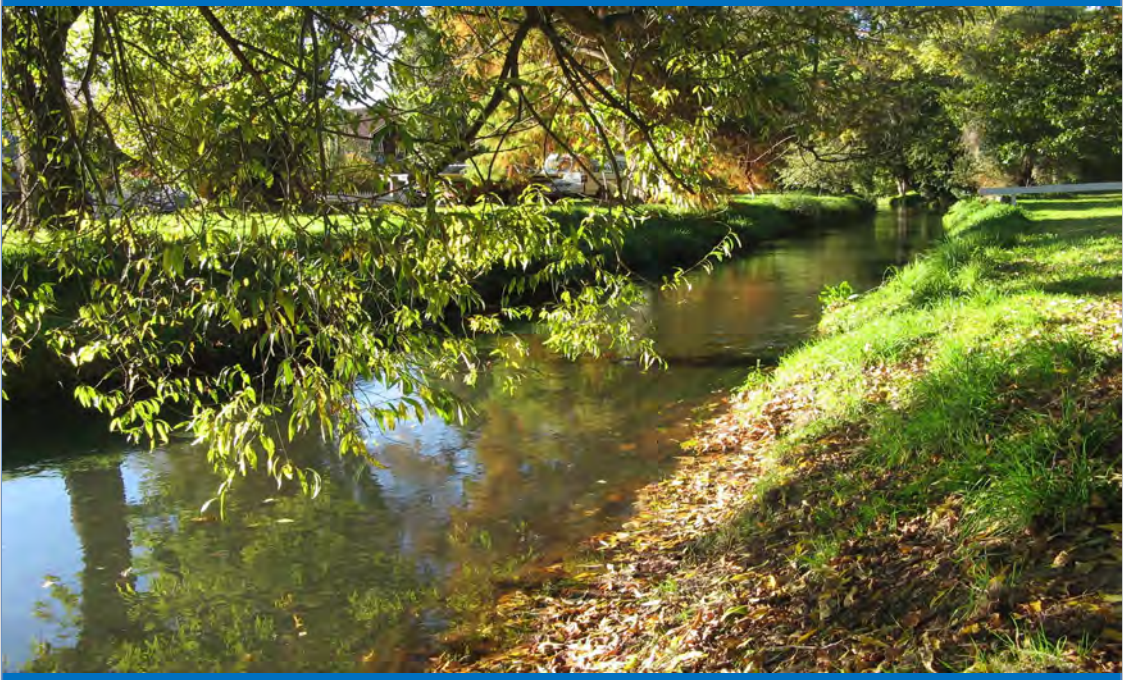
Waterways Postgraduate Student Conference **2018**



Tuesday November 20, 2018
Lincoln University,
Christchurch, New Zealand

LINCOLN UNIVERSITY
TE WHARE WĀNAKA O AORAKI

UC UNIVERSITY OF CANTERBURY

Waterways
Centre for Freshwater Management

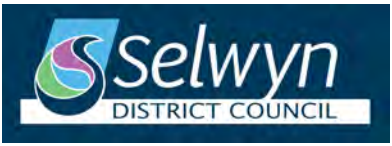
The Organising Committee would like to acknowledge our generous sponsors:

Platinum

Gold

(continued next page)

Gold (continued)



Silver


ENVCO
www.envcoglobal.com
Environmental, Industrial
& Scientific Equipment


ENGEO
Expect Excellence


the styx-pūrākaunui
Living Laboratory Trust

The Waterways Centre for Freshwater Management is a teaching and research centre, jointly supported by the University of Canterbury and Lincoln University. Established in 2009, it aims to improve the knowledge-driven management of freshwater resources by offering a full complement of nationally accredited tertiary courses and actively supporting postgraduate research programmes.

Conference Programme

Time	Presentation	
8:30	Registration	
9:00	Introduction – **Professor Jenny Webster-Brown**, Director, Waterways Centre for Freshwater Management	
9:05	Welcome – **Professor James McWha**, Tumu Whakarae/Vice Chancellor, Lincoln University	
9:15	Shock encounters with water supply contamination: Impact on the perceptions and practices of small businesses	Rachel Teen Lincoln University
9.30	Opening locked gates: Identifying land owners' attitudes to Kaitiakitanga	Corinne Bataille University of Canterbury
9:45	Estimation of the five-year impact of the Hinds MAR Trial on ground water levels and quality	Patrick Durney University of Canterbury
10:00	Development and assessment of a hydropower reservoir routine for Soil and Water Assessment Tool (SWAT)	Jayandra Srestha University of Canterbury
10:15	Assessing seawater intrusion vulnerability associated with sea level rise in Christchurch using GIS-based methods	Irene Setiawan Lincoln University
10.30	**Morning Tea**	
11:00	Assessing groundwater vulnerability and resilience in the Christchurch Coastal Aquifer System	Carlos Rosado University of Canterbury
11:15	Are wastewater treatment plants a significant source of microplastics to the environment?	Helena Ruffell University of Canterbury
11:30	Canterbury mudfish food webs/threats to Canterbury mudfish	Christopher Meijer University of Canterbury
11:45	Influence of fishing pressure and land use on migratory galaxiids	Andrew Watson University of Canterbury
12:00	Boosting biological recovery in degraded streams: Disturbing degraded communities to reverse the effects of environmental filtering	Issie Barrett University of Canterbury
12:15	Conservation planning for climate change: How might a natural disaster help us with sea level rise?	Shane Orchard University of Canterbury

12.30	**Lunch; Poster Session from 1:00 pm**	
1:30	Kākahi (Ecyridella menziesi) as a biological tool for stream restoration	Channell Thoms University of Canterbury
1:45	Evaluation of different methods for isolating Phytophthora from Canterbury waterways	Ashika Prasad Lincoln University
2:00	Traditional knowledge integration in water governance and its implications for rural livelihoods in Esigodini, Zimbabwe	Xolile Ncube University of Canterbury
2:15	Isoprostanes: Biomarkers of oxidative stress or potential emerging contaminants?	Kimberley Kovacs-Wilks University of Canterbury
2:30	Challenges in water governance in the Plain of Reeds, Vietnam	Khiem Nguyen University of Canterbury
2:45	Uptake of water sensitive urban design at the building-scale in Christchurch	Vicky Southworth University of Canterbury
3:00	**Afternoon Tea**	
3:30	The role of sediment in controlling in-stream phosphorus concentrations	Zach Simpson Lincoln University
3:45	Phosphorus release from activated sludge and effect of different acids	Shiv Prasad University of Canterbury
4:00	Changes in the water chemistry of Cannel Creek following remedial works at Bellvue Mine	Marlese Fairgray University of Canterbury
4:15	Quantifying and treating contaminant discharges from the James Mine on New Zealand's West Coast	Carlos Hillman University of Canterbury
4:30	Land-use and waterway quality at Mt. Grand Station, New Zealand	Shyam Provost Lincoln University
4:45	Investigating nutrient management trade-offs using the Land Utilisation Capability Indicator model	Grace Gowera Lincoln University
5:00	**Drinks and Nibbles; Prize Presentation**	

Posters

Poster Title	Presenter
Resilience isn't always healthy: Using stressors to overcome negative resistance and resilience in stream restoration	Issie Barrett University of Canterbury
Investigating the variable efficiencies of stormwater treatment devices and development of a model to estimate performance	Forrest Bilek University of Canterbury
Conceptual hydrogeological model development for Kaitorete Spit, Canterbury	Gemma Clark University of Canterbury
Groundwater seepage in Te Waihora/Lake Ellesmere	Katie Coluccio University of Canterbury
The affect of effect: Using local embodied knowledge in monitoring and evaluation of climate change adaptation interventions in Vietnam	Huong Do University of Canterbury
Pathways for nutrient contamination of Barkers Creek, South Canterbury	Hamish Graham, University of Canterbury
Improving through inclusion: Using community-based initiatives to improve freshwater ecosystem health	Will Keay University of Canterbury
The response of unconsolidated coastal environments to the 2016 Kaikoura Earthquake	Kate McDonald University of Canterbury
Environmental factors that affect kōwaro (Canterbury mudfish) populations	Christopher Meijer University of Canterbury
N and P removal from wastewater: A novel approach using sequencing batch reactor technology	Parsa Mohajeri Lincoln University
Role of urban eco-industrial complexes in coastal city flood mitigation within the context of climate change	Suphicha Muangsri Lincoln University
Upscaling of point-scale groundwater recharge measurements with demonstrated applications to New Zealand and Colombia.	Manuel Rios Rivera Lincoln University
Seawater intrusion impacts on the aquifer surrounding Lake Kate Sheppard	Marc Scaife University of Canterbury
Reconnecting people to their water supply: A social perspective to water resource management	Rachel Teen Lincoln University

The 2018 Conference Committee

This year's organizing Committee is:

Julie Clarke	PhD Candidate/Senior Tutor, Waterways
Katie Coluccio	PhD Candidate, Waterways
Suellen Knopick	Administrator, Waterways
Xolile Ncube	Masters Candidate, Waterways
Khiem Nguyen	Masters Candidate, Waterways
Katie Nimmo	Project Manager, Waterways
Shane Orchard	PhD Candidate, Waterways (Chair)
Rachel Teen	Masters Candidate, Waterways

The MC for the day will be Shane Orchard. Please look for Shane if you have any questions on the programme or housekeeping at the conference.

How to find presenters

Presenters and committee members can be identified by coloured name tags. Presenters are keen to hear your questions and feedback, so please feel free to approach them throughout the day. Also, please let a committee member know if you need any assistance.

Posters

There is a scheduled poster session in the foyer from 1:00 to 1:30 pm when all poster presenters will be available at their poster for questions and discussion. However, please feel free to approach poster presenters throughout the rest of the day.

The People's Choice Award

Please let us know who you think deserves to win for their outstanding oral or poster presentation. At the end of the day, simply fill in the slip of paper at the back of the book and drop it in the box at the front desk. The winner will be announced during the prize presentation.

Introduction

Tēna koutou katoa

A very warm welcome to you all for our 7th Waterways Postgraduate Student Conference day!

This day is, without a doubt, the highlight of our year. It is an opportunity for us to showcase university research being undertaken by postgraduate students on freshwater systems, on policies that affect water use and water environments, and on potential solutions to our freshwater management issues.

