

# water



**NOVEMBER / DECEMBER 2016**

**ISSUE 197**

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2016 Conference**

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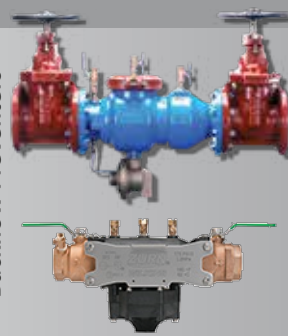


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# water

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The official journal of Water New Zealand – New Zealand's only water environment periodical. Established in 1958, Water New Zealand is a non-profit organisation.



# Collaborating through turbulent waters

**Dukessa Blackburn-Huettner,  
President, Water New Zealand**

I hope those of you who attended our Annual Conference this year enjoyed it as much as I did. It's always energising to listen to inspiring speakers, attend workshops and of course, there are the new products, innovations and ideas that we see in the important expo side of the conference. Certainly plenty for everyone!

The conference again provided a great opportunity for us to meet and collaborate with each other – something I note we're very good at in the water sector. I want to thank all of you who contributed to making this a success from speakers, to sponsors, exhibitors and of course the delegates.

Our keynote speaker at the conference, Paul Bowen from Coca-Cola, threw down the challenge to leave a legacy in what we do. It's really about stepping up and taking a leadership role on a day-to-day basis.

In my first column as Water New Zealand President, I'd like to stress that collaboration will be a vital ingredient in how we navigate our way through the turbulent waters ahead. While I say we collaborate well as professionals and individuals, we work in a very fragmented sector and we don't always have an agreed view on the future management of our water resource.

We need to build on the goodwill and support that was clearly evident at this year's conference and turn it into a strong and united voice so that we chart our own future.

This year Environment Minister Nick Smith spoke to us about the fact that Hawkes Bay has reminded us that we cannot take fresh water for granted and that we're not as sophisticated and careful as we could be. He challenged us to collaborate more and step outside our own silos. We need to be able to demonstrate leadership in joining up the sector so that conversations about water occur within a context and not in isolation.

The Government is looking at developing a stronger national direction around improving freshwater management and we need to make sure we're determining how that future develops. It's reasonably clear that the National Policy Statement (Freshwater Management) will have significant implications for the future management of water, and we need to ensure we are central to those discussions.

I listened with interest to the many thought-provoking and insightful speakers at conference, including Malcolm Alexander (Local Government New Zealand), Dr Lester Levy (Auckland Transport and Auckland/Waitemata District Health Boards) and Raveen Jaduram from Watercare.

Raveen talked about the need to be customer focused and responsive. We need to ensure that our stakeholders, including those in the government, know what we are doing and why we are doing it. Dr Levy talked about possible new

technologies, such as the atmospheric harvesting of water, which could eliminate the need for a pipeline reticulation network. We need to be open to ideas that are currently "out there", but which could test our current paradigm about the provision of infrastructure.

At Water New Zealand we have a new strategy that ties in very closely to these themes. Our goal over the next five years is aspirational. We want a self-determining future for our water industry. In order to do this we will need to collaborate to agree on consistent technical practice. We will need to advocate for the sector as your "go-to" advisor, and we will need to progress technical issues and provide guidance.

Your previous board has set the scene and I am looking forward, as President, to being part of the team that will continue to make this happen.

## **So what are we doing?**

As well as working more closely with our national groups and special interests groups, we are forging better relationships and implementing joint projects with other industry organisations such as the IPWEA, as well as convening many regional and special interest groups for knowledge sharing, in an effort to join the industry up more.

We are lifting our game as an advocate on water issues. In the past eight months we have made 11 submissions to consultation documents from government agencies, in consultation with and input from you our members, on behalf of the industry.

We aim to strengthen our strong focus on technical guidance to the sector to lift sector performance. We have strengthened our technical team, reviewed and refreshed our technical programme and are putting out technical guides on a number of topics. We also run and produce the National Performance Review and are working to align this to provide input to other national programmes and initiatives with local and central government as well as comparability with similar overseas initiatives.

We will have a significant input into the Havelock North Drinking Water Inquiry and advocate strongly for a review of the systemic issues that led to that contamination crisis.

But, of course, we need to be continuing to look for new opportunities for improvement. So I urge you to be active members of Water New Zealand, to get involved and communicate with the staff or board if you have suggestions for improvement.

I am honoured to lead your Association over the next two years and am very much looking forward to my tenure as your President. **WNZ**

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## For the record

**Water New Zealand** chief executive John Pfahler says the Court of Appeal ruling supporting the South Taranaki District Council's decision to fluoridate its water supply means that common sense has prevailed and this is good news for dental health in the community.

"It now means that after nearly four years of costly legal delays, the Council is able to extend fluoridation to residents who have not had the benefits of added fluoride in their public water supply."

However, he also says it is disappointing and concerning that lobby groups representing an extreme position, not backed by scientific evidence, have been able to hold a small council to ransom.

"The benefits of fluoride protection for dental health are irrefutable and pose no health risks at the recommended level of 0.7 to 1.0 parts per million in drinking water.

"It would appear that the opponents of fluoride deliberately targeted a small council."

He says that's one reason Water New Zealand strongly supports the proposal to shift responsibility for fluoridating water supplies from councils to district health boards.

"Fluoridation is a public health issue and it should not be left to councils to be responsible for making decisions over the dental health of communities.

"I look forward to seeing the legislation supporting this move going through Parliament."

## New freshwater institute

**The Government** has set up a new freshwater institute between NIWA and the University of Waikato called Te Waiora, Joint Institute for Freshwater Management, and based on the university's campus.

"This is a significant step forward in freshwater management in New Zealand and will enhance our research capabilities and facilities to address future management of our freshwater resources and environments," says Science and Innovation Minister Steven Joyce.

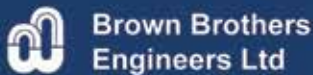
He says the Joint Institute will be a world-leading centre for interdisciplinary freshwater research and teaching.

"This is the first time such an interdisciplinary approach has been taken and it represents a significant change in how New Zealand's fresh waters are studied and managed."

Research programmes will span river environments, lakes and wetlands and urban environments and the interactions between science, human behaviour, economics and policy. The institute will work on assessing the values of ecosystem services provided by freshwater, plus the impacts of moving to higher quality standards for different water bodies.

Waikato Regional Council will fund a Rivers Chair for the institute and also sit on the advisory board along with other key national and international partners.

The university and NIWA will provide funding over three years as an initial investment and the centre will be housed in a new building within the NIWA complex on the university campus.



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# 2017 Stormwater Conference

The 2017 Stormwater Conference is to be held in Auckland next May at the Pullman Hotel.

This conference theme of 'Innovative, Resilient and Future Ready' provides the platform to introduce, explore, address and challenge the way the industry responds to the impacts of stormwater on the environment.

Bronwyn Rhynd, Chair of the Water New Zealand Stormwater Group Committee, says the conference will explore ways to manage and integrate stormwater, from the concept and design, through to construction and into operation and maintenance.

"Innovation needs to be introduced, explored and embraced within the industry and its collaborative partners to push the boundaries of the urban infrastructure and support industry growth in our city centres.

"Resilient stormwater infrastructure is supported by a collaborative approach from design to implementation. This theme has been explored previously and this conference will continue to share examples,

acknowledge and celebrate this important component of providing resilient systems.

"Future Ready is a progressive way of introducing the challenge of supporting an urban environment that can meet the needs of a growing population and to incorporate the innovation and resilience required by society.

"The selection of themes and sub-themes has been designed to attract technical papers, expert panel sessions, open discussion forums and exhibitions to provoke thoughts, challenge stormwater practitioners' thinking and knowledge while expanding their views on holistic stormwater management.

"I invite you to participate in this innovative conference which will celebrate, acknowledge and share many great examples undertaken in this industry whilst challenging today's thinking and expanding views on holistic stormwater management."

## Advance notice of WATER LOSS TRAINING EVENT 23 & 24 February 2017, Auckland.

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- Pressure management
- Active leak detection
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Update by Ronnie McKenzie, Chair of the IWA Water Loss Specialist Group.

Contact: richard.taylor@tcec.co.nz

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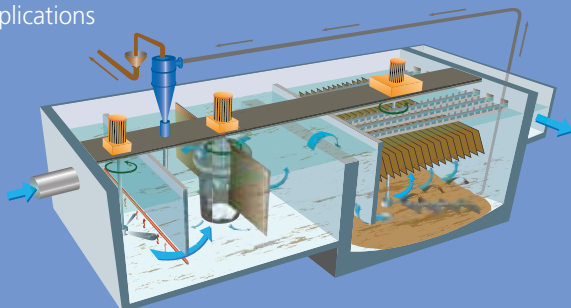


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# Tapping in to water news

## Backflow conference 2017

The Water New Zealand Backflow Group will be holding its biennial conference at the Trinity Wharf Hotel, Dive Crescent, Tauranga on Thursday 3 and Friday 4 August 2017. The Backflow committee is working to develop an exciting and informative programme for the two days. Targeted delegates include backflow practitioners, territorial water utilities, regional councils and Ministry of Health water assessors.

## Hydro scheme notification

The Department of Conservation has asked for public feedback on 'approving in principle' an application from Westpower to build and operate a hydroelectric power scheme on the Waitaha River near Hari Hari on the West Coast of the South Island.

The hydro scheme proposal is a run-of-river

scheme and does not need a dam, only a weir (at the upstream end of Morgan Gorge), a tunnel, powerhouse, and a two kilometre access road.

Water would be returned to the river 2.6 kilometres downstream, below the proposed powerhouse.

Once the public notification process has been completed and submissions taken into account, the final decision will be made. The project would be for a term of 49 years and would be subject to a number of conditions.

## Remove politics from water

Water managers have been told they need to take a stronger lead in ensuring communities are supplied with safe drinking water.

Around 200 water sector leaders and representatives attended a panel discussion on the implications of the Havelock North water contamination crisis as part of the three-day Water New Zealand Conference and Expo in Rotorua last month.

Members talked about the frustration of having recommendations to treat water ignored by local government politicians despite the risks involved.

"There are cases of contamination that happen all over the country that people don't hear about and what we've been hearing today is that ratepayers and politicians are not qualified or knowledgeable enough to make crucial decisions around water safety," says Association Chief John Pfahlert.

The conference heard how the Havelock North outbreak despite the seriousness of it, could have been even worse.

"If the campylobacter infection had taken a different form, we could have been facing a scenario where many people died, as has happened overseas."

Pfahlert says the Havelock North inquiry is a great opportunity to look at the systemic issues around what went wrong and how this can be prevented from happening again in the future.

## Freshwater Research Centre

An **Alpine Lakes** Research and Education Centre (ALREC) is being built in Wanaka to support the health management of South Island alpine lakes, rivers and other freshwater ecosystems.

A MoU was signed between the new Lake Wanaka Trust, Otago Fish and Game, which is providing an area of their hatchery land in Wanaka for the centre, and the University of Otago, which will use the facilities.

The Steering Group working on this

initiative includes Ella Lawton and Calum McLeod from Queenstown Lakes District Council, Ruth Harrison from the Department of Conservation, Don Robertson from the Guardians of Lake Wanaka and others representing the local community.

ALREC Steering Group spokesperson, Maggie Lawton, says there are significant community concerns regarding recent ecological changes to the lakes and rivers.

"In addition to lagarosiphon and didymo,

there are now the problems caused by the arrival of 'lake snow', which is impacting on recreational use and water supply infrastructure."

In addition to research, the centre will provide an education and outreach facility for the local community and school groups.

The concept for the centre is currently under development with planning and fundraising to be completed.

## Tourist town rejects water plant project

**Bruce Smith**, Westland District Council's new mayor, says a \$6.2 million wastewater treatment plant for the Franz Josef township is unlikely to go ahead. The town's oxidation ponds were badly damaged in floods back in March when the Waiho River broke its banks.

Before the elections the community asked the outgoing Westland District Council to hold off on any decision over a new plant until a new council had been elected, after balking at the proposed cost.

The election results saw an almost completely new Westland District Council being formed with only one previous councillor re-elected.

Smith says the proposed wastewater treatment plant is highly unlikely to go ahead under his watch. "The general consensus seems to be that the option of spending six and a half million, for a community of 300 people, is completely unaffordable."

Residents and business owners in the

district say the proposal has been a complete waste of time and money.

The new council will have to look at alternative options to keep up with demand during the busy summer tourist season, including repairing and upgrading the current oxidation ponds. Before the local body elections the old council had already spent \$150,000 on the proposal for the treatment plant and another \$150,000 on repairing the ponds after flood damage.



# Central Plains Water Stage 2 underway

**Stage 2** of the Central Plains Water irrigation scheme has been given the green light by its shareholders and construction of the 20,000 hectare, \$250 million stage is expected to be completed by September 2018. Concurrent with Stage 2 will be the building of the 4250 hectare Sheffield Scheme.

While preliminary design work has already started on both projects, the main construction will not hit peak until the middle of next year.

Central Plains Water Ltd (CPWL) is a shareholder-owned company set up in 2003 to progress the irrigation scheme, which was to be developed in three stages. CPWL will be responsible for the implementation and operation of the scheme and the company employs a core team of 30 staff and is governed by a board of seven directors from a variety of backgrounds including farming, legal, finance and farm advisory.

Derek Crombie, CEO of CPWL, says that Stage 2 differs from what was originally planned, both in scale and construction methodology.

"Originally we were going to build the scheme in three stages and continue the canal across the Canterbury Plains towards Sheffield. We are now using a buried pipeline and will lay approximately 21 kilometres of 2.5 metre to 1.6 metre diameter glass reinforced polymer trunk main pipe linking to a further 184 kilometres of HDPE pipes to take the water to the farm gate. Fourteen pump stations will also be built.

"We will also not be taking water from the Waimakariri River for Stage 2, as originally planned, as we can now also source water from Lake Coleridge.

"Very little extra capacity has been built into each pipeline, so it is imperative that those wanting to purchase further shares do so now, otherwise it could be too late. We cannot retrofit extra capacity.

"The other good news is that across all the three stages, mixed farming systems (dairy, sheep and beef, arable including some dairy support), will be the predominant land use."

The total CPWL scheme (Stage 1, Stage 2 and Sheffield) will cost \$400 million and cover 50,000 hectares of productive land.



"The scheme will provide significant environmental


benefits by replacing current groundwater abstraction with very reliable river water sourced from the Rakaia and Lake Coleridge catchments," says Crombie.

Stage 1 of the scheme has already replaced 75 percent of the groundwater abstraction in that area and the same is expected in the next stages, he adds.

"Already we are starting to see benefits in the Stage 1 area with bore levels remaining steady, even during a drought period."


The CPWL scheme has been developed by about 360 shareholders who have contributed \$90 million, supported by initial development funding from the Ministry for Primary Industries Irrigation Acceleration Fund, short term loans from the Selwyn District Council and construction funding from CPWL Banks ANZ and Westpac. Crown Irrigation Investments has also committed significant support for the Stage 2 phase of the project.



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# Take the lead – you are the water experts

The Water New Zealand annual conference with its theme ‘Pathways to Excellence’ proved a showcase of industry knowledge, innovation and inspiration.

**T**he conference was held in Rotorua with the Events Centre providing an excellent venue for speakers, exhibitors and delegates alike.

The opening keynote speaker was Paul Bowen, who is president of the Water Environment Federation and global director of ‘sustainability’ for Coca-Cola. His task at Coca-Cola is to reduce the amount of wastewater the company produces in its 1000-or-thereabouts manufacturing plants, scattered across 200 countries. The company is focusing on plant performance – seeing how efficiently it can produce its beverages.

Interestingly, until this year, Coca-Cola used to create more wastewater than beverages. Paul said it used to take four litres of water to produce one litre of beverage (global average). This year the company used 1.98 litres of water for that litre of product, and is aiming to reduce that to just 1.7 litres by 2020.

Thursday’s keynote speaker had a challenge for all Water New Zealand members. Raveen Jaduram, CEO of Watercare, placed the future of the industry, and the environment, firmly in the hands of the association members.

“We need leadership. Be strong,” he said. “If you feel strongly about something, speak up.”

Minister for the Environment Nick Smith echoed the sentiment in his speech, saying we need a stronger national direction in fresh water management. He said we are very lucky, “We have more fresh water per capita than anywhere, but this has made us very complacent.”

He said the Hawke’s Bay “debacle” is a wake-up call.

This particular topic gave rise to a very interesting and informative panel session, titled, ‘Issues Arising from the Havelock North Water Contamination Outbreak – and the Way Forward’. Graham McBride of NIWA, Rob Blakemore of Wellington Water, Iain Rabbitts of Harrison Grierson and Noel Roberts of Water New Zealand sat down to discuss the subject in front of a packed auditorium.

Graham explained more about campylobacter, the bacteria that causes campylobacteriosis, which affected thousands of residents of Havelock North in August. He says campylobacter is not persistent, but prevalent – in other words, although the bacteria die out quickly, they are found in a lot of animals.



Keynote speaker Paul Bowen

Graham described the disease as mild, in that everyone recovers in two or three days, although there can be severe, if rare, side effects. Interestingly, he did say that if the animal that infected the water supply in Hawke’s Bay had been carrying toxic E.coli, which is also transmitted via animal faeces, the outbreak would have likely resulted in deaths.

He says a precautionary approach to drinking water should be standard.

The issue of ‘Government intervention’ in water quality, as a result of the Hawke’s Bay incident was a central theme throughout the conference. Most agreed that while the country needs a national water quality standard (in the face of individual Council prerogative) we don’t need a strong-arm central government approach with the likes of a ‘water ministry’.

Rob Blakemore’s view is that water suppliers shouldn’t just comply with standards, but understand them. “Compliance is just the ambulance at the bottom of the cliff,” he said.

“By the time you know you have deviated from the standard it’s too late.”

Iain Rabbitts believes water treatment should be mandatory through the country. We have a serious problem if the people who decide whether or not to treat drinking water are not held accountable for their decisions. He fears decisions around chlorination of water are based on re-elections and not public health.

Members talked about the frustration of having their recommendations to treat water ignored by local government politicians despite the risks involved, with many believing the treatment of water shouldn’t be a political decision but a mandatory one.

And here is where the onus returns to the association and its members because you are, in the end, the experts in this country on all matters pertaining to ‘water’.

The takeaway message from the conference was to take the lead. Don’t be complacent. You should support each other and create your own legacy. **WNZ**

# WNZ Board welcomes new members

**Helen Atkins and Shayne Cunis** have been newly elected to the Water New Zealand Board.

Helen served on the board last term as a co-opted member while this is Shayne's first term in his role as board member.

Shayne is a professional engineer, who is currently the general manager – Service Delivery at Watercare. He is responsible for Watercare's operational management of the drinking water and wastewater systems, along with asset protection, trade and asset maintenance management for the Auckland region. This includes serving 1.4 million customers with assets of \$8.68 billion and leading a team of 270.

Helen is one of the founding partners of the boutique environment and public law firm, Atkins Holm Majurey. She has

worked for a number of years for a variety of private and public sector clients on a range of environmental, local government and public law matters. Helen has served on both the New Zealand Planning Institute local branch Committee (Wellington) and on the Resource Management Law Association National Committee (including as president from 2009 to 2011). She recently finished an 11 year term as a member of the Hazardous Substances and New Organism Committee of the Environmental Protection Authority (ERMA).

The 2016/17 board members are: Dukessa Blackburn-Huettner – President; Helen Atkins; Shayne Cunis; Vijesh Chandra; Kelvin Hill; David Simpson, and Colin Crampton.

## CONFERENCE EXHIBITION AWARDS

**Exhibitor's Award Multi-stand winner** – Aquatec

**Multi-stand runner up** – Water Supply Products

**Single stand winner** – Bürkert Fluid Control Systems

**Single stand runner up** – Aurora

*More conference awards on page 12*

## AGM GOLD SHOVEL MEMBERS

**Gold Shovel Member** – Brent Manning

*Group Manager Engineering Services| South Taranaki District Council*

**Gold Shovel Member** – Hugh Blake-Manson

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# Water New Zealand 2016 Award winners



Water New Zealand Chief John Pfahlert.

## IXOM OPERATOR OF THE YEAR

Southland District Council's Matthew Keil was named Operator of the Year for his project to improve the quality and supply of water to Orawia, a tiny community of just eight residential dwellings in western Southland.

Matthew inherited significant historical issues when he took up this challenge to provide safe and acceptable-quality water in a cost-effective way to the community, yet he achieved a very positive outcome through good planning and perseverance, and by fostering good relationships with a local farmer and others in the industry.

The result is he has been able to build a new, quality water supply for Orawia locals at a reasonable cost.

## CH2M BECA YOUNG WATER PROFESSIONAL OF THE YEAR

Jules Scott-Hansen received the award for Young Water Professional of the Year.

An engineer with Opus International, she has impressed her associates and colleagues with her professionalism, communication skills and passion for engineering, in particular how it can make a real difference to people's lives.

In her role at Opus, she has been working on a project identifying the best way to undertake a city-wide assessment of the damage of the land drainage network following the Canterbury earthquakes.

Jules is regarded as an outstanding young professional who truly cares about the environment, people and the wider community.

## YWP CONFERENCE ATTENDANCE AWARD

The Conference Attendance Award is a new prize to allow a recent graduate to attend the association's annual conference. The inaugural winner was Michaela Aspell, a civil engineer with Tonkin & Taylor.

