



## Economics of Water Resources-EBGN 598\_C/498\_C

Division of Economics and Business

Spring 2019

Instructor: Steven M. Smith  
Office: Engineering Hall 323  
Email: [ssmith1@mines.edu](mailto:ssmith1@mines.edu)  
Phone: (303) 273-3150  
Lecture: TTh: 12:30-1:45, Alderson Hall 130  
Office Hours: T: 10:00-11:00; TH: 2:00-3:00; and by appointment  
Website: [Canvas](#)

### Course Description:

This course seeks to develop the underlying economic logic of water use and how policy impacts the allocation of water in our economy. Water is a critical input for a number of sectors; from our basic sustenance to agriculture production, from industrial processes to ecological services, and from mineral extraction to energy production. Meanwhile, the supply of water is highly variable across space and through time while pollutants can further diminish the useable extent, making the policies to allocate and manage the resource central to understanding how the resource is utilized. The course will survey topics across sectors and water sources while applying economic theory and empirical/policy analysis.

**Pre-requisites:** ECON 409/509 or CALC III (GEGN 580 can satisfy this HSE students).

### Students will learn

1. Economic modelling of water systems
2. Empirical assessment of water policies
3. Valuation techniques for water resources
4. How institutional structure effect development
5. Economic tools to assess
  - a. Water allocation
  - b. Water pollution control
6. Application to specific sectors
  - a. Agriculture
  - b. Energy
  - c. Domestic Use
  - d. Recreation

### Required Text

Griffin, Ronald C. (2016). *Water Resource Economics: The Analysis of Scarcity, Policies, and Projects*. (Second Edition) The MIT Press

### Texts for Reference

- Dinar, A. & K. Schwabe (2015). *Handbook of Water Economics*. Edward Elgar Publishing
- Shaw, W.D. (2005). *Water Resource Economics and Policy: An Introduction*. Edward Elgar Publishing
- Getches, D.H. (2009). *Water Law in a nutshell*. Thomson West.
- Gardner, B. Delworth & Randy T. Simmons (2014). *Aquonomics: Water Markets and the Environment*. Transaction Publishers.

## Grading

There will be 5 components of your final grade.

Midterm 1	20%	Surface Exam
Midterm 2	20%	Groundwater Exam
Project	20%	Application of techniques
Assignments	25%	5 assignments to practice economic models
Reports	15%	3 Reports on Articles

## Grading Scale

A	92.00-100.00	C	72.00-77.99
A-	90.00-91.99	C-	70.00-71.99
B+	88.00-89.99	D+	68.00-69.99
B	82.00-87.99	D	62.00-67.99
B-	80.00-81.99	D-	60.00-61.99
C+	78.00-79.99	F	<59.99

**Exams:** Two midterms will be taken in class. These will test your understanding of the economic models, issues, and policies related to surface water (February 14) and groundwater (March 12).

**Assignments:** There are five assignments throughout the semester intended to help understand the economic tools applied to different issues: Economic modeling, surface water, groundwater, pollution, and policy/project analysis.

**Reports:** Three times throughout the semester you will be charged with reading a specific article, writing up a short report, and presenting the findings to the class. This will include leading a “case study” discussion in the final month of class. These may or may not be with a partner dependent on enrollment.

**Project:** In lieu of final, you will write up a 5-page paper on a topic of your choice. The idea is to bring economics to your specific research interests in water, or bring water concerns to your economic research questions of interest. You will submit your initial idea by the end of Spring Break before completing the project for Finals week.

## Coursework Return Policy

I will make a good-faith effort to return all submitted work within 1 week.

## Course Schedule

Day	Topic	Sub-Topic	Book Chapter	Articles	Due/Activity
Jan. 8	Intro		Ch. 1		
Jan. 10	<b>No Class</b>				
Jan. 15	Economic Tools	Basics	Ch. 2		
Jan. 17	Economic Tools	Water	Ch. 2		
Jan. 22	Surface	Institutions	Ch. 5	Harris v. Brooks	<b>Economic Assignment</b>
Jan. 24	Surface	PA Doctrine		Leonard & Libecap (2019)	
Jan. 29	Surface	PA Doctrine		Burness & Quirk (1979)	
Jan. 31	Surface	Water Markets	Ch. 8		

