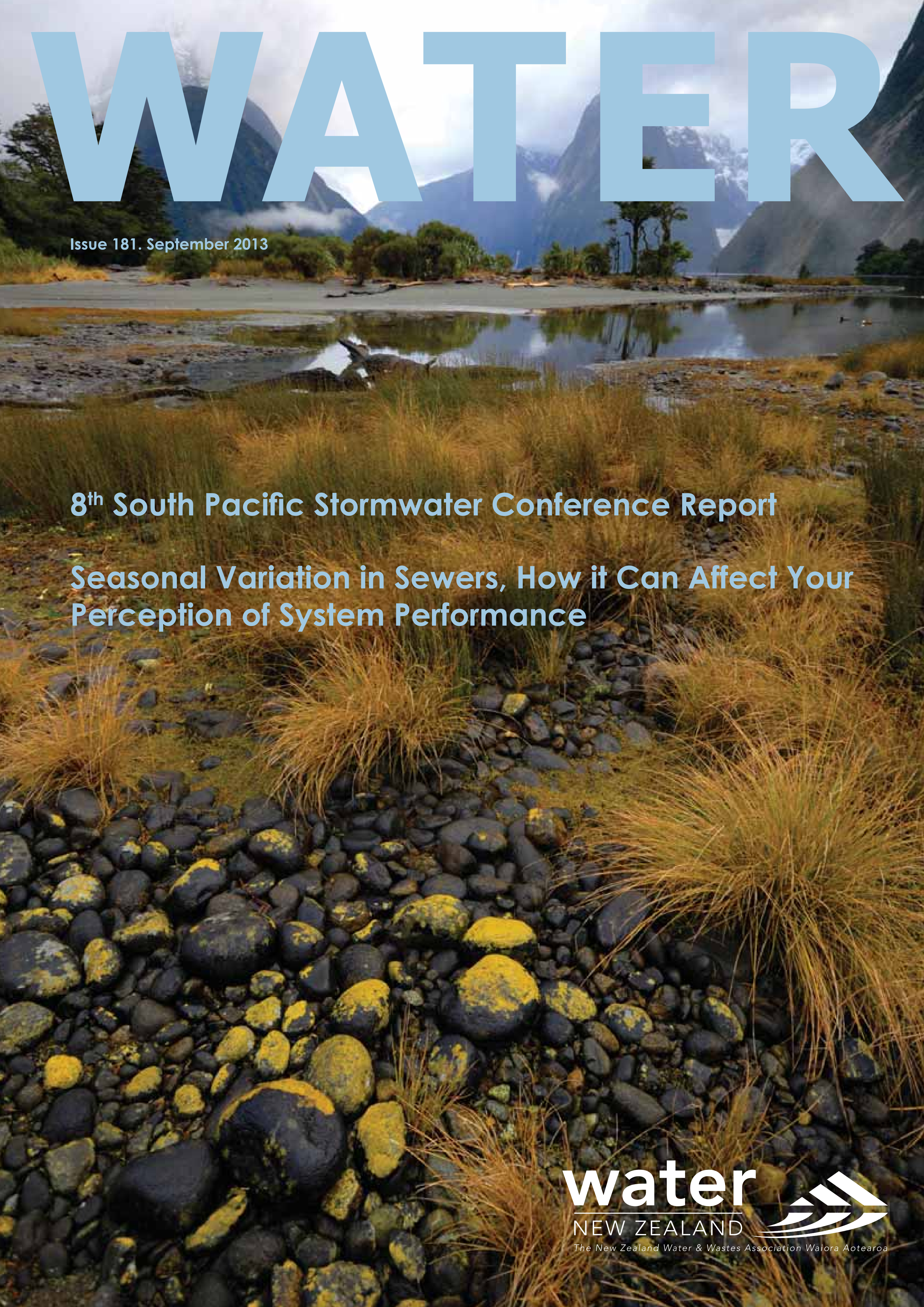

WATER

Issue 181. September 2013

8th South Pacific Stormwater Conference Report

Seasonal Variation in Sewers, How it Can Affect Your Perception of System Performance

water
NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

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The next issue of *WATER* will be published in November 2013.

WATER

On the Cover

Water New Zealand News

Features and Articles

Cover photo: istock.com

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.

Steve Couper

The Fluoride Debate

I received a flyer in the mail box a few weeks back entitled – *Is Water Fluoridation Safe?* It stated *"Listen to the evidence from the team of doctors and dentists that ended fluoridation in Hamilton."* I would have attended if it wasn't for the five dollar door charge. Details can be found at www.fluoride.org.nz or www.fannz.org.nz

Fluoridation of water supplies is once again in the press. The subject seems to stir up debate whenever it raises its head. From a science perspective the positive dental health benefits are beyond doubt. These are summarised by recent comments from the Prime Ministers' Science Advisory Committee, who through Sir Peter Gluckman advised that *"the science of fluoride in water is effectively settled. It has been one of the most thoroughly worked questions in public health science over many decades."*

The great majority of dental practitioners – a profession that stands to benefit financially from increased tooth decay – support this position. So why all the hype around dosing our water supply with hydrofluosilicic acid or sodium fluoride?

Recently at work we took a look at some of the research papers on fluoridation of water supplies around the world. There are literally thousands of papers on the subject. The basic conclusion is that fluoride is beneficial to human dental health in trace amounts but toxic when taken in excess. This is the same with all elements we ingest.

Generally speaking we take up to 20 – 30% of our dietary fluoride requirements from the water we drink. The optimal range for daily intake of fluoride – i.e. the level that maximises protection against tooth decay but minimises other risks – is generally considered to be 0.05 to 0.07 milligrams per kilogram of body weight. For a 70kg person this is about 5.0mg per day.

The Drinking Water Standard for New Zealand specifies a maximum acceptable value for fluoride in drinking water of 1.5mg/l. The Ministry of Health recommends levels of between 0.7 – 1.0mg/l for optimal dental health. If we drink 1.5 litres per day of fluoridated water we are likely to be taking in 0.7 x 1.5L = 1.05mg a day of fluoride. That's about 20% of our "daily dietary" requirement. The rest we will get from the food we eat.

And at this level Sir Peter reiterates the scientific facts, saying *"it is absolutely clear that at doses used in New Zealand to adjust the natural level to one that is consistent with beneficial effects (0.7 – 1.0mg/litre), there is no health risk from fluoride in the water."*

So what is all the fuss about? After all we also add calcium, magnesium, aluminium, activated carbon, UV radiation, ozone and chlorine to our water supplies (the latter having the potential to combine with organics producing carcinogens).

It comes down to a matter of principle around New Zealand's public health policy rather than a rational and balanced assessment of the risks. Fluoridation can be perceived as mass medication. Making such decisions which balance public good with individual choice lies with our local civic leaders. It overrides centrally-led public health policy.

Over the past two years the work of those who oppose this *"mass medication"* has resulted in cessation of fluoridated water supplies in New Plymouth, Hamilton, and recently forced a judicial review in relation to two of the South Taranaki District Council supplies. The review covers the legal right for a council to fluoridate water supplies, and whether doing so breaches Section 11 of the NZ Bill of Rights Act which deals with the right to refuse medical treatment.

Given the flier in my mail box – Auckland appears to be the next target.

While the science is settled, have we as an industry done enough to promote the benefits, showing how the positive effects have been carefully balanced against potential negatives, through rational risk assessment? Who is out there running the pro – fluoridation public meetings? Is it such a big deal? After all any of us can choose to ingest additional fluoride if we so please, and there is no shortage of mineral supplements these days. So why not just leave it to the individual?

Unfortunately those who are the least informed, and have the least access to the supplements, may stand to gain the most from fluoridation. Will Flouridegate Action New Zealand be ensuring all kids in Hamilton brush their teeth with fluoride toothpaste twice a day? Are they planning to start a trust fund to cover the increasing dental costs for poorer families? Will turning off the chlorine be next?

This saga makes for a great dinner party debate, after you have finished discussing politics and religion. While I am a fan of individual choice, in this case, given the ease of administering the "medication", the very low risk of harm and the associated public health benefits perhaps we should consider continuation of the practice. And perhaps it should be a policy decision for our Ministry of Health rather than the buck being passed to our local authorities where the decisions may be based on the "sell" rather than the science.

Steve Couper
President, Water New Zealand

new members

Water New Zealand welcomes the following new members:

JULIE COOK	MIKE IND	KARN SNYDER-BISHOP	KATHERINE ARMSTRONG	BRIDGET MORGAN
MICHELLE VOJTISEK	MIKE GALAMBOS	JOHN PAPESCH	KELLY GOVERNOR	SELWYN CHANG
TONI HUGHES	GREG HOLMES	DAN SWORDS	CRAIG FOWLES	DAVE BARNES
SIMON CARTWRIGHT	MIKE GILLOOLY	LOUIS DU PREEZ	ANKE RINTELMANN	YUMI BONDY
ROB BREBNER	PHIL CAHILL	HOWARD SIMPSON	ANDRE TIBSHRAENY	KIERON INGRAM
SARAH LOTHMAN	MARK MULLEN	ANDREW RINDFLEISH	NOEL SOUTHERN	CRAIG RALL
GRAHAM HARRINGTON	ALISON CORDERY	ROSS NOLAN	NICOLA SMALBERGER	AARON HODGES
LAWRENCE STEPHENSON	RICHARD WEAVER	RUSSELL DOWDLE	RAE SIMPSON	ANDREW PARSONS
HELEN MCGETTIGAN	RACHEL EAST	GEORGE TAYLOR	LOUANN HURRELL	PAUL REED
ANDREW SLANEY	TIM DRENNAN	DEREK MCKINON	MICHELLE CARSON	RICHARD BAX
MARK JOHNSON	PAUL BISHOP	TANIA WILLIAMS	MATT CONWAY	RICKY COLLINS

Murray Gibb

The Role of Membership Organisations in Standards

The activities of membership organisations such as *Water New Zealand* can broadly be divided into three areas; representation, provision of services to members and promotion of standards. Balancing effort put into each of these areas is a juggling act for Boards and staff alike. Resource is limited but demand is infinite.

In the standards area *Water New Zealand's* constitution is quite specific – Clause 3.4 Technical – requires us to "promote the advancement and application of fundamental and practical knowledge to natural water resources, water use and the environment."

Membership organisations have a role in contributing to standards on subjects within their area of expertise/interest. By doing so they are practising good corporate citizenship, benefitting both members and society.

We also regularly nominate members to serve on Standards New Zealand committees set up to develop new standards, or update existing documents. For example, members Brent Clothier and Curt Martin are currently sitting on committees considering respectively a water foot printing standard and SNZ3910 Conditions of contract for building and civil engineering construction.

Standards have always been important, and are becoming more so. To quote Standards New Zealand, "standards and standardisation span all aspects of our economy and society, creating confidence, protecting people, and ensuring the smooth flow of local and international trade, while reducing risks."

Standards under the New Zealand Standards Council banner are produced in accordance with internationally agreed processes and criteria through the International Organisation for Standardisation (ISO). Formal standards produced via these mechanisms are part of a broader standards system which includes industry organisations, non-governmental standards bodies and businesses.

The informal standards system includes manuals, guidelines and codes of practice that become significant due to public acceptance, market forces, regulatory processes, or professional organisations and affiliations. It is as important as the formal framework.

Twelve months ago, in order to improve our output in this area, *Water New Zealand* employed a technical coordinator. David Edmonds was contracted in this role. He has since retired. His replacement is Nick Walmsley.

Since employing staff to coordinate technical activity, our level of technical/standards related activity has increased.

For example the 2011/12 national performance review has been published in revised format. A decision has been made to replace the WINFO database, which was poorly populated, with a simplified New Zealand Wastewater Treatment Plant inventory. Various codes and other standards have now been reviewed and updated.

Maintaining the currency of *Water New Zealand's* existing suite of standards is an on-going task. Recently, in consultation with the Water Services Managers Group we have agreed on priorities for review and updating our technical output. This will inform our work programme over the next 12 months. Priorities include:

- Upgrading documentation on asset grading
- Updating the Infiltration and Inflow Control Manual
- Updating standards for chemical treatment of water
- Updating relevant standards for point of entry water treatment
- Extending the reach of *Water New Zealand's* national performance review
- Dialogue on the consistency of resource consents for discharges

In addition we are working with Waste MINZ, the Centre for Integrated Biowaste Research and the New Zealand Land Treatment Collective on developing guidelines for the beneficial use of organic waste. These guidelines will create a framework for dealing consistently with organic 'waste,' including sewage sludge.

Special Interest Groups are also working on projects. The Modelling SIG in conjunction with the Rivers Group is working on developing rainfall and runoff guidelines. The Backflow SIG has recently updated the Backflow Code of Practice and is working on developing a Backflow Survey Industry Standard.

Of necessity the work programme in the technical/standards related area must advance on a broad front. Activity in this area is reliant on the voluntary input of busy individuals who must fit their contributions round their professional and private lives.

It is also of immeasurable benefit to society. One example illustrates this point. Over the years hundreds of knowledgeable individuals would have contributed voluntarily to the development of standards for buildings, making them more resilient. 185 people died in the February 2011 Canterbury earthquake. By contrast, over 100,000 died in the 2010 Haiti earthquake. How many more Christchurch residents might have died but for the input of those volunteers in making buildings more safe?

Realistically though individuals cannot be expected to drop other things and prioritise their contribution to standards. Hence the need to advance on a broad front with a range of projects underway at any one time.

Funding the development and review of standards can be problematic. Through the formal framework that Standards New Zealand works within, new standards can be expensive; revisions to existing standards less so.

Water New Zealand now has some flexibility in this space. Reserves have been accumulated to cover up to 80 per cent of our annual operating expenses. By definition not for profit organisations do not exist to accumulate funds. We budget for small surpluses only. Money is budgeted annually for project expenses, including proposals from our SIGs for the development of standards. That which is not spent or committed in any one year, is put aside specifically for future projects.

In summary, the promotion of standards makes a vital contribution to society. It is heavily reliant on voluntary effort. *Water New Zealand's* contribution is not overly constrained by funding. The contribution that members make as volunteers is of enormous benefit to society.

If you would like to contribute to our technical output or have suggestions please contact our technical coordinator, Nick Walmsley at *Water New Zealand*. ■

Murray Gibb
Chief Executive, Water New Zealand

CHANGING CURRENTS

2013 WATER NEW ZEALAND'S ANNUAL CONFERENCE & EXPO
Claudelands Event Centre, Hamilton 16–18 October

STILL TIME TO REGISTER

Conference Registration

Registration is still open for the *Water New Zealand* Annual Conference & Expo 2013 at www.waternz.org.nz

The Conference programme can be downloaded from the Conference page of the *Water New Zealand* website www.waternz.org.nz

Conference Theme and Highlights

A challenging and interesting programme has been put together for this year's conference with the core theme being **'Changing Currents'.**

This year's conference will offer over 80 presentations covering every aspect of the water environment and its management. The programme includes, invited keynotes and speakers, technical streams, plus modelling and operations streams.

Friday morning at 9.00am in the Claudelands Event Centre is the *Water New Zealand* Annual General Meeting and this will be followed with Tainui representatives and others in a panel discussion on rights and interests in water.

Conference Exhibition

Visitors are welcome to come along to the Claudelands Events Centre to walk through the Trade Expo. Visitors must register at the Registration Desk on arrival to be issued with a visitors pass on both Wednesday and Thursday.

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

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

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

Wednesday 16 October
9.00am – 10.15am
11.00am – 12.15pm
2.00pm – 3.15pm
4.00pm – 5.15pm

Thursday 17 October
9.00am – 9.45am
10.30am – 11.45pm
1.30pm – 2.45pm
3.30pm – 5.00pm

Friday 18 October
9.00am – 12.00pm

Networking Opportunities

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

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

- Hynds Paper of the Year
- CH2M Beca Young Water Professional of the Year
- ProjectMax Young Author of the Year (new award)
- AWT Poster of the Year
- Ronald Hicks Memorial Award
- Opus Trainee of the Year
- Orica Operations Prize

Welcome Reception

Wednesday 16 October from 5.30pm – 6.30pm
Exhibition Halls, Claudelands Events Centre, Hamilton

Applied Instrument Group Operations Dinner

Wednesday 16 October, 7.00pm, The Verandah, Lake Domain Drive, Hamilton

Innovyze Modelling Dinner

Wednesday 16 October, 7.00pm, Rebo, SKYCITY, Hamilton

Conference Dinner & Awards Ceremony

Thursday 17 October, 7.30pm, Claudelands Events Centre, Hamilton

Water New Zealand Modelling SIG AGM

The 2013 Annual General Meeting for the Modelling SIG will be held during the Annual Conference on Wednesday 16 October 2013 at 2.00pm in the Claudelands Events Centre, Hamilton.

SWANS SIG Management Committee Meeting

The 2013 Committee Meeting for the SWANS SIG will be held during the Annual Conference on Thursday 17 October 2013 at 12.30pm in the Claudelands Events Centre, Hamilton.

Water New Zealand AGM

The 2013 Annual General Meeting will be held during the Annual Conference on Friday 18 October 2013 at 9.00am in the Claudelands Events Centre, Hamilton.

Premier Sponsors

Water New Zealand would like to thank our Premier Sponsors for their financial support

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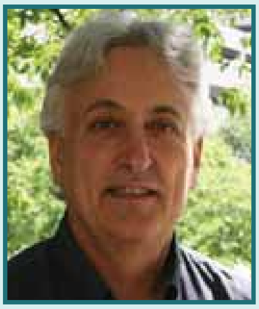
REGISTER NOW!

Conference Speakers

Below are biographies on some of our confirmed speakers for the 2013 Annual Conference to be held at the Claudelands Event Centre, Hamilton, from 16–18 October. As more details on speakers become available we'll let you know through the conference website and through Pipeline.

Keynote Speaker Profiles



Robert Costanza

Dr Costanza is currently Professor and Chair in Public Policy at the Crawford School of Public Policy, Australian National University.

Prior to this, he was Distinguished University Professor of Sustainability in the Institute for Sustainable Solutions at Portland State University (2010–2012), Gund Professor of Ecological Economics and founding director of the Gund Institute for Ecological Economics at the University of Vermont (2002–2010), Professor at the University of Maryland (1988–2002) and at Louisiana State University (1980–1988).

His trans-disciplinary research integrates the study of humans and the rest of nature to address research, policy and management issues at multiple time and space scales, from small watersheds to the global system. He is co-founder of the International Society for Ecological Economics and founding editor in chief of Solutions (www.thesolutionsjournal.org).

He is author or co-author of over 500 articles and 23 books and has been named one of ISI's Highly Cited Researchers since 2004. More than 200 interviews and reports on his work have appeared in various popular media.

Graham Dooley

Graham Dooley is one of the most experienced Chairman level people in the Australian water industry having spent 40 years delivering capital and operating water solutions across Australia.

He has been a Chairman, MD and Director of over 40 companies in the past 25 years. Graham has spent approximately 50% of his career in each of the public and private sectors, so knows the challenges and issues from both sides. Graham spent 15 years up to 2007 as Managing Director of United Utilities Australia Pty Ltd (UUA), a UK owned company which was successful in winning many water infrastructure contracts for public authorities, local Government and industry throughout Australia in which over A$300M of debt and equity finance was invested in every combination of contract possible.

He is intimately familiar with the risks and rewards of investing in water infrastructure. Before 1991, Graham also worked for Sydney Water for nearly 20 years where he filled several senior management roles including managing all aspects of Sydney Water's 31 sewage treatment plants.

Friday Forum

This year the Conference theme is 'Changing Currents' and the Friday Forum will explore iwi rights and interests.

Panellists include: Stephen Franks and John Harbord, public policy experts from law firm Franks and Ogilvie, and Huriwai Paki and Julian Williams representing Tainui.

The forum chair is David Hill, CEO, Capacity Infrastructure Services and Board member, Water New Zealand.

The Panel

Stephen Franks

Stephen is Principal at Franks & Ogilvie (incorporated as Commercial and Public Law Ltd) and is a nationally recognised specialist in business law and constitutional law.

After early general practice then two years in the Office of the Ombudsmen Stephen was with Chapman Tripp for 20 years. He chaired the firm's National Board before six years in Parliament. There he was his party's Maori Affairs and Treaty spokesman. Since 2009 Franks & Ogilvie has focussed at the intersection of government and commerce.

He served on the Minister of Energy's expert advisory group on the electricity market, the Securities Commission, the Council of the IOD, and the NZ Stock Exchange's Market Surveillance Panel.

Earlier projects included advising the New Zealand Dairy Board on the route to Fonterra, the Ministry of Commerce in drafting the Electricity Industry Reform Act, Telecom during its privatisation and international flotation and the World Bank on corporatisation.

John Harbord

Prior to joining Franks and Ogilvie as a consultant John worked in the Beehive for nearly five years, including two as senior advisor to Prime Minister John Key and almost three years as advisor to Attorney-General Chris Finlayson QC.

In that time John advised on almost every Treaty settlement negotiation concluded since late 2008, including Ngai Tuhoe and the Waikato River. He advised Government Ministers on iwi/Maori issues and litigation strategy leading to the partial float of Mighty River Power and chaired the Government's Technical Advisory Group reviewing the Foreshore and Seabed Act.

John helped develop natural resource redress guidelines for the Treaty settlement process, acted as advisor to the Government's Crown-Maori Relationship Ministers group and advised the Prime Minister on natural resource issues, including water policy and RMA reform.

John currently works as a Chief Crown Negotiator in Treaty of Waitangi claims settlement negotiations.

"This year the Conference theme is Changing Currents and the Friday Forum will explore iwi rights and interests."

Huriwai Paki

Huriwai is Claims Policy Analyst at Waikato Raupatu River Trust. He is of Ngaai Tuuhoe/Ngaati Awa descent and graduated from the University of Waikato with a Bachelor of Laws degree in 2011 majoring in Maori Legal issues, Treaty, Environmental, and Intellectual Property Law.

Huriwai is currently waiting to be admitted as a Barrister and Solicitor of the High Court. Since February 2012, Huriwai has been working as a Policy Analyst for Waikato-Tainui and is responsible for leading the technical engagement on the Taamaki Makaurau claim for Waikato-Tainui. In his spare time, Huriwai is training for the upcoming Tri-Maori 2013 at Lake Karaapiro and enjoys spending time with his wife and family.

Julian Williams

Waikato, Ngaati Makirangi, Waiti Marae. Julian is the Acting General Manager at Waikato Raupatu River Trust. He joined the tribe's Environment Unit in 2003 after graduating with a Bachelor of Social Science majoring in Resource Environment Planning and Geography. He previously worked for Fonterra and Waahi Whaanui Trust.

Julian was a technical advisor in the negotiation for the Waikato River Claim. His core functions are to implement co-management agreements with Crown Agencies and Local Authorities to promote the traditional rights, control and authority of the tribe. Julian is also engaged in the development of National Reforms for freshwater and resource management. Julian believes his role should empower marae and the community, with the support of partnerships and strong focus on our youth. Julian is happily married to his wife Roimata, who teaches at Ngaruawahia Primary School.

WATER NOVEMBER 2013

The next issue of *WATER* will be published in November. The lead theme is Water Quality, with sub-topics: Drinking Water Standards and Demand Management.

Please contact the editor, Robert Brewer, robert@avenues.co.nz if you have any story ideas, contributions or photos. The deadline for the November issue is Friday 18 October.

$7.9m to Improve Drinking-Water in Small Communities

On Wednesday August 7, Associate Health Minister Jo Goodhew announced approval of $7.9 million in subsidies to help small communities establish or improve their drinking-water supplies.

"These subsidies will help council and community water suppliers provide safer drinking-water to approximately 22,000 people," Mrs Goodhew said.

Subsidies have been approved for projects in 21 communities in the 2012/13 Drinking-Water Subsidy Scheme funding round. The subsidy covers up to 85 per cent of total project costs.

"I am very pleased that the Government has been able to provide a subsidy to every project that applied in this year's round and met the technical requirements," Mrs Goodhew said.

"Subsidies approved this year range from over $2 million for the Whakatane District Council to upgrade the Rangitikei Plains/Edgecumbe water supply, serving 1730 people, to $51,000 being provided to the Purehina Family Trust to treat and filter the Te Kohanga Purehina water supply so that around 55 people will receive safer drinking-water.

"The Drinking-Water Subsidy Scheme has $10 million available each year until 2015. With two funding rounds of the scheme still to go, I encourage any other eligible communities that may be thinking about applying to do so."

More information about the scheme and how to apply can be found on the Ministry of Health website www.health.govt.nz

People on the Move

Former *Water New Zealand* President, Michael Schruer

Michael Schruer, Executive Manager Strategy and Planning for the Nelson City Council and a former *Water New Zealand* President, has resigned to take up a role with the Ministry of Foreign Affairs and Trade as the Principal Development Manager – Infrastructure.

His role will be to provide strategic planning, programme management and advice in relation to infrastructure for the New Zealand Aid Programme. NZ Aid supports sustainable development in developing countries to reduce poverty and to contribute to a more secure, equitable and prosperous world.

"His role will be to provide strategic planning, programme management and advice in relation to infrastructure for the New Zealand Aid Programme.

Water Reports Released

The Ministry for the Environment has released two indicator reports on river conditions and swimming suitability.

The river condition indicator is based on data that was collected across more than 300 regional council and NIWA-monitored sites over a ten year period (2000–2010), out of the tens of thousands of waterways across New Zealand.

The report shows that overall concentrations of nutrients and bacteria are either stable or improving at most monitored sites, and that water quality is generally improving.

The swimming suitability indicator provides a summary of monitored swimming sites. It reflects a precautionary approach to managing public health risks, which means that even a very small risk will be flagged through a lower grading.

The report shows that many swimming spots are affected in wet weather as a result of stormwater runoff. At some sites, heavy rain and wind can churn up sediment from the bottom of the waterway, releasing pathogens back into the water.

Other common sources of water pollution are urban stormwater systems, livestock, fertilisers and dense populations of wildlife.

Backflow Prevention Code of Practice Updated

The Code of Practice for Boundary Backflow Prevention for Drinking Water Supplies, 2nd edition, June 2013 is now available on the Water New Zealand web-site. This project has been completed through the focussed efforts of the Backflow Prevention Special Interest Group. A dedicated team of Nick Fleckney, Diana Staveley and Graeme Mills has been responsible for this quality effort. This second edition supersedes the previous 2006 edition.

Water Industry Workshop – Resource Consent Consistency Issues

Nick Walmsley – Technical Coordinator, Water New Zealand

Water New Zealand ran a very successful workshop on Friday 23 August 2013 to canvas the question – "Can Greater Consistency be Achieved in Practices Associated with Establishing Compliance with Discharge Consents?". The workshop was held at the Rydges Hotel, Wellington with over 75 attendees from around the country and a wide range of discharge consent holders. Nick Walmsley and Rob Blakemore facilitated the day.

