

The University Senate of Michigan Technological University

Proposal 6-10

(Voting Units: Academic)

“GRADUATE CERTIFICATE IN SUSTAINABLE WATER RESOURCES SYSTEMS”

1. General description and characteristics of program.

We propose to establish a 15-credit graduate certificate entitled “Certificate in Sustainable Water Resources Systems.” The certificate program will be administered by the Michigan Technological University Center for Water and Society. Courses contributing to this certificate are currently offered by the Departments of Geological and Mining Engineering and Sciences, Civil and Environmental Engineering, Biological Sciences, Social Sciences, the School of Forest Resources and Environmental Science and the School of Business and Economics.

Students who complete this certificate will have a set of core competencies in understanding current water resource issues and develop an advanced understanding of the problems and new technology development in their field of expertise. This certificate will be useful to students in such fields as natural resource management, business and policy, environmental and civil engineering, geology and geological engineering, and environmental policy.

2. Rationale.

Students who complete this certificate will be able to demonstrate that they understand water resource management from an interdisciplinary perspective that includes policy, natural sciences, and applied sciences. Increasingly, water managers have to work effectively on problem solving that crosses disciplines. For instance, a community water resource management issue may involve the failure of multiple homeowner onsite wastewater systems causing lake eutrophication with negative impacts on fisheries. Solving this problem effectively necessitates an understanding of how to work effectively with the homeowners, communicate fisheries impacts, work within existing state law governing onsite wastewater management, and the technical dimensions of the wastewater systems in use. While no one individual is likely to have deep knowledge in every area, our certificate will give students literacy in multiple areas allowing them to absorb information outside of their core discipline.

3. Discussion of related programs within the institution and at other institutions.

No program like this proposed certificate program is offered at Michigan Technological University. Graduate certificates in similar fields are offered at the following institutions in the U.S.

Texas State University: Certificate in Water Resources Policy <http://www.geo.txstate.edu/degrees-programs/certificates/Certificate-in-Water-Resources-Policy.html>

This certificate program emphasizes water resources management and policy and apparently includes only minimal material on the biophysical aspects of water systems.

Stevens Institute of Technology: Water Resources Graduate Certificate

<http://www.stevens.edu/ses/wr/cert.html>

This certificate program emphasizes primarily physical hydrology and hydrologic engineering and apparently includes only minimal material on the human dimensions of water systems.

University of Arizona: Graduate Certificate in Water Policy <http://gcwp.arizona.edu/>

This certificate program emphasizes water resources law and policy and apparently includes only minimal material on the biophysical aspects of water systems .

University of Idaho: Water Resources Engineering Academic Certificate

<http://www.outreach.uidaho.edu/eo/ViewPage.aspx?pid=40>

This certificate program emphasizes primarily physical hydrology and hydrologic engineering and apparently includes only minimal material on the human dimensions of water systems

4. Projected enrollment.

We expect 10 individuals will enroll in this certificate program each year. At least initially, we expect that the individuals working toward the certificate will be students on the Michigan Tech campus and enrolled in post-baccalaureate degree programs. In the future, we will explore extending the certificate program to non-degree seeking students and course delivery via distance education, online, or at remote sites.

5. Scheduling plans (Extension, Evening, Regular).

All courses to be taken as a part of this certificate are regularly scheduled courses.

6. Curriculum design.

This certificate requires a total of 15 credits. Specific requirements for the certificate program include

- a) All students must take Water and Society Colloquium (UN5100, 1 credit).
- b) All students must take a hydrology course equivalent to the 3000 level or higher and worth at least three credits. This requirement can be fulfilled by courses listed in Table 1.

