# CVEN4503

## Groundwater Resource Investigation

Term 1, 2023

# Course Overview

## Staff Contact Details

### Convenors

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Martin Andersen | m.andersen@unsw.edu.au | | WRL, Manly Vale | |

### Lecturers

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Will Glamore | w.glamore@unsw.edu.au | | WRL, Manly Vale | |
| Dr Mahmood Sadat-Noori | m.sadat-noori@unsw.edu.au | | WRL, Manly Vale | |

## School Contact Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

### Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

# Course Details

## Units of Credit 6

## Summary of the Course

Review of groundwater occurrence in Australia. Physical properties of groundwater and groundwater occurrence. Principles of groundwater flow. Storage and transmissivity - impacts of groundwater abstraction. Groundwater in the hydrological cycle: flow nets; surface water groundwater interconnectivity. Groundwater modelling. Unsaturated zone flow and calculation of infiltration. Groundwater recharge mechanisms and water balance calculations. Drilling methods for groundwater abstraction; geophysical logging; well design and completion for water production bores. Solutions to the radial flow equation; pumping test interpretation; a program of field work and data analysis will be undertaken at the UNSW Research Field Station in Wellington (NSW).

## Course Aims

The aim of this course is to develop a student's understanding of the occurrence of groundwater and how it is
interlinked with surface water. In addition, the student will understand the basic methods of groundwater development.

## Course Learning Outcomes

After successfully completing this course, you should be able to:

| Learning Outcome | EA Stage 1 Competencies |
|---|---|
| 1. Describe key groundwater processes including its occurrence and connectivity to surface water | PE1.1, PE1.2, PE1.3, PE2.1, PE2.2, PE2.3 |
| 2. Undertake appropriate field investigation methods | |
| 3. Evaluate hydrological field data | PE2.1, PE2.2, PE3.1, PE3.5, PE3.6 |
| 4. Produce a report based on field data | PE3.1, PE3.2, PE3.3, PE3.4, PE3.6 |

## Teaching Strategies

This course for the first 4 weeks of the term involves seminars and workshops providing the background prior to the field trip in Week 5. The 3 day field trip is conducted at the UNSW Field Station in Wellington (NSW), where practical work will be undertaken to consolidate the understanding achieved in the 4 weeks of seminars. The following weeks will involve guided tutorial sessions to work on the data from the field trip to aid in producing the final group report.

## Additional Course Information

This course have a mandatory fieldwork component. 50% of the course mark will be based on this field component. Lectures and exercises will be presented in Weeks 1-4 of Term 1. There will then be a 4-day

short course at the UNSW Field Station in Wellington (NSW) where practical work will be undertaken to consolidate the understanding achieved in the 4 weeks of lectures. The field course will commence on Monday 13th of March and conclude on Friday 17th of March (3 days in the field). A bus will be hired for the transport to and from Wellington. On the Monday evening we will hold a BBQ info session at the field course accommodation on arrival.

We will follow current NSW state and UNSW guidelines regarding COVID19 requirements.

If you have concerns in regards to the field trip or covid, please contact course coordinator Dr Martin Andersen.

# Assessment

This course will be assessed by two assignments and one final report (Note: **There is no exam at the end of this course**). The two assignments are individual, which totals 50% of the course mark, are meant to test that the students understand the content of key chapters in the course notes and test their competencies in using groundwater investigation methods. They will also provide the students with early feedback on how they are progressing with the course. The final report (50% of the course mark) is a group assignment (3 students to a group). The report will consist of 1) a summary of the field activities at the Wellington Field Research Station; 2) presentation of the results; and 3) an integrated synthesis of the groundwater processes at the field station based on all results. Each student will have to do a specific part of the report for individual assessment, but it is very much a collaborative effort.

The final report will assess the students understanding of the methods demonstrated in the field, ability to present and critically assess the quality of groundwater field data obtained by a range of methods and finally their ability to interpret the findings in relation to groundwater processes. The purpose of the assessment tasks are to enable students to develop the necessary depth of understanding of groundwater resources so that they can enter the workforce and contribute accordingly.

