

water

SEPTEMBER \ OCTOBER 2015 | ISSUE 191

Water quality

Dr Jan Wright's recommendations

Smart metering the water crisis

A passion for water play

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NEW ZEALAND



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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.



It seems, however, that the effort to promote and achieve a level of standardisation is too big a mountain to climb.

The challenge of eating elephants

Brent Manning, President, Water New Zealand.

Kia Ora Koutou

I was recently at an engineering sector forum where it was stated by an engineering consultant representative that “New Zealand is an expensive place to do business”.

Why should that be?

Well for a start, each client has their own approach to procurement it seems, and tendering practices are therefore variable and perhaps more costly for those tendering than necessary.

We do have plenty of local authority clients for a country of 4.6 million people. Technical requirements and scoping standards differ, with different procurement policies applying. Some are driven by historical practice (i.e. “That’s the way we have always done it”).

Would we benefit from having common tendering processes and practices across the board?

My own view is that you probably need to allow each entity to determine their own procurement policies to reflect their situation and experience, provided that the policy is regularly reviewed and sufficiently flexible to accommodate unique opportunities if they arise.

In my own employer’s case, we have in the past year jointly procured water treatment membrane technology with a neighbouring local authority that was building a similar plant. Both councils consequently benefitted on the capital purchase price in the order of 25 percent.

What about a common set of design and construction standards?

The Water Services Managers Group tried three or four years ago to scope a project to draft common industry standards for selected construction practices. It failed for lack of both commitment and resource when it was realised how big a job it was and the level of resource such a project would involve.

There were also some challenges in deciding where to start. In my view it’s a bit like eating the elephant – one bite at a time and better to start somewhere than nowhere.

It seems however that the effort to promote and achieve a level of standardisation is too big a mountain to climb.

Later this year we are likely to see the demise of Standards New Zealand (SNZ) as an

organisation and the subsuming of their functions into the Ministry of Business, Innovation and Employment (MBIE). Water New Zealand, along with others, submitted on the changes, raising a number of concerns. These concerns on behalf of the members remain valid but the change has progressed nonetheless.

Having participated in the past as the Water New Zealand delegated representative on two Standards review committees, I appreciate the cross-industry collaboration and expertise that goes into development or revision of a New Zealand Standard. Based on my experience it was, in my view, a robust and ultimately effective process. Granted it could have been more efficient (bringing a committee of 12 to Wellington three or four times can get expensive). However, the cost of not doing anything or getting the wrong outcome is potentially far greater for New Zealand.

So there will soon be a new process for engagement on development of new Standards through MBIE. It’s less clear how revisions will be managed. No doubt we will adjust to and accommodate the changes.

Another recent backwards step has been the suspension of Waste Track as a regulatory and monitoring system for liquid wastes transported by truck (commonly referred to as ‘suckers and dumpers’). This system was a requirement for some Territorial Local Authorities and central (for them) to their responsible management of trade and hazardous wastes.

The Trade and Industrial Wastes Forum (TWIF) submitted for the retention of Waste Track and were partially successful in getting a stay of execution. Water New Zealand is working with our own Water Utilities Association to encourage the Ministry for the Environment to reconsider their earlier decision and retain Waste Track as an important industry system. We need others affected to make their views known.

The ideal opportunity to share your views, see the latest innovation and to hear about what has worked for others is coming up with our Annual Water Conference at Claudelands in Hamilton planned for September 16-18. I hope to see you there. [WZN](https://www.waternz.org.nz)

Brent Manning, Water New Zealand President.

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STILL TIME TO REGISTER

Conference Registration

Registration is still open for the Water New Zealand Annual Conference & Expo 2015 at www.waternz.org.nz. The Conference programme can be downloaded from the Conference page of the Water New Zealand website www.waternz.org.nz

Conference Theme and Highlights

A challenging and interesting programme has been put together for this year's conference with the core theme being '*Optimising our Water Value*'.

This year's conference will offer over 90 presentations covering every aspect of the water environment and its management including workshops on Earthquake Resilience; Confronting the Renewals Bow Wave – from Data Standards to Performance Standards; and the National Performance Review.

The programme will include general streams as well as specialist streams of Modelling, SWANS, Operation, and IWA.

Friday morning at 9.00am in the Claudelands Event Centre is the Water New Zealand Annual General Meeting and this will be followed by a Speakers forum held over brunch. It will run concurrently with the exhibitor visitor morning.

Networking Opportunities

Social functions throughout the conference continue to provide a prime networking opportunity. The Conference Dinner & Awards presentation again promises to be an entertaining evening.

The following Awards will be presented at the Awards Dinner on the Thursday evening:

- Hynds Paper of the Year
- CH2M Beca Young Water Professional of the Year
- ProjectMax Young Author of the Year
- Mott MacDonald Poster of the Year
- Ronald Hicks Memorial Award
- Opus Trainee of the Year
- IXOM Operations Prize

Conference Exhibition

Visitors are welcome to come along to the Claudelands Events Centre to walk through the Trade Expo. Visitors must register at the Registration desk on arrival to be issued

with a visitors pass on both Wednesday and Thursday.

The Friday morning is set aside as an exhibitor visitor morning and will be a great opportunity for exhibitor/client meetings.

Please note the times listed below when visitors will have access to the Expo area.

Access to the Expo on Wednesday and Thursday is during these times only. There will be no exceptions.

Wednesday 16 September

9.00am – 10.15am
11.00am – 12.15pm
2.00pm – 3.15pm
4.00pm – 5.15pm

Thursday 17 September

9.00am – 9.45am
10.30am – 11.45am
1.00pm – 2.15pm
3.00pm – 4.15pm

Friday 18 September

9.00am – 12.00pm

ProjectMax Welcome Reception

Wednesday 16 September from 5.30pm – 6.30pm
Exhibition Hall, Claudelands Events Centre.

Applied Instrument Group Operations Dinner

Wednesday 16 September, 7.00pm, The Ferrybank,
199 Grantham Street.

Jeff Booth Consulting Modelling Dinner

Wednesday 16 September, 7.00pm, Victoria Street Bistro.

Hawkins Infrastructure Conference Dinner & Awards Ceremony

Thursday 17 September, 7.00pm, Bluestone Steakhouse,
186 Victoria Street.

WATER NEW ZEALAND MODELLING GROUP AGM

The 2015 Annual General Meeting for the Modelling Group will be held during the Annual Conference on Wednesday 16 September at 1.30pm in the Claudelands Events Centre, Hamilton.

WATER NEW ZEALAND AGM

The 2015 Annual General Meeting will be held during the Annual Conference on Friday 18 September at 9.00am in the Claudelands Events Centre, Hamilton.

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• **PLEASE NOTE:** Some of the speakers' times may change – refer to the conference webpage closer to the event for the latest updates.

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CONFERENCE KEYNOTE SPEAKERS

RAHUI PAPA

*Chairman Waikato-Tainui Executive –
Te Arataura*

9:40am Wednesday 16 September

Te Huinga o Ngaa Wai – A Meeting of the Waters

Rahui is chairman of the Waikato-Tainui executive Te Arataura and has represented his marae in the tribal parliament since its inception in 1999. Rahui also co-chairs the Ngaati Koroki-Kahukura Tribal Trust. He has a background in broadcasting and education and currently chairs several

community organisations from Kohanga Reo to Tribal and Community Trusts and sits on Iwi-Government governance groups.

Rahui has been a director and member on various tribal, local and national organisations, mainly focusing on the wellbeing and development of Waikato-Tainui and Maori in general. He is pou tikanga for tertiary and corporate groups within the Waikato.



LUCIA CADE

*Chair – Western
Water Victoria,
Australia*

9:00am Thursday

17 September

Rethinking Water Infrastructure: How Do We Plan, Fund and Deliver

Lucia has extensive experience in the utility, infrastructure and construction industries in Australia, New Zealand and South East Asia as an executive and an advisor, specialising in business strategy, organisational change, strategic stakeholder engagement, incentivised procurement models and major projects.

She is chairman of Western Water, a government-owned water utility in Victoria. She is an advisor member of Goulburn Murray Water's Connections Committee which oversees the investment of the \$2 billion food bowl irrigation infrastructure upgrade in central Victoria. Lucia is a past president of the Australian Water Association, was a director of that organisation for seven years and was previously a director of Western Water for five years.

Lucia's executive experience includes roles with AECOM, Evans & Peck, Comdain Infrastructure, City West Water and Melbourne Water. She holds Bachelor degrees in engineering and economics, a Masters of Engineering Science and an MBA. She is a fellow of the Australian Institute of Company Directors and of Engineers Australia.



Tahu interests in freshwater management are protected and as a result, is actively participating in the Freshwater Iwi Advisors Group.

Prior to this role, Donna led the Waikato-Tainui team that provided technical and administrative support to the co-negotiators for the Waikato River Claim, and subsequent settlement with the Crown. To see the realisation of the Waikato River Settlement in 2008 (and subsequent review in 2009) was a personal aspiration for Donna.

JULIAN WILLIAMS

11:00am Wednesday
16 September

POLICY

Iwi Rights and Interests in Water – Parts 1 & 2

Julian joined Waikato Tainui's Environment Unit in 2003 after graduating with a Bachelor of Social Science majoring in Resource Environment Planning and Geography. He previously worked for Fonterra and Waahi Whaanui Trust.

As strategy manager, in recent years he has been developing strategic relationships at local, regional and national levels, and he continues to be the tribe's leading technical advisor on freshwater, resource management and national policy forums.

Julian's core responsibilities are to:

- Lead and oversee the development and ongoing work of the trust, in particular, to pursue the restoration and protection of the health and wellbeing of the Waikato River;
- Execute legislative requirements of the Waikato River Settlement, and translate the legislation into tactical programmes;
- Ensure that Waikato-Tainui works in a coordinated way with other tribal groups and sector stakeholders across regulatory and investment areas; and
- Provide specialist advice to support the resolution of outstanding Waikato-Tainui claims and related interests.



INVITED SPEAKERS

DONNA FLAVELL

11:00am Wednesday
16 September

POLICY

Iwi Rights and Interests in Water – Parts 1 & 2

Donna Flavell is the general manager of Strategy and Influence, at Te Rūnanga o Ngāi Tahu, currently on secondment from Waikato-Tainui. She holds key responsibilities for external relations, claims protection and engagement with central government across a range of portfolios.

Donna is also involved in ensuring Ngāi



LOKESH PADHYE

11:00am Wednesday
16 September

IWA/SCIENCE

Emerging Contaminants in New Zealand's Aquatic Environment

Dr Lokesh Padhye obtained his Master's and Doctorate in environmental engineering from Georgia Institute of Technology in the United States. He then worked as an environmental



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engineer at Geosyntec Consultants in Atlanta for three years before entering an academic career. During his tenure as a post-graduate student and as an academic staff member, he has won numerous awards including the 'Young Faculty Award' from Indian Institute of Technology, 'Outstanding PhD Candidate' award from Georgia Tech, 'Graduate Student Award' from the American Chemical Society, and an academic scholarship and a fellowship. He has been working in the field of emerging environmental contaminant research for the past 15 years and has published numerous research articles and book chapters.

RICHARD WARD

11:00am Wednesday

16 September

POLICY

The 2015 National Infrastructure Plan

Richard has led the work on the New Zealand Infrastructure Plan since 2011. Initially focused on working with agencies and stakeholders to implement the 2011 Plan, this flowed into the development of the new Thirty Year New Zealand Infrastructure Plan published last month. Based in Wellington, Richard has particular focus within the Plan on the three waters and energy sectors and particular projects on: Alternative sources of funding, Integrated long-term regional planning and coordination, and the Ten-year Capital Intentions Plan. Prior to the National Infrastructure Unit, Richard managed teams across a number of strategic and operational roles in the education and justice sectors. Areas he worked on included Pasifika education, developing and implementing the new regulatory framework for early childhood education and modernising the Court collections and civil enforcement systems. Richard originally did a LLB/BA and started his career in the insurance industry before moving into government where he completed a Masters of Public Management.



MICHAEL WOOLSTON

2:00pm Wednesday

16 September

POLICY

Infrastructure Funding

Michael Woolston leads Frontier Economics' water practice in Australia. Michael is an economist with particular expertise in microeconomic and regulatory reform, specialising in the water and wastewater sector. Michael has led a number of major policy studies in areas including water entitlements and markets, water pricing, institutional and regulatory arrangements, and resource management issues. Michael has advised key Commonwealth Government bodies including the National Water Commission, the Australian Competition and Consumer Commission and the Murray Darling Basin Commission, State Governments, regulators, water businesses and industry bodies such as the Water Services Association of Australia, and financial institutions. Frontier Economics has been interested in New Zealand water reform since 2006, when it developed a best practice scorecard for water reform for Meridian Energy, which it updated in 2014.



ELDON TATE

2:00pm Wednesday

16 September

IWA/SCIENCE

Photocatalytic Oxidation for Water Purification

Eldon Tate is a final year PhD student studying chemistry at Victoria University of Wellington, under the supervision of Professor Jim Johnston. His research is concerned with the development, characterisation and commercial potential of novel antimicrobial and photocatalytic coatings for antifouling and water purification applications. He has presented the science at three international conferences and has five publications in the area. He was awarded the 2014 AMP National scholarship.



PAUL CHADWICK

2:30pm Wednesday

16 September

POLICY

Transformation Across the Water Sector

Paul is a qualified civil engineer by background with 30 years' experience in the water and wastewater sector. He leads Mott MacDonald's water sector work in the fields of asset management, regulation and water resources. He is currently responsible for teams working on asset management, water resources, asset reliability, asset information and investment planning projects incorporating risk and uncertainty for UK and international water companies.

He supports water companies and organisations from other sectors through asset management capability gap analyses and benchmarking of best practice and implementing projects to deliver capability and performance improvements. He also advises Ofwat and other regulators on a range of issues. In the water sector he is an acknowledged expert in the field of capital maintenance and his recent work has focused on developing business processes to incorporate forward-looking risk principles into day-to-day operations and decision-making. Increasingly, his asset management expertise is being sought and applied in other sectors.



MARTYN COLE

4:30pm Wednesday

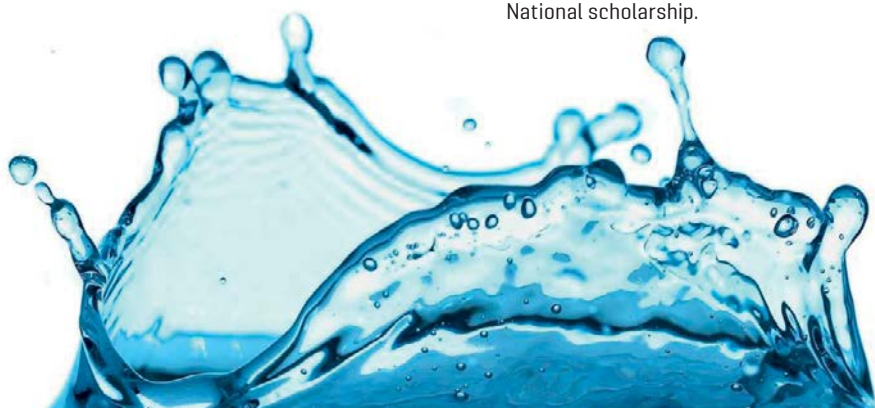
16 September

POLICY

Metering and Beyond – Lessons from Metering and the Next Steps for the Future

Martyn is a Chartered Engineer with Engineers Ireland and has over 21 years' experience planning and delivering projects in the water industry including nine years spent overseas in Ireland and the UK.

He is passionate about making a real difference for the community he serves by continuously delivering value and increasing the confidence in and communication of the decision making processes. Martyn is the Water and Wastewater asset manager for Kapiti Coast District Council responsible for the planning and delivery of asset management and long term strategic goals for water and wastewater services in Kapiti.



HELMUT MODLIK

5:00pm Wednesday 16 September
POLICY

A New Training Landscape

Helmut Modlik is the inaugural chief executive of Connexis – the Infrastructure ITO created out of the October 2013 merger of InfraTrain (civil construction ITO) and ESITO (electrical supply ITO).

His prior experience spans a range of senior management and consulting positions, including chief executive of TTS (education sector systems integrator), ASPX (cloud computing service provider), Poutama Trust (New Zealand's only pan-Maori economic development agency) as well as numerous private and public sector directorships including the New Zealand government's drug purchasing agency, a Maori tertiary institution, a Ministerial advisory committee, and a nationwide aquaculture joint venture and management consultancy.

Helmut has a particular interest in strategy and change management, and deep experience in new venture planning and business performance improvement. He is also personally committed to Maori social and economic development.

Helmut holds a Bachelor of Commerce and Administration (1989) and Master of Business Administration (1993) from Victoria University, Wellington.



HELEN ATKINS

10:30am Thursday 17 September
POLICY

Ruataniwha and the Legal Landscape

Helen Atkins is one of the founding partners of the boutique environment and public law firm, Atkins Holm Majurey. Helen 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 including in relation to all aspects of water management.

Helen was previously a long serving member of the Resource Management Law Association National Committee and was its president from 2009 to 2011. She is currently a member of the Hazardous Substances and New Organisms Committee of the Environmental Protection Authority (ERMA) having previously served as a Board member of the Environmental Risk Management Authority (ERMA) before it became the EPA. Helen is in her second year as a co-opted member of the Water New Zealand Board.



MATHEW TELFER

11:00am Thursday 17 September
POLICY

Customer Service – What Does it Mean?

Mathew has worked in the water industry for 10 years with a focus on delivering excellent customer service to water and wastewater customers across the Auckland Region.

Mathew played a key role in the largest company amalgamation in New Zealand with the integration of six existing retail water entities (including Metrowater, Manukau Water and Ecowater) into the previously wholesale water company (Watercare) as part of the Auckland 'supercity' amalgamation. His key focus was to deliver a seamless integration of retail functions including customer service and billing for Watercare's 430,000 customers.

Since amalgamation, Mathew has contributed to key projects including monthly billing for 430,000 customer accounts and implementing an Auckland-wide domestic and non-domestic wastewater tariff regime (previously 44 different tariffs across Auckland).

Mathew will share the transformation that Watercare customers experienced over the past five years, and the vision Watercare has for delivering on the moments that matter to customers in the future.



HAYDN READ

11:30am Thursday 17 September
POLICY

The Metadata Project

Haydn has nearly 20 years' international experience in manufacturing and operations management, predominantly as a senior executive in the steel industry. He returned to New Zealand in 2007 to manage assets and operations as director of Works & Services at Whakatane District Council. In 2012, he moved to Wellington City Council where he manages the strategic asset management planning and investment forecasting functions across its \$6.5 billion portfolio. Haydn has a Master's of Science from Auckland University, an MBA in International Business and Finance, and is currently working on a PhD at Victoria University School of Government. The working title of his thesis is "Decision-making in Local Government – what influences decisions in large capital investments?"



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Plan identifies \$15b water spend

The recently released 30 Year New Zealand Infrastructure Plan has identified significant expenditure in the 'three waters' sector over the next decade including 1167 projects totting up to more than \$15 billion.

It says a key challenge is ensuring adequate investment in three waters infrastructure for regions experiencing high levels of growth.

A dramatic improvement in the quantity of information available is a significant step forward and has reinforced the need for a common set of data standards. It says that complying with regulatory standards is a significant issue and notes that 45 percent of potable and waste water networks are categorised as "ungraded".

The document highlights the contribution of irrigation to economic growth – in 2011/12 it contributed \$4.8 billion to GDP – while outlining uncertainties facing farmers who need to balance the intensification inherent in irrigation systems with the need to reduce nutrient run-off.

The plan was welcomed by Water New Zealand with CEO John Pfahlert saying that: "it is very encouraging to see that Central Government is facing the infrastructure challenges head on with an increased focus on developing a better understanding of water-related infrastructure assets."

Standardising and centralising the management of some of New Zealand's three water infrastructure assets is essential if we are to maximise existing assets and ensure new water infrastructure is built effectively and for the benefit of all users, he said.

"As part of this, Water New Zealand's recommendation to establish shared metadata standards for the country's \$45 billion of existing three waters pipelines has been recognised.

"This will ensure we have a consistent information base across the councils for assessing the condition of pipes and will ensure greater consistency in the collection and reporting of the condition of these pipes. This is important for calculating the level of expenditure by councils and allowing comparisons between councils," said Pfahlert.

The plan also signals a positive response to Water New Zealand's proposal for the development of a set of National Rainfall and Runoff Standards to improve hydraulic modelling by councils.


"The Standards we put forward are designed to be used by council staff and engineers in the private sector and will ultimately improve the resilience of both urban and rural infrastructure, reduce insurance claims and reduce the risks from flood damage," he said.



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'DRINKABLE' BOOK FOR A THIRSTY WORLD

A "drinkable" book whose pages can be torn out to filter drinking water has already proved effective in early field trials – the results of which were presented at a recent American Chemical Society conference in the United States.

As well as serving a more book-like function – as an instruction manual for how and why to clean drinking water – the book's pages contain nanoparticles of silver or copper, which kill bacteria in the water as it passes through. The technology was developed by Teri Dankovich, a post-doctoral researcher at Carnegie Mellon University in Pittsburgh. So far, Dankovich has made each page by hand in a church kitchen, with the goal to create a pilot paper-making plant.

Long term, the aim is to transform the lives of millions of people in developing countries who don't have access to clean water.

HEALTHY RIVERS – HEALTHY ECONOMIES

The significant contribution that healthy rivers make to our economies and wellbeing will be the focus of the 2015 International Riversymposium being held in Brisbane from September 21 – 24.

