PhD in freshwater research:
Multiple positions, Industry funded

THE UNIVERSITY OF MELBOURNE

We are seeking up to three PhD candidates in the Water, Environment and Agriculture Program, Department of Infrastructure Engineering (https://infrastructure.eng.unimelb.edu.au/) at The University of Melbourne, to undertake freshwater research aligned with the Flow-MER program (https://flow-mer.org.au/).

Flow-MER is the Commonwealth Environmental Water Holder (CEWH)'s on-ground science program that assesses how the environment responds to environmental water delivered as part of the Murray-Darling Basin Plan. Through monitoring, evaluation and research (MER) activities, Flow-MER aims to demonstrate environmental outcomes and inform management of Commonwealth Environmental Water to improve river health and biodiversity. The current Flow-MER Program runs from July 2024 until June 2029 with MER activities across a range of themes including Cultural Outcomes (led by First Nations groups), Native vegetation, Waterbirds, Native fish, Invertebrates, River metabolism and Physical form.

We are seeking enthusiastic candidates to lead research programs in rivers and wetlands of north-central Victoria (Goulburn River and Northern Victorian Tributaries Area). Candidates may choose from a range of research themes that align with the priorities of Flow MER, including the projects proposed below. Other project proposals may also be considered.

Successful applicants will enjoy a range of advantages, including:

- Generous funding scheme (see below).
- Research training at the leading university in Australia.
- Working as an integral part of the Goulburn River and Northern Victorian Tributaries project team, with members from three universities, two consulting companies, two environmental management agencies, and multiple First Nations organisations.
- Studying with a cohort of PhD students embedded in the same program at similar stages of candidacy.
- Collaboration with networks of freshwater researchers, managers, policy makers, and community and First Nations groups across Victoria and the Murray Darling Basin.

Application process

Prospective candidates must be eligible to apply for an Australian Government Research Training Program (RTP) Scholarship at the University of Melbourne and be highly competitive for that award. For guidance, students based outside Australia should have a Weighted Average Mark on previous degrees of ~85% or higher. Local students (including overseas students who have studied in Australia) require ~82%. Please email your expression of interest to Prof Angus Webb & Dr Wim Bovill (contact details below). The EOI should include:

- Cover letter explaining why you believe that you would be a suitable candidate for the position
- CV
- Full statement of academic results for undergraduate and any postgraduate study
- Research statement of up to 300 words specifying preferred project. If nominating for one of the projects below, provide initial ideas about how research would proceed. If nominating for a different project, provide an outline of the project concept including how it relates to the management of Commonwealth Environmental Water

We will select applicant/s to go through to the University of Melbourne PhD program application stage and will provide support to prepare applications. While selection at the EOI stage does not guarantee a PhD position at the University of Melbourne, we will only select candidates who are highly competitive for an RTP award.

Important information for applicants

EOIs due:	20 December 2024
RTP Applications due:	Round 1: 9 January 2025 (outcomes notified March 7 2025), or Round 2: 17 April 2025 (outcomes notified June 13 2025)
Commence:	July-December 2025
Stipend:	Research Training Program Scholarship or Melbourne Research Scholarship $37,000 p.a. (2024 rate) up to 3.5 yrs
Top-up stipend:	$10,000 p.a. industry top-up
Operational budget:	Up to $30,000 over the life of the project to cover operational costs
Tuition:	Covered by the University of Melbourne scholarship
Further Information:	Enquiries may be made by email to Professor Angus Webb at the address below
Contact:	**Prof J. Angus Webb** The University of Melbourne, Department of Infrastructure Engineering Level 6, Melbourne Connect, 700 Swanston St, Carlton The University of Melbourne, 3010, Victoria, Australia p: +61 425 884 959 e: angus.webb@unimelb.edu.au **Dr Wim Bovill** The University of Melbourne, Department of Infrastructure Engineering Level 6, Melbourne Connect, 700 Swanston St, Carlton The University of Melbourne, 3010, Victoria, Australia e: wbovill@unimelb.edu.au

Potential Research Projects

1. Understanding platypus nesting behaviours in response to water level in a regulated river system.

Research objectives:

- Map populations of platypus in the lower and mid Goulburn River
- Understand how timing and magnitude of flows affect nesting success
- Inform adaptive management of water delivery to promote platypus populations

The Goulburn River is the largest river system in Victoria, Australia and supports a sizable platypus population. However, dams have altered the natural flow regimes in the mid and lower sections of this river. Flows in these sections are heavily regulated to deliver water for agricultural and environmental endpoints, affecting the seasonal timing and magnitude of large flow events. It is predicted that high flows delivered during the breeding season may flood platypus nests that are positioned low on the riverbank, causing mortality of juveniles. To mitigate this outcome, a pulse of Commonwealth Environmental Water is currently delivered in the Goulburn River during winter, to provide a flow cue to encourage platypus to build their nesting burrows high on the riverbank where young will be safe from subsequent high flows. The effectiveness of this management approach remains unclear – and this is where you come in. As the successful applicant, you will investigate how the timing and magnitude of flow-cues affects the position of platypus nests on the riverbank and monitor the survivorship of platypus eggs and juveniles at sites in the lower and mid-Goulburn River. Outcomes of this research will be used to inform adaptive management of environmental water delivery in these reaches to safeguard platypus populations into the future.