Michaela has contributed to a variety of projects during her 22 months with Tonkin & Taylor, including working on resource consents for the Environmental Monitoring and Management Plan for the Lyttleton Port Company Channel Deepening Project. This is the largest dredging project in New Zealand, and as part of her award, Michaela will be presenting on this topic to a local Water New Zealand or Young Water Professionals meeting.

## VEOLIA HEALTH AND SAFETY INNOVATION AWARD

This is a new award which recognises an innovation that eliminates or minimises a health and safety risk in the water industry. The inaugural winner was the Fulton Hogan-John Holland Joint Venture for its solution to safety issues at the Hunua 4 Watermain project.

The project involves connecting new pipelines to the existing network, something that involves welding thousands of pipe



YWP Attendance Award L-R: Jim Bradley from MWH Global, award winner Michaela Aspell, Brent Manning.



Veolia Health and Safety Innovation Award, winner Fulton Hogan-John Holland Joint Venture L-R Keith Martin from Veolia, Tony Mills, Brent Manning.



Veolia Health and Safety Innovation Award, winner Fulton Hogan-John Holland Joint Venture L-R Keith Martin from Veolia, Tony Mills, Brent Manning.

joints near live high pressure water. Despite closing valves and other measures, there is still potential for workers to be in extremely dangerous situations.

The innovative solution the JV team came up with involved reverse rendering using a tractor inner tube. This eliminated the need for any of the workforce to be in the pipe during the shutdown, significantly improving safety.

### MOTT MCDONALD PROJECT AWARD

Another new award, the Project Award recognises excellence in the delivery of a project and the contribution of various parties to the final outcome. The inaugural winner was MWH (now part of Stantec) for its Eastern Selwyn Sewerage Scheme.

The scheme includes the first municipal bio-solids solar drying facility developed and designed on that scale in New Zealand. This was an innovative solution that met the complex challenges posed after the rapid population growth in the communities of Prebbleton, Lincoln and Rolleston following the Canterbury earthquakes.

Pictured with their award are Tania Williams of MWH and Fiona Rayner from the Selwyn District Council.

### OPUS TRAINEE OF THE YEAR

Matt Salle of Veolia in Waitomo is this year's Trainee of the Year. His employer recommended him for this award because of

his potential as well as his innovative approach and eagerness to take any opportunities to learn.

Matt completed the Opus Water Treatment Course this year and quickly adjusted to the work required in the National Certificate in Water Treatment Programme. While on the course he impressed his tutors and those around him with his active participation in all classroom activities and field trips, his supportiveness of his classmates and his good sense of humour.

### MOTT MACDONALD POSTER OF THE YEAR

The new format of interactive posters was a hit at the conference this year and encouraged the participation of young professionals. This year's winner was Su Young Ko, Coral-Lee Ertel and Aaron Falconer for the poster, 'Telling the Story of the Katikati Wastewater Model'.

The poster gave a clear and concise picture of the work the Western Bay of Plenty District Council is doing to provide simple, easy-to-understand information on the wastewater network in Katikati. The idea was to provide interactive visual information on the network and data related to points in the network. The poster gave a clear pathway of the work involved, including explanations of the approach and application for future uses.

The runner-up in the Poster of the Year competition was Sunny Mittal of DHI for 'Bathing Water Forecast'.



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**CH2M Beca Young Water Professional of the Year, Jules Scott-Hansen receives her award from Garry McDonald and Brent Manning.**

**PROJECT MAX YOUNG AUTHOR OF THE YEAR AWARD**

Fiona Myles of MfE was named Young Author of the Year for her paper, ‘The National Policy Statement for Freshwater Management and Three Waters Sector’.

The judges stated, Fiona clearly and concisely set out the challenges facing both MfE and TLA under the upcoming changes to the National Freshwater Policy Statement. Her use of visual aids and paper delivery were excellent.

“Fiona gave a balanced view of past roles of both MfE and the TLAs in their response and application of the NPSs. The presentation gave a clear picture of the effort being made by MfE to address these changes.”



**Hynds Bronze Paper of the Year, L-R David Wheeley (Hynds CEO), Bram Beuger (Fonterra), Brent Manning. See page 54.**

**ASSOCIATION MEDAL**

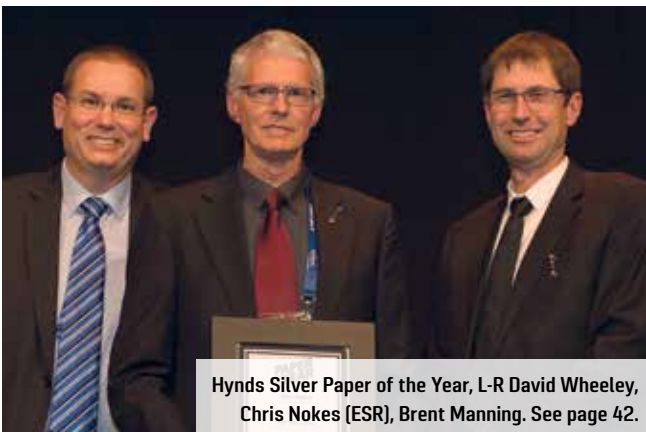
Graham McBride, principal scientist at NIWA, received the prestigious Association Medal for his outstanding contribution to the water industry and association.

The medal is awarded at the discretion of the Water New Zealand Board and, in order to retain its exclusivity and esteem, there are only a very limited number of living holders of the medal at any one time. Graham is only the fifth recipient of the medal.

In his role at NIWA, Graham is responsible for gaining and leading research and consultancy on processes involved in water pollution issues, with an emphasis on statistical and mathematical lines of enquiry. This work includes world-leading water-related human health risk assessment methodologies, particularly for microbes.

Graham is at the forefront of the application of Bayesian statistics to environmental problems in New Zealand, and he has had a substantial role in the development of the country’s regulatory tools for drinking water quality management.

For a full profile on Graham and his career, see page 20.



**Hynds Silver Paper of the Year, L-R David Wheeley, Chris Nokes (ESR), Brent Manning. See page 42.**



**Association Medal L-R Garry McDonald, Graham McBride, Brent Manning. See page 20.**



**Brent Manning, Dukessa Blackburn-Heuttner.**

PHOTOS COURTESY OF GERRY LE ROUX, ROTORUA.

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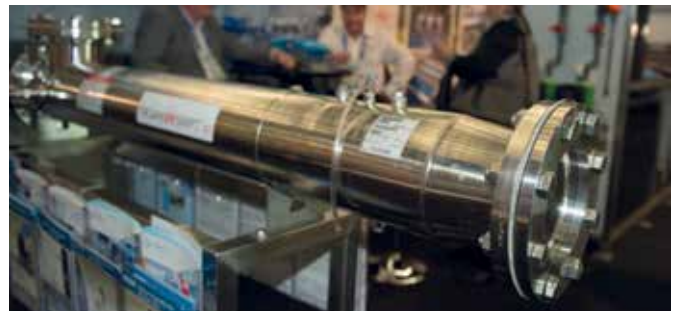


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Brett Manning out going chair and minister Nick Smith.



On the Deeco Services stand (L-R): Steve Hancock, regional sales engineer, Wellington, Deeco; Mathew Morrow, national product manager, filtration and control, Deeco; Jim Day, technical sales engineer, Deeco; Paul Friedrich, regional sales engineer, Deeco.



Matson Broederlow, managing director, Willowstick Technologies Australasia.

# Exhibition Hall



Craig Shortt, sales engineer, Brown Brothers Engineers.



Filtec stand (L-R) Alan Gilmour, MacEwans Pumping Systems; Graeme Thacker, Filtec; and Matt Ewen, managing director, Filtec.



Water New Zealand Association publications.



Lisa Wallcroft and Matt Clayton, from WSP Water Supply Products.



Applied Instruments, wisely sponsored the only coffee cart.



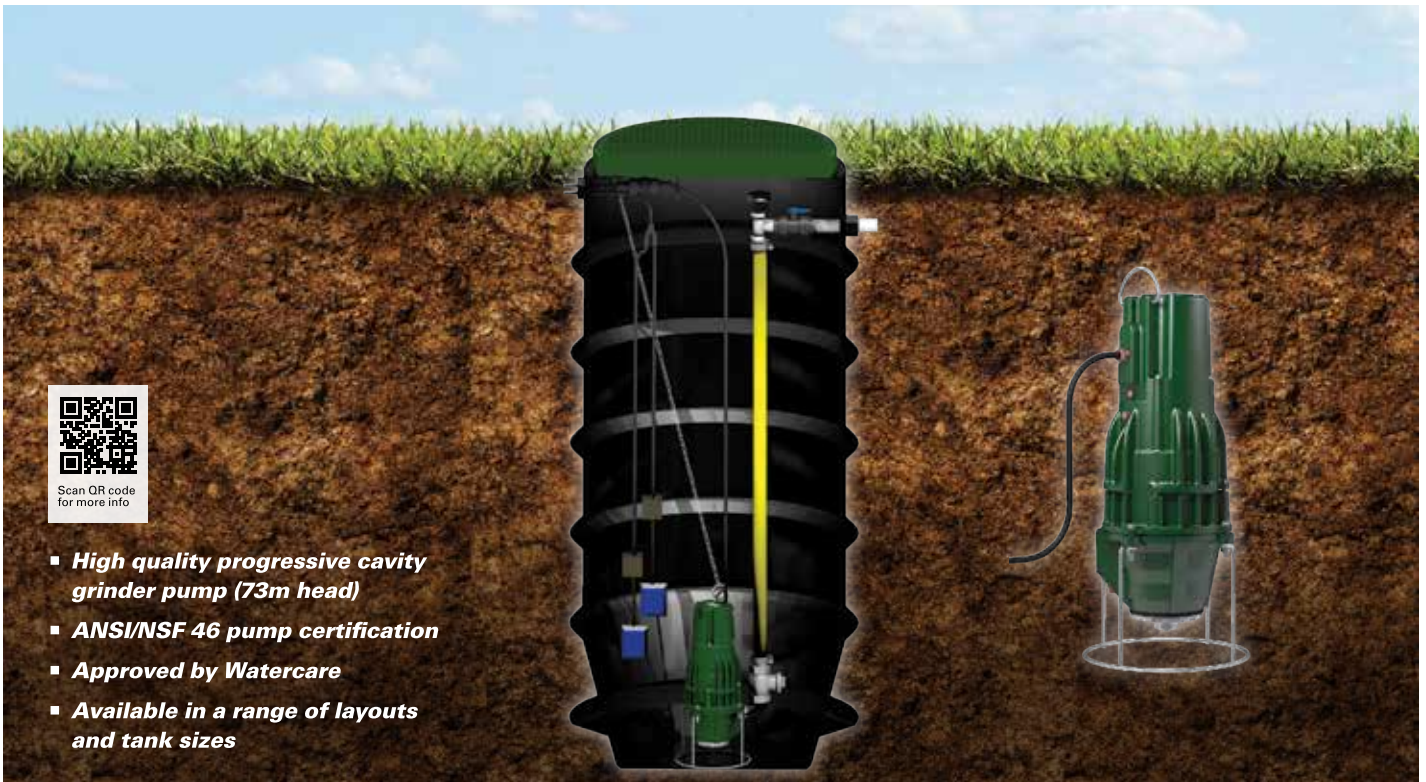
Bevan Rees, Iplex Pipelines NZ.



Joyce Nam from MacEwans Pumping Systems explaining the JWC muffin monster grinder.



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# In illustrious company

At the 2016 Water New Zealand Conference, Graham McBride was awarded the Association Medal for his outstanding contribution to the water industry and the association. It is an honour rarely bestowed, reserved only for a select few who truly are the elite of the industry. **BY MARY SEARLE BELL.**

**G**raham McBride has held senior scientist positions with NIWA since 1993. There, he is responsible for gaining and leading research and consultancy on processes involved in water pollution issues, with an emphasis on statistical and mathematical lines of enquiry.

This work includes innovative water-related human health risk assessment methodologies, particularly for microbes. Graham has also championed the application of Bayesian statistics to environmental problems, and he has had a substantial role in the development of regulatory tools for the management of drinking water quality.

Forty-five years ago, after completing a Bachelor of Science Degree, Graham began his career as a technical support person for the Water Resources Council via the Water and Soil Division of the Ministry of Works and Development (MWD) in Wellington, mostly undertaking technical investigations on the impact of point sources on water quality in rivers.

Three years later, in 1974, he went to the UK, to the University of Newcastle-upon-Tyne (supported by MWD) to complete a Master's degree in Water Resources – his thesis was on ground water pollution modelling. By this time, he says, he had come to regard working with water quality issues as contributing to a better world.

Returning to New Zealand 18 months later he resumed working with the MWD. That organisation was setting up a number of research centres, one of which focussed on water quality. Graham says this centre was deliberately located on Waikato University's campus in Hamilton in order to foster close interaction with the university and in a region where water pollution issues were common.

At about the time of Graham's move to Waikato, he became involved with what is now Water New Zealand.

"In 1978 the president of the Water Supply and Disposal Association, Brian Carlisle, accosted me in downtown Hamilton," he says.

"He thrust a piece of paper in front of me and said, 'here, sign this'. It was a membership form.

"I said, what's the annual fee?

"It's \$3', he says. So I said, good, where do I sign?

"Almost immediately he said, 'We'd like you to become secretary'."

Graham accepted the role and began serving the association, culminating in his holding the office of president from 1986-88.

"The mid-80s was about the time the RMA was being considered and a lot of the resources of the association's board were taken up with this, namely, what did we want to be in the Act from a water industry point of view?

"For example, we argued for some provision to be made for permitting some minor uses rather than requiring individual resource consents. This, and other considerations, would require comprehensive catchment or regional plans that adequately dealt with water issues – they'd require more technical input and should result in less litigation. The Act has been quite successful in this," he says.

Workwise, Graham started to move away from modelling water pollution processes into environmental statistical issues – determining trends, addressing what we mean by 'significant'. One output of this was his co-authorship of the 1990 text *Design of Water Quality Monitoring Systems* with colleagues from Colorado State University. He had another more detailed book published in 2005: *Using Statistical Methods for Water Quality Management*.

By then his focus had moved to microbial levels in rivers, lakes and on the coast – monitoring, surveying and human health risk assessment.

At that time, freshwater microbial studies were not well developed. So in the late 1990s, together with Desmond Till (retired chief bacteriologist with the National Health Institute), Eric Pyle (MfE) and Dr Michael Taylor (Ministry of Health), he obtained funds from Central Government for a national survey and associated risk analysis for pathogens and indicators in 25 recreational water sites (rivers and lakes) around the country. It was a \$2 million survey, funded at a time when Winston Peters was Treasurer.

"We have him to thank for the funding," says Graham.

"The results of that 15 month-long survey formed the basis of

the guidelines and objectives we have today. It's time we did another!"

This was the start of his involvement with QMRA (Quantitative Microbial Risk Assessment). This focuses on actual pathogens rather than bacterial indicators. This meant Graham became more involved with water related health issues. He worked abroad with the World Health Organization, which led to his authorship of a number of chapters in a WHO/IWA book on waterborne zoonoses in 2004 and another in 2012 on animal waste impacts on water and health – both very relevant to current water supply issues.

In addition to the two books mentioned, Graham has contributed eight chapters to various other books. He has also written over 80 journal papers and presented at numerous conferences around the world, including, naturally, Water New Zealand conferences, where he has received the Best Paper Award four times and the Ronald Hicks Memorial Award twice.

Graham has been with NIWA since its inception – he came across from the DSIR (the Department of Scientific and Industrial Research) when it was broken up in 1992, which, in turn, had taken over Graham's research centre from the MWD when it was disestablished in 1988. He says

**"I've been lucky to work with really competent people, particularly at NIWA. I would like to acknowledge the impact Michael Taylor, Desmond Till and David Ogilvie have had on my career."**

NIWA is, and has been, a very good employer, fostering good science.

"They support QMRA, catchment microbial modelling, and the development and advocacy of new statistical methods," he says.

"All with the objective of feeding information into groups, such as Water New Zealand, as how best to proceed."

In 1997 Graham received the Arthur Sidney Bedell Award from the USA Water Environment Federation for extraordinary person service to a WEF member association.

And in 2008 he was awarded the New Zealand Freshwater Sciences Society Medal for sustained and distinguished contributions to freshwater science.

Most recently he won the 2016 NIWA Excellence Award for Applied Science.

This latest accolade, the Association Medal, recognises his dedicated professional involvement with and commitment to Water New Zealand throughout his career. He is just the fifth person to be awarded the Association

Medal. One of the previous recipients is Dr Michael Taylor, who was Graham's first Scientist in Charge early in his career.

"I think I'm in illustrious company," he says of being awarded the medal.

"I've been lucky to work with really competent people at NIWA, especially Kit Rutherford and Bob Wilcock.

"Outside of NIWA I would like to acknowledge the impact Michael Taylor, Russell Howie, Desmond Till, Andrew Ball and David Ogilvie have had on my career. Also Robert Ward at Colorado State University, where I spent an eight-month sabbatical in 1990, for getting me enthusiastic about improving statistical methodology. And I loved my interactions with Julian Ellis, statistician at the Water Research Centre in the UK."

At 68 years old, Graham has cut his working time down to four days a week, but has no intention of retiring.

"The prospect of suddenly stopping is not at all attractive," he says.

"My work is also my hobby, which is why I don't fancy giving it up in a hurry." **WNZ**



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**Graham McBride with his wife Robyn after receiving the Association Medal at the recent Water New Zealand conference.**

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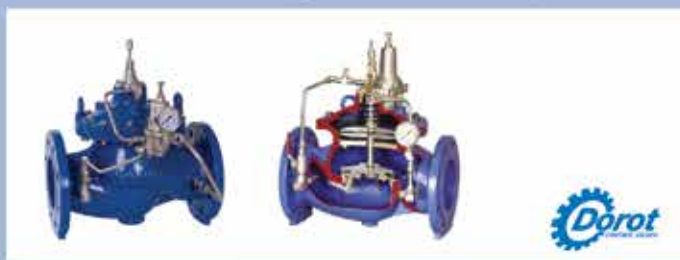
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# FIRST FLUSH STORMWATER POLLUTANTS FROM CARPARKS IN DIFFERENT URBAN SETTINGS

This paper won a gold award in the Hynds Paper of the Year Award at the 2016 Water New Zealand conference.

S. POUDYAL, T.A. COCHRANE,  
R. BELLO-MENDOZA  
Department of Civil and Natural  
Resources Engineering, University of  
Canterbury

## ABSTRACT

Carparks make up a large portion of impervious urban areas. Stormwater runoff from these areas is therefore considered a significant source of pollutants to receiving urban waterways, particularly of total suspended solids

(TSS) and heavy metals such as zinc (Zn), copper (Cu) and lead (Pb). Pollutant concentrations can be substantially higher during the initial period of the runoff hydrograph commonly known as first flush (FF). In Christchurch, the influence of land use around urban carparks on the water quality of the first flush is poorly understood. This research thus focuses on quantifying FF TSS and metals from carparks within different urban land use settings. To achieve this objective, grab samplers (1 L HDPE) were deployed in a hospital carpark, a university carpark, and an industrial carpark in Christchurch. Concentrations

of TSS, Zn, Cu, and Pb were quantified for each of seven rain events. TSS and total metal concentrations were higher in the FF from the industrial carpark due to its unique land use activities as compared to the other two sites studied. Furthermore, dissolved Zn and Cu were found to be above recommended guidelines for all carparks. It is concluded that characterizing the FF for individual carpark types is important for the design of effective stormwater treatment systems such as filters.

Keywords: First Flush, Stormwater, Heavy Metals, TSS, Land Uses, Carparks

## 1 INTRODUCTION

The establishment of car parking spaces continues to grow as the number of vehicles increases together with their associated use for work and leisure activities (Revitt, et al. 2014). In New Zealand, there are 4.7 million registered vehicles (3.1 million passenger car/van) and this number continues to grow daily (NZTA, 2014). Carparks have become a key component for both transport and land use planning related to the development of commercial centers, factories, office complexes, residential housing as well as institutional complexes.

Carpark surfaces are typically impervious and, like roads, represent a major source of stormwater pollutants such as TSS, metals, anthropogenic organic compounds, nutrients and microbial contaminants (Gobel et al., 2007). Degradation of water quality in urban freshwater ecosystems typically occurs when stormwater runoff from impervious surfaces such as carparks is channeled directly into local waterways (Blakely & Harding 2005; Cochrane et al., 2010; Wicke et al., 2012). Heavy metals (importantly Zn, Cu, and Pb) and TSS are reported as the dominant pollutants in Christchurch's waterways (CCC, 2003).

Traffic related activities such as traffic volume, traffic patterns, vehicle type and maintenance, and surrounding land use have been identified as the primary contributors of the above pollutants to urban stormwater runoff (Davies et al. 2001; Goonetilleke et al. 2008; Sartor and Boyd 1972). The sources of these pollutants are therefore largely dependent upon various land uses activities, as well as atmospheric deposition (Figure 1). The main sources of Zn are combustion exhaust, galvanized parts and railing, fuel and oil, brake lining and rubber tyres (Councell et al, 2004). Cu comes off from the wear of plating, bearings, brake linings and other moving parts, whereas Pb primarily originates from the use of leaded fuel by vehicles. Besides these, materials deposited on impermeable surfaces from the air (e.g., atmospheric deposition and wind transported pollutants) can be an indirect source of these pollutants in carparks as well as contributions from connected roads and roofs. In Christchurch, the majority of the

stormwater runoff from carpark surfaces is discharged, untreated, directly into urban surface waterways via underground-piped networks (CCC, 2003).