"Healthy Rivers – Healthy Economies" offers an opportunity to engage with the multitude of businesses and organisations who contribute to and benefit from the wise management of rivers and their catchments. Water has risen high on the business agenda and a decline in freshwater quality and quantity was judged the greatest risk facing the globe at the 2015 World Economic Forum.

The 2015 Riversymposium will connect businesses who rely on rivers and catchments with community representatives, scientists, policy makers and river professionals to jointly explore the links between river health and economic performance in different contexts globally.

More information at riversymposium.com



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RIVERPRIZE FINALISTS ANNOUNCED

The quality of river restoration project work has been recognised with the International River Foundation's announcement of four finalists for the first Morgan Foundation New Zealand Riverprize.

These are:

- Aorere River – a farmer-led catchment project in Tasman in which New Zealand Landcare played a key coordination role;
- Lake Taupo – a partnership between central and local government bodies with local iwi to protect the quality of waters in New Zealand's largest lake;
- Manawatu River – after hitting the headlines for all the wrong reasons in 2010 has since become a beacon for all the challenges facing freshwater quality throughout New Zealand and the focus of the Manawatu River Leaders' Accord; and
- Project Twin Streams – a large-scale environmental restoration project to restore water quality in streams throughout the Huruwhiri and Henderson Creek catchments in Auckland's Waitakere region.

"The finalists are exceptional," according to Gayle Wood, chair of the New Zealand Riverprize Judging Panel and

former winner of the Thiess International Riverprize.

"They demonstrate the best that New Zealand has to offer in integrated river basin management. While protecting the country's rivers and lakes, the finalists all approach their work in unique ways – some are community led partnerships and others are coordinated by the government. New Zealand should be very proud of this environmental work which ranks among the best in the world."

The winner of the inaugural New Zealand Riverprize will receive a \$20,000 cash prize and will also have a shot at being named the winner of the prestigious Thiess International Riverprize in 2016.

The four finalists will present their achievements at the International Riversymposium in Brisbane in September, with the winner to be announced in front of an international audience of river practitioners at the Riverprize Gala Dinner on Tuesday September 22.

The Morgan Foundation NZ River prize is an initiative of the International River Foundation which also awards the Australian, European and North American River Prize as well as the Thiess International River Prize for achieving the best outcomes in river and basin management.



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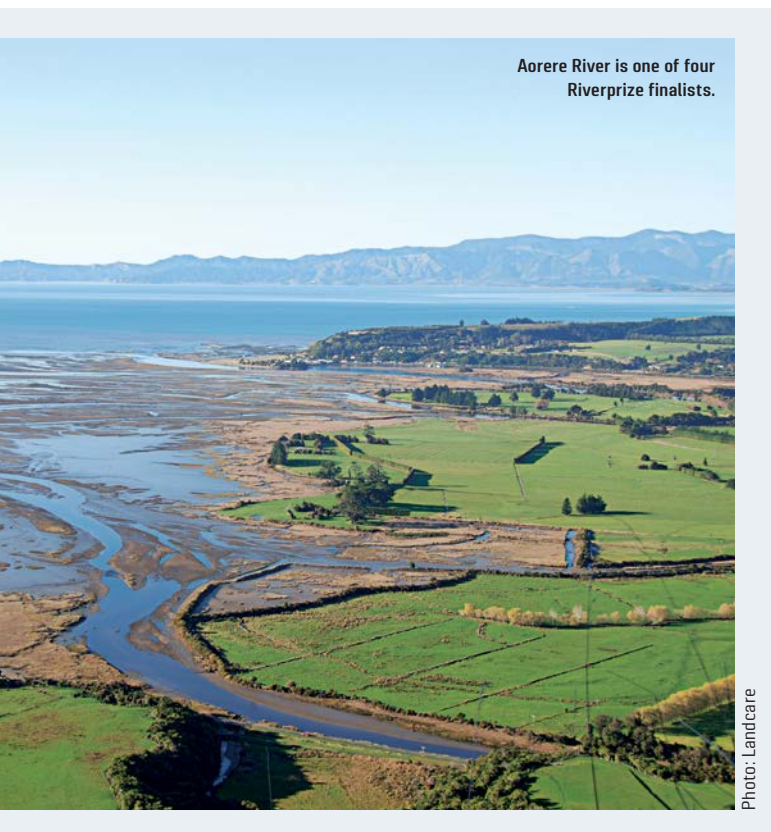
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Aorere River is one of four Riverprize finalists.

Photo: Landcare

COMMUNITIES CELEBRATE WATER GRANTS

Seddon and Whatutu are two communities celebrating the approval of Government grants to upgrade their drinking water supplies.

Seddon residents have received \$1 million that will go towards a \$3 million water filtration plant in the town. The Marlborough community's water supply has previously gone untreated and flooding has caused issues with the water quality since the 1940s. Concerns that residents were suffering health consequences following the failure of an existing chlorination plant to cope with floodwaters, the Awarere Seddon Water Group was formed to lobby for action and were last month welcoming a funding boost that will ensure the project can go ahead.

Marlborough District Council is now seeking tenders for the design and build process with construction expected to start in July next year.

Residents in the small East Coast settlement of Whatutu (inland from Tolaga Bay) are also looking forward to a healthier water supply after gaining a \$386,000 subsidy that will give them access to a treated water supply. Its current supply doesn't meet NZ Drinking Water Standards. It's expected to be up and running by mid next year.

The grants are part of a \$10 million funding programme which aims to help smaller communities establish or upgrade drinking water supplies.

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BOOK REVIEW

Squandered – The Degradation of New Zealand’s Freshwaters

Dr Mike Joy

An on-going failure to factor the value of eco-system services into our national accounts has led to a situation where New Zealand is squandering its natural capital and compromising future generations.

That’s the message Dr Mike Joy delivers in his newly released eBook, *Squandered: the degradation of New Zealand’s freshwaters*. In it, the senior lecturer in ecology and environmental science at Massey University issues a strongly worded warning that present economic policies are driving this country’s “pristine” image down the drain.

“For many, the idyllic remaining protected places are rarely if ever seen except on a screen...”

The reality, he says, is that most New Zealanders live around lowland rivers, lakes, estuaries and harbours that are “now degraded and mostly unusable for food gathering or recreation”.

He lays the blame at the feet of an economic environment which favours a deregulated approach to land use and on government departments that make decisions based mainly on calculations of growth, employment and return on investments while ignoring the “largely unquantified negative externalities”.

Those “externalities” include the impact of increased nutrients (eg nitrogen, phosphate) on freshwater ecology and on water quality as well as biodiversity loss and negative impacts on both environmental and human health.

As Mike Joy details in the first section of a short and readily accessible publication, the economic value of eco-system services such as wetlands were initially poorly understood – and then ignored in favour of “more productive” land uses such as agriculture. The result has been a massive loss of such services.

Manawatu, for instance, has lost nearly 99 percent of its pre-settlement wetlands. That represents not just the loss of habitat for fish and birds, says Joy, but “the loss of an incredibly productive ecosystem to be replaced by one of much lower productivity”.

Because wetlands are the “kidneys” of waterways, their value as filters, bio-accumulators and flood energy dissipaters is almost immeasurable, Dr Joy says. For Maori, wetlands functioned as the larder and were vital to existence. And he notes that if the cultural, aesthetic and recreational values of this loss are not convincing enough, then the economic argument should be.

“For example, the Manawatu wetlands that were destroyed in 200 years have been valued at more than \$40,000 per hectare per year...

“This is their monetary value if you were to replace the services existing wetlands give through services like nutrient stripping, mitigating flood impacts, water storage and much more. As a stark comparison, the best you could expect from a dairy farm would be \$3000 per hectare per year.”

Intact healthy ecosystems are national assets that, he says, “we have been stripping for a long time”. Around 70 percent of

native vegetation has gone and healthy freshwater systems have been stripped through wetland removal, pollution with nutrients, sediments and pathogens, removal of water from rivers, use of waterways as dumping grounds and the physical impacts of damming and stop-banking.

Agricultural intensification over the past three decades has hastened waterway pollution and using the Rotorua Lakes clean up project as an example, Dr Joy says the cost of removing pollutants such as nitrogen from waterways far exceeds the potential revenue lost by just not using it in the first place.

In short, Dr Joy reckons central government has got its accounting systems all askew because it doesn’t factor in either environmental degradation or the loss of ecosystem services.

“Incongruously, the value of services we derive from nature is considered to be zero by Treasury economists even though studies have shown it to massively exceed the gross domestic product of all countries.”

While he admits that changing our current land use directions won’t be easy, he says that if we want to protect the added value component of our clean, green image, then we have to make some immediate changes. These include putting a cost on pollution – or premium on not polluting as well as an immediate move away from fossil fertiliser and from imported fertiliser and feed.

Reviewed by Vicki Jayne.

• *Mike Joy is a Senior Lecturer in Ecology and Environmental Science at Massey University’s Ecology group. He researches and teaches freshwater ecology, especially freshwater fish ecology and distribution, ecological modelling bioassessment and environmental science. Squandered can be downloaded from <https://freshwaternz.files.wordpress.com/2015/05/squandered.pdf>*



INNOVATIVE PLANT WINS AWARD

An upgrade of Tokomaru's Water Treatment Plant has won the national "Infrastructure Project of the Year" award for Horowhenua's District Council.

Described as outstanding and innovative, the water treatment plant upgrade resolved a major challenge for the Council in providing a quality water supply to Tokomaru residents. Water from the plant had been assessed as carrying an unacceptable level of health risk and, from 2009 to 2014, residents were advised to boil water. With the project costs originally estimated at between \$2 and \$3 million, the community faced a 10-year wait for the upgrade.

However, Council staff continued to investigate solutions that would enable them to bring forward the upgrade to ensure the plant was fully compliant with Drinking Water Standards. While several potential schemes were investigated and found unsuitable – or unaffordable – the Council eventually identified a possible innovative treatment and engaged the Wellington-based Filtec water and wastewater treatment specialists to install a pilot plant.

Following a successful four-month trial, the Council, working with water purification system providers h2ope and Council contractor Downer, agreed to press ahead with the scheme

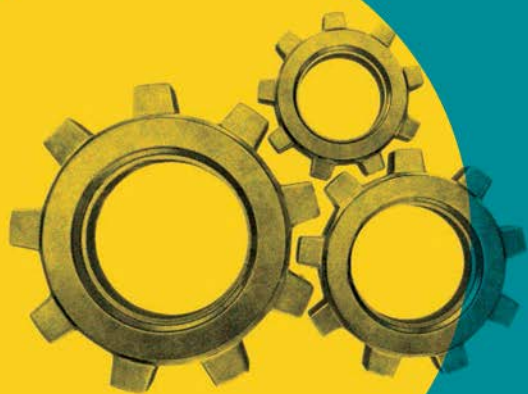
which involves the water being treated using chlorine disinfection, coarse sand filter, carbon filters, cartridge filtration and UV disinfection.

Installation was completed just 102 days after Council approval with the compact full-scale treatment plant installed in a shipping container. The project cost only \$350,000, funded from existing capital budgets for water treatment plant upgrades in Council's 2014/15 Annual Plan. That meant there was no impact on rates.

The award was presented at the Local Government New Zealand (LGNZ) Excellence Awards in July, where LGNZ president Lawrence Yule described it as, "an excellent example of a council thinking innovatively, responding to community concerns and finding a solution was both affordable, on time and met community and Ministry of Health expectations".

Horowhenua District Mayor Brendan Duffy says he is proud of Council winning such a prestigious award, having already achieved a fantastic outcome of providing a quality water supply – and said the Council really is 'going from good to great'.

Highly commended in the Infrastructure Project of the Year category were Napier City Council's Filter Waste Water project, and Western Bay of Plenty District Council's WestLink collaborative road maintenance strategy.



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A passion for **WATER PLAY**





Bronwyn Rhynd is a stormwater specialist whose pragmatic and often playful designs create a link between natural and built environments.

She talks to **Vicki Jayne** about her passion for water play.

Good stormwater design is a given for Bronwyn Rhynd – but her eyes really light up when she talks about playful ways to create visual cues that clearly link natural waterflow into built environments.

One example involves watering cans set up to catch gutter run-off at an East Auckland school and then transfer the water onto nearby tree plantings before it is diverted to a tank that now feeds the school's thriving gardens. This particular project earned her a bowl of vege soup produced from those gardens when it was opened with a formal blessing.

"That," says Rhynd, "was very heart warming."

It also sits well with a practical nature that drives her passion to create win-win solutions for dealing with the inevitable intensification of stormwater run-off in an urbanised environment. That her speciality has been lifted from design, after thought to the planning front end of urban projects such as Auckland's new "special housing" areas, opens a much wider range of possibilities.

While there are times when the flows need to be piped underground, she would rather try to "mimic" the sort of solutions nature already offers – creating raingardens to help absorb the flows, and "swales" (vegetated drainage depressions) to help direct it. Both not only slow run-off but help improve its quality – and a keen awareness of impacts on the "receiving environment" (streams, rivers, sea) of stormwater flow is very much part of the process.

Appreciation of Rhynd's design solutions is certainly not limited to soup.

In 2012, her work on the upgrade of Parnell's Judge's Bay earned Rhynd the prestigious IPENZ Arthur Mead award for "the application of environmental awareness to the solution of an engineering project".

Water quality, both for an all-tides swimming destination and for the on-going ecological values of the bay, was a key driver for the project which involved diverting piped stormwater through raingardens and "daylighting" a natural stream course via constructed swales.

The result is a happy blend of visual appeal and practical outcome. The park adjoining the bay now sports some good-looking gardens and "people are back swimming in the bay," notes Rhynd.

While justifiably proud of such "flagship" projects as this and the Addison residential development in South Auckland, she has to be prompted to admit to other professional acknowledgements of her stormwater design solutions. Yes, she owns, her work is included in 'best practice' presentations

to environmental management students studying stormwater solutions at Auckland University.

Shining examples of how best to do it?

"Well, hopefully," she laughs.

Born and raised in a small Northland town, Rhynd grew up in an environment where nature ruled. Halfway between Whangarei and Dargaville, Tangiteroria boasts only the basics of urban life – primary school, service station, marae, pub, community centre – but is sited on the northern Wairoa River.

Floods, recalls Rhynd, were a fairly common experience.

"There were times I had to walk to school because we couldn't get down the driveway. It's all part of living by a river."

It may, she agrees, have influenced her later choice of career but says she was mainly attracted by the flexibility of thinking she could apply to water resource solutions.

"When I was doing my bachelor of engineering, that area really appealed because it offers more of a lateral thinking solution than, say, roading or construction. There are so many different ways to deal with water."

After graduating with a Bachelor of Engineering (Civil) in 1999, Rhynd worked for environmental consultancy Pattle Delamore Partners for three years before starting her own business, Stormwater Solutions, and later completing a Masters degree in her chosen speciality.

Now she's made another major career move – amalgamating her business with CKL, a fully integrated engineering land development consultancy with offices in Auckland, Hamilton and Te Awamutu. She says the two companies have already worked on projects together and the merger decision kind of flowed from the synergies the two organisations enjoyed.

"The cultures are similar. We both take a very grassroots approach in terms of ensuring that clients are very well informed. The values of the two companies are similar in terms of taking a very collaborative approach to projects. Both have an equally strong focus on environmental values and on outcomes that build resilience."

It also enables her to add both scope and scale to her business.

"A lot of my clients were wanting more than we could manage – so we can now offer other suites of expertise and experience."

The ability to collaborate across disciplines will

make it a lot easier to get projects fulfilled – as well as allowing her to see every bit of the project jigsaw, says Rhynd.

She rates lateral thinking as one of the strengths she brings to the job and it helps her to work across disciplines.

“For example, you could be working with structural specialists on green roof or green wall projects – where you are trying to integrate water harvesting into structural elements like apartment buildings. Or with roading specialists – where there are various treatment devices for handling the run-off and reducing the contaminants. So I have a finger in a lot of pies. Every project is different.”

The good news is that stormwater management is now seen as a vital aspect of infrastructure development – which means that her expertise is engaged more at the front end of the urban design process.

“So with all Auckland’s special housing areas (there are six projects on our books at present ranging from 100 lots to 800 lots), we are involved at the early planning stages working with archaeologists, ecologists, urban planners, traffic designers, owners, project managers. Often we are part of the integral decision-making on what the scheme plan looks like.”

This shift up the design pecking order is both pragmatic and aspirational. Creating new built up areas inevitably increases stormwater flow – and climate change will only exacerbate that. It’s not only a lot easier to design that reality in upfront rather than to retrofit stormwater solutions – it also opens up some visually appealing possibilities.

“I think the [construction] industry is growing to understand you can do a lot more with [stormwater] than put it in a pipe. So the new buzz words are around ‘water-sensitive’ urban design and ‘low-impact’ design.

“The good thing is that these things can be used not just as a design tool but as a marketing tool. It gives a point of difference,” says Rhynd. She points out that there are often good reasons why some areas come late to development in that they tend to be on more marginal, often low-lying land. But you can design around that reality.

“With the Addison development in Takanini which was an

old kauri swamp area, we went in and designed a low-impact stormwater system for the whole of that 14ha site based on a series of small catchments. Each of these has a raingarden and swale – so we do treatment and conveyance and overland flow and deal with it locally.

“That also makes the streetscape very different – the streets are very green and the rain gardens mimic the sort of wetlands you might see in a kauri swamp.”

In her ideal urban design world, there would be stronger focus on stormwater harvesting.

“It’s such a precious commodity and I like being able to harvest it because it connects the natural environment with the built environment. That also sums up where we sit – providing a link between the natural and built environments. You can’t stop it raining but you can actually connect it to whatever you want it to be.”

She’d like to see a lot more education around better use and practical dispersal of stormwater. While rainwater tanks are now included in new housing areas, their use is not well understood. The same applies to overflow easements and there is often a lack of communication between the rationale for stormwater design parameters and the end users.

“All the new special housing areas will have some water-sensitive element – from tanks to raingardens so we write operational maintenance plans for these elements because the people who live there will need to know what these things are for.”

In Rhynd’s ideal world, every urban dweller would be connected in some way with their natural environment – and it could be a playful experience. For one inner city design project, she envisaged a sort of interactive space where the flow from an existing water fall could be manually pumped to a series of gardens and a waterwheel built to power lights.

“You can see the connections – have fun with it, make a piece of visual art,” she grins.

It’s fairly obvious that Bronwyn Rhynd is not just passionate about her job but about designing clever ways to make best use of our precious water resources. **WNZ**



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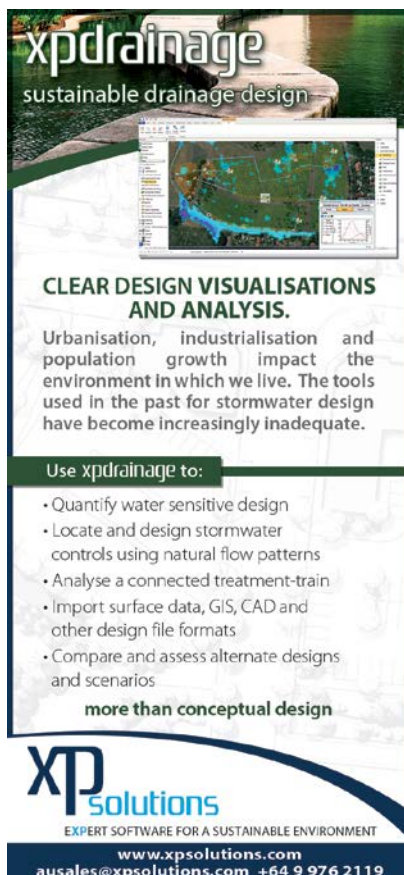
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Water quality

the need to be aspirational



Flaws in current Government policy for managing New Zealand freshwater quality need to be addressed, says **Dr Jan Wright**, the Parliamentary Commissioner for the Environment.



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When I became Commissioner, I knew little about water quality. I also knew that I would not be alone in this. This motivated my first report on the subject *Water quality in New Zealand: understanding the science* in 2012. It was focused on the three water pollutants of greatest concern – pathogens, sediment, and nutrients (nitrogen and phosphorus).

In 2013 I published a second report, *Water quality in New Zealand: Land use and nutrient pollution*, which examined the relationship between changes in land use and nutrient pollution. I found that New Zealand is undergoing large scale land use change that is putting pressure on water quality by increasing nutrient loads in waterways. There is a clear correlation between conversion to dairying and increased nitrogen loads.

This winter I released my latest two reports on water quality. One is an update on the 2013 report and contains new information on changes to land use which had not been available for the original report. It also contains the most recent available data on nutrient and water quality trends.

The other, *Managing water quality: Examining the 2014 National Policy Statement*, is a review of the Government's main policy for managing fresh water – the 2014 National Policy Statement for Freshwater Management (NPS). The purpose of this report is to explain my concerns about

aspects of the NPS and recommend improvements to better protect water quality.

To its credit, the Government has invested heavily in developing policy to improve the management of fresh water. It first introduced the NPS in 2011 with an objective of maintaining or improving water quality. Then in 2014 the NPS was given real heft with the addition of a framework proposed by the Land and Water Forum – a framework that introduced 'bottom lines' for water quality.

The 2014 NPS is a major step forward. Some regional councils have already begun to act, and there is a real sense of momentum. However, we are not out of the woods yet. We have a long way to go to address poor and deteriorating water quality in many places. Some lakes and streams are below bottom lines and many others are not far above them. Restoration will take time and effort.

The Government is planning to review the 2014 NPS next year. In my report I have identified six areas for improvement.

My first recommendation is focused on the objective of 'maintaining and improving' water quality. As currently written, the NPS envisages regional councils allowing degradation of some waterways to be compensated by improvements in others.

This is unworkable in any scientific way. But even if it were, surely we should, and can be, more aspirational.

Of course, some waterways may get worse before they get better, but that is no reason to set our sights low. If, for some reason it is decided that some waterways should be allowed to degrade, this should be made transparent in the NPS by way of exception.



Another of my concerns is the omission of estuaries. Estuaries are a mix of fresh water and seawater because they are located at the bottom of catchments where rivers meet the sea. But they are not currently covered by the NPS because it is only concerned with fresh water.

Yet estuaries are home to shellfish like tuangi and pipi, wading birds like oystercatchers and pied stilts, and juvenile fish like snapper, eels, and whitebait. Some have submerged forests of undulating seagrass, the only flowering plant in the sea. Estuaries are particularly vulnerable because of their location at the bottom of catchments.

A further weakness of the NPS is that it does not direct councils to take a strategic approach. Water bodies that are very vulnerable or subject to particular pressures should be considered first. Otherwise, the difficulty and cost of 'maintaining and improving' will be that much greater.

One such pressure is the increasing nitrogen load on waterways from

THE COMMISSIONER'S RECOMMENDATIONS

The Commissioner has made six recommendations aimed at improving the effectiveness and clarity of the Government's fresh water policy.

- "Maintaining and improving" water bodies should mean what it says.
- Criteria should be provided for dividing regions into water management zones.
- Exceptions policy (allowing certain water bodies to remain in a poor state) should be tightly defined.
- Regional councils should be required to prioritise the protection of vulnerable water bodies and catchments.
- The health of aquatic ecosystems should be measured using an indicator called the Macroinvertebrate Community Index.
- The policy should be expanded to include estuaries.

changing land use. In my 2013 report, I said that the expansion of dairying was creating a classic economy versus environment dilemma. Now it is pleasing to see the research effort being put into the 'nitrogen challenge' and the work on setting nutrient limits that will begin to drive innovation in some catchments.

I am also encouraged by the growing recognition that increased production is not the only way to increase the value of primary sector exports. In its *Briefing to the Incoming Ministers* last year, the Ministry for Primary Industries wrote:

"Consensus is building across the primary sector that the more we can grow exports by growing value, the more we can insulate our economy from commodity cycles, and the better we can mitigate environmental impacts."

Next year's scheduled review of the NPS is a major opportunity to ensure that the policy we have in place will actually lead to better water quality in our rivers and streams, our lakes and estuaries, and groundwater. [WNZ](#)



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Water quality

– reducing THM risk



Michael Chapman



Michael Kennedy

For water supply systems that experience periodic high levels of Dissolved Organic Carbon (DOC) associated with previous storm events, or return to average rainfall after extended dry periods, there can be a problem with noncompliance with Total Trihalomethanes (TTHM) limits. **Michael Chapman** and **Michael Kennedy** from GHD summarise a recent case study where this has been managed.

Pilot scale testing, then full scale construction and operation of a new Powdered Activated Carbon (PAC) dosing system at an existing 35ML/d DAFF plant was a successful way to keep DOC levels below the concentration, above which excessive levels of THMs are formed following chlorination.

For a treatment plant that has enhanced coagulation, DAFF or clarifier/filtration process then PAC dosing can be optimised by use of an online S:CAN or similar multispectral UV monitoring system. This will enable the correct dose of PAC added to maintain treated water DOC below a threshold value above which excessive TTHM levels will emerge after chlorination.

Depending on the frequency of high DOC events in the raw water this approach can be a cost – effective

option compared to other enhanced DOC removal technologies such as MIEX and Ozone/GAC. This approach also has the added benefit of removal of periodic blue green algae and stagnant water generated taste/odour chemicals such as MIB and Geomisin.

Trihalomethane limits in drinking water

There is ongoing investigation of disinfection by-products from chlorination of drinking water and there are also different THM limits and components of THMs for drinking water. From our research, it is evident that there is a wide range of views around the world on what THM limits, and even what species, are important. There is also a downward trend in THM limits in the USA and Canada, but an upward

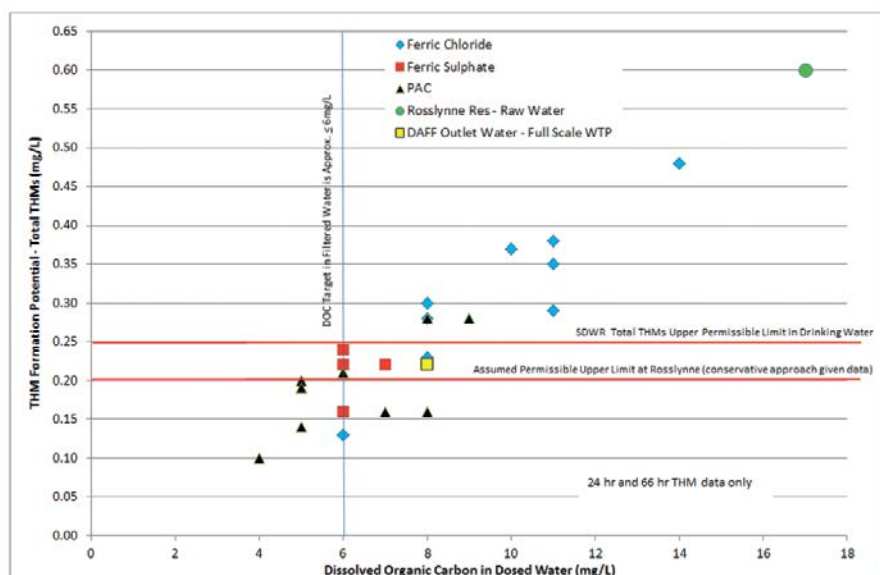


Figure 1: Jar test results for PAC dosing and alternative coagulants

trend in these in Australia and WHO. To achieve compliance with any of these targets would generally require a TTHM* level <100ug/L as a rolling average. This would also tend to mean the maximum TTHM of perhaps <150ug/L.

Enhanced coagulation, plus PAC dosing

As part of this study, jar test work was also completed to assess what could be done with enhanced coagulation using alum or ferric based coagulants. Optimised DOC removal occurs when the zeta potential is zero. It was found that ferric coagulant operating at a coagulant pH around 4.8 to 5 would achieve this zeta potential. However, DOC removal was still limited. *Figure 1* summarises the findings. It also shows that addition of PAC with enhanced coagulation could further reduce the DOC. The large green dot at the top right hand corner shows the raw water DOC starting point of 18mg/L.

Case study for retrofitting PAC dosing for enhanced DOC removal and TTHM control.

In this case, a 35ML/d capacity Dissolved Air Flotation Filtration (DAFF) in Victoria was, after heavy rain-flush events following long dry periods, unable to achieve current Safe Drinking Water Act (2005) requirements for TTHM <250ug/L and there was an objective to achieve

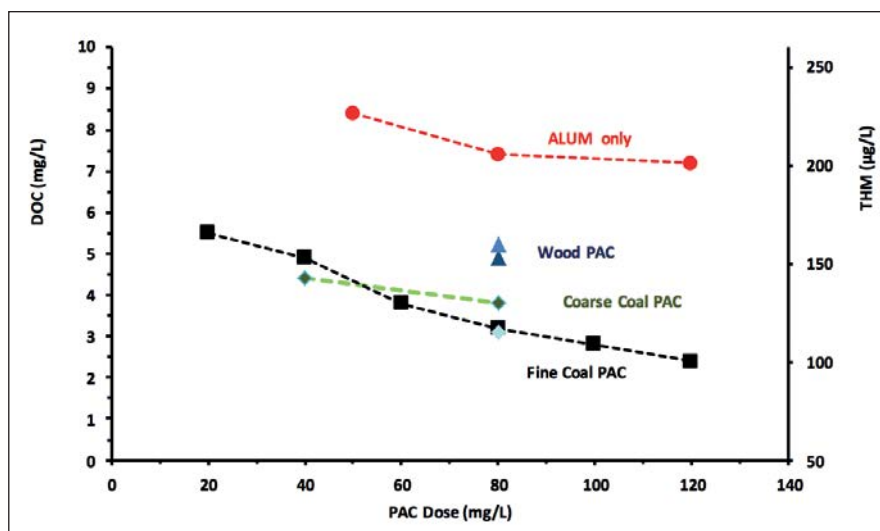


Figure 2: Effect of Alum coagulation only and alum plus various types of PAC on DOC and TTHMs.

<150 to 200ug/l in line with the precautionary principle. The problem was that DOC levels in the raw water would rise to >20 mg/L in this soft reservoir water. With enhanced coagulation using alum at pH6 it was possible to get the DOC down to about 9 to 10mg/L. However, this was not sufficient to achieve TTHM objectives.

The next step in this investigation was to determine the relationship between PAC dose and type of PAC product that best suited this water. The raw water DOC was about 18mg/L during the test work. Results of jar tests for this aspect indicated a fine coal based product was best and dose of PAC of about 60 to 80mg/L would be needed to get to TTHM <150ug/L (refer figure 2).

The last two issues were (1) what minimum detention time for the PAC prior to alum dose was best and (2) can the DAFF process handle the increased suspended solids load of 80mg/L on top of the suspended solids from the 100 to 150mg/l of alum needed for enhanced coagulation.

Jar test work indicated that a contact time of only about 10 minutes was sufficient. Full scale pilot testing by dosing PAC to the inlet main of this DAFF plant showed the DAFF process could handle up to about a PAC around 80 to 100mg/L without excessive reduction in filter run time or de-rating of the plant capacity and also without elevated filtered water turbidity.

*TTHM = sum of chloroform, bromodichloromethane, dibromochloromethane, bromoform



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Raw Water DOC level	Treated water DOC with Enhanced Coagulation only	PAC dose to get more DOC removal than get from EH only (mgPAC /mg extra DOC removed)	Comment
15 to 20mg/L	7 to 10mg/l	15 to 20	Easier to get extra DOC removed as still some big molecular wt species of DOC remaining
10 to 15 mg/L	5 to 8 mg/L	20 to 30	
5 to 10mg/L	3 to 5mg/L	30 to 40	
<5mg/L	2.8 to 3mg/L	>50	

PAC dose versus additional DOC removal

PAC dose versus additional DOC removal

A key determining factor for the cost effectiveness calculation for this simple PAC dosing concept is the relationship between PAC dose and reduction in DOC. As a general rule the R&D work carried out by GHD at a number of sites indicates the above general rules:

Cost considerations

Construction of the PAC dosing system and PAC contact tank for this 35ML/d plant was completed in 2014 at a cost of about \$1.8 million. The supply cost for PAC has been about \$2000 to \$2500/tonne.

Full scale testing at up to a PAC dose of 80mg/l with an alum dose around 65mg/l has shown:

- Filter run times >16 to 24 hours running at up to 26ML/d;
- A need to raise filter aid polymer dose from about 0.05mg/L to about 0.15mg/L to maintain filtered water turbidity;
- The sludge from the process has a poorer drying characteristic probably due to the extra polymer added;
- A S:CAN multispectral UV analyser is a reliable operational tool for monitoring raw water DOC and for

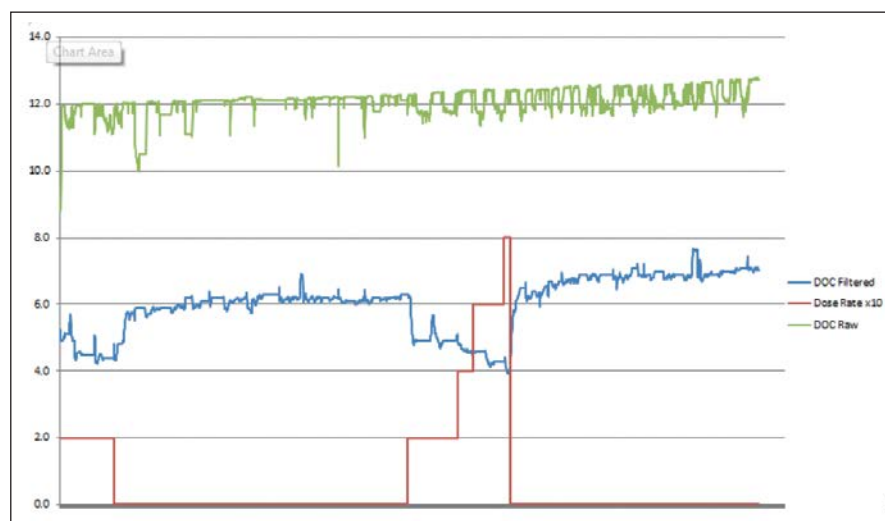


Figure 3: Raw and treated water DOC levels and PAC dose effect on treated water DOC level versus time during 2015 trial at DAFF plant.

optimising the PAC dose to achieve the desired final treated water DOC level which is known to maintain TTHM at an acceptable level (*Refer figure 3*).

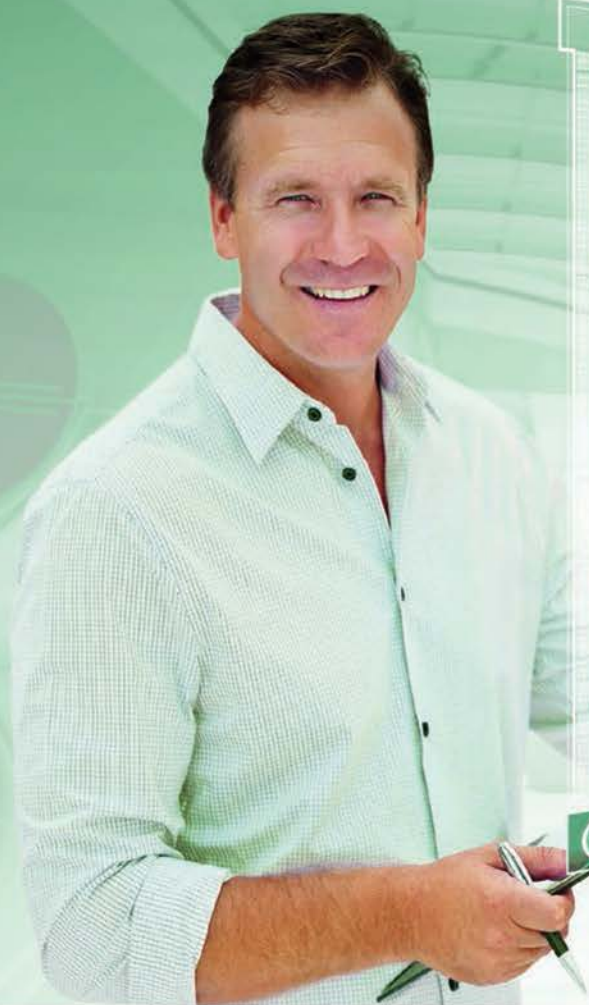
Conclusions

For systems with variable raw water DOC levels that can reach levels which after traditional treatment would be a THM noncompliance risk, installing a suitably sized PAC dosing

system and reaction tank to dose PAC to the untreated water prior to where coagulant is dosed can be a cost-effective option.

Most of the work to establish the suitability of a particular site can be completed via jar test work and by establishing the long-term variation in raw water DOC levels. **WNZ**

• Author's contacts: michael.chapman@ghd.com, michael.kennedy@ghd.com.



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Water crisis calls for smart metering

BY **MICHAEL WELZEL**, CHIEF TECHNOLOGY OFFICER, CTO

As water shortages affect more of the global population, the need for effective water metering is increasingly evident.



Extrême weather conditions, pollution and overpopulation – the causes of water stress are numerous and diverse – and the need for conservation of water attracts still more political attention globally.

The situation becomes all the more critical as the water supply problem is interwoven with environmental, development and security issues.

It's a problem that cannot be said to be limited to economically undeveloped regions. High living standards seem to entail high water consumption, as is clearly illustrated by the fact that it takes 1000-3000 litres of water to produce just one kilogram of rice and 13,000 to 15,000 litres to produce one kilogram of grain-fed beef.¹

Given the very different drivers such as water intensive agriculture, urbanisation and tourism, practically no country will be left untouched by the water crisis. Even in less challenged areas in mid – and northern Europe, water costs for domestic use are now similar to the level of household energy costs. Hence consumer awareness is growing, and people are demanding fair billing and a high degree of professionalism and efficiency from their water supplier.

Pricing water

The aggravating water crisis brings about an increasing political focus on water metering. China has adopted a “one household, one water meter” policy; and the European Commission has identified water tariffs and compulsory metering as one of the key targets in the move towards a water saving economy.²

With pricing recognised as an efficient incentive for saving water, measuring water consumption on a household level is required. In 2010, the number of water meters worldwide was well over 900 million, compared to almost 1.9 billion households worldwide.³

Approximately 80 million additional water meters are being installed annually, equaling a 6.6 percent growth rate (predominantly driven by China).⁴

Pricing water consumption correctly is a great opportunity for the water supplier to educate its consumers into being more “usage-aware” customers.

The intelligent water meter

Residential water metering in itself seems to have a psychological effect by educating the consumer about water consumption. But the benefits of residential water metering are being further enhanced with the deployment of electronic water meters with automatic reading features. Intelligent

water meters open up a whole palette of opportunities for customer services, Automatic Meter Reading (“AMR”) and data management.

The newest electronic water meters on the market seek to address all important aspects concerning global requirements and the utilities’ needs for usability, customer servicing and sound economy.



The latest electronic water meter on the market, flowIQ 2102 is designed to resemble a traditional water meter, but contains a microprocessing calculator and an ultrasonic flow sensor in the same hermetically sealed meter case. The meter case is made of composite material (PPS) shielding the essential parts from contact with the water. The wireless interface is compliant to the NZ/AUS regulations.

“Drive By” or Automatic Meter Reading (AMR)

There is a growing demand for automatic reading of water meters in order to rationalise an otherwise expensive and bothersome part of managing a water utility. AMR also allows the water utility to control meter reads and conveys a fuller overview of consumption patterns.

Electronic water meters have a variety of capabilities in terms of automatic meter reading, be it integration into a radio mesh network or wireless reading by means of hand-held devices. A new and very easy to use wireless meter reading method is to employ a concentrator or a converter/smart phone combination making “Drive By” or AMR a usable and economic feature, allowing even small utilities to benefit.

Depending on their business needs, suppliers of energy and water, like utilities, bodies corporate, housing associations and building administrators, may require different meter reading solutions.

Precision and durability

The use of ultrasonic technology for measuring water consumption is particularly useful for measuring low-flow rates. Capturing low-flow rates is extremely important in order to accurately record a typical household consumption. Meters that start counting at 15 or even 20 litres per hour

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will often not register a leaking toilet/tap. However, some ultrasonic water meters start measuring at flow rates as low as two litres/hour.

Furthermore, the absence of mechanical parts in the ultrasonic water meter means there is no internal wear and tear: the meter can be mounted regardless of the pipe construction, and it is immune to impurities and sediments in the water to which traditional mechanical water meters are sensitive.

Floodable environment

Water meters are often placed in moist environments. This has previously been an impediment to utilities that could have good use from electronic metering. However, electronic meters with IP68 protection are now being marketed. They endure immersion in water where the battery-driven water meter will keep functioning year after year under rough conditions.

Leak detection

Small leakages are hard to detect and can easily grow into major leaks / pipe bursts. Early detection of leaks will help prevent costly repairs and waste of water. Electronic water meters are programmable and can, for example, be set to inform if they do not register at least one hour with zero flow during a 24-hour period (thus indicating a possible leak in the system). Likewise, they can be programmed to notify in case of a sudden excessive flow.

Diagnosing and trouble shooting

An electronic water meter virtually serves as a surveillance instrument for optimising the distribution grid. There are water meters with comprehensive logging capacities enabling a detailed mapping of the consumption history.

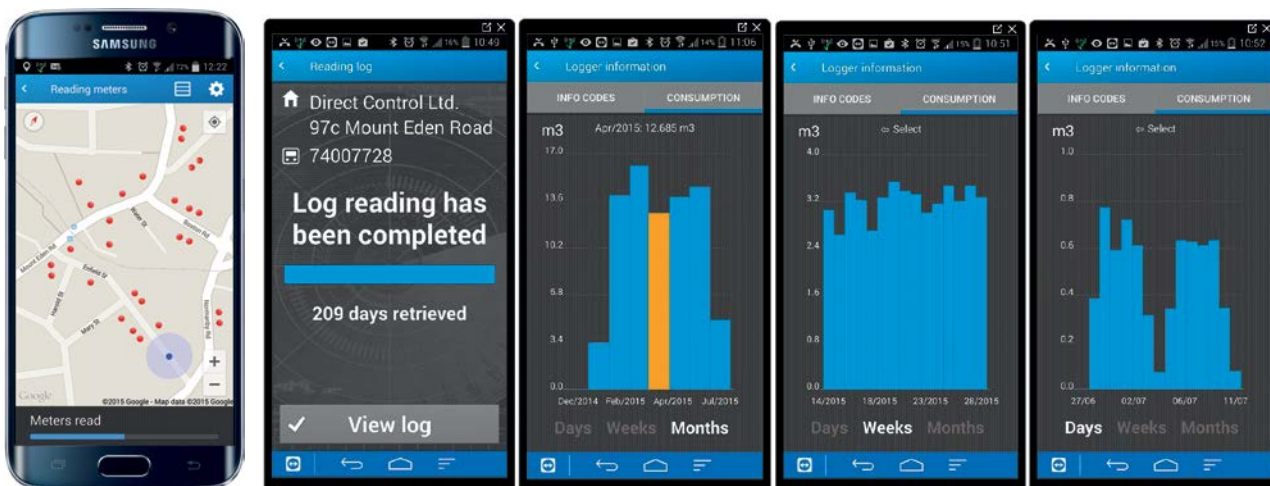
Requirements for New Zealand and Australia

The OIML and ISO standards in New Zealand and Australia are similar to the ones used in Europe. However, Europe allows the use of the 868MHz frequency with none of the restrictions evident in Australia and New Zealand.