Key competencies:

This project will require extended periods of data collection in the field (rural and semi-remote areas), including wading and potential boating on a large river system. The successful applicant must hold or obtain a valid Victorian Drivers Licence and be able to work away from home for several days at a time. Experience working with mammals is desired.

Supervisors:

Prof J. Angus Webb
The University of Melbourne,
Dep. Infrastructure Engineering

Dr Wim Bovill
The University of Melbourne,
Dep. Infrastructure Engineering

2. Hydrological effects on the storage, release and metabolism of carbon from wet and dry parts of the river channel.

Research objectives:

- Identify key geomorphological features storing coarse and fine carbon in dry and wet parts of the river channel.
- Examine effects of hydrology (timing, frequency, magnitude of flows) on: (1) storage and decomposition of carbon on the dry and wet riverbed; (2) liberation and metabolism of carbon and nutrients (N & P) within the water column.
- Compare outcomes among large vs small; regulated vs unregulated rivers in Northern Victoria.
- Assess the contributions of benthic vs pelagic primary production (and respiration) to the whole stream estimate of metabolism.

The successful applicant will evaluate the energetic outputs provided by flows that liberate stores of carbon and nutrients (N & P) within the channel, with implications for aquatic food-webs and the biomass of dependent organisms. Key to this analysis will be an investigation of the features of the river-channel that trap and store coarse (plant detritus) and fine (detritus) carbon in dry and wet parts of the channel. This may include physical features (e.g. flood-runners) and hydrological features (e.g. slackwaters). These stores of material may be liberated and metabolised during freshes and other high-flow events, providing energetic pulses and ecosystem metabolism that may support positive (food production) or negative (blackwater) outcomes. Understanding the combined effects of channel morphology and hydrology on metabolism outcomes is a primary objective of this research.

More specifically, this project will involve a combination of field and laboratory studies, with a focus for the latter on measuring respiration rates of sediment cores as well as soil cores that are rewetted. Both the quantity and quality (enzyme analysis, SUVA, FEEM) of the organic carbon will be important here. For the dried flood runners and billabongs, time since last inundation will be a consideration. Measurement of liberated phosphate and ammonia/nitrate will be essential so we can link that to enhanced primary production. A final interesting aspect is to examine the effect of extended inundation of soil cores, sourced from the floodplain, to test hypotheses regarding whether extended periods of floodplain inundation result in water returning to the river that is essentially depleted in any labile organic carbon and nutrients.

Key Competencies

Competency in analytical and/or environmental chemistry, demonstrated by Masters-level research with a chemistry component or strong marks in undergraduate chemistry units. Experience conducting field surveys and laboratory experiments is desired.

Supervisors:

Prof J. Angus Webb
The University of Melbourne,
Dep. Infrastructure Engineering

Assoc. Prof Michael Grace
Monash University,
School of Chemistry

Dr Wim Bovill
The University of Melbourne,
Dep. Infrastructure Engineering

3. Recruitment of aquatic and littoral plants in rivers: effects of propagule supply, river network position and local conditions

Research objectives:

- Examine source, abundance and species diversity of seeds that deposit onto riverbanks at different positions within a river network.
- Evaluate contributions of tributary inflows as sources of seed to reaches lacking local diversity
- Compare whether local recruitment of aquatic and littoral plants is limited by suitable habitat (microsites) or by the supply of seed.

Numbers and diversity of seedling recruits may be limited by the supply of seeds or vegetative propagules that deposit on riverbanks, or by the amount or suitability of the substrate available for germination and establishment. In river systems, dispersal linkages connecting source and supply of propagules may be strongly influenced by the topology and hydrology of river networks, especially for species that disperse by water (hydrochory).

This project will use field surveys, informed by hydrological modelling, to examine the effects of river network linkages on local abundance and diversity of propagules that deposit on the riverbank. Hydrological models and existing datasets of vegetation distribution, field-verified with vegetation surveys, will be used to identify the likely sources of propagules arriving locally on riverbanks to support dispersal connections between parts of the river network. In low-order rivers, such as the regulated lower Goulburn River, tributary flows may provide important sources of drifting propagules and nutrient-rich sediments for plant colonisation from less degraded catchments upstream. Subsequent field experiments will determine whether recruitment of seedlings *in situ* is limited by the arrival of propagules, or by other factors including available substrate, hydrology, and other factors that may inhibit germination and seedling survival.

The student will evaluate factors shaping the source, deposition and recruitment of aquatic and riparian plants, and how the delivery of Commonwealth water for the environment may be managed to deliver propagules to targeted parts of the riverbank, promoting recruitment of native vegetation across the bank profile.

Key competencies:

This project will require data collection in the field (rural and semi-remote areas), including wading and potential boating on a large river system. The successful applicant must hold or obtain a valid Victorian Drivers Licence and be able to work away from home for days at a time. Experience conducting field surveys and nursery experiments is desired.

Supervisors:

Dr Wim Bovill
The University of Melbourne,
Dep. Infrastructure Engineering

Dr Joe Greet
The University of Melbourne,
School of Agriculture, Food and Ecosystem Sciences

Prof J. Angus Webb
The University of Melbourne,
Dep. Infrastructure Engineering