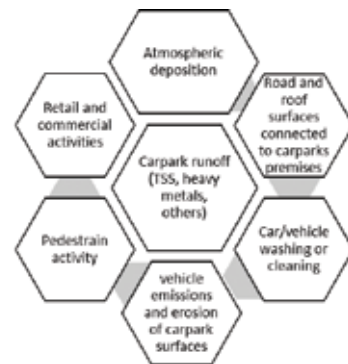


Figure 1: Sources of pollutants contributing to car parks runoff

Various monitoring studies of different impermeable surfaces have shown that pollutant concentrations are substantially higher during the initial period of the runoff hydrograph, commonly known as first flush, than in the later stage of runoff. However, the first flush process is still poorly understood and debated by researchers as several studies have observed the aforementioned phenomenon while other studies have not found discernable evidence (Han et al. 2006; Tiefenthaler et al. 2008). Therefore, understanding the first flush behavior is critical since most treatment options are designed to accommodate this initial portion of runoff events (Deng et al. 2005).

In addition, the composition and characteristics of stormwater pollutant loads vary between commercial, residential and industrial land use areas, however there is a lack of information on quantifying how land use characteristics influence pollutant loads in stormwater runoff. There is a need to better understand the relationship between land use and the corresponding stormwater quality characteristics.



In particular, there are very few studies in New Zealand that monitor pollutant loads from different land use areas during FF and thus implementing appropriate stormwater treatments for each land use area is difficult.

The objective of this study was thus to characterize stormwater pollutant loads, particularly TSS and heavy metals (dissolved and particulate), from three urban carparks representing different land use types (a hospital, a university, and industrial) during first flush conditions.

## 2 MATERIALS AND METHODS

### 2.1 SAMPLING SITES

A university carpark, a hospital carpark, and an industrial carpark in Christchurch were chosen for this study (Figure 2). These three sites represent a wide range of mixed residential, commercial, and industrial carparks in the city. The three sites have similar rainfall characteristics, which ensured that rainfall factors would not significantly contribute to any difference in observed stormwater runoff quality between sites. The university carpark (Figure 2) is located within a residential development. The site's catchment area includes a mix of roof, parking lots, trees and lawns. The site is characterized by low to medium traffic predominated by light vehicles.



Figure 2: Three sampling sites: 1) University 2) Hospital (PMH) and 3) Industrial (Kiwirail) in Christchurch, New Zealand

The industrial (Kiwirail) carpark is located in an industrial setting. There is light industry activity in this area including rail and road freight infrastructure. The third sampling site is a hospital carpark (Princess Margaret hospital). This sampling site is located at the foot of the Port Hills within a commercial setting. The majority of the carpark is asphalt with little pervious cover.

### 2.2 SAMPLING METHOD

Nalgene™ Storm Water Sampler bottles (1 L HDPE) were deployed in the three urban carparks. The samplers were deployed by suspending the bottle from the sump grate with a cable tie, in the corner of the sump where the initial runoff would flow directly into the bottle (Photograph 1b). Samplers were positioned at the most appropriate place prior to a storm event, and left in place until after the storm as shown in Photograph 1b. The sampling mechanism closed after sample collection to prevent mixing and dilution with subsequent run off. After the rain started, the water simply flowed through the sampler's collection funnel, and directly in to the bottle. Once the bottle was full, a floating ball valve sealed off the sample collection port. After the sample was retrieved, the collection funnel was removed and replaced with a standard cap to prevent leaks. The use of these samplers

allows the collection of first flush samples where there is only one person available to sample from many sites or when the rain starts in the evening.



Photograph 1: (a) Pathway of runoff flow (b) First flush sampler

### 2.3 DATA COLLECTION

Seven storm events were monitored to investigate the first flush phenomenon under various rainfall conditions from September 2015 to April 2016. After the storm event, full first flush bottles were picked up as soon as possible or early next morning if it rained in the evening. All samples were taken to the Environmental Engineering laboratory at the University of Canterbury for analysis within 24 hours of collection. The weather characteristics of each sampling event were recorded from a Campbell weather station situated at the University of Canterbury. The weather station was approximately 0.5 km from UC, 8.5 km from PMH and 3.5 km from Kiwirail. For events 1 and 2, first flush stormwater from the industrial site was not sampled due to logistical problems.

### 2.4 SAMPLING PROTOCOL

Before sampling, all first flush sampler bottles were thoroughly cleaned with an acid solution (10% HCl) to avoid any potential contamination. The bottles were scrubbed properly before placing them in the acid bath for a period of 48 hours. All bottles were rinsed thoroughly with deionized water and left to air dry. Following each sampling event, all the first flush samplers were replaced with fresh acid-washed first flush bottles.

### 2.5 SAMPLE PRESERVATION AND ANALYSIS

All samples were stored at 4°C in a refrigerator before chemical analysis. Samples for total recoverable metal (Cu, Pb, Zn) analysis were preserved with concentrated HNO<sub>3</sub> (70% Fisher, trace analysis grade) to a pH < 2.0 (APHA 2005). Samples for dissolved metal analysis were filtered through a 0.45 µm PVDF filter before being preserved with HNO<sub>3</sub> to a pH < 2.0. TSS was measured in accordance to SM2540D guidelines (APHA 2005). All heavy metals were analysed by ICPMS (Agilent) according to SM3125-B (APHA 2005). The limits of detection of these methods of analysis are shown in Table 1.

Water quality Parameters	Analytical methods	Method description	Limit of Detection
TSS	APHA 2005	Filtration using pore size 0.45 µm	3g/m <sup>3</sup>
Total metals	APHA 2005 (SM 3125-B)	HNO <sub>3</sub> digestion, ICPMS (trace level)	0.1µm/L
Dissolved metals	APHA 2005 (SM 3125-B)	Filter through 0.45 µm, ICPMS (trace level)	2.1 µm/L

Table 1: Summary of analytical methods used during the analysis

### 3 RESULTS AND DISCUSSION

#### 3.1 EVENT BASED TSS LOADS FROM URBAN CARPARKS

The concentration of TSS monitored from different urban carparks varied over the seven storm events captured [Figure 3]. Variation in concentration of TSS occurred within the individual storm events and between the different storm events. Rainfall event characteristics as measured at the University show a range of conditions (Table 2). Rainfall variation between sites is believed to be minimum. The significant difference in FF TSS loads between carparks suggest that carpark characteristics and surrounding land use activities may have a strong influence on TSS generation and deposition in each carpark.

Storm Events (SE)	Date of sampling	(ADD)	Rain duration (mm)	Rainfall intensity (mm/hr)	Rain depth (mm)
Storm 1	10/9/2015	4.5	3.8	2.0	8.0
Storm 2	23/9/2015	0.1	3.4	2.2	7.4
Storm 3	27/1/2016	0.2	5.2	4.4	22.7
Storm 4	17/2/2016	20.2	2.4	3.1	7.4
Storm 5	16/3/2016	5.6	2.8	2.2	3.2
Storm 6	24/3/2016	7.5	6.3	1.7	10.6
Storm 7	8/4/2016	3.6	0.9	2.4	2.0

Table 2: Summary of rainfall event characteristics

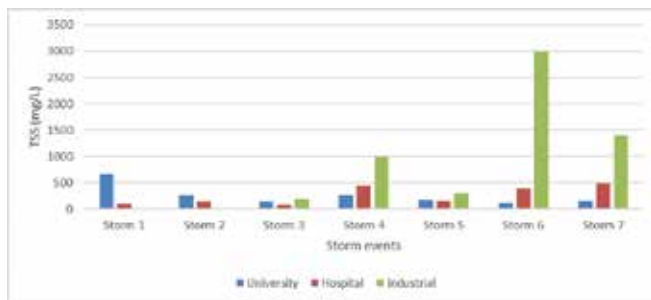


Figure 3: TSS monitored from different urban carparks for seven storm events (the industrial carpark was not monitored for storms 1 and 2)

#### 3.2 DISTRIBUTION OF POLLUTANT LOADS BASED ON LAND USE CHARACTERISTICS

TSS concentrations were consistently higher in FF from the industrial carpark as compared to the other two carparks. The university carpark had lower TSS as compared to hospital and industrial carparks. The concentrations of TSS in the first flush from the industrial carpark were at least one order of magnitude higher than in the other two carparks (Figure 4). This was attributed to anthropogenic activities such as traffic characteristics, loading and unloading activities, the size of the vehicles involved in the industrial land use, poorer road conditions and carpark surfaces as well as less street sweeping in nearby roads as compared to residential and commercial areas. In this research, the university carpark, which was in a residential setting, exhibited the lowest first flush TSS loads (Figure 4).

The total concentration of Zn, Cu and Pb were also higher in the industrial carpark as compared to the other two carparks (Figure 5). Total Zn concentrations show a similar pattern to TSS concentration in the industrial and university carparks, suggesting that a large portion of the total Zn may come from the same source as solids in the respective carparks. Total Zn had a similar range in the university

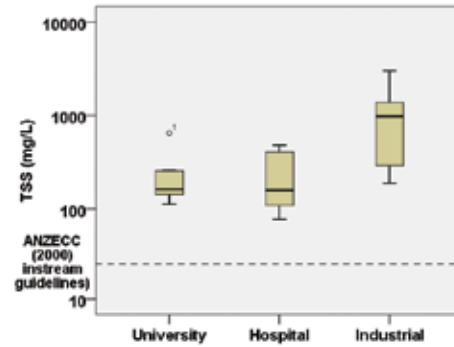


Figure 4: TSS concentrations at each sampling site (\* denotes outliers'  $\pm 1.5 \times$  Inter Quartile Range (IQR)

and hospital carparks whereas, lower concentration of total Cu and Pb were found in the hospital carpark. Differences of dissolved metals were observed from the different carparks. Although the loadings of dissolved metals vary widely in stormwater due to factors such as pH (Liebens, 2001; Ujevic et al., 2000), no relationship was found between dissolved metals and pH (pH ranged from 3.8 to 7.9) for any of the carparks.

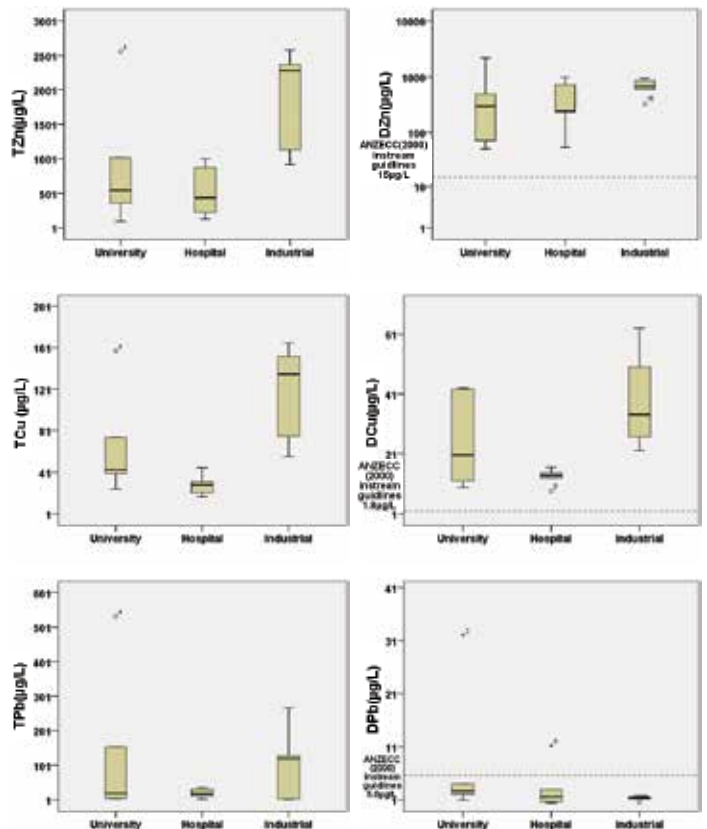


Figure 5: Comparison of total and dissolved metals concentrations in different land use areas

#### 3.3 HEAVY METALS PARTITIONING

The highest percentage of dissolved Zn was 68% at the university carpark, but the range did not vary widely as the industrial and hospital carparks had 62% and 65% dissolved Zn respectively (Figure 6). The dissolved Cu ranged from 45% to 49%. As expected, a smaller percentage (below 31%) of dissolved Pb was measured for all sites. The university carpark had the highest percentage of dissolved Zn, Cu and Pb as compared to the other two sites. The dissolved fraction of these heavy metals in stormwater runoff are influenced by adsorption mechanisms with solids particles (Gunawardana et al., 2015).

Zn, for example, is subject to a cation exchangeable form of adsorption which has a high likelihood of being subsequently released from solid particles due to possible changes in environmental conditions.

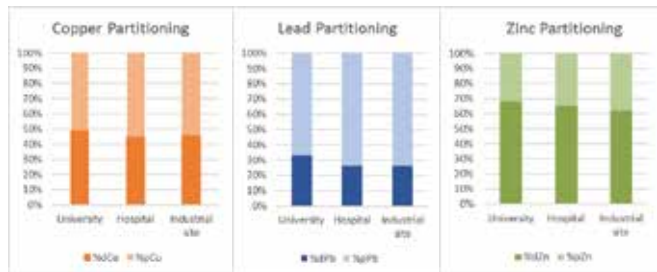


Figure 6: Average zinc, copper and lead partitioning between dissolved and particulate from each carpark

### 3.4 COMPARISON OF STORMWATER RUNOFF QUALITY WITH EXISTING BENCHMARKS

The observed dissolved metal concentration results were compared with the Australian and New Zealand instream guidelines for Fresh and Marine Water Quality [2000] at the 90% level of protection. For all the sites, the observed dissolved Zn and Cu values exceeded the trigger values, but dissolved lead was consistently below trigger values. TSS values were also found to be 3.7 to 120 times higher than the ANZECC [2000] instream trigger values (threshold: 25 mg/L).

#### Implication of dissolved metals in waterways

The presence of heavy metals (particularly in dissolved form) in urban runoff is of concern, as they are considered most toxic due to enhanced bioavailability. Dissolved heavy metals have the potential for acute and long-term toxicity for aquatic life and a greater potential of affecting groundwater (Hatje, 2003; Marsalek et al., 1999; Pitt et al., 1995). Removal of particulates can be achieved with stormwater

filter systems, and this can have the potential to make a substantial improvement to instream health. The removal of dissolved metals is difficult, but if it is accomplished, it will achieve the greatest benefit in long-term improvement of waterways health.

## 4 CONCLUSIONS

Land use activities exhibit a strong influence on TSS and total metals loadings during the first flush. Concentrations of TSS and total metals were found to be higher in industrial carparks than in university and hospital carparks. TSS values for all sites, however, were found to be 3.7 to 120 times higher than the ANZECC [2000] instream trigger values (threshold: 25mg/L). Zn and Cu in dissolved forms were also found to be much higher than recommended ANZECC [2000] guidelines for all carparks. No relationship was found between pH and dissolved metals. High values of TSS, Zn, and Cu were attributed to anthropogenic activities within the carparks such as traffic characteristics, loading and unloading activities, the size of the vehicles involved, and the surrounding land use.

The design of stormwater filter devices to remove suspended solids and particulate heavy metals needs to be carefully formulated to suit carpark characteristics as results show that a "one size fits all" approach may not be adequate. In addition, removal of dissolved metals from runoff needs to be taken into consideration. It is recommended that additional monitoring be conducted to quantify dynamics of these pollutants over steady flow periods. Furthermore, the relationship of these pollutants with respect to different rainfall characteristics needs to be better understood.

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# Where the role leads

Brian Carlisle's work has taken him all around the country and further. Saying yes to the opportunities at hand and sticking with what he enjoyed has provided him with a successful and fulfilling career. **BY MARY SEARLE BELL.**

**B**rian Carlisle was born in England in January 1930. As an 18-year-old, he joined the Royal Air Force for his two years' military service, and was assigned to the Meteorological Office group headquarters in Suffolk. There, he was part of a team that provided regular weather forecasts and information to RAF pilots.

"We were open 24 hours a day," he says. "There was around 20 staff – about four or five forecasters and 10 to 15 assistants.

"We issued a major forecast at 9am, which was updated every three hours, and a weather summary every hour, and provided weather forecasts for any flights."

With his military service complete, Brian was able to focus on his career. He realised he wanted to do surveying and drafting so got a job with the Agricultural Committee of the local district council. However, he wasn't there long before he made the decision to move to New Zealand.

His widowed mother, along with her father and two sisters, had emigrated to Whakatane the year prior. Brian decided to join them, so in 1953, duly booked a passage on the Captain Cook.

He soon got a job in drainage with the Ministry of Works in Thornton, a village 15 kilometres along the coast.

"They had put a lot of returned servicemen [in Thornton] but they objected to the fact a lot of it was underwater," he says wryly. "Their drainage system was there but a lot of maintenance work was required."

In his role as a field assistant, Brian was kept busy measuring water flows and the flow in the river.

"Also, Kawerau [Tasman Mill] was just being built and they needed a lot of water for the paper plant," he says.

At work one day he came across a magazine which had an advert by an organisation for surveying and engineers' assistants.

"They had a course on engineering – it covered the topic from one end to the other. It was all done by post and had an examination," he explains. "I learnt quite a lot there."

Newly qualified, Brian got a job as an engineer's assistant



Brian Carlisle

with the Hawea Borough in Central Otago, where for the next two-and-a-half years he was kept busy building kerb and channel among other general borough work.

Next came a role with the Waimairi County Council in Christchurch – a job he describes as more of the same but on a bigger scale. However, while in this position he was given a two-year leave of absence to complete his qualifications to become a registered civil engineer.

He went to Auckland during term time – to Seddon

Memorial Technical College – and completed a five-year part time course in two years, full time.

“I missed a lot of lectures doing it this way but it gave me a lot of spare time to study, which made up for it.”

In 1960, just as the course finished, he married a girl he had met when living in Hawea, and the couple returned to Christchurch.

His next job took them to Feilding and a role with two distinct parts. The town had a reticulation system that only worked when it was raining. And when it did rain, it flooded and the sewers filled with water, pouring raw sewage into the streets. This, naturally, needed addressing.

Feilding was also in the process of constructing a sewage treatment plant – quite a large one as it was to cater for the borough, freezing works and sale yards (paved and possibly the largest in New Zealand at the time), as well as the discharge from the Palmerston North abattoir.

“It was a three stage treatment plant and took two to three years to get set up,” says Brian.

With that project complete, he took a job in Hamilton.

“Hamilton had virtually no sewerage system – the older part of the city had septic tanks that went into the Waikato River, while houses in the new part had their own septic tanks. As the city is on clay, there was no overflow drainage so instead sewage would run into the streets.

“I was appointed as design engineer for drainage with the Hamilton City Council and we had to start from scratch.

“There was considerable fall to the treatment plant so we designed three main lines to the plant, drained by gravity. In the low areas we used submersible pumps – the first use of these in the country.”

The council was having trouble getting the money for this project, so Brian and his family took an opportunity to spend a few years in Fiji. Brian had a contract with Harrison Grierson, planning a sewerage system for Suva then working on a big residential development scheme.

They returned to New Zealand in 1973, a time when the government was becoming concerned with the quality of the water in rivers. Brian was employed by the Waikato Valley Authority to look after Waikato River’s water quality.

“I determined the conditions for permits to discharge,” he says. “It wasn’t too difficult – the Waikato is a big river, with a huge flow that’s deep and fast. It’s pretty hard to get a build-up of pollution.”

A restructure in 1977 meant Brian was out of a job, but the Hamilton City Council was in need of a new drainage engineer. So Brian returned to the council, holding the role until he retired at the end of 1991.

It seems the traveller was finally tamed, and Brian, now 86, and his wife are happy to remain in Hamilton. **WNZ**

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# Improving Water governance

Water governance is a global issue that calls for collaborative solutions and studies in New Zealand have contributed to the OECD's new Principles on Water Governance, including a valuable discussion paper first written five years ago. Alan Titchall explains.

**W**ater New Zealand has published online a discussion paper called *Improving Water Governance in New Zealand* (IWGNZ) that was originally published in *Policy Quarterly* and authored by Andrew Fenemor (Landcare Research), Diarmuid Neilan, Will Allen, and Shona Russell.

The full paper can be read at: [www.waternz.org.nz](http://www.waternz.org.nz)

I can only summarise a few points from this 6000-word discussion paper written in 2011. Suffice to say that this document is still very pertinent today, and it contributed to the OECD's Principles on Water Governance, which were adopted at the seventh World Water Forum in Daegu, Korea last year (see box stories).

As pressure on water resources has increased around the world, there has been a realisation that technocratically-driven water management and science is not the full answer. Our rivers, streams, lakes and aquifers need good water governance. "As is the case in many other parts of the world, New Zealand is seeing growing evidence of stresses on its freshwater resources as land uses intensify and demands for water, especially for irrigation, reach limits of availability," says the report.

## WHO'S IN CHARGE HERE?

Water governance in this country is under the control of central government agencies and local authorities. The two key pieces of legislation are the Resource Management Act 1991 (RMA), which has a sustainable management focus, and the Local Government Act 2002 (LGA), which has a sustainable development focus. Unlike in most other developed countries, New Zealand is unique in that water policy and decision-making are devolved almost wholly to local authorities at regional level.

This level of devolution in New Zealand has existed since catchment boards were formed in the 1940s to implement soil conservation and flood control measures.

