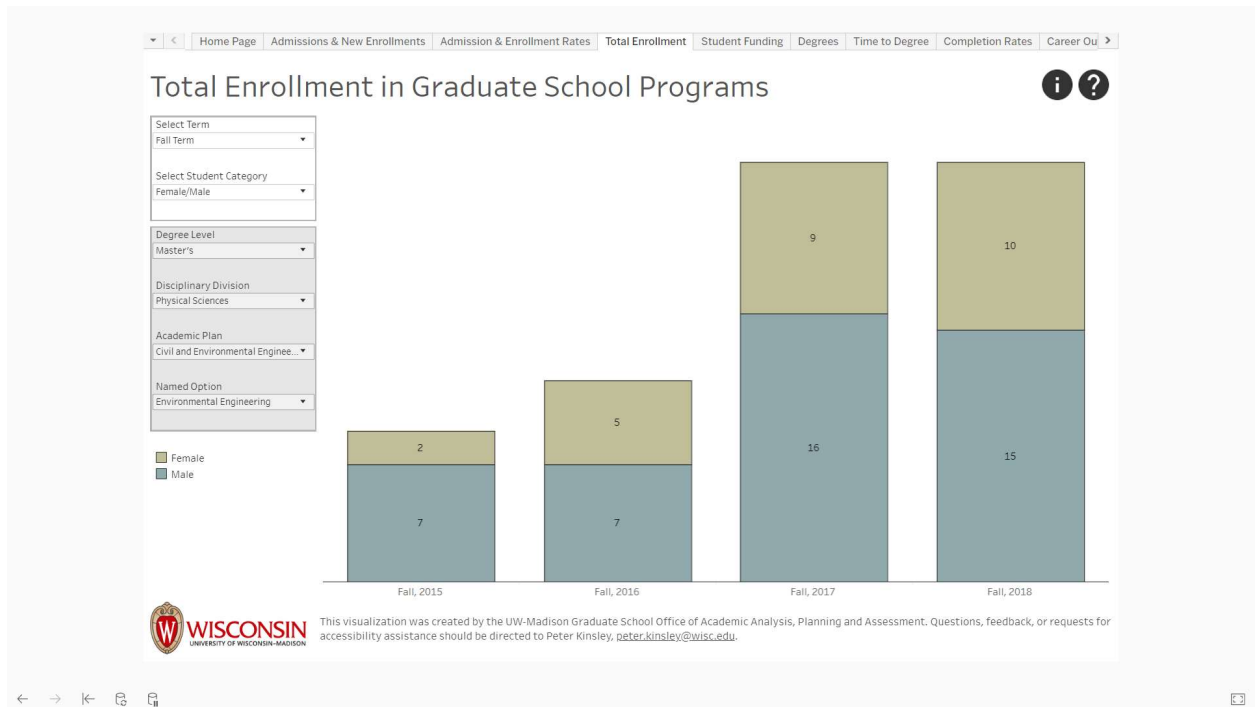


Figure 7 – Female and Male Students in Program Since Program Inception – Fall Terms

