Course Change Request

Date Submitted: 08/27/25 8:36 pm

Viewing: GEOL 313 : Hydrogeology

Last approved: 04/05/22 5:15 am

Last edit: 09/29/25 9:53 am

Changes proposed by: jgoldspi

Catalog Pages referencing this course

Chemistry, BS

Department of Atmospheric, Oceanic and Earth Sciences

Select modification type:

Substantial

In Workflow

1. **AOES -Curriculum Committee**
2. **AOES Chair**
3. **SC Curriculum Committee**
4. SC Assistant Dean
5. Assoc Provost-Undergraduate
6. Registrar-Courses
7. Banner

Approval Path

1. 09/10/25 2:54 pm Barry Klinger (bklinger): Approved for AOES - Curriculum Committee
2. 09/10/25 4:54 pm Mark Uhen (muhen): Approved for AOES Chair

History

1. Aug 30, 2017 by pchampan
2. Dec 21, 2018 by Gregory Craft (gcraft)
3. Apr 5, 2022 by Jennifer Bazaz Gettys (jbazaz)

Are you completing this form on someone else's behalf?

No

Effective Term: Spring 2026

Subject Code: GEOL - Geology **Course Number:** 313

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Hydrogeology

Banner Title: Hydrogeology

Will section titles vary by semester? No

Credits: 4 ~~3~~

Schedule Type: Lecture w/Lab

Hours of Lecture or Seminar per week: 3

Hours of Lab or Studio per week: 1

Repeatable: May be only taken once for credit, limited to 3 attempts (N3)

Max Allowable Credits: 12 ~~9~~

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

GEOL 101 and GEOL 103, or GGS 102; ~~102,~~ MATH 113; ~~113,~~ and CHEM 211.

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Geological and hydrologic factors controlling occurrence, distribution, movement, quality, and development of groundwater. Designated a Green Leaf Course. A field trip may be required during one of the laboratory meeting times.

Justification:

What: Adding a laboratory element to the lecture

Why: A laboratory element will allow for direct, hands-on experimentation with different factors that affect groundwater chemistry, flow, and storage. The lab will also allow for more time to be spent on numerical modeling, and therefore allow students to develop a greater level of knowledge and experience with numerical models. Numerical modeling is an important aspect of professional hydrogeology in addition to being a marketable skill for students to have.

Does this course cover material which crosses into another department? No

Learning Outcomes:

Know the range of physical and chemical properties common in groundwater systems

Understand how surface conditions affect groundwater systems and vice versa

Know the principles of groundwater flow, and how flow is characterized and calculated

Know the principles of groundwater storage, and how storage is characterized

Understand the practical issues related to aquifer development and depletion

Understand the basic processes of aquifer contamination and remediation

Gain experience with some of the tools and resources used to monitor, study and understand groundwater systems. This includes both physical tools and computer tools.

Will this course be scheduled as a cross-level cross listed section? Yes

Please use the Additional Attachments button to attach two syllabi for review, one undergraduate and one graduate, preferably as separate documents. These should be provided in order to demonstrate the difference in expectations and assessments for undergraduates and graduates taking the course.

Attach Syllabus
GEOL_313_Syllabus_Sp2026_DRAFT2.pdf

Additional Attachments

Specialized Course Categories:
Green Leaf

Green Leaf Course Designation

The proposed course is requesting (choose one):
Sustainability-related designation

Below, include a brief statement regarding how this course meets either the “sustainability focused” or “sustainably related” criteria.

Sustainability-related courses help build knowledge about a component of sustainability or introduce students to sustainability concepts during part of the course. They may complement sustainability-focused courses by providing students with in-depth knowledge of a particular aspect or dimension of sustainability (such as the natural environment) or by providing a focus area (such as renewable energy) for a student's sustainability studies, or they may broaden students' understanding of sustainability from within different disciplines.

previously approved

Attach Syllabus

Have you reached out to the Libraries to determine whether there are adequate resources to support your course? If not, please email Meg Meiman, Associate University Librarian for Learning, Research, and Engagement at mmeiman2@gmu.edu.

