

## Master of WRM Thesis Topic Ideas

	Priority Research Themes	Research Aim
1	Technology & Infrastructure	To develop and assess innovative infrastructure, technologies and Best Management Practice to improve water use efficiency and reduce water contamination, while supporting economic growth in the industry sector.
2	Managing Better II: People and Water	To build a better understanding of the relationship between people and water, in order to underpin alternative, sustainable freshwater management approaches that meet community aspirations for the resource.
3	EoRE End-of-river environments	To develop best practice for the protection of community – specified values in lower catchment environments, such as river mouths, coastal lakes and estuaries. Encompasses many Te Waihora /Lake Ellesmere research initiatives.
4	Blue-Green Urban Waters	To better manage water use, discharge and re-use in an urban environment, assessing infrastructure and processes that enhance the value of urban water, promote efficient use (e.g., recycling) and protect natural waterways.
5	Functional Waterways Networks	To enhance aquatic ecosystem services and biodiversity in water networks, from the mountains to the sea (ki uta ki tai); assessing the ability of ecosystems to adapt to change (in climate, high/low water flow, quality and species invasions), and how network systems can be optimized to improve ecosystem resilience in the face of these changes.
6	Sustainable Nutrients	To minimize nutrient movement, within economic and environmental constraints, from developed land into water, and to reduce the effects of excessive nutrients in water bodies.
7	Sustainable Groundwaters	To improve confidence in the assessment of the effects of groundwater use, utilizing interdisciplinary aspects of groundwater research, applied knowledge and existing monitoring sites and data.

## Notes ....

1. All of the Waterways Centre's research falls within these **Priority Research Themes**. Thesis topics that have been suggested by potential supervisors are grouped under these themes in this document, together with the type of skills that would be needed to undertake this topic, and potential supervisors.
2. Where an **external interest** in the topic is cited, this simply indicates an expressed interest which could translate into supervision, support in-kind or scholarship contributions, or may not. Where a scholarship arrangement has been discussed and is likely, this is denoted by (\$). This cannot be confirmed until an appropriate thesis student is available and the specific research conditions are negotiated.
3. The skill sets indicated are a very general guide and should not be taken as exhaustive or definitive. Further clarification can be sought from the proposed supervisor(s) on the skills that would be required. The key is;

PG or HG	Physical Geography or Human Geography
G	Geology
C	Chemistry
B	Biology, particularly ecology
ERM	Environmental and/or Resource Management
E	Engineering
Ec	Economics
M	Māori studies
Ag	Agricultural science or management
L	Landscape Architecture

Multiple skill sets, where indicated, usually imply that the topic can be slanted to suit particular skills.

4. If you see a topic here that interests you, make a time to talk to the proposed supervisor about it. Find out more about what the research entails. Ask about the skills that will be required, and be prepared to talk about what your skills, interests and career plans are. The topic may evolve and change during your discussion - that is fine as long as the final topic suits both you and your supervisor.
5. Supervisors can only take on so many students for thesis supervision – if they are already “full” they may not be able to help you with a topic. Contacting them as early as possible helps avoid this situation. If it happens, don't take it personally ... It just means you need to continue trying to find a suitable topic.

**PRT 1: Technology and Infrastructure**

Thesis topic	Skill set	Supervisors	External interest
Low impact urban design (e.g. green roof) options for minimizing stormwater flows and contaminants in rebuilt Christchurch	E, C	Tom Cochrane	CCC/CWMS Zone Comm.
Developing water efficiency standards for exported goods (as for energy efficiency ratings)	HG, Ec	John Reid (NTRC)	
Stream augmentation: An option for returning “swimmability” to Coes Ford, Selwyn River?	E, PG	Brett Painter/Jenny Webster-Brown	ECan
Effluent from WSUD systems (e.g. rain gardens) and its potential toxicity.	E, C	Tom Cochrane	ECan/CCC
Fish screen design for irrigation races	E	Tonny DeVries (CNRE)	Irrigation NZ
Improved remote sensing of water quality and riparian development	E, PG	Peyman Zawar-reza	ECan
Water-Food-Energy-Climate Nexus: an assessment of the Waitaki river basin in New Zealand using WEAP and LEAP	E, PG, ERM	Markus Pahlow	NIWA
Assessment of ecosystem services in the Selwyn catchment using the Land Utilisation and Capability Indicator (LUCI) framework	E, PG, ERM	Markus Pahlow	Environment Canterbury; Victoria University of Wellington
Coupled modelling to assess water flows and contaminant transport in the Selwyn River catchment	E, pG	Markus Pahlow	NIWA
Efficiency of sediment traps, and use in for in-stream habitat restoration in the Cam River Catchment, Waimakariri District	E, B	Tom Chochrane	
Application and assessment of a hydrological multi-model ensemble for probabilistic forecasting in selected catchments in Germany and New Zealand	E, PG	Markus Pahlow	NIWA, BfG (Germany)
Investigating a novel technique to assess the effectiveness of sediment traps	E, AG, B	Tom Cochrane	SDC
Effectiveness of current alpine river monitoring to protect ecosystem health of salmonids, what gaps exist – especially when compared against 1980s baseline braided river inventories (e.g., Rakaia and Waimakariri).	ERM, B, PG		Fish and Game ECAN