For those external to our university, this day provides a rare glimpse into research at this level, to see what is being done, and to interact and engage with those who are doing it. It also provides our students with a valuable opportunity to engage directly with the community, iwi, industry, economic, regulatory, consultancy and research stakeholders in the freshwater resources of Canterbury and New Zealand.

The Conference is entirely organised by a committee of Waterways Centre Masters and Doctoral research students. We greatly appreciate their efforts and they deserve all of the compliments that I am sure will come their way. We would also like to thank all of those who directly support the work of the Waterways Centre, through scholarships, support for research expenses or help in-kind, and sponsorship for today. This research embodies the tangible results of your support.

By the end of the day, I trust you will share my confidence that there is room for hope regarding the future management of New Zealand's freshwater resources.

Ngā mihi nui

Professor Jenny Webster-Brown
Director - Waterways Centre for Freshwater Management

Professor James McWha

Tumu Whakarae - Vice-Chancellor, LU

Professor James McWha has an esteemed career in the tertiary education sector. For over 30 years, Professor McWha has held numerous leadership roles, devoting his time to teaching, research and educational administration in New Zealand, Northern Ireland and Australia.

Professor McWha graduated with a Bachelor of Science and Bachelor of Agriculture (with honours in Agricultural Botany) from Queens University Belfast before going on to receive his PhD from Glasgow University. He lectured in the Department of Botany at Canterbury University, followed by a term as Head of the Department of Plant and Microbial Sciences. He then served as Professor and Head of Agricultural Botany at Queen's University Belfast, and Deputy Chief Scientific Officer in the Northern Ireland Department of Agriculture. He returned to New Zealand in 1989 to become the Director of DSIR Fruit and Trees in the Department of Science and Industrial Research. In 1992 he became the foundation Chief Executive of HortResearch, the Horticulture and Food Research Institute of New Zealand.

In 1996 Professor McWha was appointed Vice-Chancellor and President of Massey University, a position he held until 2002 when he moved to the same role at the University of Adelaide. After 17 years leading established universities, in 2013 Professor McWha took up the challenge of founding the University of Rwanda. He held the role of Vice-Chancellor there until his retirement in 2015.

Professor McWha was Secretary General of the International Association of University Presidents from 2002 to 2005 and also the honorary treasurer and executive committee member of the Association of Commonwealth Universities from 2007 to 2017.

Professor McWha joined the Lincoln University Council in 2017 and has been appointed Vice-Chancellor of Lincoln University through December 2018. He has been tasked with spearheading a cultural revolution which will ignite the University's future direction.

Oral Presentation Abstracts

Havelock North's shock encounters with water supply contamination: Impact on the perceptions and perspective of small businesses

Rachel Teen, Masters Candidate
rachel.teen@lincolnuni.ac.nz
Supervisors: Lin Roberts, LU; Ed Challies, UC

Safe drinking water is essential to public health. In August 2016 an outbreak of gastroenteritis in Havelock North, New Zealand, shook the public's trust in the water supply service. Over 5,500 of the town's 14,000 residents were estimated to have fallen ill with campylobacteriosis, and 45 people were hospitalised. Business owners were detrimentally affected – financially, operationally and emotionally. Their perceptions of water were immediately affected, particularly with the application of chlorine to the water supply, and their trust in their local government bodies diminished.

Transformational Learning Theory was the lens used to ascertain if the contamination event transformed Havelock North business owners' perspective of water. All business owners underwent perception changes in their water supply and all critically reflected on the context of the contamination event. However, none underwent a transformation in their perspective of water because they did not engage in any critical self-reflection. The various causes of the contamination were all external to Havelock North business owners; they perceived there was no need for them to critically self-reflect on themselves nor their business strategies. While the disruption triggered them to think about the connectivity of water to natural ecosystems, including humanity, business owners still unquestioningly accepted the unwritten hydrosocial contract with the local councils. None had experienced a transformational perspective change whereby they sought to renegotiate this contract.

Research/Career Interests:

- Hydrosocial water management
- Urban, engaged, integrated and adaptive water management.

Opening locked gates: Identifying land owners' attitudes to kaitiakitanga

Corinne Bataille, PhD Candidate
corinne.lucas-dsouza@pg.canterbury.ac.nz
Supervisors: Sanna Malinen, UC; Phil Lyver, Manaaki Whenua

My research investigates attitudes, enablers and barriers towards kaitiakitanga (environmental guardianship). I examined psychological factors affecting the ability of tangata whenua to practice kaitiakitanga, focusing on mahinga kai (customary harvest and management of waterfowl and wetlands). A general inductive approach was used; and Kaupapa Māori research principles (indigenous epistemology) were followed, which assume early and ongoing consultation with, and guidance from iwi (Ngāi Tahu).

Twenty-five participants from two interest groups, tangata whenua (i.e., Māori customary practitioners and harvesters) and land owners, who associate with waterfowl or wetlands, in Te Wai Pounamu (New Zealand's South Island), took part in semi-structured interviews. Findings suggest that access to or through privately owned land is a major barrier to tangata whenua practicing kaitiakitanga and customary harvest. Moreover, affect (e.g., trust, fear) plays a primary role in land owners' willingness to grant access. Other barriers include cognitive factors (e.g., knowledge) and social factors (e.g., intergroup contact). Using Contact Theory and Common In-group Identity Theory, the research suggests that (1) positive intergroup contact may reduce fear, increase trust and promote positive intergroup perceptions, and (2) both land owners and tangata whenua may achieve their own goals – around managing and harvesting waterfowl– through collaboration and the adoption of a shared affiliation (e.g., as environmental stewards). These strategies would contribute to the revitalisation of kaitiakitanga and the cultural expressions (e.g. language, kawa, tikanga) that accompany the practices.

Research/Career Interests:

- Understanding psychological factors that promote collaboration between culturally diverse groups

Estimation of the five-year impact of the Hinds MAR Trial on ground water levels and quality

Patrick Durney, Masters Candidate
padu@dhigroup.com, patrick.durney@pg.canterbury.ac.nz
Supervisors: Leanne Morgan, UC; David Scott, ECAN; Theo Sarris, ESR

The Hinds Plains Managed Aquifer Recharge Trial (MAR) is now two years into its five-year programme. This research aims to use groundwater modelling to estimate the effects of the MAR pilot on groundwater levels and water quality at the trial's completion in 2021. Specifically, the research focuses on the:

- assessment of how far downgradient the 0.1 m of mounding will propagate
- assessment of groundwater head change at a set location
- area of groundwater head changes greater than 0.1 m
- change in volume at a change in groundwater head > 0.1 m.

Early in the research confounding factors were encountered that eliminated the viability of simpler analytical models to predict the final effects of the trial. In response, the research turned to more advanced numerical methods utilising MODFLOW NWT and MT3DMS.

Unfortunately, the confounding factors encountered with the analytical modelling still present problems with the numerical modelling undertaken. The confounding factors encountered include the presence of a leaky stock water race running past the site with no recorded flow, several nearby farm irrigation ponds and a leaky water delivery race to the MAR site. These features act to both mask and multiply the impacts of the trial. Recognising the inability to quantify all the elements affecting the trial results the research has instead utilised uncertainty analysis to capture some of the most probable outcomes of the trial using the Null Space Monte Carlo technique. This presentation details the results of the research to date.

Research/Career Interests:

- Quantification of uncertainty analysis
- Environmental restoration

Development and application of a hydropower reservoir routine for the Soil and Water Assessment Tool (SWAT)

Jayandra Shrestha, PhD Candidate
jayandra.shrestha@pg.canterbury.ac.nz
Supervisors: Markus Pahlow, Thomas Cochrane, UC

The Soil and Water Assessment Tool (SWAT) is a physically based hydrological model initially developed to assess water, sediment and nutrient processes in large watersheds. However, SWAT lacks a hydropower reservoir operation routine.

The main aim of this study is to develop an integrative tool in the SWAT to quantify changes in the flow regime due to the operation of a hydropower system with subsequent tests and applications. The new routine enables the simulation of hydropower reservoir operations and computes energy generation as guided by a predefined rule curve.

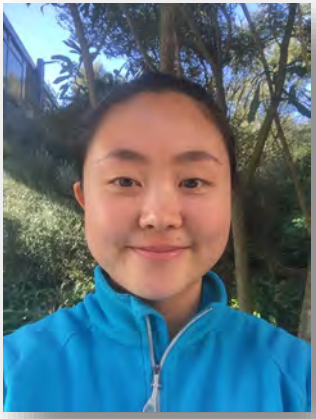
A case study simulation was carried out for the Yali reservoir in the Sesan River basin (7445 km2) of Vietnam. The SWAT simulation outputs runoff, precipitation and potential evaporation have been used as input for the newly developed hydropower reservoir routine. Similarly, the HEC-ResSim model, which was specifically designed to simulate hydropower reservoir operations and has been tested and validated in numerous studies, was used as a benchmark and set up utilizing the same input data generated by the SWAT model. The simulation results of these two models were compared using Nash-Sutcliffe efficiency (NSE). The values of NSE (NSE= 0.95) show that the results obtained with the newly developed routines are in good agreement with the HEC-ResSim model. Overall, the extended SWAT model is well capable to simulate the operation of the Yali hydropower reservoir given the set of rule curves.

Research/Career Interests:

- Hydrological modelling
- Hydropower reservoir sedimentation
- Climate change impacts

Assessing seawater intrusion vulnerability associated with sea level rise in Christchurch using GIS-based methods

Irene Setiawan, BAgSc(Hon)
irene.Setiawan@lincolnuni.ac.nz
Supervisor: Leanne Morgan, UC



Seawater intrusion (SWI) is the landward movement of the seawater-freshwater interface in coastal aquifers. Causes of SWI include groundwater pumping, sea level rise, reduced recharge and land drainage. Christchurch aquifers provide one of the highest quality drinking water sources in the world, which local residents completely rely on for critical needs. In this study, a qualitative GIS-based method called GALDIT (Lobo-Ferreira et al. 2007) was used to assess SWI vulnerability in the shallow confined Riccarton Gravel aquifer in Christchurch, under different sea level rise (SLR) scenarios.