No

Additional Comments:

Reviewer Comments

Key: 7222

Geology 313-001
Hydrogeology
Spring 2026 Syllabus

Instructor

Dr. Jules Goldspiel
Department of Atmospheric, Oceanic and Earth Sciences (AOES)
Office: Exploratory Hall 3414
Office Hours: Mondays 3:00 – 5:00 pm
Other days and times by appointment
e-mail: jgoldspi@gmu.edu (best contact method)

Meeting Times and Location

Wednesdays and Fridays 4:30 – 7:10 pm
Exploratory Hall 1005 (in-person)

Course Description

4 Credits
Prerequisites: GEOL 101 (Physical Geology) and GEOL 103 (Physical Geology Lab)
or GGS 102 (Physical Geography)
MATH 113 (Analytic Geometry and Calculus I)
CHEM 211 (General Chemistry I)
Or similar lab-science courses in each of Geology, Calculus and Chemistry

This course contains both a lecture and laboratory component. Lectures will occur on Wednesdays. Labs will occur on Fridays. A field trip may be required during one of the laboratory meeting times.

The course will focus on the geologic and hydrologic factors that control the occurrence, distribution, movement, quality and development of groundwater. In addition to the general properties that distinguish a groundwater system as an aquifer, this course will cover the physical and chemical properties of groundwater, groundwater interactions with the surface, and how groundwater flow can be calculated and studied analytically, graphically and with computer models. Natural and engineered processes will both be discussed.

The goals of this course are for students to:

- Appreciate the range of physical and chemical properties common in groundwater systems
- Understand how surface conditions affect groundwater systems and vice versa
- Understand the principles of groundwater flow, and how flow is characterized and calculated
- Understand the principles of groundwater storage, and how storage is characterized
- Understand the practical issues related to aquifer development and depletion
- Understand the basic processes of aquifer contamination and remediation
- Gain experience with some of the tools and resources used to monitor, study and understand groundwater systems. This includes both physical tools and computer tools.

Hands-on exercises and computer modeling will be part of the course. University computers will be available for students to participate in the modeling exercises, but students may also use their own computers. Computers running the Microsoft Windows operating system are best suited for the modeling exercises, but other operating systems may be used also. Students will also find it helpful to have ready access to a scientific calculator, spreadsheet program or other method for calculations. Please talk to instructor if access to any of these tools may be a problem.

Course Textbook and Other References

Primary Lecture Textbook (Recommended)

Applied Hydrogeology, 5th Edition, 2022, C.W. Fetter and D. Kreamer, Waveland Press

Available in print and electronic formats. See GMU Bookstore or publisher (https://waveland.com).

Other Useful References

Alley, W. M., et al., 1999, Sustainability of ground-water resources, USGS Circular 1186. (Available at https://pubs.usgs.gov/circ/circ1186/pdf/circ1186.pdf)

Ferris, J. G., et al., 1962, Theory of aquifer tests, USGS Water-Supply Paper 1536-E. (Available at https://pubs.usgs.gov/wsp/wsp1536-E/pdf/wsp_1536-E.pdf)

Hem, J. D., 1985, Study and interpretation of the chemical characteristics of natural water, 3rd Edition, USGS Water-Supply Paper 2254. (Available at https://pubs.usgs.gov/wsp/wsp2254/pdf/wsp2254a.pdf)

Winter, T.C., et al., 1998, Ground water and surface water: A single resource, USGS Circular 1139. (Available at https://pubs.usgs.gov/circ/circ1139/pdf/circ1139.pdf)

Required Coursework & Grading Weights

The graded coursework for this class and the weight of each component is as listed in the table at left.

Weight	GEOL 313 Coursework
10%	Quizzes (all combined)
15%	Homeworks (all combined)
10%	Semester Exercise
10%	Preliminary Exam I
10%	Preliminary Exam II
20%	Final Exam
25%	Laboratory Exercises (all combined)

Quizzes will cover facts and concept details from lectures. They are intended to check your understanding of specific information and concept details discussed since the last quiz. Each quiz will consist of questions in multiple choice and/or short answer format.

Homework assignments will cover quantitative aspects of the course. They will generally involve calculations, graphing and graph interpretation, basic computer modeling and/or concept questions. Calculators, spreadsheets or other computational programs may be used, but intermediate steps and calculation methods must be shown.

The Semester Exercise will involve collecting and summarizing groundwater data. The data will be gathered from publicly available U.S. Geological Survey (USGS) websites.

Laboratory Exercises will involve weekly participation in physical experiments, field-related measurements and computer modeling exercises.

Grading Schema

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Weighted Score (%)	≥ 99%	92.0 – 98.9%	90.0 – 91.9%	88.0 – 89.9%	82.0 – 87.9%	80.0 – 81.9%	78.0 – 79.9%	70.0 – 77.9%	67.0 – 69.9%	50.0 – 66.9%	< 50%

Course grades will be determined by the weighted percentage of total points possible (see Coursework & Grading Weights). The standard grading schema for this class is as indicated in the table above.