The 868MHz frequency spectrum is not allowed for Short Range Devices like wireless water meters in Australia and is restricted to 2mW transmission power in New Zealand. This is not sufficient power to allow for the normal reading distance required for “drive by”/Automatic Meter Reading.

There is also a very small gap in the 400MHz band. It is not recommended to use this for Short Range Devices (SRDs) because of the high usage of other organisations with overlapping frequencies and higher transmission allowance.

The assigned frequency for Short Range Devices in New Zealand and Australia is 923MHz. A number of suppliers and distributors in New Zealand are offering products which use the 868MHz frequency spectrum, regardless of the existing restrictions. This might be because it is a new evolving market or it is due to an imprecise research of the situation. **WNZ**



Conclusion

Residential smart water metering is acknowledged as an important means to manage water stress. The meters will play an essential role in providing water utilities with a wealth of information, helping to reduce water losses, increase efficiency, ensuring correct bills are issued, providing a professional customer service and

maintaining a robust distribution network.

Smart water meters are becoming increasingly competitive with traditional mechanical meters, particularly when considering the life-cycle costs and the benefits gained from automatic meter reading and leak detection

Footnotes:

1 UN-Water: www.unwater.org/statistics_sec.

2 Andrew Farmer: *Challenges of Developing a European Union Strategies Approach to Water Scarcity*, in: 4th International Conference on Water Resources and Arid Environments (ICWRAE 4), p 103-112.

3 ABS Energy Research: *Water Meter Report*. Ed. B 2010.

4 IMS Research: *The World Market for Water and Heat Meters*. October 2010.

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Harvesting stormwater and building resilience

Floods one season; drought the next – how best to build resilience to the challenges of climate change? One City Council in New South Wales has found an answer in stormwater harvesting.



Alison Hanlon outlines how stormwater harvesting schemes save costs and improve environmental outcomes.



As the impacts of climate change become more apparent, managing water in a sustainable way is becoming an increasingly critical issue for municipal authorities.

“From increased storm severity and flooding to drought conditions and water restrictions, climate change is causing a lot of management issues,” environmental scientist Alison Hanlon told delegates to the recent 2015 IFME World Congress on Municipal Engineering and IPWEA International Conference in Rotorua.

“That has caused us to look for more innovative solutions.”

In her role as manager for Environmental Sustainability at Hurstville City Council (in Southern Sydney), she has been involved in three recent projects designed to build resilience to climate change by harvesting stormwater. The keystone project within these initiatives is the \$2.6 million Peakhurst Light Industrial Stormwater Harvesting and Reuse Scheme which harvests water from a 160ha industrial and residential catchment.

Hanlon said that more extreme weather events had helped highlight just how important water is in managing the liveability of cities – particularly from a local government perspective.

“Water is essential for maintaining parks and green spaces which provide social and health benefits to the community. It’s important for maintaining ecosystems and bio diversity and, increasingly in urban areas like Hurstville, it’s important for creating green spaces that can counteract heatwave conditions

through the creation of cooler microclimates and green spaces with city areas.”

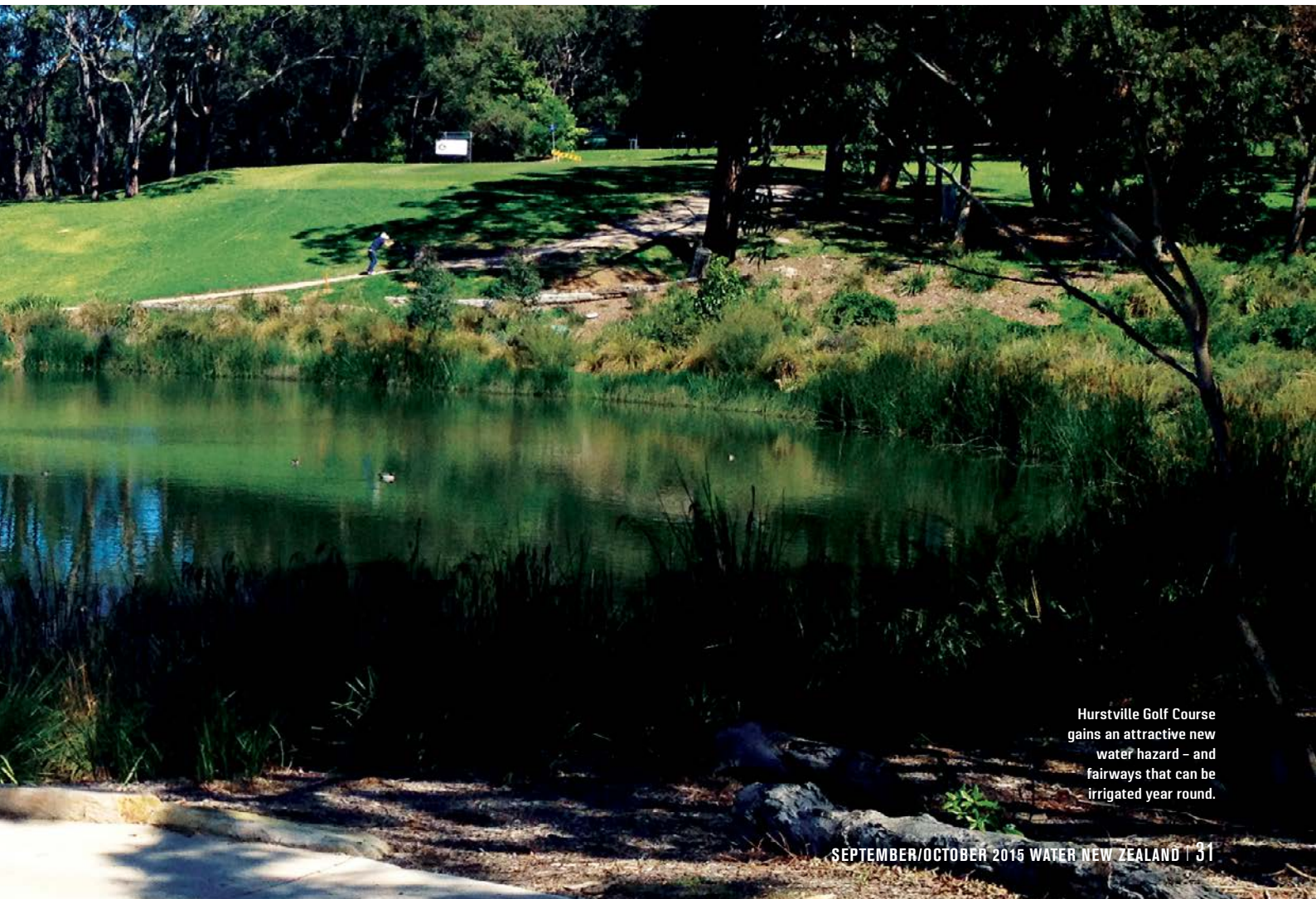
She said a variety of factors prompted the Council to “think outside the box” in 2011 and look at solutions such as stormwater harvesting – securing a reliable supply of water for green spaces while conserving potable water.

“Stormwater harvesting delivers cost savings, in terms of potable water saved and also allows us to meet important environmental goals such as improving stormwater quality and water conservation.”

She outlined three stormwater schemes currently operating in the Hurstville City area on publicly owned land: Hurstville Golf Course; Gannons Park (a former landfill area now being used as a sports field); and Webbs dam at Evatt Park.

The golf course project offered some challenges related to its history. Originally an area of mangroves, the site was approved for reclamation in 1967 and became a landfill for residential, industrial and trade waste. This operated until the early 1980s when it was closed, capped and then established as a golf course, Hanlon explained.

“The golf course was our second highest user of water of all council facilities. Only the western half of the course was irrigated through pop-up sprinklers. The eastern half of the course was unirrigated and the fairways were in very poor condition. So in 2011 Council was faced with several dilemmas: how to improve irrigation at the course without increasing costs and from where to source the water?”



Hurstville Golf Course gains an attractive new water hazard – and fairways that can be irrigated year round.

Modelling had shown that the 160ha catchment area was more than capable of delivering what was needed for irrigation demand and the scheme utilises both base and stormflows. The construction of the scheme also presented challenges due to the site being a former landfill tip. Excavation was limited within the design to ensure works where possible were built above ground and where trenching and laying of irrigation networks was required, it was done on top of the clay capping liner wherever possible into imported topsoil and clay.

As part of the project over 30,000 cubic meters of clean topsoil and clay was delivered to the site free of charge in exchange for Council accepting the fill which saved a Sydney based earthworks company the cost of disposing of the fill at a waste disposal facility, Hanlon said.

The scheme operates by harvesting stormwater from catchments to the north, east and west of the course via a large Council owned stormwater culvert that runs beneath the golf course and discharges to the Georges River. From there storm flows in excess of 90L/s are pumped via a rising main to a gross pollutant trap and are then discharged into a large bioretention system which filters out nutrients, suspended solids, and other pollutants. The filtered stormwater then enters a 2500m³ storage pond. The water subsequently passes through a post storage treatment system comprising mechanical filtration and UV disinfection prior to it being stored in existing header tanks to be used for irrigation.

As well as the bioretention system and storage pond, the

scheme includes a smaller overflow wetland which, together with the large storage pond, act as attractive water hazards that have proved popular with golfers.

The scheme has delivered environmental, social and economic benefits, Hanlon says.

“The condition and quality of the fairways and greens across the course is now excellent and the course has a beautiful new water feature, improved biodiversity through the creation of two new wetlands and the introduction of more than 30,000 new plants. The scheme can capture and reuse more than 50 megalitres of stormwater per annum and has conserved over 27 megalitres of potable water. In addition, it has significantly reduced the quantity of untreated water running through to the Georges River and has improved stormwater quality.”

Since the introduction of the scheme, the golf course has experienced increased patronage and the interpretive signage has helped build community understanding of the environmental benefits of the stormwater treatment process, she says.

The most important achievement of the golf course project is that no potable water has been used to irrigate the course since the scheme became operational in February 2014.

Hurstville Council is now embarking on a new stormwater-harvesting scheme in Gannons Park at Lugarno in Sydney which has the potential to be an even higher profile regional demonstration site for stormwater harvesting. The area is seen as a regionally significant park that includes popular sports fields as well as large areas of native vegetation.

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Storage pond
from the south.

In addition to harvesting stormwater for the irrigation of eight sports fields, the scheme will involve the “renaturalisation” and daylighting of a former creek which runs the full length of the 27ha park, but is currently piped underground. It will include a bioretention system, wetland, storage ponds and swales to remove pollutants and sediments draining through the park and into the Georges River estuary. The scheme is currently in the detailed design planning stage and it is hoped construction will start in 2016.

The final project discussed was the Webbs Dam upgrade at Evatt Park. This project has also created a win-win outcome in that it beautified an existing picnic spot, increased biodiversity, improved the quality of stormwater runoff into the dam and created the capacity for the reuse of dam water to irrigate the adjoining Evatt Park Sports fields. The project has ticked a lot of boxes, Hanlon says.

The dam had to be “dewatered” before a bioretention system or “raingarden” was constructed within the existing footprint of the dam. This includes layers of sand and other filter media to remove finer sediment and nutrients such as nitrogen and phosphorus from stormwater draining from a 13ha catchment prior to entering the dam.

The improved water quality has helped to reduce the incidence of algal blooms on the dam and intensive planting has increased the area’s biodiversity.

While such water-sensitive urban design projects were only “sporadically” funded by the State and Commonwealth government in Sydney and throughout Australia, Hanlon expressed confidence that the recent Senate inquiry into stormwater management and harvesting instigated by Senator Nick Xenophon would help raise awareness of the importance of managing stormwater as a valuable resource and lead to more reliable funding for local government to implement stormwater harvesting schemes and improvement projects in the future.

Hurstville City had gained funding support from a variety of local and federal government initiatives – including the Australian Government’s Water for the Future Initiative and the NSW Office of Environment & Heritage. **VNZ**

• *Alison Hanlon is the manager of Environmental Sustainability at Hurstville City Council. She holds a degree in Environmental Science and has seven years experience in co-ordinating environment management on a regional scale – particularly across the Georges River Catchment in Sydney.*

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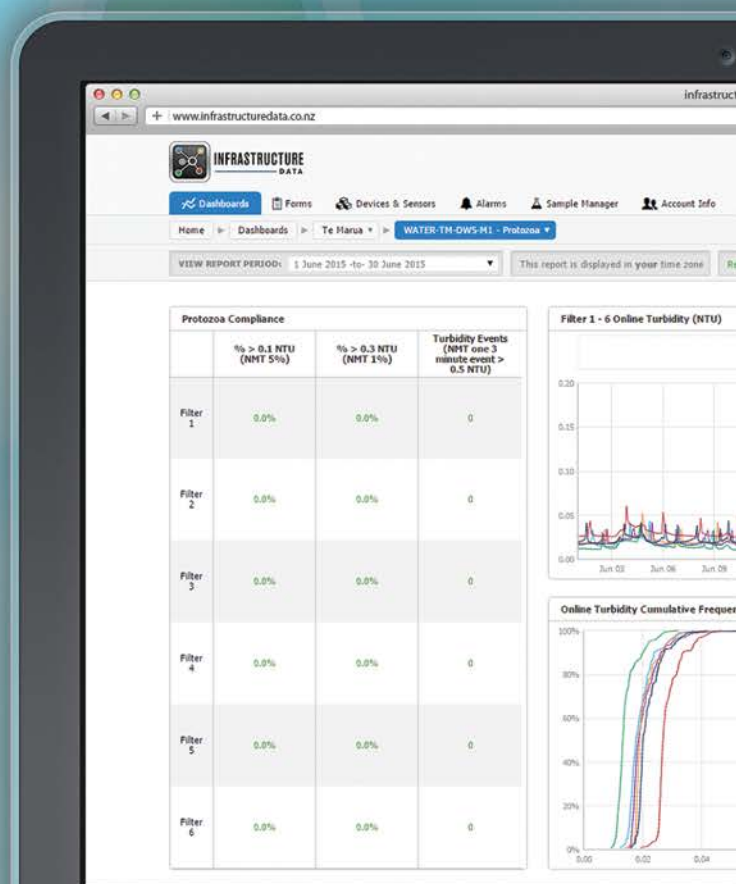
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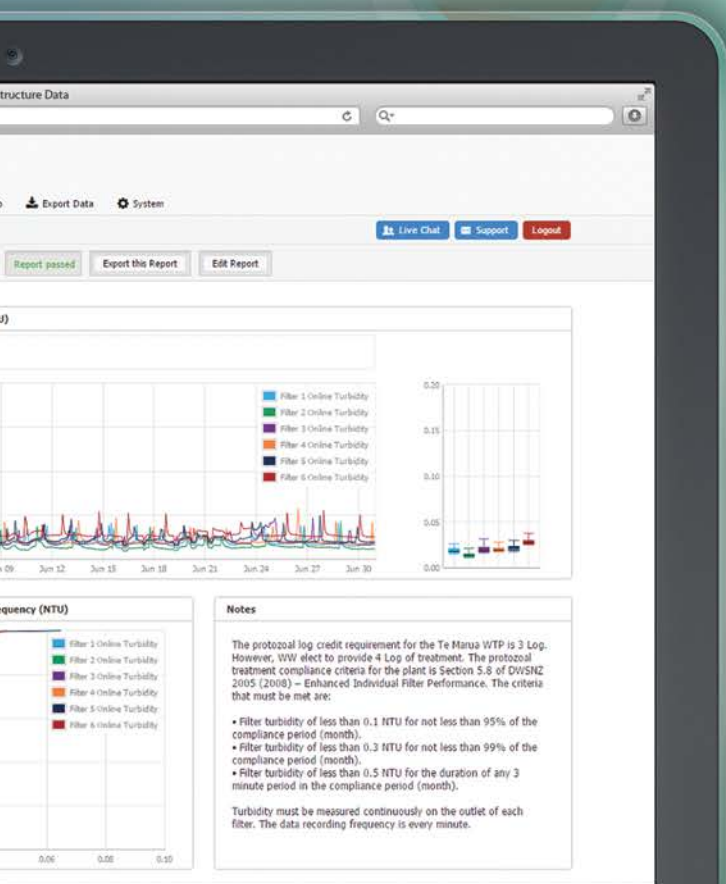
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ONLINE COMPLIANCE A DECADE OF LESSONS

The Drinking Water Standards for New Zealand 2008 (DWSNZ) provide a water quality framework which all drinking water suppliers must adhere to. Jason Colton, principal process engineer at h₂ope discusses the issues.

The Drinking Water Standards for New Zealand regulate aspects such as water quality, water quality sampling, water treatment processes, water safety plans and online instrumentation requirements to ensure the production and delivery of safe water from source through to the customer's tap.

A drinking water supplier must meet a range of criteria to demonstrate compliance with the DWSNZ. Bacterial and protozoal compliance are two cornerstones of the standard, and the DWSNZ provide a range of options to demonstrate compliance. Suppliers providing water to a population of greater than 500 usually elect to demonstrate their bacteriological and protozoal compliance with what is called online compliance.

Online compliance uses the output from field instrumentation to demonstrate that water quality parameters do not exceed the mandated limits for more than a set period of time. For example, online compliance uses the output from a turbidity meter that continuously samples and analyses the filtered water turbidity.

Although the DWSNZ provide rigorous criteria to use when assessing an overall compliance pass or fail, they do not address many of the subtleties and pitfalls associated with the collection and analysis of compliance related information.

There are two key aspects to consider regarding the integrity of the online compliance process:

- Generating information that accurately reflects water treatment plant performance;
- Analysis of that information against the requirements of the DWSNZ.

The team at h₂ope have 10 years of experience in developing and operating online compliance reporting systems. Below are some of the lessons we have learnt.

Contextualising field information and identifying exceptions

The output from a compliance instrument alone is often insufficient to fully describe how the process was performing over a given period of time. For example, a filtered water turbidity meter will continue to measure turbidity at the outlet of the filter when it is off line or undergoing a backwash. This

can lead to difficulties when preparing compliance reports because any high turbidity measurements made while the filter is off line would need to be covered by an exception report. (NB: an exception report is an explanation of what went wrong, and why, for periods when the compliance criteria were not met. The report usually has to be accompanied by substantiating information.)

Additional instrumentation that provides position indication on the filter outlet valve(s) will enable the determination of whether:

- The filter is online;
- The filter is running to supply or filtering to waste.

Using PLC sequence steps to indicate the filter state should be avoided. We have seen examples where logging of filter turbidity is stopped as soon as the filter enters the backwash sequence. Normally the first step in the sequence is to drain down the filter by closing the inlet valve and leaving the outlet valve open so, in this example, turbidity measurements were not being collected even though the filter was still producing water.

Another problem we have encountered is where a turbidity meter has had no flow for weeks at a time and yet the meter output has been collected and used for compliance reporting. Whilst not mandated by the DWSNZ, sample flow monitoring, usually in the form of a low-flow switch, is considered best practice and ensures that performance monitoring is not compromised by a loss of instrument sample flow.

Most instrumentation has in-built signal averaging functions. It is important that these functions are not set to a frequency greater than the required reporting interval eg. one minute.

Most instruments also have a "hold" function for use during calibrations. Alternatively, water suppliers may have calibration buttons on their SCADA system. In order to prevent abuse of these functions, accurate and auditable records of instrument calibrations should be maintained.

It is vital that instrument loops are effectively commissioned. It is not unusual to see discrepancies between an instrument's local display value and the value displayed on SCADA.

Problems can also occur if values are artificially constrained

in the PLC. We have seen examples where the maximum value that could be stored for a turbidity measurement was actually below the compliance limit.

Data storage and compression

Data compression techniques are often used to reduce storage space. If data compression is used, it is a requirement of the DWSNZ that the accuracy of the original data is preserved. Key considerations include:

- Ensure the number of significant figures and rounding that is applied to the signal data is commensurate with the data requirements. This is critical for instruments such as turbidimeters that are required to operate at relatively small absolute numbers.
- Minimise signal dead banding to avoid masking or exacerbating an exception event. A signal dead band of 5-10 percent or greater is often applied to the process value. This can reduce the resolution of that data, especially where the plant may be operating slightly above or below the compliance failure value. As a result, the percentage of time above or below the compliance value may be misrepresented.

An issue that we have come across when data compression is being used is missing minutes. Data collection and transmission systems can “drop out” for a variety of reasons, resulting in missing minutes of data.

When minutes are missing, compliance with DWSNZ cannot be demonstrated and thus an exception report is required. When data-compression techniques are used, the gaps between

recorded values can be as high as 30 minutes, thus it is not possible to prove that 1440 minutes are present each day.

We have seen situations where the use of VBA scripts to export data has also caused missing minutes. In this example, the format of the script and the time at which they were run resulted in rounding errors and minutes of data being omitted.

