WATER SCIENCE

Description

Website: http://snr.unl.edu/undergrad/majors/water

The degree program in water science is designed to educate students in basic and applied sciences related to water resources. The goal is to educate individuals to gather and synthesize information from several disciplines, to formulate rational and broadly informed solutions to complex water related problems, and to effectively implement various water-based programs.

The curriculum is designed to meet the needs of students who intend to pursue careers in public and private organizations that conduct scientific water research or manage water resources, in private consulting companies that offer water research or management services, in agencies that form or implement water related policy, and in a broad range of nonprofit institutions that are interested in water resources. The program also provides students the opportunity to prepare for graduate study in water/hydrological sciences and water resources.

A minimum of 120 credit hours is required for the bachelor of science degree. Of these requirements, 43-48 credit hours are in an integrated water science curriculum designed to provide both breadth and depth in water resources. The water science degree program also requires 21 credit hours of science and mathematics. In addition, the student must select an option area consisting of approximately 18-26 credit hours. The option allows students to develop an individualized area of study. To complete the degree, the student must take 24 credit hours of communication, humanities, and social science courses.

Option areas include:

- Aquatic Ecology Option
- Hydrology Option
- Water Law and Policy Option
- Water Quality Option
- Watershed Management Option

Application for University of Nebraska–Lincoln freshman scholarships automatically makes you eligible for SNR scholarships. Many scholarships are available, including the Viessman Scholarship, specifically for students in water science. For more information, visit http://snr.unl.edu.

College Requirements

College Admission

Requirements for admission into the College of Agricultural Sciences and Natural Resources (CASNR) are consistent with general University admission requirements (one unit equals one high school year): 4 units of English, 4 units of mathematics, 3 units of natural sciences, 3 units of social studies, and 2 units of foreign language. Students must also meet performance requirements: ACT composite of 20 or higher OR combined SAT score of 950 or higher OR rank in the top one-half of graduating class; transfer students must have a 2.0 (on a 4.0 scale) cumulative grade point average and 2.0 on the most recent term of attendance. For students entering the PGA Golf Management degree program, a certified golf handicap of 12 or better (e.g., USGA handicap card) or written ability (MS Word file) equivalent to a 12 or better handicap by a PGA professional or high school golf coach is required. For more information, please visit: http://pgm.unl.edu/requirements.

Admission Deficiencies/Removal of Deficiencies

Students who are admitted to CASNR with core course deficiencies must remove these deficiencies within the first 30 credit hours at UNL, or within the first calendar year at Nebraska, whichever takes longer, excluding foreign languages. Students have up to 60 credit hours to remove foreign language deficiencies. College-level coursework taken to remove deficiencies may be used to meet degree requirements in CASNR.

Deficiencies in the required entrance subjects can be removed by completion of specified courses in the University or by correspondence.

The Office of Admissions, Alexander Building (south entrance), City Campus, provides information to new students on how deficiencies can be removed.

College Degree Requirements

Curriculum Requirements

The curriculum requirements of the College consist of three areas: ACE (Achievement-Centered Education), College of Agricultural Sciences and Natural Resources Core, and Degree Program requirements and electives. All three areas of the College Curriculum Requirements are incorporated within the description of the Major/Degree Program sections of the catalog. The individual major/degree program listings of classes ensures that a student will meet the minimum curriculum requirements of the College.

Foreign Languages/Language Requirement

Two units of a foreign language are required. This requirement is usually met with two years of high school language.

Minimum Hours Required for Graduation

The College grants the bachelors degree in programs associated with agricultural sciences, natural resources, and related programs. Students working toward a degree must earn at least 120 semester hours of credit. A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

Grade Rules

Removal of C-, D, and F Grades

Only the most recent letter grade received in a given course will be used in computing a student’s cumulative grade point average if the student has completed the course more than once and previously received a grade or grades below C in that course.

The previous grade (or grades) will not be used in the computation of the cumulative grade point average, but it will remain a part of the academic record and will appear on any transcript.

A student can remove from his/her cumulative average a course grade of C-, D+, D-, or F if the student repeats the same course at the University of Nebraska and receives a grade other than P (pass), I (incomplete), N (no pass), W (withdraw), or NR (no report). If a course is no longer being offered, it is not eligible for the revised grade point average computation process.
For complete procedures and regulations, see the Office of the University Registrar website at http://www.unl.edu/regrec/course-repeats.

**Pass/No Pass**

Students in CASNR may take any course offered on a Pass/No Pass basis within the 24-hour limitation established by the Faculty Senate. However, a department may specify that the Pass/No Pass status of its courses be limited to non-majors or may choose to offer some courses for letter grades only.

**GPA Requirements**

A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

**Transfer Credit Rules**

To be considered for admission, a transfer student, Nebraska resident or nonresident, must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who have completed less than 12 credit hours of college study must submit either ACT or SAT scores.