Before the RMA became the statutory basis for 'regional plans', water and soil management programmes were previously prepared by these catchment boards under the 1967 Water and Soil Conservation Act. Regional councils replaced catchment boards and other single purpose organisations in 1989.

Today our 16 regional/unitary councils have a broader mandate under the RMA to develop region-wide policies, develop specific plans for publicly-owned or managed natural resources, and issue consents for use of those resources, including water and discharge permits. Territorial authorities (district and city councils) also develop policies and issue land use consents for development, while unitary authorities (Auckland, Gisborne, Marlborough, Nelson, Tasman) combine functions of regional and territorial authorities within one organisation.

As agencies with major responsibilities for water resource management, council performance has come under the spotlight at times – perhaps best illustrated by the Minister for the Environment's action over 2010-2016 to replace the elected council at Environment Canterbury with non-elected commissioners.

At the next level up, central government develops guiding

## A Global Coalition

This year the Organisation for Economic Co-operation and Development (OECD) has set up the Global Coalition for Good Water Governance and has invited interest from around the globe to join it. The OECD has developed global Principles on Water Governance (see separate box) [www.oecd.org/governance/oecd-principles-on-water-governance.htm](http://www.oecd.org/governance/oecd-principles-on-water-governance.htm).

The OECD, of which New Zealand is a member, estimates that the global water crisis is mainly a "governance crisis".

"Water demand will increase 55 percent by 2050 due to growing demand from manufacturing, thermal electricity generation and domestic use," it says. "Managing and securing access to water for all is not only a question of money, but equally a matter of good governance."

Water governance is the set of rules, practices, and processes through which decisions for the management of water resources and services are taken and implemented, and decision-makers are held accountable, says the international organisation.

"There is now an urgent need to take stock of recent experiences, identify good practices and develop practical tools to assist different levels of governments and other stakeholders in engaging effective, fair and sustainable water policies."

To this effect, the Global Coalition for Good Water Governance aims to trigger collective action towards effective, efficient and inclusive governance so that water security contributes to global growth and well-being. Over 2016-2018, the coalition says it will guide public action from policymakers, business and society at large through the identification, collection and up-scaling of innovative solutions that can shape the future of water.

"In practice, the Global Coalition will catalyse through its members hundreds of success stories at international, national, basin and local levels, and foster related knowledge and experience sharing."

These world-class solutions to water governance gaps will be disclosed in a user-friendly OECD database at the 8th World Water Forum to be held in Brasilia, March 2018.

"In addition, the 170+ members of the Global Coalition will also be consulted on the ongoing development of indicators to support the implementation of the OECD Principles on Water Governance. Such indicators will help assess, amongst others, whether the framework conditions are in place to get water governance right; the progress over time against a baseline; and the impact of governance structures on policy outcomes in terms of managing too much, too little and too polluted water and ensuring universal coverage of water services."

national policy and binding standards (such as National Environmental Standards), and also adjudicates through independent panels, or the Environment Court, when decisions at either level are contested.

Successive central governments have devised programmes of work to improve water management which have included the National Agenda for Sustainable Water Management (1999); the Sustainable Water Programme of Action

(2003); and the New Start for Freshwater (2009). There has been increasing recognition of Maori interests in water, the first co-governance body being the joint iwi/Crown-governed Waikato River Authority. The Government has committed \$210 million funding over 30 years to restore New Zealand’s largest river.

New Zealand’s water governance has been subject to criticism, especially the legalistic statutory hearing processes imposed by the RMA and the time required to make regional plans operative. There is a perception that both planning and consent decision-making is dominated by “techno-corporatist legal formalism” – or a reliance on legal and statutory planning processes.

The scope of current freshwater management plans is commonly water allocation and water quality management, and their spatial scales range from catchment-scale to regional.

The IWGNZ authors say that these plans demonstrate a regional variance according to regional pressures on water use, as would be expected. Plans are also in varying states of implementation, with some fully operative, some still in the hearing phase, and some being reviewed or rewritten.

“Arguably, the emphasis on integrated and catchment-based planning has been weakened by the broader RMA mandates, and more regional focus of regional and unitary council planning than earlier catchment-based water and soil plans.”

**DEFICIENCY IN GOVERNANCE**

As a widening range of stakeholders is affected by water decisions, questions of a less technical nature are being raised – such as who gets what water; whose voices and what values are influencing decision making; why are plans and strategies poor at delivering good environmental outcomes; and how could cumulative effects be better addressed, especially between land use and water quality.

“In light of those questions, resource managers are recognising that our inability to adequately manage freshwater stressors is not so much a deficiency of science as a deficiency in governance.”

The test of an effective system of water governance would seem to be whether it sets and delivers sustainable water management outcomes. However, there are other tests, which should also apply, because water governance is also about the *processes* for achieving enduring and adaptive outcomes (see box below for a synthesis of principles of good water governance).

**SOME GOOD NEWS**

The authors acknowledge “notable advances in water planning” in New Zealand, such as the first catchment plans in the 1980s, for example for the Omaha catchment in Auckland, the Waimea Basin in Tasman, and the Opihi in Canterbury, with the waters of the Waimea Basin all deemed fully allocated by 1996.

Since 2000, Horizons Regional Council (Manawatu–Wanganui) has pioneered the idea of a single consent for farms as a method for controlling sediment and nutrient contamination under its ‘One Plan’. The Waikato Regional Council implemented ‘cap and trade’ for controlling nutrient losses to Lake Taupo, and the Bay of Plenty Regional Council, through its ‘Rule 11’, set limits for nutrient losses to protect the Rotorua lakes from eutrophication.

More recently, the Land and Water Forum has championed collaborative freshwater planning and many regional councils are developing next-generation plans via collaborative groups.

Research and comparative stakeholder opinions about water management planning in the IWGNZ paper revealed a need for staff to work in this more collaborative mode.

“The research has indicated that a ‘think tank’ approach

Table 1

**Principles of Good Water Governance**

The *Improving Water Governance In New Zealand* paper suggests six principles of good water governance relevant to this country.

These principles (below) are evaluation criteria for a governance evaluation tool which interpreted the results of interviews with 56 stakeholders to identify 14 attributes that, alongside innovations in collaboration and co-governance, would help improve NZ water governance.

**Participatory** The different stakeholders and iwi involved need to be identified and included in policy and decision-making. Inclusive processes build confidence in the resulting policies, and in the institutions. Two-way communication using engaging language creates trust and a sense of democracy.

**Transparent and accountable**

Information flows freely and steps taken in policy development are visible to all. This helps ensure legitimacy by being seen to be fair to all the parties. It implies the need to be seen to be ethical and equitable, for the roles and responsibilities of both institutions and

stakeholders to be clear, and for the rule of law to apply.

**Integrative** A holistic approach is taken to the primary influences within the water system, be they landscape components such as land use or river – groundwater connections, different community world views or diverse scientific interpretations. Integration recognises linkages within the management system; in turn, policies and action must be coherent and aligned – this requires political leadership and consistent approaches amongst institutions.

**Efficient** Governance should not impede effective action. Transaction costs are minimised, including financial and time costs of decision-making and compliance, administrative costs, complexity, and ease of understanding of how the system operates.

**Adaptive** The system incorporates collaborative learning, is responsive to changing pressures and values, and anticipates and manages threats, opportunities and risks. It recognises that the system is complex and constantly in flux.

**Competent** Decisions must be based on sound evidence. Competence requires development of capability at all levels: skills, leadership, experience, resources, knowledge, social learning, plans and systems to enable sustainable water management.



to water management at council level may create a more integrative approach to problem solving, in which consents staff, policy staff and resource scientists meet regularly, especially at consent renewal time, to discuss decisions.”

RMA planning also raised strong opinions.

“The RMA is effects-based and many stakeholders were unhappy with the slow response of plans to emerging water issues such as land use intensification. Examples were cited of existing consents with long-term expiry dates constraining the ability of the council to adjust plan rules – for example to change water allocation limits or environmental flows.

“Stakeholders saw the benefit of having catchment groups involved in monitoring and advocacy so that emerging issues can be addressed more quickly, and of having reviews of consents (RMA, s128) linked to plan review dates (eg, 10-yearly). However, water user stakeholders also wanted consent renewals to be made less bureaucratic.”

## STAKEHOLDER INVOLVEMENT

Applying the broad governance principles in Table 1 can improve water governance at the decision-making level. The IGWNZ paper researched and compared stakeholder opinions about water management planning and implementation processes across five case-study catchments in the South Island.

Amongst the findings, the authors found that involving stakeholders in monitoring was considered likely to increase their sense of ownership of any water plan, especially if they can see how the monitoring benefits them and how the data they collect is used for decision making.

“If target outcomes have been adequately defined in the planning phase, stakeholders mostly wanted to be involved in monitoring those targets and considered this would assist in adaptive management.”

Stakeholders expressed frustration about objectives in some plans that had “broad narratives with little connection to what was actually going on at ground level”. They wanted a plan in which objectives, policies and methods were clearly defined so that the ‘rules of the game’ were clearly outlined, including limits on water allocation and water quality.

With only 30–50 percent of council water planning and management costs commonly met by consent holders, funding for water management was also a consistent issue.

“Some stakeholders favoured applying volumetric or flow-based levies on water users to support science and monitoring, including devolved monitoring approaches such as audited self-management.”

Among the primary areas that stakeholders felt needed improvement were: the need for national priorities for sustainable water management, more consistent setting of resource limits in plans, and a mechanism for holding regional and unitary councils more accountable for good water management.

Since this research was completed, the National Policy Statement for Freshwater Management (Ministry for the Environment, 2014) has set some process targets and minimum standards for water quality to address these concerns.



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On the question of governance accountability, some stakeholders supported the idea of a national regulatory authority having a role in benchmarking the effectiveness and efficiency of regional plans and providing guidance on meeting national objectives on a local level.

## CONCLUSIONS

The basic theme of this paper is that governance has not received the same attention as technical and infrastructure development in the water sector.

“Water management has for decades relied upon improving technical understanding of water resource occurrence and behaviour, then designing management systems to keep exploitation of those resources, and associated land uses, within biophysical limits.

“Those management systems have often proven unable

to deliver sustainable water management, because of lack of buy-in by stakeholders and poorly-supported sociopolitical and administrative systems.

“Technical understanding of our water resources is vital, but the design of good governance is also fundamental to sustainable water management.

“Identifying principles and attributes of good water management planning helps in evaluating how to improve our water governance. Discussions of governance regimes are not divorced from technological and infrastructure decisions; rather these are intertwined.”

Water decision makers and managers are starting to realise the potential of new forms of governance, such as facilitating collaborative decision-making processes, better recognition of Maori interests in water, and implementation of water plans by catchment groups. **WNZ**

# Fresh water forum role in governance

**The Land and Water Forum, a group of 68 organisations that have interests in fresh water, was formed to come up with viable solutions to a complex and urgent problem.**

Hugh Logan, a lecturer and research associate at Lincoln University, took over as chair of the Land and Water Forum after Alastair Bisley stood down in August after seven years in the role.

The Land and Water Forum was set up in late 2008 in the face of the challenging issue of freshwater policy reform.

The Forum’s recommendations have formed the basis for decisions by Government and regional councils that are progressively deploying its recommendations.

The Land and Water Forum is the trading name for the Land and Water Trust – a small group with around 30 participants who meet on a monthly basis and reports to a plenary, which has a membership of nearly 70 organisations with a stake in freshwater and land management.

Water New Zealand has been a member of the Forum from the outset.

They are joined by central and local government participants in developing a common direction through collaboration for freshwater management and provide advice to the Government. The Forum operates under a mandate from the Minister for the Environment and Minister for Primary Industries.

The strength of the Forum lies in its collaborative approach. It was established in a belief that stakeholders needed to engage



**Hugh Logan.**

directly with each other if we are to get better water management.

Since 2010 the Forum has produced four reports for central government.

In the first report, it recommended that central government should define objectives for our waterbodies, and that regional councils should express these objectives as measurable environmental states and link them to catchment based environmental limits.

The report highlighted the need for an improved water allocation system, proposed changes to regional and national planning and decision-making processes, and recognised the importance of governance changes, including the role of iwi as stakeholders.

The Forum’s second report set out in greater detail a national framework by which limits would be set in each catchment. It also outlined how collaborative planning should be done so that the community and all interested parties are involved in decisions about water management. It set out how regional water planning could be made more agile and responsive to changing circumstances

and better information. The third report recommended ways regional councils and land and water users could manage within water quality and quantity limits, including the role of industry Good Management Practice and a detailed framework for a better water allocation system. It made a number of recommendations on the role that central government should take to facilitate water management reform.

The Forum’s fourth report set out a range of proposals around integrated catchment management, including the importance of prioritising limit-setting towards high-risk catchments, and an initial focus on identifying and managing critical source areas of contaminants, and protecting areas of significant ecological value.

Its focus was on ensuring that water management limits could be achieved through flexible and adaptive systems that encouraged efficiency, and improving and standardising the science and information needed.

The report also made specific recommendations on keeping livestock out of waterbodies. It included specific recommendations about water quality management in urban environments, including aligning ‘three waters’ infrastructure planning and management with water quality objectives, and the role of water sensitive urban design.

In all of this work, the Forum has had a real focus on the role of good governance and decision-making in water management.

## THE VMO PROGRAMME

Landcare Research has published a journal paper on *Science and collaborative processes: changing roles for Science and Scientists* based on an ongoing research programme called Freshwater Values, Monitoring and Outcomes (VMO), along with other papers on water governance.

Now in its second phase, the VMO research programme supports, informs, and helps implement an ongoing programme of reform, retaining flexibility to adapt to meet emerging future policy needs in freshwater management.

The programme is a collaboration between Landcare Research, Cawthron Institute, NIWA, Lincoln University, Geoff Kaine Research, and Margaret Kilvington. The first phase also involved Nimmo-Bell & Company and Will Allen.

The programme brings together

economists, social scientists, ecologists, water scientists, and policy researchers to identify processes and develop tools for freshwater management.

## REGIONAL COUNCIL FORUM

Landcare's Regional Council Forum is designed as a pathway for involving regional councils in its ongoing research.

The forum meets at least annually for two days to explore the experiences of councils, share knowledge and insights between the councils and research team, and discuss how research findings can be used and enhanced to improve decision-making in regional councils and other key stakeholders in freshwater management.

Landcare says it currently works with a group of 10 regional councils (Environment Southland, Bay of Plenty Regional Council, Waikato Regional Council, Hawke's Bay Regional Council, Horizons Regional Council,

Tasman District Council, Environment Canterbury, Northland Regional Council, Auckland Council, and Greater Wellington Regional Council) and the Ministry for the Environment.

Landcare says freshwater management is changing with different processes (eg, collaborative processes), different requirements (such as those resulting from the National Policy Statement for Freshwater Management), and different expectations on the extent and type of knowledge needed to support decisions.

Learnings from the programme are communicated through a series of journal articles and conference presentations, policy briefs and guidance documents, workshops, research reports, and seminars. These publications and presentations can be found on the Landcare website.

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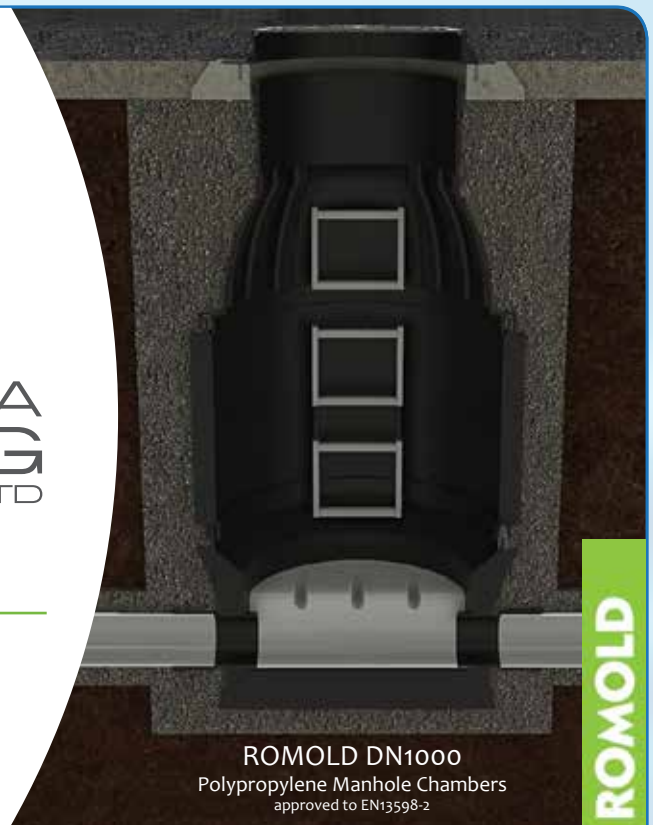
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# A call for rational water governance

By John Pfahlert, chief executive officer, Water New Zealand.

It is no secret that the governance of water administration in New Zealand is somewhat fragmented. With several central government agencies, 67 district councils and a dozen regional councils all with some aspect of control, the scope for widely differing approaches and competence in delivery exists.

In the area of reticulated water management the Government has recently taken steps via amendments to the Local Government Act to enable a more directed approach by including new provisions for the implementation of Council Controlled Organisations for water. Even that approach has seen Local Government New Zealand be highly critical of the Government, arguing that it undermines local democracy and decision making.

Our Association has historically advocated for changes to the structure of Local Government, and for a more corporate/business approach to the delivery of water services. That message has not always been well received by Local Government and to be fair, has been counter-productive to a good working relationship with councils.

Acknowledging the limitations of the existing administrative arrangements, we have embarked on a more collaborative approach with councils to drive consistency of approach in the way in which water assets are managed. Clearly the existing system is not optimal, but in the absence of any political desire for change we are focused on what can be done.

So how and where does Water New Zealand get involved in governance-related matters to do with water?

We do so at a number of levels.

At the highest level we almost always contribute submissions to proposed changes to legislation affecting the sector. The recent Local Government Act changes above are a case in point. Other examples in the past year are submissions to select committees on proposed changes to the management of Standards New Zealand (which has now been brought within the Ministry of Business, Innovation and Employment), the Resource Management Act and on the proposed Fire and Emergency NZ Bill.

Of much greater significance however is our work at the policy level, long before legislation actually appears in the

House. In the nine months of 2016 we have contributed submissions in the following areas – all of which can be found on our website:

- Submission to MBIE on hazardous substances regulations
- Preliminary comments to the Productivity Commission on better urban planning
- Submission to MFE on Next Steps for Fresh Water – a Land and Water Forum paper
- Submission to the Waikato Regional Council on its freshwater discussion paper
- Submission to WorkSafe on the management and removal of asbestos draft code of practice
- Submission to MFE on proposed National Policy Statement on urban development capacity
- Submission to DIA on new fire and emergency regulations
- Submission to MBIE on verification methods
- Submission to the Attorney General on the Terms of Reference for the Havelock North enquiry
- Final submission to the Productivity Commission on better urban planning

The development of our submissions always involves us seeking input from the membership before they are lodged.

We also engage with external groups who have an interest in governance and water management issues. For example we have participated in the Land and Water Forum (LAWF) over many years, contributing to each of its four reports. That work is ongoing and we are raising issues of urban stormwater management with LAWF at present.

We also work closely with government departments involved in water-related issues. Foremost among these are the Department of Internal Affairs, Ministry for the Environment and the Ministry of Health.

The most recent issue to present itself is the Commission of Inquiry into the Havelock North campylobacter outbreak. It is likely our focus will be on any systemic issues associated with water management which the inquiry identifies as needing attention.

The role of the Association is to represent the sector where an identified need presents itself, and where we believe we can add value. Ongoing input from the sector is essential to discharging that role. [WVNZ](http://www.waternz.org.nz)

## OECD PRINCIPLES ON WATER GOVERNANCE

**Supporting the Global Coalition for Good Water Governance are the OECD's Principles on Water Governance.**

These water governance principles were adopted at the seventh World Water Forum in Daegu, Korea last year. Among those around the world who helped develop and support these principles was our own Andrew Fenemor from Landcare Research.

The OECD Principles on Water Governance provide the 12 must-do's for governments to design and implement effective, efficient, and inclusive water policies in a shared responsibility with the broader range of stakeholders. They were developed using a multi-stakeholder approach within the OECD Water Governance Initiative, and backed by ministers at the OECD Ministerial Council Meeting on June 4, 2015.

The Principles were developed on the premise that there is no one-size-fits-all solution to water challenges worldwide, but a menu of options building on the diversity of legal, administrative and organisational systems within and across countries. The OECD Principles on Water Governance recognise that governance is highly contextual, that water policies need to be tailored to different water resources and places, and that

governance responses have to adapt to changing circumstances. They acknowledge that water governance is a shared responsibility between levels of government, public, private and non-profit stakeholders.

The OECD Principles on Water Governance provide a framework to understand whether water governance systems are performing optimally and help to adjust them where necessary. They can catalyse efforts for making good practices more visible, learning from international experience, and setting reform processes into motion at all levels of government to facilitate change where and when needed. They can also help avoid traps and pitfalls, learning from international experience.

Since their adoption, the Principles have been endorsed by 42 countries, including New Zealand, and some 140 major stakeholder groups. Work is now underway to identify and scale-up local, basin and national best practices for each Principle, and to develop water governance indicators to assess the state of play of water governance in interested countries, basins and cities. Results will be published in the OECD's Water Governance at a Glance report in 2018.