Methods of analysis and reporting

Following the collection and storage of performance information, some analysis is required to determine compliance with the DWSNZ. Often this is undertaken on a monthly basis. Three methods of data analysis and reporting are commonly in use in New Zealand.

1. Microsoft Excel

Many organisations use Microsoft Excel to analyse and report on compliance information.

The advantage of this approach is that many people are familiar with Excel and it is widely available on PCs. Excel templates are a great tool but have to be carefully set up and managed to avoid problems. Some hints and tips from us are:

- Validating the calculations used are correct;
- Lock down calculation cells so that they can't be changed;
- Develop a method for quantifying missing data;
- Check the sheet thoroughly after updating your version of Excel;
- Document the process of operating the spreadsheet and ensure that at least two people know how to run it;
- Make sure the sheet can deal with daylight saving;

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- Prepare exception reports as soon as possible and make sure they have sufficient detail to satisfy the Drinking Water Assessor;
- Keep a good record of all instrument maintenance and calibration activities so that you can use them to substantiate exception reports;
- Check the operation of the spreadsheet by importing a set of test data which will give known pass/fail results;
- Backup the sheets to a secure location.

2. PLC Based

Some organisations have developed bespoke systems which run in their own PLC. These are often very effective, however the level of transparency and auditability can be limited. One method that we have seen is the printing off of monthly trends from the SCADA system. The limitations of this approach are now widely recognised, namely that such a printout typically contains 4095 values when there are up to 44,640 minutes in a month.

3. Third Party Web based

As we have seen in many other areas of information management, the proliferation of web-based systems is increasing. The use of such systems for DWSNZ compliance is not widespread in New Zealand, however they can have benefits over other methods including:

- Ease of use;
- Automated data collection and reporting;
- Clear audit trail;
- Reports available on line and viewable from any platform, anywhere;
- Standardised and validated calculations;
- Locked in quality control.

Conclusion

Since the introduction of the 2005 DWSNZ, many organisations have refined the way they manage on-line compliance and improved their systems for collecting and analysing compliance information. Likewise, Drinking Water Assessors have improved their understanding of plant operations and where the typical problem areas lie in terms of compliance reporting.

It is important to train operations staff in your on-line compliance process and understand the limitations of the system that you use. There are often some simple improvements that can be made to any system to improve its integrity.

Given the difficulties in auditing 'black box' data management systems, one simple way to check that your system is handling data correctly is to use pre-prepared validation datasets that can be loaded into your spreadsheet, or other system, to check its accuracy and completeness.

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Rural drinking-water – a new guideline

In 2007, the Health Act 1956 was amended to require “every drinking-water supplier [to] take all practicable steps to ensure that the drinking water supplied by that supplier complies with the drinking-water standards”. Water suppliers are only required to take practicable steps to comply with the Standards, and affordability is specifically recognised in the definition of ‘practicable steps’. In addition, if a water supplier is implementing an approved water safety plan, they are deemed to be taking all practicable steps to comply with the Standards.

A rural agricultural drinking-water supplier has three different pathways for demonstrating compliance with the water quality requirements of the Health Act: Meet the NZ Drinking-Water Standards; or develop an individual water safety plan that includes the provisions relating to the Drinking-Water Standards; or develop a water safety plan that meet the requirements of the (new) guideline.

During the development of the legislation, Local Government NZ raised concerns that rural agricultural water suppliers would be unfairly burdened by the compliance requirements being introduced, in that most of the water is not used for human consumption. To address this issue, rural agricultural drinking-water supplies were established as a separate class of supply. A rural agricultural drinking-water supply may serve a population of any size but at least 75 percent of the water must be used for agricultural purposes.

In 2008, the Ministry of Health established an expert working group to draft a rural agricultural drinking-water standard. In 2013, Health officials consulted on a draft guideline for rural agricultural drinking-water suppliers to demonstrate they have taken all practicable steps to comply with the drinking-water standards.

Submissions generally opposed any prescribed water treatment

system. Submitters, especially water suppliers, supported the use of point-of-entry or point-of-use filters, although some submitters were concerned about water quality, maintenance, cost and logistics. Comments were also received on the method for determining agricultural water usage and domestic consumption, the use of water safety plans, monitoring and compliance. The guideline was revised to address this advice.

The guideline is on the Ministry of Health website: www.health.govt.nz/publication/rural-agricultural-drinking-water-supply-guideline

It requires an agricultural drinking-water supplier to implement a water safety plan that: Ensures there is an adequate supply of drinking-water; ensures the quality of source water so it can be adequately treated by a point-of-use or point-of-entry filter or other treatment system; ensures the filter or other treatment system is appropriate (eg, complies with the relevant Australia/New Zealand Standard) and includes a maintenance plan; outlines how water is distributed to buildings, including backflow prevention; identifies all risks that may arise with the water supply including the source, distribution, treatment, and how the risks will be addressed; outlines the monitoring programme; and describes remedial actions when a health risk is detected.

Rural agricultural water suppliers who are considering adopting the guideline can contact their local Drinking Water Assessor to clarify requirements. Water suppliers need to discuss management options with their consumers as the final control of water quality may rest with the householder. This may need to be reflected in supply agreements.

Ministry of Health officials welcome feedback. Please send any comments or thoughts to the Ministry at info@health.govt.nz and put ‘Rural Agricultural Drinking-water Supply Guideline’ in the subject line..



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KEEPING THE WATERS AT BAY

Stage by stage, a vital protection scheme is progressing to combat floods that have periodically devastated areas of the eastern Bay of Plenty for more than a century. **GAVIN RILEY** reports.

By their high-profile nature, civil-construction projects such as Auckland's infrastructure, the Christchurch rebuild, and the seven roads of national significance attract a welter of publicity. Other projects remain under the radar even when their skilful execution may be crucial in helping to prevent a regional disaster.

The Rangitaiki floodway scheme in the eastern Bay of Plenty is firmly in the latter category.

Consent for this lengthy undertaking was granted in 2009, three stages have been finished, and another five are scheduled before the project's completion in 2020.

Its purpose is to take pressure off the flood-prone Rangitaiki River by diverting some of its flow to a waterway known as Reid's Canal. The scheme's effectiveness is vital to the area's future well-being – as local history clearly indicates.

Though official records have been kept only since 1949, it is known that major flooding of the 155km-long river occurred in 1906 and 1925. Due to lack of preventive measures, there was more flooding over the next 20 years, with thousands of hectares of land inundated and extensive damage caused.

Between 1944 and 1983 the level of flooding was reduced to below that of 1925 by the construction of 109km of stopbanks on the main river and major canals, the erection of flood walls in Edgumbe and other urban areas, and the building of Reid's Canal.

However, problems continued. In 1987, the Edgumbe earthquake damaged flood-protection systems and works had to be carried out to repair stopbanks and improve flood controls. Then in 2004, a near-disaster struck – flooding breached a stopbank south of Edgumbe, sending more than a quarter of the swollen Rangitaiki River onto the plains and

overwhelming the Reid's Canal floodway.

If the waters had entered Edgumbe substation they would have knocked out power supply to the entire eastern Bay of Plenty. As it was, they reached residential areas, part of the Fonterra factory on the edge of town, and thousands of hectares of farmland and associated property infrastructure. Roads were closed and there was an estimated \$50 million in damages and lost production.

Such devastation demanded emphatic action. Bay of Plenty Regional Council and Whakatane District Council jointly undertook measures in the 2009-10 and 2010-11 construction seasons to protect vulnerable parts of Edgumbe against a 300-year flood. Included were the power station, Fonterra, major kiwifruit packer EastPack, and homes.

Bay of Plenty Regional Council's Rangitaiki floodway project to ease pressure on the river started in 2011/12 when Hickey Contractors from Rotorua carried out stage one, which involved new stopbank construction and considerable geotechnical work. The total value of the stage was \$3.2 million.

"One of the reasons we had a major failure in 2004 was because of a geotechnical failure on the Rangitaiki River," says regional council works engineer Arch Delahunty, who has been involved in all three stages of the project to date.

"In 2012-13 we didn't do much on the floodway because we were moving downstream and had an issue with local landowners buying into the project. A few of them didn't agree with what we were going to do. It took 16 months of negotiating before they signed up for it."

Waiotahi Contractors of Whakatane and Doug Gerrard of Papamoa jointly carried out the stage 2A contract in



1. Aerial views of stage 2B earthworks.
2. The "cell" methodology of widening Reid's Canal.
- 3, 4. Forming of the new canal bank and stabilising with graded rock.
5. Map showing Rangitaiki Floodway upgrade flood mitigation project.



New 32-metre farm bridge being built for stages 2A and 2B.

2013-14. This work involved canal widening, stopbank reconstruction or rebuild, and more geotechnical work. The total value was again \$3.2 million.

“With this stage we worked on the properties of landowners who had been questioning what we were doing,” Arch says. “When we went to sign them up for stage 2B, last summer, they had no hesitation in doing so. They were very satisfied with the way the regional council had dealt with the reconstruction and all the other issues we had to deal with on their properties.”

Stage 2B, which began in September 2014 and finished in late May this year, was carried out by Doug Gerrand, which was founded more than 40 years ago as a specialist stopbank and large-scale river-control works contractor but now also does general contracting and manages two large landfill sites in Whakatane and Rotorua.

Gerrand’s contract involved the construction of about 1500 lineal metres of stopbanking; the importing of 90,000 tonnes of material suitable for stopbank construction; canal reconstruction of about 800 lineal metres (comprising around 75,000 cu metres of cut material); and the placement of geotechnical fabric and rocks over the 800 metres of reconstructed canal bank. The total value of this stage was \$2.5 million.

The five stages remaining in the floodway project include the section below the Matata-Whakatane highway, raising the stopbanks from the McLean Road area to McCracken Road, constructing a modified spillway to allow water to flow from the Rangitaiki River into the floodway, and designing the stopbanks with flatter slopes to allow farmers to work their land more easily.

Geotechnical work will be undertaken as part of the project works and fencing will be installed to restrict stock access to waterways.

Bay of Plenty Regional Council environmental engineer Mark Townsend is the project manager for the remaining five stages. “With the current long-term plan we took the opportunity to shuffle things around so they went in a more logical order,” he says.

“We can view it as two separate projects – a continuation of the widening, then stopbank-raising further upstream. No widening, just lifting of the stopbanks.”

He says the \$2.05 million stage 3A, programmed for the 2015-16 construction season, will involve working on the right bank of the floodway downstream section, from Thornton Road down to the confluence with the Rangitaiki River. There will also be some widening upstream, where stage one was, and the replacement of a bridge there.

As part of getting ready for the stopbank-raising there will be geotechnical testing of the upstream stopbank. Also, as part of the geotechnical work, a wick system and drainage trenches will be put in behind the stopbanks of stages 2A and 2B to control a seepage outlet.

When asked if the floodway scheme has proved successful so far, Mark replies that there hasn’t been a breach since 2004.

He admits to concerns over the possible effects of climate change, including erratic weather patterns and rising sea levels. “It’s a big thing for us, through all our schemes. We’ve got some major projects, which I won’t go into now, where we’re looking at exactly that, and basically the sustainability of all our schemes.”

Mark does not know of any area of New Zealand that has a floodway scheme of greater magnitude than the eastern Bay of Plenty’s. “In terms of the capital works we’re undertaking, there’s no one doing more that I’m aware of.”

Arch Delahunty says the reality is the council has 11.25 kilometres of floodway. “That’s a significant footprint and, as we’ve alluded to [in this interview], we’ve also got major geotechnical problems.”

He says stages 2A and 2B of the scheme attracted six and eight tenderers, including nationwide companies, and that leaves him feeling “pretty comfortable” with the contractor resource available for the remaining stages.

Mark believes the parcels of work the council has set out over the next five years are manageable by those teams. “We don’t think the volume of work could cause difficulties for us. We think we’ve got the measure about right,” he says. **WNZ**

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VANUATU CYCLONE PAM

RECOVERING FROM

Safe water supply remains a challenge in Vanuatu's poor, often isolated communities – and post Cyclone Pam, Oxfam is focused on rebuilding basic infrastructural needs.

Despite its reputation as a popular tourist destination, Vanuatu is one of the poorest countries in the Pacific and its people face many challenges. For most families, an education beyond primary school is a luxury they can't afford. Job opportunities are sparse and many people live off the land, growing traditional Pacific crops like taro.

With many of its 80 islands hours or even days' distant from the capital, Port Vila, Vanuatu's economic growth is hindered by isolation and poor infrastructure. It is also the country most at risk of experiencing natural disasters, according to the World Risk Index 2013.

Cyclones in the Pacific severely hinder development. In the short term, people need help with the basics – food, water, shelter, sanitation. But longer term, fragile infrastructure and livelihoods need repairing and rebuilding. Around three-quarters of people in Vanuatu live in rural areas and are dependent on subsistence farming, which can be destroyed by the cyclones which frequently hit the island group – Cyclone Pam is the most recent of these.

When it hit in March 2015, causing major damage, it also put to test the Rural Training Centres that Oxfam has spent more than a decade helping to develop.

These are central to the work Oxfam has been doing to improve the lives of people living in rural communities. This includes education for Vanuatu's youth, delivering safe buildings, ensuring safe and accessible water and sanitation, and implementing strategies for sustainable water supplies.

We have been working with local communities to make these RTCs cyclone proof, therefore ensuring that young people not only have good facilities to learn in, but also that the wider

communities have access to water and sanitation and a safe place to shelter during emergencies.

Cyclone Pam's impact

The eye of this Category 5 cyclone passed close to Efate Island, where Vanuatu's capital, Port Vila, is located and affected about 188,000 people across 22 islands. An estimated 15,000 homes were damaged or destroyed, about 96 percent of food stocks were decimated and the water supply to 110,000 people was disrupted, destroyed or contaminated.

Many water sources became unsafe and toilets were damaged with families left with no soap or disinfectant. Thousands were left with no access to water as rainwater harvesting tanks and catchment roofs were destroyed and water sources contaminated. Ground water sources became contaminated with seawater and mud, and water systems that relied on electricity were not functioning due to lack of power. Gravity systems were also affected by fallen trees and landslides, and latrines damaged.

Consequently, one of Oxfam's main areas of focus was to ensure that people had access to clean water, sanitation and hygiene (WASH). Our emergency aid team:

- provided clean water for communities,
- rehabilitated water sources,
- distributed hygiene kits to people, and
- carried out hygiene education.

Oxfam's WASH response to date has focused on both immediate water supply and rehabilitation of water sources for the longer term needs of communities. This approach ensured people were provided with clean water when they urgently

needed it after the cyclone. It also ensures they have ongoing access to clean water following these emergency provisions.

Meeting life-saving needs

Oxfam's immediate actions in the Cyclone's aftermath included delivering water trucks to Port Vila to assist 6000 people, delivering Emergency Hygiene Kits to accessible Evacuation Centres, delivering a 10,000 litre water tank for Erakor Village, Efate, and assessing all existing water tanks. Oxfam also trucked drinking water to 3000 people in Etas Village on Efate.

When the life-saving phase of the emergency response passes, it's critical that communities are provided with sustainable solutions that will help them recover and, importantly, be better prepared for the next cyclone. In line with this, Oxfam has recently been working to install water tanks and extend water piping networks in areas previously not reached by the system. We have also surveyed community latrines and gravity-fed water systems to shape the focus of future programming in target areas.

Oxfam has been distributing hygiene kits to families on Ambrym, Epi and Efate islands to provide them with basic essentials for maintaining good hygiene and personal health. The kits include items such as toothbrushes, toothpaste, soap, a hair brush, washing powder, towels, a plastic basin, sanitary pads and a bucket for storing water and cloths.

We are also working with long-term partner Wan Smolbag Theatre to present plays promoting good hygiene and health promotion to communities in which hygiene kit distribution and other WASH activities are being carried out. Educational materials about good sanitation practices are handed out at the performances.

The RTC value

Oxfam's long term work with the Rural Training Centres (RTCs) helped many communities prepare for emergencies, and many RTCs were used as Evacuation Centres during Cyclone Pam, especially on Tanna Island. Our WASH manager, Hilary Gareau, was on Tanna Island when the cyclone struck. He mobilised local communities surrounding the RTC at Lorakau and advised them to shelter there. During the cyclone, 112 people used Lorakau RTC to shelter for a few days and it then became an evacuation centre, housing over 20 children, three sick people, two pregnant women and three newborns, alongside other local villagers.

Ultimately, this RTC saved lives but now we must look at the rebuild in the aftermath of Cyclone Pam and safe-proof the community once again. Many of the RTCs located in the areas hit hardest by Cyclone Pam have been damaged so this is one of our main focus areas.

Need to rebuild

Our preliminary rapid assessments indicate that RTCs on Tanna, Epi, Erramango and Paama have sustained the most damage from Cyclone Pam and therefore the rebuild in these areas will be prioritised.

We know that the RTCs work. Not only have they proved to be a community shelter during life-threatening emergencies, they are also a vital facility for communities to access safe drinking



water and a fantastic way for young people to gain vocational training so that they can lift themselves and their families out of poverty and become self-sufficient. It is imperative that we rebuild these six important community assets.

Our current aim in Vanuatu is to:

- Support community reconstruction of damaged RTCs and water systems.
- Repair damaged community water systems.
- Enable staff and students to resume their educational programme.
- Provide a more secure environment for young female students.

Expected outcomes

RTC students, staff and committees, and the communities surrounding the RTCs are actively engaged in the repair of their RTC facilities and have access to safe, disaster resilient facilities, namely shelter and water.

Communities will once again have access to safe and constant water supplies.

Students have access to secure and working facilities that allow them to live and study at the RTC and complete their education.

The rebuilds are vital to ensure these community assets again become fully functional so students can once again learn in a safe, secure and pleasant environment. Our focus on repairing the damage will support the development of local communities in Vanuatu and ensure that they have access to basics we take for granted like clean water.

If you would like to know more about our work in Vanuatu or across the Pacific, please contact Hannah Davies on 09 355 6854 or Hannah.Davies@oxfam.org.nz. **WNZ**

- *Oxfam would like to take this opportunity to thank Water New Zealand for its support. Through promoting Oxfam's work, aims and activities, we are able to give more people living in poverty in the Pacific a hand up – thank you.*

VANUATU: DONATIONS IN ACTION

- 265,800 litres of clean water delivered to 3474 beneficiaries through water trucking activities on Efate Island.
- 10,305 people accessing clean water through water system rehabilitation.
- 16,797 people on Efate, Epi and Ambrym islands received hygiene kits.
- 3406 people have learned good hygiene practices through watching a theatrical performance by Oxfam's partner Wan SmolBag.

WASTE NOT, WANT NOT TREATMENT SOLUTIONS

As water resources become increasingly important, the use of onsite wastewater treatment systems that recharge aquifers are gaining in popularity worldwide and new technology is making these more effective. Environment Technology's **Sian Clement** explains.

As technology improves, community systems are becoming an increasingly popular solution to accommodate the sanitary needs of growing populations worldwide. These community systems are designed to treat the wastewater from sections of a city, town, village, subdivision, resort area, camp, or other groups of homes and businesses. This strategy offers lower capital investment and on-going costs than municipal treatment systems.

These systems provide a higher level of water quality protection, support the local water supplies, can easily accommodate growth, require less infrastructure, and make it easy to employ water re-use techniques. With the incorporation of passive technology, communities are achieving these benefits with very little energy consumption, maintenance, chemicals, or additives resulting in significantly reduced upfront and operational costs.

Takaka-based company Wastewater Design is incorporating a simple and highly effective onsite wastewater system that provides a solution for these community and individual systems in New Zealand.

Dick Lamb and Hazel Pearson started the Takaka-based company Wastewater Design in 2010 specialising in detailed site assessment and design information for building consents and property records across the top of the South Island. Designing wastewater systems in the Tasman and Marlborough regions has meant overcoming a number of hurdles: the fragile eco-systems of the Marlborough Sounds; Moutere clays; rising sea levels in areas such as Ruby Bay and the Kina Peninsula (which has now resulted in banning further development of the area) and along the coast in Tasman Bay and Golden Bay which has seen the Pakawau coastline recede dramatically.

"Our search for effective wastewater treatment systems that could be designed and installed with confidence and with positive long-term results for our clients and the environment resulted in the introduction of the AES system to New Zealand," says Pearson.

Advanced Enviro-Septic (AES) systems were created

in New Hampshire in the United States by David Presby of Presby Environmental out of his desire to protect the sensitive natural environment in his region. Over 250,000 systems have been installed in the US in the past two decades.

Here in New Zealand, more than 60 systems have been installed from Riverton to Kaipara with several now in Golden Bay.

"Designing a wastewater treatment system requires the consideration of numerous factors," Pearson says, "but now that we have AES as an option, it can easily address many site-specific issues. As well as being cost effective to install with no ongoing running costs, the system is so easy to design, you wonder how you got on before AES."

The essential design component for this passive system is the Advanced Enviro-Septic pipe. A traditional primary septic system has wastewater influent entering a septic tank where heavier solids settle, with the liquid effluent and suspended solids moving on to a soil disposal/leaching field, where they are broken down by bacteria as they soak into soil.

Presby believed the piping in a conventional leaching field did not lend itself to a healthy bacterial community; he saw a lack of circulating oxygen and too little surface area for bacteria to colonise and grow on. The AES design relies on a 300mm diameter central plastic pipe with two distinctive features: deep ridges on the outside to increase the surface area and provide additional bacterial growth areas, and plastic skimmer tabs on the inside of the pipe to prevent grease and suspended solids from exiting the pipe before bacteria have the opportunity to break them down. The AES pipes are flexible, lightweight and easy to install to avoid obstacles. The adjustable footprint of the treatment bed also provides more flexibility. An AES system can go in on smaller house sites and can be installed on considerable slopes.