Ordinarily, credits earned at an accredited college are accepted by the University. The College, however, will evaluate all hours submitted on an application for transfer and reserves the right to accept or reject any of them. Sixty (60) is the maximum number of hours the University will accept from a two-year college. Ninety (90) is the maximum number of hours the University will accept from a four-year college. Transfer credit in the degree program must be approved by the degree program advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major. At least 9 hours in the major field, including the capstone course, must be completed at the University of Nebraska–Lincoln regardless of the number of hours transferred.

The College will accept no more than 10 semester hours of C, D+, D, and D- grades from other schools. The C, D+, D, and D- grades can only be applied to free electives. This policy does not apply to the transfer of grades from UNO or UNK to the University of Nebraska–Lincoln.

**Joint Academic Transfer Programs**

The College of Agricultural Sciences and Natural Resources has agreements with many institutions to support joint academic programs. The transfer programs include dual degree programs and cooperative degree programs. Dual degree programs offer students the opportunity to receive a degree from a participating institution and also to complete requirements for a bachelor of science degree in CASNR. Cooperative programs result in a single degree from either the University of Nebraska–Lincoln or the cooperating institution.

**Dual Degree Programs**

**A to B Programs**

The A to B Program, a joint academic program offered by the CASNR and participating community colleges, allows students to complete the first two years of a degree program at the participating community college and continue their education and study in a degree program leading toward a bachelor of science degree.

The A to B Program provides a basic knowledge plus specialized coursework. Students transfer into CASNR with junior standing.

Depending on the community college, students enrolled in the A to B Program may complete the requirements for an associate of science at the community college, transfer to the University of Nebraska–Lincoln, and work toward a bachelor of science degree.

**3+2 Programs**

Two specialized degree programs in animal science and veterinary science are offered jointly with an accredited college or school of veterinary medicine. These two programs permit CASNR animal science or veterinary science students to receive a bachelor of science degree from the University of Nebraska–Lincoln with a degree in animal science or veterinary science after successfully completing two years of the professional curriculum in veterinary medicine at an accredited veterinary school. Students who successfully complete the 3+2 Program must provide transcripts and complete the Application for Degree form via MyRED. Students without MyRED access may apply for graduation in person at Husker Hub in the Canfield Administration Building, or by mail. Students should discuss these degree programs with their academic advisor.

**Cooperative Degree Programs**

Academic credit from the University and a cooperating institution is applied towards a four-year degree from either the University of Nebraska–Lincoln (University degree-granting program) or the cooperating institution (non University degree-granting program). All have approved programs of study.

**UNL Degree-Granting Programs**

A University of Nebraska–Lincoln degree-granting program is designed to provide students the opportunity to complete a two-year program of study at one of the four-year institutions listed below, transfer to CASNR, and complete the requirements for a bachelor of science degree.

**Chadron State College.** Chadron State College offers a 2+2 program leading to a grassland ecology and management degree program and a transfer program leading to a bachelor of science in agricultural education in the teaching option.

**Wayne State College.** Wayne State College offers a 3+1 program leading to a bachelor of science in plant biology in the ecology and management option and a 3+1 program leading to a bachelor of science in Applied Science.

**University of Nebraska at Kearney.** Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

**University of Nebraska at Omaha.** The University of Nebraska at Omaha (UNO) cooperates with CASNR in providing four-semester pre-agricultural sciences, pre-natural resources, pre-food science and technology, pre-horticulture, and pre-turfgrass and landscape management transfer programs.
A student enrolled in these programs may transfer all satisfactorily completed academic credits identified in the suggested program of study and enter CASNR to study toward a degree program leading to a bachelor of science degree. The total program would require a minimum of four years or eight semesters (16 credit hours/semester or 120 credit hours).

Nebraska CASNR faculty teach horticulture and food science and technology courses at UNO to assist an urban population in better understanding the food processing, horticulture, and landscape horticulture industries.

For more information, contact the CASNR Dean's Office, 800-472-8800, ext. 2541.

Non University of Nebraska–Lincoln Degree-Granting Programs

CASNR cooperates with other institutions to provide coursework that is applied towards a degree at the cooperating institution. Pre-professional programs offered by CASNR allow students to complete the first two or three years of a degree program at the University prior to transferring and completing a degree at the cooperating institution.

Chadron State College—Range Science. The 3+1 Program in range science allows Chadron State College students to pursue a range science degree through Chadron State College. Students complete three years of coursework at Chadron State College and one year of specialized range science coursework (32 credit hours) at CASNR.

Dordt College (Iowa)—Agricultural Education: Teaching Option. This program allows students to pursue an Agricultural Education Teaching Option degree leading toward a bachelor of science in agricultural education. Students at Dordt College will complete 90 credit hours in the Agricultural Education: Teaching Option Transfer Program.