To overcome limitations of this method, the analytic solutions of Morgan and Werner (2015) were developed and applied within a GIS framework, for the first time. Both methods were applied under the current sea level and a two-meter SLR. Both methods (i.e., GALDIT and analytic solutions) showed that the Riccarton Gravel aquifer was most vulnerable to SWI in the locations of Brooklands, Woolston and Ferrymead. The analytic solutions were able to quantify SWI vulnerability in greater detail by determining the change in the theoretical seawater wedge toe position along the coast under SLR scenarios. Nevertheless, these analytic solutions have a number of limitations and should be used only as a first pass approximation to highlight areas of highest possible risk. Further assessments can then be targeted toward these high-risk areas.

Research/Career Interests:

- Freshwater-Agriculture interactions
- Groundwater modelling,
- Sustainable development

Assessing groundwater vulnerability and resilience in the Christchurch Coastal Aquifer System

Carlos Rosado, PhD Candidate
carlos.rosado@pg.canterbury.ac.nz
Supervisors: Leanne Morgan, UC; Zeb Etheridge, ECAN

Where is the saltwater-freshwater interface located in the Christchurch Coastal Aquifer System? Is it somewhere 40 km offshore or much closer to the city's coastline? If it is closer to the coastline, will some of the drinking water supply wells be at risk of seawater intrusion? We know that groundwater quality is generally very good in deeper aquifer layers below the city, but will this continue to be the case in the eastern coastal part of the city in the context of climate change and increased groundwater extraction?

These questions are highly relevant for groundwater security and resilience in Christchurch. Groundwater is a highly valued resource for the city because it is the main source of drinking water supply. The aquifer system that provides this high-quality water lies below the city in several water-bearing layers. Some of these layers continue offshore, but it is not well understood how much (if any) groundwater flows out from them as submarine groundwater seepage. And if it does flow out, can it be detected?

In this presentation, I will give an overview of the coastal hydrogeology of Christchurch and I will explore the ideas and methods that I will likely use to address these important questions.

Research/Career Interests:

- Coastal hydrogeology
- Offshore groundwater,
- Groundwater contamination and remediation,
- Groundwater sustainability

Are wastewater treatment plants a significant source of microplastics to the environment?

Helena Ruffell, Masters Candidate
helena.ruffell@pg.canterbury.ac.nz
Supervisors: Sally Gaw, UC; Olga Pantos, ESR; Grant Northcott

The use of plastic has grown exponentially since it came into common use in the 1950s. Improper disposal has resulted in significant volumes of plastic entering the environment each year. Microplastics are plastic particles less than 5 mm in diameter. They result from fragmentation of plastic products, or are purposefully produced (e.g. abrasives for commercial and personal care products). Microplastics also include synthetic fibres (<300 mm in length) released to the environment through the washing of synthetic textiles and general wear.

Microplastics may be actively or passively ingested by aquatic organisms. Internal damage to tissues, and blockage of the intestinal tract may occur, resulting in a false sense of satiation, resulting in starvation. Microplastics may act as a vector for the uptake of chemical contaminants sorbed to their surface, into biological systems. It has been suggested that wastewater treatment plants (WWTPs) are a significant source of microplastics, particularly microfibres sourced from washing machine effluent, into aquatic and terrestrial environments. There is currently a lack of data in New Zealand on the amounts and types of microplastics entering and being discharged from WWTPs, and the risks they pose to the environment.

This study will increase the understanding of whether WWTPs are a significant source of microplastics to the environment in Canterbury, and whether treatment processes and season influence the levels seen.

Research/Career Interests:

- Management of harmful physical and chemical effects on the environment

Kōwaro (Canterbury mudfish) food webs across a gradient of drought intensity

Christopher Meijer, Masters Candidate
christopher.meijer@pg.canterbury.ac.nz
Supervisors: Angus McIntosh, Helen Warburton, UC

Stress-tolerant species that reside in extreme conditions outside the niche of competitors and predators are likely to be particularly vulnerable to global environmental change. Kōwaro (Canterbury mudfish, *Neochanna burrowsius*) are an example of such a species. They persist only in isolated waterbodies on the Canterbury Plains which allow them to avoid predators. However, these habitats are often subject to harsh environmental conditions, such as extreme habitat drying.

Sites, identified as either an isolated pool or 20 m reach, were selected within the Waianiwaniwa Valley and along the Hororata River and, using stable isotope analysis with support from gut content analysis, site-specific isotope biplots were constructed. Using variation in pool depth as a proxy for drought intensity and canopy cover, we investigated the likely impact of changing drought regimes on the food webs of mudfish-inhabited waterways. Whilst there was no change in overall community stable isotope biplots, the trophic position of kōwaro was significantly influenced by both drying intensity and canopy cover. Therefore, it is important that both the aquatic and riparian environments are considered and included in future kōwaro population management.

Research/Career Interests:

- Food webs
- Freshwater ecology
- Changes to drought regimes
- Threatened species

Evaluation of West Coast whitebait fishing closed areas

Andrew Watson, PhD Candidate
andrew.watson@pg.canterbury.ac.nz
Supervisors: Michael Hickford, David Schiel, Jon Harding, UC

An assessment of the current network of areas closed to whitebait fishing along the West Coast of New Zealand's South Island is essential for conservation and management of the fishery. The closure of some areas was based more on a desire to ensure adequate escapement from fishing pressures rather than on ecological knowledge that closure would contribute to increased whitebait production. Monitoring stream health, community composition, species demographics, habitat and productivity of the closed areas regularly is critical for understanding the effect that this network has on the whitebait fishery.

We propose a specific project to evaluate the in-stream physical, chemical, and biological conditions of areas closed to whitebait fishing. Specifically, our research aims to quantify the physical, chemical and biological conditions annually throughout the current network of closed areas, and monthly at a subset of closed areas and fished areas characteristic of different land use types. We fully expect these data to be used to develop science-based criteria for improvement and future design of freshwater reserves, facilitate habitat characterization of the species that comprise the whitebait fishery and provide basic ecological data necessary to inform appropriate management decisions for sustaining the fishery.

Research/Career Interests:

- Conservation biology
- Aquatic ecology
- Community ecology
- Stream and watershed assessment

Boosting biological recovery in degraded streams: Disturbing degraded communities to reverse the effects of environmental filtering

Issie Barrett, PhD Candidate
isabelle.barrett@pg.canterbury.ac.nz
Supervisors: Helen Warburton, Angus McIntosh, UC

The environment imposes filters on communities through which only species with particular traits are able to pass. This filtering process shapes communities into distinguishable community types, associated with particular environmental conditions. For example, a braided river invertebrate community shaped by frequent flooding will be dominated by mobile species that can withstand disturbances (e.g. mayfly and stonefly larvae), whereas an agricultural stream community shaped by nutrient and sediment input will be dominated by sedentary, pollution-tolerant invertebrates (e.g. worms and snails). These community types will each respond differently to additional stress: if more of the same stress is applied to a system, community composition will remain relatively stable, however if conditions change and novel environmental filters are applied, community composition will change.

To test this, stream mesocosm experiments were conducted to investigate the impacts of different stressors (flooding, sedimentation, and nutrients) on three community types sourced from braided rivers, stable springs and agriculturally impacted streams. Invertebrates were placed in channels and stressors applied for 24 hours. Both invertebrates drifting out of the channels and those remaining in the channels at the end were collected and identified. Results suggest that how individual taxa respond to stress depends on disturbance history and resulting pre-stress community composition. I propose that whilst using stressors to further disturb degraded ecosystems seems counter-intuitive, it could be used to trigger positive community change as a valuable restoration tool.

Research/Career Interests:

- Resistance, resilience and restoration
- Community ecology

Conservation planning for climate change: How might a natural disaster help us with sea level rise?

Shane Orchard, PhD Candidate
s.orchard@waterlink.nz, shane.orchard@pg.canterbury.ac.nz
Supervisors: Ken Hughey, LU; David Schiel, Mike Hickford**,** UC

The 2010-11 Canterbury earthquakes caused large-scale and persistent environmental change, yet recovery activities present opportunities to 'build back better' and improve resilience to future events. After the earthquakes, strategic planning for land use change was especially important in the vicinity of waterways, while similar considerations are essential to address climate change. Importantly, these challenges apply to natural and built environments. Here we provide an example of how responses to a natural disaster may inform adaptation to sea level rise for the conservation of īnanga (*Galaxias maculatus*), a declining diadromous fish.

We hypothesised that earthquake-induced landscape change would cause a shift in ecosystems associated with waterway margins, and that this would pose new risks to the achievement of riparian management goals if not matched with appropriate responses. We also suspected that these spatial rearrangements might provide 'natural laboratories' for predicting the impacts of sea level rise because of similarities in the hydrological changes involved. We linked observed shifts in the spawning habitat distribution to earthquake-induced salinity changes through the use of a hydrodynamic model calibrated for pre- and post-earthquake bathymetries. We then applied a scenario-modelling approach to predict the future distribution under sea level rise and with varying river flows. Our results provide insights into the causal factors responsible for observed habitat shifts and guidance for achieving conservation objectives in the face of ongoing change.

Research/Career Interests:

- Spatial ecology
- Conservation planning
- Aquatic systems
- Climate change

The roles of feeding and habitat preferences of kākahi (*Echyridella sp*.) a taonga species and insights into translocation and restoration across waterways in Canterbury

Channell Thoms, PhD Candidate
channel.thoms@pg.canterbury.ac.nz
Supervisors: Jon Harding, Catherine Febria, John Pirker, UC

Freshwater mussels or kākahi (*Echyridella sp*.) are taonga (highly valued) species found in lakes and waterways throughout Aotearoa New Zealand. Kākahi are ecologically important as filter feeders, ecosystem engineers and are recognised by many iwi as a mahinga kai (food gathering) resource. Functionally, this species removes algae and particulate matter including potentially harmful bacteria. They create habitats for other species and assist sediment transport through bioturbation, and their living and spent shells serve as habitat for other invertebrates. Taken together, these functions make kākahi ideal biological tools for stream restoration which ultimately support restoration of mahinga kai as a food resource and practice. Unfortunately, kākahi are now classified as "in decline" and there are grave concerns for their persistence. There are knowledge gaps about feeding behaviours and preferences at the individual, population and community levels of organisation.

My PhD research examines *E. menziesi* in streams and river ecosystems of Waitaha Canterbury. First, I conducted feeding trials to test for patterns across season, size and site. Next, I conducted field surveys and drew upon historic knowledge of their distributions throughout Mid and South-Canterbury. In this presentation I will conceptualise and quantify the factors influencing their survival and feeding biology, identify environmental cues that may be shaping their populations in the wild, and outline hypotheses to inform future translocations of kākahi populations and restoration of their stream habitats.