The AES system can handle large variations in daily loading without chemical or mechanical intervention. Anaerobic bacteria utilise the effluent to form biomat layers on the provided surfaces during high flows and during low flows,



1. This picture shows a pressure-compensated dripper line being installed by mole plough 100mm deep in an orchard. In this case, the drip specification is drippers on the purple pipe at 0.6m centred and rated 3.5 litres/hour each. As more than 300 metres of pipe were installed, this spacing and drip rate was chosen to reduce the pump run time. For those with small-sized sections, a secondary wastewater system such as this would require less area for dispersal to ground in the Land Application Area (LAA). In all Standards a reserve area for the LAA is required to be available which again can be half the size of that required for the dispersal of primary treated effluent.



2 & 3. Blodgett Landing during construction and as it looks now.

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aerobic bacteria consume the biomat. Bacterial efficiency is increased by the large air supply and fluctuating liquid levels which provide large food supplies.

To achieve the advanced secondary treatment in an AES bed, it is necessary to create and maintain aerobic conditions that provide the habitat in which the aerobic bacteria thrive. This is achieved by differential venting where air is drawn in through a low vent at the end of the AES bed, through the AES pipes and out through a high vent. The vents can be positioned either at the bed or at a distance from the AES bed if this is more practical or for aesthetic reasons.

AES can be used to refurbish sand filtration beds by bacterially treating primary effluent and protecting the infiltration bed against progressive failure, or for completely new sewerage treatment plants with massive reductions in capital and operating costs over standard mechanical and chemical plants.

A spreadsheet AES Calculator has been developed for the sizing of the system. Data is entered and the size and shape of the system required is determined. Data entered includes; occupancy, daily flow per occupant, soil category, and Daily Loading Rate of the soil (DLR). The latter is determined by information gathered at the site and soil analysis and the desktop study. The soil analysis includes testing ribbon length, colour, texture, strength, permeability and so on to determine the category and properties. The most appropriate

DLR from the AS/NZ Standards 1547: 2013 table L 1 is then selected.

The size of the AES bed is then calculated depending on the size of the area available. For a three-bedroom home, around 12 AES pipes are used. Each is 300mm in diameter and three metres in length and they can be installed in series, for example in two rows of six, three rows of four, or four rows of three. Only 150mm is required between pipes and 300 on either side. The degree of slope is also entered to ensure a gravity feed and if it is fairly steep, a velocity diffuser can be used or a 90deg bend installed before the AES pipes. The pipes are laid in a bed of AES System Sand. This is a clean coarse sand which wicks treated effluent from the outer layers of the pipe and disperses it evenly to the ground beneath.

Re-use of wastewater for irrigation of orchards and shelter belts has obvious benefits. Pumping secondary treated effluent from an AES system through dripper lines is a cost-effective method of achieving this and is also a practical option for sites with steep slopes where it would be impossible to install large beds. Secondary treatment or better is required for drip irrigation systems because it reduces the likelihood of the drippers becoming clogged. AES can lower the Total Suspended Solids to <2mg/litre which is 1/10th of that required for secondary treatment standards.

Sites with very permeable soil and high groundwater levels

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could also benefit from this set up, although, in the latter case, the AES system could be installed in an elevated mound with primary treated effluent pumped up to it to reduce the risk of groundwater contamination.

Climate can also be a contributing site factor, with high rainfall in particular, potentially affecting how a wastewater system performs. On the other hand, in areas with dry climates, re-use of the effluent for irrigation may be a preference. AES systems are adaptable for this use with the AES system installed in a lined bed with a pump chamber included within the bed pressurising the treated effluent to be dispersed, usually through pressure-compensated sub-surface drippers.

Advanced Enviro-Septic can handle large variations in daily loading without chemical or mechanical intervention, which makes it a practical solution for community facilities, show grounds, caravan parks, camping grounds and small towns.

In regards to capital, maintenance and operating costs, councils and rural communities can benefit from the passive nature of the AES system. It can be used to refurbish sand filtration beds by bacterially treating primary effluent and protecting the infiltration bed against progressive failure, or for completely new sewerage treatment plants with massive reductions in capital and operating costs over standard mechanical and chemical plants.

An example of a larger scale application is the 198,000 litres/day installation at the Municipal Treatment Plant at Blodgett Landing in the town of Newbury, New Hampshire. The existing sand filtration beds were upgraded to AES beds in 2011, due to a growing community and higher treatment standards. Fifty percent of the treated effluent is recycled through the treatment system for further nitrate reduction. With a small budget and limited space, the town had to find a product to handle 50,000 gallons per day that would be easy to maintain with minimal upfront and ongoing costs. The town decided to upgrade its system to a series of passive Enviro-Septic beds

In August this year, when the plant renewed its license, the testing interval was increased to six months as the testing regime for the previous two years had produced consistent and high-quality results to the following levels: TSS = 5.0mg/L, BOD = 6.0mg/L, TN = 7.1 mg/L. According to Plant manager Tim Mulder: "The upfront cost saving with minimal ongoing cost and maintenance is exceptional. We are very pleased."

In New Zealand, the Department of Conservation recently installed a system at Mount Nimrod near Waimate and seven DOC houses at Kaitawa near Lake Waikaremoana, which is the largest AES installation in the country to date. A free, online training programme has been created which allows wastewater designers and drainlayers to learn about the system from two video presentations and 75 multiple choice questions which earn the latter six Continuing Professional Development (CPD) points from the PGDB. **WNZ**

• For further information, please contact Wastewater Design at info@wastewaterdesign.co.nz or call 03 525 9006.

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WHY IT PAYS TO MERGE GREEN WITH GREY

A more holistic approach to integrating green and grey infrastructure in our towns and cities will create more resilient outcomes. **Shaun Jones** explains.

Without the constraint of cost, the multiple priorities juggled by our cities' decision-makers would be easier to manage. But cost is often the biggest constraint, and as the government, local councils and business deliver capital infrastructure, the ever-growing demands on revenue are coming under scrutiny.

Given that each dollar comes from ratepayers' pockets, ensuring a positive return on investment is essential. Traditionally, this has meant focusing on the efficiency gains of grey infrastructure such as the initial investment, hydraulics and durability.

Yet the concept of project efficiency becomes muddled when factors such as resilience, costs over the project's entire lifespan and design integration are considered. Arguably, the attention paid to cost becomes a cost in itself.

When design and innovation is limited by this framework, an opportunity to integrate the benefits of green infrastructure is lost.

By balancing grey and green infrastructure, we can create spaces and places that enhance our built, natural and social environments, ensuring they are inherently resilient and sustainable.

By integrating green infrastructure approaches into planning controls, we reduce combined sewer overflow (CSO) volumes, remove heavy metals and other contaminants, reduce heat island effects and improve urban engineering and landscape design to create liveable cities.

Auckland Council is working towards this integrated approach on projects such as Te Auaunga Awa – Walmsley and Underwood Reserves Project, which is seeing the restoration of an area also known as Oakley Creek.

Here, road bridges are being re-built and heavy civils are being utilised to provide flood protection to hundreds of

homes, and significant planning has gone into ensuring this grey infrastructure is integrated with its green counterpart.

The result is that while the traditional infrastructure needs have been met, there's an added social and environmental payoff; communities can gather at the awa and water quality objectives can be met.

The cost of achieving these wider benefits is marginal compared to the cost required to meet the minimum project objective of flood management. What could be considered as competing priorities are now integrated with good effect.

The awa project proves that thinking about our projects with holistic and multiple outcomes can achieve cost-effective solutions that engage and satisfy a range of key stakeholders.

Competing priorities in planning for the future of our cities will always be at the heart of this issue. Getting the right balance is tricky when prioritising investment on outcomes like growth and affordable housing versus community health and cleaning up our waterways.

Strategic decisions that direct local government over long periods of time should be the cornerstone for prioritisation with checks and balances in a local context.

Balancing development and water quality

The National Policy Statement for Freshwater Management (NPSFM) is an example of this.

Although best practice is moving towards the integration of green and grey infrastructure, a transformational and strategic shift in mindset will be required to effect a long-term change.

The objectives of the NPSFM imply a step-change away from current approaches where water quality is considered, but easily de-prioritised in the face of competing objectives such as flood control, yield of residential units or other outcomes that generate immediate economic benefits.

To achieve these wider objectives in urban environments, councils and communities will need to make challenging decisions that balance equally important objectives such as housing supply and the health of our rivers and harbours.

While investments in grey infrastructure will remain essential on projects, the changing needs of cities and their citizens will force integrated design solutions to become the norm. Understanding and managing the inherent challenges will be critically important in order to realise the real and long-term benefits.

This means developing robust design standards that have considered unintended consequences and maintenance solutions with the end-operator in mind, to name just two important considerations.

Proof of this approach can be found in New York City, where billions of dollars have been invested to minimise sewer overflows into their receiving environment. The scheme found that about 80 percent of its objective – a harbour that is cleaner than it has been in the past 100 years – could be achieved with grey infrastructure.

However, New York has reached a point where achieving further reduction in contaminants entering the receiving environment through conventional infrastructure could only be achieved through excessively, and disproportionately, high costs.

As a result, a green infrastructure plan was developed, which

combines the value gained through traditional infrastructure with the benefits of green infrastructure.

Back home at the Te Auaunga Awa – Walmsley and Underwood Reserves Project, the careful integration of green and grey infrastructure is proving seamless. The outcome will be a merger of grey and green infrastructure enabling a community space.

At this river, water is valued and the environment is given significance – alongside the steel and concrete. But the economic benefits of the project have also been maintained in the form of flood protection of hundreds of properties and the enabling of future growth for hundreds more.

Both green and grey infrastructure have a place in our modern cities. Despite the evidence supporting the efficacy and co-benefits of incorporating green infrastructure, large-scale implementation is yet to be consistently incorporated.

When a balance is achieved, we can transform the cities and places in which we live. By applying innovative engineering and integrated design, we can move towards efficient, environmentally-sustainable, and sensitive places for our communities – a future our children's children will value. **WNZ**

• *Shaun Jones is a water and urban development specialist at AECOM. He would like to acknowledge the contribution of his colleague and principal consultant – environment, James Hughes.*

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An experiment in floodproofing

It's a somewhat novel approach to flood prevention – making threatened buildings waterproof. **Hugh de Lacy** explains a Christchurch experiment.

It may not be the solution for the earthquake-induced flooding problems in Christchurch City's Flockton Basin, but spraying a waterproof membrane over buildings, and plugging apertures such as doors and air-vents, seems to ensure that at least floodwaters don't get inside.

The 2011 quakes made the 600-home inner-city suburb highly prone to flooding through a combination of vertical tectonic movement, liquefaction-induced settlement, lateral spreading and river channel capacity changes.

Essentially, the ground dropped, the water table rose, and hundreds of homes were flooded in the heavy rains of March and April last year.

Worse, there was no simple solution to prevent the same thing happening every time Christchurch received heavy rain – something that fortunately hasn't happened since.

The Christchurch City Council (CCC) trialled a range of responses to the ongoing threat, one of which was to make the individual houses flood-proof by coating them in a waterproof membrane and blocking off the doorways and the air-vents in the foundations.

Seepage inevitably accumulating under the floorboards would be pumped out to keep the space round the foundations relatively dry.

The spray-on membrane at the heart of the strategy is called Blue Barrier Liquid Wrap 2300, a product of Australian

company Australasian Building Envelope Protection, or ABEP, which has a Napier-based New Zealand subsidiary, ABEP (NZ).

The liquid wrap is simply sprayed on the outer surface of the building to be protected, making it impermeable to water.

In setting up the test on a single house site, the CCC called in water barrier company Hydro Response, based in Rangiora, which has a range of five products designed for various water exclusion scenarios.

Hydro Response, launched by managing director Clay Griffin a couple of years before the quakes, has since been mostly involved in holding back the water round the city's bridges so that engineers can assess the quake damage and, later, so that contractors can effect repairs.

More recently, Hydro Response has supplied water barriers and expertise to combat the flooding that occurred in Whanganui in June this year.

In the Flockton Basin trial, carried out in collaboration with the CCC's Flooding Taskforce, ABEP first sprayed a red-zoned weatherboard house, which was awaiting demolition, with its bright blue membrane, and Hydro Response surrounded it with 80 metres of its Swedish-manufactured Geodesign barrier, which can exclude water up to 2.4m deep, plus an American-made water-filled tube barrier and a self-inflating barrier from Canada..

Griffin and Hydro Response then blocked off the foundation ventilation apertures with slabs of wood sealed in place and fitted with plastic tubes with removable lids.

The company also deployed its British-made Floodgate barrier system across the doorways, two of them side-by-side at the wide rear porch, and one at the narrower front porch.

With the systems in place, they opened the fire hydrants and filled the space between the Geodesign barrier and the house with water to a depth of a metre – and waited to see how it would work.




In fact, it worked well with no water at all getting into the house, and the inevitable seepage into the underfloor area being easily controlled by a small pump.


The experiment supported the scenario of the

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householder, faced with a flood threat, going round the house fitting caps to the foundation vents, and then setting up the Floodgates to keep water from the doors.

They could then flee the scene, confident that when the water receded they could immediately take up residence again with no water damage.

This scenario assumed the householder would have the Floodgate doorway barriers permanently on hand – possibly owning them.

The CCC's general manager for the infrastructure rebuild, John Mackie, says the level of property protection provided by the trial was "viable," but "there is not a great deal of enthusiasm for it from the communities affected, as it still leaves them with access problems and nuisance flooding of land and outbuildings".

Accordingly, "it does not form part of the recovery programme for flood mitigation," Mackie says.

The cost might also prove a deterrent in Flockton-like situations: it could cost up to \$20,000 to flood-proof a single house-sized building in this way.

This would include applying the membrane, and the \$3000-\$4000 needed for the barriers, depending on the number of doorways and other apertures.

Water barrier use expands

In November last year, the CCC announced that its \$48 million answer to the basin's flooding problems would instead comprise a new pump station and bypass system, requiring the outright or partial purchase of several of the 580 homes it will protect.

The bypass, made feasible by the widening of the Dudley Creek channel and the installation of a new pumping station at Tay Street, will be 700 metres long and gravity-fed.

Griffin's launch of his Hydro Response systems was nicely timed for a role in the Christchurch earthquake recovery, but the application of his water barrier products has spread throughout both main islands, and gone from clearing water round bridge foundations for inspections to holding back floodwaters.

In the latter role, the company's systems were used extensively in the Whanganui floods, where the river



Main image : Flood trial house Christchurch

Above: WIPP barrier trials Horizon Regional Council Whanganui.

overflowed its eastern embankments, putting the area from the Dublin Street to the Victoria Avenue bridges under water.

An increasing number of local authorities have bought and stockpiled Hydro Response's water barriers to limit flood damage, exclude water from bridge piles and allow stream beds to be dredged.

And in Wellington, the Building Research Association of New Zealand (BRANZ) is presently carrying out trials on small-scaled houses on various foundations which are surrounded with Geodesign barriers filled with water.

The houses are fitted with sensors to measure the performance of internal building materials, as part of a project looking at post-flood events and their effects on building structures.

Hydro Response is also expanding its Australian operations, and Griffin will be opening an office there before the end of this year. **WNZ**



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RECOMMENDED READS

These first three Stormwater Technical Papers were presented at the 2015 Asia Pacific Stormwater Conference and have been singled out for their excellence. All four papers are now published on the Water New Zealand website

WETLANDS – HONOURING THE PAST, BUILDING FOR THE FUTURE

By Seb Head – senior Civil (Water) engineer, MWH NZ.

Sam Bourne – associate principal, senior landscape architect, Boffa Miskell.

ABSTRACT

Designing wetlands for stormwater management is more than meeting performance-related criteria to satisfy regulatory requirements and the NZ Transport Agency (NZTA) stormwater standards.

Increasingly, through the NZTA's projects, urban and landscape design, environmental and heritage benchmarks are being applied to deliver multiple outcomes for stormwater management areas.

As part of the Waikato Expressway's: Rangiriri Section Project, the NZTA, Fletcher Construction, Waikato Tainui, Archaeologist and the design team MWH and Boffa Miskell have sought to deliver, social, environmental and cultural outcomes through the stormwater aspects of the project. A Partnering Charter was formed between NZTA, Fletcher and Waikato-Tainui in acknowledgement of the unique cultural heritage of the project area which defined the function and form of stormwater management.

One of the key features is the Rangiriri Wetland, located on the site of the 1863 Battle of Rangiriri, a significant event

in the context of the NZ Land Wars. The opportunities for this history to be revealed were established at an early stage through the urban design and landscape framework (UDLF). In close consultation with Waikato Tainui and the Archaeologist, this design framework developed, setting the scene for both the cultural mitigation works and the opportunities for the wetland design.

Conceptually, the wetland was envisaged to form part of the wider story of the battle site, Pa and historic trench, and Waikato River wetland margins.

This paper provides an overview of the project wide stormwater management philosophy with specific focus on the Rangiriri Wetland design, and how an integrated solution was developed. Commentary on the design will highlight how the form and function of the wetland was developed based on the site specific constraints.

The Rangiriri wetland demonstrates how, through collaboration, stormwater, urban design and landscape outcomes can reveal our important cultural heritage in the landscape.

PRESENTER PROFILE

Seb Head is a senior civil water designer and pipeline design specialist with MWH. He has 18 years' experience, which includes hydrology, hydraulics, pumping station design, road drainage design and pipeline design. He has led design teams on multi-disciplinary projects in New Zealand, Australia, and the Middle East.

Sam Bourne, associate principal Boffa Miskell: Sam has been involved with a diverse range of infrastructure projects throughout New Zealand over the last 11 years; including being the Rangiriri urban and landscape design lead collaborating with MWH, Fletcher Construction, the NZTA, Waikato Tainui, Archaeologist Warren Gumbley and NZ Heritage.

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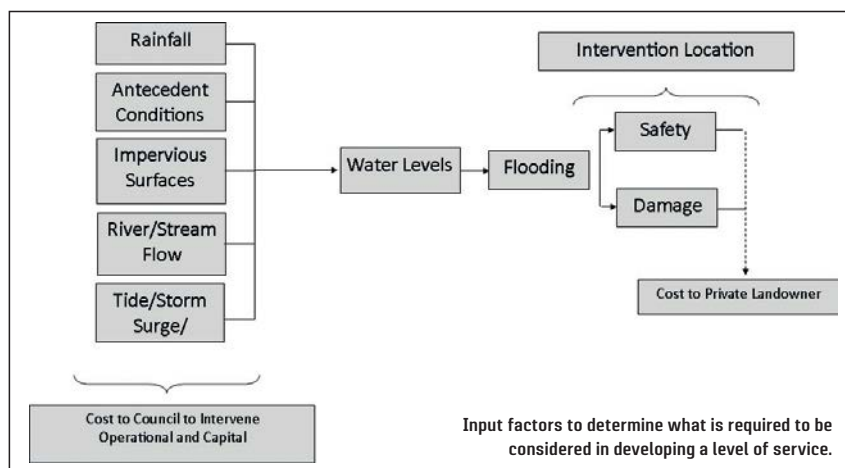
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IS PROVIDING A STORMWATER LEVEL OF SERVICE FOR SIGNIFICANT FLOOD EVENTS REALLY REALISTIC?

By Campbell Larking: Tauranga City Council and Mark Pennington: Tonkin & Taylor.

ABSTRACT

A significant flood event is a strong trigger for infrastructure improvement works, and many Councils find themselves making political and public statements around acceptable tolerance levels for flooding, especially in the wake of a significant event. Often these flood events are extreme, and are in excess of what would ordinarily be regarded as provision of a basic stormwater utility service.

The distinction between the utility provision and defence against the flooding natural hazard is often blurry. The key question that is not often considered through these statements is whether the desired outcome (for this paper a level of service) is affordable, or even attainable.

In Tauranga, the stormwater budget is subject to large expenditure spikes immediately following intense rainfall events which have resulted in flooding.

Following the May 2005 flood event, the Council initiated a flood recovery programme which resulted in the construction of major stormwater infrastructural projects in the parts of the city affected by that event, resulting in approximately \$80 million being spent over a four-year period, with the intention of delivering a 50-year ARI level of service (where attainable).

Continued improvements to the stormwater network are required if the Council and community want to reduce the existing flood risk within previously affected areas and those potentially at risk from flooding, if it intends to reduce the risk through infrastructure provision alone.

In 2009, the then Council, received a paper from staff outlining an additional \$170 million that would be required to improve the current situation, however no financial analysis had been undertaken to determine the accuracy of that figure, nor had any modelling been undertaken to determine the extent of the flooding issues. The key issue is

in deciding on any approach will be couched within the cost to the community of intervening or not, and whether other approaches can be put in place to support an infrastructure programme. To consider a consistent approach to stormwater a level of service (LoS) provides the ability for a framework of intervention, however this is strongly influenced by funding considerations given the city's current debt levels.

A LoS also ensures the consistent delivery of the Council's message to the community and can result in an appropriate backstop for the Council in regard to intervention and to ensure staff are appropriately provided with a policy approach to work within and funding to be provided.

To test these strategic issues above, the Council embarked on the development of a stormwater project which considered: 2D modelling and flood hazard identification; development of an affordable and realistic level of service in relation to flood hazard management; utilising policy/regulatory, educational and infrastructure opportunities to reduce flood risk; and establishing priority areas and considering economic benefits and implications of future upgrades and other options.