Residency

Students must complete at least 30 of the total hours for their degree using University of Nebraska—Lincoln credits. At least 18 of the 30 credit hours must be in courses offered through CASNR, including the appropriate ACE 10 degree requirement or an approved ACE 10 substitution offered through another Nebraska college and excluding independent study regardless of the number of hours transferred. Credit earned during education abroad may be used toward the residency requirement if students register through UNL and participate in prior-approved education abroad programs. University of Nebraska—Lincoln open enrollment and summer independent study courses count toward residence.

1 Includes courses taught by CASNR faculty through interdisciplinary prefixes (e.g., LIFE, MBIO, ENVIR, SCIL, EAEP, HRTM, ENSC) and CASNR crosslisted courses taught by non-CASNR faculty.

Online and Distance Education

There are many opportunities to earn college credit online through the University of Nebraska—Lincoln. Some of these credits may be applicable not only as elective credits, but also toward the fulfillment of the College's education requirements. Credits earned online may count toward residency. However, certain offerings may not be counted toward scholarship requirements or academic recognition criteria.

For further information, contact:
Office of Online and Distance Education
University of Nebraska—Lincoln
305 Brace Labs
Lincoln, NE 68588-0109
402-472-4681

http://online.unl.edu/

Independent Study Rules

Students wishing to take part in independent studies must obtain permission; complete and sign a contract form; and furnish copies of the contract to the instructor, advisor, departmental office, and the Dean's Office. The contract should be completed before registration. Forms are available in 103 Agricultural Hall or online at the CASNR website.

Independent study projects include research, literature review or extension of coursework under supervision and evaluation of a departmental faculty member.

Students may only count 12 hours of independent study toward their degrees and no more than 6 hours can be counted during their last 36 hours earned, excluding senior thesis, internships, and courses taught under an independent study number.

Other College Degree Requirements

Capstone Course Requirement

A capstone course is required for each CASNR degree program. A capstone course is defined as a course in which students are required to integrate diverse bodies of knowledge to solve a problem or formulate a policy of societal importance.

ACE Requirements

All students must fulfill the Achievement Centered Education (ACE) requirements. Information about the ACE program may be viewed at ace.unl.edu (https://ace.unl.edu).

The minimum requirements of CASNR reflect the common core of courses that apply to students pursuing degrees in the college. Students should work with an advisor to satisfy ACE outcomes 1, 2, 3, 4, 6, and 10 with the college requirements.

Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to the University of Nebraska—Lincoln or when they were first admitted to a Joint Academic Transfer Program. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Agricultural Sciences and Natural Resources. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Learning Outcomes

Graduates of water science will be able to:

1. Demonstrate a broad range of knowledge and understanding of basic and applied sciences that relate to water resources.
2. Gather and synthesize information from several disciplines, formulate ecologically and economically rational alternatives, and effectively implement various water-based programs.
3. Communicate through writings and oral presentations complex ideas and develop sound arguments based on technical knowledge.
4. Pursue careers in agencies that form or implement policy at all levels of government, in public and private organizations that manage water and land resources, and in a broad range of public, private, and nonprofit institutions that are interested in water resources.
5. Conduct original research that includes developing a hypothesis, designing appropriate experiments, collecting and analyzing data, interpreting results, and drawing conclusions.

## Major Requirements

### Core Requirements

#### Natural Resources Core

- **College Integrative Course (ACE 8)**
- SCIL 101 Science and Decision-Making for a Complex World 3

**Credit Hours Subtotal:** 3

#### Natural Sciences

- **CASNR Approved Life Sciences (ACE 4)**
  - CHEM 109 General Chemistry I (ACE 4) 4

**Select one of the following:**
- BIOS 101 General Biology 1
  & BIOS 101L and General Biology Laboratory 4
- LIFE 120 Fundamentals of Biology I 4
  & LIFE 120L and Fundamentals of Biology I Laboratory 4
- LIFE 121 Fundamentals of Biology II 4
  & LIFE 121L and Fundamentals of Biology II Laboratory 4

**Select one of the following:**
- MSYM 109 Physical Principles in Agriculture and Life Sciences 4
  & MSYM 109L and Physical Principles in Agriculture and Life Sciences Laboratory 4
- PHYS 141 Elementary General Physics I 4
- PHYS 151 Elements of Physics 4
  & PHYS 153 and Elements of Physics Laboratory 4
- PHYS 211 General Physics I 4
  & PHYS 221 and General Physics Laboratory I 4

**Credit Hours Subtotal:** 13

#### Mathematics and Statistics (ACE 3)

- MATH 106 Calculus I 5
- STAT 218 Introduction to Statistics 3

**Credit Hours Subtotal:** 8

#### Communication

- **Written Communication (ACE 1)**
  - Select one of the following:
    - ENGL 150 Writing and Inquiry 3
    - ENGL 151 Writing and Argument 3
    - ENGL 254 Writing and Communities 3
    - JGEN 120 Basic Business Communication 3
    - JGEN 200 Technical Communication I 3
    - JGEN 300 Technical Communication II 3