Table 1: Courses Suitable for Fulfilling Hydrology Requirement

Courses	Prerequisites	Credits	Offering
CE3620 Water Resources Engineering	(ENG 3200 or ENG 3507) & (MA 3710 or CE 3502)	4	Fall, Spring
CE3650 Hydraulics and Hydrology		3	Fall, Spring
FW 4370 Forest and Landscape Hydrology		3	Spring
GE 3850 Geohydrology		3	Fall

Table 1: Courses Suitable for Fulfilling Hydrology Requirement

Relevant courses completed by the certificate participant from other institutions prior to enrolling in the certificate program ^{a, b}

^a For example, the undergraduate institution attended by the certificate participant

^b Must be approved by Center for Water and Society Advisory Committee

- c) All students must take a minimum of one class from each of the three categories listed in Table 2. All classes taken to fulfill the requirements of the certificate, with the exception of the Water and Society Colloquium and the exceptions described in item c) above, must come from the list in Table 2. The courses that satisfy the hydrology requirement, described in item c) above, can be used to satisfy the requirement of taking minimum of one class from each of the three categories listed in the Table 2, if the course is taken at Michigan Tech, while the certificate participant is enrolled in the certificate program.
- d) A grade of B or higher in must be obtained in each of the courses taken to fulfill the certificate requirements.
- e) At least 9 of the total certificate credits must be at the 5000-level or higher.

Table 2: Certificate Courses and Corresponding Categories

Category	Courses	Prerequisites	Credits	Offering
Natural Systems	BL 4450 Limnology		4	Fall
	BL 5451 Aquatic Ecology		4	Fall ^b
	BL 5460 Advanced Ecology: Ecosystems		3	Spring ^a
	FW 4220 Wetlands		4	Fall
	FW 4370 Forest and Landscape Hydrology ^e		3	Spring
	FW 5115 Restoration Ecology		3	Spring ^c
Policy and Societal Systems & Economics	CE 4506 Application of Environmental Regulations and Pollution Prevention to Engineering Practice	CE 3501 or CE 3503	3	Spring
	EC 5640 Natural Resource Economics	EC 3001 or EC 3002 or EC 2001	3	Fall
	EC 5650 Environmental Economics	EC 3001 or EC 3002 or EC 2001	3	Spring
	SS 5100 Global Environmental Systems		3	Fall
	SS 5200 Environmental Decision-Making		3	Spring
	SS 5300 Environmental Policy and Politics		3	Fall
	SS 5350 Environmental Policy Analysis	SS 5200	3	Spring
	SS 5400 Sociology of the Environment		3	Fall

Category	Courses	Prerequisites	Credits	Offering
Physical Hydrology and Engineered Water Resources Systems	CE3620 Water Resources Engineering	(ENG 3200 or ENG 3507) & (MA 3710 or CE 3502)	4	Fall, Spring
	CE 4505 Surface Water Quality Engineering	CE 3501 or CE 3503	3	Fall
	CE 4507 Water Distribution and Wastewater Collection Design	CE 3501 or CE 3503	3	Spring
	CE 4508 Water and Wastewater Treatment	(ENG 3507 or ENG 3200) & (CE 3501 or CE 3503)	3	Fall
	CE 4620 River and Floodplain Hydraulics	CE 3620	3	Fall
	CE 4630 Stormwater Management and Low Impact Development	CE 3620	3	Spring
	CE 5502 Biological Treatment Processes		3	Fall, Spring
	CE 5503 Physical/Chemical Treatment Processes		3	Spring
	CE 5504 Surface Water Quality Modeling		3	Spring
	CE 5508 Biogeochemical Processes	CE 4501	3	Fall, Spring
	CE-CH 5509 Transport and Transformation of Organic Pollutants	CE 4501 or CH 3510	3	Fall ^d
	CE 5620 Stochastic Hydrology	MA 3710 and CE 3620	3	On demand
	CE 5661 - GIS Applications	CE 3620	3	On demand
	CE 5664 Water Resources Modeling	CE 3620	3	On demand
	CE 5665 Stream Restoration	CE 3620	3	On demand
	CE 5666 Water Resources Planning & Management	CE 3620 and (EC 3402 or ENT 3402 or EC 3400)	3	On demand
	GE 3850 Geohydrology		3	Fall
	FW 4370 Forest and Landscape Hydrology ^e		3	Spring
	GE 4800 Groundwater Engineering	GE 3850	3	On demand
GE 5850 Advanced Groundwater Engineering and Remediation		3	Spring	