The workshop contained formal presentations focussed on a range of discharge consents covering much of the country with consented discharges from both municipal and industrial facilities discharging to both water and land. Active discussion followed each presentation with many comments from personal experience, as well as follow up questions. Many of the presentation examples focussed on waste discharges but a lot of the discussion and examples from participants included consents for stormwater and water treatment residuals.

This was only the first stage of a process focussed on national improvements and was aimed at gathering facts on areas where efficiencies could be gained; both to protect the environment and reduce the effort and costs for all parties involved.

There was unanimous agreement that both the process and conditions could and should be improved with frequent reference to updating the New Zealand Municipal Wastewater Monitoring Guidelines. Provision of templates covering protocols and some standardised conditions were also mentioned. *Water New Zealand* is now working through the information gained from the workshop and formulating a programme to widen the stakeholder engagement and gain national agreement on the way forward. This will include both central and regional government. *Water New Zealand* will take a proactive lead on this issue.

The presentations, list of attendees, notes and commentary along with an outline of the future work program can be reviewed on the *Water New Zealand* website www.waternz.org.nz –under PUBLICATIONS/Library/*Water New Zealand* Workshops.

Watch this space! ■

Primary Industry Training Organisation Cements First Successful Year with Fresh New Brand


Kevin Bryant

On 1 October 2012, Water Industry Training, Agriculture ITO, Horticulture ITO, Equine Industry Training and NZ Sports Turf ITO came under one banner to form Primary ITO.

Since then, the organisation has been operating under these five different brands with the aim of launching a singular Primary ITO brand in 2013.

"While we've been working as one cohesive organisation since last year, we haven't looked like one. Now the time has come for to reveal a fresh new look," says Primary ITO Chief Executive Kevin Bryant.

As part of this change, Mr Bryant embarked on a round of industry consultations with regard to the possible rebranding of Water IT to Primary ITO.

> "The transition to the new Primary ITO logo will happen gradually so you may notice the old Water IT Logo from time to time."

"We recognised there was a perceived sensitivity to the possibility of losing the unique water identity within the greater organisation. The results of the consultation process with a range of key stakeholders were positive. The water industry is well-represented visually in the new Primary ITO brand.

"Reticulation, water treatment and wastewater treatment are part of the ITO's coverage. Water is an important resource for New Zealand and across the primary industries so we wanted to ensure it was represented in our logo," Mr Bryant says.

The new Primary ITO logo represents the connected elements of New Zealand's natural resources and primary production – land, plants and water.

"While we might look a little different, our focus on quality remains the same and we'll continue to deliver practical, relevant training that delivers the best results for our customer's careers and businesses," Mr Bryant says.

The transition to the new Primary ITO logo will happen gradually so you may notice the old Water IT Logo from time to time.

To enrol or for more information about Primary ITO's qualifications, please contact your local Primary ITO adviser on 0800 20 80 20 or visit www.primaryito.ac.nz ■

PrimaryITO
KNOWLEDGE TO GROW

Our primary focus is the same as yours
Better business. Better careers.
The Primary Industry Training Organisation has been set up with the primary focus of improving the knowledge and capability of people working in our industries.
We've combined water, agriculture, horticulture, equine and sports turf training under the one banner. We're united through the shared use of New Zealand's natural resources - land, plants and water.
Our aim is to improve skills and knowledge across our industries in support of New Zealand's economic growth.
We offer high quality, relevant workplace qualifications, resulting in better business and better careers, and more opportunities for your growth and success.
Find out how to improve your business or career. Give us a call now or check out our website.
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www.primaryito.ac.nz
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Labour Releases Draft Policy

In early August, Labour released is draft policy statement as a penultimate step in final policy development leading up to the 2014 election. Of particular relevance to readers of WATER is Chapter 4 of the draft policy statement covering policy relating to water management and conservation – as well as environmental stewardship in general. Chapter 4 is reproduced in full below.

The following commentary is to inform readers on current political policies. Subsequent issues will feature policy in the same area from other political parties.

Publication of this, or any other political policy in WATER, does not represent Water New Zealand's endorsement of the policy.

Vision

Labour believes future generations should enjoy the biodiversity of the world around them rather than learn about it in history books. Kiwi kids should grow up enjoying the results of our stewardship from preserving our environment, rather than cursing us for our greed in damaging it.

We understand that our environment has an intrinsic value, and that the health of New Zealand's economy depends on conserving and enhancing our environmental assets. As such, our environmental approach is guided by a strong sense of kaitiakitanga/guardianship.

Sustainability is one of Labour's core values. We believe that a sustainable approach to our environment is especially important given how central the environment is to our economic and social wellbeing.

Labour understands sustainability to be about the capacity of systems to endure. The United Nations World Commission on Environment and Development report (the Brundtland Report) states that sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

A commitment to sustainability means that Labour's policies must:

- Take a long-term view
- Understand that resources have limits
- Understand that eco-systems are inter-linked
- Be mutually reinforcing instead of trading off gain in one area for degradation in another

We recognise that environmental capital is a finite resource – it can be degraded beyond recovery or, in the case of flora and fauna species, pushed into extinction. Labour believes that we must establish clear environmental bottom lines for the development and consumption of natural resources so that we can ensure sustainable outcomes. Identifying these bottom lines requires good science and active data measurement and interpretation.

Without a healthy environment, we cannot have a healthy economy or a healthy society. The benefits of that healthy environment sustain important elements such as:

- Provision of fresh, clean water
- Flood protection from wetlands
- Carbon absorption from forests
- Social benefits from recreation
- Economic benefits from tourism and agricultural product branding

The 'ecosystem services' and amenity value that we derive from our environment come from private as well as publicly owned land. Local and central government need to ensure that the value of these services is recognised and protected.

Recognising the intrinsic, economic, and social value of our environment, Labour's environmental vision for New Zealand includes:

- Rivers, streams, lakes, estuaries, and coastal waters throughout the country that support healthy aquatic and marine biodiversity; are safe to swim in; and are protected from the impacts of intrusive commercial development and agricultural runoffs and toxicity
- Access to fresh water that is safe to drink
- Reduced gross carbon emissions enabling us to meet our international obligations as part of a more efficient and productive economy
- Air quality that meets world health organisation standards in all urban areas
- Soils free as possible from chemical contamination
- Pest and weed-free forest and tussock lands
- Productive land managed to maintain long-term productivity and minimise soil erosion
- Biologically diverse and stable native ecosystems in protected status across the country
- Protected 'wilderness' areas

A Framework for Environmental Protection

Our vision includes the legal and governance arrangements needed to achieve our environmental objectives. Labour commits to:

- Meaningful community participation in resource management decision-making
- Resource management legislation that includes:
  - » Environmental protection
  - » A clear understanding of the finite nature of natural resources
  - » The right incentives to ensure that development occurs in a sustainable manner
  - » The promotion of high-quality urban design
- Integration between resource management legislation and other legislation that contributes towards improved environmental outcomes including local government and conservation legislation
- Central government leadership based on robust scientific information that determines, targets, monitors, and reports on environmental bottom lines ensuring sustainability and, where needed, recovery
- Strong, democratically elected regional and local government with clear responsibilities and mandates for ensuring that:
  - » Resource management achieves or exceeds bottom lines
  - » Regional monitoring and reporting are undertaken
  - » Enforcement measures are applied where necessary
- Working collaboratively with local government, private sector, and other community groups to develop environmentally sound solutions to the problem of allocating scarce resources

Our Approach

Labour will take an all-of-government approach to environmental management so that decisions across all related policy areas support each other and do not undermine particular policy initiatives.

Climate Change – Labour wants New Zealand to honour its international commitment to reduce our gross greenhouse gas

“Community wellbeing, as determined by local communities, needs to be placed at the heart of local government purpose and decision-making.”

emissions through good science and responsible behaviour by companies and individuals. We will encourage the development of mitigation technologies and industries, such as forestry. We will make sure our Emissions Trading Scheme has environmental credibility as an ‘all gases all sectors’ scheme, ultimately free from subsidies to greenhouse gas polluters.

Labour recognises the need for New Zealand to prepare for, and mitigate, the likely environmental, economic, and social impacts of climate change, and will take action to plan for this based on scientific advice.

Energy – Labour will prioritise the development of renewable and low-carbon energy technologies for a smooth transition away from our dependence on fossil fuels. With a strong base of existing renewable energy including hydro, geo-thermal, and wind, we believe all New Zealanders should benefit from our use of sustainable natural resources.

Labour believes that it is a central government role to ensure energy security by stimulating the use of solar water heating and photo-voltaic generation by households and businesses, including through regulatory measures such as mandatory targets and incentives. We will focus on energy efficiency in homes and industry, and promote the wider use of electric vehicles and biofuels in conventional motor vehicles.

Resource Extraction – While we move away from our dependence on fossil fuels, the extractive industries will continue to be a significant part of the New Zealand economy. These industries deliver construction and manufacturing materials and/or overseas currency vital to our current economic model. Labour is committed to the lowest possible environmental risk from these extractive industries. We will have clear environmental expectations of those engaging in exploration and extraction. Future projects must meet higher standards in emergency response preparedness, liability, and ability to pay if an accident occurs.

Labour will put in place appropriate legislative provisions to protect the environment, and appropriate regulatory controls for this purpose (including stringent environmental impact statements and ongoing monitoring of sites), backed by adequate and appropriately skilled inspectorate. As part of resource management decision-making, we will consider the appropriate weighting of criteria for extractive resource proposals, including the end use and type of extracted resources, and their contribution to greenhouse gas emissions.

Conservation Estate – Labour led the world in 1987 by establishing the Department of Conservation as an agency dedicated to protecting our natural environment and providing opportunities for Kiwis to enjoy the outdoors. Labour upholds the values and aspirations that support conservation and protect biodiversity.

The focus on protecting endangered species will be improved. New Zealand needs first-class biosecurity systems to keep pests and diseases out and to protect our country from environmental and economic damage.

To protect the Conservation Estate, the Minister and department will have advocacy responsibility for conservation matters. The Minister will also have the sole decision-making powers. The capacity of all departments responsible for environmental monitoring and protection will be strengthened.

The Conservation estate, and areas with important conservation values, will require restrictions on commercial activity. Labour will not allow the mining of National Parks and other areas of high conservation value. Labour will strengthen protection for wild rivers.

We will work in partnership with commercial and volunteer supporters of conservation work, but recognise that conservation work is a core government role.

Water – Labour will ensure our valuable water resource is managed for the benefit of all New Zealanders, recognising the essential need for access to clean water. We recognise the key interest that iwi have in the health and management of water catchments.

Labour acknowledges that our water resource has been contaminated and abused. We will ensure continuous improvement of the quality of water and the reduction of contamination. We will ensure that the value of this resource is recognised when it is used for industrial purposes.

Transport and Urban Design – Labour wants all New Zealanders to grow up in a country with a high-quality and pleasant built environment where:

- our homes are healthy and energy efficient
- our cities are well designed
- our transport systems are accessible, safe, and efficient
- people are able to walk and cycle without fear for their safety
- public transport is available for people who need it

Labour will champion urban planning and urban design, building a critical mass of expertise so that central government can work alongside local councils and the private sector to transform our cities, towns, and suburbs. We are aware of the importance of preserving valuable agricultural and natural areas, and will work with local authorities to discourage unnecessary urban sprawl.

The foundations for a sustainable transport network were laid by the last Labour government with a 15-fold increase in public transport spending. Labour electrified Auckland rail, bought back KiwiRail, and legislated for sustainable biofuels.

Labour will build an efficient and sustainable transport system by investing in modern public-transport systems for our cities, and an integrated freight network that gets the best out of all modes: roads, rail, coastal shipping, and ports.

Oceans – Labour's vision is for healthy oceans that are wisely managed to protect marine species and birdlife. In exercising economic opportunities, we must protect our marine environment for generations to come. Labour supports legal requirements for environmental impact assessment of significant ocean and ocean-floor development. We support fishing rules and quotas that achieve long-term sustainable use. We believe in integrated oceans legislation to ensure the sustainable use and environmental protection of marine resources.

Agriculture/Rural Sector – Labour recognises the strides that many in the agricultural and rural sectors have been making in developing good environmental practices. We will work with farmers and agricultural scientists so that best practices become the industry norm. This approach recognises that, in the long term, our prosperity is bound up in retaining important eco-services and in the international perception of environmental stewardship. Labour will support those in the agricultural and rural sectors who protect and enhance the environment, and hold responsible those who do not meet their obligations and continue to pollute the environment.

In addition to the above, in Chapter 11 which covers how Labour would work with Local Government the following comments are made:

Working with Local Government and Local Communities

Local government has a unique and vital role in our overall system of government, and we believe that role should be respected and enhanced. We believe that co-operation and collaboration hold more benefit for communities than a model based on competition and focused on short-term cost cutting. Community wellbeing, as determined by local communities, needs to be placed at the heart of local government purpose and decision-making. Community wellbeing should be the guiding principle of local government – whether it is in Council's responsibility for a clean and safe environment, the enforcement of standards for food and water quality, or the oversight of building standards essential to safe and warm homes.

Local government will receive the support it needs to deliver on the transport needs of our cities, towns, and regions. In particular, Labour will work with local government to enhance affordable, sustainable, and energy-efficient public transport in all its forms – on roads, rail, waterways, cycleways, and walkways – in line with the aspirations of communities.

For more information see www.labour.org.nz ■

8th South Pacific Stormwater Conference Report

WATER NEW ZEALAND'S
8TH SOUTH PACIFIC STORMWATER CONFERENCE
STORM WATER 2013
8–10 MAY AUCKLAND

Water New Zealand's 8th South Pacific Stormwater Conference was held 8–10 May 2013 at the Rendezvous Hotel, Auckland. The conference was once again a success with the support of over 250 delegates over three days.

The conference began on Wednesday morning with Penny Hulse, Auckland Deputy Mayor, welcoming delegates to Auckland and wishing them an enjoyable conference. Penny's welcome was followed by an official conference opening from Dukessa Blackburn-Huettner, on behalf of the *Water New Zealand* Board.

The first Keynote speaker, Dr Andrew Simon from Cardno ENTRIX, Portland, USA brought an international perspective to the conference. Andrew is a geomorphologist who specialises in streambank erosion and stream restoration. He emphasised stream bank erosion as the main contributor to sedimentation and explained how the physics of erosion and sediment transport are the same everywhere in the world because gravity is constant. He outlined how changes in flow regime affect the stability and sustainability of urban streams. He presented a number of examples from the US and emphasised how important it is to collect data and to analyse the problem, not just the symptom.

After lunch delegates enjoyed a Keynote Address from Rachel de Lambert. Rachel is a Design Director at Boffa Miskell and in her address she presented a landscape architects view on water. Firstly, she outlined the opportunities with the blueprint for the Christchurch Central Recovery Plan and the importance of blending landscape qualities with engineering priorities. She talked about embracing the river, creating open spaces and habitat restoration. Secondly, she outlined the benefits of landscaping and enhancing the waterways and stormwater reserves in Auckland and how water needs to inform a landscape architect's thinking. She said there are many opportunities to push water solutions but there needs to be collaboration between the scientists, engineers and designers.

Day one concluded with the Stormwater SIG AGM followed by the Welcome Reception. The Stormwater committee welcomed new members; Aidan Cooper, Andy Irwin, Brian Hawkins, Ken Williams and Sue-Ellen Fenelon. Paul Kennedy stood down as chair with Vijesh Chandra taking on this role. The committee farewelled Barry Carter and Keith Caldwell, the latter having served on the committee since it was formed in 2002.

Annette Bos, a Research Fellow from Monash University in Melbourne, gave the Keynote Address at the start of the second day. Annette is a social scientist and civil engineer and she presented a social science perspective on governance initiatives for integrating stormwater management. She used as her example the Cooks River in Sydney. This is considered Australia's most polluted urban river and discharges into Botany Bay adjacent to Sydney airport. She outlined the collaborative planning approach across 6 sub-catchments and 8 councils. This involved environmental officers, technical staff and an executive champion from each council together with stakeholders and community representatives working together. Annette's message was that social and political changes are as important as technical innovation for integrated stormwater management.

After lunch delegates had plenty of choices with three site visits, a workshop on the new Auckland Council planning tools and a modelling forum with a panel of experts from NZ and Australia.

> "Planning is underway for the 2014 Stormwater Conference which will be held in Christchurch."

Delegates were given the opportunity to relax and network at the conference dinner on Thursday night. Delegates were treated to a spectacular acrobatic circus theatre from The Dust Palace. Everyone held their breath in the finale watching Eve doing a handstand on the top of 4 unstable looking wooden chairs stacked on a table. This was teamed with a comedy rap act by John Carr and a song performance by conference MC Frankie Stevens.

The final day of the conference began with a Keynote Address from Ludo Campbell-Reid from Auckland Council. Ludo came to Auckland in 2006 from London to be the Council's first ever Design Champion. Since 2010 Ludo has been Manager of the Environmental Strategy & Policy Department, Auckland Council's Centre of Environment Excellence. Ludo provided an international perspective on the value of water and the pressures resulting from population migration to cities. He gave examples from New York, Seattle and Seoul to show how they are

Above Left to Right – Keynote Speaker, Dr Andrew Simon; Keynote Speaker, Rachel de Lambert; Keynote Speaker, Ludo Campbell-Reid; Keynote Speaker, Annette Bos; Dinner Entertainment; The Dust Palace; Dinner Entertainment, John Carr

rediscovering the value of green recreation space and waterways downtown. Ludo believes that with amalgamation into the new Auckland Council, Auckland has an opportunity to take a lead in showing the world how environmental guardianship and innovative, people-based place-making can be blended to create a unique and fantastic urban and natural environment. He believes in green infrastructure solutions and considers stormwater projects are multi-disciplinary place-making projects of which civil engineering is only a component.

As well as the keynote addresses delegates were able to hear a stimulating array of presentations on topics such as Samoa's responses to climate change and cyclones, renewal forecasting of stormwater pipeline assets, construction of LID solutions at Long Bay, responding to an actual 100 year storm in Auckland, raingarden maintenance, development of a low cost high efficiency litter trap, modelling papers and many others. There was also an outstanding presentation on the January 2013 500 year return period Bundaberg floods.

The conference was supported with an extensive trade Expo of suppliers and consultants displaying new and innovative products and services.

Special thanks are given to our Sponsors: Premier Sponsor – Stormwater 360, Conference Partner – Lend Lease and Industry Supporter – Morphum, for their support towards making this a successful event. Many thanks to the *Water New Zealand* Stormwater Conference Committee who contributed an enormous amount of time and effort to make this conference the success it was.

The Stormwater Conference Committee:

- John Palmer, Consultant, Tauranga (Chair)
- Barry Carter, Auckland Council, Auckland
- Nick Simpson, Aurecon New Zealand, Wellington
- Bronwyn Rhynd, Stormwater Solutions Consulting Ltd, Auckland
- Dean Watts, Morphum Environmental Ltd, Auckland
- Nick Brown, Auckland Council, Auckland (Modelling SIG)
- Mark Pennington, Tonkin & Taylor, Tauranga (Rivers Group)

Planning is underway for the 2014 Stormwater Conference which will be held in Christchurch. Keep an eye out for details and we look forward to seeing you in Christchurch in May next year.

RMA Reforms and Reporting

Helen Atkins – Partner and Vicki Morrison-Shaw – Senior Associate, Atkins Holm Majurey

Introduction

A constant theme of our recent articles has been that of reform and this article is no different. The Government is pushing full steam ahead in its quest to improve the RMA – from processes to reporting and everything in between. In this article we provide a brief summary of the reasons the Government has given as to why further reform is necessary and we provide a brief overview of the next stage of RMA reforms. We then turn to the issue of monitoring and reporting. First up is an overview of the Government's proposed new National Monitoring System which is to replace the current two yearly "State of the Environment" reports. We outline the objectives, coverage areas, priorities and expected benefits. Next we look briefly at the issue of environmental reporting and the announcement that the Government recently made regarding reform in that area. Finally, we provide you with a summary of a recent case where the issue of what constitutes a river was discussed.

RMA Reforms – Third Stage

On 10 August 2013 the Minister for the Environment, the Hon Amy Adams announced the third stage of the RMA reforms[1]. The objective of the reforms is[2]:

"…to create a system that's more certain, less costly and enables growth while protecting core environmental standards which are so critical to New Zealand."

The Minister explained that such reforms were necessary as the systems and processes that had developed over the past 22 years were not serving us well[3]:

"Instead of enabling a strong housing supply – it is slowing or blocking development when it is desperately needed.

Instead of encouraging investors to create jobs – it is discouraging them with uncertainty, bureaucracy and delays.

Instead of protecting our communities and businesses with strong modern infrastructure – it hinders projects of all sizes with unnecessary costs, delays and processes."

To illustrate the point the Minister cited a number of "RMA horror stories" which she had come across recently[4]:

- A $3,500 consent being needed to do an $800 job to remove a chimney to help quake safe a home
- Or $7,000 in consent costs to add a further 4m to an existing deck
- Needing a resource consent and an arborist's report to trim a tree in your own backyard
- Heritage protections applied to a 14 year old Lockwood home
- A consent being needed for a sea plane to do a one-off touch and go landing on a harbour
- And visual streetscape rules applied to a back section not visible from the street

"The Government is pushing full steam ahead in its quest to improve the RMA – from processes to reporting and everything in between."

The Minister noted that it was sometimes argued that we needed to accept the RMA warts and all because of the important role it played in protecting the natural environment. In response the Minister stated[5]:

"We have to move away from the misguided belief that seems to have developed that the more time and money that gets spent on a process, somehow the better the outcome will be…

When the RMA becomes the basis on which Councils look to:

- Take their own stance on national laws they dont agree with or
- Make rules about how big the front windows can be in our homes, or
- The placement of lounges within houses, or
- Whether a kid can build a tree house

…we have to ask whether that really is the enabling effects based regime that was to allow almost anything to occur as long as the effects on the environment could be properly mitigated, that the original architects of the Act promised back in 1991."

The key components of the reforms which are proposed to stop such horror stories from occurring are:

- Revision of sections 6 and 7 of the Act into a single set of matters of national importance
- Introduction of a mandatory national template for plans to make plans more consistent in terms of format, layout and terms used and hence more user friendly
- Requiring a single plan to be created between councils within a region (ie so all regional and district plan rules are in the one place) and made available electronically
- Amending consenting processes and requirements to ensure they are streamlined and proportionate to the activity including introducing a 10 day fast track consent process for the simplest projects that have few environmental effects – e.g. alterations to residential properties
- Requiring plans to be more proactive so that fewer consents will be needed

- Allowing councils to exempt projects from the need to obtain resource consents where a rule is breached in a technical or marginal way but any effects of the project would be negligible
- Requiring councils to set and publish a list of fixed fees for simple consent applications and to publicly report on consent charges and costs
- Placing a greater emphasis on council engagement with communities and local iwi up front in the planning processes
- Improving council reporting and benchmarking in relation to how they are meeting local environmental, cultural, social and economic needs
- Requiring better consideration of natural hazards in planning

The Minister also indicated that some changes had been made to the reform proposals following feedback on the RMA discussion document which was released earlier this year. In particular there have been amendments to:

- The proposed matters of national importance
- Clarify that the Minister's power to intervene in plan processes does not include writing the plan
- Confirm that the proposals for an alternative appeals tribunal or Crown consenting agency will not proceed

These reforms are to be included within a further RMA amendment Bill which is due to be introduced later this year. We will continue to monitor the reforms and provide comment on the Bill once it becomes available.

National Monitoring System for the RMA

A discussion document was recently released which proposes adopting a national monitoring system ("NMS") for the RMA[6] in order to understand whether the RMA functions, tools and processes are

"The new reporting regime will also provide a means for New Zealand to track how it is performing against other countries and in particular, New Zealand's trading partners."

achieving what they were intended to and to identify any areas where changes may be required.

It is important to note that the information sought to be gathered under the proposed NMS relates to the implementation of the RMA rather than environmental outcomes per se. There is a separate process underway to improve information on outcomes (see in part next section).

The NMS is proposed to replace the current two yearly survey of local authorities. The objectives of the NMS are to[7]:

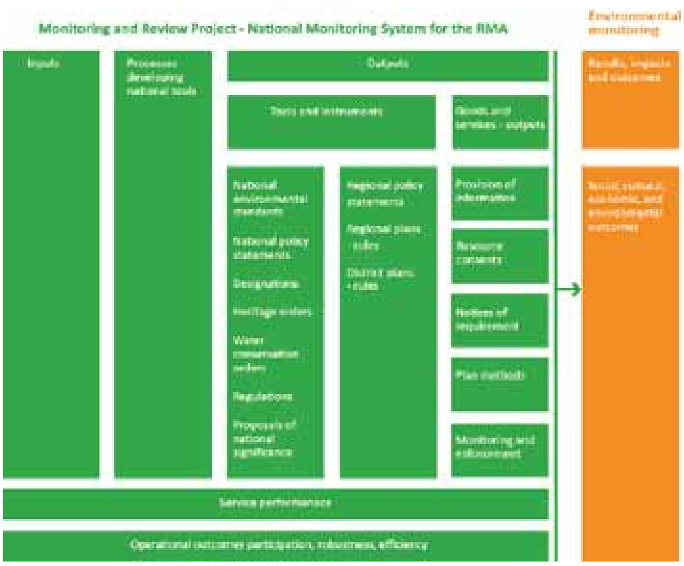
- Develop a clear and transparent national monitoring system that can provide:
  - » robust information on the implementation of the RMA
  - » information on the implementation and effectiveness of national tools – eg, national environmental standards and national policy statements
  - » information to produce a coherent and considered picture of the outcomes from the functions, tools and processes of the RMA
  - » Improve the availability, consistency and comparability of RMA information
- Streamline the collection of RMA information to achieve efficiencies.

> "The Minister noted that it was sometimes argued that we needed to accept the RMA warts and all because of the important role it played in protecting the natural environment."

The NMS will cover all RMA processes with the initial priority areas being:

- Plan making
- Resource consents
- Complaints, monitoring, enforcement and compliance;
- Environmental Protection Authority – Nationally significant proposals
- Designations
- Heritage orders
- Direct referral
- Water conservation orders
- National environmental standards and national policy statements – development processes and monitoring, implementation and effectiveness

The scope of the proposed NMS for the RMA is shown in the figure below[8]:



The NMS is expected to deliver benefits to Government, local government and New Zealanders. These include better quality information to inform policy development and council practice and accountability; increased clarity and certainty about what information will be collected, why, when and how; and greater efficiency for councils through improved alignment with existing systems and sharing of good systems tools and processes.

The discussion document sought feedback from stakeholders (central and local government and others) on the proposed NMS and its implementation; how well the monitoring would align with councils' existing monitoring and reporting functions data and systems; and any new or additional work that will be required to capture the proposed monitoring information. The feedback period closed on 30 August 2013. We will follow the progress of the NMS and report back in a future article.