Thesis topic	Skill set	Supervisors	External interest
Analysis of soil moisture time series data to identify drainage trigger point signals using a machine learning technique to inform irrigation management	E, PG, Ag	Markus Pahlow MS Srinivasan	NIWA
Estimating runoff and evapotranspiration for NZ using the SWAT+ model and global climate models	E, ERM	Tom Cochrane, Markus Pahlow	Work with Texas A&M, USA Work with NIWA
Using aerial multispectral imagery and high precision topography to identify nutrient/pollutant runoff pathways	E, ERM	Tom Cochrane, Markus Pahlow	Use of drone Interests in Future Agriculture
Forest hydrology: estimating forest water losses (i.e. ET) from field observations, remote sensing and available data sets.	E, ERM	Markus Pahlow, Tom Cochrane	Collaborate with NIWA/Scion
Delta city multi-hazards: how do we assess, manage and plan for these? Case studies exploring 'Laboratory Christchurch' and/or other places	PG, G, GIS	Deidre Hart	
Development of novel photo/electro-catalysts for improved water purification	C	Vladimir Golovko	
Mitigating diffuse nitrate pollution using waste resources in an engineered baffle system	E,C	Aisling O'Sullivan	
The innovative Storminator™: monitoring the ecologically-engineered stormwater treatment systems in different catchments (field-based locally)	E,C	Aisling O'Sullivan	
Life Cycle Assessment (LCA) modelling of different stormwater treatment systems to quantify their true sustainability	E	Aisling O'Sullivan	
Hydraulic Modelling of the Storminator™ system: experimental tracer trials on various Storminator™ systems and using the data to populate a hydraulic model	E	Aisling O'Sullivan	
Living (green) roof systems: experimental trials of different waste substrates for water quality treatment from roof runoff	E, C	Aisling O'Sullivan	
Treating emerging contaminants using recycled waste resources	E, C	Aisling O'Sullivan	
Constructed wetlands to treat wastewater from select industries	E	Aisling O'Sullivan	
Floating treatment wetlands in the Wigram Stormwater Basin	E	Aisling O'Sullivan	

## PRT 2: People and Water

*Note there are many other potential social science/ resource management research topics under this PRT, relating to other catchments and other countries, and to iwi resource management issues. Please look up the research profiles of Ed Challies, Kelly Dombroski (UC), Hirini Matunga (LU) and the Ngāi Tahu Research Centre (UC) for further information on potential research areas.*

Thesis topic	Skill set	Supervisors	External Interest
Valuing (economically) the aesthetics, recreational and ecosystem services of Te Waihora and its tributaries/drains	B, HG, ERM, Ec	Adrienne Lomax & Hamish Rennie	WET
The rise and demise of the commercial fishing community and industry at Te Waihora	ERM, HG, Ec	Hamish Rennie	
Understanding (and modelling?) bird shooter behaviour and choice of bird hide site at Te Waihora	B, HG, ERM	Hamish Rennie	
Selwyn Huts, Greenpark Huts and Fisherman's point community relationships with Te Waihora/Lake Ellesmere and the Selwyn River	HG, ERM	Hamish Rennie	
Foodways and cultural customs of the Te Waihora/Lake Ellesmere Pakeha	HG, ERM	Hamish Rennie	
Public attitudes towards/relation to urban waterways	HG, ERM	Ed Challies	CCC
Are Water Conservation Orders effective in managing changing river attributes over time – identify key strengths and weaknesses, and options to improve (e.g., Rakaia and Rangitata)	ERM, B, PG		Fish and Game ECAN
Impact of provider/user models for water supply and management on resource consumption practices, and the resilience of water supply systems'	HG, ERM	Lin Roberts	
A geography of freshwater aquaculture in New Zealand	HG	Hamish Rennie	
Post hoc evaluation of riparian 'restoration' programmes on lowland and highland streams.	ERM	Hamish Rennie	