Please note that the grading schema is subject to change from the standard schema based on class performance or other unforeseen factors. However, if any changes are made, the changes will be in a manner that is favorable to student grades (i.e., if the schema is changed, the change will set the cutoff for a grade to a lower weighted score percentage not higher).

Tentative Course Schedule

Week			Topic (and corresponding textbook sections)	Quiz	HW
1	Lect	01/21	Course Information & Hydrogeology Overview (Fetter and Kreamer: Chapters 1, 2.1-2.7)		
	Lab	01/23	Campus Walk / Field Trip - Hydrogeology Field Examples		
2	Lect	01/28	Physical Properties and Physical Environments of Groundwater (Fetter and Kreamer: Chapters 3, 12.1−12.2)	#1	
	Lab	01/30	Hydraulic Conductivity Demonstration and Experiments		
3	Lect	02/04	Chemical Properties and Chemical Environments of Groundwater (Fetter and Kreamer: Chapter 9)		#1
	Lab	02/06	Activities/Solubility Demonstration and Experiments		
4	Lect	02/11	Hydrologic Connections Between Groundwater and Surface Water (Fetter and Kreamer: Chapters 2.8-2.14, 6)		#2
	Lab	02/13	Infiltration/Seeps Demonstration and Experiments		
5	Lect	02/18	Groundwater Flow and Storage: Controls and Impacts (Fetter and Kreamer: Chapter 8)	#2	
	Lab	02/20	Specific Yield and Specific Storage Demonstration and Experiments		
6	Lect	02/25	*Preliminary Exam I*		
	Lab	02/27	Physical Modeling of Surface and Groundwater Flow (Stream Table and/or Other Physical Models)		
7	Lect	03/04	Groundwater Flow: Governing Equations and Approximations (Fetter and Kreamer: Chapter 4)	#3	
	Lab	03/06	Application of Governing Equations and Approximations		
8	Lect	03/11	*Spring Break – No Class*		
	Lab	03/13	*Spring Break – No Class*		
9	Lect	03/18	Numerical Modeling: General Principles, Mechanics and Applications (Fetter and Kreamer: Chapter 13)		#3
	Lab	03/20	Numerical Model Installation and Checkout		
10	Lect	03/25	Groundwater Flow: Wells (Fetter and Kreamer: Chapter 5)		#3
	Lab	03/27	Numerical Modeling: Wells		
11	Lect	04/01	Groundwater Flow: Regional Systems (Fetter and Kreamer: Chapter 7)	#4	
	Lab	04/03	Numerical Modeling: Regional Systems		
12	Lect	■ 04/08	Aquifer Protection, Contamination and Restoration (Fetter and Kreamer: Chapters 10, 11.7-11.8)		#4
	Lab	04/10	Numerical Modeling: Restoration/Mitigation After Contamination		
13	Lect	04/15	*Preliminary Exam II*		
	Lab	04/17	Field Trip - Well Drilling		
14	Lect	04/22	Hydrogeology in Especially Wet, Dry and/or Cold Environments (Fetter and Kreamer: Chapters 7.7, 8.5-8.6)	#5	
	Lab	04/24	Numerical Modeling: Simulating Conditions for one Semester Exercise Location and Comparing Measurements to Model Results		

15	Lect	04/29	To Be Determined (Possible options: Course Review, Groundwater Rights, Hydrogeology in Planetary Environments, expansion of previous topic and/or topics not previously discussed)		
	Lab	05/01	To Be Determined based on class interests (Possible options: Revisiting some physical experiments, Reviewing some numerical model applications, Application of Numerical Model Inputs Summary to create new model)		
16		05/07	*Final Exam* (4:30-7:15 pm)		

- Semester Exercise due

Quiz and Homework (HW) numbers in the schedule are the weeks these items will be assigned.

Note: Course content and schedule may be modified by the instructor as the semester progresses.

Other Important Dates

Jan 27 Last day to add classes
Feb 03 1st drop deadline (full tuition refund, no record on transcript)
Feb 10 2nd drop deadline (50% tuition refund, no record on transcript)
Feb 24 Last day for unrestricted Self-Withdrawal (no tuition refund, W on transcript)
Mar 30 Last day for Selective Withdrawal (no tuition refund, W on transcript)

Course Policies

Attendance: While attendance is not strictly required, students are expected to attend class regularly.