The purpose of this was to seek to define an appropriate and affordable level of service coupled with other risk reduction techniques in an overall approach to flood risk management.

In this paper, the above process is described.

Further, this paper explores the issues surrounding the political environment of delivering stormwater improvement works and setting levels of service along with consideration of the options available to Councils to create community resilience to the current situation. The focus is a Tauranga example and is based upon the learnings that the Tauranga City Council has made to these strategic issues over the past year.

PRESENTER PROFILE

Campbell Larking is the senior policy planner and Integrated Stormwater project manager for the Tauranga City Council. Over the past year he has lead the Council's Integrated Stormwater Project, bringing together all aspects of Council strategic and

policy planning, infrastructure planning and delivery and regulatory management to aid in the determination on 'what is an appropriate level of service'.

Web link: waternz.org.nz/MainMenu

RESTORATION OF DUCK CREEK AS PART OF LAND DEVELOPMENT

By Dion Mead and Laura Verry, Cardno (NZ).

ABSTRACT

“The Banks” at Whitby demonstrates how large-scale land development can provide a positive impact on the surrounding environment through the integration of restoration works.

The development of the historic Whitby Golf Course includes approximately 320 residential sections alongside Duck Creek in Porirua City’s hill suburb of Whitby.

Duck Creek is an important natural resource for the local area and it discharges into the nationally significant Pauatahanui Inlet arm of Porirua Harbour.

A key component of the development design was the realignment and restoration of a section of the stream (Duck Creek) to become a core amenity of the area. A Comprehensive Development Plan (CDP) was completed for the work with significant consultation with Porirua City Council, Greater Wellington Regional Council, Department of Conservation, Iwi, Residents Associations and other special interest groups.

The design integrated surveying, engineering, planning, ecology, landscaping and flood modelling to provide a

solution that satisfied the CDP intentions.

The restoration plan for Duck Creek had three main objectives: increase in ecological value; flood management; and public amenity enhancement. The design provided a central spine linkage along the majority of Duck Creek and created a native riparian habitat and passive recreation facilities.

Flood modelling was undertaken and the design was developed to control and manage flood waters in Duck Creek in a safe, efficient and sustainable manner including allowing for climate change. The restoration included two full diversions / realignments of Duck Creek, placement of erosion protection, bank stabilisation works, planting and earthworks to raise the floodplain and change the profile of the river. The successful restoration of the waterway and adjoining areas required the balancing of the three key objectives and has successfully provided a valuable resource of which the whole community can be proud.

Creek diversion planting design potential growth



Typical creek elevation with planting at 5 years' growth



Typical creek elevation with planting at 20 years' growth

PRESENTER PROFILE

Dion Mead is a registered professional surveyor who specialises in project management of land-development projects. Dion has been involved in the project from the development of the initial Comprehensive Development Plan through to construction today and has provided the coordination and project management.

Laura Verry is a civil engineer with Cardno (NZ) in Wellington. She has a wide range of experience in civil/environmental engineering. She has a key engineering role in the design and construction management of the current stages of The Banks development.

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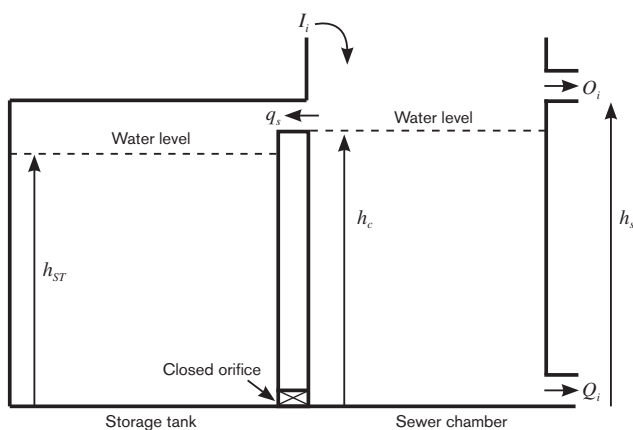
By Upaka Rathnayake and Tiku Tanyimboh.

ABSTRACT

Combined sewer networks carry wastewater and stormwater together. Capacity limitation of these sewer networks results in combined sewer overflows (CSOs) during high-intensity storms. Untreated CSOs, when directly discharged to the nearby natural water bodies, cause many environmental problems. Controlling existing urban sewer networks is one possible way of addressing the issues in urban wastewater systems. However, it is still a challenge, when considering the receiving water quality effects. This paper presents

an evolutionary constrained multi-objective optimisation approach to control the existing combined sewer networks.

The control of online storage tanks was taken into account when controlling the combined sewer network. The developed multi-objective approach considers two important objectives, i.e. the pollution load to the receiving water from CSOs and the cost of the wastewater treatment. The proposed optimisation algorithm is applied here to a realistic interceptor sewer system to demonstrate its effectiveness.



PRESENTER PROFILE

Upaka Rathnayake (PhD) can be contacted at the Department of Civil Engineering, Faculty of Engineering, Sri Lanka Institute of Information Technology, Sri Lanka, email: upaka.r@slit.lk. Tiku Tanyimboh can be contacted at the Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, email: tiku.tanyimboh@strath.ac.uk

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Left: Schematic diagram of sewer chamber with on-line storage tank.



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WAR STORIES

FROM TENDER EVALUATORS



By **Caroline Boot**, Plan A, tender specialist.

Why didn't we win that tender? If your latest bid was an unexpected disappointment, listen up. We're about to tell you some surprising things about tender evaluator processes and preferences. You can't change the past, but if you use this information wisely, you might be able to boost your win rate next time around.

One of the unexpected bonuses that I get every time I train or assess a tender evaluator, is the insight that the process gives as to what happens behind the scenes on tender evaluations. Far from being alarming, in most cases this information serves to firm up my confidence in the integrity of most tender evaluation processes in New Zealand infrastructure.

For those bidders who have little faith in the fairness of the process, there is light at the end of the tunnel. Reality is that tender evaluation processes in New Zealand, while still not perfect, are more transparent, process-driven, and inherently fair than those in most other places. And the trend is for our procurement processes to continue to improve.

So, here are some of the myths we've encountered on tender evaluation.

Myth #1: Past performance doesn't matter – they'll assess the bid based solely on what we write.

If you've made a hash of your last contract, your client will be looking for ways to build that assessment of past performance into their evaluation criteria. They'll be working with the latest tools (such as the revised PACE evaluation scoring methods) to inform their decision. Where your people have been difficult to deal with, have introduced delays and variations, or not met quality standards, you'll find the evaluation tools are weighted to make things difficult for you to win next time.

What's more, if your approach to the contract negotiation is aggressive or uncooperative, expect to be dumped early on. In a recent case, pages and pages of tags, combined with

stubborn refusal to negotiate, led to the evaluators accepting a bid more than \$1million more than the original. Working with a company that difficult just wasn't worth it.

Myth #2: Getting good-looking graphic design on the bid will win me the work.

Seven or eight years ago, only the biggest bids were presented in a graphic-designed format, so it was easy to make your bid stand out with some good-looking graphics. Some evaluators back then were swayed by glossy brochures, custom boxes, folders and slip-cases, and pages full of pretty diagrams. Today, we're seeing clients using standard formats more and more, so that they can focus on the content of bids over and above their form.

Don't get me wrong – an attractive cover and pages that are formatted to maximise information transfer make sense. They will help you to put your message across clearly, and good use of graphics or photo case studies will definitely

Tender evaluation in New Zealand is becoming better balanced, more consistent, fairer, and better aligned to project priorities.

reinforce the strengths of your offer. But don't over-do it. Extensive graphic design components usually mean compromise to bid review time – usually at a time when you can least afford it.

Myth #3: You have to wine and dine the evaluators to get a look in.

Tender evaluators in New Zealand are perhaps more exposed to, and more conscious of potential conflicts of interest than those in larger jurisdictions. While it's certainly helpful if they have heard of your company (in a positive manner!) previously, most public procurement professionals are acutely aware of the need to remain impartial in their assessment of bids.

One organisation I recently worked with has gone to the trouble of stripping the names of the bidders from the (soft copy) bids, to remove any potential bias.

Myth #4: The cheapest price always wins.

This was very true in the post-GFC dark days, when government budgets were cut to the quick, and companies

were driven to the wall in droves through dog-eat-dog pricing. And perhaps we are not out of the woods yet. But the reality is that government organisations have had their fingers (and finances!) burnt by contractors cutting quality in order to meet unsustainable pricing, by variation after variation escalating project out-turn costs, and by companies folding, leaving them high and dry with major costs to re-let the work and finish it.

The appetite for driving tender box prices down to unsustainable levels has diminished – and the focus is shifting to reliability, quality and solutions that save money on the whole-of-life costs of the assets. That's good news for bidders who are also focused on delivering intelligent, innovative products and services that drive long-term cost-efficiencies. The number of bidders who are winning tenders without being the cheapest is steadily rising. As it should, to reflect balanced and sensible procurement decisions.

So the smart thing for bidders to do is to work very hard on making their bid stand out from the competition. It's no longer enough to simply answer the questions – that's what all the bidders will do. Put some time and effort into developing a solution that goes out of its way to improve the outcomes to your client, and then focus all your attention into describing how that solution will benefit them, in your tender document.

They'll remember the things that make your tender stand out, not the predictable but compliant responses that your competitors write.

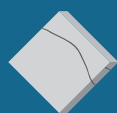
A climate for smarter solutions

Tender evaluation in New Zealand is becoming better balanced, more consistent, fairer, and better aligned to project priorities. If this means that it takes more than competitive tender box pricing to win a contract, most companies will see that as a great thing. If it also means that you have to put more effort into developing smarter solutions and documenting them in your tender responses, then that's a good thing too.

Especially if it means that clients reward innovative methods, quality products and services, and long-term savings over cut-throat tender box pricing.

Good luck for your tenders this year! **WNZ**

- *Caroline Boot is the founder and managing partner of Plan A Tender Specialists and Clever Buying™. She and her colleagues are dedicated to helping companies improve their win rates on tenders, by working with their clients to write winning tender responses. For more information, see www.plana.co.nz.*



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Professionalism – the time is nigh

The case for common professional standards is strong even in normal times – during emergencies, it can mean the difference between life and death, says Connexis CEO **Helmut Modlik**.

I recently read a thought-provoking article by the American Water Works Association (AWWA), forwarded to me by Shayne Cunis of Watercare. The article, which you may have seen, talks about the launch of a nationally recognised professional designation system in the United States.

The idea of a unified system is not new. The US model follows the Victorian Operator Certification Scheme, led by Water Industry Operators Association of Australia, which was successfully implemented a couple of years ago and is now being rolled out across Australia.

The issues leading to the introduction of the systems in Australia and the US are the same issues facing us here in New Zealand. Some – a lack of consistency, unclear standards, and insufficient recognition – can impact on productivity and are unhelpful. However, others – unsafe drinking-water, harm to the environment, low health and safety awareness – have far more serious implications.

When infrastructure assets deliver something as important and potentially dangerous as water, and damaging to our environment as wastewater it is wise to use all levers available to ensure quality and safety.

The case for the introduction of nationally-recognised, accredited work competencies is strong even in normal times.

However, during times of crisis or emergency it becomes vital, and can mean the difference between life and death.

The AWWA article uses Hurricane Katrina as a prime example. Operators came from all over the US to work on repairs, but red tape prevented them from doing so due to differing regional standards and requirements. In a country such as ours which is seismically volatile and subject to extreme weather conditions, ensuring the optimal competence of the available workforce is clearly wise. It is important to note that once a consistent standard has been agreed across our workforce, we need to push for a National code of practice for water reticulation to avoid the New Orleans situation.

Professionalisation of the water industry in New Zealand is not a new idea. In fact, many of you will be aware that the first attempt to launch a professional development regime was made back in 2011.

Now is the time to make it happen.

A single, nationally-recognised regime that delivers and monitors the quality of skills, maintains currency and encompasses new technologies and practices, is the future, and thankfully, most of the required elements are already available.

In New Zealand, the water industry has a long and well-established culture of high-quality training. Industry and workforce buy-in is strong and there is widespread acceptance of the value of qualifications-based-training. Fit-for-purpose qualifications are available, and standards of training are very high. All that's missing is the crucial final step of setting up registration

and governance to operate a formal, professional regime.

The timing to do this could not be better. Water New Zealand and the Water Industry Operations Group, with the support of Connexis, are relaunching a new, improved Water Operations Professionals (WOP) Continuing Professional Development regime. Connexis is partnering with the two peak bodies to support CPD for people working all levels of the industry – from trades through to professional/technical roles.

In addition, the recently announced Civil Trade Regime is the equivalent for the civil construction sector, and a sound example of how such a system can work. Industry association Civil Contractors New Zealand (CCNZ), who are leading the initiative, are championing the value of having nationally recognised and transferable skills, validated by industry, incorporated into a formal professional trade regime.

CCNZ President Dave Connell is originally from the water reticulation sector, and believes that the Civil Trade Regime could (and should) be successfully replicated in the water industry. When we first met, Dave shocked me a bit by saying, “Working in water gives me a licence to kill”. What he meant was – if I don’t do my job correctly, people can get hurt or worse – and he’s right. The importance of a recognised trade regime can’t be overstated. We owe it to ourselves, to the end users, and to the wider industry to make it happen. **WNZ**

• For further information go to www.connexis.org.nz or call 0800486 626.



Helmut Modlik



TRAINEES TRUMP AT KAPITI COAST

With the resignation and retirement of some of our long standing operators, we were required to fast track the recruitment process and fortunately had some very strong candidates apply. From past experience we have found that it's better to employ people with an existing complementary trade and train them in Water Treatment.

Craig Guthrie was transferred from KCDC (Kapiti Coast District Council) reticulation area with a National Cert in Reticulation. He is also a qualified tool maker. Christos Kaloyanis came to us from Wellington where he was pumps supervisor for City Care. He also has his limited electrical registration.

Tony Attewell has many life skills including engineering and air automation.

All three applied for the Government grant of \$2000 for training in crucial vocations that was paid to the Council. That was a total of \$6000 towards their training.

Also as part of this grant, they each received an additional \$2000 personally towards their training. All three decided to contribute that also to Council to help with the costs. That's an all-up financial contribution of \$12,000. This was a fantastic gesture by all three and is just an example of their dedication to this role.

All three completed all compulsory theory credits of the National Certificate in Water Treatment at the Opus Environmental

Training Centre and their practical elective units were related to the process at the Waikanae Water Treatment plant.

This was also completed while working out of Portocoms while the plant was being upgraded. I am immensely proud of this dedicated team and what they have achieved together.

By Dave Bassett, Water and Wastewater Treatment Plants manager.

• If you are interested in the National Certificates in Water or Wastewater NZWETA have courses running before the end of the year. Go to www.nzweta.org.nz for more information or call 0800678 738.



Receiving their certificates from Dave Bassett (L-R): Chris Kaloyanis; Craig Guthrie; and Tony Attewell.

ON-SITE COURSES A WINNER

The NZWETA on-site wastewater treatment course continues to grow in popularity with 25 people attending the recently completed course in Auckland.

The course is intended for anyone involved with onsite wastewater treatment and dispersal systems from designers, installation and maintenance personnel to council and territorial authority staff involved in building consents, resource management compliance and environmental health.

It is delivered in two three-day learning blocks which provides

comprehensive coverage of the topic.

Module 1 is an overview of treatment processes and dispersal systems including legislation and regulatory context, treatment processes, different dispersal systems, management and maintenance of systems, troubleshooting and risk.

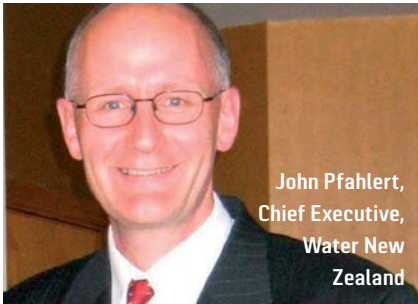
Module 2 is practically focussed and includes basic hydraulics, understanding the receiving environment, soils and installation and operation of systems.

Details of the course are available at www.NZWETA.org.nz/

UPCOMING SHORT COURSES

Although we are nearly two thirds of the way through the year, there are still many short courses available including PE Pipe Buttwelding and Electrofusion welding, Backflow Prevention, Pools, Chemical Handling, and Confined Space training. Go to www.NZWETA.org.nz/upcomingcourses or call 0800 678 738.

Rain and runoff – a need for national guidelines?



John Pfahlert,
Chief Executive,
Water New
Zealand

During the past four years, there has been considerable discussion among members of Water New Zealand over the idea of developing a set of national rainfall and runoff guidelines (NZRR).

There has been a variety of industry workshops and conference presentations on the matter. The idea has also previously been canvassed in some detail in an article in this journal by Mark Pennington (September 2013).

At a meeting earlier this year, the Board of Water New Zealand agreed with staff that although momentum had been lost over the past couple of years, the idea still retained significant merit and that we should resurrect the project.

In late June 2015, a small group of industry members who have been supportive of the project for some years again got together in Wellington to identify steps which could be taken to progress the matter.

Participants were heartened by the good progress that has been made in Australia on the development of national guidance. Led by Engineers Australia and the Bureau of Meteorology, their project is updating guidance documents from the 1980's. That it has, to date, taken 10 years and \$12million perhaps helps explain why the project has languished on this side of the Tasman.

Action so far has seen Nick Walmsley and myself socialise the idea of a major project with the National Infrastructure Unit of Treasury. Their response has been positive but much work needs to be done to develop a firm proposal. We have taken the approach that an NZRR

would fit well within the context of the NZ 30 Year Infrastructure Plan.

The 2015 Plan is part of the journey to maintain a knowledge base and strategic long-term outlook to ensure infrastructure is adequate to support an efficient economy for aspirational higher living standards. Launched at the NZ Council for Infrastructure Conference in late August, the Plan provides a systemic response model to encourage infrastructure providers to plan better infrastructure outputs. A consistent approach to hydraulic modelling by Councils in both the rural and urban environments seems to fit well with the Plan's broader objectives.

While flooding is New Zealand's greatest risk, there has been no integrated policy guidance for managing flood risks at the local level since the work started by the now disbanded Water and Soil Directorate in 1988. Since that time, councils have, with varying success, had to develop flood-risk planning separately in the absence of any national guidance.

NZRR national guidance would assist in achieving universal and effective planning and management outcomes. Many of the communities exposed to flood risk are constrained in terms of knowledge and skills availability, the affordability of flood management techniques such as flood forecasting and access to funding for capital works.

The cost of flooding was reported to be an average of \$17m per year between 1976 and 2003. Since then the insurance cost has averaged >\$75m which is estimated at about 40 percent of the total cost. In other words, total flood-related costs are reported to be averaged at \$190m/year.

These cost patterns align with climate change predictions for an increase in the frequency of extreme weather events and ever increasing land use modifications.

Currently there are a number of regional guidelines and methods, as well as informal and in-house approaches to generating flood estimates by rainfall-

runoff methods. Each of them can (and have) produce widely varying outputs, even when using the same input data. +/- 50 percent variation in runoff volume is easily possible.

Benefits of a NZRR would include savings from:

- Consent applications where analyses are undertaken using approved methods, saving the need for extensive justification of method employed and for peer review;
- The development of separate guidelines across all regions – one set of guidelines could apply nationally;
- Consistency in results across different methods would lend greater credibility to analyses, resulting in higher confidence in outputs;
- Reduction in insurance costs as certainty and consistency allows improved infrastructure and reduces insurance premiums; and
- Reduction in central government costs to assist communities in recovery from floods.

Given the time and cost associated with the Australian experience in the same field, I don't expect progress to be rapid. The project has numerous elements to it which will require the participation of a wide range of stakeholders. Among these will be Council staff and private sector consultants involved in hydraulic modelling, as well as the developers of proprietary software products.

Conversations to date with staff in regional councils, crown research institutes, district councils and universities suggest there is widespread interest in the subject matter. Developing meaningful work packages to deal with the many elements to the project will take time.

The first priority is to secure agreement to funding and governance of the project, which in itself may take 12 months. Anyone with an interest in being kept advised of progress should contact myself or Nick Walmsley. **WNZ**



A MODERN DAY PIONEER

FREDERICK JAMES RABBITS

On Sunday June 21, 2015 Frederick James Rabbits died peacefully in Nelson, age 94. Fred was the founder and owner of Dormarg Equipment, an Auckland-based manufacturer of water and wastewater treatment equipment well known by specialists for the quality and reliability of its work.

Fred was born and raised in England, where he also completed his engineering education. He learned his craft working for many years in India before coming to New Zealand. He arrived in Auckland in 1956 when the Harbour Bridge was still being built and when the Mangere sewage works constructions had just started. Working for D McLeay Wallace, he built his first package plant in 1963 for the township of Waitakere City.

In 1965, Fred founded Dormarg

Equipment together with his business partner Keith Relf. Fred's package plant designs became so popular that they were installed all over New Zealand as well as exported.

Over the years Dormarg Equipment produced an increasingly larger and more complex range of equipment ranging from dewatering presses and digester equipment to large clarifiers and whole treatment plants. Dormarg's equipment can be found on many of New Zealand's largest and small treatment plants including Auckland, Christchurch, Rotorua, Taupo and Russell to name only a few.

Fred's small company (maximum eight people at its prime) also designed and exported equipment to Malaysia, Australia and to major treatment plants in Hong Kong.