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# Lessons from New Orleans

Brent Manning was one of a number of Kiwi guests at the world's largest annual water quality exhibition organised by the US-based Water Environment Federation (WEF) and held in New Orleans last month. He talks with **Alan Titchall** about lessons from Hurricane Katrina a decade ago and why it has been declared a 'manmade' disaster.

**B**rent Manning was one of a number of Kiwi guests at the world's largest annual water quality exhibition organised by the US-based Water Environment Federation (WEF) and held in New Orleans last month. He talks with Alan Titchall about lessons from Hurricane Katrina a decade ago and why it has been declared a 'manmade' disaster.

The annual water exhibition is called WEFTEC and it is a huge event, says ex Water New Zealand Chair Brent Manning, this year drawing over 22,000 delegates.

"Myself, Raveen Jaduram of Watercare and Onno Mulder of City Care were provided a briefing by the mayor of New Orleans on the recovery measures the city has taken, and Onno and I were fortunate to get a tour of some of the affected areas and remedial works, including some parts that have been restored since Hurricane Katrina, or are still under repair.

"I have to say there are huge parallels between what New Orleans experienced, and is still experiencing, and our own Christchurch.

"For a start there was a lot of criticism of a lack of communication between central and local agencies and the time taken to resolve issues, especially insurance claims.

"Those in the most vulnerable flooded areas didn't have the means to evacuate and some 1400 people died.

"The SuperDome ended up being a staging point but was built for 75,000 people to watch a game for two hours and

go home, not to sleep and accommodate thousands of people for a long period of time. All the wastewater systems blocked and caused more issues."

Katrina occurred 11 years ago in August 2005 and there are some areas that are still effectively 'red zones' that are devoid of houses or buildings, says Brent.

"Many of these areas will remain permanently abandoned to be used as soakage basins for future flooding situations."

There are still a lot of funds to be spent restoring the city, he adds and the US government has spent US\$14 billion to mitigate the levees (bunds) to contain the Mississippi River where it outlets via canals to the Gulf.

"Total property damage has been estimated at US\$108 billion and no doubt the city itself has spent billions on repairs and funds to raise houses on the flood zones. They are also building new subdivisions on green-field sites. It is interesting that the cost of these new houses, including the land is the equivalent to NZ\$230,000-\$260,000, and the average home is 190 square metres on a large section. So, they are getting that right over there."

Brent says he picked up on the fact the authorities do not refer to Katrina as a natural disaster – rather a 'manmade' one.

One of the museums had an exhibition on the hurricane, which he visited during some downtime and there were models demonstrating the impact of the loss of estuarine,



Typical New Orleans levee construction – many failed due to piping and scour under the concrete walls, or over-topping of the walls due to the hydraulic lateral load.



Red Zone? A suburb yet to be rehabilitated.

offshore atolls around the delta and the lack of buffering against sea surges.

“The big issue is not the river anymore but the sea surge. The city is about 300 years old and until the late 1880s the river used to flood the area and deposit silt that encouraged the development of offshore islands and pushed the delta forever outward.

“Once the river was confined and trained to flow as a channel that did not ‘over-top’, the buffer zone was destroyed and the sea surge and salt water pushed inland, killing off vegetation and leaving nothing to hold the soil, so the buffer islands were gradually eaten away.”

Most people think Katarina was a one-off but it wasn’t says Brent. Not long after, hurricane Rita hit a little further up the coast and was almost as powerful.

“The exhibition demonstrated that the city gets force three to five hurricanes off the Caribbean every three or four years.”

The city celebrates its 300th birthday next year and was originally built on the only area near the river that didn’t flood, known as the French quarter.

“You can’t change the past but decisions made years ago greatly impacted on the city’s vulnerability.

“As the city has developed and spread over a high water table (below sea level) they have also been pumping and de-watering, which makes the ground settle further and consolidates, compounding the problem as the city sits even lower.

“It is a sombre lesson in not messing with nature without knowing the long-term effects and consequences.”

Some 1.7 million people were evacuated from the city as a result of Katrina and it has taken a long time for them to attract people back. However, as a result of the disaster, the state and federal governments now have better control over the management of the canals and levees, says Brent.

“And a big change is that they are being more transparent about the risks, and the fact it could happen again. They have learnt a lot about emergency response and management.

“They are saying they need to learn to live with water and accept that sometimes some places are going to get wet and we should not treat water as an evil and try to get rid of it.

“They have admitted it was a manmade disaster and are going to get used to living with nature rather than working against it.” **WNZ**



New Orleans residential soakage basin (formerly a residential site).

## A CITY THAT LIVES WITH WATER

The impacts of water still loom large in New Orleans, a city that mostly sits on ground below sea level, and has the Mississippi River running through its midst, with stop-banks (or levees as they are called) keeping the river in its course, albeit some feet above the city. The consequences of Hurricane Katrina are still being put right as the city enters its 11<sup>th</sup> year of the recovery phase.

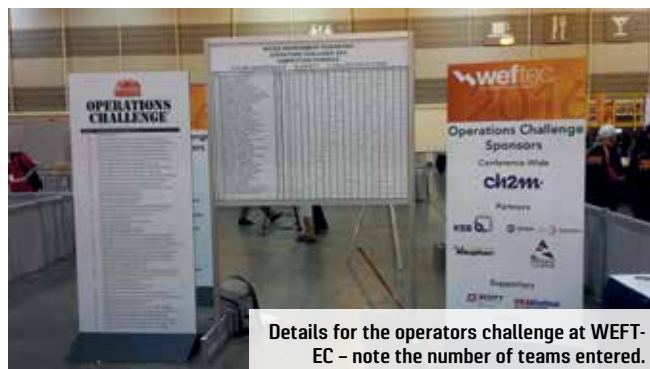
Their risks therefore are: flooding from the river, although by and large this is contained now by the levees and upstream dams and controls; sea storm surge forcing sea water to top the levees and canals and thence into the city; sinking ground levels as a result of dewatering of ground water through over pumping; and deteriorating water quality as a result of all of the above.

Hurricane Katrina was a Caribbean-borne force three to five hurricane. New Orleans and environs has typically experienced similar strength hurricanes every three to four years throughout its 300-year existence.

Katrina is universally referred to by the mayor and his staff as a ‘manmade disaster’ as the flooding that engulfed the city resulted from the actions of man; namely overtopping and failure of the levees (through poor design and sometimes poor construction); through poor coordination between the agencies that control and operate the levee and canal systems, eg, the main cuts from the Mississippi River were built and are controlled by the US Army Corps of Engineers, however, the interconnecting canals and pumps that pump into them are controlled by the city!

The US Government has funded the rebuild of the main levees – to the tune of US\$14 billion and its Federal Emergency Management Agency (FEMA) has developed better coordination for operation of the levee system with greater New Orleans and city as a result.

The city accepts that flooding will occur from time to time and is attuning its citizens to accept that fact and prepare to ‘live with water’. The city has established incentives for home owners to raise houses onto poles (where possible), and has embarked with the Federal government on a programme of new home building in green-fields suburbs to attract residents back. New homes are being built on sizeable flat sections and good quality single level homes of 1700-1800 square feet (about 180-190 square metres) cost between US\$160,000-\$180,000.



Details for the operators challenge at WEFT-EC – note the number of teams entered.

# Looking ahead to bright futures

A Young Water Professionals sector report.

**M**ichaela Aspell is a young engineer looking forward to a bright future. This year she was the first winner of the Water New Zealand Young Professionals award – a new award aimed at giving one young water professional the opportunity to attend this year’s Water New Zealand Conference in Rotorua.

In her 22 months as a civil engineer for Tonkin & Taylor, she’s already worked on the largest dredging project in New Zealand – the Lyttleton Port Company Channel Deepening project.

For Michaela, her long-term aspirations are centred on the provision of environmentally sustainable safe water. Like many young engineers, she’s got a global outlook.

Young engineers like Michaela face a very different future than that of their predecessors. Issues such as climate change and financial constraints will increasingly underpin the way they operate. It’s an environment that will require very different solutions – many of which will have less to do with building and infrastructure, and more to do with information and digital technology.

It’s not surprising that at this year’s Water New Zealand Conference, the Young Water Professionals’ sessions were amongst the most popular, with dozens of young engineers now keen to belong to what’s becoming an important networking group.



Michaela Aspell.

The Young Water Professionals Group has three chapters, Auckland chaired by Matt Ewen, Wellington chaired by Fiona Myles and Christchurch chaired by Richard Gramstrup. Each chapter meets regularly to work on actions that assist in promoting the sector to people looking to start their careers. Regular events are also held with upcoming events in Auckland, Christchurch, and Wellington at the time of writing.

The Young Water Professionals Group is still in its infancy, yet the chair of the Canterbury branch, Richard Gramstrup says around 30 to 40 young engineers attend most of the events, which include anything from social quiz nights to presentations.

Providing networking opportunities for young people and support and information for undergraduates thinking of going into the water sector are key goals of the group.

“We want to make sure that student engineers know about us and the opportunities that are available in the water sector.

“There’s going to be a lot of work and opportunity in this area over the next 10 years as we seek new solutions to replace and update our aging infrastructure,” he says.

“We’re going to need many more skilled people and we

**The majority of engineers in the water sector are now aged over 50 and we can expect to see a huge wave of retirement over the next 10 to 15 years.**

need to make sure students are aware of the attraction and benefits.”

Richard says the water sector has suffered from a low profile compared to other sectors such as construction and that’s why there hasn’t traditionally been the same interest amongst students.

“Unlike a new bridge that people can see, no one really knows about water reticulation unless it’s broken.”

He says the recent Canterbury earthquakes have made people realise the importance of potable water in that region.



“Christchurch people now know just how critical water reticulation is.”

As well as an aging infrastructure, the water sector is facing an aging workforce.

The majority of engineers in the water sector are now aged over 50 and we can expect to see a huge wave of retirement over the next 10 to 15 years.

This will leave many of the younger engineers in the driving seat and that’s why networking, not only with other young professionals, but also tapping in to the knowledge of senior colleagues has become another key focus.

“We need that skill set and knowledge transferred to young professionals and tradespeople before we get a mass exodus of seniors from the industry. These are the guys that built the infrastructure that we’ll inherit. They know how it works.”

All this points to some very good reasons why this group has an important role to play, not only in supporting the long-term aspirations for young engineers, but in the sector as a whole. And this is a message that needs to get out.

“There’s a lot of understanding about what belonging to the IPENZ can do for networking and professional opportunities but much less so about belonging to Water New Zealand.”

For students, membership is free. As well as opportunities to meet with like-minded colleagues and find out more about what’s going on in the water sector, membership also provides access to technical papers.

This, says Richard, provides a valuable resource for students as well as those starting out in a new job.

“I would have liked to have had access to some of those papers when I was a student. I didn’t even know they existed, but they would have been very helpful as reference material.”

Along with new challenges of making the most of the digital age, the increasingly global environment that inspires young water engineers like Michaela is becoming another focus for the Young Water Professionals Group.

“The global outlook is strong, and that’s why we’re working hard on establishing global links, most recently with Young Water Professionals in the UK.”

In an environment where knowledge and personal contact is becoming increasingly important, both here and overseas, the YWP is providing an important support base and link for engineers starting out or in the early stages of their career.

If you would like more information about YWP events and how to join, go to the Water New Zealand website [www.waternz.org.nz/YoungWaterProfessionals](http://www.waternz.org.nz/YoungWaterProfessionals). **WNZ**

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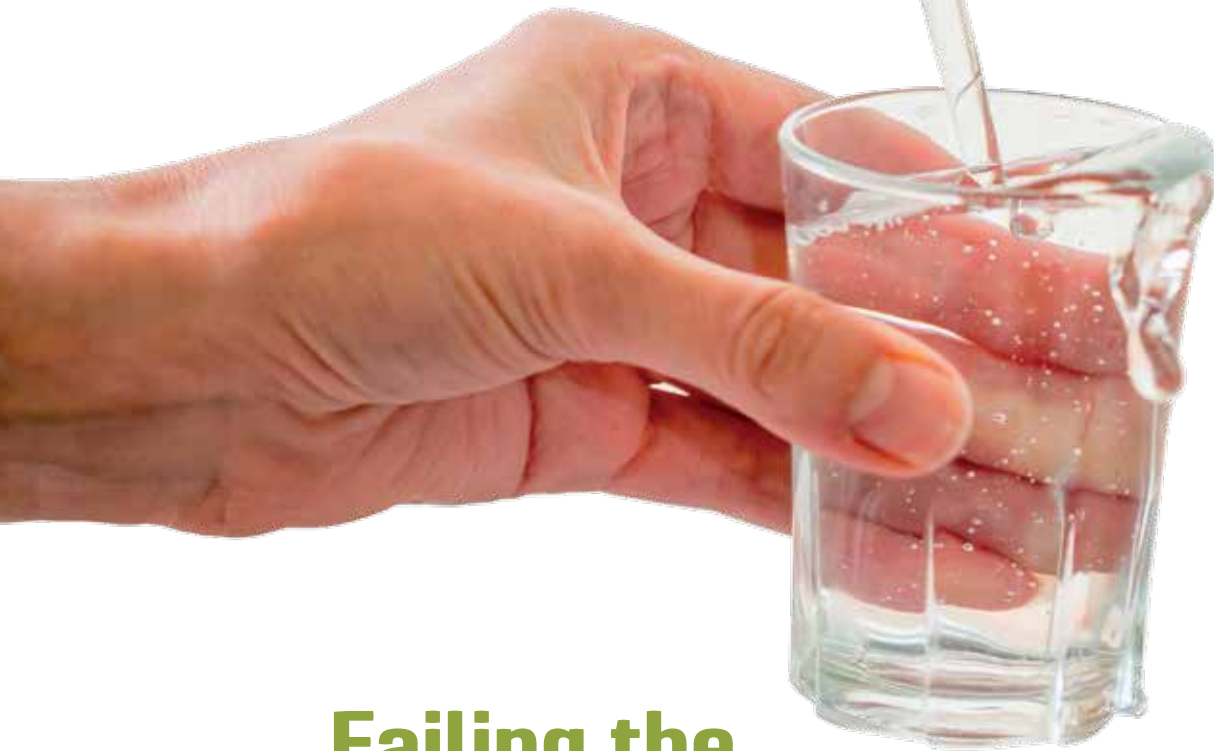
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# Failing the Drinking water standards

A paper presented by **Barry Mattingley, David Wood and Chris Nokes**, (ESR) at the 2017 Water New Zealand conference. This is an introduction to its tasks and findings and the full paper can be viewed at [www.waternz.org.nz](http://www.waternz.org.nz). This paper also won a silver award in the Hynds Paper of the Year Award at the 2017 Water New Zealand conference.

**E**ach year ESR, the Crown Research Institute that specialises in science relating to people and communities, surveys all networked water suppliers that provide water to more than 100 people for information on their achievement of the Drinking-water Standards for our country.

This information is used to prepare the Annual Report on Drinking-water Quality for the Ministry of Health. The latest study analysed four years of survey data 2010-2014 (341 zones), with a focus on those zones that did not achieve the Standards for *E. coli* or chemicals. Its aim is to better understand the reasons for non-achievement to help improve risk management.

The study found the main reason for zones failing to meet the *E. coli* and chemical requirements of the Standards was too many transgressions (maximum acceptable value exceedences). Almost all zones with an excessive number of transgressions, for both *E. coli* and chemicals, served populations in the 501-5000 bracket. Corrective actions were considered adequate in 91 percent of zones with *E. coli* transgressions, despite repeated failures over the four years. In contrast, in 23 percent of zones with chemical transgressions, corrective actions were considered adequate.

Actions are currently being taken to address both bacteriological and chemical non-achievement in some zones that are expected to improve levels of achievement when treatment upgrades take effect.

## KEY FINDINGS

Too many transgressions during a reporting year was the prime cause of the non-achievement of the Standards for both *E. coli* and chemical determinands.

Despite excessive numbers of *E. coli* transgressions repeatedly causing non-achievement in some zones, corrective actions to address the transgressions were, in the great majority of cases, considered adequate by those completing the Survey.

The great majority of corrective actions in response to chemical transgressions were considered inadequate. Effective corrective actions for addressing chemical transgressions present water suppliers with a difficult problem because they cannot generally be implemented immediately and they can be expensive.

Treatment plant upgrades to UV irradiation was planned for many of the zones in which there had been repeated *E. coli* transgressions. This should provide a barrier to

pathogens entering the distribution zone, but provides no means of controlling post-treatment bacterial contamination of the water.

Improvements in levels of E. coli and chemical achievement can be expected when planned treatment upgrades are commissioned and teething troubles being presently experienced are overcome. The ability and willingness of water suppliers to fund the necessary improvements in their water supplies will determine the extent and rate at which levels of achievement will improve.

The benefits of water supply upgrades may not be fully realised if capital expenditure cannot be matched by appropriate levels of operational expenditure, eg, staffing levels and staff training.

Some water supplies appear to have made a decision not to carry out the monitoring required for achievement of the Standards, particularly for chemical determinands. This may be because of the expense of the analyses. Non-achievement in these zones can be expected to continue.

### IMPROVING LEVELS OF STANDARDS

In relation to achievement of the E. coli and chemical standards the study suggests:

Water safety plans include a requirement to investigate the cause of transgressions and that measures to address the

causes are implemented. The need for investigation of E. coli transgressions is made clear in the Standards.

Good evidence is needed before concluding that sample contamination is the reason for E. coli detection in a sample. When sample contamination is the cause, actions, such as sampler training, need to be taken to prevent recurrence.

Water suppliers should seek help from their drinking-water assessor if they encounter difficulties with their investigation.

Where source water turbidity may rise with rainfall, ensure filtration is installed as part of treatment plant upgrades to guard against the efficacy of the disinfection processes being compromised. This should ensure that the water quality leaving the treatment plant is satisfactory.

Where repeated non-achievement of the E. coli standards occurs because of transgressions, take steps to maintain a disinfecting residual in the zone.

The relatively inexpensive measure of introducing a residual disinfectant into zones that presently contain no residual provides a means of helping to control the risk to public health of low-level post-treatment contamination.

Communities that are opposed to chlorination need to be informed of the potential consequences of this decision to ensure they are fully aware of its ramifications.

- Read the full paper at: [www.waternz.org.nz](http://www.waternz.org.nz) **WNZ**



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# Hunua 4

## Innovations

Auckland's Watercare called for ideas and innovation to soften the impact on communities of its massive infrastructure building projects. Story supplied by Watercare.

**W**ith the scene for many of projects now set in the built urban environment, Watercare is expecting contractors to go quickly and go 'gently'.

Those who meet the challenge can share in a big works pie: A \$4.9 billion investment programme in upgrading and expanding infrastructure over 10 years that was announced in July.

As an Auckland Council-controlled organisation, Watercare is under pressure to deliver dozens of projects for significant housing intensification while at the same time minimising the cost and effects of construction on its owners – the community.

One of its key projects for Auckland's future water supply is the construction of the \$400 million Hunua 4, a pipeline 1.6 metres to 2.0 metres in diameter that travels for 32 kilometres between Watercare's reservoirs in Redoubt Road, Manukau to those in Khyber Pass, Auckland City.

The project – which has been in construction since 2008 – achieved a significant milestone in July when works in Campbell Road, One Tree Hill were completed, enabling Watercare to bring 26 kilometres of the pipeline into service.

The next 2.5 kilometres around One Tree Hill has been installed and is being tested before entering service in October. This will establish a high volume connection between Watercare's southern and Epsom reservoirs, helping to service growth and provide redundancy for the Hunua 3.

Already, the Hunua 4 has provided redundancy to large parts of the water infrastructure in Auckland and reduced the reliance on the existing infrastructure supplying the city. It has also created additional capacity in high-growth areas such as Manukau, East Tamaki, Auckland airport and its surrounding industrial precincts.

Hunua 4's final section – from Market Road, Epsom to Khyber Pass, Grafton – will bring the pipe length to 32



The Hunua 4 pipe bridge is installed on State Highway 20 in December 2013.



Watercare chief executive Raveen Jaduram.



Laying the pipe at Puhinui, Manurewa. Contractors have tackled a variety of engineering challenges along the way, from the changing ground material – peaty silt in Mangere and basalt in Onehunga – to heavy traffic areas and crossings of major arterial routes.

kilometres. Construction is forecast to start in early 2018 and finish in 2020.

It will be in one of the city's oldest and most populous districts, with heavily congested roads, the City Rail Link construction underway and a need for hard rock tunnelling on some of the section.

The potential for disruption to traffic and business led to a departure to the way Watercare engages with contracts.

Rather than going out to market with a confirmed design, Watercare produced a specimen design and asked potential contractors to submit alternative proposals. The proposals were then developed through an interactive tendering process that has included workshops with Watercare engineers.

"We wanted the contractors to tell us how they would best build it and minimise disruption," says Hunua 4 project manager David Moore.

"It will be a design and build procurement – the key for us is to deliver the least disruption for the best price."

