

**Programme of study for Doctor of Philosophy – Water and Waste Infrastructure and Services Engineering for Resilience (Water WISER) 2020/21**

School responsible for the programme: Civil Engineering

Criteria for Admission: 1st class (Hons) degree in relevant subject area e.g. engineering, social sciences, health sciences, economics etc. Where candidates have other relevant qualifications or experience candidates with a II(i) will also be considered.

**Year One**

- An outline training plan will be developed at the start of Year 1 when the PGR selects the taught elements
- Month 6: submit a draft research plan and supervisory teams appointed
- Month 12: submit final draft PhD proposal for approval by the CDT management team (including the training plan)
- A minimum of four (60 Credits) of specialised subject modules must be taken over Year One and Two selected from the following list:

NUFF5065M Key Issues in International Health  
CIVE5050M Management of WASH Projects  
CIVE5055M Engineering for Public Health  
CIVE5311 Wastewater and Faecal Sludge Management  
CIVE5680M Environmental Microbiology  
CIVE5370 Indoor and Urban Air Quality  
CIVE5535 Advanced Wastewater Treatment  
CIVE5990 Project and Asset Management  
CIVE5321M Water Supply  
CIVE5316M Water Resources Management  
CIVE5575M Groundwater Pollution and Contaminated Land  
CIVE5557M Solid Waste Management  
CIVE5985M Circular Economy and Resource Recovery from Waste  
CIVE5596M Engineering in Emergencies  
SOEE5095M Environmental Economics and Policy  
TRAN5750M Transport in Development  
GEOG5060M GIS and Environment  
GEOG5530M River basin management for water quality  
GEOG5710M Digital Image Processing for Environmental Remote Sensing  
GEOG5790M Programming for Geographical Information Analysis; Advanced Skills  
GEOG5830M Environmental Assessment  
SOEE5483M Critical Perspectives in Environment and Development  
SOEE5550M Climate Change; Impacts and Adaptation  
SOEE5970M Terrestrial Biosphere in Earth System  
NUFF5635M Epidemiology and Biostatistics for Health Systems Strengthening

other options may be included if approved by the Programme Leader. The structured training programme must be discussed and agreed with the CDT management team via the Programme Leader.

- a compulsory non-credit-bearing research skills training course called Water WISER Research Skills
- compulsory training events; annual team building, challenge week conference and two professional networking events

Successful completion of the taught elements of the programme is required in order for PGRs to progress on the programme.

## Year Two

- Commence research under the direction of their supervisor(s)
- Candidates may opt to take additional taught subject modules<sup>1</sup> selected from the following list, to a minimum total of 60 credits over Year One and Year Two (additional credits can be taken if judged necessary within the training plan):

NUFF5065M Key Issues in International Health  
CIVE5050M Management of WASH Projects  
CIVE5055M Engineering for Public Health  
CIVE5311 Wastewater and Faecal Sludge Management  
CIVE5680M Environmental Microbiology  
CIVE5370 Indoor and Urban Air Quality  
CIVE5535 Advanced Wastewater Treatment  
CIVE5990 Project and Asset Management  
CIVE5321M Water Supply  
CIVE5316M Water Resources Management  
CIVE5575M Groundwater Pollution and Contaminated Land  
CIVE5557M Solid Waste Management  
CIVE5985M Circular Economy and Resource Recovery from Waste  
CIVE5596M Engineering in Emergencies  
SOEE5095M Environmental Economics and Policy  
TRAN5750M Transport in Development  
GEOG5060M GIS and Environment  
GEOG5530M River basin management for water quality  
GEOG5710M Digital Image Processing for Environmental Remote Sensing  
GEOG5790M Programming for Geographical Information Analysis; Advanced Skills  
GEOG5830M Environmental Assessment  
SOEE5483M Critical Perspectives in Environment and Development  
SOEE5550M Climate Change; Impacts and Adaptation  
SOEE5970M Terrestrial Biosphere in Earth System  
NUFF5635M Epidemiology and Biostatistics for Health Systems Strengthening

other options may be included if approved by the Programme Leader. The structured training programme must be discussed and agreed with the CDT management team via the Programme Leader.

- complete compulsory training events; annual team building, challenge week, conference and two professional networking events.
- Month 16: First Formal Progress Report
- Undergo the transfer assessment process at the end of year 2 (month 24).

Candidates will be required to pass 60 taught credits and successfully transfer to full PhD status in order to progress on the programme.

## Year Three

- The PGR will continue research under the direction of their supervisor.
- Month 36: Annual Progress Review

## Year Four

- The PGR will continue research under the direction of their supervisor.