Independent Environmental Reporting

The Government has recently announced[9] that it will introduce an Environmental Reporting Bill later this year to require independent national environmental reporting in relation to air, climate and atmosphere, freshwater, marine and land, with biodiversity included in all of these areas.

The purpose of the Bill is to make comprehensive environmental information available so that the impacts of natural occurrences and human activities are able to be fully understood. The new reporting regime will also provide a means for New Zealand to track how it is performing against other countries and in particular, New Zealand's trading partners.

No further details are as yet available – however we will maintain a watching brief and keep you posted.

Recent Case – Carruthers v Otago Regional Council [2013] NZHC 632

This case was an appeal against convictions under the RMA for digging and allowing livestock to disturb the bed of a river. The key issue in this case was whether the watercourse in question amounted to a river. Water was diverted from a river and discharged into an unnamed creek which then flowed into a gully which had been formed by past water flows. In considering the issue the Court confirmed that:

- Once water is taken from a river or lake and is in an artificial watercourse (such as an irrigation channel), section 13 of the RMA (which imposes restrictions on the use of beds of lakes and rivers) does not apply and that this is so even if the artificial watercourse develops biologically to sustain plant, insect and fish life – refer para [31]
- Where a case presents a set of facts not expressly anticipated by Parliament (such as here where the water course does not fall into the normal simple context of an artificial watercourse) there are always difficult problems of statutory interpretation – refer para [32]
- A watercourse with intermittent flows could qualify as a river and therefore obtain protection under section 13 – refer para [37]. However, the definition of the bed of a river made it clear that Parliament did not intend for floodwaters or flows following only from major storms would fall within the definition of a river – refer para [41]
- In determining whether the gully was a river, it was inclined to the view that the source of the water (ie being originally from a river) did not matter. However, the Court did not finally decide that point – refer paras [51] and [53]

Justice Fogarty ultimately found that it was not proved that the disturbance to the bed of the gully came within the parameters of section 13 and therefore allowed the appeal. ■

Footnotes

[1]Refer to 10 August 2013 Ministerial speech of Hon Amy Adams "Resource Management Act Reform" available from www.beehive.govt.nz/speech/resource-management-act-reform.

[2]Ibid, at page 3.

[3]Supra note 1 at page 1.

[4]Supra note 1 at page 1.

[5]Supra note 1 at page 2.

[6]Ministry for the Environment, "A National Monitoring System for the Resource Management Act" (June 2013).

[7]Ibid, at page 5.

[8]Supra note 2 at page 3.

[9]Refer to 8 August 2013 Ministerial Release for Hon Amy Adams "Govt to mandate three-yearly State of the Environment reports" available from http://www.beehive.govt.nz/release/govt-mandate-three-yearly-state-environment-reports.

Action on Fresh Water Management

Phil Gurnsey – Technical Director, Beca Ltd

Phil Gurnsey

Fresh water is one of New Zealand's greatest natural assets and, as such, appropriate management of the resource is vital for New Zealand's success. But, are we ahead of the game or playing catch up on fresh water management? New Zealand has an abundance of water and we've sat our laurels for quite some time, operating under the premise we have enough fresh water.

Our water management framework is embodied in the Resource Management Act (RMA). The RMA doesn't recognise water management sufficiently. Regional water plans aren't mandatory, even though all councils have one, and decisions about water allocation are made on a first in first served basis. But there is a bright side in that successive Governments have been looking to improve fresh water management and we may finally see some action.

Drivers

We are seeing action on water for a number of reasons, but the main driver is primary industry. We are heavily dependent on agriculture

"The policy of the past will not be fit for the future and the Government is determined to get the environmental settings right."

and will continue to be so. New Zealand's economy depends on the primary sector, producing fruit and vegetables worth more than $5 billion-a-year and dairying exports of $13 billion-plus-a-year. Government has kick-started irrigation to promote more productive sector output. A Crown company is in place now to manage Crown investment in more and better irrigation. This is coupled with a higher proportion of government research investment going to food and agriculture.

The second driver of water reform is the environment. The Government is investing heavily in cleaning up our waterways. More than $450 million has been committed to cleaning up rivers, lakes and wetlands, although it makes sense to avoid degradation in the first place. The policy of the past will not be fit for the future and the Government is determined to get the environmental settings right.

The Land and Water Forum

The Government's initiative on a policy front was spear-headed through the consensus reaching the Land and Water Forum (LAWF) in 2012. The outcome of the LAWF is interesting but the Government's implementation of it is incomplete, with many of the more difficult decisions having been put on the back burner for the next administration to address.

The LAWF was primarily about demonstrating whether collaboration could work in setting policy goals on water. It did, and now the Minister for the Environment is proposing to extend application of this collaborative planning model to the RMA and make regional councils pick it up.

The Collaborative Model

Of the three reports of the LAWF it is the collaborative model being rolled out first – and everyone involved is taking a pat on the back for its success.

The collaborative model, where everyone develops a shared vision for water bodies while balancing their different aspirations, represents a move to get early buy-in to the planning process. Collaboration is a move away from the cheque-book orientated and litigious nature of the current planning process. Collaboration is already occurring successfully at regional and national levels, having been adopted voluntarily by some local government organisations. The Canterbury Water Management Strategy is testament to this and makes for an interesting case study. What is more interesting will be how the legislative framework enshrines the consensus making agenda.

A feature of the process is the recognition of the joint governance role iwi have in decision making. Some areas have formalised this through iwi settlement legislation, such as the joint governance role the Waikato River Authority takes on the management of the Waikato River. The move reflects a growing acknowledgement of the importance of joint governance between iwi and councils.

A hurdle in the process will be achieving integrated management when decisions on matters related to water are made under the collaborative plan making process but others relating to natural hazards and land use occur under normal processes. There will be different processes for different resources and as such the integration and interdependencies of their management may be lost in translation. Surely an integrated hearings process would be more logical and efficient for all resource management decisions.

Other Aspects of the Reforms

Other parts of the freshwater reforms include the creation of a National Objectives Framework and better water accounting. This year the Government intends to amend legislation to facilitate the introduction of a National Objectives Framework, and it will release the framework for discussion. The National Objectives Framework will have a standard list of possible values, such as swimming, fishing or irrigating and set standards for those values, in bands A – D. The Framework will not detail every value and water body type immediately but will be populated progressively over time as information becomes available.

An earlier aspect of the reforms which now appears to be off the table is replacing the Water Conservation Order process. Unsurprisingly this met with significant opposition from green groups. However, the Water Conservation Order process sits as an oddity among the RMA framework – to one side. Anyone can seek a Water Conservation Order and the Minister must consider that request. It is seen as being akin to the national parks for waterways. But oddly we don't manage our national parks in this way.

RMA Reforms

Alongside the Water Reforms sit the RMA Reforms 2013. Looking at the discussion documents released in March 2013 its clear that the parallel tracks for reform need better entwining. This is expected to occur as legalisation is developed.

One of the more controversial parts of the reforms comes in the form of proposed changes to Sections 6 and 7 of the RMA, two fundamental sections in the Act. The proposal recognises the RMA has never been interpreted by the Courts as safeguarding a set of environmental bottom lines. It is not an environmental protection statute – its purpose is sustainable management – and use, development and protection are inter-related. That purpose is not altered by the proposed changes, rather the intent is clarified. If the RMA was about environmental bottom lines (elements of which for water will be highlighted by the National Objectives Framework) then entirely different construction for the statute would need to be adopted in order for it to work transparently and effectively.

> "For water uses, trout and salmon are still to be referenced as being nationally important ahead of native species, as is a reflection of the natural character of lakes and rivers, and the effective functioning of ecosystems."

For water uses, trout and salmon are still to be referenced as being nationally important ahead of native species, as is a reflection of the natural character of lakes and rivers, and the effective functioning of ecosystems. What's new is a due recognition of the efficient provision of infrastructure.

What the background to these reforms points to, is that after 22 years the RMA has become very complicated in carrying out its sustainable management purpose. Although the significant pain of starting again isn't worth thinking about, this reform probably signals the biggest change to the RMA since its inception and for years to come. ■

Using Computational Fluid Dynamic (CFD) Modelling to Evaluate and Optimise the Performance of Chlorine Contact Tanks

Jonathan Church and Jason Colton – $h_2$ope Ltd

This paper was presented at the 2012 Annual *Water New Zealand* conference within the conference modelling stream. It won the Modelling Special Interest Group modelling award. The Modelling Special Interest Group is managed under the umbrella of *Water New Zealand* by an enthusiastic management committee. More information is available from the *Water New Zealand* website.

When water flows through a chlorine contact tank or reservoir the theoretical detention time (TDT) can be calculated using the flowrate and volume (equation 1).

Equation 1
$$TDT\ [min] = \frac{Volume\ [m^3]}{Flowrate\ [m^3/min]}$$

The TDT is a gross simplification because it assumes perfect plug flow conditions and that every bit of space in the tank is used equally. In reality this is far from the case, phenomenon such as short circuiting and dead zones result in the actual contact time in the tank being significantly less than the TDT. Reduced contact time can have a big effect on the efficacy of the disinfection process. This is addressed in the New Zealand drinking water standards (DWSNZ2008) by requiring that a contact time of not less than 30 minutes taking into account short circuiting is provided.

The widely accepted method for quantifying reduced contact time is by determining the T_{10} contact time. The T_{10} contact time is defined in the USEPA Guidance Manual for Disinfection Profiling and Benchmarking (2003), as the minimum detention time experienced by 90 percent of the water passing through the tank.

There are three methods available to water suppliers to determine the T_{10}. The first is by using a baffle factor, which is a gross simplification. The second is by using tracer testing, which is very laborious and the third is by using computational fluid dynamic (CFD) modeling.

Baffle Factors

The T_{10} can be estimated by using a baffle factor (Equation 2). This factor is the ratio between the T_{10} for a particular tank and the theoretical maximum detention time of that tank. A list of baffle factors and the corresponding baffle design is provided in Table 1.

Equation 2 T_{10} = Theoretical Detention Time (TDT) x Baffle Factor

Tracer Testing

Tracer testing can be used to determine a T_{10} experimentally. Tracer testing is where a chemical is added to the water entering the chlorine contact tank and the change in concentration at the exit of the tank is measured over time. The shape of the resulting concentration versus time graph provides insight into the amount of short-circuiting and dead zones within the tanks and actual T_{10} and baffle factors can be determined. There are two methods of tracer testing: the slug-dose method and the step-dose method. The easiest method to use is usually the step-dose method since chemicals that are already in use on the plant, for example fluoride, can be used as the tracer. The step-dose method entails dosing of a tracer chemical at a fixed dose until the concentration at the exit of the tank reaches a steady-state level (the concentration dosed). A graph of tracer concentration at the exit of the tank (C) / dosed tracer concentration (C0) is plotted and from this the T_{10} can be identified (Figure 1). This type of graph is also known as cumulative distribution function curve.

> "Tracer testing is a proven technique for demonstrating T10 contact times. However, it is time consuming and can be expensive since a minimum of four tests are recommended - covering different flow and level conditions"

Tracer testing is a proven technique for demonstrating T_{10} contact times. However, it is time consuming and can be expensive since a minimum of four tests are recommended – covering different flow and level conditions. It can also have a significant impact on plant operations. Flow and level need to be fixed for each test, which can often mean inhibiting filter backwashing. Furthermore there may be some situations where a tracer is not readily available e.g. the fluoride dosing point may be after the chlorine contact tank. In which case an alternative tracer has to be used, increasing the cost.

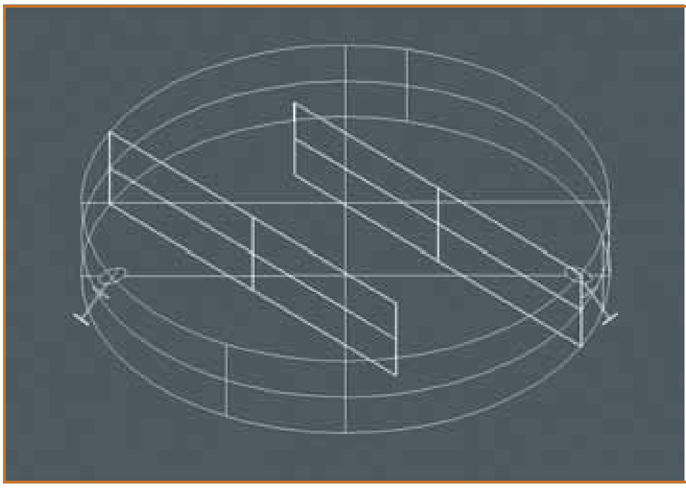
Computational Fluid Dynamics (CFD) Modelling

Computational fluid dynamics (CFD) is a branch of fluid mechanics that uses numerical methods and algorithms to solve and analyse problems that involve fluid flow. Computers are used to perform the calculations required to simulate the interaction of liquids and gases with surfaces defined by boundary conditions.

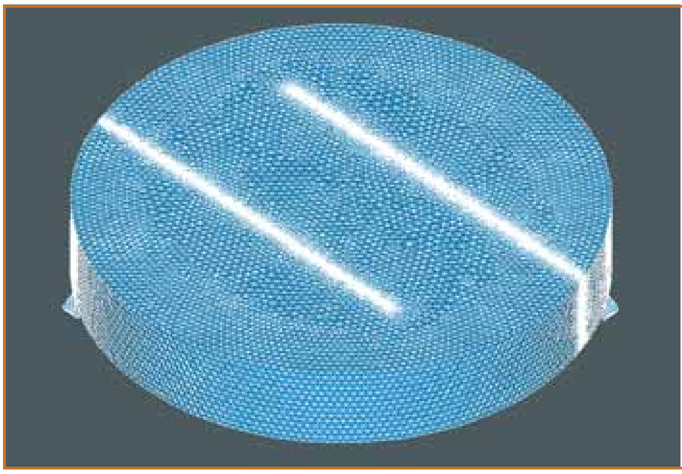
CFD is used widely overseas in a range of industries but its use in New Zealand, particularly in the water industry, has been limited. The reason for this is both cost and resources. Up until recently CFD software had extremely high licensing costs which meant engineering and consulting companies were reluctant to invest in it. This in turn meant that there were very few people capable of running CFD simulations. The recent release of an open source CFD software suite (CAE-Linux) allied to advances in computing power has changed this making CFD very price competitive compared to tracer testing (30–40% cheaper than tracer testing).

In order to use CFD to determine T_{10} contact times a number of steps have to be followed. A real world example to demonstrate the steps is provided.

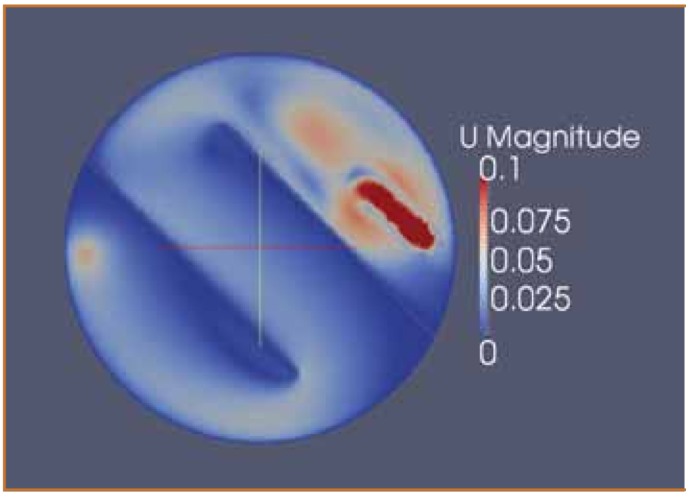
The Wainuiomata WTP chlorine contact tank is a circular tank, 16.9m diameter and 6m tall with a volume of 5170m^3. The reservoir is baffled by two parallel membrane curtains 25m long running from opposing walls. These curtains are fixed to the floor using a full length skirt which was factory welded to the main membrane curtain. Water enters on the right of the reservoir through a 1200mm CLS pipe angled at 45 degrees from underground towards the floor. The pipes are flush with the floor of the reservoir, providing an elliptical exit



A basic wireframe model was built in a simplistic form. The wireframe represents the edges of an available incompressible volume for the water to flow through. Different geometries need to be created for different reservoir levels.

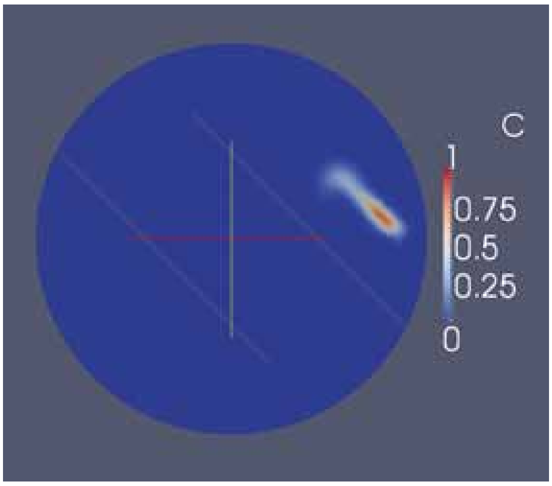


Using the NetGen 3D method in Salome-Meca the contact tank was meshed to represent individual 'bubbles' of volume within the tank. For the Wainuiomata WTP chlorine contact tank in the 96% full scenario this created 299,434 bubbles. Each bubble of volume is a cell in which the CFD mathematics are performed. The meshed reservoirs were then exported to the OpenFoam software. Note that the bubble density increases automatically around features such as baffles.

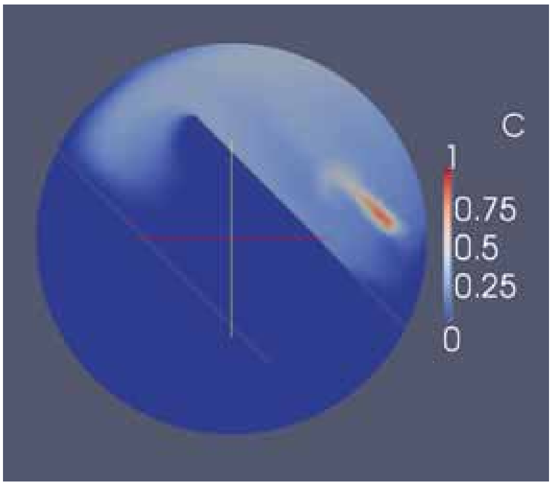


For each scenario the steady state velocity is determined using a Navier-Stokes solver, with the inlet velocity as the only starting condition.

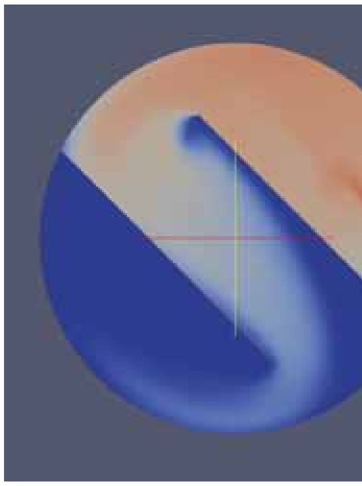
A tracer test was simulated by adding 1mg/L of an inert tracer to the inlet of the tank. The simulation was run until the tank outlet reached steady state i.e. 1mg/L. A time sequence of the tracer concentration in the Wainuiomata chlorine contact tank for 60ML/d and 96% level is shown.



1 Minute



10 Minutes



30 Minutes

The simulated tracer concentration at the exit of the tank was used to plot a cumulative distribution function curve (C/Co vs time) from which the T_{10} could be calculated. A baffle factor was then calculated by dividing the calculated T_{10} contact time by the theoretical contact time. The output of the tracer test simulations for a range of scenarios are shown as cumulative distribution function curves in Figure 2. The calculated T_{10} contact times are shown in Table 2.

It can be seen from Figure 2 and Table 2 that when the reservoir is operated at maximum flow (60ML/d) and minimum operating level (51%) that the T_{10} contact time is less than 30 minutes. The calculated baffle factors for all the scenarios are shown in Table 3. This shows a range in baffle factors from 0.34 to 0.46. This data highlights two issues with using the standard baffle factor definitions shown in Table 1. The first is that when a baffle factor is selected it is applied to all flow and level scenarios. In reality the baffle factor varies with both flow and level. The second issue is that given the range in actual baffle factors it is quite difficult to select a baffle factor which will cover all scenarios. For example, the baffle factor that has been selected for the Wainuiomata WTP chlorine contact tank was 0.4. This was selected because it was felt that the tank fell between the 0.3 and 0.5 definitions. It can be seen from Table 3 that under many operating scenarios the baffle factor was underestimating short-circuiting.

CFD modeling can be used to provide additional value over and above the determination of T_{10} contact times. These can be summarised as follows:

- **Identification of dead zones** – CFD clearly identifies dead zones in any flow scenarios.
- **Locating sample points** – One area where dead zone identification is important for existing tanks is in the locating of sample points. If the tank is being sampled from a dead zone then the sample will not be representative under changing conditions. If the sample is being used for pH and or chlorine measurement and control then the process control will be very difficult to tune effectively. In order to achieve good process control performance a homogenous sample is required. Using CFD an optimum sample location can be selected.
- **Evaluating tank modifications** – Modifications to inlets/outlets and baffles can be evaluated offline. Sometimes a simple fix can be provided to an existing problem. For example in the examples provided the T_{10} was less than 30 minutes in one scenario. A number of inlet modifications were evaluated and it was found that a simple deflector plate at the inlet would increase the T_{10} to greater than 30 minutes.

Conclusions

CFD is a viable alternative to tracer testing in order to determine actual chlorine contact times. In fact CFD has many advantages over tracer testing. It is now cheaper than tracer testing due to the availability of open source software, it has no operational impact and can be used to provide additional value over and above the determination of T_{10} contact times and baffle factors. It can be used to identify dead zones, to identify optimum sample locations and to evaluate and optimise tank modifications.

The use of standard baffle factors is a gross simplification and that their use can result in an underestimate of short-circuiting in chlorine contact tanks. ■

Figure 1 – Step Dose Tracer Test – Cumulative Distribution Curve

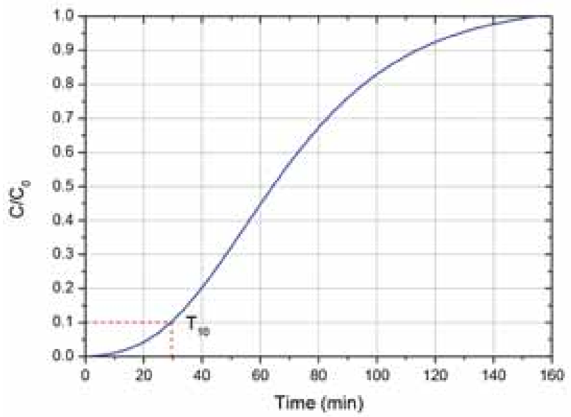
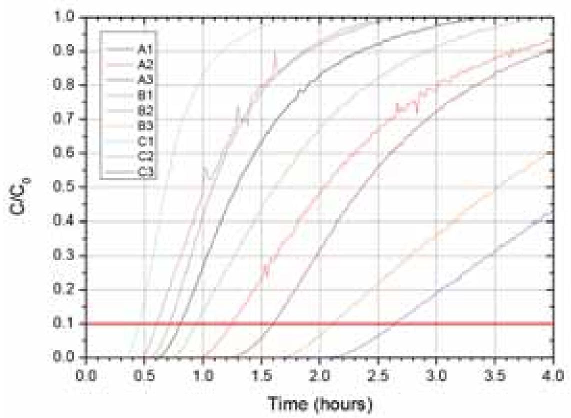
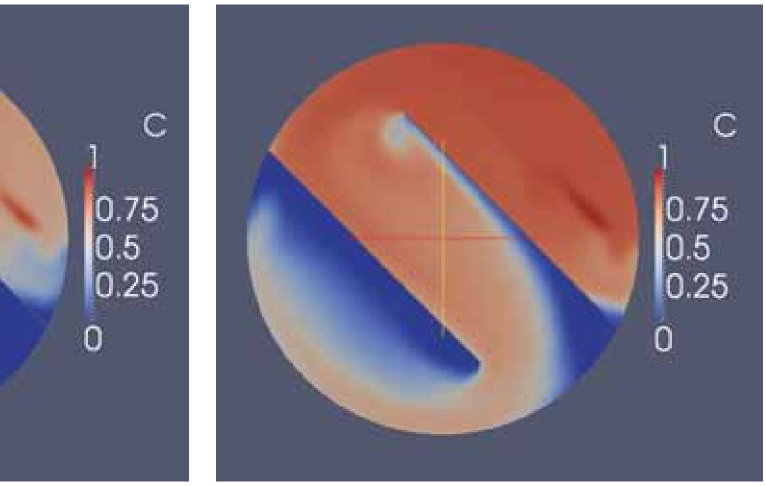


Figure 2 – Wainuiomata WTP CCT – Cumulative Distribution Functions – All Scenarios





60 Minutes

Table 1 – Baffle Factor Definitions (USEPA Guidance Manual Disinfection Profiling and Benchmarking)		
Condition	**Baffle Factor**	**Description**
Un-baffled (mixed flow)	0.1	None, agitated basin, very low length to width ratio, high inlet and outlet flow velocities. Can be approximately achieved in flash mix tank.
Poor	0.3	Single or multiple un-baffled inlets and outlets, no intra-basin baffles.
Average	0.5	Baffled inlet or outlet with some intra-basin baffles.
Superior	0.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders.
Perfect (plug flow)	1.0	Very high length to width ratio (pipeline flow), perforated inlet, outlet, and intra basin baffles.

Table 2 – Wainuiomata WTP CCT T_{10} Contact Times For All Scenarios			
Level (%)	**T_{10} Contact Time (mins)**		
	60 ML/d	**40 ML/d**	**20 ML/d**
96	49	75	159
76	37	57	127
51	28	43	100

Table 3 – Wainuiomata WTP CCT Baffle Factors For All Scenarios			
Level (%)	**Baffle Factor**		
	60 ML/d	**40 ML/d**	**20 ML/d**
96	0.34	0.36	0.40
76	0.35	0.37	0.41
51	0.39	0.42	0.46

Seasonal Variation in Sewers, How it Can Affect Your Perception of System Performance

Thomas Joseph – AWT Water Limited

1. Introduction

In this paper we will examine how long term monitoring significantly changed the model calibration and subsequent outlook on how the system performs. We will use the Whangarei sewer catchment as our case study which highlights dramatic seasonal differences in dry weather base flow and consequently inflow and infiltration estimates.

In early 2010 AWT built and calibrated a detailed hydraulic model of the Whangarei sewerage system for Whangarei District Council (WDC). The model output was subsequently used to develop high level options for the sewer network.

At the conclusion of the original 2010 monitoring campaign it was recommended to keep a core network of long term monitors in place to assist in understanding the seasonal variation in the catchment. The long term monitoring data was then used the following year to validate the original calibration and verify the system performance.

For demonstrative purpose in this paper we will examine the data from a single monitor located along the main trunk in the CBD (monitor 10852). Monitor 10852 was chosen as a good surrogate monitor as it reacts similarly to the other monitors in the catchment. The monitor is relatively low in the catchment and is susceptible to the high ground water table in the CBD. This paper highlights the journey through the modelling effort including the original calibration, validation, re-calibration, and updated system performance.

2. Background

The Whangarei sewerage collection system services Whangarei City and the Whangarei Heads area.

> "In a typical sewer master planning project it is common to undertake monitoring and hydraulic modelling to determine optimised strategies and capital works programmes."

The existing catchment is approximately 3,343ha. Infill development is anticipated within the existing catchment and an additional 5,444ha is zoned for urban development in the District Plan, Proposed District Plan and Coastal Management Plan.

The sewerage collection system consists of approximately 424 km of sewer pipes including rising mains and storage tanks ranging in size from 50 mm diameter to 2100 mm. The larger diameter trunk mains are typically concrete. The condition of the pipes in the network is largely unknown. According to GIS data the network was developed between 1901 and 2008. The network contains approximately 69 pump stations all of which are included in the model.

The Whangarei wastewater collection system carries the sewer flow for a population of 47,991 based on the 2006 Census data.

"At the conclusion of the original 2010 monitoring campaign it was recommended to keep a core network of long term monitors in place to assist in understanding the seasonal variation in the catchment."

Land use within the township is predominantly residential with commercial and industrial activities in the CBD.

Soils within the area are predominantly clay and are not free draining. Parts of the network are below mean sea level. This results in considerable potential for inflow and infiltration into the aging wastewater network.

There are a number of known wet weather over flow locations in the system. These include constructed overflows at pump stations and overflows from manholes and chambers in the network.

3. Model Calibration

The original model calibration utilised flow and rainfall monitoring data collected from March to June 2009. The original monitoring data revealed relatively large inflow and infiltration issues across the Whangarei catchment. Many of the monitors never returned to the base flows that were witnessed at the beginning of the monitoring period.

Overall, an excellent calibration of all 22 monitoring locations was achieved over the range of rain events that occurred during the original three month monitoring period.

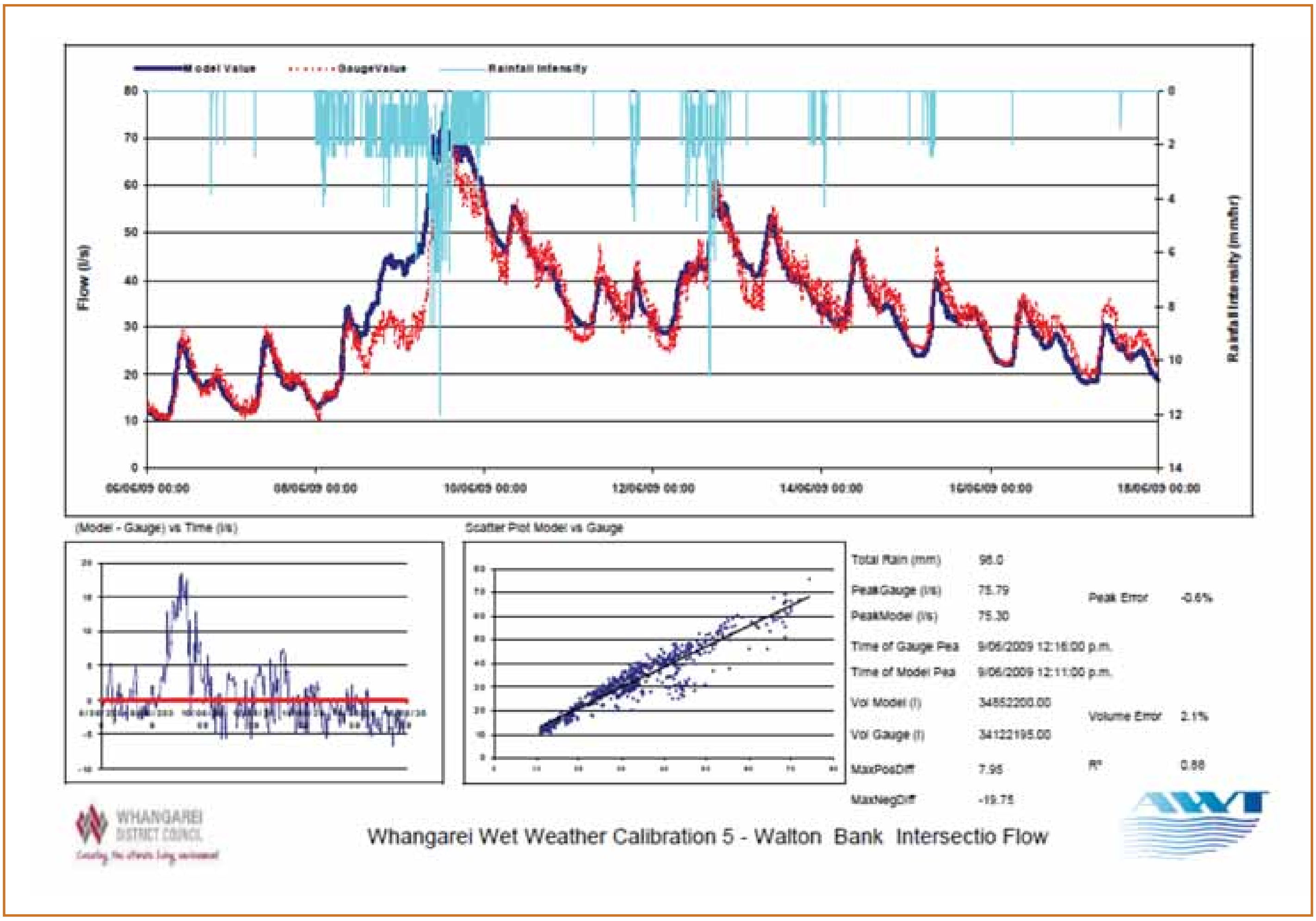
Table 1 shows the general calibration results for monitor 10852 and Figure 1 is a calibration plot from one of the calibration events.

Figure 2 below highlights how the dry weather flow at 10852 never returned back to the base flow for the entire length original monitoring period. At the conclusion of the original monitoring period it was difficult to tell if the base flow witnessed at the start of the period was the true base flow or if it was already increasing from the preceding antecedent conditions. This phenomenon prompted us to maintain a core set of long term monitors in the ground to establish the true base flow across the catchment.

Table 1 – Original Monitoring Period (winter 2009) – Flow Calibration Results Monitor 10852

Event	Volume Error	Peak Error	R^2
DWF	-2.1%	-5.9%	0.87
Event 1	11.5%	10.3%	0.80
Event 2	5.1%	3.9%	0.82
Event 3	-2.7%	-0.7%	0.77
Event 4	-7.5%	-11.4%	0.89
Event 5	2.1%	-0.6%	0.88

Figure 1 – Original Monitoring Period (winter 2009) – Flow Calibration Plot for Event 5 Monitor 10852



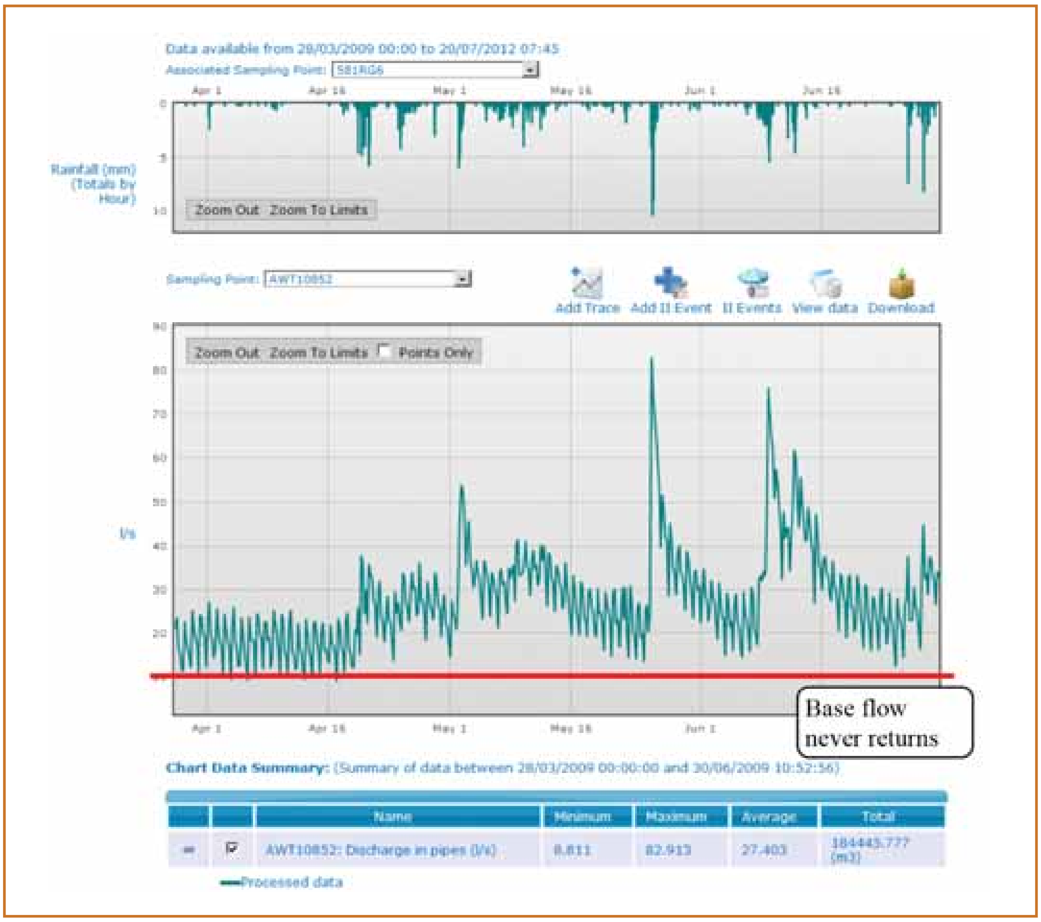


Figure 2 – Flow for the Original Monitoring Period (winter 2009) Monitor 10852

4. Model Validation

As discussed above a core network of long term monitors were kept in place to assist in developing a better understanding of the seasonal variation in base flow. The model validation exercise essential consisted of running the calibrated model for the entire long term monitoring period (April 2009 – August 2011) and looking at the model performance compared to the monitored flow. The primary goal of the validation was to get an understanding of how the original calibration parameters performed over a long term wetting and dying cycle.

In general the model validates well in the proximity of the original monitoring period (winter 2009), however the further away from the winter of 2009 the model starts to significantly over predict wet weather flow. It was noticed that the original monitoring period was

"For the most part the recent monitoring and subsequent re-calibration has shown an increase in ingress values."

undertaken during a particularly wet period where as the long term monitoring has picked up two seasonal drought periods.

Following the original monitoring period we had no base line to differentiate base infiltration as a result of high groundwater to actual dry weather wastewater production. This high ground water was subsequently lumped into the dry weather flow production for each monitor. Therefore the long term validation showed that the model was over predicting seasonal events. This situation is exacerbated in Whangarei with such a high ground water influence during wet seasons. Without the long term monitoring information it would not have been possible to obtain an accurate seasonal base line.

Figure 3 and Figure 4 below show a few validation plots for monitor 10852. As shown in the figures the model is significantly over predicting peak flow and volume for both a summer and autumn event. The model over prediction is a direct result of over allocated dry weather production.

Figure 3 – Summer Validation Event Monitor 10852

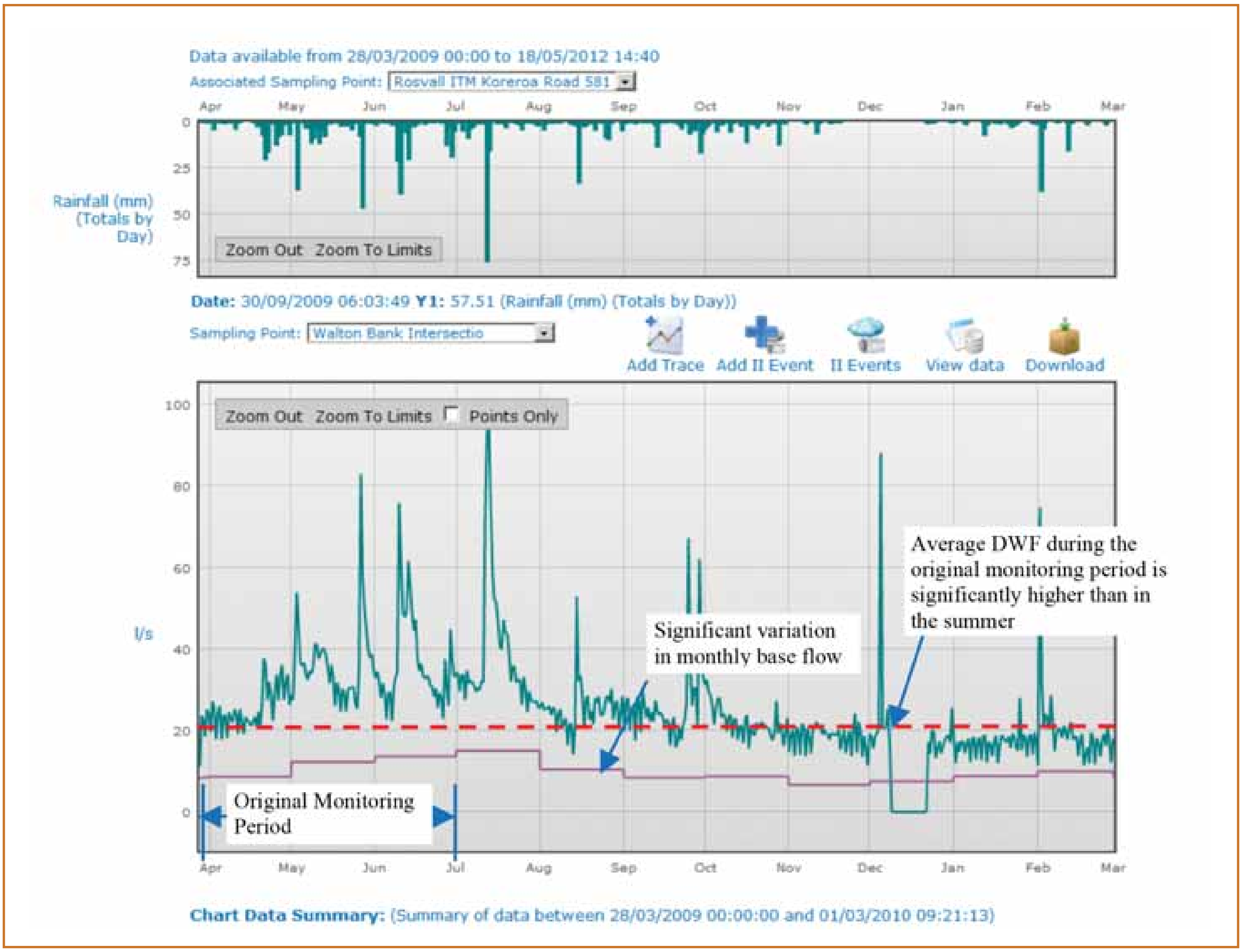
Figure 4 – Autumn Validation Event Monitor 10852

5. Model Re-Calibration

Following validation it was recommended that all long term monitors be re-calibrated for dry weather flow. The primary reason for suggesting dry weather re-calibration was that the dry weather volume prediction derived during the original calibration period was shown to be significantly higher than what was monitored in the subsequent months. As seen in Figure 5 the average dry weather flow during the original monitoring period is significantly higher than subsequent months. The average monthly base flow also varies significantly for this monitor from an average of 15.0 l/s in July 2010 to 5.5 l/s in November 2010. A similar phenomenon is seen for nearly all of the monitors throughout Whangarei.

> "For the most part the recent monitoring and subsequent re-calibration has shown an increase in ingress values. This is an interesting outcome because in general the re-calibrated model shows a significant reduction in predicted overflows across the catchment."

Figure 5 – Measured Flow over the Entire Monitoring Period for 10852



5.1 Dry Weather Flow Calibration

The model re-calibration consisted of redefining the dry weather volume predictions (l/person/day) and profiles for each of the long term monitors. The dry weather flow was split into monthly dry weather production and base flow. For each monitor the monthly dry weather flow production was different based on the average measured flow for that month across the 3 years. Varying the dry weather flow on a monthly basis significantly improved both dry and wet weather flow calibration for the long term monitors. Once the dry weather production was adjusted little wet weather adjustment was required to maintain calibration criteria.

5.2 Wet Weather Flow Calibration

Adjusting the dry weather to have varying monthly base flow and production rates generally resulted in the wet weather calibration of most monitors to fit within calibration criteria for a range of summer and winter events. However some compromise had to be made to fit the maximum number of calibration events. Some of the original 2009 calibration events were therefore not as good as previous results showed. This is a result of utilising three (3) years of monitoring data. For example: in the original calibration there was only a single dry weather production rate for each monitor based on a week in April 2009. With the long term monitoring we have utilised (3) Aprils which were averaged into a single average April production figure.

Therefore there is a unique dry weather production rate for each month we have monitoring data for. This makes any single calibration event more difficult but the overall average model calibration much better and enhances the models capability to simulate a multitude of seasonal events.

Although the previous calibration was of excellent standard it proved to be poor at simulating seasonal variation. The updated calibration was not as good for the 2009 winter period but it better simulates more events throughout the year. It is very difficult to have a good calibration match for every event, especially with large seasonal variations and long periods between events.

This re-calibration has also highlighted that simply calibrating a hydraulic model to three winter events will not necessarily represent other system states, and could under (or over) predict system performance. The following section discuses the changes in system performance between the original calibration and the updated model.

6. System Performance Comparison

The objectives of model system performance analysis is to quantify the capacity of the network at the present time and for future scenarios under both dry and wet weather conditions. For comparative purposes for this analysis we will examine two standard wet weather system performance criteria for monitor 10582 and overflow performance.

6.1 Rainfall Ingress (I/I)

- Rainfall ingress is typically expressed in two ways:
- Rainfall ingress (percentage) based on area
- % of I/I ingress = [I/I Volume] / A * Rn
- Rainfall ingress (L/m/mm) based on sewer length.
- leakage rate = [I/I Volume] / [Ls * Rn]

Rainfall ingress values for 10582 are shown in Table 2. These values were an average taken across several events throughout the long term monitoring period. For comparative purposes the original ingress estimates are also included in Table 2

For the most part the recent monitoring and subsequent re-calibration has shown an increase in ingress values. This is an interesting outcome because in general the re-calibrated model shows a significant reduction in predicted overflows across the catchment. The increase in ingress seen in the recent analysis is directly related to the decrease in the monthly dry weather flow production. The decrease in dry weather flow production, as discussed above, is a result of the longer gauging period and better monthly dry weather averages. Consequently for the same measured flow a smaller portion is attributed to dry weather and therefore a larger ingress estimate for each catchment has been calculated.

Table 2 – Ingress Metrics for 10852

I/I Metric	Value
Area (ha)	22.3
Approx Sewer Length (m)	3934
Original Calibration Average I/I (L/m/mm)	7.64
Recalibrated Average I/I (L/m/mm)	10.88
Original Calibration Average I/I %	13.5
Recalibrated Average I/I %	19.16
Recalibrated Max I/I (L/m/mm)	19.78
Recalibrated Max I/I %	34.84

6.2 Overflow Performance

The existing and future model was run with the same four (4) selected ARI events from the original monitoring to establish the frequency and volume of overflow from all overflow locations within the catchment. Table 3 below shows the predicted overflow results from the model. It is interesting to note the significant differences between the original (2009) model predictions and the current recalibrated model. As seen Table 3 in the overflow numbers are significantly lower in the latest model results, which are directly attributed to the significantly lowering the original dry weather flow production values and better calibrating the flow for the seasonal events.

Table 3 – System Wide Predicted Overflow Performance

ARI Flow Event	Original Calibration No. of Overflow Manholes (> $30m^3$)	Recalibrated No. of Overflow Manholes (> $30m^3$)
Existing 6 month	73	29
Existing 1 year	95	48
Existing 2 year	123	58
Existing 5 year	182	89
Future 6 month	96	44
Future 1 year	96	61
Future 2 year	151	74
Future 5 year	212	102

7. Conclusions

In a typical sewer master planning project it is common to undertake monitoring and hydraulic modelling to determine optimised strategies and capital works programmes. In most cases short term rainfall and flow monitoring (8–12 weeks) is used to give a snapshot of how a wastewater system performs during a single wet season. Although this generally provides a sound basis to build and calibrate a network model it can sometimes skew our sense of system performance and ultimately the preferred set of options.

In this paper we examined how long term monitoring significantly changed the model calibration and subsequently the resulting outlook on how the Whangarei system performed. The selected catchment is heavily influenced by groundwater conditions and highlights dramatic seasonal differences in dry weather base flow and consequently inflow and infiltration estimates. These seasonal flow differences were unseen with the short term flow monitoring effort and the above analysis highlights the risk of using only a short snapshot of monitoring data to project long term trends and develop long term options.

8. Acknowledgements

The author would like to acknowledge Andrew Carvell at the Whangarei District Council for allowing us to utilise the collected data and having the forward vision of the benefits of long term monitoring.

New Zealand Rainfall and Runoff

Mark Pennington – Tonkin & Taylor, Tauranga

Modern analysis for flood protection and stormwater system design frequently involves the use of hydrological and hydraulic models. Hydrological models are used to derive runoff time series in response to input design rainfall data, and these runoff time series are often used in hydraulic models for determination of flood-related effects.

Advances in modelling and complex analyses allow for more detailed output than was previously available. However, more detailed outputs demand more detailed inputs.

A key input parameter is design rainfall, and this is generally derived from frequency analysis of appropriate rainfall records. The results of such an analysis are generally given as depth-duration-frequency data. These depth-duration-frequency data are typically available throughout New Zealand by make use of NIWA's HIRDS, although in some places more locally-specific data may be more applicable.

Many hydrological assessment methods have been derived; these make use of rainfall as the input parameter and, by a wide variety of different approaches, result in runoff as the output. Many historical methods are aimed at estimation of peak discharge in response to a rainfall event of given probability of occurrence. Knowing peak discharge, hydraulic design of various pieces of infrastructure is made possible. However with the widespread use of hydraulic models for total storm simulation, peak discharge alone is insufficient as an input. The entire hydrograph is what is required, and it is in estimation of this that many hydrological methods are found wanting. Furthermore, published rainfall depth-duration-frequency data is insufficient, on its own, where a rainfall distribution with time (hyetograph) for design events is sometimes required to obtain the desired runoff time series (hydrograph).

"At another level the whole issue of event-based versus long-term simulation analysis has emerged in some contexts."

At another level the whole issue of event-based versus long-term simulation analysis has emerged in some contexts. Guidance documents have been produced for some specific areas in New Zealand (mainly larger centres), and these form the basis of hydrological and hydraulic analysis that is carried out. A worrying trend, which has been termed "regional drift", has emerged where methods developed for one particular area are being applied in other areas where no specific guidance exists, sometimes with erroneous results.

With the methods that have been developed for certain larger centres in New Zealand, there is little consistency in results across these methods even with the same input data. This presents significant uncertainty, particularly for those regions where no locally specific data exist.

In response to member requests, the Rivers Group and the Water New Zealand Modelling Special Interest Group have begun consultation with the industry on rainfall-runoff analyses. There has been widespread support for the initiative of collation of appropriate methods for use in New Zealand, with guidance on where and when each may be applicable. This would result in significant savings to the industry in

- Consent applications where analyses are undertaken using approved methods, saving the need for extensive justification of method employed and for peer review
- No need for development of separate guidelines across all regions – one set of guidelines could apply nationally
- Consistency in results across different methods would lend greater credibility to analyses, resulting in higher confidence in outputs

The initiative of development of a set of rainfall-runoff guidelines for New Zealand has been influenced by the knowledge that the Australian Rainfall and Runoff Guide (ARR), which is frequently referred to in New Zealand, is currently undergoing a comprehensive updating process with extensive research and development being undertaken. As this ARR document is in wide use around New Zealand, even without locally specific data being available, it is likely that a New Zealand-specific document of a similar nature would be even more widely used. The next version of ARR will comprise 39 Chapters over a total of nine books. Currently New Zealand has no national guideline on this topic.

There is a desire within the New Zealand technical community to see the development of a comprehensive guideline, similar to the updated ARR, for use nationally around New Zealand. This would be a significant undertaking, but would ultimately deliver value to practitioners nationwide.

The Rivers Group and Modelling Special Interest Group have made a start in setting up a group to steer the initial phase of investigation into development of a national guidance document. The steering group is currently made up of the following interested volunteers:

- Ian Garside – Beca, Water New Zealand Conference Technical Committee Chair
- Ian McComb – Hamilton City Council
- Mark Pennington – Tonkin & Taylor, Rivers Group Chair

"Many hydrological assessment methods have been derived; these make use of rainfall as the input parameter and, by a wide variety of different approaches, result in runoff as the output."

- Asaad Shamseldin – University of Auckland
- Helen Shaw – Golder

The group has developed terms of reference as follows:

- To co-ordinate and progress the development of a set of rainfall-runoff guidance documents with national relevance and applicability
- To interact and liaise with relevant stakeholders with regard to industry needs, and to ensure that the overall project is progressed in accordance with meeting these needs
- To co-ordinate funding opportunities for ongoing tasks
- To liaise with industry stakeholders to keep interested parties informed of progress
- To manage individual work packages on behalf of funding organisations to ensure on-time delivery of end products that meet the required quality standards

Contact with the group can be made through Mark Pennington – mpennington@tonkin.co.nz

The first stage of the project has Water New Zealand backing, and is aimed essentially at finding out what resources are currently available around New Zealand for rainfall-runoff assessment, and by doing this it is envisaged that gaps in available information will emerge. Comparison with the proposed updated Australian Rainfall and Runoff document will be made, together with reference to other international documents. In Figure 1 the update projects for the revised Australian Rainfall and Runoff project are shown. These have been grouped by subject, but retain the numbering system used for ARR for clarity. In New Zealand suitable guidance is currently available for many of these topics, and it is likely that no further development of guidance material is required. However, a collation exercise could be beneficial in that all material that is proved to be of value can be stored at some central repository and be available for use.

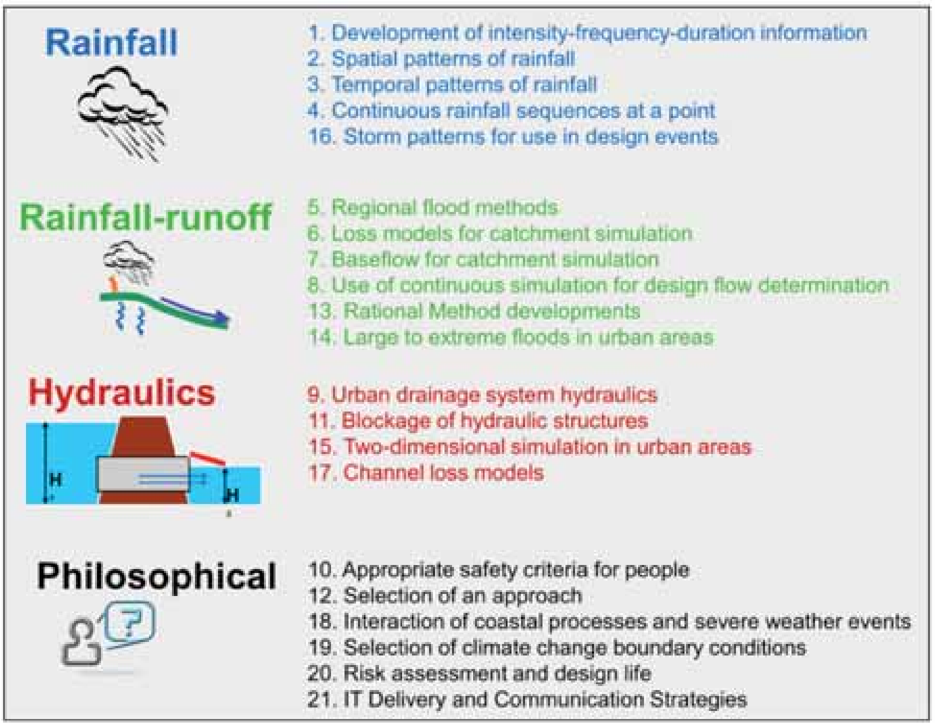
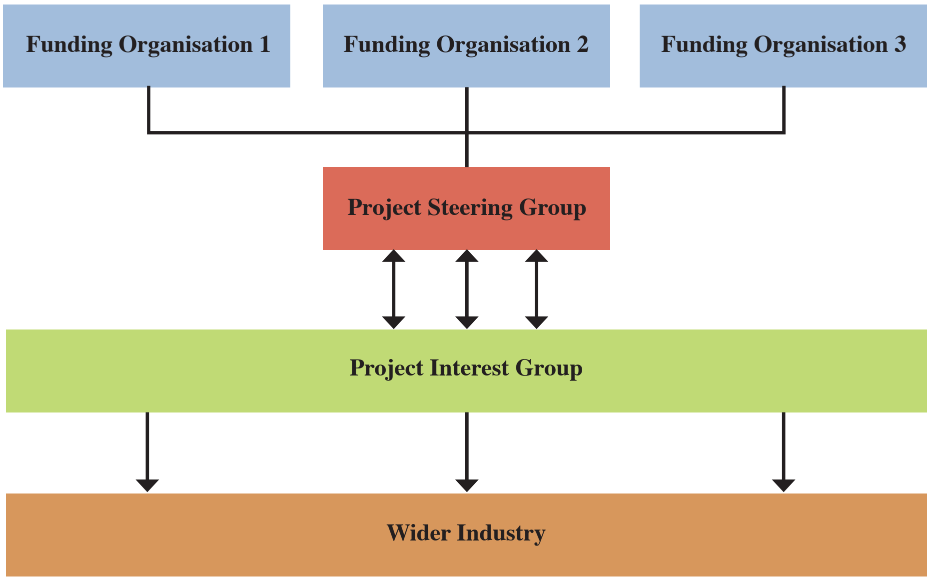


Figure 1 – ARR Update Projects

The steering group will present an update at the up-coming Water New Zealand Annual Conference, due to be held in Hamilton in October 2013. It is envisaged that an interest group will be established, which would be comprised of interested individuals who would be primary recipients of any material developed as part of the ongoing project. Thus the steering group will guide the overall process and then disseminate information to the interest group for comment. Ultimately, once material has been through the interest group, it is envisaged that it will be published for wider distribution. A proposed organisational diagram is shown in Figure 2.

Figure 2 – Organisational Diagram



"Advances in modelling and complex analyses allow for more detailed output than was previously available. However, more detailed outputs demand more detailed inputs."

Asset Optimisation Saves Operating Costs and Defers Capex

Rainer Hoffmann – Chief Process Engineer, Kevin McDonnell – Principal Mechanical Engineer, Charles Mellish – Principal Process Engineer, MWH Global and Marion Sheldon – Tauranga City Council

The following provides a taste of the presentation, "Tauranga Waste Water Treatment Plants – The 10 Year Journey of Asset Optimisation," which will be presented by Rainer Hoffmann, Chief Process Engineer, MWH Global at the Water New Zealand 2013 Conference. It presents the outcomes from a long period of participation in optimising the assets at both Chapel Street and Te Maunga Waste Water Treatment Plants to meet the projected wastewater treatment capacity for the city.

Introduction

The Tauranga City Council (TCC) owns and operates two wastewater treatment plants (WWTPs) namely Chapel Street and Te Maunga. The treated wastewater from the Chapel Street WWTP is pumped to the Te Maunga Wetlands and the treated wastewater from the Te Maunga WWTP gravitates through a separate oxidation pond and wetland in series. The outflow from the two wetland systems is combined upstream of the outfall pump station from where it is pumped via a pipeline and diffuser arrangement into the ocean.

In order to provide additional treatment capacity to meet projected population increases and improved treatment capability to meet new effluent discharge consent requirements, the Tauranga City Council (TCC) needed to implement a development programme for their two WWTPs, namely Chapel Street and Te Maunga.

> "The implementation works were staged to match increasing capacity demands and the coming into effect of new consent discharge conditions, to enable project implementation to fit within "live" plant operational constraints, to match funding availability, and to allow the progressive refinement of follow-on designs based on the commissioning outcomes from project packages which had been implemented at an earlier stage of the programme."

The following traverses the journey from inception to completion and highlights some of the challenges and smart solutions implemented to provide redundancy and treatment security, and defer capital investment by maximising the use and performance of existing assets at the two operational WWTPs.

MWH Global carried out feasibility studies and prepared Design Statements for development programmes at the two WWTP's and project managed and designed over twenty project work packages over a period of 13 years, to implement the agreed development programme. The implementation works were staged to match increasing capacity demands and the coming into effect of new consent discharge conditions, to enable project implementation to fit within "live" plant operational constraints, to match funding availability, and to allow the progressive refinement of follow-on designs based on the commissioning outcomes from project packages which had been implemented at an earlier stage of the programme.

The process optimisation studies and capacity investigations at both WWTPs clearly showed that major capital works can be shelved by following an optimisation route which maximises the use and performance of existing assets.

Chapel Street WWTP Optimisation

The over-riding objective for the design of the WWTP's development was to optimise the use and performance of the existing assets and achieve the required treatment outcomes at minimal capital and operating cost.

The optimisation strategy which was implemented considered the following key factors:

- Plant Item Effectiveness;
- System De-Bottlenecking;
- System Integration and Operational Security

The effectiveness of individual plant items was assessed against the required performance, reliability and other specified development outcomes. Options for improvement were considered, including modifications to the item itself or to its "support infrastructure" such as power supply or controls. An example was the 50 percent increase in treatment capacity of the Contact Stabilisation Tank (CST) at Chapel Street WWTP, as a result of upgraded diffusers and improved air distribution piping and aeration control. This improvement in effective treatment capacity within the existing process unit meant that the previously-planned construction of an additional CST was able to be shelved.

Opportunities to improve the overall effectiveness of connected system elements by removing the limitations or restrictions which existed between them were identified and assessed. These "bottlenecks" were often severely limiting the performance of the downstream elements.

Examples of "de-bottlenecking" which resulted in allowing the downstream elements to operate much more effectively include replacement of the flow distribution chamber and piping to the primary sedimentation tanks at Chapel Street WWTP, and provision of new larger influent piping to the oxidation ditch at Te Maunga WWTP. These improvements enabled the downstream process units to operate at their maximum performance levels and helped defer the construction of additional process units to handle the expected plant loads.

Options for improving the reliability and security of operation, and for maintaining operation in the event of process unit failure, were identified and evaluated so as to maximise the use of existing assets within each plant and between both plants. The objectives were to:

- Provide adequate operational redundancy;
- Reduce the risk of overall system outage and the potential for consent non-compliance; and
- Minimise the construction of major new standby process units (for example, bioreactors and clarifiers)

Examples of optimising the use of existing assets to provide adequate operational security include the investigative works on the Chapel Street CST (to reduce tank structural uncertainty to an acceptable level), provision of bypass system extensions at Chapel Street WWTP, and the addition of an emergency bypass connection between

> "The implementation works were staged to match increasing capacity demands and the coming into effect of new consent discharge conditions, to enable project implementation to fit within "live" plant operational constraints, to match funding availability, and to allow the progressive refinement of follow-on designs based on the commissioning outcomes from project packages which had been implemented at an earlier stage of the programme."

the Chapel Street effluent pipeline and the Te Maunga WWTP. These measures making integrated use of existing assets avoided significant investment in additional standby capacity.

The first stage of upgrade for Chapel Street WWTP was implemented in 2002 by replacing the existing coarse bubble aeration with fine bubble dissolved aeration (FBDA) system, including an advanced dissolved oxygen control system, and providing increased hydraulic capacity through the plant which resulted in power savings of about 20 percent. The optimisation study identified several opportunities to increase the existing treatment capacity of 16,300 m^3/d to 25,000 m^3/d in stages.

Additional upgrades were implemented from 2004 to 2012 to increase hydraulic and treatment capacity and reduce operating and maintenance costs which included:

- Increased raw sewage pumping capacity for peak flows
- Improved screenings capture of influent wastewater
- Reduced hydraulic restrictions between inlet works and primary sedimentation tanks
- Improved control of balancing tank operation
- Increased final effluent pumping capacity
- Installation of a new screenings facility
- Construction of a bypass system
- Installation of a new biogas cogeneration facility
- Installation of a new waste activated sludge thickening facility
- Installation of hydraulic mixing system in anaerobic digesters

The aerial view of the Chapel Street plant layout is provided below to demonstrate the restricted nature of the site and the proximity to commercial development on the adjoining predominantly eastern boundaries.

Figure 1 – Aerial view of the Chapel Street WWTP[1]

Figure 2 – New pipework to feed the primary settling tanks, and removing plant bottle-necks has increased hydraulic capacity

The By-Pass system at the Chapel Street WWTP provides the facility to by-pass peak wet weather flows in excess of 750 L/s and an extreme wet weather flow in the order of 1,000 L/s, whilst still meeting the conditions of the Resource Consent.

The Resource Consent allows, under extreme wet weather conditions, for secondary treated disinfected wastewater to be discharged directly to the harbour. This was achieved by diverting the peak wet weather flows from the Flow Balancing Tank past the CST and clarifiers, and connecting the Chapel Street Plant effluent using the rising main to the Te Maunga Wetlands.

This diversion ensures that only disinfected secondary treated wastewater is discharged into the harbour. The bypass control was programmed to divert flows at specific setpoints to protect secondary treatment processes under these conditions. The bypass strategy also allowed the CST to be taken out of service for maintenance without compromising the ocean outfall water quality.

Te Maunga WWTP Optimisation

The Te Maunga WWTP provides wastewater treatment for the domestic, commercial and industrial communities from the Mount Maunganui and Papamoa catchments. The industrial chemical oxygen demand (COD) load to the plant is about 13 percent of the total incoming load. Whilst the industrial component is not large, the composition and the variable nature of the trade wastes posed several operational issues and have historically been attributed to being the cause of the instability and variable performance of the treatment process. The main issue with the plant related to periodic loss of nitrification and poor settleability of the sludge due to high levels of filamentous bacteria in the biomass.

The original bioreactor consisted of a single oxidation ditch, configuration rated at 9,000m^3/d, with fine bubble aeration and slow speed vertical shaft mixers to maintain an internal recycle rate of 100 to 200 times average daily flow (ADF) to achieve nitrification and denitrification.

Although the existing reactor channel can be considered a plug type system, the high internal recycle resulted in a system that is completely mixed. Notwithstanding the geometry of the oxidation ditch (continuous channel without partitions) it was considered appropriate to provide partitions in the existing ditch so that the anoxic zones become separate reactors and also provide controlled internal recirculation for overall process stability.

The proposed modifications to the oxidation ditch had to consider the continued operation of the 'single train' oxidation ditch during the construction period to ensure that a good quality effluent was maintained. TCC allowed short term (a few hours) shut downs for tie-ins and other construction related works.

The first anoxic zone of the biological nutrient removal (BNR) process is now preceded by an unaerated selector (previously aerated) to increase the food to mass ratio to create environmental conditions that promote the growth of floc forming bacteria.

Figure 3 – Aerial view of the Te Maunga WWTP

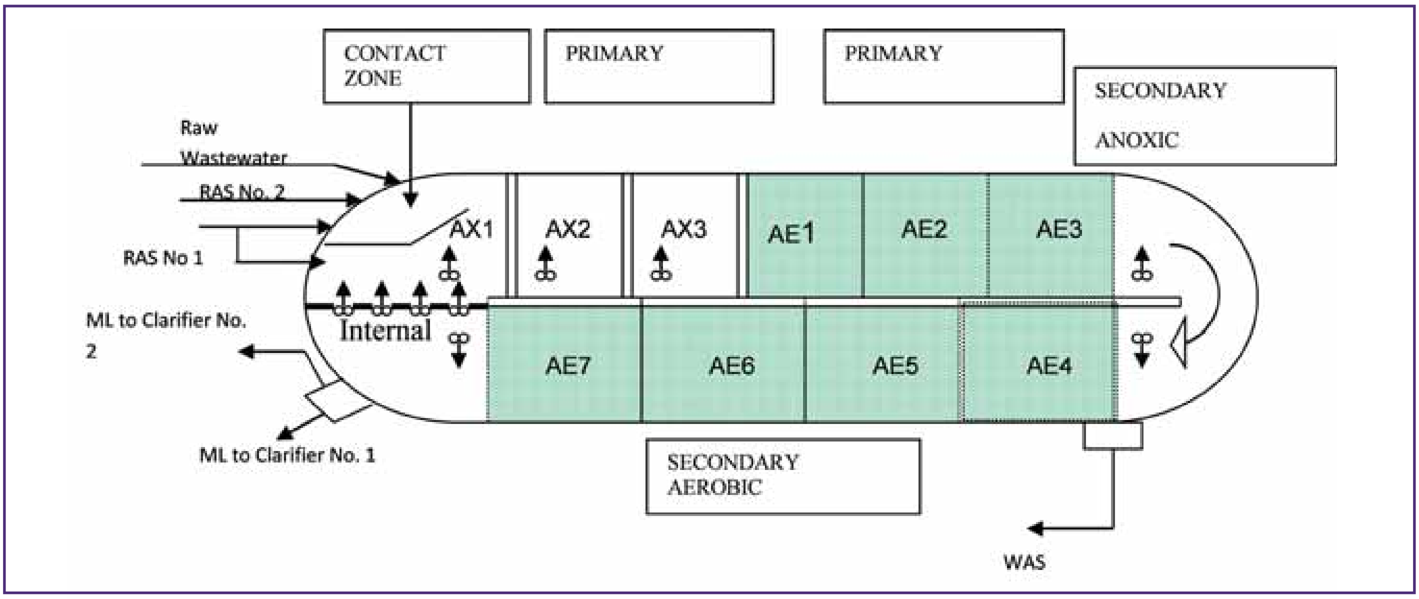


Figure 4 – Schematic layout of bioreactor

"The optimisation of the performance of the existing oxidation ditch meant that increased load could be treated without the significant cost of an additional process unit."

The advanced aeration control system was designed to control the amount of air to maintain a constant level of oxygen concentration in the seven aeration zones.

The aeration system consists of three control loops for control of blower air, dissolved oxygen and blower pressure. The return activated sludge (RAS) pumps are variable speed driven and the rate of return flow is set as a percentage (70 percent) of the incoming raw wastewater flow which is operator adjustable. The control system for the RAS pumps has also been provided with a minimum setpoint to ensure that settled mixed liquor from the clarifier is recycled at a specified rate under all incoming flow conditions.

The internal recycle pumps have been selected to provide a minimum internal recycle rate four times the average daily incoming flow. The selection of the number of pumps depends on the actual daily incoming flow.

The optimisation of the performance of the existing oxidation ditch meant that increased load could be treated without the significant cost of an additional process unit.

Chapel Street WWTP Operational Experience

The installation of the automatic aeration control system has achieved process stability and the dissolved oxygen (DO) concentration remains constant around the setpoint.

Significant energy savings have been achieved by controlling the amount of air according to the oxygen demand and maintaining a constant level of oxygen concentration in the contact zones.

The plant has been operating with the new diffuser and improved dissolved oxygen control system since October 2002 and the average power saving on the blower system is in the order of 48 kW/h. The overall site power usage has dropped by 10 percent and can be attributed largely to the more efficient aeration system. The power saving on the aeration system is about 30 percent.

The installation of the new screens equipment, which consisted of band screens with 5mm opening screen face, has made big changes to the plant operational activities:

- The pre-treatment tank was previously cleaned out monthly; this is now scheduled for six monthly cleaning
- The aerated grit pump clogged regularly; this hasn't required cleanout or inspection for the last six months
- Regular cleaning of screenings from the primary settling tanks is no longer required
- Reduction of rag accumulation in pumps in general and the anaerobic digesters has occurred, requiring less disruption to treatment processes and less labour inputs

The blowers were repaired and maintained a number of years ago and there has been no further problems experienced with the blower operation. The change from coarse to fine bubble diffused aeration improved aeration control a great deal, while the observed benefit was that the treated wastewater quality was much more consistent.

The treated wastewater pumped from Chapel Street WWTP is no longer disinfected with the UV disinfection system, as the effluent is pumped to the Te Maunga wetlands as shown in Figure 2. This results in a significant electrical power saving and annual lamp replacement cost. The 2005 annual power costs were about $44,000, with annual lamp maintenance costs of $58,000, amounting to an annual $102,000 total operating cost, or approximately $120,000 annual savings in present day terms.

The UV system is only operated when treated wastewater is likely to be discharged to the harbour. The change in flow path as a result of the final effluent pump upgrade together with the installation of the new by-pass pipe lines has allowed an improved and lower environmental impact on the harbour, while reducing the operating costs for disinfection of the order stated above.

The bypass system was tested up to 900L/s during the 23 July 2012 wet weather event and the setpoints checked and adjusted to suit the new bypass pipework arrangement. The bypass strategy has allowed the UV system to be shut down unless required during an extreme wet weather event (as discussed above). Only two events have initiated a discharge of treated wastewater to the harbour.

The co-generation of anaerobic digester methane using combined heat and power generation has realised a daily production of around 3,300kWH.This equates to 150kW of installed motor capacity which is about the same power requirement of the blowers. The cogen plant operates well using primary sludge with limited Thickened Waste Activated Sludge (TWAS). A portion of the TWAS is transported to the Te Maunga WWTP and treated with the raw wastewater in the bioreactor to avoid the operational control problems and ensure that power generation is maximised at the Chapel Street WWTP. In time, when funds are available, separate treatment of TWAS can be considered to further reduce the volatile solids in the anaerobic digesters to increase gas production.

Te Maunga WWTP Operational Experience

Since the upgrade, the performance of the plant has improved significantly in terms of nitrogen removal and settleability of the biomass.

The total nitrogen in the treated wastewater is consistently less than 10 mg/L and the settleability measured as SVI (sludge volume

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index) is less than 150ml/g, whereas prior to the upgrade the SVI was higher than 250ml/g.

The treatment plant capacity was previously limited by the clarifier capacity due to the poor settling biomass, but with the improved settleability and an additional clarifier, considerably more clarification capacity has been created. The biological treatment plant capacity has been doubled by the upgrade.

> "The UV system is only operated when treated wastewater is likely to be discharged to the harbour. The change in flow path as a result of the final effluent pump upgrade together with the installation of the new by-pass pipe lines has allowed an improved and lower environmental impact on the harbour, while reducing the operating costs for disinfection of the order stated above."

The additional diffusers and upgrading of the DO control system and new blowers with variable speed drive (VSD) control resulted in a reduction in daily airflow requirements, more stable and reliable operation and reduced maintenance and power consumption.

Te Maunga inlet works was also upgraded with fine screens with a similar improvement to the general plant operation. The plant is remotely operated from Chapel Street and with improved screenings capture rate, problems with clogging of the clarifier inlet well have been avoided and planned changes to the clarifier inlet well have been shelved. The Te Maunga WWTP has had no changes made to sludge wasting rates or aeration control for the last year and operates as an unmanned plant, providing a big reduction in labour input costs.

Integration of Both Plants

The additional benefit of the bypass strategy has been to allow the CST at Chapel Street WWTP to be isolated for planned maintenance and emergency events. In September 2012, the CST was prepared for maintenance and the primary settled wastewater was diverted to Te Maunga for full treatment. The CST was out of service for at least three weeks during the drain down, inspection and minor metalwork repair and strengthening that was required.

The plant performed as expected and Te Maunga WWTP operated at near upgraded design capacity levels, receiving 9,000 m^3/d of normal flows with an additional flow of 16,000m^3/d from Chapel Street. The organic load was about 90 percent of the upgraded Te Maunga WWTP design load and treated the water to the required consent quality without the need for additional oxygen. A temporary Vitox system was configured to be used under these conditions, but during this period the existing aeration system coped with the increased loads. If the load exceeds the plant capacity, then Vitox will add additional oxygen to achieve full treatment for a limited duration.

By employing the bypass upgrades, the consent conditions have not been breached during the extreme wet weather events or when a process unit has been taken off-line. This is a significant achievement with minimal investment in additional capital, but rather improved use of existing assets at both plants in a reconfigured fully integrated manner.

Conclusions

The successful plant optimisation upgrades at the Chapel Street and Te Maunga WWTPs demonstrate that there are opportunities at existing facilities to improve energy efficiency and optimise treatment and hydraulic capacities by maximising the use and performance of existing assets, thus reducing capital, operating and maintenance costs.

In summary the specific benefits achieved at the Chapel Street WWTP are:

- A 10 percent overall site power saving which equates to a 30 percent power saving on the aeration system
- Lower utilisation of blowers hence longer life expectancy of equipment
- Increased overall treatment capacity due to more efficient diffusers and automatic DO control
- Process stability and uninterrupted operation of the plant
- Increased hydraulic capacity by providing by-pass facilities
- Increased screenings capture
- Provision of treatment security
- Integration with Te Maunga WWTP
- Reduced labour and maintenance input

In summary the specific benefits achieved at the Te Maunga WWTP are:

- A 20 percent overall site power saving which equates to at least 30 percent power saving on the aeration system as reflected in lower airflow requirements
- Lower utilisation of blowers hence longer life expectancy
- Doubling the treatment capacity at significantly lower capital cost when compared to the construction of a second bioreactor and clarifier
- Improved effluent quality in terms of ammonia and nitrates with a total nitrogen concentration of less than 10 mg/L
- Improved settleability (SVI < 150 ml/g) of the biomass which creates additional settling capacity in the clarifiers which will match the bioreactor capacity and thus avoid the need for a third clarifier
- The commissioning of a second bioreactor has been deferred until 2019
- The provision of oxygen injection to increase treatment capacity
- Reduced labour and maintenance input

Acknowledgements

The assistance and support of the Tauranga District Council in providing data and plant information is gratefully acknowledged, in particular Marion Sheldon and Peter Gohns have been helpful in providing valuable feedback on operational improvements. ■

Footnote

[1]Aerial view courtesy of Google Maps

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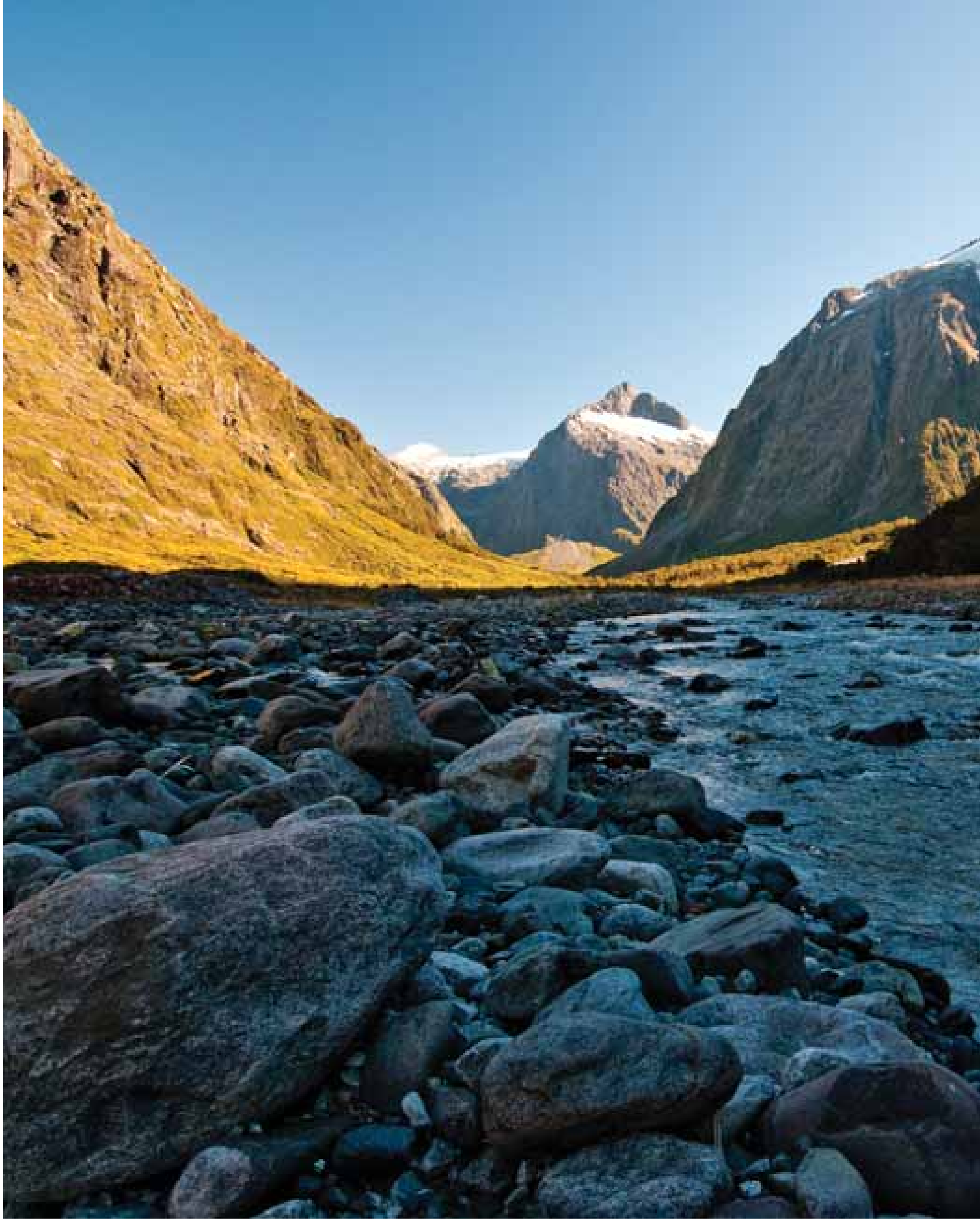
Water 20/20 – Bringing Smart Water Networks into Focus

Colin Walsby – Vice President, Strategic Solutions Development, Sensus



Executive Summary

Water is both challenging to manage and increasingly precious. Within the next decade, approximately 1.8 billion people worldwide will be living in areas of absolute water scarcity[1].

As a finite resource, access is at risk from a growing population and an increase in need that will continue to put pressure on infrastructure requirements, particularly in cities.

The water industry is aware of the issues it faces including environmental impacts, an aging infrastructure and increases in energy prices. Globally, utilities are spending nearly $184 billion each year related to the supply of clean water – $14 billion of which is spent on energy costs just to pump water around the current networks.

Water not only feeds bodies, it also feeds countries. Given the link between gross domestic product (GDP) and the availability of drinking water, this vital resource is both a source of life and livelihood.

The human, environmental and financial stakes couldn't be higher.

Smart Water Networks Provide the Right Opportunity Right Now

Smart technologies can be leveraged to help address these water challenges. Advancements in technology that deliver enhanced data make that possible today. To understand the business case for smart water networks, we conducted in-depth interviews and comprehensive surveys with 182 global water utilities and analysed utility operations and budgets. Our analysis found up to $12.5 billion in annual savings from a combination of the following:

- **Improved leakage and pressure management:** One-third of utilities around the globe report a loss of more than 40 percent of clean water due to leaks. Reducing leaks by 5 percent, coupled with up to a 10 percent reduction in pipe bursts, can save utilities up to $4.6 billion annually. By reducing the amount of water leaked, smart water networks can reduce the amount of money wasted on producing and/or purchasing water, consuming energy required to pump water and treating water for distribution. Intelligent solutions can make a difference. The use of different types of smart sensors to gather data and apply advanced analytics, such as pattern detection, could provide real-time information on the location of a leak in the network.
- **Strategic prioritisation and allocation of capital expenditures:** Employing dynamic asset management tools can result in a 15 percent savings on capital expenditures by strategically directing investment. Such tools can save up to $5.2 billion annually. To close the gap between the capital spending required and the amount of financing available, utilities need access to information to better understand the evolving status of their network assets, including pipes.
- **Streamlined network operations and maintenance:** By implementing smarter technology that provides the critical data, via remote operations, utilities can save up to $2.1 billion annually, or up to 20 percent savings in labor and vehicle efficiency and productivity. A smart water network solution can help streamline network operations and maintenance by automating tasks associated with routine maintenance and operation of the water distribution system.
- **Streamlined water quality monitoring:** Smart water networks can save up to $600 million annually, or 70 percent of quality monitoring costs, and far more in avoided catastrophe. A smart water network solution for water quality monitoring would enable utilities to automatically sample and test for water quality and intervene quickly to mitigate potential issues. By implementing such a system, utilities can incur lower costs from labor and equipment needed to gather samples, as well as a reduction in the amount and cost of chemicals used to ensure regulatory quality standards

The Right Players Must Take Action

Our research found key challenges to implementing smart water networks. However, those challenges are not insurmountable, provided the right players join forces.

- **Lack of a strong business case:** Sixty-five percent of survey respondents frequently cited unfavorable economics or the lack of a solid business case as key barriers to adoption of smart water networks. But it is important to understand the business case to use smart water technologies as an alternative to investing heavily in capital expenditures.
- **Lack of funding even if there is a business case:** Possible solutions to lower the barrier to entry include risk-sharing contracts to lower upfront investment required and third-party suppliers who manage and analyse the data.
- **Lack of political and regulatory support:** Utilities suggested that regulatory support at all levels – as well as incentives – would be critical to kick-starting smart water management, beginning in water-scarce areas where the need for water efficiency and conservation is greatest.
- **Lack of a clear, user-friendly integrated technology solution:** Fragmented product and services offerings from various vendors make it difficult for utilities to integrate a common business plan across their disparate operating divisions.

People and Technology Will Bring Smart Water Networks into Focus

Moving smart water networks past the barriers and taking it from promising experiment to widespread reality will require engagement across a diverse set of stakeholders including utilities and municipalities, regulators, investors, industry and utility associations, technology providers and academia. Collectively, these industry leaders can address the environmental and financial needs for smart water networks to revolutionise the water distribution infrastructure of the future.

Utilities can partner with technology providers to develop and refine solutions and establish benefits of smart water networks. They can also explore opportunities to learn more about the benefits of investing in holistic solutions to smart water networks.

Regulators can reward and incentivise improvements in operational efficiency. Simply diverting savings captured by utilities to other municipal operations or reducing tariffs and price increases leaves little incentive for utilities to seek additional productivity improvements. If water utilities have the capability to monitor water on a real-time basis, regulators could consider defining new standards which require more frequent reporting and testing.

Just as industry associations and individual industry leaders played a significant role in encouraging legislation needed to push adoption of electric smart grid solutions, the same approach should be taken for smart water solutions.

Now is the Time to Act

All of our findings on smart water networks point to a massive opportunity for utilities and could truly revolutionise water distribution networks around the world – many of which have remained largely static and untouched for decades.

The world can adopt smart water networks if we focus on partnering the right technologies with the right stakeholders.

Through innovative partnerships, the situation could be drastically improved; utilities and municipalities, regulators, investors, industry and utility associations, technology providers and academia have an opportunity to affect change.

Approximately two-thirds of the world's population, or 4.6 billion people, face water stressed conditions in the next decade[2]. With the human toll and the financial well-being of utilities at stake, the time to act is now.

> "The world can adopt smart water networks if we focus on partnering the right technologies with the right stakeholders.Through innovative partnerships, the situation could be drastically improved; utilities and municipalities, regulators, investors, industry and utility associations, technology providers and academia have an opportunity to affect change."

Introduction

Water scarcity and water quality are emerging as key issues of public concern and more pressing inhibitors of growth in cities and countries around the world. As a result, the market for safe, available water and for the infrastructure and technologies that treat and transport water is expected to continue to grow rapidly as stakeholders look for new solutions and approaches to integrated water resource management.

Smart water networks offer utilities a tremendous opportunity to improve productivity and efficiency while enhancing customer service.

Yet, despite the market's increasing size and significance, many utilities continue to struggle with forming a convincing business case to replace and upgrade aging and inefficient distribution networks. According to Growing Blue, a consortium of industry colleagues, scientists, academia and environmental professionals at leading NGOs, one-third of reporting countries lose more than 40 percent of the clean water pumped into the distribution system because of leaks before that water reaches end consumers[3].

However, the same utilities have been unable to obtain the financial resources or the political support to tackle these inefficiencies. Insufficient public and private financing for infrastructure improvements has long been recognised and continues to be constrained. Utilities are forced to seek creative sources of savings in order to

fund capital expenditures. Estimates show that the cost of repairing and expanding the potable water infrastructure in the United States alone will exceed $1.7 trillion in the next 40 years[4]. Yet, many regulatory policies fail to reward cost-conscious efforts to upgrade or better manage networks. In addition, water conservation efforts often result in lower utility revenues.

Around the world, consumers and regulatory bodies have been slow to demand and create the types of incentives for investment in infrastructure modernisation that helped drive development of the electric smart grid. A utility in Asia reported that "water scarcity and low water tariffs have starved our utility of revenue and so investments to improve infrastructure fall to lowest priority." Indeed, the top priority of water utilities is far more basic: to simply build and expand the infrastructure needed to supply surging populations with safe drinking water.

While many utilities have identified the need for smarter infrastructure and technological investments, few have embraced an end-to-end smart water network. Smart water networks offer utilities of all varieties a tremendous opportunity to improve productivity and efficiency while enhancing customer service. Smart water networks also have incredible potential to help alleviate the impending water scarcity.

This white paper outlines the potential benefits of smart water networks, such as increased efficiencies and productivity enhancements that smart water network technologies can unlock. It also presents the benefits of smart water networks to various industry stakeholders and identifies the path forward in achieving widespread adoption of smart water network solutions.

What is a Smart Water Network?

A smart water network is a fully integrated set of products, solutions and systems that enable water utilities to:

- Remotely and continuously monitor and diagnose problems, pre-emptively prioritise and manage maintenance issues, and remotely control and optimise all aspects of the water distribution network using data-driven insights
- Comply transparently and confidently with regulatory and policy requirements on water quality and conservation
- Provide water customers with the information and tools they need to make informed choices about their behaviors and water usage patterns

The following sections explain how smart water networks require people and technology to help utilities benefit from implementing these solutions at scale.

Financial Benefits of Smart Water Networks

As illustrated in figure 1, utilities worldwide spend nearly $100 billion on water-related operations and almost $90 billion on capital expenditures each year. Based on interviews with utilities, much of the spending is inefficiently allocated and savings opportunities are lost because utilities:

- Do not have access to sufficient information regarding leaks, status of pipes and water quality
- Do not have data and knowledge integration across multiple operating divisions
- Are not capable of analysing the information to drive decisions
- Lack sufficient access to automated technologies that could turn information analysis and decisions into network improvements in real time

Figure 1. Cost breakdown of global water utility expenditures by process step

Note: Operating expenditure forecast and water and wastewater capex forecast, derived from Global Water Intelligence, "Global Water Market 2011 – Meeting the World's Water and Wastewater Needs Until 2016," (March 2010), overview available at http://www.globalwaterintel.com/publications-guide/market-intelligence-reports/global-water-market-2011/

Globally, water utilities stand to realise significant savings from technologies and solutions designed to manage and monitor smart water networks. Our research shows that utilities can save between $7.1 and $12.5 billion each year from implementing smart water solutions that reduce operational inefficiencies and optimise capital expenditures. As illustrated in figure 2, more than 5 percent of current operating and capital budgets could be repurposed and reinvested in network upgrades or given back to water users in the form of lower rates and tariffs.

"Utilities can save between $7.1 and $12.5 billion each year by implementing smart water solutions."

Figure 2. Summary of global savings by smart water solution

Category	Savings as Percentage of Baseline Cost		Description
Leakage and Pressure Management	2.3 - 4.6	(3.5%)	Reduction in leakage levels by precise detection of leaks; predictive modeling to estimate potential future leaks and pressure managment
Strategic Capital Expenditure Prioritization	3.5 - 5.2	(12.5%)	Improved dynamic assessment, maintenance, replacement, planning and designing of network to optimize spending on infrastructure needs
Water Quality Monitoring	0.3 - 0.6	(0.4%)	Automatic water sampling, testing and quality monitoring; reduction in costs from labor and truck rolls for manual sample collection
Network Operations and Maintenance	1.0 - 2.1	(1.6%)	Real-time, automated valve/pump shutoff to facilitate flow redirection and shutoffs; more efficient and effective workflow planning
Total Smart Water Savings Opportunity	**7.1 - 12.5**	**(7.4%)**	

$U.S. billion

Figure 3. Biggest opportunities to improve the performance of utilities

	Levers	Base as a Percent of Total	Savings Opportunity	Potential Savings	Basis of Savings Opportunity [3]
Leakage and Pressure Mgmt.	Reduced waste of produced/ purchased water	Production costs = 41% of Water Opex	2 - 5 percentage point reduction in leakage	$1,400	Global Water Intelligence, "SWAN's way - in search of lost water," (June 2011) [A]
	Reduced waste of energy costs from pumping	Network pressurization = 5% of water Opex	2 - 5 percentage point reduction in leakage	$182	Global Water Intelligence, "SWAN's way - in search of lost water," (June 2011) [B]
	Reduced leakage detection costs	Leakage detection = 3% of water Opex	20 - 25 percentage point reduction in leakage	$584	D.C. Water case study, referenced in AWWA Webcast, "AMI Improves Customer Service and Operational Efficiency," (February 2012) [C]
	Fewer pipe bursts	Pipe repairs = 16% of water Opex	5-10% reduction of pipe bursts	$1,168	Malaysia case study, referenced in Global Water Intelligence, "SWAN's way - in search of lost water," (June 2011) [D]
	Reduced waste of chemicals from leakage	Chemical treatment [1] = 3% of Opex	2-5 percentage point reduction of leakage	$109	Global Water Intelligence, "SWAN's way - in search of lost water," (June 2011) [E]
Capital Allocation Optimization	Reduced pipe Capex	Pipe Capex = 40% of water Capex	10-15% savings on pipe Capex	$4,348	Alaskan water and wastewater utility case study, derived from interview with an industry expert
Water Quality Monitoring	Reduced costs from manual samples [2]	Sample collection = 1% of water Opex	30-70% savings on sample collection costs	$197	Estimate based on industry expert opinion
	Reduced chemical costs	Chemical treatment = 3% of water Opex	5-10% of savings on chemical costs	$234	Estimate based on opinion of a representative water utility's lab expert
Network Optimization and Maint.	Fewer O&M-related truck rolls	Network O&M costs = 8% of water Opex	10-20% savings on network O&M costs	$1,557	D.C. Water case study, referenced in AWWA Webcast, "AMI Improves Customer Service and Operational Efficiency," (February 2012) [F]

[1] Applies only to chemical treatment in water distribution network

[2] Excludes U.S.

[3] Savings opportunities represent conservative estimates derived from existing cases or expert opinion

References

[A, B, D, E] http://www.globalwaterintel.com/archive/ 12/6/market-profile/swans-way-search-lost-water.html

[C, F] http://www.acwa.com/events/awwa-webcast-ami-improves-customer-service-and-operational-efficiency

$U.S. million

Opportunities and Solutions

Consistent with the findings in the global water utility survey, leakage and pressure management, capital spending optimisation, streamlined water quality monitoring, and network operations and maintenance represent the biggest opportunities to improve utility performance.

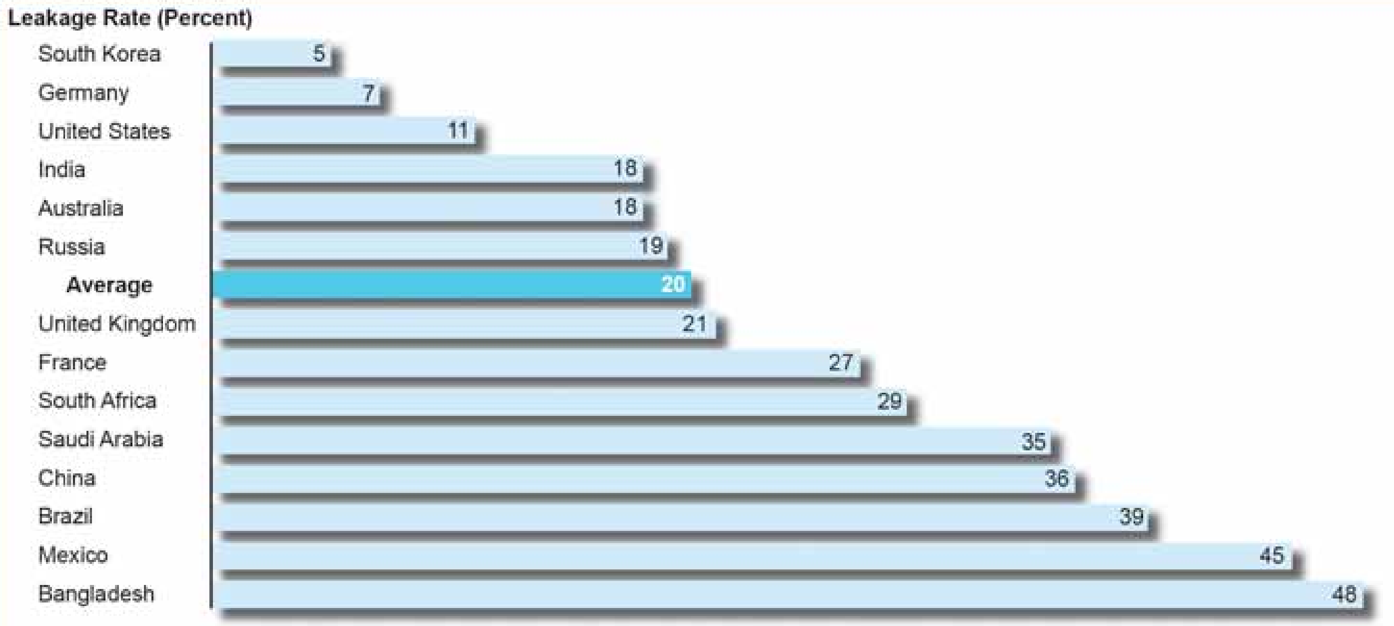
Improved Leakage and Pressure Management $2 billion to $4.6 billion in Savings

Opportunity

Water leakage in the distribution network is difficult to detect and is an important issue that will draw increased attention in the coming decades. Globally, one-third of all reporting countries face leakage levels of more than 40 percent of the clean water treated and pumped into the distribution system. Figure 4 outlines leakage rates by country.

Many utilities currently manage leakage and pressure primarily on an ad-hoc and reactive basis, responding to visible or obvious leaks and bursts and repairing infrastructure as needed. This approach is not only costly and time consuming, due to the mobilisation of large field forces to address problems after they occur, it is also extremely risky, with water losses going on for months potentially leading to flooding in houses and stopping traffic for days or weeks at a time. In addition, limits on the ability to monitor and control water pressure

Figure 4. Leakage rates by country



Source: GrowingBlue, "Water. Economics. Life." pp. 22-30, available at **http://growingblue.com/wp-content/uploads/2011/04/Growing-Blue.pdf.**
Average based on country-level leakage percentage estimates weighted by water opex spending by country.

"As demand for clean water increases in the coming decades and supply remains stagnant or shrinks, solutions to manage and minimise leaks will become increasingly critical."

in real time can lead to pipe bursts that cause major water losses and significant disruptions in service.[5]

As demand for clean water increases in the coming decades and supply remains stagnant or shrinks, solutions to manage and minimise leaks will become increasingly critical. As we have learned, many water utilities struggle to even measure and locate leaks in their distribution networks, let alone implement leak-reducing solutions. Most utilities have little or no visibility into the amount of water leaked in their networks. Only 40 percent of water utilities reported they have leak detection devices, according to our survey of global water utilities, though the need is recognised by all respondents. Surveyed utilities identified fixed-leak detection devices as their most desired technology.

Collectively, water utilities lose an estimated $9.6 billion on an annual basis because of leaked water. Of those losses:

- Nearly $8 billion is attributed to wasted operational expenditures on water production
- More than $1 billion of energy pumping costs are wasted
- More than $600 million of chemical costs are spent on lost water

In addition to the nearly $9.6 billion, approximately $2.5 billion is spent annually on leak detection efforts.

The economic drivers for these losses were identified by our water utility survey, during which utilities around the world consistently highlighted wasted energy costs, wasted water treatment costs and misdirected network repair and maintenance as the three most significant challenges for network leakage.

Solution

The desire for real-time data on leakage and pressure management emerged as a key finding from our global smart water survey. A real-time, accurate approach to leakage and pressure management can drive significant savings against the $10 billion of estimated losses.

Smart water networks can identify leaks early. This early detection reduces the amount of water that is wasted and saves utilities money that would otherwise be spent purchasing and treating additional water. By reducing the amount of water leaked, smart water networks can reduce the amount of money wasted on producing and/or purchasing water, consuming energy required to pump water and treating water for distribution.

These solutions include the use of flow sensors to gather data, analyse the data using algorithms to detect patterns that could reveal a leak in the network, and provide real-time data on the location of a leak. In addition, pressure sensors and pressure-regulating valves can allow for automated feedback and controls to ensure that pressure does not reach a level high enough to cause a pipe burst.

These technologies can provide additional savings by reducing the cost of leak detection and decreasing pipe repair costs by preventing pipe bursts. Many utilities recognise the benefits of improved leakage and pressure management, including a large utility in the UK: "Real-time data will allow us to take leak detection and response to the next level by allowing us to react quickly and eliminate reliance on customer alerts."

It is estimated that current technologies can reduce leakage by 2 to 5 percentage points globally. This underlying assumption was echoed in the global smart water survey, where approximately 68 percent of respondents indicated a desire to reduce leakage by 5 percent over current levels during the next five years.

As illustrated in figure 5, global operational expenditures related to water production, energy consumption and water treatment could be reduced by approximately $1.0 to nearly $2.5 billion. Including the reduction of leak detection and pipe repair costs, the total aggregate savings opportunity from leakage and pressure-related improvements ranges from $2.4 to $4.8 billion. The most significant challenges are illustrated in figure 6.

Figure 5. Savings from leakage and pressure management

Category	Baseline Cost	Savings Opportunity	Calculation	Potential Savings
Production	$40,000	2 - 5 percentage point reduction in leakage[1]	$40,000 x 2 - 5%	$800 - $2000
Network Pressurization	$5,000	2 - 5 percentage point reduction in leakage[1]	$5,000 x 2 - 5%	$100 - $250
Chemicals	$3,000	2 - 5 percentage point reduction in leakage[1]	$3,000 x 2 - 5%	$60 - $150
Leakage Detection	$3,000	20 - 25 percentage point reduction of all leakage detection costs[2]	$3,000 x 20 - 25%	$600 - $750
Repairs	$16,000	5 - 10 percentage reduction of pipe bursts[3]	$16,000 x 5 - 10%	$800 - $1000
			Total	**$2,360 - $4,750**

Reducing leakage by 5% can save $2.4 billion

Note: Values are rounded and thus may not match other values in this paper

1 Based on Global Water Intelligence, "SWAN's way - in search of lost water," (June 2011), available at http://www.globalwaterintel.com/archive/12/6/market-profile/swans-way-search-lost-water.html

2 Based on D.C. Water case study, referenced in AWWA Webcast, "AMI Improves Customer Service and Operational Efficiency," (February 2012), available at http://www.acwa.com/events/awwa-webcast-ami-improves-customer-service-and-operational-efficiency

3 Based on Malaysia case study, referenced in Global Water Intelligence, "SWAN's way - in search of lost water," (June 2011), available at http://www.globalwaterintel.com/archive/12/6/market-profile/swans-way-search-lost-water.html

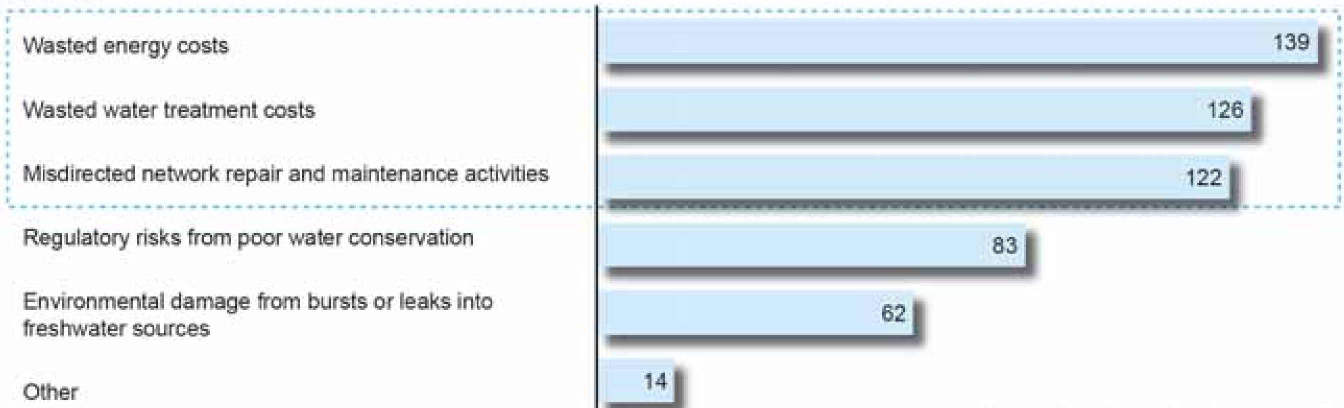
$U.S. million

Figure 6. Most significant challenges from leaked water

What are the most significant challenges to your business from leaked water?

Number of times selected as the first, second or third most important opportunity

Total N=182



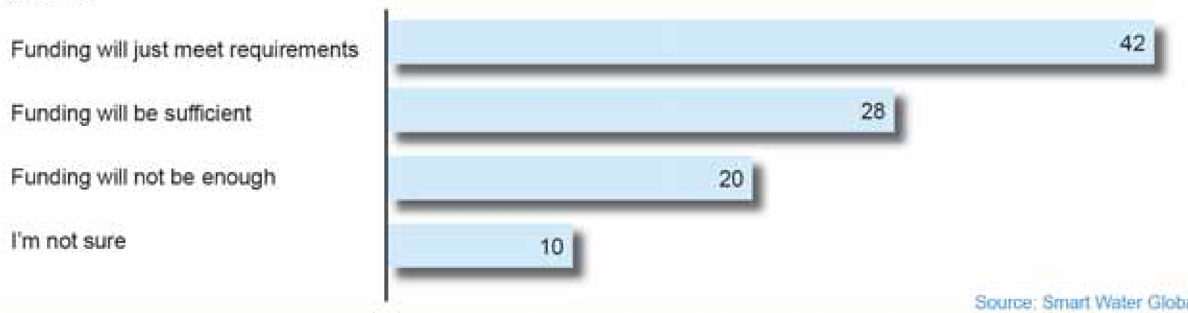
Source: Smart Water Global Survey, July 2012

Figure 7. Funding availability for capital infrastructure projects

How available is funding for capital infrastructure projects for your utility during the next 5 - 10 years?

Percent of respondents

Total N=182



Source: Smart Water Global Survey, July 2012

Strategic Prioritisation and Allocation of Capital: $3.5 billion to $5 billion in Savings

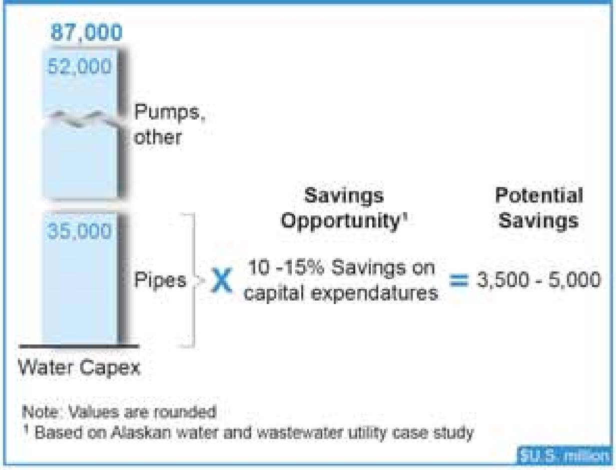
Opportunity

In addition to operational inefficiencies, utilities face deteriorating network assets and a lack of funding for maintaining and improving those assets. The American Water Works Association (AWWA) has estimated that the cost of repairing and expanding the potable water infrastructure in the United States alone will top $1 trillion in the next 25 years and $1.7 trillion in the next 40 years. In addition, a recent survey conducted by Black & Veatch shows that 34 percent of U.S. utilities surveyed believe that they will not have sufficient funding for their capital infrastructure projects.

On a global level, our smart water survey identified a similar gap, with only 28 percent of utilities indicating sufficient capital to meet their infrastructure needs during the next five to 10 years, and approximately 20 percent who believe they do not have sufficient funding. Figure 7 outlines availability of funding for capital infrastructure projects.

Our utility research shows that more than 50 percent of respondents reported funding constraints for capital infrastructure projects. Most utilities also lack the ability to anticipate network deterioration and, as a result, cannot strategically plan for necessary repairs and replacements. While many of them have embraced geographic information systems (GIS) in order to map maintenance work orders, they often lack the ability to prioritise and properly time maintenance to deploy capital expenditures more efficiently.

Figure 8. Savings from capex allocation optimization



To close the gap between the capital spending required and the amount of financing available, utilities need access to information to better understand the evolving status of pipes throughout the network. Improved understanding will allow utilities to avoid premature replacement and to identify problems that require replacement of equipment before catastrophic failures occur. Figure 8 shows that approximately $35 billion is spent on capital expenditures directed toward pipes in the water distribution network annually; this area represents a major spending driver for utilities.

"Utilities need access to information to better understand the evolving status of pipes throughout the network."

Solution

Utilities can optimise capital expenditures by leveraging data to identify the "right life" of assets, incorporating parameters such as criticality, age, material, soil condition and pressure and maintenance history to determine the appropriate risk profile of pipes in the network. Advanced modeling software can leverage that data to estimate the remaining life of assets, integrating with GIS and other mapping tools to help utilities prioritise maintenance activities and understand the potential risk and impact of asset failure. Interviews with utilities revealed great interest in the opportunity for improved capital allocation through smart water networks. "Collection of real-time flow and pressure data will enable easier pressure adjustment, inform pipe replacement and energy management," expressed a large German utility. A large Australian utility reiterated, "This information would be a huge help with capital investment decision making."

By leveraging its database of asset conditions and updated risk profiles, utilities can use predictive analytics for the most critical locations. This is far more cost effective than the current method of systematically – and perhaps unnecessarily – replacing miles of pipe and other assets. A prioritised approach also ensures that capital expenditures are optimised with minimal impact and disruption to communities and customers.

For example, recent efforts by a utility in Alaska illustrate the potential impact of smart water networks on capital-asset management. Using risk-based algorithms to prioritise network renewals, the utility has been able to save $30 million of $130 million over six years. As illustrated in figure 8, improved asset management could reduce capital expenditures on pipes in the water network by 10 to 15 percent and the use of such algorithms could result in global savings ranging from nearly $3.5 billion to more than $5 billion.

Streamlined Water Network Operations and Maintenance: $1 billion to $2 billion in Savings

Opportunity

Given the complexity of water distribution systems and the need to maintain water service to consumers at all times, routine utility operations and maintenance can be costly and time-consuming. Today, few water utilities can adjust and control distribution system operations remotely and in real time. Utility personnel often must shut off valves manually and perform other operations in the field, slowing repairs, installations and maintenance activities. In addition, inefficient allocation of human resources leads to higher numbers of repair crew truck deployments and higher costs to address various issues in the network. "We are in the stone age for our work orders management," reports a Belgian utility. It comes as no surprise that field operations and maintenance costs exceed $10 billion per year globally, representing a significant portion of utilities' operational expenditures.

Solution

A smart water network solution can help streamline network operations and maintenance by automating tasks associated with routine maintenance and operation of the water distribution system.

While supervisory control and data acquisition (SCADA) and other solutions used today allow water utilities to control and operate assets remotely in the distribution system, the level of control is limited and not enabled in real time. Many maintenance activities involve the use of labor-intensive, time-consuming

"A smart water network solution can help streamline network operations and maintenance by automating tasks associated with routine maintenance and operation of the water distribution system."

truck deployments to operate physical hardware.

A smart water network solution for streamlined operations and maintenance would extensively deploy automated and remote-controlled valves and pumps that can be used to quickly shut off flow and adjust pressure to facilitate maintenance, installation and asset replacement activities. Business intelligence and analytics software and robust dashboards can bolster transparency on key performance indicators in real time and can also integrate with SCADA systems to enable remote control of the distribution system.

A more robust distribution system with remote-controlled assets would help utilities save on labor costs, optimise maintenance needed and reduce disruptions to customers and communities from water shutoff. One case study in our survey demonstrates that through improved efficiency of field operations and maintenance, 10 percent to 20 percent savings on these costs could be achieved, saving utilities approximately $1 billion to $2 billion on an annual basis.

Figure 9. Savings from streamlined field operations and maintenance

Baseline Cost	Savings Opportunity	Calculation	Potential Savings
$10,000	10 - 20%	$10,000 x 10 - 20%	$1,000 - $2,000

Note: Values are rounded
1 Based on D.C. Water case study, referenced in AWWA Webcast, "AMI Improves Customer Service and Operational Efficiency," (February 2012), available at http://www.awwa.com/events/awwa-webcast-ami-improves-customer-service-and-operational-efficiency

$U.S. million

Streamlined Water Quality Monitoring: $300 million to $600 million in Savings

Opportunity

Ensuring that consumers receive clean water that meets stringent quality standards is another important concern for both water utilities and regulators. Many regulators are imposing higher water quality standards and focusing increasingly on managing security risks and vulnerabilities in the distribution system.

There is a greater need to conduct frequent and rigorous assessments to protect against threats to the water supply as a result of rapid population growth, urbanisation and the dangers of contamination and bioterrorism. "Measuring water quality in the network near hydrants has become increasingly important because it would allow us to identify any possible security breaches to the network," explained a large U.S. utility.

Aging and oversized water infrastructures have also emerged as a water quality concern. "We have Roman pipes that are oversized, and with lower water throughput due to conservation efforts, water is sitting longer and longer in the distribution system," explains a German utility. A large Brazilian utility expresses a similar concern, "With our extended distribution network and aging infrastructure, we need to better understand water quality in the pipes."

Need Versus Reality

Our global smart water survey revealed that 41 percent of utilities still rely entirely on manual collection of water quality samples, which can take several days, while only 16 percent rely exclusively on automated sampling. Despite this current lack of automated sampling, utilities expressed a strong desire for real-time data on water quality in the near future, demonstrating a large gap between need and reality. While more than 40 percent of utilities would like to have hourly or real-time data measurement for water quality, only 17 percent of them currently do.

Solution

Automated sampling will require near real-time water quality monitoring solutions, both to ensure the security of clean water supplies and to help utilities allocate scarce budget resources more efficiently and effectively. With annual costs related to ensuring water quality at approximately $3 billion and heightened regulatory pressure that could potentially increase costs, more than 50 percent of global survey respondents believe water quality regulations will become stricter in the next five years.

> "A smart water network solution for water quality monitoring would enable utilities to automatically sample and test for water quality and intervene quickly to mitigate potential threats. By implementing such a system, utilities can incur lower costs from labor and equipment needed to gather samples, as well as a reduction in the amount and cost of chemicals used to ensure regulatory quality standards."

A smart water network solution for water quality monitoring would enable utilities to automatically sample and test for water quality and intervene quickly to mitigate potential threats. By implementing such a system, utilities can incur lower costs from labor and equipment needed to gather samples, as well as a reduction in the amount and cost of chemicals used to ensure regulatory quality standards.

Furthermore, automated sampling throughout the network will broaden utilities' knowledge of how water quality changes as it travels through the network. "I'd like to measure chlorine levels in the network, and the placement of velocity probes throughout the network would be helpful to understand how hydraulics impact water quality," explained a large utility in the U.K. This knowledge can enable utilities to further optimise their water treatment and quality-testing processes.

A smart solution to water quality monitoring includes sensors for pH, biological indicators, chlorine and other chemicals as well as heavy metals along vulnerable network locations (e.g., hydrants).

Strategic placement of sensors along the network can be very effective in detecting contaminants or biological agents, since many of those agents would be preceded by a detectable dechlorinating agent or change in pH levels.

These sensors would transmit in real time to a centralised data hub, where analytic software would compare water quality against regulatory requirements and locate potential hazards. Analytics and pattern detection runs using historical data could help minimise false alarms. A water quality dashboard for utility operators can support automated and remote-controlled hardware in the distribution system to shut off water flow and contain hazards.

Sample collection typically makes up an estimated 20 percent of the average utility's water quality monitoring costs. Such costs, according to water experts surveyed, could be reduced 30 percent to 70 percent by moving from manual sampling to online monitoring; global annual costs could be reduced approximately $120 million to $270 million.

Having better knowledge of chemical levels in the network will enable utilities to moderate spending on substances such as chlorine, resulting in additional savings of $150 to $300 million. Thus, automated water quality sampling could save utilities approximately $270 to $570 million in aggregate as seen in figure 10.

Additional Benefits of Smart Water Networks Beyond Utilities

Smart water solutions will help regulators, lawmakers and municipalities:

- **Achieve greater transparency into water quality and network safety:** Regulators and municipalities want to increase safety, but they also want to reassure the public in an era of increasingly open government. Smart water networks help regulators quickly and immediately learn of quality issues and potential contaminants. In addition, sensors on the market today support regulatory efforts to impose higher water quality standards as well as manage security risks and vulnerabilities in the distribution system
- **Conserve water:** Reducing leaks and bursts, minimising the amount of water wasted and boosting operational efficiency will become increasingly critical regulatory priorities in light of looming concerns over water scarcity and rising prices
- **Deliver improved customer service:** Leading regulators are increasingly focused on measuring and tracking customer service experiences. Britain's Ofwat, for example, has recently changed its water regulatory requirements to emphasise customer service as a key performance indicator. Given increasing consumer engagement on water conservation and billing, Ofwat's focus is a likely indicator of a broader regulatory shift that will take place across markets in the coming years
- **Maintain price stability:** Water prices are increasing in many parts of the world due to scarcity, high demand and the cost of capital projects to modernise infrastructure. Smart water networks can help regulators and municipal governments slow such increases by reducing the amount of water wasted, improving utility efficiency and ensuring that capital expenditures are prioritised
- **Minimise community disruptions:** Water main bursts and other major system failures lead to disruptions in daily life – thousands of hours of lost productivity on top of the costs of repair. Better predictive analytics and real-time issue identification will reduce the number and severity of these disruptions

Smart water networks will help consumers:

- **Receive water with fewer disruptions:** By managing leaks and pressure continuously, water utilities are able to supply water to customers with fewer disruptions from service shutoff and traffic-disrupting water main bursts.
- **Pay for and manage water service easily and transparently:** A smart water network solution that includes smart meters enables e-billing and e-payment options and allows consumers to interact with utilities via web portals for service requests and billing inquiries. Smart metering also enables detection of consumer-level leaks and ensures that consumption is billed accurately and precisely
- **Manage water consumption more proactively to conserve water and pay less:** As water prices increase and scarcity constrains consumption, smart water networks that enable customers to view and manage their usage will become increasingly valuable

Required Technologies for Smart Water Networks

In order to achieve these goals effectively, smart water networks must draw from a wide spectrum of technologies. The good news is many of these technologies are available today. Others are in research and development. As outlined below and in figure 11, these can be viewed as components within five interconnected layers of functionality needed for a comprehensive smart water network solution.

- **Measurement and sensing devices**, such as smart water meters and other smart endpoints, are the physical hardware within the water distribution network that collect data on water flow, pressure, quality and other critical parameters. This foundational layer

Figure 10. Savings from water quality monitoring

Category	Baseline Cost	Savings Opportunity	Calculation	Potential Savings
Reduced costs from manual samples	$390[2]	30 - 70 percentage point reduction in sampling costs[1]	$390 x 30 - 70%	$120 - $270
Reduced chemical costs from better information about chemical levels	$3,000	5 - 10 percentage point reduction in chemical costs[1]	$3,000 x 5 - 10%	$150 - $300
			Total	$270 - $570

Note: Values are rounded
1 Excludes U.S.
2 Assumes sampling costs represent 20% of total water quality monitoring costs
3 Estimate based on industry expert opinion
4 Estimate based on opinion of a representative water utility's lab expert

$U.S. million

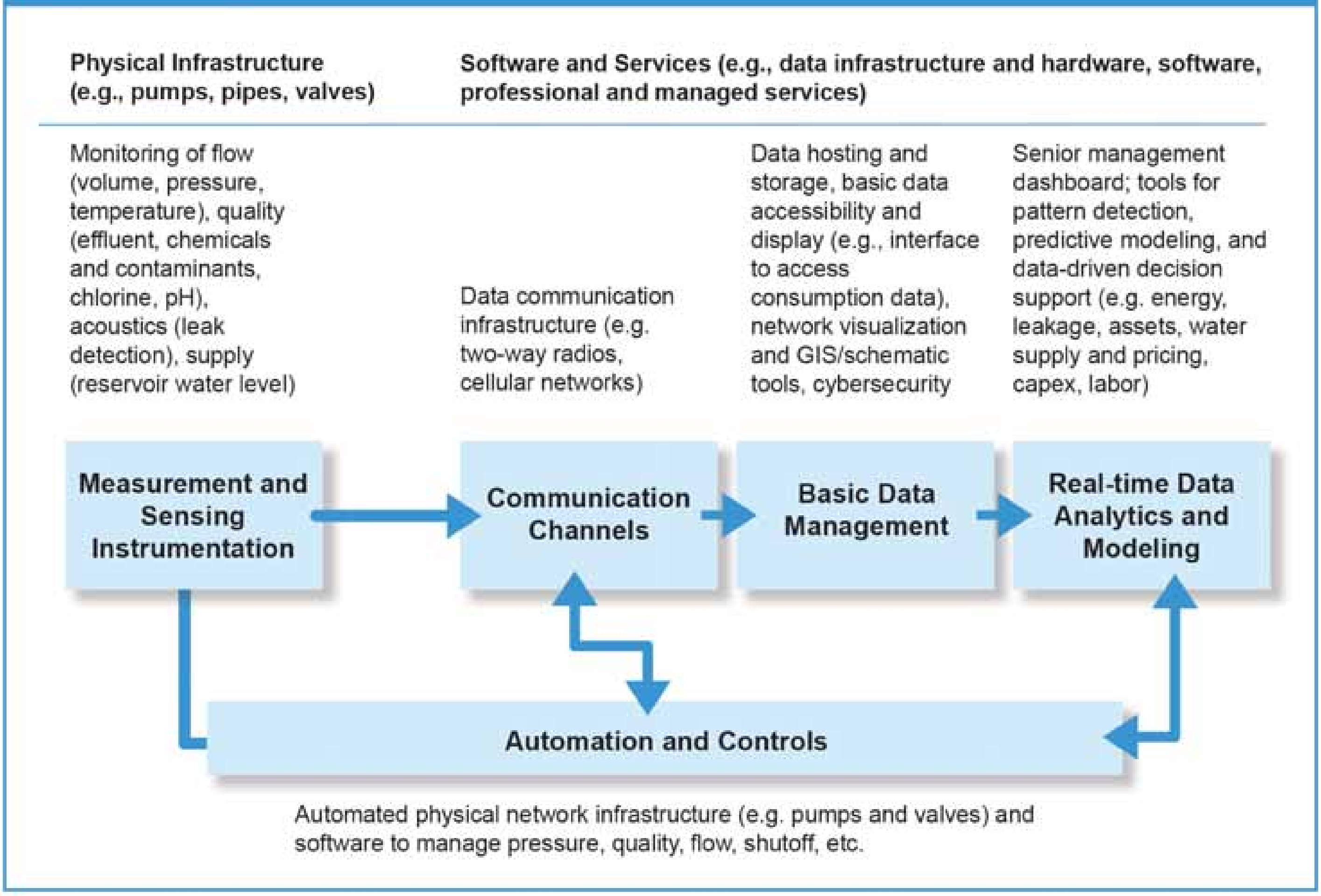
"The good news is many of these technologies are available today. Others are in research and development."

includes electromagnetic and acoustic sensors that can help detect potential leaks and abnormalities within the distribution system

- **Real-time communication channels** allow utilities to gather data from measurement and sensing devices automatically and continuosly. This layer features multiple communication channels that are used for two-way communications to instruct devices on what data to collect or which actions to execute (e.g., remote shutoff)
- **Basic data management software** enables utilities to process the collected data and present an aggregated view via basic network visualisation tools and GIS, simple dashboards or even spreadsheets and graphs. This layer can also include data warehousing and hosting, cybersecurity of computer systems and basic business function support tools (e.g., work order management and customer information systems)
- **Real-time data analytics and modeling software** enables utilities to derive actionable insights from network data. This layer serves as the central source of the economic value of smart water networks for utilities. Dynamic dashboards allow utility operators to monitor their distribution network in real time for hazards or anomalies. At the same time, network modeling tools can help operators understand the potential impact of changes in the network and analyse different responses and contingencies. Pattern detection algorithms can draw on historical data to help distinguish between false alerts and genuine concerns, and predictive analytics allows operators to consider likely future scenarios and respond proactively and effectively
- **Automation and control tools** enable water utilities to conduct network management tasks remotely and automatically. This layer provides tools that interface with the real-time data analytics and modeling software, leveraging communication channels and the physical measurement and sensing devices within the network. Many utilities have existing SCADA systems that can be integrated with smart water networks to further enhance their control over the distribution system

"To help drive adoption of these technologies and services across different markets and ensure maximum effectiveness and return on investment, smart water network solutions will likely need to be tailored according to economic and non-economic utility circumstances. Innumerable mindsets, incentives and interests shape the opportunity for different utility segments."

Figure 11. Five layers of comprehensive smart meter network solutions



Tailoring Smart Water Networks

To help drive adoption of these technologies and services across different markets and ensure maximum effectiveness and return on investment, smart water network solutions will likely need to be tailored according to economic and non-economic utility circumstances. Innumerable mindsets, incentives and interests shape the opportunity for different utility segments. Utility interviews and surveys provide insights into some of the likely factors under consideration.

Economic Considerations

Smart water solutions will need to be tailored according to economic factors such as utility size (i.e., population served), demographic and population shifts, and macroeconomic conditions. For example, interviews with utilities suggest that smaller utilities lack in-house IT capabilities and personnel. "We get overwhelmed with all the data we collect because we don't have anyone who can do anything with it," shared a small utility in the U.S. A large U.S. utility agreed, "I don't know if the economics make sense for small utilities if you don't address the fact that they don't have sufficient IT capacity and data analytics in-house." They went on to say, "Small utilities will have varying interest in smart water. It's less about size and more about level of existing technological sophistication."

As a result, some small utilities say they are likely to favor technology providers that offer "software-as-a-service" solutions or cloud-based network and software hosting. Larger utilities, in contrast, prefer to keep data and software on site when possible and only use a third-party supplier for insight generation for highly complex data analytics. Large utilities also benefit from economies of scale and larger budgets that enable them to invest in smart water network solutions, while smaller utilities may not be able to afford the large fixed costs of meters and other advanced sensor networks.

For this reason, a risk-sharing contract may be a preferred option for small-to mid-sized utilities, where they pay a smaller flat rate to a smart water network solutions provider and then share a portion of their additional revenue or saved costs with that provider. As illustrated in figure 12, survey findings reiterated that 20 percent of respondents from both large and small utilities are currently engaged in a risk-sharing contract, while an additional 40 percent said they would consider entering into one in the future.

Interviews also suggest that macroeconomic conditions could play a significant role, with utilities in some developing countries having an excess of funding available for infrastructure investment for a variety of reasons (e.g., access to EU Cohesion Fund grants), while many utilities in developed countries remain heavily budget constrained. This gives utilities in these developing nations a unique opportunity to "leapfrog" the challenges faced in many more established markets by investing in smart water network technologies.

Non-Economic Considerations

Non-economic factors affecting the design and deployment of smart water solutions include local topography, water scarcity levels and regulatory conditions. One Australian utility, for example, explained that it would want smart water networks to improve recovery/measurement of non-revenue water and it was less focused

Figure 12. Reasons for entering a risk-sharing contract

on opex-related costs because the utility serves a low topography region where very few areas need pumping. Since most of the distribution is done via gravity, in this case, smart water would be tailored for different terrains so that the business case would deprioritise costs related to wasted energy from pumping.

"Smart water solutions will need to be tailored according to economic factors such as utility size (i.e., population served), demographic and population shifts, and macroeconomic conditions. For example, interviews with utilities suggest that smaller utilities lack in-house IT capabilities and personnel."

As another example, in some highly water-scarce areas, utilities may rely heavily on technology for wastewater treatment and reuse, desalination or wholesale purchasing of water from other locations. In fact, 43 percent of all respondents in the survey indicated that they purchase water from a wholesaler. These factors may dramatically alter utility water economics and lead to different incentives and decision-making criteria.

Regulatory environments also differ significantly by geography. The U.S. Environmental Protection Agency, for example, has long focused on enforcing water quality standards (e.g., microbials or water treatment byproducts) while Britain's Ofwat has set price limits to aid consumers and threatened major utilities with fines for failing to meet mandated leakage reduction targets.

Europe's Water Framework Directive requires countries to pursue water charges that reflect their costs and heavily promotes water efficiency, which has spurred interest in metering from European regulators and governments. China has focused on drinking water standards and wastewater treatment.

In 2006, China's drinking water regulation was updated to the level of The European Union's drinking water standard, which has the most stringent standards in the world. Meeting these standards now requires a significant investment in Chinese water infrastructure, including upgrades to advanced water treatment technologies and rehabilitation of the water distribution network. Chinese regulators have also been improving wastewater treatment regulation in the past 10 years and mandated in 2010 that all new wastewater treatment plants must have sludge treatment capacity and existing plants must retrofit sludge treatment by the end of 2012.

Barrier to Adoption

Smart water networks have existed conceptually for years but have failed to gain traction among utilities, technology providers and other industry stakeholders. Some innovative companies have taken steps to integrate various solutions and offer an end-to-end smart water platform to utilities, but adoption of these solutions has been slow.

Based on utility interviews and surveys, smart water networks have not been widely adopted because of lack of consensus or of understanding about the business case, lack of funding, lack of political support and disparate product and solutions. Approximately 65 percent of respondents cited a business case that fails to be compelling as a 'significant' or 'very significant' barrier to adopting smart water networks, while 74 percent and 62 percent of respondents said even given a compelling business case, lack of funding and of political support, respectively, would be challenges to adoption. Figure 13 illustrates those barriers.

Lack of a Strong Business Case

Sixty-five percent of survey respondents frequently cited the unfavorable economics or the lack of a solid business case as key barriers to adoption of smart

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- The unique versatility of our fittings and saddles has put us on the world stage as a leading supplier in plastic piping system. Our far-reaching and application-led assortment of components includes, in addition to the modular electrofusion system, a comprehensive range of spigot end fittings, machines and tools.

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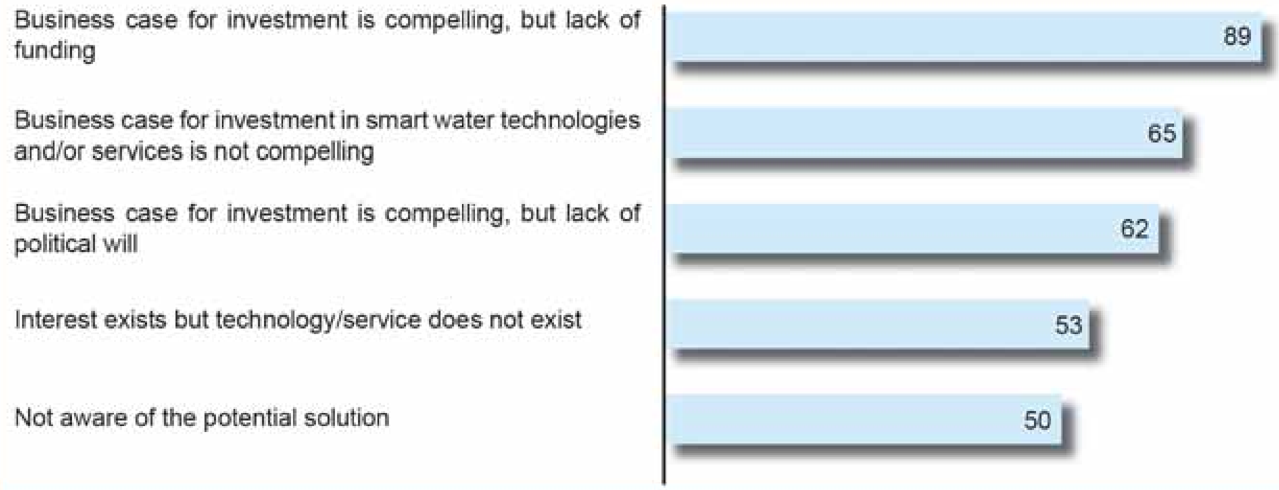
Or visit us: www.georgfischer.co.nz

Figure 13. Barriers to smart water network adoption

What are the major factors that prevent you from adopting these smart water technologies and/or services?

Percent of respondents who answered 'very significant' or 'significant'

Total N=182



water solutions. As illustrated in figure 14, of the 119 respondents who answered they weren't sure if there was a compelling base, 57 percent said the benefits were not high enough to justify the investment.