- **Oral Communication (ACE 2)**
  - Select one of the following:
    - ALEC 102 Interpersonal Skills for Leadership 3
    - COMM 101 Communication in the 21st Century 3
    - COMM 209 Public Speaking 3
    - COMM 210 Communicating in Small Groups 3
    - COMM 215 Visual Communication 3
    - COMM 283 Interpersonal Communication 3
    - COMM 286 Business and Professional Communication 3

**Communication and Interpersonal Skills Electives**

**Select one of the following:**
- ALEC 102 Interpersonal Skills for Leadership 3
- COMM 101 Communication in the 21st Century 3
- ENGL 150 Writing and Inquiry 3
- ENGL 151 Writing and Argument 3
- JGEN 200 Technical Communication I 3
- JGEN 300 Technical Communication II 3
- NRES 301 Environmental Communication Skills 3

**Credit Hours Subtotal:** 9

#### Economics, Humanities and Social Sciences

**Select one of the following (ACE 6):**
- ECON 200 Economic Essentials and Issues 3
- ECON 211 Principles of Macroeconomics 3
- ECON 212 Principles of Microeconomics 3
- AECN 141 Introduction to the Economics of Agriculture 3

**Select one course each from ACE outcomes 5, 7, and 9:**

**Credit Hours Subtotal:** 9

**Total Credit Hours:** 45

### Specific Major Requirements

**NOTE:** Courses taken in the Water Science Core do not count toward the Water Science Options.

#### Water Science Core Courses

- NRES 453 Hydrology 3

**Select one of the following:**
- GEOL 100 Introduction to Geology 3
- GEOL 101 Dynamic Earth 3
- GEOL 106 Environmental Geology 3
- GEOL 109 Oceanography 3

**Select one of the following:**
- METR 100 Weather and Climate 3
- NRES 208 Applied Climate Sciences 3
- NRES 408 Microclimate: The Biological Environment 3

**Select one of the following:**
- NRES 312 / GEOG 312 Introduction to Spatial Sciences 3
- NRES 412 / GEOG 412 Introduction to Geographic Information Systems 3
- NRES 220 Principles of Ecology 4
  & NRES 222 and Ecology Laboratory 4
- NRES 484 / AGRO 484 / GEOG 484 / GEOLE 484 / WATS 484 Water Resources Seminar 1
### Water Science

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<td>SOIL 354</td>
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Select one of the following: 3-4

- ENVR 499A: Environmental Studies Senior Thesis I
- & ENVR 499B: Environmental Studies Senior Thesis II
- ENVR 499H: Honors: Environmental Studies Senior Thesis I & II
- WATS 498A & WATS 498B: Senior Project I and Senior Project II

Credit Hours Subtotal: 30-34

### Law, Policy and Management

Select two of the following: 6

- AECN 265 / NREE 265: Resource and Environmental Economics I
- AECN 357 / NREE 357: Natural Resource and Environmental Law
- AECN 457 / NREE 457 / WATS 457: Water Law
- CRPL 470: Environmental Planning and Policy
- NRES 323: Natural Resources Policy
- NRES 423: Integrated Resources Management
- WATS 465 / AECN 465 / NREE 465: Resource and Environmental Economics II
- WATS 475 / AGRO 475 / CIVE 475 / CRPL 475 / GEOL 475 / MSYM 475 / NRES 475 / POLS 475 / SOCI 475 / SOIL 475: Water Quality Strategy

Credit Hours Subtotal: 6

### Science and Technology

Select two of the following: 6-8

- NRES 319 & NRES 320: Fundamentals of Environmental Sampling and Fundamentals of Environmental Sampling Laboratory
- NRES 451: Soils, Water, and Environmental Chemistry
- NRES 463 & NRES 463L: Fisheries Science and Fisheries Science Lab
- NRES 477: Great Plains Field Pedology
- NRES 488 / GEOL 488: Groundwater Geology
- WATS 361 / AGRO 361 / GEOI 361 / SOIL 361 / NRES 361: Soils, Environment and Water Quality
- WATS 418 / GEOI 418 / NRES 419: Chemistry of Natural Waters
- WATS 452 / AGRO 452 / MSYM 452: Irrigation Systems Management
- WATS 459 / BIOS 459 / NRES 459: Limnology
- WATS 468 / BIOS 458 / NRES 468: Wetlands
- WATS 481 / BIOS 481 / NRES 481: Stream and River Ecology

Credit Hours Subtotal: 6-8

### Core Requirements

Complete requirements 45

Credit Hours Subtotal: 45

### Option Requirements and Electives

Complete requirements 18-26

Credit Hours Subtotal: 18-26

### Free Electives

Select 3-15 hours

Credit Hours Subtotal: 3-15

Total Credit Hours: 108-134

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1 The Senior Project fulfills the capstone requirement for water science students. The project is usually provided by private industry, government agencies, or nonprofit organizations. The senior thesis consists of research designed by the student along with the aid of faculty.