Watercare chief executive Raveen Jaduram says it is more a collaborative approach to the estimated \$60 million job

## ENGINEERING CHALLENGES

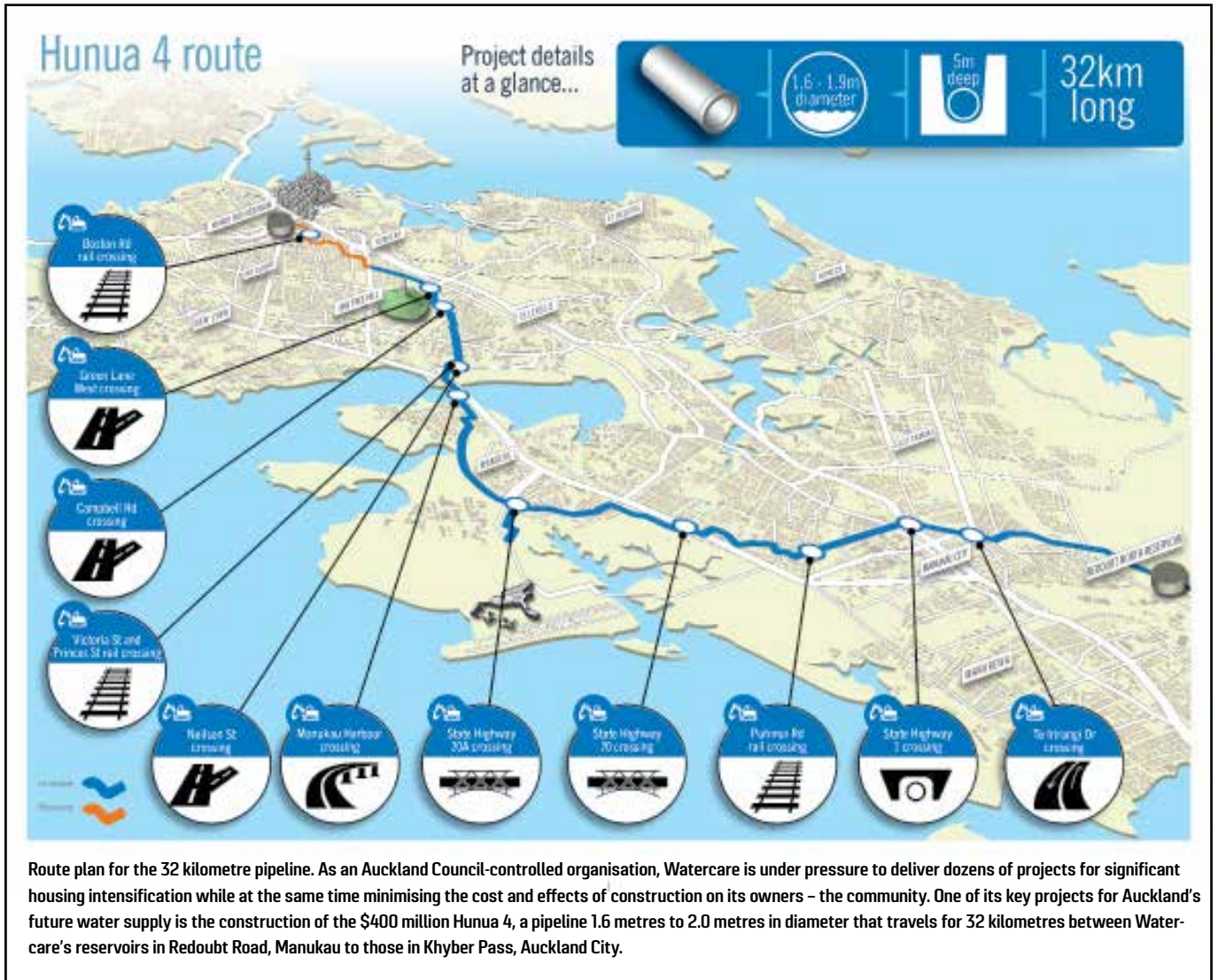
The majority of Hunua 4 has been constructed by the Fulton Hogan John Holland Joint Venture and their main subcontractors, March Cato and Taranaki Engineering.

At its height more than 120 people were working on the construction at any one time.

These contractors have tackled a variety of engineering challenges along the way, from the changing ground material – peaty silt in Mangere and basalt in Onehunga – to heavy traffic areas and crossings of major arterial routes.

In order to minimise disruption, major crossings of Te Irirangi Drive, Neilson Street and Green Lane West took place during holiday periods.

Other highlights of the project include the construction of the tunnel under Stage Highway 1 at the Manukau Sports Bowl and the pipeline's installation on a bridge over the South Western Motorway.



but leaves the necessary commercial tension and incentive for the market to give competitive pricing.

“The feedback from contractors is that they can add to the solution.”

He says there is a lot of work around but contractors’

investment in Watercare as a client promises a return for a long period, because most of the upcoming jobs will be in a similar category – in the built environment.

Watercare is currently reviewing the final proposals and plans to award the contract in coming months. **WNZ**

## KEEPING COMMUNITIES INFORMED

Until late 2014, the project had a low profile but that changed when the big diggers rolled into Mangere to install 1.9-metre diameter pipes in the road.

A community began to question the disruption to their commuter and school run and blocked driveways.

While contractor Fulton Hogan John Holland Joint Venture had stakeholder liaison managers, a dedicated project email and a 24-hour helpline to give up-to-date information, it became clear this was not enough.

Watercare project manager David Moore says as the trenching moved to the busy roads of Onehunga and One Tree Hill and more disruption to people’s daily lives was anticipated, the project rolled out a beefed-up communications strategy supported by a traffic

management plan – warning commuters to steer clear of road closures and suggesting detours. It was a success.

A project ambassador was appointed to help residents, who were without driveway access, to bring in their shopping and young children from the car. She puts out residents’ rubbish bins and delivers Meals on Wheels.

In schools, Watercare has used a trained teacher to delivered lessons on Auckland’s water supply and the Hunua 4 project.

The company’s contractors also sponsored a photography competition, helped out with gardening and invited a group of pupils to tour the site. The pupils created posters describing the diggers’ scoops, claws and rock hammers. And the “brave men” building the pipeline.

# Washing away troubles

One of the latest Oxfam initiatives in the Pacific region is building toilets in schools that desperately need them and making a huge difference to the health of children in the Eastern Highlands of Papua New Guinea.

**R**ebecca lives in Kurumba village in the Eastern Highlands of Papua New Guinea. Before Oxfam and its partner ATprojects began work to improve the water and toilets at the school, the only water Rebecca and her classmates had to drink or wash their hands came from a small, dirty stream. It's no surprise that she would get very sick every few weeks.

Thanks to Oxfam supporters, Rebecca's school is one of 84 schools in the Highlands of PNG that now has water for drinking and hand washing, along with toilets for students and teachers to use.

That's 28,780 more children living a much healthier life!

And when the children are healthier, they can spend more time at school, helping to break the cycle of poverty for good.

Nearly 90 percent of PNG's population lives in rural areas and Oxfam's project focuses on upgrading rural schools, which usually lack most basic services.

Roads are poor or non-existent, so many rural schools are hard to reach. On some of the school upgrade projects, the Oxfam team and local communities had to carry all the materials and equipment up steep bush tracks.

So far some 9000 litre water tanks have been installed along with VIP (Ventilated Improved Pit) latrines. The latrines have a covered vent pipe to take smells up and away, which prevents flies from spreading disease. They also have a washable concrete slab floor that helps stop the transmission of hookworm — a major sickness for many school-age children in PNG.

And the last word goes to Rebecca who wants to be a pilot when she leaves school.

"I am very happy to have toilets and water at school. Without them we might get sick and we will not learn our lessons properly."

Thank you to the Water New Zealand association and its members for their generosity in helping create powerful change for children that will last and create a legacy. **WNZ**



Construction Namta Primary.



Oxfam/Kopas Village toilet.

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# The year that was and 2017 – The year that will be



By **Helen Atkins**, partner, **Vicki Morrison-Shaw**, senior associate; and **Phoebe Mason**, solicitor – Atkins Holm Majurey

## INTRODUCTION

They say that change is as good as a holiday, and as this year draws to a close there is both change and a holiday on the horizon!

Indeed, 2016 has been a year of change with local government and resource management reforms progressed and further reforms signalled. In this article we provide a brief update on the progress of the current local government and resource management bills as well as the Havelock North Water Inquiry.

The remainder of this article is dedicated to a case law update, profiling three recent, but very different cases of interest involving a Christchurch dam proposal; a water consent lapse date; and the latest instalment in the fluoridation litigation.

Also, as this is our last article for 2016 and while it seems a tad early to mention the word “Christmas” yet, we would like to take this opportunity to wish you all the very best for the upcoming festive period and holidays.

## LOCAL GOVERNMENT BILL

The Local Government Amendment Bill<sup>1</sup> has proved to be hugely controversial with a large number of councils and other submitters coming out in opposition to what they see as the death of local democracy.

Over 200 submissions were received on the Bill and while the Select Committee hearings have now concluded the Minister of Local Government Peta Simons has suggested that further time be allowed to enable policy consideration and drafting changes to the Bill.

The original report back date for the Select Committee was 28 October 2016 and the suggested new report back date is 31 March 2017. At the time of writing, the Select Committee had not yet confirmed whether it would extend the report back date.

## RESOURCE LEGISLATION AMENDMENT BILL

As we noted in earlier articles, submissions on the Resource Legislation Amendment Bill 2015 (RLAB) closed in March this year and the Select Committee report was originally due to be issued in early September.

However, the Committee applied for and was granted an extension to 7 November 2016. As we will not receive that report in time to comment on it in this article, we will do so in our first article of next year.

For now, we simply note that given the number of concerns raised by a range of submitters, we expect there will be some significant amendments should the Select Committee recommend that the Bill be passed.

## HAVELOCK NORTH WATER INQUIRY

As we noted in our last article, in August 2016, the Government announced an inquiry into the Havelock North contaminated water incident. In mid-September the Government released further details about the inquiry as well as the names of the panel that will conduct the inquiry.

### Inquiry Details

The inquiry will focus on finding the answers to the following key questions:

- how the Havelock North water supply system became contaminated;
- how this was subsequently addressed;
- how local and central government agencies responded to the public health outbreak that occurred as a result of the contamination; and how to reduce the risk of outbreaks of this nature recurring.

### The Panel

The panel will be chaired by retired Court of Appeal judge, the Honourable Lyn Stevens QC. The other members of the panel are Dr Karen Poutasi CNZM, the current NZQA CEO and former Director-General of Health; and Anthony Wilson, chief engineer of Wellington City Council and former Water NZ president.

The panel is required to report back by 31 March 2017.

## CASE LAW UPDATE

*Three cases aroused our interest in the past couple of months. The first, another large scale dam proposal looking to provide greater security for water supply in Canterbury; the second a case which discussed the rather vexed issue of when a (water) consent can be said to have lapsed; and the third is the latest (but not necessarily final) instalment in the water fluoridation debate.*

<sup>1</sup> Local Government Amendment Act 2002 Amendment Bill (No 2) 2016



***Eyre Community Environmental Safety Society Incorporated v Christchurch Regional Council 2016 NZEnvC 178***

Access to water, particularly in times of drought, can be the difference between livestock and crops surviving or perishing. Since, as yet, no one has been able to control (or even that accurately predict!) the weather, efforts to ensure security of supply, have shifted to other avenues.

One of these, which was the subject of this case, was a proposal for large-scale water storage. In this case, Waimakariri Irrigation Limited sought a number of consents to enable the construction of two large storage ponds holding 8.2 million cubic metres of water, covering approximately 120 hectares, and located above an existing community.

The prime issue in this case was safety – and in particular the risk to those who might be in the flow path if there was a catastrophic breach of the embankments of the ponds.

The Court reiterated that while the RMA is not a “no effects” statute, due to the definition of “effect” in section 3, there was a need to consider effects of low probability but high potential impact, (such as a breach of the ponds), and the ability of the community (or not) to protect itself.

The parties agreed, and the Court accepted that the NZSOLD Dam Safety Guidelines 2015 were an appropriate standard against which the proposal should be judged. The Court however indicated that it did not have sufficient information on a number of matters to determine that the design for the project was “suitably conservative” to ensure safety.

All other effects were accepted to generally be no more than minor, and the proposal was found to be generally consistent with the relevant planning documents (with the exception of the risk of dam failure).

The Court made orders for further information and evidence to be provided on key safety-related issues, including: engineering design of the ponds; quality control of the geomembrane liner for the ponds; the proposed dam management safety plan; and emergency action and emergency evacuation plans.

While the decision provided guidance about the matters that conditions would need to include if consents were subsequently granted, the Court reserved its position in relation to whether consent would in fact be granted:

[217]... The question of whether or not we shall be able to grant consent will be informed by whether or not we are satisfied with the responses. The question of whether consent can issue in this case is by no means answered at this stage. Other parties shall have the opportunity to lodge evidence and make submissions on the responses as well.

So for now, it is a case of watch this space, to see whether the proposal can ultimately gain consent.

***Koha Trust Holdings Limited v Marlborough District Council [2016] NZEnvC 152***

Water as we all know is crucial for growers and water consents, particularly in over allocated areas, are highly sought after and often hotly contested.

This case was no exception. Here, the Council had granted water take and use consents to Mr Woolley in February 2010. The consents included a couple of “implementation” type conditions which required that certain steps be taken (in particular the installation and inspection of water

meters and reporting) before water could be taken.

Further, as the catchment was over-allocated, the consents were made subject to a two-year lapse date. Mr Woolley took and used the water, but did not comply with the implementation conditions. After the two-year period had elapsed, Mr Woolley leased his land and transferred the water permits to a third party (Constellation Brands).

In the meantime, the Council had however received an application to take and use water from Koha Trust Holdings Limited (Koha) on the basis that the Woolley consents had lapsed. This was actively disputed by both Mr Woolley and Constellation Brands.

In an effort to gain clarity around the issue, Koha applied to the Environment Court for a declaration that the consents had lapsed and agreed to its consent application being placed on hold while the Environment Court proceedings were worked through.

The Environment Court found (in line with earlier High Court authority)<sup>2</sup> that whether a consent had been given effect to was an issue of degree and would vary from case to case depending on the facts of the case, the nature of the work authorised by the consent, what had been done and the reasons why it had not been completed.<sup>3</sup>

Here, the Court agreed that the condition requiring the installation and inspection of meters was an “implementation” or “establishment” condition that had to be complied with before water could be taken:

[62] Whether the factual matrix in any given case is straightforward such as in GUS and Goldfinch, or more complex such as in Biodiversity, the possibility may remain that some conditions can be identified as implementation or establishment conditions, and others as continuing conditions. It is possible that conditions of the latter type might generally be more amenable to enforcement than to operation of the lapse provisions in s 125. Conditions of the former type, particularly where they involve a prohibition against operation of the consent until the required steps are completed, are likely, if those steps are not carried out before the end of the lapse period, be amenable to testing against the standard in s 125(1A)(a) “the consent is given effect to”. We find that this is one of those cases, and hold accordingly.

Interestingly though, while the Court made this finding, it then refused to issue the declaration sought, finding it would be unfair to the innocent third party, Constellation Brands. Quite where this leaves things for the Council is unclear. Probably not the outcome that Koha or indeed the Council expected!

***New Health New Zealand Incorporated v South Taranaki District Council [2016] NZCA 462***

The debate around fluoridation, and in particular whether a Council could and/or should fluoridate its water supplies has been raging for many years, with parties on either side of the debate investing significant time and effort into advocating their positions. The latest instalment in this debate is a decision from the Court of Appeal which considered appeals from three related proceedings brought by New Health New Zealand Inc (New Health) challenging the lawfulness of fluoridating water supplies.

<sup>2</sup> *Goldfinch v Auckland City Council* [1997] NZRMA 117 (HC).

<sup>3</sup> At paragraph [12].

The three proceedings were:

- An unsuccessful judicial review action challenging the decision of the South Taranaki District Council to fluoridate its water supplies (Council appeal);
- Another unsuccessful judicial review action challenging the validity of regulations which were introduced to clarify that the two fluoridation compounds were not medicines (Regulations appeal); and
- The refusal of an application for declaration that two fluoridation compounds added to water were medicines in terms of the Medicines Act 1981 (Medicines appeal).

### Council appeal

In terms of the Council appeal, the Court noted at the outset that it was only concerned with the lawfulness of the process of fluoridation – the merits of the process were not relevant except at a broad level in relation to Bill of Rights grounds.<sup>4</sup>

The two key issues in the Council appeal were:

- whether it was lawful to fluoridate water supplies; and
- whether such fluoridation breached s 11 of the New Zealand Bill of Rights Act 1990 (NZBORA).

Rights Act 1990 (NZBORA).

The Court found that the Local Government Act 2002 and the Health Act 1951 authorised the fluoridation of water supplies:

<sup>4</sup> Refer paragraph [12].

[58] ...In summary, within the prescribed New Zealand Standards the Lower Hutt City case established the lawful authority to fluoridate water in 1965 under the Municipal Corporations Act 1954. That authority continued under similar legislation at least until the passage of LGA 2002. In providing under the LGA 2002 that local government organisations were, required to continue provide water services, Parliament must be taken to have been aware of the Lower Hutt City case and to have authorised the continuation of the practice of fluoridating water, which by that time had been established for almost 50 years.

[59] The matter was put beyond any doubt by the introduction in 2008 of pt 2A of the Health Act. During the Select Committee’s consideration of this measure, the issue of fluoridation water was raised. Concerns that local authorities might construe pt 2A as requiring the fluoridation of water supplies led to introduction of s 690(3)(c) to clarify that point. The absence of any provision prohibiting the use of fluoride in drinking water is a powerful indicator that Parliament intended to authorise local authorities to fluoridate water supplies if they wished do so. It follows that by necessary implication Parliament clearly authorised but did not compel the fluoridation of drinking water...

In terms of the second issue, the Court found that the power to fluoridate did not infringe against the right under s 11 of the NZBORA to refuse to undergo medical treatment:

[87] ...the right guaranteed by s 11 to refuse to undergo medical treatment does not extend to public health measures such as the

## Ruataniwha dam project hurdle

**The Ruataniwha dam project is based on the Department of Conservation (DOC) and the council-owned Hawke’s Bay Regional Investment Company exchanging 22 hectares of Ruahine Forest Park land for 170 hectares of nearby farmland known as the Smedley Block.**

To create a reservoir behind the dam for irrigation some 22 hectares of DOC land needs to be flooded.

The scheme hit a serious hurdle when the Court of Appeal ruled the process of acquiring the protected conservation land for the \$900 million irrigation scheme unlawful and ordered the Director-General of Conservation to reconsider his decision on the land swap.

That hearing took place after Forest & Bird appealed a High Court decision upholding the land swap deal.

Now the Hawke’s Bay Regional Council has joined DOC in seeking an appeal to the Supreme Court over the decision.

Forest & Bird acting chief executive Mike Kotlyar says if the land swap goes ahead it will “set a precedent for up to one million hectares of specially protected conservation land, creating the possibility that these areas can be reclassified and destroyed”.

Forest & Bird says the land that would be swapped would include mature forest that was home to threatened wildlife, including long-tailed bats and falcons.

The Court of Appeal made its decision in a 2:1 split, with Justices Rhys Harrison and Helen Winklemann in favour, while Justice Ellen France would have dismissed the Forest & Bird appeal.

The Court said the land was part of a conservation park held for recreational purposes under the Conservation Act and, under this Act, the

Director-General would have had to be convinced in his assessment that the intrinsic values of the land in question were no longer worth permanent protection.

The Appeal Court ruled that the Director-General was not entitled, as the High Court had ruled, to base his decision on a broad assessment of the merits of the proposed land swap for the conservation estate as a whole.

Its decision overturned Justice Matthew Palmer’s decision earlier this year to decline Forest & Bird’s application for judicial review on the basis that the Director-General acted lawfully by reference to “broad conservation purposes”.

The Court of Appeal said that central to the case was identifying the purpose or purposes for which the Act had conferred the powers to declare and revoke special protection.

“In the case of conservation parks, account must be taken of the purpose of special protection – to permanently maintain its intrinsic values, provide for its appreciation and recreational enjoyment by the public, and safeguard the options of future generations – as well as the emphasis on recreation which distinguishes conservation parks from other specially protected areas,” says the Court.

While the Labour and Green parties rejoiced over the decision, those in favour of the scheme see it as just another hurdle.

Hawke’s Bay’s Federated Farmers president Will Foley says: “It’s obviously a little bit disappointing to come up against another hurdle, but at this stage we’ve seen plenty of these hurdles. This is just another bit of a roadblock – but I don’t see it stopping the overall project.

“It’s just going to add delay which is what we’ve become used to.” **WNZ**

fluoridation of drinking water intended to benefit the public at large. As the judge said, it would be a significant step to extend the s 11 right beyond its application to medical treatment in a therapeutic relationship. To take such a step is not justified for three reasons: the language of the provision itself; the common law as it stood at the time the NZBORA was enacted; and the human rights values underlying s 11.

The Court also noted that if it was wrong in its conclusion that the fluoridation of water was not a medical treatment, then it considered that fluoridation was a justifiable limitation prescribed by law and recognised under s 5 of the NZBORA.<sup>5</sup>

### Regulations appeal

In terms of the Regulations appeal, two grounds were advanced: that the regulations were based on an error of law; and that the Regulations were made for an improper purpose.

In relation to the first ground, the Court found that it was unnecessary to determine whether the two compounds were medicines under the Medicines Act 1981 as the regulation making power expressly authorises the Governor General to specify that substances “are, or are not” medicines. If this occurs, then the substances are removed from the definition of medicines:

[190] ...The power to specify that substances are not medicines **exist** regardless of whether the substance would otherwise have been a medicine within the relevant definition. Whether the substance was, or

was not, a medicine as defined in the Medicine Act prior to the making of the regulations is therefore immaterial.