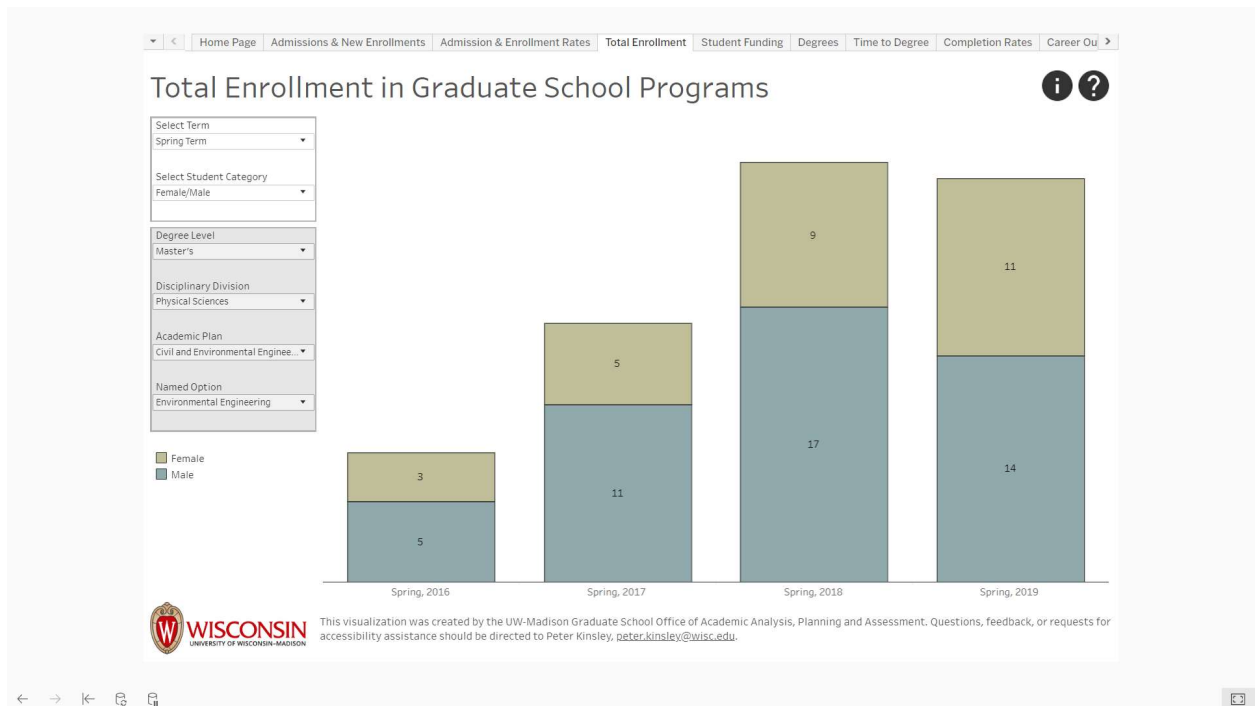


Figure 8 – Female and Male Students in Program Since Program Inception – Spring Terms