### Tracks/Options/Concentrations/Emphases Requirements

Students must consult with an advisor to select an option prior to the beginning of their junior year.

**NOTE:** Courses taken in the Water Science Options do not count toward the Water Science Core.

### Aquatic Ecology Option

This option is designed for students interested in lake, river, stream, or wetland ecology. Students are prepared for careers as research scientists or technicians with public agencies, private consulting firms, universities, and nonprofit organizations. Completion of this program provides excellent preparation for graduate study.

**Option Requirements**

- LIFE 121 & LIFE 121L: Fundamentals of Biology II and Fundamentals of Biology II Laboratory
- CHEM 110: General Chemistry II
WATS 459 / BIOS 459 / NRES 459
Limnology 4

WATS 481 / BIOS 481 / NRES 481
Stream and River Ecology 4

Credit Hours Subtotal: 16

Electives
Select one of the following: 3-4
BIOS 424 / GEOL 424
Biogeochemical Cycles

BIOS 457 / GEOL 457
Ecosystem Ecology

NRES 402 / BIOS 485 / ENTO 402
Aquatic Insects

& NRES 402L / BIOS 485L / ENTO 402L
and Identification of Aquatic Insects

NRES 470
Lake and Reservoir Restoration

NRES 468 / BIOS 485 / WATS 468
Wetlands

NRES 489 / BIOS 489
Ichthyology

Credit Hours Subtotal: 3-4

Total Credit Hours 19-20

Hydrology Option
This option trains students in the quantitative aspects of hydrologic sciences and is designed for students considering careers as a professional hydrologist, research scientist, or consultant (among others). Completion of this program provides excellent preparation for graduate study.

Option Requirements
NRES 488 / GEOL 488
Groundwater Geology 3

MATH 107
Calculus II 4

PHYS 212 & PHYS 222
General Physics II and General Physics Laboratory II 5

WATS 461 / AGRO 461 / GEOL 461 / SOIL 461 / NRES 461
Soil Physics 3

Credit Hours Subtotal: 15

Electives
Select one of the following: 3-4
CHEM 110
General Chemistry II

CIVE 456
Surface Water Hydrology

GEOL 472
Water in Geosciences

MATH 208
Calculus III

MATH 221
Differential Equations

WATS 479 / METR 479 / NRES 479
Hydroclimatology

Credit Hours Subtotal: 3-4

Total Credit Hours 18-19

Water Law and Policy Option
Under this option, a student gains expertise in water issues pertaining to water quality, quantity, allocation, and planning. Careers in this rapidly emerging field of water include lobbyists, community planners, public and tribal liaisons, and policy makers, to name a few. This option also prepares students for continued education in water law.

NOTE: Students in the Water Law and Policy Option should select AECN 357 Natural Resource and Environmental Law and NRES 323 Natural Resources Policy under the Law, Policy, and Management cluster of the Water Science Core.

Option Requirements
AECN 265 / NREE 265
Resource and Environmental Economics I 3

AECN 456 / NREE 456
Environmental Law 3

AECN 457 / NREE 457 / WATS 457
Water Law 3

CRPL 470
Environmental Planning and Policy 3

ECON 211
Principles of Macroeconomics 3

POLS 235
Public Policy Concepts and Processes 3

SOCI 346
Environmental Sociology 3

Credit Hours Subtotal: 21

Total Credit Hours 21

Water Quality Option
This option trains students with a desire to pursue a career examining water chemistry or quality within lakes, streams, rivers, and groundwater. This option is designed for students considering careers as water quality specialists, research scientists, laboratory and field technicians, water or environmental chemists, and many more.

Option Requirements
CHEM 110
General Chemistry II 4

CHEM 251
Organic Chemistry I 4

or CHEM 221
Elementary Quantitative Analysis

GEOL 418 / WATS 418 / NRES 419
Chemistry of Natural Waters 3

NRES 475 / AGRO 475 / WATS 475
Water Quality Strategy 3

SOIL 361 / AGRO 361 / GEOL 361 / NRES 361 / WATS 361
Soils, Environment and Water Quality 3
Credit Hours Subtotal: 16-17