Thesis topic	Skill set	Supervisors	External Interest
An environmental history and geography of the Selwyn River/Waikirikiri, Hamish Rennie	HG, ERM	Hamish Rennie	
A geography of eel fishing in New Zealand	HG, ERM	Hamish Rennie	
Analysing water users' attitudes during a pilot of water trading underpinned by indigenous partnership	ERM, M, Ag	Ed Challies, Mark Milke	Ngai Tahu Research Centre
Governance of urban waterways and storm water in Christchurch	HG, ERM	Ed Challies	CCC
Comparative analysis of collaborative water resource management in NZ and beyond	HG, ERM	Ed Challies Hamish Rennie	
Analysis of public consultation and stakeholder engagement in irrigation scheme development in NZ and beyond	HG, ERM	Ed Challies	
Social dimensions of groundwater governance	HG, ERM	Ed Challies	
Implications for Māori of collaborative water governance arrangements or co-management agreements	M, HG, ERM	Ed Challies	Ngāi Tahu Research Centre
Greening flood risk management	HG, ERM	Ed Challies	
Carbon co-benefits of riparian planting	HG, ERM	Ed Challies	
Collaborative and participatory approaches in flood risk management	HG, ERM	Ed Challies	
Water resource management in Pacific Island states	HG, ERM	Ed Challies	
Transfer of water resource management policies/paradigms through the NZ Aid Programme	HG, ERM	Ed Challies Hamish Rennie	
Values, perceptions and management of the University of Canterbury campus streams	HG, ERM	Ed Challies	
Case studies of grassroots/community-driven local water resource management or restoration projects	HG, ERM	Ed Challies	
The Waimea Inlet Management Strategy and Action Plan / Waimea Inlet governance (Tasman District)	HG, ERM	Ed Challies	Waimea Inlet Forum
Analysing bidding strategies and shadow prices in a pilot water trading program.	G, ERM, Ec	Mark Milke, Jeremy Clark	
Exploring the potential of Lake Ellesmere/Te Waihora and its environs as a sustainable tourism destination	HG, Ec, ERM	Hamish Rennie Valerie Manna	
Can existing regional and district plans and bylaws adequately protect a river bed?	ERM	Hamish Rennie	

### PRT 3: EoRE: End of River Environments

*NB. Many of these relate to Te Waihora/Lake Ellesmere and its catchment, where there is external interest from ECan, WET, Ngai Tahu, ECan, DoC, MPI and others.*

Thesis topic	Skill set	Supervisors	External Interest
A nitrogen budget for Lake Forsyth/ Wairewa	C,B	Jenny W-B	ECan
What should be the baseline target for Te Waihora restoration?	ERM, B	Hamish R, Jenny W-B	WET
Diurnal extremes in EColi, nutrients and other water quality parameters in Te Waihora and Wairewa.	C, B	Jenny W-Brown & Tim Clough	
Gas fluxes and dissolved gases (e.g. N <sub>2</sub> O) in Te Waihora.	C	Tim Clough	
Coastal shore erosion (accretion rates and determinant factors) in Te Waihora	PG	Hamish Rennie	
Vehicle damage to ecology on margins of Te Waihora	B	Nick Dickinson , Robin Smith	DoC
Soil salinity state and trend around Te Waihora	Ag, C, G	Adrienne Lomax/Jenny W-B	WET
Modelling potential impacts of climate change on Te Waihora	PG	Peyman Zawar-reza	
Amberley Beach Lagoon – is salinity change causing flipping?	B	Angus MacIntosh	
Hydrodynamics of Te Waihora and relationship to opening regimes, and catchment dynamics.	E, PG	Tom Cochrane	
Why have freshwater mussels disappeared from Te Waihora?	B	Islay Marsden	
Lake Flies: Factors affecting abundance around Te Waihora.	B	Mike Bowie	
Distribution of invasive plants in Te Waihora	B	Nick Dickinson	
Te Waihora food webs: Role in support of swamp birds	B	Ken Hughey	
Ecosystem services assessment and value (e.g., of invertebrates) for Te Waihora	B, Ec, ERM	Ken Hughey Angus McIntosh	DOC (Philippe Gerbeaux)