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<sup>1</sup> Subject to available capacity on the module and agreement of the module manager

- Month 48: Annual Progress Review (unless thesis submitted)

## Exit Award

PGRs who fail to progress but who have acquired the required number of taught module credits may be entitled to exit with the award of a PG Cert (60 credits) [or PG Dip if sufficient credit has been awarded].

## Learning Outcomes / Transferable Key Skills / Learning Context / Assessment for PhD

### 1. Learning Outcomes

On completion of the research programme PGRs should have shown evidence of being able:

- to discover, interpret and communicate new knowledge through original research and/or scholarship of publishable quality which satisfies peer review
- to present and defend original research outcomes which extend the forefront of a discipline or relevant area of professional/clinical practice
- to demonstrate systematic and extensive knowledge of the subject area and expertise in generic and subject/professional skills
- to take a proactive and self-reflective role in working and to develop professional relationships with others where appropriate
- to independently and proactively formulate ideas and hypotheses and to design, develop, implement and execute plans by which to evaluate these
- to critically and creatively evaluate current issues, research and advanced scholarship in the discipline
- to demonstrate systematic knowledge of and be able to critically assess, analyse and engage with the ethical and legal context of their research and any ethical and legal implications of their research.

In addition the students will be expected to demonstrate competency and knowledge of all of the core engineering specialisations and a deep knowledge and understanding of at least one of these; competency and knowledge of at least 3 technical and research skills areas; and mastery of the range of professional skills as set out in the Table below.

	Technology	Planning	Institutions	Finance
Challenge areas/Core Engineering Specialisations (Year 1 MSc modules and supplemental training in years 2 to 4)	Water treatment processes Wastewater treatment processes Faecal sludge treatment processes and management Solid waste management Sanitation service delivery Water service delivery Behaviour change, marketing and demand creation	Integrated water resources management; River basin management Pollution control City wide sanitation planning Integrated Urban planning Water smart cities	Institutional and policy development Capability enhancement Utility management Equity and empowerment Land tenure, housing and education	Public finance Project finance Contract design and management Public Private Partnerships Tariff design Tax and transfer management

Technical skills (Year 1 MSc modules and supplemental training in years 2 to 4)	Human centred design Architectural design Civil and structural engineering Process engineering Behavioural science Computational fluid dynamics	Decision support science Risk management Project management Asset management Optioneering	Institutional analysis Policy analysis Service delivery assessment	Cost benefit analysis Carbon accounting Engineering economics
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Research skills (Year 1 Research skills module and supplemental training)	Design Modelling GIS and remote sensing Water quality, microbiology, sampling	Economics Social science Political economics
	Citizen science and big data Mixed methods research and dissemination skills Computational methods	
Professional & personal skills (Yrs 1-4 Training)	Problem solving, communication, data driven decision making, collaboration, partnerships, co-production, planning, use of ICT, data collection, data analysis, mentoring, conflict resolution, ethics in research and practice, research commercialisation and securitisation, entrepreneurship, marketing	

## 2. Transferable (Key) Skills

PGRs will have had the opportunity to acquire the following abilities through the research training and research specified for the programme

- the skills necessary for a career as a researcher and/or for employment in a senior and leading capacity in a relevant area of professional/clinical practice or industry
- evaluating their own achievement and that of others
- self-direction and effective decision making in complex and unpredictable situations
- independent learning and the ability to work in a way which ensures continuing professional development

## 3. Learning Context

This will include the critical analysis of, and decision making in, complex and unpredictable professional and/or clinical situations. The structure of the programme will provide research and/or professional training, breadth and depth of study and opportunities for drawing upon appropriate resources and techniques. Opportunities will be provided for PGRs to:

- develop to a high level interests and informed opinions
- develop to a high level their design and management of their learning activities
- develop to a high level their communication of their conclusions
- make an original contribution to the field

PGRs will be expected to engage in the exercise of autonomous initiative in their study and work in professional environments.

#### **4. Assessment**

Achievement will be assessed by the examination of the candidate's thesis<sup>2</sup> and performance under oral examination. Assessment will involve the achievement of the candidate in:

- evidencing an ability to conduct original and independent broad and in-depth enquiry within the discipline or within different aspects of the area of professional/clinical practice normally leading to published work
- drawing on and/or developing a range of research techniques and methodologies appropriate to enquiries into the discipline/area of professional practice
- demonstrating independent critical ability in the application of breadth and depth of knowledge to complex issues within the discipline or specialist area of professional/clinical practice
- drawing on a range of perspectives on the area of study
- evaluating and criticising received opinion
- making reasoned and well-informed judgements on complex issues within the specialism whilst understanding the limitations on judgements made in the absence of complete data
- the written style and overall presentation of the thesis

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<sup>2</sup> or alternative form of thesis