**Electives**
Select two of the following: 6-8

- BIOS 312: Microbiology
- CIVE 456: Surface Water Hydrology
- GEOL 424 / BIOS 424: Biogeochemical Cycles
- GEOL 472: Water in Geosciences
- NRES 451: Soils, Water, and Environmental Chemistry
- NRES 468: Wetlands
- NRES 470: Lake and Reservoir Restoration
- NRES 488 / GEOL 488: Groundwater Geology
- MATH 107: Calculus II
- PHYS 212: General Physics II
- STAT 318: Introduction to Statistics II
- WATS 459 / BIOS 459 / WATS 459: Limnology
  - or WATS 481 / Stream and River Ecology
  - BIOS 481 / NRES 481

Credit Hours Subtotal: 6-8

Total Credit Hours 22-25

**Watershed Management Option**
Watershed Management Option is the management of the water, land, and biological resources to achieve a desired outcome of the water quality and water quantity. This option is designed for students considering careers as water resource managers working for local, state, and federal agencies and private consultants.

**Option Requirements**
- AECN 357 / NREE 357: Natural Resource and Environmental Law 3
- CHEM 110: General Chemistry II 4
- NRES 488 / GEOL 488: Groundwater Geology 3
- WATS 361 / AGRO 361 / NRES 361 / SOIL 361: Soils, Environment and Water Quality 3
- WATS 452 / AGRO 452 / MSYM 452: Irrigation Systems Management 3
- WATS 459 / BIOS 459 / NRES 459: Limnology 4
  - or WATS 481 / Stream and River Ecology
  - BIOS 481 / NRES 481

Credit Hours Subtotal: 20

Total Credit Hours 20

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**Requirements for Minor Offered by Department**

**Required Courses**
- WATS 281 / GEOG 281 / NRES 281: Introduction to Water Science 3
- WATS 354 / MSYM 354 / SOIL 354: Soil Conservation and Watershed Management 3

Credit Hours Subtotal: 6

**Advanced Courses**

**Law, Policy and Management**
Select at least one of the following: 3-6

- AECN 265 / NREE 265: Resource and Environmental Economics I
- AECN 357 / NREE 357: Natural Resource and Environmental Law
- AECN 457 / NREE 457 / WATS 457: Water Law
- CRPL 470: Environmental Planning and Policy
- NRES 323: Natural Resources Policy
- NRES 423: Integrated Resources Management
- WATS 465 / AECN 465 / NREE 465: Resource and Environmental Economics II
- WATS 475 / AGRO 475 / CIVE 475 / CRPL 475 / GEOL 475 / MSYM 475 / NRES 475 / POLS 475 / SOCI 475 / SOIL 475: Water Quality Strategy
- WATS 484 / NRES 484: Water Resources Seminar

**Science and Technology**
Select at least two of the following: 6-9

- NRES 319: Fundamentals of Environmental Sampling
- NRES 320: Fundamentals of Environmental Sampling Laboratory
- NRES 451: Soils, Water, and Environmental Chemistry
- NRES 453: Hydrology
- NRES 463: Fisheries Science & NRES 463L: Fisheries Science Lab
- NRES 488 / GEOL 488: Groundwater Geology
- WATS 361 / AGRO 361 / GEOL 361 / NRES 361 / SOIL 361: Soils, Environment and Water Quality
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<td>AGRO 808, GEOG 808, HORT 808, METR 808, NRES 808</td>
<td>AUTUMN</td>
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<tr>
<td>WATS 459</td>
<td>Limnology</td>
<td>BIOS 459, NRES 459 or WATS 468 Wetlands</td>
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<td>3</td>
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<td>Graded with Option</td>
<td>AGRO 907; HORT 907</td>
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<tr>
<td>WATS 481</td>
<td>Stream and River Ecology</td>
<td>WATS 484, NRES 484</td>
<td></td>
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<td>1-5</td>
<td></td>
<td></td>
<td>Graded with Option</td>
<td>AGRO 907</td>
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<tr>
<td>WATS 484</td>
<td>Water Resources Seminar</td>
<td>WATS 484, NRES 484</td>
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<td>1-5</td>
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<td></td>
<td>Graded with Option</td>
<td>AGRO 907; HORT 907</td>
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<tr>
<td>WATS 281</td>
<td>Introduction to Water Science</td>
<td>GEOG 281, NRES 281</td>
<td></td>
<td>Survey of the water science from the perspective of both natural and social sciences. Water budget, precipitation, evapotranspiration, runoff and stream flow, groundwater, water quality parameters, economics of water, water policy, water law and water politics.</td>
<td>3</td>
<td></td>
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<td>Graded with Option</td>
<td>AGRO 458, AGRO 858, NRES 458, NRES 858, SOIL 458</td>
<td>AUTUMN</td>
</tr>
<tr>
<td>WATS 299</td>
<td>Career Experiences</td>
<td></td>
<td></td>
<td>Permission and advanced approval of plan or work. May include participation in water resource management, water measurement, water quality monitoring, water supply, water administration; research in laboratories, green houses and fields; or preparation of educational materials.</td>
<td>1-5</td>
<td></td>
<td></td>
<td>Graded with Option</td>
<td>AGRO 808, GEOG 808, HORT 808, METR 808, NRES 808</td>
<td>AUTUMN</td>
</tr>
</tbody>
</table>

