

DEPARTMENT OF WATER RESOURCES MANAGEMENT

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The Department of Water Resources Management offers programs in Environmental Engineering (ENE) and Water Resources Management (WRM). In addition to its primary role of offering baccalaureate programs, the department also offers continuing education opportunities for practicing professionals in the field of water resources management and environmental engineering. The department engages in research and in outreach activities to attract high school students to pursue higher education in these fields.

The programs in the department lead to Bachelor of Science degrees in Environmental Engineering and Water Resources Management. They are structured to provide students with the knowledge of diverse aspects of these interdisciplinary fields. An internship is a requirement in environmental engineering and water resources management.

DEGREE REQUIREMENTS

A total of 129 semester hours are required for the B.S. degree in environmental engineering with a grade-point average of at least 2.0 in the major concentration.

A total of 120 semester hours are required for the B.S. degree in water resources management with a grade-point average of at least 2.0 in the major concentration.

GENERAL EDUCATION REQUIREMENTS FOR PROGRAMS IN THE DEPARTMENT

The University General Education Requirements apply to the WRM majors (please refer to the General Education Requirements in the University Course catalog). Students in WRM and ENE automatically fulfill the natural science requirements under general education by taking their major requirements.



ENVIRONMENTAL ENGINEERING (B.S.) PROGRAM –MISSIONS, GOALS, AND PROGRAM EDUCATIONAL OBJECTIVES

The Bachelor of Science (B.S.) degree program in Environmental Engineering is dedicated to undergraduate environmental engineering education and is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET), <https://www.abet.org>.

Environmental Engineering Mission

The overarching mission of the program is to prepare engineers who specialize in the field of environmental systems at the baccalaureate level and who understand how to apply engineering principles to solve water resources and environmental problems and harness renewable energy while maintaining the integrity of the ecosystem. The program offers opportunities for students to gain additional knowledge in related areas such as policy, economics, and legal aspects of environmental issues, and geospatial and sensor technologies as applied to environmental problems.

The specific goals of the program are:

1. To impart knowledge of planning, designing, operating, and optimally managing systems essential for human health and biodiversity. Such systems are designed for the abatement and control of pollution of ecosystems comprising air, water, and soils in residential, occupational, city, and regional environments.
2. To provide education in the application of environmental engineering principles for environmental processes and systems at localized and distributed scales.
3. To provide training in the applications of principles to practical environmental problems.
4. To introduce the concepts of sustainable energy development and energy recovery from waste.

The ENE program expects the graduates within a few years of graduation to attain the following five specific **Program Educational Objectives (PEOs)**:

1. Be employed as practicing engineers in environmental engineering or related fields (civil, chemical, ecological, or agriculture) and satisfy and exceed employers' expectations;
2. Develop professionally through the attainment of licensure, or through enrolling in or completing advanced studies in engineering or engineering management;
3. Attain progressive management or leadership positions through professionalism and adherence to engineering code, ethics, and responsibilities;
4. Contribute to the sustainable development of civil, process, and industrial infrastructures through natural resource conservation, environmental preservation and protection, and economic and environmental stewardship;
5. Make a positive impact on the environment, public health, and wellness of global society.

ENVIRONMENTAL ENGINEERING (ENE) CURRICULUM

The curriculum relies on a strong foundation in sciences and mathematics by requiring students to take courses in rigorous college physics (calculus-based), chemistry, and mathematics to advanced levels of differential equations and linear algebra. The program also promotes the holistic development of students through courses in humanities, and in social and behavioral sciences as required in the general education curriculum.

Students take general engineering courses such as Engineering Computer Graphics, Statics, Dynamics, Strength of Materials, and other courses from the manufacturing engineering department (MFE). With this set of basic science and engineering courses, the program then provides a background in Applied Hydraulics, Wastewater Treatment Systems, Solid and Hazardous Waste Management, Air Quality Engineering, and other engineering-based courses. There is an internship requirement and students engage in a capstone project during the final year. The C. J. Mc Lin International Center for Water Resources Management, which houses the WRM Department, has excellent laboratory equipment in the areas of hydraulics, hydrology, water quality, and soils that are essential for the study of environmental engineering.

