WATER / GEOLOGY 383/583: HYDROGEOLOGY

Spring Semester, 2018

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Office Hours: Monday and Wednesday, 9:00-11:00 and 2:00-3:00 (or by appointment)

Course Overview:

This course examines principles of groundwater occurrence, movement and utilization as a resource. The emphasis of the class is on applied hydrogeology, learning how theories relate to actual field conditions. Much of the class will be spent working on assignments that provide opportunities to solve a variety of hydrogeological problems. Thus, students are expected to compete the reading assignments and read the online lecture notes prior to each class and to come prepared to participate in the classroom activities.

Course Objectives:

The readings, lectures, assignments, and exams are intended to help students both learn and demonstrate that they understand:

1. how the surface topography, surface water hydrology and geology influence the occurrence and recharge of groundwater;
2. how to construct hydrologic budgets for groundwater basins;
3. the concepts of safe yield and sustainability;
4. how to calculate recharge rates using: climatic data, changes in the water table elevation, and average annual baseflow measurements;
5. the significance of aquifer properties and how they vary in natural environments;
6. the concept of hydraulic head, how it is measured, and its importance to ground water movement;
7. how to create potentiometric surface maps and to measure both horizontal and vertical hydraulic gradients;
8. how to use Darcy's Law to calculate groundwater discharge and average linear flow velocity within confined aquifers;
9. how to use the Dupuit equation/assumptions to calculate groundwater discharge within unconfined aquifers;
10. the hydrogeologic factors controlling groundwater interaction with springs, lakes, and streams.

Required Text:

Applied Hydrogeology (4th ed.) by C. W. Fetter, Jr. (2001) has an associated web site: http://www.appliedhydrogeology.info/, which has corrections to errors in the textbook and provides solutions to odd-numbered problems at the end of each chapter.

There is also a D2L web site associated with the course. In addition to announcements, this site contains lecture notes and handouts needed for all of the assignments.

Attendance Policy:

Attendance is expected at every meeting, and class participation will factor into the final grade (see Grading Policy). During many class meetings (20 times during the semester) students will work on in-class assignments. These assignments are not graded, but to receive credit, a student must have been present and completed the assignment.

Grading Policy:

Final grades are determined from two hour exams, class participation, and a final exam.

GRADING INSTRUMENT	VALUE	WEIGHT
Semester exams (2)	26% each	52% of final grade
Class Assignments (20)	1% each	20% of final grade
Final Exam (1)	28% each	28% of final grade

Final letter grades in the course will include the plus and minus option. In no case will an incomplete be granted unless the student has a long-term illness or a family emergency. A student in one of these situations must arrange for an incomplete with me prior to the end of the semester.

Examinations:

Each of the exams will be an **open book, open note** test and will cover the material from both lecture and laboratory sessions. The emphasis of these tests is on problem solving, although short-answer questions are also included. Exams from previous years are not available, but I do assign optional, review questions at least one week prior to the date of a test (solutions to those questions can be found at the Applied Hydrogeology web site). Exams are scheduled during a two-hour lab session to provide sufficient time to finish.

"Make-up" exams may be given *only* to those students who have *prior* approval from the instructor. Illness is a valid excuse *only* when the student has verifiable evidence of that illness from a doctor. There will be *no* "extra credit" available for missed exams.

Student Responsibilities:

Student rights and responsibilities, including the behaviors that are expected of students and faculty in the classroom environment, are described on pages 2 through 4 of a UW-System online document: http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf.

SCHEDULE OF LECTURES, ASSIGNMENTS, EXAMS, AND READINGS

DATE	LECTURE TOPIC OR IN-CLASS ASSIGNMENT	READINGS
01/23	Introduction; Hydrologic Basins and Water Budgets	1-23
01/25	Water Budget Calculations for Schmeekle Reserve	441-449
01/26	“Safe Yield”: Irrigation Effects in the Central Sands Region	Online Reading
01/30	Porosity, Specific Yield, and Groundwater Occurrence	69-81; 223-234
02/01	Factors Influencing Water Table Recharge Part 1	225-234
02/02	Factors Influencing Water Table Recharge Part 2	24-42
02/06	Baseflow and Recharge Rates in Central Wisconsin	42-51
02/08	Intrinsic Permeability and Hydraulic Conductivity	81-90
02/09	The Water Table, Aquifers, and Confining Beds	93-98
02/13	Sedimentary Bedrock Aquifers of South Dakota	268-272
02/15	Transmissivity, Storativity, Heterogeneity and Anisotropy	100-106
02/16	Hydrostratigraphy: Calculating Aquifer Properties	Online Reading
02/20	Groundwater Movement in Fractured, Crystalline Bedrock	319-321; 469-474
02/22	Data Presentation: Structure Contour and Isopach Maps	Online Reading
02/23	Review for Exam 1	---
02/27	**EXAM 1**	---
03/01	Piezometers, Hydraulic Head, and Hydraulic Gradients	113-122
	The Cause and Significance of Vertical Hydraulic Gradients	129-131
03/02	Flow Net Construction in Homogeneous, Isotropic Media	132-136
03/06	Flow Net Construction for Schmeekle Reserve	---
03/08	Flow Net Construction for Heterogeneous, Isotropic Media	136-138
03/09	Flow Net Construction for Homogeneous, Anisotropic Media	131-132
03/13	Darcy's Law, Groundwater Discharge and Flow Velocity	122-125; 401-403
03/15	Steady State Groundwater Flow in Confined Aquifers	138-140
03/16	Groundwater Flow Net Analysis for Schmeekle Reserve	---
03/20	Steady State Vertical Groundwater Flow Calculations	138-140
03/22	Steady State Groundwater Flow in Layered Systems	268-272
03/23	Groundwater Flow in Layered Bedrock of South Dakota	268-272
04/03	Groundwater Flow in Layered Bedrock of South Dakota	268-272
04/05	Groundwater Flow in the Floridan Aquifer of Florida	255-262
04/06	Review for Exam 2	---
04/10	**EXAM 2**	---
04/12	Groundwater Basins and Steady State Regional Flow	236-243
04/13	Steady State Groundwater Flow in Unconfined Aquifers	140-141
04/17	Steady State Flow and Discharge to the Tomorrow River	142-146
04/19	Steady State Recharge Rates within Portage County	142-146
04/20	Groundwater and Surface Water: A Single Resource	Online Reading
04/24	Hydrogeologic Controls on the Occurrence of Springs	248-250
04/26	Lake Classification: Recharge, Discharge, Flow-Through	272-278
04/27	Water Budget and Groundwater Flow at Starr Lake, Florida	Online Reading
05/01	Characteristics of Lakes within the Sand Hills of Nebraska	D2L Reading
05/03	Groundwater Interaction with Effluent Streams	Online Reading
05/04	Surface Water Infiltration Induced by Pumping Wells	46-48
05/08	Steady State Recharge Areas for Pumping Wells	436-439
05/10	Water Budgets and Recharge Areas for Pumping Wells	---
05/11	Review for Final Exam	---
05/16	**FINAL EXAM (10:15 AM)**	---