**WATS 354 Soil Conservation and Watershed Management**

**Crosslisted with:** MSYM 354, SOIL 354

**Prerequisites:** AGRO/SOIL 153; and MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211

**Description:** Watershed hydrology, soil erosion, erosion control, water management, and land surveying and mapping. Includes rainfall-runoff relationships; determination of watershed characteristics; terraces, waterways, vegetative filters, and residue management; ponds, wetlands, non-point source pollution control, and water conservation; profile and topographic surveying.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**WATS 361 Soils, Environment and Water Quality**

**Crosslisted with:** AGRO 361, GEO 361, NRES 361, SOIL 361

**Prerequisites:** AGRO/HORT/SOIL 153; MATH 102 or 103; two semesters chemistry (CHEM 105, 106 or CHEM 109,110) and WATS/GEOG/NRES 281

**Description:** Chemical and physical processes that influence the fate and transport of contaminants (inorganic, organic, microbial) in soil-water environments. Extent, fate, mitigation and impact of various sources of pollution. Remedial technologies used for environmental restoration of contaminated environments.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**WATS 408 Microclimate: The Biological Environment**

**Crosslisted with:** AGRO 408, GEOG 408, HORT 408, METR 408, NRES 408, AGRO 808, GEOG 808, HORT 808, METR 808, NRES 808

**Prerequisites:** Junior standing, MATH 106 or equivalent, 5 hrs physics, major in any of the physical or biological sciences or engineering.

**Description:** Physical factors that create the biological environment. Radiation and energy balances of earth's surfaces, terrestrial and marine. Temperature, humidity, and wind regimes near the surface. Control of the physical environment through irrigation, windbreaks, frost protection, manipulation of light, and radiation. Applications to air pollution research. Instruments for measuring environmental conditions and remote sensing of the environment.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** AUTUMN
WATS 418 Chemistry of Natural Waters
Crosslisted with: GEOL 418, GEOL 818, NRES 419, NRES 819
Prerequisites: CHEM 109 and 110, 113 and 114, or CHEM 111.
Description: Principles of water chemistry and their use in precipitation, surface water, and groundwater studies. Groundwater applications used to determine the time and source of groundwater recharge, estimate groundwater residence time, identify aquifer mineralogy, examine the degree of mixing between waters of various sources and evaluate what types of biological and chemical processes have occurred during the water’s journey through the aquifer system.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L; GEOL 917, NRES 917

WATS 418L Chemistry of Natural Waters Laboratory
Crosslisted with: GEOL 418L, GEOL 818L, NRES 419L, NRES 819L
Prerequisites: CHEM 109 and 110 or CHEM 113 and 114; GEOL 418 or parallel.
Description: Basic laboratory techniques used to perform water analysis including various wet chemical techniques, instrument use (AA, IC, UV-Visible) and computer modeling. Techniques for sample collection and preservation, parameter estimation and chemical analysis.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

WATS 452 Irrigation Systems Management
Crosslisted with: MSYM 452, MSYM 852, AGRO 452
Prerequisites: MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211
Notes: AGRO/SOIL 153 recommended.
Description: Irrigation management and the selection, evaluation, and improvement of irrigation systems. Includes soil-water measurement, crop water use, irrigation scheduling, irrigation efficiency, measurement of water flow, irrigation systems, groundwater and wells, pumping systems, applying chemicals with irrigation systems, and environmental and water resource considerations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL
Prerequisite for: AGEN 854, MSYM 854; AGEN 955, AGRO 955, CIVE 955, GEOL 985; MSYM 855

WATS 457 Water Law
Crosslisted with: AECN 457, AECN 857, NREE 457
Prerequisites: AECN/NREE 357.
Description: Environmental impact review; public trust doctrine; endangered species; land use controls; wetlands regulation; surface and ground water rights; Indian and federal water rights; impact of water quality regulations on water allocation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

WATS 459 Limnology
Crosslisted with: BIOS 459, BIOS 859, NRES 459, NRES 859
Prerequisites: 12 hrs BIOS, including BIOS/NRES 220/BIOS220x; two semesters CHEM.
Description: Physical, chemical, and biological processes that occur in fresh water. Organisms occurring in fresh water and their ecology; biological productivity of water and its causative factors; eutrophication and its effects.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOS 866, NRES 866
ACE: ACE 10 Integrated Product

WATS 461 Soil Physics
Crosslisted with: AGRO 461, GEOL 461, NRES 461, SOIL 461, AGRO 861, GEOL 861, NRES 861
Prerequisites: AGRO/SOIL 153; PHYS 141 or equivalent, one semester of calculus.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: AGEN 955, AGRO 955, CIVE 955, GEOL 985