The department has faculty with expertise in the areas of air quality engineering, hydraulics, hydrology, solid waste management, water quality, water policy and regulations, economics, geography, and geology. The uniqueness of the Environmental Engineering (ENE) program at CSU is the availability of interdisciplinary courses within the Water Resources Management (WRM). These courses cover important issues in water, such as policy, socio-economic impact,

environmental regulations, and GIS. The program directly serves the university's land-grant mission by preparing students towards careers in civil engineering, environmental engineering, and hydrology in Agriculture both in public and private sectors.

The Environmental Engineering majors can pursue minors in nuclear engineering or approved minors in other programs.

Student Outcomes for ENE Curriculum

To achieve the program educational objectives, the environmental engineering program at CSU has adopted the following seven ABET student outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Core Competencies for ENE Graduates

The environmental engineering curriculum provides students with the following competencies upon successful completion of the program:

1. Application of mathematics, physics, chemistry, hydraulics, and engineering for finding solutions for environmental problems.
2. Problem-solving skills by using mathematical, logical, analytical, and algorithmic constructs.
3. Effective communication with peers as well as the general public through reading, speaking, and writing skills.
4. Capability to use technology tools in planning, design, operation, and management of environmental engineering systems and in the assessment of spatially distributed problems using geospatial tools such as GIS and remote sensing.

5. Ability to use appropriate laboratory and field instrumentation needed in environmental engineering work.
6. Understanding and appreciation of the need for accuracy in professional judgment, accountability, ethics, and social responsibility.
7. The necessity to continuously update skills in the environmental engineering profession. The coursework, laboratory experiences, fieldwork, summer internship, and a capstone design project are used to teach these competencies to hydraulic and environmental engineering students.

Curriculum details are provided as part of the degree requirements.

WATER RESOURCES MANAGEMENT (WRM) PROGRAM

The Bachelor of Science in Water Resources Management, a program that was one of the first of its kind in the nation, educates students in the interrelationships of the technical, social, political, and economic aspects of the field. The objective of the program is to provide students with educational skills and background necessary for the positions in water resources management in private industry, government, and nongovernmental organizations. The program directly serves the university's land-grant mission by preparing students towards careers in water-related fields in Agriculture such as soil and water conservation with the U.S. Department of Agriculture. Water resources management is intertwined with the environmental field and the curriculum offers courses that enable students to gain a background in this field as well.

As the population expands and pressure on development increases, the need for water resources management professionals is felt at the state, national and international levels. The program responds to the critical need for water resources professionals who have an understanding of all phases of water resources management within the agriculture and municipal sectors. These professionals help to identify the most effective solutions to water resources management problems, involving both technical and non-technical aspects. The curriculum emphasizes environmental subjects such as soil and water conservation, water chemistry, streams and lakes, and urban water problems. Many graduates of the program have progressed further by obtaining graduate degrees in specialized fields such as public works management and water resources/environmental engineering. The curriculum has been enhanced to include water resources management within the industry in general and particularly in shale based oil and gas energy development.

MINORS

Two options are available in the Department of Water Resources Management for those students interested in pursuing a minor in related fields.

Minor in Environmental Science

In collaboration with the Department of Agricultural and Life Sciences, the Department of Water Resources Management offers an interdisciplinary minor in Environmental Science. This minor will be particularly helpful to students majoring in Biology, Chemistry, Sustainable Agriculture, Water Resources Management, or Environmental Engineering, who are seeking a career in environmental fields.

Requirements for this minor include a total of 26 credit hours with 17 credit hours of core courses BIO 1500, 3500 (7 Credit hours); CHM 2200 (3 credit hours) WRM 2200, and 3330 (7 credit hours) and 9 credit hours from elective courses BIO 2000, BIO 2050, 2650, 4200, 4300; CHM 2401, 2402, 4200, 4300; GEL 2205; MTH 2001; WRM 3306, 3308, 3310, 3370, and 4470 Students are expected to familiarize themselves with the prerequisites required for each course. A grade of "C" or better is required.