Thesis topic	Skill set	Supervisors	External Interest
Effects of Canadian Geese on water quality and Te Waihora ecology.	B, ERM	Nick Dickinson	
Emerging contaminants from current and changing farm practices in the Selwyn catchment.	C, Ag	Sally Gaw, Brett Robinson, Tim Clough.	
The role of storm events in adding nutrients to Te Waihora	PG, B, ERM	Jenny W-B	
Shoreline accretion rates in Canterbury , and effect of sediment delivery from rivers	PG, E	Crile Doscher, Deidre Hart	ECan, CCC
Sustainable Fishery: Impact of commercial eel fishing on customary fishing, and impact of lake closure and seasons.	B, ERM	NIWA researchers?	
Concentration of pathogens present in mahinga kai from Te Waihora and potential health risk	B, C	TBC	Ngai Tahu
Priorities for on-farm nutrient limiting practices: Going beyond GMP to reduce nutrient losses	Ag, C, PG, ERM	TBC	
Rakaia rivermouth: state, functioning, management: what is the current state of its geomorphology and ecosystems, and how can we work to improve this system?	PG, G, GIS	Deirdre Hart	
Coastal hydrosystems (see MfE report: Hume et al. 2016) – what different types occur where in NZ, and how can differences in type/ functioning affect management practices for healthy systems. How does their geomorphology relate to ecology?	PG, G, GIS	Deirdre Hart	
Hapua – projects investigating any physical science and/or management aspects of this type of predominantly freshwater rivermouth lagoon on high energy coasts	PG or HG	Deirdre Hart	
Are the current legal definitions and guidelines fit for purpose for New Zealand’s coastal hydro-systems?	PG or HG	Deirdre Hart	
Assessing the impact of irrigation on the geomorphology of hapua and waituna in Canterbury.	PG, G, GIS	Deirdre Hart	



Thesis topic	Skill set	Supervisors	External Interest
What is the future of the Te Waihora/Lake Ellesmere sea barrier within a climate change and sea level rise context?	PG, G, GIS	Deirdre Hart	
Interactions of turbidity, salinity and nutrients, and the effect on algal blooms.	C, PG, B	Brett Robinson	TRONT, ECan
Testing possible sediment amendments to reduce P release from lake sediments	C, PG, G, Ag	Jenny W-B, Brett Robinson, Peter Almond	ECan, SDC
Lower Selwyn spring chemistry (incl. nutrient & isotopes) survey, to determine spatial and temporal variability and establish nutrient pathways.	C, Ag, G	Travis Horton/Jenny W-B	ECan
The role of particulate organic matter in mobilizing legacy phosphorus from river and lake sediments in the Te Waihora catchment	C, PG, G, Ag	Nik Lehto	
Testing time-integrated sampling methods for improved measurement of nutrient fluxes into Te Waihora	C, PG, G, Ag	Nik Lehto	

**PRT 4: Urban Waters**

Thesis topic	Skill set	Supervisors	External Interest
GIS modelling of contaminant loading of urban streams in Christchurch	PG, E	Tom Cochrane & Ash O'Sullivan	
Trace metal inputs to the Akaroa Harbour	C	Sally Gaw	
Effects of Ruapuna Raceway use on local air and water quality	C	Jenny W-B & Sally Gaw	ECan
Modelling metal toxicity and removal mechanisms in urban stormwaters	C	Jenny W-B & Frances Charters	
Trace element concentrations in the sediments of Avon-Heathcote estuary, and their variation through time.	C, ES	Jenny W-B	
Assessment of municipal pesticide use on urban water quality	C	Jenny W-B	