^a Offered alternate years beginning with the 2000-2001 academic year

^b Offered alternate years beginning with the 2007-2008 academic year

^c Offered alternate years beginning with the 2004-2005 academic year

^d Offered alternate years beginning with the 2005-2006 academic year

^e FW 4370 can satisfy the course requirements from *either* the “Natural Systems” *or* the “Physical Hydrology and Engineered Water Resources Systems” categories, *but not both*.

7. New course descriptions.

UN 5XXX. Center for Water and Society Colloquium: 1 credit, spring. Seminar based class covers relevant, current topics in water resources. Objectives: (1) build towards a common literacy on water

resources issues; (2) identify areas of common interest among students and faculty with an eye towards potential areas of collaboration on research projects or other initiatives, in the area of water resources. Open to all graduate students and undergraduate students with permission of course instructor(s)

Course [Add Proposal Form](#) is attached.

8. Library and other learning resources.

No new library or other learning resources are required.

9. Computing Access Fee.

No additional computing access fee is required for students on campus and enrolled in post-baccalaureate degree programs at Michigan Technological University. In the future, as we explore extending the certificate program to non-degree seeking students and course delivery via distance education, online, or at remote sites, we will develop appropriate mechanisms for charging computer access fees.

10. Faculty resumes.

Resumes for the following faculty can be found at the Center for Water and Society web site: <http://www.mtcws.mtu.edu/participants3.html>. These faculty include the Director and members of the Advisory Committee for the Center for Water and Society, and have endorsed this proposal. Affiliations and research expertise are indicated for each faculty.

Nancy Auer, Department of Biological Sciences, Fish Biology, Zooplankton Ecology, Limnology, Conservation Biology

William Breffle, School of Business & Economics, Natural Resource Economics

John Gierke, Department of Geological & Mining Engineering & Sciences, Chemical Fate in the Environment, Remote Sensing for Hazard Mitigation

Kathleen Halvorsen, Department of Social Sciences, Sociology of Natural Resources, Natural Resource and Environmental Policy

Alex Mayer, Department of Civil & Environmental Engineering and Director, Center for Water and Society, Water Resources Management

Tom Pypker, School of Forest Resources and Environmental Science, Ecohydrology

Noel Urban, Department of Civil & Environmental Engineering, Environmental Geochemistry

11. Description of available/needed equipment.

No equipment is needed.

12. Program costs

The Center for Water and Society Colloquium will be team taught and rotated among the faculty participants in the Center for Water and Society. Deans of the Colleges and Schools participating in the Center for Water Society have assured that faculty time will be made available to teach the course (see attached memos).

13. Space.

No space is required.

14. Policies, regulations and rules.

The certificate will be administered by the Center for Water and Society Advisory Committee and the Graduate School. Changes to the certificate program must be approved by the Center for Water and Society Advisory Committee and the Dean of the Graduate School, except for substitutions for course requirements. Course requirement substitutions may be approved by the Director of the Center for Water and Society.

This certificate program will follow current (as of 12/1/08) Michigan Technological University regulations for graduate certificates.

All coursework counted towards the certificate must be completed with a grade of “B” or better.

15. Accreditation requirements.

No accreditation is required.

16. Internal status of the proposal.

Proposal has been reviewed by Center for Water and Society Advisory Committee and the Dean of the Graduate School.

17. Planned implementation date

As soon as approved.

[Supporting Letter from Deans](#)

Introduced to Senate: 21 October 2009

Adopted by Senate: 04 November 2009

Approved by Administration: 06 November 2009