Fred was an example of a modern day pioneer to New Zealand, of a true English



gentleman and of an engineer to the very core.

His passion was the design and construction of well-built water and wastewater treatment equipment at which he worked way into his 80s. As such, he has significantly contributed for over 40 years to the protection of the country's environment.

Fred has gone. But Dormarg Equipment's nameplate is still on many installations and they will continue to work quietly, and reliably away – as he did – for still many years to come.



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ON A RISING TIDE



Maria Utting,
chairperson,
The Rising Tide.

Every year, more than 1300 engineering graduates leave university to forge a career in their chosen discipline. There are many opportunities available to a new graduate and attracting young

engineers into the water industry is crucial for the ongoing development of water engineering in New Zealand.

The Rising Tide is a Water New Zealand group focused on young water industry professionals and



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encouraging their involvement within Water New Zealand and the industry. The group began in Auckland in 2013 and now includes a committee in the Canterbury region. The Rising Tides Committee includes representatives from local government, contractors and consultants, providing a wide coverage across the industry

To date, The Rising Tide has hosted a number of events which have provided opportunities for young engineers to network and gain some valuable CPD (continuing professional development) hours in a relaxed environment. Events have included project presentations from both contractors and local government organisations and the ever-popular “Speed Networking” event, which has become a regular fixture on the calendar.

“Speed Networking” provides the opportunity for young engineers to engage with senior engineers in the industry and learn how they got to their current position and how this industry

has changed over the years. There is always plenty of time for networking and catching up with familiar faces at the events as well.

These events are open to anyone with an interest in the water industry and provide a good opportunity to keep up to date with Water New Zealand activities and other upcoming activities. Other initiatives undertaken by the Rising Tide group have included working with Auckland University to develop a relationship between the Civil and Environmental department and Water New Zealand.

The Rising Tide Group has presented at fourth year papers, introducing Water New Zealand as an organisation and promoting the free student membership that is available to University students. Students can sign up to Water New Zealand through the website by choosing “Student” as their membership type.

Future initiatives will continue a focus on the universities and on getting

event invitations out to audiences that may not currently have access to event invitations or a strong knowledge of the industry.

Upcoming events planned for this year include a presentation on a major water project being undertaken within the Auckland region and a site visit, which will be confirmed as we approach summer and have more daylight hours available.

We are excited by the opportunity to promote Water New Zealand and work with young engineers to build and support their enthusiasm for the water industry. Look out for the invitation to our next event; we look forward to seeing you there. **WNZ**

• *Maria Utting is a chartered environmental engineer with the Mott MacDonald water team. Maria has seven years experience in the water industry, primarily focusing on stormwater and wastewater civil design and hydraulic modelling.*

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Water understands civilisation well

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

The increasing sophistication of water quality and quantity science, policy and law continues to give credence to Ralph Waldo Emerson's mid-17th century observation (in his poem *Water*) that "The water understands civilisation well".

Civilisation's shifts in industry and regulation do have marked impacts and the increasing use of water, for both productive and recreational uses, has repercussions for water quality and quantity. Legacy nutrient loads are making their way through groundwater stores, denoting New Zealand's land use practices of the past. As one example, the 2013 Parliamentary Commissioner for the Environment ("PCE") report *Water quality in New Zealand: Land use and nutrient pollution* drew a clear correlation between the amount of land converted to dairy farms and the amount of nitrogen that finds its way into water. Similar correlations have been shown between degraded water quality and other productive land uses, as well as stormwater runoff from impervious surfaces in urbanising areas.

The legal world is shifting in response – civilisation is trying to understand water in return. This article discusses three such examples: a recent PCE report on the *National Policy Statement for Freshwater Management 2014* ("NPSFM"); a recent case on the approach to water quality required by the NPSFM 2014; and the final decision of the Tukituki Board of Inquiry. The PCE's *Managing Water Quality: Examining the National Policy Statement Report* (June 2015) makes recommendations on six aspects of the NPSFM, which are considered unclear¹.

Maintaining and improving water quality

The PCE report (at page 6) aligns with the Land and Water Forum in recommending that 'maintain' and 'improve' be defined by way of the attribute bands set out in the *National Objectives Framework* ("NOF"). Where an attribute stays within the same band, it is maintained, and where an attribute moves to a higher band, it is improved. This "allow[s] a degree of flexibility, but preclude[s] significant degradation of water quality".

The PCE report recommends the deletion of the word 'overall' in Objective A2 to address the 'unders and overs' interpretation implemented by some councils, and to accord more closely

with a recent finding of the Environment Court. The rationale for this change is perhaps best explained as follows (at page 1)

"This 'unders and overs' approach is unworkable in any scientific way. But even if it were, surely we should, and can be, more aspirational than this. Of course, some waterways may get worse before they get better, but that is no reason to set our sights low. If, for some reason, it is decided that some waterways should be allowed to degrade, this should be made transparent in the NPS by way of exception."

Freshwater Management Units ("FMUs")

The PCE Report recommends that the Minister for the Environment provide a set of clear criteria for regional councils to use when selecting FMUs, since there are no guiding principles within the NPSFM itself.

Exceptions to national bottom lines

Appendix 3 of the NPSFM permits exceptions to the bottom lines for water quality where existing infrastructure is a "contributing factor".

The PCE report recommends that the Minister amend the NPS so that the infrastructure exception only applies where the infrastructure is the reason for the FMU being below the national bottom line, not merely a contributing factor; and that the exception only applies to infrastructure which was in place by 2014.

Taking a strategic approach

The PCE report acknowledges that for some water bodies, delaying action may lead to water quality falling and the task of improving it therefore made harder and more costly.

The PCE report therefore recommends that the Minister amend the NPSFM to require regional councils to prioritise the setting of objectives and limits for water bodies and catchments that are particularly vulnerable and under increasing pressure, and to set interim measures to prevent degradation in the meantime.

Measuring ecosystem health – a bio-indicator

To measure the compulsory freshwater value of 'ecosystem health' set by the NPSFM, the PCE recommends that the NPSFM be amended to include the *Macroinvertebrate Community Index* as a compulsory attribute for the measurement of ecosystem health.

Estuaries

Given the intention of the NPSFM to manage catchments in an integrated manner, and given the fact that the health of estuaries is directly impacted by the health of the waterways which flow into them, the PCE Report recommends that the Minister for the Environment direct his officials to prioritise the work required to bring estuaries into the NPSFM.

NPSFM UPDATE: SUSTAINABLE MATATĀ V BAY OF PLENTY REGIONAL COUNCIL

Sustainable Matatā v Bay of Plenty Regional Council [2015] NZEnvC 90 was an appeal against a decision of the Bay of Plenty Regional Council to grant consents and designations to the Whakatāne District Council for a wastewater treatment plant near Matatā, and a related land application field.

In regards to water issues, the Applicant and Respondent case was that "the stream [the Old Rangitaiki Channel] is so ecologically compromised that the further addition of nutrients to certain limits will not make the ecological situation significantly worse" (at paragraph [376]).

The court however considered that this position did not align with the NPSFM, particularly when considered in concert with:

- NPSFM Policy A4(1) which requires Regional councils to avoid adverse effects from contamination in the interim period before the limit setting process is undertaken; and
- The functions of a Regional Council as set out in s30 of the Resource Management Act 1991 ("RMA") to support the interpretation of Objective A2, in particular the function in s30(1)(c) to: "control of the use of land for the purpose of... (ii) the maintenance and enhancement of the quality of water in water bodies and coastal water: (iii) the maintenance of the quantity of water in water bodies and coastal water: (iiia) the maintenance and enhancement of ecosystems in water bodies and coastal water"

The Environment Court held that the word 'overall' in Objective A2 of the NPSFM must be interpreted in light of section 5 of the RMA, and further that "[i]t would be contrary to the Act for the National Freshwater Policy to mean that individual catchments could fail to meet [RMA s5(2)] (a), (b), or (c)." This is in line with the findings

1. The PCE has also produced an accompanying Update Report – Water Quality in New Zealand: Land use and nutrient pollution (June 2015).

of the Environment Court in *Ngāti Kahungunu Iwi Incorporated v Hawke's Bay Regional Council* [2015] NZEnvC 50.

The Sustainable Matatā Environment Court concluded (at paragraph [377]):

"Once we consider the primary objective to safeguard the life-supporting capacity and sheet this home to Part 2 and the Regional Council's functions, we conclude that maintenance at least must be assumed. Adding to existing background level albeit degraded, will not achieve maintenance."

TUKITUKI: BOARD OF INQUIRY'S FINAL DECISION

The final decision of the Board of Inquiry ("BOI") on the Tukituki Catchment Proposal has been issued. This decision follows a referral back from the High Court, with a direction to reconsider Rule TT1(j) – the 'deeming' provision.

As we noted in previous articles, the BOI's proposed 'deeming' provision was an exception to a requirement that farms not cause or contribute to a certain level of nitrogen leaching, the exception being that where the 'at source' leaching rates were met by the farm, it was deemed not to be causing or contributing to the exceedance of limits leached overall.

The deeming exception did not appear in the BOI's draft report, but featured in the final report. The High Court found that the BOI made a material error of law by inserting the deeming provision into the final decision without the parties having a chance to comment on it. The High Court also found that the effect of the deeming provision was: "that the Regional Council will lose an important tool in its management of the amount of DIN that enters significant portions of the Catchment Area. ... the factual deeming provision in Rule TT1(j) does not avoid, remedy or mitigate the adverse effects of activities on the environment or give effect to the National Freshwater Policy Statement 2011" (*Hawke's Bay and Eastern Fish and Game Councils v Hawke's Bay Regional Council* [2014] NZHC 3191 at paragraph [8]).

The High Court reasoned that the deeming exception created a 'factual fiction' that 615 farms were not contributing excessive quantities of DIN to the waterway 'when in fact they are likely to be doing so' (paragraph [189]).

The BOI's final 2015 decision has deleted

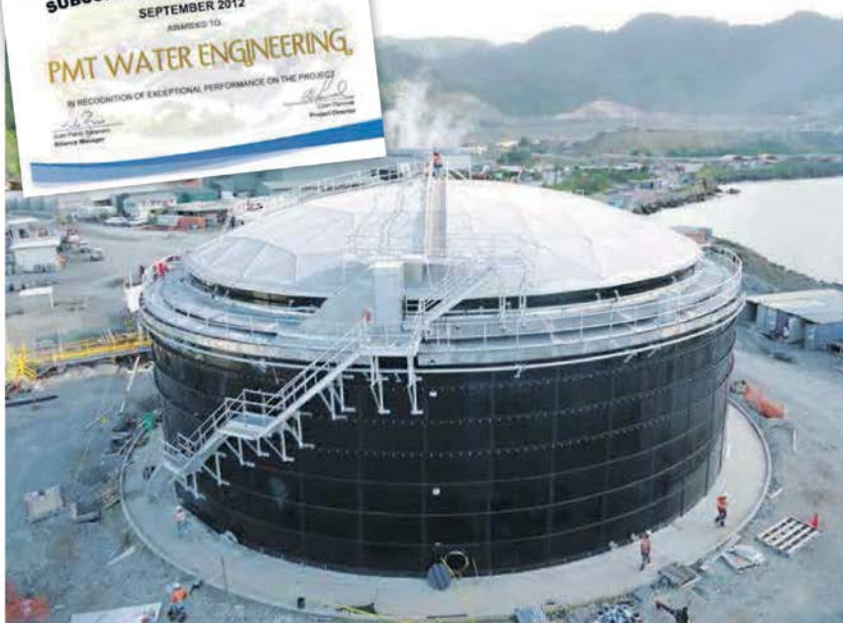
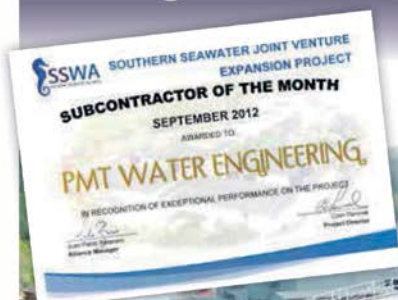
the deeming provision; included exceptions for low intensity farming systems (which it has defined) and plantation forestry; and more accurately identified where the measurement of DIN is to take place. Consequential amendments were also made to other policies and to the conditions for the Ruataniwha Water Storage Scheme.

In terms of reaction to the decision, the Environmental Defence Society confirmed in a recent media release that it is satisfied that the limits set for water quality are acceptable and should protect aquatic life in the river system. The decision has not been appealed and the appeal period closed on 30 July 2015.

CONCLUDING REMARKS

The continuing development of the NPSFM and related case law is reflecting both New Zealand's past impacts on water and the changing tide of societal values. These values are increasingly demanding protection of both the biological and cultural values of water. Hopefully, this ongoing development of water law and policy will enable us to avoid Emerson's somewhat ominous premonition that when water is "[w]ell used, it decketh joy ...[but] ill used, it will destroy". **WNZ**

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What price quality water?

Kevin McFarlane ponders the price some pay for a potable water supply.

There is something that many of us see in the streets today that we would not have seen a generation or so ago. It's something we take for granted in 2015, yet 30 years ago we might have looked twice at a person carrying this item – an item that we see everywhere today being held by people from all walks of life.

Can you guess what it is?

We see them being carried in offices, shops, on the streets, in cinemas and at the gym. We put them easily into handbags, they sit on our desks or neatly between the driver and passenger in a car. These items come in different shapes and sizes; there is more than one producer of them and millions are produced and sold.

Have you guessed yet? I bet you thought I was writing about the ubiquitous mobile phone. Not at all – the item we have taken to our hearts is the bottle of drinking water.

I cannot imagine anyone, 30 years ago, going into a shop in [say] the UK to buy a plastic bottle containing one litre of drinking water. Add to that the fact that the purchaser would have paid more for the water than for a litre of petrol [on one Australian supermarket web site at time of writing, bottled mineral water was typically \$2 to \$3.33 per litre; petrol was \$1.29c per litre] and one might think they were crazy.

But here we are doing exactly that. And one can even choose flavoured water or fizzy water. Yet, at home, I can turn on a tap and receive clean, healthy drinking water.

So why do some of my friends, family and colleagues feel the need to spend more on drinking water than on petrol when they don't have to? Perhaps it's fashionable or maybe we have been convinced by advertisers that the bottled option of "mineral" water is healthier?

It makes me laugh when petrol prices rise

by a few cents and the media goes wild with frenzy. Yet where are the articles from the media on the cost (and necessity) of bottled water?

In Australia, Yarra Valley Water listed its prices in 2014/15 as follows: "... residential customers will pay \$2.5559 per 1000 litres (1 kilolitre) for water use up to an amount equal to 440 litres times the number of days in the meter reading period."

That's \$0.0025 per litre!

Water quality is an issue facing the planet. The chemical, physical, biological, and radiological characteristics of our planet's water is a topic for debate worldwide. Water quality is a problem that is growing as the population of the planet races to reach nine billion within a generation or two.

Our impact on water quality as we manufacture, farm, travel and live is cause for concern. According to UNICEF, an estimated 1.1

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billion people still do not have access to safe water. Fixing this issue is an enormous task.

And water quality isn't simply an issue about potable water. The planet's ecosystems are constantly at threat from human activity. The quality of freshwater water in rivers and lakes is under scrutiny; pesticides and fertilisers leach into groundwater and then into water courses. Sea water quality is the focus of attention whether it's to protect our reefs, fishing stocks or sport and leisure activity.

The proposed Carmichael coal mine in Queensland, Australia, was in the news recently. When operational, Australia's largest coal mine would have produced an estimated 60 million tonnes of coal a year. However, the mine has been staunchly opposed on environmental grounds with its potential negative impact upon the Great Barrier Reef and groundwater with plans to dump mine spoil at sea.

Next year, the Olympics will be wowing its multi-billion worldwide audience from Rio de Janeiro in Brazil. The Olympics brings joy to many. But it's not all fun and games. The BBC covered a story where a small flotilla of 30 boats took to the waters to protect against

water pollution in Guanabara Bay where sailors will compete for Olympic Gold in 2016. The issue is the high level of bacteria in the water from raw sewage. The Brazilian authorities had promised to clean up the pollution before the Games, but recently accepted they had failed to meet the targeted reduction of 80 percent. Oh well, competitors had better not fall in then and swallow a mouthful as they race for glory.

So are we doing enough to clean up our act?

The technology is there; the science is understood and we know what we should do. The information is available to the politicians and decision makers. However, people are dying each and every day due to poor water quality and the numbers are frightening. Yet we are still abusing the most fundamental natural resource we have – the one that keeps us alive.

We cannot live without water.

Up to 60 percent of the human body is made up of water; we each need something like 2-3 litres of water per day just to keep us alive. Then add the need for water to enable us to wash, cook, generate electricity etc. Our planet Earth is unusual galactically-speaking because it holds water in liquid form; Earth spins

through space in the "Cinderella Zone" (where the Earth's distance from the sun means the surface temperature is not too hot nor too cold). Our planet contains a lot of water, both fresh and salt.

The estimated volume of all water on, in, and above the Earth (in the atmosphere), is about 1,386,000,000 cubic kilometres, which would form a sphere approximately 1385 kilometers in diameter.

So what am I doing about the issue? Alas I am not a water engineer or scientist. However, I do not buy bottled water. I fill a bottle from the tap. We catch rainwater at our home and use that for the garden; we also have an irrigation system in the garden which is set on a timer to make efficient use of water in the hot, summer months. And, indirectly, I use the money I save by not buying bottled water to sponsor three children in countries less developed than the one I live in. I know my modest contribution to those children in Rwanda, Cambodia and Honduras is keeping them healthy as the essential projects I help fund include the provision of clean, healthy drinking water.

Now that's good use of my money. **WNZ**



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Councils and industrial and mining companies invest billions of dollars into equipment and infrastructure to process waste water and sewage while corrosion of this infrastructure, and in some cases the subsequent leakage, costs industry in excess of \$1 billion each year.

The main assets that are impacted by corrosion in waste water treatment plants (WWTP) are the pipelines, storage tanks, clarifier ponds and sewage channels. As much of the WWTPs infrastructure is ageing, it is starting to require refurbishment or replacement. One method of refurbishment of these assets is to carry out surface repairs and then apply protective coatings. These coatings must be strong, flexible and resistant to chemical attack.

Rhino Linings are designed to minimise water treatment plant degradation and chemical spills.

"Special consideration has to be given when coating structures in sewage treatment plants," says Dennis Baker, a special projects engineer at Gold Coast-based Rhino Linings Australasia. "One of the more corrosive by-products of sewage is hydrogen sulphide gas.

"Hydrogen sulphide reacts with moisture on surfaces in a waste water plant and bubbles up to form sulphuric acid which really loves concrete."



One type of coating from RLA that is ideally suited for waste water treatment is spray applied Polyurea. The company has been working with this material since the early 1990s and now manufactures in Australia a range of consistent formulations which are suitable for a variety of applications.

Pure Polyurea is a relatively modern material that has been developing rapidly during the past 10 – 15 years. "Polyureas

and particularly Pure Polyurea came to the forefront in 1980 when the entire outer surface of the Alaskan oil pipeline was coated in polyurea," says Baker.

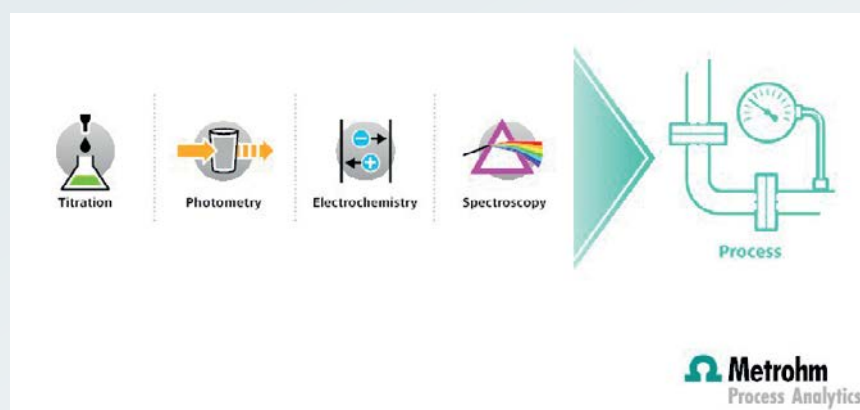
"Many people do not know that spray applied Pure Polyureas are a very good method of protecting most structure. We need to educate the engineering market place about the benefits and cost effectiveness of this versatile and adaptable material."

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robustness and the company says thousands of installations worldwide, "makes them a world leader in wet chemical process analysis".

Metrohm Process Analytics solutions are

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AUTOMATIC TITRATION

The new Hach TitraLab AT1000 analysis system is a one-touch, automatic titration system, with pre-set methods that can quickly deliver accurate and reliable results.

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Hach says its customers can expect simplified titration, "straight from the box with the system." Each AT1000 model will include an application-specific kit to make it quick and easy for anyone to set up and operate a test.

"The application-specific kits include a USB key that automatically programs the required endpoints and calculations to ensure testing is done according to standards, but without the complex programming."

Features include: Application kits that provide all necessary equipment and programming to run a titration; easy-to-use product interfaces; and compatibility with Hach IntelliCAL probes.



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Another new release from Hach is its QbD1200 Laboratory Total Organic Carbon (TOC) Analyser, which it says features a time-saving, 90-minute, fully automated calibration, a 10.4 inch color touch screen user interface, and a process that nearly eliminates sample-to-sample carryover. A full 18-point calibration with six concentrations and three replicates is said to each take only 90 minutes and is fully automated.

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