In relation to the second ground the Court held that there was nothing improper in passing regulations to give certainty to those using the compounds for water fluoridation that such use was legal or to protect against collateral legal challenges.<sup>6</sup> The fact that this action impaired New Health’s right of appeal was not unlawful.

### Medicines appeal

As a result of the Court’s findings on the other actions, the question of whether the two compounds were medicines under the Medicines Act was rendered moot. The Court held there was no need to make a ruling on the issue as the “Regulations has settled the controversy for the future and we see no utility in determining the issue for the period prior to 30 January 2015”.

The appellant was ordered to pay costs to the respondent for all three proceedings.

This may however, not be the end of the story, as New Health can apply for leave to appeal to the Supreme Court. Only time will tell if that is all she wrote. **WNZ**

<sup>5</sup> Refer paragraphs [108], [152] and [158], [161] and [165].

<sup>6</sup> Refer paragraph [195].

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# Call for national water asset policy

While the Local Government Act 2002 Amendment Bill is currently in select committee, other government agencies are concerned at inefficiencies in council infrastructure data and the difference between their forward budgets and what they spend. By **Alan Titchall**.

**“U**nlike the Transport Agency, which has a highly sophisticated and regulated way of doing roading business, water infrastructure provision in this country provides plenty of scope for improvement.”

This was the opening statement made by Water New Zealand Chief John Pfahlert at the 2016 Civil Contractors New Zealand Conference.

John was a guest presenter at the conference talking about the scale of investment in water infrastructure in this country and the opportunities for civil contracting. His association represents the interests of the three waters – waste, storm and drinking water – and many of its members work for local authorities.

Water New Zealand is also involved in collecting water infrastructure data from our 67 different district and city councils. This annual survey is ‘voluntary’ and the last survey only covered 41 councils (albeit the major urban ones). John says the association is hoping this year’s survey will attract over 50 council participants. This is the only survey to collect such vital information, he adds.

“Nor is there any central Government or national agency in charge of water infrastructure performance (expenditure, design and build), even though this is a ‘big ticket item’.

“The national water spend and local roading makes up, on average, about half of council expenditure each year – evenly split 50/50.”

Without a national water asset programme in place (such as we do with roading), mistakes are not uncommon, as in the failed Whanganui wastewater plant.

The association’s annual national performance review collects a host of information, some of it around expenditure and some around the performance of three waters assets (the reporting does not get down to individual project level). The results are published on the Water New Zealand website. The last survey was 2014-2015.

“The total spend between participating councils was \$2.2 billion for that year, with some large urban centres such as Auckland exhibiting big growth-related expenditure in areas such as new subdivisions,” says John, adding that New Zealand councils collect and spend considerably less than their counterparts across the ditch in Australia.

Over the next decade councils plan to increase water infrastructure budgets by over 30 percent (3.3 percent compounding increase per annum), says John.

“This totals about \$41 billion on capital works over the next 10 years. Around \$8 billion of this will be made up of new assets, and about \$13 billion will be spent on improving



Water New Zealand Chief John Pfahlert

existing assets and services. Some \$20 billion across the country will be spent on replacing existing assets as they age.”

## Discrepancies between budgets and spending

The Government is increasingly putting pressure on councils to produce 10 to 30 year infrastructure plans.

“Yet, a problem we face as a country is that only 64 percent of council budgets have been actually spent, so this is a real disconnect. The Office of the Auditor General is starting to take a considerable interest in what councils say they are going to spend in their forward documents and what is actually spent.”

The implication, he says, is that councils are collecting the budgeted money from ratepayers, but aren’t spending it or spending it on other areas. “There’s been a lot of interest from Treasury in particular on this ‘disconnect’.”

John says that an Auditor General report identified a \$7 billion difference, over the next seven years, between what councils are budgeting to spend and what they are on-track to spend.

“The AG office is starting to look more closely at individual councils and ask why this is happening and what are you doing wrong?”

One reason for budget/spend discrepancy, he says, is the number of rural councils facing a declining rate-paying stream.

“Work done by Local Government NZ as part of its three waters programme identified that about a third of councils face a declining rate-paying community – some 18 districts have been identified with declining populations. What incomes are there are also static, reducing the capacity for councils to collect rates and invest money in water renewals.”

John notes that Local Government NZ’s attempts to open a dialogue with Government about new funding streams for councils (other than rates) have been thwarted.

“The Local Government association produced a think piece last year on alternative funding to rates and it took about 30 minutes from the time this document hit the media to the Prime Minister issuing a statement effectively saying, ‘I am not having any of that, thank you very much and we don’t want to

give local government broader powers to collect revenue’.

“So there isn’t any easy answer to the question of infrastructure funding for small councils.”

Treasury, he adds, is also concerned about the fact about a third of councils might not be able to afford the cost of asset replacements.

“The penny has dropped with Treasury that it might end up being the funder of last resort for these councils.”

### Renewal guess work

Unlike roading where repairs are ‘obvious’, water assets are mostly underground, which means owners can take a ‘just in time’ approach to asset management.

“In many cases we don’t know how long these assets are going to last and a lot of infrastructure was built underground in the 1950s and 1960s. Unfortunately, 80 percent of determination wherever a water pipe fails is based on how well it was originally laid by the contractor,” says John.

### National water infrastructure policy

The NZTA, notes John, collects and reports detailed information about local roading and has a big say in asset management. “If you want the NZTA roading subsidy it’s done the NZTA way or councils pick up the full cost.

“Yet there is no consistency in how local government information is gathered, stored and analysed for water

infrastructure, and no consistent national water asset management policy.

“If you want to build a wastewater plant you can choose any design and supplier – it’s entirely a local choice. There is no requirement on how to approach asset management.”

As a result, the country has seen a number of spectacular water project failures such as Whanganui, John says.

“This council spent \$33 million of ratepayers’ money on a wastewater treatment plant that couldn’t cope. They decommissioned it and went back to drawing board [the council has given the green light to a new project that doesn’t try and combine all parts of it wastewater treatment functions in one lagoon].

“Treasury looks at these things sideways and over the past year has been developing a set of data standards with the NZTA, Water New Zealand, and MBIE (on behalf of commercial buildings) to improve the way in which councils collect, store and report on the information to do with roading, building and water assets.

“Hopefully it is going to provide us with a much better set of information and reportage.”

These new standards are expected to be rolled out from the middle of next year, he says.

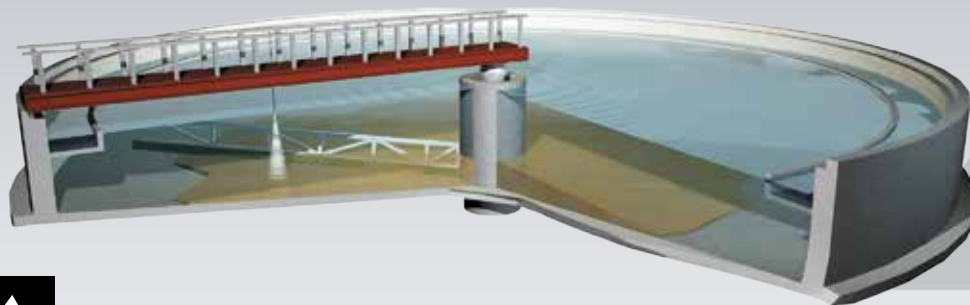
“The problem is that the central Government does not want to pull a regulatory lever, but only wants to ‘encourage’ councils to use these new standards.” **WNZ**

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# Dairy factory wastewater challenges and innovations

A précis of a paper by Jess Daly (Beca) and Bram Beuger (Fonterra), which also won a Bronze Award in the Paper of the Year Awards sponsored by Hynds at the 2017 Water New Zealand conference.

In recent years, Fonterra has expanded a number of its dairy manufacturing sites to increase the overall milk processing capacity of its operations. A new dryer was installed at Fonterra's Pahiatua site in 2015 and a new milk powder dryer is being built at the Co-operative's Lichfield site.

In order to accommodate the increased wastewater flows from the sites, new wastewater treatment plants (WWTPs) were required as part of the overall expansions.

Dairy factory wastewater has a number of characteristics that require careful management, including influent pH swings of 2-13, high fat loads and variable incoming organic and nutrient loads. Variations occur both on a seasonal and daily basis.

A number of innovations and features were incorporated into the Pahiatua and Lichfield treatment plant designs to overcome these challenges including; Use of a mixed liquor recycle to buffer pH swings; use of mechanical surface aerators with floating acoustic covers; in-pond anoxic cycling to promote denitrification; use of dynamic process modelling to assess the sensitivity of the design to peak loads and aid in the development of risk management strategies;

and beneficial irrigation of waste activated sludge on to surrounding farms.

Elements of this approach to wastewater treatment in the dairy industry could be adopted in a wider setting. For example in municipal plants treating an industrial wastewater component or municipal oxidation ponds that require upgrading to meet more stringent consent conditions.

Fonterra has traditionally used pond based activated sludge systems when implementing biological wastewater treatment.

These systems combine the engineering economy of a pond with the performance of an activated sludge plant. However, increasingly stringent discharge consent conditions, particularly in regards to nutrient loads, noise and odour and Fonterra's commitment to limiting its environmental impact, has led to improvements in the traditional treatment approach.

Challenges in dairy wastewater treatment are very much linked to the seasonality of the dairy industry. During winter there is little or no wastewater being produced by the factories for that 2-3 month period. Wastewater volumes and loads increase very rapidly at the start of the dairy season

and biological treatment systems have to be robust enough to be able to maintain enough biological activity during the winter to start treating the wastewater when the new season starts.

The wastewater contains mainly dilute milk or milk products (milk fat, protein and lactose), with significant quantities of cleaning compounds and sanitizers, including a high sodium content from the use of sodium hydroxide for cleaning. Wastewater characteristics can change through the season due to product mix, but also daily due to Clean-In-Place (CIP) and production cycles. Unplanned events in the factory can lead to very concentrated product being discharged to the wastewater stream with a very high COD load, or high nitrogen or phosphorous concentration. Conversely, during the season nutrient imbalances may occur in the biological plants, which can impact on the treatment plant performance.

The pH of the wastewater can vary greatly. Milk powder and butter plants tend to have strongly alkaline wastewater while the production of lactic acid in the wastewater from cheese, casein and whey plants makes the wastewater from these plants acidic. The wastewater pH can vary anywhere between 2 and 13 within short timeframes.

Providing a treatment system that can manage these varying conditions and provide reliable treatment to comply with consent conditions is a significant challenge. The approach to these challenges has been to include a number of treatment processes in the WWTP, the selection depending on the characteristics of the wastewater, the required effluent quality, cost and availability of land and predicted future quality standards.

## COMPLEX IRRIGATION

Irrigation is the most commonly used method to treat dairy processing wastewater in this country and involving complex treatment systems with elements of physical and biological treatment. Considerations in the irrigation design

and operation are 'volume' requiring irrigation, the nutrient content (organics, fats, nitrogen and phosphorous), pH, and metal ion and salt content.

The first step in any irrigation system is flow equalization and pH balancing. The primary purpose is to aid neutralization (where both acid and alkaline waste streams are present) and to equalize concentration fluctuations before chemical or biological treatment. Flow equalization is essential to optimize the DAF plant or an irrigation system.

Irrigation is currently used to treat wastewater directly from a site or after primary treatment (DAF). The irrigation system is operated at daily application rates between 15 and 25mm with a rotation period (start of an irrigation event to the start of the next event) of 16 to 20 days to allow conversion of the organic matter.

Soils must have good infiltration capacities. If the infiltration rate is too low then wastewater will pond on the surface of the land. If this happens wastewater can undergo anaerobic decomposition resulting in odours, acidification and damage to the plant cover. If infiltration rates are too high, then the wastewater will spend insufficient time in the top soil to receive adequate treatment and groundwater contamination may occur.

Soil moisture plays an important role in irrigation management and is one of the challenges of any wastewater irrigation system. The soil moisture on an irrigation property is related to the soil moisture characteristics (saturation capacity, field capacity and drainage), weather conditions (rainfall, wind, evapotranspiration, temperatures) and irrigation. Irrigating soils that are too wet can lead to compliance issues (ponding and run-off) and damage to the farming system. Traditionally, wastewater irrigation systems only have about four hours of storage, which means that all volume generated by the factory had to be irrigated almost immediately, resulting in a challenge to maintain a balance between irrigation and the farming operation.

The overall wastewater application is often driven by the

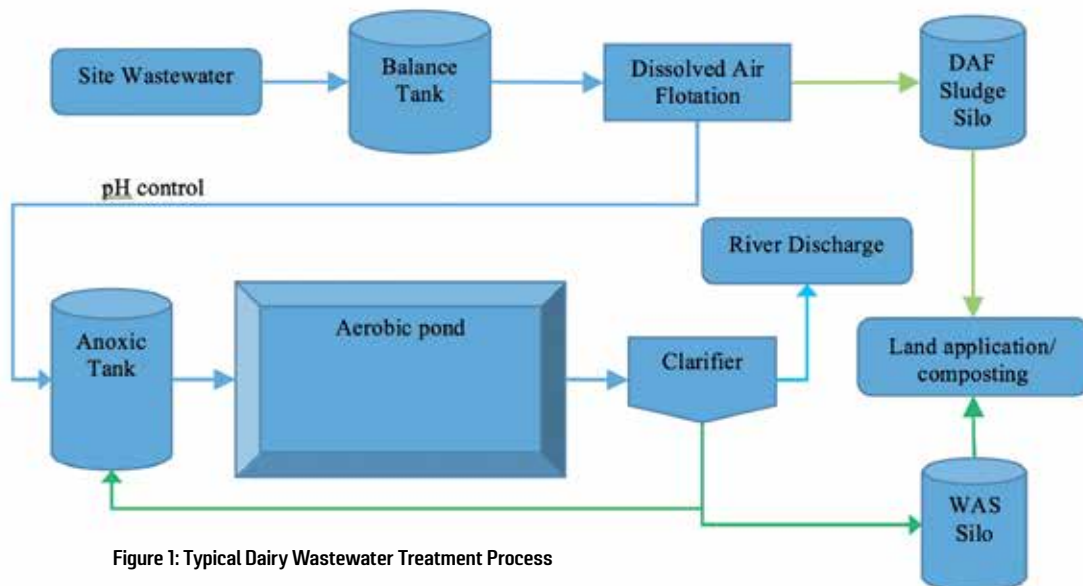


Figure 1: Typical Dairy Wastewater Treatment Process

annual nitrogen application rate. This rate is an integral part of irrigation consenting. In past years the focus has been shifting from a nitrogen loading rate (kgN/ha/y) to a nitrogen leaching rate. As leaching is difficult to measure, Overseer modelling is used to determine nutrient balances for the farms. The modelling looks at the whole farm and can make recommendations on the operation of the farming and irrigation system. Apart from nitrogen, phosphorous is becoming a major focus of any irrigation system. Achieving wastewater treatment using irrigation with a minimal impact on the environment is another significant challenge within a wastewater irrigation system.

### **BIOLOGICAL TREATMENT**

A schematic of a typical biological wastewater treatment process implemented by Fonterra is presented in Figure 1.

DAF – Dissolved Air Flotation plants have been installed at a number of dairy sites to remove fat and protein and these plants are used as a primary treatment step for WWTPs as well as for irrigation systems. The advantages of DAF are that it has a small footprint and reduces the loads to a WWTP significantly. Removal of fat before irrigation is important to prevent “sealing” of the soil surface, which can reduce infiltration. Disadvantages are high operating cost and difficulty of further treatment of the DAF sludge.

Anoxic Tank – The dairy industry tends to have nitrate rich wastewaters primarily from the cleaning chemicals used in the factory (e.g. nitric acid). For this reason, initial anoxic conditions in the form of an anoxic tank are favoured for denitrification. This often requires pH adjustment to achieve adequate denitrification rates.

Pond Based Aerobic System – A pond based aerobic activated sludge system has often been the preferred treatment process if space allows. The key advantage is that it provides a robust system that balances variable flows and loads. Typical hydraulic residence times are four to eight days, with a sludge retention time between 20 and 30 days. Clarifiers have typically been used for secondary solids separation.

Aeration System – Most aeration systems used are based on floating mechanical surface aerators. Over the years they have proven to be reliable, with low maintenance requirements and an constant oxygen transfer efficiency over time. Downsides are that they are a significant contributor to the noise budget and on windy days spray drift can cause a nuisance.



Figure 2: Floating Surface Aerator with Acoustic Cover and Motor Silencer

Either land-based treatment or biological treatment have traditionally been used exclusively. If sufficient land was available land based treatment has been the preferred treatment method. If no suitable land was available, biological treatment was implemented prior to discharge to a nearby surface water source. In more recent times, both systems have been used in combination, with biological treatment used as a contingency during wet weather when the soils are too wet to irrigate. During this time, the treated wastewater is discharged to surface water.

### **TREATMENT INNOVATIONS**

Variations of the traditional treatment approach including a number of innovations were adopted at the Pahiatua and Lichfield Fonterra sites.

Typically, Fonterra uses floating mechanical aerators for all pond-based activated sludge plants and this was the approach taken at the Lichfield WWTP.

However, the Pahiatua WWTP was required to comply with very stringent boundary noise and odour conditions and, hence, an alternative approach was adopted. The WWTP consent application was based on using submerged aeration to meet nighttime boundary noise limits of 45 dBA, which would not be possible with conventional surface aerators.

During preliminary design, the following submerged aeration systems were reviewed, including blowers and floating aeration laterals with suspended submerged diffusers, and submerged bottom mounted self-aspirating mechanical aerators.

While such systems were likely to comply with the noise limits, concerns were raised about access and maintenance, odour risk from dead zones in the pond, risk of pond liner damage and the limited track record of such systems in New Zealand.

To minimise risk, an alternative solution using mechanical surface aerators with acoustic covers, motor hoods and silencers was developed and a variation to the consent conditions granted. The addition of the acoustic cover, motor hood and silencer resulted in an 8 dBA reduction when compared with the supplier stated noise level from a standard 75 kW aerator.

The use of acoustic covers on mechanical surface aerators (Figure 2) was a first in this country and has aided in the site successfully meeting the overall noise performance requirements set out in the resource consent.

### **ANOXIC CYCLING**

Pond anoxic cycling is a technique implemented by Fonterra to promote nitrogen removal at a number of its sites with two pond systems.

During an anoxic cycle, all aerators in the primary pond are turned off to reduce dissolved oxygen (D.O.) concentrations to a level that is suitable for denitrification to occur. After a set time period, the aerators restart and operate to maintain a D.O. set-point until the next anoxic cycle is initiated. The number of anoxic cycles that take place each day is typically operator determined and may vary throughout the season.



The second pond is continuously aerated to maintain an overall positive D.O. concentration in the system.

Anoxic cycling was considered for nitrogen removal at both the Pahiatua and Lichfield WWTPs. The specific site conditions at each WWTP determined which process was selected.

The Pahiatua site had limited space available and was in close proximity to sensitive neighbours. In addition, the resource consent for the site stipulated that the treatment pond was to maintain a positive D.O. at all times. This site was therefore better suited to an anoxic tank, which has a compact footprint and is able to be retrofitted with a cover and odour treatment system in the event that odours from the site become an issue.

The Lichfield site had space available for a two pond system and was in a relatively remote location. This site was therefore better suited to an in pond anoxic cycling process, eliminating the need for a separate anoxic tank.

Careful control of the cycling is required to achieve optimal nitrogen removal and to prevent performance issues such as odour and poor settling sludge.

During the design of the Lichfield WWTP, dynamic modelling was used to predict the optimal anoxic cycle duration and overall aeration requirements for the system in order to more consistently meet the nitrate targets in the discharge. The anoxic cycle time was 'tuned' during commissioning of the plant.

Wastewater from a milk powder plant can vary between pH 2-13 with an overall bias towards more alkaline conditions. For denitrification to occur successfully, a pH range of 6-9 is typically required. To achieve ideal pH conditions in the anoxic tank for denitrification, pH balancing or neutralisation may be required. Sulfuric acid dosing to control pH was considered upstream of the Pahiatua anoxic tank. However, Fonterra was seeking to eliminate the chemical handling and associated health and safety risks as well as the capital and ongoing operational costs of an acid dosing system.

As an alternative, the anoxic tank was enlarged and the mixed liquor recycle rates increased above that required for denitrification in order to provide additional pH balancing. The increased capital and operating costs from the upsizing was offset by the savings from eliminating a sulfuric acid dosing system.

## PONDS AT LICHFIELD AND PAHIATUA

Both sites use a storage pond to store treated wastewater before irrigation to assist in the management of the irrigation systems.

During normal operation treated wastewater from the pond is irrigated onto the farms on a daily basis, subject to weather and soil conditions. During the spring and autumn the volumes of wastewater produced may exceed the volume that can be reliably irrigated on the farms. The excess treated wastewater during wet weather is stored in the pond until it can be irrigated in a drier period.

The Lichfield irrigation system consists of Fonterra owned irrigation farms as well as pod irrigation on third party farms. The development included an expansion of the irrigation on

Fonterra owned land previously used as forestry, but now converted to pasture. The irrigation system is based on a fixed sprinkler irrigation system and is split into four blocks that can be irrigated simultaneously. Each of the blocks has 34-37 zones, with four zones (up to 2.5 hectares each) are sequentially irrigated every day at a peak flow of 165 m<sup>3</sup>/hr.