Research/Career Interests:

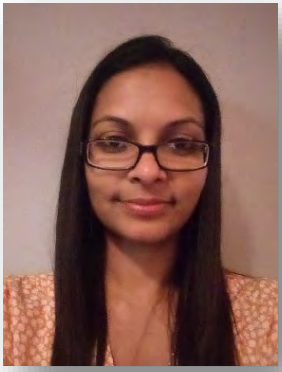
- Restoration ecology
- Mahinga kai species

Evaluation of different methods for isolating *Phytophthora* from Canterbury waterways

Ashika Prasad, Masters Candidate

ashika.Prasad@lincolnuni.ac.nz

Supervisors: Eirian Jones, Seona Casonato, Natalia Cripps-Guazzone, LU



Phytophthora spp. pose a risk to New Zealand's managed and natural ecosystems. As *Phytophthora spp.* are well adapted to aquatic environments, water surveillance can be used to identify their distribution. Seven bait species (*Rhododendron arborescens, Pittosporum undulatum, Banksia attenuata, Camellia japonica, Pittosporum eugenioides, Pinus radiata, and Cedrus deodara*) were evaluated for *Phytophthora spp*. isolation. Water was collected from 2 sites in the Tai Tapu river and half was membrane filtered (3-µm pore size) to capture spores. Leaf baits were floated directly on unfiltered water at room temperature in the laboratory for 7 days. Baits were also placed in nylon-mesh bags and floated in the Tai Tapu river sites (in situ) for 7 days.

Leaf lesions and membrane filters were cultured on *Phytophthora spp*. selective media. Eighty-six *Phytophthora spp.* isolates representing 5 colony morphotypes were recovered, 6 (3 morphotypes) from membrane filters, 25 (4 morphotypes) from baits on collected river water, and 55 (5 morphotypes) from in situ baits. The highest numbers of isolates were recovered from *R. arborescens* (50.6%; 4 morphotypes), *Pinus radiata* (17.2%; 3 morphotypes) and P*ittosporum undulatum* (12.6%; 2 morphotypes). In situ baiting using *Rhododendron arborescens* and *Pinus radiata* was the most effective method of isolating *Phytophthora* species.

Research/Career Interests:

- Plant pathology
- Biosecurity related issues

Traditional knowledge integration in water governance and its implications on rural livelihoods in Esigodini, Zimbabwe

Xolile Ncube, Masters Candidate
xolile.ncube@pg.canterbury.ac.nz
Supervisors: Ed Challies, Garth Cant, UC

Passed on from generation to generation within indigenous tribes, traditional knowledge has survived colonisation, westernisation, globalisation and modernisation. Indigenous people around the world continue to utilise traditional water management systems for decision making including boundary demarcations, water allocation and conflict resolution. However, traditional knowledge is rarely recognized by formal water governance regimes. In Zimbabwe, the Water Act of 1998 makes no mention of indigenous knowledge, and there are no provisions for improved access to water for communal farmers, or for the expansion of subsistence agriculture for improved rural livelihoods. This qualitative study draws on fieldwork in Zimbabwe to explore the different traditional water management practices of the Ndebele tribe. It identifies the opportunities and challenges of establishing a system that integrates formal and informal water governance systems and considers how such a system can impact rural livelihoods.

The research finds that although traditional practices still exist, they have evolved over time to address current water challenges including climate variability and increased water demand. The study concludes that traditional water management does encourage sustainable water use and a water governance system that integrates formal and informal knowledge systems can support improved and diversified rural livelihoods and reduce donor dependency. Challenges such as local communities losing faith in government initiated collaborative processes, have impelled the study to recommend the engagement of a third party from within the nation's borders to establish the relevant protocol for an integrated water governance system.

Research/Career Interests:

- Water governance
- Traditional knowledge
- Rural livelihoods
- Water and food security

Isoprostanes: Biomarkers of oxidative stress or potential emerging contaminants?

Kimberley Kovacs-Wilks, Masters Candidate
kimberley.kovacswilks@pg.canterbury.ac.nz
Supervisors: Sally Gaw, UC; Grant Northcott

Wastewater treatment plants (WWTPs) result in the continuous discharge of chemical contaminants to the environment. Endogenous compounds, produced and excreted by humans, are an example of emerging contaminants found in wastewater. Although they have not previously been considered a concern, they now pose risks to receiving environments due to their bioactive nature, and the volume which is produced and discharged as a result of rising human populations.

Isoprostanes (IsoPs) are a class of endogenous, bioactive compounds produced by humans and other animals in response to oxidative stress. Excreted in the urine, they are produced in response to lifestyle toxicants (e.g. alcohol and drugs), disease and natural biological processes. IsoPs are also mediators of inflammatory processes, and even in the nanomolar range, can induce pathologic responses. Based on their biological activity, chemical stability and presence in wastewater, there is the potential for IsoPs to be emerging contaminants of concern. Wastewater analysis is required to determine if WWTPs are a mechanism for the entry of IsoPs into the environment.

An analytical method is currently being developed for the reliable detection of IsoPs by gas chromatography mass spectroscopy. This method will then be used to analyse IsoP concentrations in effluent collected from Canterbury WWTPs. This research will enable a better understanding of how IsoPs and other endogenous contaminants enter the environment. Such findings could also allow for improved mitigation against the potentially adverse effects they may have on receiving ecosystems.

Research/Career Interests:

- Environmental chemistry
- Emerging contaminants and their interactions with receiving environments

Challenges in water governance in the Plain of Reeds, Vietnam

Nguyen Khiem, Masters Candidate
khiem.nguyen@pg.canterbury.ac.nz
Supervisors: Ed Challies, Thanh Tung Phan, UC

This research explores current water uses in Dong Thap Muoi sub-region (the Plain of Reeds) in Vietnam, and identifies factors that constrain and enable sustainable water resources management (WRM).

A multi-level governance lens was applied to identify the connections, gaps and evolving interdependencies across policy areas and key actors. Document analysis and field research findings from focus group discussions and key informant interviews, show how sustainable WRM is constrained by varying factors.

Key constraints include lack of information, limited capacity and weak cooperation among administrative authorities and agencies.

Moreover, increasing upstream demands on water resources and the shifting weather and rainfall patterns also hinder water management at the local level. The study finds that NGOs play an active role in influencing water management policies in Vietnam, and the central government has launched several important policies to promote sustainable water management. However, important challenges remain for implementation.

Research/Career Interests:

- Environmental sociology
- Development studies
- Water resource management

Barriers to the uptake of building-scale water sensitive urban design technologies in Christchurch

Vicky Southworth, Masters Candidate
vicky.southworth@pg.canterbury.ac.nz
Supervisors: Tom Cochrane, Eric Pawson UC

Christchurch's growing population is to be accommodated in a densified city, but traditionally densification increases urban runoff. Contamination and flooding caused by stormwater runoff is already a problem in Christchurch. Climate change is expected to exacerbate these problems whilst society increasingly expects higher standards. Building-scale devices, such as rainwater tanks and permeable paving, provide at-source management. In Christchurch, building-scale devices have often been omitted from development, despite the multiple benefits they can offer, including: enhanced ecological value of waterways; supporting wellbeing and cultural values; and increasing resilience during droughts, following earthquakes and in the face of climate change.

This research aims to identify why building-scale techniques for stormwater management are not more prevalent in Christchurch, and to propose solutions that could be implemented to increase the uptake in new development and retrofit projects. Through interviews the key barriers identified were cost and technical uncertainty, particularly maintenance and long-term effectiveness. Solutions are likely to include education, particularly public education to build wide support for change; local demonstration projects with research and monitoring; and more and earlier collaboration between a variety of professionals and community groups. Incentive schemes have been successful elsewhere, but are unlikely to gain funding in Christchurch in the near future.

Research/Career Interests:

- Development projects/Master planning
- Urban resilience
- People, the city and connecting nature

Catchment, stream, and sediment biogeochemistry control dissolved reactive phosphorus at baseflow

Zach Simpson, PhD Candidate
zach.simpson@lincolnuni.ac.nz
Supervisors: Rich McDowell, Leo Condron, LU

Many processes – both biotic and abiotic – contribute to the retention of dissolved reactive phosphorus (DRP) or its release back into the water-column at baseflow. The exchange of DRP with benthic sediments is likely dominant in many streams at baseflow, yet this process remains poorly understood. To elucidate sediment-P interactions, this research examines sediment and water-column chemistry across a gradient of streams in Canterbury, New Zealand. Particularly, we (1) partition sediment-P by metal-oxide phases (i.e., Fe vs Al) and by reactivity (amorphous vs crystalline metal-oxides), (2) model chemical equilibria in the water-column, and (3) place this information in the context of the stream characteristics and historical water-quality data.

During base flow conditions in autumn 2018, we sampled streams varying in catchment geology, land use, topography, and hydraulic characteristics. Fine benthic sediments and stream water samples were collected from areas of active flow.

Sediment P fractions varied immensely depending on the site's biogeochemical characteristics. The quantity and reactivity of sediment Fe-(oxy)hydroxides influenced the sediment's ability to retain P; this pool was the most dynamic across sites and likely constrains the Fe-P-redox mechanism in streams. However, sites where Ca-P mineral interactions are significant – as indicated through P-mineral solubilities and stream chemistry – the Fe-P-redox mechanism is less important. These results further our understanding of what P interactions are significant in streams according to the catchment's biogeochemical setting and therefore focus our mitigation strategies.

Research/Career Interests:

- Stream hydrology and chemistry
- Biogeochemical cycles
- Mathematical and statistical modelling

Phosphorus release from activated sludge and effect of different acids

Shiv Prasad Pokhrel, PhD Candidate
shiv.pokhrel@pg.canterbury.ac.nz
Supervisor: Mark W Milke, UC

Waste activated sludge (WAS) is an important source of phosphorus (P). Optimisation of P release from WAS could make recycling of P cost-effective. Addition of HCl (pH <6) during anaerobic digestion has been found to promote P release, but the differences between acids or their side effects on further treatment had not been studied.