WATS 465 Resource and Environmental Economics II
Crosslisted with: AECN 465, AECN 865, NREE 465
Prerequisites: MATH 104 and one course in statistics.
Description: Application of resource economics concepts and empirical tools to resource management problems. Public policy issues involving environmental quality, land and water management.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: AECN 868

WATS 468 Wetlands
Crosslisted with: BIOS 458, NRES 468, NRES 868, BSEN 468, BSEN 868
Prerequisites: CHEM 109 and CHEM 110, or CHEM 105 and CHEM 106; Junior or Senior Standing.
Notes: Offered even-numbered calendar years.
Description: Physical, chemical and biological processes that occur in wetlands; the hydrology and soils of wetland systems; organisms occurring in wetlands and their ecology wetland creation, delineation, management and ecotoxicology.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
WATS 472 Applied Soil Physics
Crosslisted with: AGRO 472, AGRO 872, NRES 472, NRES 872, SOIL 472
Prerequisites: AGRO/HORT/SOIL 153 or equivalent; MATH 104 or MATH 106 or equivalent.
Description: Emphasis on applied soil physics. Discussion of theoretical principles followed by field and laboratory exercises and applications. Fluxes of water, solutes, air, and heat through the soil. Emphasis on water infiltration, water retention, other soil hydraulic properties. Components of soil water balance. Management of soil water.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

WATS 475 Water Quality Strategy
Crosslisted with: NRES 475, NRES 875, SOCI 475, SOCI 875, SOIL 475, AGRO 475, NRES 875, CIVE 475, CIVE 875, CRPL 475, CRPL 875, GEOL 475, GEOL 875, MSYM 475, MSYM 875, POLS 475, POLS 875
Prerequisites: Senior standing.
Notes: Capstone course.
Description: Holistic approach to the selection and analysis of planning strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing the impact of strategies on whole systems and subsystems; for selecting strategies; and for evaluating present strategies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product
Groups: American Government & Public Policy

WATS 479 Hydroclimatology
Crosslisted with: NRES 479, METR 479, BSEN 479, NRES 879, METR 879, BSEN 879
Prerequisites: NRES 208 or METR 100 or METR/NRES 370.
Notes: Offered spring semester of even-numbered calendar years.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

WATS 481 Stream and River Ecology
Crosslisted with: WATS 881, BIOS 481, NRES 481
Prerequisites: NRES 222 or equivalent
Description: Fundamental physical drivers operating in stream and river ecosystems and how those vary in space and time. Major classes of organisms associated with stream ecosystems and their functional roles. Fundamental controls on biotic diversity in stream and river ecosystems and its variance. Major aspects of stream ecosystem function including energy flow and nutrient cycling. Ecosystem services provided by stream and river ecosystems and causes and consequences of human impacts on streams and rivers. Underlying principles of bioassessment and current methods of stream restoration.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded

WATS 484 Water Resources Seminar
Crosslisted with: AGRO 484, GEOG 484, GEOL 484, NRES 484, NRES 884, AGRO 884, GEOG 884, GEOL 884, WATS 884
Prerequisites: Junior or above standing
Description: Seminar on current water resources research and issues in Nebraska and the region.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

WATS 496 Principles and Problems in Water Science
Prerequisites: 15 hours in water science or closely related areas.
Description: Individual or group projects in research, literature review, or extension of course work under the supervision and evaluation of a water science faculty member.
Credit Hours: 1-5
Min credits per semester: 1
Max credits per semester: 5
Max credits per degree: 12
Grading Option: Graded with Option

WATS 498A Senior Project I
Prerequisites: Senior standing
Notes: First course of a two-semester sequence of courses consisting of WATS 498A and WATS 498B.
Description: Work as individual or as a team member to develop solutions to water resource problems. Problem involves multi-disciplinary features. Requires independent research, proposal preparation and presentation.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
Prequisite for: WATS 498B
ACE: ACE 10 Integrated Product

WATS 498B Senior Project II
Prerequisites: WATS 498A
Notes: Second course of a two-semester sequence of courses consisting of WATS 498A and WATS 498B.
Description: Continuation of WATS 498A. Carry out proposal and present findings orally and in writing.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option

WATS 499H Honors Thesis
Prerequisites: Admission to the University Honors Program and permission, AGRI 299H recommended.
Description: Conduct a scholarly research project and write a University Honors Program or undergraduate thesis.
Credit Hours: 3-6
Min credits per semester: 3
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Graded
ACE: ACE 10 Integrated Product

PLEASE NOTE
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences.
to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

**Water Science - Aquatic Ecology**
**Water Science - Hydrology**
**Water Science - Watershed Management**
**Water Science - Water Law & Policy**
**Water Science - Water Quality**