Minor in Water Resources Management

A minor in Water Resources Management is designed for students from other areas who desire knowledge in the field as it pertains to their major.

Requirements for this minor include a total of 20 credit hours with 14 credit hours of core courses WRM 2200, 3330, 3335, 4402, and a minimum of 6 credit hours of elective courses from other WRM courses. Students are expected to familiarize themselves with the prerequisites required for each course. A grade of "C" or better is required.

BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING — ENG 1100 or ENG 1101, ENG 1102 (8|9 credit hours); USS 1000 (2 credit hours); 12 credit hours from Social and Behavioral Sciences and Humanities Electives with two courses per each including HIS 1110| HIS 1121| HIS 1122| PSY 1200| SOC 1105 and WRM 3370.

All students must take the following major requirements: ENE 2200, 3305, 3309, 3315, 3320, 3325, 4405, 4415, 4430, 4425, 4440, 4496 and 4498 (total of 34 credit hours); WRM 3308 (3 credit hours), Internship ENE 4596 (3 credit hours); and coursework from related areas with following distribution: INT 1210 (3 credit hours), INT 3650 (3 credit hours), MFE 1210, 2310, 2420, 3530, 3550 (15 credit hours); CHM 1201, 1202 (8 credit hours); GEL 1101 (4 credit hours); PHY 2411 and 2412 (10 credit hours); MTH 2001, 2502, 2503, 3002, 3110 (20 credit hours) and BIO 2650 (4 Credit Hours). Students must earn a grade of “C” or better in their ENE courses.

**SUGGESTED CURRICULUM FOR THE DEGREE, BACHELOR OF SCIENCE
MAJOR IN ENVIRONMENTAL ENGINEERING**

The curriculum below is to be used in consultation with an academic advisor. The student must be familiar with the University requirements, the General Education Requirements, and any Special Requirements for the above degree.

FALL SEMESTER			SPRING SEMESTER		
COURSE #	TITLE	CREDIT HRS	COURSE#	TITLE	CREDIT HRS
FRESHMAN			FRESHMAN		
CHM 1201	General Chemistry I	4	CHM 1202	General Chemistry II	4
ENG 1101	Introduction to Writing for College	4	ENG 1102	Writing and Research the Essay	4
USS 1000	Undergraduate Success Seminar	2	MFE 1210	Engineering Analysis I	3
INT 1210	Engineering Computer Graphics	3	MTH 2503	Calculus II	5
MTH 2502	Calculus I	4			
		17			16
SOPHOMORE			SOPHOMORE		
ENE 2200	Intro to Environ Engineering	3	INT 3650	Surveying	3
CORE	HIS 1110 21 22 PSY 1200 SOC 1105	3	MTH 2001	Probability & Statistics I	3
MFE 2310	Statics	3	MFE 2420	Dynamics	3
MTH 3110	Differential Equations	4	GEL 1101	Physical Geology	4
PHY 2411	University Physics I w/ lab	5	PHY 2412	University Physics II w/ lab	5
		18			18
JUNIOR			JUNIOR		
ENE 3305	Fluid Mechanics and Hydraulics	3	ENE 3315	Air Quality Engineering	3
ENE 3309	Water Chemistry	3	ENE 3320	Engineering Hydrology	3
MFE 3530	Strength of Materials	3	ENE 3325	Groundwater Hydraulics	3
MFE 3550	Thermodynamics & Heat Transfer	3	MTH 3002	Calculus III	4
WRM 3370	Introduction to GIS (used for List C)	3	BIO 2650	Microbiology	4
		15			17
SENIOR			SENIOR		
ENE 4415	Water Supply	3	BRIDGE	From General Education List B	3
ENE 4440	Environmental Prof. Seminar	1	ENE 4405	Applied Hydraulics	3
ENE 4596	Internship ENE	3	ENE 4430	Wastewater Treatment Systems	3
ENE 4496	Senior Capstone Design Project I	1	ENE 4498	Senior Capstone Design Project II	2
BRIDGE	From General Education List B C	3	WRM 3308	Environmental Law	3
ENE 4425	Solid and Hazard. Waste Mgmt.	3			
		14			14

Minimum hours needed to obtain a Bachelor of Science in Environmental Engineering – 129

BACHELOR OF SCIENCE IN WATER RESOURCES MANAGEMENT — ENG 1100 or ENG 1101, ENG 1102; MTH 1750 or STEM MTH; USS 1000; HHP 1101-1121; 12 credit hours from Social and Behavioral Sciences and Humanities Electives with two courses per each including HIS 1110| HIS 1121| HIS 1122| PSY 1200| SOC 1105.

All students must take the following major requirements: WRM 2200, WRM 3302, WRM 3308, WRM 3310, WRM 3330, WRM 3335, WRM 3340, WRM 3370, WRM 4402, WRM 4470, WRM 4495 (total of 33 credit hours), ENE 3309, WRM 4596 (Internship - 3 credit hours); electives from WRM|ENE|AGR|BIO (a total of 20 credit hours with a minimum of 10 credit hours from WRM electives); and coursework from related areas: BIO 1500, BIO 2050 (7 credit hours); CHM 1201, CHM 1202 (8 credit hours); GEL 1110, GEL 2205 (6 credit hours); MTH 2001, MTH 2500|2501 (7|6 credit hours); PHY 2611, PHY 2612 (8 credit hours). Students must earn a grade of “C” or better in their WRM courses.

SUGGESTED CURRICULUM FOR THE DEGREE, BACHELOR OF SCIENCE 3MAJOR IN WATER RESOURCES MANAGEMENT

The curriculum below is to be used in consultation with an academic advisor. The student must be familiar with the University requirements, the General Education Requirements, and any Special Requirements for the above degree.

FALL SEMESTER			SPRING SEMESTER		
COURSE #	TITLE	CREDIT HRS	COURSE#	TITLE	CREDIT HRS
FRESHMAN			FRESHMAN		
ENG 1101	Introduction to Writing for College	4	BIO 1500	Environmental Science w/ lab	4
USS 1000	Undergraduate Success Seminar	2	ENG 1102	Writing and Research the Essay	4
CORE	HIS 1110 21 22 PSY 1200 SOC 1105	3	MTH 2001	Probability & Statistics I	3
MTH 1750	College Algebra	3	MTH 2501	Trigonometry	3
WRM 2200	Introduction to WRM	3	ELECTIVE	From General Education List B C	3
		15			17
SOPHOMORE			SOPHOMORE		
CHM 1201	General Chemistry I	4	ELECTIVE	From General Education List C	3
BIO 2050	Biology of the Environment w/ lab	3	CHM 1202	General Chemistry II	4
HHP 1xxx	HHP Activity (List A)	1	PHY 2612	College Physics II	4
PHY 2611	College Physics I	4	WRM 3302	Water Resources Policy	3
ELECTIVE	From General Education List B	3	WRM 3308	Water and Environmental Law	3
		15			17
JUNIOR			JUNIOR		
ENE 3309	Water Chemistry	3	GEL 2205	Environmental Geology	3
GEL 1110	Oceanography	3	WRM 3310	Streams and Lakes	3
WRM 3311	Water Resources Economics	3	WRM 3335	Irrigation and Drainage	3
WRM xxxx	WRM ENE Elective 1	1	WRM 4596	Internship (Summer Term)	3
WRM3370	Introduction to GIS	3	WRM 3330	Soil and Water Conservation	4
WRM xxxx	WRM ENE AGR BIO Elective 1	2			
		15			16
SENIOR			SENIOR		
WRM xxxx	WRM ENE Elective 2	1	WRM 3340	Hydrometry	2
WRM xxxx	WRM ENE AGR BIO Elective 2	3	WRM 4470	Applied Remote Sensing	3
WRM4402	Urban Water Problems	4	WRM 4495	Senior Capstone Project in WRM	2
WRM xxxx	WRM ENE AGR BIO Elective 3	4	WRM xxxx	WRM ENE AGR BIO Elective 4	3
		12			13

Minimum hours needed to obtain a Bachelor of Science in Water Resources Management - 120