Conduct During Class: Students are responsible for their actions during class and exam times, and should always maintain an awareness of those around them. Everyone is expected to avoid engaging in disruptive or disrespectful behavior (including loud talking) that could interfere with other students' ability to hear or concentrate on the class discussions.

Electronic Devices: The use of electronic devices (computer, tablet, phone and the like) is permitted during class with some restrictions. The use of such devices is subject to the AI Tools policies for this course. Furthermore, their use may not be distractive or disruptive to the class, and all use of electronic devices must be respectful of your peers and instructor while class is being conducted.

For example, while in class, audible alerts on your devices must be off. You also may not use your electronic devices to engage in activities that are unrelated to the class while class is in session. The instructor reserves the right to prohibit the use of electronic devices by any student whose use of a device is unrelated and/or disruptive to the class.

Earbuds and headphones may not be worn at any time during class or during exams without an approved accommodation or prior approval from the instructor.

Calculators are the only aid that may be used during exams. If you plan to use a calculator function on a phone, tablet or other electronic device during an exam, you may only use the calculator function. Except for taking online exams themselves in the event the class transitions to online, no other use of electronic devices is allowed during exams, i.e., you may not use electronic devices to access notes or any other information during exams.

Please also see the GMU polices website for a summary of the university computer policies (https://universitypolicy.gmu.edu/policies/responsible-use-of-computing/). All university policies apply to any use of George Mason University computers and computer systems for this course.

Course Materials: All course materials provided or presented by the instructor (e.g., lecture outlines, lecture slides, exams, assignments, quizzes, exercises, demonstrations) are for course use only. *These materials may not be shared, posted or in any way redistributed outside of the course, either electronically or as hardcopy*. Sharing or redistribution of course materials in any form is a violation of the GMU Academic Standards Code.

Recording of Lectures: Lectures and demonstrations may *not* be electronically recorded in any format without prior permission of the instructor and completion of a recording agreement form. Acceptable agreement forms are the "Recording (Audio/Video) and Copies of Class Presentations Acknowledgement" form from Disability Services, or a similar form provided by the instructor. In all cases, the opinions, questions and comments of other class members may not be shared at any point with anyone else.

Exams: Preliminary Exams will be taken during the class meeting time on the dates listed in the course schedule. The time and date for the Final Exam is as listed on the course schedule. If GMU is closed on the scheduled date of the Final Exam, the make-up date and time for the Final Exam will be announced through the class Canvas site and GMU e-mail.

All exams will be taken in person unless the class transitions to online, in which case exams will be online. All exams are closed book and closed notes. Use of these materials, or any other source of information, is prohibited during all exams.

Homeworks and Quizzes: Homework assignments and quizzes will be posted on Canvas on the dates listed in the course schedule. Except when specifically noted otherwise, quizzes and homework assignments are due by the start of class (4:30 pm) one week after they are issued.

Quizzes must be completed within Canvas. Quizzes are time-limited with a flexible start time. You may start the quizzes at any time during the window that each quiz is available. Once started, all quizzes must be completed within 60 minutes of when the quiz is started.

Quizzes are open book and open notes; you may use notes, books or any other information for the quizzes.

Homework assignments may be completed within Canvas or outside of Canvas. Homework assignments do not have a time limit except for the due date. Assignments may be given to instructor directly, e-mailed to the instructor, or submitted through Canvas if that option is enabled. *Please do not leave assignments in the instructor's office mailbox or in the instructor's office if the instructor is not present at the time.*

Homework assignments are open book and open notes; you may use notes, books or any other information for the homework assignments.

Laboratory Exercises: Laboratory exercises are intended to be active exercises where students apply the principles and mathematical tools that are discussed in the lectures. The laboratory exercises will be scored based on participation and level of effort on each exercise. All work for the laboratory exercises is to be conducted in class and finished by the end of the class period.

Late or Missed Coursework: Reasonable accommodations will be made for late homeworks and quizzes, and for exams missed due to sickness, religious observance and other unavoidable schedule conflicts if the instructor is notified prior to the date the homework or quiz is due or date the exam is given. Without prior notification, late exams and quizzes are subject to a 10% reduction of the possible score (e.g., a 10-point reduction from an exam worth 100 points). Unusual situations that prevent advance notice to the instructor will be handled on a case-by-case basis. In any event, homeworks, quizzes and exams that are not turned in, are not made up, or remain unexcused one week after the scheduled due date or exam date are subject to a grade of zero.