P speciation was examined under anaerobic conditions, with pH 4 from different acids (oxalic, citric, acetic, hydrochloric, and paracetic). Dissolved reactive P (DRP) was measured and tests were conducted on changes in COD (Chemical Oxygen Demand) and settleability after acid treatment to consider any side effects of P extraction. Two batch tests were run for seven days. The initial characteristics of WAS of the first batch were pH 6.7 and TSS (Total Suspended Solids) of 4780 mg/L and batch 2 had pH 6.8 and TSS of 8740 mg/L. The maximum DRP was observed with oxalic acid from two batches though only 5% more than with HCl. HCl and oxalic acid led to the highest COD, indicating their greater ability to assist with methane production. A SVI (Sludge Volume Index) of 91 ml/g was measured for HCl, which was more than the lowest SVI of 78 ml/g under citric acid. The SVI with HCl was similar to that for other acids and the control.

These findings indicate that hydrochloric acid is a good choice to optimise P release from WAS without affecting other parameters.

Research/Career Interests:

- Water quality
- Nutrient removal from wastewater

Changes in the water chemistry of Cannel Creek following remedial works at Bellvue Mine

Marlese Fairgray, PhD Candidate

marlese.fairgray@pg.canterbury.ac.nz

Supervisors: Jenny Webster-Brown, UC; James Pope, CRL Energy

Acid mine drainage (AMD) is an environmental phenomenon where the dissolution of metal sulfides from an ore body results in an acidic solution containing high concentrations of sulfate and heavy metals. When this solution enters a stream environment the receiving environment becomes degraded and the aquatic ecosystem impacted. Remediation of AMD waters aims to raise the pH to near-neutral conditions and remove heavy metals from solution so that their concentration is no longer at a toxic level. Sulfate reducing bioreactors (SRBRs) have been shown to be effective at treating AMD.

At Bellvue Mine, West Coast, NZ, untreated AMD was discharged into a nearby stream, Cannel Creek. This resulted in the stream becoming degraded and the aquatic ecosystem impacted. SRBRs have been installed at Bellvue Mine to treat the AMD water before it enters Cannel Creek so that the stream ecosystem can recover.

Monitoring of water chemistry in Cannel Creek prior to and following the installation of the SRBRs has shown that immediately downstream of where the AMD enters the stream, pH has increased to above 6.5. Fe, Al and Ni have been reduced by >80%. Zn and Co have been reduced by >60%. This section of the stream now meets water quality guidelines for aquatic ecosystem protection for all metals, except Al which is naturally high in the streams in this area, when AMD flow is <1.5L/s (88% of time).

Research/Career Interests:

- Acid mine drainage
- Water chemistry
- Stream rehabilitation

Quantifying and treating contaminant discharges from the James Mine on New Zealand's West Coast

Carlos Hillman, Masters Candidate
carlos.hillman@pg.canterbury.ac.nz
Supervisors: Ricardo Bello-Mendoza, UC; Dave Trumm, James Pope, CRL Energy

The James Mine represents an interesting case study for highly contaminated AMD with challenging geochemistry, topography and varying flow-rates posing significant challenges to established treatment technologies. The present research sought to find a solution to these problems and treat the mine effluent at its source by implementing Dispersed Alkaline Substrate (DAS) technology. The DAS system works on the foundation of applying a fine-grained reactive substrate mixed with a coarse inert substrate to retard passivation, provide a significant reactive surface and a means of dispersion for nuclei allowing for precipitates to form on the inert material. Laboratory and field experiments demonstrated that the DAS was able to abate AMD consisting of high metal concentrations with pH ≈ 2.54 and a net acidity of 1349 mg/L as CaCO3. Peak performance of the field experiments showed a metal removal rate of 99 % (Fe, Al, Cd and Cu), 41 % (Mn), and 91 % (Zn and Ni) while increasing pH levels to >6.40. Depth profiles provided chemical data that was used to create reactive transport models while hydraulic parameters were calculated during the experimental phase to determine hydraulic residence times.

Each aspect assisted in identifying the evolution of the AMD allowing for a more comprehensive analysis. The size of the DAS implemented was big enough to treat 2150 L/day of AMD effectively; however, the high acid load of the AMD quickly exhausted the neutralising capacity of the reactive substrate.

Research/Career Interests:

- Geochemistry
- Environmental science

Land-use and waterway quality at Mt. Grand Station, New Zealand

Shyam Provost, PhD Candidate
shyam.provost@lincolnuni.ac.nz
Supervisors: Nicholas Dickinson, Niklas Lehto, Mike Bowie, LU

This research project focuses on the waterways of Mt. Grand, a South Island high country sheep station. The station is 2136 ha of mostly mountainous terrain, running fine wool merino sheep and a small herd of beef cattle.

Nearby, flatter land has undergone agricultural intensification, and several higher altitude areas have been converted to public conservation land through Tenure Review. Situated between these conversions, Mt. Grand faces intensified agronomic pressures to remain economically viable, which may affect the ecological quality of its waterways. The steep catchments of Mt. Grand face soil erosion issues, and are a ready source of sedimentation.

On three occasions during the year, stream waters in three differing catchments were sampled for analysis of total phosphorus, total dissolved phosphorus, cDGT (diffusive gradient on a thin-film) and total suspended solids concentrations, as well as other associated physicochemical parameters. Total phosphorus concentrations in riparian soils, and in deposited stream sediment were also sampled. Benthic macroinvertebrate communities were sampled, and the results used a bioindicator of ecosystem health.

Overall, the ecological quality of stream water was good, but was reduced at lower altitudes in one catchment. Phosphate and total suspended solids concentrations were highest in the catchment containing no significant native vegetation and increased agricultural intensity. This catchment also recorded the lowest macroinvertebrate biodiversity. The combined results from all catchments show a negative relationship between the observed percentages of sensitive macroinvertebrate taxa, and phosphate enrichment.

Research/Career Interests:

- Freshwater management and biodiversity
- Benthic macroinvertebrates
- Soil management and sustainable farming.

Investigation of nutrient management trade-offs using the Land Utilisation Capability Indicator (LUCI)

Grace Tariro Gowera, Masters Candidate
grace.gowera@lincolnuni.ac.nz
Supervisors: Crile Doscher, Peter Almond, LU

Ecosystems provide several services that are important to human livelihoods, such as clean water and nutritious food. This has led to the demand for an enhanced understanding of ecosystem services throughout the world. Rural land-use has intensified, concerns over the impacts on ecosystem service and water quality management have increased. This places farmers under pressure to manage the export of nutrients to waterways and maintain sustainability of freshwater. To meet the demand of water quality management, several modelling tools have been developed. These range from tools that provide simple mapping of ecosystem services to advanced process-based models.

The Land Utilisation Capability Indicator (LUCI) models a variety of ecosystem services: agricultural productivity, habitat, carbon sequestration, flood mitigation, diffuse pollution and erosion. LUCI runs simultaneously from farm to catchment and national scale with a fine resolution and focuses on rural environments, which assists farmers in quantifying and exploring spatially explicit solutions to improve water quality. The aim of this research is to identify sources, sinks and pathways of nutrients in the Kaituna and Selwyn catchments. Within the Kaituna catchment, the initial results indicate strong spatial gradients in the total generated Nitrogen (N) and Phosphorus (P) loads. The topography of the catchment has a great influence on the N and P loads as the highest loads are positioned at the toe-slope in the landscape and the lower loads are positioned uphill.

Research/Career Interests:

- Geographic Information Systems (GIS)
- Surface water quality
- Irrigation technology

Poster Abstracts
Poster Session from 1.00pm to 1.30pm in the foyer

Resilience isn't always healthy: Using stressors to overcome negative resistance and resilience in stream restoration

Issie Barrett, PhD Candidate
isabelle.barrett@pg.canterbury.ac.nz
Supervisors: Helen Warburton Angus McIntosh, UC

Resistance and resilience are terms commonly used to describe the capacity of an ecosystem to withstand and recover from a disturbance. Community resistance and resilience often underpin restoration goals, and are associated with good ecological health. However, degraded ecosystems can also be resistant and resilient to disturbance (negative resistance and resilience) making them resistant to restoration. In New Zealand, many aquatic ecosystems have become degraded and are locked in restoration-resistant states.

We hypothesise that resistance to restoration is a consequence of degraded communities becoming dominated by species with traits which enhance food web stability (e.g. trophic generalism), thereby increasing resistance to restoration actions (negative resistance). Therefore, these restoration-resistant communities must first be destabilised to facilitate recovery. 'Pushing' a degraded environment by applying a stressor may help to both alleviate poor abiotic conditions and create the instability needed to overcome negative resistance. To prevent the community from slipping back to the degraded state, actions can then be taken to aid natural colonisation; 'pulling' the community towards its desired state may be achieved by adding in missing traits through physically importing species. Using freshwater ecosystems as a model system, we present a theoretical framework to explain the mechanisms behind negative resistance and resilience and how these might be overcome.

Research/Career Interests:

- Resistance
- Resilience
- Restoration
- Community ecology

Investigating the variable efficiencies of stormwater treatment devices and development of a model to estimate performance

Forrest Bilek, PhD Candidate
forrest.bilek@pg.canterbury.ac.nz
Supervisors: Tom Cochrane, Frances Charters, UC

Urban stormwater drainage systems have historically been designed and developed for the purpose of removing runoff as efficiently as possible, with little thought for water quality of the receiving environment. Through directing untreated urban runoff into streams, high concentrations of contaminants such as suspended solids, heavy metals, nutrients, and hydrocarbons end up in our natural waterbodies.

In an effort to remove contaminants from stormwater runoff and improve downstream water quality, stormwater treatment devices have been integrated into the built environment. These include detention basins, treatment wetlands, rain gardens, and commercially engineered devices. An incomplete understanding of variables affecting performance has led to a high variability in treatment system efficiencies, reported even within systems of the same type.

To facilitate investigation of the numerous variables affecting efficiency, three categories will be investigated: load characteristics, treatment system qualities, and monitoring techniques. Using internationally available monitoring data as well as experimental data from Christchurch, NZ, patterns will be drawn between key treatment efficiency variables. A review of all data and identification of key variables will allow for construction of a model to better estimate the post-installation efficiencies of new treatment devices. A better understanding of the significant variables that affect treatment device performance will help improve their design and placement in the future.