Feb. 5	Surface	Water Markets		Howe & Goemans (2003)	<i>Surface Water Assignment</i>
Feb. 7	Surface	Urban Water	Ch. 11 (optional)	Olmstead & Stavins (2009)	
Feb. 12	Surface	Water Pricing	Ch. 9		
Feb. 14					<i>Surface Water Midterm</i>
Feb. 19	<b>Presidents Day Break</b>				
Feb. 21	Groundwater	Discounting	Ch. 3		
Feb. 26	Groundwater	Dynamic Optimization		Math tools (Handout)	
Feb. 28	Groundwater	Open Access		Gisser and Sanchez (1980) and Pfeiffer & Lin (2012)	
Mar. 5	Groundwater	Management		Ayers et al. 2018	<i>Groundwater Assignment</i>
Mar. 7	Groundwater	Management		multiple	<i>Reports (all)</i>
Mar. 12					<i>Groundwater midterm</i>
Mar. 14	Pollution	Industrial (point)		Fisher-Vanden & Olmstead (2013)	
Mar. 19	Pollution	Agriculture (non-point)		Shortle & Horan (2001)	
Mar. 21	Pollution	Groundwater		Fleming et al. (1995)	
Mar. 26	<b>Spring Break</b>				
Mar. 28	<b>Spring Break</b>				
Apr. 2	Economic Tools	Cost-Benefit Analysis	Ch. 7 (and Ch. 6-optional)		<i>Pollution assignment and Project Proposal</i>
Apr. 4	Economic Tools	Cost-Benefit Analysis		Morimoto & Hope (2004)	
Apr. 9	Economic Tools	Demand Analysis	Ch. 10		
Apr. 11	Economic Tools	Demand Analysis		multiple	<i>Reports (all)</i>

Apr. 16	Case Study	TBA		TBA	<i>Economic Tools Assignment</i>
Apr. 18	Case Study	TBA		TBA	<i>Reports (some)</i>
Apr. 23	Case Study	TBA		TBA	<i>Reports (some)</i>
Apr. 25	Case Study	TBA		TBA	<i>Reports (some)</i>
Apr. 30	Case Study	TBA		TBA	<i>Reports (some)</i>
May. 2	Case Study	TBA	Ch. 13	TBA	<i>Reports (some)</i>
<b>May 4-9</b>	<b>Finals</b>				<i>Final Project</i>

**Case Studies:** The final 6 topics and readings will be selected by the class based on your interests. These may be more in-depth applications of tools covered earlier in class or another sector all together. Possibilities include, but are not limited to: transboundary management, ocean resources, instream flow protection, transportation, storm water management, energy sector (extraction, cooling, hydro), and water in the developing county setting.

**Diversity and Inclusion:**

At Colorado School of Mines, we understand that a diverse and inclusive learning environment inspires creativity and innovation, which are essential to the engineering process. We also know that in order to address current and emerging national and global challenges, it is important to learn with and from people who have different backgrounds, thoughts, and experiences.

Our students represent every state in the nation and more than 90 countries around the world, and we continue to make progress in the areas of diversity and inclusion by providing [Diversity and Inclusion programs and services](#) to support these efforts.

**Students with Disabilities:**

The Colorado School of Mines is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you anticipate or experience any barriers to learning in this course, please feel welcome to discuss your concerns with me. Students with disabilities may also wish to contact Disability Support Services (DSS) to discuss options to removing barriers in this course, including how to register and request official accommodations. Please visit their website at [disabilities.mines.edu](http://disabilities.mines.edu) for contact and additional information. If you have already been approved for accommodations through DSS, please meet with me at your earliest convenience so we can discuss your needs in this course.

**Accessibility within Canvas:**

Read the [Accessibility Statement](#) from Canvas to see how the learning management system at the Colorado School of Mines is committed to providing a system that is usable by everyone. The Canvas platform was built using the most modern HTML and CSS technologies, and is committed to W3C's Web Accessibility Initiative and [Section 508](#) guidelines.