The storage pond at Pahiatua is required to maintain a DO concentration of 0.5mg/L at all times. During design, the requirement for supplementary aeration and mixing within the storage pond to prevent odours and algal growth was assessed. Given the large surface area of the pond, turnover in the pond, low BOD loadings (30- 50kg BOD/ha.day) and prevalent windy conditions, the requirement for aeration and mixing in the pond was considered unnecessary. Retrofit solutions were considered as part of the design and can be implemented in the future should algae growth become a problem. To date DO concentrations in the storage pond have been at or near saturation with typical concentrations being 6-8mg/L. Nor has there been any odour problems reported.

The biological treatment of wastewater removes a large portion of nutrients before irrigation on the nearby Fonterra owned dairy farms. Therefore, fertilizer applications would be required to maintain pasture growth rates and quality on the farms. The waste biomass from the biological treatment process contains nitrogen and phosphorus that can be beneficially applied to land as a slow release fertiliser, thereby eliminating fertilizer costs and reducing costs for the transportation and composting of biomass.

## WIDER INDUSTRY APPLICATION

While dairy factory wastewater presents a number of unique challenges, parts of the approach taken to treatment could be applied to a wider industry such as municipal systems treating a trade waste component or oxidation ponds that require upgrading to meet more stringent consent conditions.

Acoustic Covers Surface aerators with acoustic covers could be adopted in municipal or industrial pond activated sludge systems that are required to meet strict noise boundary conditions.

Peak Load Management Dynamic modelling can be used to assess the sensitivity of a system to peak loading and aid in the development of management strategies. This approach is more applicable for treatment plants discharging to land where short-term excursions in effluent quality are better able to be managed than a system discharging to surface water.

In-pond Anoxic Cycling Anoxic cycling could be adopted in existing treatment processes in order to remove nitrate from the system. Careful control of the cycling would be required to achieve optimal nitrogen removal and to prevent performance issues such as odour and poor settling sludge.

Lastly, a large-scale storage pond could be implemented for systems that have limited irrigation capacity during wet weather. Treatment would be required prior to long-term storage to prevent the development of odours. **WNZ**

- View the full paper at: [www.waternz.org.nz](http://www.waternz.org.nz)

# A farmer's view on Havelock North

**Hugh Ritchie** is a cropping farmer who dutifully maintains three private irrigation bores on his Hawke's Bay farm. He is a board member of IrrigationNZ and the Foundation for Arable Research. He is also a former board member and water spokesperson for Federated Farmers of New Zealand.

The water supply contamination that recently plagued Havelock North clearly shows our towns have work to do to ensure domestic water supply is safe. While a public inquiry investigates what caused the campylobacter contamination, what we can be certain of is that it was not the result of intensive agriculture.

What we do know is that this isn't the first time Havelock North's water supply has been contaminated. A 1998 report details an earlier contamination of the same Brookvale Road wells and concludes that contamination was very likely due to the poor design of the water supply bore and insecure well head (see supplied graphics).

The head of the well is below ground level and is not adequately protected – it allows contaminated water to flow into it during flood events. The concern is we're now 18 years on and the same incident has once again occurred, this time with far greater consequences. Evidence that will be presented to the government inquiry shows the bore is now badly corroded and there are cracks in the casing.

It seems Havelock North has been caught in a perfect 'storm'. Water infrastructure that is at the end of its serviceable life (common in many New Zealand towns and cities); a dramatic weather event that has resulted in surface flooding directly into the bore – contaminating the water in the well around the pump (not the aquifer); and an extended power outage meaning the pump – meant to remove dirty flood water around the bore – failed.

This example shows we have a long way to go to ensure drinking water supply is well managed in New Zealand. The question is how many more Havelock Norths are out there?

There have been misleading and

alarmist claims by the anti-farming lobby that the aquifer itself has been contaminated by intensive agriculture. This is completely untrue and here's why.

Surrounding bores that draw from the same aquifer have been tested and show no contamination – the aquifer is not polluted.

Any Hawke's Bay resident will tell you there is no intensive livestock agriculture in the area – in fact the closest dairy farm is more than 40 kilometres away. There were however spring lambs grazing in the paddock opposite the bores.

Stock walking around a paddock doesn't cause this sort of contamination. Campylobacter from livestock does not move down through the soil to contaminate aquifers – the soil provides a natural filter. This contamination is the result of surface water directly entering the well because of inadequate infrastructure.

Quality asset management for public water supplies, wastewater and stormwater infrastructure is a huge challenge for New Zealand's towns and cities which are already facing significant cost increases. Councils' only source of

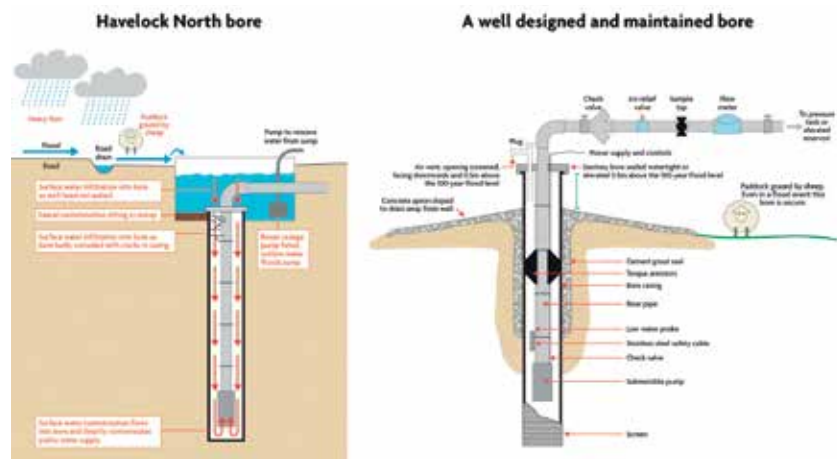
significant income is from rates. While the question must be asked as to why Havelock North's water supply bores were not adequately designed and maintained for the type of event they have recently experienced, we need to acknowledge that our district councils are struggling to fund infrastructure upgrades as more pressure results from tourism and general population growth.

Rural land users are also being challenged with significant and costly changes to way we are able to farm.

These new farm practices are aimed at limiting nutrient leaching and runoff. Regional councils up and down the country are putting in place limits and community expectations for managing water quality in their catchments.

Irrigated farms are in the spotlight and tough requirements are in place; inevitably there will be more to come. Farmers are getting on and planning for this and so too must our towns and cities because we all have a role to play.

Water quality is an emotive issue but we all want the same thing – healthy rivers and streams, safe water to drink and thriving regions. **WNZ**



*This is a personal view and not that of Water New Zealand. There is an inquiry that will determine the real cause.*

# New national drinking-water database

The new Ministry of Health (MoH) national drinking water database is expected to start flowing in mid-2017 and it is called Drinking-Water Online. By Derryn Bracey Water Engineer Beca.

Drinking-Water Online will replace the existing system, Water Information for New Zealand (WINZ), which has been around since the late 1990s and has a significant history with the industry.

WINZ was developed and maintained by the Institute of Environmental Science and Research (ESR), providing a comprehensive and complementary service for drinking-water supply management. Importantly, it includes sample management, drinking-water Standards assessment and compliance, annual reporting, supply registration, recognition of test methods, and approved laboratories.

WINZ, a mixture of desktop and online databases, is fragmented between two databases (WINZ 6 and WINZ 7) and includes further workarounds that create duplication and inefficiencies for the sector. Much of the current solution was developed prior to the 2007 changes to the Health Act. These changes introduced additional requirements in delivering against the Act's purpose. MoH recognised that the current system falls short in meeting the present and future requirements and in assisting the industry to manage supplies.

The National Drinking-Water Database project was awarded to Beca in March 2016. The objectives from the MoH included an

expectation to provide a modern, robust platform that will meet the needs of the Ministry and the sector over the next 15 years and to support the Ministry of Health and the wider industry in continuing to meet their obligations under the Health Act 1956.

The project is now well underway. Drinking-Water Online is built from the relevant functionality of the current database, and will deliver improved benefits in accessibility, usability and integration. It features web accessible features which are intended to streamline some of the existing systems used by the sector to update and access existing information. Some of the features of Drinking-Water Online include personalised, role-specific sign-on so suppliers can only access and update their own information, intuitive, user-friendly layout and structure, bulk upload capability, automatic transgression identification, and test scheduling.

Drinking-Water Online is essentially much simpler and easier to use than the existing WINZ system. It will replace what is currently three separate tools with one, reducing duplication and inconsistencies. As it's web based, it can run on most devices with internet access. Some rationalisation and right sizing has occurred - for example functionality within the current databases associated with DWSNZ 2000, the grading calculation, and template Water Safety

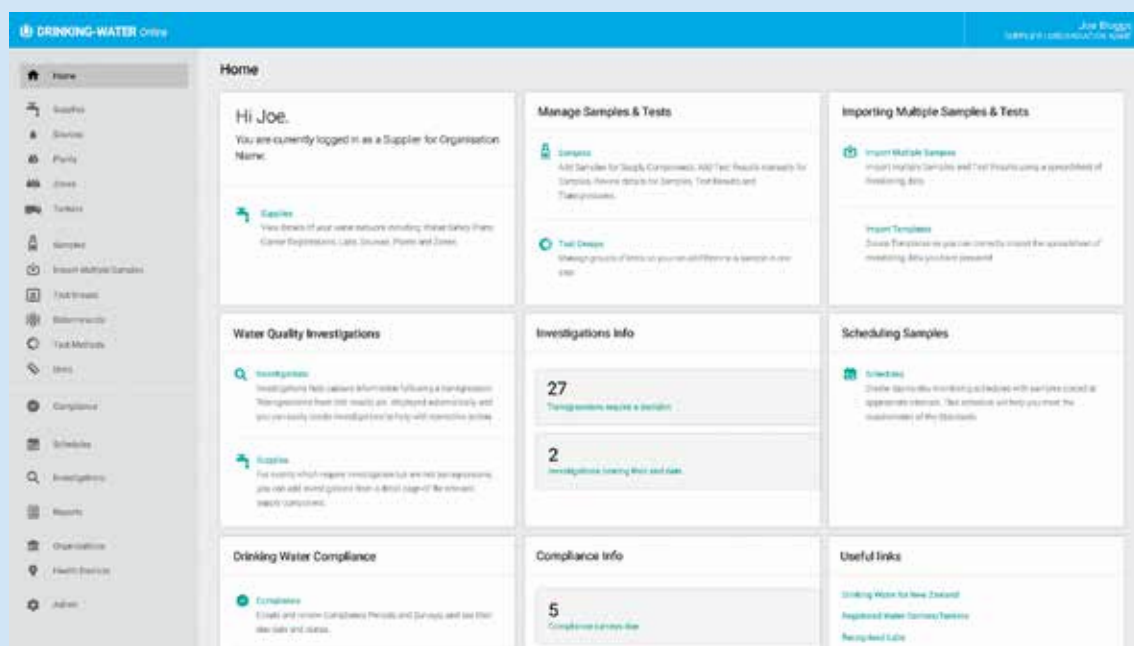
Plans are not replicated.

An Industry Advisory Group of key stakeholders has been established and are being engaged through industry testing and feedback supporting an interactive project methodology. Industry testing is taking place in November 2016. ESR Ltd are supporting the project and will continue to provide scientific and analytical support services associated with the data, information and administration of the new system. Similarly, the breadth of stakeholders engaged with the current WINZ database is not expected to significantly change.

Drinking-Water Online will be launched in 2017 with the following transition sequence:

1. The 2016/2017 Annual Report will use the existing WINZ database.
2. Between April 2017 and 1 July 2017, users will be able to access Drinking-Water Online and familiarise themselves with the database, validate supply structures, etc. No official data entry can be made at this stage.
3. 1 July 2017 - official start date for input of water supply data into Drinking-Water Online.
4. The 2017/2018 Annual Report will use the new Drinking-Water Online database.

• Updates on the project will be provided to the sector at key milestones during the project. To subscribe to these updates, please contact [winz@beca.com](mailto:winz@beca.com). **WNZ**



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SCADAPack 500E Smart RTUs or remote PACs combine the monitoring and communications capabilities of remote terminal units (RTU) with the processing power of programmable controllers (PLC/PAC). The design delivers superior functionality in one of the most compact RTU form factors on the market.

The SCADAPack 500E can perform multiple roles simultaneously. Through a simple configuration-based approach, you can conduct basic to complex telemetry processes using the same field unit. In turn, this reduces total cost of ownership to address future changes, while also improving process security and reliability at the core of the RTU.

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SCADAPack 500E Smart RTUs offer an array of flexible connectivity and programming features that reduce design and implementation time:

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- open protocols: interface to third-party SCADA infrastructure
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email [sales@nz.schneider-electric.com](mailto:sales@nz.schneider-electric.com)



# Schneider Electric's new telemetry partner

Hastings-based CR Automation – an integration specialist with an extensive track record in control and monitoring solutions for the water and wastewater industries – has become Schneider Electric's latest telemetry partner.

While CR Automation's client base is diverse – industry sectors range from Food & Beverage to timber – it has a particular expertise in the water and wastewater industries.

“Most of our work in this sector involves Councils,” says owner Peter Richards. “We've designed and installed control and monitoring equipment at a large number of facilities around the North Island.

“There's a growing movement among Councils to streamline the monitoring and control functions of their plants – treatment and pump stations, reservoirs, bore holes – and connect them via telemetry so that they can be viewed and operated remotely from central control facilities.

“Being able to monitor the plants 24/7 eliminates the need to maintain a large complement of engineers and technicians who often travel vast distances to physically inspect these plants. Remote monitoring and control is not only far more efficient but also translates into a more reliable infrastructure and improved Health Safety Security and Environment statistics.”

Though every plant has specific network requirements, CR Automation's telemetry solutions are based on a common platform: Schneider Electric's Wonderware SCADA system and a communication infrastructure comprising Radio over Ethernet.

“In most cases we are layering the new SCADA equipment over the top of the Councils' existing IT hardware,” says Peter.

“Thanks to Wonderware's user-friendly interface and the open Ethernet protocol, integration with a Council's existing servers is relatively seamless – compatibility issues are exceptionally rare.”

The radio communication system includes Schneider Electric's Trio Licensed Radio Units, interfaced to SCADAPack Remote Terminal Units (RTUs). The radios operate over licensed UHF frequencies, which provides ownership and exclusive use of data across the frequencies and ensures total data integrity.

“An advantage of the SCADAPack Smart RTUs is their use of the DNP3 (distributed network protocol) that is also natively time and date stamped,” says Peter.

“This enables a data buffering capability and prevents any data being lost if there is any loss of communication. The system continues to capture and buffer the data and then releases it when the communication link is recovered.”

## ALARMS

A key part of the new installation is the alarm facility. Says Peter; “Monitoring the levels in facilities such as reservoirs and bore wells is critical – as is the functioning of pump stations.



Previously, a dangerously low water level at a facility might remain undetected until an interruption of supply occurred or someone happened to go along and check it.

“Now, any problems are immediately conveyed to operations crews via SMS, email or app notification to their smart phones and devices.”

Because all the critical data points are logged on the SCADA system's Historian function, all events are time- and date-stamped. This, Peter adds, makes it easy for crews to review and analyse patterns in plant reliability and, if necessary, amend maintenance schedules.

“Compliance issues around drinking water standards, for example, are directly impacted by the ability to monitor facilities. The new technology – monitoring the plants in real time – makes it much easier for Council to check on reservoirs and respond far more quickly if there is a problem.”

## TELEMETRY PARTNER

Being a Schneider Electric telemetry partner, says Peter, has obvious advantages.

“For us it means having access to quality, proven equipment. This provides added credibility and gives us an edge when we're submitting tenders to new clients. They know they will be getting a reliable solution from a trusted supplier.

“For Schneider Electric, it means entrusting its technology to an integration company recognised for its expertise. We would never compromise the brand.

“Radio Telemetry is a vital component for the water and wastewater industries. It underpins the move by these industries to become cleaner, safer, more reliable and energy efficient, while remaining competitive and profitable. “The technology we're installing delivers an easy, proven solution.” **WNZ**

- For more information, contact Schneider Electric on 0800 652 999.

# Flygt Concertor trial

**Operators of a municipal wastewater pumping station in the rural town of Lomma on Sweden's south-western coast agreed to install and trial a revolutionary new wastewater pumping system in an effort to solve clogging issues at the pump station.**

As well as delivering clog-free pumping Xylem's Flygt Concertor, a state-of-the-art pumping system with integrated intelligence, significantly reduced energy consumption at the wastewater pumping station.

The operators were so impressed that they decided to purchase and permanently install the new system at the facility.

Lomma Municipality is located in the Skane region of southern Sweden. It serves over 23,000 inhabitants in three main districts including several villages and neighbouring communities. The municipality's Civil Administration Unit is working intensively to expand and improve its services as its population has steadily grown over the last five years.

It is in this context that operators of the Borgeby treatment plant agreed to trial Concertor, Flygt's new wastewater pumping system, in one of their pump stations. The main challenges were to improve plant efficiency and reduce instances of pump clogging, which typically required maintenance staff to intervene once a month.

In June 2015, Flygt Concertor was installed at Fladie Lundavagen pumping station and the system's performance was closely monitored over a period of six months. This showed that the newly installed system delivered a significant reduction in energy consumption. In addition to the energy savings, maintenance costs decreased by 1300 Euros annually.

Anders Sjostrand, Manager at Borgeby treatment plant says; "Since

installing Flygt Concertor we have seen a significant drop in our energy bill. Furthermore, maintenance call-outs have also been reduced to zero as the overall performance at the station has been greatly improved. We were so impressed with the system that we decided to replace our current system and install this new solution permanently at Fladie Lundavagen."

Furthermore, the benefits of acquiring a system that is so flexible is that in addition to the immediate positive impact of the trouble-free pumping and energy savings, operators can, for example, plan a significant reduction in their pump stock, reducing the variety of pumps needed to cover all of their applications.

"By having Concertor with three outlet dimensions, we can drastically reduce our inventory as we won't need so many varieties of pumps and impellers," says Sjostrand.

"We're confident that this can deliver savings for us, and we are looking forward to seeing how it will work in the future,"

One of Concertor's unique features is its flexibility. Not only does this new system adjust pump performance based on actual flow requirements, making selection easier and guaranteeing optimal performance under variable flow, but it is also scalable, which means that it is possible for operators to add new functionality without losing their initial investment. This makes it suitable for challenges in many different sectors, being able to improve the efficiency of stations with different characteristics.

Flygt Concertor will be available in New Zealand from early 2017. [WNZ](http://www.waternz.org.nz)





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# REDUCING METERING OWNERSHIP COSTS

While there is an intense sporting rivalry between New Zealand and Australian sporting teams, (we seem to win the important rugby games while they generally win most other codes), we share similar culture and values that were forged through the ANZAC spirit.

As such, when an Aussie company talks about some of the problems it has solved, (and reduces cost), usually we tend to take notice. And this is the case with this story.

At the 2016 Rotorua WaterNZ conference DataCol forged its own Pathway to Excellence with a trans-Tasman partner – Strongcast, a Queensland company providing solutions to the Australian Council water sector. They have some interesting experiences that we see as being relevant to our water industry, especially as the problems Aussie utilities had, could be similar to the ones facing our utilities.

One such issue is around the use of diaphragm valves, polymer ball valves and stop cocks. These have largely been surpassed by the use of full-bore ball valves, which are the only accepted means of isolating domestic meters in the vast majority of Australian utilities. However, the time taken to replace these problematic diaphragm valves had Australian Councils replacing entire base units because itemised maintenance was too difficult and time consuming. Brass ball valves offered a robust and reliable means of isolating water and had minimal maintenance issues. In addition, brass manifold meters and bases are also the only accepted means of manifold metering due to the high failure rate polymer versions present.



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Strongcast was approached by the largest Australian utility using manifold meters with the hope that these issues could be eliminated. A solution was provided using a manifold/ball valve unit. The manifold base kit not only eliminated the chance of a valve failure, but also ensured that the initial infrastructure would be extremely durable and had longevity - certain to be set in place for several meter replacements, (expected life span is 25 years, but can reach 40 years). The separation of the meter housing from the valve also introduced an itemised approach to the future maintenance of the metering unit.

In addition, the base part could be easily separated from the valve with ball valves easily replaced during live pressure (unlike diaphragms). In the unlikely event that the ball valve were to fail, it would only require itemised replacement as the base part would stay in place. This makes the repair/replacement procedure very cost effective in comparison. However, this is not the current procedure. A number of councils throw away the whole unit once the diaphragm tap fails - an appalling waste of resources and this would nearly double the costs per meter replacement if the bases are frequently replaced as well.

Ensuring a secure network is critical to the success of any metering system. When the apparent losses and actual losses can be addressed and successfully reduced, the NRW losses can be significantly advantageous for a Council's revenue. This obviously requires initial outlay, but the combination of the right pipe infrastructure and accurate metering assets empowers utilities to manage a system that is guaranteed to last significantly longer than the other assemblies available in New Zealand.

The ball valves manufactured can also be used for inline meters, so in scenarios where inline and manifold meters are equally spread throughout a Council, the valves and water meter boxes are compatible with the base unit and inline meters. This simply brings the two forms of metering so much closer together to unify the infrastructure from Council to Council.

DataCol can now offer this completely customized solution to all councils around the country; from meter boxes, valves and fittings to AMR/AMI water meter solutions, including time of use DMA meter monitoring. [WNZ](http://www.datacolgroup.com)

• More information: [www.datacolgroup.com](http://www.datacolgroup.com)



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