

WATR7001 - Science of water (2 units)

Foundation module

Course description

This course is one of four foundation courses and is an introduction to key ideologies and philosophies of integrated water management. Key issues include: concepts and practice of integrated water resource management; principles of water science; and, whole-of-water-cycle approaches.

Course introduction

This course introduces students to some of the fundamental science which underpins the understanding of the whole of catchment water cycle, including water quality and water treatment for human consumption. The module introduces the properties of water (physical and chemical), as well as concepts relating to the natural hydrological cycle and the ecology of inland aquatic systems. The module also addresses the human uses of water including water quality and water treatment and highlights the dynamic relationship between human and natural aquatic systems.

This module covers key skills that are critical for a rigorous understanding of integrated water management problems. There is an emphasis on the whole-of-water-cycle and adaptive management approaches. Students will be exposed to both the theoretical and practical components of the course content (case study material, etc). They will participate in a one day [field trip on the Brisbane River](#) from the catchment to the coast. Other field trips will include a visit to a wastewater treatment plant, and a water sampling day at Griffith University. The course content will also be reflected against material presented through case-study exploration.

Course delivery

- **Full-time** (on-campus) students, including international students, are required to enrol in the internal offering in Semester 1. Semester 1 begins with a three-day field trip to [North Stradbroke Island](#). Full-time students will also participate in a one-day field trip on the [Brisbane River](#) from the catchment to the coast. Other field trips will include a visit to a wastewater treatment plant, and a water sampling day at Griffith University.
- **Part-time** (external) students are required to attend a three-day [field trip to North Stradbroke Island](#) followed immediately by an intensive three-day block of classes (9am-5pm). The remainder of the course will be taught externally on-line.

Assumed background

This is a postgraduate course in general water science offered as part of the International WaterCentre Master of Integrated Water Management. Students are expected to have basic background knowledge through undergraduate science or engineering

programs. For this particular module, it is assumed that students have a basic understanding of chemical equations and stoichiometry.

Learning objectives

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

- describe the physical and chemical properties of water. These are the basic properties of water that underpin its role in the environment, and contribute to an understanding of water quality and water treatment for human consumption;
- describe the processes that affect these physical and chemical properties with respect to water quality. This includes human influences in the environment, such as increased nutrient and organic loads on waterways, land use changes, hydrological changes and urbanisation;
- analyse, interpret and write about water quality data. Analyse given water quality data using correct analysis methods and statistics; present water quality data using correct tables and figures; interpret the outcomes of this analysis; write a meaningful report about the data and its implications for water quality, ecosystem health, or human use;
- describe basic hydrology of catchments, and physical processes within catchments. An understanding of basic catchment hydrology is important in understanding water quality, linkages between the terrestrial and aquatic environment, the influence of land-use change on aquatic systems, reservoir function and water treatment needs and environmental flows;
- describe basic ecological processes in aquatic systems and measure key water quality and biologic indicators for ecological health in an aquatic system.

“I am a very practical person. I love the hands-on approach that the Masters Program has offered us in the teaching and learning process.”
 – Masters student

A student is preparing equipment for measuring aquatic eco-system productivity.





IWC Graduates receive a co-badged degree from four leading Australian universities, ranked amongst the top 1% of the best universities in the world for teaching and research. (QS Global Ranking)

In understanding the whole of catchment water cycle it is important to also have an understanding of the functioning of natural aquatic systems and the trajectories of change imposed on these systems by human development and modification. Monitoring and assessing the health of aquatic systems is an integral part of water resource management;

- understand the principles of water storage and treatment. Most of the world's freshwater systems have been modified for human use with water storage for human consumption a major use. Understanding the principles of water storage and its subsequent treatment for human use is a major component of integrated water management, particularly with respect to sustainable water use;
- be aware of larger issues of water security, such as climate change. In the current context of climate change it is important to understand issues relating to water security. Climate change models can be used to assess water supply changes and also model changes in water quality;
- have improved (1) their ability to manage their own study and (2) their ability to work effectively in an engineering team; and should particularly be able to:
 - reflect on own learning and improve study approaches on basis of this learning;
 - work in a team to solve a large complex problem and communicate the solution effectively;
 - identify and overcome issues/problems in a team to make the team result better than the sum of the individuals;
 - have participated in an integrated group project exploring detailed aspects of integrated water management.

Teaching staff

Course Coordinator (and Lecturer): [Dr Steven Pratt](#) (The University of Queensland)

Lead Lecturer: [Dr Fran Sheldon](#) (Griffith University)

Lecturer: [Prof Paul Lant](#) (The University of Queensland)

Problem-Based Learning (PBL) projects

PBL projects and field trips will run through the semester, comprising roughly 50% of the total contact time and assessment weight. These enable students to develop skills that complement the content delivered in the four co-requisite courses: WATR7000, WATR7001, WATR7002, WATR7003. Please see other co-requisite course profiles to cross-reference.

The PBL stream for the Foundation semester comprises an individual project and a group project conducted in multidisciplinary teams (full-time students complete two PBL projects per semester while part-time students complete one PBL per semester):

- **PBL1:** Situation analysis and critique of an existing water management project or program (Group project)
- **PBL2:** Design of a project proposal to address a real-world water management issue from an Integrated Water Management perspective (Individual project)

A significant amount of project time will be spent exploring the case study material with respect to the topic content of the Science of water course. Students will be provided with an introduction to the case study catchments from the water science perspective. They will examine water quality data from the different catchments; gain an understanding of the different parameters measured and what information these are providing about the system in question. Students will be given an opportunity to explore real hydrological data from the case study catchments and gain an understanding of how flow data can inform understanding of catchment functions. Students will explore issues relating to water resource development within each case study catchment and discuss the rationale for environmental flows. They will examine available biological data from the catchments and generate conceptual models reflecting physical and biological patterns and processes within these catchments. They will be provided with opportunities to discuss biological monitoring (broadly) and the implementation of monitoring programs. Students will examine the water storages within the case study catchments and explore different modes of water treatment. Finally, linking with material taught in the other modules, students will reflect on water security within the case study catchments and examine aspects of risk assessment.

Field trips

Students begin the Foundation semester with a three-day field trip to [North Stradbroke Island](#). The cost of the trip (including transport from Brisbane, accommodation and meals) is included in the tuition fees.

As part of this module (WATR7001 - Science of water), students also participate in the following activities:

- one-day trip on the [Brisbane River](#)
- half-day field trip to an Advanced Wastewater Treatment Plant (Queensland)
- half-day water sampling field trip (Griffith University, Nathan Campus, Brisbane)

For a complete list of field trips that students undertake during the program, please refer back to "Field trips" on page 4 of this syllabus or visit [IWC website](#).