Research/Career Interests:

- Stormwater quality and stormwater treatment characterisation
- Ecological treatment systems for water quality
- Multi purpose infrastructure for environmental health

Conceptual hydrogeological model development for Kaitorete Spit, Canterbury

Gemma Clark, PMEG Candidate
gmc106@uclive.ac.nz
Supervisor: Leanne Morgan, UC

Kaitorete Spit is a gravel barrier located south of Christchurch. While the geomorphology of Kaitorete Spit is quite well understood, little is known about fresh groundwater flow dynamics within Kaitorete Spit. This is despite the fact that fresh groundwater within the spit acts as a hydraulic barrier holding back seawater from Te Waihora (Lake Ellesmere).

This study aims to commence the development of a detailed hydrogeological conceptual model of Kaitorete Spit. A hydrogeological conceptual model is needed in order to improve our understanding of the way in which fresh groundwater (and hence the hydraulic barrier) within Kaitorete Spit will respond to future stresses such as climate change-induced sea level rise and recharge reduction. This will also assist future studies looking at the impact of climate change on Lake Ellesmere.

The objectives of the study are to:

- Compile previous studies relating to the geology and geomorphology.
- Compile and analyse data from groundwater and climate monitoring sites.
- Use the collected data to develop a first-pass hydrogeological conceptual model of Kaitorete Spit.
- Carry out 2D cross-sectional modelling (analytic or numeric) to explore a range of conceptual questions such as whether fresh groundwater exists as a classic freshwater lens (as occurs on islands) within the spit.

Groundwater seepage in Te Waihora/Lake Ellesmere

Katie Coluccio, PhD Candidate
katie.coluccio@pg.canterbury.ac.nz
Supervisor: Leanne Morgan, Marwan Katurji, UC; Fouad Alkhaier, ECAN

Te Waihora/Lake Ellesmere is a coastal lagoon just south of Christchurch that holds important ecological, cultural, economic, social and recreational value for many stakeholders. The Te Waihora catchment is also intensively farmed, which has contributed to declining water quality in the lake. Given the multitude of stakeholders, integrated management of the lake has been a challenge.

It is important for effective management of Te Waihora that there is a thorough understanding of inflows to the lake. The water flowing into the lake both as surface water and groundwater impacts the lake in terms of water quality and lake levels. Currently there is a gap in the understanding of groundwater that seeps upward through the lakebed, both in regard to its quantity and quality.

This study will adopt a multi-method approach. First, broad-scale data will be collected using airborne thermal imaging and radon (Rn-222) and salinity mapping of the lake. These results will inform the second phase of the study where point-scale techniques, such as temperature sensors, nested mini-piezometers, seepage meters and sediment core analysis will be used to quantify groundwater seepage and analyse its chemistry. The technical data gathered through these methods will be enhanced with anecdotal evidence on known locations of upwelling and springs in the lakebed.

Research/Career Interests:

- Groundwater-surface water interactions
- Applied hydrology
- Research and academic opportunities

The affect of effect: Using local embodied knowledge in monitoring and evaluation of climate change adaptation interventions in Vietnam

Huong Do, PhD Candidate
thi.do@pg.canterbury.ac.nz
Supervisor: Kelly Dombrowski, Ed Challies, UC

All over the world, climate change adaptation interventions (CCAIs) are being implemented in various ways. Existing monitoring and evaluation (M&E) practices of these CCAIs can only provide results with reference to goals and processes, and tend to be top-down and neo-colonial in method and scope. This leads to oversimplification and outside-imposed priorities and knowledge about climate change.

Our research takes an open-ended approach to M&E, exploring the role of embodied knowledge in local level monitoring and evaluation in Vietnam. We suggest that for CCAIs, we need to pay attention to the embodied knowledge of local residents who have everyday experiences of living in the affected environment. Through paying attention to embodied knowledge, we find the actual impacts on local residents in Thai Binh province of Vietnam are multi-layered, consisting of not only the physical and material changes in their environment and livelihoods, but also their changing concerns about, and their care for, the surrounding environment and nonhuman others. These concerns and cares enact and affect substantially on-going place-based interventions that are more effective, efficient, and potentially transformative. The implication of embodied knowledge for M&E can open up more possibilities for post-development and post-humanist projects for transformative change.

Research/Career Interests:

- Embodied monitoring and evaluation for climate change adaptation interventions

Pathways for nutrient contamination of Barkers Creek, South Canterbury

Hamish Graham, Masters Candidate
hamish.graham@ecan.govt.nz, hamish.graham@pg.canterbury.ac.nz
Supervisors: Leanne Morgan, UC; Carl Hanson, ECAN; Lee Burberry, ESR

Barkers Creek, a main tributary of the Waihi River, is located approximately 3 km north of Geraldine, nestled between the Waihi River to the north and Hae Hae Te Moana River to the south. Land-use within the catchment includes dairying, sheep, beef and deer grazing, cropping and fruit growing, lifestyle blocks and forestry. Nitrogen, dissolved reactive phosphorus and sediment were all identified as pollution issues impacting the creek. Through my research I tested two hypotheses:

1. That the spring-fed streams located at the bottom of Barkers Creek catchment act as the major route via which nitrate is exported into the creek;
2. That storm flow events control phosphorus and sediment inputs to Barkers Creek.

I aimed to test these hypotheses through characterising the hydrogeology of Barkers Creek, including practical examination of surface water - groundwater interactions within the catchment, and identification of nitrate-pollution hot-spots. It also identified the pathway via which phosphorus and sediment is entering the lower reaches of the creek.

My overall monitoring strategy could be broken down into three components:
1. Initial, broad catchment-wide site survey and spot measurement of full water chemistry analytical suite;
2. Low-frequency monitoring by spot flow gauging and concurrent water quality measurement at a reduced number of sites;
3. High-frequency (automated) monitoring of flows and nitrate at select sites, including monitoring of several storm flow events.

Research interests:

- Hydrogeology
- Water quality
- Hydrology

Improving through inclusion: Using community-based initiatives to improve freshwater ecosystem health

Will Keay, Masters Candidate

will.keay@pg.canterbury.ac.nz

Supervisors: Eric Pawson, Ed Challies, Heather Purdie, Shelley McMurtrie, UC

The quality of freshwater throughout New Zealand is of importance to the public. The state of urban freshwater systems is of particular concern. There is a desire among the general public to improve the condition of our freshwater systems. This research explores whether community-based initiatives can be part of the solution required to improve urban freshwater ecosystem health.

Initially, a model was created that identified the key components of community participation. This model was then utilised as a sorting mechanism to analyse several case studies. Drivers and barriers to participation were extracted using this process. Semi-structured interviews were then conducted to elicit answers about the perceptions of the state of urban waterways, their management and how community-based initiatives can be integrated into freshwater management regimes. Interview participants were sought from a range of backgrounds including freshwater science professionals, through to local iwi, and stream care group members.

Findings from this process will be applied to the Ōpāwaho/Heathcote River catchment, an urban river catchment that consistently displays poor freshwater health. This catchment has a range of issues that impact freshwater quality. However, there is a series of interested community groups that could be engaged to help mitigate and remediate detrimental impacts to its health. Application of these research findings to this local catchment may help to provide pragmatic suggestions about ways in which community-based improvements for freshwater ecosystem health could actually become a reality.

Research/Career Interests:

- Freshwater ecology
- Environment-society interactions
- Balancing multiple values of freshwater

The response of unconsolidated coastal and rivermouth environments to rapid tectonic change, Kaikoura

Kate MacDonald, Masters Candidate
kate.macdonald@pg.canterbury.ac.nz
Supervisors: Deirdre Hart, Seb Pitman UC

Historic analyses of mixed sand and gravel (MSG) coasts affected by earthquakes indicates erosional trends can be initially masked by significant uplift, but over time the dynamic coast reworks itself to re-establish its pre-quake profile, with key environmental factors, such as the balance between river contributions to sediment budgets and wave climate, driving long-term trends. The 7.8 magnitude Kaikoura earthquake on November 14th, 2016, caused 0.5 to 5.7m of uplift to the coastline. This research aims to determine how coastal and river-coast environments respond in the short term to rapid tectonic change, to help inform resource management, and to better understand the role of processes and responses that run Ki uta ki tai - from the mountains to the sea – relative to tectonic activity.

The 2016 Kaikoura earthquake was unquestionably significant on a geological scale, but the likely duration of its signature in the dynamic hapua lagoon and MSG beach environments remains unknown. Geomorphic and sediment data from 1997 to 2015 was analysed to determine the pre-quake coastal trends of Kaikoura's unconsolidated coastal and rivermouth environments while a re-survey 20 months after the seismic event was used to capture the post-quake environmental states. Initial results point to immediate increase of volume in the beach profile, with geomorphic features such as berms, reworking further down the beach profile relative to mean sea level.

Research/Career Interests:

- Environmental science
- Coastal processes and geomorphology
- Coastal interface environments
- Water quality

Environmental factors that affect kōwaro (Canterbury mudfish) populations

Christopher Meijer, Masters Candidate
christopher.meijer@pg.canterbury.ac.nz
Supervisors: Angus McIntosh, Helen Warburton, UC

Stress-tolerant species that reside in habitats characterised by extreme environmental conditions are likely to experience contractions of inhabitable niche space, particularly when dispersal to alternative habitats is limited. A comparison of 26 populations of stress-tolerant Kōwaro (Canterbury mudfish, *Neochanna burrowsius*) in the Waianiwaniwa Valley and along the Hororata River indicated that these resident populations were influenced by both riparian and instream conditions. These effects were both direct, such as the relative abundance of young-of-the-year being positively associated with plant coverage, and indirect, such as variation in water depth (a proxy for drying intensity) being dependent upon an interaction between canopy cover and dominant tree type.

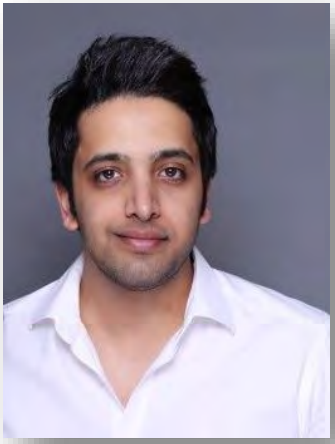
Therefore, it is important that both the aquatic and riparian environments are considered and included in future kōwaro population management.