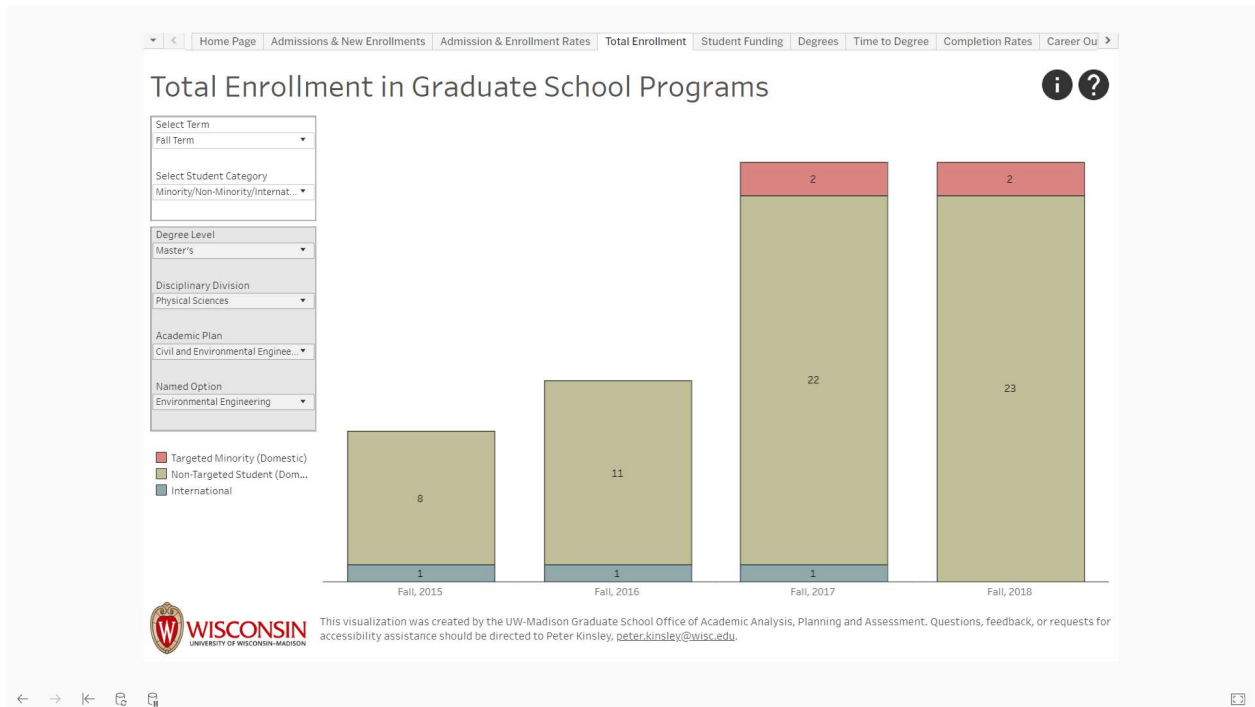


Figure 9 – Minority Students in Program Since Program Inception – Fall Terms

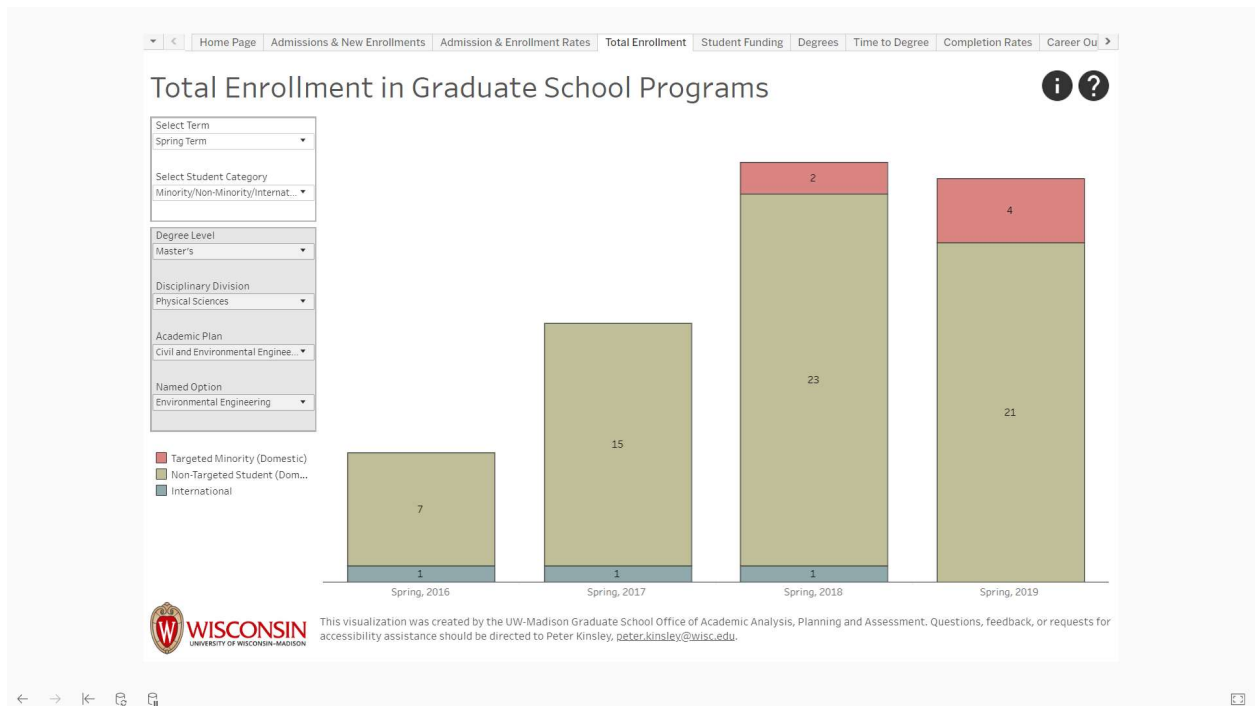


Figure 10 – Minority Students in Program Since Program Inception – Spring Terms

**Annual Assessment Report** **Master of Engineering, Civil and  
Worksheet** **Environmental Engineering,  
October 23, 2018** **Environmental Engineering Option**

This assessment report worksheet is meant to aide in documenting the systematic approach to reviewing the student learning experience for your academic program. *Use this worksheet to gather, organize and pre-record content for your report prior to completing the online submission form.* A simple, straightforward assessment report includes:

- **What** – What are students expected to learn?
- **Where** – Where in the curriculum are students expected to learn and apply the knowledge and skills specified as the learning goals?
- **How** – How do program faculty know (what is the evidence) that students are learning what they expect them to?
- **So What** – Faculty review the assessment activity findings to determine if students are meeting the expectations and identify ways to improve the program, if necessary.

Note: Responses are provided in red text.

---

**Demographic Information**

- Please provide your name.  
Michael D. Doran
  - Please provide your administrative unit.  
Civil and Environmental Engineering
  - Please provide your email address.  
michael.doran@wisc.edu
  - If you are not an Academic Unit Chair (or Director of Graduate Studies) – that is, you have been designated by the Chair or DGS – please provide which Academic Unit Chair or DGS has designated you.  
David Noyce, Chair of Civil and Environmental Engineering (CEE)
  - Please select the academic year.  
✓ AY 2017-18
-

### **Assessment Activities**

1. Which program learning outcomes were assessed?

*A list of program learning outcomes as they appear in the Guide will be provided. Select the “+” icon to the right of a learning outcome if the assessment activity being described applies to multiple learning outcomes.*

*The following program learning outcomes were assessed:*

1	<i>Demonstrate a Strong Understanding of Mathematical, Scientific, and Engineering Principles in the Field.</i>
2	<i>Demonstrate an Ability to Formulate, Analyze, and Independently Solve Advanced Engineering Problems.</i>