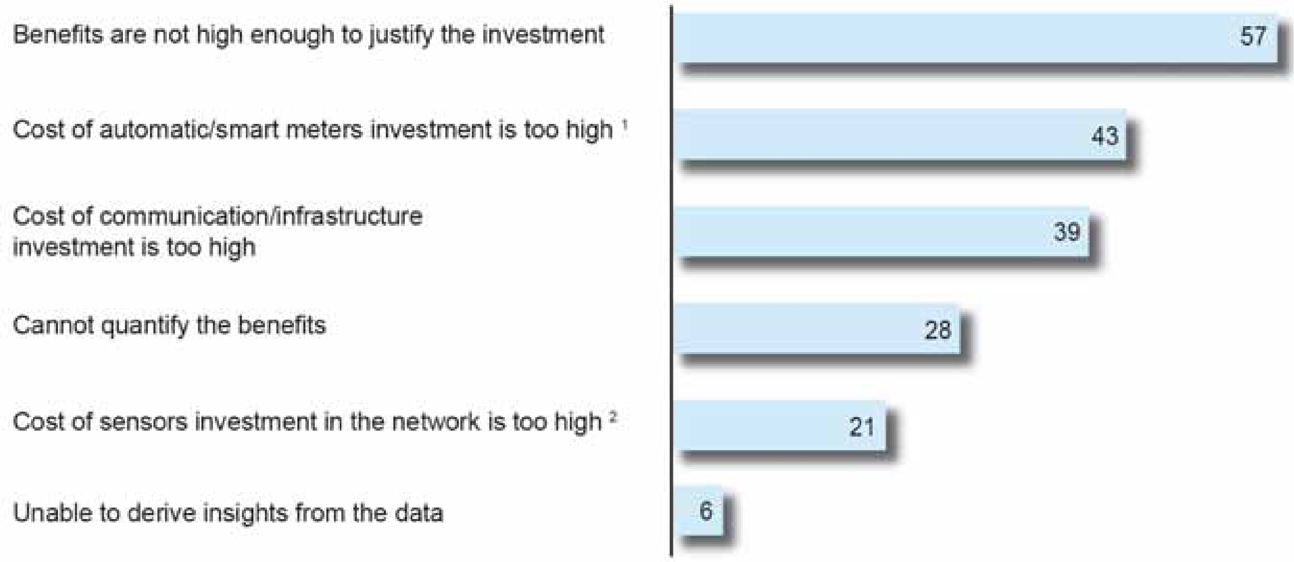
In addition, approximately 39 percent and 43 percent of respondents said the cost of communications infrastructure and automatic/smart meters, respectively, were prohibitively high. Indeed, during interviews, many utilities mentioned that the cost associated with enabling smart water network solutions – such as investments in sensors and hardware, IT infrastructure and software – was perceived to be very high and the value or return on investment would be difficult to quantify. "We make our decisions primarily around a three-year payback, avoidance of fines or ecological payments, better satisfying our customers and improving labor conditions," explained a Russian utility, "but the payback has to make sense." Similarly, a French utility explained, "We worry the cost of a

Figure 14. Why the business case may not be compelling

If you answered "significant" or "very significant" that the business case is not compelling, why?

Percent of respondents

Total N=119



1 E.g., Remotely collect data on water consumption at least 4 times per day
2 E.g., Pressure and flow sensors

Source: Smart Water Global Survey, July 2012

> "Internally, key decision makers need to be convinced of the potential for smart water network solutions. In particular, higher-level utility executives should be targeted for decision making."

communication infrastructure and support of other systems (e.g., advanced metering infrastructure) is too high."

The recurring cost of maintenance, support and services added another hurdle. "Offsetting costs against maintenance of this technology is key. Data quality is only as good as you maintain it," expressed a large utility in the U.K. Finally, some utilities suggested that it would be difficult for technology providers to make an accurate business case due to the existence of non-economic variables such as opportunity costs, conservation benefits and other "soft" considerations.

A small U.S. utility commented, "Smart water networks will need to have a very strong business case to gain traction." "We need a compelling business case to convince decision makers to move away from small operational investments over a long period of time," reiterated a large utility in the U.S. Without a compelling business case, there is little political appetite to eliminate jobs and increase automation in the distribution network via smart water network solutions, utilities said.

Lack of Funding Even if There is a Business Case

Lack of funding emerged as a key constraint, even if the business case is compelling. "It's too hard and expensive to buy all at once and manage lifecycle costs because vendors want to sell a 20-year investment all at once," explained a large utility in the U.S. Small utilities echoed the same message, but with even greater concerns around gaining access to financing and mobilising sufficient funds for an upfront investment. Possible solutions to lower the barrier to entry include risk-sharing contracts to lower upfront investment required and third-party suppliers who manage and analyse the data.

Lack of Political and Regulatory Support

Political support consistently emerged as a theme preventing the adoption of smart water networks, both internal to utilities and external through municipalities as well as regulators.

Internally, key decision makers need to be convinced of the potential for smart water network solutions. In particular, higher-level utility executives should be targeted for decision making. Forty-five percent and 54 percent of survey respondents identified the chief operating officers and chief executive officers of their water utilities as key decision makers on large investments.

Internally, it was also highlighted that a smart water network leader is needed within the organisation. "You need someone who is technology oriented and can champion the idea," expressed a Chinese utility.

Externally, political support of municipalities is needed, especially where utilities are publicly owned. "Once you have political support, you can do what you need to do, (e.g., invest) to pull it off in the

"Finally, there was a clear message from utilities that technological solutions need to be user-friendly, especially for small utilities that have limited IT staff and don't have the capacity to train multiple operators in data interpretation and analysis."

market," explained a large utility in the U.S. In many cases, this will involve engaging city councils to understand the big picture, as they often make the final decision on large investments. Approximately 40 percent of utility respondents identified their city councils and mayors as key stakeholders who need to be influenced and supportive of the decision.

Generating political support will involve overcoming the current lack of regulatory support for smart water networks, as survey respondents identified regulators as either key decision makers or influencers (25 and 36 percent of respondents, respectively). Utilities suggested that regulatory support at the state and federal level – as well as incentives – would be critical to kick-starting smart water management, beginning in water-scarce areas where the need for water efficiency and conservation was greatest.

In the U.S., utilities noted that on the whole, existing regulations lacked "teeth" for reporting and compliance, providing little impetus to switch to new smarter approaches. Water utilities drew parallels with the Energy Act of 2005, which they said was essential in driving development of the electrical smart grid in the U.S, and suggested that a similar approach would be needed to foster adoption in the water market.

In the United Kingdom, where environmental rules accelerated smart metering, the latest stipulations by the Department of Energy and Climate Change (DECC) are spelling out an aggressive technology approach that will push shareholders to fund smart metering via distribution utilities. The European Union broadly has a mandate to reach full smart electric metering by 2020.

Lack of a Clear, User-friendly Integrated Technology Solution

Interviews with utilities also revealed concerns regarding perceived deficiencies in smart water technologies on the market. They emphasised in particular the lack of a quality, integrated solution. Proprietary vendor solutions were difficult to integrate, utilities said, and different vendors had different strengths in their offerings. The lack of international open standards for devices posed an additional challenge. "Systems don't mix. We have a data warehouse with encryption and had to create a workaround to integrate/de-encrypt with another system. We need international standards," said a U.S. utility.

Finally, there was a clear message from utilities that technological solutions need to be user-friendly, especially for small utilities that have limited IT staff and don't have the capacity to train multiple operators in data interpretation and analysis.

The Path Forward

Smart water networks will begin to take hold when the potential value for utilities becomes abundantly clear and the ability to capture that value is made easier. This white paper aims to bring to light the various barriers and opportunities that exist to help utilities around the world make smart water decisions based on a rigorous, analytically sound approach.

This shared understanding, while necessary, is not sufficient to drive widespread adoption of smart water networks. Only with a concerted effort from all major stakeholders can we truly redefine the water industry as it stands today and overcome the looming challenges posed by water scarcity and water quality. Below, we provide some initial thoughts on ways in which industry stakeholders can help catalyse adoption of smart water networks.

Utilities and Municipalities

- **Help technology providers pilot solutions and establish benefits of smart water networks.** Utilities, while rightfully wary of change and concerned about return on investment, should recognise the potential for tremendous value from smart water networks and take measured risks. At a minimum, utilities can aid technology providers by sharing data and reaching out to technology providers to help innovators understand utility needs and mindsets
- **Explore opportunities to learn more about the benefits of investing in holistic solutions to smart water networks.** Utilities need to actively learn about smart water networks and how end-to-end solutions can holistically support improvement in key areas of their utility's performance. As part of this assessment, they should explore to what extent an investment in smart water network solutions could impact their budget for traditional capital spending on infrastructure improvement as well as their budget for operations and maintenance
- **Identify an internal smart water network champion.** Identify an existing senior manager or hire a champion who is excited by new technologies, seeks opportunities to introduce innovative technologies or services and is willing to explore the business case for smart water networks and champion discussions on the topic with key decision makers within the utility

Regulators

- **Reward and incentivise improvements in operational efficiency.** Simply diverting savings captured by utilities to other municipal operations or reducing tariffs and price increases leaves little incentive for utilities to seek additional productivity improvements. In countries such as Ireland where regulators decide on tariffs and validate utility investment decisions, potential new investments and adoption of smart technologies should be approached with an open mind. In areas of high water scarcity, regulators should prioritise favorable economic conditions and reward utilities that conserve water by implementing smart water network solutions
- **Leverage smart water technologies to achieve higher water quality standards.** Regulators have an obligation to ensure the establishment and maintenance of water utility services and to ensure that such services are provided to deliver water quality at rates and conditions that are fair, reasonable and nondiscriminatory for all consumers. If water utilities have the capability to monitor water quality on a real-time basis, regulators could consider defining new standards which require more frequent reporting and testing

Investors

- **Apply a results-driven investment approach to technologies across the industry.** To achieve maximum impact,

smart water networks will require innovative approaches and solutions in all aspects of the value chain, from ubiquitous, battery-powered measurement and sensing devices to software with pattern detection and predictive analytic capabilities. Investors should approach technologies across the entire spectrum with an open mind, funding the most innovative and promising solutions but closely monitoring impact and financial success

- **Offer financial products, such as long-term, low-interest loans.** Financial support can be funded by payback from technology investments that enable utilities to realise up-front savings from major technology installation investments

Industry and Utility Associations

- **Promote innovative solutions and publicly champion smart water networks.** Since the market for smart water network solutions is still in its infancy, industry associations will play a critical role in encouraging utilities, regulators and technology providers to coalesce around a shared vision for smart water networks and their potential benefits for all parties. Indeed, industry associations and individual industry leaders played a significant role in encouraging the legislation needed to push adoption of electric smart grid solutions, and the same approach should be taken for smart water solutions. Industry associations can reiterate the value of smart water network solutions to utilities and regulators by serving as a powerful outlet for promoting the business case for smart water technology and sharing successful case studies and results. They can also reiterate the value that smart water networks deliver to consumers by creating fewer and shorter service interruptions, advancing water quality and improving the availability and transparency of information that consumers need to manage their water consumption and associated costs
- **Facilitate communication, idea sharing and partnerships between various stakeholders (e.g., technology providers, universities, investors, utilities).** Successful smart water networks will require capabilities drawn from a currently fragmented landscape of technology providers, and industry associations will play a critical role in driving collaboration. Some consortia have made positive strides in defining smart water networks and in bringing technology players and utilities together. These consortia can expand their impact through a more significant effort to educate regulators and utilities

Technology Providers

- **Continue developing concrete, marketable smart water network products and solutions.** Working closely with utilities in research and development and pilot phases will be critical for success, as will collaborative efforts to influence regulators and other key stakeholders
- **Collaborate to develop and adopt open standards and ensure interoperability of different hardware and software offerings.** Such standards will be critical to driving smart water network adoption since many utilities remain wary of entering into long, costly contracts with individual technology and service providers. Interoperability also ensures backup providers and provides peace of mind that comes from guaranteed continuity of service

- **Broaden awareness of smart water network technologies and solutions among regulators and the general public.** Industry players in the market today are heavily fragmented and lack established channels for communication and idea sharing. Successful smart water network solutions will require end-to-end capabilities that few players in the industry can provide independently today. Technology providers should foster a collaborative "smart water ecosystem" that begins with advocacy and lobbying work with regulators to increase awareness around the opportunities for smart water networks and encourage regulatory changes that could stimulate adoption. For the general public, technology providers should conduct public outreach to bolster awareness for smart water networks, leveraging the widespread use of electric smart meters and increased conservation efforts. Consumer engagement and awareness of the need for conservation has increased significantly in certain geographies. In Belgium, for example, wastewater reuse and conservation strategies are prevalent among consumers. Simply providing consumers with water usage data helps drive increased conservation and improves public awareness of water challenges. Technology providers can also help consumers understand how concepts in electric smart meters (e.g., their ability to help consumers manage consumption and simplify billing) apply to the water industry as well.

Academia

- **Foster awareness and understanding of water economics, challenges and innovative solutions including smart water.** Like industry and customer associations, academia can serve as a powerful forum to facilitate rigorous conversation, encourage partnerships and collaboration and validate business cases
- **Fund smart water research.** University research could serve as a launching pad for innovative smart water technologies, on both hardware and software. Some universities are increasingly paying back the costs of their research by monetising patents. Universities can also invest in educating the next generation of smart water network engineers, managers and leaders

Conclusion

Smart water networks represent a tremendous opportunity for water utilities to realise significant financial savings, address global concerns on water safety and quality, and position themselves for an increasingly resource-constrained future. The time is right for utilities to seize this opportunity, but that success will require the collective effort and collaboration of stakeholders across the water industry.

In this paper, we have drawn on market analyses and a range of utility interviews and survey insights to craft a vision for smart water network solutions and their potential benefits for utilities and their stakeholders. While smart water networks will continue to evolve as industry players innovate and utilities discover new needs and challenges, many of the technologies critical to building smart water networks are in development or already on the market today. Utilities will need to consider carefully which solutions to implement and work closely with technology providers to create the right set of tools.

The future of smart water networks will rely on the partnership between people and technology to address one of our most precious resources: water. The vision of safe, clean drinking water for all is one that smart water networks can help us keep in focus.

Survey Methodology

A team of experienced consultants was commissioned by Sensus to conduct a survey of utilities in more than a dozen countries around the world. As a first step, a number of screening questions were posed to more than 1,000 utility executives to ensure they had sufficient information and perspective to answer questions that would be representative of utility views. The survey included a mix of multiple choice and open-ended questions. Results included 182 completed surveys from around the world and from various size water utilities.

Interviews of utilities – The consultants then conducted blind interviews (i.e., no mention of Sensus) of more than 20 utilities around the world. These interviews covered questions about the financial and operational challenges facing utilities, existing utility activities in smart water systems monitoring and optimisation, data analysis, decision-making and controls, implementing these measures and about the projected return on investment. Finally, the questions addressed barriers to implementation of smart water networks. All interviews were conducted for 60 minutes, via telephone with an experienced consultant.

Industry analysis – Industry financial statements were analysed. Conclusions were formed based on the shared experiences with hundreds of utilities around the world analysing the operations of utilities and determining the size of the opportunity to improve different financial and operational metrics. Industry experts were interviewed to derive and test assumptions in the models. The global utility market size data was analysed based on operating and capital expenditures. The numerical ranges used in this paper are due to different assumptions about smart water network adoption.

> "Industry associations can reiterate the value of smart water network solutions to utilities and regulators by serving as a powerful outlet for promoting the business case for smart water technology and sharing successful case studies and results."

Overview of technologies – In-depth research was conducted into the technologies of several dozen smart water technology companies. This included a review of reference case materials, available product demonstrations and patents and interviews with utilities that utilise products from smart water technology companies. The research also included interviews with smart water companies via telephone and at industry trade shows. ■

For more informaton go to www.sensus.com

Footnotes

[1]www.un.org/waterforlifedecade/scarcity.shtml

[2]www.un.org/waterforlifedecade/scarcity.shtml

[3]http://growingblue.com/wp-content/uploads/2011/04/Growing-Blue.pdf

[4]American Water Works Association (AWWA) report: "Buried No Longer: Confronting America's Water Infrastructure Challenge"

China Thinks Long-Term as More Landia Pumps and Mixers Head to the Magic City of Guilin

Guilin, the pearl of China's emerging tourist industry, has chosen Landia's flowmakers, mixers and recirculation pumps for two new Wastewater Treatment Plants that are being built in the city famed for its magical land formations.

The order, for a total of 78 Landia Flowmakers, Mixers and Recirculation Pumps was based on the ultra-reliability and performance of 20 Landia Flowmakers that have served Guilin since 1995.

"We are immensely proud of this important new order," said Landia's Export Sales Director, Thorkild Maagaard. "It demonstrates that forward-thinking customers recognize and appreciate the operational and financial benefits that can be gained from investing in top quality equipment. For product longevity and reliability, Landia's reputation in China and the Far East goes from strength to strength".

Landia's proven POPL-I flowmakers will be installed in the Aeration, Anoxic and Anaerobic Zones at Guilin, where their low rotations provide unrivalled flexibility for wastewater treatment. POP-I Mixers from Landia, which are designed for harsh conditions, will also agitate, homogenize and keep solids in suspension.

Meanwhile, Landia's AXP-I Pumps, which recirculate large volumes of water at low head but without creating excessive energy bills, will recirculate activated sludge from the Aeration Zone into the Anoxic Zone at Guilin.

This latest export order for Landia follows its recent contract with Triveni Engineering & Industries Limited to supply 18 BioMover mixers for an advanced water treatment plant in Agra, India. ■

Guilin, China – an increasingly important tourist destination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Kawakawa Beach – closed for business

Environmentally Friendly Sewage Reticulation Systems Gaining Ground in New Zealand

When Christchurch City Council engineers started evaluating the sewer networks after the earthquakes of 2010/2011, it became obvious that a large majority of the networks were irreparable and would need to be replaced.

Historically New Zealand has relied on deep gravity sewerage networks combined with large pump stations. Based on the time and cost to repair these pipes however, Christchurch quickly realised they would need to look at replacing a lot these networks with shallow, robust systems that would be quick and easy to maintain in the event of future earthquakes.

Vacuum sewage technology has been widely used in environmentally sensitive areas around the world for the last 40 years and this is one of the key technologies that Christchurch engineers have used to help them get the city's sewer networks functioning again.

Using fast moving air instead of traditional water pumps to transport sewage to the treatment plant, a vacuum system requires electricity only at the central vacuum pump station. In addition, a back-up generator is typically installed so even in the event of a power cut, the vacuum system should be able to operate effectively to keep the sewer network operational. The pressure pipes used in a vacuum system are typically buried between 1 to 1.5m deep which make them easy to install and also easy to repair if necessary.

Vacuum systems were introduced to New Zealand by Flovac Systems, a worldwide leader in vacuum technology based in Australia. The first project was constructed at Kawakawa Bay in Auckland in response to extensive pollution of the harbour by failed septic tanks. This pollution had led to the local beach being permanently closed and serious health risks to the local residents.

Owned by Manukau Water, now Watercare, and commissioned in 2010, the Kawakawa Bay Flovac system caters for an existing 268 houses and has the capacity to handle future expansion in the area for up to 3,000 people.

> "One of the primary objectives in building a sewage network in Christchurch has been the requirement to withstand future earthquakes and Flovac engineers have worked extensively with SCIRT engineers to design a customised solution to suit Christchurch's specific requirements."

Apart from the immediate benefit of not having septic tanks in their back-yards, the local residents can now enjoy the local beach which has recently been re-opened after the pollution levels have dropped to acceptable standards.

The residents aren't the only ones impressed by this system however. The operators have also enjoyed working with the Flovac system and have remarked on the ease and reliability of the system. The lack of odour and exposure to the sewage has also been a key factor for the operators.

Installation of Flovac pit in Christchurch

"Using fast moving air instead of traditional water pumps to transport sewage to the treatment plant, a vacuum system requires electricity only at the central vacuum pump station."

Flovac is also being used extensively in Christchurch and will be installing vacuum systems for two communities. The first project will incorporate 600 houses and is currently being constructed by McConnell Dowell Contractors. It is expected to be commissioned late 2013. The second project will ultimately handle up to 2000 houses and construction of this system is due to begin in August 2013 with commissioning expected in early 2014.

One of the primary objectives in building a sewage network in Christchurch has been the requirement to withstand future earthquakes and Flovac engineers have worked extensively with SCIRT engineers to design a customised solution to suit Christchurch's specific requirements.

One vital aspect of this design is the on-going monitoring of the network. Flovac Systems is the leading developer of SMART Sewer technologies that allow extensive monitoring of the sewerage network at the Council's operations base. This will notify operators of any faults or potential overflow risks within the network. After an earthquake, this information becomes critical to operators and will ensure they can get the system operating without loss of service to homeowners.

The end result is an extremely resilient, environmentally friendly sewerage system that will hopefully see the end of port-a-loos in Christchurch streets forever. ■

BECA Appointments

CH2M Beca (a joint venture of CH2M Hill and Beca) recently appointed Rob Burchell to the role of Programme Manager for water and wastewater treatment and conveyance design delivery and Kate Simmonds to the role of Project Delivery Lead – New Zealand. Both are based in Beca House, Auckland.

"CH2M Beca (a joint venture of CH2M Hill and Beca) recently appointed Rob Burchell to the role of Programme Manager for water and wastewater treatment and conveyance design delivery and Kate Simmonds to the role of Project Delivery Lead – New Zealand. Both are based in Beca House, Auckland."

Rob brings with him more than 25 years of experience delivering a wide variety of projects in municipal and industrial water and wastewater treatment and large capacity conveyance and collection system programs. As one of the alternative delivery resources within the CH2M HILL global network, Rob can readily tap into CH2M HILL and Beca talent globally and bring best in industry Project Delivery knowledge and understanding to assist clients in Auckland.

Rob has relocated with his family from North America, where he previously carried out delivery of the large infrastructure projects and programmes in Seattle, Orlando and Toronto. Rob was the Programme Manager for the Hanlan Feedermain in Peel Region, 9km of 3.5m diameter tunnelled conveyance program and the FJ Horgan Water Treatment Plant – Ozone Expansion in Toronto.

During his first stint in New Zealand, Rob was the Technical Manager for Project Manukau, the design and construction of the $400M upgrade of the Mangere Wastewater Treatment Plant for 3 years as well as delivering CH2M Beca projects in Hamilton and the Hutt Valley. Rob considers the projects he worked on in New Zealand to be some of the best of his career and is "stoked" to return for an even longer stay. Rob is currently the Project Manager for the Mangere BNR Upgrade in Auckland.

Kate commenced work in the CH2M Beca Auckland Office in July, having relocated with her family from Melbourne, where she previously performed this role for CH2M HILL in Victoria.

Kate is a rare thing – a Kiwi returning from Australia – and initially worked in Auckland for more than 4 years after graduating from Massey University as an Environmental Engineer. During her time in NZ she was involved with a number of water reuse projects for industrial clients, the Project Hobson Sewer Tunnel, the Hillcrest Catchment Sewer Amplification, and a number of CSO projects.

Kate has more than ten years of experience in the water and wastewater industry. She has performed various roles throughout her career and has a wide variety of multidisciplinary experience with engineering projects in New Zealand, the UAE and Australia. Kate's core strength lies in Project Management. She also brings the benefit of a range of technical capabilities including infrastructure design, integrated water management, odour treatment and management, and has experience working on major programs including the Victorian Desalination Plant, the Gippsland Water Factory in Victoria, Australia (recent winner of the 2011 Gold Banksia) and Masdar City in the UAE.

Kate is passionate about the environment and working on sustainable projects. Recently Kate has been involved with a number of projects focussed on generating biogas and energy using non-sewage waste streams co-digested with sewage sludge.

Kate was actively involved in the Water Industry in Australia and volunteered on the AWA Committee in Victoria 2010–2012, was Chairperson of the Member Services Sub-committee 2011–2012, and was a volunteer on the AWA National Sustainability Specialist Network Committee from 2009–2013. In recognition of her achievements to date and her commitment to the industry Kate was awarded the National Australian Young Water Professional of the Year, 2012 (AWA). ■

Rob Burchell and family who have relocated from North America

Kate Simmonds, returns to New Zealand from Melbourne with her family

MWH Global Bolsters Water Treatment Capability

Chris Povey

MWH Global has announced the appointment of Chris Povey to the new role of principal engineer for water and wastewater treatment and network design. He will be based in the MWH Auckland office having relocated from MWH in Melbourne, where he previously carried out this role for Australia.

Povey brings with him more than 25 years of experience in a wide variety of projects in water treatment and supply and large capacity wastewater collection and treatment from planning, design and construction management perspectives. He also brings strong project management and leadership skills across all phases of the project lifecycle.

"Povey brings with him more than 25 years of experience in a wide variety of projects in water treatment and supply and large capacity wastewater collection and treatment from planning, design and construction management perspectives. He also brings strong project management and leadership skills across all phases of the project lifecycle. "

As champion for knowledge transfer and innovation for the MWH Water Knowledge Centre, Chris can readily tap into MWH talent globally and bring best-practice knowledge and understanding to assist clients in Auckland.

Recently, Povey was the testing and commissioning review manager for the Victorian desalination plant in Australia, and is a member (and inaugural chair) of the $600m Water Resources Alliance leadership team for Melbourne Water, which included over 100 separate capital projects in water supply and wastewater treatment.

Povey has recently worked on Waitakere Water Treatment Plant filters, Huia Water Treatment Plant implementation strategy, Waikato water take, Onehunga Water Treatment Plant Chemical Unloading Upgrade and Ultra Violet Disinfection Concept Design. ■

Portavo by Knick: The First Portable Analyser for Memosens

With the new Portavo Models 902, 904(X) and 907, Knick is presenting the first portable analysers in the market for measuring pH value, conductivity or dissolved oxygen with Memosens technology. Depending on the model, analog sensors and optical oxygen sensors can be used in addition to the digital Memosens sensors.

The Portavo series devices are the first portable analysers for Memosens sensors

Portavo analysers are uniquely tailored to practical requirements in other ways as well: the Model 904X is the only portable analyser with ATEX approval for Zones 0 and 1. All Portavo housings are made of high-strength plastic and are designed for rough industrial use thanks to IP 66 protection. An integrated protective cover that protects the display against scratches and damage in the field can be used as a benchtop stand in laboratory applications. The housing also features an integrated sensor quiver that protects the sensor against drying out. Knick offers the right solution for all needs with a selection of different versions: the Portavo 902 is available as the economic base model for measuring pH or conductivity. In the 904X hazardous-area version, the Portavo 904 is also available as a multiparameter analyser. The Portavo 907 for demanding applications also allows the use of optical oxygen sensors. While the Models 902 and 904 are equipped with static displays, the Portavo 907 offers a four-color matrix display. Versions 904 and 907 feature a lithium-ion battery,

"An integrated protective cover that protects the display against scratches and damage in the field can be used as a benchtop stand in laboratory applications. The housing also features an integrated sensor quiver that protects the sensor against drying out."

additional memory for data logging functions and a USB interface, supporting remote control and configuration from a PC with the corresponding Paraly 112 software. Knick has entirely revised the interface in the current software version, adapting the design and functionality to the Memosuite software. Measurements, calibration logs and data can be archived, displayed, documented, printed and processed on a PC with Paraly 112. ■

Water New Zealand Conferences & Events

Water New Zealand Annual Conference & Expo 2013 – Changing Currents

16 – 18 October 2013
Claudelands Event Centre, Hamilton, New Zealand
For more information visit www.waternz.org.nz
or contact Hannah Smith hannah.smith@waternz.org.nz

Water New Zealand Stormwater Conference 2014

14 – 16 May 2014
Christchurch, New Zealand

For more information on *Water New Zealand* conferences visit www.waternz.org.nz

Other Conferences

86th Annual Water Environment Federation Technical Exhibition and Conference

5 – 9 October 2013
McCormick Place South, Chicago, Illinois, USA
For more information visit www.weftec.org

Pacific Water Conference & Expo 2013

13 – 15 November 2013
Rarotonga, Cook Islands
For more information visit www.pwwa.ws

2014 Australian Water Association Conference 'Ozwater 2014'

29 April – 1 May 2014
Brisbane, Australia
For more information visit www.awa.asn.au

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