

The University Senate of Michigan Technological University

Proposal 16-21

(Voting Units: Academic)

Establishment of a New Graduate Certificate in Resilient Water Infrastructure

Submitted by: Department of Civil and Environmental Engineering

1. Proposal Date:

May 15, 2020

2. Proposing Contacts and Department:

- Dr. Brian Barkdoll, Ph.D., PE, Department of Civil and Environmental Engineering, barkdoll@mtu.edu
- Dr. David Watkins, Ph.D., PE, Department of Civil and Environmental Engineering, dwatkins@mtu.edu
- Dr. Melanie Kueber-Watkins, Ph.D., PE, Department of Civil and Environmental Engineering, mkueber@mtu.edu
- Dr. Veronica Webster, Ph.D., PE, Department of Civil and Environmental Engineering vlweb@mtu.edu

3. Sponsor Department Approvals

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4. General Description and Characteristics of Program:

4.1 General Description of Certificate

This certificate includes 3 out of 4 courses (all online-ready now) that involve a treatment of aspects of infrastructure related to water, including dams, embankments, diversions, and cross drainage, levees, water distribution systems, sewer systems, and restoration of rivers to a more natural state.

5. Rationale for Certificate:

The skills gained here will be to design best management practices for water and sewer systems, stormwater and low impact development and stream restoration, water-related structures such as dams, embankments, diversions, and cross drainage as resilient

infrastructure issues become more prevalent in our society due to urbanization and climate change. This certificate will be offered online and will be available to anyone around the world. Both graduate students who want this stackable certificate towards an MS degree or working professionals who want to expand their skills to deal with flooding problems will benefit from this certificate. These courses currently draw significant numbers of MTU students and offering them as a certificate will increase these numbers even more. In addition, the certificate can attract working professionals who find working full time and getting an MS degree to be too cumbersome.

6. Related Programs:

California State University, Sacramento – Grad cert in Engineering Hydraulics, 12 credits,
<https://catalog.csus.edu/colleges/engineering-computer-science/engineering-civil/certificate-in-engineering-hydraulics/>

This certificate is longer and has many topics besides the topics given in the proposed degree.

University of Arizona, Hydraulics and Water Resources Engineering (Certificate), 12 credits
<https://grad.arizona.edu/catalog/programinfo/HWECRTG>

This certificate is longer and has many topics besides the topics given in the proposed degree.

Villanova, Urban Water Design and Dam Engineering, 12 credits

<https://www1.villanova.edu/villanova/engineering/departments/cee/graduate/certificates.html>

This certificate is focused more on urban settings, unlike the proposed certificate.

University of Colorado Denver, Water Resources Engineering for Urban Watershed Management Graduate Certificate, 12 credits

http://catalog.ucdenver.edu/preview_program.php?catoid=23&poid=6983&returnto=6399

This certificate is longer and has many topics besides the topics given in the proposed degree.

7. Projected Enrollments:

These courses exist already and have had about 10-15 students in them. Offering them all online and in a stackable certificate will make them more attractive and more easily accessible, especially since many international graduate students may be hesitant to come to the US and Michigan Tech due to recent events.

Semester	On-campus Enrollment	On-line Enrollment
Fall 2021	17	20
Fall 2022	20	25
Fall 2023	25	30
Fall 2024	30	35

8. Scheduling Plans:

No change in the regular scheduling of the existing courses is anticipated. Courses will be available online throughout the academic year and during summer semester.

9. **Curriculum Design:** The certificate is designed to be completed in 2 or 3 semesters. Students can start any semester, for increased flexibility.

Elective Coursework (9 credits, 3 out of the 4 listed courses for the certificate):

CEE 5507 Water Distribution and Wastewater Collection (3 cr., Spring)

[\(link to new Course Proposal\)](#)

Application of basic principles in civil and environmental engineering to the analysis and design of water distribution systems, wastewater collection systems, and their appurtenances.

CEE 5640 Stormwater Management and Low Impact Development (3 cr., Summer)

Design techniques for stormwater collection, conveyance, infiltration, and detention storage systems are discussed, both traditional stormwater management systems and newer approaches based on the philosophy of low impact development (LID) that seek not to alter the natural ecology of a site.

CEE 5650 Hydraulic Structures (3 cr., Fall)

[\(link to new Course Proposal\)](#)

Application of basic principles fluid mechanics in civil and environmental engineering to the analysis and design of hydraulic structures. Analysis of research on some topic of the course.

CEE 5665 Stream Restoration (3 cr., Spring)

Basic mechanics of the transport of sediments in natural systems, including tractive forces and geomorphic functions

10. Model Schedule Demonstrating Completion Time

The certificate is designed to be completed in 2-3 semesters. Students can take 1-2 courses in the spring semester and one course in the fall or summer semesters. All courses are currently online-ready. Students can start any semester as shown in the table below:

Option			
A	Fall: CEE5650 Hydraulic Structures	Spring: CEE5507 Water Distribution and Wastewater Collection OR CEE5665 Stream Restoration	Summer: CEE5640 Stormwater Low Impact Development
B	Fall: CEE5650 Hydraulic Structures	Spring: CEE5507 Water Distribution and Wastewater Collection AND CEE5665 Stream Restoration	
C	Spring: CEE5507 Water Distribution and Wastewater Collection OR CEE5665 Stream Restoration	Summer: CEE5640 Stormwater Low Impact Development	Fall: CEE5650 Hydraulic Structures
D	Spring: CEE5507 Water Distribution and Wastewater Collection AND CEE5665 Stream Restoration	Summer: CEE5640 Stormwater Low Impact Development	
E	Summer:	Fall: CEE5650 Hydraulic Structures	Spring:

	CEE5640 Stormwater Low Impact Development		CEE5507 Water Distribution and Wastewater Collection OR CEE5665 Stream Restoration
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11. Library and other Learning Resources

No library or other learning resources are required at this time.

12. Faculty Resumes

The following faculty will be supporting the program.

- Dr. Brian Barkdoll, Professor of Civil and Environmental Engineering
<http://www.cee.mtu.edu/barkdoll/>
- Dr. David Watkins, Professor of Civil and Environmental Engineering
<https://www.mtu.edu/cee/people/faculty-staff/faculty/watkins/watkins-cv.pdf>
- Dr. Melanie Kueber Watkins, Research Assistant Professor, Civil and Environmental Engineering
<https://www.mtu.edu/cee/people/faculty-staff/faculty/kueber-watkins/>
- Dr. Veronica Webster, Associate Professor of Civil and Environmental Engineering
<http://www.cee.mtu.edu/webster/>

13. Equipment

No additional equipment will be required.

14. Program Costs

Initial costs for offering the certificate will not incur additional costs. As online/remote instruction enrollment grows, the additional costs associated with instruction will be covered from tuition return from the students who are enrolled online.

15. Space

There are no new space requirements.

16. Policies, Regulations, and Rules

Not applicable

17. Accreditation Requirements

The proposed certificate will not seek additional accreditation.

18. Planned Implementation Date

Spring 2021

19. Assessment

The learning objectives of the Certificate are to:

1. Design resilient water infrastructure systems

20. Approval Process

Departmental Graduate Committee : May 15, 2020

Department: May 22, 2020

College of Engineering: June 9, 2020

Provost's Office and Deans' Council: June 17, 2020

Graduate School: June 23, 2020

Approved by the Senate:

Approved by the President: