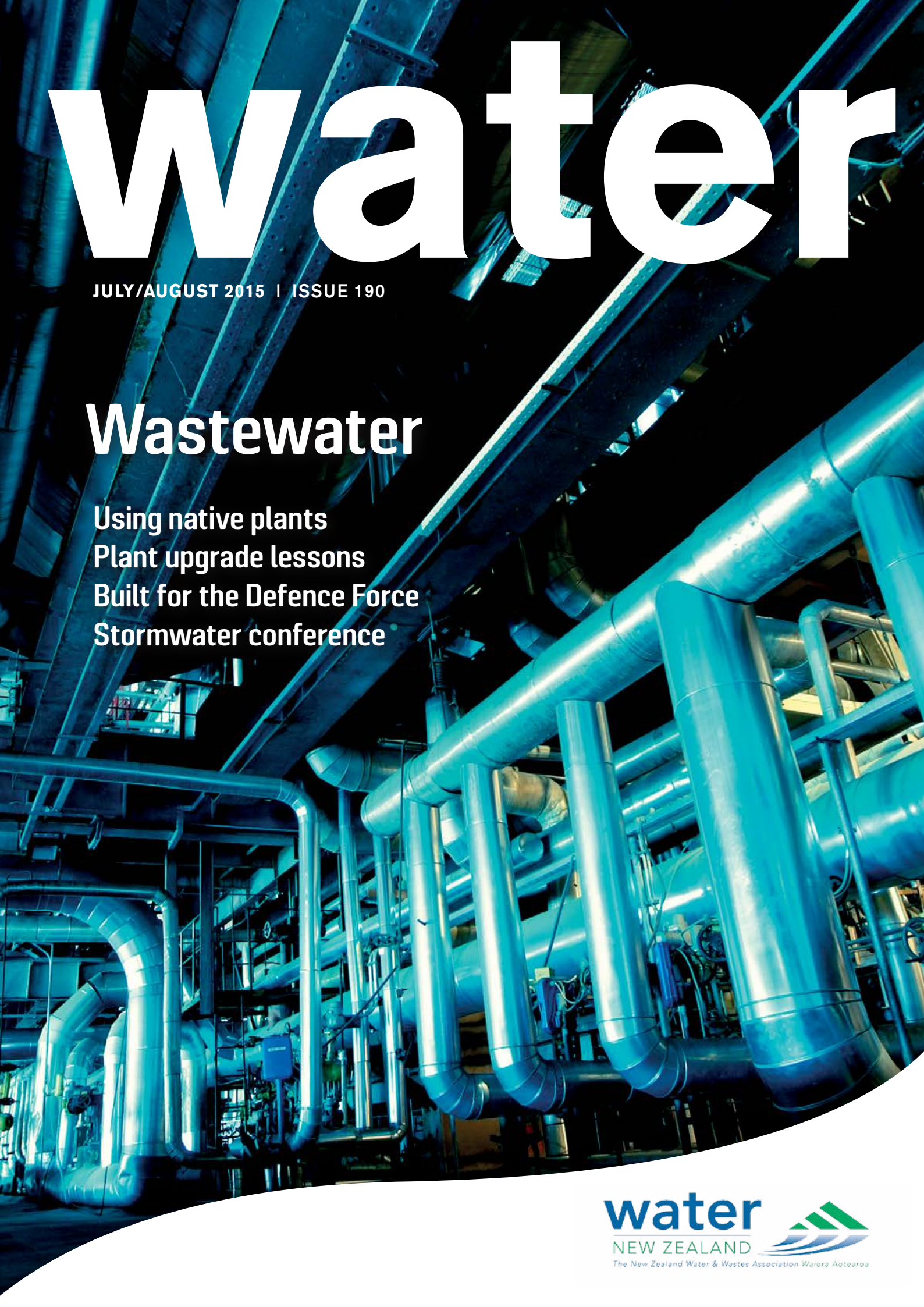
water

JULY/AUGUST 2015 | ISSUE 190



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Postal: PO Box 1316, Wellington 6140
Level 12, Greenock House,
39 The Terrace, Wellington, 6011
P +64 4 472 8925, F +64 4 472 8926
enquiries@waternz.org.nz
www.waternz.org.nz

President: Brent Manning
Board Members: Hugh Blake-Manson, Kelvin Hill, Dukessa Blackburn-Huettner, Adrian Hynds, Helen Atkins, David Simpson
Chief Executive: John Pfahlert
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SPECIAL INTEREST GROUPS
Trade Waste: Geoff Young, P +64 7 858 2101
Stormwater: Vijesh Chandra, P +64 9 368 6311
Operations: Peter Whitehouse, P +64 4 495 0895
Backflow: Graeme Mills, P +64 7 577 7052
Modelling: Louisa Sinclair, P +64 3 474 3896
Small Water Systems: Craig Freeman, P +64 4 232 2402
Small Wastewater & Natural Systems: Gareth Williams, P +64 9 445 8333
Telemetry: Tim Harty, P +64 7 838 6699
Rivers Group (with IPENZ): Peter Whitehouse, P +64 4 495 0895

WATER JOURNAL
Managing Editor: Alan Titchall, alan@contrafed.co.nz, P +64 9 636 5712
Contrafed Publishing
Advertising Sales: Noeline Strange, P +64 9 528 8009, M +64 27 207 6511, n.strange@xtra.co.nz
Articles: To contribute to future issues please contact Alan Titchall, alan@contrafed.co.nz
Design: Contrafed Publishing
Suite 2.1, 93 Dominion Road
PO Box 112357, Penrose, Auckland
P +64 9 636 5715
www.contrafed.co.nz
Distribution: Hannah Smith, P +64 4 495 0897,

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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.

Lessons from Australia

Brent Manning, president, Water New Zealand.

Essentially the Aussies have had to face the food, water, environment nexus head-on; however they are doing this retrospectively.

There's a line of a Jimmy Barnes song that goes, "As sure as the river runs to the sea…"

Well, as iconic as Jimmy and his songs are to modern day Australians, that river flow doesn't necessarily bear true in the Lucky Country any more.

Thanks to the extended dry years from 2001-2010 in the Murray Darling basin, subsequently coined "the Millennium Drought", Australians have been questioning the future of the river system against a backdrop of depleted agricultural outputs, all-time extreme environmental low flows, and Canberra-led policy changes.

Amongst others, these topics spawned some good paper presentations and workshop fora at the Ozwater '15 annual conference of the Australian Water Association (AWA), which I was privileged to recently attend. The conference theme was "Delivering Growth and Prosperity".

Fitting too, that the conference this year was held in Adelaide, South Australia, arguably the most impacted of the states drained or watered by the Murray-Darling catchment. South Australia is heavily reliant on the flows at the 'bottom end' of the system as they abstract water from the Murray for towns and agriculture on the lower reaches, including Adelaide City, a mere 100 kilometres away and requiring a 300-metre elevation lift.

The problem is, so is every other historically developed jurisdiction up and down these rivers. This over-reliance on river water combined with drastic cuts to available flows through the drought led to Adelaide City's decision to build a A$1.8 million desalination plant. I also took the opportunity to visit this plant while in Adelaide. Commissioned in 2012 it can augment Adelaide's water supply with up to 300 mega-litres (ML) per day, to offset other predominantly surface sources. However, at full production of up to 300ML/day the plant uses $50 million worth of electricity charges and with annual operating costs of another $30 million, it's currently not cheap water. Nowadays though, every major coastal city in Australia has a desalination plant (or two in the case of Perth).

In the past few years the Australian federal government has budgeted $12.9 billion (you read right – that's nearly $13 billion!) to unravel legacy water licences and to rebuild established, inefficient water irrigation and flood harvesting infrastructure. Policy initiatives have seen $5.8 billion of government (read taxpayer) money spent on installing new more efficient pump, pipe and distribution systems, the rub being that the government claws back the water saved to retain flows in the river. It's worth noting that in some reaches the Darling River dried up completely during the drought, including the river 'outlet' to the sea below Lake Alexandrina in South Australia.

So while their government's bold, and in many cases, unpopular, policy action seems to be restoring some kind of balance between water for towns, economic growth and environment, their Bureau of Meteorology recently announced the onset of another El Nino system.

So what does all this mean to New Zealand?

Essentially the Aussies have had to face the food, water, environment nexus head-on; however they are doing this retrospectively.

We needn't think we are immune from these same concerns for our future here in Godzone, albeit on a different scale, nonetheless just as critical for NZ Inc. As I see it the implementation of the 2014 National Policy Statement for Freshwater Management gives us, and our communities, the opportunity to have the policy debate here before the onset of climate change prompted crisis.

NB: I am grateful to the AWA for the invite to Water New Zealand CE John Pfahlert and myself to Ozwater '15. Go to www.awa.asn.au for further related information.

I also would like to acknowledge the Acciona Agua and TRILITY joint venture (known as AdelaideAqua), as operators of the plant, for hosting my visit to Adelaide Desalination Plant.

Feel free to send any feedback on this column or the journal content to John Pfahlert (ceo@waternz.org.nz).

Brent Manning, *Water New Zealand President*

Ozwater' 15 Annual Gala Dinner – pictured courtesy of AWA: Representatives of the Water World Cup? Fitting, I thought in this Rugby World Cup year, that the five key nations of South Africa, New Zealand, Australia, England and France were represented by the following heads of their respective organisations, and in the presence of former Wallaby and MC for the evening Peter FitzSimons. Pictured from left to right: Trility managing director Francois Gouws; Brent Manning, representing Water New Zealand; Graham Dooley (now immediate past president) AWA; Peter FitzSimons; John Ringham SA Water chief executive; Thierry Mallet head of Suez Corporation.

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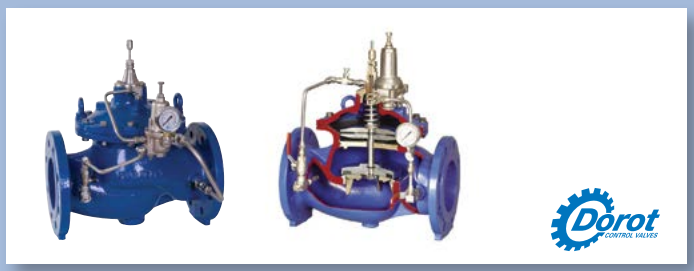

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Improved funding for irrigation

IrrigationNZ has welcomed the $25 million of new funding to the Irrigation Acceleration Fund (IAF) in this year's budget.

"This will boost the development stages of water storage and irrigation distribution infrastructure, which is desperately needed in our summer dry east coast regions," says Nicky Hyslop, IrrigationNZ chair.

"With additional IAF funds contributing to the early stages of this infrastructure development, it will be essential that RMA process reforms which empower collaboration also occur, so that the funds do not go to waste.

"We are encouraged to see that the government has also put money toward assisting councils with the implementation of the National Policy Statement for Freshwater Management and the 2014 National Objectives Framework, and to supporting a new collaborative approach to resolving managing freshwater."

Irrigation projects will receive a kick start of $25 million in operating funding for five years from 2016/17 through the IAF.

Says Primary Industries Minister Nathan Guy: "This funding will help to complete the investigation and development of new regional scale irrigation proposals.

"The need for more water storage projects is obvious given that nearly every part of the country has suffered through drought at some stage over the past three years."

Around 100,000 hectares of new irrigated areas are expected from IAF-funded projects to date, with around 36,000 hectares of that commissioned or currently being constructed.

Connexis takes water qualifications

Connexis is taking on responsibility for water-aligned qualifications and training from the agriculture-based Primary ITO.

There are about 500 trainees undertaking qualifications in water treatment, wastewater treatment and water reticulation trades.

Connexis was set up in 2013 with the merger of electricity supply industry training and civil construction. Connexis CEO Helmut Modlik says the addition of water is a logical move as it provides for synergies with the other infrastructure qualification areas.

"The transfer will benefit existing Water Industry Training customers by giving them an enhanced level of service and increased support from the Connexis nationwide field team. We also believe that there are benefits for the wider infrastructure sector in that it enables most if not all training to be met by one organisation, rather than dealing with multiple ITOs."

Connexis has been undertaking preparatory work with its new customers, prior to the final Tertiary Education Commission approval, to ensure a smooth transition for both trainees and employers, he adds.

"Better qualifications obviously benefit individual workers and their employers and also address the government's goal of providing infrastructure to enable a thriving New Zealand economy."

Preserving water through collaboration

Much work still needs to be done to improve water management in New Zealand and reduce increasing risks the country is facing in protecting one of its most precious resources, according to PwC director David Walker.

"A usable supply of water is fundamental to the New Zealand economy and permeates across all industries – notably farming, forestry, electricity generation and public sectors," he says. "However, continued effective water management is becoming more complex and costly. New Zealand faces its own risks which differ from those in other parts of the world, and these risks are increasing."

A recent PwC publication, *Preserving water through collaboration that works*, considers how New Zealand, within a global context, has responded to water risks and the potential to improve water management in the future.

The report identifies steps that are being taken by the public sector to address New Zealand's water needs with local government working on 1160 water-related infrastructure projects valued at $16.07 billion, planned or already in progress through to 2025.

"Public funding is only one piece of the puzzle though," says Walker. "While New Zealand has a relative abundance of freshwater coupled with a small population, we cannot afford to become complacent. There's still much to be done to improve water management through collaboration and the Land and Water Forum initiative."

McConnell Dowell awarded NOIC contract

Plans to deliver valuable irrigation water into the Kakanui Valley in North Otago have progressed with the signing of a $48 million contract by North Otago Irrigation Company (NOIC) and McConnell Dowell Constructors.

The contract, which will see McConnell Dowell deliver the infrastructure required for the expansion of the irrigation scheme, is the culmination of about 10 months' work for the company's engineering construction team.

Chair of NOIC Leigh Hamilton said that the company wanted to express its appreciation to local farmers for their confidence in NOIC to deliver on the expansion, stating... "we look forward to participating in the positive changes this will bring to the community".

McConnell Dowell is no stranger to the South Canterbury / North Otago region having recently completed the Waitaki Bridges replacement project, which was a finalist in the NZ Workplace Health and Safety awards.

Kiwi Smart Valve in LA

Los Angeles is trialing the products of Auckland water meter company Digital Water, following a trade delegation of local businesses to the city.

California is facing a water shortage and LA authorities have taken an interest in Smart Valve, technology developed by Digital Water which reduces water consumption and protects against damage and waste caused by leaks.

How simple is that?

SODIS, a simple method to disinfect contaminated drinking water, was endorsed by the World Health Organisation in 2000 and is used globally by more than 10 million people, yet the method has only just been introduced to the Pacific Island region.

The method involves exposing water to the sun in clear bottles on a reflective surface for six hours. The combined effect of ultraviolet radiation and heat from the sun results in water that is safe for consumption. The method is better than boiling water for disinfection purposes and is cheaper and less time consuming.

Trade Waste qualification survey online

The NZ Trade and Industrial Waste Forum is encouraging trade waste officers and site environmental managers to complete the survey on Water New Zealand's website (waternz.org.nz).

The data collected will be used to better understand training needs with a view to establishing a formal qualification for trade waste officers and anyone responsible for trade waste, whether at local authority level or within industry.

A committee, set up two years ago to investigate the feasibility of a qualification, is checking to see if a course available in Australia can be adapted for use here. Committee members Chris Feely (Timaru District Council), Richard Manson (Wellington Water) and Gordon George (Hutt City Council) say the decision to move water industry training from Primary ITO to Connexis has been a catalyst for action on a trade waste qualification as well.

Roger McRae managing director of McConnell Dowell and Leigh Hamilton, chair of NOIC at the contract signing.

Cows jeopardising water quality

Jan Wright, the Parliamentary Commissioner for the Environment, is very concerned about water quality in many parts of the country as the dairy industry expands.

Wright's office released two reports on water quality that show some lakes and streams are below bottom lines and many others are not far above them.

Wright says current policy, known as 'unders and overs', allows regional councils to degrade some rivers and lakes as long as they make improvements elsewhere.

Land use data between 2008 and 2012 reveals sheep and beef farming has reduced by 152,000 hectares while dairying has increased by 158,000 hectares, particularly in the Waikato, Canterbury, Otago and Southland regions.

Forest plantations have also decreased, with state-owned Landcorp converting forestry to pasture near Taupo and dairy conversions in the Waikato and other regions.

Between 2008 and 2012, says the agency's reports, the Waikato lost 18,700 hectares of plantation forests, while another 28,400ha of land was turned into dairy farms. In total, we lost 9600ha of plantation forests, but increased dairy by 157,900ha.

The Green Party has asked the Commissioner to call for a moratorium into further dairy conversions. Wright has not backed calls for a moratorium, but noted even farming leaders had discussed one.

"I'm interested in getting the national policy correct and for the regional councils to have more clarity about what central government is expecting them to do so they can get on and do it. They may well choose to do that [a moratorium]," Wright told news sources.

Environment Minister Nick Smith says the government plans to have a discussion document out on the next steps in freshwater reform early next year.

"We already have work underway on guidance on freshwater management units, exceptions to the national bottom lines, including the Macroinvertebrate Community Index and coastal lagoons," he says.

"Officials will continue to work closely with councils and others with an interest in freshwater on the huge task of implementing the National Policy Statement and Standards at a regional level.

"Next year's scheduled review of the National Policy Statement will give us the opportunity to evaluate our progress and make sure that the policy is working effectively."

Apparently an engineering degree is not enough

A local Kapiti coast tribe and the Kapiti District Council will manage water in a "culturally appropriate" way within the Waikanae, Paraparaumu and Raumati catchment.

The iwi and the council recently launched the 'River Recharge Scheme', which uses traditional Maori scientific knowledge (sic) to oxygenate the river with tuna, or eels.

The chair of Te Āi Awa ki Whakarongotai Water Working Group, Bill Carter, said it confirmed the important role iwi played as kaitiaki of natural resources.

"We saw there was a position as Treaty partners for the three [local iwi] of us having a joint responsibility," Carter says.

"So that the progress of the River Recharge project was jointly managed by an adaptive management committee comprising representatives of the Wellington Regional Council, the Kāpiti Coast District Council and the Te Āiawa ki Whakarongotai Water Group."

Kāpiti Coast District mayor Ross Church said tribal involvement in the scheme was an important step forward as tāngata whenua brought valuable knowledge and a guardianship role to the table.

Church said the Te Āi Awa working group and the iwi as a whole had an immensely valuable role in the plan to revitalise the river, as well as the contribution of their knowledge and cultural advice.

He said it was the iwi who suggested the tuna (eels) as a way of aerating the water, removing gases, and oxygenating the water by putting it over a waterfall before it meets the river.

"Adding 400-year-old aquifer water is more than just a practical solution, it's one that demonstrates the spiritual significance of caring for the awa [river], and nurtures the area's most precious resource – water."

Church said it was important to recognise publicly how much the council values the contribution of the Te Āi Awa ki Whakarongotai Water Working Group and Te Āiawa.

He said their partnership on the River Recharge Scheme reflected the vibrant, thriving and diverse Kāpiti the council is seeking to create via its long-term plan.

Bill Carter said arrangements such as this build on top of the long-standing 20-year relationship local iwi have with the council which they're also very proud of.

Grundies for your water bottle

From the 'what will they think of next files' comes Opantsu – a series of teensy tiny knickers to dress up your water bottle.

Available exclusively in Japan and sold in gashapon (vending) machines for just NZ$2.20, these tiny collectible panties deal to those insidious little water droplets from sweaty water bottles that wet your delicate hands mid-drink.

Available in a variety of styles, manufacturer Kitan Club has however been rather sizeist and is only offering panties for a standard 500ml bottle.

IRRIGATION SYSTEMS

FROM THE SOURCE TO THE FARM GATE

HYNDS

Novel approach to water allocation in Marlborough

'Unlocking' water allocated, but unused, on one property, so that it can be used on a nearby property which has a lower allocation in its resource consent permit, has been proposed by Marlborough District Council as one solution to saving scarce water resources in the region.

The "quick and free" method of sharing water between neighbours, called 'enhanced transfer' was outlined to around 100 water permit holders and environmental and industry groups at a Water Forum presentation in Renwick recently.

The meeting was the result of three years' consultation and discussion between council staff and the 12-member Water Allocation Working Group (WAWG), set up in 2012 to try and find ways to resolve the growing pressure on water resources. It identified nine issues including more efficient water allocation to the 1300 permit holders, phasing out over allocation, setting 'reasonable use' limits, limiting water takes from rivers and aquifers, encouraging water storage in dams, providing certainty and reliability of water resource, providing equal access for everyone to a limited resource, and monitoring the effects of groundwater takes, and forestry, on river flows.

The region's water supply was already fully allocated and cannot be increased. The water take has already affected aquifer levels in some places and the rapid growth of the wine industry during the past decade has increased pressure on water availability.

The draft framework presented at the meeting outlined a number of options to each of the issues under the council's long term resource management plans and regional policy statement.

The consultative draft will be presented to council's regional planning and development committee in September. The public will then be able to make submissions.

Water scheme options advanced in Wairarapa study

Two options for schemes to store and distribute water in Wairarapa have been selected for a feasibility study, following investigations of six options carried out over the past 18 months. The two schemes selected, Black Creek and Tividale, between them could irrigate almost 30,000 hectares between north of Masterton and southwest of Greytown and provide water for other uses.

Storage reservoirs would be in the Kaituna area west of Masterton and the Taueru catchment northeast of Masterton.

Black Creek incorporates a smaller option, Wakamoekau, which has the potential to be a stand-alone scheme.

Water storage has been considered in Wairarapa for many years and has the potential for significant long-term economic and social gains. An independent study last year concluded that irrigating an additional 30,000 hectares would add $157 million of GDP to the greater Wellington region per year and create 1200 new jobs. A further $90 million in GDP would be added and more than 1100 jobs created for one year as a one-off result of farmers converting to irrigation.

Independent experts estimated the net present cost of building the Black Creek scheme at between $138 million and $205 million; and Tividale between $71 and $105 million.

"There is a lot more work to be done in all areas," says Wairarapa Water Use Project director Michael Bassett-Foss. "By the end of the feasibility study, we need to know whether the scheme/s are feasible so we can then go on to seeking resource consent."

The 18-month study will cost approximately $4 million and will be funded jointly by Greater Wellington Regional Council and the government through its Irrigation Acceleration Fund.

Auckland needs more water

Former New Zealand politician Rodney Hide gives his take on Auckland's water supply in a recent *Herald on Sunday* opinion piece (tinyurl.com/hideonwater).

Aucklanders, he says, can take pride in being the wisest, best and most efficient users of water in the country, adding that we are environmental paragons able to look down our conservationist noses at a wasteful world around us. "We are careful because our water is metered. Metering is the greenest of policies and Aucklanders lead the way."

But Auckland is growing, he says, and so, "despite our conservationist care, Auckland needs more water".

Hide discusses the options: The cheapest and best source, he says, is allowing Watercare to take another 200,000 cubic metres per day from the Waikato river. The next best is desalination. "But that would cost five times as much, so it's a no-brainer," says Hide.

"But watch," he cautions. "There's a consent to be obtained. This will take years and cost millions."

The biggest waste of resources is not Aucklanders with Waikato water, he says. It's the Resource Management Act and the Byzantine processes that we must follow to get the water.

2015 Water New Zealand Annual Conference & Expo

More detail on page 57 and at the Water New Zealand website: www.waternz.org.nz

Getting to know

Adrian Hynds

I grew up wanting to work in the family water business since a young age. Hynds Pipes started in the backyard garage of the family home and I can remember the concrete truck hitting our house as it backed awkwardly down the driveway.

I first studied civil engineering at University of Auckland and, after graduating in 1990, joined Hynds Pipe Systems. I worked in the South Auckland factory and liaised with civil contractors and consultants who needed custom-made precast drainage and retaining wall products. The company later expanded into ferrous iron casting and plastic extrusion. As the business grew I have been able to work in different management roles and in different cities and now, after 25 years, I am leading our manufacturing and distribution businesses both here and in Australia.

My first exposure to Water New Zealand was when it was still called NZWWA in the mid 1990s, when, each year, Hynds sponsored the Paper of the Year award as a way to promote excellence and innovation. Since then the association has developed considerably, with a large membership across many public and private organisations.

I have had the privilege of sitting on the Board for the past three years and, during this time, have met many passionate people within the sector. Many contribute within our Special Interest Groups, regional groups, Rising Tide Group, and technical groups. I have participated as Board liaison for the Stormwater Group and SWANS Group, and I am currently chair of the Awards Committee, as well as performing audit and remuneration committee functions.

Within my area of the water industry, I believe we need to have an informed conversation and debate towards developing a 'whole of life' approach to asset management for drainage and water pipelines. Currently pipeline design, sourcing, installation, and inspection are not commonly aligned towards optimising lifespan of materials. There are many material options available, but each one requires its own discrete design/installation/inspection methodology. I have seen varied specifications of inappropriate materials for pipelines, sometimes with insufficient installation and QA practices such that the intended design life could not be achieved. Since we spend so much time and resource in building and maintaining water assets, it is important that we do it in a way to optimise their lifespan.

Water New Zealand membership allows access to such a debate, and I want to be part of this for the benefit of our sector and for future New Zealanders.

THE CCO TREND AMONG COUNCILS

Three Waikato local authorities may be on the point of following Auckland into establishing a council-controlled organisation (CCO) to manage their fresh, storm and waste-water, aiming at potential cost-savings of nearly $500,000 over three decades. By **Hugh de Lacy**

Auckland's Watercare Services is already operating as a CCO, and Wellington has one too, though it differs from both Auckland's and the proposed Waikato CCO in not owning the assets.

Consultants Cranleigh in May released a report funded by Hamilton City and the Waipa and Waikato District Councils that recommends all three transfer their water assets into a single ratepayer-owned organisation.

The report is at pains to allay any fears of privatisation of water assets, noting that that would flout New Zealand law, and while it's recommended the councils retain ownership of the stormwater assets their management should be out–sourced.

The Cranleigh report estimates a CCO structure would save an estimated $468 million over 28 years, or $107 million over a decade.

Other benefits would include a stronger regional water network, cleaner drinking water, better wastewater control and the creation of a regional centre of excellence that other councils would be able to tap into, and which would attract and retain expert staff.

The CCO would act as a not-for-profit company in which any surpluses would be re-invested in the water network or returned to ratepayers as reduced water costs.

The three councils would appoint a board of directors to govern the CCO, and a joint committee of elected councillors to set its operating parameters and review its performance.

The CCO was one of three options the report evaluated, the others being retaining the status quo, and boosting the councils' existing services into an Enhanced Shared Services (ESS) model.

The status quo was dismissed as offering "only basic service delivery and performance at a higher cost to ratepayers", and while an ESS was feasible, the report said co–ordination costs, including reconciling the differences between operating standards and priorities over the three local authorities, "could easily exceed the savings".

The ESS would offer an improvement on the status quo, but "shared services models are rarely successful over the long term because they rely on the goodwill and collegiality of all parties".

The CCO would instead operate as a limited liability company but with no constitutional power to declare or pay dividends to its shareholders.

It will in effect perform as a co–operative, though ratepayers will not be shareholders, and the degree of separation of powers between the authorities and the CCO would be governed by a Statement of Intent (SoI).

Management of the CCO would be by way of a board of six independent professional directors under a chair appointed by all three councils, and by a chief executive officer reporting to the board.

The Wellington model of a non-asset-owning CCO was not thought appropriate to the Waikato region because "experience shows that while some savings can be achieved, only full network, operational and financial integration will generate substantial benefits".

The report, jointly funded last year by the three councils, was commissioned in the face of growing population and water infrastructure costs, and the competing uses for water and resources which are challenging water managers in New Zealand no less than globally.

The Cranleigh report is the latest of several produced by the Waikato Mayoral Forum to deal with the council's current inability to provide water for new water-intensive industries, and the effect any new financial demands will have on an ageing population.

The quality of water currently being supplied to most of the sub-region's communities fails to meet New Zealand drinking water standards, and most wastewater treatment plants are only partly compliant with their resource consents.

These considerations, plus the need to replace old infrastructure, have raised the amount of capital needed in the three councils' long-term plans from $495 million in the 2012-2022 version to $764 million in the 2015-2025 update.

Cranleigh managing director Paul Bayly noted that the report did not consider tariff issues, such as the installation of water meters, because it was about infrastructure, and had "nothing to do with how councils may or may not choose to recoup their costs".

The CCO would reduce water management staff numbers by 36 over three years.

"This is within the levels of normal staff turnover, so we would anticipate very few if any redundancies," Bayly said.

The chair of the group of councillors overseeing the report, Waikato Mayor Allan Sanson, said the recommendation to form a CCO was now "squarely in the hands of the individual councils.

"Only a recommendation has been received; no decisions have been made and won't be made for some time yet, and certainly not without public input.

"There are a lot of questions that have to be answered, and each council will need to consider the report separately and come to its own conclusion," Sanson said. **WNZ**

Large aquifers in trouble

New US studies, published in *Water Resources Research* journal, used Nasa's Grace satellites to take measurements of the underground water reservoirs around the world between 2003 and 2013.

They revealed that 21 of the world's 37 largest underground reservoirs (aquifers) – in locations from India and China to the United States and France – have passed their sustainability tipping points, as water is being sucked out of them faster than it is being replaced.

These groundwater reserves take thousands of years to accumulate, say scientists, and only slowly recharge with rain water and snowmelts.

Underground aquifers supply 35 percent of the water used worldwide and researchers say the water table is dropping all over the planet. In Australia, the Canning Basin in the country's western end had the third highest rate of depletion in the world, attributed to heavy mining in the region. In the US, California's Central Valley Aquifer is considered to be 'in trouble' as it is drained to irrigate farm fields.

2015 Water New Zealand Annual Conference & Expo

Registration is open for the 2015 Water New Zealand Annual Conference and Expo being held in Hamilton, September 16-18. Also open are the 2015 Awards programme and nominations.

The theme for the conference is 'Optimising our Water Value' and this year's format will follow that of 2014 with two full days of presentations on Wednesday and Thursday, with Friday set aside for the Water New Zealand AGM, a panel discussion and the exhibitor visitor morning.

More detail on page 57 and at the Water New Zealand website: www.waternz.org.nz, or contact Hannah Smith at Water New Zealand on 04 495 0897, hannah.smith@waternz.org.nz

OPTIMISING OUR WATER VALUE
WATER NEW ZEALAND'S ANNUAL CONFERENCE & EXPO

Water bill shocks Stoke couple

When Nelson woman Angela Quinn received a water bill for more than $60,000 she thought her partner's gardening habits might be to blame.

"He's always watering the grass in the garden," she says, "but he can't have used that much." The six-month bill for $62,886.30 was for 30,000 cubic metres of water – enough to fill 12 Olympic-sized swimming pools.

A Nelson City Council spokesperson reassured Quinn that it was likely the bill was the result of an error caused by a faulty meter or a manual error at the time of taking the reading.

Quinn's partner, Alan Goodman, joked that if Paul Henry thought the rates rises in Auckland were bad, he should look at the cost of water in Nelson. "There will be no more water for the pets, they can drink whisky, it's cheaper."

RESILIENCE
A CRITICAL CONSIDERATION

BY **PETER WHITEHOUSE, MANAGER ADVOCACY & LEARNING, WATER NEW ZEALAND.**

Resilience – elasticity, physical or mental', or so the dictionary would have it. The good people of Christchurch exhibited a great deal of the latter in the aftermath of the devastating earthquake sequence, but there was less evidence of 'physical elasticity' in relation to critical infrastructure, particularly those underground assets such as water and sewer lines. Subsequent flood events have also shown that 'physical elasticity' is difficult to achieve after major sub-surface disruption.

While the earthquakes resulted in tragedy for some and enormous disruption for many, the Christchurch scenario has stimulated a discussion on what does resilience mean in terms of essential networks, and how might it be achieved. If it is considered a prudent and desirable goal, what are the costs and benefits both social and economic? In the case of water assets, is it even achievable to move the whole country to a resilience 'bottom line'?

Recent work by Water New Zealand has shown the average asset age of reticulated (underground) pipework to be 30-40 years. The significance here is that this is a median figure – in other words much of the pipework will be considerably older. And that pipework may be of the type that exhibits extremely limited 'elasticity' – ie, cast iron, asbestos cement and, in some cases, brickwork.

The Christchurch sequence of earthquakes in 2010-2011 is estimated to have caused $2.5 billion to $3 billion of damage to the horizontal infrastructure – roads, power and pipe networks. Of this, $100 million hit the potable water system, $800 million of damage was done to the stormwater system, and $1 billion to the wastewater network.

These are big numbers, but not as big as the estimated $45 billion that will be required over the next 20-30 years to replace aging water infrastructure. Recent changes to the Local Government Act now require local authorities to prepare infrastructure strategies covering at least 30 consecutive financial years. This kind of funding requirement will present challenges.

The population growth figures for the Auckland isthmus are a constant subject of discussion – less well aired is the fact that in other areas of the country the population is static or declining, with some communities moving to a position where the majority are in a fixed income position. The current model for funding water services is largely rates-based and in many areas 'affordability' is a serious issue.

Compounding this is the fact that much of the three waters underground infrastructure was originally installed between the 1940s and 1970s. While there is debate on what the life expectancy of this may be, it does infer much of it may be between 45–75 years old. So where to for 'resilience'?

If you venture into the Google world and dial-up 'resilience' you will find hundreds, if not thousands, of links. Remember a few years ago when you couldn't open a magazine or newspaper, or listen to a news broadcast, particularly if it featured a politician or 'social commentator', and the only word you ever saw or heard was 'sustainable'. Now it's 'resilience' and it, too, has garnered an array of meanings and interpretations.

A multi-faceted discussion such as this is interesting. It is, however, debatable what it may contribute to a consideration of how you or I might react if we were asked what actions we were prepared to take if we wished to minimise the loss of essential water and waste services as was faced by the residents of Christchurch in the 2010/2011 earthquake sequence.

How aware are we of what it would mean to our daily routines? Are we adaptive enough to deal with the potential disruption? Do we know if our local infrastructure has reserve capacity to continue to operate after a major event? Are we as a society prepared to enter into a discussion on how pipeline redundancy, alternatives and back-ups might be funded?

Remember a few years ago when you couldn't open a magazine or newspaper, or listen to a news broadcast, particularly if it featured a politician or 'social commentator', and the only word you ever saw or heard was 'sustainable'. Now it's 'resilience'.

These are all important questions that need to be addressed. In some areas of the country action in these areas has been advanced, in others the discussion is non-existent – apart from among small groups of specialists. Regrettably, the public at large has little engagement in these considerations.

Eighty percent of us live in built-up urban centres. It is incumbent on us all as members of a society living in a green and pleasant but shaky land to at the very least begin to ask the questions on how we can best ensure our essential infrastructure remains in a reasonable working condition, even when placed under severe stress. That is what resilience is really about. **WNZ**

Getting to know

David Simpson

I spent the first 21 years of my life living in Dunedin, where I went through school and spent a significant amount of my spare time in Wanaka – my parents bought a bare block of land there that they spent many years working on and improving, and they still live there today.

After finishing school I attended Otago University and completed a BSc in Zoology. While this was an interesting degree to complete I decided that it wasn't going to get me into a career I wanted, so I headed off to Canterbury University to undertake a degree in Environmental Engineering.

With my degree complete I returned to Dunedin and started working for Royds Garden, developing solid waste management strategies for a range of district councils following the introduction of the Resource Management Act. A couple of years later I headed off to Auckland, working for MWH as an advisor to Watercare on Project Manukau – the $450 million upgrade of Auckland's main Wastewater Treatment Plant. This was a fantastic opportunity to be involved in a massive New Zealand project and was the start of many years involvement in the water industry.

Over the next 10 years I worked for MWH, Watercare and Metrowater in a range of project management, operational management and commercial leadership roles where I learnt a huge amount. My wife Cathy and I then decided to return to Dunedin, where I spent five years working as the owner of two small businesses that sold and installed domestic heating and ventilation systems.

Two years ago we returned to Auckland to work for Downer, where I am now the general manager of utility services – leading our national water, open space, engineering services and facilities management businesses. In this role I deal with a large number of clients and customers from across the country who are dealing with a lot of similar issues.

I see a great opportunity for the water sector to increase the value it delivers by tapping into and sharing the wealth of knowledge that is held in the industry.

I have been married to Cathy for 14 years, and together we have three young children – Daisy (10), Monty (8) and Bruno (4), plus a Golden Lab called Buzz.

Talking with Eldon Tate

Eldon Tate is one of the industry's young leaders of the future and a final year PhD student studying chemistry at Victoria University of Wellington.

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 a 2014 AMP National Scholarship and will be a guest speaker at this year's Water New Zealand conference.

Eldon tells us that he is 28 years old, and born and bred in Wellington.

"Unfortunately PhD study takes up most of my time at the moment which has left a few of my other pursuits by the wayside," he says.

"When I'm not at uni I can often be found putting my chemistry degree to good use, distilling whisky or home brewing with a couple of mates."

Please explain how you got to where you are in your academic and working status.

I completed my BSc in Chemistry at Victoria University and after a brief stint as a lab technician returned for postgraduate studies. I completed my MSc (Hons) first class and carried on to my PhD, both under the supervision of Professor Jim Johnston.

How did you get into 'science' (as opposed to engineering)? Is it an industry sector you wanted to get into at an early age?

Interestingly, Dad is an engineer and studying engineering did cross my mind when I was finishing high school. But it was in 7th form when I really decided that I wanted to do something involving chemistry. I think it was thanks to some great teachers in high school, who gave me a great understanding and really piqued my interest in the subject. Of course university chemistry is nothing like high school, it put off a lot of students but it reeled me in; the huge amount of specialities within one subject area was mind blowing. This is when I first encountered nanotechnology, and like in high school, some great lecturers helped me really find a passion for nanotechnology and materials science.

At what stage has your doctorate study reached?

I'm currently in the third year of my PhD, due to finish early 2016. My research is focused on the synthesis, characterisation and application of nanocomposite materials: materials that incorporate nanoparticles to impart new properties to the material. For this project we are looking at photocatalytic composites that use light to carry out reactions,

and antimicrobial composites. Much of my early research was focused on the synthesis and characterisation of these nanocomposites, and once I had successfully accomplished this it was time to think about applications. I've been carrying out lab-scale proof-of-concept experiments; some of this work is ongoing and some has progressed further, involving some scale up for application.

You mentioned the "commercial potential of novel antimicrobial and photocatalytic coatings for antifouling and water purification applications". Where do you see these commercial applications being applied in the future?

There are a few different applications that lend themselves to antimicrobial and photocatalytic composites. For antimicrobial coatings, medical applications, marine antifouling paints and mould and fouling prevention come to mind. The antimicrobial properties of the coatings can prevent the spread of infection, stop adhesion of marine organisms to submerged surfaces and stop mould growth. Some of these applications we are actively pursuing at the moment with industry partners, and we have had some pretty promising results. The photocatalytic composites have the ability to break down organic contaminants and bacteria using light, so they could have use in purification applications, and in particular we have been looking at low energy water and air purification applications.

The paper you will present at the 2015 conference in Hamilton – is it the same as the ones you have delivered overseas? If not please detail the differences.

This paper will be different to conference talks that I have given in the past, which were at specialist nanotechnology or polymer conferences. For Hamilton I plan to give an overview of photocatalysis for water treatment, some of the principles, previous and ongoing research and then present some of my own work.

Could you detail the overseas conferences – who invited you, etc? Did you enjoy the experience? Did you learn anything?

The previous conferences that I have spoken at include: TechConnect World 2013, 16th annual Nanotech Conference and Expo, Washington DC, USA; and the 12th international conference on frontiers of polymers and advanced materials 2013, Auckland. And I will be speaking at Nanotech France 2015, Paris, on June 17.

I've also had a couple of poster presentations both in New Zealand and the US. They have all been great conferences and I'm very lucky to have had the opportunity to attend so many during my PhD. Some of the larger international conferences can be pretty daunting but the networking and feedback on your research is exceptional.

You have five publications in your field already – how have they been received?

I'm still pretty early on in my research career and have a fairly limited publication record, however I would say it has been generally well received. The work is often seen as useful progression from fundamental research to applied research.

Could you explain the 2014 AMP National Scholarship – why was it awarded and how has it been used?

The AMP National Scholarship is a pretty unique scholarship, open to anyone in New Zealand, in any field. That meant there was a wide variety of really inspiring applicants and recipients, many of whom I got to meet on judging day and the awards ceremony. In my year the recipients ranged from a forensic anthropologist to an 8-year-old BMX World Champ. I was fortunate enough to receive one of the AMP National scholarships to help me with my research to create a water purification device using my photocatalytic nanocomposite materials. The scholarship has enabled me to attend the Nanotech France conference and to scale up my composite and build a small scale prototype reactor which I am using for some more real world testing at the moment.

What do you see as future challengers for the industry?

From a bit of an outsider point of view (to the water industry), I think that globally one of the biggest challenges is still water scarcity. Water scarcity impacts so many areas, from agriculture to industry, in the countries that suffer from it, but I see the biggest problem being the lack of drinking water. The statistics are staggering when it comes to the number of people without access to safe drinking water. Whilst the UN's millennial development goals and the water for life decade have greatly increased access to improved water sources, 800 million people still lack access to safe drinking water.

What do you think the solutions are?

Most likely a combination of strategies is needed, there's no one solution to this problem. Strategies that manage existing water resources through conservation or increased efficiency need to be used in conjunction with new or improved procurement systems such as desalination and water harvesting technology. One of the major flaws that needs to be remedied is the pathetically low rate of wastewater treatment. Improved water treatment technologies are key to enabling wastewater recycling; this could provide a substantial and sustainable source of clean water, whilst decreasing environmental impact, particularly for urban and industrial areas.

Where do you think you will be, or would like to be, in 10 years' time?

It's hard to say where I'll be in 10 years, although hopefully over the next eight months as I finish up my PhD I'll start to get an idea of my next steps.

I don't see myself as the academic type and would love to work in a space where science meets industry, such as in R&D or product development, where smart ideas can be developed from concept to market. **WNZ**

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Liveable communities make up liveable cities

Water New Zealand's Stormwater Conference is held every two years in Auckland. This year the delegate invites were extended beyond the South Pacific to the wider Asia Pacific region.

Vijesh Chandra, the chair of the Water New Zealand Stormwater Group Committee, says he was very pleased with the turnout.

"The international interest was overwhelming," he says.

"We had delegates and speakers from Europe and the US and the committee members had worked very hard to ensure the technical depth and high quality of the technical papers.

"The total numbers of delegates was 320, which is the highest we have recorded. The last one in 2011 drew 297 delegates, so interest in the conference is growing with each event."

The theme this year was 'liveable cities, liveable communities'.

"Modern cities and communities around the world are striving to be more liveable and compete for business investment, residents and visitor revenue," says Vijesh.

"This Asia Pacific region is the fastest growing economic region in the world and, as stormwater practitioners, we have a fantastic opportunity to turn stormwater management challenges into opportunities.

"And it is not just a technical challenge, but a 'community' one, as liveable cities are actually made up of 'liveable communities', so we have to look at this opportunity from a number of levels."

On a detailed level the Water New Zealand Stormwater Conference covered both urban and rural water and all technical disciplines from asset management, design and modelling to operations and management.

"Through this conference, we have strongly connected 'Liveable Cities, Liveable Communities' to stormwater management. This is an important connection to make as it raises the profile of the stormwater industry.

"The topics and key notes covered material from many international cities and we had our first discussion forum at the conference facilitated by the New Zealand Transport Agency (NZTA)."

The conference was organised as a joint effort between the sub-committee and Avenues Event Management and Water New Zealand and Vijesh says he would like to especially thank John Palmer and the members of the Conference Committee for the inaugural Asia Pacific International Stormwater Conference.

"I would also like to thank Stormwater 360 again for being a premier sponsor and, of course, thank Morphum Environmental (conference partner); Harker (welcome function) and Pump Valve (wifi and coffee cart)."

Vijesh says the Stormwater Group has come a long way since its foundation in 2002.

"In the last 11 months I and committee members have been working to extend the Stormwater Group's leadership in two areas; New Zealand's rural sector and the Asia Pacific region.

"In the rural sector, the health of our streams, rivers and lakes is critical to our economy both from a tourism and agricultural perspective and stormwater management is key to influencing change.

"It is time that an industry organisation such as ours takes a proactive approach in engaging and making a difference and thus, we are inviting practitioners from the rural sector to actively participate in the Water New Zealand Stormwater Group.

"The Asia Pacific region is an area that is important to New Zealand's economy. In many towns and cities, regular flooding occurrences and environment degradation from stormwater run-off contaminants is severely impacting on people, infrastructure and the environment.

"With respect to this, it was very important that we held our first Water New Zealand Asia Pacific International Stormwater Conference."

1.


2.


3.

4.

1. Nick Smith, Minister of Housing and Conservation, acknowledged the work of the Land and Water forum, and the work of Peter Whitehouse from Water New Zealand.
2. John Pfahlert, Water New Zealand chief executive with Dr Jan Wright, Parliamentary Commissioner for the Environment.
3. Vijesh Chandra, the chair of the Water New Zealand Stormwater Group Committee.
4. Mike Titchener, sales manager; and Michael Hannah, managing director, Stormwater 360.
5. Yasenko Krpo, Stormwater Infrastructure & Environmental Services; Auckland Council; Priya Kumar; and Branko Veljanovski.

5.

Teaming up for effective management

Early engagement when it comes to effective stormwater management is key to ensuring stormwater assets are appropriately designed and maintained.

This was one of the key take-away messages from the panel discussion on the last day of the Water New Zealand – Asia Pacific Stormwater Conference.

With the theme of 'stormwater management and roading', and chaired by the NZ Transport Agency Environment and Urban Design manager Rob Hannaby, the panel comprised of Transport Agency's principal environmental scientist David Greig, senior project manager Simon Paton, Opus Stormwater Assets manager Peter Mitchell (representing the Auckland Motorway Alliance), and Tonkin and Taylor senior water engineer/project director Tim Fisher.

The panel was asked to identify what each considered the top challenge for stormwater management.

Peter Mitchell first identified the important need for an asset operator to be involved early in the planning and design process of a stormwater system, to ensure that the stormwater system delivered is safe and effective to operate and maintain, as well as providing a suitable solution for the problem being addressed.

It was often a balance between innovation and consistency for effective maintenance and operation. When asked how the Transport Agency could support the exchange of information to ensure alignment between design, implementation and maintenance, the panel identified a number of different channels.

This included taking the opportunity to work with the existing asset operator team, so the team can shed light on constraints and considerations encountered on a working road that may not necessarily be obvious when at the design stage. This was particularly important as it would help to ensure that staff would not be subject to risk during the course of their activities – the safety of road users, customers/stakeholders, and operational staff was paramount on an operation and maintenance contract.

Another challenge was aligning council consent processes, particularly when it came to the agency building and operating stormwater systems. It was important that collaborative relationships were developed between councils and the Transport Agency. This would enable both parties to be focused on outcomes and less focused on specifying the method of compliance, which should lead to simplifying the conditions.

The Transport Agency has various environmental requirements relating to stormwater including the Environmental and social

One hell of a cloud burst

Alan Titchall talks to international keynote speaker, Lykke Leonardsen, at the Water New Zealand, Asia Pacific Stormwater Conference.

I ask Lykke if she has an engineering or a meteorologist qualification.

"No. I am an anthropologist," she laughs, and adding it is probably a better qualification for her job in Denmark.

Lykke is head of the climate unit for the Technical and Environmental Administration for the city of Copenhagen, and is involved in stormwater management and 'liveability'. She was in Auckland as a keynote speaker at the 2015 Water New Zealand, Asia Pacific Stormwater Conference.

A major project for her unit is preparing the city for another one in 1000 year cloud burst.

The famous city was hit by such a cloud burst back in 2011 and didn't cope very well.

"It was an absolute mess," says Lykke. "We got 150mm of rain in two hours, the highest on records, and the stormwater and sewerage systems just couldn't cope. There was flooding and pollution everywhere."

Damage cost to the old city totalled $1.5 billion, she adds.

The city set up Lykke's unit to come up with an answer.

"The first thing we understood is that it was financially prohibitive to replace or upgrade the existing sewerage system, which is not big enough to cope with a deluge.

"So we turned to the city's existing surface infrastructure – parks and gardens to retain the water, and the roading systems to transport it to the harbour and then discharge it to the sea."

This is where Lykke's 'urban anthropology' played a major role.

"It is not just about 'drainage' engineering. This is about 'urban space' that is going to be used, when it isn't raining as normal recreational and transport space.

"We had to take a broad view of the project that considered the citizens of the city and how they could benefit from these 'water detainment' spaces when it wasn't raining."

The roads are being modified with a slight indentation of 10cm in the middle to funnel the water towards the harbour.

"The traffic and services can still use the lanes either side."

As the harbour edge has a number of infrastructural 'obstacles', the run-off down the roading system is eventually collected into tunnels which exit into the city's harbour.

"This surface design and project worked out at half the cost of a pipe-base solution," says Lykke.

• If you want to contact Lykke for more information: lykleo@tmf.kk.dk **WNZ**

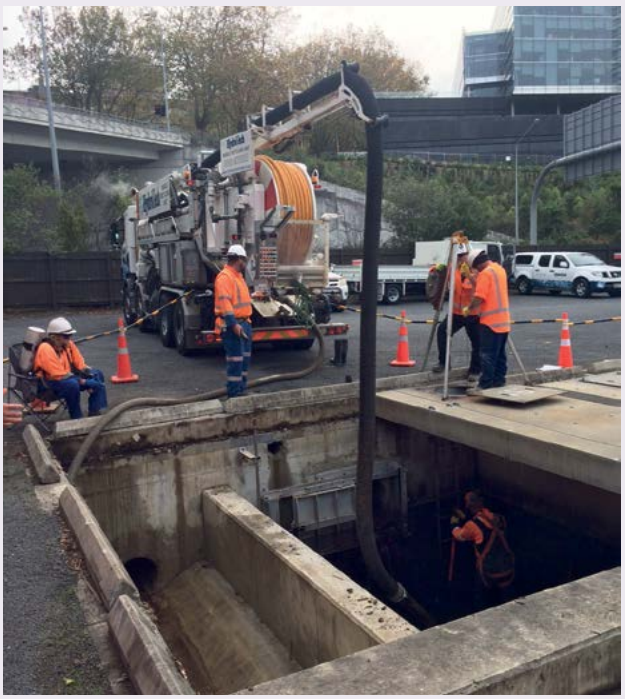
responsibility standard and Stormwater treatment guidelines. As part of this suite of requirements the agency through Tonkin and Taylor is developing a standardised stormwater specification which will form the basis of the Principal Requirements for future capital projects.

Tim Fisher from Tonkin and Taylor, who is supporting the Transport Agency's Carol Bannock on this work, asked the audience for its view of how prescriptive, or otherwise, these requirements should be for them to be useful.

The general consensus was they should be prescriptive but flexible enough to be applied throughout New Zealand, with a focus on outcomes, but specific enough to encourage consistency. The point was made that the success of implementation of such specifications depends on the procurement contract awarded. Traditional contracts were harder to influence, whereas alliances were more outcomes focused, enabling better collaboration between parties and allowing operational consistency while still providing space for innovation.

A draft of these requirements will be released for comment. In the meantime contact environment@nzta.govt.nz for more detail.

All agency environmental and stormwater standards, guidelines, screens, technical memoranda, and specifications can be found on hip.nzta.govt.nz/technical-information/environmental-and-social.



NZ Transport Agency contractors in action, clearing a sediment detention device in Grafton Gully.

WASTE TREATMENT with NATIVE PLANTS

BY **SHERIDAN GUNDRY, GEMS COMMUNICATIONS.**

It's science in action at Gisborne city's wastewater treatment plant. In the industrial subdivision, half a kilometre from popular Midway Beach, rows of blue barrels filled with several varieties of wet-loving native species have gained pride of place. Here, every centimetre of growth is watched with anticipation, measured, analysed...and admired.

The trials are under way to see if the city's treated human wastewater, which currently discharges 1.8 kilometres to sea via an outfall pipe, could instead be treated through native plants in wetlands.

Removing human wastewater from waterways and improving the quality and mauri of the water in Poverty Bay by the end of 2020 is the long-term goal.

Gisborne District Council and the Wastewater Technical Advisory Group (WTAG) are working with NIWA, ESR and the Centre for Integrated Biowaste Research (CIBR) to assess which species grow best and in what medium, and ultimately remove contaminants from wastewater.

The quality of the water in the bay has improved significantly

Scientists pitch in to help set up blue barrel lysimeters for trial wetland plantings at Gisborne's wastewater treatment plant. From left are environmental consultant and Gisborne Wastewater Technical Advisory Group member Gordon Jackman, CIBR's Dr Jacqui Horswell, LEI's Hamish Lowe and Peter Hill, and Research Consultants' Dr Grant Northcott.

since the early-2011 commissioning of the biological trickling filter plant and industrial separation scheme – a watershed in a long, contentious history of wastewater treatment and disposal.

Until 1965, untreated human wastewater was discharged onto Waikanae and Midway beaches at the low tide level leaving the high tide to wash the sewage away. The Kaiti freezing works pumped fat-laden wastewater on to Kaiti Beach, just north of Gisborne's river port; the city abattoir, on to Midway Beach.

An innovative new system installed in 1965, in which mashed-up sewage was discharged 1.8 kilometres into the bay through a new outfall pipe, was a major milestone in the city's public health and wastewater history. This commonly accepted system continued through the following decades but growing numbers in the community – including tangata whenua – began to call for no human waste to be discharged to sea.

The volume of discharged wastewater increased by more than 50 percent over 20 years and by the late 1980s, East Cape Catchment Board was set to prosecute Gisborne City Council for breaching its discharge right. An improvement was made in 1991, with sewage milliscreened to remove the "lumps" before being discharged to sea. But there was no treatment as such.

Council gained permits through to 1999 on the condition a long-term disposal scheme was put into action. A wastewater working party began to discuss options in the late 1990s yet

in 2005, the Environment Court criticised council's lack of progress towards meeting tangata whenua calls for zero waste to sea. The "poo in the bay" problem continued.

Community and council were at loggerheads with the issue again heading for court when a collaborative approach brought together individuals and groups with widely divergent views.

The working party developed into the Wastewater Options Review Group with representatives from tangata whenua, health, council, environment and industry. The group agreed on a biological trickling filter (BTF) system to transform sewage into plant-like matter before its discharge to sea through the existing outfall. Community affordability was key.

Tangata whenua made a significant compromise by accepting the need for long-term consents, and approving a system that would rely on discharge to sea for years ahead. In September 2007, 35-year resource consents were granted for the upgrade which included two BTF tanks on a site several kilometres out of town, and a scheme to separate industrial wastewater from the domestic flow.

Three groups were set up as consent conditions – a Wastewater Management Committee comprising councillors and tangata whenua representatives, an Independent Review Panel and a Wastewater Technical Advisory Group (WTAG).

When the fully consented scheme came in at $84 million, the community and project team went back to the drawing board. They reduced the scheme to one BTF tank instead of two, siting it closer to the existing outfall and for a total cost of $39.5 million – still the largest capital infrastructure project for Gisborne in 45 years.

Engineering consultants CH2M Beca and contractors HEB Construction and Downer EDI worked together to ensure the scheme was built and put into action from December 2010 as set by the consent. A further treatment stage – ultraviolet disinfection – was to be added by the end of 2014.

WTAG monitored the plant from commissioning. Chair Dr Bruce Duncan, who is also Tairawhiti District Health's medical officer of health, says the group's role included assessing how well the plant was working – the efficacy of the treatment process and extent of biotransformation being achieved.

"After three years, we reported ESR's 2013 view that the plant was working as well as could be expected for the type of treatment, and at a similar level to oxidation ponds."

ESR also found the plant was unlikely to treat sewage to a level that would meet New Zealand expectations for removing microbes, or meet community expectations for biotransformation.

Extra treatment was needed.

WTAG said installing disinfection by the end of 2014 was not achievable and instead recommended a wetland or series of wetlands as the best alternative for dealing with 15,000 cubic metres of BTF effluent a day.

"This would provide a more cost-effective and sustainable long-term outcome, meet all consent requirements and achieve satisfactory biotransformation."

Because more time was needed to further investigate wetlands, council applied for a variation to its consent. This was granted in May.

CIBR's Dr Jacqui Horswell (left) and NIWA's Dr Chris Tanner check to ensure plant roots are viable before planting in one of 60 barrels at the Gisborne wastewater treatment plant.

Wetland plant trials under way

At the Banks Street treatment plant today, 60 barrels are planted with two main species – raupo (*Typha orientalis*) and lake club-rush (*Schoenoplectus tabernaemontani),* the species most likely to grow well in sludge – and another three just in case – a sedge (*Carex geminata*), marsh club-rush (*Bolboschoenus fluviatilus*) and jointed twig-rush (*Machaerina articulata*). Half grow in gravel; half in bark.

The plants were watered with plain water to get them established and then with low-dose treated wastewater. Settled sludge will be applied early next year. The idea is to see which plants grow best and in what medium, and how well they can de-water and break down the sludge.

NIWA's Dr Chris Tanner and Dr Jason Park and CIBR's Dr Jacqui Horswell are driving the council-CIBR joint-funded trial with major input from WTAG and council staff. Environmental microbiologist Dr Horswell leads the sludge drying wetlands part. She is science leader at ESR and leads the Centre for Integrated Biowaste Research. She deals in the solids; principal scientist Dr Tanner, in the water. His research over 25 years has focused on understanding wetland systems ecology and the processes of removing pollutants.

Wastewater scientist Dr Park is assessing Gisborne's BTF sludge – looking at how it settles and how it resists drainage – and comparing his results with similar trials in Waikato and Europe. Tests to date show the sludge settles well – 85 percent of solids settling within an hour – but has poor drainability. Settled solids could go to a planted sludge drying bed wetland for treatment. Watery effluent could go to an effluent treatment wetland where the natural process of slowly trickling through

extensive plantings would further treat it.

Tanner says the aim is to treat the final effluent with wetlands to a level seen as sufficient to protect health and the environment, and to meet cultural requirements.

"It's using a combination of natural ecological processes to remove contaminants from the water and return its life-sustaining capacity." Research so far shows about six hectares could be required for sludge treatment wetlands and another 50 hectares for effluent treatment wetlands.

In planted sludge drying beds, bacteria and microbes around plant roots help decontaminate the sludge and get rid of disease-causing organisms (pathogens). They could also reduce emerging organic contaminants such as triclosan, the antibacterial, antifungal agent found in soaps, detergents and cosmetics. Sludge drying treatment wetlands have the capacity to gradually accumulate dewatered sludge for up to 10 years, at which time it will need to be removed, producing high-grade biosolids.

Research is promising. The systems have been used in Europe for 25 years but have not been previously applied in New Zealand. Experience with sludge from a BTF plant is limited. Tanner says overseas systems cannot simply be imported to the Gisborne or New Zealand environment.

"The technology needs to be adapted for New Zealand conditions. The wetland plants used successfully overseas are noxious weeds here. Every sludge and effluent is different. New Zealand, and Gisborne itself, has a specific climate with different rainfall, humidity and temperatures.

"This is a low-energy, natural process that could produce high-quality water and biosolids and reduce costs to the community." The WTAG team is looking at overall wetland design, biosolids use, virus risk, sensitive materials such as mortuary waste and emerging organic contaminants, and alternative use and treatment of wetlands-treated effluent.

Horswell says the native plants growing in half-barrels will be moved to 35 full-size barrels or lysimeters in October when they have grown bigger. Weekly effluent watering will continue until they are ready to shift – probably at year's end – to ESR's Kenepuru Science Centre in Porirua, where Gisborne's BTF sludge will be applied at five different rates. The trial will continue through into 2017 to enable multiple sampling and analysis.

"Having 35 lysimeters enables us to trial more variables," she says. "We will look at how much sludge can be applied, at what rate per day and how long the beds need to be rested between applications. If the beds need longer resting times, for instance, we will need more sludge drying beds.

"Within two years, we will be able to tell what happens to heavy metals and other contaminants, which plant species are good at dewatering and if the system will work.

"The science is reasonably new. If it works, it will be exciting for New Zealand and will be able to be applied in lots of places including small townships."

All going well, a wetland complex could begin to be constructed from late 2019. Eliminating human wastewater from the bay could be a reality by late 2020. **WNZ**

From little boysenberries BIG THINGS GROW

Before the Tasman District Council (TDC) put out its tender for the Richmond Water Treatment Plant (RWTP) build, there was a lot that needed considering. **Patrick Watson** explains.

Not only would the plant need to have a 50-year lifespan that would meet the drinking-water demands (and regulations) of one of the country's fastest growing areas, but its build would have to incorporate a new water filtration technique.

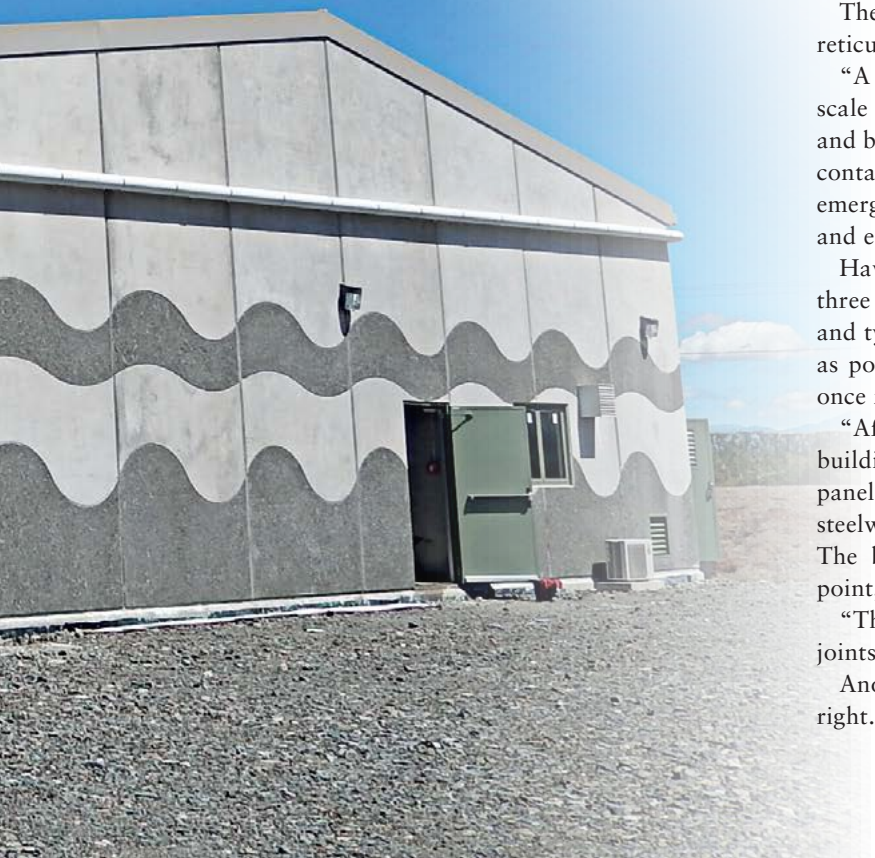
The existing water supply system, which required considerable altering, would also have to continue to function for industrial and residential users as the construction went on. To top it all off, the build site for RWTP was a sprayed out boysenberry field with no direct road access.

Hawkins Infrastructure was eventually awarded the tender, but only after negotiating the total cost in partnership with the council. The negotiation, which was necessary because Hawkins' initial price exceeded available funds, saw TDC select a more cost-effective glass-fused steel balance tank, instead of a more traditional concrete tank as it originally wanted.

As a major player in the civil engineering space, Hawkins' ability to overcome significant design changes and budget constraints put it in good favour with the council. Hawkins currently has a reported annual turnover of around $500 to $600 million and a water project portfolio that includes, among others, the Greymouth Waste and Patea Water Treatment Plants, as well as the Riverhead Reservoir and Domain Watermain Project.

The other core member in the RWTP build is MWH Global, which designed the plant and helped supervise its construction. The total estimated project cost for RWTP now sits at $10.5 million, $7.5 million of which is construction related.

Ground first broke on the project in May 2014. Just over nine months later, the commissioning of the RWTP is underway and a seven-metre high, 18-metre diameter tank (capable of holding 1.5 million litres of treated water) is connected to three kilometres of pipework.



The full project should be complete at the end of July, after a three-month trial operation. In all, it will include a treatment plant building, reservoir tank and changes to the pipe network between the Waimea Bores and the new treatment plant.

Getting it to this point, however, has seen Hawkins work across three core sites and make use of seven subcontracting companies to deal with, among other tasks, earthworks, pipe laying, building, mechanical, electrical and tank work.

In its most basic form, the RWTP will allow the council to maximise how it manages its water supply, which will help accommodate Richmond's population growth and provide greater security of supply in periods of drought.

The plant itself is designed to keep any operational noise within acceptable levels. The walls of the building have a textured surface to provide aesthetic interest and are screened by bunds approximately 1.5-2 metres high, to keep with the Lower Queen Street environment where it is located.

The council's project manager for engineering services, Chris Blythe, says Richmond has been supplied by two main bore fields and the supplies have been distributed separately, with one chlorinated and the other untreated. The RWTP will blend the two sources and treat them with UV light instead of chlorine.

"A key challenge was bringing two quite different water supplies into one treatment plant, owing to the chemical composition being different. Complex controls are needed to manage the flows from the different sources – pump speeds, blend ratios, etc," says Chris.

The other challenge was the significant change to the reticulation network from two supplies to one.

"A large portion of the work was installing pipelines, large scale valve installations and deep trenching. The building and balance tank were the other main elements. The building contains high lift pumps, UV units, caustic soda treatment, emergency chlorine treatment, surge vessels, mixing units, and electrical-mechanical controls."

Hawkins' senior project engineer Thomas Maw says the three kilometres of pipework involved pipes of various sizes and types, with piping work beginning as far from the plant as possible, so as to tie in with the works at the plant site once ready.

"After the earthworks had been constructed, the slab, building foundation and building was erected. This is a tilt panel building that has considerable portal frame and bracing steelwork to meet level one earthquake asset specifications. The balance tank foundation was also completed at this point," he says.

"The tank slab was constructed with no construction joints and in one pour to eliminate potential leak points."

Another major phase was getting the process pipework right.

Richmond water treatment plant

"[This] had been designed with no flexible couplings, dissembling joints or gibaults. Therefore the whole plant was hard piped and had to be perfect to ensure fit."

For his part, the most challenging part of the project was integrating the existing infrastructure, which required proving the build approach in 12 carefully-considered and strategic stages. This approach was necessary to ensure council buy-in and stop risk, as well as to enable minimal interruption to existing water supply or outages.

"Once commissioned, to start sending water to supply it had to be integrated, which significantly increased the risk and challenge of the task, but saved the client a significant portion of capital because we re-used infrastructure assets that were capable and would have otherwise become redundant and abandoned," Thomas says.

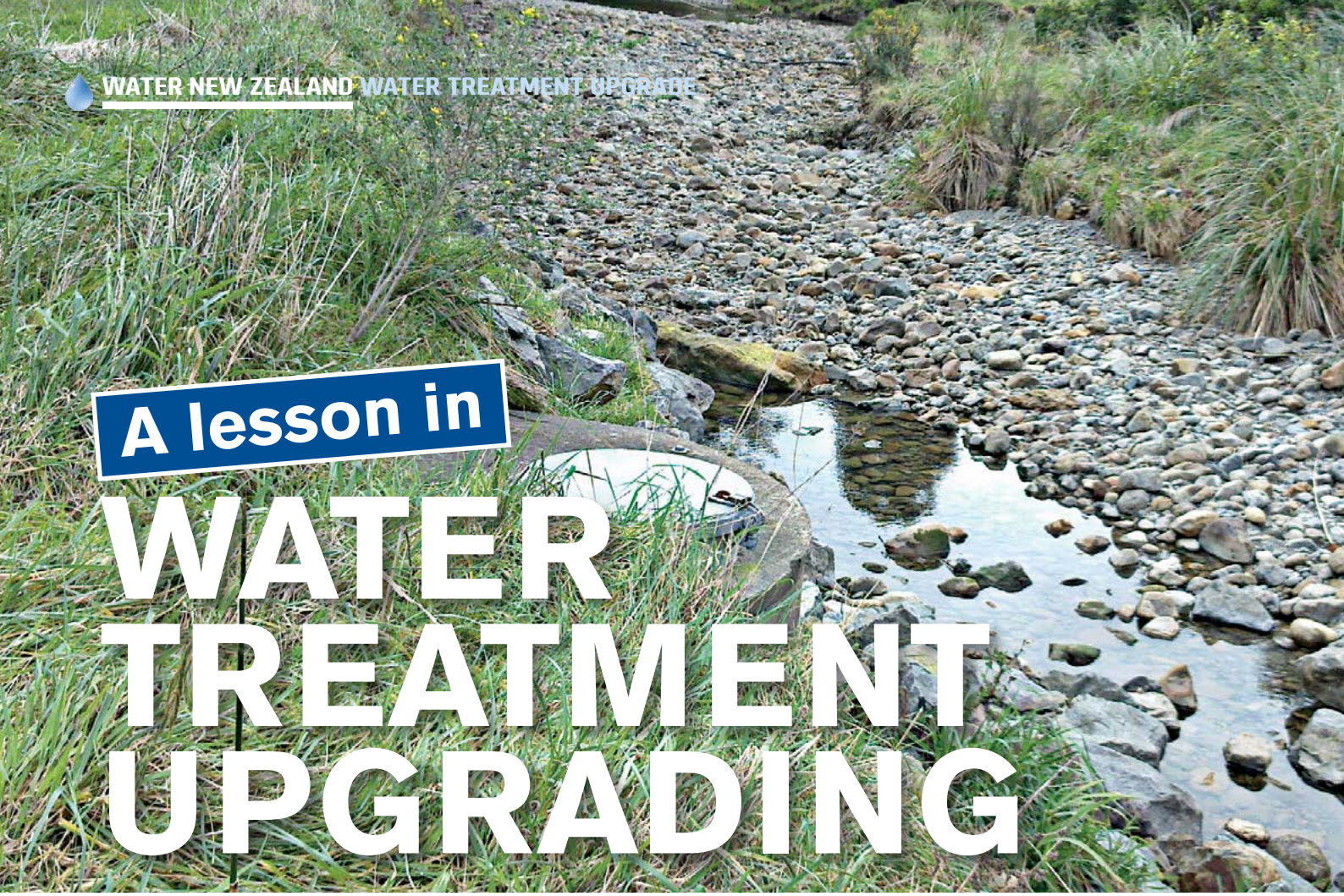
The Hawkins team also had to take an innovative approach to research and development, in particular with how they achieved the exposed aggregate pattern on the pre-cast panels.

"As the exposed aggregate faces were on the face down site for the casting bed it meant that there was the need to develop an innovative approach to achieving a sharp edge to the exposed area and not having the retardant run or travel past this edge.

"We had to achieve this without reducing the cover to the steel reinforcing. The approach was to weld R6 steel rod to the bed to create the negative detail and an edge to the exposed area while stopping the retardant from running and affecting outside of this area." Thomas credits subcontractors Gibbons Construction with going the extra mile to ensure quality and testing out the different ideas around how to achieve the pattern.

The next phase of work is the commissioning and trial operation of the plant. Commissioning will take place between January and April and trial operations will start once the plant is successfully commissioned.

The project is on track for completion by the end of July. **WNZ**



A lesson in WATER TREATMENT UPGRADING

By **Jonathan Church**, senior process engineer at $h_2$ope, project manager and commissioning engineer for the Tokomaru WTP upgrade.

Tokomaru is a small village in the Horowhenua District. It is located 18 kilometres southwest of Palmerston North. Water for the Tokomaru water supply is drawn from the Tokomaru River which is classified as having a '4 log protozoal' risk. It serves approximately 550 residents, as well as a primary school and several businesses. As the supply is not classified as a 'small water scheme' it requires full compliance with Drinking Water Standards New Zealand 2005 [Revised 2008] (DWSNZ2008).

The treatment comprised selective abstraction and chlorination. The plant had an E grade and in 2009 a decision was made by the Drinking Water Assessor to place a permanent boil water notice on the supply.

The Horowhenua District Council (HDC) engaged consultants to investigate treatment options. These included conventional and membrane treatment options with estimated capital costs ranging from $2.4 million to $2.6 million. Another option investigated was to connect Tokomaru to the Linton water supply. The cost for this option was estimated to be $3 million. HDC attempted to attain Community Assistance Programme (CAP) funding for the project, however Tokomaru did not meet the criteria for funding.

Due to affordability issues, a decision was made through the 2012/2022 Long Term Plan to defer the upgrade of Tokomaru water supply to 2025. The Tokomaru community made it clear during opportunities to engage with HDC that this position was not acceptable. The community continued to advocate for a review of that decision.

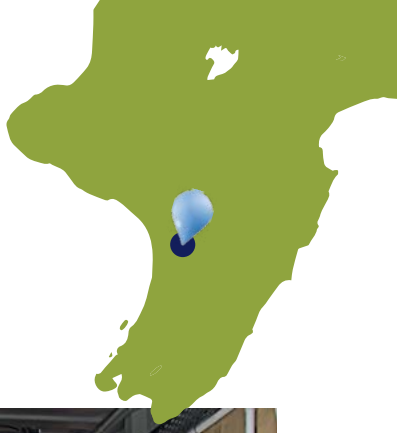
HDC staff and in particular Gallo Saidy, who at the time was the acting water and waste manager, took on the challenge of looking for an alternative pathway for the Tokomaru WTP. Gallo initiated investigations into potential solutions ranging from slow sand filtration to treatment at individual properties. The option that seemed like the best potential fit for providing 4 log of protozoal treatment was UV disinfection and cartridge filtration. However there were challenges that required addressing before the option could be developed further.

Treatment challenges

The Tokomaru River is low in turbidity and the selective abstraction meant that the maximum turbidity historically seen by the plant was 2.5 NTU. However, the river has a moderate to high dissolved organic content particularly after rainfall events. As a result the plant had the following P2s assigned:

- Dichloroacetic Acid (DCA)
- Trichloroacetic Acid (TCA)
- HAA MAV Ratio.

The challenge was to meet the following pre-treatment criteria for UV under all conditions at an affordable operating cost:



- Turbidity <1NTU for 95 percent of the month and no three minute events >2NTU;
- UV transmitivity (UVT) not less than 80 percent for any three minute period.

In order to validate the process and develop a design basis for a full-scale plant, trials were run over a period of four months with granular activated carbon (GAC) and cartridge filters. These trials showed that a process without chemical coagulation would be viable and economic.

A full process train was developed comprising the following unit processes:

- Existing raw water pumping (with selective abstraction);
- Roughing filter (1 x MM750A Multimedia Filter)
- GAC filters (4 x CN900A GAC Filters – EBCT = 8 mins)
- Cartridge filter (1µm Cuno Polypropylene)
- UV (1 x Trojan Viqua Pro50)
- Chlorination with chlorine gas (existing system)
- Backwash collection tank and pumping to sewer.

In order to reduce the capital cost of the plant it was decided to install the plant in a shipping container. The advantage of this was that no building work was required on site and the vast majority of the work could be completed offsite in the supplier's workshop. The footprint was also extremely compact.

The estimated capital cost for the works was $350,000 with a forecast annual operating cost of $31,000.

Council approval

With a proposed design and capital cost estimate prepared, council staff engaged with the project's subcommittee and finance subcommittee of HDC to begin discussions on the opportunities and potential outcomes. This governance structure enabled detailed and comprehensive discussion which resulted in HDC having the confidence and courage to fund an additional project outside of the Annual Plan process. There was no formal consultation regarding the recommendation to bring forward the upgrade of the Tokomaru WTP. However, a number of people were kept advised of the investigation and resulting recommendation that was considered by HDC. The project was given the green light on September 3, 2014.

Construction and commissioning

The enabling works required on site were a concrete pad for the shipping container, upgrade of the power supply and connection points to the raw and treated water. A new backwash handling tank and pump were installed and a new link to the local sewer was provided.

Automation of the new plant was provided by a new panel PLC which also controlled the existing chlorination process giving one control system with telemetry, allowing dial-in capability.

The water treatment plant container was built at Filtec's

KEEP IT SIMPLE
AND WORK WITH A WILLING COUNCIL

The Tokomaru Water Treatment Plant upgrade officially opened after a little ingenuity allowed the project to be brought forward from 2025 and costs slashed. It had been estimated to cost up to $3 million to get clean drinking water to the residents of Tokomaru. Horowhenua mayor Brendan Duffy credits Infrastructure Services Group manager Gallo Saidy for a solution that cost only $350,000 for the upgrade."When Gallo joined he reviewed the advice we had received and suggested an alternate option that could be developed in six months. He saved us money and introduced the solution in an outstandingly short timeframe," says Duffy. Since the story appeared on current affairs show *Campbell Live*, a number of councils and even one Pacific Island have contacted him for advice on putting a similar system in to their own communities.

"This is not a solution that will necessarily fit every location because the source and quality of water, proximity to services all factor in to how to come up with a solution that works. But the principle of what Gallo has done has potential to be explored for other locations."

The $350,000 water treatment plant upgrade was funded from existing capital budgets for water treatment plant upgrades in the 2014/15 Annual Plan, meaning there was no impact on rates. In addition to the chlorine disinfection, the upgrade sees the water now treated using a coarse sand filter, carbon filters, cartridge filtration and UV disinfection. There is an annual operating and maintenance cost of $35,000.

Council had previously investigated various options to upgrade the Tokomaru Water Treatment Plant, but due to costs and affordability the decision was made through the 2012/2022 Long Term Plan to defer the upgrade to 2025. Council had attempted to secure funding from the Government's Capital Assistance Programme (CAP) for the upgrade, but without success due to Tokomaru not meeting the deprivation index criteria set as part of CAP. Meanwhile, Saidy says that for other councils interested in an option like this, the best thing to do was to assess first what the problems are with any water supply before exploring any remedial options."

Just because this solution worked for Tokomaru, does not mean it can be adopted for other small communities, determining which solution to use will depend on the localised problems associated with the water source."

Commenting on aspects of the project that were key to its success, he mentions, "A willing and supportive council and CEO"; and, "Keep it simple – if a layman in the street cannot understand how it works then it may be overly complicated."

Wellington workshop. Once the container was delivered to the site water, power and control systems were connected. Sand and GAC media were loaded into the filters and the plant was ready for commissioning.

The new plant started supplying water to the public on the February 11, 2015.

The outcome

Initial performance results show that the plant is achieving full compliance with DWSNZ2008 even when faced with some extremely heavy rainfall events. The project was delivered just under budget and in a timeframe of 161 days.

The approach taken by HDC allowed it to deliver a compliant water supply to the residents of Tokomaru 10 years ahead of the date and at one seventh of the price of what was originally proposed in the Long Term Plan. The community is understandably delighted with the results.

The team

The project outcome was achieved due to a council willing to find and accept an unorthodox solution and by a team that went the extra mile to deliver that solution in a cost effective and expeditious manner. The team comprised the following members – Filtec (pilot trials, design, equipment supply and fitting out of container); Downer (installation, commissioning and operation); $h_2$ope (design, project management, commissioning and documentation); Automation For Industry (automation and commissioning) and of course the star of the show, Gallo Saidy, now the infrastructure manager at HDC. **WNZ**

GREYWATER REUSE COMPLIANCE
IN NEW ZEALAND AND OVERSEAS

Alma Siggins[1,2], Hamish Lowe[2,3], Ben Thompson[4] and Jacqui Horsell[1,2]

[1]Institute of Environmental Science and Research, Ltd (ESR), Porirua; [2]The Centre for Integrated Biowaste Research (CIBR); [3]Lowe Environmental Impact, Palmerston North; [4]Kapiti Coast District Council

ABSTRACT
This paper discusses the regulatory compliance of greywater reuse and disposal in a New Zealand context. Comparisons with overseas regulations and compliance allow us to develop recommendations to improve compliance, resulting in a reduced risk to environmental and public health.

The "Greywater-wise" research programme at ESR has been investigating the drivers for greywater use in an NZ context. Diversion of greywater for disposal purposes is common and often unregulated – compliance with regulatory requirements for greywater disposal is low.

Overseas, countries such as the USA, Canada and Australia have varying state/territory/regional requirements for greywater reuse. This is often appropriate as these are large, geographically variable countries, with defined internal divisions (eg, state). New Zealand is a much smaller country and little is gained by all 16 regions having separate and conflicting regulations for greywater reuse.

We would recommend that in order to improve compliance, information regarding greywater reuse and disposal risks needs to be more readily accessible to the homeowners. There should also be an attempt to improve the consistency of information and requirements between different regulatory authorities.

KEYWORDS
Greywater; Regulation; Compliance; Risk Assessment

1 INTRODUCTION
Greywater (from showers, baths, bathrooms sinks and laundry) can account for up to 75 percent of the wastewater from a domestic household (Eriksson et al., 2002), with the remaining blackwater stream originating from toilet waste. Wastewater from kitchen sinks and dishwashers may be included in either stream, depending on regionally varying recommendations and specifications. It is generally accepted that greywater containing kitchen waste requires some form of treatment, while kitchen waste must be excluded from greywater streams that are reused without treatment.

Although the nature and extent of greywater use in New Zealand is not well documented, there are anecdotal reports that a growing number of NZ households are using some form of unregulated and unreported greywater disposal system. These are typically basic, with no flow regulation, and include pipes from washing machines going through a window and directly onto a lawn area (personal communication, Lowe Environmental Impact).

This has implications for public health as well as

Unregulated greywater disposal from a washing machine outlet onto a lawned area.

environmental contamination concerns. Greywater has been reported to have a potentially high microbial load, including bacterial (Gross et al., 2007), protozoan (Birkes et al., 2004) and viral (O'Toole et al., 2012) as well as chemical contaminants originating from pharmaceuticals (Hernandez Leal et al., 2010) and household cleaning products (Harrow et al., 2011).

2 DRIVERS FOR GREYWATER REUSE

The availability of fresh water is likely to have the biggest impact on the drivers of greywater reuse, and is most likely to vary globally as fresh water is unevenly distributed worldwide.

2.1 AUSTRALIA

In Australia, ongoing water shortage issues, susceptibility to drought, high water consumption and low population density result in the strict management of water resources to reduce the demand for high-quality potable water. Therefore, greywater reuse systems are common and may be practised by 55 percent of households (Australian Government, National Water Commission, 2008).

2.2 USA AND CANADA

The USA and Canada have the highest annual water consumption per capita in the world; however greywater reuse is generally discouraged in all areas except those that experience critical water shortage.

2.3 UNITED KINGDOM

In the UK, the south east of England has lower levels of water availability than many Mediterranean countries (Environment Agency, 2011) and although greywater reuse is not routinely practised in the UK, it is increasing in popularity.

2.4 NEW ZEALAND

Lowe Environmental Impact (Cass et al., 2012) reported a common reason for diverting greywater in water rich New Zealand is to reduce the pressure on infrastructure such as septic tanks. Alternative reasons were that there is insufficient infrastructure, or an unwillingness, to pipe greywater from a laundry at one side of the house to a septic tank at the other side of the house. Homeowners also reported issues with undersized septic tanks, particularly at holiday homes that have short-term periods of high occupancy.

A key message that came from the Cass et al., (2012) report was that water shortage was not found to be a significant driver for greywater reuse in New Zealand, except in drier regions, such as the Kapiti Coast, Central Otago, and Nelson. However, factors such as climate change with increasing droughts, population pressures, and increased use of water intensive appliances such as washing machines and dishwashers, could result in increased water shortages in the future. This may result in a greater demand for greywater reuse.

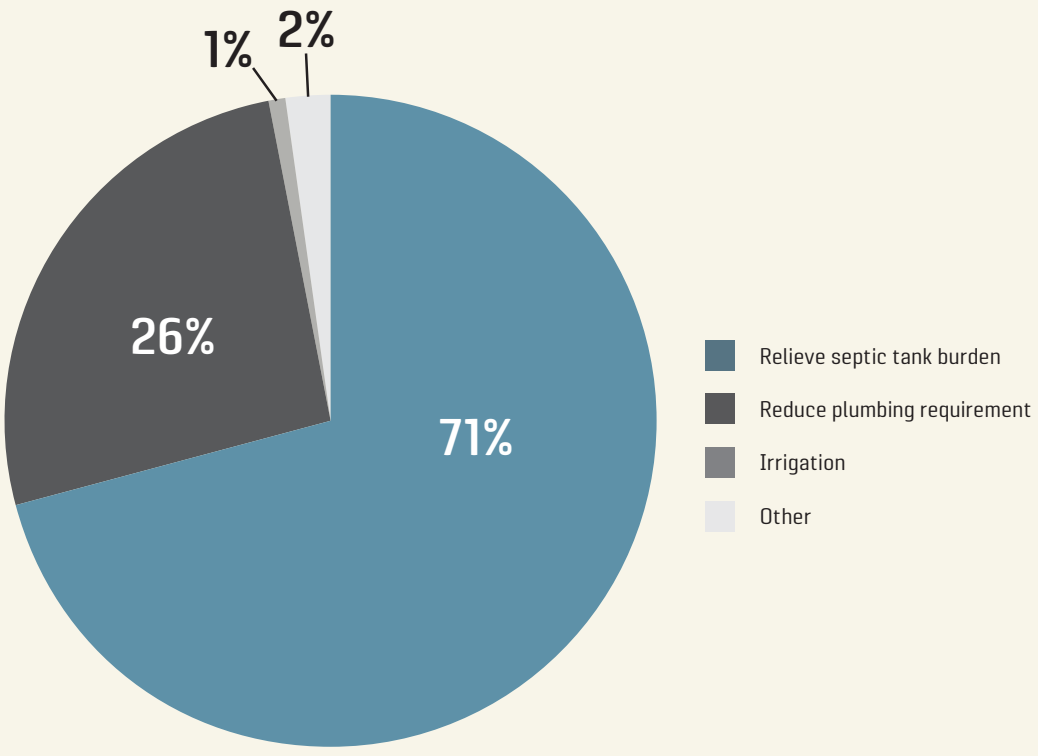


Figure 1. Reasons for greywater diversion, according to an LEI survey on a small community practising extensive unregulated greywater diversion.

3 CURRENT OVERSEAS GUIDELINES AND LEGISLATION

3.1 AUSTRALIA

The Australian greywater reuse guidelines typically require a high level of treatment prior to reuse (Leonard et al., 2008), often to the same level required for sewage effluent.

3.2 USA

There is no national policy regarding greywater use in the USA, and as of 2012, 30 states and one territory had individual, and varying, regulations (USEPA 2012). States that do not have specific regulations for greywater reuse may permit such an activity on a case-by-case basis (USEPA 2004).

3.3 EUROPEAN UNION

There is no uniform regulation regarding water reuse in the European Union, with the European Council Directive 91/271/EEC stating that 'treated wastewater shall be reused where appropriate', although there is no definition of 'where appropriate'. With respect to greywater recycling (treating greywater using membrane filtration and/or biological treatment) there is no European regulation, but certain countries, for example, Germany and the UK have adopted guidance relating to the European Bathing Water Directive (European Union 2006). In these cases, treated greywater is permitted for use in toilets and for laundry washing, but the guidance is based on best practice and voluntary compliance.

3.4 THE UNITED KINGDOM

The Environment Agency provides an information guide for domestic users of greywater systems in the UK (Environment Agency 2011). Water utilities provide advice on the use of domestic greywater systems, but most state that the adoption of greywater systems is slow due to the initial expense of installation and the problem of rapid deterioration in quality when greywater is stored. There is currently no regulatory standard for non-potable water quality. Guidelines for greywater quality are provided in BS 8525-1:2010. They are adapted from the water quality standards in the European Union Bathing Water Directive (European Union 2006). The guidelines suggest monitoring for *E. coli*, enterococci, *Legionella pneumophila* and total coliforms.

3.5 NEW ZEALAND

There are no current national greywater reuse guidelines in New Zealand; some information may be obtained from the relevant sections of the AS/NZS 1547:2012, TP58 (Auckland Regional Council 2004) and NZS 4404:2010, but none of these are specific to greywater reuse. Cass et al., (2012) concluded that a lack of suitable guidance regarding the safe and appropriate discharge of greywater was a key hindrance to the diversion or re-use of greywater.

Greywater systems discharging into the environment must comply with the Resource Management Act 1991, Buildings Act 2004, Health Act 1956 and Local Government Act 2002. While most regional councils include greywater reuse as a permitted activity in their regional plans, only a small number of district and city plans specifically mention greywater reuse.

4 DISCUSSION

There are known difficulties associated with the regulation and control of the environmental and public health risks associated with greywater reuse. This is further complicated due to the variable nature of greywater, particularly as the composition of greywater will vary significantly from household to household, based on hygiene habits, consumer choices. Knowledge of the operating of the greywater system will also affect greywater quality, as informed homeowners are more likely to know when it is appropriate to divert greywater for reuse, or when it should be directed to a septic tank/on site treatment system/reticulated sewer system. Greywater quality may also vary hugely within households due to illness, diurnal routines and changes in household products, and occupancy of the household that may vary due to school holidays etc. Ultimately the successful use of a greywater diversion system is the responsibility of the individual homeowner, and they must inform themselves about the "do's and don'ts" of greywater management. Unfortunately, not all homeowners are knowledgeable about their greywater systems. In areas where greywater diversion/reuse is not a requirement the homeowners that make the effort to install a greywater diversion system are likely to be interested in environmental and water conservation issues, and are therefore more likely to be well informed on safe greywater management practices. Some regions (such as Kapiti Coast) have included a water conservation requirement for new developments into their district plan, which may include a greywater diversion system (KCDC, 2009a). To inform homeowners about safe greywater reuse practices, the Kapiti Coast District Council has produced a document outlining the council requirements and suggestions for the homeowners (KCDC, 2009b). This is a clear and readily available document, that details region specific greywater diversion information. Such documents are not available for all areas, and the requirements for greywater reuse between different regions can be confusing and variable.

This is not unique to a New Zealand context. International legislation surrounding greywater reuse is extremely variable, and complex. Indeed, legislation within countries often varies between regions, states or areas. However, in other countries, such as the United States, Canada and Australia, regions or states are much larger than the regions affected in New Zealand. Often significant geographical and climatic differences require a completely different set of greywater reuse criteria between regions. Although there are geographical variations in New Zealand, this could be taken into account for in any national guideline document for safe greywater management practices.

Complexity and rigidity of greywater legislation is likely to impact on compliance by the homeowner. Exceptionally stringent criteria for greywater reuse, as in California, USA, often results in low compliance (0.01 percent; Sheikh, 2010). This is also the outcome of unclear or highly variable

requirements for greywater reuse. Therefore there is a requirement for a greywater legislation to be clear, available and achievable by homeowners, to increase the rates of compliance, but not too lenient as to allow for any potential public health risk as a result of improper greywater reuse in a domestic setting.

Evidence indicates that a lack of understanding of the requirements for greywater use in New Zealand has contributed towards extensive unregulated and undocumented practices (Siggins et al., 2013). The extent of this unregulated greywater reuse is largely undocumented and unknown. It would be useful for the full extent of greywater reuse in New Zealand to be understood and acknowledged, particularly with regard to unregulated greywater diversion in rural and environmentally sensitive areas. This knowledge would assist in assessing and improving compliance with region specific requirements for greywater reuse and/or disposal practices.

5 CONCLUSIONS

- Legislation surrounding greywater reuse criteria should be clear, and readily available to homeowners
- Excessively complex legislation discourages compliance
- Variable requirements within a relatively small geographical area adds to confusion and non-compliance.

ACKNOWLEDGEMENTS

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When the DEFENCE FORCE CALLS

Warren McKenzie, environmental engineer and Rob Docherty, technical director Water Infrastructure, Pattle Delamore Partners, discuss the design of a new treatment plant.

The New Zealand Defence Force (NZDF) owns and operates a Wastewater Treatment Plant (WWTP) at Waiouru, which was originally built in 1957.

The WWTP treats wastewater generated from the NZDF military base and from commercial and residential sources within the township and serves a total population of around 3000. Pattle Delamore Partners (PDP) has assisted NZDF in the upgrade of the WWTP throughout the consenting, investigation, design, construction and operation of the plant.

The upgrade of the plant included a new dual tank Sequencing Batch Reactor (SBR), alum dosing for phosphorus removal, UV treatment, improved sludge handling facilities and the refurbishment of many of the existing treatment processes. The overall construction cost was about $3.5 million. The plant discharges into the Waitangi Stream which is a small alpine stream which enters the Whangaehu River a few kilometres downstream.

Detailed design

PDP started the design in October 2012. The process design was assisted by utilising Biowin wastewater treatment modelling software.

The process design was undertaken in parallel with detailed design and site investigation given the tight timeframe required to meet key consent dates. Information was fed from the process design and site investigations to the detailed design team and the design progressed quickly with design documentation completed in February 2013.

A key part of the project was to incorporate as much of the existing treatment plant infrastructure as possible and in particular utilise the existing trickling filters as these were accepted by local Maori representatives as providing spiritual cleansing of the wastewater.

Flow data

The historical WWTP wastewater flow data comprised "hand kept" records (spanning some 10 years) which were essential in sizing unit processes.

Some significant flows have been encountered at the Waiouru WWTP due to stormwater inflow and groundwater infiltration (I and I) in the township. The average daily flow for the plant is around 800m³/d but flows have been recorded in excess of 5000m³/d. These large flows required the incorporation of overflow points at particular locations through the treatment process, the SBR tanks being one such point where bypassing will occur when inflow exceeds 1600m³/d. Following plant commissioning in early 2014 no flow in excess of 1600m³/d has been experienced.

Characterisation of loads entering the WWTP is of particular importance. Post-screen flows were characterised for their contaminant loads to provide valuable process sizing information. The low BOD:N ratio required supplementing of the incoming SBR flow with an artificial carbon source to enhance denitrification and enable a high percentage removal of nitrogen in the SBR.

Designing the plant for cold weather was also a challenge, with recorded air temperatures of -6°C being common and wastewater temperatures often being less than 10°C. Heat transfer theory was applied, resulting in the insulation of pipework and the provision for heating of some chemicals. Stagnant flow in pipework was avoided and some unit processes have been programmed for periodic pulsed operation to prevent freezing.

Nitrification inhibition

Some difficulties were experienced in early 2014 just two and a half months after commissioning with poor treatment being achieved by the SBR tanks. After some investigation, it was discovered that a local contractor had been contracted to provide portaloos for a temporary military exercise and he was regularly discharging portaloo contents into the sewer network. The products used in these portaloos for odour control are antimicrobial and were having an adverse effect on SBR treatment. While these portaloo discharges may have been acceptable in small quantities, during army exercises 75 to 100 portaloos were being emptied every three days into the plant's relatively small 800m³/d inflow.

The portaloo discharges inhibited nitrification in SBR 1. SBR 2 was then used to reseed the affected SBR tank with activated sludge. SBR 1 fully recovered in seven to 10 days following reseeding and ammoniacal nitrogen concentrations returned to normal (< 5mg/L). The ability to reseed an affected tank has proven very useful and this is one of the advantages of a dual SBR system and an allowance should be made in any design to enable the operator to transfer activated sludge between process tanks.

To prevent future recurrence of the portaloo discharges, the portaloo contractor is now required to use a wastewater treatment friendly product that relies on enzymes for odour control. No issues have been experienced at the plant since this new product was introduced.

PLANT EQUIPMENT

The upgraded plant includes (new treatment processes bolded):

- Inlet works, with grit chamber and step screen
- Primary clarifier
- **SBR Lift Pumpstation with 40L/s capacity.**
- **2 x 800m³ SBR tanks (400m³ live volume per cycle) with diffused aeration, submersible mixers, sludge wasting pumps, floating decants and monitoring probes.** Shown in Figure 1.
- **Caustic dosing to increase alkalinity prior to nitrification in SBRs (alkalinity deficient wastewater).**
- **Carbon dosing to assist denitrification (due to an inadequate C:N ratio)**.
- Trickling filters (2 of, working in parallel).
- **A recirculation pumpstation with 25L/s capacity (to keep the trickling filters wet during SBR idle phases).**
- **Alum dosing prior to secondary clarifier**.
- Secondary clarifier.
- **Ultraviolet treatment.** Shown in Figure 2.
- **Improved sludge handling facilities with a geobag dewatering system**.

Figure 1

Figure 2

REMOTE OPERATION USING SCADA

PDP has been providing operational assistance to NZDF since the plant was commissioned in early 2014. Operational assistance is provided remotely (using a SCADA connection) and monthly site visits undertaken in order to provide training to the existing plant operator.

A SCADA link is used by PDP staff from the Auckland and Tauranga offices to remotely access key information from the plant such as flows, dissolved oxygen, pH, temperature, valve positions, equipment status and tank wastewater levels. The development of the SCADA system was discussed in some detail within the construction contract documents and with the contractor's programmer throughout construction to ensure it provides the correct level of detail in an "easy to use" format.

The SCADA link also provides monitoring trends which are invaluable for troubleshooting purposes. A well performing SCADA link is a key requirement in providing operational assistance to any technologically advanced WWTP. Screenshots of the SCADA system are shown in Figures 3 and 4.

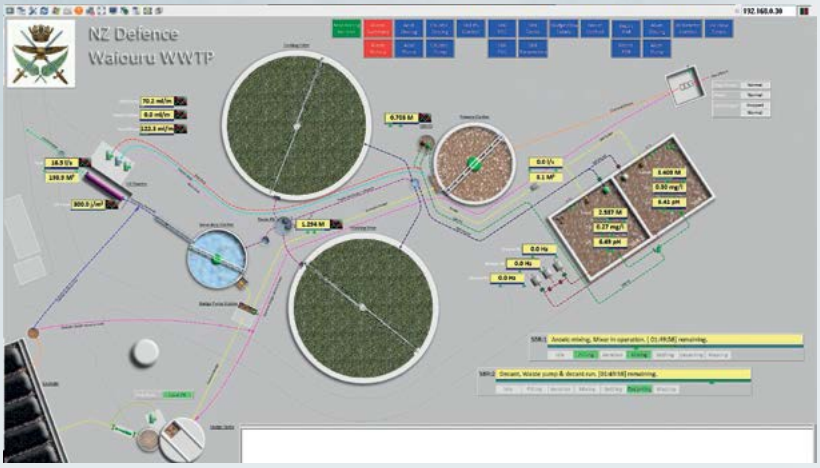


Figure 3

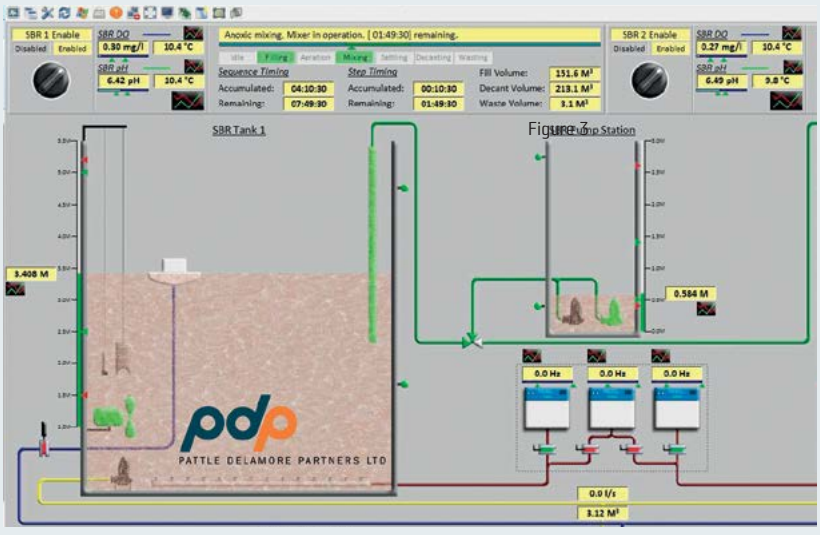


Figure 4

Temperature

Wastewater temperatures declined to 8°C during/after snowfall in mid-July 2014. While it would be normal to expect a drop off in nitrogen removal at these temperatures, interestingly no negative effects were seen on the nitrification and denitrification ability of the SBRs.

Onsite sampling

Troubleshooting of performance difficulties in a WWTP can prove difficult, particularly given the seven-day turnaround time of any effluent sample sent to a laboratory for analysis. To overcome this, PDP staff and the plant operators utilise a colorimeter allowing real-time measurement of ammoniacal nitrogen, nitrate, nitrite, dissolved reactive phosphorus (DRP) and suspended solids (SS). This has proved to be an invaluable tool for the operator as it allows him to make proactive adjustments to the plant control. The colorimeter results were compared against a laboratory sample and were remarkably similar for the nitrogen species and within acceptable limits for DRP and SS.

Plant performance

Median effluent results for the plant over the last 12 months (May 2014 to April 2015 inclusive) are shown in Table 1. The plant is showing comfortable compliance with all parameters.

Nitrogen removal can be improved by increasing the carbon dosing rate which reduces residual nitrate concentrations. However, this has operational cost implications and for this reason nitrogen concentrations are maintained at a comfortable level of compliance.

Conclusion

PDP has worked alongside NZDF throughout the full project lifecycle of the Waiouru Sewage Treatment Plant Upgrade which was commissioned in early 2014.

The new plant has significantly reduced the discharge of nitrogen, phosphorus, faecal coliforms, BOD and suspended solids to the Waitangi Stream. PDP's work has included consenting, detailed design, contract management, operational assistance and operator training which has provided NZDF with a highly functioning WWTP that will serve Waiouru. **WNZ**

Table 1

WAIOURU SEWAGE TREATMENT PLANT: EFFLUENT DISCHARGE COMPLIANCE			
PARAMETER	**UNIT**	**MEDIAN**	**CONSENT LIMIT**
Biochemical Oxygen Demand	mg/L	2	20
Ammoniacal Nitrogen	NH_4- N mg/L	0.54	5
Total Nitrogen	mg/L	7.7	12
Soluble Inorganic Nitrogen	mg/L	6.5	10
Total Suspended Solids	mg/L	13	25
Total Phosphorus	mg/L	0.74	0.9
Dissolved Reactive Phosphorus	mg/L	0.04	0.7
E Coli	MPN/100 mL	1	1000
Faecal Coliforms	CFU/100 mL	1	2000

Open channel flow measurement

Open channel flow measurement installations can provide invaluable data for decision-making – but there are some things you need to know. **Geoff Young** of BPO says he has some tips for getting it right, gleaned over many years of assessing and calibrating flumes and weirs.

The measurement of flow in drainage reticulation is often perceived as being either difficult or a complete waste of time, depending on the collective experience in the organisation. This general misconception is due to a number of factors, most commonly inadequate information in the planning phase. The reality is that a well-planned, well-designed flow measurement installation with the right maintenance and calibration practices can provide invaluable data for either the operation of the downstream asset or for planning processes around future upgrades or consent requirements.

Open channel flow measurement has been seen as a cheap, poor quality option. The reality is that a good open channel flow measurement installation is rarely cheap, but that doesn't mean it isn't the right option, and a good open channel flow measurement installation should be able to achieve accuracy levels of +/- 5%, which for most applications is more than adequate.

As discussed previously, a well-installed correctly specified flume or weir should be able to provide an accuracy of +/- 5%. The validity of the data generated in these devices can be easily verified by measurements and checks for comparison to the Standard. What is not so simple is checking the engineering around the approach and discharge section of the device, but nonetheless it is still achievable.

Compare this to the more recent technologies such as area velocity and Parti-Mag meters, which, although often convenient to install and relatively plug-and-play, auditing the installation provides little or no real insight into the validity of the data. Calibrations of level and velocity measurements can be done offline, but typically not in situ. Problems with these devices include ragging around the cabling to the bottom mounted sensor, blinding of the sensor array by accumulation of grit and solids and, despite the claims of the local agents, accuracies that are nowhere near the promised five percent or in one case two percent.

To be fair to the agents, this is not entirely their fault. The manufacturers make these claims, but then say in the small print that this is only on every other Sunday when the temperature is between x and y and the flow range is between a and b in a near-perfect installation. It is then we

EIGHT THINGS YOU NEED TO CONSIDER

1 Is the pipeline big enough?
Open channel flow measurement only works when the pipe is operating as a gravity pipeline, not a surcharged pressurised main. This may sound basic but the number of installations that get this basic wrong is phenomenal.

2 Is the flow straight and regular?
Whether you are using a flume, a standard area velocity or a Parti-Mag, all these technologies rely on the flow being parallel with the pipe and of uniform velocity. Installation straight after a corner without sufficient straight section prior to the measurement device, or immediately after a vertical dropper, will give you poor results. This includes coming straight out of a pipe into the device without an adequate control section to level out the flow.

3 Has the device been installed correctly?
One of the services we provide is to audit and verify open channel flow devices. It is always very disappointing when the device has to be condemned because it has been incorrectly installed.

4 Device designed to foul!
Weirs are regularly criticised because they foul up with foreign material and debris but the issue is not the weir, it is the selection of inappropriate technology. The use of a narrow throated flume in a location with volumes of large foreign objects will also give poor results. The selection of the primary device (weir or flume) needs to consider not only the volumetrics of the application but also what is likely to pass down the pipeline.

5 Inspections and maintenance
Too often, flumes and weirs are installed in the bottom of manholes with not much more than crawl space to access the extremities of the flume. With the current regulation around Confined Space Entry, this makes inspections and maintenance difficult, if not impossible, which means they just don't happen. Unless the device is checked regularly and calibrations are current, the device cannot be relied upon. A recent design development is a free-standing unit which allows level adjustment for re-certification.

6 Poor selection of primary device
All open channel flow devices have optimum flow rates at which they give the best accuracy. If you find a device that spends a significant chunk of its measurement period well outside this flow range, then data errors can be expected. There are also numerous different types of flumes and weirs, all of which have their application. It does, however, pay to avoid "orphans". Some of these devices are orphans because they weren't very good and some are orphans because there is something else in the market place which is just as good and much more common. If you select one of these orphans, finding someone who understands the device well enough to verify it or debug it when it is not working properly may be challenging.

7 Poor selection of secondary device
In 1990, the dairy industry was in the process of throwing out all the Mannings UTC ultrasonic level transmitters which had been purchased in the mid-1980s, and replacing them with bubblers. The problem? When the temperature in the drain exceeded the ambient temperature, water vapour accumulated on the surface of the flow, and this water vapour either absorbed the ultrasonic signal, causing it to lose echo, or provided a false level that exaggerated flows. Whichever way it went, the data was of no value at all. The selection of the secondary measurement device is critical to the success of the installation. There are some installations where ultrasonic devices work well. Dairy factory drainage isn't one of them.

8 Level measurement problems
These are varied but the common ones are:
a) Mounted in wrong location;
b) Incorrect calibration;
c) No zero offsets, where this is essential for the particular flume;
d) Ranging of field instrument different to ranging of data processing.

1. Well-installed flume showing uniform flow.
2. Sampler obstructing flume throat.
3. Obstruction in inlet.
4. Inadequate approach causing back-eddies.


1.


2.


3.


4.

installers that really screw it up, by putting them in less than perfect installations with highly variable temperatures and flow rates with accumulating solids and almost never record Sunday data!

The latest round of technology is non-contact area velocity flow meters which look very exciting. We are hoping to trial one with multiple point laser velocity measurement before the end of the year. The primary goal of this exercise won't only be to establish the accuracy level or the flexibility of the device. It will also be to determine what its shortcomings are. As it has an ultrasonic level measurement, we are already concerned about its ability to deal with water vapour in the measurement path.

Finally my current big hate in the flow measurement space: submerged Mag-flow meters.

This is where a drop leg has been put in the drain to create a submerged section and a Magflow installed. Sometimes they even have the recommended 10 diameters before and five diameters of straight section after the flow meter, although not often.

These are being promoted by some consultants and some industrial electrical contractors. These units invariably accumulate a solids layer in the bottom of the drain within 12 months, which slowly reduces the active area of flow. The Mag meter only measures velocity and sees the cross sectional area as fixed. We have removed a number of these installations to overcome exaggerated flow rates and in one case to clear a blockage caused by ragging in the submerged section.

So looking back over my ramble, what is it I am trying to say?

- Open channel flow measurement is not a cheap option but it may still be the best one.
- Technology selection in both primary and secondary devices is critical to the success of the installation.
- The installation has to be right; there is no close enough is good enough.
- Getting a second opinion about open channel measurement may be wise. There are a number of proposals being put forward with little or no understanding of the basic principles of open channel flow measurement.
- Unless you are absolutely positive there is no chance of solids or foreign matter entering your drain, don't use a submerged Mag. And as the old saying goes, if the technology looks too good to be true it probably is! **WNZ**

Trade waste management

– obligation or customer service?

BY **SVEN EXETER, RESOURCE MANAGEMENT ADVISOR, MOTT MCDONALD.**

Trade waste discharges represent a significant risk to local authorities and a significant cost to industry.

Typically a trade waste bylaw or a specific trade waste agreement is established to provide local authorities mechanisms for recovering costs and mitigating risks through limiting industries to certain standards for safety and asset protection. Charging models and cost structures typically cover historic capital works and do not usually consider future upgrade requirements and this can cause issues when a substantial upgrade is required by the local authority but not planned as part of the industries budgeting. As a result trade waste agreements can become dated over time and as a result may not be cost reflective and have limited 'regulatory teeth'.

Various legal, management and charging models can be used as part of a trade waste bylaw or agreement to provide industry and local authorities with a defined, agreed framework for the management of trade waste discharges and to charge for this service in a "cost reflective" manner. Whatever the model selected, it should be cost and risk reflective to meet the needs of the community, industry and the local authority. The system should ideally be developed in collaboration with industries, have a fair and equitable charging regime that is robust, and balances the recovery of revenue from industry against the administrative, operational and capital costs to obtain this recovery.

Legal basis

Trade waste management and control is an important operational aspect for local authorities to ensure the protection of health and safety, reticulation and treatment plant assets, and the environment. It is worth noting that under the Local Government Act (LGA, 2000), local authorities are not obliged to accept trade wastes. The collection, treatment and safe disposal of trade wastes can pose significant risks to a local authority and for this reason it is prudent that effective management systems and strategies are in place. Such strategies typically incorporate key documentation such as a bylaw and/or special trade waste agreements promulgated under the LGA.

In New Zealand, wastewater systems are administered by local authorities or local authority trading enterprises and given that there are over 60 local authorities, some of which have multiple sewage catchments, there is a variety of trade waste charging and administrative regimes.

Where local authorities do collect and treat trade wastes they have obligations to protect their wastewater collection and treatment systems; from damage,

to protect workers and the general public from harm and minimise the effects from wastewater entering the receiving environment.

A trade waste bylaw is typically the best option for managing trade wastes and the LGA sets out measures that can be taken when offences are committed against any bylaw. Section 242 of the LGA provides that any person convicted of an offence against a bylaw made under Section 146(a)(iii) (which relates to trade wastes) is liable to a fine not exceeding $200,000.

Implementing a bylaw

A bylaw provides the basis for the management of trade wastes within the local authorities' jurisdiction or in the use of a special agreement to individual customers.

When implementing a bylaw to ensure an effective administrative frame work there are some key considerations including:

- **Controlled and prohibited substances** – usually incorporates a non-exhaustive list of several substances and is typically derived from drivers such as – protection of the sewerage assets, health and safety, treatment process protection, environmental protection, and biosolids quality requirements.
- **Charging or cost recovery** – for the administration, collection, treatment and disposal of trade wastes typically incorporating a degree of cost reflective charging.
- **Sampling and analysis requirements** – for both compliance purposes and for evaluating trade waste charges.
- **Trade waste management issues** – incorporating rules, plans, policies and other consenting issues such as criteria for storm-water and cooling water discharges, consent requirements, risk analysis and criteria, pre-treatment requirements, encouragement of waste minimisation and environmental best practice.

Charging mechanisms

Across the country, charging rates and methods for both domestic and trade waste vary widely. This is due to a range of reasons such as wastewater treatment system types and economies of scale. For trade waste, charges are generally set annually via the special consultative procedure and annual plan process. Local authority charging rates for trade waste vary from uniform to targeted and variable rates. Some local authorities charge trade customers based simply on the customers discharge flow and other local authorities' charges are more cost reflective using a combination flow, and pollutant loads.

Under the LGA, local authorities are able to fairly recover the real costs of dealing with trade waste discharged by all businesses into the wastewater system. When implementing a charging system, it is important that a balance be struck between cost reflective charging and the cost of implementing the system itself. Charging systems should be fair and equitable and allow councils to recover costs but not introduce complex administrative requirements that add to the cost of the service.

Local authorities can be exposed to a significant financial risk where large trade waste customers impose a significant load on a treatment plant. To minimise financial risk, local authorities need to ensure that they can recoup the capital and operating costs, and implement financially binding trade waste agreements or consents under a bylaw with large trade waste customers. Local authorities under a bylaw regime can still opt to have special agreements with specific customers, and these agreements can allow for special charging arrangements. Such agreements may only be required on a case-specific basis depending on the type of industry and their contribution to the catchment. And they may provide mitigation of the financial risk to the council where the industry is a significant contributor to a small catchment and there is a substantial capital commitment for acceptance into a scheme.

Volume and load based charges are typically applied to industries who contribute significantly through unit rates that reflect the actual cost of collecting and treating a certain volume and/or pollutant load. Typically, these charges are imposed if a trade waste customer discharges at or above a set limit in terms of volume of discharge per day or mass load of pollutant per day. It is relatively simple to implement, is consistent and uniform for all large or high risk trade waste customers in a catchment, and it apportions the costs fairly on a 'user-pays' basis.

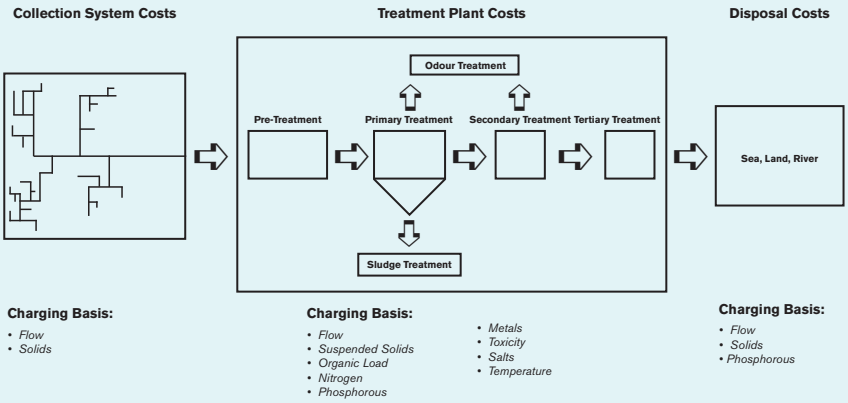
A cost reflective charging regime is typically based on flow and pollutant loads; where both the capital costs (in the form of depreciation) and operational costs are recovered through unit charges relating to flow and load. Unit charge rates are derived from actual financial and wastewater characterisation data to determine the cost for a council to collect, convey, treat and dispose a unit of trade waste (in m^3 or kg). This 'user-pays' method is used in most jurisdictions in New Zealand and around the world where there are significant "wet" industries in the catchment. Unit charge rates can also be calculated using only operational costs to give Opex-based pollutant load charges. In this case, the capital costs might be recovered from the trade waste customer through other agreed mechanisms such as an upfront capital contribution to a scheme.

Figure 1 right presents a diagram with some of the typical cost centres and unit charging parameters that can be used to develop cost reflective charging mechanisms. Models need to be developed for the specific costs incurred by a particular scheme or catchment, and can vary greatly depending on the treatment and disposal processes employed.

Unit charge rates can also be calculated to include future infrastructure costs, so that the capital costs of future works are able to be partly recovered by all trade waste customers in a simple and efficient way (rather than having individual agreements with each customer setting out different amounts of capital contributions). However, many councils do not currently capture this cost effectively in their charging models, and as such are not aware that they are not recovering the entire cost of trade waste management. Ultimately this passes the cost on to the community.

Figure 2 below presents differences in selected charging regimes across New Zealand based on hypothetical wastewater discharges for wet industries based on 2014/15 trade charges. Discharge 1 is representative of a highly biodegradable organic load waste with a minimal nutrient and solids load such as a brewery wastewater, whereas Discharge 2 is representative of a high organic, nutrient and solids load waste such as meat process wastewater, the characterisation of both "typical" discharges is listed in Table 1 opposite.

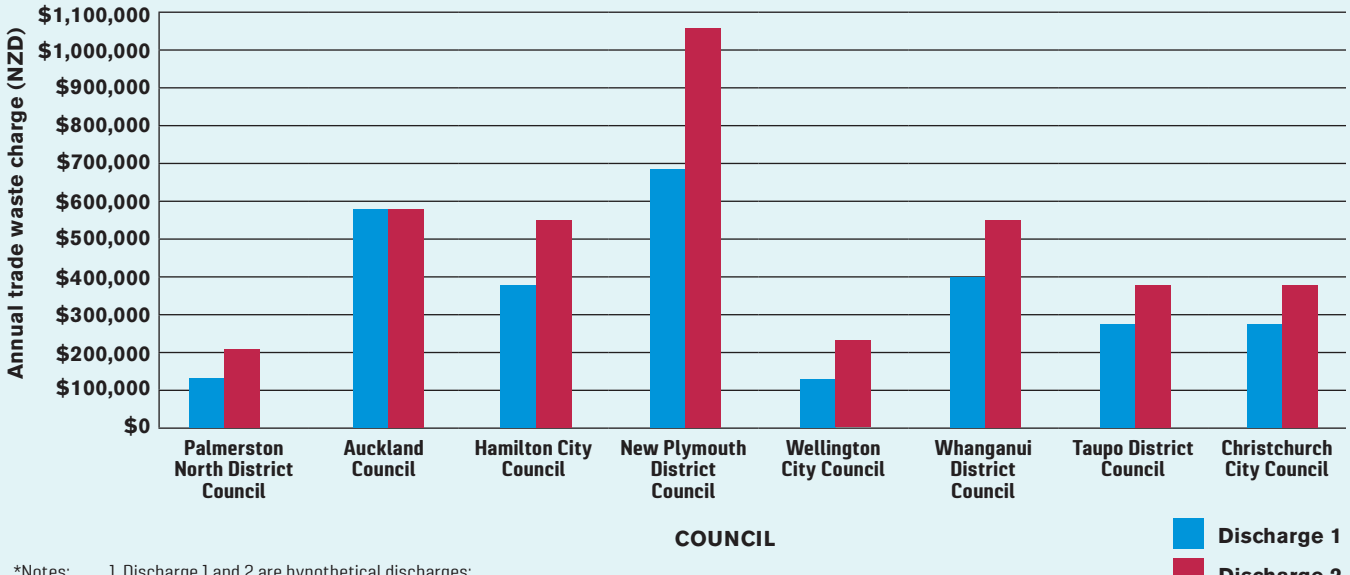
Figure 1: Example parameters for cost reflective trade waste charging mechanisms.



As can be seen in Figure 2, the variation between councils can be attributed to the inclusion or exclusion of, and variance in their unit charges; this is often determined based on the type of wastewater treatment employed, its level of complexity and the effluent quality targets required in a given discharge consent. For example, Whangarei District Council, and Hamilton City Council include a TKN charge because of the nature of the discharge environment, whereas New Plymouth District Council has an organic loading charge that is almost four times higher than the average of the other councils.

What is particularly evident in Figure 2 is that a highly biodegradable waste (Discharge 1) incurs a lesser charge than a waste that is more complex to degrade or a waste that requires nutrient removal (Discharge 2) with the exception of Auckland where the charges are now based on volume providing no economic benefit to a more biodegradable discharge and little incentive to pre-treat or implement cleaner production techniques

Figure 2: Differences in selected charging regimes across New Zealand*



*Notes:
1. Discharge 1 and 2 are hypothetical discharges;
2. Discharge 1 is representative of a highly biodegradable discharge such as a brewery
3. Discharge 2 is representative of a less degradable discharge with a substantial nutrient load such as a meat processing wastewater.
4. Auckland City Council bylaw only charges on a flow basis, and is managed by Watercare Services.

Early communication

Recent reviews of New Zealand "3-waters services" highlighted that with more collaboration between industry, local authorities and the community, wastewater management will improve and therefore this could potentially reduce costs for industry. It is important therefore that councils (or council utilities) as the service providers, maintain good communications with their trade waste customers and are able to show the value of the service provided. Both parties are reliant on the other and our experience is that there are generally better outcomes and acceptance of charges where there has been proactive communication on the part of the service provider.

In summary

The collection, treatment and disposal of trade waste can present a significant risk to local authorities, and cost to industries. Some form of management regime (either through a bylaw or other mechanism) is required to mitigate this risk. Most bylaws or management regimes contain four key aspects, these being: The controlled or prohibition of discharge of certain substances; a charging or cost recovery system; protocols for monitoring (including sampling and analysis), and management aspects.

A commonly employed and cost reflective charging model uses flow and load unit charges calculated based on actual conveyance, treatment, and disposal costs and if implemented appropriately can incentivise industries to improve the treatability of their discharge or implement appropriate pre-treatment systems. This in turn benefits the service provider as they receive a better quality resource.

Recent studies have demonstrated that it is important for local authorities to communicate well with trade waste customers so that they understand the value of the service provided. **WNZ**

Table 1: Characterisation of the hypothetical discharges

Parameter	Units	Discharge 1	Discharge 2
Flow	m^3/d	500	500
Biochemical oxygen demand (BOD)	mg/L	1,000	1,000
Chemical oxygen demand (COD)	mg/L	1,800	3,000
Suspended solids (SS)	mg/L	100	500
Total Kjeldahl nitrogen (TKN)	mgN/L	20	150

Murky Waters

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

What does the National Policy Statement for Freshwater Management 2014 (NPSFM) actually mean for freshwater quality?

Does it enable an 'unders and overs' approach to freshwater across a catchment? Or does it require no further degradation of any freshwater body? The Environment Court has recently been wrestling with these two questions, and two differently constituted benches of the court have given two different answers.

This article provides an overview of those two cases. In Ngāti Kahungunu, the court found that regional councils are required to 'aspire and attempt' to improve water quality, and not to risk degradation in an 'overs and unders' approach to water management. In Puke Coal, the court was influenced by considerations of 'workable practicality' and proportionality in achieving the protection and restoration of the Waikato catchment.

As Environment Court decisions do not act as binding precedent, the situation will not become clear until there is some superior court determination on the NPSFM. So for the moment, it is as clear as mud, and in our view is likely to largely turn on the facts of any particular case.

NGĀTI KAHUNGUNU IWI INC V HAWKE'S BAY REGIONAL COUNCIL (2015) NZENVC 50

Ngāti Kahungunu Iwi Inc successfully appealed Hawke's Bay Regional Council's Proposed Change 5 (PC5) to the Hawke's Bay Regional Resource Management Plan – Land Use and Freshwater Management. Judge Thomson declined to allow PC5, and ordered the retention of the operative objectives (with one small change requested by Ngāti Kahungunu):

> Objective 21: No degradation of existing groundwater quality in the Heretaunga Plains and Ruataniwha Plains aquifers systems.
>
> Objective 22: The maintenance or enhancement of groundwater quality in aquifers in order that it is suitable for human consumption and irrigation without treatment, or after treatment where this is necessary because of the natural water quality.

Alongside minor consequential amendments, PC5 had deleted Objective 21 of the Regional Policy Statement section and amended Objective 22 to read: The groundwater quality in the Heretaunga Plains and Ruataniwha Plains aquifer systems and in unconfined or semi-confined productive aquifers is suitable for human consumption and irrigation without treatment, or after treatment where this is necessary because of the natural water quality.

The council's reasoning behind PC5 The operative Objectives 21 and 22 were notified in 2000 and effective from 2006, but over the last 14 years there have been increases of nitrate-nitrogen at 18 percent of monitoring sites in the region. In light of this decrease in water quality, the council promoted PC5 for two reasons.

Firstly, the council considered that the absolute wording of "no degradation" made Objective 21 impossible to achieve. Council lawyer Lara Blomfield noted that the 'no degradation' stance "would mean a prohibition on all farms, all horticulture, and taken to an extreme level, even native bush because it too leaches nitrogen into the soil and that nitrogen inevitably reaches groundwater".

Secondly, the council noted that due to the time lag between cause and effect upon water in aquifers, there is a "load to come" which cannot be avoided – namely, water quality will get worse before it gets better.

Council science manager Dr Stephen Swabey considered that the council was setting a pragmatic and practical objective based on a water quality thought to be achievable, in light of the likelihood of observation bores reflecting contamination which occurred years or decades before the date of the observation.

Ngāti Kahungunu appeal The Ngāti Kahungunu appeal was based on three arguments.

The first was a minor point objecting to the use of the terminology "productive aquifers", which was noted and accepted by the court. Ngāti Kahungunu considered that delineating aquifers by their use neglected their inherent qualities.

The second was a consistency argument. Counsel for Ngāti Kahungunu, Ngaio Tiuka, argued that as PC5 "allowed for degradation", it would create internal inconsistency as it did not amend Policy 17 of the RRMP, a policy which "requires maintenance" of existing quality in aquifers.

The third argument was based on section 6(e) of the Resource Management Act (RMA), which requires the regional council to recognise and provide for "the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga".

The uncontested evidence of three tangata whenua witnesses established that the water quality of the catchment had degraded over time, and that the quality of the water was intrinsically tied with the hauora or wellbeing of Ngāti Kahungunu. There was also evidence of the degraded quality of the water affecting the Ngāti Kahungunu way of life, given the intrinsic relationship of the wai with the iwi, and cultural obligations and practices, such as the embarrassment of feeding visitors polluted mussels from the catchment. While Ngāti Kahungunu "is supportive of economic development in their region they do not want development at the cost of detriment to the natural resources".

The court's decision The court concluded that the council's "approach to the interpretation of overall quality is fundamentally flawed, and that drafting and/or interpreting the Change 5 objectives in [the way submitted by council] could result in a more degraded and unacceptable water outcome". The court thus preferred the legacy wording to HBRC's PC5 wording.

Aspiration and attempt The court objected to the 'load to come' and 'impossibility' arguments, which it considered to be the council making excuses for "not trying at all" to improve water quality. Moreover, the council's submission that 'no degradation' was too absolute "somewhat overstates both the issue and the possible consequences of adopting Ngāti Kahungunu's position".

Judge Thomson considered that the council had "failed to even aspire, let alone improve, the quality of the water" in the aquifers. Judge Thomson noted in explaining the court's analysis that:

> ...to not aspire and attempt to at least maintain the quality of water abdicates the functions of a regional council under s30 and the requirements of a regional policy statement under s62(3) and fails to implement the role of such a document in the hierarchy of planning instruments.

At a fundamental level, the court considered that "the overall thesis of Change 5 is the acceptance of a lower water quality than that

which can be measured today. It is working down rather than up".

Human consumption as a water quality standard The court also objected to a water quality standard of "suitable for human consumption", which it considered "carries with it a risk that there is acceptance of a general degradation of the water quality potentially below what the load to come might bring". The quality of water in the Heretaunga aquifer is largely well above the Ministry of Health standard for human health in drinking water. Ngāti Kahungunu and the court considered that:

> ... if this level of degradation were to occur it would be well below the current environmental level, and at the cusp of being detrimental to, and therefore unable to sustain, the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of freshwater.

Tangata whenua views The court considered Objective D1 and Policy D1 of the NPSFM which require tangata whenua values and interests to be identified and reflected in the management of freshwater.

The court accepted Ngāti Kahungunu's evidence that degradation of the quality of the water harms the land and the people, given the interconnectedness of things in a Māori world view, and that section 6(e) of the RMA requires a Māori world view to be taken into account in decision-making. The court concluded that s6(e) required "nothing less" than the absolute prevention of further degradation, and improvement over time.

The role of a regional council The court considered that one role of a regional council under s30(1)(c)(iii) RMA – controlling "the use of land for the purpose of... the maintenance and enhancement of the quality of water in water bodies", must influence plan-making, and the content of an objective in the RPS.

Overall quality The council argued that Objective A2 of the NPSFM allowed for, and mandated, an 'overs and unders' approach, whereby deterioration of the quality of water in one area or water body could be tolerated, so long as there is a matching (or greater) improvement in water quality somewhere else.

The court could not accept this view in light of the council's role under s30(1)(c)(ii) nor the RMA's s69 prohibition on standards in plans which may result in a reduction of water quality. The court could see the council's argument in terms of balancing quality between water bodies, but considered that practical difficulties in implementing an overs and unders approach meant that it could not have been the intention of the NPSFM:

> ... tangled issues can be readily imagined if the council's view of the term overall quality is adopted. Insofar as aquifer water is concerned, the practical issues could be acute. If it is impossible to know and anticipate the location, extent, or exact cause, of water quality decline over time through the load to come, how could anyone possibly plan for, or put into effect, compensatory improvements in other water bodies in other parts of the region?

PUKE COAL LTD V WAIKATO REGIONAL COUNCIL (2014) NZENVC 223

Puke Coal interpreted the NPSFM, both the 2011 version and the now-operative 2014 version, in the context of discharges into a tributary of the Waikato River, and the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 (the Waikato-Tainui Act). Due to s12 and its specificity to the area, the Waikato-Tainui Act takes precedence over National Policy Statements.

The appeal considered whether or not the Vision Strategy for the Waikato River, now contained in the regional and district planning documents for the protection and restoration of the river, would be satisfied by the proposed stormwater and erosion discharges.

Facts Puke Coal's site was 12 kilometres out of Huntly, along the Rotowaro Road past the Solid Energy Rotowaro open cast mine. Puke Coal had received consent from the Waikato District and Regional Councils to construct and operate a new landfill on the site, upon which coal mining, a construction and demolition landfill (C&D landfill), and an end-of-life tyre depot already operated. A neighbour's group, PAR Society Incorporated, appealed the grant of consent.

An unnamed tributary of the Waitawhara Stream ran through the site, and was proposed to be used to treat the stormwater running off the new landfill, as it was currently used for treating stormwater from the coal mine and the existing C&D landfill. The Waitawhara Stream runs into Lake Waahi, and ultimately into the Waikato River.

The unnamed tributary was found to show signs of degradation, and the existing water quality was not capable of supporting a healthy benthic community. However it was also noted that the added effects from the stormwater or groundwater leachate from the landfill were likely to be minimal.

Interpretation of the planning documents The court held that, looking at the Waikato-Tainui Act and the Regional and District Plans as a whole, "the only reasonable conclusion that can be reached [on interpretation] is an intention to improve the catchment of the river and of the river itself within a reasonable period of time (several decades) to a condition where it is safe for swimming and food gathering over its entire length".

In regards to the method of reaching this goal, the Environment Court was convinced by matters of 'workable practicality' and proportionality, which it derived from the decision of the Supreme Court in King Salmon:

> Implicit in the Supreme Court decision was the matter of workable practicality thus any protection or restoration must be proportionate to the impact of the application on the catchment. However, it is clear that it intends to go further than avoiding effect. We have concluded protection and restoration includes protection from future and restoration from past damage. Restoration can only involve recreation of a past state. Thus, some element of betterment is involved.

The court effectively held that the Waikato-Tainui Act, and the Vision and Strategy, did not require total avoidance of any degradation, but rather that each application shows real benefit to the river in proportion to the impact of the proposal. Thus, while:

> ... the scale of [recognition of the generational impacts on the Waikato] is clearly a matter for the discretion of the council relevant to each case ... we would expect that it would be interpreted as there being an opportunity wherever possible within the catchment to improve any streams or waterways and the quality within it.

Applications affecting the river catchment were acceptable where they demonstrated ways in which they protect and restore the river in proportion to:

(a) The activity to be undertaken;

(b) Any historical adverse effects; and

(c) The state of degradation of the environment.

CONCLUDING COMMENTS

While the different factual and legislative contexts in the two cases may go some way to explaining the different approaches taken by the court, there is still a fundamental difference in interpretation that requires resolution.

Until we have that resolution – either through a legislative change or determination of the superior courts – there will remain considerable uncertainty for councils and others in the water sector as to just what they are required or allowed to do in terms of water quality. **WNZ**

A Waikato CCO?

John Pfahlert, chief executive, Water New Zealand

By now most members of Water New Zealand will have caught up on the news of the Council Controlled Organisation proposed for Waikato, Waipa and Hamilton City Councils.

The key recommendation is that councils transfer their water and wastewater assets into a jointly owned not for profit CCO. The report recommends the three councils should retain ownership of their stormwater assets, but outsource their management to the CCO on a cost recovery basis.

The documentation announcing the proposal suggests that the key benefits are: lower water charges producing savings for councils and customers; a stronger more resilient network across the region; and improved quality of drinking and treated wastewater across the district.

Improvement to drinking and wastewater standards is expected, in part, because the directors of the proposed CCO would be personally liable for any significant environmental or regulatory compliance breaches.

Other benefits include: the ability of the CCO to attract and retain talented staff; providing an improved 3 Waters network and planning, and creating a centre of excellence on 3 Waters administration that it should be able to share with other councils in the region.

The economic analysis shows that ratepayers would each be better off by between $38 and $106 per annum as a result of a move to a CCO model. These savings are of course contingent upon a significant number of assumptions contained within the analysis. For example, savings comparisons have been made with other jurisdictions where a CCO has been established, both here and overseas. A reasonable question might be how comparable the savings generated by an organisation like Watercare servicing 1.4 million people will be compared with those of a CCO servicing a population of about 258,000?

On the balance of probabilities the economic analysis suggests the CCO approach is likely to be of greater advantage in the management of 3 Waters assets in the Waikato than the status quo.

The engineering analysis contains a considerable number of assumptions about synergies that could be achieved from capital expenditure savings associated with a CCO. Not all of these potential savings have been considered. Given there is significant scope for alternative interpretations on what capital expenditure will actually be required over a planning horizon of 30 years, there will no doubt be variations over time.

The reports acknowledge these risks, noting that the benefits to be obtained over the 28 year assumed planning horizon should be seen as a "possible outcome based on council's long term estimates…"

If the CCO does proceed, monitoring how closely delivered outcomes match with projected savings will be instructive for all three councils and other councils around New Zealand who might be considering a CCO approach.

Water New Zealand has long been a champion of both local government reform and the creation of CCO type arrangements for the administration of 3 Waters assets. Since I started at Water New Zealand last December the board and I have agreed to dial back the advocacy around promoting fewer district and city councils in New Zealand. That shouldn't be taken that we agree with the current structure of local government, it's just that there appears to be no political appetite at the local or central government level to make changes. In such an environment there are frankly other issues to focus on.

That focus has moved to providing encouragement and support for initiatives such as the one described above, because in the long run we believe rate payers will get a better deal from more commercial approaches to the management of infrastructure.

There may well be scope for arguing about the assumptions made in the reports presented to the three councils involved. Concerns by Waipa District Council over perhaps being dominated by Hamilton City in a new CCO are valid and need to be carefully managed by the participants.

On the balance of probabilities the economic analysis suggests the CCO approach is likely to be of greater advantage in the management of 3 Waters assets in the Waikato than the status quo. Governance of the new structure would be by a board appointed by the respective councils.

The ball is now in the court of the elected councillors to consider the reports they have commissioned and decide whether they wish to proceed. If they do then the next step is for each council under the Local Government Act to put the proposal to the public via a special consultative procedure. So the outcome is far from determined or certain. **WNZ**

WATER NEW ZEALAND CONFERENCE & EXPO

Registration is now open on www.waternzconference.org.nz for the 57th Water New Zealand Annual Conference & Expo, held this year at Claudelands in Hamilton, September 16-18. An early-bird registration offer closes July 24.

The theme for the conference is 'Optimising our Water Value' and this year's format will follow that of 2014 with two full days of presentations on Wednesday and Thursday, with Friday set aside for the Water New Zealand AGM, a panel discussion and the exhibitor visitor morning.

The call for abstracts has now closed and authors have been notified of selection. It is anticipated there will over 90 presentations at the conference covering every aspect of the water environment and its management. A preliminary programme can be viewed on the dedicated conference website www.waternzconference.org.nz.

A separate call for poster presentations was made at the end of June and nominations are now being sought for the conference awards. The definition and scope of each award, the criteria for selection, along with the nomination processes and timelines for submission can be found under 'Awards' at www.waternzconference.org.nz/.

Awards presented (and closing dates for nominations where applicable) are:

• Hynds Paper of the Year Award • ProjectMax Young Author of the Year • CH2M Beca Young Water Professional of the Year (nominations close August 28) • Mott MacDonald Poster of the Year (posters due July 28) • Ronald Hicks Memorial Award (nominations required by August 28) • Opus Trainee of the Year (nominations required by August 28) • IXOM Operations Prize.

Call for nominations for Water NZ board

Nominations for the board of Water New Zealand will close on Thursday July 30. The board comprises six elected members and may include two co-opted members. Members are elected for three-year terms. This year two positions are available. Sitting members Dukessa Blackburn-Huettner and Adrian Hynds will retire by rotation.

Members contemplating standing for the board may wish to discuss the role and responsibilities of directors with sitting members of the board. The candidate, nominator, and seconder must all be financial members of the Association.

Water NZ board AGM

The Water New Zealand 2015 Annual General Meeting will take place at 9am on Friday, September 18 at the annual conference venue, Claudelands Conference & Event Centre, Hamilton.

To meet constitutional deadlines any notices of motion for this meeting must be supplied to the chief executive by 9am, Friday August 14.

Notice of Meeting, Agenda, and any Call for Notices will be sent to financial members by Friday August 21.

Please contact Hannah Smith, Association Secretary, Water New Zealand, if you have any queries.
Phone: +64 4 495 0897, Email: hannah.smith@waternz.org.nz

Connexis adds water to industry coverage

Connexis, the Infrastructure ITO, has expanded its industry coverage to include infrastructure-related Water Industry Training.

The move sees water treatment, wastewater treatment and water reticulation trades included in Connexis qualifications and service coverage, and has been widely welcomed within the industry.

The change will result in a number of benefits for customers in the water sector, who can expect an enhanced level of service with increased support from Connexis nationwide field team. In addition customers working in the wider infrastructure space will now be able to have most if not all of their training needs met by one organisation, rather than dealing with multiple ITOs.

The Connexis field team has undertaken preparation for its new role including attending a Familiarisation Day hosted by Opus and New Zealand Water and Environment Training Academy (NZWETA) at the Opus Environmental Training Centre premises in Petone, where national water qualifications have been provided continuously for more than 60 years. The team will be supported by water training consultants Martyn Simpson and Nigel Hesford, who have over 50 years of industry experience between them.

Helmut Modlik

Connexis chief executive Helmut Modlik says; "We are delighted to extend our coverage to the water industry. The addition of Water Industry Training is good news for everyone concerned. Customers will continue to receive everything they have had in the past – top quality training and expert support.

"However, they will now also have the opportunity for their staff to be coordinated and supported in their learning by a much larger field team, who can provide a greater level of personal contact and support.

"From an organisational perspective, the addition of water represents the first step since the creation of Connexis to fulfil our vision to become the ITO to service the wider infrastructure industry. Most other ITOs serve disparate industry groups, which presents a range of challenges for them and their customers.

"When Connexis was established, directors made the conscious decision to focus solely on the infrastructure domain, the horizontal built environment. This means Connexis knows the infrastructure space and is very clear and focused on the issues facing our customers and asset owners.

"Our aspiration is to be the ITO of choice for employers in infrastructure, and the addition of the 3-water industries is an important step in that direction."

Annie Yeates, water industry training manager, says that the merger comes at an exciting time in the water industry.

"Water reticulation in particular is a huge growth area at present, and now that infrastructure sits within one ITO we can plan an integrated approach to developing training in areas such as the management of stormwater.

"Now that the future of Water Industry Training has been decided, we'll be in a position to develop new training programmes," she says.

"Integrating Water into the Connexis portfolio will enable us to build a bigger vocational pathway for the infrastructure industry.

"There will be enhanced career prospects for water professionals, with opportunities for progression linked to qualifications such as the National Diploma in Infrastructure Asset Management and New Zealand Diploma in Engineering Practice." **WNZ**

- *For further information go to www.connexis.org.nz or call 0800 486 626.*

TRAINING UPDATE

We have had several Water Authority of Fiji (WAF) employees attend NZWETA courses at our training centre located in Petone this year.

WAF is the national provider of water and wastewater services delivering these services to 144,000 Fijian residential and metered business customers. In the rural context WAF is responsible for establishing water supply systems for 700,000 people around the country.

Using New Zealand Aid scholarship funding five Fijian engineers and operations staff attended The Introductory Principles and Trends Wastewater course held in April. A further three participants from the Fijian National Water Laboratory and the Trade Wastes team attended an Environmental Sampling and Microbiology in Wastewater course. With the cold wintery blasts we had in Wellington during both courses our Fijian guests first point of call was a quick shopping spree for warm clothes and woolly hats, before the course got underway.

The Principles and Trends of Wastewater Treatment course covers the fundamentals of wastewater treatment and includes a mixture of classroom theory with field trips to see the processes which were explained in class put into practice in different treatment plants. An Environmental Sampling and Microbiology in Wastewater Course was customised specifically for our guests and theoretical work was supplemented by field trips to several treatment plants and laboratories.

The training was very well received by the Fijian students with some positive feedback received and the Training Centre is also working alongside the WAF to provide training in Water/Wastewater Treatment and Reticulation for Fiji's Water operational staff in Fiji over the next 12 months.

After the retirement of Bruce Porteous from IXOM (formerly Orica NZ) the Environmental Training Centre was approached to take over Chemical Handling training. The centre will now concentrate on re certification for expiring certificates, however subject to demand will offer this course throughout New Zealand. Contact the Centre for more information or to register your interest. www.nzweta.org.nz, or phone 0800 678 738.

We have a range of courses coming up over the second half of the year and visit the NZWETA website for more information on dates, costs etc.

By Janet Bengree, programme administrator, Opus International Consultants.

How we assess conference papers

By Ian Garside, technical director – Environmental Engineering, Beca.

Water New Zealand's Technical Committee strives to continually improve the standard of the papers at our national conference. We felt that there was insufficient understanding in the industry regarding "what makes a good paper" and we should, seek to communicate this, through this article. Here we describe the process that the committee goes through in selecting and marking the abstracts, written papers, presentations and poster papers.

Selecting the abstracts

The committee work with the Water New Zealand team in the call for abstracts. At this time they will define the format and content style for abstracts. Concurrently Water New Zealand pre-selects key note speakers and invited speakers who are asked to attend to present a topical paper.

Following the abstract submission, the abstracts are uploaded to a secure website where "on line" marking of abstracts occurs. At least two markers from the Technical Committee assess each abstract to determine whether the content could be put forward for further consideration for a paper. Each abstract is marked against the following five criteria, which are similar to the criteria used by WEF for the WEFTEC conference in the United States.

1. Wider applicability
2. Demonstrated results and conclusions
3. Relevance to the current state of the industry
4. Content, including innovation,
5. Clarity and quality.

Abstracts are ranked in descending order and the top ones provisionally selected for inclusion in the technical programme.

The committee meet as a group in May, and break into subgroups to reconsider each abstract in terms of "fit" for the conference programme. Abstracts are pre-grouped into themes prior to the group meeting. "Fit" for the conference programme means abstracts align with the theme of the conference and the appropriate subtopic. After alignment is determined, papers with a common topic are grouped. Further re-assessment occurs at this point to make sure that the abstracts are of sufficient calibre to be invited to present a paper. The top abstracts are finally grouped to populate the conference programme and create streams, along with the invited speakers.

High quality abstracts not selected for the first round of invites to present a paper are put on a 'wait list'. Sadly, there are always papers that are withdrawn after the programme is finalised so we always need to call on this important list.

Where abstracts are deemed not to have met the required standard and/or are not suitable for poster papers, they are rejected. There are usually too many papers for the limited number of programme sessions in each stream, thus rejection does not always mean the paper is not up to standard but may not have been the best fit for the theme. There are numerous reasons for rejection, such as too many papers; commercial; or have been presented before at another conference.

All abstract authors are contacted shortly after this process and requests are made to successful authors to present a paper at the conference. This request is time bound to ensure that tight time frames are met; papers submitted past the cut off date are not eligible for the paper of the year awards for both papers and poster papers. They are, however, still able to present at the conference.

Selecting the poster papers

We seek expressions of interest, known as poster summaries, from potential authors of poster papers in June each year. In addition to the criteria for selecting the papers from the abstracts we also assess whether the topic expressed in the poster summary lends itself to visual presentation. As with the abstracts, the marks of the poster summaries are ranked in descending order and the top summaries are selected for inclusion as poster papers. Historically the poster papers at conference have been hard copy, but for 2015 they will be electronic.

Marking the written papers

The next stage is papers presented within the allowed time frame are reviewed on line by at least two reviewers. This time the papers are reviewed by members of the committee who have specific expertise in similar areas to that of the authors and marks entered into a marking schedule. This pre–conference marking of written papers represents 60 percent of the marks to be awarded for the "paper of the year" prize. This is a very important component of the "paper of the year" and "young author of the year" award and is very time consuming.

Marking the presentation of the written papers

The same marking schedule is used at conference to mark the presentation of written papers and results from conference marking are entered and these scores represent 40 percent of the mark. At least two Technical Committee members mark each presentation.

There is a moderation scale used to ensure that papers are moderated as they are marked; this means that the winning paper at conference cannot be determined until the last marks of the last papers presented are entered.

The Technical Committee meet continually throughout the conference to ensure that papers are being attended, that quality control is maintained and to input the scores from each paper presented.

Poster paper marking

During the conference, all posters are marked by Technical Committee members. Each poster is marked by at least three members of the Technical Committee.

Paper marking criteria

The selection and marking criteria for the abstracts, written and presented papers and posters are discussed below.

Following submission of the written papers they are marked in each of the following five categories as follows:

Technical Content – It is essential that all papers have technical content, but it is recognised that interesting and high quality papers do not necessarily need to be completely technical and being only one of the five criteria this balance is preferred.

Practical Content – Having a requirement that the paper is practical within the context of the

water industry reflects the wish to use ideas or processes to solve problems in the industry.

Future Use – This criterion encourages the use of the ideas or thoughts in a future setting. The learning and the development of ideas is an important role of such a conference.

Clarity & Logic – In order for good ideas and findings from doing projects to be applied in the future, the ideas need to be logically and clearly explained. This criterion may encourage authors to use drawings, figures or flow charts to explain concepts rather than simply words.

Originality – The development of original work or ideas is positively encouraged and previously presented ideas or a project is frowned upon with this criteria.

Overall the paper marking makes up 60 percent of the overall marking with the remaining marks coming from the oral presentation.

Presentation marking

Marking of the presentation makes up 40 percent of the mark. This is relatively high but it is logical that a good paper needs to be well articulated. The presentations are marked in each of the following categories, each with an equal weight:

Delivery – High scores are applied to papers which are well and clearly articulated with arguments well presented and thought out.

Visual Aids – The appropriateness of the visual aids to support the presentation and its arguments and ideas are scored well in this category.

Content – The actual content of the presentation.

Responses to questions – The ability of the presenter to respond to questions often demonstrates the presenter's knowledge of the subject and high marks are awarded when this is demonstrated. Should no questions be initially asked, the session chair or one of the Technical Committee members will ask a question so that this criterion may be scored.

Poster paper marking

Poster papers are marked at the conference and are usually marked at a set time so that the author may be present to answer questions. Posters are marked with equal weighting in the following areas:

Content – Good poster papers will have good and relevant topics and will convey a clear message.

Visuals – The poster paper should be visually appealing and should use graphics to support the message or story which is being told.

Originality/Applicability – High scoring poster papers will have an original message or topic and ideas or message conveyed will have the potential to be applied in the future.

Responses to questions – The ability of the author to respond to questions often demonstrates the presenter's knowledge of the subject and high marks are awarded when this is demonstrated.

Summary

We hope this unravels some of the mysteries concerning the selection and subsequent marking of papers and will lead to further improvements to the technical programme at our conference. As we continually strive to raise the bar of the presentations at each conference, we review the marking procedures each year and make changes to streamline our processes and criteria where changes are required. **WNZ**

Beyond the fence

A discussion on the impacts and challenges of aging household laterals on public water and wastewater networks.

By **Lesley Smith, Water New Zealand.**

From a national perspective, approximately one quarter of assets in the water, wastewater and stormwater sectors are more than 50 years old (Castalia Strategic Advisors, 2014). Councils around the country are heavily investing in renewal programmes to renew assets under their ownership, and a lively debate about funding challenges and options for meeting these has emerged in the public sphere.

Beyond the property gate, however, lies a more challenging and politically fraught renewals challenge, with water, wastewater and sewer house laterals (ie, the service delivery pipes that are within a resident's property line) under private ownership.

With an estimated 50 percent of groundwater inflow and infiltration entering through private laterals (GHD Limited, 2015), and current annual real water losses of nearly twice our Australian counterparts (Water New Zealand, 2015) impacts of aging house laterals are undoubtedly being felt. Limits of house lateral ownership vary by jurisdiction, but challenges across regions are the same.

On sewer networks lateral private ownership often begins at the first inspection opening, sometimes the property boundary, or where the lateral connects to the main sewer (which can be either inside or outside the property boundary). Residential ownership of water laterals typically begins at the Toby – the valve that allows property water mains to be closed off.

Sewage infiltration results from private stormwater and sewer laterals commonly caused by root intrusion in shallower house laterals, and stormwater cross connections on properties. Where earthenware and concrete sewer pipes have been used, another major source of infiltration can occur at the junction of the lateral with the sewer, where heavy pipes drop vertically over time and shear off the joint. Inflow and infiltration create unnecessary pumping and treatment costs and can lead to sewer overflows and capacity constraints in heavily loaded networks.

Similar challenges exist with private water laterals. Here also pipe burst leakages lead to unnecessary treatment and transfer costs in the network. For home property owners undetected leaks create wet boggy areas (or in sandy areas go completely undetected) that may undermine building foundations. More importantly, they waste water, our most precious resource.

Low participation and completion rates in private lateral rehabilitation and repair programmes have been reported by New Zealand water agencies as well as those around the world (GHD Limited, 2015). So whose problem is this and what can be done?

Whose problem is this?

Laterals on private property rest squarely with the property owner, but can become blurry where a single lateral services multiple dwellings such as apartments, condominiums, multi-family homes and town homes. While responsibility for laterals may rest with the property owner, local authorities are required to deal with the majority of the problems they create; management of sewer overflows, water demand management, and water and wastewater network transfer and treatment costs.

Clauses G12 and G13 of the Building Code set out water and foul water (sewage) functional requirements to mitigate against problems privately owned laterals face. The code references AS/NZS 3500 Plumbing and Drainage Works, which outline detailed requirements for on-property water, sewage and drainage. However, the code and the standard do not guarantee well-functioning house laterals in perpetuity. Over time laterals degrade and require maintenance. Local authorities do have some legal instruments at their disposal. Part 26 of the Local Government Act 1974 contains provisions that provide water agencies the legal basis to perform certain actions that help address private laterals. Some of the provisions include powers of entry to perform investigation and rehabilitation work, the construction of works on private property to rehabilitate sewers and/or disconnect illegal sewer sources, and the removal of works that are a source of inflow. The act also contains provisions for local authorities to adopt bylaws.

Nelson City Council is an example of a local authority that has adopted bylaws to facilitate its infiltration management. In its Wastewater Bylaw (No 224) June 2014, it is stated that the discharge of stormwater into the wastewater system is prohibited. This provides the council a legal basis for investigating and rehabilitating inflow and infiltration sources on private property. The bylaw could also be used to issue defect notices and require property owners to remediate any issues on their property.

While legal instruments do exist, political sensitivities are rife. What brave politician will be bold enough to ask Grandma to spend her next year's pension on digging up her rose garden for example? For this reason a number of authorities are exploring alternative funding arrangements to having owners pay the full cost of lateral removals. Some provide incentives, or in other cases taking full ownership of laterals. Conversely, restrictions on the use of public funds on private property apply in some areas, and have political sensitivities of their own.

What are people doing about it?

There are a number of approaches being explored around the country and the world to manage these challenging issues.

Take ownership of assets and fully fund future renewals

In 2011 the UK introduced law changes that allow water agencies to take ownership of the lateral between the property boundary and the main, and also portions of laterals that are shared by multiple dwellings. This ownership transfer has facilitated water agencies' ability to maintain and rehabilitate laterals. Home owners can ask local water or sewerage companies to take over or adopt a private sewer or lateral drain if the sewer or drain has been constructed or improved to the standards required by the company and is in reasonable condition.* (https://www.citizensadvice.org.uk/consumer/water-supply/sewerage/who-is-responsible-for-repairing-drains-and-sewers/)

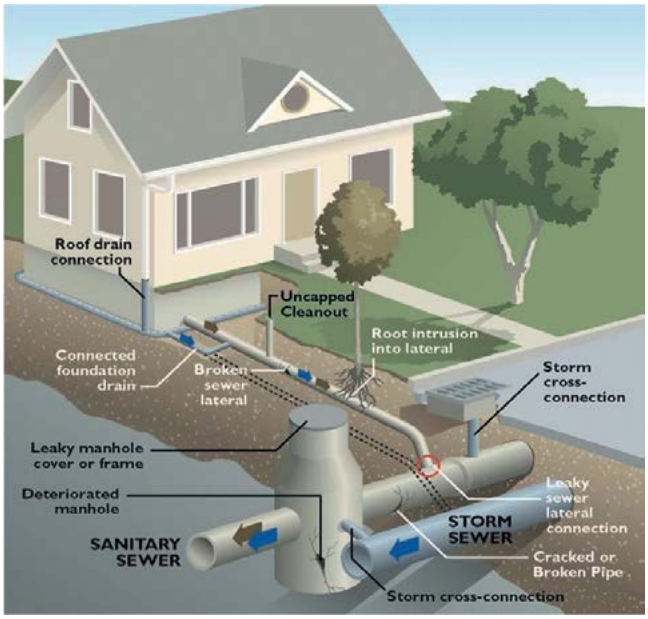
Create triggers for improvement works to be undertaken

The East Bay Municipal Utility District (EBMUD) in the USA has put in place a Private Sewer Lateral (PSL) programme that provides legal and financial arrangements to address system-wide lateral rehabilitation. Under the programme, a property owner who meets a trigger condition is required to obtain a certificate from EBMUD indicating that their private laterals are without defects and have proper connections. Failure to provide such a certificate necessitates repair or replacement of the lateral when one of the triggers is reached. The three triggers are: the sale of a property; renovations in excess of capital value of $100,000; or changing the water meter size or adding an additional meter.

Direct customer engagement

Tauranga City Council regularly undertakes catchment surveys that include identification of defective laterals.

When a defect is identified, a notice is issued to the householder who is provided with a list of approved service providers and given a month to contact them to rectify the problem. Tauranga reports a high proportion of compliance with the system, however where the issue is not corrected within the month a staff member follows up with a phone call. Staff negotiate extensions to repair times based on individual customer circumstances. In what Tauranga reports as a very exceptional circumstance, if the issue is still not resolved, council notifies householders it will repair the defect and send through an invoice.



Household sources of sewer inflow and infiltration.

Unsurprisingly this often gets the householder to quickly fix it themselves!

Offer incentives

Martinborough District Council offers financial assistance to properties located in areas where public works are underway. When a roading project is unearthing private laterals, the council offers private property owners the chance to incorporate lateral renewal work at a reduced rate. This scheme helps private and public wastewater works to be undertaken at the same time and by the same contractor. This also helped to provide cost savings as there would be less mobilisation costs with a single contractor performing the works.

Community education

Community education instruments trialled around the world include:

- Outreach materials: websites, brochures and videos are some of the mechanisms used to reach a wide range of stakeholders. Examples include the St Louis Project Clear website: www.projectclearstl.org, and Gisborne District Council's YouTube movie "Let's talk wastewater".
- Face-to-face public meetings.
- Targeted engagements with affected groups. For example, Gippsland Water engaged with the drain layer industry in its recent inflow and infiltration programme. EBMUD worked with property councils to implement the aforementioned trigger conditions.
- Video footage: the previous North Shore Council would use CCTV in laterals with areas of high infiltration. Video footage was added to the YouTube footage that could be sent to householders and accessed by plumbers.

Use regulatory instruments

Gisborne District Council uses the Local Government Act 1974 Section 459, to require private landowners to repair their defective laterals. The Local Government Act allows councils to:

- Create bylaws which prohibit substances such as stormwater from entering the private sewer laterals,
- remove works that violate the bylaws requiring landowners to provide private stormwater drains that drain the private land and discharge to a public main, and
- require landowners to clean, repair or relay existing stormwater or wastewater pipes on their private land.

The Health Act and the Health (Drinking Water) Amendment Act 2007 place responsibilities on water agencies to protect the quality and safety of drinking water. These responsibilities include the duty to take reasonable steps to contribute to protection of sources of drinking water. Wellington Water uses provisions in the Health Act as the legal basis to issue infiltration and inflow defect notices to property owners, on the basis that inflow and infiltration problems lead to sewer overflows which in turn poses a risk to public health. **WNZ**

Where to from here?

None of these responses will provide a silver bullet, and the best solution will depend on local circumstances. What is clear is that aging house laterals are an issue that will not go away. Do you have solutions in mind? If so, we would like to hear from you. Email: technical@waternz.org.nz, or in the next issue of *Water Magazine*, write a letter to our editor.

Wastewater solution with web monitoring meters

Outpost Central smart meters identify and rectify the cause of excess infiltration at the Omaha Wastewater Treatment Plant.

When the township of Point Wells, 70 kilometres north of Auckland, was upgraded from existing and failing septic tanks to grinder pumps and pressure sewer one of the expected benefits was that there would be minimal inflow and infiltration.

Wastewater from grinder pump stations at each lot in the township was pumped to the Omaha Wastewater Treatment Plant via a small bore electro fused PE pipe network.

Ecogent supplied the council with smart meters from Outpost Central to record flows to the treatment plant and rainfall. The peak wet weather flow increase due to infiltration during heavy rain was predicted to be no more than 20 percent over the average dry weather flow, however, the first major rain event resulted in a 500 percent increase!

This level of infiltration was unacceptable due to the potential of overloading the Omaha wastewater plant but also because treated effluent is subsurface irrigated to the local golf course and such large flow increases would have required increases to the installed irrigation area.

To investigate the source of the increase Ecogent provided several additional Outpost smart meters with amp meters that could be clamped to individual grinder pump power supply cables. Clamping to the cable did not require an electrician for the installation and the smart meters are battery powered and only need to be swiped with a magnet to go online so moving each smart meter around several properties was an economical exercise.

An additional rain gauge and rising main pressure monitor were also connected to the existing Outpost smart meter units to obtain an overall picture. All Outpost smart meters were accessible through the same websites and the data could be viewed in real time. It quickly became evident which pump units were affected by rainfall and steps were taken to identify and rectify the cause of the excess infiltration. The total system infiltration reduced from an extreme 500 percent to an acceptable 20 percent over a 12-month period as a result of this programme.

Infiltration could mainly be attributed to historic poor drainage work which was retained but not thoroughly checked as a part of the upgrade including leaks around concrete tank risers and pipes in isolated situations and poor workmanship by installing drainlayers.

ABOUT OUTPOST SMART METERS

Outpost Central produces smart meters which are easily connected to a variety of sensors allowing investigation and management of a range of parameters to be cost effectively undertaken. Any invested party with an approved password can access the data and this allows designers, installers, engineers and operators to view data simultaneously from different locations.

The units are excellent for monitoring flow and pressure, reservoir, dam and tank levels in the water and wastewater pipeline sector. Unlike supervisory control and data acquisition (SCADA) systems they can be easily connected to remote locations and viewed remotely and all data is retained on a secure database, according to Outpost Central. It says the uptake of Outpost units for municipal and communal water meter monitoring within New Zealand and Australia is almost 20,000 units and is growing rapidly.

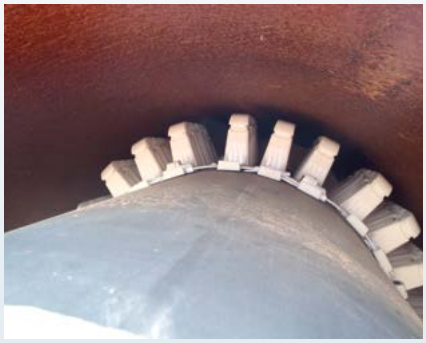
Reducing the load with trenchless technology

Trenchless crossings require detailed planning and precise installation. Being able to use reliable materials like kwik-ZIP spacers ensures there is one less thing to worry about.

While many water pipelines can be constructed using open trench excavation, followed by backfill and restoration, trenchless technology is often required to get the pipeline under obstacles like rivers, roads and railways. Centralising the pipe within the casing is a key challenge often faced by contractors during a trenchless installation.

It is not uncommon for a wide variety of ground conditions to be encountered on a major drilling or civil construction project and selection of the correct technique can depend on issues like the ground conditions, the length of the crossing and the available space.

Trenchless methods used frequently in rail, river and road crossings include slurry microtunnelling, thrust boring, guided auger boring and horizontal directional drilling. Common to many of these trenchless techniques is the use of casing pipe which can be installed first to protect the actual product pipe. Correct placement of the product pipe within the casing is essential



for grouting and for the safe and efficient operation of the pipe.

Historically, many contractors have improvised. But utilising effective, high-quality and long lasting materials in any construction is key to the longevity of an installation, and Australian owned and manufactured kwik-ZIP centraliser and spacer systems are being increasingly use on this side of the Tasman.

Designed and developed by drilling professionals, the kwik-ZIP range of spacers handles a range of casing, bar and pipe diameters. Each centraliser spacer system is manufactured from high grade thermoplastic called ACETAL POM, which is characterised by high flexural strength, high temperature resistance, low coefficient of friction, and high resistance to organic chemicals, oils and synthetic detergents – even when immersed for long periods of time.

Using a load sharing runner system, each unit maximises its weight-bearing capacity by distributing the pipe load across multiple runners. This reduces point loading at any one location, boosting and optimising the overall support capacity of the spacer exponentially as pipe size increases.

The load sharing runner system also delivers a suspension and dampening effect, resulting in a reduction in the transfer of potentially damaging vibration and movement from the outer casing to the carrier pipe.

This can be particularly beneficial for high traffic crossings where ongoing external vibration could affect the outer casing.

See www.kiwizip.com for more detail or email support@kiwizip with enquiries.

New influent solution from Vaughan

Vaughan's 16W centrifugal chopper pump has a 16" discharge and is capable of producing flows up to 3180 cubic metres per hour.

Vaughan Company, a leading manufacturer of heavy-duty centrifugal chopper pumps for over 50 years, has expanded its product range by developing and releasing a 16" chopper pump for high flow municipal sewage and wastewater applications.

Capable of flow rates up to 3180 cubic metres per hour (880 L/s), the new Vaughan model 16W, 16" discharge centrifugal chopper pump is available in multiple configurations including dry well and submersible designs. Unlike generic solids handling pumps, Vaughan Chopper Pumps are not limited by their ability to pass specific spherical diameters. The time-tested and patented chopping action of the Vaughan Chopper Pump reduces solids in the waste stream to a more manageable size before being pumped out to reduce clogging at the influent location of a system.

The 16W has a best efficiency of 78 percent and typically runs at a

Hach water quality analyzer streamlines testing

A new portable parallel water quality analyzer from Hach offers faster testing, less variability and less hassle.

Hach Pacific has introduced the Hach SL1000 Portable Parallel Analyzer (PPA) platform, which it says is an important and innovative new technology for the drinking water industry.

The analyser is specifically designed and engineered to streamline water quality testing by offering faster testing of multiple parameters, reduced variability from test to test and operator to operator and significantly less hassle than traditional methods of testing. Hach says its PPA platform is the only hand-held drinking water instrument that is able to test up to four colorimetric and two probe-based parameters simultaneously, eliminating the need to run multiple tests back to back and thus saving time and money.

Designed for use in the drinking water distribution system and treatment plant, the PPA platform performs the same tests with less than half the manual steps compared with traditional methods, while producing highly accurate and reliable results, says Tom Siller, global product manager at Hach. "By reducing the number of testing steps, the PPA platform also minimises opportunities for errors, and saves time by testing up to six parameters all at the same time."

Siller says the company has also developed Chemkey Reagents to accompany the PPA system. "These Chemkey Reagents contain the same chemicals our customers know and trust, but are now delivered in a simple, self-contained package."

The Hach SL1000 Portable Parallel Analyzer (PPA) platform is available on its own or as a fully operational, rugged kit including everything that is needed to start testing, including the instrument, probes and Chemkey Reagents. The simple use model of the PPA platform offers operators of all skill levels the flexibility to test for the parameters that are relevant to their processes, including both colorimetric testing methods and probe-based measurements.

• For more information on Hach's new PPA platform, visit www.hach.com/ppa or call 0800-505 566.

slow speed of 600-900RPM, which combined with its hardened and heat-treated components offers extended operating lifespans for wear parts, bearings and mechanical seals.

Since its release in 2013, the Vaughan 16W chopper pump has proven itself as a alternative to existing large sized solids handling pumps and is ideal for a wide range of high flow applications in local authority pump stations, influent wet wells, wet weather stations, combined sewer overflow basins etc.

- *For further information on the Vaughan 16W, please contact Vaughan authorised distributor, Pump Systems Ltd on 0800 609 060, or email info@pumpsystems.co.nz.*

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