*Students who perform poorly in the two first assignments are recommended to discuss progress with the lecturer during the semester. The final grade is calculated based on the individual assessments. Passing the course requires a final grade of 50%. The Course Coordinator reserves the right to adjust the final scores by scaling if agreed by the Head of School.*

| Assessment task | Weight | Due Date | Course Learning Outcomes Assessed |
|---|---|---|---|
| 1. Assignment 1 | 20% | 02/03/2022 09:00 AM | 1 |
| 2. Assignment 2 | 30% | 10/03/2022 05:00 PM | 1 |
| 3. Wellington Field Assignment | 50% | 24/04/2022 05:00 PM | 1, 2, 3, 4 |

## Assessment 1: Assignment 1

**Start date:** 23/02/2022 11:00 AM
**Assessment length:** N/A
**Due date:** 02/03/2022 09:00 AM

This assignment will assess the student's ability to use the physical properties of water for calculating groundwater flow.

## Assessment 2: Assignment 2

**Start date:** 02/03/2022 11:00 AM
**Assessment length:** N/A
**Due date:** 10/03/2022 05:00 PM

This assignment will assess the student's ability to use groundwater chemistry methods in groundwater investigations.

## Assessment 3: Wellington Field Assignment

**Start date:** 13/03/2022 12:00 AM
**Assessment length:** N/A
**Due date:** 24/04/2022 05:00 PM

This assignment will assess the students understanding of the methods demonstrated in the field, ability to present and critically assess the quality of groundwater field data obtained by a range of methods and finally their ability to interpret the findings in relation to groundwater processes. Work is completed as a group but individuals nominate which section they wrote and are marked accordingly.

## Attendance Requirements

For this course the Wellington Field component is mandatory. 50% of the course mark is based on the Wellington field assignment. Students who think that they may have a problem with attending the field component should contach the course coordinator A/Prof Martin Andersen to discuss.

Students are otherwise strongly encouraged to participate in class and online seminars and workshops.

## Course Schedule

CVEN4503 is divided into 3 sections:

Weeks 1 to 4: Consists of seminars and workshops introducing the theory, the necessary material for Assignments 1 and 2, and information for the field trip. We have decided that Weeks 3 and 4 will be taught online only due to covid-19. Hopefully this precaution will allow us to do the field trip.

Weeks 1 to 2: will be taught face to face in CE701 (The Civil Engineering building)

Weeks 3 to 4: will be taught online only.

Week 5: The Wellington field trip (Monday to Friday).

Weeks 6 to 10: Workshops and group work on the collected Wellington data. We hope that this section of the course can be delivered face to face.

View class timetable

### Timetable

| Date | Type | Content |
|---|---|---|
| O-Week: 6 February - 10 February | | |
| Week 1: 13 February - 17 February | Seminar | Thursday 9:00-11:00 (Room: CE701)<br><br>Introduction to hydrogeology<br><br>A/Prof Martin Andersen |
| | Workshop | Thursday 11:00-13:00 (CE701)<br><br>Workshop on 3D geological structures and implications for groundwater occurrence |
| Week 2: 20 February - 24 February | Seminar | Thursday 9:00-11:00 (CE701)<br><br>Physical properties of soil and water and equations of groundwater flow<br><br>A/Prof Martin Andersen |

| | | |
|---|---|---|
| | Workshop | Thursday 11:00-13:00 (CE701)<br><br>This workshop 2 is on material for Assignment 1 (assessable):<br><br>Physical properties of water and calculation of groundwater flow |
| Week 3: 27 February - 3 March | Seminar | Thursday 9:00-11:00 (CE701)<br><br>Geochemical investigations<br><br>A/Prof Martin Andersen |
| | Workshop | Thursday 11:00-13:00 (CE701)<br><br>This is Workshop 3 and is on material for Assignment 2 (assessable). |
| Week 4: 6 March - 10 March | Seminar | Thursday 9:00-11:00 (CE701)<br><br>Surface water groundwater interactions<br><br>A/Prof Martin Andersen |
| | Workshop | Thursday 11:00-13:00 (CE701)<br><br>This is Workshop 4 and is on Surface water - groundwater interactions (non-assessable) |
| Week 5: 13 March - 17 March | Fieldwork | This is the **Wellington Field Course week.** We will be leaving Sydney on Monday the 13th of March at 12:00 (exact time and place TBA). We will stay at the Wellington Caves Campground. The return to Sydney will be on Friday the 17th of March in the early afternoon. |
| Week 6: 20 March - 24 March | Homework | **FLEXIBILITY WEEK**<br><br>No scheduled class. Continue working on Wellington field trip follow-up: Groupwork, data quality assessment, data processing, trouble shooting and Q&A. |
| Week 7: 27 March - 31 March | Group Work | Thursday 9:00-13:00. Room CE701<br><br>Wellington field trip follow-up: Groupwork, data quality assessment, data processing, trouble shooting and Q&A. |
| Week 8: 3 April - 7 April | Group Work | Thursday 9:00-13:00. Room CE701<br><br>Wellington field trip follow-up: Groupwork, data |