Research/Career Interests:

- Food webs
- Freshwater ecology
- Changes to drought regimes
- Threatened species

N and P removal from wastewater: A novel approach using sequencing batch reactor technology

Parsa Mohajeri, PhD Candidate
parsa.mohajeri@lincolnuni.ac.nz
Supervisors: Carol Smith, Niklas Lehto, Henry Chau, LU



GDP from agriculture in New Zealand averaged 2596.53 NZD Million from 1987 until 2017. The challenge for the nation is to seek a balance between primary productivity and environmental protection of the natural environment. Discharge of different contaminants from industrial and residential sources threatens the surrounding environment and ecosystems. One of the biggest environmental issues facing New Zealand is N and P contamination of surface water. Nitrogen and phosphorus together are the cause of the algal blooms and other unwanted plant growth in waterways. Anchored by the Resource Management Act, New Zealand's government has declared its desire to follow sustainable development principles in its economic, social and environmental policies.

The specific focus of this research is to find a near market and sustainable way to remove the N and P from the wastewater of agricultural industries such as fertiliser company distribution yards, using a combination of bioreactor technology, floating treatment wetlands, and mathematical modelling. The significance of finding a solution to this challenge is that there are many similar industries in New Zealand, where constraints to wastewater discharge exist. In addition, there are other land management practices impacting on surface water quality and nitrate concentration. So, the issue of surface and ground water quality as related to nitrate and phosphorous contamination is an environmental issue of concern, in Canterbury, New Zealand and globally.

Research/Career Interests:

- Environmental engineering
- Wastewater management
- Water and soil pollution
- Contaminated land

Role of urban eco-industrial complexes in coastal city flood mitigation within context of climate change

Suphicha Muangsri, PhD Candidate
suphicha.muangsri@lincolnuni.ac.nz
Supervisors: Wendy McWilliam, Jenny Webster-Brown, LU

Protecting coastal cities from flooding in a context of climate change is challenging. With limited riparian areas, hard engineered solutions on publicly owned areas of waterways have been relied upon to mitigate this flooding (Bolton, Westerlund, & Clark, 2009), but have often failed to provide sufficient flood protection to surrounding developments (Chan et al., 2018). Privately owned lands adjacent to these waterways have the potential to play this role (Sayers et al., 2016). However, most studies have focused on the potential role of residential areas, and few have focused on larger industrial areas which, due to their characteristics, could play a much larger and more easily implemented role. They often are characterised by large lots which provide abundant space for water storage. Additionally, there are fewer participants involved in implementation than within residential areas. Eco-industrial parks that are a cluster of individual industries concerned about environmental impacts and maximising their profits (Cohen-Rosenthal, 2003), could play a particularly potent role for flood mitigation within industrial lands. Using content analysis of policy documents, long interviews of stakeholders, and inventory and assessment of industrial complexes, this research will determine the role that New Zealand eco-industrial parks play and could potentially play in municipal flood mitigation. It will also determine the enablers and barriers to its implementation.

Research/Career Interests:

- Flood mitigation
- Green stormwater management
- Impacts of climate change
- Policy implementation

Upscaling of point-scale groundwater recharge measurements in Canterbury, New Zealand

Manuel Rios, Masters Candidate
manuel.RiosRivera@lincolnuni.ac.nz
Supervisors: Markus Pahlow, UC; MS Srinivasan, NIWA

Land surface recharge (LSR) can be estimated employing numerical models, or through direct measurements at a lysimeter monitoring site. Lysimeters are known to be the most direct method of quantifying recharge, yet utilization for decision making in water management is limited as merely point-scale estimates of the process are provided. It is therefore essential, to find ways by which an environmental process can be represented on larger areas to evaluate the effect of management activities.

The aim of this study is to upscale point-scale (i.e. lysimeter) drainage measurements employing artificial neural networks, and to quantify the uncertainty related to the up-scaled recharge estimations. Such information might be useful for water managers to plan e.g. water allocation.

First results suggest that employing a neural network to upscale point-scale recharge measurements to provide future estimates is promising. The model trained based on data (i.e. rainfall, irrigation, PET and soil particle size) collected at Dorie, Methven and Dunsandel has shown R2 values of 0.654 when tested against unseen data. These machine-learning tools can be utilised to estimate future spatial recharge, which in turn can support water managers to identify sustainable allocation strategies.

Research/Career Interests

- Hydrogeology
- Irrigation design and management
- Water engineering
- Modelling

Seawater intrusion impacts on the aquifer surrounding Lake Kate Sheppard

Mark Scaife, PMEG Candidate
mas247@uclive.ac.nz
Supervisor: Leanne Morgan, UC

Seawater intrusion into shallow coastal aquifers was recognized as a potential issue for Eastern Christchurch. These claims were derived from potential sea level rise due to climate change but did not take into account the subsidence of over 1m during the Christchurch Earthquake Sequence (CES). Lake Kate Sheppard, which is adjacent to the better-known Travis Wetland, is connected to the Avon River within the tidal zone. It is surrounded by a shallow unconfined aquifer within the Christchurch Formation comprising of coastal sand deposits. Since the CES, Lake Kate Sheppard has subsided by approximately 750mm, placing most of the area surrounding the lake within 0.5 m of mean sea level. The aim of this project is to characterize the magnitude of seawater intrusion within the shallow coastal aquifer and investigate the effects tidal fluctuations have on the phreatic water surface.

This will be completed by utilising Environment Canterbury wells in the area as well as installing one standpipe near the shore of the lake to monitor properties (conductivity, temperature, depth). Furthermore, sampling and lab testing of two nearby springs that have appeared after the CES will be compared to samples collected from the shallow aquifer for common ions. This will illuminate the nature and origin of the springs. This project is in the early stages and results will be presented at the conference.

Research/Career Interests:

- Seawater intrusion
- Sea level rise
- Hydrological geotechnical works

Reconnecting people to their water supply: a social perspective to water resource management

Rachel Teen, Masters Candidate
rachel.teen@lincolnuni.ac.nz
Supervisors: Lin Roberts, LU; Ed Challies, UC

Safe drinking water is essential to public health. In August 2016 an outbreak of gastroenteritis in Havelock North, New Zealand and local business owners were detrimentally affected – financially, operationally and emotionally. While this "disorienting dilemma" did trigger business owners' perception changes in their water supply none underwent a transformation in their perspective of water supply.

It appears that the various causes of the contamination were all deemed external to Havelock North business owners' responsibilities. They still unquestioningly accepted the traditional, 'technocratic', unwritten hydrosocial contract with their local authorities. None experienced a transformational perspective change whereby they sought to renegotiate the community's contract using a hybridised approach that incorporates adaptive and/or hydrosocial water resource management.

Research/Career Interests:

- Hydrosocial water management
- Urban, engaged, integrated and adaptive water management.

About Our Platinum & Gold Sponsors

Environment Canterbury is the regional council for this magnificent region. In Canterbury we have one of the most astonishing environments in New Zealand – from the turquoise Lake Tekapo, the stunning Southern Alps, the widespread agricultural plains, and beautiful coastline – not to mention our 'capital' city of Christchurch – and everything in between. The regional council is responsible for this environment, with the community's support and in collaboration with many other organisations.

The work of Environment Canterbury takes place under seven broad portfolios: the Canterbury Water Management Strategy; air quality; biodiversity and biosecurity; hazards, risks, and safety; planning, consents and compliance; transport, Greater Christchurch rebuild and urban development; and regional leadership. Within these portfolios, the regional council covers such things as the Harbourmaster's Office, regional parks, coastal erosion, buses, freshwater quality, pest management, flood protection, and air pollution. Industry, and the economic impact of activity within the environment, are key to the council's decision making.

We are proud to support the 2018 Waterways Postgraduate Student Conference. Water is the driving force behind much of our economy and protection of this precious resource requires science to mitigate negative impact to ensure that we have a positive impact.

Water New Zealand is the principal trade association representing the interests of the water industry. We have 1900 members representing Councils, engineering service providers and providers of goods and services. We are actively engaged in advocacy, development of technical guidance and industry engagement with the goal of driving consistency into the way in which water systems are operated.

PreSens is partnering with AS1 Ltd in Biology & Environmental Research tools. PreSens' worldwide customer base in biological and environmental research has now grown to hundreds of users coming from the University of Alaska in Anchorage to the University of Wellington in New Zealand. The various optical sensor designs – from microsensors thinner than a hair to robust stainless steel probes – make them applicable in a wide range of research fields. Whether it is contactless respiration measurements, monitoring in sediment pore water, profiling in biofilms, or 2-dimensional recording of analyte distributions in root systems, PreSens can deliver the right sensor solution for investigations in micro- or macro-scale.

ESR is a Crown Research Institute (CRI) that uses the power of science to tackle critical challenges facing New Zealand in the areas of public health, serious crime, food safety and water quality.

ESR's purpose is to deliver enhanced scientific and research services to the public health, food safety, security and justice systems, and the environmental sector to improve the safety of, and contribute to the economic, environmental and social well-being of people and communities in New Zealand.

ESR provides research and scientific services and knowledge transfer in partnership with key stakeholders including government, industry and Māori to:

- Safeguard the health of New Zealanders through improvements in the management of biosecurity and threats to public health
- Increase the effectiveness of forensic science services applied to safety, security and justice investigations and processes
- Enhance protection of New Zealand's food based economy through the management of food safety risks associated with traded goods
- Improve the safety of freshwater and groundwater resources for human use and the safer use of biowastes.

Our point of difference is that we deliver science services and research that keep communities safe, healthy and prosperous. ESR's science capabilities include health science, forensic science, food and water science, radiation science, social systems and workplace drug testing. Our high calibre teams provide independent, authoritative and trusted science solutions. We are especially known for our advanced science capabilities in microbiology, DNA and our ability to solve complex problems.

Hill Laboratories is New Zealand's largest privately-owned analytical testing laboratory, specialising in environmental, agricultural food testing. With more than 350 staff working across New Zealand, it is a significant employer of science graduates from New Zealand tertiary institutions.

The objective of Our Land and Water – Toitū te Whenua, Toiora te Wai – National Science Challenge is to enhance primary sector production and productivity while maintaining and improving our land and water quality for future generations. The way we use and manage our land and water will be transformed by: identifying and providing for innovative resilient land and water uses; building collaborative capacity in our communities; and creating and/or capturing greater value for our agricultural products in our global markets. These drivers, along with research to connect them, form the three themes Challenge research is addressing. The Māori title is "Toitū te Whenua, Toiora te Wai". Toitū te Whenua – let the permanence of land remain intact; Toiora te Wai – let water abound. The title is an adaption of the Māori proverb, "toitū te whenua, whatungarongaro te tangata" – land is permanent while people come and go.