**PRT 5: Functional water networks**

Thesis topic	Skill set	Supervisors	External Interest
Changes in land cover/use and riparian planting, and relationship to water quality changes in the Styx River catchment.	PG, B	Chris Phillips, Jenny W-B.	Styx Living Laboratory
The effects of culverts on freshwater fish, in particular crayfish	B	Angus McIntosh, Helen Warburton?	Boffa Miskell (\$)
Effect of wildfires on water quality: stream monitoring and assessment	C, B, PG	Jenny W-B	CCC, ECAN
Zinc in rural runoff and groundwater systems in Canterbury	C, G	Sally Gaw & Jenny W-B	
The state of stock water races and their future in Selwyn District – causes, effects, consequences and implications	PG, C, B	Hamish Rennie & Jenny W-B.	
3 Ashburton lakes projects, on factors driving trophic status of the Ashburton lakes, long fin eel recruitment and sediment accumulation (4 topics)	B, C, PG, G	See Jenny W-B for more information	DOC (\$)
The composition of the “first flush” water flow through the seasonally dry beds of Canterbury rivers.	C	Jenny W-B	
Lower Waitaki Catchment monitoring – assessing the effect of more sustainable irrigation on water and nutrient cycling.	C, PG, G	Leanne Morgan, Jenny W-B	Waitaki Irrigators Collective Ltd (\$)
What effects are high temperatures and low DO levels having on the lower Rakaia mainstem/hapua, and consequences for salmonids.	B,C		Fish&Game ECAN
What effects are fine sediment deposits having on aquatic biota in the lower Rakaia mainstem, and consequences for salmonids.	B,C		Fish&Game ECAN
Understanding the factors which stimulate and/or suppress the growth of weed and mahinga kai in waterways	B, C		CCC ECAN
Microplastics in agricultural streams	C	Sally Gaw	

## PRT 6: Sustainable Nutrients

Thesis topic	Skill set	Supervisors	External Interest
Mitigation of N-leaching from rural land	B, C, Ag ,PG	Keith Cameron & Hong Di	
Nitrate removal from groundwater ...what are our options?	C, E	Jenny W-B and CNRE	
Baseline nitrate concentrations in Canterbury water – what should we be aiming for?	B, C, ERM	Jenny W-B and Ian Hawes	
Quantification of the effects of irrigation on nutrient cycling in an agricultural landscape	C, Ec, Ag, PG	John Hunt	Landcare (\$)
Lakes 380 project: establishing the trophic history of lakes of the Canterbury region	C, B	Jenny W-B and Sean Waters (Cawthron)	Lakes 380 initiative

## PRT 7: Sustainable Groundwaters

Thesis topic	Skill set	Supervisors	External Interest
Seawater intrusion vulnerability - various topics available e.g., assessing the potential impact of sea-level rise on Christchurch groundwater	E, PG, G, ERM	Leanne Morgan	Ecan, CCC
Characterizing offshore fresh groundwater – various topics available	E, PG, G, ERM	Leanne Morgan	NIWA
Groundwater-surface water exchange in braided rivers – various topics available	E, PG, G, ERM	Leanne Morgan	Ecan, NIWA, Lincoln Agritech
Assessing post-pumping seawater intrusion under heterogeneity and time varying boundary conditions	E, PG, G, ERM	Leanne Morgan	BGR (Germany)
A field investigation of groundwater seepage entering Te Waihora through the lake bed	G, E	Leanne Morgan	Ecan
A hydrogeological characterisation of Te Waihora's Kaitorete Barrier.	G, E	Leanne Morgan	Ecan
Groundwater ecosystem response to salt water intrusion: How robust are they and what will it mean for groundwater quality?	B, G, E	Leanne Morgan, Louise Weaver	ESR
Quantifying groundwater recharge in Canterbury aquifers at the regional scale	E, Ag, G, C	Leanne Morgan & MS Srinivasan	NIWA
Stygofauna diversity in Canterbury aquifers	B, G, E	Leanne Morgan, Louise Weaver, Annette Bolton	ESR
Managed aquifer recharge in the Canterbury region	E, PG, G, ERM	Leanne Morgan	MHV Water
Application of on-site wastewater to the soil zone and the risk to groundwater	B, G, E	Leanne Morgan, Louise Weaver	ESR
Using the nitrate-phosphate-iron relationship to estimate groundwater redox conditions	C, G, PG	Jenny W-B	
Quantifying the Waimakariri River's contribution to the Chch groundwater aquifer	G, C, E	Travis Horton & Leanne Morgan	CWMS

Thesis topic	Skill set	Supervisors	External Interest
Spatial Interpolation of groundwater quality parameters using copulas	PG, G, E	Markus Pahlow	
The effects of Rolleston Sewage Treatment plant on groundwater quality.	C, G, PG	Jenny W-B	
Tracking the leachate plume at the now closed Burwood landfill.	G, C, E	Hugh Thorpe Mark Milke	
Groundwater quality in the vicinity of the old Waimairi County "dump"	G, C, E	Hugh Thorpe Mark Milke	
Changes in water user attitudes under experimental water allocation trading systems	G, ERM, Ec	Mark Milke, Jeremy Clark	