Make-up laboratory exercises will not be offered for missed labs.

Collaboration: Students are encouraged to study together and discuss with each other the information and concepts covered in the lectures and course readings. Collaboration on homework assignments, quizzes and the Semester Exercise is permitted so long as all students in the collaboration fully participate in the discussion of all questions and do a fair share of the collaborative work. For the Semester Exercise, collaborating students must also use different data sets and do their own write-ups. Simple division of labor (i.e., dividing questions within the group) is not consistent with this collaboration policy and is not permitted.

Collaboration of any sort is not permitted during exams.

Use of Artificial Intelligence (AI) Tools: AI Tools of any type are neither needed nor encouraged to be used for this class. Students may use an AI Tool for personal study purposes if they choose, for example to test themselves or organize their own notes, but that is the only permitted use of AI Tools for this class.

AI Tools may not be used to create any coursework submitted to the instructor. This includes exams, quizzes and in-class exercises.

Consistent with the Recording of Lectures policy stated above, AI Tools may not be used to take notes during class without prior written approval from the instructor. Similarly, AI Tools may not be used to represent or stand-in for any student at any time during class. Deploying an AI Assistant, for example, is not a suitable substitute for attending class.

Consistent with the Course Materials and Presentations policy above, AI Tools may not be used to repackage and redistribute any class materials or presentations provided by the instructor.

If you have any questions or concerns about AI use for this class, please see the instructor.

Grade Postings: All course scores will be posted on the course Canvas website unless otherwise requested.

Unscheduled University Closure: In the event of an unscheduled university closure or access limitation due to weather or other reasons, check Canvas and your GMU email for any class announcements. If class cannot meet because of the closure or access limitations, supplementary activities may be assigned.

Extended Emergency Adaptation: All classes are scheduled to be conducted in person. If an extended emergency situation prevents in-person classes, classes may be shifted to a synchronous online mode (i.e., live online) and conducted through Canvas. You will be told if classes are being shifted to online mode and given instructions on how to access the online system.

Non-Discrimination Commitment: The instructor is committed to providing all students equal opportunity and an educational environment free from any discrimination on the basis of race, color, religion, ethnic national origin (including shared ancestry and/or ethnic characteristics), sex, disability, military status (including veteran status), sexual orientation, gender identity, gender expression, age, marital status, pregnancy status, genetic information, or any other characteristic protected by law. The instructor is also committed to providing an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected. Please see the instructor if any actions or incidents in or related to this class run contrary to these commitments.

University Policies

Students must abide by the GMU Common Policies Addendum. These policies are posted at https://stearnscenter.gmu.edu/home/gmu-common-course-policies/

Title IX

Title IX is a federal civil rights law that prohibits discrimination on the basis of sex under any education program or activity receiving federal funding. GMU receives federal funds in many forms and so is required to comply with Title IX.

Sexual assault and sexual harassment are forms of sex discrimination covered by Title IX. Other issues that are investigated under Title IX include stalking, intimate partner violence, gender-based harassment, sexual exploitation, complicity in the commission of any act prohibited by this policy, and retaliation for good faith reporting of any of these forms of conduct or participation in any investigation or proceeding.

More information regarding Title IX is available at:

- https://oacc.gmu.edu/access-services/title-ix/title-ix-mason/university-title-ix-statement
- https://www.ed.gov/laws-and-policy/civil-rights-laws/title-ix-and-sex-discrimination

Student Support Resources

GMU has several support resources available to all students. Potentially useful starting points include:

- Mason email: https://mail.gmu.edu
- Learning Services: https://learningservices.gmu.edu
- Student Health Services: https://shs.gmu.edu
- Counseling and Psychological Services: https://caps.gmu.edu
- Student Support and Advocacy Center: https://ssac.gmu.edu
- University Career Services: https://careers.gmu.edu
- Office of the University Ombudsperson: https://ombuds.gmu.edu
- Office of Access, Compliance, and Community: https://oacc.gmu.edu
- Non-Discrimination resources: https://oacc.gmu.edu/access-services/non-discrimination
- Sex- or Gender-based Discrimination and Sexual Misconduct resources: https://oacc.gmu.edu/equity-access-services/title-ix/what-title-ix
- Title IX Contacts at Mason: https://oacc.gmu.edu/access-services/title-ix/who-can-i-speak

Many other resources are listed on the GMU Student Life website: https://www.gmu.edu/student-life