3	<i>Apply the latest Scientific and Technological Advancements, Advanced Techniques, and Modern Engineering Tools to these Problems.</i>
4	<i>Recognize and Apply Principles of Ethical and Professional Conduct.</i>

*These are the programmatic learning outcomes for Master of Science (MS) engineering programs as drafted by the College of Engineering. Although this program is a Master of Engineering Program, the MS learning outcomes are used for assessment, as the program was developed to meet MS learning outcomes, and since CEE has been seeking a name change for the program from MEng to MS through the Graduate School.*

2. What type of assessment was conducted? (select one)

*Select either direct assessment or indirect assessment. You may opt to select both. You will be asked to provide information for each assessment activity conducted.*

- Direct Assessment  
*Examples of direct assessment include: embedded questioning, capstone assignments evaluated with rubrics, standardized testing, portfolio reviews, etc.*
- Indirect Assessment  
*Examples of indirect assessment include: use of institutional data such as the NSSE, Master’s and Doctoral Exit survey, course evaluation responses, surveying alumni or graduating students, etc.*

*A Direct Assessment was conducted.*

3. How many students were assessed?

*Enter a whole number.*

*15 students were assessed.*

4. Please provide a brief description of how the assessment was conducted.

*Include: who was involved in the administration of the assessment activity,*

*who was assessed (description of the students), and what was assessed (student work or survey analysis).*

The assessment was performed with the aid of professional engineers that served as team mentors for student teams in CivEngr 823 (Environmental Engineering Design Project), Spring 2018. There were four mentors and four student teams. Each mentor completed a comprehensive rubric for assessing student performance in meeting the program learning outcomes. This was based on written documents prepared by the student teams, formal project presentations made by the student teams, and informal presentation and discussion during class time. Scores assigned to each area of the comprehensive rubric were then averaged and mapped to the four overall learning outcomes above.