**Discrimination, Harassment, and Title IX:**

All learning opportunities at Mines, including this course, require a safe environment for everyone to be productive and able to share and learn without fear of discrimination or harassment. Mines' core values of respect, diversity, compassion, and collaboration will be honored in this course, and the standards in this class are the same as those expected in any professional work environment. (More information can be [found here](#).) **Discrimination or harassment of any type will not be tolerated.** As a participant in this course, we expect you to respect your instructor and your classmates. As your instructor, it is my responsibility to foster a learning environment that supports diversity of thoughts, perspectives and experiences, and honors your identities. To help accomplish this:

- Course rosters are provided to the instructor with the student's legal name. I will honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.
- If something is said or done in this course (by anyone, including myself) that made you or others feel

uncomfortable, or if your performance in the course is being impacted by your experiences outside of the course, please report it to:

- Me (if you are comfortable doing so)
- Wellness Center- [Counseling](https://www.mines.edu/counseling-center/) (https://www.mines.edu/counseling-center/)
- [Speak Up](https://www.mines.edu/speak-up/) (https://www.mines.edu/speak-up/) – Anonymous Option

In this course, we will cultivate a community that supports survivors, prevents interpersonal violence, and promotes a harassment free environment. Title IX and Colorado State law protects individuals from discrimination based on sex and gender in educational programs and activities. Mines takes this obligation seriously and is committed to providing a campus community free from gender and sex-based discrimination. Discrimination, including sexual harassment, sexual violence, stalking, and domestic violence, is prohibited and will not be tolerated within the Mines campus community. If these issues have affected you or someone you know, you can access the appropriate resources on the [Mines Title IX website](#). You can also contact the Mines Title IX Coordinator, Camille Torres, at 303.384.2124 or [titleix@mines.edu](mailto:titleix@mines.edu) for more information.

It's on us, all of the Mines community, to engineer a culture of respect.

### **CARE @ Mines:**

If you feel overwhelmed, anxious, depressed, distressed, mentally or physically unhealthy, or concerned about your wellbeing overall, there are resources both on- and off-campus available to you. If you need assistance, please ask for help from a trusted faculty or staff member, fellow student, or any of the resources below. As a community of care, we can help one another get through difficult times. If you need help, reach out. If you are concerned for another student, offer assistance and/or ask for help on their behalf. Students seeking resources for themselves or others should visit [care.mines.edu](http://care.mines.edu).

Additional suggestions for referrals for support, depending on comfort level and needs include:

- [CARE at Mines](http://care.mines.edu) (care.mines.edu)– for various resources and options, or to submit an online “CARE report” about someone you’re concerned about (email [care@mines.edu](mailto:care@mines.edu))
- [CASA](https://www.mines.edu/casa) (https://www.mines.edu/casa) – for academic advising, tutoring, academic support, and academic workshops
- [Counseling Center](https://www.mines.edu/counseling-center/) (https://www.mines.edu/counseling-center/)– for students to call 303-273-3377 for an appointment. There are also online resources for students on the website. Located in the Wellness Center 2<sup>nd</sup> floor at 1770 Elm St.
- [Health Center](https://www.mines.edu/student-health/) (https://www.mines.edu/student-health/) – students may call 303-273-3381 for appointment. Located in Wellness Center 1<sup>st</sup> floor at 1770 Elm St.
- [Colorado Crisis Services](http://coloradocrisiservices.org) (http://coloradocrisiservices.org) – for crisis support 24/7, either by phone, text, or in person. Colorado Crisis Services is a great confidential resource, available to anyone by calling 1-844-493-8255, or texting “TALK” to 38255. Walk-in location addresses are posted on the website.

All of these options are available for free for students. The Counseling Center, Health Center, and Colorado Crisis Services are confidential resources. The Counseling Center will also make referrals to off-campus counselors, if preferred.

In an emergency, you should call 911, and they will dispatch a Mines or Golden PD officer to assist.

### **Absence Policy:**

The [Student Absences](#) webpage outlines CSM's policy regarding student absences. It contains information and documents to obtain excused absences.

**Note:** All absences that are not documented as excused absences are considered unexcused absences. Faculty members may deny a student the opportunity to make up some or all of the work missed due to unexcused absence(s). However, the faculty members do have the discretion to grant a student permission to make up any missed academic work for an unexcused absence. The faculty member may consider the student's class performance, as well as their attendance, in the decision.

In the case of an absence, the student is responsible for determining what work was missed and for putting forth a good faith effort to review the material on their own.

**Policy on Academic Integrity/Misconduct:**

The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining and fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy can be found in the [Mines' Policy Library](#).

**Absence Policy:**

The [Student Absences](#) webpage outlines CSM's policy regarding student absences. It contains information and documents to obtain excused absences.

In the case of an absence, the student is responsible for determining what work was missed and for putting forth a good faith effort to review the material on their own.