NIWA is New Zealand's leading provider of atmospheric, freshwater and marine research and applied science services.

Our vision is "to enhance the benefits of New Zealand's natural resources". Our research helps New Zealanders benefit from our natural environments, without compromising their ecological, recreational, cultural and spiritual value.

We also help New Zealand and Pacific communities build resilience to potential hazards associated with tsunamis and climate variability and change.

Our work takes us from the top of the atmosphere to the bottom of the ocean. We operate world-class facilities and employ world-renowned specialists in weather and climate, coastal and marine science, aquaculture, freshwater and estuarine science, fisheries, environmental data monitoring and management, and Māori environmental research.

Key assets include a fleet of ocean-going and inshore research vessels for our coastal and marine research activities and a wide range of commercial activities; a High Performance Computing Facility that underpins our sophisticated environmental modelling and forecasting capabilities, and our marine research centre at Bream Bay near Whangarei, where world-leading research aims to improve the viability and sustainability of commercial fish farming.

We employ around 670 scientists, technicians and support personnel, spread throughout New Zealand and a subsidiary operation in Perth, Australia.

As a Crown Research Institute, we receive core funding from the Government to undertake research for the long-term benefit of all New Zealanders, and we also serve clients in many sectors on a commercial basis, including farming, forestry, horticulture, transport, energy, marine fisheries, and aquaculture.

We're proud of the unique value we bring to our clients at WSP Opus with unrivalled local knowledge harnessed from 148 years of pioneering the important infrastructure and environments of New Zealand. We connect our world-class technical experts in Transport, Water, Property and Buildings, Power and Environmental who are part of the 40 communities around New Zealand in which we live in, we know this place like no other. This combined with our network of 43,000 WSP experts around the world means that we have the power to generate solutions that question today, imagine tomorrow and create for the future.

We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors, environmental specialists, as well as other design, program and construction management professionals.

What sets us apart is our wealth of collective experience and the collaborative way we work across disciplines and with our clients: WSP Opus projects are powered by connected expertise.

We work closely with our clients to really understand their needs and aspirations, and deliver innovative and creative solutions for what are often complex design challenges.

Above all, we are proud to be trusted partners in the creation of sustainable communities through the development and management of world-class infrastructure.

The Rivers Group is a community of people with a technical interest in river management, which seeks to develop and share its body of knowledge to influence and facilitate better outcomes for New Zealand's rivers. The Rivers Group was formed in 2009 to provide a forum for those involved with, and with an interest in rivers, flood risk management and the operational and environmental issues of catchments and river systems. While the Rivers Group was formed as 'a joint technical group of Engineering New Zealand and Water New Zealand', it encourages membership by those working in a wide variety of fields and of practice and interest to do with rivers, including cultural health, water quality, ecology water quantity, flood management, energy generation and environment management. The Rivers Group aims to promote a multi-disciplinary approach to river management, which reflects cultural and societal diversity in an integrated and holistic manner.

Its key objectives are:

- To facilitate cross-disciplinary interaction between individuals, communities and professionals involved in catchment management, flood risk management and river management throughout New Zealand;
- To promote best practice, leadership and the sharing of technical knowledge in all aspects of catchment management, including flood risk management, river restoration and river engineering throughout urban and rural environments in New Zealand;
- To support and promote relevant science and research in river and catchment management and to disseminate that information among professionals, academics, decision makers and the general public;
- To promote and facilitate input into local and central government policies, strategies, standards and programmes affecting catchment and river management;
- To assist in the integration of the principles of the Treaty of Waitangi in best practice river management.

Further information see https://riversgroup.org.nz/

Christchurch City Council

Christchurch City Council has a responsibility to ensure that surface water resources are managed in a manner that supports the environmental, social, cultural and economic well-being of current and future generations.

The Council's Surface Water Strategy 2009 goals are to:

1. Improve the water quality of our surface water resources;
2. Reduce the adverse effects of flooding;
3. Improve the ecosystem health of surface water resources;
4. Protect and restore Ngāi Tahu values associated with surface water resources;
5. Support a range of recreation activities on and around waterways;
6. Protect heritage values associated with surface water;
7. Protect and enhance the landscape values of surface water;
8. Support community involvement in surface water management;
9. Manage stormwater in an efficient manner that supports Goals 1 – 8.

Rangitata Diversion Race Management Ltd (RDRML) is a non-profit water supply company whose role includes abstracting, managing and supplying water for irrigation, generation and community stock water schemes. Its shareholders comprise two irrigation schemes (Mayfield-Hinds Valetta Water Ltd (MHV Water) and Ashburton-Lyndhurst irrigation Ltd), TrustPower Ltd, and the Ashburton District Council as owner of the stock water system.

RDRML owns and operates the Rangitata Diversion Race (RDR). This infrastructure is some 67 km in length and runs between the Rangitata and Rakaia Rivers. The RDR is the largest race that supplies water for irrigation in New Zealand. The RDR was opened in 1945 under government ownership, with ownership transferred to the Company in 1990. The RDR supplies its two irrigation scheme shareholders as well as one private irrigation scheme (Barhill-Chertsey Irrigation Ltd (BCI)). The two community irrigation schemes have the necessary resource consents to irrigate approximately 95,000 ha of land, of which 75,000 ha is presently irrigated. Further, two hydroelectric power generation stations and the District Council stock water network are also supplied by the RDR.

The RDR is the backbone for distributed irrigation in mid-Canterbury. As such, the RDR plays a significant role in providing for the social and economic wellbeing of the Canterbury community.

Since Ravensdown started its environmental consulting business in 2013, the team has delivered more than 33,000 contracted hours of effort helping farmers with their mitigations and compliance needs.

The specialists also assist local and regional government deliver on their objectives while supporting farming customers with practical responses to regulatory developments.

Ravensdown's is the largest farm environmental consultancy in New Zealand. It is the fastest-growing part of the farmer-owned co-operative and operates on a user-pays basis.

The Environmental team is structured around three service streams:

1. Regulatory compliance including our comprehensive service where farmers ask us to take on all the steps involved in progressing or maintaining compliance with a consent.

2. Farm Systems Analysis where experienced highly trained specialists provide tailored advice for planning the future of the farm business.

3. Integrated Catchment Management where we help farmers and local community members working together to protect their waterways.

Referrals to Ravensdown Environmental can be obtained through the Customer Centre on 0800 100 123 or environmental@ravensdown.co.nz.

AQUALINC RESEARCH LIMITED

Aqualinc is a specialist provider of water resource engineering and management services. Our mission is to deliver long-term socio-economic benefits through world-class water and land management.

Wise management of water resources is fundamental to sustaining both economic growth and natural environments, and increasing the health, wealth and well-being of New Zealanders. Aqualinc is committed to helping New Zealanders allocate and use freshwater in a sustainable, efficient and equitable way.

We provide New Zealand with world-class water management and water use efficiency through scientific and policy research, technology development and deployment, water engineering water management advisory services, and irrigation management services.
We enjoy making a positive difference to environmental quality and the economic well-being of communities through the projects we are involved with.

Our team of professional environmental, water resource, natural resource and irrigation engineers, hydrologists, hydrogeologists and resource management consultants, are available to help with your water and land management needs.

We are always keen to talk with exceptional engineers and scientists about joining us on our mission at one of our offices in Christchurch, Ashburton, Hastings or Hamilton.

www.aqualinc.com www.myIrrigation.info

Wallbridge Gilbert Aztec (WGA) is a multi-disciplinary, award-winning engineering and project management consultancy of over 270 staff, with an ethos based on developing long-term collaborative client relationships and delivering innovative, buildable and economical solutions. WGA offers experience across a wide range of consulting services, including structural, civil, water resources, maritime, mechanical, geotechnical, heavy lifting, electrical, pressure vessels and project management.

We offer over 30 years of practical experience in the investigation, consenting, design, delivery and operation of a wide range of Integrated Water Management Services, where the solutions to water management challenges are developed from a conjunctive surface-groundwater approach. These specialised services include applying the tools of Managed Aquifer Recharge (MAR) to varied hydrogeological settings. Our internationally-renowned MAR projects range from catchment scale to site-specific applications, utilising water sourced from high quality alpine rivers, stormwater, treated wastewater and co-produced water from mining activities.

Our approach to the delivery of water infrastructure projects recognises and builds on past successes and lessons learned, addresses challenges and enables our clients to realise future opportunities. In delivering projects, we work with the client to recognise and consider external drivers of change, including policy and regulatory developments, population growth, land use evolution and cross-jurisdictional issues.

WGA is a proud sponsor of this year's 2018 Waterways Postgraduate Conference to help provide a showcase for young professionals entering a career in water.

Selwyn stretches across the Canterbury Plains, bounded by the Rakaia and Waimakariri Rivers, with Arthur's Pass National Park in the Southern Alps to the west and the Pacific Ocean to the east.

With a population of more than 60,000 Selwyn is the third largest territorial authority in the South Island, following a number of years of sustained growth. While this growth was initially driven by relocation following the Canterbury earthquakes, it is now equally sustained by industrial and commercial movement towards the south west of Greater Christchurch. The district also supports a thriving primary production sector including dairying, assisted by ongoing irrigation investment.

Selwyn District Council is planning significant investment over the next 10 years in community services, facilities and infrastructure, including the management of our 5 Waters services – water supply, wastewater, stormwater, land drainage and water races.

The availability of clean, safe water and the safe disposal of wastewater are fundamental to the health of our community and natural environment. The Council takes an integrated approach to managing water resources, recognising that our 'mountains to sea' landscape means there is a strong connection between these services.

Much of the district lies within the catchment of Te Waihora/Lake Ellesmere, one of New Zealand's most important wetland systems, and central to the mana of Ngāi Tahu. The Council is working actively with Ngāi Tahu, Environment Canterbury and other partners on widespread cultural and ecological restoration projects.

Other priority projects include the expansion and upgrading of wastewater treatment facilities, increasing water supply capacity and the upgrade of water supply treatment plants.

Notes


LINCOLN
UNIVERSITY
TE WHARE WĀNAKA O AORAKI
UC
UNIVERSITY OF
CANTERBURY
Waterways
Centre for Freshwater Management