5. Optional: Include any instruments/rubrics/scoring guides.  
*Upload your .pdf, .xlsx, or .docx document.*
6. What percentage of students assessed met the criteria for this outcome?  
*Enter a number expressed as percent.*

*100% of students met or exceeded expectations.*

7. Briefly describe the analysis of the results of this assessment project.  
*Include: how the results were compiled and analyzed (faculty/staff involved in the process), how the results were disseminated to faculty/other stakeholders, what discussions occurred, what was seen in the data.*

The detailed professional engineering mentor rubrics were scored in each category as 4 (exceeds expectations), 3 (meets expectations), and 2 (does not meet expectations). A total of sixty-four scores given by each mentor were thus compiled and averaged, with the average scores mapped to the four outcomes (above). The compiled averages for each of the four overall outcomes were obtained as:

1	<i>Demonstrate a Strong Understanding of Mathematical, Scientific, and Engineering Principles in the Field.</i>	3.45
2	<i>Demonstrate an Ability to Formulate, Analyze, and Independently Solve Advanced Engineering Problems.</i>	3.46
3	<i>Apply the latest Scientific and Technological Advancements, Advanced Techniques, and Modern Engineering Tools to these Problems.</i>	3.59
4	<i>Recognize and Apply Principles of Ethical and Professional Conduct.</i>	3.00

Professor Doran initially compiled this information. Professor Harrington provided input to the assessment methodology. Professors Noguera and

Carlson reviewed the methodology and results. Following review and discussion among the degree program executive committee, the results were finalized. Professors Carlson and Doran are Adjunct Professors, and Professors Harrington and Noguera are Professors in CEE.

These results appear to demonstrate that the program students are most proficient in applying scientific and technological advancements and modern engineering tools; and demonstrate a strong understanding of mathematical, scientific and engineering principles; and also have the ability to formulate, analyze and independently solve engineering problems. The students just met expectations in the recognition and application of ethical principles and professional conduct.

In reviewing the detailed assessment information provided by the CivEngr 823 mentors, the students were not able to clearly demonstrate their understanding and capabilities in two areas because of course content limitations:

- a. design and implementation of data collection programs, and evaluation of results
  - b. demonstration of understanding of the need for and a commitment to lifelong learning.
8. Based on the results, are there any recommendations to improve students' achievement of the learning outcomes? If so, include expected timeline for action.

Based on the 2017-2018 assessment, it is recommended that strategies be put in place to:

- a. Demonstrate skills in the design and implementation of experimental and other data collection programs, and evaluation of results. This could be accomplished by including an experimental design and evaluation task within the environmental engineering design projects in CivEngr 823 or in other core program courses.
- b. Better demonstrate student understanding of the need for and a commitment to professionalism and lifelong learning. This could be accomplished by adding an appropriate student assignment within CivEngr 823 or CivEng 929 (Environmental Science and Engineering Seminar).

CivEngr 823, a required course, could be modified for AY 2019-2020 to include a project scope element that requires development of an experiment or other data collection program, and inclusion of the analysis of results into the project design. This will require careful coordination between the course instructor and the team mentors to include relevant tasks in the project

scope descriptions. Alternatively, other core program course(s) could be modified to incorporate this component.

CivEngr 929, a required course, should be modified for Spring 2019 to include student reading of selected article(s), or viewing of selected recorded presentation(s), on the need for professionalism and lifelong learning, with preparation of a short paper on these topics by the student. This outcome could be assessed in the future by means of indirect assessments (e.g., exit surveys).

9. If you would like to upload additional documentation, you may do so here. This is not required. Typical upload documents include assessment reports the program provides to their discipline-specific accrediting agency or professional organization.