| | | |
|---|---|---|
| | | quality assessment, data processing, trouble shooting and Q&A. |
| Week 9: 10 April - 14 April | Group Work | Thursday 9:00-13:00. Room CE701<br><br>Wellington field trip follow-up: Groupwork, data quality assessment, data processing, trouble shooting and Q&A. |
| Week 10: 17 April - 21 April | Group Work | Individual work in reporting groups and report submission on the Monday the 24th, before 5 pm. |

# Resources

## Prescribed Resources

This couse will rely on the lecture notes and face to face lecture presentations. The actual lectures and the powerpoints will also be available online on Moodle.

## Recommended Resources

Recommended general textbooks are:

- Applied Hydrogeology - Fourth Edition (2001) by C.W. Fetter; published by Prentice Hall - For a basic introduction.
- Physical and Chemical Hydrogeology - Second Edition (1997) by Domenico and Schwartz; published by John Wiley and Sons - More detailed theoretical discussion of many aspects.
- Groundwater Hydrology - Conceptual and Computational Models (2003) by K.R. Rushton; published by Wiley - Excellent practical and theoretical approach to groundwater resource assessment.
- Water Wells and Boreholes - Misstear, Banks and Clark (2006); published by Wiley
- Groundwater in the Environment - An Introduction: by Paul L Younger (2007); published by Blackwell
- Geochemistry, Groundwater, and Pollution (2005); Appelo, C.A.J., Postma, D.; 2nd ed. A.A. Balkema, Rotterdam. 649 pp. ISBN: 04 1536 428 0. - Best textbook on the market for groundwater chemistry! It can be ordered via website www.crcpress.com

The UNSW Connected Waters website provides a portal to the groundwater world. This can be accessed at: http://www.connectedwaters.unsw.edu.au. The Hydrogeology Journal is the academic publication of the International Association of Hydrogeologists. The web address for the IAH is http://www.iah.org/ and journal articles are on line at http://link.springer.de/link/service/journals/10040/index.htm.

## Course Evaluation and Development

The course rely on the students providing their constructive criticism and suggestions for improvement anonymously using the course evaluation MyExperience. We also welcome feedback (positive and negative) at anytime during the lectures and workshops and via confidential email if necessary.

## Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

**UNSW has a standard late submission penalty of:**

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

## Academic Honesty and Plagiarism

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

# Academic Information

**Final Examinations:**

Final Exams in T1 2023 will be held on campus between the 28th of April and the11th of May, and Supplementary Exams between the 22nd of May and the 26th of May. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

**ACADEMIC ADVICE**

- Key Staff to Contact for Academic Advice (log in with your zID and password): https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw
- Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): https://intranet.civeng.unsw.edu.au/student-intranet
- Student Life at CVEN, including Student Societies: https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life
- Special Consideration: https://student.unsw.edu.au/special-consideration
- General and Program-Specific Questions: The Nucleus: Student Hub
- Book an Academic Advising session: https://unswengacademicadvising.as.me/schedule.php

# Disclaimer

*This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.*

## Image Credit

Mike Gal.

## CRICOS

CRICOS Provider Code: 00098G

## Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

## Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

| **Program Intended Learning Outcomes** | |
|---|---|
| Knowledge and skill base | |
| PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline | ✓ |
| PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline | ✓ |
| PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline | ✓ |
| PE1.4 Discernment of knowledge development and research directions within the engineering discipline | |
| PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline | |
| PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline | |
| Engineering application ability | |
| PE2.1 Application of established engineering methods to complex engineering problem solving | ✓ |
| PE2.2 Fluent application of engineering techniques, tools and resources | ✓ |
| PE2.3 Application of systematic engineering synthesis and design processes | ✓ |
| PE2.4 Application of systematic approaches to the conduct and management of engineering projects | |
| Professional and personal attributes | |
| PE3.1 Ethical conduct and professional accountability | ✓ |
| PE3.2 Effective oral and written communication in professional and lay domains | ✓ |
| PE3.3 Creative, innovative and pro-active demeanour | ✓ |
| PE3.4 Professional use and management of information | ✓ |
| PE3.5 Orderly management of self, and professional conduct | ✓ |
| PE3.6 Effective team membership and team leadership | ✓ |